YASKAWA

YASKAWA AC Drive-L1000E

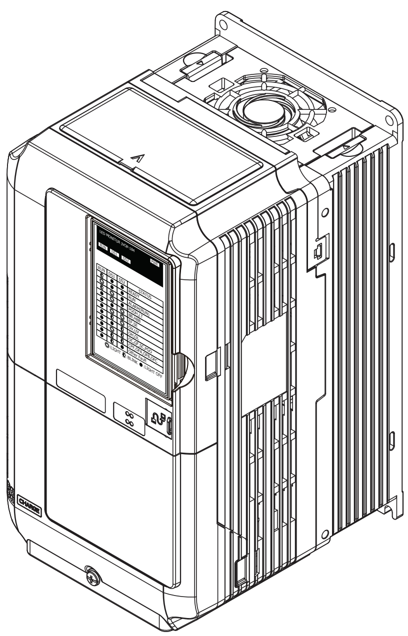
AC Drive for Elevator Applications

Technical Manual

Type: CIMR-LE□A□

Models: 200 V Class: 3.7 to 110 kW (5 to 150 HP)
400 V Class: 3.7 to 110 kW (5 to 150 HP)

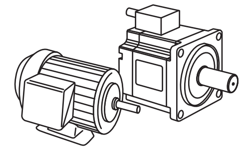
To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.



iQRISE™

MANUAL NO. SIEP YAIL1E 01B

◆ Quick Reference

Drive a Synchronous PM Motor	
L1000E can operate synchronous PM motors. ***Refer to Flowchart C: Auto-Tuning for PM Motors on page 111***.	

Perform Auto-Tuning
Automatic tuning sets motor parameters. ***Refer to Types of Auto-Tuning on page 113***.

Maintenance Check Using Drive Monitors
Use drive monitors to check fans, capacitors, and other components may require maintenance. ***Refer to Performance Life Monitors Maintenance Monitors on page 317***.

Fault Display and Troubleshooting
Refer to Drive Alarms, Faults, and Errors on page 270 and ***Refer to Setup Troubleshooting and Possible Solutions on page 147***.

Standards Compliance	
Refer to UL Standards on page 448.	c UL US LISTED

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Table of Contents

Preface & General Safety

This section provides safety messages pertinent to this product that, if not heeded, may result in fatality, personal injury, or equipment damage. Yaskawa is not responsible for the consequences of ignoring these instructions.

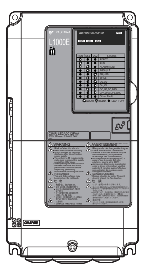
i.1 Preface

Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer or end user. Yaskawa accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Yaskawa product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product manufactured by Yaskawa must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by Yaskawa must be promptly provided to the end user. Yaskawa offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Yaskawa manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. Yaskawa assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

This manual is designed to ensure correct and suitable application of L1000E-Series Drives. Read this manual before attempting to install, operate, maintain, or inspect a drive and keep it in a safe, convenient location for future reference. Be sure you understand all precautions and safety information before attempting application.

◆ Applicable Documentation

The following manuals are available for L1000E series drives:

	L1000E Series AC Drive Quick Start Guide
	Read this manual first. This guide is packaged together with the product. It contains basic information required to install and wire the drive, in addition to an overview of fault diagnostics, maintenance, and parameter settings. Use the information in this book to prepare the drive for a trial run with the application and for basic operation.
	L1000E Series AC Drive Technical Manual (this book)
	This manual provides detailed information on parameter settings, drive functions, and MEMOBUS/Modbus specifications. Use this manual to expand drive functionality and to take advantage of higher performance features.

◆ Symbols

Note: Indicates a supplement or precaution that does not cause drive damage.

TERMS Indicates a term or definition used in this manual.

◆ Terms and Abbreviations

TERMS

- **Drive**: Yaskawa L1000-Series Drive
- **BCD:** Binary Coded Decimal
- **H:** Hexidecimal Number Format
- **IGBT**: Insulated Gate Bipolar Transistor
- **kbps:** Kilobits per Second
- **MAC:** Media Access Control
- **Mbps:** Megabits per Second
- **PG:** Pulse Generator
- **r/min:** Revolutions per Minute
- **V/f:** V/f Control
- **OLV:** Open Loop Vector Control
- **CLV:** Closed Loop Vector Control
- **CLV/PM:** Closed Loop Vector Control for PM
- **PM motor:** Permanent Magnet Synchronous motor (an abbreviation for IPM motor or SPM motor)
- **IPM motor:** Interior Permanent Magnet Motor (e.g., Yaskawa SSR1 Series and SST4 Series motors)
- **SPM motor:** Surface mounted Permanent Magnet Motor (e.g., Yaskawa SMRA Series motors)

◆ Trademarks

- EnDat is a trademark of Heidenhain Corporation.
- HIPERFACE is a trademark of Sick Stegmann, Inc.
- CANopen is a trademark of CAN in Automation (CiA).
- Other companies and product names mentioned in this manual are trademarks of those companies.

i.2 General Safety

◆ Supplemental Safety Information

General Precautions
• The diagrams in this manual may be indicated without covers or safety shields to show details. Replace the covers or shields before operating the drive and run the drive according to the instructions described in this manual. • Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable. • The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual. • When ordering a new copy of the manual due to damage or loss, contact your Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cover. • If nameplate becomes worn or damaged, order a replacement from your Yaskawa representative or the nearest Yaskawa sales office.

⚠ WARNING
Read and understand this manual before installing, operating or servicing this drive. The drive must be installed according to this manual and local codes. The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or fatal injury or damage to the products or to related equipment and systems.

⚠ DANGER
Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

⚠ WARNING
Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

WARNING! *may also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

⚠ CAUTION
Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

CAUTION! *may also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

NOTICE
Indicates a property damage message.

NOTICE: *may also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

◆ Safety Messages

⚠ DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

Electrical Shock Hazard

Do not connect or disconnect wiring or service the drive while the power is on.

Failure to comply will result in death or serious injury.

Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.

⚠ WARNING

Sudden Movement Hazard

The drive system or elevator may start unexpectedly upon application of power, resulting in death or serious injury.

- Clear all personnel from the drive, motor, and machine area before applying power.
- Secure covers, couplings, shaft keys, and machine loads before applying power to the drive.

Ensure there are no short circuits between the main circuit terminals (R/L1, S/L2, and T/L3) or between the ground and main circuit terminals before restarting the drive.

Failure to comply may result in serious injury or death and will cause damage to equipment.

System may start unexpectedly upon application of power when the Auto-restart function is enabled resulting in death or serious injury.

Use care when enabling Auto-restart as this function may cause unintended start of the elevator.

Use parameter S1-12 to enable/disable automatic switching of the Motor Contactor Control output signal during Auto-Tuning.

When using setting S1-12 = 1, ensure that the multi-function output terminals are properly wired and in the correct state before setting parameter S1-12.

Failure to comply could result in damage to the drive, serious injury or death.

Electrical Shock Hazard

Do not attempt to modify or alter the drive in any way not explained in this manual.

Yaskawa is not responsible for damage caused by modification of the product made by the user. Failure to comply could result in death or serious injury from operation of damaged equipment.

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

WARNING

When a drive is running a PM motor, voltage continues to be generated at the motor terminals after the drive is shut off while the motor coasts to stop. Take the precautions described below to prevent shock and injury:

- In applications where the machine can still rotate even though the drive has fully stopped a load, install a switch to the drive output side to disconnect the motor and the drive.
- Do not allow an external force to rotate the motor beyond the maximum allowable speed or to rotate the motor when the drive has been shut off.
- Wait for at least the time specified on the warning label after opening the load switch on the output side before inspecting the drive or performing any maintenance.
- Do not open and close the load switch while the motor is running, as this can damage the drive.

If the motor is coasting, make sure the power to the drive is turned on and the drive output has completely stopped before closing the load switch.

Do not connect or disconnect wiring to the drive or motor while the power is on.

Failure to comply will result in death or serious injury. Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are OFF and measure the DC bus voltage level to confirm safe level.

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.

Do not change wiring, remove covers, connectors or options cards, or attempt to service the drive with power applied to the drive.

Failure to comply could result in death or serious injury. Disconnect all power to the drive and check for unsafe voltages before servicing.

Do not allow unqualified personnel to use the equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Fire Hazard

Drive Short-Circuit Current Rating

Install adequate branch circuit protection according to applicable local codes and this Installation Manual.

Failure to comply could result in fire and damage to the drive or injury to personnel.

The device is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (200 V class) and 480 Vac maximum (400 V class) when protected by branch circuit protection devices specified in this manual.

WARNING

Applications using a braking option should wire a thermal relay so that the output contactor opens when the thermal relay trips.

Inadequate braking circuit protection could result in death or serious injury by fire from overheating resistors.

Do not use improper combustible materials.

Failure to comply could result in death or serious injury by fire.

Attach the drive to metal or other noncombustible material.

NOTICE

Equipment Hazard

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

Yaskawa is not responsible for any modification of the product made by the user. This product must not be modified.

Failure to comply could result in damage to the drive or braking circuit.

Observe proper electrostatic discharge procedures (ESD) when handling the drive, circuit boards, and option cards.

Failure to comply may result in ESD damage to the drive circuitry.

Do not operate damaged equipment.

Failure to comply could result in further damage to the equipment.

Do not connect or operate any equipment with visible damage or missing parts.

Do not lift the drive up while the cover is removed.

This can damage the terminal board and other components.

Do not expose the drive to halogen group disinfectants.

Failure to comply may cause damage to the electrical components in the drive.

Do not pack the drive in wooden materials that have been fumigated or sterilized.

Do not sterilize the entire package after the product is packed.

◆ General Application Precautions

■ Motor Selection

Drive Capacity

The output current should not exceed 130% of the drive rated current for 30 seconds. Select a drive that can output enough current when accelerating a load at 100%.

For specialized motors, make sure that the motor rated current is less than the rated output current for the drive.

Starting Torque

The startup and acceleration characteristics of the motor are restricted to the drive's overload current rating.

The overload rating for the drive determines the starting and accelerating characteristics of the motor. Expect lower torque than when running from line power. To get more starting torque, use a larger drive or increase both the motor and drive capacity.

■ Stopping

Fast Stop

When the drive faults out, a protective circuit is activated and drive output is shut off. This, however, does not stop the motor immediately. A mechanical brake may be required to stop the motor if Fast Stop deceleration is insufficient.

Mechanical Brake

A mechanical brake is required to prevent the elevator from free falling during a drive fault condition.

Repetitive Starting/Stopping

Elevators and other applications with frequent starts and stops often approach 150% of their rated current values. Heat stress generated from repetitive high current will shorten the life span of the IGBTs.

Yaskawa recommends lowering the carrier frequency, particularly when audible noise is not a concern. It is beneficial to reduce the load, increase the acceleration and deceleration times, or switch to a larger drive to help keep peak current levels under 150%. Be sure to check the peak current levels when starting and stopping repeatedly during the initial test run, and make adjustments accordingly.

■ Installation

Enclosure Panels

Keep the drive in a clean environment by installing the drive in an enclosure panel or selecting an installation area free of airborne dust, lint, and oil mist. Be sure to leave the required space between drives to provide for cooling, and take proper measures so the ambient temperature remains within allowable limits and keep flammable materials away from the drive. Yaskawa offers protective designs for drives that must be used in areas subjected to oil mist and excessive vibration. Contact Yaskawa or your Yaskawa agent for details.

Installation Direction

NOTICE: *Install the drive upright as specified in the manual.* ***Refer to Mechanical Installation on page 41*** *for more information on installation. Failure to comply may damage the drive due to improper cooling.*

■ Settings

DC Injection Braking

NOTICE: *Excessive current during DC Injection Braking and excessive duration of DC Injection Braking can cause motor overheating. Adjust DC Injection parameters to prevent motor overheating.*

Acceleration/Deceleration Ramp

Acceleration and deceleration times are affected by the amount of torque generated by the motor, the load torque, and the inertia moment. Set a longer accel/decel time when Stall Prevention is enabled. The accel/decel times are lengthened for as long as the Stall Prevention function is in operation. Install one of the available braking options or increase the capacity of the drive for faster acceleration and deceleration.

■ General Handling

Selecting a Molded Case Circuit Breaker or Ground Fault Circuit Interrupter (GFCI)

Select an appropriate GFCI. This drive can cause a residual current with a DC component in the protective earthing conductor. Where a residual current operated protective or monitoring device is used for protection in case of direct or indirect contact, always use an GFCI of type B according to IEC 60755.

Select a MCCB (Molded Case Circuit Breaker) with a rated current that is 1.5 to 2 times higher than the rated current of the drive in order to avoid nuisance trips caused by harmonics in the drive input current. Also refer to ***Installing a Molded Case Circuit Breaker (MCCB) on page 353***.

WARNING! *Sudden Movement Hazard. Install a properly controlled contactor on the input-side of the drive for applications where power should be removed from the drive during a fault condition. Improper equipment sequencing could result in death or serious injury.*

WARNING! *Fire Hazard. Shut off the drive with a magnetic contactor (MC) when a fault occurs in any external equipment such as braking resistors.* ***Refer to Installing a Magnetic Contactor at the Power Supply Side on page 354****. Failure to comply may cause resistor overheating, fire, and injury to personnel.*

NOTICE: *To get the full performance life out of the electrolytic capacitors and circuit relays, refrain from switching the drive power supply off and on more than once every 30 minutes. Frequent use can damage the drive. Use the drive to stop and start the motor.*

Inspection and Maintenance

WARNING! *Electrical Shock Hazard. Capacitors in the drive do not immediately discharge after shutting off the power. Wait for at least the amount of time specified on the drive before touching any components after shutting off the power. Failure to comply may cause injury to personnel from electrical shock.*

CAUTION! *Burn Hazard. Because the heatsink can get very hot during operation, take proper precautions to prevent burns. When replacing the cooling fan, shut off the power and wait at least 15 minutes to be sure that the heatsink has cooled down. Failure to comply may cause burn injury to personnel.*

WARNING! *Electrical Shock Hazard. When a drive is running a PM motor, voltage continues to be generated at the motor terminals after the drive is shut off while the motor coasts to stop. Take the precautions described below to prevent shock and injury:*

- In applications where the machine can still rotate after the drive has fully stopped a load, install a load disconnect switch on the drive output side to disconnect the motor and the drive.
- Do not allow an external force to rotate the motor beyond the maximum allowable speed or to rotate the motor when the drive is powered off.
- Wait for at least the time specified on the warning label after opening the load switch on the output side before inspecting the drive or performing any maintenance.
- Do not open and close the load switch while the motor is running.
- If the motor is coasting, make sure the power to the drive is turned on and the drive output has completely stopped before closing the load switch to reconnect the drive to the motor.

Wiring

Yaskawa recommends using ring terminals on all drive models for UL/cUL compliance. Use only the tools recommended by the terminal manufacturer for crimping.

Transporting the Drive

NOTICE: *Never steam clean the drive. During transport, keep the drive from coming into contact with salts, fluorine, bromine, phthalate ester, and other such harmful chemicals. Failure to comply may damage the drive.*

◆ Motor Application Precautions

■ Standard Induction Motors

Insulation Tolerance

NOTICE: *Consider motor voltage tolerance levels and motor insulation in applications with an input voltage of over 440 V or particularly long wiring distances.*

NOTICE: *Ensure that the motor is suitable for inverter duty and/or the motor service factor is adequate to accommodate the additional heating with the intended operating conditions. A motor connected to a PWM drive may operate at a higher temperature than a utility-fed motor and the operating speed range may reduce motor cooling capacity.*

High-Speed Operation

NOTICE: *Mechanical damage may occur with the motor bearings and dynamic balance of the machine when operating a motor beyond its rated speed. Operate the motor within specifications to prevent motor damage.*

Low-Speed Range

The cooling fan of a standard motor should sufficiently cool the motor at the rated speed. As the self-cooling capability of such a motor reduces with the speed, applying full torque at low speed will possibly damage the motor. Reduce the load torque as the motor slows to prevent motor damage from overheat. Use a motor designed specifically for operation with a drive when 100% continuous torque is needed at low speeds.

Torque Characteristics

Torque characteristics differ compared to operating the motor directly from line power. The user should have a full understanding of the load torque characteristics for the application.

Vibration and Shock

The drive allows selection of high carrier PWM control and low carrier PWM control. Selecting high carrier PWM can help reduce motor oscillation.

If resonance occurs, install shock-absorbing rubber mounts around the base of the motor and utilize the Jump frequency selection to prevent continuous operation in the resonant frequency ranges.

Audible Noise

Noise created during run varies by the carrier frequency setting. When using a high carrier frequency, audible noise from the motor is comparable to the motor noise generated when running from line power. Operating above the rated r/min, however, can create unpleasant motor noise.

■ Precautions for PM Motors

NOTICE: *Damage to Equipment. Improper sequencing of output motor circuits could result in damage to the drive. Do not connect electromagnetic switches or magnetic contactors to the output motor circuits without proper sequencing. Do not open the main circuit between the drive and the motor while the PM motor is rotating.*

- Contact Yaskawa or your Yaskawa agent if you plan to use any PM motor not endorsed by Yaskawa.
- When using a holding brake, release the brake prior to starting the motor. Failure to set the proper timing can result in speed loss.

WARNING! *Sudden Movement Hazard. Use the Initial Pole Search Status Signal (H2-□□= 61) to interlock the brake to ensure the brake is not released before the Initial Magnetic Pole Search is completed. Failure to comply may cause inadvertent elevator movement resulting in serious injury.*
This safety message is applicable under these conditions:

- When applying a PM motor, with an external brake sequence, and the PG-F3 option is not being used.

WARNING! *Electrical Shock Hazard. The motor must be at a complete stop before performing any maintenance, inspection, or wiring.*

- With a PM motor, drive output must be fully interrupted when the power is shut off and the motor is still rotating. Failure to comply can result in personal injury from electrical shock.

◆ Drive Label Warnings

Always heed the warning information listed in *Figure i.1* in the position shown in *Figure i.2*.

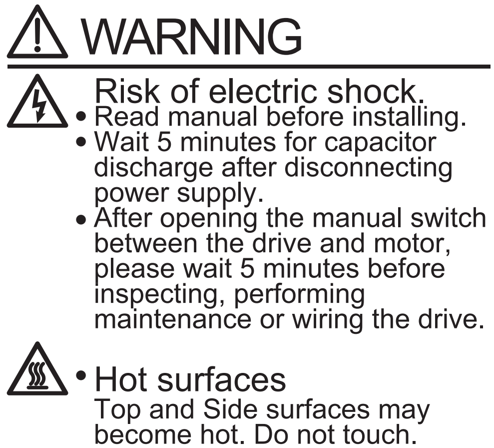


Figure i.1 Warning Information

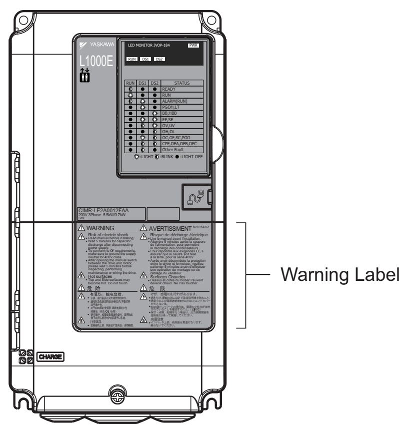


Figure i.2 Warning Information Position

◆ Warranty Information

■ Restrictions

The drive is not designed or manufactured for use in devices or systems that may directly affect or threaten human lives or health.

Customers who intend to use the product described in this manual for devices or systems relating to transportation, health care, space aviation, atomic power, electric power, or in underwater applications must first contact their Yaskawa representatives or the nearest Yaskawa sales office.

WARNING! *Injury to Personnel. This product has been manufactured under strict quality-control guidelines. However, if this product is to be installed in any location where failure of this product could involve or result in a life-and-death situation or loss of human life or in a facility where failure may cause a serious accident or physical injury, safety devices must be installed to minimize the likelihood of any accident.*

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Receiving

This chapter explains how to inspect the drive upon receipt, and gives and overview of the different enclosure types and components.

1.1 Section Safety

⚠ CAUTION

Crush Hazard

Always hold the case when carrying the drive.

Carrying the drive by the front cover may cause the main body of the drive to fall, resulting in minor or moderate injury.

NOTICE

Equipment Hazard

Do not connect electromagnetic switches or magnetic contactors to the output motor circuits without proper sequencing.

Improper sequencing of output motor circuits could result in damage to the drive.

Do not open the main circuit between the drive and the motor while the PM motor is rotating.

Improper sequencing of output motor circuits could result in damage to the drive.

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

A motor connected to a PWM drive may operate at a higher temperature than a utility-fed motor and the operating speed range may reduce motor cooling capacity.

Ensure that the motor is suitable for drive duty and/or the motor service factor is adequate to accommodate the additional heating with the intended operating conditions.

1.2 General Description

◆ L1000E Model Selection

Refer to Selecting an L1000E AC Drive for Elevator Applications on page 31 for proper sizing and derating.

Motor Power kW (HP)	Three-Phase 200 V Class		Three-Phase 400 V Class	
	Drive Model	Rated Output Current (A)	**Drive Model**	**Rated Output Current (A)**
3.7 (5)	2A0018	17.5 <1>	4A0009	9.0 <1>
5.5 (7.5)	2A0022	21.9 <1>	4A0012	11.5 <1>
7.5 (10)	2A0031	31.3 <1>	4A0019	18.5 <1>
11 (15)	2A0041	41.3 <1>	4A0023	22.5 <1>
15 (20)	2A0059	58.8 <1>	4A0030	30.0 <1>
18.5 (25)	2A0075	75.0 <1>	4A0039	38.8 <1>
22 (30)	2A0094	93.8 <1>	4A0049	48.8 <1>
30 (40)	2A0106	106 <1>	4A0056	56.3 <1>
37 (50)	2A0144	143 <1>	4A0075	75.0 <1>
45 (60)	2A0181	181 <2>	4A0094	93.8 <1>
55 (75)	2A0225	225 <2>	4A0114	113 <1>
75 (100)	2A0269	268 <2>	4A0140	140 <2>
90 (125)	2A0354	353 <2>	4A0188	187 <2>
110 (150)	2A0432	432 <2>	-	-

<1> These values assume the carrier frequency is not set higher than 8 kHz.
<2> These values assume the carrier frequency is not set higher than 5 kHz.

Note: The drive automatically decreases the rated output current when setting higher carrier frequency.

Receiving

1

◆ Control Mode Selection

Table 1.1 gives an overview of the L1000E motor control method (control modes) and their various features.

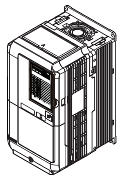
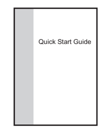
Table 1.1 Control Modes and their Features

Motor Type		Induction Motors			Permanent Magnet Motors	Comments
Control Mode		V/f	OLV	CLV	CLV/PM	–
Parameter Setting		A1-02 = 0	A1-02 = 2	A1-02 = 3	A1-02 = 7	Default Setting is Open Loop Vector Control.
Basic Description		V/f control	Open Loop Vector control	Closed Loop Vector control	Closed Loop Vector control for PM motors	–
Type of Applications	Motor Type	IM	IM	IM	PM	–
PG Option Card		N/A	N/A	YES	YES	–
Control Characteristics	Speed Control Range	1:40	1:200	1:1500	1:1500	May fluctuate with characteristics and motor temperature.
	Speed Accuracy	±2 to 3%	±0.2%	±0.02%	±0.02%	Speed deviation when operating at constant speed. May fluctuate with characteristics and motor temperature.
	Speed Response	3 Hz (approx.)	10 Hz	100 Hz	100 Hz	Max. frequency of a speed reference signal that the drive can follow. May fluctuate with characteristics and motor temperature.
	Starting Torque	150% at 3 Hz	200% at 0.3 Hz	200% at 0 r/min	200% at 0 r/min	May fluctuate with characteristics and motor temperature. Performance may differ by capacity.
Application-Specific	Auto-Tuning	Line to line resistance	• Rotational • Stationary • Line to line resistance	• Rotational • Stationary • Line to line resistance	• Stationary • Stationary Stator Resistance • Encoder Offset • Rotational Back EMF Constant	Automatically adjusts parameter settings that concern electrical characteristics of the motor.
	Torque Limit	N/A	YES	YES	YES	Sets the maximum torque for the motor to protect the load and connected machinery.
	Droop Function	N/A	N/A	YES	YES	Controls the load sharing between two motors that drive the same mechanical system.
	Energy-Saving Control	N/A	N/A	N/A	YES	Saves energy by always operating the motor at its maximum efficiency.
	Inertia Compensation	N/A	N/A	YES	YES	Improves speed accuracy when the load changes by compensating effects of the system inertia.
	DC Injection at Start and Stop/Position Lock	YES (DC injection braking at start and stop)	YES (DC injection braking at start and stop)	YES (Position Lock)	YES (Position Lock)	Builds up motor torque during stop in order to prevent movement of the elevator when the brake is released at start and applied at stop.
	Torque Compensation	N/A	N/A	YES	YES	Avoids rollback at start using the analog signal from an external load cell connected to the drive.
	Anti Roll Back	N/A	N/A	N/A	YES	Prevents roll back at start without any external load signal.
	Slip Compensation	YES	YES	N/A	N/A	Adjusts the leveling speed reference in order to improve the stopping accuracy.
	Short Floor	YES	YES	YES	YES	Optimizes the stopping time at rides where the nominal speed is not reached.

1.3 Model Number and Nameplate Check

Please perform the following tasks after receiving the drive:

- Inspect the drive for damage.
  If the drive appears damaged upon receipt, contact the shipper immediately.
- Verify receipt of the correct model by checking the information on the nameplate.
- If you have received the wrong model or the drive does not function properly, contact your supplier.

Description	Drive	Controller Power Supply Cable for Rescue Operation	Quick Start Guide
–			
Quantity	1	1	1

◆ Nameplate

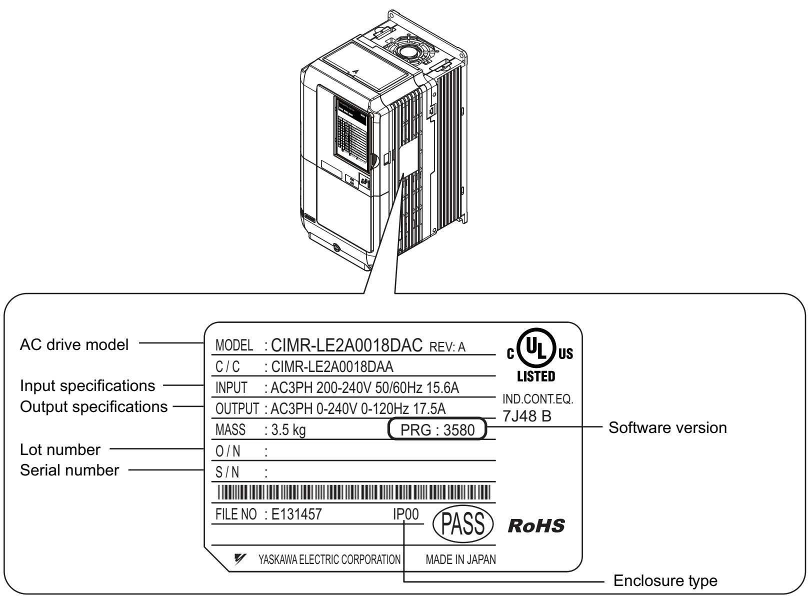
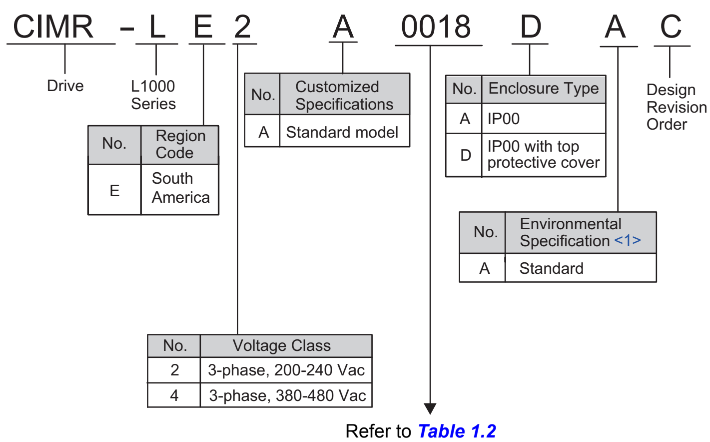


Figure 1.1 Nameplate Information

◆ Model Number



<1> Drives with these specifications do not guarantee complete protection for the environmental conditions indicated.

■ Model Number and Specifications

Table 1.2 Model Number and Specifications

Three-Phase 200 V			Three-Phase 400 V		
Drive Model	Max Motor Capacity kW (HP)	Rated Output Current A	Drive Model	Max Motor Capacity kW (HP)	Rated Output Current A
2A0018	3.7 (5)	17.5	4A0009	3.7 (5)	9.0
2A0022	5.5 (7.5)	21.9	4A0012	5.5 (7.5)	11.5
2A0031	7.5 (10.0)	31.3	4A0019	7.5 (10.0)	18.5
2A0041	11.0 (15.0)	41.3	4A0023	11.0 (15.0)	22.5
2A0059	15.0 (20.0)	58.8	4A0030	15.0 (20.0)	30.0
2A0075	18.5 (25.0)	75.0	4A0039	18.5 (25.0)	38.8
2A0094	22.0 (30.0)	93.8	4A0049	22.0 (30.0)	48.8
2A0106	30.0 (40.0)	106.0	4A0056	30.0 (40.0)	56.3
2A0144	37.0 (50.0)	143.0	4A0075	37.0 (50.0)	75.0
2A0181	45.0 (60.0)	181.0	4A0094	45.0 (60.0)	93.8
2A0225	55.0 (75.0)	225.0	4A0114	55.0 (75.0)	113.0
2A0269	75.0 (100.0)	268.0	4A0140	75.0 (100.0)	140.0
2A0354	90.0 (125.0)	353.0	4A0188	90.0 (125.0)	187.0
2A0432	110.0 (150.0)	432.0	4A0225	110.0 (150.0)	225.0

1.4 Selecting an L1000E AC Drive for Elevator Applications

◆ Carrier Frequency Derating

This section aids in selection and adjustment of the L1000E Series AC drive with these application criteria:

- Application: **Conventional gear-driven, traction drive elevator applications (counterweighted)**
- Motor type: 50 Hz or 60 Hz induction motors
- Near full speed, normal acceleration rates

◆ Overview

These specific elevator application needs should be considered when selecting an L1000E model:

- motor acceleration current
- motor audible noise
- overload capability and
- low speed operation.

◆ Definitions

■ What is Carrier Frequency?

Carrier frequency in PWM (pulse width modulation)-based VFD's, is the rate at which output transistors are gated, usually 2 to 15 kHz. Higher carrier frequencies yield a better current waveform, less audible motor noise, but more VFD thermal losses. Lower carrier frequencies yield a less optimum current waveform, increased audible noise, but less VFD losses. Audible motor noise in applications where the motor must operate quietly can be a concern with lower carrier frequencies.

■ Drive Nameplate Output Current

The L1000E nameplate current is the output current that the L1000E can supply at the default carrier frequency for a maximum run of 180 seconds and a motor electrical frequency above 6.0 Hz operating 50% of the time. Increasing the Carrier Frequency [C6-03] or operating below 6.0 Hz will reduce the allowable output current and available motor torque.

◆ The Effect of Carrier Frequency [C6-03] Adjustment on Output Current

Table 1.3 lists constant-speed output amps for L1000E models adjusted for carrier frequencies common to elevator applications. Select a higher Carrier Frequency [C6-03] to reduce audible motor noise when required by the application. Selecting a lower carrier frequency or a larger L1000E model, does not always result in increased current capacity.

Table 1.3 L1000E Current Derating Adjusted for Carrier Frequency by Model

Model CIMR-LE □□□□□□ DAC	L1000E Nameplate Output Amps RMS (50% ED, 180 s max.)	Parameter C6-03 Carrier Frequency Setting					
		2.0 kHz	5.0 kHz	8.0 kHz	10.0 kHz	12.5 kHz	15.0 kHz
		Derated Output Amps RMS (50% ED, 180 s max.)					
		NOTE: The shaded cells represent the output amps at the highest carrier frequency setting (C6-03) that requires no nameplate output amps derating.					
200-240 Vac Models							
2A0018	17.5	17.5			16.5	15.3	14.0
2A0022	21.9	21.9			20.6	19.1	17.5
2A0031	31.3	31.3			29.5	27.2	25.0
2A0041	41.3	41.3			38.9	36.0	33.0
2A0059	58.8	58.8			55.4	51.2	47.0
2A0075	75.0	75.0			70.7	65.4	60.0
2A0094	93.8	93.8			85.7	75.7	65.6
2A0106	106.3	106.3			97.2	85.8	74.4
2A0144	143.8	143.8			131.5	116.1	100.6
2A0181	181.3	181.3		159.5	145.0	-	-
2A0225	225.0	225.1		198.0	180.0	-	-
2A0269	268.8	268.8		236.6	215.0	-	-
2A0354	353.8	353.8		311.4	283.1	-	-
2A0432	432.5	432.6		380.7	346.1	-	-
380-480 Vac Models							
4A0009	9.0	9.0			8.0	6.7	5.4
4A0012	11.5	11.5			10.2	8.5	6.9
4A0019	18.5	18.5			16.4	13.7	11.1
4A0023	22.5	22.5			19.9	16.7	13.5
4A0030	30.0	30.0			26.6	22.3	18.0
4A0039	38.8	38.8			34.3	28.8	23.3
4A0049	48.8	48.8			43.2	36.2	29.3
4A0056	56.3	56.3			49.8	41.8	33.8
4 A0075	75.0	75.0			66.4	55.7	45.0
4A0094	93.8	93.8			83.1	69.7	56.3
4A0114	113.8	113.8			100.8	84.5	68.3
4A0140	140.0	140.0		114.8	98.0	-	-
4A0188	187.5	187.5		153.8	131.3	-	-
4A0225	225.0	225.1		184.5	157.5	-	-

■ 30-Second Overload Capacity

The overload capacity of the L1000E is 133% for 30 seconds. **Multiply the carrier derated output amps in *Table 1.3* by 1.33 to obtain the 30 second overload capacity.** Acceleration of the elevator and the counterweight to full speed generally requires output amps above the motor's nameplate rating.

Example: L1000E model CIMR-LE2A0075 operating at 15 kHz carrier has a derated current of 60.0 Amps, *Table 1.3*. The 30 second overload is 133% of 60.0 Amps (80.0 Amps) for 30 seconds.

■ 5-Second Overload Capacity

Table 1.4 lists the maximum 5.0 second overload current capacity of L1000E models at carrier frequencies common to elevator applications. Most elevators will reach full speed in less than 5.0 seconds.

NOTICE: Prevent overload/overcurrent faults by not exceeding the 5.0 second overload capacity.

Table 1.4 Maximum 5.0-Second Overload Capacity (RMS Amps)

<table>
<tr><th rowspan="3">Model
CIMR-LE □□□□□□ DAC</th><th rowspan="3">L1000E Nameplate Output Amps RMS</th><th colspan="6">Parameter C6-03 Carrier Frequency Setting</th></tr>
<tr><th>2.0 kHz</th><th>5.0 kHz</th><th>8.0 kHz</th><th>10.0 kHz</th><th>12.5 kHz</th><th>15.0 kHz</th></tr>
<tr><th colspan="6">Derated Output Amps RMS (5.0 s or less @ > 6.0 Hz output freq)</th></tr>
<tr><td colspan="8">200-240 Vac Models</td></tr>
<tr><td>LE2A0018</td><td>17.5</td><td colspan="3">27.6</td><td>26.8</td><td>25.8</td><td>24.8</td></tr>
<tr><td>LE2A0022</td><td>21.9</td><td colspan="3">31.9</td><td>30.9</td><td>27.7</td><td>24.9</td></tr>
<tr><td>LE2A0031</td><td>31.3</td><td colspan="3">45.6</td><td>44.2</td><td>42.4</td><td>40.6</td></tr>
<tr><td>LE2A0041</td><td>41.3</td><td colspan="3">67.6</td><td>65.7</td><td>63.4</td><td>61.0</td></tr>
<tr><td>LE2A0059</td><td>58.8</td><td colspan="3">94.7</td><td>92.0</td><td>88.7</td><td>85.3</td></tr>
<tr><td>LE2A0075</td><td>75.0</td><td colspan="3">113.7</td><td>110.3</td><td>106.0</td><td>101.7</td></tr>
<tr><td>LE2A0094</td><td>93.8</td><td colspan="3">153.2</td><td>146.7</td><td>138.7</td><td>127.9</td></tr>
<tr><td>LE2A0106</td><td>106.3</td><td colspan="3">185.6</td><td>178.3</td><td>167.2</td><td>145.0</td></tr>
<tr><td>LE2A0144</td><td>143.8</td><td colspan="2">222.7</td><td>218.1</td><td>203.3</td><td>186.3</td><td>171.0</td></tr>
<tr><td>LE2A0181</td><td>181.3</td><td colspan="2">301.6</td><td>274.6</td><td>257.9</td><td>-</td><td>-</td></tr>
<tr><td>LE2A0225</td><td>225.0</td><td colspan="2">371.2</td><td>349.6</td><td>335.2</td><td>-</td><td>-</td></tr>
<tr><td>LE2A0269</td><td>268.8</td><td colspan="2">424.6</td><td>376.3</td><td>339.2</td><td>-</td><td>-</td></tr>
<tr><td>LE2A0354</td><td>353.8</td><td colspan="2">519.7</td><td>460.4</td><td>412.7</td><td>-</td><td>-</td></tr>
<tr><td>LE2A0432</td><td>432.5</td><td colspan="2">696.2</td><td>654.7</td><td>627.0</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">380-480 Vac Models</td></tr>
<tr><td>LE4A0009</td><td>9.0</td><td colspan="3">15.2</td><td>14.4</td><td>13.0</td><td>10.5</td></tr>
<tr><td>LE4A0012</td><td>11.5</td><td colspan="3">16.7</td><td>15.7</td><td>14.4</td><td>13.1</td></tr>
<tr><td>LE4A0019</td><td>18.5</td><td colspan="3">26.9</td><td>25.2</td><td>23.1</td><td>21.0</td></tr>
<tr><td>LE4A0023</td><td>22.5</td><td colspan="3">35.0</td><td>32.9</td><td>30.3</td><td>26.3</td></tr>
<tr><td>LE4A0030</td><td>30.0</td><td colspan="3">48.7</td><td>46.0</td><td>42.6</td><td>35.1</td></tr>
<tr><td>LE4A0039</td><td>38.8</td><td colspan="3">62.6</td><td>59.1</td><td>54.7</td><td>45.3</td></tr>
<tr><td>LE4A0049</td><td>48.8</td><td colspan="3">78.9</td><td>70.8</td><td>62.4</td><td>55.5</td></tr>
<tr><td>LE4A0056</td><td>56.3</td><td colspan="3">97.5</td><td>92.3</td><td>81.4</td><td>65.8</td></tr>
<tr><td>LE4A0075</td><td>75.0</td><td colspan="3">120.7</td><td>113.8</td><td>105.3</td><td>87.7</td></tr>
<tr><td>LE4A0094</td><td>93.8</td><td colspan="2">150.8</td><td>137.0</td><td>121.7</td><td>105.8</td><td>92.8</td></tr>
<tr><td>LE4A0114</td><td>113.8</td><td colspan="2">185.6</td><td>156.0</td><td>134.3</td><td>112.7</td><td>95.7</td></tr>
<tr><td>LE4A0140</td><td>140.0</td><td>225.0</td><td>209.9</td><td>168.3</td><td>148.3</td><td>-</td><td>-</td></tr>
<tr><td>LE4A0188</td><td>187.5</td><td>297.0</td><td>281.4</td><td>222.0</td><td>193.7</td><td>-</td><td>-</td></tr>
<tr><td>LE4A0225</td><td>225.0</td><td>382.8</td><td>379.5</td><td>298.8</td><td>261.5</td><td>-</td><td>-</td></tr>
</table>

■ Low Speed Operation

Table 1.3 and *Table 1.4* pertain to motor operation above 6.0 Hz. Elevators applications make use of the L1000E's S-curve function to limit the rate of change of acceleration ('jerk') to provide an comfortable ride. Acceleration current increases linearly over the S-curve interval (about 0.5 seconds) while speed and frequency increase simultaneously. A typical 50/60 Hz geared elevator motor will be near or above 6.0 Hz before full acceleration current is required. The 5.0 second overload capacities in *Table 1.4* assume the drive is operating near or above 6.0 Hz before it achieves full acceleration.

Some elevator applications require the drive to spend a significant portion of the acceleration time below 6.0 Hz. L1000E current capacity must be derated below 6.0 Hz to maximize the life of its IGBTs. Consequently the L1000E current capacity is decreased from 100% at 6.0 Hz and above, to 50% at 0.0 Hz (DC). The derating is linear as depicted in the graph below.

The operating frequency at which the motor reaches full acceleration torque should be used as the basis for low-frequency derating.

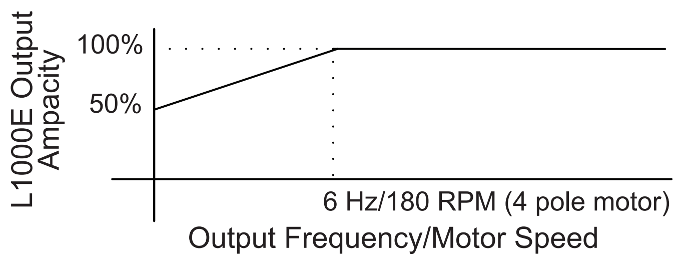


Figure 1.2 Low Speed Operation Derating

◆ Using Torque Boost

■ Function Description

Automatic Torque Boost [L8-38] is useful in elevators that experience occasional high starting current due to overload. Enable the Automatic Torque Boost Function [L8-38=3] to boost motor torque during heavy load conditions. The L1000E automatically reduces the carrier frequency to 3.0 kHz to make increased current available when the starting current is about to exceed the current level as indicated in *Table 1.4*. The carrier frequency will return to the [C6-03] value as the heavy load condition subsides.

Note: Audible motor noise will increase when the Automatic Torque Boost function is operates.

Automatic Torque Boost Function Parameters	
Parameter Name	**Setting**
L8-38 (Automatic Torque Boost Selection)	0: Disabled (Default) 3: Enabled
L8-39 (Reduced Carrier Frequency)	3.0 kHz (Default) (Range: 1.0 to 15.0 kHz)

Note: Audible motor noise will increase when the Automatic Torque Boost function is operates.

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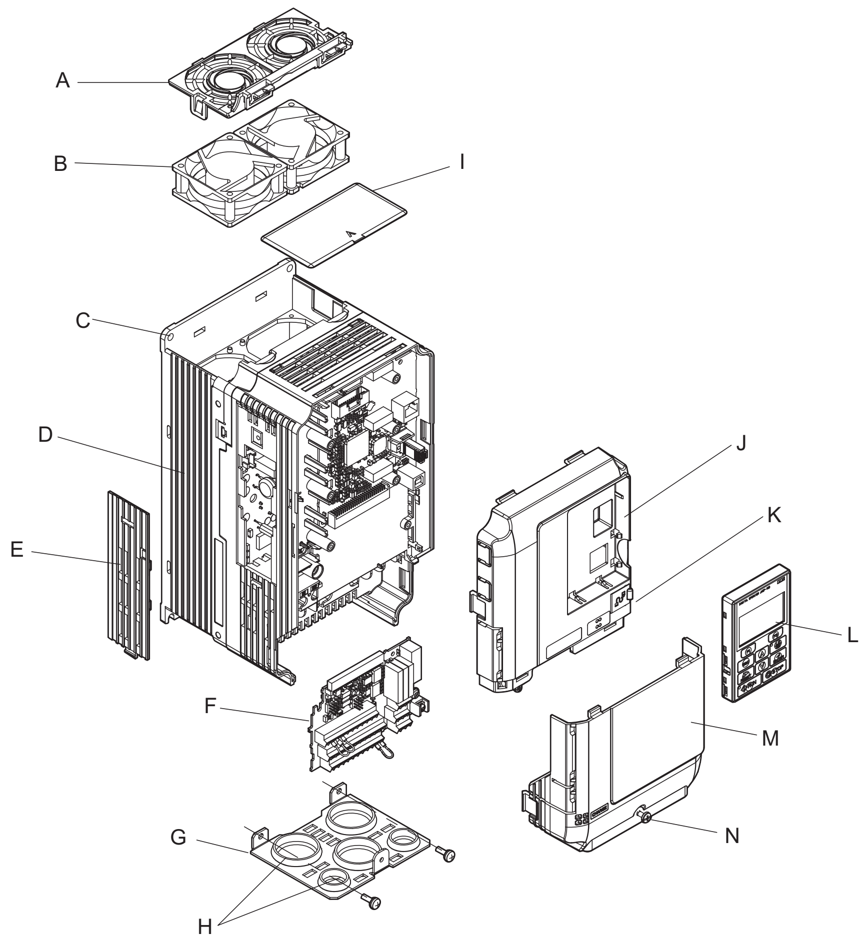
1.5 Component Names

This section gives an overview of the drive components described in this manual.

Note: **1.** *Refer to Using the LED Monitor/Digital Operator on page 89* for a description of the operator keypad.
2. The drive may have no cooling fans or only one cooling fan depending on the model.

◆ IP00 Enclosure with Top Protective Cover

■ Three-Phase AC200 V 2A0018D to 2A0094D Three-Phase AC400 V 4A0009D to 4A0049D

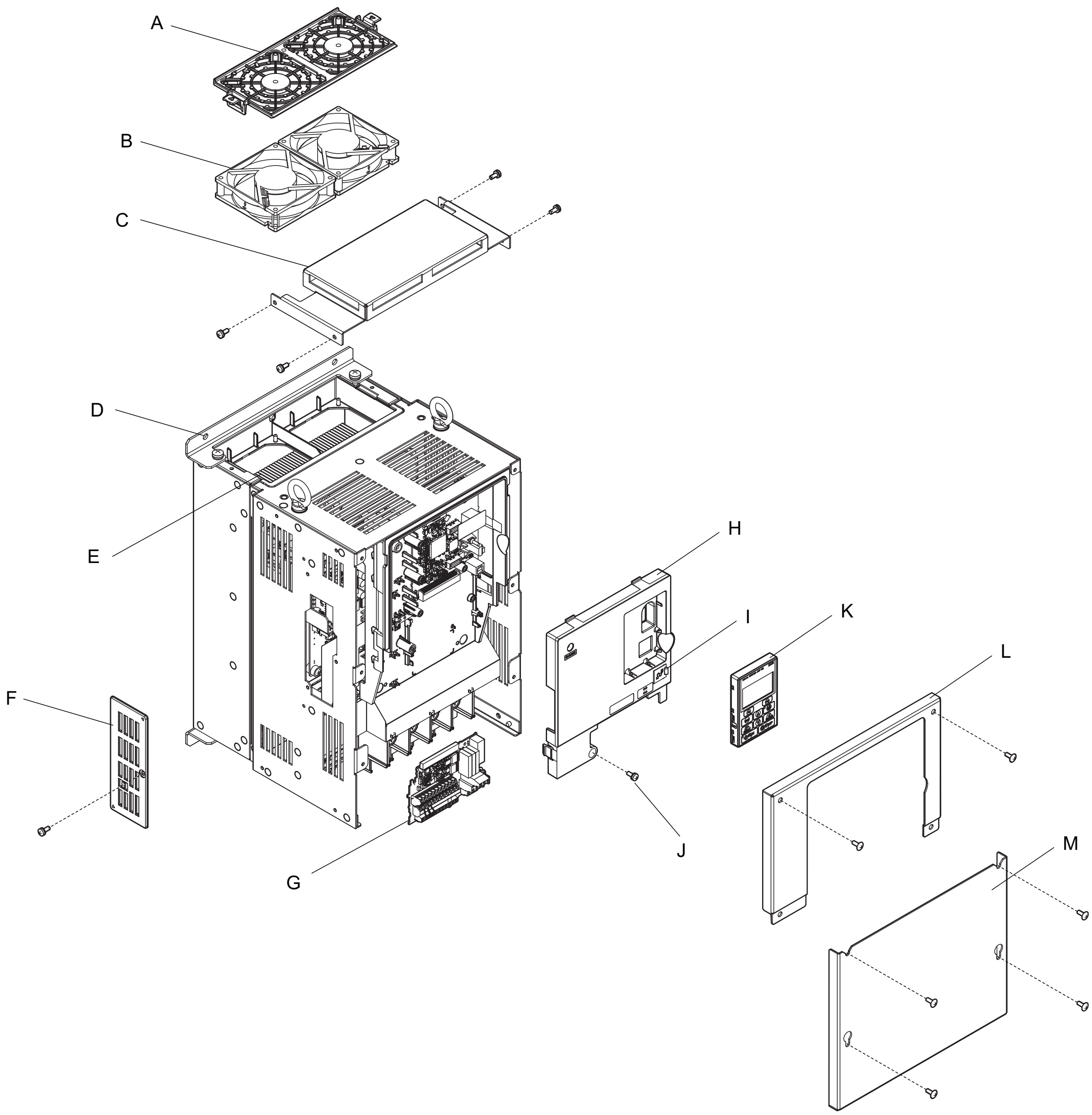


A – Fan finger guard <1>
B – Cooling fan <1>
C – Mounting hole
D – Heatsink
E – Optional 24 V DC power supply connector cover
F – Terminal board
G – Bottom cover
H – Rubber bushing
I – Top protective cover
J – Front cover
K – USB port (type-B)
L – Digital Operator
M – Terminal cover
N – Terminal cover screw

<1> Drive models 2A0018D, 2A0022D, 4A0009D, and 4A0012D have a single cooling fan.

Figure 1.3 Exploded View of IP00 Enclosure Drive with Top Protective Cover (2A0031D)

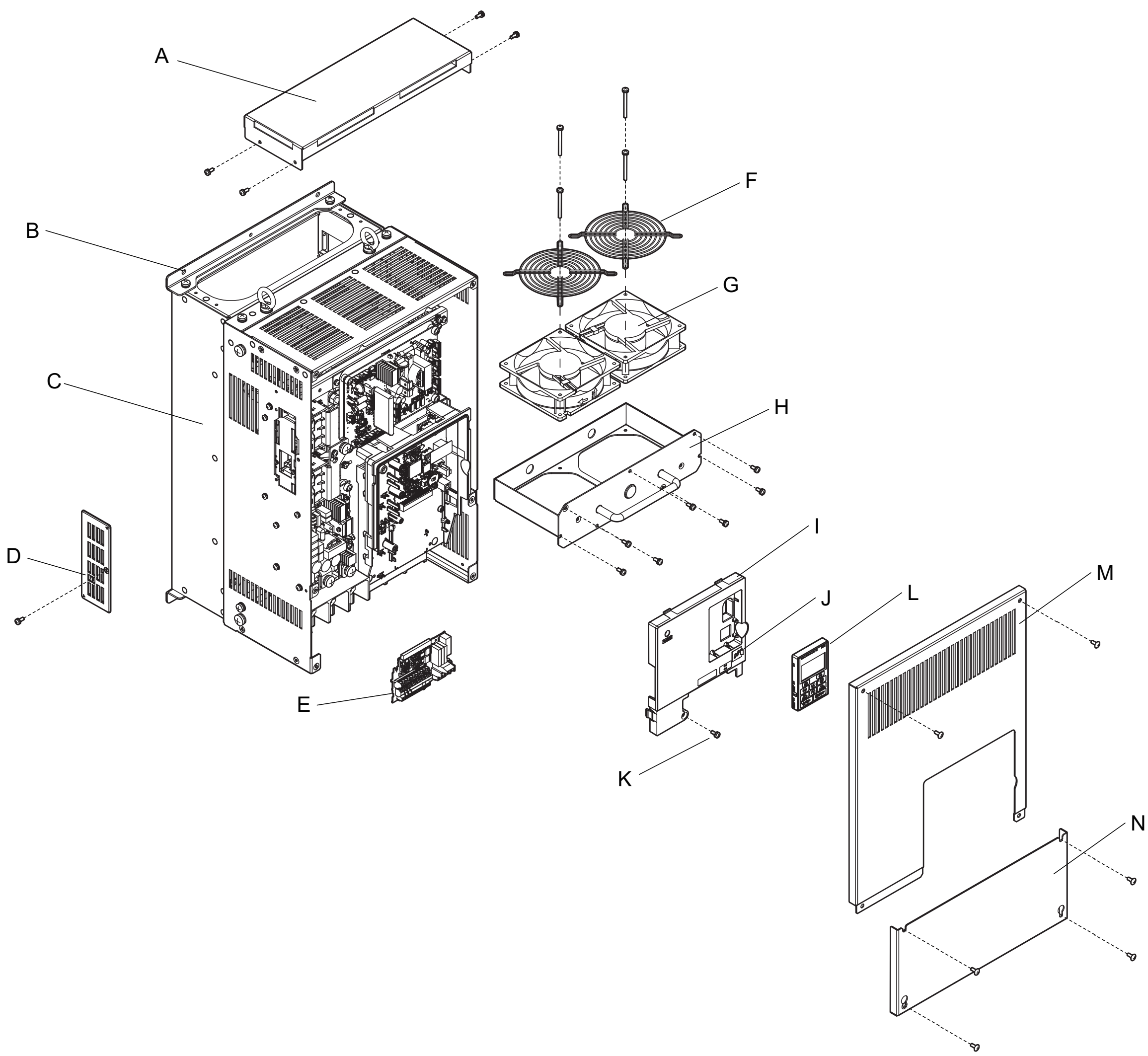
■ Three-Phase AC200 V 2A0106D and 2A0144D Three-Phase AC400 V 4A0056D to 4A0114D



A – Fan finger guard	**H – Front cover**
B – Cooling fan	**I – USB port (type-B)**
C – Top protective cover	**J – Front cover screw**
D – Mounting hole	**K – Digital operator**
E – Heatsink	**L – Drive cover**
F – Optional 24 V DC power supply connector cover	**M – Terminal cover**
G – Terminal board	

Figure 1.4 Exploded View of IP00 Enclosure Drive with Top Protective Cover (2A0106D)

■ Three-Phase AC200 V 2A0181D and 2A0225D Three-Phase AC400 V 4A0140D and 4A0188D

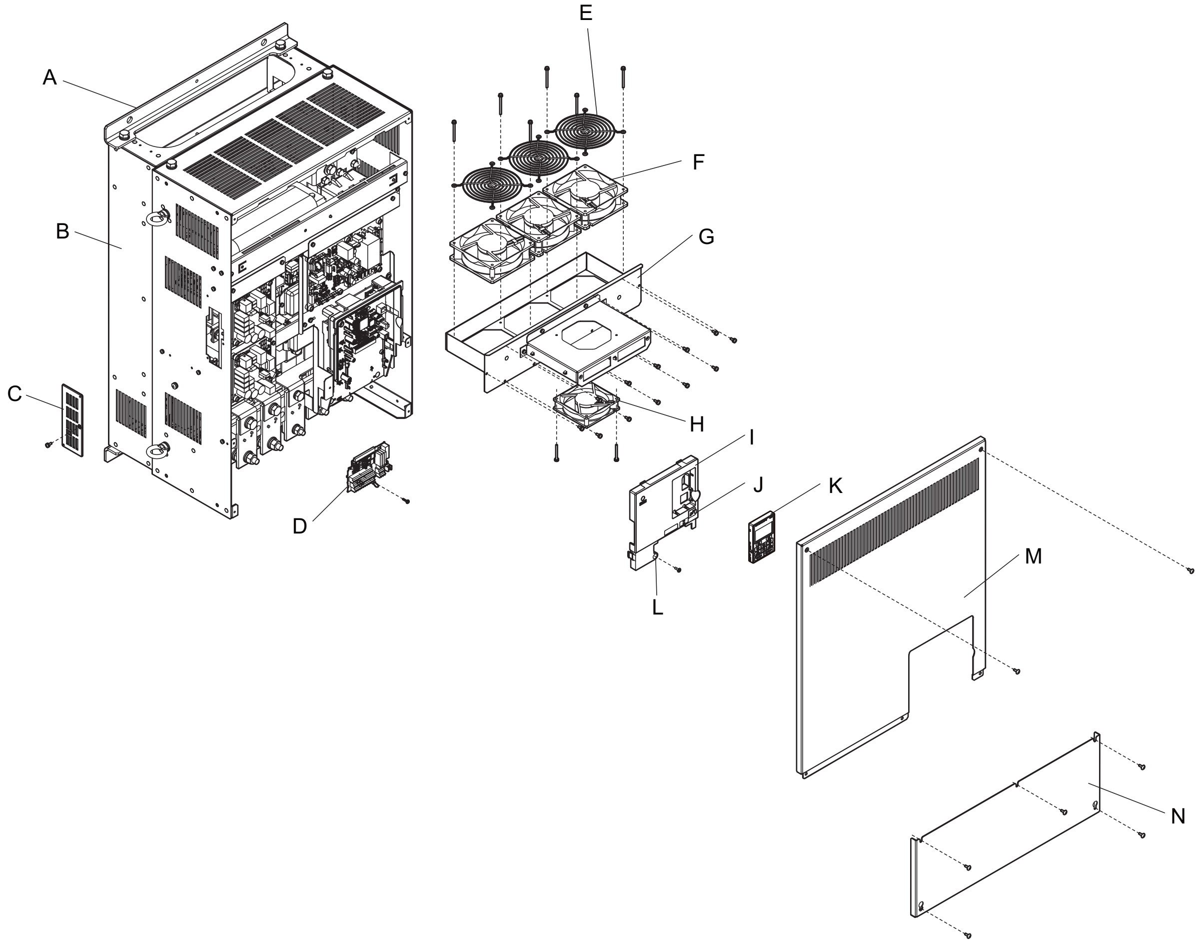


A – Top protective cover
B – Mounting hole
C – Heatsink
D – Optional 24 V DC power supply connector cover
E – Terminal board
F – Fan finger guard
G – Cooling fan
H – Fan unit
I – Front cover
J – USB port (type-B)
K – Front cover screw
L – Digital operator
M – Drive cover
N – Terminal cover

Figure 1.5 Exploded view of IP00 Enclosure Drive with Top Protective Cover (4A0188D)

◆ IP00 Enclosure

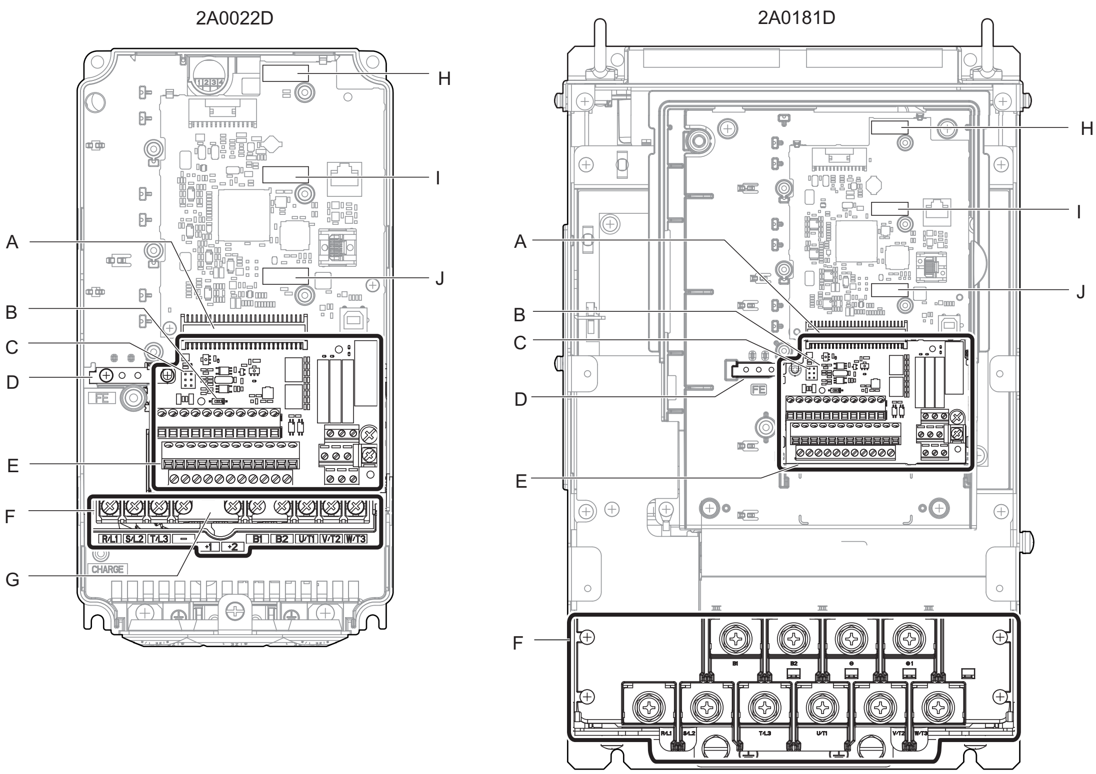
■ Three-Phase AC200 V 2A0269A to 2A0432A
Three-Phase AC400 V 4A0225A



A – Mounting hole	H – Circulation fan
B – Heatsink	I – Front cover
C – Optional 24 V DC power supply connector cover	J – USB port (type-B)
D – Terminal board	K – Digital operator
E – Fan finger guard	L – Front cover screw
F – Cooling fan	M – Drive cover
G – Fan unit case	N – Terminal cover

Figure 1.6 Exploded view of IP00 Enclosure Drive (2A0432A)

◆ Front Views



A – Terminal board connector

B – DIP switch S2 (*Refer to MEMOBUS/ Modbus Termination on page 86*)

C – Jumper S3 (*Refer to Sinking/Sourcing Mode Selection for Safe Disable Inputs on page 80*)

D – Ground terminal

E – Terminal board (*Refer to Sinking/ Sourcing Mode Selection for Safe Disable Inputs on page 80*)

F – Main circuit terminal (*Refer to Wiring the Main Circuit Terminal on page 72*)

G – Protecting cover to prevent miswiring

H – Option card connector (CN5-C)

I – Option card connector (CN5-B)

J – Option card connector (CN5-A)

Figure 1.7 Front View of Drives

2

Mechanical Installation

This chapter explains how to properly mount and install the drive.

2.1 Section Safety

⚠ WARNING

Fire Hazard

Provide sufficient cooling when installing the drive inside an enclosed panel or cabinet.

Failure to comply could result in overheating and fire.

When multiple drives are placed inside the same enclosure panel, install proper cooling to ensure air entering the enclosure does not exceed 40 °C.

⚠ CAUTION

Crush Hazard

Do not carry the drive by the front cover or the terminal cover.

Failure to comply may result in minor or moderate injury from the main body of the drive falling.

NOTICE

Equipment Hazard

Prevent foreign matter such as metal shavings or wire clippings from falling into the drive during drive installation and project construction.

Failure to comply could result in damage to the drive.
Place a temporary cover over the top during installation. Be sure to remove the temporary cover before start-up, as the cover will reduce ventilation and cause the unit to overheat.

Observe proper electrostatic discharge (ESD) procedures when handling the drive.

Failure to comply could result in ESD damage to the drive circuitry.

Operating the motor in the low-speed range diminishes the cooling effects, increases motor temperature, and may lead to motor damage by overheating.

Reduce the motor torque in the low-speed range whenever using a standard blower cooled motor. If 100% torque is required continuously at low speed, consider using a special drive or vector-control motor.

The speed range for continuous operation differs according to the lubrication method and motor manufacturer.

If the motor is to be operated at a speed higher than the rated speed, consult with the manufacturer.

Continuously operating an oil-lubricated motor in the low-speed range may result in motor failure.

When the input voltage is 440 V or higher or the wiring distance is greater than 100 meters, pay special attention to the motor insulation voltage or use a drive-rated motor with reinforced insulation.

Failure to comply could lead to motor winding failure.

Motor vibration may increase when operating a machine in variable-speed mode, if that machine previously operated at a constant speed.

Install vibration-proof rubber on the motor base.

The motor may require more acceleration torque with drive operation than with a commercial power supply.

Set a proper V/f pattern by checking the load torque characteristics of the machine to be used with the motor.

Never lift the drive up while the cover is removed.

This can damage the terminal board and other components.

Improper application of peripheral devices could result in malfunction of drive due to electrical interference.

Follow manufacturers recommendations when installing electrical devices near the drive and take precautions to shield the drive from electrical interference.

2.2 Mechanical Installation

This section outlines specifications, procedures, and the environment for proper mechanical installation of the drive.

CAUTION! *Crush Hazard. Carrying the drive by the front cover may cause the main body of the drive to fall, resulting in minor or moderate injury. Always hold the case when carrying the drive.*

◆ Installation Environment

Install the drive in an environment matching the specifications below to help prolong the optimum performance life of the drive.

Table 2.1 Installation Environment

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	IP00 enclosure with top protective cover: -10 to +40 °C IP00 enclosure: -10 to +50 °C Drive reliability improves in environments without wide temperature fluctuations. When using the drive in an enclosure panel, install a cooling fan or air conditioner in the area to ensure that the air temperature inside the enclosure does not exceed the specified levels. Do not allow ice to develop on the drive.
Humidity	95% RH or less and free of condensation
Storage Temperature	-20 to 60 °C
Surrounding Area	Install the drive in an area free from: • oil mist and dust • metal shavings, oil, water or other foreign materials • radioactive materials • combustible materials (e.g., wood) • harmful gases and liquids • excessive vibration • chlorides • direct sunlight
Altitude	1000 m or lower, up to 3000 m with derating (*Refer to Drive Derating Data on page 366*)
Vibration	10 to 20 Hz at 9.8 m/s^2 20 to 55 Hz at 5.9 m/s^2 (2A0018 to 2A0225 and 4A0009 to 4A0188) or 2.0 m/s^2 (2A0269 to 2A0432 and 4A0225)
Orientation	Install the drive vertically to maintain maximum cooling effects.

NOTICE: *Avoid placing drive peripheral devices, transformers, or other electronics near the drive as the noise created can lead to erroneous operation. If such devices must be used in close proximity to the drive, take proper steps to shield the drive from noise.*

NOTICE: *Prevent foreign matter such as metal shavings and wire clippings from falling into the drive during installation. Failure to comply could result in damage to the drive. Place a temporary cover over the top of the drive during installation. Remove the temporary cover before startup, as the cover will reduce ventilation and cause the drive to overheat.*

◆ Installation Orientation and Spacing

WARNING! *Fire Hazard. Provide sufficient cooling when installing the drive inside an enclosed panel or cabinet. Failure to comply could result in overheating and fire. When drives are placed inside the same enclosure panel, install proper cooling to ensure air entering the enclosure does not exceed 40°C.*

■ Installation Orientation

Install the drive upright as illustrated in *Figure 2.1* to maintain proper cooling. *Refer to Mechanical Installation on page 44* for details on installing the drive.

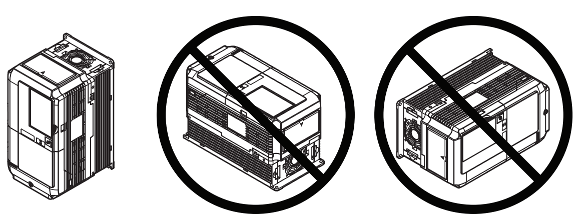
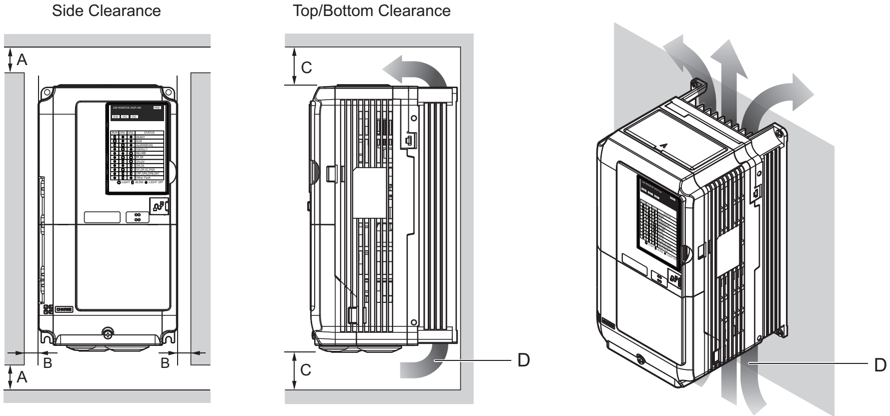


Figure 2.1 Correct Installation Orientation

■ Installation Spacing

Figure 2.2 shows the installation distance required to maintain sufficient space for airflow and wiring.



A – 50 mm (1.97 in.) minimum
B – 30 mm (1.18 in.) minimum
C – 120 mm (4.72 in.) minimum
D – Airflow direction

Figure 2.2 Correct Installation Spacing

◆ Top Protective Cover

Drive models 2A0018 to 2A0225 and 4A0009 to 4A0188 are designed to IP00 specifications with a top protective cover. The drive is able to operate in the ambient temperature of 50 °C by removing this top protective cover.

■ Removing the Top Protective Cover

Insert the tip of a straight-edge screwdriver into the small openings located on the front edge of the top protective cover. Gently apply pressure as shown in *Figure 2.3* to free the cover from the drive.

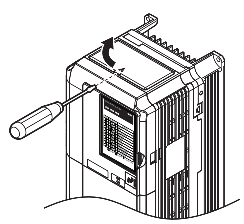


Figure 2.3 Removing the Top Protective Cover

■ Reattaching the Top Protective Cover

Align the small protruding hooks on the sides of the top protective cover with the corresponding mounting holes on the top of the drive. Pinch the hooks inward so that the they connect with the mounting holes and fasten the top protective cover back into place.

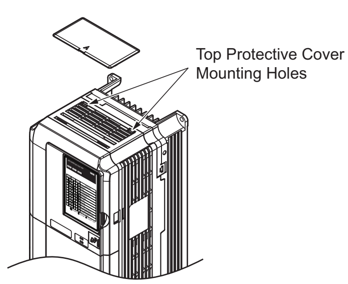


Figure 2.4 Reattaching the Top Protective Cover

Mechanical Installation
2

◆ LED Monitor Remote Usage

■ Remote Operation

The LED monitor mounted on the drive can be removed and connected to the drive using an extension cable up to 3 m long to facilitate operation when the drive is installed in a location where it can not be easily accessed.
The LED monitor can also be permanently mounted in remote locations such as panel doors using an extension cable and an installation support set (depending on the installation type).

Note: *Refer to Drive Options and Peripheral Devices on page 339* for information on extension cables and installation support sets.

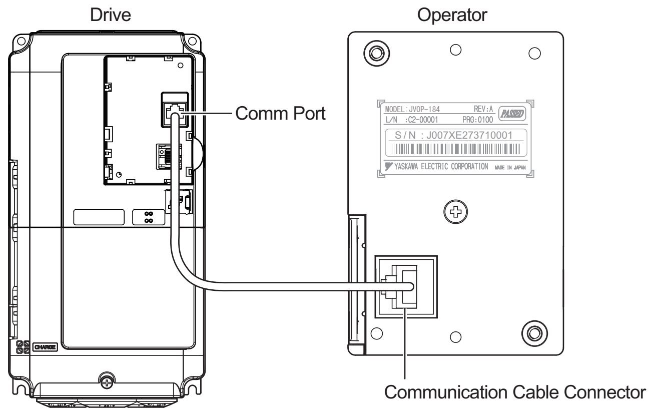


Figure 2.5 Communication Cable Connection

■ LED Monitor Remote Installation

LED Monitor Dimensions

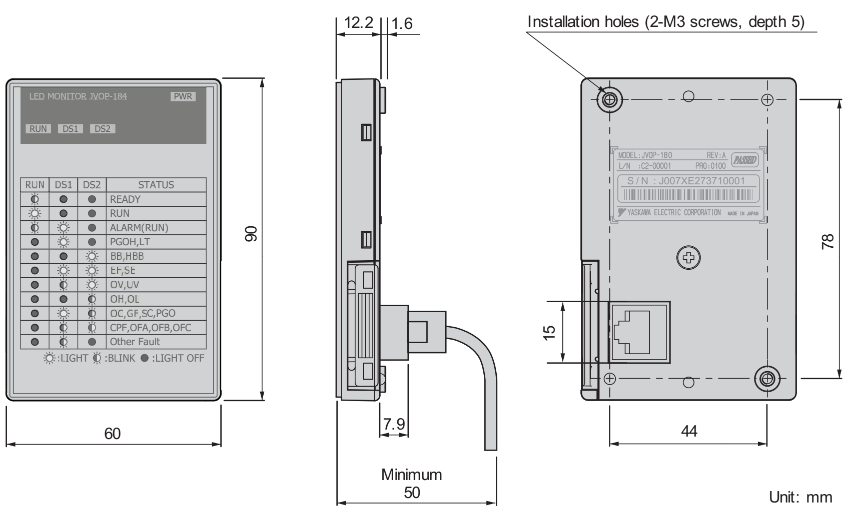


Figure 2.6 LED Monitor Dimensions

Installation Types and Required Materials

The LED monitor mounts to an enclosure two different ways:

1. External/face-mount installs the operator outside the enclosure panel
2. Internal/flush-mount installs the operator inside the enclosure panel

Table 2.2 LED Monitor Installation Methods and Required Tools

Installation Method	Description	Installation Support Sets	Model	Required Tools
External/Face-Mount	Simplified installation with the digital operator is mounted on the outside of the panel with two screws.	–	–	Phillips screwdriver (#1)
Internal/Flush-Mount	Encloses the digital operator in the panel. The digital operator is flush with the outside of the panel.	Installation Support Set A (for mounting with screws through holes in the panel)	EZZ020642A	Phillips screwdriver (#1, #2)
		Installation Support Set B (for use with threaded studs that are fixed to the panel)	EZZ020642B	Phillips screwdriver (#1) Wrench (7 mm)

NOTICE: *Prevent foreign matter such as metal shavings or wire clippings from falling into the drive during installation and project construction. Failure to comply could result in damage to the drive. Place a temporary cover over the top of the drive during installation. Remove the temporary cover before drive start-up, as the cover will reduce ventilation and cause the drive to overheat.*

External/Face-Mount

1. Cut an opening in the enclosure panel for the LED monitorr as shown in *Figure 2.8*.
2. Position the LED monitor so the display faces outwards, and mount it to the enclosure panel as shown in *Figure 2.7*.

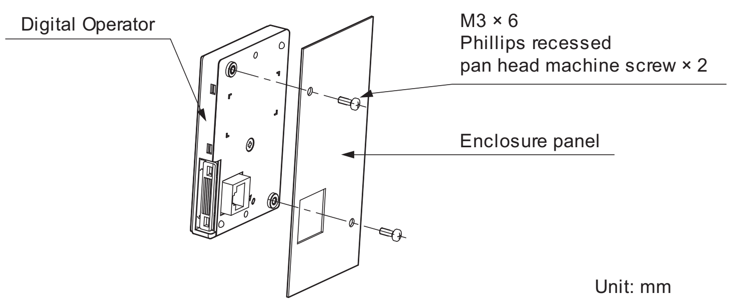


Figure 2.7 External/Face-Mount Installation

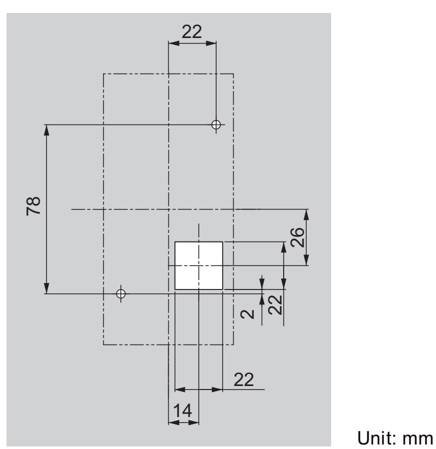


Figure 2.8 Panel Cut-Out Dimensions (External/Face-Mount Installation)

Mechanical Installation
2

Internal/Flush-Mount

An internal flush-mount requires an installation support set that must be purchased separately. Contact a Yaskawa representative to order an installation support set and mounting hardware. *Figure 2.9* illustrates how to attach the Installation Support Set A.

1. Cut an opening in the enclosure panel for the LED monitor operator as shown in *Figure 2.10*.
2. Mount the LED monitor to the installation support.
3. Mount the installation support set and LED monitor to the enclosure panel.

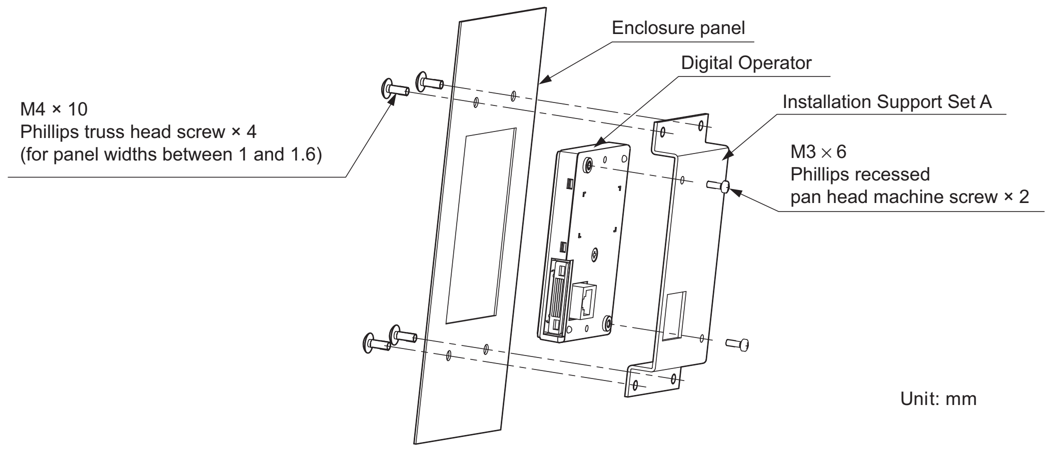


Figure 2.9 Internal/Flush Mount Installation

Note: Use a gasket between the enclosure panel and the LED monitor in environments with a significant amount of dust or other airborne debris.

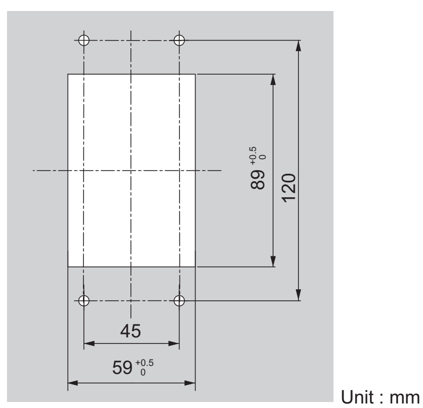


Figure 2.10 Panel Cut-Out Dimensions (Internal/Flush-Mount Installation)

◆ Exterior and Mounting Dimensions

■ IP00 Enclosure Drive with Top Protective Cover

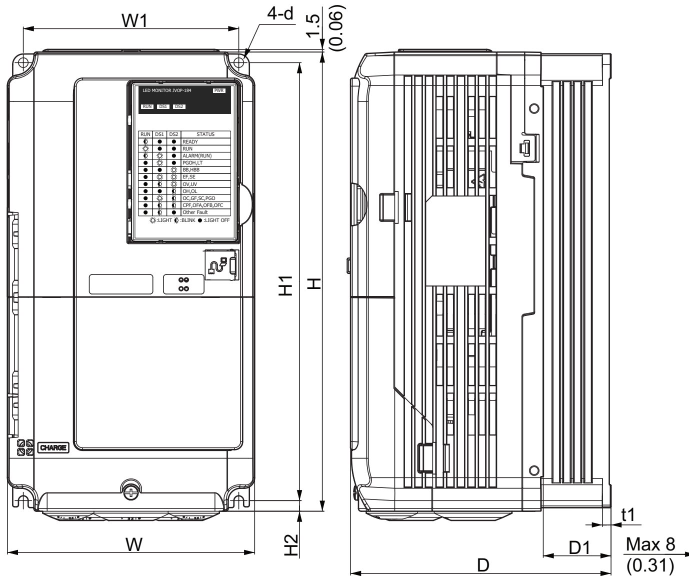


Figure 1

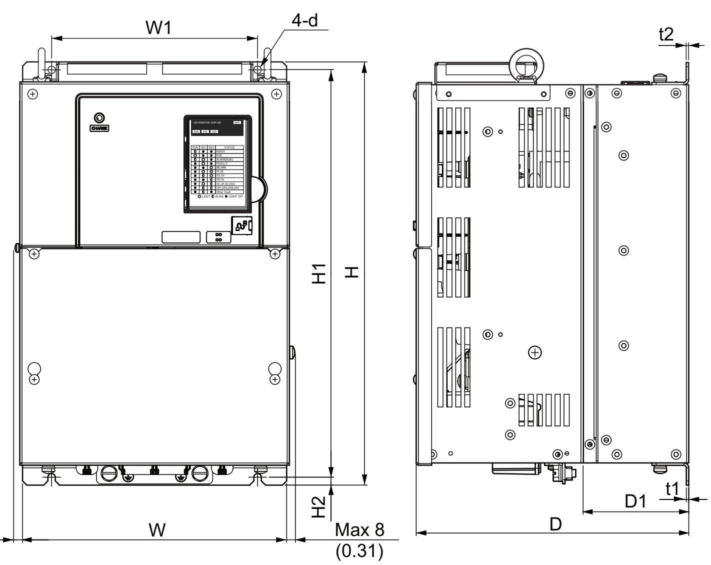


Figure 2

Table 2.3 IP00 Enclosure Drive with Top Protective Cover Dimensions: 200 V Class

Drive Model	Figure	Dimensions mm (in)										Weight kg (lbs)
		W	H	D	W1	H1	H2	D1	t1	t2	d	
2A0018	1	140 (5.50)	259 (10.20)	165 (6.50)	122 (4.80)	249 (9.80)	5 (0.20)	56 (2.20)	.5 (0.20)	–	M5	3.5 (7.7)
2A0022		140 (5.50)	259 (10.20)	165 (6.50)	122 (4.80)	249 (9.80)	5 (0.20)	56 (2.20)	.5 (0.20)	–	M5	3.5 (7.7)
2A0031		140 (5.50)	259 (10.20)	168 (6.60)	122 (4.80)	249 (9.80)	5 (0.20)	56 (2.20)	.5 (0.20)	–	M5	4.0 (8.8)
2A0041		140 (5.50)	259 (10.20)	168 (6.60)	122 (4.80)	249 (9.80)	5 (0.20)	56 (2.20)	.5 (0.20)	–	M5	4.0 (8.8)
2A0059		180 (7.10)	300 (11.80)	188 (7.40)	160 (6.30)	284 (11.20)	8 (0.30)	76 (3.00)	.5 (0.20)	–	M5	5.6 (12.3)
2A0075		221 (8.70)	351 (13.80)	198 (7.80)	193 (7.60)	335 (13.20)	8 (0.30)	79 (3.10)	.5 (0.20)	–	M6	8.7 (19.2)
2A0094		221 (8.70)	351 (13.80)	198 (7.80)	193 (7.60)	335 (13.20)	8 (0.30)	79 (3.10)	.5 (0.20)	–	M6	9.7 (21.4)
2A0106	2	249 (9.80)	399 (15.70)	259 (10.20)	196 (7.70)	386 (15.20)	8 (0.30)	99 (3.90)	.25 (0.10)	.25 (0.10)	M6	21.0 (46.3)
2A0144		274 (10.80)	450 (17.70)	259 (10.20)	221 (8.70)	434 (17.10)	8 (0.30)	99 (3.90)	.25 (0.10)	.25 (0.10)	M6	25.0 (55.1)
2A0181		325 (12.80)	551 (21.70)	284 (11.10)	259 (10.20)	536 (21.10)	8 (0.30)	109 (4.30)	.25 (0.10)	.25 (0.10)	M6	37.0 (81.6)
2A0225		325 (12.80)	551 (21.70)	284 (11.10)	259 (10.20)	536 (21.10)	8 (0.30)	109 (4.30)	.25 (0.10)	.25 (0.10)	M6	38.0 (83.8)

Table 2.4 IP00 Enclosure Drive with Top Protective Cover Dimensions: 400 V Class

Drive Model	Figure	Dimensions mm (in)										Weight kg (lbs)
		W	H	D	W1	H1	H2	D1	t1	t2	d	
4A0009	1	140 (5.50)	259 (10.20)	165 (6.50)	122 (4.80)	249 (9.80)	5 (0.20)	56 (2.20)	5 (0.20)	–	M5	3.5 (7.7)
4A0012		140 (5.50)	259 (10.20)	165 (6.50)	122 (4.80)	249 (9.80)	5 (0.20)	56 (2.20)	5 (0.20)	–	M5	3.5 (7.7)
4A0019		140 (5.50)	259 (10.20)	168 (6.60)	122 (4.80)	249 (9.80)	5 (0.20)	56 (2.20)	5 (0.20)	–	M5	4.0 (8.6)
4A0023		140 (5.50)	259 (10.20)	168 (6.60)	122 (4.80)	249 (9.80)	5 (0.20)	56 (2.20)	5 (0.20)	–	M5	4.0 (8.9)
4A0030		180 (7.10)	300 (11.80)	168 (6.60)	160 (6.30)	284 (11.20)	8 (0.30)	56 (2.20)	5 (0.20)	–	M5	5.4 (11.9)
4A0039		180 (7.10)	300 (11.80)	188 (7.40)	160 (6.30)	284 (11.20)	8 (0.30)	76 (3.00)	5 (0.20)	–	M5	5.4 (11.9)
4A0049		221 (8.70)	351 (13.80)	198 (7.80)	193 (7.60)	335 (13.20)	8 (0.30)	79 (3.10)	5 (0.20)	–	M6	8.0 (18.3)
4A0056	2	249 (9.80)	399 (15.70)	259 (10.20)	196 (7.70)	386 (15.20)	8 (0.30)	99 (3.90)	3 (0.10)	3 (0.10)	M6	22.0 (46.3)
4A0075		274 (10.80)	450 (17.70)	259 (10.20)	221 (8.70)	434 (17.10)	8 (0.30)	99 (3.90)	3 (0.10)	3 (0.10)	M6	25.0 (55.1)
4A0094		325 (12.80)	511 (20.10)	259 (10.20)	259 (10.20)	495 (19.50)	8 (0.30)	104 (4.10)	3 (0.10)	3 (0.10)	M6	36.0 (79.4)
4A0114		325 (12.80)	511 (20.10)	259 (10.20)	259 (10.20)	495 (19.50)	8 (0.30)	104 (4.10)	3 (0.10)	3 (0.10)	M6	36.0 (79.4)
4A0140		325 (12.80)	551 (21.70)	282 (11.10)	259 (10.20)	536 (21.10)	8 (0.30)	109 (4.30)	3 (0.10)	3 (0.10)	M6	41.0 (90.4)
4A0188		325 (12.80)	551 (21.70)	282 (11.10)	259 (10.20)	536 (21.10)	8 (0.30)	109 (4.30)	3 (0.10)	3 (0.10)	M6	42.0 (92.6)

■ IP00 Enclosure Drive

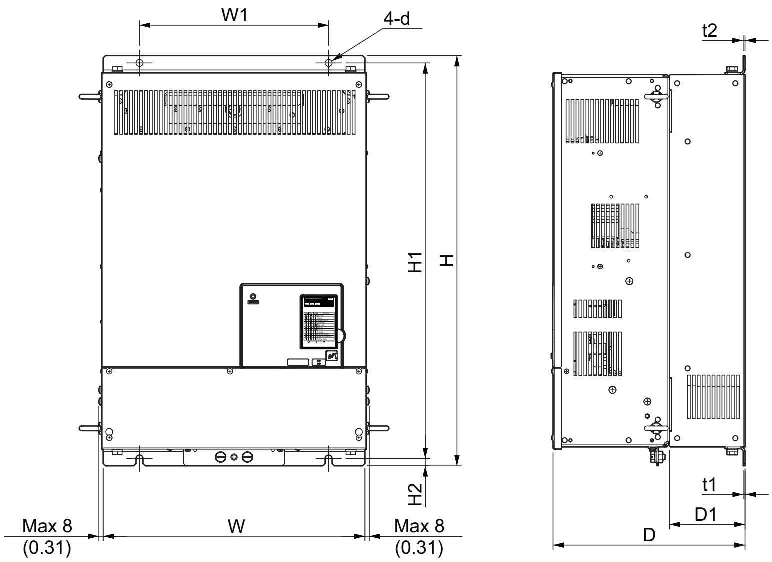


Figure 1

Table 2.5 IP00 Enclosure Drive Dimensions: 200 V Class

Drive Model	Figure	Dimensions mm (in)										Weight kg (lbs)
		W	H	D	W1	H1	H2	D1	t1	t2	d	
2A0269	1	450 (17.70)	706 (27.80)	330 (13.00)	325 (12.80)	681 (26.80)	13 (0.50)	130 (5.10)	3 (0.10)	3 (0.10)	M10	76 (167.6)
2A0354		450 (17.70)	706 (27.80)	330 (13.00)	325 (12.80)	681 (26.80)	13 (0.50)	130 (5.10)	3 (0.10)	3 (0.10)	M10	80 (176.4)
2A0432		500 (19.70)	800 (31.50)	330 (13.00)	371 (14.60)	772 (30.40)	13 (0.50)	130 (5.10)	5 (0.20)	5 (0.20)	M12	98 (216.1)

Table 2.6 IP00 Enclosure Drive Dimensions: 400 V Class

Drive Model	Figure	Dimensions mm (in)										Weight kg (lbs)
		W	H	D	W1	H1	H2	D1	t1	t2	d	
4A0225	1	450 (17.70)	706 (27.80)	330 (13.00)	325 (12.80)	681 (26.80)	13 (0.50)	130 (5.10)	3 (0.10)	3 (0.10)	M10	79 (174.2)

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3

Electrical Installation

This chapter explains proper procedures for wiring the control circuit terminals, motor, and power supply.

3.1 Section Safety

DANGER

Electrical Shock Hazard

Do not change wiring, remove covers, connectors or options cards, or attempt to service the drive with power applied to the drive.

Disconnect all power to the drive, and lock out the power source. After shutting off the power wait for at least the amount of time specified on the drive front cover safety label. Measure the DC bus voltage for unsafe voltages to confirm safe level before servicing to prevent electric shock The internal capacitor remains charged even after the power supply is turned off. Failure to comply will result in serious injury or death from electric shock.

WARNING

Sudden Movement Hazard

Operating a drive with untested emergency circuits could result in death or serious injury.

Verify all drive fast stop wiring and additional emergency circuits before operating the drive.

Ensure start/stop, I/O and safety circuits are wired properly and in the correct state before energizing or running the drive.

Failure to comply could result in death or serious injury from moving equipment.

Ensure holding brake circuits are properly configured, load equipment may fall or drop during power loss or drive fault, which could result in death or serious injury.

- Provide a separate holding brake if necessary.
- Always construct the external sequence to confirm that the holding brake is activated in the event of an emergency, a power failure, or an abnormality in the drive.
- If using the drive with an elevator, provide safety measures on the elevator to prevent the elevator from dropping.

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.

Do not allow unqualified personnel to use the equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Make sure the protective earthing conductor complies with technical standards and local safety regulations.

WARNING

Use a GFCI type B according to IEC 60755 when leakage current protection or monitoring is required to help protect against shock by direct or indirect contact with electrical equipment.

Failure to comply may result in injury due to electrical shock.

Improper equipment grounding may cause dangerous electrical potentials on equipment chassis, which could result in death or serious injury. Always use a ground wire that complies with technical standards on electrical equipment and minimize the length of the ground wire.

Always ground the ground terminal. (200 V Class: Ground to 100 Ω or less, 400 V Class: Ground to 10 Ω or less).

Sudden Movement Hazard

Comply with proper wiring practices.

The motor may run in reverse if the phase order is backward, causing incorrect elevator direction movement and injury to personnel.
Connect motor input terminals U, V and W to drive output terminals U/T1,V/T2, and W/T3. The phase order for the drive and motor should match.

Install a properly controlled contactor on the input-side of the drive for applications where power should be removed from the drive during a fault condition.

Improper equipment sequencing could result in death or serious injury.

Fire Hazard

Drive Short-Circuit Current Rating

Install adequate branch circuit protection according to applicable local codes and this Installation Manual.

Failure to comply could result in fire and damage to the drive or injury to personnel.

The device is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (200 V class) and 480 Vac maximum (400 V class) when protected by branch circuit protection devices specified in this manual.

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Improperly tightened terminal screws can also cause erroneous equipment operation.

Do not use improper combustible materials in drive installation.

Failure to comply could result in death or serious injury by fire.

Attach the drive or braking resistors to metal or other noncombustible material.

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire. Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

The braking resistor connection terminals are B1 and B2. Do not connect a braking resistor directly to any other terminals.

Improper wiring connections could result in death or serious injury by fire.

Do not connect the AC power line to the output motor terminals of the drive. Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.

- Do not connect AC line power to output terminals U, V, and W.
- Make sure that the power supply lines are connected to main circuit input terminals R/L1, S/L2, T/L3 (or R/L1 and S/L2 for single-phase power).

CAUTION

Crush Hazard

Carrying the drive by the front cover may cause the main body of the drive to fall, resulting in minor or moderate injury.

Always hold the case when carrying the drive.

NOTICE

Equipment Hazard

Only connect recommended devices to the drives braking transistor terminals.

Failure to comply could result in damage to the drive or braking circuit. Carefully review instruction manual TOBP C720600 00 when connecting a braking option to the drive.

Do not share the ground wire with other devices such as welding machines or large-current electrical equipment.

Improper equipment grounding could result in drive or equipment malfunction due to electrical interference.

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive.

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

Yaskawa is not responsible for any modification of the product made by the user. This product must not be modified.

Check all the wiring to ensure that all connections are correct after installing the drive and connecting any other devices.

Failure to comply could result in damage to the drive.

Connect braking circuits to the drive as shown in the I/O wiring examples.

Improperly wiring braking circuits could result in damage to the drive or equipment.

Do not check or test control circuit signals while the drive is running.

Improper use of test equipment could result in damage to the drive circuitry by short circuit.

Standard motors used with PWM drives may experience winding failures due to surge voltages, when input line voltage is greater than 480 V or motor wire distance is greater than 100 meters.

Select a motor design with insulation tolerant of surge voltages and drive-rated motor for use with PWM drives.

Failure to comply could lead to motor winding failure.

Do not connect control circuit ground terminals to the drive enclosure.

Improper drive grounding can cause control circuit malfunction.

Do not use the negative DC bus terminal "-" as a ground terminal. This terminal is at high DC voltage potential.

Improper wiring connections could damage the drive.

NOTICE

Before applying power to the drive, use power-off resistance checks to check for short-circuits between (R/L1, S/L2, and T/L3) or between main circuit terminals and ground.

Failure to comply may result in damage to the drive from short-circuit.

Prevent foreign matter such as metal shavings or wire clippings from falling into the drive during drive installation and project construction.

Failure to comply could result in damage to the drive. Place a temporary cover over the top during installation. Be sure to remove the temporary cover before start-up, as the cover will reduce ventilation and cause the unit to overheat.

Improper application of devices on drive output circuits can damage the drive.

Do not connect unapproved LC or RC interference suppression filters, capacitors, ground fault circuits, or overvoltage protection devices to the output of the drive.

Insulate shields with heat shrink tubing or tape to prevent contact with other signal lines and equipment.

Improper wiring practices could result in drive or equipment damage due to short circuit.

3.2 Standard Connection Diagram

Connect the drive and peripheral devices as shown in ***Figure 3.1***. It is possible to set and run the drive via the digital operator without connecting digital I/O wiring. This section does not discuss drive operation; ***Refer to Start-Up Programming & Operation on page 85*** for instructions on operating the drive.

WARNING! *Sudden Movement Hazard. Ensure holding brake circuits are properly configured, load equipment may fall or drop during power loss or drive fault, which could result in death or serious injury.*
・Provide a separate holding brake if necessary.
・Always construct the external sequence to confirm that the holding brake is activated in the event of an emergency, a power failure, or an abnormality in the drive.
・When using the drive with an elevator, provide safety measures on the elevator to prevent the elevator from dropping.

NOTICE: *Inadequate wiring could result in damage to the drive. Install adequate branch circuit short circuit protection per applicable codes. The drive is suitable for circuits capable of delivering not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400 V Class).*

NOTICE: *When the input voltage is 440 V or higher or the wiring distance is greater than 100 meters (328 ft.), pay special attention to the motor insulation voltage or use a drive rated motor. Failure to comply could lead to motor insulation breakdown.*

Note: Do not connect AC control circuit ground to drive enclosure. Improper drive grounding can cause control circuit malfunction.

NOTICE: *The minimum load for the multi-function relay output MA-MB-MC is 10 mA. If a circuit requires less than 10 mA (reference value), connect it to a photocoupler output (P1-C1, P2-C2). Improper application of peripheral devices could result in damage to the photocoupler output of the drive.*

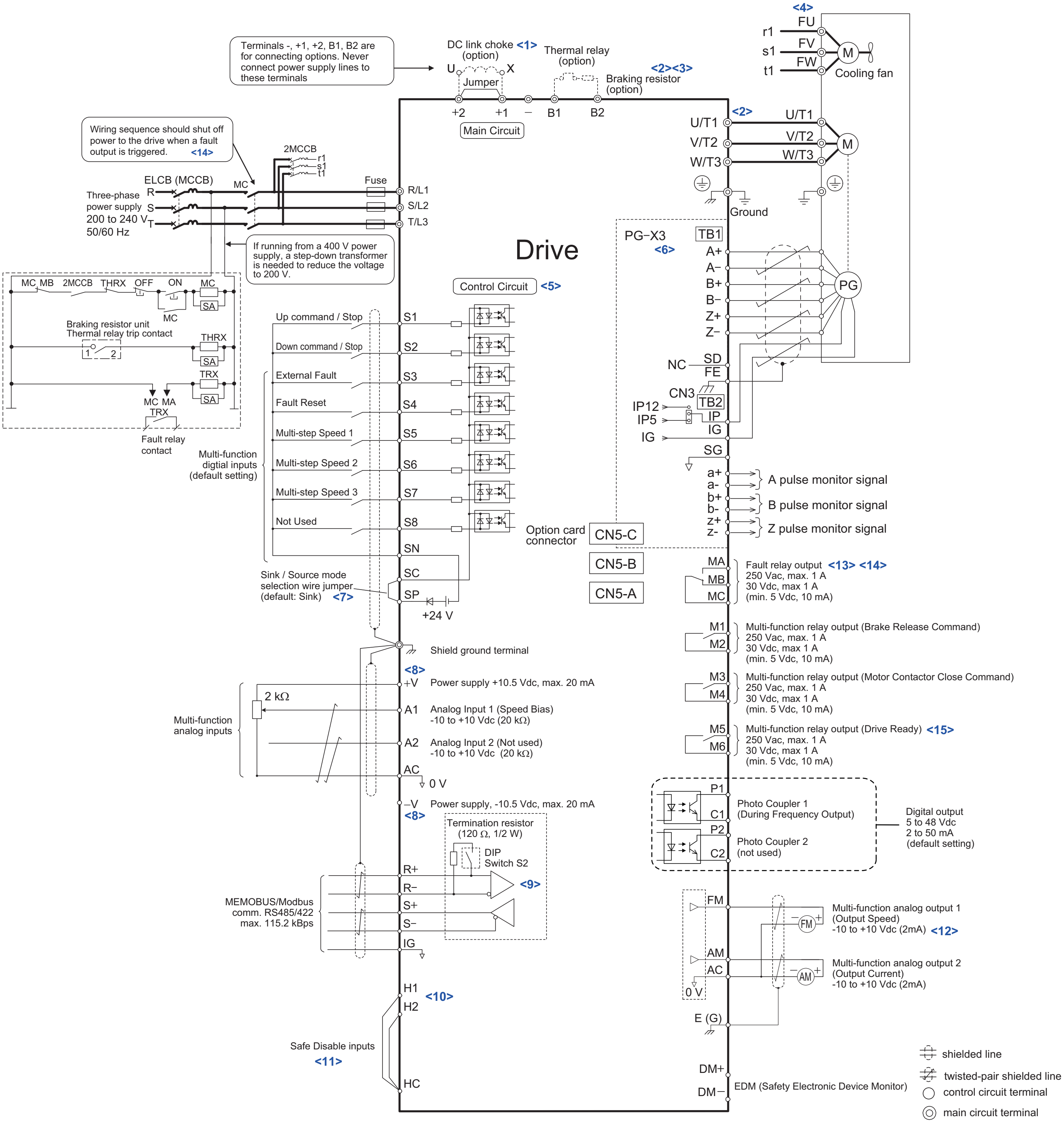


Figure 3.1 Drive Standard Connection Diagram (example: 2A0041)

<1> Remove the jumper when installing a DC link choke. Models 2A0106 through 2A0432 and 4A0056 through 4A0225 come with a built-in DC link choke.

<2> Set L8-55 to 0 to disable the protection function of the built-in braking transistor of the drive when using an optional regenerative converter or dynamic braking option.

<3> Set up a thermal relay sequence to disconnect drive main power in the event of an overheat condition on the dynamic braking option.

<4> Self-cooling motors do not require the same wiring necessary for motors with separate cooling fans.

<5> Supplying power to the control circuit separately from the main circuit requires a 24 V power supply (option).

<6> For control modes that do not use a motor speed feedback signal, PG option card wiring is not necessary.

<7> This figure illustrates an example of a sequence input to S1 through S8 using a non-powered relay or an NPN transistor. Install the wire link between terminals SC-SP for Sink mode, between SC-SN for Source mode, or leave the link out for external power supply. Never short terminals SP and SN, as it will damage the drive.

<8> The maximum output current capacity for the +V and -V terminals on the control circuit is 20 mA. Never short terminals +V, -V, and AC, as it can cause erroneous operation or damage the drive.

<9> Set DIP switch S2 to the ON position to enable the termination resistor in the last drive in a MEMOBUS/Modbus network.

<10> The sink/source setting for the Safe Disable input is the same as with the sequence input. Jumper S3 has the drive set for an external power supply. When not using the Safe Disable input feature, remove the jumper shorting the input and connect an external power supply. ***Refer to Sinking/Sourcing Mode Selection for Safe Disable Inputs on page 80*** for instructions.

<11> Disconnect the wire jumper between H1 - HC and H2 - HC when utilizing the Safe Disable input.

<12> Monitor outputs work with devices such as analog frequency meters, ammeters, voltmeters, and wattmeters. They are not intended for use as a feedback-type of signal.

<13> When the drive is set to trigger a fault output upon activation of the fault reset function (L5-02 = 1), a sequence to interrupt power when a fault occurs will shut off the power to the drive when the drive attempts a reset. The default setting for L5-02 is 0 (fault output not active during reset attempt).

<14> Wire fault contact outputs MA, MB, and MC. Wire so that a fault will open the safety circuit and interrupt drive output.

<15> When using the Programming Mode to edit parameter settings, the drive will not accept an Up/Down command. If the drive still will not run when an Up/Down command has been entered and no fault is present, then use the "Drive ready" signal (the default setting for terminal M5-M6) to interlock components.

WARNING! *Sudden Movement Hazard. Ensure start/stop and safety circuits are wired properly and in the correct state before energizing the drive. Failure to comply could result in death or serious injury from moving equipment.*

NOTICE: *When using the automatic fault reset function with wiring designed to shut off the power supply upon drive fault, make sure the drive does not trigger a fault output during fault reset (L5-02 = 0, default). Failure to comply will prevent the automatic fault reset function from working properly.*

3.3 Main Circuit Connection Diagram

Refer to the *Figure 3.2* when wiring the main circuit of the drive. Connections may vary based on drive capacity. The DC power supply for the main circuit also provides power to the control circuit.

NOTICE: *Do not use the negative DC bus terminal "-" as a ground terminal. This terminal is at high DC voltage potential. Improper wiring connections could damage the drive.*

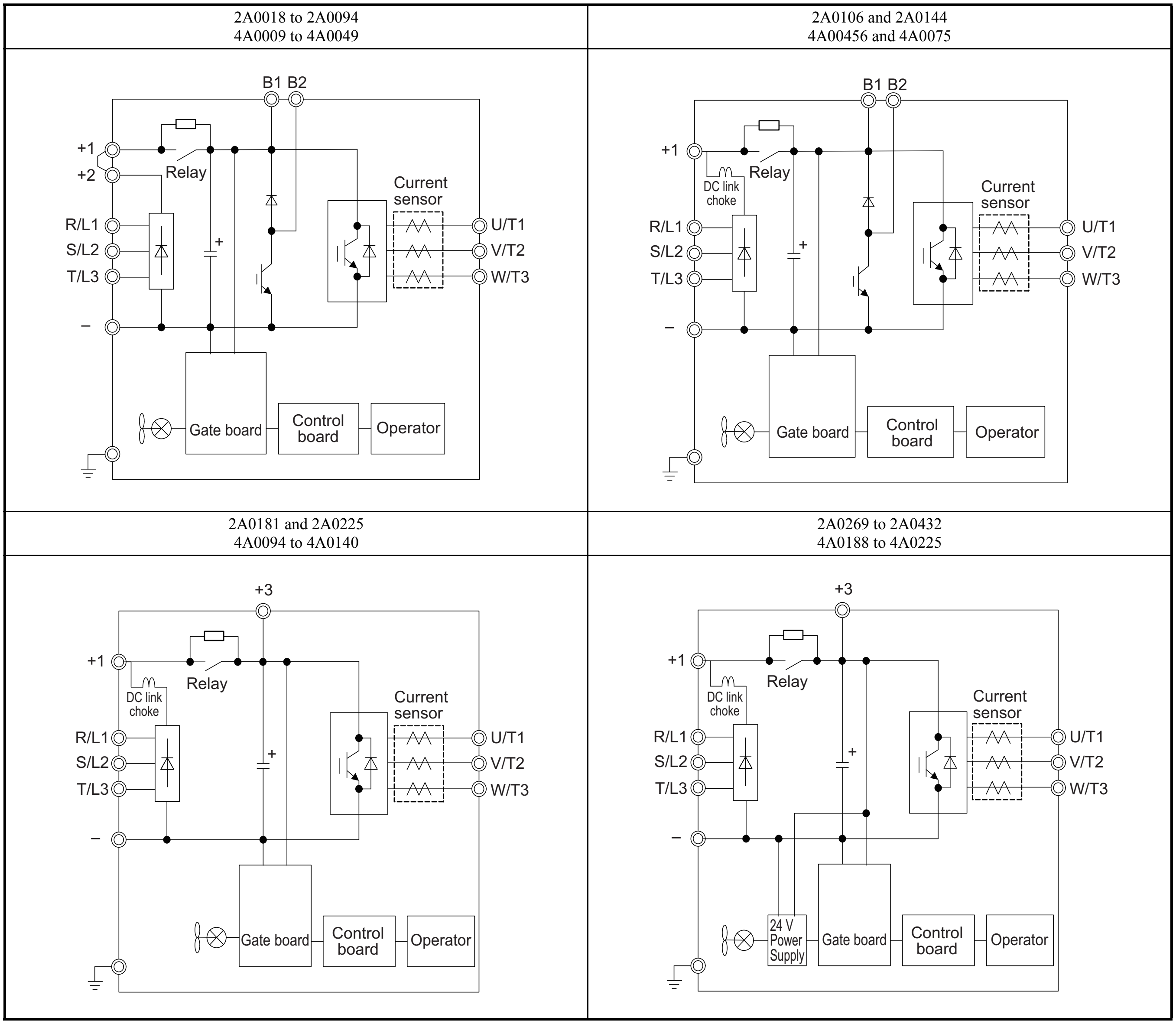


Figure 3.2 Drive Main Circuit Configurations

3.4 Terminal Block Configuration

Figure 3.3 shows the different main circuit terminal arrangements for the drive capacities.

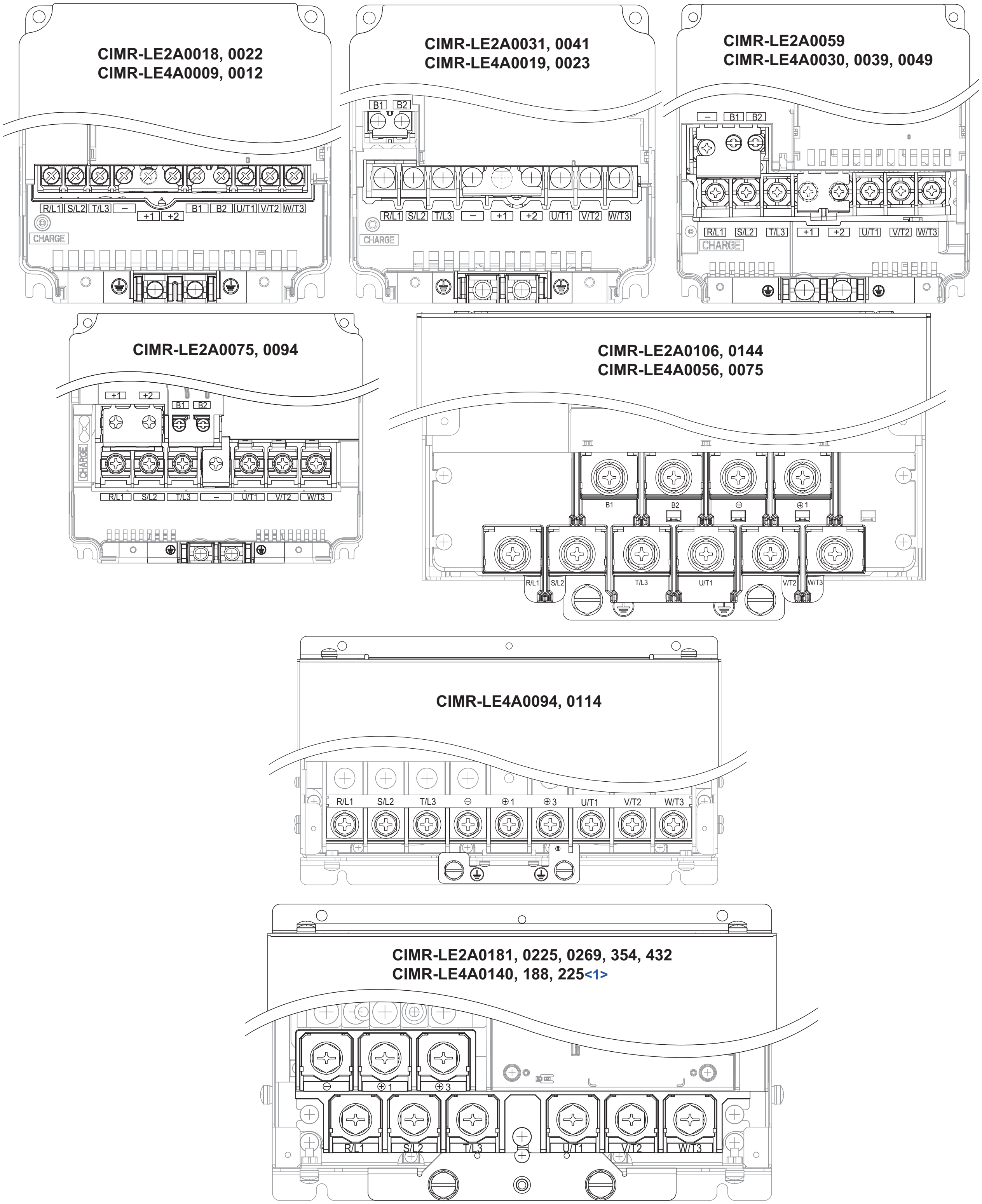


Figure 3.3 Main Circuit Terminal Block Configuration

<1> Terminal board design differs slightly for models 2A0269 through 2A0432, and 4A0225.

3.5 Terminal Cover

Follow the procedure below to remove the terminal cover for wiring and to reattach the terminal cover after wiring is complete.

◆ Removing/Reattaching the Terminal Cover

■ Removing the Terminal Cover

Models 2A0018 to 2A0094 and 4A0009 to 4A0049

1. Loosen the terminal cover screw using a #2 Phillips screwdriver. Screw sizes vary by drive model.

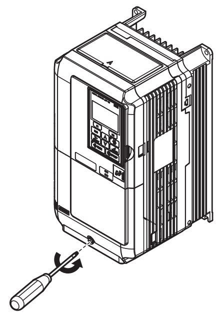


Figure 3.4 Removing the Terminal Cover

2. Push in on the tab located on the bottom of the terminal cover and gently pull forward to remove the terminal cover.

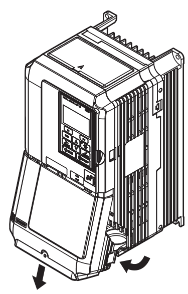


Figure 3.5 Removing the Terminal Cover

Models 2A0106 to 2A0432 and 4A0056 to 4A0225

1. Loosen the screws on the terminal cover, then pull down on the cover.

CAUTION! *Do not completely remove the cover screws, just loosen them. If the cover screws are removed completely, the terminal cover may fall off causing an injury.*

Note: The shape of the terminal covers and the numbers of screws differ depending on the drive models. ***Refer to Component Names on page 31*** for details.

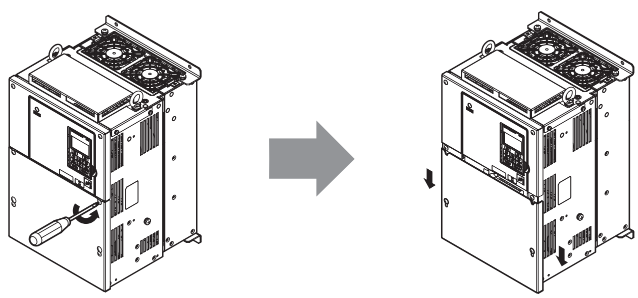


Figure 3.6 Removing the Terminal Cover

2. Pull forward on the terminal cover to free it from the drive.

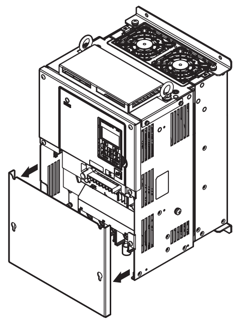


Figure 3.7 Removing the Terminal Cover

■ Reattaching the Terminal Cover

Models 2A0018 to 2A0094 and 4A0009 to 4A0049

Power lines and signal wiring should pass through the opening provided. ***Refer to Wiring the Main Circuit Terminal on page 76*** and ***Wiring the Control Circuit Terminal on page 76*** for details on wiring.

Reattach the terminal cover after completing the wiring to the drive and other devices.

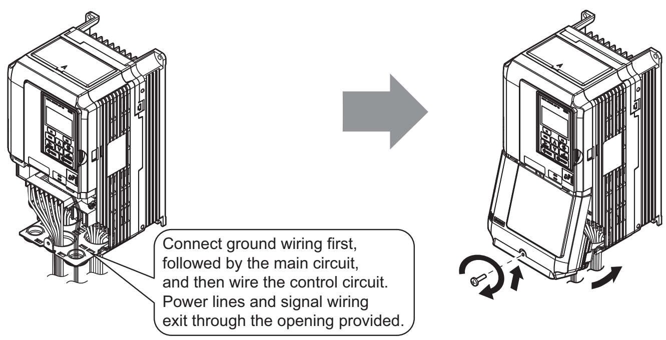


Figure 3.8 Reattaching the Terminal Cover

Models 2A0106 to 2A0432 and 4A0056 to 4A0225

After wiring the terminal board and other devices, double-check connections and reattach the terminal cover. ***Refer to Wiring the Main Circuit Terminal on page 72*** and ***Wiring the Control Circuit Terminal on page 76*** for details on wiring.

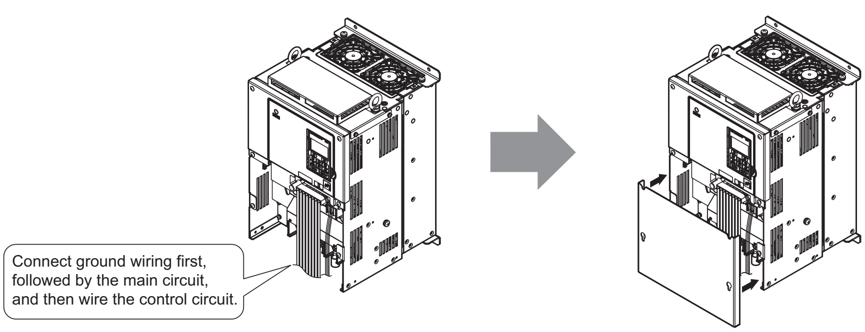


Figure 3.9 Reattaching the Terminal Cover

3.6 LED Monitor Operator and Front Cover

Detach the LED monitor from the drive for remote operation or when opening the front cover to install an option card.

Note: Be sure to remove the LED monitor prior to opening or reattaching the front cover. Leaving the LED monitor plugged into the drive when removing the front cover can result in erroneous operation caused by a poor connection. Firmly fasten the front cover back into place before reattaching the LED monitor.

◆ Removing/Reattaching the LED Monitor

■ Removing the LED Monitor

While pressing on the tab located on the right side of the LED monitor, pull the LED monitor forward to remove it from the drive.

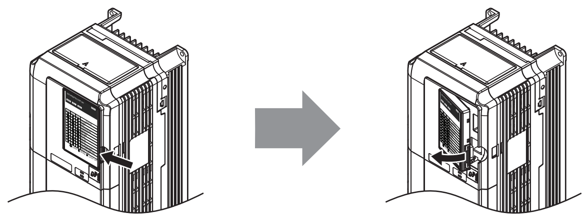


Figure 3.10 Removing the LED Monitor

■ Reattaching the LED Monitor

Insert the LED monitor into the opening in the top cover while aligning it with the notches on the left side of the opening.

Next, press gently on the right side of the LED monitor until it clicks into place.

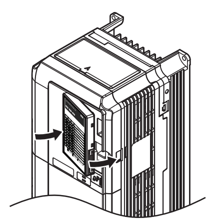


Figure 3.11 Reattaching the Digital Operator

◆ Removing/Reattaching the Front Cover

■ Removing the Front Cover

Models 2A0018 to 2A0094 and 4A0009 to 4A0049

After removing the terminal cover and the LED monitor, loosen the screw that affixes the front cover (models 2A0059, 4A0030, and 4A0039 do not use a screw to affix the front cover). Pinch inwards on the tabs found on each side of the front cover, then pull forward to remove it from the drive.

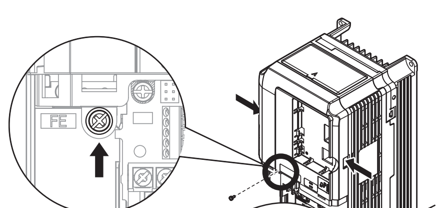


Figure 3.12 Remove the Front Cover (Models 2A0018 to 2A0094 and 4A0009 to 4A0049)

Models 2A0106 to 2A0432 and 4A0056 to 4A0225

1. Remove the terminal cover and the LED monitor.
2. Loosen the installation screw on the front cover.
3. Use a straight-edge screwdriver to loosen the hooks on each side of the cover that hold it in place.

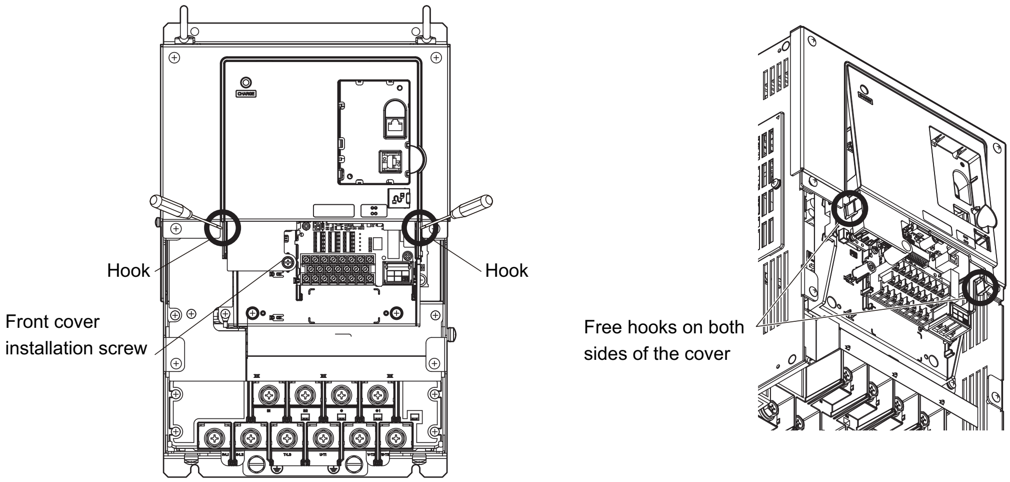


Figure 3.13 Remove the Front Cover (Models 2A0106 to 2A0432 and 4A0056 to 4A0225)

4. Unhook the left side of the front cover then swing the left side towards you as shown in ***Figure 3.14*** until the cover comes off.

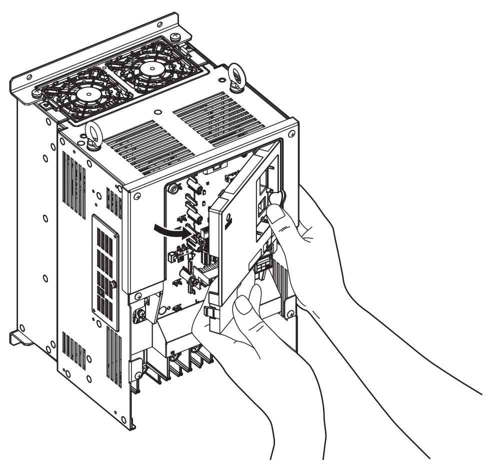


Figure 3.14 Remove the Front Cover (Models 2A0106 to 2A0432 and 4A0056 to 4A0225)

■ Reattaching the Front Cover

Models 2A0018 to 2A0094 and 4A0009 to 4A0049

Reverse the instructions given in *Remove the Front Cover (Models 2A0018 to 2A0094 and 4A0009 to 4A0049) on page 65* to reattach the front cover. Pinch inwards on the hooks found on each side of the front cover while guiding it back into the drive. Make sure it clicks firmly into place.

Models 2A0106 to 2A0432 and 4A0056 to 4A0225

1. Slide the front cover so the hooks on the top connect to the drive.

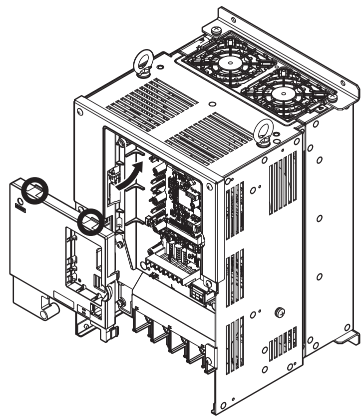


Figure 3.15 Reattach the Front Cover (2A0106 to 2A0432 and 4A0056 to 4A0225)

2. After connecting the hooks to the drive, press firmly on the cover to lock it into place.

3.7 Main Circuit Wiring

This section describes the functions, specifications, and procedures required to safely and properly wire the main circuit in the drive.

NOTICE: *Only connect recommended devices to the drives braking transistor terminals. Failure to comply could result in damage to the drive or braking circuit. Carefully review instruction manual TOBP C720600 00 when connecting a braking option to the drive.*

NOTICE: *Do not use the negative DC bus terminal "-" as a ground terminal. This terminal is at high DC voltage potential. Improper wiring connections could damage the drive.*

NOTICE: *Equipment Hazard. Comply with proper wiring practices. The motor may run in reverse if the phase order is backward, causing incorrect elevator direction movement. Connect motor input terminals U, V and W to drive output terminals U/T1,V/T2, and W/T3. The phase order for the drive and motor should match.*

Note: Do not solder the ends of wire connections to the drive. Soldered wiring connections can loosen over time. Improper wiring practices could result in drive malfunction due to loose terminal connections.

NOTICE: *Do not switch the drive input to start or stop the motor. Frequently switching the drive on and off shortens the life of the DC bus charge circuit and the DC bus capacitors, and can cause premature drive failures. For the full performance life, refrain from switching the drive on and off more than once every 30 minutes.*

◆ Main Circuit Terminal Functions

Table 3.1 Main Circuit Terminal Functions

<table>
<tr><th colspan="2">Terminal</th><th colspan="3">Type</th><th rowspan="3">Function</th><th rowspan="3">Page</th></tr>
<tr><th>200 V Class</th><th rowspan="2">Drive Model</th><th>2A0018 to 2A0094</th><th>2A0106, 2A0144</th><th>2A0181 to 2A0432</th></tr>
<tr><th>400 V Class</th><th>4A0009 to 4A0049</th><th>4A0056, 4A0075</th><th>4A0094 to 4A0225</th></tr>
<tr><td colspan="2">R/L1</td><td colspan="3" rowspan="3">Main circuit power supply input</td><td rowspan="3">Connects line power to the drive</td><td rowspan="3">54</td></tr>
<tr><td colspan="2">S/L2</td></tr>
<tr><td colspan="2">T/L3</td></tr>
<tr><td colspan="2">U/T1</td><td colspan="3" rowspan="3">Drive output</td><td rowspan="3">Connects to the motor</td><td rowspan="3">54</td></tr>
<tr><td colspan="2">V/T2</td></tr>
<tr><td colspan="2">W/T3</td></tr>
<tr><td colspan="2">B1</td><td colspan="2" rowspan="2">Braking resistor</td><td rowspan="2">Not available</td><td rowspan="2">Available for connecting a braking resistor or a braking resistor unit option</td><td rowspan="2">347</td></tr>
<tr><td colspan="2">B2</td></tr>
<tr><td colspan="2">+2</td><td rowspan="3">• DC link choke connection (+1, +2) (remove the shorting bar between +1 and +2)
• DC power supply input (+1, –)</td><td colspan="2">not available</td><td rowspan="4">For connection
• of the drive to a DC power supply (terminals +1 and – are not UL approved)
• of dynamic braking options</td><td rowspan="4">351</td></tr>
<tr><td colspan="2">+1</td><td rowspan="2">• DC power supply input (+1, –)</td><td rowspan="3">• DC power supply input (+1, –)
• Braking unit connection (+3, –)</td></tr>
<tr><td colspan="2">–</td></tr>
<tr><td colspan="2">+3</td><td colspan="2">not available</td></tr>
<tr><td colspan="2">⏚</td><td colspan="3">For 200 V class: 100 Ω or less
For 400 V class: 10 Ω or less</td><td>Grounding terminal</td><td>75</td></tr>
</table>

Note: Use terminal B1 and - when installing the braking unit (CDBR type) to the drives with built-in braking transistor (2A0018 to 2A0144, 4A0009 to 4A0075).

◆ Wire Gauges and Tightening Torque

Use the tables in this section to select the appropriate wires and crimp terminals.

Gauges listed in the tables are for use in the United States.

Note: 1. Wire gauge recommendations based on drive continuous current ratings using 75°C 600 Vac vinyl-sheathed wire assuming ambient temperature within 40 °C and wiring distance less than 100 m (328 ft.).

2. Terminals B1, B2, +1, +2, and +3, are for connecting a DC link choke, braking resistor or DC power supply. Do not connect other nonspecific devices to these terminals.

- Consider the amount of voltage drop when selecting wire gauges. Increase the wire gauge when the voltage drop is greater than 2% of motor rated voltage. Ensure the wire gauge is suitable for the terminal block. Use the following formula to calculate the amount of voltage drop:

  Line drop voltage (V) = $\sqrt{3}$ × wire resistance (Ω/km) × wire length (m) × current (A) × 10^{-3}

- Refer to instruction manual TOBP C720600 00 for braking transistor option or braking resistor option wire gauges.
- Use terminal +1 and the negative terminal when connecting a regenerative converter or a regen unit.
- Use terminal B1 and - when installing the braking unit to the drives with built-in braking transistor (2A0018 to 2A0144, 4A0009 to 4A0075).
- ***Refer to UL Standards Compliance on page 448*** for information on UL compliance.

Yaskawa recommends using closed-loop crimp terminals on all drive models. UL/cUL approval requires the use of closed-loop crimp terminals when wiring the drive main circuit terminals on models 2A0106 to 2A0432 and 4A0056 to 4A0225. Use only the tools recommended by the terminal manufacturer for crimping. ***Refer to Closed-Loop Crimp Terminal Recommendations on page 453***.

The wire gauges listed in the following tables are Yaskawa recommendations. Refer to local codes for proper wire gauge selections.

■ Three-Phase 200 V Class

Table 3.2 Wire Gauge and Torque Specifications (Three-Phase 200 V Class)

Drive Model	Terminal	Recommended Wire Size mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
2A0018	R/L1, S/L2, T/L3	6.0 (10)	2.5 to 6.0 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	6.0 (10)	2.5 to 6.0 (14 to 10)		
	–, +1, +2	–	2.5 to 6.0 (14 to 10)		
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	6.0 (10)	2.5 to 6.0 (14 to 10)		
2A0022	R/L1, S/L2, T/L3	6.0 (10)	2.5 to 6.0 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	6.0 (10)	2.5 to 6.0 (14 to 10)		
	–, +1, +2	–	4.0 to 6.0 (12 to 10)		
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	6.0 (10)	4.0 to 6.0 (12 to 10)		
2A0031	R/L1, S/L2, T/L3	10 (8)	2.5 to 16 (12 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	10 (8)	2.5 to 16 (12 to 6)		
	–, +1, +2	–	6.0 to 16 (10 to 6)		
	B1, B2	–	4.0 to 6.0 (12 to 10)		
	⏚	10 (8)	6.0 to 10 (10 to 8)	M5	2 to 2.5 (17.7 to 22.1)
2A0041	R/L1, S/L2, T/L3	16 (6)	2.5 to 16 (12 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	16 (6)	2.5 to 16 (12 to 6)		
	–, +1, +2	–	16 (6)		
	B1, B2	–	4.0 to 6.0 (12 to 10)		
	⏚	10 (8)	6.0 to 10 (10 to 8)	M5	2 to 2.5 (17.7 to 22.1)

Electrical Installation
3

Drive Model	Terminal	Recommended Wire Size mm^2 (AWG, kcmil)	Wire Range mm^2 (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
2A0059	R/L1, S/L2, T/L3	25 (4)	16 to 25 (6 to 4)	M6	4 to 6 (35.4 to 53.1)
	U/T1, V/T2, W/T3	25 (4)	16 to 25 (6 to 4)		
	–, +1, +2	–	16 to 25 (6 to 4)		
	B1, B2	–	6.0 to 10 (10 to 6)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	16 (6)	10 to 16 (8 to 6)	M6	4 to 6 (35.4 to 53.1)
2A0075	R/L1, S/L2, T/L3	35 (3)	6.0 to 35 (10 to 2)	M8	9 to11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	35 (3)	6.0 to 35 (10 to 2)		
	–, +1, +2	–	16 to 25 (4 to 3)		
	B1, B2	–	10 to 16 (8 to 6)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	16 (6)	16 to 25 (6 to 4)	M6	4 to 6 (35.4 to 53.1)
2A0094	R/L1, S/L2, T/L3	35 (2)	6.0 to 35 (10 to 2)	M8	9 to11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	16 × 2P (6 × 2P)	6.0 to 35 (10 to 2)		
	–, +1, +2	–	25 to 35 (3 to 2)		
	B1, B2	–	16 (6)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	16 (6)	16 to 25 (6 to 4)	M6	4 to 6 (35.4 to 53.1)
2A0106	R/L1, S/L2, T/L3	70 (1/0)	6.0 to 50 (10 to 1/0)	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	70 (1/0)	6.0 to 50 (10 to 1/0)		
	–, +1	–	35 to 50 (2 to 1/0)		
	B1, B2	–	16 to 50 (6 to 1/0)		
	⏚	16 (6)	16 to 25 (6 to 4)		
2A0144	R/L1, S/L2, T/L3	70 (2/0)	6.0 to 95 (10 to 3/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	95 (3/0)	6.0 to 95 (10 to 3/0)		
	–, +1	–	50 to 70 (1/0 to 3/0)		
	B1, B2	–	25 to 70 (4 to 2/0)		
	⏚	25 (4)	25 (4)	M8	9 to 11 (79.7 to 97.4)
2A0181	R/L1, S/L2, T/L3	95 (4/0)	70 to 95 (1/0 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	95 (4/0)	70 to 95 (1/0 to 4/0)		
	–, +1	–	50 to 95 (1 to 4/0)		
	+3	–	70 to 95 (1/0 to 4/0)		
	⏚	25 (4)	25 to 35 (4 to 2)		

Drive Model	Terminal	Recommended Wire Size mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
2A0225	R/L1, S/L2, T/L3	70 × 2P (1/0 × 2P)	70 to 95 (1/0 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	70 × 2P (1/0 × 2P)	70 to 95 (1/0 to 4/0)		
	–, +1	–	50 to 95 (1 to 4/0)		
	+3	–	70 to 95 (1/0 to 4/0)		
	⏚	25 (4)	25 to 50 (4 to 1/0)		
2A0269	R/L1, S/L2, T/L3	95 × 2P (3/0 × 2P)	95 to 150 (3/0 to 300)	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	95 × 2P (3/0 × 2P)	95 to 150 (3/0 to 300)		
	–, +1	–	95 to 150 (3/0 to 300)		
	+3	–	35 to 150 (2 to 300)	M10	18 to 23 (159 to 204)
	⏚	35 (3)	35 to 150 (2 to 300)	M12	32 to 40 (283 to 354)
2A0354	R/L1, S/L2, T/L3	120 × 2P (4/0 × 2P)	95 to 150 (3/0 to 300)	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	120 × 2P (4/0 × 2P)	95 to 150 (3/0 to 300)		
	–, +1	–	95 to 150 (3/0 to 300)		
	+3	–	95 to 150 (3/0 to 300)	M10	18 to 23 (159 to 204)
	⏚	35 (2)	35 to 150 (2 to 300)	M12	32 to 40 (283 to 354)
2A0432	R/L1, S/L2, T/L3	150 × 2P (250 × 2P)	95 to 300 (4/0 to 600)	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	185 × 2P (300 × 2P)	95 to 300 (4/0 to 600)		
	–, +1	–	120 to 300 (250 to 600)		
	+3	–	70 to 300 (3/0 to 600)	M10	18 to 23 (159 to 204)
	⏚	50 (1)	120 to 240 (1 to 350)	M12	32 to 40 (283 to 354)

Note: When connecting peripheral devices and options to the terminals –, +1, +3, B1, and B2, refer to the instruction manuals for each device. For more information, contact Yaskawa or your nearest sales representative.

■ Three-Phase 400 V Class

Table 3.3 Wire Gauge and Torque Specifications (Three-Phase 400 V Class)

Drive Model	Terminal	Recommended Wire Size mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
4A0009	R/L1, S/L2, T/L3	2.5 (14)	2.5 to 6.0 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2.5 (14)	2.5 to 6.0 (14 to 10)		
	–, +1, +2	–	2.5 to 6.0 (14 to 10)		
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	6.0 (10)	2.5 to 6.0 (14 to 10)		

Drive Model	Terminal	Recommended Wire Size mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
4A0012	R/L1, S/L2, T/L3	4.0 (12)	2.5 to 6.0 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2.5 (14)	2.5 to 6.0 (14 to 10)		
	–, +1, +2	–	2.5 to 6.0 (14 to 10)		
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	6.0 (10)	2.5 to 6.0 (14 to 10)		
4A0019	R/L1, S/L2, T/L3	6.0 (10)	2.5 to 16 (12 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	6.0 (10)	2.5 to 16 (12 to 6)		
	–, +1, +2	–	4.0 to 16 (12 to 6)		
	B1, B2	–	4.0 to 6.0 (12 to 10)		
	⏚	6.0 (10)	2.5 to 6.0 (14 to 10)	M5	2 to 2.5 (17.7 to 22.1)
4A0023	R/L1, S/L2, T/L3	6.0 (10)	2.5 to 16 (12 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	6.0 (10)	2.5 to 16 (12 to 6)		
	–, +1, +2	–	4.0 to 16 (12 to 6)		
	B1, B2	–	4.0 to 6.0 (12 to 10)		
	⏚	6.0 (10)	4.0 to 6.0 (12 to 10)	M5	2 to 2.5 (17.7 to 22.1)
4A0030	R/L1, S/L2, T/L3	10 (8)	6.0 to 16 (10 to 6)	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	10 (8)	6.0 to 16 (10 to 6)		
	–, +1, +2	–	6.0 to 16 (10 to 6)		
	B1, B2	–	6.0 to 10 (10 to 8)	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	10 (8)	6.0 to 10 (10 to 8)	M6	4 to 6 (35.4 to 53.1)
4A0039	R/L1, S/L2, T/L3	16 (6)	6.0 to 16 (10 to 6)	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	10 (8)	6.0 to 16 (10 to 6)		
	–, +1, +2	–	16 (6)		
	B1, B2	–	6.0 to 10 (10 to 8)	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	16 (6)	6.0 to 16 (10 to 6)	M6	4 to 6 (35.4 to 53.1)
4A0049	R/L1, S/L2, T/L3	16 (6)	16 to 25 (6 to 4)	M6	4 to 6 (35.4 to 53.1)
	U/T1, V/T2, W/T3	16 (6)	16 to 25 (6 to 4)		
	–, +1, +2	–	16 to 25 (6 to 4)		
	B1, B2	–	6.0 to 10 (10 to 8)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	16 (6)	10 to 16 (8 to 6)	M6	4 to 6 (35.4 to 53.1)

Drive Model	Terminal	Recommended Wire Size mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
4A0056	R/L1, S/L2, T/L3	25 (4)	6.0 to 50 (10 to 1/0)	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	25 (4)	6.0 to 50 (10 to 1/0)		
	–, +1	–	16 to 35 (6 to 1)		
	B1, B2	–	10 to 16 (8 to 4)		
	⏚	16 (6)	10 to 16 (8 to 6)		
4A0075	R/L1, S/L2, T/L3	35 (3)	6.0 to 70 (10 to 3/0)	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	35 (3)	6.0 to 70 (10 to 3/0)		
	–, +1	–	25 to 35 (4 to 1)		
	B1, B2	–	16 to 25 (6 to 3)		
	⏚	16 (6)	16 to 25 (6)		
4A0094	R/L1, S/L2, T/L3	35 (2)	16 to 120 (6 to 250)	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	50 (1)	16 to 120 (6 to 250)		
	–, +1	–	25 to 50 (3 to 1/0)		
	+3	–	16 to 50 (6 to 1/0)		
	⏚	25 (4)	16 to 25 (6 to 4)		
4A0114	R/L1, S/L2, T/L3	70 (1/0)	16 to 120 (6 to 250)	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	70 (1/0)	16 to 120 (6 to 250)		
	–, +1	–	25 to 50 (3 to 1/0)		
	+3	–	25 to 50 (4 to 1/0)		
	⏚	25 (4)	16 to 25 (6 to 4)		
4A0140	R/L1, S/L2, T/L3	95 (3/0)	50 to 95 (1/0 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	70 (2/0)	50 to 95 (1/0 to 4/0)		
	–, +1	–	50 to 95 (1/0 to 4/0)		
	+3	–	25 to 95 (3 to 4/0)		
	⏚	25 (4)	25 (4)		
4A0188	R/L1, S/L2, T/L3	95 (4/0)	50 to 95 (1/0 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	95 (4/0)	50 to 95 (1/0 to 4/0)		
	–, +1	–	35 to 95 (1 to 4/0)		
	+3	–	50 to 95 (1/0 to 4/0)		
	⏚	25 (4)	25 to 35 (4 to 2)		

Drive Model	Terminal	Recommended Wire Size mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
4A0225	R/L1, S/L2, T/L3	50 × 2P (1 × 2P)	35 to 150 (2 to 300)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	70 × 2P (1/0 × 2P)	35 to 150 (2 to 300)		
	–, +1	–	50 to 150 (1 to 250)		
	+3	–	25 to 70 (3 to 3/0)		
	⏚	25 (4)	25 to 150 (4 to 300)		

Note: When connecting peripheral devices and options to the terminals –, +1, +3, B1, and B2, refer to the instruction manuals for each device. For more information, contact Yaskawa or your nearest sales representative.

◆ Main Circuit Terminal and Motor Wiring

This section outlines the various steps, precautions, and checkpoints for wiring the main circuit terminals and motor terminals.

WARNING! *Electrical Shock Hazard. Before servicing, disconnect all power to the equipment and lock out the power source. Failure to comply may result in injury from electrical shock. Wait at least five minutes after all indicators are OFF and measure the DC bus voltage level and main circuit terminals to confirm the circuit is safe before wiring.*

WARNING! *Electrical Shock Hazard. Verify motor wiring bare wire ends do not contact the drive chassis or enclosure when wiring drive terminals U/T1, V/T2, W/T3. Failure to comply may result in serious injury or death due to electrical shock.*

WARNING! *Electrical Shock Hazard. Improper equipment grounding could result in death or serious injury by contacting the motor case. Always properly ground the motor-side grounding terminal.*

WARNING! *Fire Hazard. Tighten all terminal screws to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections. Improperly tightened terminal screws can also cause erroneous equipment operation.*

WARNING! *Fire Hazard. Do not use an improper voltage source. Failure to comply could result in death or serious injury by fire. Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.*

WARNING! *Do not connect the AC power line to the output motor terminals of the drive. Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.*

NOTICE: *Equipment Hazard. Comply with proper wiring practices. The motor may run in reverse if the phase order is backward, causing incorrect elevator direction movement and injury to personnel. Connect motor input terminals U/T1, V/T2, and W/T3 to drive output terminals U/T1,V/T2, and W/T3. The phase order for the drive and motor should match.*

NOTICE: *Equipment Hazard. Improper equipment sequencing could shorten useful life of the electrolytic capacitors and circuit relays of the drive. Refrain from switching an input contactor more often than once every 30 minutes. Normally the drive I/O should be used to stop and start the motor.*

NOTICE: *Equipment Hazard. Standard motors used with PWM drives may experience winding failures due to surge voltages, when input line voltage is greater than 480 V or motor wire distance is greater than 100 meters. Select a motor design with insulation tolerant of surge voltages and drive-rated motor for use with PWM drives. Failure to comply could lead to motor winding failure.*

NOTICE: *Do not use the negative DC bus terminal "-" as a ground terminal. This terminal is at high DC voltage potential. Improper wiring connections could damage the drive.*

NOTICE: *Improper application of devices on drive output circuits can damage the drive. Do not connect unapproved LC or RC interference suppression filters, capacitors, ground fault circuits, or overvoltage protection devices to the output of the drive.*

NOTICE: *Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits. Failure to comply could result in damage to the drive, phase-advancing capacitors, LC/RC noise filters or ground fault circuit interrupters.*

NOTICE: *Properly integrate auxiliary contacts into the control logic circuit to avoid unnecessary fault displays caused by contactors or output switches placed between drive and motor. Improper installation of input and output contactors could result in damage to the drive.*

NOTICE: *Before applying power to the drive, use power-off resistance checks to check for short-circuits between (R/L1, S/L2, and T/L3) or between main circuit terminals and ground. Failure to comply may result in damage to the drive.*

■ Cable Length Between Drive and Motor

Voltage drop along the motor cable may cause reduced motor torque when the wiring between the drive and the motor is too long, especially at low frequency output. This can also be a problem when motors are connected in parallel with a fairly long motor cable. Drive output current will increase as the leakage current from the cable increases. An increase in leakage current may trigger an overcurrent situation and weaken the accuracy of the current detection.

Adjust the drive carrier frequency according to ***Table 3.4***. If the motor wiring distance exceeds 100 m (328 ft.) because of the system configuration, reduce the ground currents. ***Refer to C6-03: Carrier Frequency on page 172***.

Table 3.4 Cable Length Between Drive and Motor

Cable Length	50 m (164 ft.) or less	100 m (328 ft.) or less	Greater than 100 m (328 ft.)
Carrier Frequency	15 kHz or less	5 kHz or less	2 kHz or less

Note: When setting carrier frequency for drives running multiple motors, calculate cable length as the total wiring distance to all connected motors.

■ Ground Wiring

Follow the precautions to wire the ground for one drive or a series of drives.

WARNING! *Electrical Shock Hazard. Always use a ground wire that complies with technical standards on electrical equipment and local installation regulations. Minimize the length of the ground wire. Improper equipment grounding may cause dangerous electrical potentials on equipment chassis, which could result in death or serious injury.*

WARNING! *Electrical Shock Hazard. Be sure to ground the drive ground terminal (200 V class: Ground to 100 Ω or less, 400 V class: Ground to 10 Ω or less). Improper equipment grounding may cause dangerous electrical potentials on equipment chassis, which could result in death or serious injury.*

NOTICE: *Do not share the ground wire with other devices such as welding machines or large-current electrical equipment. Improper equipment grounding could result in drive or equipment malfunction due to electrical interference.*

NOTICE: *When using more than one drive, ground multiple drives according to instructions. Improper equipment grounding could result in abnormal operation of drive or equipment.*

Refer to ***Figure 3.16*** when using multiple drives. Do not loop the ground wire.

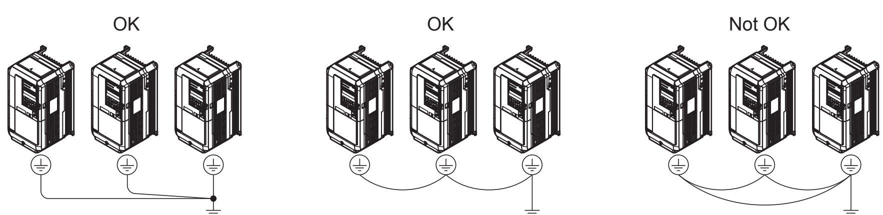


Figure 3.16 Multiple Drive Wiring

Electrical Installation

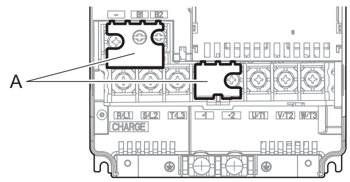
3

■ Wiring the Main Circuit Terminal

WARNING! *Electrical Shock Hazard. Shut off the power supply to the drive before wiring the main circuit terminals. Failure to comply may result in death or serious injury.*

Wire the main circuit terminals after the terminal board has been properly grounded.

Models 2A0018 through 2A0094 and 4A0009 through 4A0049 have a cover placed over the DC bus and braking circuit terminals prior to shipment to help prevent miswiring. Use wire cutters to cut away covers as needed for terminals.



A – Protecting Cover

Figure 3.17 Protecting Cover to Prevent Miswiring (2A0059)

■ Main Circuit Connection Diagram

Refer to Main Circuit Connection Diagram on page 57 when wiring terminals on the main power circuit of the drive.

WARNING! *Fire Hazard. The braking resistor connection terminals are B1 and B2. Do not connect braking resistors to any other terminals. Improper wiring connections could cause the braking resistor to overheat and cause death or serious injury by fire. Failure to comply may result in damage to the braking circuit or drive.*

3.8 Control Circuit Wiring

◆ Control Circuit Connection Diagram

Refer to Standard Connection Diagram on page 54 when wiring the drive control circuit terminals.

◆ Control Circuit Terminal Block Functions

Drive parameters determine which functions apply to the multi-function digital inputs (S3 to S8), multi-function digital outputs (M1 to M6), multi-function photocoupler outputs (P1-C1, P2-C2), multi-function analog inputs (A1, A2), and multi-function analog monitor output (FM, AM). The default setting is listed next to each terminal in *Figure 3.1* on page *55*.

NOTICE: *Equipment Hazard. Improper equipment sequencing could shorten useful life of the electrolytic capacitors and circuit relays of the drive. Refrain from switching an input contactor more often than once every 30 minutes. Normally the drive I/O should be used to stop and start the motor.*

WARNING! *Sudden Movement Hazard. Always check the operation and wiring of control circuits after being wired. Operating a drive with untested control circuits could result in death or serious injury.*

WARNING! *Sudden Movement Hazard. Confirm the drive I/O signals and external sequence before starting test run. Failure to comply may result in death or serious injury.*

NOTICE: *Frequently switching the drive power supply to stop and start the motor can damage the drive.*

NOTICE: *To get the full performance life out of the electrolytic capacitors and circuit relays, refrain from switching the drive power supply off and on more than once every 30 minutes. Frequent use can damage the drive. Use the drive to stop and start the motor.*

Note: Do not solder the ends of wire connections to the drive. Soldered wiring connections can loosen over time. Improper wiring practices could result in drive malfunction due to loose terminal connections.

■ Input Terminals

Table 3.5 lists the input terminals on the drive. Text in parenthesis indicates the default setting for each multi-function input.

Table 3.5 Control Circuit Input Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting	Page
Digital Inputs	S1	Up Command (Closed: Up, Open: Stop)	Photocoupler 24 Vdc, 8 mA Use the wire link between terminals SC and SN or between SC and SP to select sinking or sourcing, and to select the power supply.	382
	S2	Down Command (Closed: Down, Open: Stop)		
	S3	Multi-function input 1 (External Fault)		
	S4	Multi-function input 2 (Fault Reset)		
	S5	Multi-function input 3 (Multi-Step Speed Reference 1)		
	S6	Multi-function input 4 (Multi-Step Speed Reference 2)		
	S7	Multi-function input 5 (Multi-Step Speed Reference 3)		
	S8	Multi-function input 6 (Not used)		
Digital Input Power Supply	SC	Multi-function input common	24 Vdc, 150 mA (only when DI-A3 is not used) Use the wire jumper between terminals SC and SN or between SC and SP to select sinking or sourcing, and to select the power supply.	79
	SN	0 V		
	SP	+24 Vdc		
Safe Disable Inputs <1>	H1	Safe Disable input 1	24 Vdc, 8 mA One or both open: Drive output disabled Both closed: Normal operation Internal impedance: 3.3 kΩ Off time of at least 1 ms Set the S3 jumper to select sinking or sourcing, and to select the power supply.	458
	H2	Safe Disable input 2		
	HC	Safe Disable function common	Common for the Safe Disable function	

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting	Page
Analog Inputs	+V	Power supply for analog inputs	10.5 Vdc (max allowable current 20 mA)	156
	-V	Power supply for analog inputs	-10.5 Vdc (max allowable current 20 mA)	–
	A1	Multi-function analog input 1 (Speed reference bias)	-10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ)	156 193
	A2	Multi-function analog input 2 (Not used)	-10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ)	156 193
	AC	Analog input common	0 V	156
	E (G)	Ground for shielded lines and option cards	–	–

<1> Setting jumper S3 for an external power supply makes the wire jumper between terminals H1, H2, and HC ineffective. Remove the wire jumper and connect an external power supply that can supply terminals H1, H2, and HC continuously.

■ Output Terminals

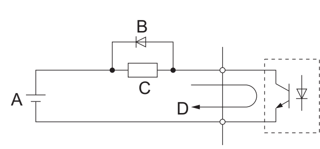
Table 3.6 lists the output terminals on the drive. Text in parenthesis indicates the default setting for each multi-function output.

Note: Multi-function relay output terminals are rated at a minimum of 10 mA. If less than 10 mA is required, use the photocoupler outputs (P1-C1, P2-C2). Using the wrong current output level may cause the output to malfunction when the terminal is activated.

Table 3.6 Control Circuit Output Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting	Page
Fault Relay	MA	N.O.	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA	193
	MB	N.C. output		
	MC	Fault output common		
Multi-Function Relay Output <1>	M1	Multi-function relay output 1 (Brake release command)	Contact relay output 30 Vdc, 10 mA to 1 A 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA	193
	M2			
	M3	Multi-function relay output 2 (Output contactor close command)		
	M4			
	M5	Multi-function relay output 3 (Drive ready)		
	M6			
Multi-Function Photocoupler Output	P1	Photocoupler output 1 (During Frequency output)	48 Vdc, 2 to 50 mA <2>	–
	C1			
	P2	Photocoupler output 2 (Not Used/Through Mode)		
	C2			
Monitor Output	FM	Analog monitor output 1 (Output speed)	-10 to +10 Vdc or 0 to +10 Vdc	193
	AM	Analog monitor output 2 (Output current)		
	AC	Monitor common	0 V	–
Safety Monitor Output	DM+	Safety monitor output	Outputs status of Safe Disable function. Closed when both Safe Disable channels are closed. Up to +48 Vdc 50 mA	–
	DM-	Safety monitor output common		

<1> Refrain from assigning functions to terminals M1 thru M6 that involve frequent switching, as doing so may shorten relay performance life. Switching life is estimated at 200,000 times (assumes 1 A, resistive load).
<2> Connect a suppression diode as shown in *Figure 3.18* when driving a reactive load such as a relay coil. Make sure the diode rating is greater than the circuit voltage.



A – External power, 48 V max.
B – Suppression diode
C – Coil
D – 50 mA or less

Figure 3.18 Connecting a Suppression Diode

■ Serial Communication Terminals

Table 3.7 Control Circuit Terminals: Serial Communications

Type	No.	Signal Name	Function (Signal Level)	
MEMOBUS/Modbus Communication <1>	R+	Communications input (+)	MEMOBUS/Modbus communication: Use an RS-485 or RS-422 cable to connect the drive.	RS-485/422 MEMOBUS/Modbus communication protocol 115.2 kbps (max.)
	R-	Communications input (-)		
	S+	Communications output (+)		
	S-	Communications output (-)		
	IG	Shield ground	0 V	

<1> Enable the termination resistor in the last drive in a MEMOBUS network by setting DIP switch S2 to the ON position. For more information on the termination resistor, *Refer to Control I/O Configuration on page 79*.

◆ Terminal Configuration

Control circuit terminals are arranged as shown in *Figure 3.19*.

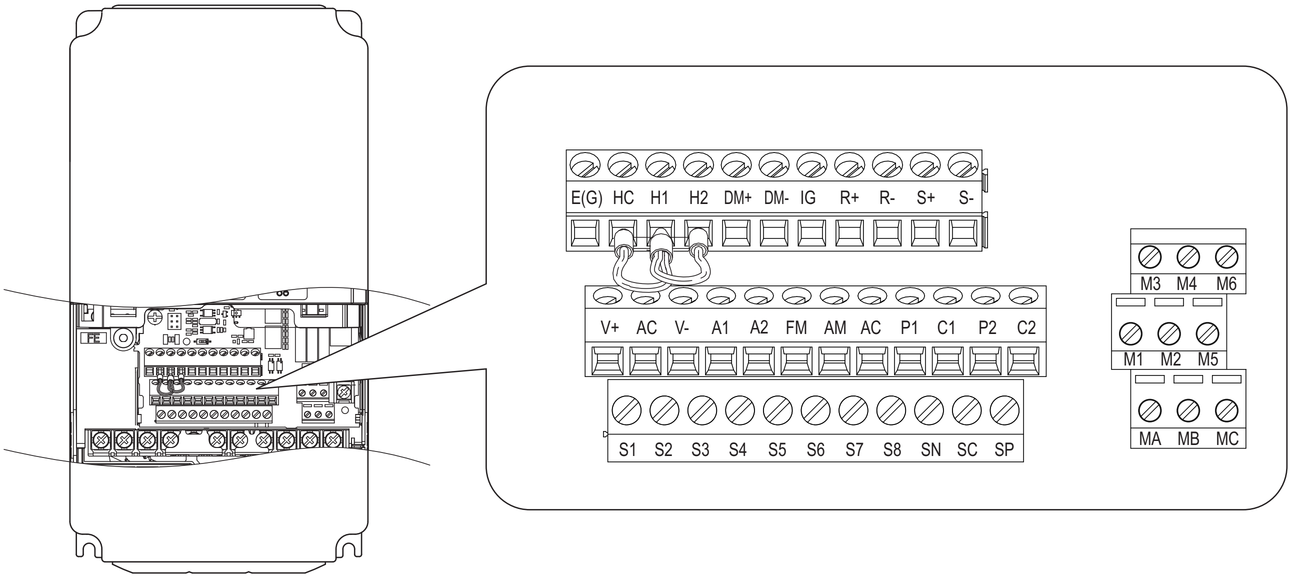


Figure 3.19 Control Circuit Terminal Arrangement

■ Wire Size and Torque Specifications

WARNING! *Fire hazard. Tighten all terminal screws to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections. Improperly tightened terminal screws can also cause erroneous equipment operation.*

Select appropriate wire type and gauges from *Table 3.8*. For simpler and more reliable wiring, use crimp ferrules on the wire ends. Refer to *Table 3.9* for ferrule terminal types and sizes.

Table 3.8 Wire Gauges and Torque Specifications

Terminal Block	Terminal	Size	Tightening Torque N·m (lb.in.)	Bare Wire Terminal		Ferrule-Type Terminal		
				Applicable Wire Size mm² (AWG)	Recomm. mm² (AWG)	Applicable Wire Size mm² (AWG)	Recomm. mm² (AWG)	Wire Type
TB1, TB2, TB4, TB5, TB6	FM, AC, AM, P1, P2, PC, SC, A1, A2, A3, +V, -V, S1-S8, MA, MB, MC, M1, M2, HC, H1, H2, DM+, DM-, IG, R+, R-, S+, S-, RP, MP, E (G)	M2	0.22 to 0.25 (1.9 to 2.2)	Standard wire: 0.25 to 1.0 (24 to 17) Solid wire: 0.25 to 1.5 (24 to 16)	0.75 (18)	0.25 to 0.5 (24 to 20)	0.5 (20)	Shielded wire, etc.

■ Ferrule-Type Wire Terminals

Yaskawa recommends using CRIMPFOX 6, a crimping tool manufactured by PHOENIX CONTACT, to prepare wire ends with insulated sleeves before connecting to the drive. Refer to *Table 3.9* for dimensions.

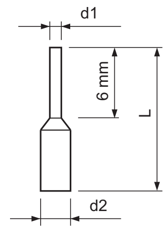


Figure 3.20 Ferrule Dimensions

Table 3.9 Ferrule Terminal Types and Sizes

Size mm² (AWG)	Type	L (mm)	d1 (mm)	d2 (mm)	Manufacturer
0.25 (24)	AI 0.25-6YE	10.5	0.8	2	PHOENIX CONTACT
0.34 (22)	AI 0.34-6TQ	10.5	0.8	2	
0.5 (20)	AI 0.5-6WH	14	1.1	2.5	

◆ Wiring the Control Circuit Terminal

This section describes the proper procedures and preparations for wiring the control terminals.

WARNING! *Sudden Movement Hazard. Operating a drive with untested emergency circuits could result in death or serious injury. Verify all drive fast stop circuit wiring and any additional emergency circuits before operating the drive.*

WARNING! *Fire hazard. Tighten all terminal screws to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.*

WARNING! *Electrical Shock Hazard. Do not remove covers or touch the circuit boards while the power is on. Failure to comply could result in death or serious injury.*

WARNING! *Electrical Shock Hazard. Before servicing, disconnect all power to the equipment and lock out the power source. Failure to comply may result in injury from electrical shock. Wait at least five minutes after all indicators are OFF and measure the DC bus voltage level and main circuit terminals to confirm the circuit is safe before wiring.*

WARNING! *Sudden Movement and Hazard. Install additional emergency circuits separately from the drive fast stop circuits. Failure to comply may result in personal injury.*

NOTICE: *Equipment Hazard. Do not connect control circuit ground terminals to the drive enclosure. Improper drive grounding can cause control circuit malfunction.*

NOTICE: *Equipment Hazard. Insulate shields with heat shrink tubing or tape to prevent contact with other signal lines and equipment. Improper wiring practices could result in drive or equipment malfunction due to short circuit.*

NOTICE: *Equipment Hazard. Use twisted-pair or shielded twisted-pair cables for control circuits. Improper wiring practices could result in drive or equipment malfunction or nuisance trips.*

NOTICE: *Connect the shield of shielded cable to the appropriate ground terminal. Improper equipment grounding could result in drive or equipment malfunction or nuisance trips.*

NOTICE: *Separate wiring for output terminals MA, MB, MC, M1 and M2 from wiring to other control circuit lines. Improper wiring practices could result in drive or equipment malfunction or nuisance trips.*

NOTICE: *Separate control circuit wiring from main circuit wiring (terminals R/L1, S/L2, T/L3, B1, B2, U/T1, V/T2, W/T3, -, +1, +2) and other high-power lines. Improper wiring practices could result in drive malfunction due to electrical interference.*

NOTICE: *Use a class 2 power supply (UL standard) when connecting to the control terminals. Improper application of peripheral devices could result in drive performance degradation due to improper power supply.*

NOTICE: *Do not exceed 50 meters (164 feet) for the control line between the drive and the operator when using an analog signal from a remote source to supply the frequency reference. Failure to comply could result in poor system performance.*

NOTICE: *Do not use unshielded cable for control wiring. Failure to comply may cause electrical interference resulting in poor system performance. Use shielded, twisted-pair wires, and ground the shield to the ground terminal of the drive.*

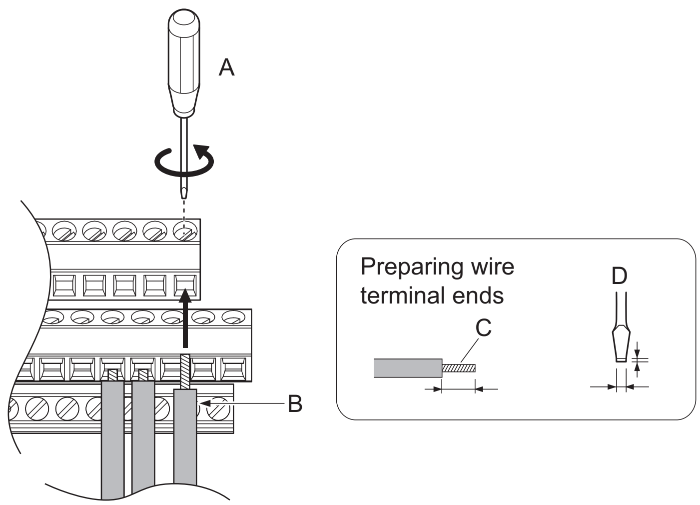
NOTICE: *Insulate shields with tape or shrink tubing to prevent contact with other signal lines and equipment. Improper wiring practices could result in drive or equipment malfunction due to short circuit.*

Wire the control circuit only after terminals have been properly grounded and main circuit wiring is complete. Refer to *Figure 3.21* for details. Prepare the ends of the control circuit wiring as shown in *Figure 3.22*. Refer to *Wire Size and Torque Specifications on page 79*.

WARNING! *Do not tighten screws beyond the specified tightening torque. Failure to comply may result in erroneous operation, damage the terminal block, or cause injury due to fire from overheating of loose electrical connections.*

NOTICE: *Use shielded twisted-pair cables as indicated to prevent operating faults. Improper wiring practices could result in drive or equipment malfunction due to electrical interference.*

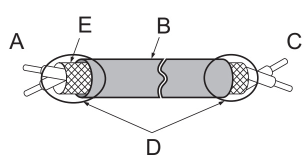
Connect control wires as shown in *Figure 3.21*.



A – Loosen screw to insert wire
B – Single wire or stranded wire
C – Avoid fraying wire strands when stripping insulation from wire. Strip length 5.5 mm.
D – Blade depth of 0.4 mm or less
Blade width of 2.5 mm or less

Figure 3.21 Terminal Board Wiring Guide

When connecting control wires to the terminals, use shielded twisted-pair wires (treating wire ends as shown in *Figure 3.22* and connect the shield to the ground terminal (E [G]) of the drive.



A – Drive side
B – Insulation
C – Control device side
D – Shield sheath (insulate with tape or heat-shrink tubing)
E – Shield

Figure 3.22 Preparing the Ends of Shielded Cables

NOTICE: *Do not exceed 50 meters (164 ft.) for the control line between the drive and the operator when using an analog signal from a remote source to supply the frequency reference. Failure to comply could result in poor system performance.*

◆ Switches and Jumpers on the Terminal Board

The terminal board is equipped with several switches used to adapt the drive I/Os to the external control signals. *Figure 3.23* shows the location of these switches. *Refer to Control I/O Configuration on page 79* for setting instructions.

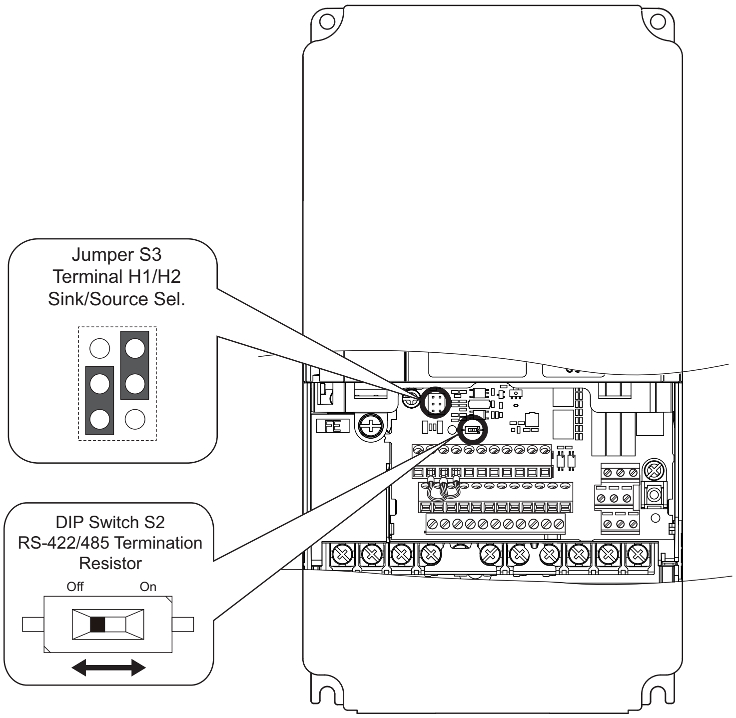


Figure 3.23 Locations of Jumpers and Switches on the Terminal Board

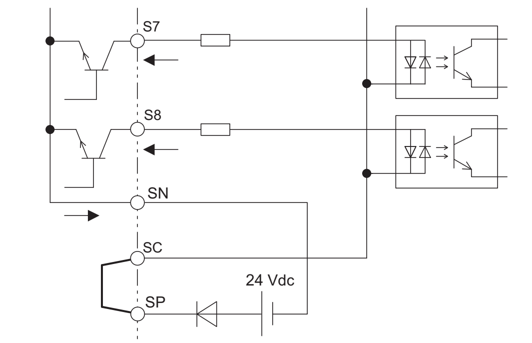
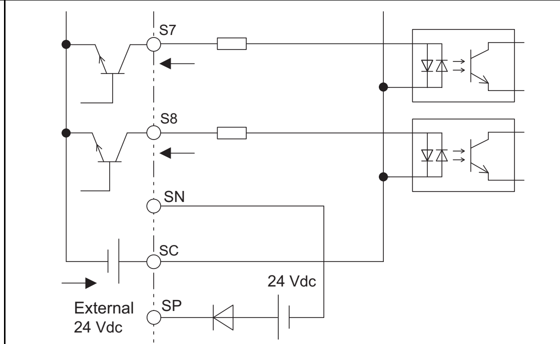
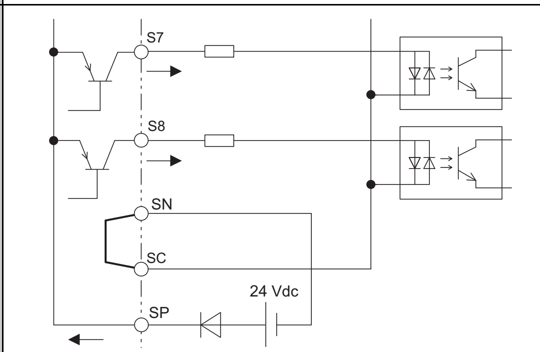
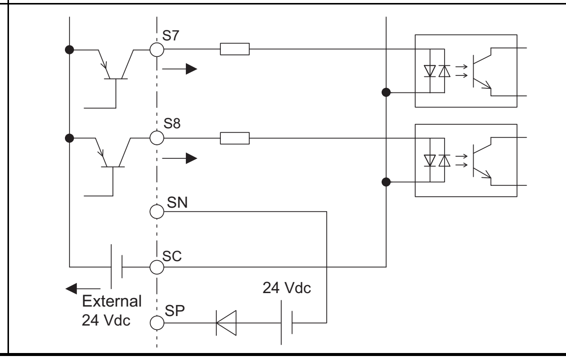
3.9 Control I/O Configuration

◆ Setting Sink/Source with Input Terminals SN and SP

Use the wire jumper between terminals SC and SP or SC and SN to select between Sink mode, Source mode or external power supply for the digital inputs S1 to S8 as shown in ***Table 3.10*** (Default: Sink mode, internal power supply).

NOTICE: *Damage to Equipment. Do not short terminals SP and SN. Failure to comply will damage the drive.*

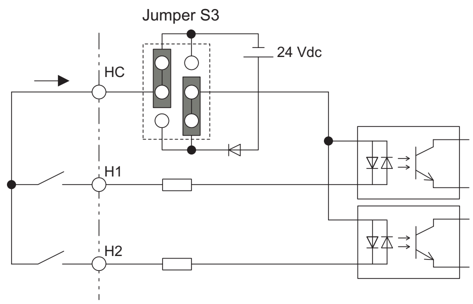
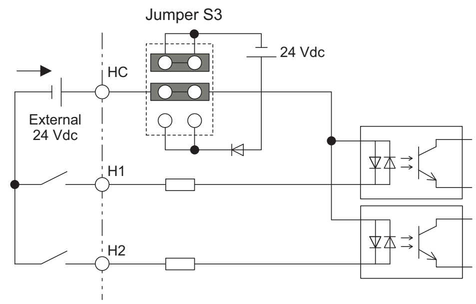
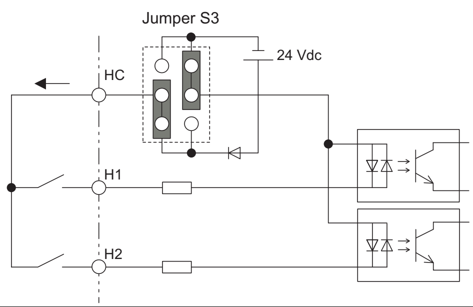
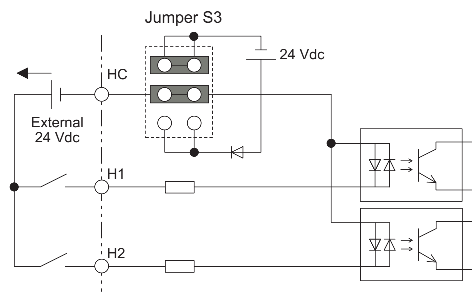
Table 3.10 Digital Input Sink / Source / External Power Supply Selection

	Drive Internal Power Supply (Terminal SN and SP)	External 24 Vdc Power Supply
Sinking Mode (NPN)		
Sourcing Mode (PNP)		

◆ Sinking/Sourcing Mode Selection for Safe Disable Inputs

Use jumper S3 on the terminal board to select between Sink mode, Source mode or external power supply for the Safe Disable inputs H1 and H2 as shown in *Table 3.11* (Default: Sink mode, internal power supply).

Table 3.11 Safe Disable Input Sink / Source / External Power Supply Selection

	Drive Internal Power Supply	External 24 Vdc Power Supply
Sinking Mode		
Sourcing Mode		

3.10 Connect to a PC

This drive is equipped with a USB port (type-B).

The drive can connect to a USB port on a PC using a USB 2.0, AB-type cable (sold separately). After connecting the drive to a PC, Yaskawa DriveWizard Plus software can be used to monitor drive performance and manage parameter settings. Contact Yaskawa for more information on DriveWizard Plus.

Download and install the USB driver before connecting L1000E to a PC with the USB cable.
To obtain the driver and software of USB Copy Unit, CopyUnitManager and DriveWizardPlus, access these sites:
U.S.A: http://www.yaskawa.com

Other areas: contact a Yaskawa representative.

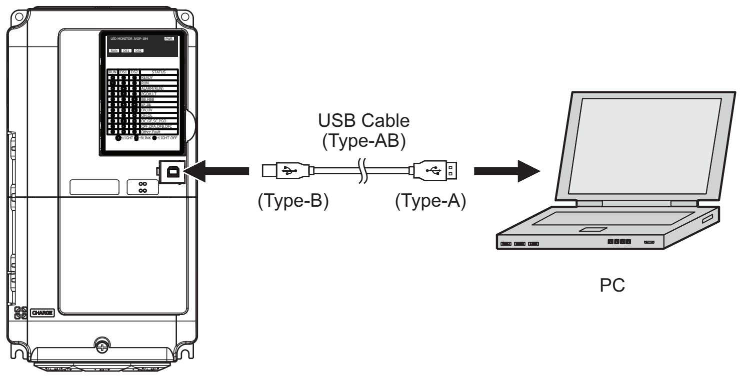


Figure 3.24 Connecting to a PC (USB)

3.11 MEMOBUS/Modbus Termination

This drive is equipped with a built-in termination resistor for the RS-422/485 communication port. DIP switch S2 enables or disables the termination resistor as shown in *Figure 3.25*. The OFF position is the default. The termination resistor should be placed to the ON position when the drive is the last in a series of slave drives.

Table 3.12 MEMOBUS/Modbus Switch Settings

S2 Position	Description
ON	Internal termination resistor ON
OFF	Internal termination resistor OFF (default setting)

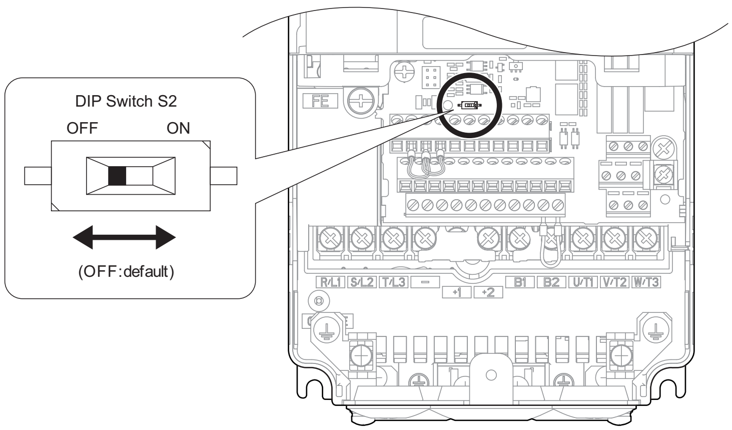


Figure 3.25 DIP Switch S2

Note: *Refer to MEMOBUS/Modbus Communications on page 417* for details on MEMOBUS/Modbus.

3.12 Wiring Checklist

☑	No.	Item	Page
		Drive, peripherals, option cards	
☐	1	Check drive model number to ensure receipt of correct model.	–
☐	2	Make sure you have the correct braking resistors, DC link choke, noise filters, and other peripheral devices installed.	335
☐	3	Check the option card model number.	335
		Installation area and physical setup	
☐	4	Ensure that the area surrounding the drive complies with specifications.	40
		Power supply voltage, output voltage	
☐	5	The voltage from the power supply should be within the input voltage specification range of the drive.	178
☐	6	The voltage rating for the motor should match the drive output specifications.	29
☐	7	Verify that the drive is properly sized to run the motor.	29
		Main circuit wiring	
☐	8	Confirm proper branch circuit protection as specified by national and local codes.	54
☐	9	Properly wire the power supply to drive terminals R/L1, S/L2, and T/L3.	57
☐	10	Properly wire the drive and motor together. The motor lines and drive output terminals R/T1, V/T2, and W/T3 should match in order to produce the desired phase order. If the phase order is incorrect, the drive will rotate in the opposite direction.	71
☐	11	Use 600 Vac vinyl-sheathed wire for the power supply and motor lines.	64
☐	12	Use the correct wire gauges for the main circuit. . • Consider the amount of voltage drop when selecting wire gauges. Increase the wire gauge when the voltage drop is greater than 2% of motor rated voltage. Ensure the wire gauge is suitable for the terminal block. Use the following formula to calculate the amount of voltage drop: Line drop voltage (V) = $\sqrt{3}$ × wire resistance (Ω/km) × wire length (m) × current (A) × 10^{-3} • If the cable between the drive and motor exceeds 50 m (164 feet), adjust the carrier frequency set to C6-02 accordingly.	64 64 71
☐	13	Properly ground the drive.	71
☐	14	Tightly fasten all terminal screws (control circuit terminals, grounding terminals)..	64
☐	15	Install a magnetic contactor when using a dynamic braking option. Properly install the resistor and ensure that overload protection shuts off the power supply using the magnetic contactor.	350
☐	16	Verify phase advancing capacitors, input noise filters, or ground fault circuit interrupters are NOT installed on the output side of the drive.	–
		Control circuit wiring	
☐	17	Use twisted-pair line for all drive control circuit wiring.	75
☐	18	Connect the shields of shielded wiring to the ground terminal (E [G]).	75
☐	19	Properly wire any option cards.	75
☐	20	Check for any other wiring mistakes. Only use a multimeter to check wiring.	–
☐	21	Properly fasten the control circuit terminal screws in the drive.	64
☐	22	Pick up all wire clippings.	–
☐	23	Ensure that no frayed wires on the terminal block are touching other terminals or connections.	–
☐	24	Properly separate control circuit wiring and main circuit wiring.	–
☐	25	Analog signal line wiring should not exceed 50 m (164 ft.).	–
☐	26	Safe Disable input wiring should not exceed 30 m (98 ft.).	–

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4

Start-Up Programming & Operation

This chapter explains the functions of the digital operator and provides programming instructions for initial drive operation.

4.1 Section Safety

DANGER

Electrical Shock Hazard

Do not change wiring, remove covers, connectors or options cards, or attempt to service the drive with power applied to the drive.

Disconnect all power to the drive, and lock out the power source. After shutting off the power wait for at least the amount of time specified on the drive front cover safety label. Measure the DC bus voltage for unsafe voltages to confirm safe level before servicing to prevent electric shock The internal capacitor remains charged even after the power supply is turned off. Failure to comply will result in serious injury or death from electric shock.

WARNING

Sudden movement Hazard

Do not perform elevator test operations or drive setup when the elevator is occupied.

The elevator car may not stop properly during test operation resulting in serious injury to personnel. Additionally, ensure these parameters are set correctly and tested before operating an occupied elevator:

- parameter o1-20 (Traction Sheave Diameter)
- parameter S5-11 (Deceleration Distance), or
- parameter S5-12 (Stop Distance)

Use the Initial Pole Search Status Signal (H2-☐☐ = 61) to interlock the brake to ensure the brake is not released before the Initial Magnetic Pole Search is completed.

Failure to comply may cause inadvertent elevator movement resulting in serious injury.

This safety message is applicable under these conditions:

-When applying a PM motor, with an external brake sequence, and the PG-F3 option is not being used.

Ensure all personnel are clear of the motor and elevator before Auto-Tuning.

The motor or equipment may suddenly rotate during the Auto-Tuning process, which may result in serious personal injury or death.

Electrical Shock Hazard

When a drive is running a PM motor, voltage continues to be generated at the motor terminals after the drive is shut off while the motor coasts to stop.

Take the precautions described below to prevent shock and injury:

- In applications where the machine can still rotate even though the drive has fully stopped a load, install a switch to the drive output side to disconnect the motor and the drive.
- Do not allow an external force to rotate the motor beyond the maximum allowable speed or to rotate the motor when the drive has been shut off.
- Wait for at least the time specified on the warning label after opening the load switch on the output side before inspecting the drive or performing any maintenance.
- Do not open and close the load switch while the motor is running, as this can damage the drive.
- If the motor is coasting, make sure the power to the drive is turned on and the drive output has completely stopped before closing the load switch.

WARNING

Sudden Movement Hazard

Ensure all personnel are clear of the motor and elevator before Auto-Tuning.

The motor or equipment may suddenly rotate during the Auto-Tuning process, which may result in serious personal injury or death.

The drive is capable of running the motor at high speed. Verify the maximum drive output frequency before starting the drive.

Failure to comply may cause injury or death due to inadvertent high speed operation.

Verify drive parameter b1-03 Stopping Method is set to 0:Ramp to Stop before starting the drive.

Failure to comply may cause the elevator to free-fall when the Up/Down command is removed.

System may start unexpectedly upon application of power when the Auto-Reset function is enabled resulting in death or serious injury.

Use care when enabling Auto-Reset as this function may cause unintended start of the elevator.

Ensure holding brake circuits are properly configured, load equipment may fall or drop during power loss or drive fault, which could result in death or serious injury.

- Provide a separate holding brake if necessary.
- Always construct the external sequence to confirm that the holding brake is activated in the event of an emergency, a power failure, or an abnormality in the drive.
- If using the drive with an elevator, provide safety measures on the elevator to prevent the elevator from dropping.

Install additional emergency circuits separately from drive fast stop circuits.

Failure to comply may result in personal injury.

Remove the Up/Down Command before resetting alarms and faults.

Failure to comply can result in death or serious injury.

The drive and motor may start unexpectedly during Auto-Tuning, which could result in death or serious injury.

- Remove main power from the drive before servicing the drive or motor.
- Do not touch the motor during Auto-Tuning.
- Ensure the area surrounding the drive motor and load are clear before proceeding with Auto-Tuning.

System may start unexpectedly, resulting in death or serious injury.

Before starting or applying power to the drive, clear all personnel from the drive, motor and machine area and check sequence and safety circuitry. Secure covers, couplings, shaft keys and machine loads.

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may include drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

CAUTION

Burn Hazard

Do not touch a hot drive heatsink.

Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and make sure heatsink has cooled down.

NOTICE

Equipment Hazard

Only perform Rotational Auto-Tuning with the motor disconnected from the load (ropes removed from traction sheave).

Failure to comply will cause the drive will be unable to automatically set motor parameters correctly. This will result in erroneous operation.

Do not check or test control circuit signals while the drive is running.

Improper use of test equipment could result in damage to the drive circuitry by short circuit.

Do not use the Rescue Operation feature for extended periods.

Failure to comply may result in drive heat sink overheat alarms (oH).

Set parameter E1-01 to match the input voltage of the drive. The drive input voltage (not motor voltage) must be set in E1-01 for the protective features to function properly.

Failure to set the correct drive input voltage may result in improper drive operation.

Use the drives Torque Detection function to notify the PLC of potential overcurrent or overload situations at the load prior to a drive overload fault.

Failure to comply may cause the drive to fault leaving the motor coasting, potentially damaging equipment.

Correctly set parameter o2-04 when replacing the control terminal board.

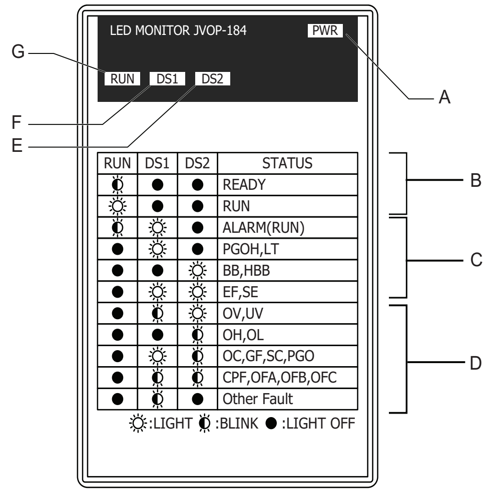
Failure to comply may result in drive damage due to lack of protective functions and poor drive performance.

4.2 Using the LED Monitor/Digital Operator

LED Monitor JVOP-184 shows information about drive status including faults and alarms; optional digital operator JVOP-180 can be used to adjust parameters as required.

◆ LED Monitor JVOP-184

The LED monitor indicates operation status by combinations of the LEDs (LIGHT/BLINK/OFF) at RUN, DS1, and DS2.



A – PWR LED (Red)
B – Drive Status Indications
C – Alarm Indications
D – Fault Indications
E – DS2 LED (Green)
F – DS1 LED (Green)
G – RUN LED (Green)

Figure 4.1 LED Monitor Component Names

■ LED Display Examples

Normal Operation

Figure 4.2 shows the LED display when the drive is ready and no FWD/REV signal is active.

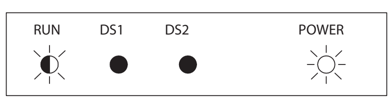


Figure 4.2 Normal Operation LED

Alarm

Figure 4.3 shows the LED display when a minor fault occurs. *Refer to Troubleshooting on page 267* and take appropriate countermeasures.

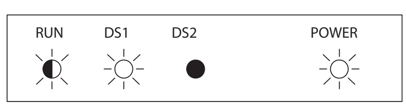


Figure 4.3 Alarm LED

Fault

Figure 4.4 shows the LED display when an oV or UV fault has occurred.

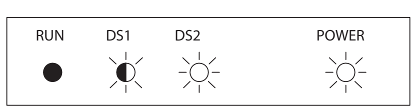


Figure 4.4 Fault LED

Start-Up Programming & Operation
4

◆ Digital Operator JVOP-180 Keys and Displays

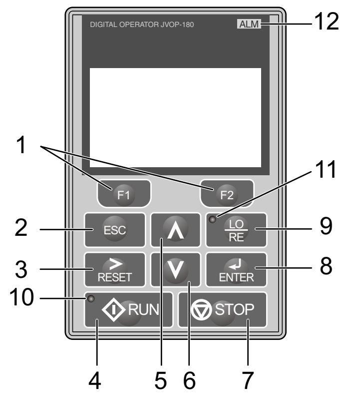


Figure 4.5 Keys and Displays on the Digital Operator

No.	Display	Name	Function
1	F1 F2	Function Key (F1, F2)	The functions assigned to F1 and F2 vary depending on the currently displayed menu. The name of each function appears in the lower half of the display window.
2	ESC	ESC Key	• Returns to the previous display. • Moves the cursor one space to the left. • Pressing and holding this button will return to the Speed Reference display.
3	> RESET	RESET Key	• Moves the cursor to the right. • Resets the drive to clear a fault situation.
4	RUN	RUN Key	Starts the drive in the LOCAL mode. The Run LED • is on, when the drive is operating the motor. • flashes during deceleration to stop or when the speed reference is 0. • flashes quickly, the drive is disabled by a DI, the drive was stopped using a fast stop DI, or an Up/Down command was active during power up.
5	∧	Up Arrow Key	Scrolls up to display the next item, select parameter numbers, and increment setting values.
6	∨	Down Arrow Key	Scrolls down to display the previous item, select parameter numbers, and decrements setting values.
7	STOP	STOP Key <1>	Stops drive operation.
8	ENTER	ENTER Key	• Enters parameter values and settings. • Selects a menu item to move between displays.
9	LO RE	LO/RE Selection Key <2>	Switches drive control between the operator (LOCAL) and the control circuit terminals (REMOTE) for the Run command and speed reference. The LED is on when the drive is in the LOCAL mode (operation from keypad).
10	RUN	RUN Light	Lit while the drive is operating the motor. Refer to page *97* for details.
11	LO RE	LO/RE Light	Lit while the operator is selected to run the drive (LOCAL mode). Refer to page *97* for details.
12	ALM	ALM LED Light	*Refer to ALARM (ALM) LED Displays on page 96*.

<1> The STOP key has highest priority. Pressing the STOP key will always cause the drive to stop the motor, even if an Up/Down command is active at any external Up/Down command source. To disable the STOP key priority, set parameter o2-02 to 0.
<2> The LO/RE key can only switch between LOCAL and REMOTE when the drive is stopped. By default settings the LO/RE key function is disabled. To allow using the LO/RE key for switching between LOCAL and REMOTE, set parameter o2-01 to 1.

■ Digital Operator JVOP-180 LCD Display

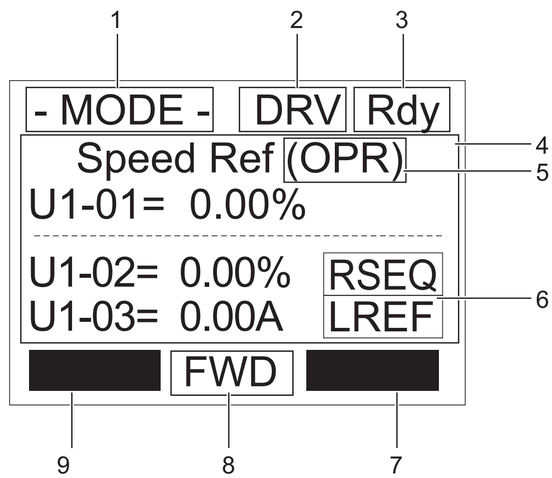


Figure 4.6 LCD Display

Table 4.1 Display and Contents

No.	Name	Display	Content
1	Operation Mode Menus	MODE	Displayed when in Mode Selection.
		MONITR	Displayed when in Monitor Mode.
		VERIFY	Indicates the Verify Menu.
		PRMSET	Displayed when in Parameter Setting Mode.
		A.TUNE	Displayed during Auto-Tuning.
		SETUP	Displayed when in Setup Mode.
2	Mode Display Area	DRV	Displayed when in Drive Mode.
		PRG	Displayed when in Programming Mode.
3	Ready	Rdy	Indicates the drive is ready to run.
4	Data Display	–	Displays specific data and operation data.
5	Speed Reference Source Assignment <1>	OPR	Displayed when the speed reference source is assigned to the LCD Operator.
		COM	Displayed when the speed reference source is assigned to MEMOBUS/Modbus Communication.
		OP	Displayed when the speed reference is assigned to an option card.
6	LO/RE Display <2>	RSEQ	Displayed when the Up/Down command is supplied from a remote source.
		LSEQ	Displayed when the Up/Down command is supplied from the operator keypad.
		RREF	Displayed when the speed reference is supplied from a remote source.
		LREF	Displayed when the speed reference is supplied from the operator keypad.
7	Function Key 1 (F1)	HELP	Pressing F1 displays the Help menu.
		←	Pressing F1 scrolls the cursor to the left.
		HOME	Pressing F1 returns to the top menu (Speed Reference).
		ESC	Pressing F1 returns to the previous display.
8	FWD/REV	FWD	During Up command
		REV	During Down command
9	Function Key 2 (F2)	FWD/REV	Pressing F1 switches between Up and Down when the Up/Down command is set from the digital operator.
		DATA	Pressing F1 scrolls to the next display.
		→	Pressing F1 scrolls the cursor to the right.
		RESET	Pressing F1 resets the existing drive fault or error.

<1> Displayed when in Drive Mode.
<2> Displayed when in Drive Mode and Monitor Mode.

◆ Powering Up the Drive and Operation Status Display

■ Powering Up the Drive

Perform the following power-off checks before applying main power to the drive.

WARNING! *Electrical Shock Hazard. Do not contact live electrical parts. Failure to comply could result in death or serious injury. Never touch the output terminals directly with your hands or allow the output lines to come into contact with the drive case.*

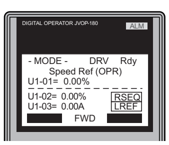
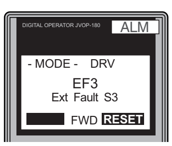
WARNING! *Sudden Movement Hazard. Operating a drive with untested emergency circuits could result in death or serious injury. Always check the operation of drive fast stop circuits and any additional emergency circuits after they are wired. Fast stop circuits are required to provide safe and quick shutdown of the drive.*

WARNING! *Sudden Movement Hazard. Ensure start/stop and safety circuits are wired properly and in the correct state before energizing the drive. Failure to comply could result in death or serious injury from moving equipment.*

Power-off Checks	Description
Power supply voltage	Ensure the power supply voltage is correct on the supply side of the disconnect, before applying power to the drive. 200 V class: 3-phase 200 to 240 Vac 50/60 Hz 400 V class: 3-phase 380 to 480 Vac 50/60 Hz
	Properly wire the power supply input terminals (R/L1, S/L2, T/L3). Check for correct wiring, terminals are tightened, and there are no loose wire strands.
	Check for proper grounding of drive and motor.
Drive output terminals and motor terminals	Properly wire drive output terminals U/T1, V/T2, and W/T3 with motor terminals U/T1, V/T2, and W/T3. Check for correct wiring, terminals are tightened, and there are no loose wire strands.
Control circuit terminals	Check control circuit terminal connections. Check that control circuit terminals are correctly wired, terminals are tightened, and there are no loose wire strands.
Drive control terminal status	Open all control circuits to the drive I/O terminal block.

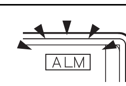
■ Status Display

When the power supply to the drive is turned on, the digital operator lights will appear as follows:

No.	Name	Description
Normal Operation		The data display area in the upper half of the display, displays the speed reference. DRV is displayed.
Fault	 External fault (example)	Data displayed varies by the type of fault. *Refer to Fault Displays, Causes, and Possible Solutions on page 280* for more information and possible solutions. ALM LED is lit and DRV displayed.

◆ ALARM (ALM) LED Displays

Table 4.2 ALARM (ALM) LED Status and Contents

State	Content	Display
Illuminated	When the drive detects an alarm or error.	
Flashing	• When an alarm occurs. • When oPE is detected. • When a fault or error occurs during Auto-Tuning.	
Off	Normal operation (no fault or alarm).	

◆ LO/RE LED and RUN LED Indications

Table 4.3 LO/RE LED and RUN LED Indications

LED	Lit	Flashing	Flashing Quickly <1>	Off
LO/RE	When source of the Up/Down command is assigned to the digital operator (LOCAL).	–	–	Up/Down command to be given from a device other than the digital operator (REMOTE).
RUN	During run	• During deceleration to stop. • When an Up/Down command is input and speed reference is 0%.	• While the drive is set for LOCAL, an Up/Down command was entered to the input terminals after which the drive was then switched to REMOTE. • An Up/Down command was entered via the input terminals while not in the Drive Mode. • During deceleration when a Fast Stop command was entered. • The drive output is shut off by the Safe Disable function. • While the drive was running in the REMOTE mode, the STOP key was pushed.	During stop
Examples	RUN	RUN	RUN	RUN

<1> Refer to ***Figure 4.7*** for the difference between “flashing” and “flashing quickly”.

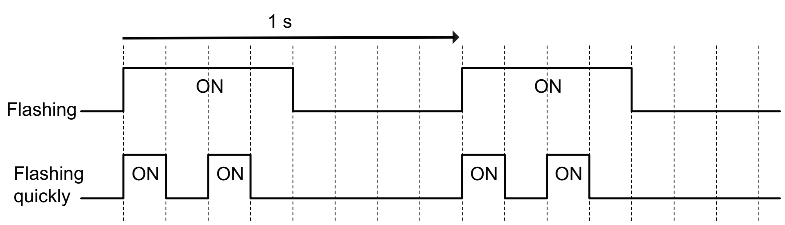


Figure 4.7 RUN LED Status and Meaning

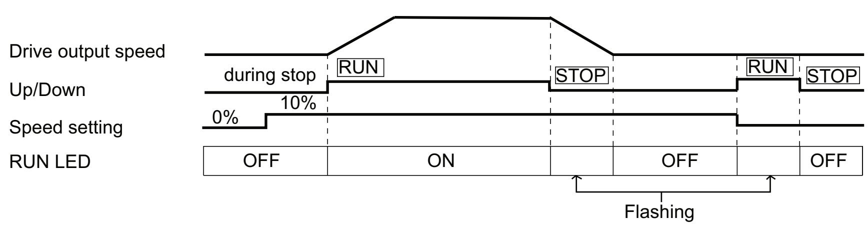


Figure 4.8 RUN LED and Drive Operation

◆ Menu Structure for Digital Operator

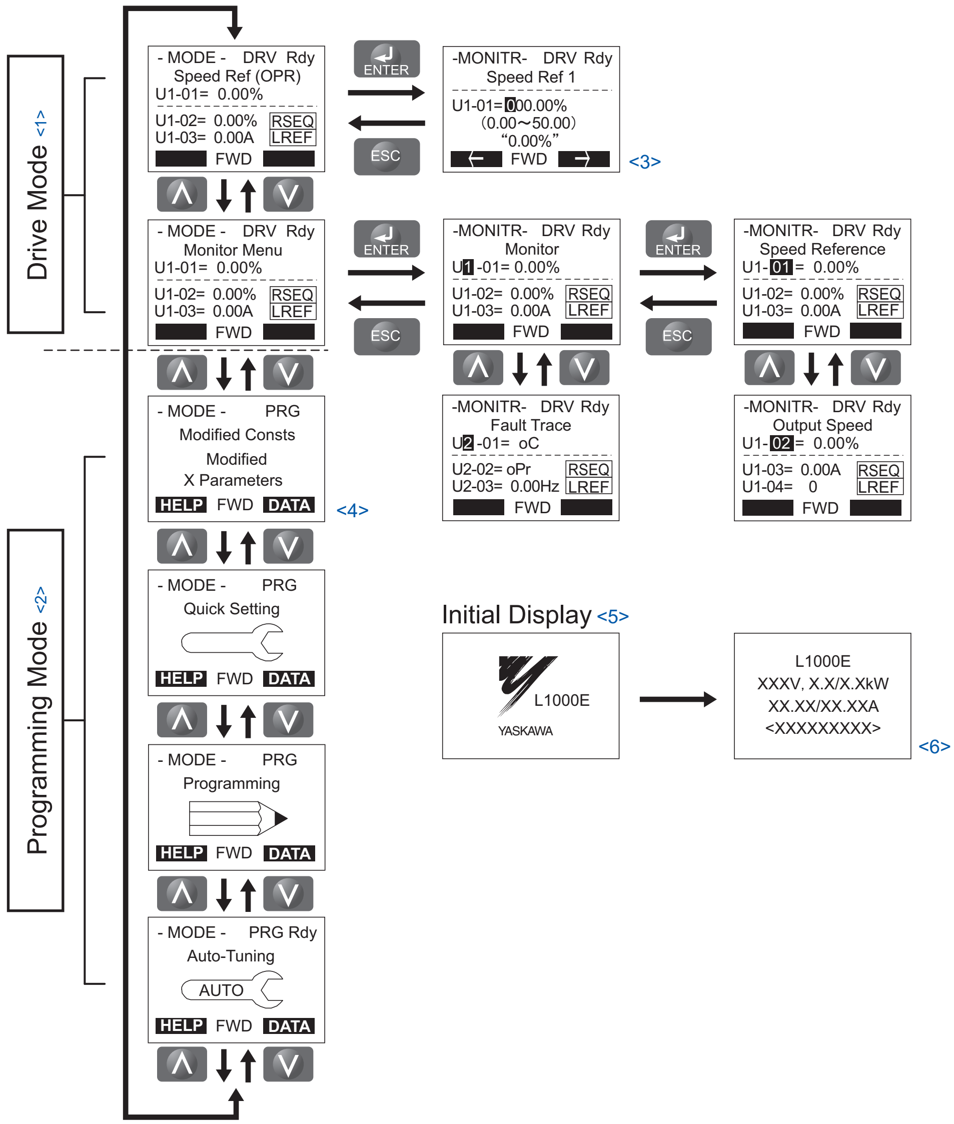


Figure 4.9 Digital Operator Menu and Screen Structure

<1> Pressing RUN will start the motor.

<2> Drive cannot operate the motor.

<3> Flashing characters are shown as 0.

<4> An "X" character is used as a placeholder for illustration purposes in this manual. The LCD Operator will display the actual setting values.

<5> The Speed Reference appears after the initial display which shows the product name.

<6> The information that appears on the display will vary depending on the drive.

4.3 The Drive and Programming Modes

The drive has a Drive Mode to operate the motor and a Programming Mode to edit parameter settings.

Drive Mode: In Drive Mode the user can operate the motor and observe U Monitor parameters. Parameter settings cannot be edited or changed when in Drive Mode.

Programming Mode: In Programming Mode the user can edit and verify parameter settings and perform Auto-Tuning. The drive will not accept an Up/down command when the digital operator is in the Programming Mode unless parameter b1-08 is set to 1 to allow an Up/down command.

Note: **1.** If b1-08 is set to 0, the drive will only accept an Up/Down command in Drive Mode. After editing parameters, the user must exit the Programming Mode and enter Drive Mode before operating the motor.
2. Set b1-08 to 1 to allow the drive to run the motor while in Programming Mode.

◆ Navigating the Drive and Programming Modes

The drive is set to operate in Drive Mode when it is first powered up. Switch between display screens by using the ∧ and ∨ keys.

Mode	Contents	Operator Display	Description
Power Up	Speed Reference (default)	- MODE - DRV Rdy Speed Ref (OPR) U1-01= 0.00% U1-02= 0.00% RSEQ U1-03= 0.00A LREF FWD	This display screen allows the user to monitor and change the speed reference while the drive is running. *Refer to The Drive and Programming Modes on page 99*. **Note:** The user can select the data displayed when the drive is first powered up with parameter o1-02.
Drive Mode		∧ ↓↑ ∨	
	Monitor Display	- MODE - DRV Rdy Monitor Menu U1-01= 0.00% U1-02= 0.00% RSEQ U1-03= 0.00A LREF FWD	Lists the monitor parameters (U□-□□ parameters) available in the drive. Press the Enter Key and then use the Up, Down, ESC, and Reset keys to navigate through the drive monitors.
Programming Mode		∧ ↓↑ ∨	
	Verify Menu	- MODE - PRG Modified Consts Modified X Parameters HELP FWD DATA	Lists all parameters that have been edited or changed from default settings. ➡ *Refer to Verifying Parameter Changes: Verify Menu on page 102*.
		∧ ↓↑ ∨	
	Setup Group	- MODE - PRG Quick Setting HELP FWD DATA	A select list of parameters necessary to get the drive operating quickly. ➡ *Refer to Using the Setup Group on page 103*.
		∧ ↓↑ ∨	
	Parameter Setting Mode	- MODE - PRG Programming HELP FWD DATA	Allows the user to access and edit all parameter settings. ➡ *Refer to Parameter List on page 367*.
		∧ ↓↑ ∨	

Mode	Contents	Operator Display	Description
Programming Mode	Auto-Tuning Mode	- MODE - PRG Auto-Tuning AUTO HELP FWD DATA	Motor parameters are calculated and set automatically. ➡ *Refer to Auto-Tuning on page 113*.
		∧ ↓↑ ∨	
Drive Mode	Speed Reference	- MODE - DRV Rdy Speed Ref (OPR) U1-01= 0.00% U1-02= 0.00% RSEQ U1-03= 0.00A LREF FWD	Returns to the speed reference display screen.

■ Drive Mode Details

The following actions are possible in the Drive Mode:

- Run and stop the drive
- Monitor the operation status of the drive (speed reference, output speed, output current, output voltage, etc.)
- View information on an alarm
- View a history of alarms that have occurred

Figure 4.10 illustrates how to change the speed reference from 0.00% to 10.00% while in the Drive Mode. This example assumes the reference source is assigned to the digital operator (b1-02 = 0) and d1-01 is set to 0 or 3.

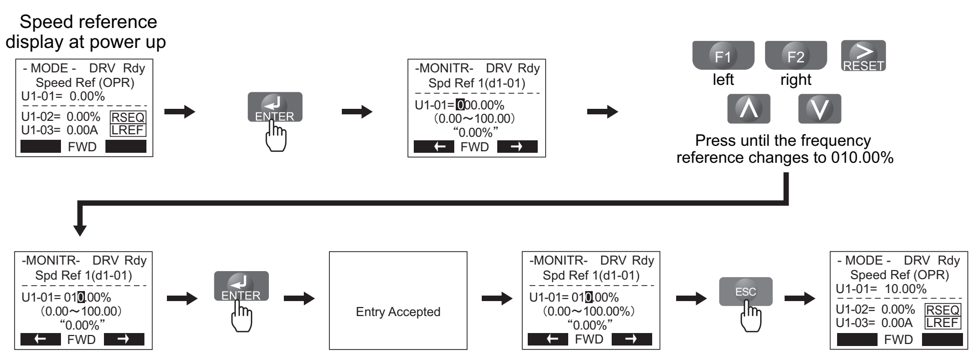


Figure 4.10 Setting the Speed Reference while in the Drive Mode

Note: The drive will not accept a change to the speed reference until the ENTER key is pressed after the speed reference is entered. This feature prevents accidental setting of the speed reference. To have the drive accept changes to the speed reference as soon as changes are made without requiring the ENTER key, set o2-05 to 1.

■ Programming Mode Details

The following actions are possible in the Programming Mode:

- **Parameter Setting Mode:** Access and edit all parameter settings.
- **Verify Menu:** Check a list of parameters that have been changed from their original default values.
- **Setup Group:** Access a list of commonly used parameters to simplify setup (refer to *Simplified Setup Using the Setup Group on page 103*).
- **Auto-Tuning Mode:** Automatically calculate and set motor parameters to optimize drive performance.

◆ Changing Parameter Settings or Values

This example explains changing C1-02 (Deceleration Ramp 1) from 1.50 seconds (default) to 2.50 seconds.

Step			Display/Result
1.	Turn on the power to the drive. The initial display appears.	➡	- MODE - DRV Rdy Speed Ref (OPR) U1-01= 0.00% U1-02= 0.00% RSEQ U1-03= 0.00A LREF FWD
2.	Press ∧ or ∨ until the Parameter Setting Mode screen appears.	➡	- MODE - PRG Programming HELP FWD DATA
3.	Press ENTER to enter the parameter menu tree.	➡	-PRMSET- PRG Initialization A1-00= 0 Select Language ← FWD →
4.	Press ∧ or ∨ to select the C parameter group.	➡	-PRMSET- PRG Basic Setup C1-01 = 1.50 sec Accel Ramp 1 ← FWD →
5.	Press ENTER two times.	➡	-PRMSET- PRG Accel/Decel C1-01= 1.50 sec Accel Ramp 1 ← FWD → ➡ -PRMSET- PRG Accel Ramp 1 C1-01= 1.50 sec (0.0~600.00) "1.50 sec" ← FWD →
6.	Press ∧ or ∨ to select the parameter C1-02.	➡	-PRMSET- PRG Decel Ramp 1 C1-02= 1.50 sec (0.0~600.00) "1.50 sec" ← FWD →
7.	Press ENTER to view the current setting value (1.5 s). The left most digit flashes.	➡	-PRMSET- PRG Decel Ramp 1 C1-02= 001.50 sec (0.0~600.00) "1.50 sec" ← FWD →
8.	Press F1 (left), F2 (right) or > RESET until the desired number is selected. "1" flashes.	➡	-PRMSET- PRG Decel Ramp 1 C1-02=001.50 sec (0.0~600.00) "1.50 sec" ← FWD →
9.	Press ∧ and enter 0020.0.	➡	-PRMSET- PRG Decel Ramp 1 C1-02=002.50 sec (0.0~600.00) "1.50 sec" ← FWD →
10.	Press ENTER to confirm the change.	➡	Entry Accepted
11.	The display automatically returns to the screen shown in Step 4.	➡	-PRMSET- PRG Decel Ramp 1 C1-02= 2.50 sec (0.0~600.00) "1.50 sec" ← FWD →

Step			Display/Result
12.	Press ESC as many times as necessary to return to the initial display.	➡	- MODE - DRV Rdy Speed Ref (OPR) U1-01= 0.00% U1-02= 0.00% RSEQ U1-03= 0.00A LREF FWD

◆ Verifying Parameter Changes: Verify Menu

The Verify Menu lists edited parameters from the Programming Mode or as a result of Auto-Tuning. The Verify Menu helps determine which settings have been changed, and is particularly useful when replacing a drive. If no settings have been changed, the Verify Menu will read “None”. The Verify Menu also allows users to quickly access and re-edit any parameter settings that have been changed.

Note: The Verify Menu will not display parameters from the A1 group (except for A1-02, Control Method Selection) even if those parameters have been changed from their default settings.

The following example is a continuation of the steps above. Here, parameter C1-02 is accessed using the Verify Menu, and is changed again from 1.50 s to 2.50 s.

The steps below are an example of how to check the list of edited parameters:

Step			Display/Result
1.	Turn on the power to the drive. The initial display appears.	➡	- MODE - DRV Rdy Speed Ref (OPR) U1-01= 0.00% U1-02= 0.00% RSEQ U1-03= 0.00A LREF FWD
2.	Press ∧ or ∨ until the display shows the top of the Verify Menu.	➡	- MODE - PRG Modified Consts Modified X Parameters HELP FWD DATA
3.	Press ENTER to enter the list of parameters that have been edited from their original default settings. If parameters other than C1-02 have been changed, use ∧ or ∨ to scroll until C1-02 appears.	➡	- VERIFY - PRG Rdy Decel Ramp 1 C1-02 = 2.50sec (0.0~600.00) “1.50sec” Home FWD DATA
4.	Press ENTER to access the setting value. Left digit flashes.	➡	- VERIFY - PRG Rdy Decel Ramp 1 C1-01=002.50sec (0.0~600.00) “1.50sec” Home FWD DATA

◆ Simplified Setup Using the Setup Group

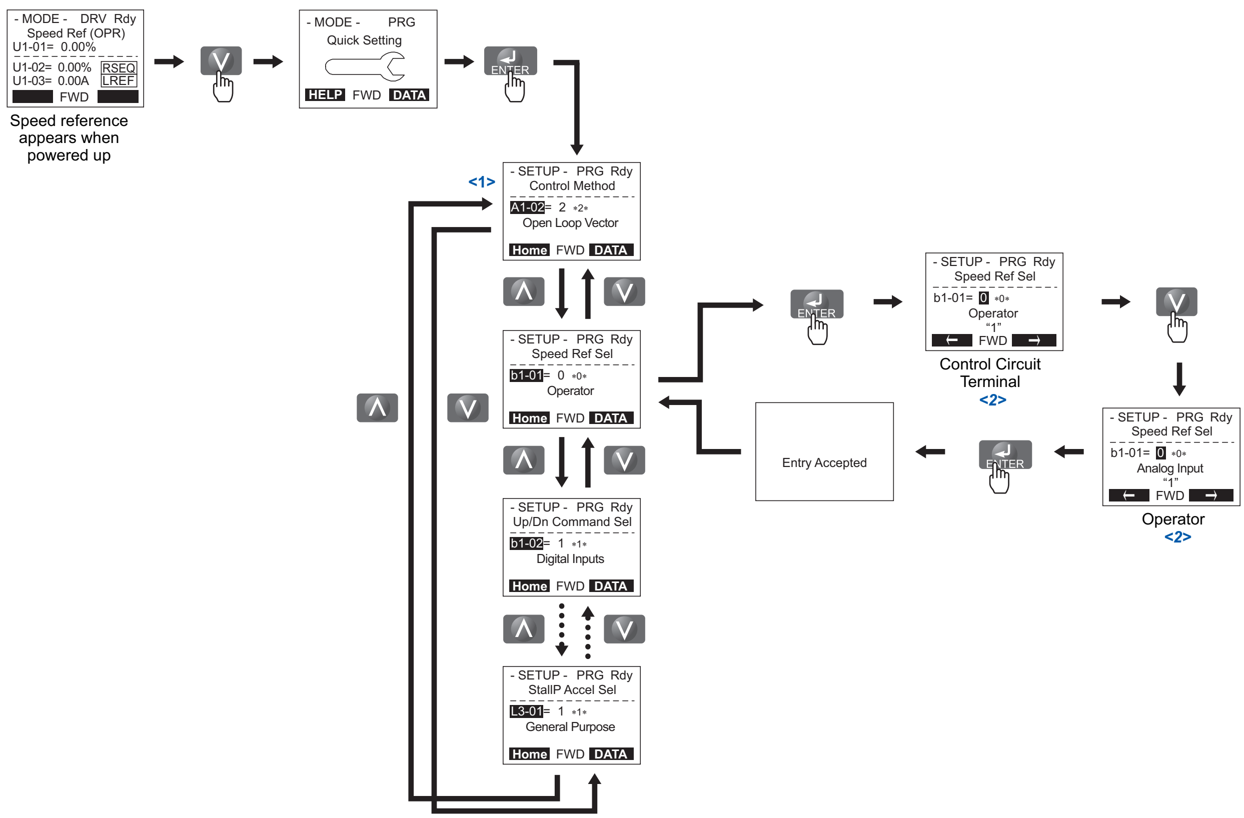
In the Setup Group, the drive lists the basic parameters needed to set up the drive for an elevator application. This group expedites the startup process for an elevator application by showing only the most important parameters for the application.

■ Using the Setup Group

Figure 4.11 illustrates how to enter and how to change parameters in the Setup Group.

The first display shown when entering the Setup Group is the Control Method menu. Skipping this display will keep the current Setup Group parameter selection. The default setting for the Setup Group is a group of parameters most commonly use in control methods.

In this example, the Setup Group is accessed to change b1-01 from 0 to 1. This changes the source of the speed reference from the digital operator to the control circuit terminals.



<1> Use the up and down arrow keys to scroll through the Setup Group. Press the ENTER key to view or change parameter settings.
<2> To return to the previous menu without saving changes, press the ESC key.

Figure 4.11 Setup Group Example

■ Setup Group Parameters

Table 4.4 lists parameters available by default in the Setup Group.

If a parameter that needs to be edited is not displayed in the Setup Group, access the parameter through the Programming Mode.

Table 4.4 Setup Group Parameters

Parameter	Name	Parameter	Name
A1-02	Control Method Selection	E1-01	Input Voltage Setting
b1-01	Speed Reference Selection	E1-04	Maximum Output Frequency
C1-01	Acceleration Ramp 1	E1-05	Maximum Voltage
C1-02	Deceleration Ramp 1	E1-06	Base Frequency
d1-01	Speed Reference 1	E1-09	Minimum Output Frequency
d1-02	Speed Reference 2	E1-13	Base Voltage
d1-03	Speed Reference 3	E2-01	Motor Rated Current
d1-04	Speed Reference 4	E2-11	Motor Rated Output
d1-26	Leveling Speed	L1-01	Motor Overload Protection Selection

Note: Parameter availability depends on the control mode set in A1-02; some parameters listed above may not be accessible in all control modes.

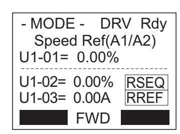
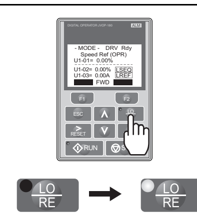
◆ Switching Between LOCAL and REMOTE

LOCAL mode is when the drive is set to accept the Up/Down command from the digital operator keypad. REMOTE mode is when the drive is set to accept the Up/Down command from an external device (via the input terminals or serial communications, etc.).

Switch the operation between LOCAL and REMOTE using the LO/RE key on the digital operator or via a digital input. This key is disabled with default settings, but can be enabled by setting parameter o2-01 to 1.

Note: **1.** After selecting LOCAL, the LO/RE light will remain lit.
2. The drive will not allow the user to switch between LOCAL and REMOTE during run.

■ Using the LO/RE Key on the Digital Operator

	Step		Display/Result
1.	Turn on the power to the drive. The initial display appears.	→	
2.	Press . The LO/RE light will light up. The drive is now in LOCAL. To set the drive for REMOTE operation, press  again.	→	

4.4 Start-Up Flowcharts

This section covers basic setup for the drive, including Auto-Tuning procedures and corresponding flowcharts. Follow the flowchart that matches the motor used in your application. Refer to *Types of Auto-Tuning on page 113* for details on the types of Auto-Tuning.

Flowchart	Purpose	Page
A	Installation, wiring, and basic steps required to setup the motor and elevator for operation.	*106*
B	Auto-Tuning for induction motors.	*110*
C	Auto-Tuning for PM motors.	*111*
D	Encoder Offset Auto-Tuning	*112*

◆ Flowchart A: Installation, Wiring, Basic Setup for Motor and Elevator

The flowchart below covers the basic procedure required to install the drive, motor, and elevator.

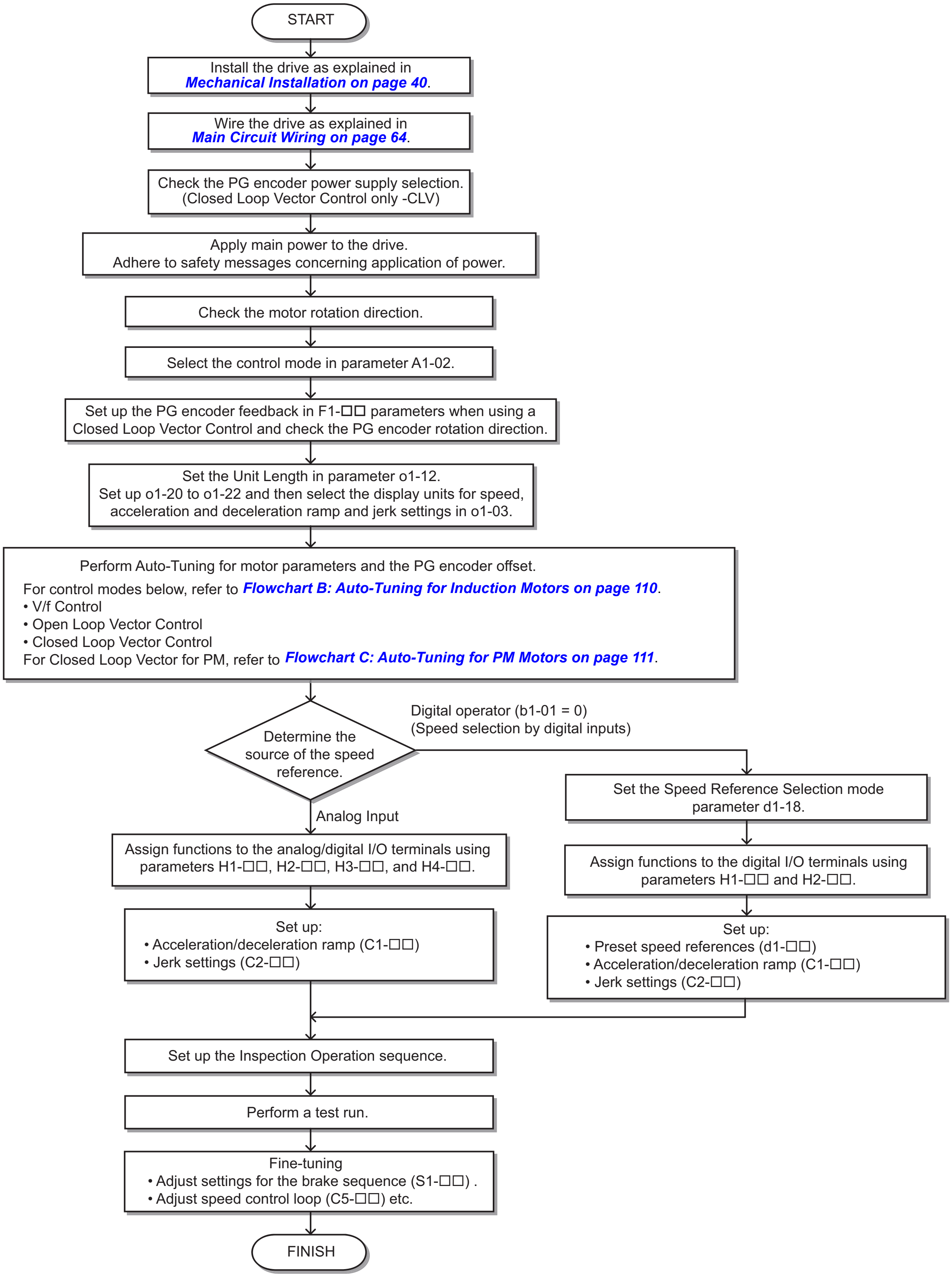


Figure 4.12 Installation, Wiring, Basic Setup for Motor and Elevator

Note: Set parameter H5-11 to 1 when setting parameters using MEMOBUS/Modbus communications.

◆ Power On

Take the following precautions before applying main power to the drive:

WARNING! *Sudden Movement Hazard. Ensure start/stop, I/O and safety circuits are wired properly and in the correct state before energizing or running the drive. Failure to comply could result in death or serious injury from moving equipment.*

WARNING! *Fire Hazard. Do not use an improper voltage source. Failure to comply could result in death or serious injury by fire. Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.*

WARNING! *Fire Hazard. Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections. Tighten all terminal screws to the specified tightening torque.*

WARNING! *Fire Hazard. Do not connect the AC power line to the output motor terminals of the drive. Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.*

- *Do not connect AC line power to output terminals U/T1, V/T2, and W/T3.*
- *Make sure that the power supply lines are connected to main circuit input terminals R/L1, S/L2, and T/L3 (or R/L1 and S/L2 for single-phase power).*

WARNING! *Sudden Movement Hazard. Clear personnel, secure equipment and check sequence and safety circuitry before starting the drive. Failure to comply could result in death or serious injury from moving equipment.*

- *Clear all personnel from the drive, motor, and machine area.*
- *Secure covers, couplings, shaft keys, and machine loads.*
- *Ensure start/stop and safety circuits are wired properly and in the correct state.*

WARNING! *Sudden Movement Hazard. Operating a drive with untested emergency circuits could result in death or serious injury. Always check the operation of drive fast stop circuits and any additional emergency circuits after they are wired. Fast stop circuits are required to provide safe and quick shutdown of the drive.*

NOTICE: *Equipment Hazard. Comply with proper wiring practices. The motor may run in reverse if the phase order is backward. Connect motor input terminals U/T1, V/T2, and W/T3 to drive output terminals U/T1,V/T2, and W/T3. The phase order for the drive and motor should match.*

NOTICE: *Equipment Hazard. Check all the wiring including the PG encoder wiring and PG option jumper settings, to ensure that all connections are correct after installing the drive and connecting any other devices. Failure to comply could result in damage to the drive.*

After applying the power, the drive mode display should appear and no fault or alarm should be displayed. ***Refer to Drive Alarms, Faults, and Errors on page 270*** in the event of a drive fault or error code.

◆ Control Mode Selection

Select one of the four motor control modes after applying power to the drive. Note that Closed Loop Vector modes require PG encoder feedback cards. The table below indicates possible control modes depending on the motor type and shows the required encoder feedback card.

Machine Type	Control Mode	A1-02 setting	Encoder Option Card
Induction motor without encoder	V/f Control	0	No card required
	Open Loop Vector Control	2	No card required
Induction motor with incremental encoder	Closed Loop Vector Control	3	PG-B3 / PG-X3
Permanent magnet motor with EnDat 2.1/01, EnDat 2.2/01, or EnDat 2.2/22 encoder	Closed Loop Vector Control for PM motors	7	PG-F3
Permanent magnet motor with ERN1387 or ERN487 encoder	Closed Loop Vector Control for PM motors	7	PG-E3
Yaskawa IPM motor with incremental encoder	Closed Loop Vector Control for PM motors	7	PG-X3

◆ Motor Rotation Direction Setup

Check the direction of motor rotation to verify the Up command causes the elevator to move in the upward direction. Perform the following checks to confirm proper motor and load direction:

- The drive outputs motor voltage in U/T1-V/T2-W/T3 phase sequence when an Up command is issued. Check the motor rotation with this phase sequence (for most motors clockwise is seen from the shaft side).
- If the motor drives the elevator in up direction with a U/T1-V/T2-W/T3 sequence, make sure parameter b1-14 is set to 0.
- If the motor drives the elevator in down direction with a U/T1-V/T2-W/T3 sequence, make sure parameter b1-14 is set to 1. Motor direction may also be changed by reversing two motor leads connected to U/T1, V/T2, W/T3 on the drive terminal block.

DANGER! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply will result in death or serious injury. Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are OFF and measure the DC bus voltage level to confirm safe level.*

Note: Always perform motor rotation direction setup prior to setting the encoder rotation direction.

◆ PG Encoder Setup

■ PG Encoder Resolution Setup

Set the encoder resolution (incremental signal in the case of absolute encoders with Sin/Cos channels) in parameter F1-01.

■ PG Encoder Rotation Direction Setup

Perform the following steps to make sure the PG encoder rotation direction is set up correctly in the drive:

If information about the signal sequence of the PG encoder is available:

1. Check the sequence of PG encoder phases A and B when the motor drives the elevator in up direction.
2. If the PG encoder A phase leads phase B, make sure F1-05 is set to 0.
3. If the PG encoder B phase leads phase A, make sure F1-05 is set to 1.

If no information about the signal sequence of the PG encoder is available:

1. Turn the motor manually in elevator up direction while checking the value of monitor U1-05.
2. If the value in U1-05 is positive, the set PG encoder direction is correct.
3. If the value in U1-05 is negative, alter the setting of parameter F1-05.

Note: Always set the motor rotation direction prior to the encoder rotation direction. Refer to ***Motor Rotation Direction Setup on page 108***.

◆ Digital Operator Display Unit Selection

The drive can display different types of engineering units for speed related parameters and monitors, acceleration and deceleration ramp, and jerk settings. Select the speed units using parameter o1-03 as shown below.

<table>
<tr><th rowspan="2">o1-03 Setting</th><th colspan="3">Display Unit</th></tr>
<tr><th>Speed Setting/Monitors
(d1-□□, U1-02, U1-02,...)</th><th>Accel/Decel Ramp
(C1-□□)</th><th>Jerk Settings
(C2-□□)</th></tr>
<tr><td>0</td><td>0.01 Hz</td><td rowspan="5">0.01 s
Set as the time in required to accelerate from zero to the rated speed, and to decelerate from rated speed to zero.</td><td rowspan="5">0.01 s
Set as the time used to change the accel/decel ramp from zero to the accel/decel ramp setting of C1-□□ and vice versa.</td></tr>
<tr><td>1 (default)</td><td>0.01%</td></tr>
<tr><td>2</td><td>1 rpm</td></tr>
<tr><td>3</td><td>User defined</td></tr>
<tr><td>4</td><td>0.01 m/s</td></tr>
<tr><td>5</td><td>0.01 m/s</td><td>0.01 m/s² (Set as accel/decel ramp)</td><td>0.01 m/s³ (set as jerk value)</td></tr>
<tr><td>6</td><td>0.1 ft/min</td><td>0.01 ft/s² (Set as accel/decel ramp)</td><td>0.01 ft/s³ (set as jerk value)</td></tr>
</table>

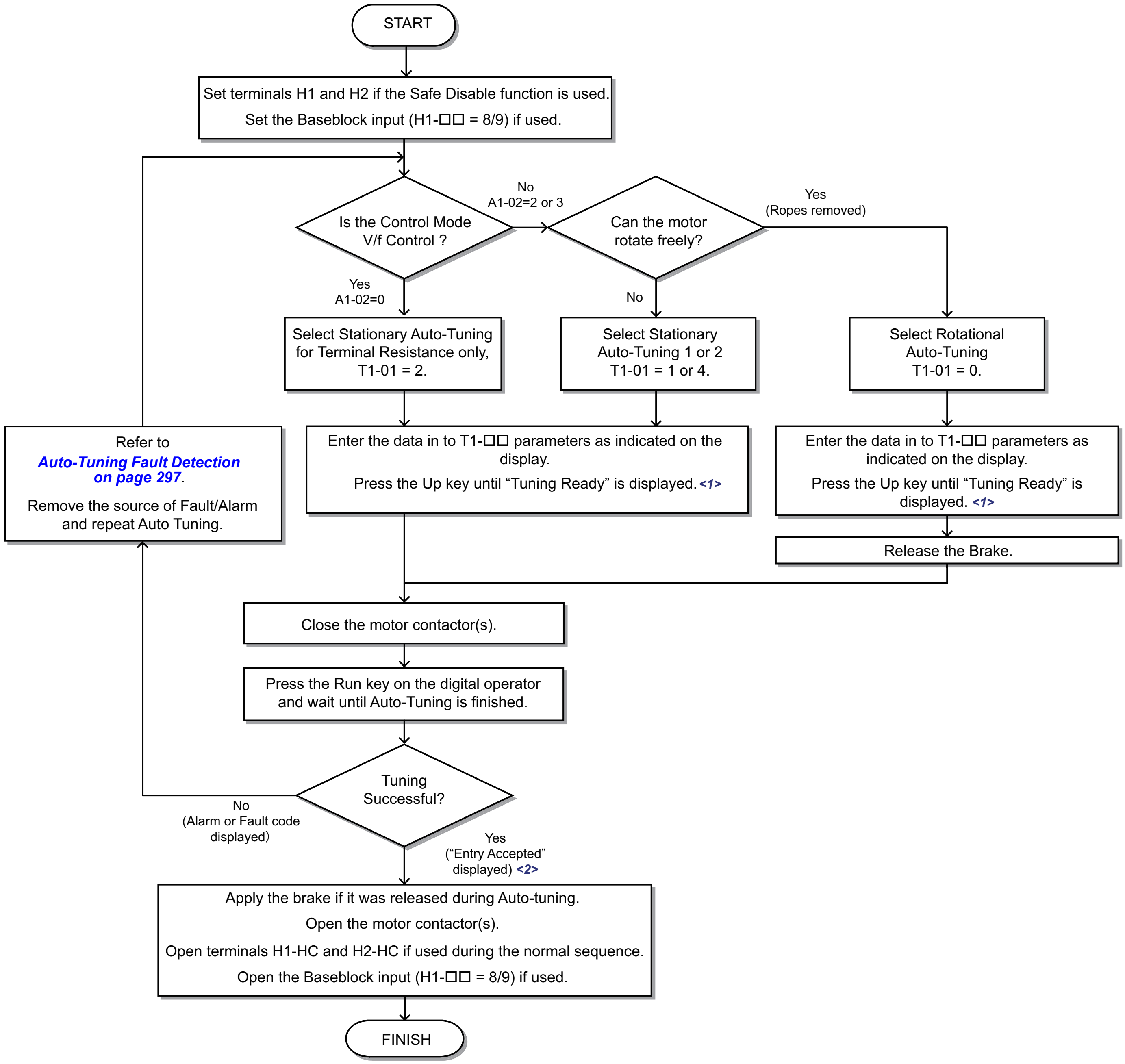
Certain mechanical data must be programmed to the drive prior to setting o1-03 to 4, 5, or 6. Perform the following steps when using one of those settings:

1. Make sure motor data are set up correctly. Verify the setting of the maximum output frequency in parameter E1-04 and the setting for the number of motor poles in parameter E2-04 or E5-04.
2. Set the traction sheave diameter in units of mm to parameter o1-20.
3. Set the correct roping to parameter o1-21.
4. If a mechanical gear is used, set the gear ratio ($n_{Motor}/n_{Traction\ Sheave}$) to parameter o1-22. If a gearbox is not used, make sure o1-22 is set to 1.0.
5. Change parameter o1-03 to setting 4 or 5. The unit and setting values of related parameters will be changed automatically.

Refer to o1: Digital Operator Display Selection on page 395 for details.

◆ Flowchart B: Auto-Tuning for Induction Motors

The flowchart below covers Auto-Tuning for induction motors operating with V/f Control, Open Loop Vector Control, or Closed Loop Vector Control.

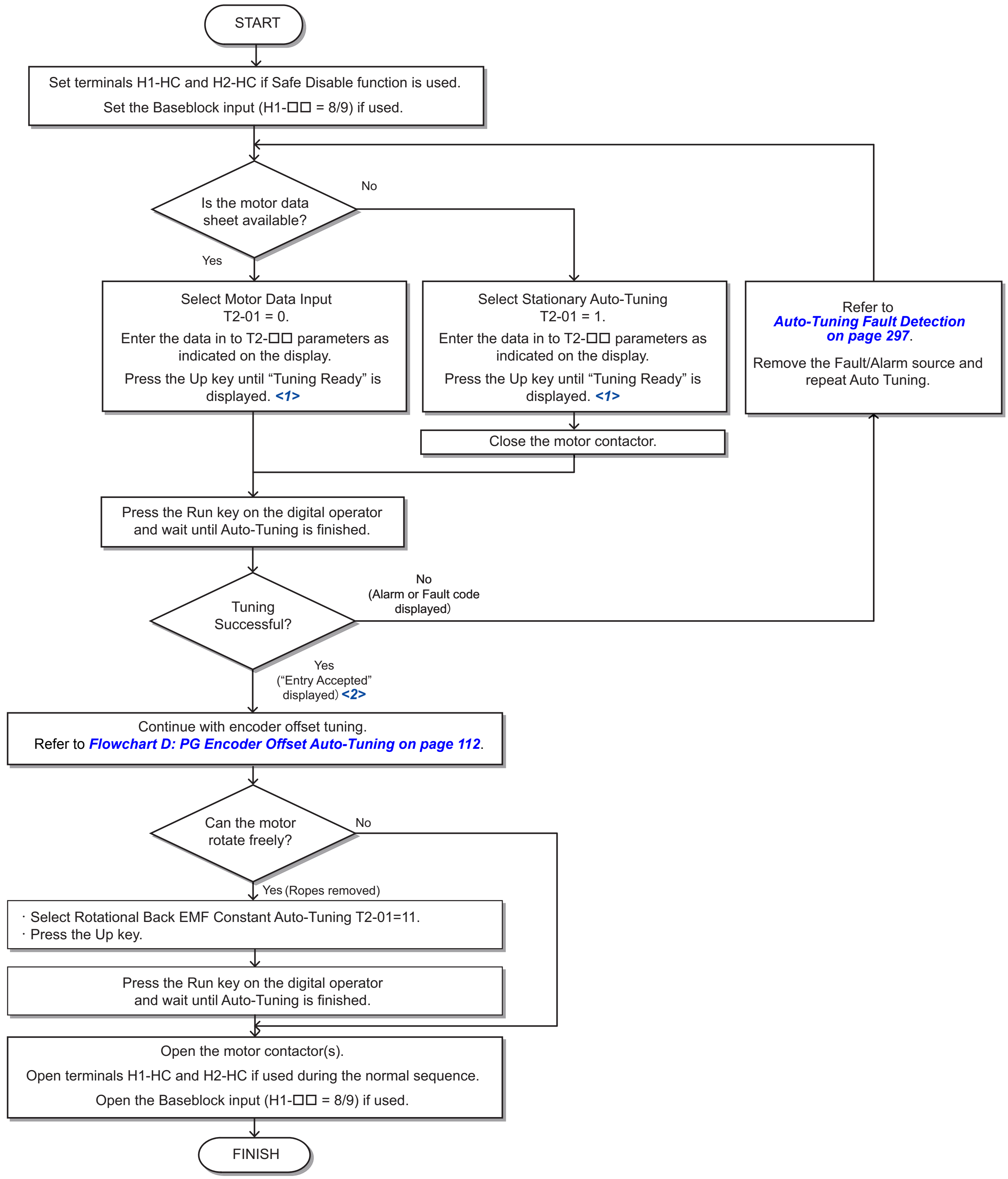


<1> If an LED operator is used, the display shows “TUn10”.
<2> If an LED operator is used, the display shows “End”.

Figure 4.13 Auto-Tuning for Induction Motors

◆ Flowchart C: Auto-Tuning for PM Motors

The flowchart below covers Auto-Tuning for permanent magnetic (PM) motors operating with Closed Loop Vector Control for PM motors.

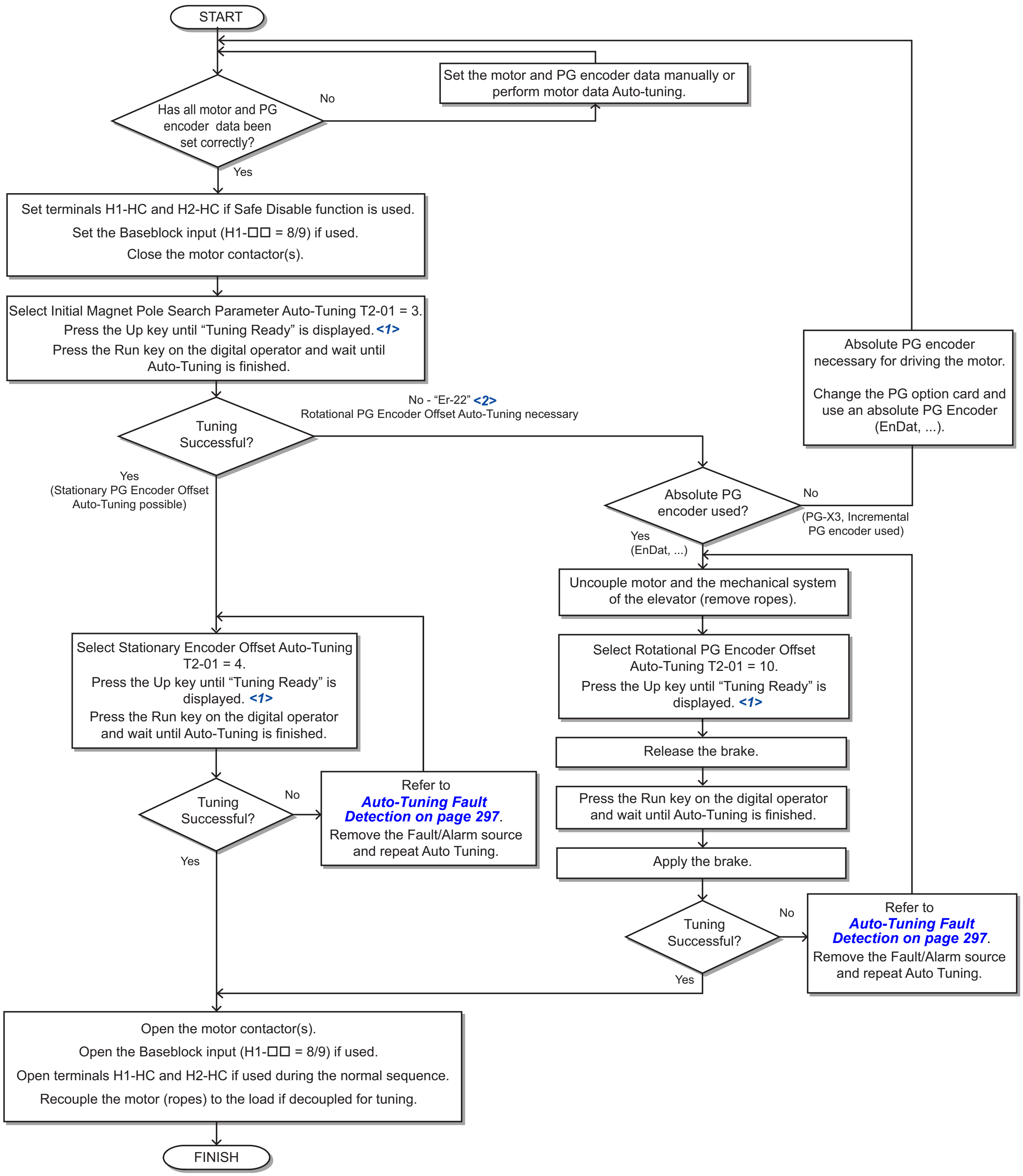


<1> If an LED operator is used, the display shows “TUn10”.
<2> If an LED operator is used, the display shows “End”.

Figure 4.14 Auto-Tuning for PM Motors

◆ Flowchart D: PG Encoder Offset Auto-Tuning

The flowchart below covers Rotational and Stationary Auto-Tuning procedures used to automatically set up the PG encoder offset. PG encoder Offset Tuning should be performed when the PG encoder offset (T2-17) is unknown, when a PG encoder offset value has been set but problems with the speed feedback occur, or when the PG encoder is replaced.



<1> If an LED operator is used, the display shows “TUn 10”.
<2> If an LED operator is used, the display shows “Er-22”.

Figure 4.15 PG Encoder Offset Auto-Tuning

4.5 Auto-Tuning

WARNING! *Sudden Movement Hazard. The drive and motor may start unexpectedly during Auto-Tuning, which could result in death or serious injury. Ensure the area surrounding the drive motor and load are clear before proceeding with Auto-Tuning. Remove main power from the drive before servicing the drive or motor. Do not touch the motor during Auto-Tuning.*

Note: When using a PM motor for the first time, or when replacing the drive or PM motor, always make sure that motor parameters are set properly and the speed detection functions accurately prior to operation. Using a PM motor requires that the encoder offset be set correctly in addition to entering motor data to corresponding parameters. If the motor, encoder, or drive are ever replaced, be sure to perform Encoder Offset Auto-Tuning.

Insufficient torque can cause the elevator car to move in the direction of the load, or cause the motor to behave erratically (reverse operation, stand still, sudden accelerations, etc.).

For more information, refer to the instruction manual included with the motor.

◆ Types of Auto-Tuning

The drive offers different types of Auto-Tuning for induction motors and permanent magnet motors. The type of Auto-Tuning used differs further based on the control mode and other operating conditions. Refer to the tables below to select the type of Auto-Tuning that bests suits the application. Directions for performing Auto-Tuning are listed in *Start-Up Flowcharts on page 105*.

Note: The drive will only show Auto-Tuning parameters that are valid for the control mode that has been set in A1-02. If the control mode is for an induction motor, the Auto-Tuning parameters for PM motors will not be available. If the control mode is for a PM motor, the Auto-Tuning parameters for induction motors will not be available. Inertia Tuning and ASR Gain Tuning parameters and setting options will be visible only when the drive is set for operation with CLV or CLV/PM.

■ Auto-Tuning for Induction Motors

This feature automatically sets the V/f pattern and motor parameters E1-□□ and E2-□□ for an induction motor. Additionally, the feature also sets some F1-□□ parameters for speed feedback detection in Closed Loop Vector.

Table 4.5 Types of Auto-Tuning for Induction Motors

Type	Setting	Requirements and Benefits	Control Mode (A1-02)		
			V/f (0)	OLV (2)	CLV (3)
Rotational Auto-Tuning	T1-01 = 0	• Rotational Auto-Tuning gives the most accurate results, and is recommended if possible. • Motor must run freely or with light load (<30%), i.e. ropes have to be removed.	No	Yes	Yes
Stationary Auto-Tuning 1	T1-01 = 1	• A motor test report listing motor data is not available. • Automatically calculates motor parameters needed for vector control. • Use if ropes can not be removed. Note that the accuracy is less then with Rotational Auto-Tuning.	No	Yes	Yes
Stationary Auto-Tuning for Line-to-Line Resis-tance	T1-01 = 2	• Used for V/f Control or in vector control modes when the drive was previously set up properly and now the motor cable has changed. • Used in V/f control if drive and motor capacities differ. • Should not be used for any vector control modes unless the motor cable has changed.	Yes	Yes	Yes
Stationary Auto-Tuning 2	T1-01 = 4	• A motor test report is available. Once the no-load current and the rated slip have been entered, the drive calculates and sets all other motor-related parameters. • Use if ropes can not be removed and if slip and no-load current data are available.	No	Yes	Yes

Table 4.6 lists the data that must be entered for Auto-Tuning. Make sure this data is available before starting Auto-Tuning. The necessary information is usually listed on the motor nameplate or in the motor test report provided by the motor manufacturer. Also refer to *Flowchart B: Auto-Tuning for Induction Motors on page 110* for details on Auto-Tuning process and selections.

Table 4.6 Auto-Tuning Input Data

Input Value	Input Parameter	Unit	Tuning Type (T1-01)			
			0 Standard	1 Stationary 1	2 Line-to-Line Resistance	4 Stationary 2
Control Mode	A1-02	–	2, 3	2, 3	0, 1, 2, 3	2, 3
Motor Rated Power	T1-02	kW	YES	YES	YES	YES
Motor Rated Voltage	T1-03	Vac	YES	YES	N/A	YES
Motor Rated Current	T1-04	A	YES	YES	YES	YES
Motor Rated Frequency	T1-05	Hz	YES	YES	N/A	YES

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Input Value	Input Parameter	Unit	Tuning Type (T1-01)			
			0 Standard	1 Stationary 1	2 Line-to-Line Resistance	4 Stationary 2
Number of Motor Poles	T1-06	–	YES	YES	N/A	YES
Motor Rated Speed	T1-07	r/min	YES	YES	N/A	YES
PG Number of Pulses per Revolution	T1-08	–	YES <1>	YES <1>	N/A	YES <1>
Motor No-load Current	T1-09	A	N/A	YES	N/A	YES
Motor Rated Slip	T1-10	Hz	N/A	N/A	N/A	YES

<1> Input data is needed for CLV/PM only.

■ Auto-Tuning for Permanent Magnet Motors

Automatically sets the V/f pattern and motor parameters E1-□□, E5-□□, and some F1-□□ parameters for speed feedback detection.

Table 4.7 Types of Auto-Tuning for Permanent Magnet Motors

Type	Setting	Requirements and Benefits
Motor Data Input	T2-01 = 0	• Use if a motor test report is available • Input motor data from the motor test report. Convert data into the correct unit before inputting data if necessary. • Motor does not rotate during Auto-Tuning
Stationary Auto-Tuning	T2-01 = 1	• Use if a motor test report is not available • Input motor data from the motor name plate. Make sure to convert data into the correct units. The drive automatically calculates the motor data.
Stationary Stator Resistance Auto-Tuning	T2-01 = 2	• Tunes stator resistance only. • Should be performed if the motor cabling has changed.
Rotational Back EMF Constant Auto-Tuning	T2-01 = 11	• Use if a motor test is not available • Tunes the Motor Induction Voltage only • Should be performed after Motor data are set and the encoder offset is adjusted. • The motor must be uncoupled from the mechanical system (remove ropes).
Auto-Tuning of PG-E3 Encoder Characteristics <1>	T2-01 = 12	Use in CLV/PM control mode to obtain accurate position data from the motor rotor for driving a PM motor.

<1> Auto-Tuning of PG-E3 encoder characteristics requires a PG-E3 option with software version 1102 or later. To identify the PG-E3 software version, refer to the PG-E3 labeling on the option in the field designated “C/N” (S + four-digit number).

Table 4.8 lists the data that must be entered for Auto-Tuning. Make sure the data is available before starting Auto-Tuning. The information needed is usually listed on the motor nameplate or in the motor test report provided by the motor manufacturer. Also refer to *Flowchart C: Auto-Tuning for PM Motors on page 111* for details on the tuning mode selection and the tuning process.

Table 4.8 Auto-Tuning Input Data

Input Value	Input Parameter	Unit	Tuning Type (T2-01)						
			0 Motor Parameter Settings	1 Stationary	2 Stationary Stator Resistance	3 Initial Magnet Pole Search Parameters Auto-Tuning	4 Encoder Offset Stationary Auto-Tuning	10 Encoder Offset Rotational Auto-Tuning	11 Back EMF Constant
Control Mode	**A1-02**	**–**	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Motor Rated Power	T2-04	kW	Yes	Yes	N/A	N/A	N/A	N/A	N/A
Motor Rated Voltage	T2-05	V	Yes	Yes	N/A	N/A	N/A	N/A	N/A
Motor Rated Current	T2-06	A	Yes	Yes	Yes	N/A	N/A	N/A	N/A
Number of Motor Poles	T2-08	N/A	Yes	Yes	N/A	N/A	N/A	N/A	N/A
Motor Rated Speed	T2-09	r/min	Yes	Yes	N/A	N/A	N/A	N/A	N/A
Stator 1 Phase Resistance	T2-10	Ω	Yes	N/A	N/A	N/A	N/A	N/A	N/A
d-Axis Inductance	T2-11	mH	Yes	N/A	N/A	N/A	N/A	N/A	N/A
q-Axis Inductance	T2-12	mH	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Induced Voltage Constant Unit Selection	T2-13	N/A	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Voltage Constant	T2-14	<1>	Yes	N/A	N/A	N/A	N/A	N/A	N/A
PG Number of Pulses per Revolution	T2-16	N/A	Yes	Yes	N/A	N/A	N/A	N/A	N/A
Z Pulse Offset	T2-17	deg (mech.)	Yes	N/A	N/A	N/A	N/A	N/A	N/A

<1> Depends on T2-13 setting.

■ Auto-Tuning of PG-E3 Encoder Characteristics

This feature optimizes the drive settings for the characteristics of the PG-E3 speed-control option card for the ERN1387 encoder (manufactured by HEIDENHAIN) while rotating the motor. Perform Auto-Tuning to obtain accurate position data from the motor rotor for driving a PM motor. This type of Auto-Tuning automatically sets the characteristics of the PG-E3 option card for the ERN1387 encoder in parameters F1-66 to F1-81 (Encoder Adjust 1 to 16).

Note:
1. The motor rotates during execution of Auto-Tuning of PG-E3 encoder characteristics. Before starting, refer to the drive technical manual.
2. Auto-Tuning of PG-E3 encoder characteristics adjusts the unique characteristics of the ERN1387 encoder connected to the drive by using a PG-E3 option card. This type of tuning should be performed when setting up the drive or after replacing the encoder or drive. The signal lines between the PG-E3 option card and the ERN1387 encoder must be connected between the R+ and R- terminals while this type of tuning is performed.
3. The setting values of parameters F1-66 to F1-81 are reset to factory default values when A1-03 is set to 2220. The setting values of parameters F1-66 to F1-81 are modified at completion of Auto-Tuning of PG-E3 encoder characteristics.

■ PG Encoder Offset Auto-Tuning

PG encoder Offset Tuning is used for PM motors (A1-02 = 7). It measures the angle between the PG encoder zero position and the rotor magnet orientation. PG encoder offset tuning should be performed when:

- setting up the drive for the first time,
- after initialization,
- after changing the motor rotation direction (b1-14),
- after changing the encoder rotation direction (F1-05),
- or after replacing the encoder.

Properly set the motor and PG encoder data before performing PG Encoder Offset Tuning.

Table 4.9 Types of Auto-Tuning for PG Encoder Offset

Type	Setting	Requirements and Benefits
Initial Magnet Pole Search Parameters Auto-Tuning	T2-01 = 3	• Should be performed after motor Auto-Tuning in order to determine the PG encoder tuning method. • Attempts to detect the motor rotor position, determines whether PG encoder offset can be tuned using Stationary Encoder Offset Tuning and sets parameters needed for Initial Magnet Pole Search (n8-36, n8-37). • When using the Rescue Operation mode, perform this tuning to let the drive automatically set the parameters needed for Initial Magnet Pole Search with power supply from a battery or UPS (n8-81, n8-82). • Must be performed when using an incremental PG encoder. **Important:** If this tuning fails when using a PG-X3 card with an incremental PG encoder the motor cannot be driven using an incremental PG encoder. Change the PG encoder to an absolute PG encoder.
Stationary PG Encoder Offset Auto-Tuning	T2-01 = 4	• Tunes the PG encoder offset without rotating the motor. • If the PG encoder offset cannot be tuned properly by this method, try Rotating PG Encoder Offset Tuning.
Rotational PG Encoder Offset Auto-Tuning	T2-01 = 10	• Tunes the PG encoder offset while rotating the motor. • Motor and mechanical system must be uncoupled (ropes must be removed from traction sheave).

◆ Before Auto-Tuning the Drive

Check the items below before Auto-Tuning the drive.

■ Basic Auto-Tuning Preparations and Precautions

WARNING! *Sudden Movement Hazard. When performing Rotational Auto-Tuning for motor data or PG encoder offset, always uncouple the motor from the mechanical system (remove ropes from traction sheave). Performing Rotational Auto-Tuning with the mechanical system connected to the motor can cause hazardous situations, injury to personnel and damage to the equipment.*

WARNING! *Electrical Shock Hazard. Do not touch the motor during Auto-Tuning. Lethal voltages may be present on the motor case. Failure to comply may result in serious injury from electrical shock.*

WARNING! *Electrical Shock Hazard. When executing Stationary Auto-Tuning for motor data or PG encoder offset, the motor does not rotate, however, power is applied. Do not touch the motor until Auto-Tuning is completed. Failure to comply may result in death or serious injury from electrical shock.*

WARNING! *Sudden Movement Hazard. Use parameter S1-12 to enable/disable automatic switching of the Motor Contactor Control output signal during Auto-Tuning. When using setting S1-12 = 1, ensure that the multi-function output terminals are properly wired and in the correct state before setting parameter S1-12 = 1 Enabled. Failure to comply could result in damage to the drive, serious injury or death.*

WARNING! *Sudden Movement Hazard. If installed, do not release the mechanical brake during Stationary Auto-Tuning. Inadvertent brake release may cause damage to equipment or injury to personnel. Ensure that the mechanical brake release circuit is not controlled by the drive multi-function digital outputs.*

Note:
1. Rotational Auto-Tuning T1-01 = 0 (recommended method)
   - Rotational Auto-Tuning provides more accurate tuning results compared to Non-Rotating Auto-Tuning.
   - Perform Rotational Auto-Tuning when the motor can be uncoupled from the elevator mechanical system (remove ropes from traction sheave).
   - Make sure to release the mechanical brake (if installed) for Rotational Auto-Tuning methods.

   Stationary Auto-Tuning T1-01 = 1, 2, or 4 (alternate method)
   - Perform Stationary Auto-Tuning when the motor and mechanical system cannot be uncoupled.
   - Make sure that the mechanical brake remains applied for all Stationary Auto-Tuning methods.
2. When using a motor contactor, make sure it remains closed during the Auto-Tuning process.
3. Ensure H1 and H2 signals are ON when performing Auto-Tuning.
4. A digital input programmed for Baseblock (H1-□□ = 8/9) must be set so that the drive is not in a baseblock condition during Auto-Tuning.
5. Ensure the motor is securely mounted and bolted in place prior to Auto-Tuning.
6. To cancel Auto-Tuning, press the STOP key on the digital operator.
7. Make sure motor nameplate data is readily available before Auto-Tuning the drive. Auto-Tuning requires the user to input data from the motor nameplate or motor test report.
8. When performing Auto-Tuning for motor 2, make sure motor 2 is connected to the drive output terminals.
9. For best performance, the drive input power supply voltage should be greater than the motor rated voltage.
10. Improved performance is possible when using a motor with a base voltage that is 10% less than the input supply voltage. This is particularly important when operating the motor above 90% of base speed, where high torque precision is required.

WARNING! *Sudden Movement Hazard. System may start unexpectedly upon application of power, resulting in death or serious injury. Clear all personnel from the drive, motor and machine area before applying power. Secure covers, couplings, shaft keys and machine loads before applying power to the drive.*

Table 4.10 describes digital input and output terminal operation while Auto-Tuning is executed.

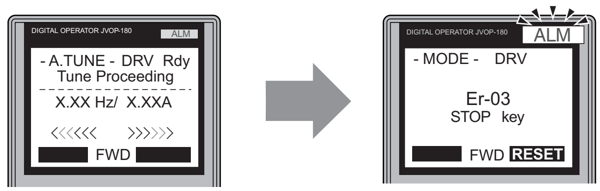
Table 4.10 Digital Input and Output Operation During Auto-Tuning

Motor Type	Auto-Tuning Type	Digital Input	Digital Output
IM Motor	Rotational Auto-Tuning	Digital input functions are disabled.	Functions the same as during normal operation
	Stationary Auto-Tuning 1	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning
	Stationary Auto-Tuning for Line-to-Line Resistance	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning
	Stationary Auto-Tuning 2	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning
PM Motor	Motor Data Input	Digital input functions are disabled.	Digital output functions are disabled.
	Stationary Auto-Tuning	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning
	Stationary Stator Resistance Auto-Tuning	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning
	Initial Magnet Pole Search Parameters Auto-Tuning	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning
	Stationary PG Encoder Offset Auto-Tuning	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning
	Rotational PG Encoder Offset Auto-Tuning	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning
	Rotational Back EMF Constant Auto-Tuning	Digital input functions are disabled.	Functions the same as during normal operation
	Auto-Tuning of PG-E3 Encoder Characteristics	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning

Note: When using a PM motor for the first time or when replacing the drive or PM motor, be sure to set the motor parameters properly and check that the speed detection functions properly prior to operation. Using a PM motor requires setting the encoder offset correctly and entering motor data. Perform Encoder Offset Auto-Tuning after replacing the motor, encoder, or drive. Insufficient torque may cause the elevator car to move in the direction of the load or cause the motor to behave erratically (reverse operation, stand still, sudden accelerations, etc.). For more information, refer to the instruction manual included with the motor.

◆ Auto-Tuning Interruption and Fault Codes

If tuning results are abnormal or the STOP key is pressed before completion, Auto-Tuning will be interrupted and a fault code will appear on the digital operator.



During Auto-Tuning   Auto-Tuning Aborted

Figure 4.16 Auto-Tuning Aborted Display

◆ Auto-Tuning Operation Example

The following example demonstrates Rotational Auto-Tuning when using OLV (A1-02 = 2).

■ Selecting the Type of Auto-Tuning

	Step		Display/Result
1.	Turn on the power to the drive. The initial display appears.	➡	- MODE - DRV Rdy Speed Ref (OPR) U1-01= 0.00% U1-02= 0.00% RSEQ U1-03= 0.00A LREF FWD
2.	Press Λ or V until the Auto-Tuning display appears.	➡	- MODE - PRG Auto-Tuning AUTO HELP FWD DATA
3.	Press ENTER to begin setting parameters.	➡	- A.TUNE - PRG Tuning Mode T1-01= 0 *0* Standard Tuning ESC FWD DATA
4.	Press ENTER to select the value for T1-01.	➡	- A.TUNE - PRG Tuning Mode T1-01= 0 *0* Standard Tuning "0" ← FWD →
5.	Save the setting by pressing ENTER.	➡	Entry Accepted
6.	The display automatically returns to the display shown in Step 3.	➡	- A.TUNE - PRG Tuning Mode T1-01= 0 *0* Standard Tuning ESC FWD DATA

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■ Enter Data from the Motor Nameplate

After selecting the type of Auto-Tuning, enter the data required from the motor nameplate.

Note: These instructions continue from Step 6 in "Selecting the Type of Auto-Tuning".

	Step		Display/Result
1.	Press ∧ to access the motor output power parameter T1-02.	→	- A.TUNE - PRG Mtr Rated Power T1-02= 3.70kW (0.00 ~ 650.00) "3.70kW" ESC FWD DATA
2.	Press ENTER to view the default setting.	→	- A.TUNE - PRG Mtr Rated Power T1-02= 003.70kW (0.00 ~ 650.00) "3.70kW" ← FWD →
3.	Press F1 (left), F2 (right), > RESET, ∧ and ∨ to enter the motor power nameplate data in kW.	→	- A.TUNE - PRG Mtr Rated Power T1-02= 004.00kW (0.00 ~ 650.00) "3.70kW" ← FWD →
4.	Press ENTER to save the setting.	→	Entry Accepted
5.	The display automatically returns to the display in Step 1.	→	- A.TUNE - PRG Mtr Rated Power T1-02= 4.00kW (0.00 ~ 650.00) "3.70kW" ESC FWD DATA
6.	Repeat Steps 1 through 5 to set the following parameters: • T1-03, Motor Rated Voltage • T1-04, Motor Rated Current • T1-05, Motor Base Frequency • T1-06, Number of Motor Poles • T1-07, Motor Base Speed	→	- A.TUNE - PRG Mtr Rated Power T1-02= 4.00kW (0.00 ~ 650.00) "3.70kW" ESC FWD DATA ↓ - A.TUNE - PRG Rated Speed T1-07= 1450RPM (0 ~ 24000) "1450RPM" ESC FWD DATA

Note: *Refer to Parameter Settings during Induction Motor Auto-Tuning: T1 on page 119* for details.

■ Starting Auto-Tuning

WARNING! *Sudden Movement Hazard. The drive and motor may start unexpectedly during Auto-Tuning, which could result in death or serious injury. Ensure the areas surrounding the drive, motor and load are clear before proceeding with Auto-Tuning.*

WARNING! *Electrical Shock Hazard. High voltage will be supplied to the motor when Stationary Auto-Tuning is performed even with the motor stopped, which could result in death or serious injury. Do not touch the motor until Auto-Tuning has been completed.*

WARNING! *When performing Rotational Auto-Tuning for motor data or PG encoder offset, always uncouple the motor from the mechanical system (remove ropes from traction sheave). Performing Rotational Auto-Tuning with the mechanical system connected to the motor can cause hazardous situations, injury to personnel and damage to the equipment.*

NOTICE: *Rotational Auto-Tuning will not function properly if a holding brake is applied on the load. Ensure the motor can freely spin before beginning Auto-Tuning. Failure to comply could result in improper operation of the drive.*

Enter the required information from the motor nameplate. Press ∧ to proceed to the Auto-Tuning start display.

Note: These instructions continue from Step 6 in "Enter Data from the Motor Nameplate".

Step			Display/Result
1.	After entering the data listed on the motor nameplate, press ∧ to confirm.	➡	- A.TUNE - DRV Auto-Tuning 0.00 Hz/ 0.00A Tuning Ready ? Press RUN key ESC FWD
2.	Press ◇RUN to activate Auto-Tuning. The drive begins by injecting current into the motor for about 1 min, and then starts to rotate the motor. Note: The first digit on the display indicates which motor is undergoing Auto-Tuning (motor 1 or motor 2). The second digit indicates the type of Auto-Tuning being performed.	➡	- A.TUNE - DRV Rdy Tune Proceeding X.XX Hz/ X.XXA ‹‹‹‹‹‹ ›››››› FWD
3.	Auto-Tuning finishes in approximately one to two minutes.	➡	- MODE - DRV End Tune Successful FWD RESET

◆ Parameter Settings during Induction Motor Auto-Tuning: T1

The T1-□□ parameters are used to set the Auto-Tuning input data for induction motor tuning.

Note: For motors operating in the field weakening range, first perform the Auto-Tuning with the base data. After Auto-Tuning is complete, change E1-04, Maximum Output Frequency, to the desired value.

■ T1-01: Auto-Tuning Mode Selection

Sets the type of Auto-Tuning to be used. *Refer to Auto-Tuning for Induction Motors on page 113* for details on the different types of Auto-Tuning.

No.	Parameter Name	Setting Range	Default
T1-01	Auto-Tuning Mode Selection	2 (V/f) 0 to 2, 4 (OLV, CLV)	2 (V/f) 1 (OLV, CLV)

Setting 0: Rotational Auto-Tuning

Setting 1: Stationary Auto-Tuning 1

Setting 2: Stationary Auto-Tuning for Line-to-Line Resistance

Setting 4: Stationary Auto-Tuning 2

■ T1-02: Motor Rated Power

Sets the motor rated power according to the motor nameplate value.

No.	Parameter Name	Setting Range	Default
T1-02	Motor Rated Power	0.00 to 650.00 kW	Determined by o2-04

■ T1-03: Motor Rated Voltage

Sets the motor rated voltage according to the motor nameplate value. Enter the motor voltage at base speed here if the motor is operating above base speed.

Enter the voltage needed to operate the motor under no-load conditions at rated speed to T1-03 for better control precision around rated speed when using a vector control mode. The no-load voltage can usually be found in the motor test report available from the manufacturer. If the motor test report is not available, enter approximately 90% of the rated voltage printed on the motor nameplate. This may increase the output current and reduce the overload margin.

No.	Parameter Name	Setting Range	Default
T1-03	Motor Rated Voltage	0.0 to 255.5 V <1>	200.0 V <1>

<1> Values shown are specific to 200 V class drives. Double value for 400 V class drives.

■ T1-04: Motor Rated Current

Sets the motor rated current according to the motor nameplate value. Set the motor rated current between 50% and 100% of the drive rated current for optimal performance in OLV or CLV. Enter the current at the motor base speed.

No.	Parameter Name	Setting Range	Default
T1-04	Motor Rated Current	10 to 200% of drive rated current	Depending on o2-04

■ T1-05: Motor Base Frequency

Sets the motor rated frequency according to the motor nameplate value. If a motor with an extended speed range is used or if the motor is used in the field weakening area, enter the maximum frequency to E1-04 (E3-04 for motor 2) after Auto-Tuning is complete.

No.	Parameter Name	Setting Range	Default
T1-05	Motor Base Frequency	0.0 to 120.0 Hz	60.0 Hz

■ T1-06: Number of Motor Poles

Sets the number of motor poles according to the motor nameplate value.

No.	Parameter Name	Setting Range	Default
T1-06	Number of Motor Poles	2 to 48	4

■ T1-07: Motor Base Speed

Sets the motor rated speed according to the motor nameplate value. If a motor with an extended speed range is used or if the motor is used in the field weakening area, enter the speed at base frequency to T1-07.

No.	Parameter Name	Setting Range	Default
T1-07	Motor Base Speed	0 to 24000 r/min	1750 r/min

■ T1-08: PG Number of Pulses Per Revolution

Sets the number of pulses from the PG encoder. Set the actual number of pulses for one full motor rotation.

No.	Parameter Name	Setting Range	Default
T1-08	PG Number of Pulses Per Revolution	0 to 60000 ppr	1024 ppr

Note: T1-08 will only be displayed in CLV.

■ T1-09: Motor No-Load Current

Sets the no-load current for the motor. The default setting displayed is no-load current automatically calculated from the output power set in T1-02 and the motor rated current set to T1-04. Enter the data listed on the motor test report. Leave this data at the default setting if the motor test report is not available.

No.	Parameter Name	Setting Range	Default
T1-09 <1>	Motor No-Load Current	0 to [T1-04] A (Max: 0 to 2999.9)	–

<1> The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.

■ T1-10: Motor Rated Slip

Sets the rated slip for the motor.

The default setting displayed is the motor rated slip for a Yaskawa motor calculated from the output power set in T1-02. Enter the data listed on the motor test report.

No.	Parameter Name	Setting Range	Default
T1-10	Motor Rated Slip	0.00 to 20.00 Hz	–

◆ Parameter Settings during PM Motor Auto-Tuning: T2

The T2-□□ parameters are used to set the Auto-Tuning input data for PM motor tuning.

■ T2-01: PM Auto-Tuning Mode Selection

Selects the type of Auto-Tuning to be performed. *Refer to Auto-Tuning for Permanent Magnet Motors on page 114* for details on different types of Auto-Tuning.

No.	Parameter Name	Setting Range	Default
T2-01	PM Auto-Tuning Mode Selection	0 to 4, 10 to 12 <1>	0

<1> Auto-Tuning of PG-E3 encoder characteristics requires a PG-E3 option with software version 1102 or later. To identify the PG-E3 software version, refer to the PG-E3 labeling on the option in the field designated “C/N” (S + four-digit number).

Setting 0: Motor Data Input
Setting 1: PM Stationary Auto-Tuning
Setting 2: PM Stationary Stator Resistance Auto-Tuning
Setting 3: Initial Magnet Pole Search Parameters Auto-Tuning
Setting 4: Stationary PG Encoder Offset Auto-Tuning
Setting 10: Rotational PG Encoder Offset Auto-Tuning
Setting 11: Rotational Back EMF Constant Auto-Tuning
Setting 12: Auto-Tuning of PG-E3 Encoder Characteristics

■ T2-04: PM Motor Rated Power

Specifies the PM motor rated power in kilowatts.

No.	Parameter Name	Setting Range	Default
T2-04	PM Motor Rated Power	0.00 to 650.00 kW	Depending on o2-04

■ T2-05: PM Motor Rated Voltage

Sets the PM motor rated voltage.

No.	Parameter Name	Setting Range	Default
T2-05	PM Motor Rated Voltage	0.0 to 255.0 V <1>	200.0 V <1>

<1> Values shown are specific to 200 V class drives. Double value for 400 V class drives.

■ T2-06: PM Motor Rated Current

Enter the PM motor rated current in amps.

No.	Parameter Name	Setting Range	Default
T2-06	PM Motor Rated Current	10% to 200% of the drive rated current.	Depending on o2-04

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■ T2-08: Number of PM Motor Poles

Enter the number of motor poles.

No.	Parameter Name	Setting Range	Default
T2-08	Number of PM Motor Poles	2 to 120 <1>	6

<1> When PG-E3 option connected: Max. setting = 48.

■ T2-09: PM Motor Base Speed

Enter the motor rated speed in r/min.

Note: T2-09 will be displayed when in CLV/PM.

No.	Parameter Name	Setting Range	Default
T2-09	PM Motor Base Speed	0 to 24000 r/min	150 r/min

■ T2-10: PM Motor Stator Resistance

Enter the motor stator resistance per motor phase.

No.	Parameter Name	Setting Range	Default
T2-10	PM Motor Stator Resistance	0.000 to 65.000 Ω	–

■ T2-11: PM Motor d-Axis Inductance

Enter the d axis inductance per motor phase.

No.	Parameter Name	Setting Range	Default
T2-11	PM Motor d-Axis Inductance	0.00 to 600.00 mH	–

■ T2-12: PM Motor q-Axis Inductance

Enter the q axis inductance per motor phase.

No.	Parameter Name	Setting Range	Default
T2-12	PM Motor q-Axis Inductance	0.00 to 600.00 mH	–

■ T2-13: Induced Voltage Constant Unit Selection

Selects the units used for setting the induced voltage coefficient.

No.	Parameter Name	Setting Range	Default
T2-13	Induced Voltage Constant Unit Selection	0, 1	1

Setting 0: mV (r/min)

Setting 1: mV (rad/sec)

Note: If T2-13 is set to 0, then the drive will use E5-24 (Motor Induction Voltage Constant 2), and will automatically set E5-09 (Motor Induction Voltage Constant 1) to 0.0. If T2-13 is set to 1, then the drive will use E5-09 and will automatically set E5-24 to 0.0.

■ T2-14: PM Motor Induced Voltage Constant

Enter the motor induced voltage constant.

No.	Parameter Name	Setting Range	Default
T2-14	PM Motor Induced Voltage Constant	0.0 to 2000.0	Depending on T2-02

■ T2-16: PG Number of Pulses Per Revolution for PM Motor Tuning

Enter the number of pulses from the PG encoder per motor rotation.

No.	Parameter Name	Setting Range	Default
T2-16	Encoder Resolution (Pulses Per Revolution)	1 to 15000 ppr	1024 ppr

■ T2-17: PG Encoder Z-pulse Offset

Sets the offset between the rotor magnet axis and the PG encoder zero position. If the PG encoder offset value is unknown or if the PG encoder is replaced, perform PG Encoder Offset Auto-Tuning.

No.	Parameter Name	Setting Range	Default
T2-17	PG Encoder Z-pulse Offset	-180.0 to 180.0 deg	0.0 deg

■ T2-18: Speed Reference for Auto-Tuning of PG-E3 Encoder Characteristics

Sets the speed reference for execution of Auto-Tuning of PG-E3 Encoder Characteristics.

No.	Parameter Name	Setting Range	Default
T2-18	Speed Reference for Auto-Tuning of PG-E3 Encoder Characteristics	1 to 30 r/min	10 r/min

■ T2-19: Rotation Direction for Auto-Tuning of PG-E3 Encoder Characteristics

Sets the direction of motor rotation of Auto-Tuning of PG-E3 Encoder Characteristics.

No.	Parameter Name	Setting Range	Default
T2-19	Rotation Direction for Auto-Tuning of PG-E3 Encoder Characteristics	0, 1	0

Setting 0: Forward (Up)
Setting 1: Reverse (Down)

4.6 Setup Procedure for Elevator Applications

◆ Up and Down Commands and Speed Reference Selection

WARNING! *Sudden Movement Hazard. Remove the Up/Down Command before resetting alarms and faults. Failure to comply can result in death or serious injury.*

WARNING! *Sudden Movement Hazard. Verify drive parameter b1-03 Stopping Method is set to 0:Ramp to Stop before starting the drive. Failure to comply may cause the elevator to free-fall when the Up/Down command is removed.*

WARNING! *Sudden Movement Hazard. The drive is capable of running the motor at high speed. Verify the maximum drive output frequency before starting the drive. Failure to comply may cause injury or death due to inadvertent high speed operation.*

WARNING! *Sudden Movement Hazard. Use the Initial Pole Search Status Signal (H2-□□ = 61) to interlock the brake to ensure the brake is not released before the Initial Magnetic Pole Search is completed. Failure to comply may cause inadvertent elevator movement resulting in serious injury.*

NOTICE: *Always turn off the RUN command before changing the setting of parameters d1-18 (Speed Reference Selection Mode), b1-01 (Speed Reference Selection), or H1-□□ (Multi-Function Digital Inputs). If the RUN command is on when changing any of these settings, the motor may unexpectedly start running, and could result in injury.*

■ Speed Reference Selection

Parameter b1-01 determines the source of the speed reference.

b1-01	Reference source	Speed reference input
0 (default)	Digital operator keypad	Set the speed references in the d1-□□ parameters and use digital inputs to switch between different reference values.
1	Analog input <1>	Apply the speed reference signal to terminal A1 or A2.
2	Serial Communication <2>	Serial Communications using the RS422/485 port
3	Option Board <2>	Communications option card

<1> If source of the speed reference is assigned to the control terminals (b1-01 = 1), then d1-18 will automatically be set to 0 (so that the drive uses multi-speed references d1-01 to d1-08).
<2> If the speed reference selection in d1-18 is set so that either the high speed reference has priority (d1-18 = 1), or so that the leveling speed has priority (d1-18 = 2), then the drive will look to the multi-function input terminals for the speed reference.

■ Up/Down Command Source Selection

The input source for the Up and Down command can be selected using parameter b1-02.

b1-02	Up/Down source	Up/Down command input
0	Operator keypad	RUN and STOP keys on the operator
1 (default)	Digital inputs	Terminal S1: Run in Up direction Terminal S2: Run in Down direction
2	Serial Communication	Serial Communications using the RS422/485 port
3	Option Board	Communications option card

■ Travel Start and Stop

Travel Start

To start the elevator in up or down direction, the following conditions must be fulfilled:

- A speed reference greater than zero must be provided.
- The Safe Disable signals at terminals H1 and H2 must both be closed (drive output enabled).
- If a multi-function digital input is programmed for Baseblock (H1-□□=8 or 9), this input must be set so the drive is not in a baseblock condition.
- An Up or Down Signal must be set at the source specified in b1-02.
- If a multifunction input is programmed for output contactor feedback (H1-□□=56), then the output contactor must be closed.

Travel Stop

The drive stops under the following conditions:

- The Up or Down command is removed.
- d1-18 is set to 1 or 2 and the Up/Down or Leveling Speed signal (H1-□□ = 53) is removed.
- d1-18 is set to 3 and all speed inputs are removed.
- A fault occurs. The stopping method depends on the specific fault that occurred, in combination with certain parameter settings.
- The Safe Disable inputs are opened or a Base Block signal is input. In this case, the brake is applied immediately and the drive output shuts off.

◆ Speed Selection Using Digital Inputs (b1-01 = 0)

Set parameter b1-01 = 0 to enable the speed selection using the drive digital inputs. Use parameter d1-18 to determine different travel speeds selected by the digital inputs.

NOTICE: *Always turn off the RUN command before changing the setting of parameters d1-18 (Speed Reference Selection Mode), b1-01 (Speed Reference Selection), or H1-□□ (Multi-Function Digital Inputs). If the RUN command is on when changing any of these settings, the motor may unexpectedly start running, and could result in injury.*

d1-18	Speed Selection
0 (default)	Multi-speed inputs 1, Speed references are set in d1-01 to d1-08
1	Separate speed inputs, Speed references are set in d1-19 to d1-24 and d1-26, Higher speed has priority
2	Separate speed inputs, Speed references are set in d1-19 to d1-24 and d1-26, Leveling speed has priority
3	Multi speed inputs 2, Speed references are set in d1-02 to d1-08, Stop if no speed selection input is enabled

■ Multi-Speed Inputs 1, 2 (d1-18 = 0 or 3)

Speed Selection

When d1-18 = 0 or 3, multi-function digital inputs are preset as shown below.

Terminal	Parameter Number	Set Value	Details
S5	H1-05	3	Multi-Speed Reference 1
S6	H1-06	4	Multi-Speed Reference 2
S7	H1-07	5	Multi-Speed Reference 3

Different speed reference settings can be selected by combining the three digital inputs as shown in the table below.

Note: Parameters d1-19 through d1-26 are displayed only if d1-18 is set to 1 or 2.

Digital Inputs			Selected Speed	
Multi-Speed Reference 1	Multi-Speed Reference 2	Multi-Speed Reference 3	d1-18 = 0	d1-18 = 3
0	0	0	Speed reference 1 (d1-01)	Stop
1	0	0	Speed reference 2 (d1-02 or terminal A1, A2 input value if H3-02 or H3-10 is set to 2)	
0	1	0	Speed reference 3 (d1-03 or terminal A1, A2 input value if H3-02 or H3-10 is set to 3)	
1	1	0	Speed reference 4 (d1-04)	
0	0	1	Speed reference 5 (d1-05)	
1	0	1	Speed reference 6 (d1-06)	
0	1	1	Speed reference 7 (d1-07)	
1	1	1	Speed reference 8 (d1-08)	

0 = Off, 1 = On

Setting d1-18 = 0

Up to eight speed references can be set using parameters d1-01 to d1-08. The drive starts with an Up or Down command, and stops when the Up or Down command is removed. When d1-18 = 0, parameters d1-19 through d1-23 will not be displayed.

Setting d1-18 = 3

Allows seven speed references to be set using parameters d1-02 to d1-08. The drive starts with an Up or Down command, and stops either when all three input terminals that set the speed reference are released, or when the Up/Down command is released. When d1-18 = 0, parameters d1-19 through d1-23 will not be displayed.

■ Separate Speed Inputs (d1-18 = 1 or 2)

Six different speed settings (defined in the parameters d1-19 to d1-24 and d1-26) can be set and selected using four digital inputs.

Speed Selection

When d1-18 = 1 or 2, multi-function digital inputs are preset as shown below:

Terminal	Parameter Number	Set Value	Details
S3	H1-03	50	Nominal speed (d1-19)
S5	H1-05	51	Intermediate speed
S6	H1-06	53	Leveling speed (d1-26)

Different speed settings can be selected depending on the assignment of the speed selection digital inputs (H1-☐☐) as shown in the table below.

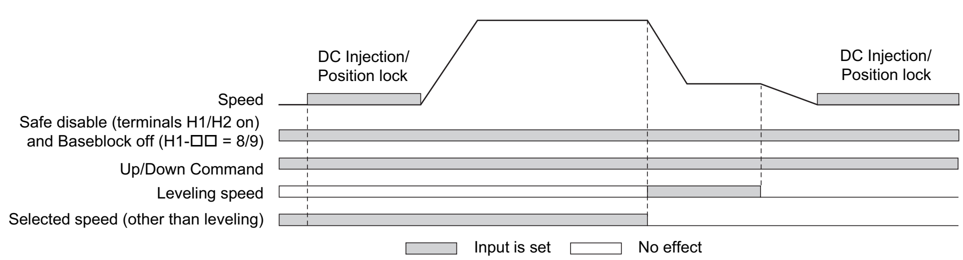
Note: Parameters d1-19 through d1-26 are displayed only if d1-18 is set to 1 or 2.

Selected Speed	Leveling and Nominal Speed assigned (H1-☐☐ = 50 and H1-☐☐ = 53)				Leveling speed not assigned (H1-☐☐ ≠ 53)			Nominal Speed not assigned (H1-☐☐ ≠ 50)		
	50	51	52	53	50	51	52	51	52	53
Nominal Speed (d1-19)	1	0	0	A	1	0	0	0	0	0
Intermediate Speed 1 (d1-20)	0	1	0	A	0	1	0	1	0	0
Intermediate Speed 2 (d1-21)	1	1	1	A	1	1	1	N/A	N/A	N/A
Intermediate Speed 3 (d1-22)	0	1	1	A	0	1	1	1	1	0
Releveling Speed (d1-23)	0	0	1	A	0	0	1	0	1	0
Leveling Speed (d1-26)	0	0	0	1	0	0	0	B	B	B
Zero Speed	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A

0 = Off, 1 = On, A = 0 when d1-18 = 2 and no influence when d1-18=1, B = no influence, N/A = Not available

Higher Speed has Priority and the Leveling Speed Input is Assigned (d1-18 = 1 and H1-☐☐ = 53) (Default)

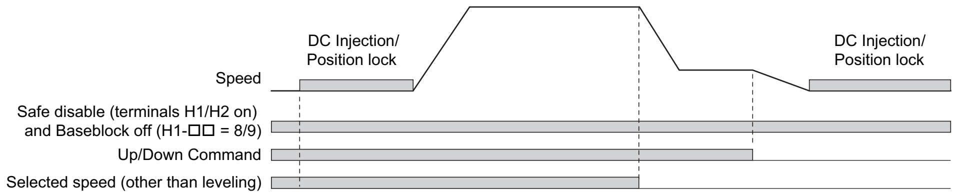
The higher speed has priority over the leveling speed. The leveling signal is disregarded as long as any other speed selection input is active. The drive decelerates to the leveling speed (d1-26) when the selected speed reference signal is removed.



Higher Speed Priority is Selected and the Leveling Speed Input is Not Assigned (d1-18 = 1 and H1-☐☐ ≠ 53)

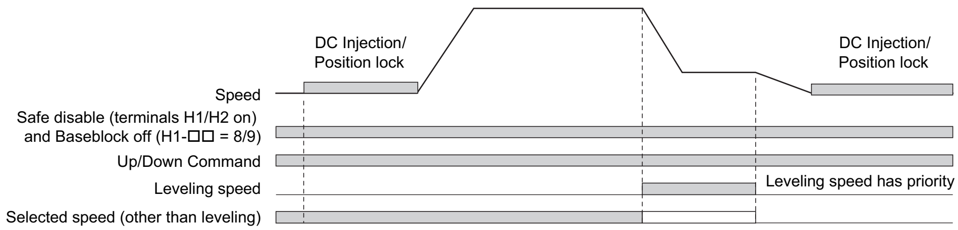
The drive decelerates to the leveling speed (d1-26) when the selected speed reference signal is removed.

If no speed reference is selected at start, the drive will trigger an “FrL” fault. Set parameter S6-15 to 0 to disable Speed Reference Missing (FrL) detection. With this setting the drive starts using leveling speed if no other speed reference is selected.



Leveling Speed has Priority and the Leveling Speed Input is Assigned (d1-18 = 2, H1-☐☐ = 53)

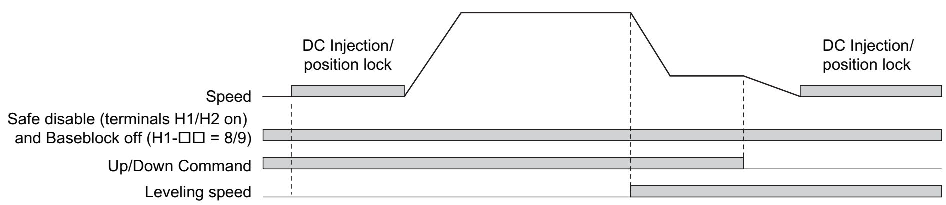
The leveling signal has priority over other speed references. The drive decelerates to the leveling speed (d1-26) when the leveling speed selection input is activated. The drive stops when either the leveling input or the Up/Down command is released.



Leveling Speed Priority is Selected and the Nominal Speed Input is Not Assigned (d1-18 = 2, H1-☐☐ ≠ 50)

The drive runs at nominal speed (d1-19) when no speed selection input is set. When the leveling speed signal is set, the drive decelerates to the leveling speed. The leveling speed signal has priority over all other speed signals.

NOTICE: *Equipment Hazard. This function may not work properly if a broken wire connection to the drive I/O causes improper elevator speed selection. Properly tighten wire connections at the drive terminals before enabling this function.*



◆ Multi-Function Terminal Setup

■ Multi-Function Digital Input (Terminals S3 to S8)

The H1 parameters assign functions to digital input terminals S3 to S8 digital input terminal functions. ***Refer to H1-03 to H1-08: Functions for Terminals S3 to S8 on page 193*** for details. .

■ Multi-Function Digital Outputs

The H2 parameters assign functions to digital output terminals M1-M2, M3-M4, M5-M6, P1-C1, and P2-PC digital input terminal functions. ***Refer to H2-01 to H2-05: Terminals M1-M2, M3-M4, M5-M6, P1-PC, and P1-P2 Function Selection on page 197*** for details.

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■ Multi-Function Analog Inputs

The H3 parameters assign functions to analog input terminals A1 and A2 analog input functions. *Refer to Multi-Function Analog Input Terminal Settings on page 209* for details.

■ Multi-Function Analog Outputs

The H4 parameters assign functions to analog output terminals FM and AM. Select the function for these terminals by entering the last three digits of the desired U monitor. *Refer to U: Monitors on page 404* for a list of analog output functions.

◆ Accel/Decel Ramp and Jerk Settings

Acceleration and deceleration ramps are set using the C1-☐☐ parameters. Use the C2-☐☐ parameters to adjust the jerk at the start of acceleration or deceleration.

Figure 4.17 explains how accel/decel ride and jerk settings can be used to adjust the ride profile.

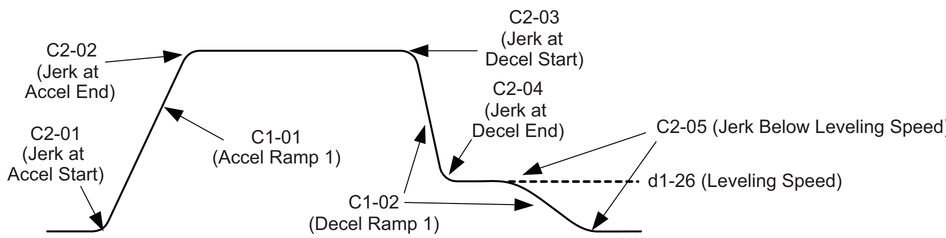


Figure 4.17 Accel/Decel Ramp and the Jerk Function

Units used to set the acceleration and deceleration ramp as well as the Jerk function change with the setting of parameter o1-03. Refer to *Digital Operator Display Unit Selection on page 109* for details.

◆ Inspection Operation

■ Start Condition in Inspection Operation

NOTICE: *Always turn off the RUN command before changing the setting of parameters d1-18 (Speed Reference Selection Mode), b1-01 (Speed Reference Selection), or H1-☐☐ (Multi-Function Digital Inputs). If the RUN command is on when changing any of these settings, the motor may unexpectedly start running, and could result in injury.*

Inspection operation is performed when an Up or Down signal is input while one of the following conditions is true:

- Parameter d1-18 is set to 0 or 3 and the selected speed is higher than d1-28 but lower than d1-29.
- Parameter d1-18 is set to 1 or 2 and a digital input programmed for Inspection Operation Speed (H1-☐☐ = 54) is enabled.

Inspection Operation uses the same acceleration characteristics and brake sequence at start as normal operation.

The carrier frequency is set to 2 kHz during Inspection Operation, but can be changed using parameter C6-21.

■ Stop Condition in Inspection Operation

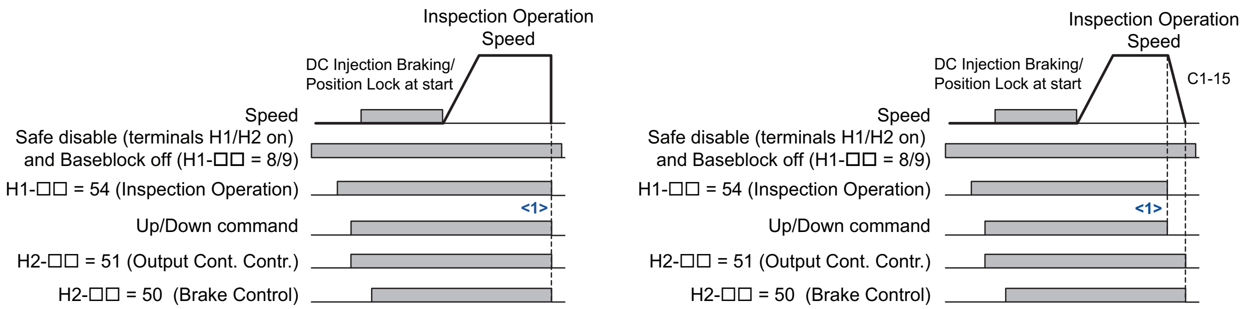
To stop the drive during Inspection Operation, either remove the Up or Down command or reset the input terminal for Inspection Operation.

A deceleration ramp can be set for Inspection Operation using parameter C1-15.

- If C1-15 = 0.00, the drive immediately applies the brake, shuts off the drive output, and opens the motor contactor, i.e., the multi-function output terminals set for "Brake Control" (H2-☐☐ = 50) and "Output Contactor Control" (H2-☐☐ = 51) are cleared.
- If C1-15 > 0.00, the drive decelerates to stop at the rate set to C1-15, then applies the brake, shuts the output off, and opens the motor contactor.

■ Inspection Operation Timing Chart

A timing chart for Inspection Operation appears in *Figure 4.18*.



<1> The drive stops if either the Up/Down command or Inspection Operation signals are removed.

Figure 4.18 Inspection Operation Sequence

◆ Brake Sequence

WARNING! *Sudden Movement Hazard. Rapid deceleration may cause the drive to fault on an overvoltage condition, resulting in death or serious injury due to an uncontrolled motor state. Be sure to set an acceptable deceleration time in parameter C1-09, Fast Stop Ramp, when using the fast-stop feature.*

NOTICE: *Always turn off the RUN command before changing the setting of parameters d1-18 (Speed Reference Selection Mode), b1-01 (Speed Reference Selection), or H1-□□(Multi-Function Digital Inputs). If the RUN command is on when changing any of these settings, the motor may unexpectedly start running, and could result in injury.*

The drive supports two types of brake sequences, one with torque compensation at start using an analog input terminal (H3-□□ = 14) and the other without torque compensation at start.

■ Brake Sequence without Torque Compensation

To configure the brake sequence operation without torque compensation, do not set any analog input terminals for "Torque compensation" (H3-□□ = 14).

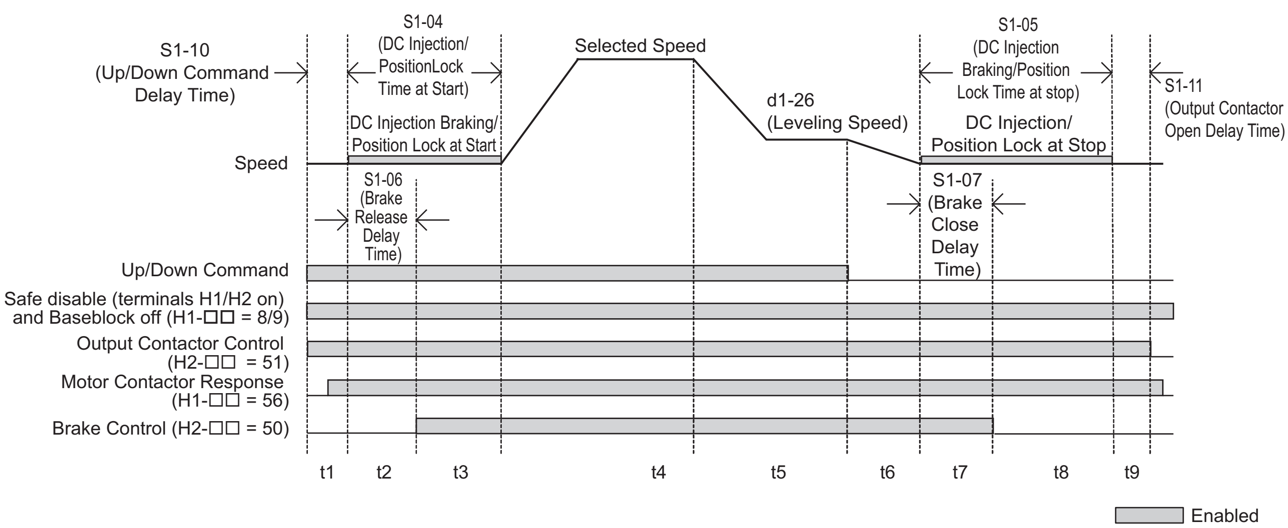


Figure 4.19 Brake Sequence without Torque Compensation at Start

Figure 4.19 is divided into time zones. *Table 4.11* explains the sequence in each time zone.

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Table 4.11 Time Zones for Brake Sequence without Torque Compensation at Start

Time Zone	Description
t1	Up or Down command is issued.
	Safe Disable terminals H1-HC and H2-HC must be set and Baseblock must be disabled (digital inputs set to H1-☐☐ = 8/9).
	Speed reference must be selected by multi-function input terminals.
	Output contactor control signal is set (H2-☐☐ = 51) by the drive.
	Drive waits for the “Motor Contactor Feedback” signal (H1-☐☐ = 56) to be issued. If the motor contactor feedback is not received within t1, or if the feedback signal is on before the contactor control command has been issued, an SE1 fault is triggered. If the motor contactor feedback signal is not used, then the drive waits for the operation start delay time set in S1-10 to pass, then proceeds to the next step.
t2	After the delay time set in S1-10 has passed, the drive outputs current to the motor. DC Injection Braking or Position Lock begins.
	After the brake release delay time set in S1-06 has passed, the drive sets the “Brake Control” output (H2-☐☐ = 50) in order to release the brake.
t3	DC Injection Braking or Position Lock will continue until: the time S1-04 has elapsed, or the time S1-06 has elapsed if S1-06 > S1-04 (this setting should be avoided since the motor could be driven against the applied brake).
t4	The drive accelerates up to the selected speed. The speed is kept constant until the leveling speed is selected.
t5	Leveling speed is selected. The drive decelerates to the leveling speed and maintains that speed until the Up or Down command is removed.
t6	The Up or Down signal is cleared. The drive decelerates to zero speed.
t7	The motor speed reaches the zero speed level (S1-01). DC Injection Braking or Position Lock is then executed for the time set in S1-05.
	After the delay time to close the brake set in S1-07 has passed, the drive clears the “Brake Control” output (H2-☐☐ = 50). The brake applies.
t8	The drive continues DC Injection or Position Lock until the time S1-05 has passed. When S1-05 has passed the drive output is shut off.
t9	After the delay for the magnetic contactor set in S1-11 has passed, the drive resets the output terminal set for “Output Contactor Control” (H2-☐☐ = 51). The Safe Disable Inputs can be cleared and Baseblock can be enabled.

■ Brake Sequence Using Torque Compensation

If a load measuring device is installed in the elevator, an analog input can be used to input a torque compensation value to the drive. This function requires one of the closed loop control modes (CLV or CLV/PM). To use torque compensation, one of the analog input terminals must be configured to provide the torque compensation signal (H3-☐☐ = 14).

Figure 4.20 is a timing chart for a brake sequence using torque compensation.

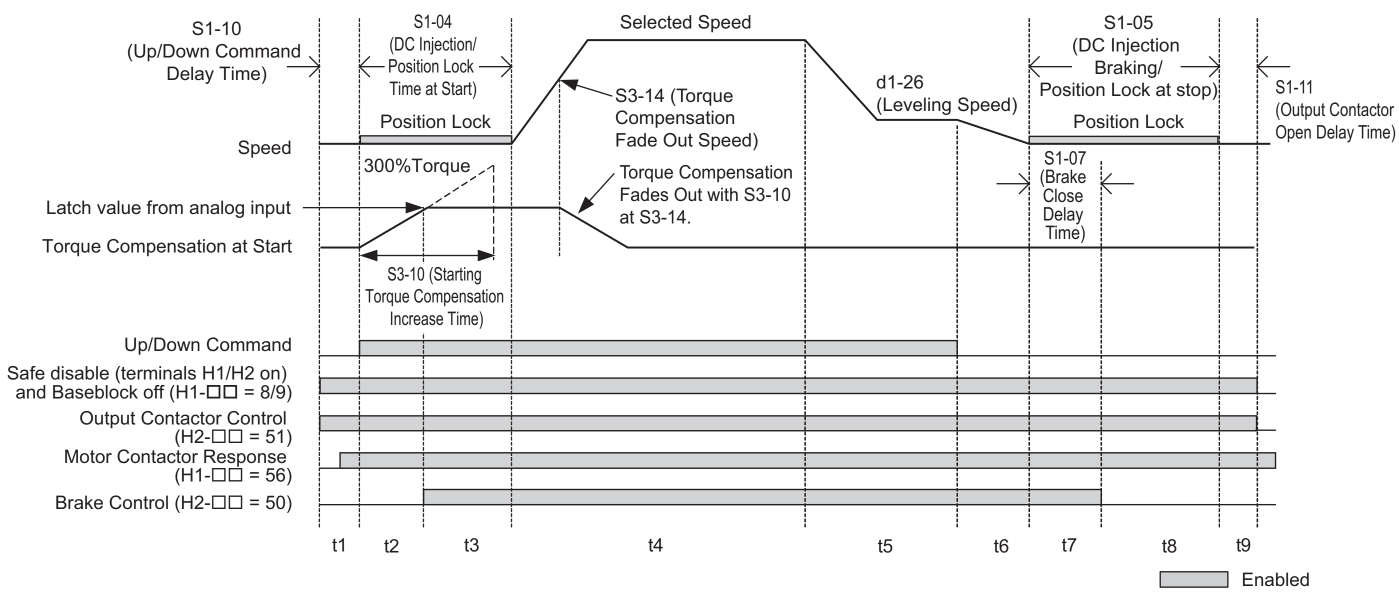


Figure 4.20 Brake Sequence Using Torque Compensation at Start

Figure 4.20 is divided into time zones. *Table 4.12* explains the sequence in each time zone.

Table 4.12 Time Zones for Brake Sequence Using Torque Compensation at Start

Time Zone	Description
t1	Up or Down command is issued.
	Safe Disable terminals H1-HC and H2-HC must be set and Baseblock must be disabled (digital inputs set to H1-□□ = 8/9).
	Speed reference must be selected by multi-function input terminals.
	Output contactor control signal is set (H2-□□ = 51) by the drive.
	Drive waits for the “Motor Contactor Feedback” signal (H1-□□ = 56) to be issued. If the motor contactor feedback is not received within t1, or if the feedback signal is on before the contactor control command has been issued, an SE1 fault is triggered. If the motor contactor feedback signal is not used, then the drive waits for the operation start delay time set in S1-10 to pass, then proceeds to the next step.
	The drive reads the torque value from the analog input (load cell).
t2	After the delay time set in S1-10 has passed, the drive outputs current to the motor. Position Lock begins.
	The torque value from the analog input is latched and internal torque compensation value is increased from zero to the latched value using the time constant set in S3-10.
	After the internal torque compensation level reaches the latched value, the drive sets the “Brake Control” output (H2-□□ = 50) in order to release the brake.
t3	The brake is released and the drive executes Position Lock until the time set in S1-04 has passed.
t4	The drive accelerates up to the selected speed. After the torque compensation fade-out speed level (S3-14) is reached during acceleration, the internal torque compensation value is reduced in accordance with the time constant set in S3-10.
t5	Leveling speed is selected. The drive decelerates to the leveling speed and maintains that speed until the Up or Down command is removed.
t6	The Up or Down signal is cleared. The drive decelerates to zero speed.
t7	The motor speed reaches the zero speed level (S1-01). DC Injection Braking or Position Lock is then executed for the time set in S1-05.
	After the delay time to close the brake set in S1-07 has passed, the drive clears the “Brake Control” output (H2-□□ = 50). The brake applies.
t8	The drive continues DC Injection or Position Lock until the time S1-05 has passed. When S1-05 has passed the drive output is shut off.
t9	After the delay for the magnetic contactor set in S1-11 has passed, the drive resets the output terminal set for “Output Contactor Control” (H2-□□ = 51). The Safe Disable Inputs can be cleared and Baseblock can be enabled.

Adjusting the Torque Compensation at Start

CAUTION! *Set all motor-related parameters (the E□-□□ parameters) and perform a test run before fine-tuning the torque compensation at start. Adjusting the torque compensation prematurely may result in faulty performance.*

To use torque compensation at start, apply at least 50% of the maximum weight to the elevator car and set the drive according to the Load Condition 2 procedure below. If using a voltage signal to the analog input terminals as a load sensor, then that input signal will determine the rate of torque compensation applied according to S3-27 and S3-28.

Before the torque compensation function can be used, the analog input scaling must be adjusted to the load sensor output. This can be done by bringing the elevator into two different load conditions and teaching the corresponding analog input value and torque reference value to the drive.

Note: **1.** This torque compensation requires a closed loop control mode (CLV, CLV/PM).
2. The torque compensation value is limited to 120%.

Set an analog input terminal for torque compensation (H3-□□ = 14) and proceed with the steps below.

Procedure for Load Condition 1 (S3-27, S3-29)

1. Make sure the drive is wired properly. ***Refer to Standard Connection Diagram on page 58*** for details.
2. Set the speed reference to 0%.
3. Apply no weight to the elevator car.
4. Note the value of the analog input monitor for the load signal input is connected to (U1-13 for terminal A1, U1-14 for terminal A2).
5. Provide an elevator Up or Down command, using Inspection Operation or normal operation mode. The car should be held in place when the brake releases.
6. Note the drives internal torque reference monitor U1-09.
7. Stop the drive.
8. Set the value noted in step 4 to parameter S3-29. Set the value noted in step 6 to parameter S3-27.

Procedure for Load Condition 2 (S3-28, S3-30)

1. Set the speed reference to 0%.
2. Apply load to the car has much as possible (at least 50% of the maximum weight).
3. Note the value of the analog input monitor for the load signal input connected to (U1-13 for terminal A1, U1-14 for terminal A2)
4. Provide an elevator Up or Down command, using Inspection Operation or normal operation mode. The car should be held in place when the brake releases.
5. Note the drives internal torque reference monitor U1-09.
6. Stop the drive.
7. Set the value noted in step 3 to parameter S3-30. Set the value noted in step 5 to parameter S3-28.

Figure 4.21 shows the Torque Compensation at Start settings with parameters S3-27 to S3-30.
The solid line in *Figure 4.21* indicates the torque compensation at start when the elevator moves up or down.

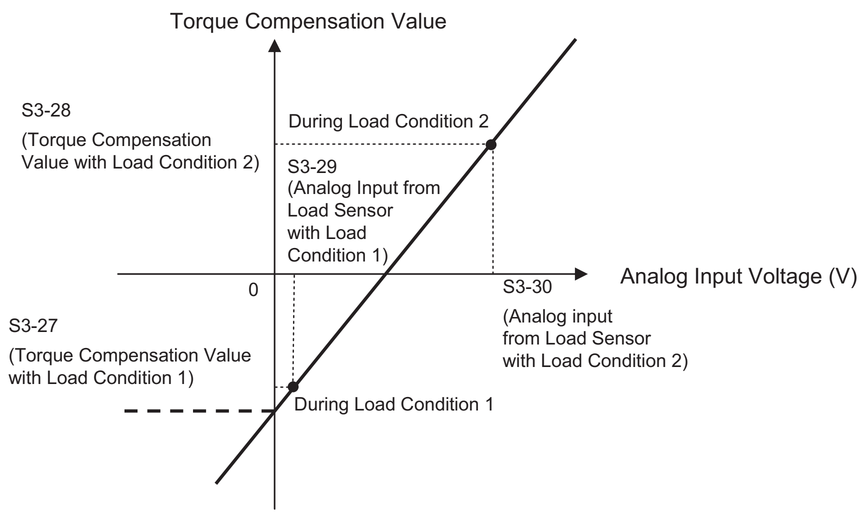


Figure 4.21 Torque Compensation at start for the Elevator in Up and Down Direction

After setting load conditions 1 and 2, perform a trial run. If required, parameter S3-12 can be set up to add a bias to the load sensor input when riding in a Down direction (default: 0.0%, same torque compensation characteristics in up and down direction). *Figure 4.22* illustrates the effect of torque compensation on the settings of S3-12 and S3-27 through S3-30.

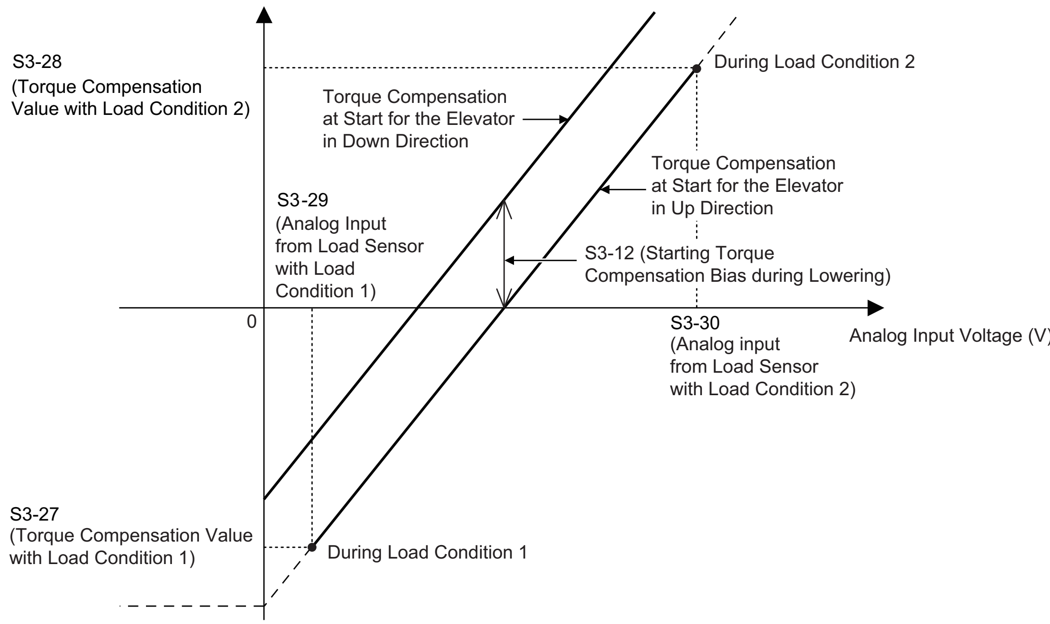


Figure 4.22 Torque Compensation at Start for the Elevator in Up and Down Direction

◆ Elevator Emergency Stop

■ Start Condition for Elevator Emergency Coast to Stop

An emergency coast to stop is performed when the Up or Down command is cleared and all of the following conditions are met.

- Parameter b1-03 (Stopping Method Selection) is set to 4.
- Parameter d1-18 (Speed Reference Selection Mode) is set to 0 or 3.
- Parameter b1-01 (Speed Reference Selection) is set to 1.
- The Up/Down command is cleared and U1-05 (Speed Feedback) is equal to or greater than S1-26 (Emergency Stop Start Level).

■ Elevator Emergency Stop Timing Chart

Figure 4.23 and *Figure 4.24* show timing charts for Elevator Emergency Coast to Stop and normal Ramp to Stop.

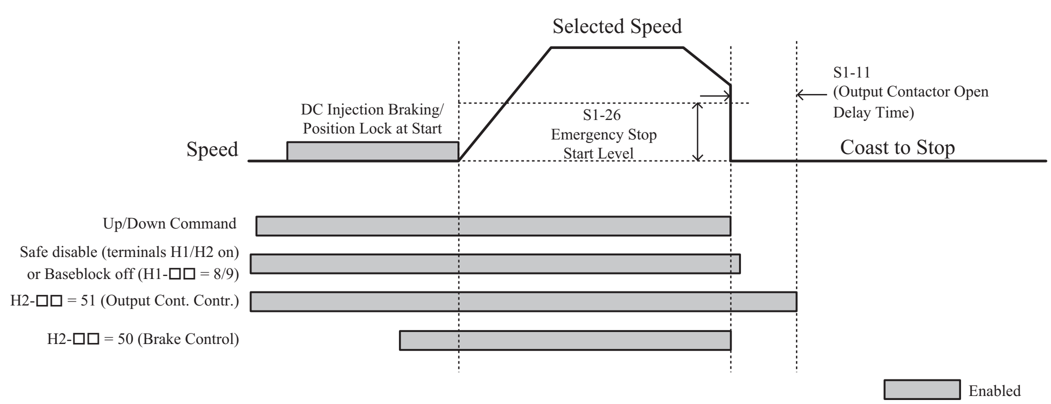


Figure 4.23 With Up/Down Command Cleared and U1-05 ≥ S1-26

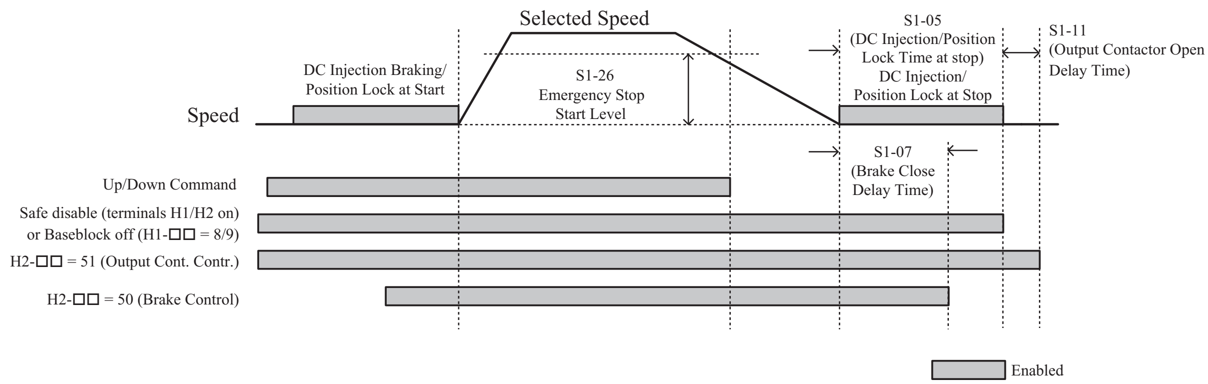


Figure 4.24 With Up/Down Command Cleared and U1-05 < S1-26

◆ Adjustments for Elevator Ride Comfort

This section explains the adjustment of drive settings used to eliminate problems with hunting, vibration, and rollback.

Perform the steps presented in this section after the Basic Application Setup procedure is complete. Also refer to *Riding Comfort Related Problems on page 149* for further descriptions on how to resolve riding comfort problems.

■ Speed Loop Adjustments (CLV and CLV/PM)

The speed control loop uses four different gain and integral time settings that can be adjusted using C5-□□ parameters. The settings are switched over when the motor speed reaches the level set in parameter C5-07.

- Proportional gain and integral time C5-03/04 are used at start when the speed is lower than the setting of C5-07.
- Proportional gain and integral time C5-01/02 are used at speeds above the setting of C5-07.
- Proportional gain and integral time C5-13/14 are used at stop when leveling speed is selected as speed reference and the speed is lower than the setting of C5-07.
- Proportional gain and integral time C5-19/20 are used During Position Lock at start in CLV/PM.

Increase the gain and shorten the integral time to increase speed control responsiveness in each of the sections. Reduce the gain and increase the integral time if vibration or oscillation occurs.

■ Inertia Compensation (CLV and CLV/PM)

Inertia compensation can be used to eliminate motor speed overshoot at the end of acceleration or undershoot at the end of deceleration caused by the system inertia. Adjust the function following the steps below.

1. Properly adjust the speed control loop parameters (C5-□□).
2. Set parameter n5-01 to 1 to enable inertia compensation.
3. Calculate and set n5-02 and n5-03 as follows:

Motor Acceleration Time n5-02	$n5\text{-}02 = J_{Mot} \cdot \frac{\pi \cdot n_{r\_Mot}}{30 \cdot T_{r\_Mot}}$	• J_{Mot} - Motor inertia in kgm² • n_{r_Mot} - Rated motor speed in min⁻¹ • T_{r_Mot} - Rated motor torque in Nm • J_{TS} - Traction sheave inertia in kgm² • i - Gear ratio (n_{Load}/n_{Mot}) • v_{r_Elev} - Rated elevator speed in m/s • Σm - Mass of all moved parts (car, counterweight, ropes, load <1>) in kg
Inertia Compensation Gain n5-03	$\Sigma J = J_{TS} \cdot i^2 + \Sigma m \cdot \left(\frac{30 \cdot v_{r\_Elev}}{\pi \cdot n_{r\_Mot}}\right)^2$ $n5\text{-}03 = \Sigma J / J_{Mot}$	

<1> Insert 0 kg for the load to calculate the lowest setting, insert the elevator rated load to calculate the maximum setting for n5-03. Use the lower setting for initial trials.

4. Change the setting of n5-03 within the limits calculated in step 3 until the desired performance is achieved. If possible, trace the output speed after soft starter (U1-16) and the motor speed (U1-05) values. Increase n5-03 if the motor speed does not follow the speed after soft start. Decrease n5-03 if the motor overshoots the designated speed at the end of acceleration or undershoots the speed at the end of deceleration.

■ Adjusting Position Lock at Start (CLV/PM)

Set the S3-☐☐ and C5-☐☐ parameters as described below in order to reduce rollback effects at start.

- With the elevator car unloaded, adjust the speed loop gain (C5-19) and integral time for Position Lock (C5-20). Increase the gain and reduce the integral time in order to reduce the rollback of the car. Set parameters C5-19 and C5-20 in the opposite way if vibration occurs.
- Adjust the Position Lock at start gain 2 (S3-02). Increase S3-02 if rollback occurs, decrease S3-02 it if vibration occurs.
- If the elevator is balanced and oscillation at start occurs, attempt gradually increasing the setting in S3-40 in increments of one pulse.

◆ Rescue Operation

In the event of a power outage, Rescue Operation allows the elevator to travel to the nearest floor by switching to a backup battery or UPS (Uninterruptable Power Supply) for power.

An input terminal set for Rescue Operation (H1-☐☐ = 55) can be used to initiate Rescue Operation. During Rescue Operation, the drive uses the speed reference set in d1-25 to travel to the nearest floor.

NOTICE: *Equipment Hazard. Do not use the Rescue Operation feature for extended periods. Failure to comply may result in drive heat sink overheat alarms (oH).*

NOTICE: *When changing parameters while the drive is supplied from the rescue operation power supply, wait at least 5 s after entering parameters before switching off the power supply. Instantly switching off the power can cause parameter settings corruption that can only be resolved by initializing the drive. This may cause erroneous drive performance.*

NOTICE: *Always turn off the RUN command before changing the setting of parameters d1-18 (Speed Reference Selection Mode), b1-01 (Speed Reference Selection), or H1-☐☐ (Multi-Function Digital Inputs). If the RUN command is on when changing any of these settings, the motor may unexpectedly start running, and could result in injury.*

■ Drive Power Supply for Rescue Operation

There are various methods of supplying power to the drive for rescue operation. Independent of the chosen method, the voltage in the DC bus of the drive and the voltage supplied to the drive control circuit must meet the specifications provided in *Table 4.13*.

The DC bus voltage can either be supplied by a battery connected to the DC bus terminals of the drive or by a UPS connected to drive terminals L1 and L2. The control circuit voltage can be supplied directly from the drives DC bus (no external wiring required), from an external battery (connection to CN19), or by using an optional 24 Vdc control power backup unit.

When using a single-phase AC power supply for rescue operation such as a single-phase UPS, the ripple in the DC bus voltage will be higher than with a three-phase or battery supply. Make sure that the DC bus voltage never falls below the minimum value listed in *Table 4.13*.

When using a PM motor with an incremental PG encoder and a PG-X3 option card, always perform Initial Magnet Pole Search Parameters Auto-Tuning (T2-01=3) with the normal power supply connected. The tuning function will prepare the drive for Rescue Operation by automatically setting certain parameters. If the tuning ends with an “End8” to “End10” fault, then rescue operation will require a battery or UPS that supplies the drive DC bus with at least 280 Vdc for 200 V class drives and 560 Vdc for 400 V class drives. Alternatively utilize to an absolute PG encoder and a PG-E3 or PG-F3 option card.

Table 4.13 Power Supply Ratings for Rescue Operation

Motor Type	Speed Feedback	DC Bus Voltage	Control Circuit Voltage
Induction Motor	Incremental PG Encoder with PG-X3 option card	200 V class drives: 48 to 340 Vdc 400 V class drives: 96 to 680 Vdc	When supplied from a battery or the drive DC bus: 200 V class drives: 250 to 340 Vdc 400 V class drives: 280 to 680 V (recommended: 500 to 680 Vdc) When supplied via a 24 Vdc control power backup unit: 200 V and 400 V class drives: 24 Vdc
Permanent Magnet Motor	Incremental PG Encoder with PG-X3 option card “End8” to “End10” error occurs during Initial Magnet Pole Search Auto-Tuning.	200 V class drives: 280 to 340 Vdc 400 V class drives: 560 to 680 Vdc	
	Incremental PG Encoder with PG-X3 option card No error occurs during Initial Magnet Pole Search Auto-Tuning.	200 V class drives: 72 to 340 Vdc 400 V class drives: 144 to 680 Vdc	
	Absolute PG Encoder with PG-F3 or PG-E3 option card	200 V class drives: 48 to 340 Vdc 400 V class drives: 96 to 680 Vdc	

■ Parameter Setup

Adjust drive parameters as described below when using Rescue Operation.

- Select the type of Rescue Operation power supply for the drives main circuit in parameter S4-06.
- When using a UPS, set the UPS power value to parameter S4-07. Use parameter S4-08 to decide if the Rescue Operation speed shall be limited automatically depending on the UPS power.
- If deterioration of the battery or UPS shall be detected, also set up parameters S4-12 and S4-13. Measure the DC bus voltage during operation using the rescue power supply and set the measured value to parameter S4-12. Set the deterioration detection level to parameter S4-13.
- Set parameters S4-01 to S4-04 if light load direction search shall be automatically performed when Rescue Operation is started.

■ Wiring Examples

Switching the main power supply to a battery or UPS requires magnetic contactors that must be controlled by an external controller. Wiring methods and the sequence used for the magnetic contactors depend on the application. This instruction manual describes the following configurations:

- A single-phase, 230 V UPS is used as backup power supply for a 200 V or 400 V class drive.
- Two separate batteries for the main power and control power supplies. Main power battery voltage is below 250 Vdc for 200 V class drives or 500 Vdc for 400 V class drives.
- Two separate batteries. One is used for the main power supply, a second battery supplies the controller via an optional 24 V Backup Power Supply Unit.
- A single battery with minimum 250 Vdc for 200 V class drives or 500 Vdc for 400 V class drives is used for the main and control power supply.

Select the configuration that matches your application. Follow the corresponding instructions for wiring and drive settings. For configurations not covered in the list above, contact your Yaskawa representative or our sales office directly for consultation.

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Never remove or install option cards or attempt to replace the cooling fan while the drive is switched on. Make sure that the drive and all devices connected to the drive have been shut off prior to performing and type of maintenance or wiring. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components or perform wiring. The internal capacitor remains charged even after the power supply is turned off.*

NOTICE: *Be sure to thoroughly read the instructions for wiring and magnetic contactor sequence described in this section before setting up the drive for Rescue Operation. Failure to follow these instructions can damage the drive.*

NOTICE: *Refrain from using Rescue Operation for extend periods of time. Rescue Operation uses a low DC bus voltage, which can cause the cooling fan to shut off temporarily during Rescue Operation. Continuing to operate under these conditions can trigger an overheat fault and damage the drive.*

■ Using a Single-Phase, 230 Vac UPS (Uninterruptable Power Supply)

Follow the instructions when using a single-phase 230 V UPS for Rescue Operation. A 230 V UPS can be used for both 200 V and 400 V class drives.

Wiring

Refer to *Figure 4.25* for a wiring diagram.

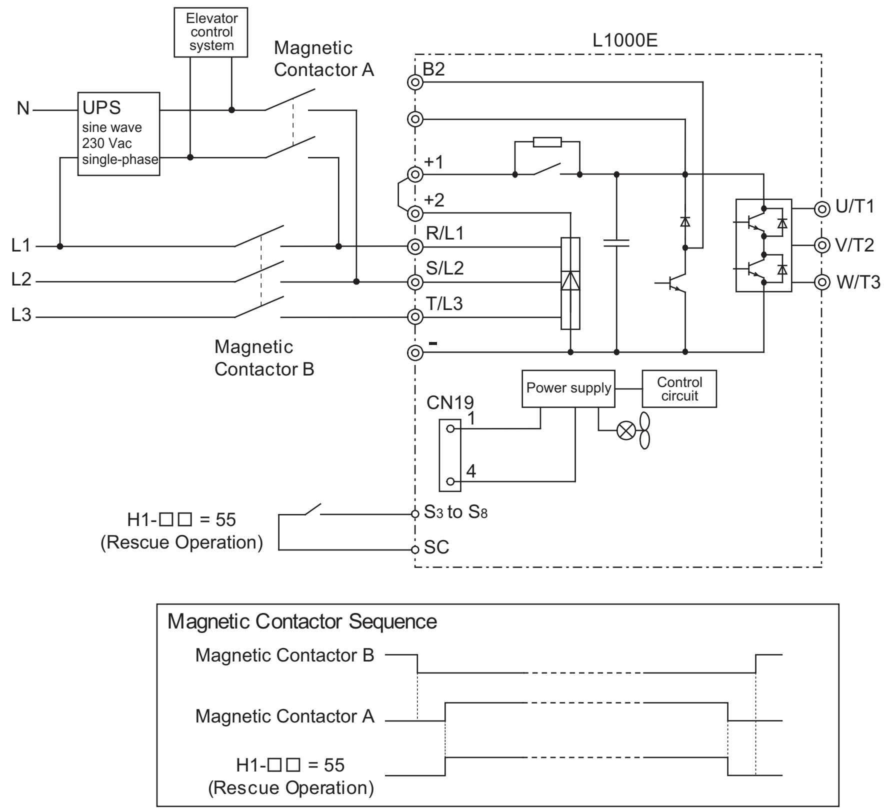


Figure 4.25 Using a Single-Phase 230 V UPS

Operation Sequence

Starting Rescue Operation

1. Open contactor B.
2. Set the input terminal programmed for Rescue Operation (H1-□□ = 55).
3. Close contactor A.
4. Set the Up/Down command.

Ending Rescue Operation

1. After the car has stopped open contactor A.
2. Clear the input terminal set for Rescue Operation (H1-□□ = 55).
3. Close contactor B to return to operation with normal power supply.

Application Precautions

The drive may fault on a control power supply fault (Uv2) if the UPS can't provide enough voltage, or if the Light Load Direction Search is not set properly. If this problem occurs, take the following corrective actions:

Corrective Action:

• Use a separate battery for the controller power supply.

- Use a battery with a voltage higher than 250 Vdc for 200 V class drives or 500 Vdc for 400 V class drives and connect it to the control power supply input (CN19). Alternatively use a 24 Vdc battery and an optional 24 V Backup Power Supply Unit.
- Enable Light Load Direction Search (S4-01 = 1).

■ Using Separate Batteries for DC Bus and Control Power Supply, DC Bus Battery under 250 Vdc (500 Vdc)

Follow these instructions when using separate batteries for Rescue Operation with the battery for the DC bus having a lower voltage than 250 Vdc for 200 V class drives and 500 Vdc for 400V class drives.

Wiring

Follow the wiring diagram shown in *Figure 4.26*. When connecting the battery for the control power supply to the L1000E, use the 1.1 m cable packaged with the product. The connector cover must first be removed in order to access connection port CN19 for the battery. Refer to *Connecting the Drive and Battery on page 141* for details.

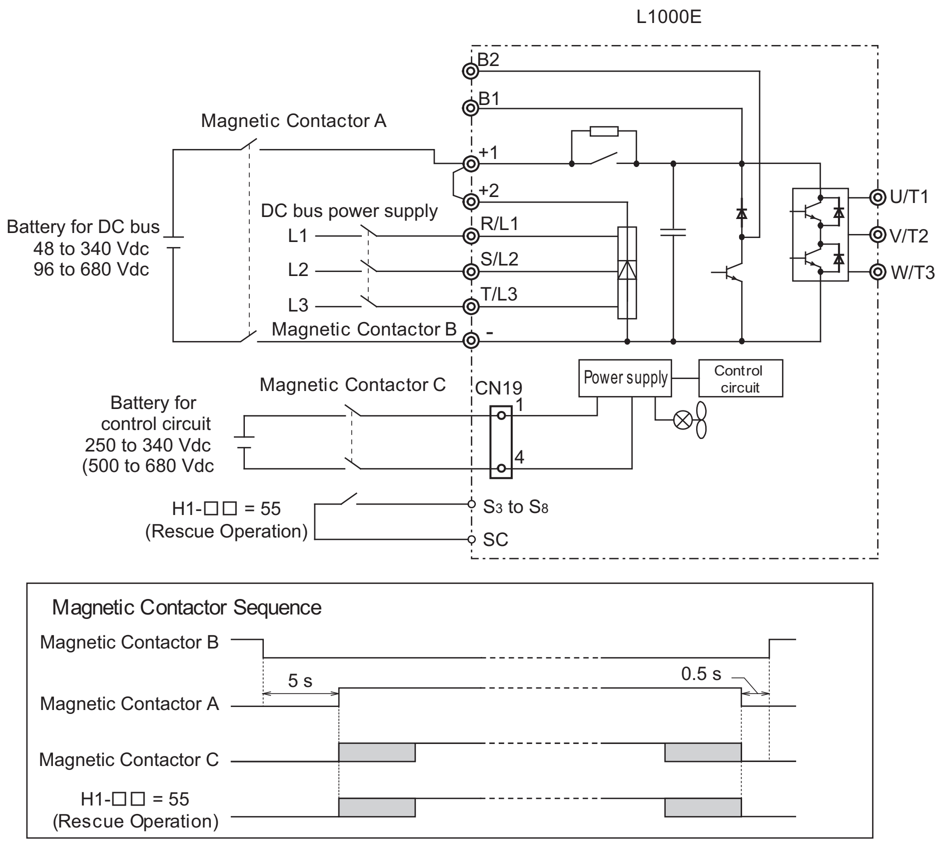


Figure 4.26 Wiring Two Batteries for DC Bus and Control Power Supply (DC Bus Battery is less than 250 V)

Operation Sequence

Starting Rescue Operation

1. Open contactor B and wait at least 5 seconds.
2. Set the input terminal programmed for Rescue Operation (H1-☐☐ = 55).
3. Close contactors A and C.
4. Set the Up/Down command.

Ending Rescue Operation

1. After the car has stopped, open contactors A and C.
2. Clear the input terminal set for Rescue Operation (H1-☐☐ = 55).
3. Wait at least 0.5 s and then close contactor B to return to operation with normal power supply.

■ Using a Battery for the DC Bus and 24 V Power Supply Unit Option for the Control Circuit

Follow the instructions when using a 24 V Power Supply Unit option for the control circuit and a battery for the main circuit. The main circuit battery voltage must be higher than 48 Vdc for 200 V class drives and 96 Vdc for 400 V class drives.

Wiring

Yaskawa offers a 24 V Power Supply Option for the control circuit that is useful in applications unable to connect to a backup battery greater than 250 V. Wiring instructions can be found in *Figure 4.27*. For a more detailed explanation of the 24 V Power Supply Option, refer to the manual provided with the option.

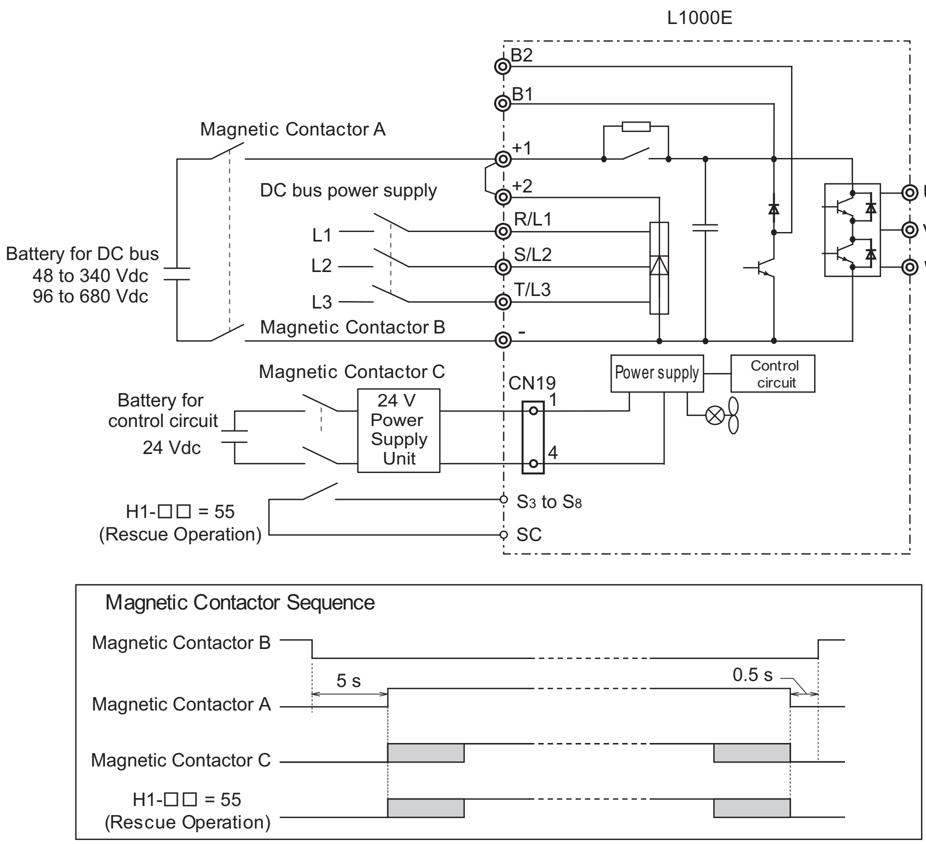


Figure 4.27 Using a Battery for the DC Bus and 24 V Power Supply Unit Option for the Control Circuit

Operation Sequence

Starting Rescued Operation

1. Open contactor B and wait at least 5 seconds.
2. Set the input terminal programmed for Rescue Operation (H1-☐☐ = 55).
3. Close contactors A and C.
4. Set the Up/Down command.

Ending Rescue Operation

1. After the car has stopped, open contactors A and C.
2. Clear the input terminal set for Rescue Operation (H1-☐☐ = 55).
3. Wait at least 0.5 s and then close contactor B to return to operation with normal power supply.

■ Using a Single Battery with Minimum 250 Vdc (500 Vdc)

Follow the instructions when using one battery to supply both, main circuit and controller. The battery voltage must be at least 250 Vdc for 200 V class drives or 500 Vdc for 400 V class drives.

Wiring

Following the wiring diagram show in *Figure 4.28*.

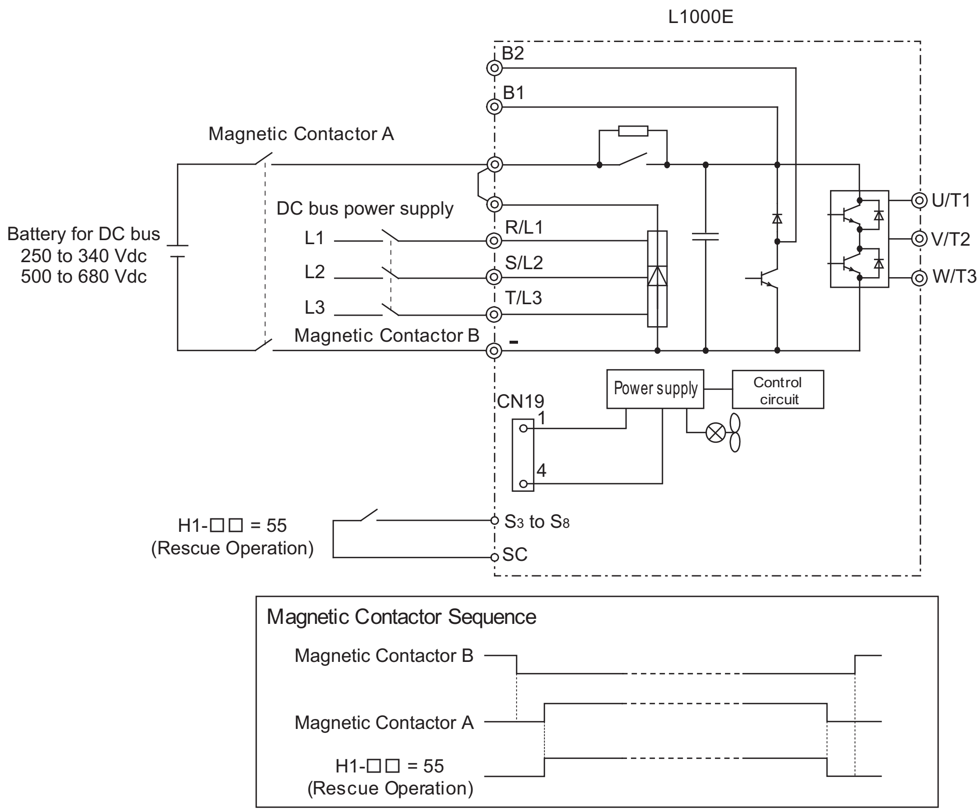


Figure 4.28 Using a Backup Battery With Minimum 250 Vdc (500 Vdc)

Operation Sequence

Starting Rescue Operation

1. Open contactor B.
2. Set the input terminal programmed for Rescue Operation (H1-☐☐ = 55).
3. Close contactor A.
4. Set the Up/Down command.

Ending Rescue Operation

1. After the car has stopped, open contactor A.
2. Clear the input terminal set for Rescue Operation (H1-☐☐ = 55).
3. Close contactor B to return to operation with normal power supply.

■ Connecting the Drive and Battery

Use the 1.1 m cable packaged with the drive to connect the battery. Remove the connector covering port CN19 before connecting the cable to CN19.

Information on battery power ratings can be found in *Table 4.13*.

Note: The connector port location and angle vary by drive model.

DANGER! *Switch off the power supply before wiring and connecting the battery cable. Failure to comply will lead to death or serious injury from electric shock.*

Battery Connections for 2A0018 to 2A0094 and 4A0009 to 4A0049

1. Insert the tip of a screwdriver into the opening on the edge of the CN19 connector cover. Slide the cover off the drive as indicated in *Figure 4.29*.

NOTICE: *A straight-edge screwdriver should be inserted into the opening provided on the connector cover at the proper angle. Attempting to insert the screwdriver blade at a different angle could damage the drive.*

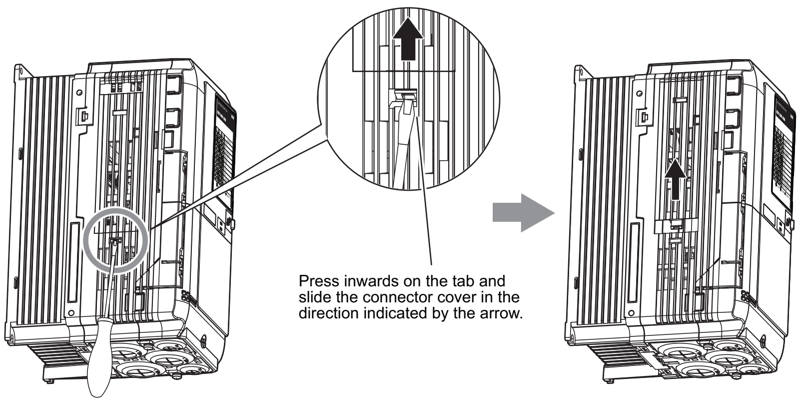


Figure 4.29 Removing the Connector Cover

2. Connect the cable provided to the CN19 port.

NOTICE: *Be sure that the connector fastens at the correct angle to the drive port. The incorrect angle could damage the battery, cable, or connector.*

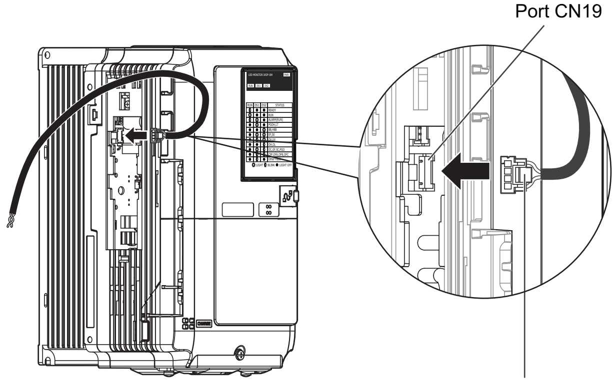


Figure 4.30 Connecting the Cable

3. Use a pair of diagonal cutters to cut an opening in the connector cover that allows the cable to pass through. The cable should pass through the connector cover with the cover fastened to the drive.

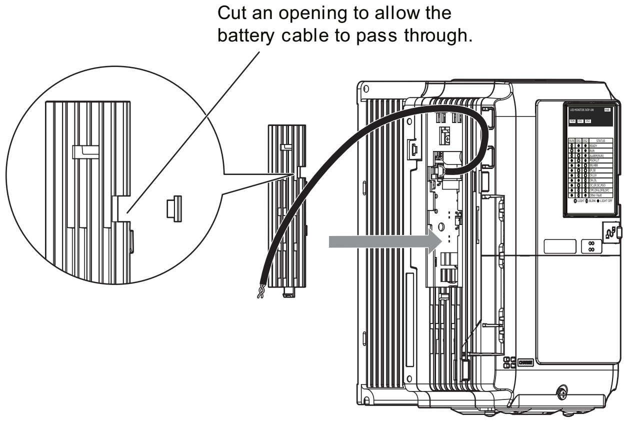


Figure 4.31 Reattaching the Connector Cover (1)

4. Slide the connector cover back into place as shown in *Figure 4.32*.

NOTICE: *Make sure the cable does not get pinched between the drive and the connector cover, as this could damage the cable.*

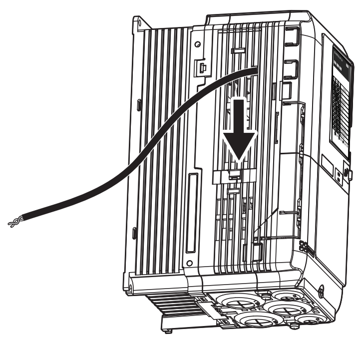


Figure 4.32 Reattaching the Connector Cover (2)

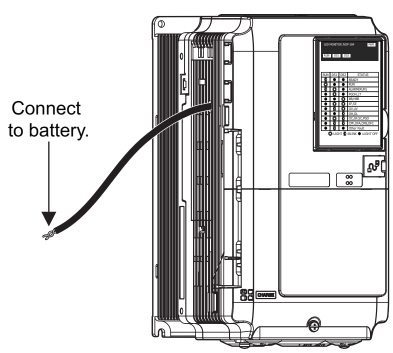


Figure 4.33 Drive and Battery Connection Complete

Models 2A0106 to 2A0432 and 4A0056 to 4A0225

1. Use a Phillips screwdriver (M4) to loosen the screw holding the CN19 connector cover in place.

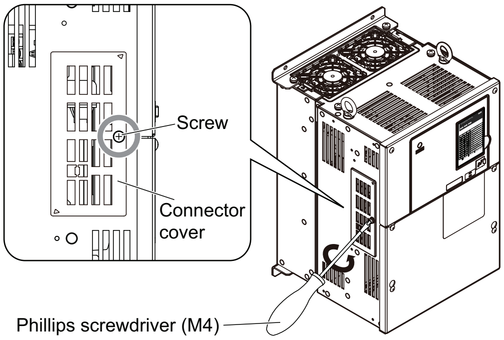


Figure 4.34 Removing the CN19 Connector Cover

2. Slide the CN19 connector cover from the drive as shown in ***Figure 4.35***.

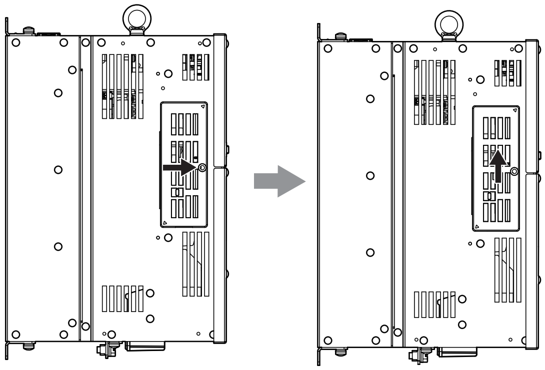


Figure 4.35 Sliding the CN19 Connector Cover

3. Insert a straight-edge screwdriver into the opening as shown in ***Figure 4.36***, then remove the CN19 connector cover by sliding it as shown in ***Figure 4.36***.

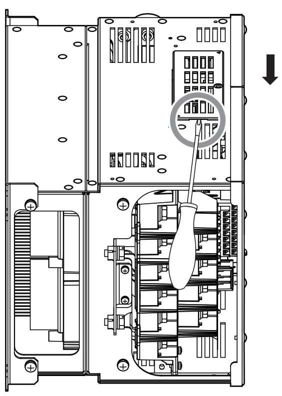


Figure 4.36 Removing the CN19 Connector Cover

4. Connect the cable to the CN19 connector port on the drive.

Note: The connector port location and angle vary by drive model.

NOTICE: *Be sure that the connector fastens at the correct angle to the CN19 connector port. The incorrect angle could damage the battery, cable, or connector.*

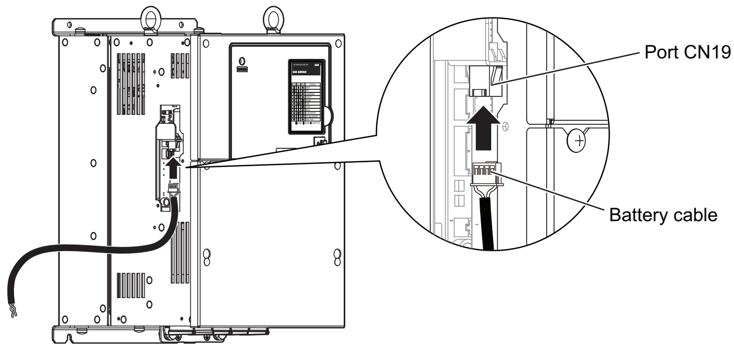


Figure 4.37 Connecting the Cable

5. The cable should pass through the connector cover with the cover fastened to the drive.

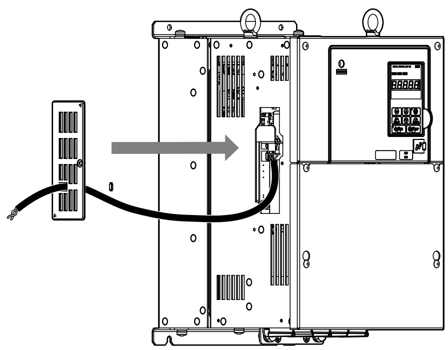


Figure 4.38 Reattaching the CN19 Connector Cover

6. Slide the CN19 connector cover back into place as shown in ***Figure 4.39***.

NOTICE: *Make sure the cable does not get pinched between the drive and the CN19 connector cover, as this could damage the cable.*

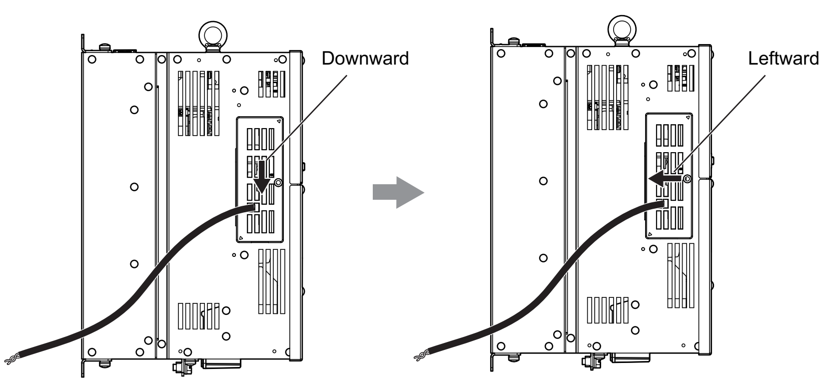


Figure 4.39 Sliding the CN19 Connector Cover into Place

7. Use a Phillips screwdriver (M4) to fasten the screw that holds the CN19 connector cover in place.

NOTICE: *Use the screw provided to fasten the connector cover into place. Using a different screw may damage the internal drive components.*

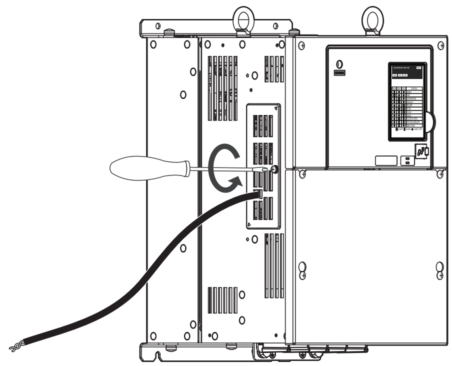


Figure 4.40 Reattaching the CN19 Connector Cover

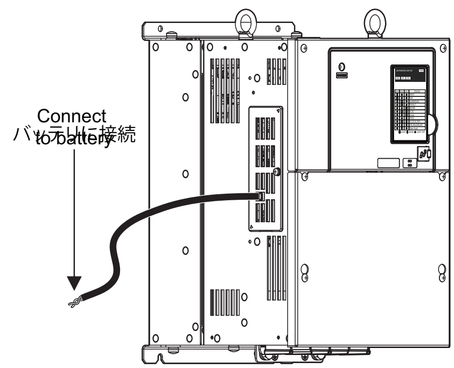


Figure 4.41 Drive and Battery CN19 Connection Complete

■ Rescue Operation Torque Limit

The Torque Limit During Rescue Operation is set in parameter S4-05. After Rescue Operation is complete, the drive utilizes to the torque limits set in the L7 parameters.

■ Light Load Direction Search Function

Light Load Direction Search can be used to automatically perform Rescue Operation in the direction with the lower load. It can help to minimize the amount of power required by the backup power supply required for Rescue Operation. Light Load Direction Search can be set so that it is automatically performed when Rescue Operation is started. To enable Light Load Direction Search set parameter S4-01 = 1.

When Light Load Direction Search is enabled the drive first runs in the up and then in the down direction, each for the time set to S4-03. It then compares the load condition of both operations and travels to the next floor using the lighter load condition direction. The speed reference used for Light Load Direction Search can be set in parameter S4-04.

- When the lightest load direction is up, the drive stops after Light Load Direction Search and then accelerates upwards to the Rescue Operation speed set in parameter d1-25. The output terminals set for “Light Load Direction” (H2-☐☐ = 54) and “Light Load Direction detection status”(H2-☐☐ = 55) will close.

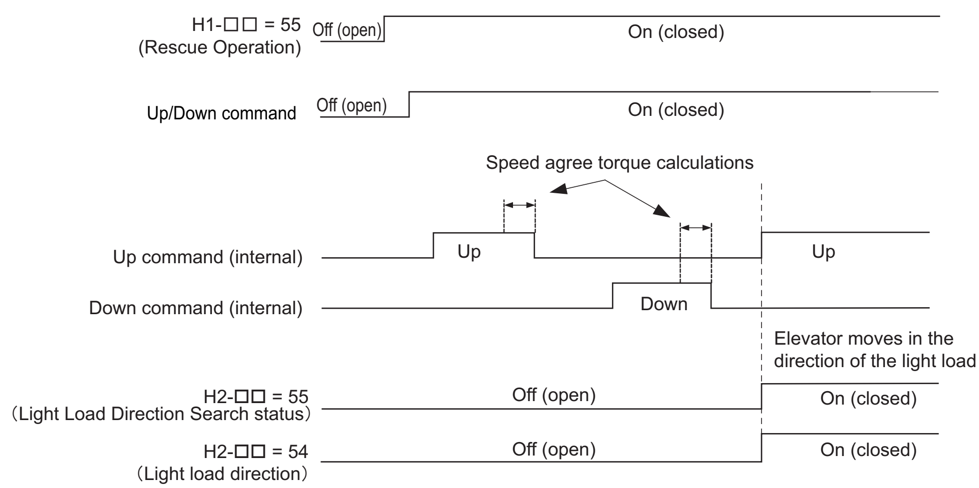


Figure 4.42 Light Load Direction Detection (Up)

- When the lightest direction is down, then after Light Load Direction Detection is finished the drive immediately accelerates to the Rescue Operation speed set in d1-25 without stopping. An output terminal set for “Light load direction” (H2-☐☐ = 54) will stay open, and an output terminal set for “Light Load Direction detection status”(H2-☐☐ = 55) will close.

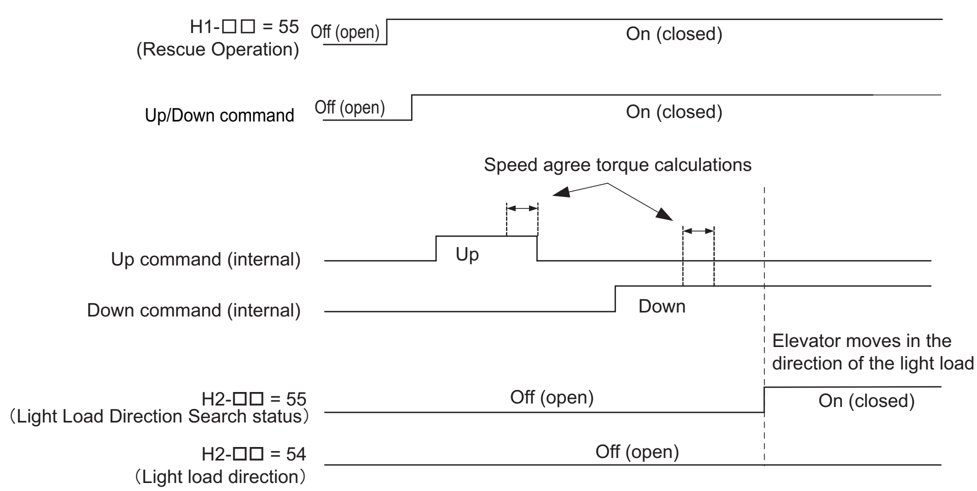


Figure 4.43 Light Load Direction Detection (Down)

4.7 Setup Troubleshooting and Possible Solutions

This section describes troubleshooting problems that do not trip an alarm or fault.

Symptom		Page
Cannot Change Parameter Settings		147
Motor Does Not Rotate Properly after Pressing RUN Button or after Entering External Up/Down Command	Motor Does Not Rotate	147
	Motor Rotates in the Opposite Direction from the Up/Down Command	148
Motor Gets Too Hot		148
Drive Does Not Allow Selection of Rotational Auto-Tuning		148
Noise From Drive or Output Lines When the Drive is Powered On		148
Ground Fault Circuit Interrupter (GFCI)		148
Encoder Offset (E5-11) Set during Auto-Tuning (Rotational or Stationary) Consistently Differs by 30 Degrees or More		149
Riding comfort related problems		149

◆ Cannot Change Parameter Settings

Cause	Possible Solutions
The drive is running the motor (i.e., the Up/Down command is present).	• Stop the drive and switch over to the Programming Mode. • Most parameters cannot be edited during run.
The Access Level is set to restrict access to parameter settings.	• Set the Access Level to allow parameters to be edited (A1-01 = 2).
The operator is not in the Parameter Setup Mode.	• Verify the digital operator mode, Drive or Programming mode? • Switch to the Programming Mode. *Refer to The Drive and Programming Modes on page 99* for details.
The wrong password was entered.	• If the password entered to A1-04 does not match the password saved to A1-05, then drive settings cannot be changed. • Reset the password. If the password is unknown: • Scroll to A1-04. Press STOP and press ∧ at the same time. Parameter A1-05 will appear. • Set a new password to parameter A1-05.
Undervoltage was detected.	• Check the drive main input voltage by looking at the DC bus voltage (U1-07). • Check all main circuit wiring.

◆ Motor Does Not Rotate Properly after Pressing RUN Button or after Entering External Up/Down Command

■ Motor Does Not Rotate

Cause	Possible Solutions
The drive is not in the Drive Mode.	• Check if the DRV on the digital operator is displayed. • Enter the Drive Mode. *Refer to The Drive and Programming Modes on page 99*.
The LO/RE button is enabled (o2-01=1) and was pushed.	Stop the drive and check if the correct frequency reference source is selected. If the digital operator is the source, the LO/RE button LED must be on. If the source is REMOTE, it must be off. Take the following steps to solve the problem: • Push the LO/RE button. • o2-01 is set to 0 by default, i.e. the LO/RE button is disabled.
Auto-Tuning has just completed.	• When Auto-Tuning completes, the drive is switched back to the Programming Mode. The Up/Down command will not be accepted unless the drive is in the Drive Mode. • Use the digital operator to enter the Drive Mode. *Refer to The Drive and Programming Modes on page 99*.
A Fast Stop was executed and is not reset.	Reset the Fast Stop command.
Settings are incorrect for the source that provides the Up/Down command.	Check parameter b1-02 (Up/Down Command Selection). Set b1-02 so that it corresponds with the correct Up/Down command source. 0: Digital operator 1: Control circuit terminal (default setting) 2: MEMOBUS/Modbus communications 3: Option card
There is faulty wiring in the control circuit terminals.	• Check the wiring for the control terminal. • Correct wiring mistakes. • Check the input terminal status monitor (U1-10).
The speed reference source setting is incorrect.	Check parameter b1-01 (Speed Reference Selection). Set b1-01 to the correct source of the speed reference. 0: Digital operator 1: Control circuit terminal (default setting) 2: MEMOBUS/Modbus communications 3: Option card
The settings for the analog speed reference are incorrect.	Check the settings (signal level, function, bias, gain) for the analog input that supplies the speed reference.

Cause	Possible Solutions
Selection for the sink/source mode and the internal/external power supply is incorrect.	Check the position of the jumper and setting for S3. ***Refer to Control I/O Configuration on page 79***
Speed reference is too low.	• Check the speed reference monitor (U1-01). • Increase the speed reference above the minimum output speed (E1-09). • Make sure speed references are set properly and the speed selection works properly. If using an analog signal make sure the input signal is present at the time the Up/Down command is issued.
The brake does not release or motor contactor is not closed.	Check the brake and motor contactor sequence.
The STOP button is enabled (o2-02=1) and was pressed when the drive was started from a REMOTE source.	• When the STOP button is pressed, the drive will decelerate to stop. • Switch off the Up/Down command and then re-enter a new Up/Down command. • o2-02 is set to 0 by default, i.e. the Stop button is disabled.

■ Motor Rotates in the Opposite Direction from the Up/Down Command

Cause	Possible Solutions
Phase wiring between the drive and motor is incorrect.	Check the motor wiring. Perform the steps described in ***Motor Rotation Direction Setup on page 108*** and ***PG Encoder Setup on page 108***.
Drive control circuit terminals for the Up and Down commands are switched.	• Check the control circuit wiring. • Correct any fault wiring.

◆ Motor is Too Hot

Cause	Possible Solutions
The load is too heavy.	If the load is too heavy for the motor, the motor will overheat as it exceeds its rated torque value for an extended period of time. Keep in mind that the motor also has a short-term overload rating in addition to the possible solutions provided below: • Reduce the load. • Lower the acceleration and deceleration ramps. (Increase the acceleration time and deceleration time) • Check the values set for the motor protection (L1-01, L1-02) as well as the motor rated current (E2-01). • Increase motor capacity.
The air around the motor is too hot.	• Check the ambient temperature. • Cool the area until it is within the specified temperature range.
The drive is operating in a vector control mode but Auto-Tuning has not yet been performed.	• Perform Auto-Tuning. • Calculate the motor value and reset the motor parameters. ***Refer to E2: Motor Parameters on page 179***. • Change the motor control method to V/f Control (A1-02 = 0).
Insufficient voltage insulation between motor phases.	When the motor cable is long, high voltage surges occur between the motor coils and drive switching. Normally, surges can reach up to three times the drive input power supply voltage. • Use a motor with a voltage tolerance higher than the max voltage surge. • Install an AC reactor on the output side of the drive. Make sure the output reactor can handle frequencies in the range of the drive carrier frequency.
The motor fan has stopped or is clogged.	Check the motor fan.

◆ Drive Does Not Allow Selection the Desired Auto-Tuning Mode

Cause	Possible Solutions
The desired Auto-Tuning mode is not available for the selected control mode.	• Check if the desired tuning mode is available for the selected control mode. ***Refer to Auto-Tuning on page 113***. • Change the motor control method by setting A1-02.

◆ Electrical Noise From Drive or Output Lines When the Drive is Operating

Cause	Possible Solutions
PWM switching in the drive generates excessive noise.	• Lower the carrier frequency (C6-03). • Install a noise filter on the input side of drive input power. • Install a noise filter on the output side of the drive. • Place the wiring inside a metal conduit to shield it from switching noise. • Ground the drive and motor properly. • Separate the main circuit wiring and the control lines. • Make sure wires and the motor have been properly grounded.

◆ Ground Fault Circuit Interrupter (ELCB/GFCI) Trips During Run

Cause	Possible Solutions
Excessive leakage current trips ELCB/GFCI ground fault circuit interrupter.	• Increase the ELCB/GFCI sensitivity or use ELCB/GFCI with a higher threshold. • Lower the carrier frequency (C6-03). • Reduce the length of the cable used between the drive and the motor. • Install a noise filter or reactor on the output side of the drive.

◆ Encoder Offset (E5-11) Set during Auto-Tuning (Rotational or Stationary) Consistently Differs by 30 Degrees or More

Cause	Possible Solutions
PG-E3 option position error with the ERN1387 encoder.	Perform Auto-Tuning of PG-E3 encoder characteristics (T2-01 = 12).

◆ Riding Comfort Related Problems

The following table describes the most common problems related to ride comfort and proposes countermeasures to those problems. Before taking any action, make sure the startup procedures have been performed as previously described.

Problem	Control Mode and Possible Cause		Corrective Action
Rollback at start	V/f and OLV	Insufficient torque when the brake is released.	• Increase the DC Injection Braking Current at Start using parameter S1-02. • Increase the Minimum Output Frequency Voltage (E1-10) and Medium Output Frequency Voltage (E1-08) V/f pattern voltages. Make sure, that the starting and leveling current does not rise too high.
		DC Injection and brake timing is not optimized.	Set the time for DC Injection Braking at Start (S1-04) as short as possible, and make sure that brake releases completely before the motor starts to turn.
	OLV	The slip or torque compensation function acts too slowly.	• Decrease the Torque Compensation Time (C4-02). • Decrease the Slip Compensation Time (C3-02).
	CLV CLV/PM	The speed control is not responding fast enough when the brake is released.	Adjust the speed control loop parameters used During Position Lock. Increase C5-19 and reduce C5-20.
		The Position Lock control loop does not respond fast enough.	• Adjust the speed control loop parameters used During Position Lock. Increase C5-19 and reduce C5-20. • Increase the Position Lock Gain at Start 1 in S3-01 gradually. If vibration occurs reduce it. • Increase the Position Lock Gain at Start 2 in S3-02 gradually until rollback disappears.
	All	Motor torque is not fully established when the brake is released.	Lengthen the Brake Release Delay Time (S1-06) and the time for DC Injection Braking / Position Lock at Start (S1-04).
		Motor contactor closes too late.	Make sure that the contactors are closed before the Up/Down command is issued.
Shock at start	All	Motor starts turning when the brake is not completely released or runs against the brake.	Increase the DC Injection Braking Time at Start using parameter S1-04.
		Acceleration rate is changing too quickly.	Decrease the Jerk at Start. Decrease C2-01 if set in m/s^2, increase C2-01 if set in s.
		Rollback occurs during brake release.	Refer to “Rollback at start”.
Shock at stop	All	Brake is applied too early, causing the motor to run against the brake.	Increase the Delay Time to Close the Brake (S1-07). If necessary, also increase the DC Injection Braking Time at Stop S1-05.
		Motor contactor is released before the brake is fully applied.	Check the motor contactor sequence.
	CLV CLV/PM	Rollback occurs before the brake applies at stop.	• Make sure the speed control loop parameters for position lock are adjusted properly (C5-13 and C5-14). • Increase the Position Lock Gain at Stop S3-03 gradually until no rollback occurs. If vibration occurs reduce the gain S3-03.
Jerk occurs due to overshoot when the motor reaches top speed.	OLV	Too fast torque or slip compensation.	• Increase the Torque Compensation Delay Time (C4-02). • Increase the Slip Compensation Delay Time (C3-02).
	CLV CLV/PM	Speed control loop setting is too soft or too hard.	• Adjust the Speed Control Loop Gain C5-01 and Integral Time C5-02. • Adjust Inertia Compensation parameters (n5-□□ if speed control loop settings can not solve the problem
		Incorrect motor data.	• For induction motors readjust the motor data (E2-□□), especially the slip (E2-02) and no-load current values (E2-03), or perform Auto-Tuning again. • For PM motors readjust the motor data in E5-□□ or perform Auto-Tuning.
		Inertia compensation function is not set up correctly.	If the Inertia Compensation Function is used (n5-01=1) make sure the values in n5-02 and n5-03 are correct.
	All	The acceleration rate changes too quickly when reaching the selected speed.	Decrease the Jerk at the End of Acceleration. Decrease C2-02 if set in m/s^2, increase C2-02 if set in s.

4.7 Setup Troubleshooting and Possible Solutions

Problem	Control Mode and Possible Cause		Corrective Action
Motor stops shortly (under-shoot) when the leveling speed is reached.	V/f and OLV	Not enough torque at low speed.	Increase the Minimum and Middle Voltage Levels for the V/f pattern voltage (E1-10 and E1-08 respectively). Make sure that the Starting and Leveling Current does not rise too high.
	OLV and CLV	Motor data incorrect.	Adjust the motor data (E2-□□), especially the motor slip (E2-02) and no-load current values (E2-03), or perform Auto-Tuning.
		Too much slip compensation.	
	CLV CLV/PM	Speed control loop responds too slow.	Increase the Speed Control Gain and reduce the Speed Control Integral Time used for Low Speed at Stop. The parameters to be changed depend on the setting of C5-05 and whether a third set of speed loop settings is used. Refer to *Speed Loop Adjustments (CLV and CLV/PM) on page 134*.
		The inertia compensation function is not set up correctly.	If the Inertia Compensation Function is used (n5-01 = 1) make sure the values in n5-02 and n5-03 are correct.
	All	The deceleration rate changes too quickly when reaching leveling speed.	Decrease the Jerk at the End of Deceleration. Decrease C2-04 if set in m/s^2, increase C2-04 if set in s.
Motor speed overshoot at acceleration end and under-shoot when reaching leveling speed occurs. Problem can not be resolved by adjusting the speed loop.	CLV CLV/PM	Inertia is high.	Use the Inertia Compensation Function. Set n5-01 to 1 and then adjust parameters n5-02 and n5-03 as described in *Inertia Compensation (CLV and CLV/PM) on page 134*.
Motor or machine vibrates at high speed or top speed.	OLV	Torque compensation responds too quickly.	Increase the Torque Compensation Delay Time (C4-02).
	CLV CLV/PM	Speed control loop adjusted too hard.	Decrease C5-01, then increase C5-02.
Motor or machine vibrates in the low or medium speed range.	V/f	Output voltage is too high.	Reduce the V/f Pattern settings (E1-08, E1-10).
	OLV	Torque compensation is responding too quickly.	Increase the Torque Compensation Delay Time (C4-02).
		Output voltage is too high.	Reduce the V/f Pattern settings (E1-08, E1-10).
	OLV CLV	The value for the motor slip is set incorrectly.	Check the Motor Slip value in parameter E2-02. Increase or decrease it in steps of 0.2 Hz.
	CLV CLV/PM	Speed control loop adjusted with too much gain.	• Decrease C5-01 and then increase C5-02 if the problem occurs at speed higher than C5-07. • Decrease C5-03 and then increase C5-04 if the problem occurs at speed lower than C5-07. • Decrease C5-13 and then increase C5-14 if the problem occurs at speed lower than C5-07 but only during deceleration.
Motor or machine vibrates in During Position Lock.	CLV CLV/PM	The Position Lock control loop does not respond fast enough.	• If vibration occurs at During Position Lock at start, first decrease S3-02. If decreasing S3-02 does not resolve the problem, decrease S3-01. • Decrease S3-03 if vibration occurs During Position Lock at stop.
		The speed control is not responding quickly enough when the brake is released.	Decrease C5-19 and then increase C5-20.
Vibrations with the frequency equal to the motor speed occur.	CLV CLV/PM	Encoder vibrates.	Check the encoder mounting and the alignment of encoder and motor shaft.
	All	Mechanical problems.	Check bearings and gearbox.
		Rotational parts (motor armature, handwheel, brake disk/drum) are not properly balanced.	Properly balance rotating parts.
Oscillations when using an analog speed reference.	All	The analog reference value is not stable or the signal is noisy.	• Check the analog signal line connection. Use shielded twisted pair cables. • Apply a filter to the analog input signal by setting parameter H3-13.
Top speed is different in motoring and regenerative mode.	OLV	Slip Compensation during Regenerative operation is switched off.	Make sure C3-04 is set properly and set parameter C3-05 to 0.
Speed reference and motor speed do not match when using an analog reference signal.	All	The drives analog input is not set according to the signal level of the controller speed reference output signal.	Check the gain and bias settings for the analog input that is used to set the speed reference. Check parameters H3-03 and H3-04 for input A1, check parameters H3-11 and H3-12 for input A2.
Acceleration is longer than set to C1-□□ parameters.	All	The load is too high.	• Check if the acceleration rate set is not too high (acceleration time is too short). • Make sure the drive rated current is enough to fulfill the application requirements. • Make sure the load is not seized, car guide lubrication is ok, etc.
	V/f and OLV	The load is too high and the current/torque exceeds the stall prevention level.	Check if the Stall Prevention Level at Acceleration in L3-03 is not set too small.
	OLV, CLV CLV/PM	The load is too high and the torque exceeds the drives torque limits.	Check it the Torque Limit parameters L7-□□ are not set too low.
Motor speed does not match the speed reference at constant speed.	All	The load is too high.	Make sure the drive rated current is enough to fulfill the application requirements.
	V/f	The load is too high and the current/torque exceeds the stall prevention level.	Check if the Stall Prevention Level During Run in L3-06 is not set too low.
	OLV, CLV CLV/PM	The load is too high and the torque exceeds the torque limits.	Check it the Torque Limit parameters L7-□□ are not set too low.
High frequency acoustic noise from the motor.	All	The carrier frequency is too low.	Increase the Carrier Frequency in parameter C6-03. If the carrier frequency is set higher than the default setting, a current derating must be considered.

4.8 Verifying Parameter Settings and Backing Up Changes

Use the Verify Menu to check all changes to parameter settings as a result of Auto-Tuning. *Refer to Verifying Parameter Changes: Verify Menu on page 102*.

Save the verified parameter settings. Change the access level or set a password to the drive to prevent accidental modification of parameter settings.

◆ Backing Up Parameter Values: o2-03

Setting o2-03 to 1 saves all parameter settings before resetting o2-03 to 0. The drive can now recall all the saved parameters by performing a User Initialization (A1-03 = 1110).

No.	Parameter Name	Description	Setting Range	Default Setting
o2-03	User Parameter Default Value	Lets the user create a set of default settings for a User Initialization. 0: Saved/Not Set 1: Set Defaults - Saves current parameter settings as the default values for a User Initialization. 2: Clear All - Clears the currently saved user settings. After saving the user parameter set value, the items of 1110 (User Initialization) are displayed in A1-03 (User Parameter Default Value).	0 to 2	0
A1-03	Initialize Parameters	Selects a method to initialize the parameters. 0: No Initialize 1110: User Initialization (The user must first program and store desired settings using parameter o2-03) 2220: 2-Wire Initialization (parameter initialized prior to shipment) 5550: oPE4 Fault reset	0 to 2220, 5550	0

◆ Parameter Access Level: A1-01

Setting the Access Level for “Operation only” (A1-01 = 0) allows the user to access parameters A1-☐☐ and U☐-☐☐ only. Other parameters are not displayed.

Setting the Access Level for “User Parameters” (A1-01 = 1) allows the user to access only the parameters that have been previously saved as User Parameters. This is helpful when displaying only the relevant parameters for a specific application.

No.	Parameter Name	Description	Setting Range	Default
A1-01	Access Level Selection	Selects which parameters are accessible via the digital operator. 0: Operation only. A1-01, A1-04, and A1-06 can be set and monitored, and U☐-☐☐ parameters can also be viewed. 1: User Parameters. Only recently changed parameters from application parameters A2-01 to A2-16 and A2-17 to A2-32 can be set and monitored. 2: Advanced Access Level. All parameters can be set and monitored.	0 to 2	2
A2-01 to A2-32	User Parameters 1 to 32	Parameters selected by the user are saved as User Parameters, including recently viewed parameters and parameters specifically selected for quick access. If parameter A2-33 is set to 1, recently viewed parameters will be listed between A2-17 and A2-32. Parameters A2-01 through A2-16 must be manually selected by the user. If A2-33 is set to 0, recently viewed parameters will not be saved to the group of User Parameters. A2-☐☐ parameters are now available for manual programming.	A1-00 to o4-13	–
A2-33	User Parameter Automatic Selection	0: Parameters A2-01 through A2-32 are reserved for the user to create a list of User Parameters. 1: Save history of recently viewed parameters. Recently edited parameters will be saved to A2-17 through A2-32 for quick access. The most recently changed parameter is saved to A2-17. The second most recently changed parameter is saved to A2-18.	0, 1	1

◆ Password Settings: A1-04, A1-05

The user can set a password in parameter A1-05 to restrict access to the drive. The password must be entered to A1-04 to unlock parameter access (i.e., parameter setting A1-04 must match the value programmed into A1-05). The following parameters cannot be viewed or edited until the value entered to A1-04 correctly matches the value set to A1-05: A1-01, A1-02, A1-03 and A2-01 through A2-33.

Note: Parameter A1-05 is hidden from view. To display A1-05, access parameter A1-04 and press STOP and ∧ simultaneously.

◆ Copy Function

Parameter settings can be copied to another drive to simplify parameter restoration or multiple drive setup. The drive supports the following copy options:

- **LCD Operator**

  The LCD operator used to operate the drive supports copying, importing, and verifying parameter settings. ***Refer to o3: Copy Function on page 244*** for details.

- **USB Copy Unit and CopyUnitManager**

  The Copy Unit is an external option connected to the drive to copy parameter settings from one drive and save those settings to another drive. Refer to the manual supplied with the USB Copy Unit for instructions.

  CopyUnitManager is a PC software tool that allows the user to transfer parameter settings between the Copy Unit and a PC. This tool is especially useful when managing parameters for various drives or applications. Refer to the manual supplied with CopyUnitManager for instructions.

- **DriveWizard Plus**

  DriveWizard is a PC software tool for parameter management, monitoring, and diagnosis. DriveWizard can load, store, and copy drive parameter settings. For details, refer to Help in the DriveWizard software.

Note: To obtain the driver and software of USB Copy Unit, Copy Unit Manager and DriveWizardPlus, access these sites:
China: http://www.yaskawa.com cn
Europe: http://www.yaskawa.eu.com
Japan: http://www.e-mechatronics.com
U.S.A.: http://www.yaskawa.com
Other areas: contact a Yaskawa representative.

5

Parameter Details

5.1 A: Initialization

The initialization group contains parameters associated with initial setup of the drive. Parameters involving the display language, access levels, initialization, and password are located in this group.

◆ A1: Initialization

■ A1-00: Language Selection

Selects the display language for the digital operator.

Note: This parameter is not reset when the drive is initialized using parameter A1-03.

No.	Parameter Name	Setting Range	Default
A1-00	Language Selection	0 to 12 <1>	0

<1> Language Settings 8 to 12 can only be selected from an LCD operator with software version 0102 or later. The version number of the LCD operator PRG software is shown on the back of the LCD operator.

Setting 0: English
Setting 1: Japanese
Setting 2: German
Setting 3: French
Setting 4: Italian
Setting 5: Spanish
Setting 6: Portuguese
Setting 7: Chinese
Setting 8: Czech
Setting 9: Russian
Setting 10: Turkish
Setting 11: Polish
Setting 12: Greek

■ A1-01: Access Level Selection

Allows or restricts access to drive parameters.

No.	Parameter Name	Setting Range	Default
A1-01	Access Level Selection	0 to 2	2

Setting 0: Operation only

Access is restricted to parameters A1-01, A1-04, and all U monitor parameters.

Setting 1: User Parameters

Access to only a specific list of parameters set to A2-01 through A2-32. These User Parameters can be accessed using the Setup Mode of the digital operator.

Setting 2: Advanced Access Level (A) and Setup Access Level (S)

All parameters can be viewed and edited.

Notes on Parameter Access

- If the drive parameters are password protected by A1-04 and A1-05, parameters A1-00 through A1-03, A1-06, and all A2 parameters cannot be modified.
- If parameters are changed via serial communication, it will not be possible to edit or change parameter settings with the digital operator until an Enter command is issued to the drive from the serial communication.

■ A1-02: Control Method Selection

Selects the Control Method (also referred to as the control mode) that the drive uses to operate the motor. Parameter A1-02 determines the control mode for motor 1 when the drive is set up to run two motors.

No.	Parameter Name	Setting Range	Default
A1-02	Control Method Selection	0, 2, 3, 7	2

Note: This parameter is not reset when the drive is initialized using parameter A1-03.

Setting 0: V/f Control for Induction Motors

Use this mode for simple speed control and for multiple motor applications with low demands to dynamic response or speed accuracy. This control mode is also used when the motor parameters are unknown and Auto-Tuning cannot be performed. The speed control range is 1:40.

Setting 2: Open Loop Vector Control

Use this mode for general, variable-speed applications with a speed control range of 1:200 that require precise speed control, quick torque response, and high torque at low speed without using a speed feedback signal from the motor.

Setting 3: Closed Loop Vector Control

Use this mode for general, variable-speed applications that require precise speed control down to zero speed, quick torque response or precise torque control, and a speed feedback signal from the motor. The speed control range is up to 1:1500.

Setting 7: Closed Loop Vector Control for PM Motors

Use this mode for high-precision control of a PM motor in constant torque or variable torque applications. The speed control range reaches 1:1500. A speed feedback signal is required.

■ A1-03: Initialize Parameters

Resets parameters back to the original default values. After initialization, the setting for A1-03 automatically returns to 0.

No.	Parameter Name	Setting Range	Default
A1-03	Initialize Parameters	0, 1110, 2220, 5550	0

Setting 0: No initialization

Setting 1110: User Initialize

Drive parameters are reset to values selected by the user as User Settings. User Settings are stored when parameter o2-03 is set to “1: Set defaults”.

Note: User Initialization resets all parameters to a user-defined set of default values previously saved to the drive. Set parameter o2-03 to 2 to clear the user-defined default values.

Setting 2220: 2-Wire Initialization

Resets all parameters back to their original default settings with digital inputs S1 and S2 configured as Forward run and Reverse run, respectively.

Setting 5550: oPE04 Reset

An oPE04 error appears on the digital operator when a terminal block with settings saved to its built-in memory is installed in a drive that has edited parameters. Set A1-02 to 5550 to use the parameter settings saved to the terminal block memory.

Notes on Parameter Initialization

The parameters shown in *Table 5.1* will not be reset when the drive is initialized by setting A1-03 = 2220 or 3330. Although the control mode in A1-02 is not reset when A1-03 is set to 2220 or 3330, it may change when an application preset is selected.

Table 5.1 Parameters not Changed by Drive Initialization

No.	Parameter Name
A1-00	Language Selection
A1-02	Control Method Selection
E1-03	V/f Pattern Selection
E5-02	Motor Rated Capacity (for PM)
E5-03	Motor Rated Current (for PM)
E5-04	Motor Poles (for PM)
E5-05	Motor Stator Resistance (for PM)
E5-06	Motor d-Axis Inductance (for PM)
E5-07	Motor q-Axis Inductance (for PM)
E5-09	Motor Induction Voltage Constant 1 (for PM)
E5-24	Motor Induction Voltage Constant 2
F6-□□	Communications Parameter (initialized when F6-08 = 1)
L8-35	Installation Selection
o2-04	Drive Model Selection

■ A1-04, A1-05: Password and Password Setting

Parameter A1-04 enters the password when the drive is locked; parameter A1-05 is a hidden parameter that sets the password.

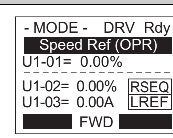
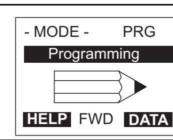
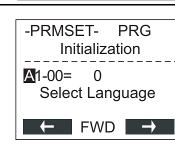
No.	Parameter Name	Setting Range	Default
A1-04	Password	0000 to 9999	0000
A1-05	Password Setting		

How to use the Password

The user can set a password in parameter A1-05 to restrict access to the drive. The password must be entered to A1-04 to unlock parameter access (i.e., parameter setting A1-04 must match the value programmed into A1-05). The following parameters cannot be viewed or edited until the value entered to A1-04 correctly matches the value set to A1-05: A1-01, A1-02, A1-03, A1-06, and A2-01 through A2-33.

The instructions below demonstrate how to set password "1234". An explanation follows on how to enter that password to unlock the parameters.

Table 5.2 Setting the Password for Parameter Lock

	Step		Display/Result
1.	Turn on the power to the drive. The initial display appears.	➡	
2.	Press ∧ or ∨ until the Parameter Setting Mode screen appears.	➡	
3.	Press ENTER to enter the parameter menu tree.	➡	

Step			Display/Result
4.	Select the flashing digits by pressing F1 (left), F2 (right) or RESET.	➡	-PRMSET- PRG Select Language A1-00= 0 *0* English ← FWD →
5.	Select A1-04 by pressing ∧.	➡	-PRMSET- PRG Enter Password A1- 04 = 0 (0~9999) "0" ← FWD →
6.	Press ∧ while holding down STOP at the same time. A1-05 will appear. **Note:** Because A1-05 is hidden, it will not be displayed by simply pressing ∧.	➡	-PRMSET- PRG Select Password A1- 05 = 0 (0~9999) "0" ← FWD → "05" flashes
7.	Press ENTER.	➡	-PRMSET- PRG Select Password A1- 05 = 0000 (0~9999) "0" ← FWD →
8.	Use F1 (left), F2 (right), RESET, ∨ and ∧ to enter the password.	➡	-PRMSET- PRG Select Password A1-05= 1234 (0~9999) "0" ← FWD →
9.	Press ENTER to save what was entered.	➡	Entry Accepted
10.	The display automatically returns to the display shown in step 5.	➡	-PRMSET- PRG Select Password A1- 05 = 1234 (0~9999) "0" ← FWD →

Table 5.3 Check to see if A1-02 is locked (continuing from step 10 above)

Step			Display/Result
1.	Press ∨ to display A1-02.	➡	-PRMSET- PRG Control Method A1-02= 2 *2* Open Loop Vector ← FWD → "02" flashes
2.	Press ENTER to make sure that the setting values cannot be selected.	–	–
3.	Press ESC to return to the first display.	➡	- MODE - PRG Programming HELP FWD DATA

Table 5.4 Enter the Password to Unlock Parameters (continuing from step 3 above)

Step			Display/Result
1.	Press ENTER to enter the parameter setup display.	➡	-PRMSET- PRG Initialization A1-00= 0 Select Language ← FWD →
2.	Press F1 (left), F2 (right) or RESET to select the flashing digits as shown.	➡	-PRMSET- PRG Select Language A1-00= 0 *0* English ← FWD → “00” flashes
3.	Press ∧ to scroll to A1-04 and ENTER.	➡	-PRMSET- PRG Enter Password A1- 04 = 0 (0~9999) “0” ← FWD →
4.	Enter the password “1234”.	➡	-PRMSET- PRG Enter Password A1- 04 = 1234 (0~9999) “0” ← FWD →
5.	Press ENTER to save the new password.	➡	Entry Accepted
6.	Drive returns to the parameter display.	➡	-PRMSET- PRG Enter Password A1- 04 = 0 (0~9999) “0” ← FWD →
7.	Press ∨ and scroll to A1-02.	➡	-PRMSET- PRG Control Method A1-02= 2 *2* Open Loop Vector ← FWD →
8.	Press ENTER to display the value set to A1-02. If the first “2” blinks, parameter settings are unlocked.	➡	-PRMSET- PRG Control Method A1-02= 2 *2* Open Loop Vector ← FWD →
9.	Use ∧ or ∨ to change the value if desired (though changing the control mode at this point is not typically done).	➡	-PRMSET- PRG Control Method A1-02= 0 *2* V/F Control “2” ← FWD → V/f
10.	Press ENTER to save the setting, or press ESC to return to the previous display without saving changes.	➡	Entry Accepted
11.	The display automatically returns to the parameter display.	➡	-PRMSET- PRG Control Method A1-02= 0 *0* V/F Control ← FWD →

Note: Parameter settings can be edited after entering the correct password. Performing a 2-wire initialization resets the password to “0000”. Reenter the password to parameter A1-05 after drive initialization.

◆ A2: User Parameters

■ A2-01 to A2-32: User Parameters 1 to 32

The user can select up to 32 parameters and assign them to parameters A2-01 through A2-32 to provide quicker access by eliminating the need to scroll through multiple menus. The User Parameter list can also save the most recently edited parameters.

No.	Parameter Name	Setting Range	Default
A2-01 to A2-32	User Parameters 1 to 32	A1-00 to o4-16	Determined by A1-02

Saving User Parameters

To save specific parameters to A2-01 through A2-32, set parameter A1-01 to 2 to allow access to all parameters, then enter the parameter number to one of the A2-☐☐ parameters to assign it to the list of User Parameters. Finally, set A1-01 to 1 to restrict access so users can only set and refer to the parameters saved as User Parameters.

■ A2-33: User Parameter Automatic Selection

Determines whether recently edited parameters are saved to the second half of the User Parameters (A2-17 to A2-32) for quicker access.

No.	Parameter Name	Setting Range	Default
A2-33	User Parameter Automatic Selection	0 or 1	1

Setting 0: Do not save list of recently viewed parameters.

Set A2-33 to 0 to manually select the parameters listed in the User Parameter group.

Setting 1: Save history of recently viewed parameters.

Set A2-33 to 1 to automatically save recently edited parameters to A2-17 through A2-32. A total of 16 parameters are saved with the most recently edited parameter set to A2-17, the second most recently to A2-18, and so on. Access the User Parameters using the Setup Mode of the digital operator.

5.2 b: Application

◆ b1: Operation Mode Selection

■ b1-01: Speed Reference Selection

Selects the frequency reference source for the REMOTE mode.

NOTICE: *Always turn off the RUN command before changing the setting of parameters d1-18 (Speed Reference Selection Mode), b1-01 (Speed Reference Selection), or H1-☐☐ (Multi-Function Digital Inputs). If the RUN command is on when changing any of these settings, the motor may unexpectedly start running, and could result in injury.*

Note: **1.** If an Up/Down command is input to the drive but the speed reference entered is 0 or below the minimum frequency, the RUN indicator LED on the digital operator will light.
2. Press the LO/RE key to set the drive to LOCAL and use the digital operator keypad to enter the speed reference.

No.	Parameter Name	Setting Range	Default
b1-01	Speed Reference Selection	0 to 3	0

Setting 0: Operator keypad

When b1-01 = 0, the user can enter the speed reference in the following ways:

- Switch between the speed references set to the d1-☐☐ parameters according to the speed reference priority (d1-18) and multi-function digital input terminal settings. *Refer to d1: Speed Reference on page 174* for details.
- Enter the speed reference directly using the digital operator keypad.

Instructions on changing speed reference settings can be found in *The Drive and Programming Modes on page 95*.

Setting 1: Terminals (analog input terminals)

If source of the speed reference is assigned to the control terminals (b1-01 = 1), then d1-18 will automatically be set to 0 so the drive uses multi-speed references d1-01 to d1-08. With this setting, the analog input terminal can be used to set the speed reference. The drive will look to analog input terminals A1 or A2 for the speed reference (provided parameter H3-02 or H3-10 must be set to "0", assigning terminal A1 or A2 respectively to the speed reference). Parameter d1-18 is to be set to 0. *Refer to d1: Speed Reference on page 174* for details.

Terminals A1 and A2 can accept a voltage signal to supply the speed reference to the drive. *Table 5.5* shows the parameter settings and voltage levels required for each terminal.

Table 5.5 Analog Input Settings for Speed Reference Using Voltage Signals

Terminal	Signal Level	Parameter Settings				Notes
		Signal Level Selection	Function Selection	Gain	Bias	
A1	0 to 10 Vdc	H3-01 = 0	H3-02 = 0 (speed reference bias)	H3-03	H3-04	–
	-10 to +10 Vdc	H3-01 = 1				
A2	0 to 10 Vdc	H3-09 = 0	H3-10 = 0 (speed reference bias)	H3-11	H3-12	–
	-10 to +10 Vdc	H3-09 = 1				

Setting 2: MEMOBUS/Modbus Communications

When b1-01 = 2, the speed reference is given to the drive using MEMOBUS/Modbus register 0002H. Setting the speed reference from MEMOBUS/Modbus requires setting parameter d1-18 to 0.

Note: Be sure to program the digital inputs for speed selection and set parameter b1-02 to 0 when switching the preset speeds set in the d1-☐☐ parameters via MEMOBUS/Modbus. Select the desired speed by switching these digital inputs using the MEMOBUS/Modbus operation command (0001H).

Setting 3: Option card

When b1-01 = 3, the drive looks to a serial network option card for the speed reference. Setting the speed reference from a communication option card requires parameter d1-18 to be set to 0.

Note: 1. Be sure to program the digital inputs for speed selection and set parameter b1-01 to 0 when switching the preset speeds set in the d1-□□ parameters via a communication option card. Select the desired speed by switching these digital inputs using the drive operation command (refer to the option card manual for details).
2. If the speed reference source is set for Option PCB (b1-01 = 3), but an option board is not installed, an oPE05 Operator Programming Error will be displayed on the digital operator and the drive will not run.

■ b1-02: Up/Down Command Selection

Determines he Up/Down command source in the REMOTE mode. Wire the motor so the elevator goes up when an Up command is issued.

No.	Parameter Name	Setting Range	Default
b1-02	Up/Down Command Selection	0 to 3	1

Setting 0: Operator

Allows the user to enter Up/Down commands from the digital operator. Use this setting when performing a test run only.

Setting 1: Control Circuit Terminal

Up/Down commands are issued from the control circuit terminals. This is the standard setting used in most elevator applications.

Setting 2: MEMOBUS/Modbus Communications

This setting requires entering the Up/Down commands via serial communications by connecting the RS-485/422 serial communication cable to control terminals R+, R-, S+, and S- on the removable terminal block. ***Refer to MEMOBUS/ Modbus Configuration on page 418*** for instructions.

Setting 3: Option Card

This setting requires entering the Up/Down commands via the communication option card by plugging a communication option card into the CN5-A port on the control board. Refer to the option card manual for instructions on integrating the drive into the communication system.

Note: If b1-02 is set to 3, but an option card is not installed in CN5-A, an oPE05 operator programming error will be displayed on the digital operator and the drive will not run.

■ b1-03: Stopping Method Selection

Selects how the drive stops the motor when the Up/Down command is removed or when a Stop command is entered.

No.	Parameter Name	Setting Range	Default
b1-03	Stopping Method Selection	0, 1, 4	0

Setting 0: Ramp to stop

Ramps the motor to stop at the deceleration ramp set in C1-02. The actual time required for deceleration may vary by load conditions (mechanical loss, inertia).

Setting 1: Coast to stop

The drive will shut off output to the motor and allow it to coast freely to stop when the Up/Down command is removed.

Setting 4: Elevator emergency stop

After the Up/Down command is cleared and when the value of U1-05 (Speed Feedback) is equal to or greater than the value of S1-26 (Emergency Stop Start Level), the drive coasts to a stop.

After the Up/Down command is cleared and when the value of U1-05 (Speed Feedback) is lower than the value of S1-26 (Emergency Stop Start Level), the drive ramps to a stop.

■ b1-06: Digital Input Reading

Defines how the digital inputs are read.

No.	Parameter Name	Setting Range	Default
b1-06	Digital Input Reading	0 or 1	1

Setting 0: Read once

The state of a digital input is read once. If the state has changed, the input command is immediately processed. With this setting the drive responds more quickly to digital inputs, but a noisy signal could cause erroneous operation.

Setting 1: Read twice

The state of a digital input is read twice. The input command is processed only if the state does not change during the double reading. This reading process is slower than the “Read once” process, but it is more resistant to noisy signals.

■ b1-08: Up/Down Command Selection while in Programming Mode

As a safety precaution, the drive will not normally respond to an Up/Down command input when the digital operator is being used to adjust parameters in the Programming Mode (Verify Menu, Setup Mode, Parameter Settings Mode, and Auto-Tuning Mode). If required by the application, set b1-08 to allow the drive to run while in the Programming Mode.

No.	Parameter Name	Setting Range	Default
b1-08	Up/Down command Selection while in Programming Mode	0 to 2	0

Setting 0: Disabled

An Up/Down command is not accepted while the digital operator is in the Programming Mode.

Setting 1: Enabled

An Up/Down command is accepted in any digital operator mode.

Setting 2: Prohibit programming during run

It is not possible to enter the Programming Mode as long as the drive output is active. The Programming Mode cannot be displayed during Run.

■ b1-14: Phase Order Selection

Sets the phase order for drive output terminals U/T1, V/T2, and W/T3. Switching motor phases will reverse the direction of the motor. Use this parameter to switch the direction of the Up and Down commands.

No.	Parameter Name	Setting Range	Default
b1-14	Phase Order Selection	0 or 1	0

Setting 0: Standard phase order (U-V-W)

Setting 1: Switched phase order (U-W-V)

Note:
1. If using a closed loop control mode such as CLV (A1-02 = 3) or CLV/PM (A1-02 = 7) and parameter b1-14 is changed, be sure to also change the direction of the motor encoder (F1-05) to match the direction of the Up and Down commands.
2. If CLV/PM is used, also perform encoder offset Auto-Tuning.

◆ b2: Magnetic Flux Compensation

■ b2-08: Magnetic Flux Compensation Value

Sets the magnetic flux compensation at start as a percentage of the no-load current value (E2-03). This function allows for the development of more flux to facilitate starting machines that require high starting torque or motors with a large rotor time constant.

No.	Parameter Name	Setting Range	Default
b2-08	Magnetic Flux Compensation Value	0 to 1000%	0%

When an Up/Down command is issued, the DC current level injected into the motor changes linearly from the level set to b2-08 to the level set to E2-03 within the time set to S1-04.

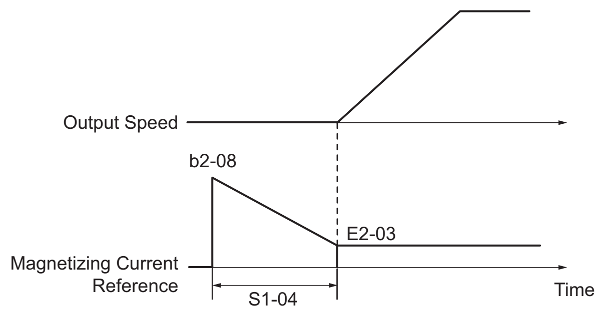


Figure 5.1 Magnetic Flux Compensation

The level of the DC current injected to the motor is limited to 80% of the drive rated current or to the motor rated current, whichever value is smaller.

Note: **1.** If b2-08 is set below 100%, it can take a relatively long time for flux to develop.
2. If b2-08 is set to 0%, the DC current level will be the DC Injection current set to S1-02.
3. As DC Injection can generate a fair amount of noise, b2-08 may need to be adjusted to keep noise levels acceptable.

◆ b4: Delay Timers

The timer function is independent of drive operation and can delay the switching of a digital output triggered by a digital input signal and help eliminate chattering switch noise from sensors. An on-delay and off-delay can be set separately.

To enable the timer function, set a multi-function input to Timer input (H1-☐☐=18) and set a multi-function output to Timer output (H2-☐☐=12). Only one timer can be used.

■ b4-01, b4-02: Timer Function On-Delay, Off-Delay Time

b4-01 sets the on-delay time for switching the timer output. b4-02 sets the off-delay time for switching the timer output.

No.	Parameter Name	Setting Range	Default
b4-01	Timer Function On-Delay Time	0.0 to 3000.0 s	0.0 s
b4-02	Timer Function Off-Delay Time	0.0 to 3000.0 s	0.0 s

■ Timer Function Operation

The timer function switches on when the timer function input closes for longer than the value set to b4-01. The timer function switches off when the timer function input is open for longer than the value set to b4-02. *Figure 5.2* illustrates the timer function operation:

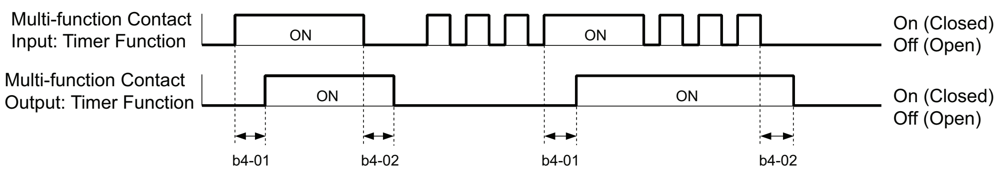


Figure 5.2 Timer Operation

◆ b6: Dwell Function

The Dwell function temporarily holds the frequency reference at a predefined value for a set time then continues accelerating or decelerating.

Figure 5.3 shows how the Dwell function works.

Note: Set the stopping method to "Ramp to Stop" (b1-03 = 0) to use the Dwell function.

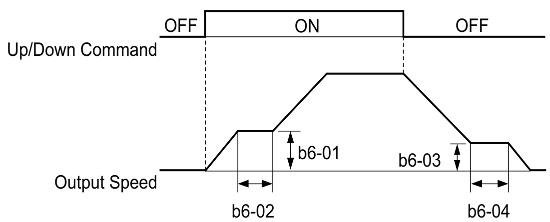


Figure 5.3 Dwell Function at Start and Stop

■ b6-01, b6-02: Dwell Speed, Dwell Time at Start

Parameter b6-01 determines the speed that is held or the time set in b6-02 during acceleration.

No.	Parameter Name	Setting Range	Default
b6-01	Dwell Speed at Start	0.0 to 100.0% <1>	0.0%
b6-02	Dwell Time at Start	0.0 to 10.0 s	0.0 s

<1> A setting of 100% is equal to the maximum speed.

■ b6-03, b6-04: Dwell Speed, Dwell Time at Stop

Parameter b6-03 determines the speed that is held for the time set in b6-04 during deceleration.

No.	Parameter Name	Setting Range	Default
b6-03	Dwell Speed at Stop	0.0 to 100.0% <1>	0.0%
b6-04	Dwell Time at Stop	0.0 to 10.0 s	0.0 s

<1> A setting of 100% is equal to the maximum speed.

◆ b7: Droop Control (CLV/PM)

Droop control automatically balances the load level between two motors driving the same load. The drive in which Droop control is activated shifts the load from one motor to another by automatically reducing the speed when the torque reference rises, and automatically increasing the speed when the torque reference falls.

Note: Disable Inertia Compensation (n5-01 = 0) whenever using Droop control.

■ b7-01: Droop Control Gain

Sets the amount of speed reduction when the torque reference is 100%. The gain is set as a percentage of the maximum output speed. A setting of 0.0% disables the Droop control function.

No.	Parameter Name	Setting Range	Default
b7-01	Droop Control Gain	0.0 to 100.0%	0.0%

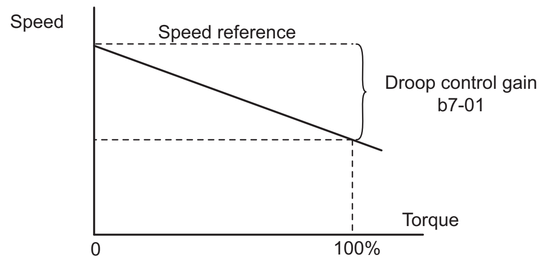


Figure 5.4 Droop Control Gain

■ b7-02: Droop Control Delay Time

Adjusts the responsiveness of Droop control. Reduce the setting if the reaction time is too long, and increase it if hunting occurs.

No.	Parameter Name	Setting Range	Default
b7-02	Droop Control Delay Time	0.03 to 2.00 s	0.05 s

◆ b8: Energy Saving

The Energy Saving function can significantly increase the efficiency of an IPM motor.

Note: The Energy Saving function should be used only with a Yaskawa IPM motor.

■ b8-01: Energy Saving Control Selection

Enables or disables the Energy Saving function.

No.	Parameter Name	Setting Range	Default
b8-01	Energy Saving Control Selection	0 or 1	0

Setting 0: Disabled
Setting 1: Enabled

■ b8-16: Energy Saving Control Constant (Ki)

Enter the Energy Saving value (Ki) as specified on the motor nameplate (for IPM motors only).

No.	Parameter Name	Setting Range	Default
b8-16	Energy Saving Control Constant (Ki)	0.00 to 2.00	0.10

■ b8-17: Energy Saving Control Constant (Kt)

Enter the Energy Saving value (Kt) as specified on the motor nameplate (for IPM motors only).

No.	Parameter Name	Setting Range	Default
b8-17	Energy Saving Control Constant (Kt)	0.00 to 2.00	1.00

5.3 C: Tuning

C parameters set the characteristics for acceleration, deceleration, and Jerk. Other parameters in the C group cover settings for slip compensation, torque compensation, and carrier frequency.

◆ C1: Acceleration and Deceleration Ramps

■ C1-01 to C1-08: Accel, Decel Ramps 1 to 4

Four different sets of acceleration and deceleration times can be set in the drive by digital inputs, motor selection, or switched automatically. Acceleration ramp parameters always set the ramp or time to accelerate from 0 to the maximum speed. Deceleration ramp parameters always set the ramp or time to decelerate from the maximum speed to 0. C1-01 and C1-02 are the default active accel/decel settings.

No.	Parameter Name	Setting Range	Default
C1-01	Acceleration Ramp 1	0.00 to 600.00 s <1>	1.50 s <1>
C1-02	Deceleration Ramp 1		
C1-03	Acceleration Ramp 2		
C1-04	Deceleration Ramp 2		
C1-05	Acceleration Ramp 3(Motor 2 Accel Time 1)		
C1-06	Deceleration Ramp 3(Motor 2 Decel Time 1)		
C1-07	Acceleration Ramp 4(Motor 2 Accel Time 2)		
C1-08	Deceleration Ramp 4(Motor 2 Decel Time 2)		

<1> The setting range and default value depend on the display units set in parameter o1-03. If o1-03 is set between 0 and 4, the time required to go from 0% speed to 100% maximum speed is expressed in seconds. If o1-03 is set to 5 or 6, then setting units will appear in m/s^2 or ft/s^2. If the drive is in V/f control mode the accel/decel ramps can be set in seconds only.

Switching Acceleration Ramps by Digital Input

Accel/decel ramps 1 are active by default if no input is set. The accel/decel ramps 2, 3, and 4 can be activated by digital inputs (H1-□□ = 7 and 1A) as explained in *Table 5.6*.

Table 5.6 Accel/Decel Ramp Selection by Digital Input

Accel/Decel Ramp Sel. 1 H1-□□ = 7	Accel/Decel Ramp Sel. 2 H1-□□ = 1A	Active Ramps	
		Acceleration	Deceleration
0	0	C1-01	C1-02
1	0	C1-03	C1-04
0	1	C1-05	C1-06
1	1	C1-07	C1-08

Figure 5.5 shows an operation example for changing accel/decel ramps. The example below requires that the stopping method be set for “Ramp to stop” (b1-03 = 0).

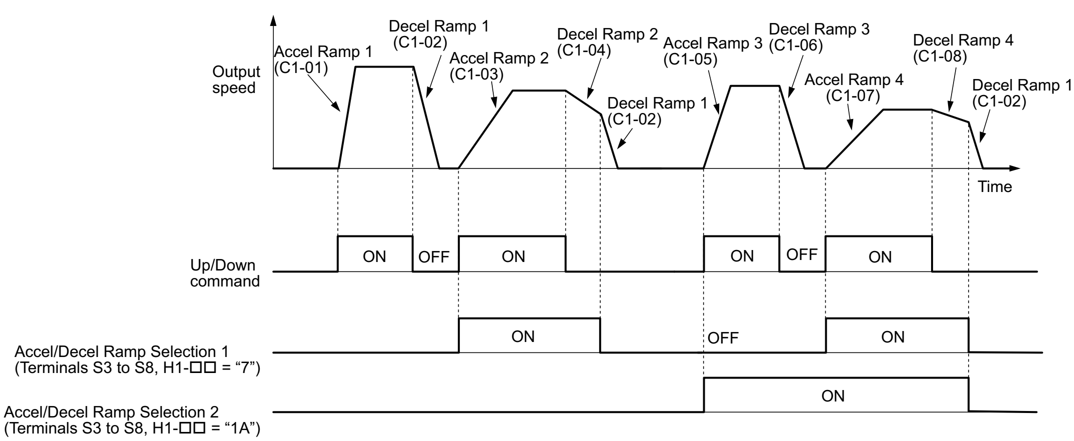


Figure 5.5 Timing Diagram of Accel/Decel Ramp Change

Switching Acceleration and Deceleration Times by Motor Selection

When switching between motor 1 and 2 using a digital input (H1-☐☐= 16), parameters C1-01 to C1-04 become accel/decel times 1 and 2 for motor 1, while C1-05 to C1-08 become accel/decel times 1 and 2 for motor 2. Accel/decel times 1 and 2 can be switched for each motor using a digital inputs set to H1-☐☐ = 7 like shown in *Table 5.7*.

Note: **1.** The motor 2 selection function cannot be used when PM motor is used.
2. The digital input setting "Accel/Decel time 2 selection" (H1-☐☐ = 1A) cannot be used together with motor 1/2 switching. Trying to do so triggers an oPE03 error, indicating a contradictory multifunction input settings.
3. The acceleration rate switch is disabled if the S3-21 "Dwell 2 End Speed" is set to any other value other than 0.

Table 5.7 Motor Switching and Accel/Decel Time Combinations

Accel/Decel Time 1 (H1-☐☐ = 7)	Motor 1 Selected (Terminal set to H1-☐☐=16 OFF)		Motor 2 Selected (Terminal set to H1-☐☐=16 ON)	
	Accel	Decel	Accel	Decel
Open	C1-01	C1-02	C1-05	C1-06
Closed	C1-03	C1-04	C1-07	C1-08

Switching Accel/Decel Ramps by a Speed Level

The drive can switch between different acceleration and deceleration ramps automatically. The drive will switch from accel/decel ramp 4 in C1-07 and C1-08 to the default accel/decel ramp in C1-01 and C1-02 when the output speed exceeds the speed level set in parameter C1-11. When it falls below this level, the accel/decel ramps are switched back. *Figure 5.6* shows an operation example.

Note: **1.** Acceleration and deceleration ramps selected by digital inputs have priority over the automatic switching by the speed level set to C1-11. For example, if accel/decel ramp 2 is selected, the drive will use this time only and not switch from accel/decel ramp 4 to the selected one.
2. The acceleration rate switch is disabled if the S3-21 (Dwell 2 End Speed) is set to any other value other than 0.

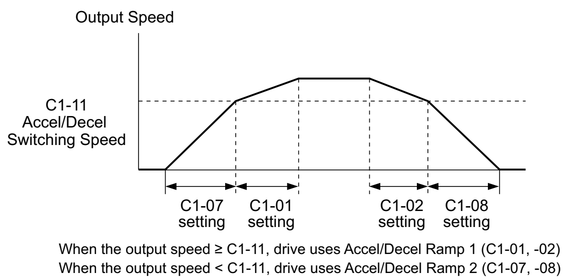


Figure 5.6 Accel/Decel Switching Speed

■ C1-11: Accel/Decel Switching Speed

Sets the speed at which the drive switches between accel/decel ramp settings. *Refer to Switching Accel/Decel Ramps by a Speed Level on page 167*.

No.	Parameter Name	Setting Range	Default
C1-11	Accel/Decel Switching Speed	0.0 to 100.0%	0.0%

Note: Setting C1-11 to 0.0% disables this function.

■ C1-09: Fast Stop Ramp

Sets a special deceleration used when a select group of faults occur or when closing a digital input configured as H1-☐☐ = 15 (N.O. input) or 17 (N.C. input). A momentary closure of the digital input will trigger the Fast Stop operation; it does not have to be closed continuously. The drive cannot be restarted after initiating a Fast Stop operation until after completing deceleration, clearing the Fast Stop input, and cycling the Up/Down command.

A Fast Stop can be selected as the action the drive should take when certain faults occur, such as L8-03 (Overheat Pre-Alarm Operation Selection).

No.	Parameter Name	Setting Range	Default
C1-09	Fast Stop Ramp	0.0 to 600.0 s <1>	1.50 s <1>

<1> The setting range and default value depend on the display units set in parameter o1-03. If o1-03 is set between 0 and 4, the time required to go from 0% speed to 100% maximum speed is expressed in seconds. If o1-03 is set to 5 or 6, then setting units will appear in m/s^2 or ft/s^2. If the drive is in V/f control mode, the Fast stop ramp can be set in seconds only.

NOTICE: *Rapid deceleration can trigger an overvoltage fault. The drive output shuts off when faulted and the motor coasts. Set an appropriate Fast Stop time to C1-09 to avoid this uncontrolled motor state and to ensure that the motor stops quickly and safely.*

■ C1-10: Accel/Decel Setting Resolution

Determines the units for the acceleration and deceleration ramps set to C1-01 through C1-09 using parameter C1-10.

No.	Parameter Name	Setting Range	Default
C1-10	Accel/Decel Setting Resolution	0 or 1	0

Setting 0: Two decimal places

Setting 1: One decimal place

■ C1-12/C1-13: Motor 2 Acceleration Time/Motor 2 Deceleration Time

Sets the accel/decel time when motor 2 has been selected using one of the multi-function input terminals (H1-□□=16).

No.	Parameter Name	Setting Range	Default
C1-12	Motor 2 Acceleration Time	0.00 to 600.00 s	1.00
C1-13	Motor 2 Deceleration Time	0.00 to 600.00 s	1.00

■ C1-15: Inspection Deceleration Ramp

Sets the deceleration ramp during Inspection Run. Refer to *Inspection Operation on page 124* for details.

No.	Parameter Name	Setting Range	Default
C1-15	Inspection Deceleration Ramp	0.00 to 2.00 s <1>	0.00 s <1>

<1> The setting range and default value depend on the display units set in parameter o1-03. If o1-03 is set between 0 and 4, the time required to go from 0% speed to 100% maximum speed is expressed in seconds. If o1-03 is set to 5 or 6, then setting units will appear in m/s^2 or ft/s^2. If the drive is in V/f control mode, the inspection deceleration ramp can be set in seconds only.

◆ C2: Jerk Settings

Jerk settings set the transition between acceleration rates. Adjust them to smooth out jerks or shocks that occur when the speed is changed.

■ C2-01 to C2-05: Jerk Settings

C2-01 through C2-05 set separate jerks for each section of the acceleration or deceleration.

No.	Parameter Name	Setting Range	Default
C2-01	Jerk at Accel Start	0.00 to 10.00 s <1>	0.50 s <1>
C2-02	Jerk at Accel End		
C2-03	Jerk at Decel Start		
C2-04	Jerk at Decel End		
C2-05	Jerk below Leveling Speed		

<1> The setting range and default value depend on the display units set in parameter o1-03. If o1-03 is set between 0 and 4, the time required to go from 0% speed to 100% maximum speed is expressed in seconds. If o1-03 is set to 5 or 6, then setting units will appear in m/s^2 or ft/s^2.

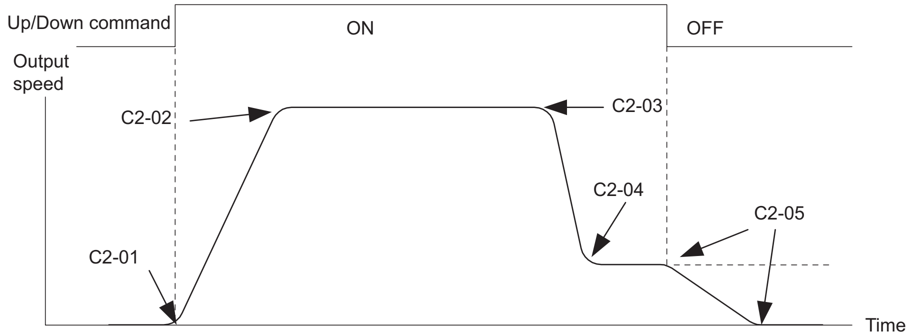


Figure 5.7 Jerk Settings

When o1-03 is set to between 0 and 4, the jerk settings are expressed in seconds. Then the actual accel/decel time including jerk settings can be calculated as follows:

Actual accel ramp = accel ramp setting + (C2-01 + C2-02) / 2

Actual decel ramp = decel ramp setting + (C2-03 + C2-04) / 2

◆ C3: Slip Compensation

The Slip Compensation function improves the speed accuracy of an induction motor. By adjusting the output speed in accordance with the motor load, it compensates the slip and makes the motor speed equal to the speed reference.

Note: Perform Auto-Tuning and make sure that the motor rated current (E2-01), the motor rated slip (E2-02), and the no-load current (E2-03) have all been set properly before making any adjustments to slip compensation parameters.

■ C3-01: Slip Compensation Gain

Sets the gain for the motor slip compensation function. Although this parameter rarely needs to be changed, adjustments may be necessary under the following circumstances:

- Increase the setting if the motor at constant speed is slower than the speed reference.
- Decrease the setting if the motor at constant speed is faster than the speed reference.

No.	Parameter Name	Setting Range	Default
C3-01	Slip Compensation Gain	0.0 to 2.5	1.0

■ C3-02: Slip Compensation Primary Delay Time

Adjusts the filter on the output side of the slip compensation function. Although this parameter rarely needs to be changed, adjustment may help in the following situations:

- Decrease the setting when the slip compensation response is too slow.
- Increase this setting when speed is unstable.

No.	Parameter Name	Setting Range	Default
C3-02	Slip Compensation Primary Delay Time	0 to 10000 ms	2000 ms

■ C3-03: Slip Compensation Limit

Sets the upper limit for the slip compensation function as a percentage of the motor rated slip (E2-02).

No.	Parameter Name	Setting Range	Default
C3-03	Slip Compensation Limit	0 to 250%	200%

The slip compensation limit is constant throughout the constant torque range (speed reference ≤ E1-06). In the constant power range (speed reference ≥ E1-06), it is increased based on C3-03 and the output speed as shown in *Figure 5.8*.

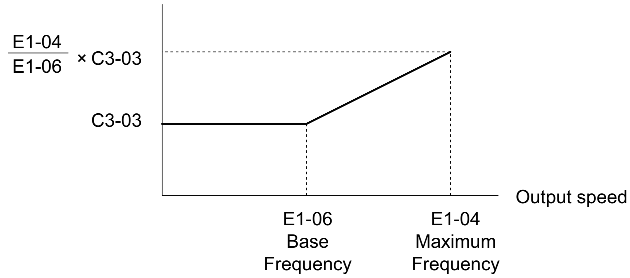


Figure 5.8 Slip Compensation Limit

■ C3-04: Slip Compensation Selection during Regeneration

Enables or disables slip compensation during regenerative operation.

This function does not operate when the output frequency is too low, regardless of whether it has been enabled.

No.	Parameter Name	Setting Range	Default
C3-04	Slip Compensation Selection during Regeneration	0 to 2	0

Setting 0: Disabled

Slip compensation is not provided. The actual motor speed might be higher than the speed reference.

Setting 1: Enabled (6 Hz and above)

Slip compensation is enabled during regenerative operation. It will not be active at output frequencies below 6 Hz.

Setting 2: Enabled (compensation provided wherever possible)

Slip compensation is enabled during regenerative operation and at frequencies as low as 2 Hz. The drive uses the motor rated slip set to E2-02 to automatically calculate the frequency range where compensation will be disabled.

■ C3-05: Output Voltage Limit Operation Selection

Determines if the motor flux reference is automatically reduced when output voltage reaches the saturation range.

If the input power supply voltage is low or the motor has a high voltage rating, this function improves the speed precision when moving heavy loads at high speeds. When selecting the drive, remember that the reduction in flux causes a slightly higher current at high speed when this function is enabled.

No.	Parameter Name	Setting Range	Default
C3-05	Output Voltage Limit Operation Selection	0 or 1	Determined by A1-02

Setting 0: Disabled

Setting 1: Enabled

■ C3-21: Motor 2 Slip Compensation Gain

Used to improve speed accuracy for motor 2. Functions in the same way that C3-01 functions for motor 1.

Adjust this parameter only after the motor rated current (E4-01), motor rated slip (E4-02), and the motor no-load current (E4-03) have all been set.

Refer to *C3-01: Slip Compensation Gain on page 169* for details on adjusting this parameter.

No.	Parameter Name	Setting Range	Default
C3-21	Motor 2 Slip Compensation Gain	0.0 to 2.5	Determined by E3-01

Note: Default setting is 0.0 in V/f Control (A1-02 = 0). Default setting is 1.0 in Open Loop Vector Control (A1-02 = 2) and Closed Loop Vector Control (A1-02 = 3). In Closed Loop Vector Control, slip compensation gain acts as an adaptable gain.

■ C3-22: Motor 2 Slip Compensation Primary Delay Time

Functions for motor 2 in the same way that C3-02 functions for motor 1.

Refer to *C3-02: Slip Compensation Primary Delay Time on page 169* for instructions on how to adjust this parameter.

No.	Parameter Name	Setting Range	Default
C3-22	Motor 2 Slip Compensation Primary Delay Time	0 to 10000 ms	Determined by A1-02

Note: The default for V/f Control (A1-02 = 0) is 2000 ms. The default for Open Loop Vector Control (A1-02 = 2) is 200 ms.

■ C3-23: Motor 2 Slip Compensation Limit

Sets the upper limit for the slip compensation function as a percentage of the motor rated slip (E4-02).

No.	Parameter Name	Setting Range	Default
C3-23	Motor 2 Slip Compensation Limit	0 to 250%	200%

The slip compensation limit is constant throughout the constant torque range (frequency reference ≤ E3-06). In the constant power range (frequency reference ≥ E3-06), it is increased based on C3-23 and the output frequency as shown in the following diagram.

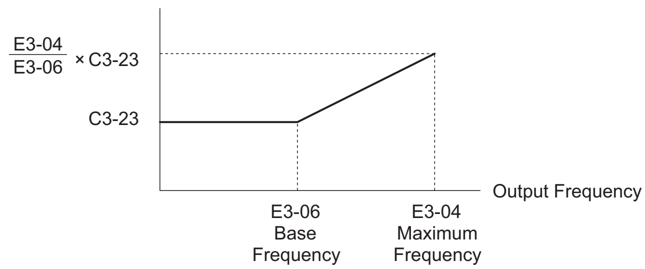


Figure 5.9 Slip Compensation Limit

◆ C4: Torque Compensation

The torque compensation function compensates for insufficient torque production at start-up or when a load is applied.

Note: Set the motor parameters and V/f pattern properly before setting torque compensation parameters.

■ C4-01: Torque Compensation Gain

Sets the gain for the torque compensation function.

No.	Parameter Name	Setting Range	Default
C4-01	Torque Compensation Gain	0.00 to 2.50	1.00

Torque Compensation in V/f:

The drive calculates the motor primary voltage loss using the output current and the line to line resistance (E2-05) and then adjusts the output voltage to compensate insufficient torque at start or when load is applied. The effects of this voltage compensation can be increased or decreased using parameter C4-01.

Torque Compensation in OLV:

The drive controls the motor excitation current (d-Axis current) and torque producing current (q-Axis current) separately. Torque compensation affects the torque producing current only. C4-01 works as a factor of the torque reference value that builds the torque producing current reference.

Adjustment

Although this parameter rarely needs to be changed, it may be necessary to adjust the torque compensation gain in small steps of 0.05 in the following situations:

- Increase this setting when using a long motor cable.
- Decrease this setting when motor oscillation occurs.

Adjust C4-01 so that the output current does not exceed the drive rated current.

Note: Refrain from adjusting torque compensation in Open Loop Vector Control, as it can have a negative effect on torque accuracy.

■ C4-02: Torque Compensation Primary Delay Time

Sets the delay time used for applying torque compensation.

No.	Parameter Name	Setting Range	Default
C4-02	Torque Compensation Primary Delay Time	0 to 60000 ms	Determined by A1-02

Adjustment

Although C4-02 rarely needs to be changed, adjustments may be necessary in the following situations:

- Increase this setting if the motor vibrates.
- Decrease this setting if the motor responds too slowly to changes in the load.

■ C4-03: Torque Compensation at Forward Start

Sets the amount of torque at start in the forward direction to improve motor performance during start with a heavy load. Compensation is applied using the time constant set in parameter C4-05. Enable this function when the load pulls the motor in reverse when starting with a Forward Up/Down command. Setting of 0.0% disables this feature.

No.	Parameter Name	Setting Range	Default
C4-03	Torque Compensation at Forward Start	0.0 to 200.0%	0.0%

■ C4-04: Torque Compensation at Reverse Start

Sets the amount of torque reference at start in the reverse direction to improve motor performance during start with heavy load. Compensation is applied using the time constant set in parameter C4-05. Enable this function if the load pulls the motor in the forward direction when starting with a Reverse Up/Down command. Setting 0.0% disables this feature.

No.	Parameter Name	Setting Range	Default
C4-04	Torque Compensation at Reverse Start	-200.0 to 0.0%	0.0%

■ C4-05: Torque Compensation Time Constant

Sets the time constant for applying the torque compensation at start that is set to C4-03 and C4-04.

No.	Parameter Name	Setting Range	Default
C4-05	Torque Compensation Time Constant	0 to 200 ms	10 ms

■ C4-07: Motor 2 Torque Compensation Gain

Functions for motor 2 in the same way that C4-01 functions for motor 1.

Refer to ***C3-01: Slip Compensation Gain on page 169*** for details on adjusting this parameter.

No.	Parameter Name	Setting Range	Default
C4-07	Motor 2 Torque Compensation Gain	0.00 to 2.50	1.00

◆ C5: Speed Control Loop

The Speed Control Loop controls the motor speed in CLV and CLV/PM control modes. It adjusts torque reference in order to minimize the difference between speed reference and actual motor speed.

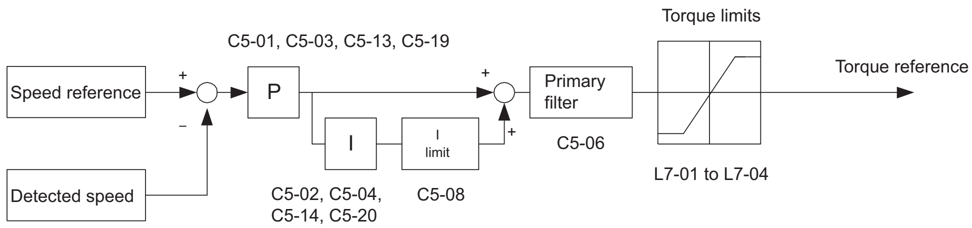


Figure 5.10 Speed Control Block Diagram

■ Adjusting the Speed Control Loop Parameters

Perform Auto-Tuning and set up all motor data correctly prior to adjusting Speed Control Loop parameters.

Analog output signals should be used to monitor the speed reference after softstarter (U1-16) and the motor speed (U1-05) when adjusting the Speed Control Loop. Refer to ***Refer to H4: Multi-Function Analog Outputs on page 210*** for details on setting up analog output functions.

Generally when tuning the Speed Control Loop, first optimize the Speed Control Loop gain, then adjust the integral time settings. Always make adjustments with the load connected to the motor.

The drive provides three different gain and integral time settings for the speed loop. They are automatically switched over if the switching speed in parameter C5-07 is set larger than 0% (default: 0% for CLV, 2% for CLV/PM). If no switching speed is defined (C5-07 = 0) the drive will use one set of speed loop parameters only (C5-01/02).

However, in order to achieve adequate performance in all sections of a trip, for the most installations it will be necessary to use two or all three sets of speed loop settings.

Additional Speed loop settings are provided for Position Lock. Those can be used to prevent rollback especially in gearless applications.

Also refer to ***C5-01, C5-03, C5-13 / C5-02, C5-04, C5-14: Speed Control Loop Proportional Gain 1, 2, 3 / Speed Control Loop Integral Time 1, 2, 3 on page 174***.

Perform the following steps for adjusting Speed Control Loop parameters:

1. Check parameter C5-07 and set a speed loop setting switching point. For CLV/PM the drive is preset to 2%. For CLV set C5-07 between 8~10%.
2. Start a trip and check for any problems like rollback, vibration, overshoot, etc.
3. Adjust C5-19/20 in order to solve rollback problems During Position Lock right before the motor starts accelerating. Increase C5-19, then shorten C5-20 if the motor rolls back right after the brake releases. Set them in the opposite way if vibration occurs. If the rollback can not be eliminated by setting C5-19/10, refer to parameters S3-01/02 (Position Lock Gains at Start).
4. Adjust C5-03/04 in order to improve the performance at start after Position Lock has been finished. Increase C5-03, then shorten C5-04 if the speed response is slow. Set them in the opposite way if vibration occurs.
5. Adjust C5-01/02 in order to solve problems that occur at speeds higher than C5-07. Increase C5-01, then shorten C5-02 if overshoot when reaching the top speed occurs. Set them in the opposite way if vibration occurs.
6. Adjust C5-13/14 in order to improve the stopping behavior. Increase C5-13, then shorten C5-14 if the landing accuracy is poor. Adjust them in the opposite way if vibrations occur. If problems can not be resolved by setting C5-13/14, refer to parameter S3-03 Position Lock Gain at Stop). Note that C5-13/14 settings will not be effective if the speed reference is set from an analog input.
7. Repeat steps 2 to 6 until the desired riding comfort has been reached. ***Refer to Riding Comfort Related Problems on page 145***.

■ C5-01, C5-03, C5-13 / C5-02, C5-04, C5-14: Speed Control Loop Proportional Gain 1, 2, 3 / Speed Control Loop Integral Time 1, 2, 3

These parameters adjust the responsiveness of the Speed Control Loop.

No.	Parameter Name	Setting Range	Default
C5-01	Speed Control Loop Proportional Gain 1	0.00 to 300.00	Determined by A1-02
C5-02	Speed Control Loop Integral Time 1	0.000 to 10.000 s	Determined by A1-02
C5-03	Speed Control Loop Proportional Gain 2	0.00 to 300.00	Determined by A1-02
C5-04	Speed Control Loop Integral Time 2	0.000 to 10.000 s	0.500 s
C5-13	Speed Control Loop Proportional Gain 3	0.00 to 300.00	Determined by A1-02
C5-14	Speed Control Loop Integral Time 3	0.000 to 10.000 s	Determined by A1-02

Speed Control Loop Gain Tuning (C5-01, C5-03, C5-13)

The higher this setting, the faster the speed response, although a setting that is too high can lead to oscillation.

Speed Control Loop Integral Time Tuning (C5-02, C5-04, C5-14)

Determines how fast a continuous speed deviation problem is eliminated. A setting that is too long reduces the responsiveness of the speed control. A setting that is too short can cause oscillation.

■ C5-06: Speed Control Loop Primary Delay Time Constant

Sets the filter time constant for the time from the speed loop to the torque command output. Increase this setting gradually in increments of 0.01 for loads with low rigidity or when oscillation is a problem. This parameter rarely needs to be changed.

No.	Parameter Name	Setting Range	Default
C5-06	Speed Control Loop Primary Delay Time Constant	0.000 to 0.500 s	0.004 s

■ C5-07: Speed Control Settings Switching Speed

Sets the speed where the drive should switch between Speed Control Loop proportional gain 1, 2, and 3 (C5-01, C5-03, and C5-13) as well as between integral time 1, 2, and 3 (C5-02, C5-04, and C5-14).

No.	Parameter Name	Setting Range	Default
C5-07	Speed Control Settings Switching Speed	0.0 to 100.0%	Determined by A1-02

Switching Between Speed Loop Settings Accel/Decel

Switching between speed loop settings helps to achieve optimal performance and riding comfort in all sections of a trip. If C5-07 is set higher than 0% then the speed loop settings automatically change with the output speed as shown in *Figure 5.11* and *Figure 5.12*.

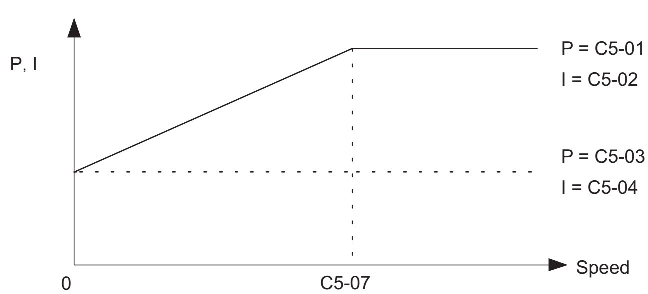


Figure 5.11 Settings at Low and High Speed during Acceleration

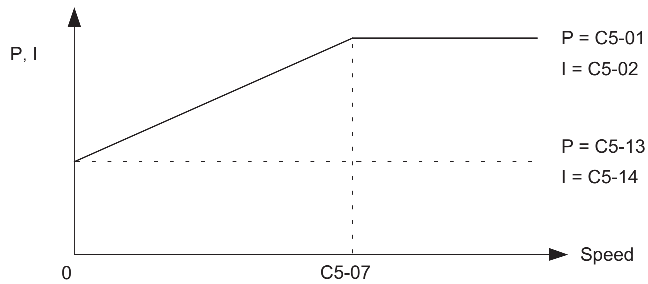


Figure 5.12 Settings at Low and High Speed during Deceleration (Leveling Speed is Selected)

■ C5-08: Speed Control Loop Integral Limit

Sets the upper limit for Speed Control Loop output as a percentage of the rated torque.

No.	Parameter Name	Setting Range	Default
C5-08	Speed Control Loop Integral Limit	0 to 400%	400%

■ C5-16: Speed Control Loop Delay Time during Position Lock

Adjusts the delay applied to the torque reference output from Speed Control Loop during Position Lock. Increase this setting gradually in increments of 0.01 when vibration is a problem. This parameter rarely needs to be changed.

No.	Parameter Name	Setting Range	Default
C5-16	Speed Control Loop Delay Time during Position Lock	0.000 to 0.500 s	0.000 s

■ C5-17, C5-18: Motor Inertia, Load Inertia Ratio

C5-17 and C5-18 determine the ratio of the machine inertia and the inertia of the motor being used.

No.	Parameter Name	Setting Range	Default
C5-17	Motor Inertia	0.0001 to 600.00 kgm^2	Determined by C6-01 and o2-04
C5-18	Load Inertia Ratio	0.0 to 6000.0	1.0

■ C5-19, C5-20: Speed Control Loop P Gain Time, I Time during Position Lock

These parameters adjust the responsiveness of Speed Control Loop during Position Lock. Increase C5-19 and shorten C5-20 if the motor rolls back immediately after the brake releases. Decrease C5-19 and lengthen C5-20 if vibrations occur.

No.	Parameter Name	Setting Range	Default
C5-19	Speed Control Loop Proportional Gain Time during Position Lock	0.00 to 300.00	Determined by A1-02
C5-20	Speed Control Loop Integral Time during Position Lock	0.000 to 10.000 s	0.100 s

■ C5-50: Set Vibrational Frequency

Sets the mechanical vibration filter frequency. Mechanical resonance may cause a humming sound or vibration while the motor is running. A vibrational frequency filter can be used to suppress certain audible noise or vibration due to mechanical resonance.

A setting of 0 will disable this parameter.

No.	Parameter Name	Setting Range	Default
C5-50	Set Vibrational Frequency	0 Hz; 20 to 1000 Hz	0 Hz

NOTICE: *Test equipment may be required to determine the mechanical frequency. Setting C5-50 to an improper frequency will result in ineffective filtering of the effects of mechanical resonance.*

◆ C6: Carrier Frequency

■ C6-03: Carrier Frequency

Sets the carrier frequency.

No.	Parameter Name	Setting Range	Default
C6-03	Carrier Frequency	1.0 to 15.0 kHz	Determined by o2-04

■ C6-06: PWM Method

Determines how the drive should perform pulse width modulation.

No.	Parameter Name	Setting Range	Default
C6-06	PWM Method	0 to 2	0

Setting 0: 2-phase/3-phase conversion

Setting 1: 2-phase modulation

Setting 2: 3-phase modulation

Note: The drive rated output current is reduced with setting 2. Contact Yaskawa or a Yaskawa representative for details.

■ C6-09: Carrier Frequency during Rotational Auto-Tuning

Determines the carrier frequency while performing Rotational Auto-Tuning. Although this parameter rarely needs to be changed, when overcurrent problems occur when Auto-Tuning a low impedance motor, it may be helpful to set C6-03 to a high value before setting C6-09 to 1.

No.	Parameter Name	Setting Range	Default
C6-09	Carrier Frequency during Rotational Auto-Tuning	0 or 1	0

Setting 0: 5 kHz

Setting 1: Same value set to C6-03

■ C6-21: Inspection Operation Carrier Frequency

Sets the carrier frequency during Inspection Run.

No.	Parameter Name	Setting Range	Default
C6-21	Inspection Operation Carrier Frequency	0 or 1	1

Setting 0: Use the value set to C6-03

Setting 1: 2 kHz

■ C6-23: Carrier Frequency during Initial Motor Pole Search

Sets the carrier frequency when estimating the initial polarity.

No.	Parameter Name	Setting Range	Default
C6-23	Carrier Frequency during Initial Motor Pole Search	0 or 1	0

Setting 0: 2 kHz

Setting 1: Use the value set to C6-03

■ C6-31: Carrier Frequency during Rescue Operation

Sets the carrier frequency during Rescue Operation.

No.	Parameter Name	Setting Range	Default
C6-31	Carrier Frequency during Rescue Operation	0, 1	0

Setting 0: Use the value set to C6-03

Setting 1: 2 kHz

5.4 d: Reference Settings

The d parameters determine the speed of the elevator including the speed reference and Field Forcing settings for motor response.

◆ d1: Speed Reference

The d1 parameter group is used to set the speed reference. Switch the multi-function input contact terminals to create a multi-step speed sequence using the various references set to the d1 parameters.

■ d1-01 to d1-08: Speed References 1 to 8

These parameters set speed references 1 through 8. Each of these speed reference values can be selected using digital inputs programmed for multi-speed selection (H1-□□ = 3, 4, 5).

No.	Parameter Name	Setting Range	Default
d1-01 to d1-08	Speed Reference 1 to 8	0.00 to 100.00% <1>	0.00% <1>

<1> Setting units and the default setting are determined by parameter o1-03. ***Refer to Defaults and Setting Ranges by Display Unit Selection (o1-03) on page 416*** for details.

Refer to Multi-Speed Inputs 1, 2 (d1-18 = 0 or 3) on page 121 for details.

■ d1-18: Speed Reference Selection Mode

Sets the priority of the speed reference inputs.

NOTICE: *Always turn off the RUN command before changing the setting of parameters d1-18 (Speed Reference Selection Mode), b1-01 (Speed Reference Selection), or H1-□□ (Multi-Function Digital Inputs). If the RUN command is on when changing any of these settings, the motor may unexpectedly start running, and could result in injury.*

No.	Parameter Name	Setting Range	Default
d1-18	Speed Reference Selection Mode	0 to 3	0

Setting 0: Use multi-speed references d1-01 to d1-08

Up to eight separate preset speed references can be programmed to the drive using parameters d1-01 through d1-08 and can be selected using binary coded digital inputs. When d1-18 is set to “0”, parameters d1-19 through d1-23 are not displayed. ***Refer to Multi-Speed Inputs 1, 2 (d1-18 = 0 or 3) on page 121*** for details.

Setting 1: High speed reference has priority

Six different speeds (d1-19 to d1-23, d1-26) can be programmed to the drive and can be selected using dedicated digital inputs. Each of the speed references set to d1-19 through d1-23 takes priority over the leveling speed set to d1-26. When d1-18 is set to “1”, parameter d1-01 to d1-08 are not displayed. ***Refer to Separate Speed Inputs (d1-18 = 1 or 2) on page 122*** for details.

Setting 2: Leveling speed reference has priority

Six different speeds (d1-19 to d1-23, d1-26) can be programmed to the drive and can be selected using dedicated digital inputs. The leveling speed reference in d1-26, however, takes priority over all other speed references when enabled via one of the multi-function input terminals (H1-□□ = 53). When d1-18 is set to “2”, parameters d1-01 to d1-08 are not displayed. ***Refer to Separate Speed Inputs (d1-18 = 1 or 2) on page 122*** for details.

Setting 3: Use multi-speed references d1-02 to d1-08, no speed selection stops the drive

Up to seven separate preset speed references can be programmed to the drive using parameters d1-02 through d1-08 can be selected using binary coded digital inputs. When d1-18 is set to “3”, parameters d1-19 through d1-23 are not displayed. ***Refer to Multi-Speed Inputs 1, 2 (d1-18 = 0 or 3) on page 121*** for details.

■ d1-19: Nominal Speed

Sets the nominal speed when a multi-function input terminal is programmed for “Nominal speed” (H1-□□ = 50).

No.	Parameter Name	Setting Range	Default
d1-19	Nominal Speed	0.00 to 100.00% <1>	100.00% <1>

<1> Setting ranges and defaults vary by the setting units determined by parameter o1-03. ***Refer to Defaults and Setting Ranges by Display Unit Selection (o1-03) on page 416*** for details.

■ d1-20, d1-21, d1-22: Intermediate Speeds 1 to 3

Sets intermediate speeds 1 through 3.

No.	Parameter Name	Setting Range	Default
d1-20	Intermediate Speed 1	0.00 to 100.00% <1>	0.00% <1>
d1-21	Intermediate Speed 2	0.00 to 100.00% <1>	0.00% <1>
d1-22	Intermediate Speed 3	0.00 to 100.00% <1>	0.00% <1>

<1> Setting ranges and defaults vary by the setting units determined by parameter o1-03. ***Refer to Defaults and Setting Ranges by Display Unit Selection (o1-03) on page 416*** for details.

■ d1-23: Releveling Speed

Sets the releveling speed when a multi-function input terminal is programmed for “Releveling speed” (H1-□□ = 52).

No.	Parameter Name	Setting Range	Default
d1-23	Releveling Speed	0.00 to 100.00% <1>	0.00% <1>

<1> Setting ranges and defaults vary by the setting units determined by parameter o1-03. ***Refer to Defaults and Setting Ranges by Display Unit Selection (o1-03) on page 416*** for details.

■ d1-24: Inspection Operation Speed

Sets the inspection speed when a multi-function input terminal is programmed for “Inspection speed” (H1-□□ = 54). A description of the inspection speed can be found in ***Inspection Operation on page 124***.

No.	Parameter Name	Setting Range	Default
d1-24	Inspection Operation Speed	0.00 to 100.00% <1>	50.00% <1>

<1> Setting ranges and defaults vary by the setting units determined by parameter o1-03. ***Refer to Defaults and Setting Ranges by Display Unit Selection (o1-03) on page 416*** for details.

■ d1-25: Rescue Operation Speed

Determines the speed during Rescue Operation. ***Refer to Rescue Operation on page 131*** for details.

No.	Parameter Name	Setting Range	Default
d1-25	Rescue Operation Speed	0.00 to 100.00% <1>	10.00% <1>

<1> Setting ranges and defaults vary by the setting units determined by parameter o1-03. ***Refer to Defaults and Setting Ranges by Display Unit Selection (o1-03) on page 416*** for details.

■ d1-26: Leveling Speed

Sets the leveling speed when a multi-function input terminal is programmed for “Leveling speed” (H1-□□ = 53).

No.	Parameter Name	Setting Range	Default
d1-26	Leveling Speed	0.00 to 100.00% <1>	8.00% <1>

<1> Setting ranges and defaults vary by the setting units determined by parameter o1-03. ***Refer to Defaults and Setting Ranges by Display Unit Selection (o1-03) on page 416*** for details.

■ Motor Switch Selection

When an input terminal selects motor 2 (H1-□□ = 16), the drive will operate a second motor using V/f Control. The drive cannot control motor 2 with OLV, CLV or CLV/PM.

The motor 2 speed reference in d1-27 can also be used to operate motor 1 using V/f Control. Refer to ***Table 5.8*** for combinations of selecting the speed reference for motor 2 and the motor 1/2 selection switch. (H1-□□ = 16).

Table 5.8 Speed Reference for Motor 2, Controlling Motor 1 and 2

The value set to d1-27	Speed reference	Control mode	Accel/Decel ramp	S-character/ Jerk	Contactor/ Brake sequence	Purpose
0.00	speed reference set to Motor 1	V/f with motor 1 <1>	C1-01 to C1-08	C2-01 to C2-05	Available	Hoist
not 0.00	d1-27	V/f with motor 2	C1-12/C1-13	N.A.	N.A.	Not for hoist

<1> Enter the same values to the E3 and E4 parameters that are set for the E1 and E2 parameters.

■ d1-27: Motor 2 Speed Reference

Sets the speed reference for motor 2.

No.	Parameter Name	Setting Range	Default
d1-27	Motor 2 Speed Reference	0.00 to 120.00 Hz	0.00 Hz

Note:
1. The drive will control motor 1 when this parameter is set to 0.00.
2. Set the accel/decel times in parameters C1-12 and C1-13 when using motor 2.
3. When motor 2 is selected, the following monitors will display values in Hz: U1-01, U1-02, U1-05, U4-19, U4-20.

■ d1-28: Leveling Speed Detection Level

When the speed priority selection in d1-18 is set to “0” or “3” and the speed reference value falls below the level set in d1-28, the drive interprets the selected speed as leveling speed. This parameter must be set to use the Speed Control Loop setting 3 when d1-18 = 0/3. ***Refer to C5: Speed Control Loop on page 169*** for details.

No.	Parameter Name	Setting Range	Default
d1-28	Leveling Speed Detection Level	0.0 to 100.0%	0.0%

■ d1-29: Inspection Speed Detection Level

When the speed priority selection in d1-18 is set to “0” or “3” and the speed reference value is below the level set in d1-29 but higher than the level set in d1-28, the drive interprets the selected speed as inspection speed. This parameter must be set to use the Inspection Operation function when d1-18 = 0/3. ***Refer to Inspection Operation on page 124*** for details.

No.	Parameter Name	Setting Range	Default
d1-29	Inspection Speed Detection Level	0.0 to 100.0%	0.0%

◆ d6: Field Forcing

Field Forcing

The Field Forcing function compensates the delaying influence of the motor time constant when changing the excitation current reference. Field Forcing can improve the motor responsiveness. It is ineffective during DC Injection Braking.

■ d6-03: Field Forcing Selection

Enables or disables the Field Forcing function.

No.	Parameter Name	Setting Range	Default
d6-03	Field Forcing Selection	0 or 1	0

Setting 0: Disabled
Setting 1: Enabled

■ d6-06: Field Forcing Limit

Sets the maximum level at which the Field Forcing function can boost the excitation current reference. The value is set as a percentage of the motor no load current. This parameter does not normally need to be changed.

No.	Parameter Name	Setting Range	Default
d6-06	Field Forcing Limit	100 to 400%	400%

5.5 E: Motor Parameters

E parameters cover V/f pattern and motor data settings.

◆ E1: V/f Pattern

■ E1-01: Input Voltage Setting

Adjusts the levels of some protective features of the drive (overvoltage, Stall Prevention, etc.). Set this parameter to the nominal voltage of the AC power supply.

NOTICE: *Set parameter E1-01 to match the input voltage of the drive. The drive input voltage (not motor voltage) must be set in E1-01 for the protective features to function properly. Failure to set the correct drive input voltage will result in improper drive operation.*

No.	Parameter Name	Setting Range	Default
E1-01 <1>	Input Voltage Setting	155 to 255 V	230 V

<1> Values shown here are specific to 200 V class drives; double the values for 400 V class drives.

E1-01 Related Values

For 400 V class drives, the input voltage setting determines the undervoltage detection levels.

Voltage	Setting Value of E1-01	(Approximate Values)		
		ov Detection Level	Braking Transistor Operation Level <1>	Uv Detection Level (L2-05)
200 V Class	All settings	410 V	394 V	190 V
400 V Class	setting ≥ 400 V	820 V	788 V	380 V
	setting < 400 V	820 V	788 V	350 V

<1> The braking transistor operation levels are valid for the internal braking transistor of the drive. When using an external CDBR braking chopper, refer to the instruction manual of that unit.

■ E1-03: V/f Pattern Selection

No.	Parameter Name	Setting Range	Default
E1-03	V/f Pattern Selection	F	F

Note: Parameter is not reset to the default value when the drive is initialized using A1-03.

■ V/f Pattern Settings E1-04 to E1-13

Figure 5.13 illustrates the V/f pattern setting.

NOTICE: *The motor may require more acceleration torque with drive operation than with a commercial power supply. Set a proper V/f pattern by checking the load torque characteristics of the elevator to be used with the motor.*

No.	Parameter Name	Setting Range	Default
E1-04	Maximum Output Frequency	10.0 to 120.0 Hz <1>	<2>
E1-05	Maximum Voltage	0.0 to 255.0 V <3>	230.0 V <3>
E1-06	Base Frequency	0.0 to 120.0 Hz	<2>
E1-07	Middle Output Frequency	0.0 to 120.0 Hz	3.0 Hz
E1-08	Middle Output Frequency Voltage	0.0 to 255.0 V <3>	<2> <3> <4>
E1-09	Minimum Output Frequency	0.0 to 120.0 Hz	<2>
E1-10	Minimum Output Frequency Voltage	0.0 to 255.0 V <3>	<2> <3> <4>
E1-11 <5>	Middle Output Frequency 2	0.0 to 120.0 Hz	0.0 Hz
E1-12 <5>	Middle Output Frequency Voltage 2	0.0 to 255.0 V <3>	0.0 V <3>
E1-13	Base Voltage	0.0 to 255.0 V <3>	0.0 V <3> <6>

<1> Setting range depends on the control mode being used. CLV allows a setting range of 10.0 to 120.0 Hz, while CLV/PM allows a setting range of 4.0 to 120.0 Hz.
<2> Default setting is determined by the control mode (A1-02).
<3> Values shown here are for 200 V class drives. Double values when using a 400 V class unit.
<4> Default setting is determined by the drive model (o2-04).
<5> Parameter ignored when E1-11 and E1-12 are set to 0.0.
<6> Auto-Tuning will set E1-13 to the same value as E1-05.

The availability of the following parameters depends on the control mode.

No.	V/f	OLV	CLV	CLV/PM
E1-07	Yes	Yes	N/A	N/A
E1-08	Yes	Yes	N/A	N/A
E1-10	Yes	Yes	N/A	N/A
E1-11	Yes	Yes	Yes	N/A
E1-12	Yes	Yes	Yes	N/A
E1-13	Yes	Yes	Yes	N/A

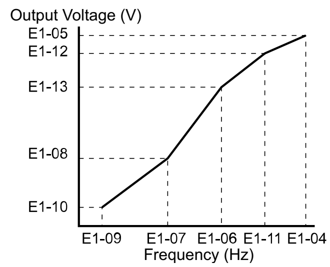


Figure 5.13 V/f Pattern

Note:
1. The following condition must be true when setting up the V/f pattern: E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04
2. To make the V/f pattern a straight line below E1-06, set E1-09 = E1-07. In this case the E1-08 setting is disregarded.
3. E1-03 is unaffected when the parameters are initialized using parameter A1-03, but the settings for E1-04 through E1-13 are returned to their default values.
4. Parameters E1-11, E1-12, and E1-13 should only be used to fine-tune the V/f pattern in the constant output range. These parameters rarely need to be changed.

◆ E2: Motor Parameters

These parameters contain the motor data for induction motors. They are set automatically when Auto-Tuning is performed (this includes Rotational Auto-Tuning, Stationary Auto-Tuning 1 and 2). ***Refer to Auto-Tuning Fault Detection on page 297*** if Auto-Tuning cannot be performed.

Note: As the motor parameters for a PM motor are set up in the E5-□□ parameters, parameters for induction motors (E2-□□) are hidden when a PM motor control mode is selected (i.e., parameter A1-02 is set to 7).

■ E2-01: Motor Rated Current

Used to protect the motor and calculate torque limits. Set E2-01 to the full load amps (FLA) stamped on the motor nameplate. If Auto-Tuning completes successfully, the value entered to T1-04 will automatically be saved to E2-01.

No.	Parameter Name	Setting Range	Default
E2-01	Motor Rated Current	10% to 200% of the drive rated current.	Determined by o2-04

Note:
1. The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.
2. Setting the motor rated current in E2-01 lower than the motor no-load current in E2-03 will trigger an oPE02 error. Set E2-03 correctly to prevent this error.

■ E2-02: Motor Rated Slip

Sets the motor rated slip in Hz to protect the motor and calculate torque limits. This value is automatically set during Auto-Tuning (Rotational Auto-Tuning, Stationary Auto-Tuning 1 and 2).

No.	Parameter Name	Setting Range	Default
E2-02	Motor Rated Slip	0.00 to 20.00 Hz	Determined by o2-04

■ E2-03: Motor No-Load Current

Set the no-load current for the motor in amperes when operating at the rated frequency and the no-load voltage. The drive sets E2-03 during the Auto-Tuning process (Rotational Auto-Tuning and Stationary Auto-Tuning 1, 2). The motor no-load current listed in the motor test report can also be entered to E2-03 manually. Contact the motor manufacturer to receive a copy of the motor test report.

No.	Parameter Name	Setting Range	Default
E2-03	Motor No-Load Current	0 to [E2-01]	Determined by o2-04

Note: The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.

■ E2-04: Number of Motor Poles

Set the number of motor poles to E2-04. If Auto-Tuning completes successfully, the value entered to T1-06 will automatically be saved to E2-04.

No.	Parameter Name	Setting Range	Default
E2-04	Number of Motor Poles	2 to 48	4

■ E2-05: Motor Line-to-Line Resistance

Sets the line-to-line resistance of the motor stator winding. If Auto-Tuning completes successfully, this value is automatically calculated. Enter this value as line-to-line and not for each motor phase.

If Auto-Tuning is not possible, contact the motor manufacturer to find out the line-to-line resistance or measure it manually. When using the manufacturer motor test report, calculate E2-05 by one of the formulas below:

- E-type insulation: Multiply 0.92 times the resistance value (Ω) listed on the test report at 75 °C.
- B-type insulation: Multiply 0.92 times the resistance value (Ω) listed on the test report at 75 °C.
- F-type insulation: Multiply 0.87 times the resistance value (Ω) listed on the test report at 115 °C.

No.	Parameter Name	Setting Range	Default
E2-05	Motor Line-to-Line Resistance	0.000 to 65.000 Ω	Determined by o2-04

■ E2-06: Motor Leakage Inductance

Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage. This value is automatically set during Auto-Tuning (Rotational Auto-Tuning, Stationary Auto-Tuning 1, 2).

No.	Parameter Name	Setting Range	Default
E2-06	Motor Leakage Inductance	0.0 to 40.0%	Determined by o2-04

■ E2-07: Motor Iron-Core Saturation Coefficient 1

Sets the motor iron saturation coefficient at 50% of the magnetic flux. If Rotational Auto-Tuning completes successfully, then this value is automatically calculated and set to E2-07. This coefficient is used when operating with constant output.

No.	Parameter Name	Setting Range	Default
E2-07	Motor Iron-Core Saturation Coefficient 1	0.00 to 0.50	0.50

■ E2-08: Motor Iron-Core Saturation Coefficient 2

Sets the motor iron saturation coefficient at 75% of the magnetic flux. If Rotational Auto-Tuning completes successfully, then this value is automatically and set to E2-08. This coefficient is used when operating with constant output.

No.	Parameter Name	Setting Range	Default
E2-08	Motor Iron-Core Saturation Coefficient 2	E2-07 to 0.75	0.75

■ E2-09: Motor Mechanical Loss

There is normally no need to change this parameter from the default value. This parameter sets to the motor mechanical loss as a percentage of motor rated power (kW) capacity.

Adjust this setting when there is a large amount of torque loss due to motor bearing friction.
The setting for the mechanical loss is added to the torque.

No.	Parameter Name	Setting Range	Default
E2-09	Motor Mechanical Loss	0.0 to 10.0%	0.0%

■ E2-10: Motor Iron Loss for Torque Compensation

Sets the motor iron loss in watts.

No.	Parameter Name	Setting Range	Default
E2-10	Motor Iron Loss for Torque Compensation	0 to 65535 W	Determined by o2-04

■ E2-11: Motor Rated Power

Sets the motor rated power in kW. If Auto-Tuning completes successfully, the value entered to T1-02 will automatically be saved to E2-11.

No.	Parameter Name	Setting Range	Default
E2-11	Motor Rated Power	0.00 to 650.00 kW	Determined by o2-04

■ Setting Motor Parameters Manually

Follow the instructions below when setting motor-related parameters manually instead of Auto-Tuning. Refer to the motor test report included with the motor to ensure the correct data is entered into the drive.

Setting the Motor Rated Current

Enter the motor rated current listed on the nameplate of the motor to E2-01.

Setting the Motor Rated Slip

Calculate the motor rated slip using the base speed listed on the motor nameplate. Refer to the formula below, then enter that value to E2-02.

Motor rated slip = rated frequency [Hz] –base speed [r/min] × (no. of motor poles) / 120

Setting the No-Load Current

Enter the no-load current at rated frequency and rated voltage to E2-03. The no-load current is not usually listed on the nameplate. Contact the motor manufacturer if the data cannot be found.

The default setting of the no-load current is for performance with a 4-pole Yaskawa motor.

Setting the Number of Motor Poles

Only required in V/f Control with PG and Closed Loop Vector Control. Enter the number of motor poles as indicated on motor nameplate.

Setting the Line-to-Line Resistance

E2-05 is normally set during Auto-Tuning. If Auto-Tuning cannot be performed, contact the motor manufacturer to determine the correct resistance between motor lines. The motor test report can also be used to calculate this value using the formulas below:

- E-type insulation: Multiply 0.92 times the resistance value (Ω) listed on the test report at 75 °C.
- B-type insulation: Multiply 0.92 times the resistance value (Ω) listed on the test report at 75 °C.
- F-type insulation: Multiply 0.87 times the resistance value (Ω) listed on the test report at 115 °C.

Setting the Motor Leakage Inductance

The motor leakage inductance set to E2-06 determines the amount of voltage drop relative to the motor rated voltage. Enter this value for motors with a low degree of inductance, such as high-speed motors. This information is usually not listed on the motor nameplate. Contact the motor manufacturer if the data cannot be found.

Setting the Motor Iron-Core Saturation Coefficient 1, 2

E2-07 and E2-08 are set when Auto-Tuning is performed.

Setting the Motor Mechanical Loss

Only required in Closed Loop Vector Control. The drive compensates for the degree of mechanical loss with torque compensation. Although E2-09 rarely needs to be changed, adjustment may benefit when there is a large amount of torque loss due to motor bearing friction.

Setting the Motor Iron Loss for Torque Compensation

Only required when using V/f Control. Enter this value in watts to E2-10. The drive uses this setting to improve the precision of torque compensation.

◆ E3: V/f Pattern for Motor 2

These parameters set the V/f pattern used for motor 2. ***Refer to Setting 16: Motor 2 selection on page 195*** for details on switching motors.

Note: The function for switching between two motors cannot be used with a PM motor. E3-☐☐ parameters are hidden when a PM motor control mode is selected (A1-02 = 7).

■ E3-04 to E3-10

Parameters E3-04 through E3-10 set up the V/f pattern used for motor 2 as shown in ***Figure 5.14***.

Note: Certain E3-☐☐ parameters might not be visible depending on the control mode. ***Refer to Parameter List on page 365*** for details.

No.	Parameter Name	Setting Range	Default
E3-04	Motor 2 Max Output Frequency	10.0 to 120.0 Hz	60.0 Hz
E3-05	Motor 2 Max Voltage	0.0 to 255.0 V <1>	230.0 V
E3-06	Motor 2 Base Frequency	0.0 to 120.0 Hz	60.0 Hz
E3-07	Motor 2 Mid Output Frequency	0.0 to 120.0 Hz	3.0 Hz
E3-08	Motor 2 Mid Output Frequency Voltage	0 to 255.0 V <1>	<2>
E3-09	Motor 2 Minimum Output Frequency	0.0 to 120.0 Hz	1.5 Hz
E3-10	Motor 2 Minimum Output Frequency Voltage	0.0 to 255.0 V <1>	<2>

<1> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<2> Default setting value is dependent on the drive model (o2-04).

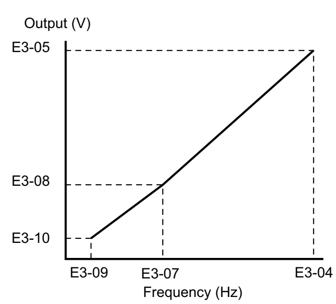


Figure 5.14 V/f Pattern for Motor 2

Note:
1. The following conditions must be true when setting up the V/f pattern: E3-09 ≤ E3-07 < E3-06 ≤ E3-04
2. To make the V/f pattern a straight line at a frequency lower than E3-07, set E3-09 equal to E3-07. In this case the E3-08 setting is disregarded.
3. Parameters E3-04 through E3-10 are reset to their default values when the drive is initialized.

◆ E4: Motor 2 Parameters

E4 parameters contain the motor data for motor 2. These parameters are usually set automatically during the Auto-Tuning process for vector control modes (Rotational Auto-Tuning, Stationary Auto-Tuning 1 and 2). *Refer to Auto-Tuning Fault Detection on page 297* if Auto-Tuning cannot be performed.

Note: The function for switching between two motors cannot be used with a PM motor. E4-□□ parameters are hidden when a PM motor control mode is selected (A1-02 = 7).

■ E4-01: Motor 2 Rated Current

Protects the motor and calculates torque limits. Set E4-01 to the full load amps (FLA) stamped on the nameplate of motor 2.

If Auto-Tuning completes successfully, the value entered to T1-04 will automatically be saved to E4-01.

No.	Parameter Name	Setting Range	Default
E4-01	Motor 2 Rated Current	10 to 200% of the drive rated current.	Determined by o2-04

Note: **1.** The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.
2. An oPE02 error will occur if the motor rated current in E4-01 is set lower than the motor no-load current in E4-03. Set E4-03 correctly to prevent this error.

■ E4-02: Motor 2 Rated Slip

Sets the motor 2 rated slip frequency and is the basis for slip compensation value. The drive calculates this value automatically during Auto-Tuning (Rotational Auto-Tuning and Stationary Auto-Tuning 1, 2). *Refer to E2-02: Motor Rated Slip on page 183* for information on calculating the motor rated slip.

No.	Parameter Name	Setting Range	Default
E4-02	Motor 2 Rated Slip	0.00 to 20.00 Hz	Determined by o2-04

■ E4-03: Motor 2 Rated No-Load Current

Sets the no-load current for motor 2 in amperes when operating at the rated frequency and the no-load voltage. The drive sets E2-03 during the Auto-Tuning process (Rotational Auto-Tuning and Stationary Auto-Tuning 1, 2). The motor no-load current listed in the motor test report can also be entered to E2-03 manually. Contact the motor manufacturer for a copy of the motor test report.

No.	Parameter Name	Setting Range	Default
E4-03	Motor 2 Rated No-Load Current	0 to [E4-01]	Determined by o2-04

Note: The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.

■ E4-04: Motor 2 Motor Poles

Sets the number of poles for motor 2. If Auto-Tuning completes successfully, the value entered to T1-06 will be automatically saved to E4-04.

No.	Parameter Name	Setting Range	Default
E4-04	Motor 2 Motor Poles	2 to 48	4

■ E4-05: Motor 2 Line-to-Line Resistance

Sets the line-to-line resistance for the motor 2 stator winding. If Auto-Tuning completes successfully, this value is automatically calculated. Enter this value as line-to-line and not for each motor phase. *Refer to E2-05: Motor Line-to-Line Resistance on page 184* to manually enter this parameter setting.

No.	Parameter Name	Setting Range	Default
E4-05	Motor 2 Line-to-Line Resistance	0.000 to 65.000 Ω	Determined by o2-04

■ E4-06: Motor 2 Leakage Inductance

Sets the voltage drop due to motor leakage inductance as a percentage of rated voltage of motor 2. This value is automatically set during Auto-Tuning (Rotational Auto-Tuning and Stationary Auto-Tuning 1, 2).

No.	Parameter Name	Setting Range	Default
E4-06	Motor 2 Leakage Inductance	0.0 to 40.0%	Determined by o2-04

◆ E5: PM Motor Settings

These parameters set the motor data of a PM motor.

For PM motors, Auto-Tuning can be performed. If motor data is known, it can also be entered manually.

Note: **1.** E5-□□ parameters are visible only when a PM motor control mode is selected (A1-02 = 7).
2. E5-□□ parameters are not reset when the drive is initialized using parameter A1-03.

■ E5-02: Motor Rated Power

Sets the rated power of the motor. Determined by the value set to T2-04 during the Auto-Tuning process.

No.	Parameter Name	Setting Range	Default
E5-02	Motor Rated Power	0.10 to 650.00 kW	Determined by o2-04

■ E5-03: Motor Rated Current

Sets the motor rated current in amps. Automatically set when the value is entered to T2-06 during Auto-Tuning.

No.	Parameter Name	Setting Range	Default
E5-03	Motor Rated Current	10 to 200% of drive rated current	Determined by o2-04

Note: The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.

■ E5-04: Number of Motor Poles

Sets the number of motor poles. Automatically set when the value is entered to T2-08 during Auto-Tuning.

No.	Parameter Name	Setting Range	Default
E5-04	Number of Motor Poles	2 to 120 <1>	12

<1> When PG-E3 option connected: Max. setting = 48.

■ E5-05: Motor Stator Resistance (Single Phase)

Sets the resistance for one motor phase. Do not enter the line-to-line resistance into E5-05 when measuring the resistance manually.

No.	Parameter Name	Setting Range	Default
E5-05	Motor Stator Resistance (Single Phase)	0.000 to 65.000 Ω	Determined by o2-04

■ E5-06: Motor d-Axis Inductance

Sets the d-Axis inductance in 0.01 mH units. This parameter is set during the Auto-Tuning process.

No.	Parameter Name	Setting Range	Default
E5-06	Motor d-Axis Inductance	0.00 to 600.00 mH	Determined by o2-04

■ E5-07: Motor q-Axis Inductance

Sets the q-Axis inductance in 0.01 mH units. This parameter is set during the Auto-Tuning process.

No.	Parameter Name	Setting Range	Default
E5-07	Motor q-Axis Inductance	0.00 to 600.00 mH	Determined by o2-04

■ E5-09: Motor Induction Voltage Constant 1

Sets the induced peak voltage per phase in units of 0.1 mV/(rad/s) [electrical angle]. This data can be obtained from either the motor nameplate or from the motor test report issued by the manufacturer of the motor.

No.	Parameter Name	Setting Range	Default
E5-09	Motor Induction Voltage Constant 1	0.0 to 6500.0 mV/(rad/s)	Determined by o2-04

Note: **1.** Set E5-24 to 0 when setting E5-09. However, setting both E5-09 and E5-24 to 0.0 will trigger OPE08. OPE08 will also be triggered if neither E5-09 nor E5-24 are set to 0.0.
2. This parameter is not reset when the drive is initialized using parameter A1-03.

■ E5-11: Encoder Offset

Sets the offset between the rotor magnetic axis and the Z-pulse of the encoder connected. This parameter is set during Auto-Tuning for PM motors and during Encoder Offset Tuning.

No.	Parameter Name	Setting Range	Default
E5-11	Encoder Offset	-180.0 to 180.0 deg	0.0 deg

■ E5-24: Motor Induction Voltage Constant 2

Sets the induced phase-to-phase rms voltage in units of 0.1 mV/(r/min) [mechanical angle]. This data can be obtained from either the motor nameplate or from the motor test report issued by the manufacturer of the motor.

No.	Parameter Name	Setting Range	Default
E5-24	Motor Induction Voltage Constant 2	0.0 to 6500.0 mV/(r/min)	0.0 mv/(r/min)

Note: **1.** Set E5-09 to 0.0 when setting E5-24. However, setting both E5-09 and E5-24 to 0.0 will trigger OPE08. OPE08 will also be triggered if neither E5-09 nor E5-24 are set to 0.0.
2. This parameter is not reset when the drive is initialized using parameter A1-03.

5.6 F: Option Settings

◆ F1: Encoder/PG Feedback Settings

The F1 parameters are used to set the drive up for operation using a motor encoder option card. Note that all speed feedback option cards must be connected to the CN5-C port.

■ F1-01: Encoder 1 Resolution

Sets the encoder resolution.

No.	Parameter Name	Setting Range	Default
F1-01	Encoder 1 Resolution	1 to 60000 ppr <1>	Determined by A1-02

<1> In CLV/PM mode, the maximum setting is 15000 ppr.

■ F1-02, F1-14: PG Open (PGo) Circuit Operation Selection, Detection Time

A PGo fault is triggered if the drive receives no pulse signal for longer than the time set in F1-14. Set the stopping method for a PGo fault in parameter F1-02.

No.	Parameter Name	Setting Range	Default
F1-02	Operation Selection at PG Open Circuit (PGo)	0 to 3	1
F1-14	PG Open-Circuit Detection Time	0.0 to 10.0 s	2.0 s

Parameter F1-02 Settings:

Setting 0: Ramp to stop (uses the deceleration ramp set to C1-02)

Setting 1: Coast to stop

Setting 2: Fast Stop (uses the Fast Stop ramp set to C1-09)

Setting 3: Alarm only

Note: Due to potential damage to motor and machinery, the "Alarm only" setting should be used only under special circumstances.

■ F1-03, F1-08, F1-09: Overspeed (oS) Operation Selection, Detection Level, Delay Time

An oS fault is triggered when the speed feedback exceeds the value set in F1-08 for longer than the time set in F1-09. Set the stopping method for an oS fault in parameter F1-03.

No.	Parameter Name	Setting Range	Default
F1-03	Operation Selection at Overspeed (oS)	0 to 3	1
F1-08	Overspeed Detection Level	0 to 120%	115%
F1-09	Overspeed Detection Delay Time	0.0 to 2.0 s	0.0 s

Parameter F1-03 Settings:

Setting 0: Ramp to stop (uses the deceleration ramp set to C1-02)

Setting 1: Coast to stop

Setting 2: Fast Stop (uses the Fast Stop ramp set to C1-09)

Setting 3: Alarm only

Note: Due to potential damage to motor and machinery, refrain from using the "Alarm only" setting except under special circumstances.

■ F1-04, F1-10, F1-11: Operation at Speed Deviation (dEv), Detection Level, Delay Time

A speed deviation error (dEv) is triggered when the difference between the speed reference and the speed feedback exceeds the value set in F1-10 for longer than the time set in F1-11. The stopping method when a speed deviation fault occurs can be selected in parameter F1-04.

No.	Parameter Name	Setting Range	Default
F1-04	Operation Selection at Deviation	0 to 3	3
F1-10	Excessive Speed Deviation Detection Level	0 to 50%	10%
F1-11	Excessive Speed Deviation Detection Delay Time	0.0 to 10.0 s	0.5 s

Settings for Parameter F1-04:
Setting 0: Ramp to stop (uses the deceleration ramp set to C1-02)
Setting 1: Coast to stop
Setting 2: Fast Stop (uses the Fast Stop ramp set to C1-09)
Setting 3: Alarm only (drive continues operating while “dEv” flashes on the screen)

■ F1-05: Encoder 1 Rotation Direction Selection

Determines the direction indicated by the motor encoder signal.

Refer to PG Encoder Setup on page 104 for details on how to set the direction for the encoder and the motor.

No.	Parameter Name	Setting Range	Default
F1-05	Encoder 1 Rotation Direction Selection	0 or 1	<1>

<1> Determined by the control mode: 0 when A1-02 = 3, 1 when A1-02 = 7.

Setting 0: Phase A leads phase B with an Up command.
Setting 1: Phase B leads phase A with an Up command.

■ F1-06: PG1 Pulse Monitor Output Division Ratio

Sets the ratio between the pulse input and the pulse output of a speed feedback option card as a three digit number, where the first digit (n) sets the numerator and the second and third digit (m) set the denominator as shown below:

$$f_{\text{Pulse Input}} = f_{\text{Pulse Output}} \cdot \frac{(1 + n)}{m}$$

Example: To have a ratio of 1/32 between the speed feedback option card pulse input and output, set F1-06 = 032.

No.	Parameter Name	Setting Range	Default
F1-06	PG1 Pulse Monitor Output Division Ratio	001 to 032, 102 to 132 (1 to $\frac{1}{32}$)	1

■ F1-18: dv3 Detection Selection (CLV/PM)

Sets the number of times the drive will detect a dv3 situation before triggering a dv3 fault. The drive detects a dv3 condition when the torque reference and speed reference are in opposite directions while the difference between the actual motor speed and the speed reference is greater than 30%. Setting F1-18 to 0 disables dv3 detection.

No.	Parameter Name	Setting Range	Default
F1-18	dv3 Detection Selection	0 to 10	10

Note: A common cause for a dv3 fault is the incorrect setting of E5-11. Make sure the correct encoder offset has been entered to E5-11.

■ F1-19: dv4 Detection Selection (CLV/PM)

Sets the number of pulses necessary to trigger a dv4 fault when there is a motor speed deviation opposite to the frequency reference. Setting F1-19 to 0 disables dv4 detection.

No.	Parameter Name	Setting Range	Default
F1-19	dv4 Detection Selection	0 to 5000	128

Note: A common cause for a dv4 fault is the incorrect setting of E5-11. Make sure the correct encoder offset is set to E5-11.

■ F1-20: PG Option Card Disconnect Detection 1

Sets whether the drive detects a fault when a speed feedback card is disconnected.

No.	Parameter Name	Setting Range	Default
F1-20	PG Option Card Disconnect Detect 1	0 or 1	1

Setting 0: Disabled

Setting 1: Enabled

■ F1-29: dEv Detection Condition Selection

Selects when dEv error detection is active.

No.	Parameter Name	Setting Range	Default
F1-29	dEv Detection Condition Selection	0 to 2	2

Setting 0: After speed reference, SFS output and motor speed have matched once.

Setting 1: After speed reference, SFS output have matched once.

Setting 2: Always during Run.

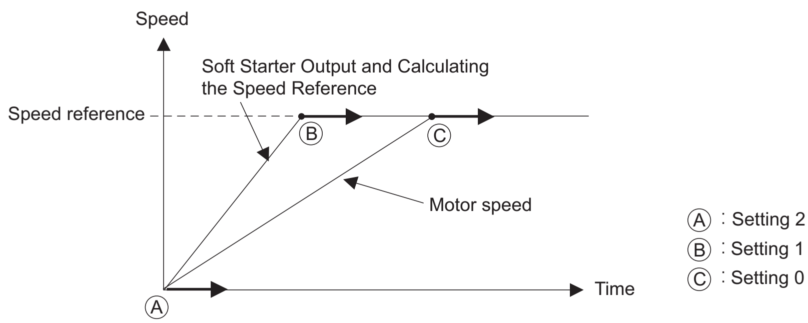


Figure 5.15 Speed Deviation Detection Conditions Flowchart

■ F1-50: Encoder Selection

Sets up the type of encoder connected to a PG-F3 option card.

No.	Parameter Name	Setting Range	Default
F1-50	Encoder Selection	0 to 2	0

Setting 0: EnDat 2.1/01, 2.2/01 Serial Communications operation + Sin/Cos

Setting 1: EnDat 2.2/22 Serial Communications operation

Setting 2: Hiperface

The use of EnDat2.2/22 encoders requires a PG-F3 option with software version 0102 or later.
To identify the PG-F3 software version refer to the PG-F3 labeling in the field designated "C/N" (S + four digit number)."

■ F1-51: PGoH Detection Level

Sets the level for detecting PG Hardware Fault (PGoH).

Usually the relation between the sin and cos track is $\sqrt{\sin^2\theta + \cos^2\theta} = 1$. If the value of the square root falls below the level set in F1-51, a speed feedback hardware fault is detected. Available when F1-20 = 1.

No.	Parameter Name	Setting Range	Default
F1-51	PGoH Detection Level	1 to 100%	80%

■ F1-52: Communication Speed of Serial Encoder Selection

Selects the speed for serial communication between a PG-F3 option card and serial encoder.

No.	Parameter Name	Setting Range	Default
F1-52	Communication Speed of Serial Encoder Selection	0 to 3	0

Setting 0: 1M bps / 9600 bps (EnDat 2.2/22 / Hiperface)
Setting 1: 500k bps / 19200 bps (EnDat 2.2/22 / Hiperface)
Setting 2: 1M bps / 38400 bps (EnDat 2.2/22 / Hiperface)
Setting 3: 1M bps / 38400 bps (EnDat 2.2/22 / Hiperface)

■ F1-63: PG-E3 R Track Selection

Enables or disables the R phase when a PG-E3 option card is used.

No.	Parameter Name	Setting Range	Default
F1-63	PG-E3 R Track Selection	0, 1	0

Setting 0: Disabled

The R track is not used. The rotor magnet position is calculated from the C and D track signal only.

Setting 1: Enabled

The R track signals are used to determine the rotor magnet position.

■ F1-66 to F1-81: Encoder Adjust 1 to 16

Sets encoder offsets 1 to 16 for the PG-E3 option card. These parameters are automatically set by the execution of Auto-Tuning of PG-E3 encoder characteristics.

No.	Parameter Name	Setting Range	Default
F1-66 to F1-81	Enoder Adjust 1 to 16	0 to FFFF	0

◆ F3: Digital Input Card Settings

These parameters set up the drive for operation with the option card DI-A3. Refer to the instruction manual packaged with the option card for specific details on installation, wiring, input signal level selection, and parameter setup.

■ F3-01: DI-A3 Option Card Input Selection

Determines the type of input for digital option card DI-A3 when o1-03 is set to 0 or 1.

No.	Parameter Name	Setting Range	Default
F3-01	DI-A3 Option Card Input Selection	0 to 7	0

Setting 0: BCD, 1% units
Setting 1: BCD, 0.1% units
Setting 2: BCD, 0.01% units
Setting 3: BCD, 1 Hz units
Setting 4: BCD, 0.1 Hz units
Setting 5: BCD, 0.01 Hz units
Setting 6: BCD, special setting (5 digit input), 0.02 Hz units
Setting 7: Binary

The unit and the setting range are determined by F3-03.
F3-03 = 0: 255/100% (-255 to +255)
F3-03 = 1: 4095/100% (-4095 to +4095)
F3-03 = 2: 30000/100% (-33000 to +33000)

Note: BCD input when o1-03 = 2 or 3. Units are determined by o1-03.

■ F3-03: DI-A3 Option Card Data Length Selection

Determines the number of bits for the option card input that sets the speed reference.

No.	Parameter Name	Setting Range	Default
F3-03	DI-A3 Option Card Data Length Selection	0 to 2	2

Setting 0: 8 bit
Setting 1: 12 bit
Setting 2: 16 bit

◆ F4: Analog Monitor Card Settings

These parameters set up the drive for operation with the analog output option card AO-A3. Refer to the instruction manual packaged with the option card for specific details on installation, wiring, input signal level selection, and parameter setup.

■ F4-01, F4-03: Terminal V1, V2 Function Selection

Selects the data to output from analog terminal V1. Enter□ the final three digits of U□-□□ to determine which monitor data is output from the option card. Some monitors are only available in certain control modes.

No.	Parameter Name	Setting Range	Default
F4-01	Terminal V1 Function Selection	000 to 999	102
F4-03	Terminal V2 Function Selection	000 to 999	103

■ F4-02, F4-04, F4-05, F4-06: Terminal V1, V2 Gain and Bias

Parameters F4-02 and F4-04 determine the gain, while parameters F4-05 and F4-06 set the bias. These parameters are set as a percentage of the output signal from V1 and V2 where 100% equals 10 V output. The terminal output voltage is limited to 10 V.

No.	Parameter Name	Setting Range	Default
F4-02	Terminal V1 Gain	-999.9 to 999.9%	100.0%
F4-04	Terminal V2 Gain	-999.9 to 999.9%	50.0%
F4-05	Terminal V1 Bias	-999.9 to 999.9%	0.0%
F4-06	Terminal V2 Bias	-999.9 to 999.9%	0.0%

Using Gain and Bias to Adjust Output Signal Level

The output signal is adjustable while the drive is stopped.

Terminal V1

1. View the value set to F4-02 (Terminal V1 Monitor Gain) on the digital operator. A voltage equal to 100% of the parameter being set in F4-01 is output at terminal V1.
2. Adjust F4-02 while viewing the monitor connected to the terminal V1.
3. View the value set to F4-05 on the digital operator. Terminal V1 outputs a voltage equal to 0% of the monitor selected by the setting value of F4-01.
4. Adjust F4-05 while viewing the output signal on the terminal V1.

Terminal V2

1. View the value set to F4-02 (Terminal V2 Monitor Gain) on the digital operator. A voltage equal to 100% of the parameter being viewed in F4-03 is output at terminal V2.
2. Adjust F4-04 while viewing the monitor connected to the terminal V2.
3. View the value set to F4-06 on the digital operator. Terminal V2 will output a voltage equal to 0% of the monitor selected by the setting value of F4-03.
4. Adjust F4-06 while viewing the output signal on the terminal V2.

■ F4-07, F4-08: Terminal V1, V2 Signal Level Selection

Sets the output signal level for terminals V1 and V2.

No.	Parameter Name	Setting Range	Default
F4-07	Terminal V1 Signal Level Selection	0, 1	1
F4-08	Terminal V2 Signal Level Selection	0, 1	1

Setting 0: 0 to 10 V

Setting 1: -10 to 10 V

◆ F5: Digital Output Card Settings

These parameters set up the drive for operation with the digital output option card DO-A3. Refer to the instruction manual packaged with the option card for specific details on installation, wiring, input signal level selection, and parameter setup.

■ F5-01 through F5-08: Digital Output Option Card Terminal Function Selection

When F5-09 = 2, the parameters listed in the table below are used to assign functions to the output terminals on the option card.

No.	Parameter Name	Setting Range	Default
F5-01	Terminal P1-PC Output Selection	0 to 161	0: During run
F5-02	Terminal P2-PC Output Selection	0 to 161	1: Zero speed
F5-03	Terminal P3-PC Output Selection	0 to 161	2: Speed agree 1
F5-04	Terminal P4-PC Output Selection	0 to 161	4: Speed detection 1
F5-05	Terminal P5-PC Output Selection	0 to 161	6: Drive ready (READY)
F5-06	Terminal P6-PC Output Selection	0 to 161	37: During frequency output
F5-07	Terminal M1-M2 Output Selection	0 to 161	F: Not used
F5-08	Terminal M3-M4 Output Selection	0 to 161	F: Not used

■ F5-09: DO-A3 Output Mode Selection

Determines how the DO-A3 option card works with the drive.

No.	Parameter Name	Setting Range	Default
F5-09	DO-A3 Output Mode Selection	0 to 2	0

Setting 0: Separate output functions for each of 8 terminals

Setting 1: Binary output

Setting 2: Output functions assigned by F5-01 through F5-08

◆ F6: Communication Option Card

These parameters configure communication option cards and communication fault detection methods.

■ F6-01: Operation Selection after Communications Error

Determines drive operation when a communication error occurs.

No.	Parameter Name	Setting Range	Default
F6-01	Operation Selection after Communications Error	0 to 3	1

Setting 0: Ramp to stop (uses the deceleration ramp set to C1-02)

Setting 1: Coast to stop

Setting 2: Fast Stop (uses the Fast Stop ramp set to C1-09)

Setting 3: Alarm only (continue operation)

■ F6-02: External Fault from Communication Option Detection Selection

Determines the detection method of an external fault (EF0) initiated by a communication option card.

No.	Parameter Name	Setting Range	Default
F6-02	External Fault from Communication Option Detection Selection	0 or 1	0

Setting 0: Always detected

Setting 1: Detection during run only

■ F6-03: External Fault from Communication Option Operation Selection

Determines drive operation when an external fault is initiated by a communication option (EF0).

No.	Parameter Name	Setting Range	Default
F6-03	External Fault from Communication Option Operation Selection	0 to 3	1

Setting 0: Ramp to stop (uses the deceleration ramp set to C1-02)

Setting 1: Coast to stop

Setting 2: Fast Stop (uses the Fast Stop ramp set to C1-09)

Setting 3: Alarm only (continue operation)

■ F6-04: bUS Error Detection Time

Sets the delay time for bUS error detection.

No.	Parameter Name	Setting Range	Default
F6-04	bUS Error Detection Time	0.0 to 5.0 s	2.0 s

■ F6-06: Torque Limit Selection from Communications Option

Selects whether torque limit values are assigned to the drive from the network.

No.	Parameter Name	Setting Range	Default
F6-06	Torque Limit Selection from Communications Option	0, 1	0

Setting 0: Disabled

Setting 1: Enabled

■ F6-08: Reset Communication Parameters

Determines whether F6-☐☐ communication-related parameters are reset after initialization.

No.	Parameter Name	Setting Range	Default
F6-08	Reset Communication Parameters	0, 1	0

Setting 0: Do not reset parameters F6-☐☐ when the drive is initialized with A1-03

Setting 1: Reset F6-☐☐ when the drive is initialized with A1-03

Note: F6-08 is not reset when the drive is initialized.

◆ CANopen Parameters

Parameters F6-35 and F6-36 set up the drive to operate on a CANopen network.

Refer to the Yaskawa AC Drive Option CANopen Installation Manual and Technical Manual for details on parameter settings.

5.7 H: Terminal Functions

H parameters are used to assign functions to the external terminals.

◆ H1: Multi-Function Digital Inputs

NOTICE: *Always turn off the RUN command before changing the setting of parameters d1-18 (Speed Reference Selection Mode), b1-01 (Speed Reference Selection), or H1-□□ (Multi-Function Digital Inputs). If the RUN command is on when changing any of these settings, the motor may unexpectedly start running, and could result in injury.*

■ H1-03 to H1-08: Functions for Terminals S3 to S8

These parameters assign functions to the multi-function digital inputs. The various functions and their settings are listed in ***Table 5.9***.

No.	Parameter Name	Setting Range	Default
H1-03	Terminal S3 Function Selection	3 to 79	Determined by d1-18 <1>
H1-04	Terminal S4 Function Selection	3 to 79	
H1-05	Terminal S5 Function Selection	3 to 79	
H1-06	Terminal S6 Function Selection	3 to 79	
H1-07	Terminal S7 Function Selection	3 to 79	
H1-08	Terminal S8 Function Selection	3 to 79	F: Through Mode

<1> With the speed reference priority d1-18 is set to 0 or 3, the default settings for parameters H1-03 to H1-07 governing input terminals S3 to S7 are: 24, 14, 3, 4, and 5 respectively. When d1-18 is set to 1 or 2, the default settings for H1-03 to H1-07 become 50, 54, 51, 53, and F respectively.

Table 5.9 Multi-Function Digital Input Terminal Settings

Setting	Function	Page	Setting	Function	Page
3	Multi-Step Speed Reference 1	197	20 to 2F	External Fault	200
4	Multi-Step Speed Reference 2		50	Nominal Speed	200
5	Multi-Step Speed Reference 3		51	Intermediate Speed	200
6	Jog reference selection	197	52	Releveling Speed	200
7	Accel/decel Ramp Selection 1	198	53	Leveling Speed	201
8	Baseblock Command (N.O.)	198	54	Inspection Operation	201
9	Baseblock Command (N.C.)		55	Rescue Operation	201
F	Not used (Through Mode)	198	56	Motor Contactor Feedback	201
14	Fault Reset	198	57	High Speed Limit Up	201
15	Fast Stop (N.O.)	198	58	High Speed Limit Down	201
16	Motor 2 selection	199	5A	Motor Contactor Feedback 2	201
17	Fast Stop (N.C.)	198	5B	Brake Feedback 2	201
18	Timer Function Input	199	5C	Stop Distance Correction	201
1A	Accel/decel Ramp Selection 2	199	67	Communications Test Mode	201
			79	Brake Feedback	201

Setting 3 to 5: Multi-Step Speed Reference 1 to 3

Switches multi-step speed frequency references d1-01 to d1-08 by digital inputs. ***Refer to Speed Selection Using Digital Inputs (b1-01 = 0) on page 121*** for details.

Setting 6: Jog reference selection

When the speed reference is not assigned to the input terminals (b1-01 ≠ 1), then the Jog frequency will be activated every time an input terminal set for the Jog frequency reference closes. Note that the speed reference priority selection in d1-18 may disable the Jog frequency.

Table 5.10 Speed Reference Priority and Jog Frequency

d1-18 (Speed Reference Selection Mode)	Jog Frequency
0	Multi-speed references take priority, and the leveling speed in d1-26 is used for the Jog frequency.
1	Jog frequency cannot be used.
2	Jog frequency cannot be used.

d1-18 (Speed Reference Selection Mode)	Jog Frequency
3	Multi-speed references take priority, and the leveling speed in d1-26 is used for the Jog frequency.

Setting 7: Accel/decel ramp selection 1

Switches between accel/decel times 1 (C1-01 and C1-02) and 2 (C1-03 and C1-04). ***Refer to C1-01 to C1-08: Accel, Decel Ramps 1 to 4 on page 162*** for details.

Setting 8, 9: Baseblock command

When the drive receives a baseblock command, the output transistors stop switching, the motor coasts to stop, and a bb alarm flashes on the digital operator to indicate baseblock.

DIgital Input Function	Drive Operation	
	Input Open	Input Closed
Setting 8 (N.O.)	Baseblock (Interrupt output)	Normal operation
Setting 9 (N.C.)	Normal operation	Baseblock (Interrupt output)

WARNING! *Sudden Movement Hazard. When using a mechanical holding brake with the drive in a lifting application, close the brake when the drive output is cut off by a baseblock command triggered by one of the input terminals. Failure to comply will result in a slipping load from the motor suddenly coasting when the baseblock command is entered and may cause serious injury or death.*

Setting F: Not used (Through mode)

Select this setting when the terminal is not used or when using the terminal in the pass-through mode. When set to F, an input does not trigger any function in the drive. Setting F, however, still allows the input status to be read out by a PLC via a communication option or MEMOBUS/Modbus communications.

Setting 14: Fault reset

When the drive detects a fault condition, the fault output contact closes, the drive output shuts off, and the motor coasts to stop (specific stopping methods can be selected for some faults such as L1-04 for motor overheat). After removing the Up/Down command, clear the fault either by pressing the RESET key on the digital operator or closing a digital input configured as a Fault Reset (H1-☐☐ = 14).

Note: Remove the Up/Down command prior to resetting a fault. Fault Reset commands are ignored while the Up/Down command is present.

Setting 15, 17: Fast Stop (N.O., N.C.)

The Fast Stop function operates similar to an emergency stop input to the drive. If a Fast Stop command is input while the drive is running, the drive decelerates to a stop in the deceleration time set to C1-09 (***Refer to C1-09: Fast Stop Ramp on page 163***). The drive can only be restarted after bringing the drive to a complete stop, turning off the Fast Stop input, and switching off the Up/Down command.

- To trigger the Fast Stop function with a N.O. switch, set H1-☐☐ = 15.
- To trigger the Fast Stop function with a N.C. switch, set H1-☐☐ = 17.

Figure 5.16 shows an operation example of Fast Stop.

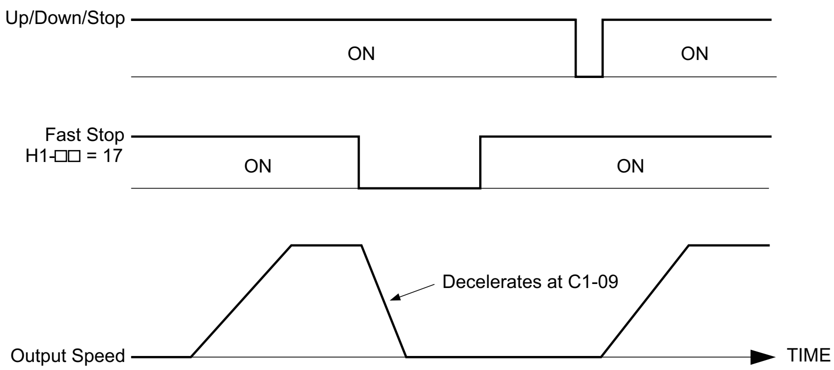


Figure 5.16 Fast Stop Sequence

NOTICE: *Rapid deceleration can trigger an overvoltage fault. When faulted, the drive output shuts off, and the motor coasts. To avoid this uncontrolled motor state and to ensure that the motor stops quickly and safely, set an appropriate Fast Stop time to C1-09.*

Setting 16: Motor 2 selection

The drive has the capability to control two induction motors independently. A second motor may be selected using a multi-function digital input as shown in *Figure 5.17*.

Note: The motor 2 selection function cannot be used when PM motor is used.

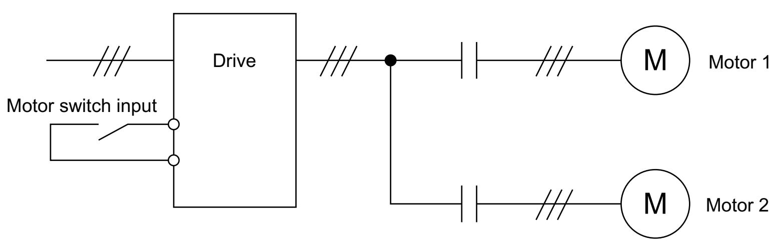


Figure 5.17 Motor Selection

When switching between motor 1 and motor 2, the parameters used to control those motors also change. Below, *Table 5.11* lists the parameters that correspond to each motor.

Table 5.11 Parameters for Switching Between Two Motors

No.	Setting 16 Open (Motor 1)	⇒	Setting 16 Closed (Motor 2)
C1-□□: Acceleration/Deceleration Time	C1-01 to C1-04	⇒	C1-12 to C1-13
E1-□□, E3-□□: V/f Pattern E2-□□, E4-□□: Motor Parameters	E1-□□, E3-□□	⇒	E3-□□, E4-□□

Note:
1. The drive can switch from motor 2 to operate motor 1 in V/f Control based on the speed reference set for motor 2. *Refer to Motor Switch Selection on page 176* for details.
2. It is not possible to switch between motor 1 and motor 2 during run. Doing so will trigger the "rUn" alarm.
3. It is not possible to switch between motors when CLV/PM control mode is selected.
4. The motor 2 selection function is available only with OLV control mode (A1-02 = 0).
5. When switching from motor 1 to motor 2, check to make sure that motor 2 is operating.

If a digital output is programmed for "Motor 2 selection" (H1-01, H1-02, or H1-03 = 1C), motor will be selected when the output is closed.

Setting 18: Timer function input

This setting configures a digital input terminal as the input for the timer function. Use this setting combination with the timer function output (H2-□□ = 12). *Refer to b4: Delay Timers on page 159* for details.

Setting 1A: Accel/decel ramp selection 2

Used to select accel/decel ramps 1 to 4 in combination with the Accel/decel ramp selection 1 command. *Refer to C1-01 to C1-08: Accel, Decel Ramps 1 to 4 on page 162* for details.

Setting 20 to 2F: External fault

The External fault command stops the drive when problems occur with external devices.

To use the External fault command, set one of the multi-function digital inputs to any value between 20 to 2F. The digital operator will display EF☐ where ☐ is the number of the terminal to which the external fault signal is assigned.

For example, if an external fault signal is input to terminal “EF3” will be displayed.,

Select the value to be set in H1-☐☐ from a combination of any of the following three conditions:

- Signal input level from peripheral devices (N.O., N.C.)
- External fault detection method
- Operation after external fault detection

The following table shows the relationship between the conditions and the value set to H1-☐☐.

Terminal statuses, detection conditions, and stopping methods marked with an “O” are applicable to the corresponding settings.

Setting	Terminal Status <1>		Detection Conditions <2>		Stopping Method			
	N.O.	N.C.	Always Detected	Detected during Run only	Ramp to Stop (fault)	Coast to Stop (fault)	Fast Stop (fault)	Alarm Only (continue running)
20	O		O		O			
21		O	O		O			
22	O			O	O			
23		O		O	O			
24	O		O			O		
25		O	O			O		
26	O			O		O		
27		O		O		O		
28	O		O				O	
29		O	O				O	
2A	O			O			O	
2B		O		O			O	
2C	O		O					O
2D		O	O					O
2E	O			O				O
2F		O		O				O

<1> Determines the terminal status for each fault, i.e., whether the terminal is normally open or normally closed.
<2> Determines whether detection for each fault should be enabled only during run or always detected.

Setting 50: Nominal speed

Closing a terminal set for “Nominal speed” makes the drive run at the speed reference set to d1-19. Conditions change, however, according to the speed selection mode set in d1-18. ***Refer to Multi-Speed Inputs 1, 2 (d1-18 = 0 or 3) on page 121*** for details.

Setting 51: Intermediate speed

Closing a terminal set for “Intermediate speed” makes the drive run at the speed reference set to d1-20. This setting can also be used in combination with other input terminals set for 50 (Nominal speed) and 52 (Releveling speed) to switch between the speed reference set in d1-21 and d1-22. Conditions change, however, according to the speed selection mode set in d1-18. ***Refer to Multi-Speed Inputs 1, 2 (d1-18 = 0 or 3) on page 121***. for details

Setting 52: Releveling speed

Closing a terminal set for “Releveling speed” makes the drive run at the speed reference set to d1-23. Conditions change, however, according to the speed selection mode set in d1-18. ***Refer to Multi-Speed Inputs 1, 2 (d1-18 = 0 or 3) on page 121*** for details.

Setting 53: Leveling speed

Closing a terminal set for “Leveling speed” makes the drive run at the speed reference set to d1-26. Conditions change, however, according to the speed selection mode set in d1-18. *Refer to Multi-Speed Inputs 1, 2 (d1-18 = 0 or 3) on page 121* for details.

Setting 54: Inspection operation

Causes the drive to operate at the speed reference set in d1-24. To use Inspection Run, this terminal must be close before the Up or Down command is entered. *Refer to Inspection Operation on page 124* for details.

Setting 55: Rescue operation

Initiates Rescue Operation when the terminal closes. *Refer to Rescue Operation on page 131* for details.

Setting 56: Motor contactor feedback

Can be used as monitoring input for the motor contactor and allows the drive to detect contactor malfunction.

Setting 57: High speed limit up

When this input is closed the speed in up direction will be limited to the leveling speed. No speed limit is applied when the car is going down.

Setting 58: High speed limit down

When this input is closed the speed in down direction will be limited to the leveling speed. No speed limit is applied when the car is going up.

Setting 5A: Motor Contactor Feedback 2

The drive monitors this input signal to detect malfunctions with the motor contactor. When the contactor is closed, the terminal is open. When the contactor is open, the contactor is closed.

Setting 5B: Brake Feedback 2

The drive confirms brake operation with this input signal when a digital output is enabled (H2-☐☐ = 50). When the brake is activated, the terminal is closed. When the brake is not activated, the terminal is open.

Setting 5C: Stop Distance Correction

When this terminal closes and a direct landing is selected for the stopping method (S5-10 = 1), the drive will stop at the designated floor with greater accuracy.

Setting 67: Communication test mode

The drive has a built-in function for self-diagnosing serial communications operation. The test involves wiring the send and receive terminals of the RS-485/422 port together. The drive transmits data and then confirms that the communications are received normally. *Refer to Self-Diagnostics on page 444* for details on how to use this function.

Setting 79: Brake feedback

This input allows the drive to monitor the brake operation and issue a fault if the brake status does not match the brake command (digital output set to H2-☐☐ = 50).

◆ H2: Multi-Function Digital Outputs

■ H2-01 to H2-05: Terminals M1-M2, M3-M4, M5-M6, P1-PC, and P1-P2 Function Selection

The drive has three multi-function output terminals. *Table 5.12* lists the functions available for these terminals using H2-01 through H2-05.

No.	Parameter Name	Setting Range	Default
H2-01	Terminals M1-M2 Function Selection	0 to 161	50: Brake control
H2-02	Terminals M3-M4 Function Selection	0 to 161	51: Output control contactor
H2-03	Terminals M5-M6 Function Selection	0 to 161	6: Drive ready
H2-04	Terminals P1-C1 Function Selection (photocoupler)	0 to 161	37: During frequency output

No.	Parameter Name	Setting Range	Default
H2-05	Terminals P2-C2 Function Selection (photocoupler)	0 to 161	F: Through Mode

Table 5.12 Multi-Function Digital Output Terminal Settings

Setting	Function	Page	Setting	Function	Page
0	During Run	*202*	1B	During Baseblock 2 (N.C.)	*208*
1	Zero Speed	*202*	1C	Motor 2 Selection	*209*
2	Speed Agree 1	*203*	1D	During Regeneration	*209*
3	User-set Speed Agree 1	*204*	1E	Restart Enabled	*209*
4	Speed Detection 1	*204*	1F	Motor Overload Alarm (oL1)	*209*
5	Speed Detection 2	*204*	20	Drive Overheat Pre-alarm (oH)	*209*
6	Drive Ready (READY)	*205*	2F	Maintenance Period	*209*
7	DC Bus Undervoltage	*205*	30	During Torque Limit	*209*
8	During Baseblock (N.O.)	*205*	33	Within Position Lock Bandwidth	*209*
9	Speed Reference Source	*205*	37	During Frequency Output	*209*
A	Up/Down Command Source	*205*	50	Brake Control	*210*
B	Torque Detection 1	*206*	47	Input Phase Loss	*210*
E	Fault	*206*	4E	Braking Transistor Fault (rr)	*210*
F	Not used (Through Mode)	*206*	51	Output Contactor Control	*210*
10	Minor Fault	*206*	52	Door Zone Reached	*210*
11	Fault Reset Command Active	*206*	54	Light Load Direction	*210*
12	Timer Output	*206*	55	Light Load Direction Detection Status	*210*
13	Speed Agree 2	*206*	58	Safe Disable Status	*210*
14	User-set Speed Agree 2	*207*	5C	Motor Current Monitor	*210*
15	Speed Detection 3	*207*	60	Internal Cooling Fan Alarm	*210*
16	Speed Detection 4	*208*	61	Motor Pole Search Status	*211*
18	Torque Detection 2	*206*	100 to 161	Functions 0 to 61 with Inverse Output	*211*
1A	During Reverse	*208*			

Setting 0: During Run

Output closes when the drive is outputting a voltage.

Status	Description
Open	Drive is stopped.
Closed	An Up/Down command is input or the drive is during deceleration or during DC injection.

Setting 1: Zero Speed

Terminal closes whenever the output speed or motor speed (CLV, CLV/PM) becomes less than the minimum output speed set to E1-09 or S1-01.

Status	Description
Open	The operating speed is greater than the minimum output frequency (E1-09) or the zero speed level at stop (S1-01).
Closed	The operating speed is less than or equal to the minimum output frequency (E1-09) or the zero speed level at stop (S1-01).

Note: When using CLV or CLV/PM control modes, the output terminal will close when the motor speed becomes less than or equal to the zero speed level set for S1-01. In all other control modes, the output terminal will close when the output frequency becomes less than or equal to the minimum output frequency set for E1-09.

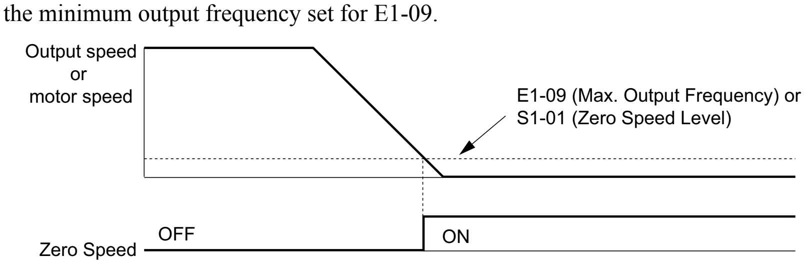


Figure 5.18 Zero-Speed Time Chart

Setting 2: Speed agree 1 (f_{ref} /f_{out} Agree 1)

Closes whenever the actual output speed (CLV, CLV/PM) is within the Speed Agree Width (L4-02) of the current speed reference regardless of the direction.

Status	Description
Open	Output speed or motor speed does not match the speed reference while the drive is running.
Closed	Output speed or motor speed is within the range of speed reference ±L4-02.

Note: Detection works in both directions, forward and reverse.

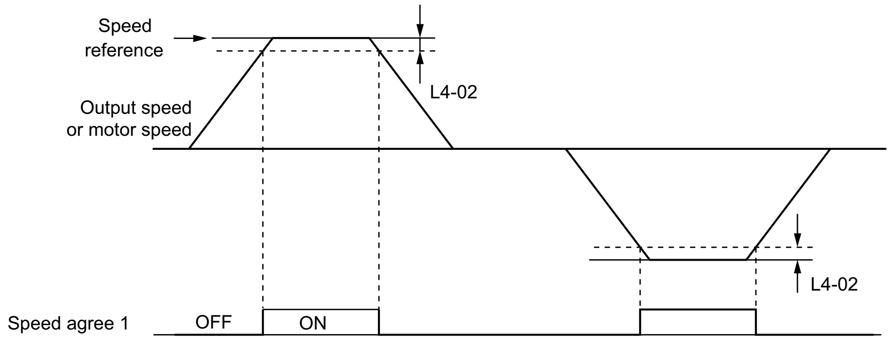


Figure 5.19 Speed Agree 1 Time Chart

Refer to L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 219 for more details.

Setting 3: User-set speed agree 1 (f_{ref} /f_{set} Agree 1)

Closes whenever the actual output speed or motor speed (CLV, CLV/PM) and the speed reference are within the speed agree width (L4-02) of the programmed speed agree level (L4-01).

Status	Description
Open	Output speed or motor speed and the speed reference are not both within the range of L4-01 ±L4-02.
Closed	Output speed or motor speed and the speed reference are both within the range of L4-01 ±L4-02.

Note: Detection works in both forward and reverse. The value of L4-01 is used as the detection level for both directions.

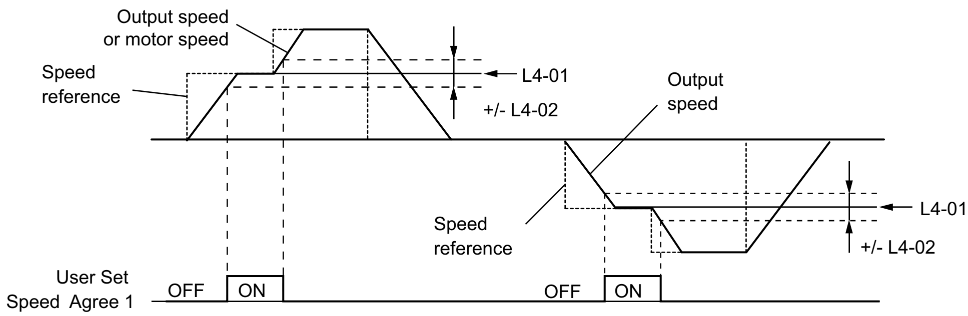


Figure 5.20 User Set Speed Agree 1 Time Chart

Refer to L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 219 for more instructions.

Setting 4: Speed Detection 1

Output opens when the output speed (CLV, CLV/PM) rises above the detection level set in L4-01 plus the detection width set in L4-02. The terminal remains open until the output speed falls below the level set in L4-01.

Status	Description
Open	Output speed or motor speed exceeded L4-01 + L4-02.
Closed	Output speed or motor speed is below L4-01 or has not exceeded L4-01 + L4-02.

Note: Detection works in both forward and reverse. The value of L4-01 is used as the detection level for both directions.

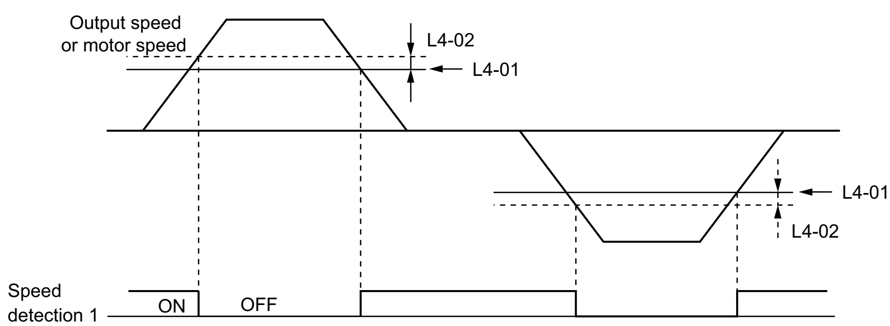


Figure 5.21 Speed Detection 1 Time Chart

Refer to L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 219 for more details.

Setting 5: Speed Detection 2

Output closes whenever the output speed or motor speed (CLV, CLV/PM) is above the detection level set in L4-01. The terminal remains closed until the output speed or motor speed falls below L4-01 minus the setting of L4-02.

Status	Description
Open	Output speed or motor speed is below L4-01 minus L4-02 or has not exceeded L4-01.
Closed	Output speed or motor speed exceeded L4-01.

Note: Detection works in both forward and reverse. The value of L4-01 is used as the detection level for both directions.

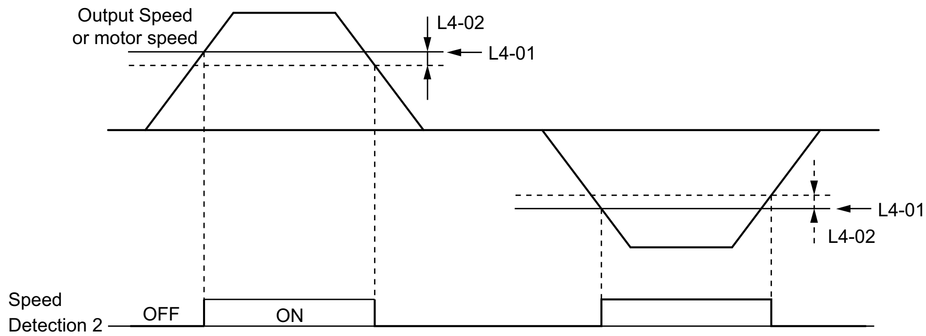


Figure 5.22 Speed Detection 2 Time Chart

Refer to L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 219 for more details.

Setting 6: Drive ready (READY)

Output closes whenever the drive is ready to operate the motor. The terminal will not close under the conditions listed below, and any Up/Down commands will be disregarded.

- When the power is shut off
- During a fault
- When the internal power supply of the drive has malfunctioned
- When a parameter setting error makes it impossible to run
- Although stopped, an overvoltage or undervoltage situation occurs
- While editing a parameter in the Programming Mode (when b1-08 = 0)
- When parameter L8-88 = 0 and at least one Safe Disable input is open

Setting 7: DC bus undervoltage

Output closes whenever the DC bus voltage or control circuit power supply drops below the trip level set in L2-05. A fault in the DC bus circuit will also cause the terminal to set for "DC bus undervoltage" to close.

Status	Description
Open	DC bus voltage is above the level set to L2-05
Closed	DC bus voltage has fallen below the trip level set to L2-05.

Setting 8: During baseblock (N.O.)

Output closes to indicate that the drive is in a baseblock state. While in baseblock, output transistors do not switch and no main circuit voltage is output.

Status	Description
Open	Drive is not in a baseblock state.
Closed	Baseblock is being executed.

Setting 9: Speed reference source

Displays the currently selected speed reference source.

Status	Description
Open	Speed reference is provided from External reference 1 (b1-01).
Closed	Speed reference is being sourced from the digital operator.

Setting A: Up/Down command source

Displays the currently selected Up/Down command source.

Status	Description
Open	Up/Down command is provided from External reference 1 (b1-02).
Closed	Up/Down command is being sourced from the digital operator.

Setting B, 18: Torque detection 1, Torque detection 2

These digital output functions to signal an overtorque or undertorque situation to an external device.

Set up the torque detection levels and select the output function from the table below. *Refer to L6: Torque Detection on page 222* for details.

Setting	Status	Description
B	Closed	Torque detection 1: Output current/torque exceeds (overtorque detection) or is below (undertorque detection) the torque value set in parameter L6-02 for longer than the time specified in parameter L6-03.
18	Closed	Torque detection 2: Output current/torque exceeds (overtorque detection) or is below (undertorque detection) the torque value set in parameter L6-05 for longer than the time specified in parameter L6-06.

Setting E: Fault

The output closes when the drive faults (excluding CPF00 and CPF01 faults).

Setting F: Not used (Through mode)

Select this setting when using the terminal in a pass-through mode. When set to F, an output does not trigger any function in the drive. Setting F, however, still allows the output status to be read by a PLC via a communication option or MEMOBUS/Modbus communications.

Setting 10: Minor fault

Output closes when a minor fault condition is present.

Setting 11: Fault reset command active

Output closes whenever there is an attempt to reset a fault situation from the control circuit terminals, via serial communications, or using a communications option card.

Setting 12: Timer output

This setting configures a digital output terminal as output for the timer function. *Refer to b4: Delay Timers on page 159* for details.

Setting 13: Speed agree 2 (f_{ref} /f_{out} agree 2)

Closes whenever the actual output speed or motor speed (CLV, CLV/PM) is within the speed agree width (L4-04) of the current speed reference, regardless of the direction.

Status	Description
Open	Output speed or motor speed does not match the speed reference while the drive is running.
Closed	Output speed or motor speed is within the range of speed reference ±L4-04.

Note: Detection works in both forward and reverse.

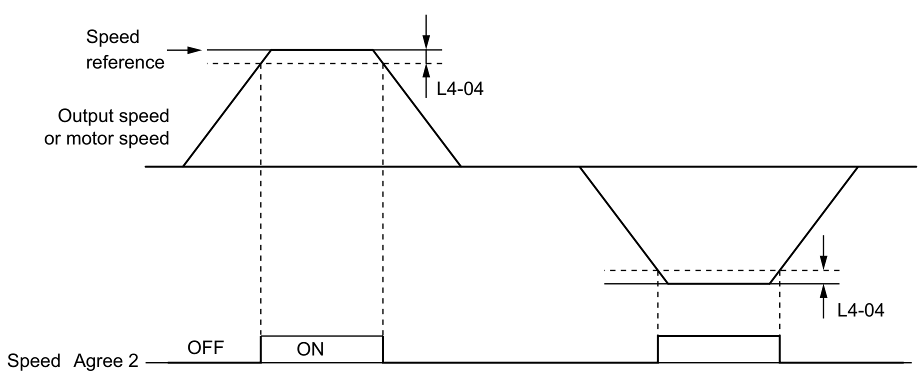


Figure 5.23 Speed Agree 2 Time Chart

Refer to L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 220 for more details.

Setting 14: User-set speed agree 2 (f_{ref} /f_{set} agree 2)

Closes whenever the actual output speed or motor speed (CLV, CLV/PM) and the speed reference are within the speed agree width (L4-04) of the programmed speed agree level (L4-03). As the detection level L4-03 is a signed value, detection works in the specified direction only.

Status	Description
Open	Output speed or motor speed and speed reference are both outside the range of L4-03 ±L4-04
Closed	Output speed or motor speed and the speed reference are both with in the range of L4-03 ±L4-04

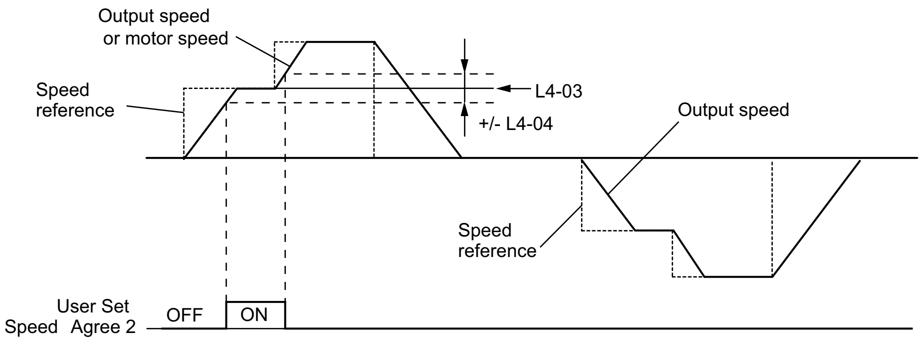


Figure 5.24 User Set Speed Agree 2 Example with a Positive L3-04 Value

Refer to L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 220 for more details.

Setting 15: Speed detection 3

Output opens when the output speed or motor speed (CLV, CLV/PM) rises above the detection level set in L4-03 plus the detection with set in L4-04. The terminal remains open until the output speed or motor speed falls below the level set in L4-03. As the detection level L4-03 is a signed value, the detection works in the specified direction only.

Status	Description
Open	Output speed or motor speed exceeded L4-03 plus L4-04.
Closed	Output speed or motor speed is below L4-03 or has not exceeded L4-03 plus L4-04 yet.

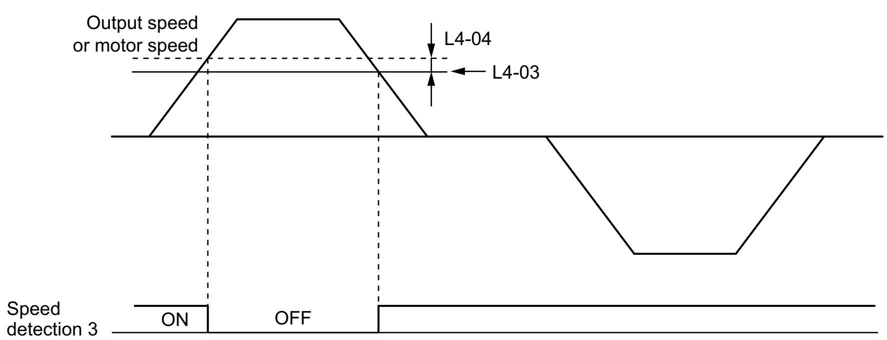


Figure 5.25 Speed Detection 3 Example with a Positive L3-04 Value

Refer to L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 220 for more details.

Setting 16: Speed detection 4

Output closes whenever the output speed or motor speed (CLV, CLV/PM) is above the detection level set in L4-03. The terminal remains closed until the output speed or motor speed falls below L4-03 minus the setting of L4-04. As the detection level L4-03 is a signed value, speed detection works in the specified direction only.

Status	Description
Open	Output speed or motor speed is below L4-03 minus L4-04 or has not exceeded L4-03 yet.
Closed	Output speed or motor speed exceeded L4-03.

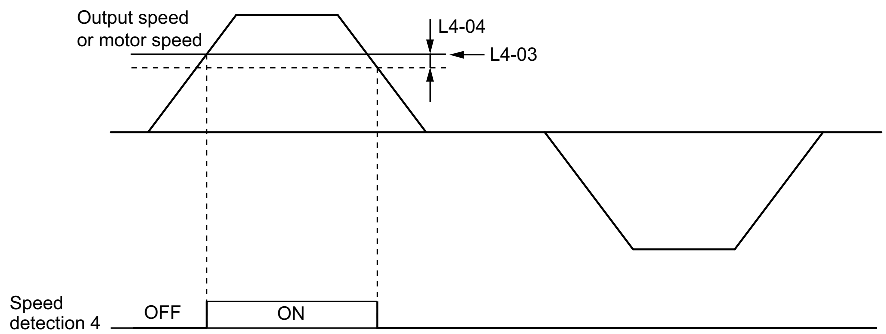


Figure 5.26 Speed Detection 4 Example with Positive L3-04 Value

Refer to L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 220 for more details.

Setting 1A: During down direction

A digital output set for "During down direction" will close whenever the drive is running the elevator in down direction.

Status	Description
Open	Elevator is being driven in up direction or stopped.
Closed	Elevator is being driven in down direction.

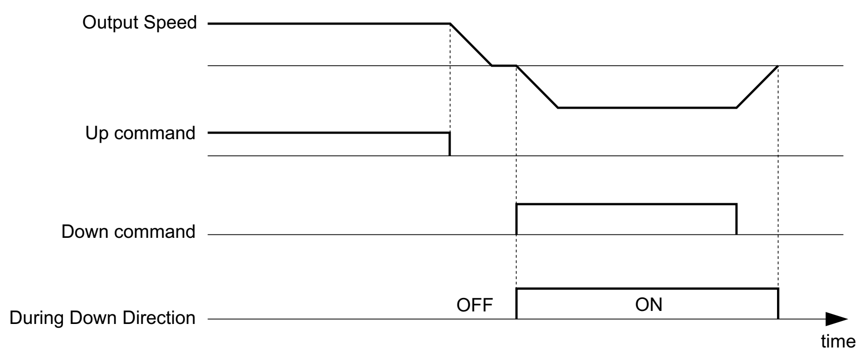


Figure 5.27 Down Direction Output Example Time Chart

Setting 1B: During baseblock (N.C.)

Output opens to indicate that the drive is in a baseblock state. While Baseblock is executed, output transistors do not switch and no main circuit voltage is output.

Status	Description
Open	Baseblock is being executed.
Closed	Drive is not in a baseblock state.

Setting 1C: Motor 2 selection

Indicates which motor is selected when another output terminal is set up to switch drive operation between two motors (H1-☐☐ = 16). Refer to *Setting 16: Motor 2 selection on page 199* for details on switching motors.

Status	Description
Open	Motor 1 is selected.
Closed	Motor 2 is selected.

Setting 1D: During regeneration

Terminal closes when the motor is driven in the regenerative mode.

Setting 1E: Reset enabled

An output set for “Reset enabled” closes when the drive attempts to reset after a fault has occurred.

The fault reset function allows the drive to automatically clear a fault. The terminal set to 1E will close after the fault is cleared and the drive has attempted to reset. If the drive cannot successfully reset within the number of attempts permitted by L5-01, a fault will be triggered and the terminal set to 1E will open. *Refer to L5: Automatic Fault Reset on page 221* for details on automatic reset.

Setting 1F: Motor overload alarm (oL1)

The output closes when the motor overload level estimated by the oL1 fault detection exceeds 90% of the oL1 detection level.

Setting 20: Drive overheat pre-alarm (oH)

Output closes whenever the drive heatsink temperature reaches the level specified by parameter L8-02. *Refer to L8-02: Overheat Alarm Level on page 225* for details on drive overheat detection.

Setting 2F: Maintenance period

Output closes when the cooling fan, DC bus capacitors, or DC bus pre-charge relay may require maintenance as determined by the estimated performance life span of those components. Component performance life is displayed as a percentage on the digital operator screen. *Refer to Periodic Maintenance on page 313* for details.

Setting 30: During torque limit

Output closes when the motor is operating at the torque limit specified by the L7-☐☐ parameters or an analog input. This setting can only be used in OLV, CLV and CLV/PM control modes. *Refer to L7-01 to L7-04: Torque Limits on page 225* for details.

Setting 33: Within position lock bandwidth

Output closes when the motor rotor position is within the position lock bandwidth (S3-04) during Position Lock at start or stop.

Setting 37: During frequency output

Output closes when the drive is outputting a frequency.

Status	Description
Open	No frequency output from drive when stopped with baseblock, stopped with DC injection braking during initial excitation, or stopped with short circuit braking.
Closed	Drive is outputting frequency.

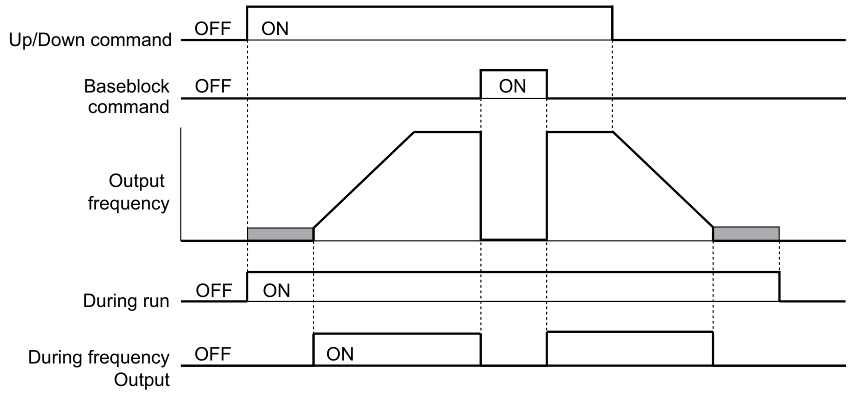


Figure 5.28 During Frequency Output Time Chart

Setting 47: Input phase loss

This terminal closes when input phase loss is detected.

Setting 4E: Braking transistor fault (rr)

Output closes when the built-in braking transistor in the drive overheats and the (rr) error is detected.

Setting 50: Brake control

This setting can be used in the brake sequence for the elevator application. Closing the output terminal should cause the brake to release, and opening the terminal should apply the brake. ***Refer to Brake Sequence on page 125*** for details.

Setting 51: Output contactor control

Assigning this command to an output terminal can send a signal to the controller to close the output contactor. The output contactor should open when the terminal is released.

Setting 52: Door zone reached

Terminals closes to indicate that the door zone speed level (L4-13) has been reached, and that controller should open the car door.

Setting 54: Light load direction

Indicates the light load direction detected during emergency operation with light load search. When the terminal is closed the light load direction is up, when it is open the light load direction is down. ***Refer to Light Load Direction Search Function on page 142*** for details.

Setting 55: Light load direction detection status

This terminal is open during Light Load Direction Search. When the search function is complete, the terminal closes. ***Refer to Light Load Direction Search Function on page 142*** for details.

Setting 58: Safe disable status

This terminal closes if either of the Safe Disable inputs H1-HC or H2-HC are opened and opens when both terminals H1-HC and H2-HC are closed.

Setting 5C: Motor current monitor

The digital output closes when motor current less than or equal to the value set in L8-99 is detected while the drive is baseblock.

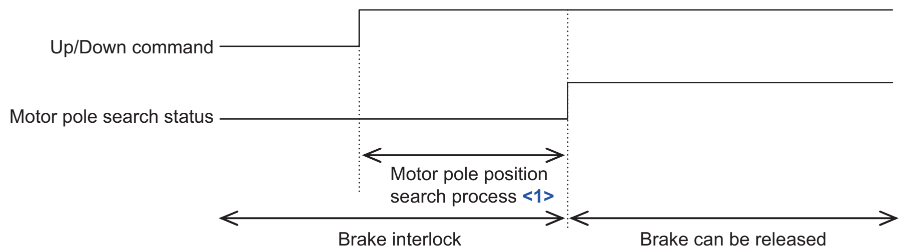
Setting 60: Internal cooling fan alarm

This terminal changes states when the internal cooling fan fault is detected.

Setting 61: Motor pole search status

This terminal changes states when the Initial Motor Pole Position Search is finished. *Refer to n8-35: Initial Rotor Position Detection Selection on page 236* for details on Motor Pole Position Search.
Use this setting in applications where the motor speed feedback is supplied from a non-absolute encoder (e.g., incremental) and where the drive brake sequence is not utilized.

Design the external brake sequence to interlock the brake as long as the Motor Pole Position Search has not finished. In this case, the external brake sequence should be designed to interlock the brake during Motor Pole Position Search.



<1> The search process takes 0.5 to 5.0 s depending on the Motor Pole Position Search method selected in n8-35 and whether Motor Pole Search Error detection is enabled in parameter n8-86.

Setting 100 to 161: Functions 0 to 61 with Inverse Output

These settings have the same function as settings 0 to 61 but with inverse output. Set as 1☐☐, where the “1” indicates inverse output and the last two digits specify the setting number of the function.

Examples:

• For inverse output of “8: During baseblock”, set 108.

◆ H3: Multi-Function Analog Inputs

The drive is equipped with two multi-function analog input terminals: A1 and A2. Refer to *Table 5.13* for a listing of the functions that can be set to these terminals.

■ H3-01: Terminal A1 Signal Level Selection

Selects the input signal level for analog input A1.

No.	Parameter Name	Setting Range	Default
H3-01	Terminal A1 Signal Level Selection	0 or 1	0

Setting 0: 0 to 10 Vdc

The input level is 0 to 10 Vdc. The minimum input level is limited to 0%, so that a negative input signal due to gain and bias settings will be read as 0%.

Setting 1: –10 to 10 Vdc

The input level is –10 to 10 Vdc. If the resulting voltage is negative after being adjusted by gain and bias settings, then the motor will rotate in reverse.

■ H3-02: Terminal A1 Function Selection

Selects the input signal level for analog input A1. Refer to *Multi-Function Analog Input Terminal Settings on page 213* for instructions on how to adjust the signal level.

No.	Parameter Name	Setting Range	Default
H3-02	Terminal A1 Function Selection	0 to 1F	0

■ H3-03, H3-04: Terminal A1 Gain and Bias Settings

Parameter H3-03 sets the level of the selected input value that is equal to 10 Vdc input at terminal A1 (gain).

Parameter H3-04 sets the level of the selected input value that is equal to 0 V input at terminal A1 (bias).

Both can be used to adjust the characteristics of the analog input signal to terminal A1.

No.	Parameter Name	Setting Range	Default
H3-03	Terminal A1 Gain Setting	-999.9 to 999.9%	100.0%
H3-04	Terminal A1 Bias Setting	-999.9 to 999.9%	0.0%

Setting Examples

- Gain H3-03 = 200%, bias H3-04 = 0, terminal A1 as speed reference input (H3-02 = 0):
  A 10 Vdc input is equivalent to a 200% speed reference and 5 Vdc is equivalent to a 100% speed reference. Since the drive output is limited by the maximum frequency parameter (E1-04), the speed reference will be equal to E1-04 above 5 Vdc.

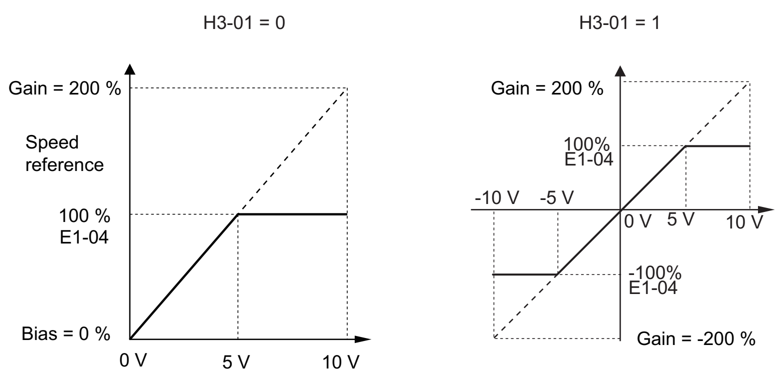


Figure 5.29 Speed Reference Setting by Analog Input with Increased Gain

- Gain H3-03 = 100%, bias H3-04 = -25%, terminal A1 as speed reference input:
  An input of 0 Vdc will be equivalent to a -25% speed reference.
  When parameter H3-01 = 0, the speed reference is 0% between 0 and 2 Vdc input.
  When parameter H3-01 = 1, the motor will rotate in reverse between -10 and 2 Vdc input.

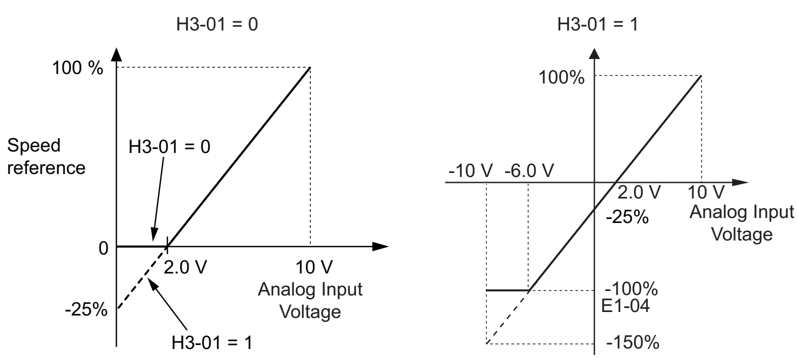


Figure 5.30 Speed Reference Setting by Analog Input with Negative Bias

■ H3-09: Terminal A2 Signal Level Selection

Selects the input signal level for analog input A2.

No.	Parameter Name	Setting Range	Default
H3-09	Terminal A2 Signal Level Selection	0 or 1	0

Setting 0: 0 to 10 Vdc

The input level is 0 to 10 Vdc. Refer to *Setting 0: 0 to 10 Vdc on page 211* for details.

Setting 1: –10 to 10 Vdc

The input level is –10 to 10 Vdc. Refer to *Setting 1: –10 to 10 Vdc on page 211* for details.

■ H3-10: Terminal A2 Function Selection

Determines the function assigned to analog input terminal A2. Refer to *Multi-Function Analog Input Terminal Settings on page 213* for a list of functions and descriptions.

No.	Parameter Name	Setting Range	Default
H3-10	Terminal A2 Function Selection	0 to 1F	1F

■ H3-11, H3-12: Terminal A2 Gain and Bias Setting

Parameter H3-11 sets the level of the input value selected that is equal to 10 Vdc input to terminal A2.

Parameter H3-12 sets the level of the input value selected that is equal to 0 V at terminal A2.

Both can be used to adjust the characteristics of the analog input signal to terminal A2. The settings work in the same way as parameters H3-03 and H3-04 for analog input A1.

No.	Parameter Name	Setting Range	Default
H3-11	Terminal A2 Gain Setting	-999.9 to 999.9%	100.0%
H3-12	Terminal A2 Bias Setting	-999.9 to 999.9%	0.0%

■ H3-13: Analog Input Filter Time Constant

Parameter H3-13 sets the time constant for a first order filter that will be applied to the analog inputs.

An analog input filter prevents erratic drive control when using a "noisy" analog reference. Drive operation becomes more stable as the programmed time becomes longer, but it also becomes less responsive to rapidly changing analog signals.

No.	Parameter Name	Setting Range	Default
H3-13	Analog Input Filter Time Constant	0.00 to 2.00 s	0.03 s

■ H3-16/H3-17: Offset for Terminal A1/A2

Parameters H3-16 and H3-17 set the offset applied analog input values from terminals A1 and A2.

Although adjustment is rarely required, these parameters can be used for zero adjustment of the analog inputs.

No.	Parameter Name	Setting Range	Default
H3-16	Offset for Terminal A1	–500 to 500	0
H3-17	Offset for Terminal A2	–500 to 500	0

■ Multi-Function Analog Input Terminal Settings

Refer to *Table 5.13* for information on how H3-02 and H3-10 determine functions for terminals A1 and A2.

Note: The scaling of all input functions depends on the gain and bias settings for the analog inputs. Set these to appropriate values when selecting and adjusting analog input functions.

Table 5.13 Multi-Function Analog Input Terminal Settings

Setting	Function	Page
0	Speed reference bias	*214*
2	Auxiliary speed reference 1 (used as a second speed reference)	*214*
3	Auxiliary speed reference 2 (used as a third speed reference)	*214*
E	Motor Temperature (PTC thermistor input)	*214*
14	Torque compensation (load cell input)	*214*
1F	Not used (through mode)	*214*

Setting 0: Speed reference bias

The input value of an analog input set to this function will be added to the analog speed reference value. When the speed reference is supplied by a different source other than the analog inputs, this function will have no effect. Use this setting also when only one of the analog inputs is used to supply the speed reference.

By default, analog inputs A1 and A2 are set for this function. Using A1 and A2 at the same time increases the speed reference by the total of all inputs.

Example: If the analog speed reference from analog input terminal A1 is 50% and a bias of 20% is applied by analog input terminal A2, the resulting speed reference will be 70% of the maximum output speed.

Setting 2: Auxiliary speed reference 1 (used as a second speed reference)

Sets the auxiliary speed reference 1 when multi-step speed operation is selected. ***Refer to Speed Selection Using Digital Inputs (b1-01 = 0) on page 121*** for details.

Setting 3: Auxiliary speed reference 2 (used as a third speed reference)

Sets the auxiliary speed reference 2 when multi-step speed operation is selected. ***Refer to Speed Selection Using Digital Inputs (b1-01 = 0) on page 121*** for details.

Setting E: Motor Temperature (PTC thermistor input)

In addition to motor overload fault detection oL1, it is possible to use a PTC (Positive Temperature Coefficient) thermistor for motor insulation protection. ***Refer to Motor Protection Using a Positive Temperature Coefficient (PTC thermistor) on page 215*** for details.

Setting 14: Torque compensation (load cell input)

This selection allows an analog signal to the input terminal adjust the amount of torque compensation to handle and unbalance at start when elevators sensors indicate that a large load has been added to the car. This helps to minimize shock and jerking at start. Setting 14 requires an analog signal from a load sensor.

Setting 1F: Not used (Through mode)

When set to 1F, an input does not affect any drive function, but the input level can still be read out by a PLC via a communication option or MEMOBUS/Modbus communications.

◆ H4: Multi-Function Analog Outputs

These parameters assign functions to analog output terminals FM and AM for monitoring a specific aspect of drive performance.

■ H4-01, H4-04: Terminal FM, AM Monitor Selection

Sets the desired drive monitor parameter U□-□□ to output as an analog value via terminal FM and AM. ***Refer to U: Monitors on page 404*** for a list of all monitors. The “Analog Output Level” column indicates if a monitor can be used for analog output.

Example: Enter “103” for U1-03.

No.	Parameter Name	Setting Range	Default
H4-01	Terminal FM Monitor Selection	000 to 999	102
H4-04	Terminal AM Monitor Selection	000 to 999	103

A setting of 031 or 000 applies no drive monitor to the analog output. With this setting, terminal functions as well as FM and AM output levels can be set by a PLC via a communication option or MEMOBUS/Modbus (through mode).

■ H4-02, H4-03: Multi-Function Analog Output Terminal FM Gain and Bias H4-05, H4-06: Terminal AM Gain and Bias

Parameters H4-02 and H4-05 set the terminal FM and AM output signal level equal to 100% of the monitor (gain). Parameters H4-03 and H4-06 set the bias added to the monitor output for terminals FM and AM. Both are set as a percentage, where 100% equals 10 Vdc analog output. The output voltage of both terminals is limited to 10 Vdc.

Select an output signal range between 0 to +10 Vdc or -10 to +10 Vdc using parameters H4-07 and H4-08. *Figure 5.31* illustrates how gain and bias settings work.

No.	Parameter Name	Setting Range	Default
H4-02	Terminal FM Gain	-999.9 to 999.9%	100.0%
H4-03	Terminal FM Bias	-999.9 to 999.9%	0.0%
H4-05	Terminal AM Gain	-999.9 to 999.9%	50.0%
H4-06	Terminal AM Bias	-999.9 to 999.9%	0.0%

Using Gain and Bias to Adjust Output Signal Level

The output signal is adjustable while the drive is stopped.

Terminal FM

1. View the value set to H4-02 (Terminal FM Monitor Gain) on the digital operator. A voltage equal to 100% of the parameter being set in H4-01 will be output from terminal FM.
2. Adjust H4-02 viewing the monitor connected to the terminal FM.
3. View the value set to H4-03 on the digital operator, terminal FM will output a voltage equal to 0% of the parameter being set in H4-01.
4. Adjust H4-03 viewing the output signal on the terminal FM.

Terminal AM

1. View the value set to H4-05 (Terminal AM Monitor Gain) on the digital operator. A voltage equal to 100% of the parameter being set in H4-04 will be output from terminal AM.
2. Adjust H4-05 viewing the monitor connected to the terminal AM.
3. View the value set to H4-06 on the digital operator, terminal AM will output a voltage equal to 0% of the parameter being set in H4-04.
4. Adjust H4-06 viewing the output signal on the terminal AM.

Example 1: Set H4-02 to 50% for an output signal of 5 V at terminal FM when the monitored value is at 100%.

Example 2: Set H4-02 to 150% for an output signal of 10 V at terminal FM when the monitored value is at 76.7%.

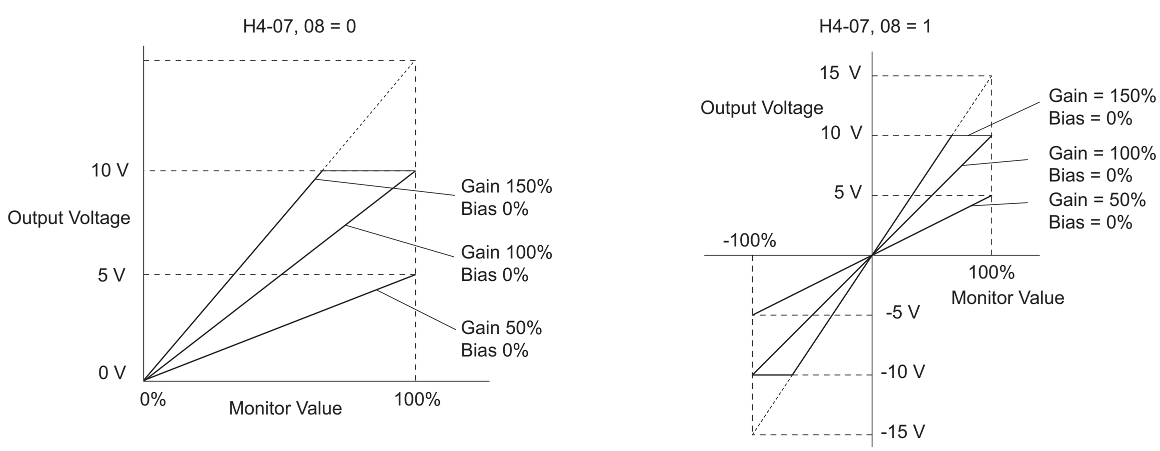


Figure 5.31 Analog Output Gain and Bias Setting Example 1 and 2

Parameter Details
5

Example 3: Set H4-03 to 30% for an output signal of 3 V at terminal FM when the monitored value is at 0%.

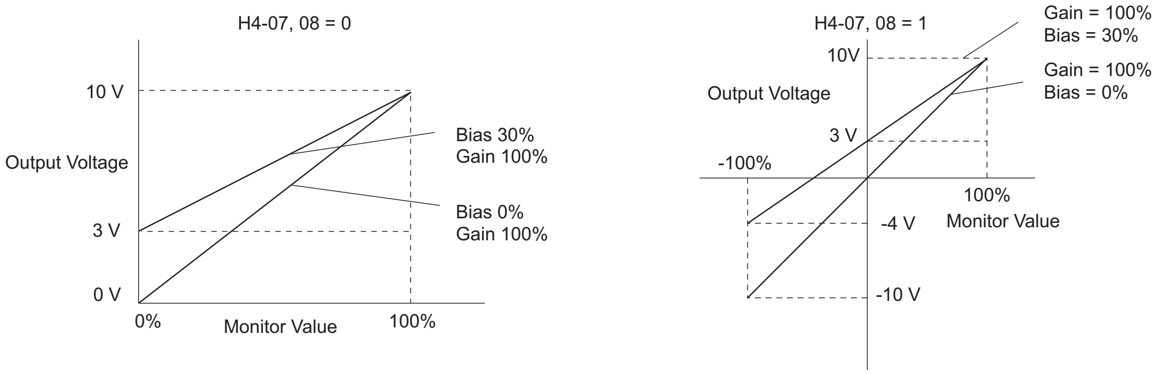


Figure 5.32 Analog Output Gain and Bias Setting Example 3

■ H4-07, H4-08: Terminal FM, AM Signal Level Selection

Sets the voltage output level of U parameter (monitor parameter) data to terminal FM and terminal AM using parameters H4-07 and H4-08.

No.	Parameter Name	Setting Range	Default
H4-07	Terminal FM Signal Level Selection	0 or 1	0
H4-08	Terminal AM Signal Level Selection	0 or 1	0

Setting 0: 0 to 10 V

Setting 1: -10 V to 10 V

◆ H5: MEMOBUS/Modbus Serial Communication

Serial communication is possible in the drive using the built-in RS-422/485 port (terminals R+, R-, S+, S-) and programmable logic controllers (PLCs) or similar devices running the MEMOBUS/Modbus protocol.

The H5-☐☐ parameters are used to set up the drive for MEMOBUS/Modbus Communications. ***Refer to MEMOBUS/ Modbus Setup Parameters on page 422*** for detailed descriptions of the H5-☐☐ parameters.

5.8 L: Protection Functions

◆ L1: Motor Protection

■ L1-01: Motor Overload Protection Selection

The drive has an electronic overload protection function that estimates the motor overload level based on output current, output speed, thermal motor characteristics, and time. An oL1 fault will be triggered when motor overload is detected and drive output will be shut off.

L1-01 sets the overload protection function characteristics according to the motor being used.

No.	Parameter Name	Setting Range	Default
L1-01	Motor Overload Protection Selection	0 to 3, 5	Determined by A1-02

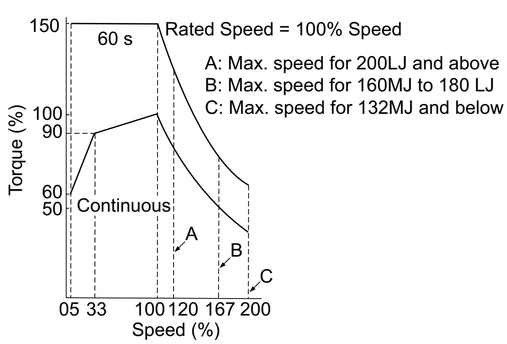
Note: **1.** When the motor protection function is enabled (L1-01≠ 0), an oL1 alarm can be output through one of the multi-function outputs by setting H2-01 to 1F. The output will close when the motor overload level reaches 90% of the oL1 detection level.
2. Set L1-01 to a value between 1 and 5 when running a single motor from the drive to select a method to protect the motor from overheat. An external thermal relay is not necessary.

Setting 0: Disabled (motor overload protection is not provided)

Use this setting if no motor overheat protection is desired.

Setting 1: General-purpose motor (standard self-cooled)

Because the motor is self-cooled, the overload tolerance drops when the motor speed is lowered. The drive appropriately adjusts the electrothermal trigger point according to the motor overload characteristics, protecting the motor from overheat throughout the entire speed range.

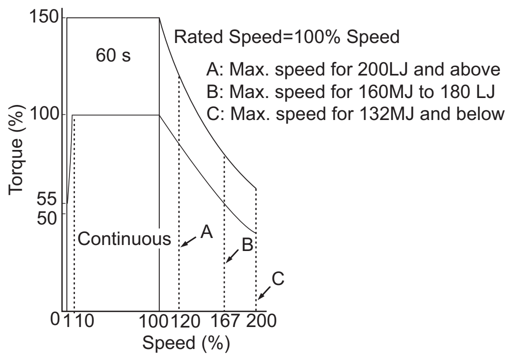
Overload Tolerance	Cooling Ability	Overload Characteristics
	Motor designed to operate from line power. Motor cooling is most effective when running at rated base frequency (check the motor nameplate or specifications).	Continuous operation at less than line power frequency with 100% load can trigger motor overload protection (oL1). A fault is output and the motor will coast to stop.

Parameter Details

5

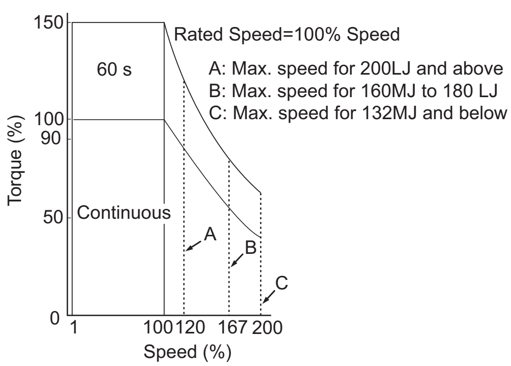
Setting 2: Drive dedicated motor (speed range for constant torque: 1:10)

Use this setting when operating a drive duty motor that allows constant torque in a speed range of 1:10. The drive will allow the motor to run with 100% load from 10% up to 100% speed. Running at slower speeds with full load can trigger an overload fault.

Overload Tolerance	Cooling Ability	Overload Characteristics
	Motor is designed to effectively cool itself even at low speeds.	Continuous operation with 100% load from 5 Hz to 50 Hz.

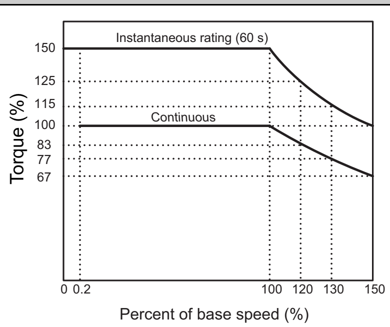
Setting 3: Vector motor (speed range for constant torque: 1:100)

Use this setting when operating a drive-dedicated motor that allows constant torque in a speed range of 1:100. This motor type is allowed to run with 100% load from 1% up to 100% speed. Running slower speeds with full load can trigger an overload fault.

Overload Tolerance	Cooling Ability	Overload Characteristics
	Motor is designed to effectively cool itself at ultra-low speeds.	Continuous operation with 100% load from 0.5 Hz to 50 Hz.

Setting 5: Constant torque PM motors (constant torque range of 1:500)

Sets protection characteristics needed when driving a PM with constant torque. These motors allow for a speed control from 0.2% to 100% when operating with 100% load. Slower speeds with 100% load will trigger overload.

Overload Tolerance	Cooling Ability	Overload Characteristics
	Motor is designed to effectively cool itself at ultra-low speeds (about 0.2% of base speed).	Continuous operation with 100% load from 0.2% to 100% of base speed.

■ L1-02: Motor Overload Protection Time

This setting rarely requires adjustment. Sets the time it takes the drive to detect motor overheat due to overload. If the motor overload tolerance protection time when an overload of 150% is imposed after continuous operation at 100% is clear, set that time as the value.

No.	Parameter Name	Setting Range	Default
L1-02	Motor Overload Protection Time	0.1 to 5.0 min	1.0 min

Defaulted to operate with an allowance of 150% overload operation for one minute in a hot start; after continuous operation at 100%.

Figure 5.33 shows an example of the electrothermal protection operation time using a general-purpose motor operating at the value of E1-06, Motor Base Speed, with L1-02 set to one minute.

Motor overload protection operates in the area between a cold start and a hot start.

- Cold start: Characteristics of motor protection operation time in response to an overload situation that was suddenly reached when starting a stationary motor.
- Hot start: Characteristics of motor protection operation time in response to an overload situation that occurred while the motor was operating continuously at or below its rated current.

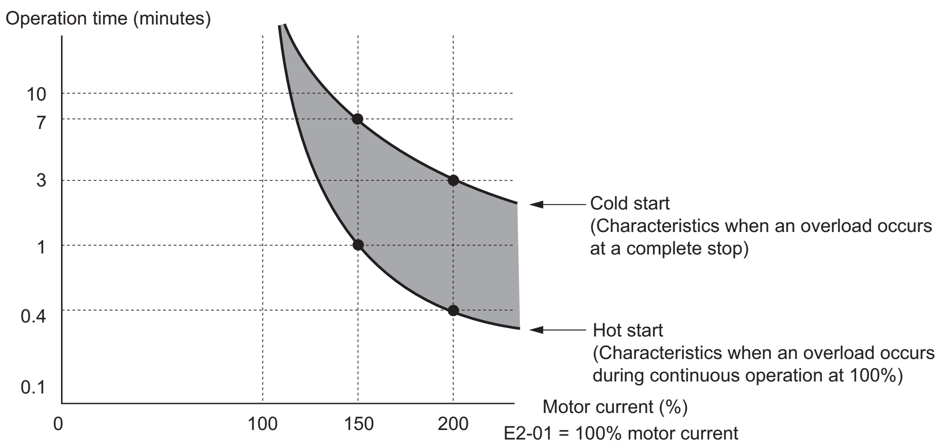


Figure 5.33 Protection Operation Time for General Purpose Motors at the Rated Output Frequency

■ L1-13: Continuous Electrothermal Operation Selection

Determines whether to hold the current value of the electrothermal motor protection (L1-01) when the power supply is interrupted.

No.	Parameter Name	Setting Range	Default
L1-13	Continuous Electrothermal Operation Selection	0 or 1	1

Setting 0: Disabled

Setting 1: Enabled

■ Motor Protection Using a Positive Temperature Coefficient (PTC thermistor)

A motor PTC thermistor can be connected to an analog input of the drive. This input is used by the drive for motor overheat protection.

When the PTC thermistor input signal reaches the motor overheat alarm level, an oH3 alarm will be triggered and the drive will continue operation according to the setting of L1-03. When the PTC thermistor input signal reaches the overheat fault level, an oH4 fault will be triggered, a fault signal will be output, and the drive will stop the motor using the stop method setting in L1-04.

Connect the PTC thermistor between terminals AC and A2 as shown in *Figure 5.34*. Set parameter H3-09 to 0 and parameter H3-10 to E

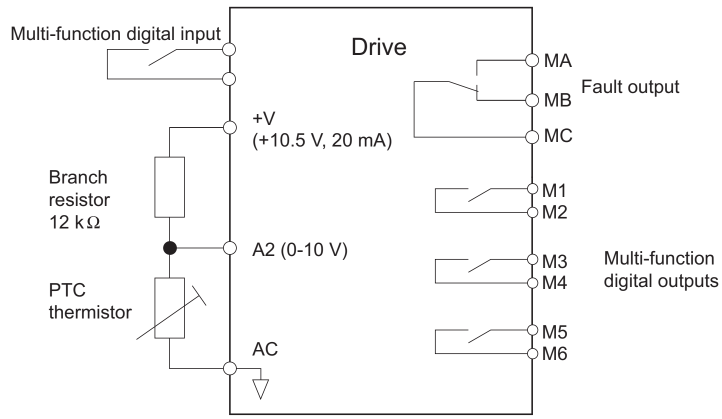


Figure 5.34 Connection of a Motor PTC Thermistor

The PTC thermistor must have the characteristics shown in *Figure 5.35* for one motor phase. The drives motor overload detection requires three PTC thermistors to be connected in series.

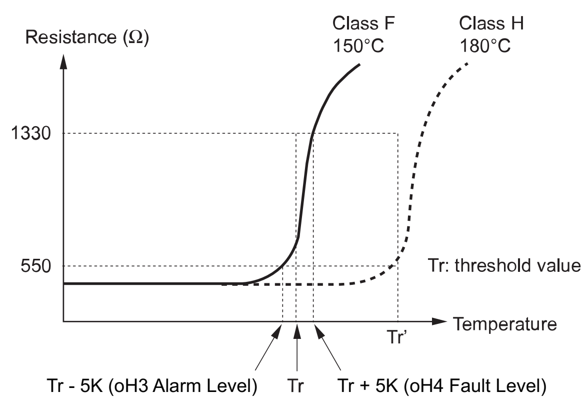


Figure 5.35 Motor PTC Thermistor Characteristics

Overheat detection using a PTC thermistor is configured with parameters L1-03, L1-04, and L1-05 as explained below.

■ L1-03: Motor Overheat Alarm Operation Selection (PTC thermistor input)

Sets the drive operation when the PTC thermistor input signal reaches the motor overheat alarm level (oH3).

No.	Parameter Name	Setting Range	Default
L1-03	Motor Overheat Alarm Operation Selection (PTC thermistor input)	0 to 3	3

Setting 0: Ramp to stop

The drive stops the motor using the deceleration time 1 set in parameter C1-02.

Setting 1: Coast to stop

The drive output is switched off and the motor coasts to stop.

Setting 2: Emergency stop (Fast stop)

The drive stops the motor using the deceleration time set in parameter C1-09.

Setting 3: Alarm only

The operation is continued and an oH3 alarm is displayed on the digital operator.

■ L1-04: Motor Overheat Fault Operation Selection (PTC thermistor input)

Sets the drive operation when the PTC thermistor input signal reaches the motor overheat fault level (oH4).

No.	Parameter Name	Setting Range	Default
L1-04	Motor Overheat Fault Operation Selection (PTC thermistor input)	0 to 2	1

Setting 0: Ramp to stop

The drive stops the motor using the deceleration time 1 set in parameter C1-02.

Setting 1: Coast to stop

The drive output is switched off and the motor coasts to stop.

Setting 2: Emergency stop (Fast stop)

The drive stops the motor using the deceleration time set in parameter C1-09.

■ L1-05: Motor Temperature Input Filter Time (PTC thermistor input)

Applies a filter on the PTC thermistor input signal to prevent inadvertent motor overheat faults.

No.	Parameter Name	Setting Range	Default
L1-05	Motor Temperature Input Filter Time (PTC thermistor input)	0.00 to 10.00 s	0.20 s

◆ L2: Undervoltage Detection

■ L2-05: Undervoltage Detection Level (Uv)

Determines the voltage at which a Uv1 fault is triggered. This setting rarely needs to be changed.

No.	Parameter Name	Setting Range	Default
L2-05 <1>	Undervoltage Detection Level	150 to 210 Vdc	Determined by E1-01

<1> Values shown are specific to 200 V class drives; double the values for 400 V class drives.

Note: Install an AC reactor option on the input side of the power supply when setting L2-05 below the default value to prevent damage to drive circuitry.

◆ L3: Stall Prevention

When the load is too heavy or acceleration ramps are too short, the motor may be unable to keep up with the speed reference, resulting in excessive slip. During acceleration, this usually causes an overcurrent fault (oC), drive overload (oL2), or motor overload (oL1). The drive can prevent the motor from stalling and still reach the desired speed without the user needing to change the acceleration or deceleration ramp settings. The Stall Prevention function can be set separately for acceleration, operating at constant speeds, and deceleration.

■ L3-01: Stall Prevention Selection during Acceleration

Stall Prevention during acceleration (L3-01) prevents tripping with overcurrent (oC), motor overload (oL1), or drive overload (oL2) faults common when accelerating with heavy loads.
L3-01 determines the type of Stall Prevention the drive uses during acceleration.

No.	Parameter Name	Setting Range	Default
L3-01	Stall Prevention Selection during Acceleration	0 to 2	1

Setting 0: Disabled

No Stall Prevention is provided. If the acceleration time is too short, the drive may not be able to get the motor up to speed fast enough, causing an overload fault.

Setting 1: Enabled

Enables Stall Prevention during acceleration.

If the output current rises above the Stall Prevention level set in L3-02, then the drive stops accelerating. Acceleration will not resume until the output current falls 15% below the setting in L3-02.

The Stall Prevention level is automatically reduced in the constant power range.

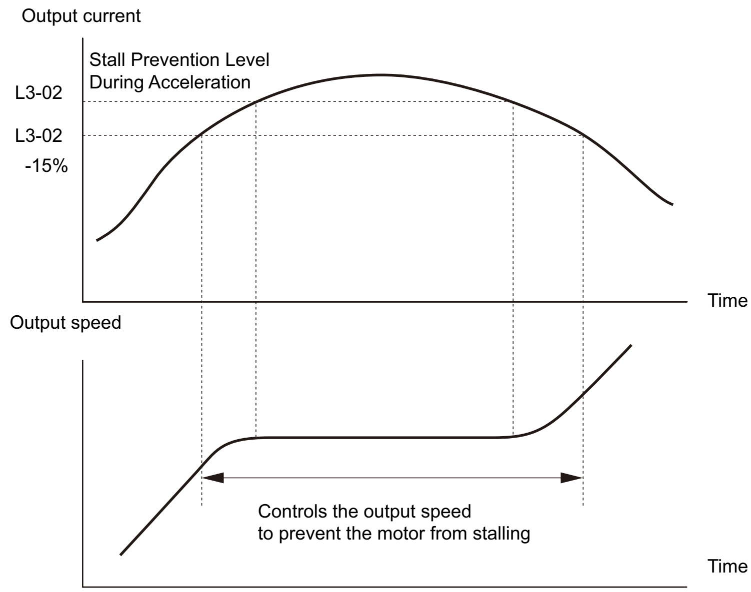


Figure 5.36 Stall Prevention During Acceleration for Induction Motors

Setting 2: Intelligent Stall Prevention

The drive disregards the selected acceleration time and attempts to accelerate in the minimum time. The acceleration rate is adjusted so the current does not exceed the value set to parameter L3-02.

■ L3-02: Stall Prevention Level during Acceleration

Sets the output current level at which the Stall Prevention during acceleration is activated.

No.	Parameter Name	Setting Range	Default
L3-02	Stall Prevention Level during Acceleration	0 to 150% <1>	<1>

<1> The upper limit and default value are determined by the carrier frequency reduction (L8-38).

- Lower L3-02 if stalling occurs when using a motor that is relatively small compared to the drive.
- Also set parameter L3-03 when operating the motor in the constant power range.

■ L3-05: Stall Prevention Selection during Run

Determines how Stall Prevention works during Run. Stall Prevention during run prevents the motor from stalling by automatically reducing the speed when a transient overload occurs while the motor is running at constant speed.

No.	Parameter Name	Setting Range	Default
L3-05	Stall Prevention Selection during Run	0 to 2	1

Note: **1.** This function is available in V/f control mode.
2. Stall Prevention during run is disabled when the output frequency is 6 Hz or lower regardless of the L3-05 and L3-06 settings.

Setting 0: Disabled

Drive runs at the set speed reference. A heavy load may cause the motor to stall and trip the drive with an oC or oL fault.

Setting 1: Decelerate using C1-02

If the current exceeds the Stall Prevention level set in parameter L3-06, then the drive will decelerate at decel ramp 1 (C1-02). Once the current level drops below the value of L3-06 minus 2% for 100 ms, the drive accelerates back to the speed reference at the active acceleration ramp.

Setting 2: Decelerate using C1-04

Same as setting 1 except the drive decelerates at decel ramp 2 (C1-04).

■ L3-06: Stall Prevention Level during Run

Sets the Stall Prevention level during run as a percentage of the drive rate output current.

No.	Parameter Name	Setting Range	Default
L3-06	Stall Prevention Level during Run	30 to 150% <1>	<1>

<1> The upper limit and default for this setting is determined by L8-38.

◆ L4: Speed Detection

These parameters set up the speed agree and speed detection functions which can be assigned to the multi-function output terminals.

■ L4-01, L4-02: Speed Agreement Detection Level and Detection Width

Parameter L4-01 sets the detection level for the digital output functions "User-set speed agree 1," "Speed detection 1," and "Speed detection 2."

Parameter L4-02 sets the hysteresis level for these functions.

No.	Parameter Name	Setting Range	Default
L4-01	Speed Agreement Detection Level	0.0 to 100.0%	0.0%
L4-02	Speed Agreement Detection Width	0.0 to 40.0%	4.0%

Refer to H2-01 to H2-05: Terminals M1-M2, M3-M4, M5-M6, P1-PC, and P1-P2 Function Selection on page 201 or details on settings 2, 3, 4, and 5.

■ L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-)

Parameter L4-03 sets the detection level for the digital output functions “Speed agree 2,” “User-set speed agree 2,” “Speed detection 3,” and “Speed detection 4.”

Parameter L4-04 sets the hysteresis level for these functions.

No.	Parameter Name	Setting Range	Default
L4-03	Speed Agreement Detection Level (+/-)	-100.0 to 100.0%	0.0%
L4-04	Speed Agreement Detection Width (+/-)	0.0 to 40.0%	4.0%

Refer to H2-01 to H2-05: Terminals M1-M2, M3-M4, M5-M6, P1-PC, and P1-P2 Function Selection on page 201 for details on settings 13, 14, 15, and 16

■ L4-05: Speed Reference Loss Detection Selection

The drive can detect a loss of an analog speed reference from input A1 and A2. Speed reference loss is detected when the speed reference falls below 10% of the previous reference, or below 5% of the maximum output frequency within 400 ms.

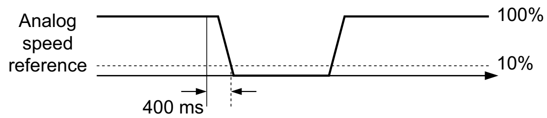


Figure 5.37 Loss of Reference Function

Parameter L4-05 selects the operation when a speed reference loss is detected.

No.	Parameter Name	Setting Range	Default
L4-05	Speed Reference Loss Detection Selection	0 or 1	0

Setting 0: Stop

Drive follows the speed reference (which is no longer present) and simply stops the motor.

Setting 1: Continue operation with reduced speed reference

The drive will continue the operation at the speed reference value set in parameter L4-06. When the external speed reference value is restored, the operation is continued with the external speed reference.

■ L4-06: Speed Reference at Reference Loss

Sets the speed reference level the drive runs with when L4-05 = 1 and a reference loss was detected. The value is set as a percentage of the speed reference before the loss was detected.

No.	Parameter Name	Setting Range	Default
L4-06	Speed Reference at Reference Loss	0.0 to 100.0%	80.0%

■ L4-07: Speed Agree Detection Selection

Determines when speed detection is active using parameters L4-01 through L4-04.

No.	Parameter Name	Setting Range	Default
L4-07	Speed Agree Detection Selection	0, 1	0

Setting 0: No detection during baseblock

Setting 1: Detection always enabled

■ L4-13: Door Zone Level

Sets the speed level for the car door to open. Once the car slows to the speed set in L4-13, a multi-function output terminal set for “Door zone reached” will close (H2-☐☐ = 52).

No.	Parameter Name	Setting Range	Default
L4-13	Door Zone Level	0.0 to 100.0%	0.0%

◆ L5: Automatic Fault Reset

After a fault has occurred, Fault Restart attempts to automatically restart the motor and continue operation instead of stopping. The inverter can reset faults automatically after the Run command has been removed. If the Run command is not removed within 10 seconds, the fault reset will expire. Remove the Run command and manually reset. The maximum number of resets can be selected as well as the operation mode of the fault relay.

Faults Allowing for Automatic Reset

The drive attempts to reset itself after one of the faults listed below has occurred. All other faults will need to be reset externally.

Fault	Name	Fault	Name
GF	Ground Fault	ov	DC Bus Overvoltage
LF	Output Phase Loss	rr	Braking Transistor Fault
oC	Overcurrent	UL3	Undertorque Detection 1
oH1	Heatsink Overheat	UL4	Undertorque Detection 2
oL1	Motor Overload	SE1	Sequence Error 1
oL2	Drive Overload	SE2	Sequence Error 2
oL3	Overtorque Detection 1	SE3	Sequence Error 3
oL4	Overtorque Detection 2	–	–

Fault Reset Time Chart

Parameter L5-01 sets the number of times the drive can attempt to reset itself after on of the faults in the table above occurs. The time chart below illustrates how fault reset works.

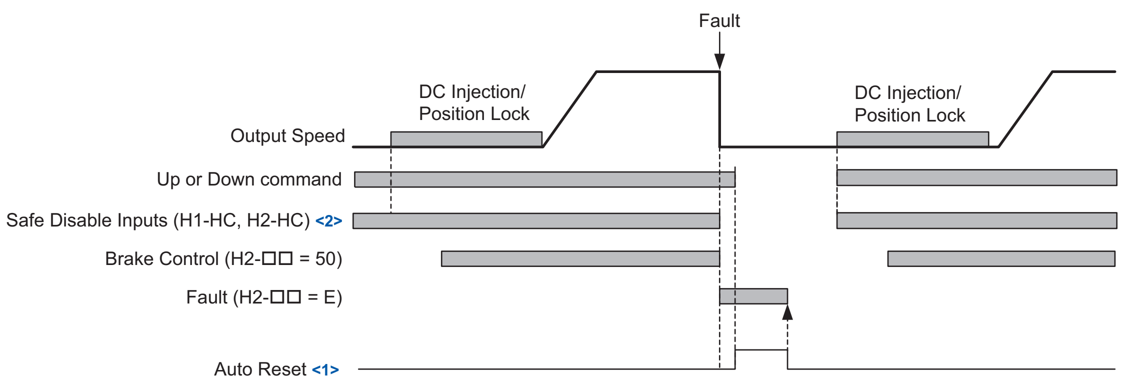


Figure 5.38 Fault Reset Time Chart

<1> The drive will accept an auto reset signal once the Up and Down commands have been removed.

<2> Software baseblock (H1-☐☐ = 8, or 9) can also be used instead of Safe Disable inputs

Use parameter L5-06 to set up automatic fault reset.

To output a signal during fault reset, set one of the output terminals to "Reset enabled" (H2-☐☐ = 1E).

■ L5-01: Number of Auto Reset Attempts

Sets the number of times that the drive may attempt to reset itself.

The drive will continuously attempt to reset. If it resets successfully, the reset counter is increased. This operation is repeated each time a fault occurs.

When the counter reaches the number set in L5-01, the operation stops and the fault has to be reset manually after correcting the cause.

The number of fault reset is reset to zero when:

- The drive operates normally for ten minutes following a fault reset.
- A fault is cleared manually after protective functions are triggered.
- The power supply is cycled.

No.	Parameter Name	Setting Range	Default
L5-01	Number of Auto Reset Attempts	0 to 10 Times	0 Time

■ L5-02: Fault Output Operation during Auto Reset

Determines if a fault output is triggered (H2-☐☐ = E) when the drive attempts to reset.

No.	Parameter Name	Setting Range	Default
L5-02	Fault Output Operation during Auto Reset	0 or 1	0

Setting 0: No fault output

Setting 1: Fault output is set

■ L5-06: Undervoltage Fault Reset Selection

Determines whether a limit should be placed on the number of reset attempts after a Uv1 fault.

No.	Parameter Name	Setting Range	Default
L5-06	Undervoltage Fault Reset Selection	0 or 1	0

Setting 0: Restrict auto-reset attempts to L5-01 after Uv1

Setting 1: No limit on auto-reset attempts after Uv1

◆ L6: Torque Detection

The drive provides two independent torque detection functions that trigger an alarm or fault signal when the load is too heavy (oL), or suddenly drops (UL). These functions are set up using the L6-☐☐ parameters. Program the digital outputs as shown below to indicate the underload or overload condition to an external device.

NOTICE: *Damage to Equipment. Use the Torque Detection function of the drive to notify the PLC of potential overcurrent or overload situations at the load prior to a drive overload fault. Failure to comply may cause the drive to fault with a coasting motor and potentially damage equipment.*

Note: When overtorque occurs in the application, the drive may stop due to overcurrent (oC) or overload (oL1). To prevent this, an overload situation should be indicated to the controller before oC or oL1 occur in the drive. Use the torque detection for this purpose.

H2-01 through H2-05 Setting	Description
B	Torque detection 1, N.O. (output closes when overload or underload is detected)
18	Torque detection 2, N.O. (output close when overload or underload is detected)

Figure 5.39 and *Figure 5.40* show the function of overtorque and undertorque detection.

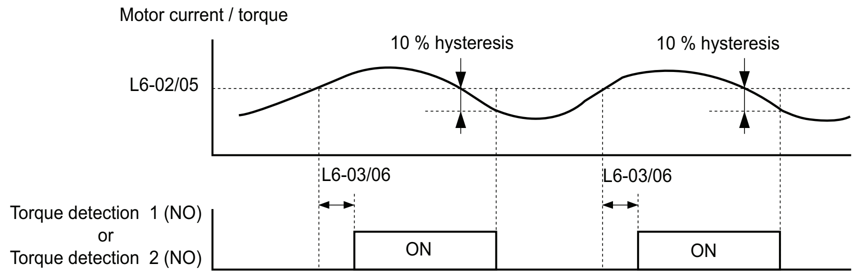


Figure 5.39 Overtorque Detection Operation

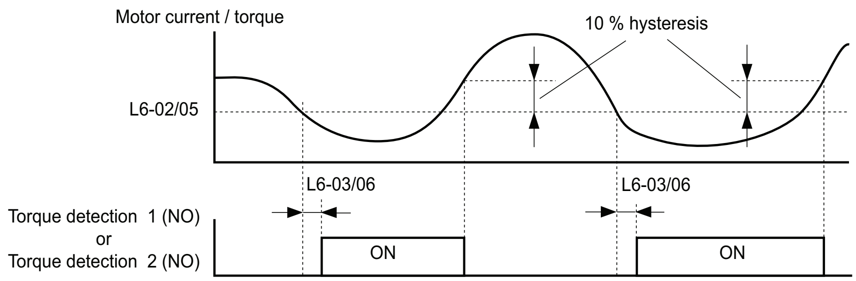


Figure 5.40 Undertorque Detection Operation

Note:
1. The torque detection function uses a hysteresis of 10% of the drive rated output current and motor rated torque.
2. In V/f, the level is set as a percentage of the drive rated output current. In OLV, CLV, and CLV/PM, it is set as a percentage of the motor rated torque.

■ L6-01, L6-04: Torque Detection Selection 1, 2

The torque detection function is triggered when the current or torque exceeds the levels set in L6-02 and L6-05 for longer than the time set in L6-03 and L6-06. L6-01 and L6-04 select the conditions for detection and the operation that follows.

No.	Parameter Name	Setting Range	Default
L6-01	Torque Detection Selection 1	0 to 8	0
L6-04	Torque Detection Selection 2	0 to 8	0

Setting 0: Disabled

Setting 1: oL3, oL4 at speed agree (Alarm)

Overtorque detection is active only when the output speed is equal to the speed reference, i.e., no detection during acceleration and deceleration. The operation continues after detection and an oL3/oL4 alarm is triggered.

Setting 2: oL3, oL4 at run (Alarm)

Overtorque detection works as long as the Up/Down command is active. The operation continues after detection and an oL3 or oL4 alarm is triggered.

Setting 3: oL3, oL4 at speed agree (Fault)

Overtorque detection is active only when the output speed is equal to the speed reference, i.e., no detection during acceleration and deceleration. The operation is stopped and an oL3 or oL4 fault is triggered.

Setting 4: oL3, oL4 at run (Fault)

Overtorque detection works as long as a Up/Down command is active. Operation stops and an oL3 or oL4 fault is triggered.

Setting 5: UL3, UL4 at speed agree (Alarm)

Undertorque detection is active only when the output speed is equal to the speed reference, i.e., no detection during acceleration and deceleration. The operation continues after detection and an oL3 or oL4 alarm is triggered.

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Setting 6: UL3, UL4 at run (Alarm)

Undertorque detection works as long as the Up/Down command is active. The operation continues after detection and an oL3 or oL4 alarm is triggered.

Setting 7: UL3, UL4 at speed agree (Fault)

Undertorque detection is active only when the output speed is equal to the speed reference, i.e., no detection during acceleration and deceleration. The operation is stopped and an oL3 or oL4 fault is triggered.

Setting 8: UL3, UL4 at run (Fault)

Undertorque detection works as long as a Up/Down command is active. Operation stops and an oL3 or oL4 fault is triggered.

■ L6-02, L6-05: Torque Detection Level 1, 2

These parameters set the detection levels for the torque detection functions 1 and 2. In V/f control mode, these levels are set as a percentage of the drive rated output current, while in vector control modes these levels are set as a percentage of the motor rated torque.

No.	Parameter Name	Setting Range	Default
L6-02	Torque Detection Level 1	0 to 300%	150%
L6-05	Torque Detection Level 2	0 to 300%	150%

■ L6-03, L6-06: Torque Detection Time 1, 2

These parameters determine the time required to trigger an alarm or fault after exceeding the levels in L6-02 and L6-05.

No.	Parameter Name	Setting Range	Default
L6-03	Torque Detection Time 1	0.0 to 10.0 s	0.1 s
L6-06	Torque Detection Time 2	0.0 to 10.0 s	0.1 s

◆ L7: Torque Limit

The torque limit function can be used to limit the torque in each of the four quadrants individually and thereby protect the elevator. It can be used in OLV, CLV, and CLV/PM control modes. The limit can be set by parameters. A digital output programmed for “During torque limit” (H2-01 through H2-05 = 30) will be switched when the drive is operating at the torque limit.

■ Setting Torque Limits

The torque limits are defined by parameters L7-01 to L7-04 for each of the four operation quadrants. *Figure 5.41* shows which of the limit settings is applied in each quadrant.

Note: The maximum output torque is ultimately limited by the drive output current. Output torque will not exceed the limit set for the drive rated current, even if the torque limits are set to higher values.

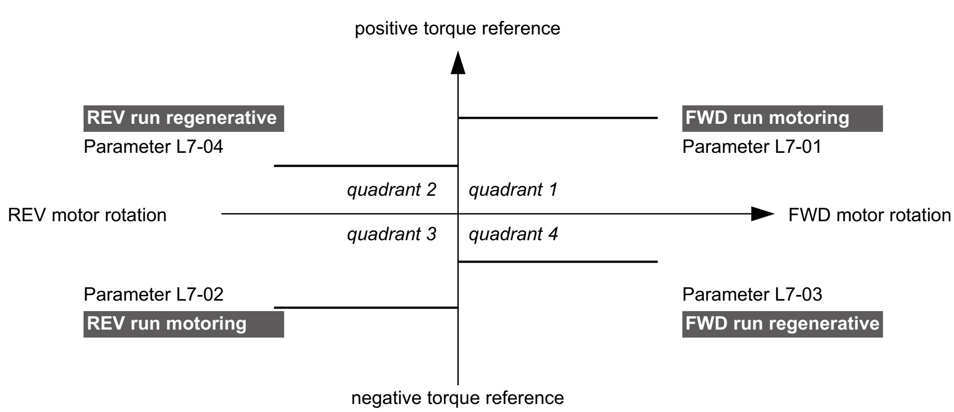


Figure 5.41 Torque Limit Parameters

■ L7-01 to L7-04: Torque Limits

These parameters set the torque limits in each operation mode.

A setting of 100% is equal to the motor rated torque.

No.	Parameter Name	Setting Range	Default
L7-01	Forward Torque Limit	0 to 300%	200%
L7-02	Reverse Torque Limit	0 to 300%	200%
L7-03	Forward Regenerative Torque Limit	0 to 300%	200%
L7-04	Reverse Regenerative Torque Limit	0 to 300%	200%

■ L7-16: Torque Limit Process at Start

Assigns a time filter to allow the torque limit to build at start.

No.	Parameter Name	Setting Range	Default
L7-16	Torque Limit Process at Start	0 to 1	1

Setting 0: Disabled

Toque limit is created at start without a delay time. Disable L7-16 to maximize response time when the application requires sudden acceleration or deceleration at start.

Setting 1: Enabled

A time filter is added to allow the torque limit to build at start.

◆ L8: Drive Protection

■ L8-02: Overheat Alarm Level

Sets the overheat alarm (oH) detection level.

The drive will output an alarm when the heatsink temperature exceeds the alarm level set in parameter L8-02.
When an output terminal is set for the oH pre-alarm (H2-□□ = 20), the switch will close when the heatsink temperature rises above L8-02.

No.	Parameter Name	Setting Range	Default
L8-02	Overheat Alarm Level	50 to 150 °C	Determined by o2-04

■ L8-03: Overheat Pre-Alarm Operation Selection

Sets the operation when an overheat pre-alarm is detected.

No.	Parameter Name	Setting Range	Default
L8-03	Overheat Pre-Alarm Operation Selection	0 to 3	3

Setting 0: Ramp to stop

If an overheat alarm occurs, the drive decelerates to stop using the deceleration ramp currently selected. If a digital output is programmed for “fault” (H2-□□ = E), this output will be triggered.

Setting 1: Coast to stop

If heatsink overheat (oH) occurs, the drive switches off the output and the motor coasts to stop. If a digital output is programmed for “fault” (H2-□□ = E), this output will be triggered.

Setting 2: Fast Stop

If an overheat alarm occurs, the drive decelerates to stop using the Fast Stop ramp (C1-09). If a digital output is programmed for “fault” (H2-□□ = E), this output will be triggered.

Setting 3: Alarm only

If an overheat alarm occurs, an alarm is output and the drive continues operation.

■ L8-05: Input Phase Loss Protection Selection

Enables or disables the input phase loss detection.

No.	Parameter Name	Setting Range	Default
L8-05	Input Phase Loss Protection Selection	0 to 3	1

Setting 0: Disabled

Setting 1: Enabled

Setting 2: Enabled during operation

Setting 3: Enabled during constant speed

A phase loss on the power supply side is detected by measuring the voltage ripple in the DC bus and the drive input voltage.

Input phase loss (PF) detection is typically triggered by single phase losses, voltage drop or phase imbalance.

Input phase loss detection is disabled when Rescue Operation is activated by one of the input terminals.

■ L8-06: Input Phase Loss Detection Level

Determines the level for input phase loss detection when a ripple is observed in the DC bus. Phase loss is detected when the value set to L8-06 is greater than the difference between the peak value and the lowest value of the voltage ripple.

100% detection level = voltage (200 V or 400 V) $\times \sqrt{2}$

No.	Parameter Name	Setting Range	Default
L8-06	Input Phase Loss Detection Level	0.0 to 50.0%	Determined by o2-04

■ L8-62: Operation Selection at Input Phase Loss

Sets stopping method when a input phase loss fault (PF) occurs.

No.	Parameter Name	Setting Range	Default
L8-62	Operation Selection at Input Phase Loss	0 to 3	1

Setting 0: Ramp to stop. Decelerates to stop using the deceleration ramp in C1-02.

Setting 1: Coast to stop

Setting 2: Fast stop. Decelerates to stop using the deceleration ramp in C1-09.

Setting 3: Alarm only. Drive continues operation.

■ L8-07: Output Phase Loss Protection

Enables and disables the output phase loss detection triggered when the output current falls below 5% of the drive rated current.

Note:
1. Output phase loss detection can mistakenly be triggered if the motor rated current is very small compared to the drive rating. Disable this parameter in such cases.
2. Output phase loss detection is not possible when the drive is running a PM motor with light load.

No.	Parameter Name	Setting Range	Default
L8-07	Output Phase Loss Protection	0 to 3	0

Setting 0: Disabled

Setting 1: Fault when one phase is lost

An output phase loss fault (LF) is triggered when one output phase is lost. The output shuts off and the motor coasts to stop.

Setting 2: Fault when two phases are lost

An output phase loss fault (LF) is triggered when two output phases are lost. The output shuts off and the motor coasts to stop.

Setting 3: Fault at phase loss at start or when two phases lost mid-operation

An output phase loss fault (LF) is triggered when one phase is lost at motor start or when two phases are lost while running at speed. The output shuts off, the motor coasts to a stop.

Note: When setting L8-07 to 3, incorrectly setting parameters S1-02 and S1-04 may cause poor performance or nuisance faults or alarms. Set S1-02 and S-04 as follows:
S1-02 (DC Injection Current at Start) = a value greater than 15%
S1-04 (DC Injection/Position Lock time at Start) = a value greater than 100 ms.

■ L8-09: Output Ground Fault Detection Selection

Enables or disables the output ground fault detection.

No.	Parameter Name	Setting Range	Default
L8-09	Output Ground Fault Detection Selection	0 or 1	1

Setting 0: Disabled

Ground faults are not detected.

Setting 1: Enabled

A ground fault (GF) is triggered when high leakage current or a ground short circuit occurs in one or two output phases.

■ L8-10: Heatsink Cooling Fan Operation Selection

Selects the heatsink cooling fan operation.

No.	Parameter Name	Setting Range	Default
L8-10	Heatsink Cooling Fan Operation Selection	0 to 2	0

Setting 0: Run with timer

The fan is switched on when a Up/Down command is active. It is switched off with the delay set in parameter L8-11 after the Up/Down command has been released. Using this setting extends the fan lifetime.

Setting 1: Run always

The fan runs whenever power is supplied to the drive.

Setting 2: Temperature controlled

Cooling fan operated depending on the temperature of the drives heatsink.

■ L8-11: Heatsink Cooling Fan Off Delay Time

Sets the cooling fan switch off-delay time if parameter L8-10 is set to 0.

No.	Parameter Name	Setting Range	Default
L8-11	Heatsink Cooling Fan Off Delay Time	0 to 300 s	60 s

■ L8-12: Ambient Temperature Setting

If the temperature where the drive is mounted is above the specified values, the drive rated current must be reduced for optimal performance life. By setting the ambient temperature to parameter L8-12 and adjusting the installation method setting in L8-35, the drive rating automatically adapts to safe values.

No.	Parameter Name	Setting Range	Default
L8-12	Ambient Temperature Setting	-10 to 50 °C	40 °C

■ L8-15: oL2 (Drive Overload) Characteristics Selection at Low Speeds

Selects whether the drive overload capability (oL fault detection level) is reduced at low speeds in order to prevent premature output transistor failures.

Note: Contact Yaskawa for consultation first before disabling this setting.

No.	Parameter Name	Setting Range	Default
L8-15	oL2 Characteristics Selection at Low Speed	0 or 1	1

Setting 0: Protection disabled at low speed

The overload protection level is not reduced. Frequently operating the drive with high output current at low speed can lead to premature drive faults.

Setting 1: protection enabled at low speed

The overload protection level (oL2 fault detection level) is automatically reduced at speeds below 6 Hz.

■ L8-27: Overcurrent Detection Gain

Adjusts the overcurrent detection level when running in CLV/PM to prevent motor damage. A setting of 100% is equal to the motor rated current. When the drive rated current is considerably higher than the motor rated current, use this parameter to decrease the overcurrent level in order to prevent motor demagnetization by too high current.

Overcurrent detection will use whichever value is the lowest: the overcurrent level for the drive, or the motor rated current multiplied by L8-27.

No.	Parameter Name	Setting Range	Default
L8-27	Overcurrent Detection Gain	0.0 to 300.0%	300.0%

■ L8-29: Current Unbalance Detection (LF2)

Enables or disables output current imbalance detection when running in CLV/PM. Current unbalance can heat up a PM motor and lead to demagnetization of the magnets. The current imbalance detection function prevents such motor damage by monitoring output current and triggering the LF2 fault when current unbalance occurs.

No.	Parameter Name	Setting Range	Default
L8-29	Current Unbalance Detection (LF2)	0 or 1	1

Setting 0: Disabled

No current unbalance protection is provided to the motor.

Setting 1: Enabled

The LF2 fault is triggered if an output current imbalance is detected. Drive output shuts off and the motor coasts to stop.

■ L8-35: Installation Selection

Selects the type of installation for the drive and changes the drive overload (oL2) limits accordingly.

Note: This parameter is not reset when the drive is initialized.

No.	Parameter Name	Setting Range	Default
L8-35	Installation Selection	0 or 2	Determined by o2-04

Setting 0: IP00 enclosure

For an IP00 enclosure drive installed with at a minimum of 30 mm space to the next drive or a cabinet wall.

Setting 2: IP00 enclosure with top protective cover

For an IP00 enclosure drive with top protective cover. The digital operator shows “IP20/Nema Type 1”.

■ L8-38: Automatic Torque Boost Function

When the output current reaches a certain level the drive automatically reduces the carrier frequency to the level set in L8-39. Because lowering the carrier frequency increases the overload tolerance, the drive is capable of creating considerably more torque. When the output current falls, the carrier frequency switches back to the value set in C6-03.

Note: **1.** Automatically lowering the carrier frequency increases motor noise.
2. Confirm drive capacity so that the maximum output current is less than the current limit.

No.	Parameter Name	Setting Range	Default
L8-38	Automatic Torque Boost Function	0 or 3	0

Setting 0: Disabled

The carrier frequency is not automatically reduced.

Setting 3: Enabled

The torque capability is improved by reducing the carrier frequency when the output current exceeds a certain value.

■ L8-39: Reduced Carrier Frequency

Determines value the carrier frequency is reduced to by the torque boost function.

No.	Parameter Name	Setting Range	Default
L8-39	Reduced Carrier Frequency	1.0 to 15.0 kHz	3.0 kHz

■ L8-55: Internal Braking Transistor Protection

Enables or disables protection for the internal braking transistor.

No.	Parameter Name	Setting Range	Default
L8-55	Internal Braking Transistor Protection	0 or 1	1

Setting 0: Disabled

Disable braking transistor protection when not using the internal braking transistor, including the following instances:

- When using a regen converter such as DC5.
- When using a regen unit such as RC5.
- When using external braking transistor options like CDBR units.
- When using the drive in common DC bus applications and the internal braking chopper is not installed.

Enabling L8-55 under such conditions can incorrectly trigger a braking transistor fault (rF).

Setting 1: Enabled

The following models come with a built-in braking transistor:

- 2A0018 to 2A0144
- 4A0009 to 4A0075

Enable L8-55 when connecting a braking resistor or a braking resistor unit to the drive built-in braking transistor.

Overload Tolerance for Internal Braking Transistor

Below, *Figure 5.42* show the overload tolerance level for the drive's built-in braking transistor.

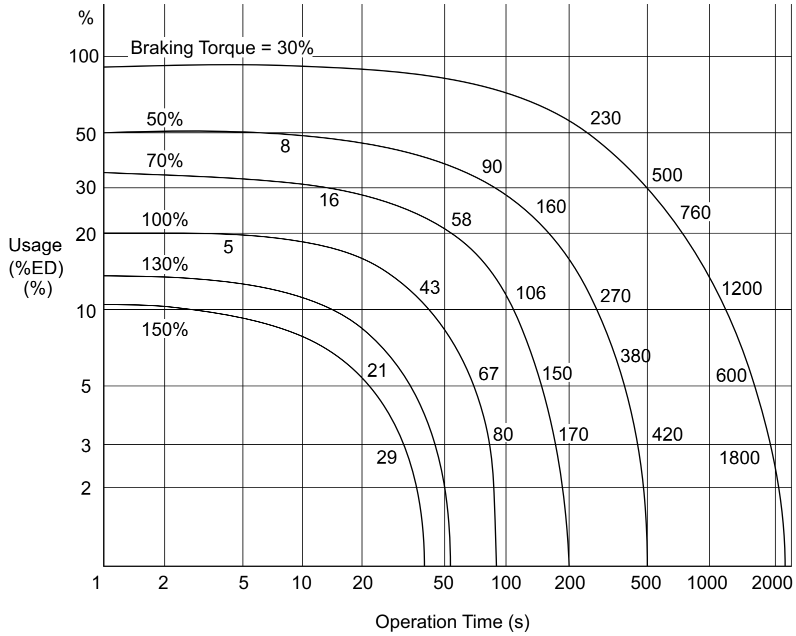


Figure 5.42 Overload Tolerance for Braking Transistor (2A0018 to 2A0144 and 4A0009 to 4A0075)

■ L8-77: Oscillation Suppression

If speed oscillations with the same frequency as the output frequency occur with an unloaded motor, parameter L8-77 can be adjusted to suppress these oscillations. While watching the motor speed, increase or decrease L8-77 until the oscillation disappears.

This parameter rarely requires adjustment.

No.	Parameter Name	Setting Range	Default
L8-77	Oscillation Suppression	–100 to 100	0

■ L8-88: Safe Disable Operation Mode

Determines the operation performed by the drive when the Safe Disable input is activated.

No.	Parameter Name	Setting Range	Default
L8-88	Safe Disable Operation Mode	0 or 1	1

Setting 0: Mode 0

Setting 1: Mode 1

When the Safe Disabled Input is triggered, the operator displays and alarm, and the corresponding output terminal will react as follows:

L8-88	Safe Disable Operation Selection	Alarm Display during Safety Disable	Alarm Output (H2-☐☐ = 10)	Drive Ready (H2-☐☐ = 6)
0 (mode 0)	Hbb	ALM flashes	ON	OFF
1 (mode1)	Hbb	ALM flashes	OFF	ON

■ L8-89: Current Monitoring Selection

Enables and disables the Current Monitoring function. When this parameter is set to 1 (Enabled), the current monitoring level (L8-99) is added to the conditions required to turn off the Motor Contactor Feedback command at a stop.

No.	Parameter Name	Setting Range	Default
L8-89	Current Monitoring Selection	0, 1	0

Setting 0: Disabled

Setting 1: Enabled

■ L8-99: Current Monitoring Level

Sets the current monitoring level as a percentage of the drive's rated current. When the output current is equal to or below the set level, the Motor Contactor Feedback command turns off. This parameter is also used to activate the Motor Current Monitor (H2-☐☐ = 5C).

No.	Parameter Name	Setting Range	Default
L8-99	Current Monitoring Level	0.0 to 50.0 %	10.0 %

5.9 n: Special Adjustments

These parameters handle a variety of specialized adjustments and functions, including AFR Control, resistance between motor lines, PM motor control functions, and current detection adjustments.

◆ n1: Hunting Prevention

■ n1-08: Leakage Current Vibration Control Selection

Selects the method of Leakage-Current Vibration Control. Parameter does not typically require adjustment.

No.	Parameter Name	Setting Range	Default
n1-08	Leakage Current Vibration Control Selection	0, 1	0

Setting 0: Method 1
Setting 1: Method 2

◆ n2: Speed Feedback Detection Control (AFR) Tuning

These parameters are used to achieve speed stability when a load is suddenly applied or removed.

Note: Properly set all motor parameters or perform Auto-Tuning before making changes to the AFR parameters.

■ n2-01: Speed Feedback Detection Control (AFR) Gain

Sets the internal speed feedback detection control gain in the AFR.

No.	Parameter Name	Setting Range	Default
n2-01	Speed Feedback Detection Control (AFR) Gain	0.00 to 10.00	1.00

Although this parameter rarely needs to be changed, it may require adjustment in the following situations:

- If hunting occurs, increase the setting value in steps of 0.05 while checking the response.
- If response is low, decrease the setting value in steps of 0.05 while checking the response.

■ n2-02, n2-03: Speed Feedback Detection Control (AFR) Time Constant 1, 2

Parameter n2-02 sets the time constant normally used by AFR.

Parameter n2-03 sets the time constant during regenerative operation.

No.	Parameter Name	Setting Range	Default
n2-02	Speed Feedback Detection Control (AFR) Time Constant 1	0 to 2000 ms	50 ms
n2-03	Speed Feedback Detection Control (AFR) Time Constant 2	0 to 2000 ms	750 ms

Note: Setting parameter n2-02 higher than n2-03 will trigger an oPE08 error.

Although these parameters rarely need to be changed, they may require adjustment in the following situations:

- If hunting occurs, increase n2-02. If response is low, decrease it.
- Increase n2-03 if overvoltage occurs with high inertia loads at the end of acceleration or with sudden load changes.
- If setting n2-02 to a higher value, also increase C4-02 (Torque Compensation Delay Time Constant 1) proportionally.

◆ n5: Inertia Compensation

Enabling Inertia Compensation improves the responsiveness of the drive to speed reference changes in applications where a high speed control proportional gain setting (C5-01, C5-03, C5-13) would lead to problems with overshoot, undershoot, or oscillation. *Figure 5.43* gives an example of overshoot reduction by Inertia Compensation. Parameters related to this function and the function principle are illustrated in *Figure 5.44*. Inertia Compensation can only be used in Closed Loop Vector Control for induction or PM motors (A1-02 = 3 or 7).

Note: Prior to using Feed Forward, always perform Auto-Tuning or set the correct motor data manually. Also perform ASR Auto-Tuning to set the speed loop gain (C5-01, C5-03, C5-13), or adjust it manually. Fine-tune the other speed control loop parameters (C5-□□) if required.

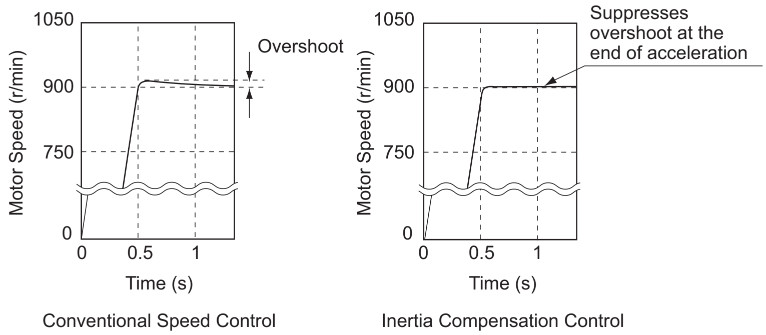


Figure 5.43 Overshoot Suppression by Inertia Compensation

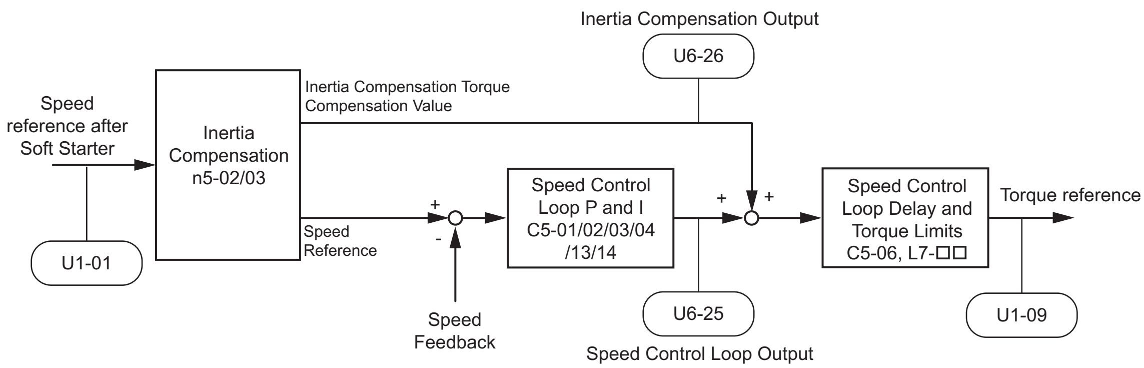


Figure 5.44 Inertia Compensation

Note: Prior to using Inertia Compensation, always perform Auto-Tuning or set the correct motor data manually. and adjust the Speed Control Loop.

■ n5-01: Inertia Compensation Selection

Enables or disables the Inertia Compensation function.

No.	Parameter Name	Setting Range	Default
n5-01	Inertia Compensation Selection	0 or 1	0

Setting 0: Disabled
Setting 1: Enabled

■ n5-02: Motor Acceleration Time

Sets the time required to accelerate the motor from a full stop up to the rated speed at the rated torque.

No.	Parameter Name	Setting Range	Default
n5-02	Motor Acceleration Time	0.001 to 10.000 s	Determined by o2-04

Calculation

The motor acceleration time can be calculated by,

$n5\text{-}02 = \dfrac{\pi \cdot J_{Motor} \cdot n_{rated}}{30 \cdot T_{rated}}$	Where: • J_{Motor} is the motor inertia in kgm^2. • n_{rated} is the rated speed of the motor in r/min • T_{rated} is the rated torque of the motor in N·m.

Parameter Details 5

Measuring Acceleration Time

Take the following steps when measuring the motor acceleration time.

1. Decouple motor and load.
2. Perform Auto-Tuning or manually enter the correct motor data.
3. Properly set up the speed loop (ASR).
4. Set the acceleration time to zero.
5. Set the forward torque limit in parameter L7-01 to 100%.
6. Set the speed reference equal to the motor rated speed.
7. While monitoring the motor speed in U1-05, start the motor in the forward direction and measure the time it takes to reach the rated speed.
8. Reverse the parameter settings above and set the measured time to parameter n5-02.

■ n5-03: Inertia Compensation Gain

Parameter n5-03 sets the inertia ratio of the load connected to the motor.

No.	Parameter Name	Setting Range	Default
n5-03	Inertia Compensation Gain	0.00 or 100.00	1.00

Calculate the value for n5-03 as explained below.

$\Sigma J = J_{TS} \cdot i^2 + \Sigma m \cdot \left(\frac{30 \cdot v_{r\_Elev}}{\pi \cdot n_{r\_Mot}} \right)^2$ $n5\text{-}03 = \Sigma J / J_{Mot}$	• J_{Mot} - Motor inertia in kgm^2 • n_{r_Mot} - Rated motor speed in r/min • T_{r_Mot} - Rated motor torque in Nm • J_{TS} - Traction sheave inertia in kgm^2 • i - Gear ratio (n_{Load}/n_{Mot}) • v_{r_Elev} - Rated elevator speed in m/s • Σm - Mass of all moved parts (car, counterweight, ropes, load <1>) in kg

<1> Insert 0 kg for the load to calculate the lowest setting, insert the elevator rated load to calculate the maximum setting for n5-03. Use the lower of calculated values for initial trials and increase n5-03 gradually until the desired performance is achieved.

■ Speed Feedback Compensation: Speed Observer

Enabling the Speed Feedback Compensation can reduce oscillation and increase responsiveness to the speed reference by compensating for phase delay.

Note:
1. Set n5-07 to 1 to use the Speed Feedback Compensation.
2. Set C5-17 (motor inertia) and C5-18 (load inertia ratio) to the correct values before using the Speed Feedback Compensation.
3. If the product of C5-17 × C5-18 is relatively large, the estimated speed will be very slow.
4. Reduce the products of C5-17 × C5-18 if oscillation is a problem.
5. C5-18 to at least 1.1 when using the Speed Feedback Compensation. A setting of 1.0 or less disables the Speed Feedback Compensation.

Adjusting the Speed Feedback Compensation

Follow the procedure below to set up the Speed Feedback Compensation

1. Set the drive for Closed Loop Vector for PM motors.
2. Enter the correct data from the motor nameplate and the motor test report to the E5-□□ parameters.
3. Set all ASR-related parameters (C5-□□) to their most appropriate values.
4. Set the Speed Feedback Compensation to operate in test mode (n5-07).
5. Connect the ropes to the motor.
6. Start operating the elevator while looking at the Speed Feedback Compensation output monitor (U6-56) and the motor speed feedback (U1-05).
7. Adjust the Speed Feedback Compensation gain (n5-08) and C5-18 so that the monitor values in U6-56 and U1-05 are relatively low.

Figure 5.45 shows a block diagram for the Speed Feedback Compensation.

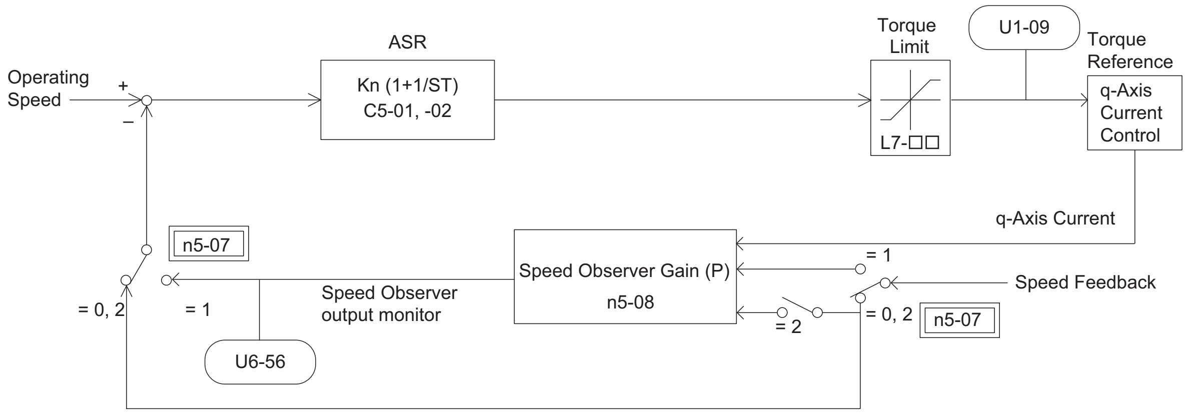


Figure 5.45 Speed Feedback Compensation Operation

■ n5-07: Speed Feedback Compensation Selection

Enables or disables the Speed Feedback Compensation.

Enabling the Speed Feedback Compensation can help stop motor oscillation that results from setting the ASR proportional gain (C5-01) to a high value for faster speed response.

No.	Parameter Name	Setting Range	Default
n5-07	Speed Feedback Compensation Selection	0 to 2	0

Setting 0: Disabled
Setting 1: Enabled
Setting 2: Speed Feedback Compensation test mode

■ n5-08: Speed Feedback Compensation Gain (P)

Sets the proportional gain for the Speed Feedback Compensation.

Although this parameter rarely requires adjustment, increasing the gain can help improve responsiveness relative to the load. Lower setting if oscillation occurs.

No.	Parameter Name	Setting Range	Default
n5-08	Speed Feedback Compensation Gain (P)	0.00 to 300.00	3.00

◆ n6: Online Tuning

Online Tuning compensates insufficient torque and diminished speed control accuracy due to fluctuating motor temperature.

■ n6-01: Online Tuning Selection

Selects the type of motor data Online Tuning uses for Open Loop Vector Control.

No.	Parameter Name	Setting Range	Default
n6-01	Online Tuning Selection	0 to 2	2

Setting 0: Disabled
Setting 1: Line-to-line resistance tuning

This setting enables line-to-line resistance online tuning. This procedure is effective for speed values up to 6 Hz and improves the overload capacity in the low speed range by adjusting the value set for the motor resistance.

Setting 2: Voltage correction

The drive adjusts the output voltage during run to improve overload tolerance and minimize the effects of high temperatures on speed accuracy.

Note: This setting can only be selected if the Energy Saving function is disabled (b8-01 = 0).

■ n6-05: Online Tuning Gain

Sets the compensation gain for the voltage correction in the Online Tuning function (n6-01 = 2). Although this parameter rarely needs to be changed, increase the set value in steps of 0.1 if an overload fault occurs during voltage correction.

No.	Parameter Name	Setting Range	Default
n6-05	Online Tuning Gain	0.1 to 50.0	1.0

◆ n8: PM Motor Control Tuning

Parameters in the n8 group are used to adjust the Initial Rotor Pole Position Search function and other PM motor control related functions like the current control loop in CLV/PM or voltage saturation prevention (voltage limit).

■ Initial Rotor Pole Position Search Settings

When a PM motor with a non-absolute encoder such as an incremental encoder with a PG-X3 option is used, the drive needs to search for the rotor pole position before it can operate the motor. This search is performed always:

- when the Up/Down command is issued for the first time after the power has been switched on.
- after one of the following errors occurred: dv1, dv2, dv3, dv4, dv6, dv7, PGo, PGoH.
- when an Up/Down command issued after the setting of parameter n8-35 had been changed.

With default settings the drive will generate a dv8 error if initial rotor pole position search fails (n8-86 = 1). The brake control output (H2-☐☐ = 50) will not open in this case.

When not using the drive’s brake sequence, include the Motor Pole Search Status signal (digital output programmed for H2-☐☐ = 61) so that the brake can open only if motor pole position search has been finished successfully. ***Refer to Setting 61: Motor pole search status on page 207*** for details.

■ n8-01: Initial Polarity Estimation Current

Sets the current used for the initial rotor position estimation as a percentage of the motor rated current.

No.	Parameter Name	Setting Range	Default
n8-01	Initial Polarity Estimation Current	0 to 100%	50%

■ n8-02: Pole Attraction Current

Sets the pull-in current used to detect rotor position. This setting rarely needs to be changed.

No.	Parameter Name	Setting Range	Default
n8-02	Pole Attraction Current	0 to 150%	80%

■ n8-35: Initial Rotor Position Detection Selection

Selects how the rotor position is detected at start.

No.	Parameter Name	Setting Range	Default
n8-35	Initial Rotor Position Detection Selection	1 or 2	1

Setting 1: High Frequency Injection

High frequency is injected in order to detect the rotor position. Some noise may be generated from the motor at start.

Setting 2: Pulse injection

A pulse signal is injected into the motor in order to detect the rotor position.

■ n8-36: High Frequency Injection Level

Sets the frequency level used for High Frequency Injection.

No.	Parameter Name	Setting Range	Default
n8-36	High Frequency Injection	25 to 1000 Hz	500 Hz

■ n8-37: High Frequency Injection Amplitude

Sets the amplitude for High Frequency Injection as a percentage of the voltage (200 V or 400 V).

No.	Parameter Name	Setting Range	Default
n8-37	High Frequency Injection Amplitude	0.0 to 99.9%	20.0%

■ n8-81: High Frequency Injection during Rescue Operation

Sets the frequency used for High Frequency Injection during Rescue Operation.

No.	Parameter Name	Setting Range	Default
n8-81	High Frequency Injection during Rescue Operation	25 to 1000 Hz	90 Hz

■ n8-82: High Frequency Injection Amplitude during Rescue Operation

Sets the amplitude for High Frequency Injection during Rescue Operation as a percentage of the voltage (200 V or 400 V).

No.	Parameter Name	Setting Range	Default
n8-82	High Frequency Injection Amplitude during Rescue Operation	0.1 to 99.9%	15.0%

■ n8-84: Polarity Detection Current

Sets the current level (E5-03) as a percentage for detecting polarity during Initial Polarity Estimation.

No.	Parameter Name	Setting Range	Default
n8-84	Polarity Detection Current	0 to 150%	100%

■ n8-86: Magnet Pole Search Error Detection Selection

Enables fault detection for Initial Polarity Estimation (dv8).

No.	Parameter Name	Setting Range	Default
n8-86	Magnet Pole Search Error Detection Selection	0 or 1	0

Setting 0: Disabled

After searching for the rotor pole position one time, the drive starts using the detected rotor position. If the detected position is wrong, an error occurs when the drive attempts to run the motor. The initial pole search takes approximately 1.5 s.

Setting 1: Enabled

The rotor pole position search is executed multiple times. The drive starts using the detected rotor position only if there is no difference between the search results. Otherwise a dv8 error will be output. The initial pole search takes approximately 1.5 to 5.0 s.

■ Other Settings

Parameters n8-29 to n8-33 can be used to adjust the current control loop. Adjustment is not normally required.

Parameter n8-62 sets a voltage limit in order to prevent voltage saturation.

■ n8-29: q-Axis Current Control Gain during Normal Operation

Sets the q-Axis proportional gain for the automatic current regulator.

No.	Parameter Name	Setting Range	Default
n8-29	q-Axis Current Control Gain during Normal Operation	0 to 2000 rad/s	1000 rad/s

■ n8-30: q-Axis Current Control Integral Time during Normal Operation

Sets the q-Axis integral time for the automatic current regulator.

No.	Parameter Name	Setting Range	Default
n8-30	q-Axis Current Control Integral Time during Normal Operation	0.0 to 100.0 ms	10.0 ms

■ n8-32: d-Axis Current Control Gain during Normal Operation

Sets the d-Axis proportional gain for the automatic current regulator.

No.	Parameter Name	Setting Range	Default
n8-32	d-Axis Current Control Gain during Normal Operation	0 to 2000 rad/s	1000 rad/s

■ n8-33: d-Axis Current Control Integral Time during Normal Operation

Sets the d-Axis integral time for the automatic current regulator.

No.	Parameter Name	Setting Range	Default
n8-33	d-Axis Current Control Integral Time during Normal Operation	0.0 to 100.0 ms	10.0 ms

■ n8-62: Output Voltage Limit

Sets the output voltage limit to prevent voltage saturation of the motor. Avoid setting this value higher than the input voltage on the motor nameplate to maintain optimum motor performance.

No.	Parameter Name	Setting Range	Default
n8-62 <1>	Output Voltage Limit	0.0 to 230.0 Vac	200 Vac

<1> Values shown here are for 200 V class drives. Double values when using a 400 V class drive.

◆ n9: Current Detection Adjustments

■ n9-60: A/D Conversion Start Delay

Sets a delay time used for A/D conversion of the current. This value rarely needs to be changed. However, it can help to resolve speed ripple problems at constant speed when using a PM motor. Prior to adjusting this value, make sure all other parameters (motor data, speed loop settings) are adjusted correctly.

No.	Parameter Name	Setting Range	Default
n9-60	A/D Conversion Start Delay	0.0 to 40.0 µs	Determined by o2-04

5.10 o: Operator Related Settings

These parameters control the various functions, features, and display of the digital operator.

◆ o1: Digital Operator Display Selection

These parameters determine the data display on the digital operator.

■ o1-01: Drive Mode Unit Monitor Selection

When using an LED operator, pressing the up arrow key will display the following data: speed reference → rotational direction → output speed → output current → o1-01 selection.
Parameter o1-01 selects the content of the last monitor in this sequence. This is done by entering the 1☐☐ part of U1-☐☐. There is no effect like this on an LCD operator.

No.	Parameter Name	Setting Range	Default
o1-01	Drive Mode Unit Monitor Selection	105 to 699 U1-04 (Control Mode) to U6-99 (Option Monitor 20) <1>	106 (U1-06)

<1> U2-☐☐ and U3-☐☐ parameters cannot be selected.

■ o1-02: User Monitor Selection after Power Up

Selects which monitor parameter is displayed upon power up. Certain monitors are not available in some control modes. *Refer to U: Monitor Parameters on page 265* for a list of monitors.

No.	Parameter Name	Setting Range	Default
o1-02	User Monitor Selection after Power Up	1 to 5	1

Setting 1: Speed reference (U1-01)

Setting 2: Motor direction

Setting 3: Output speed (U1-02)

Setting 4: Output current (U1-03)

Setting 5: User-selected monitor (set by o1-01)

If o1-02 is set to 5, o1-01 can be used to change the content of this monitor.

■ o1-03: Digital Operator Display Unit Selection

Sets the units used to display speed related settings and monitors as well as accel/decel rate settings and jerk settings. *Refer to Digital Operator Display Unit Selection on page 105*.

No.	Parameter Name	Setting Range	Default
o1-03	Digital Operator Display Unit Selection	0 to 6	1

Setting 0: 0.01 Hz units

Setting 1: 0.01% units (100% = max. output frequency)

Setting 2: r/min units (calculated by the max output frequency and the no. of motor poles)

Setting 3: User-set units (use o1-10, o1-11)

Set o1-03 to 3 for user-set units, then set parameters o1-10 and o1-11.

Set the value use for the maximum frequency reference to o1-10. The placement of the decimal point in this number should be set to o1-11.

For example, to have the maximum output speed displayed as “100.00”, set the o1-10 = 1000 and o1-11 = 2 (i.e., 1000 with 2 decimal points).

Setting 4: Elevator units 1 (speed in m/s, accel/decel rate and jerk in s)

Setting 5: Elevator units 2 (speed in m/s, accel/decel rate in m/s², jerk in m/s³)

Setting 6: Elevator units 3 (speed in ft/min, accel/decel rate in ft/s^2, jerk in ft/s^3)

■ o1-04: V/f Pattern Setting Units

Determines the units used for the frequency reference when setting parameters that create the V/f pattern: E1-04, E1-06, E1-09, E1-11, and E2-04. For motor 2, this includes parameters E3-04, E3-06, E3-07, E3-09, and E4-04.

Enabled only in vector control modes (CLV and CLV/PM).

No.	Parameter Name	Setting Range	Default
o1-04	V/f Pattern Setting Units	0 or 1	Determined by A1-02

Setting 0: Hz

Setting 1: r/min

Note: For motor 2, o1-04 can only be set to 0 for Hertz.

■ o1-05: LCD Contrast Control

Adjusts the brightness and contrast for the LCD screen of the digital operator. Lower the setting to make the LCD brighter or raise the setting to make the LCD darker.

No.	Parameter Name	Setting Range	Default
o1-05	LCD Contrast Control	0 to 5	3

■ o1-06: User Monitor Selection Mode

The digital operator display monitors shown directly below the active monitor are the next two sequential monitors. If o1-06 (User Monitor Selection Mode) is set to "1: 3 Monitor Selectable", those two monitors are locked as specified by parameters o1-07 and o1-08 and will not change as the top parameter is scrolled with the Up/Down Arrow keys.

No.	Parameter Name	Setting Range	Default
o1-06	User Monitor Selection Mode	0 or 1	0

Setting 0: 3 Monitor Sequential (Displays the next 2 sequential monitors)

Setting 1: 3 Monitor Selectable (o1-07, and o1-08 selected monitor is displayed)

■ o1-07: Second Line Monitor Selection

Selects the monitor displayed on the second line. The monitor parameter number is entered into the spaces provided: U□-□□.

For example, set "104" to display monitor parameter U1-04.

No.	Parameter Name	Setting Range	Default
o1-07	Second Line Monitor Selection	101 to 699 (Speed Reference) to U6-99 (Option Monitor 20)	102

■ o1-08: Third Line Monitor Selection

Selects the monitor displayed on the second line. The monitor parameter number is entered into the spaces provided: U□-□□. For example, set "104" to display monitor parameter U1-04.

No.	Parameter Name	Setting Range	Default
o1-08	Third Line Monitor Selection	101 to 699 (Speed Reference) to U6-99 (Option Monitor 20)	103

■ o1-10: User-Set Display Units Maximum Value

Determines the display value that is equal to the maximum output frequency.

No.	Parameter Name	Setting Range	Default
o1-10	User-Set Display Units Maximum Value	1 to 60000	Determined by o1-03

Note: This parameter is displayed only when the drive is set to allow for user-set units (o1-03 = 3).

■ o1-11: User-Set Display Units Decimal Display

Determines how many decimal points should be used to set and display the speed reference.

No.	Parameter Name	Setting Range	Default
o1-11	User-Set Display Units Decimal Display	0 to 3	Determined by o1-03

Setting 0: No decimal point
Setting 1: One decimal point
Setting 2: Two decimal points
Setting 3: Three decimal points

■ o1-12: Length Units

Sets the units used for distance control and for the sheave diameter.

Note: This parameter determines whether the following parameters are set in millimeters or inches: o1-20, S5-11, S5-12, U4-42, U4-33, and U4-44.

No.	Parameter Name	Setting Range	Default
o1-12	Length Units	0 or 1	0

Setting 0: Millimeter units
Setting 1: Inch units

■ o1-20: Traction Sheave Diameter

WARNING! *Make sure that the traction sheave diameter (o1-20), the deceleration distance (S5-11) and the stop distance (S5-12) are all set to the correct units. If these settings are incorrect, the elevator will not stop at the designated location, overrun will occur, and may cause serious injury or death. Before using stop distance control, make sure that parameter o1-20, S5-11, and S5-12 are set to correctly.*

Sets the traction sheave diameter.

No.	Parameter Name	Setting Range	Default
o1-20	Traction Sheave Diameter	100 to 2000 mm <1>	400 mm <1>

<1> The default setting will change if the length units are set in inches (o1-12 = 1). The setting range will become 3.70 to 78.00 inches, and the default will be 15.70 inches.

■ o1-21: Roping Ratio

Sets the roping ratio.

No.	Parameter Name	Setting Range	Default
o1-21	Roping Ratio	1 to 4	2

Setting 1: 1: 1
Setting 2: 1: 2
Setting 3: 1: 3
Setting 4: 1: 4

■ o1-22: Mechanical Gear Ratio

Sets the gear ratio of the mechanical gear.

No.	Parameter Name	Setting Range	Default
o1-22	Mechanical Gear Ratio	0.10 to 100.00	Determined by A1-02

■ o1-23: HBB Non Display Select

Sets the gear ratio of the mechanical gear.

No.	Parameter Name	Setting Range	Default
o1-23	HBB Non Display Select	0, 1	0

Setting 0: Show HBB

Setting 1: Hide HBB

HBB is not displayed on the digital operator while the safety signal is being input.

◆ o2: Digital Operator Keypad Functions

These parameters determine the functions assigned to the operator keys.

■ o2-01: LO/RE (LOCAL/REMOTE) Key Function Selection

Parameter o2-01 determines whether the LO/RE key on the digital operator will be enabled or not for switching between LOCAL and REMOTE.

No.	Parameter Name	Setting Range	Default
o2-01	LO/RE Key Function Selection	0 or 1	0

Setting 0: Disabled

The LO/RE key is disabled.

Setting 1: Enabled

The LO/RE switches between LOCAL and REMOTE operation. Switching is possible during stop only. When LOCAL is selected, the LED indicator on the LO/RE key will light up.

■ o2-02: STOP Key Function Selection

Determines if the STOP key on the digital operator can still be used to stop drive operation when the drive is being controlled from a remote source (i.e., not from digital operator).

No.	Parameter Name	Setting Range	Default
o2-02	STOP Key Function Selection	0 or 1	0

Setting 0: Disabled

Setting 1: Enabled

The STOP key will terminate drive operation even if the Up/Down command source is not assigned to the digital operator. Cycle the Up/Down command to restart the drive if the drive has been stopped by pressing the STOP key.

■ o2-03: User Parameter Default Value

After completely setting up drive parameters, save the values as user-set defaults with parameter o2-03. After saving the values, parameter A1-03 (Initialize Parameters) will offer the choice of "1110: User Initialize". Selecting 1110 resets all parameters to the user-set default values. ***Refer to A1-03: Initialize Parameters on page 151*** for details on drive initialization.

No.	Parameter Name	Setting Range	Default
o2-03	User Parameter Default Value	0 to 2	0

Setting 0: No change (awaiting command)

Setting 1: Set User Initialize values

The current parameter settings are saved as user-set default for a later User Initialization. Setting o2-03 to 1 and pressing the ENTER key saves the values and returns the display to 0.

Setting 2: Clear User Initialize Values

All user-set defaults for "User Initialize" are cleared. Setting o2-03 to 2 and pressing the ENTER key erases the values and returns the display to 0.

■ o2-04: Drive Model Selection

This parameter must be set when replacing the control board or the terminal board for any reason. For information on the drive model selection, refer to ***Defaults by Drive Model Selection (o2-04) on page 413***.

NOTICE: *Drive performance will suffer and protective functions will not operate properly if the correct drive capacity is not set to o2-04.*

No.	Parameter Name	Setting Range	Default
o2-04	Drive Model Selection	–	Determined by drive capacity

■ o2-05: Speed Reference Setting Method Selection

Determines if the ENTER key must be pressed after changing the speed reference using the digital operator while in the Drive Mode.

No.	Parameter Name	Setting Range	Default
o2-05	Speed Reference Setting Method Selection	0 or 1	0

Setting 0: ENTER key required

Every time the speed reference is changed using the digital operator, the ENTER key must be pressed for the drive to accept the change.

Setting 1: ENTER key not required

The output speed changes immediately when the reference is changed by the up or down arrow keys on the digital operator. The ENTER key does not need to be pressed. The speed reference is saved for 5 s after it is changed.
The operator display flashes when settings can be made for the frequency reference.

Figure 5.46 Ready for Setting Speed Reference

■ o2-06: Operation Selection when Digital Operator is Disconnected

Determines whether the drive will stop when the digital operator is removed in LOCAL mode or when b1-02 is set to 0. When the operator is reconnected, the display will indicate that it was disconnected.

No.	Parameter Name	Setting Range	Default
o2-06	Digital Operator Disconnection Operation	0 or 1	0

Setting 0: Continue operation

The operation is continued.

Setting 1: Trigger a fault

The operation is stopped and an “oPr” fault is triggered. The motor coasts to stop.

◆ o3: Copy Function

These parameters control the Copy function of the digital operator. The Copy function stores parameter settings into the memory of the digital operator to facilitate the transfer of those settings to other drives that are the same model, capacity, and same control mode setting. ***Refer to Copy Function Related Displays on page 301*** for a description of errors and displays.

■ o3-01 Copy Function Selection

Instructs the drive to Read, Write, or Verify parameter settings.

No.	Parameter Name	Setting Range	Default
o3-01	Copy Function Selection	0 to 3	0

Setting 0: Copy Select (no function)

Setting 1: INV → OP READ

Copies all parameters from the drive to the digital operator.

Note: The copy protection for the digital operator is enabled by default. Set o3-02 to 1 to unlock copy protection.

Setting 2: OP → INV WRITE

Compares the parameters in the drive with the parameter settings saved on the digital operator for matches.

Setting 3: OP ↔ INV VERIFY

Parameters in the drive are compared with the parameter settings saved on the digital operator to see if they match.

■ o3-02 Copy Allowed Selection

Allows and restricts the use of the Copy function.

No.	Parameter Name	Setting Range	Default
o3-02	Copy Allowed Selection	0 or 1	0

Setting 0: Disabled

Setting 1: Enabled

◆ o4: Maintenance Monitor Settings

■ o4-01: Cumulative Operation Time Setting

Sets the cumulative operation time of the drive. The user can also manually set this parameter to begin keeping track of operation time from some desired value. Total operation time can be viewed in monitor U4-01.

Note: The value in o4-01 is set in 10 h units. For example, a setting of 30 will set the cumulative operation time counter to 300 h. 300 h will also be displayed in monitor U4-01.

No.	Parameter Name	Setting Range	Default
o4-01	Cumulative Operation Time Setting	0 to 9999	0

■ o4-02: Cumulative Operation Time Selection

Selects the conditions for how the drive keeps track of its total operation time. This time log can be viewed in U4-01.

No.	Parameter Name	Setting Range	Default
o4-02	Cumulative Operation Time Selection	0 or 1	0

Setting 0: Power on time

The drive logs the time it is connected to a power supply, regardless if the motor is running or not.

Setting 1: Run time

The drive logs the time that the output is active. This includes whenever the Up/Down command is active (even if the motor is not rotating) and when there is voltage output.

■ o4-03: Cooling Fan Operation Time Setting

Sets the value for how long the cooling fan has been operating. This value can be viewed in monitor U4-03. Parameter o4-03 also sets the base value used for the cooling fan maintenance, which is displayed in U4-04. Reset this parameter to 0 after replacing the cooling fan.

Note:
1. The value in o4-03 increases after every 10 hours of use. A setting of 30 will set the cooling fan operation time counter to 300 h. “300” will be displayed in monitor U4-03.
2. The cooling fan may require maintenance at an earlier date in harsher environments.

No.	Parameter Name	Setting Range	Default
o4-03	Cooling Fan Operation Time Setting	0 to 9999	0

■ o4-05: Capacitor Maintenance Setting

Sets value of the maintenance monitor for the DC bus capacitors displayed in U4-05 as a percentage of the total expected performance life. Reset this value to 0 after replacing the DC bus capacitors.

Note: The actual maintenance time will depend on the environment where the drive is used.

No.	Parameter Name	Setting Range	Default
o4-05	Capacitor Maintenance Setting	0 to 150%	0%

■ o4-07: DC Bus Pre-charge Relay Maintenance Setting

Sets the value of the softcharge bypass relay maintenance time displayed in U4-06 as a percentage of the total expected performance life. Reset this value to 0 after replacing the bypass relay.

Note: The actual maintenance time will depend on the environment where the drive is used.

No.	Parameter Name	Setting Range	Default
o4-07	DC Bus Pre-charge Relay Maintenance Setting	0 to 150%	0%

■ o4-09: IGBT Maintenance Setting

Sets the value of the IGBT maintenance time displayed in U4-07 as a percentage of the total expected performance life. Reset this value to 0 after replacing the IGBTs.

Note: The actual maintenance time will depend on the environment where the drive is used.

No.	Parameter Name	Setting Range	Default
o4-09	IGBT Maintenance Setting	0 to 150%	0%

■ o4-11: U2, U3 Initialization

Resets the fault trace and fault history monitors (U2-☐☐ and U3-☐☐). Initializing the drive does not reset these monitors.

No.	Parameter Name	Setting Range	Default
o4-11	U2, U3 Initialization	0 or 1	0

Setting 0: No action

The drive keeps the record already saved concerning fault trace and fault history.

Setting 1: Reset fault data

Resets the data for the U2-☐☐ and U3-☐☐ monitors. Once o4-11 is set to 1 and the ENTER key is pressed, fault data is erased and the display returns to 0.

■ o4-12: kWh Monitor Initialization

Resets the kWh monitors U4-10 and U4-11. Initializing the drive or cycling the power does not reset these monitors.

No.	Parameter Name	Setting Range	Default
o4-12	kWh Monitor Initialization	0 or 1	0

Setting 0: No Action

The kWh data are kept.

Setting 1: Reset kWh Data

Resets the kWh counter. The monitors U4-10 and U4-11 will display "0" after they are initialized. Once o4-12 is set to 1 and the ENTER key is pressed, kWh data is erased and the display returns to 0.

■ o4-13: Number of Travels Counter Reset

The number of travels counter displayed in U4-24/25 is not reset when the power is cycled or the drive is initialized. Use o4-13 to reset U4-24/25.

No.	Parameter Name	Setting Range	Default
o4-13	Number of Travels Counter Reset	0 or 1	0

Setting 0: No Action

Keeps the number of travels counter.

Setting 1: Resets the Number of Travels

Resets the number of travels counter. The monitor U4-24/25 will show 0. Once o4-13 is set to 1 and the ENTER key is pressed, the counter value is erased and the display returns to 0.

■ o4-15: Maintenance Alarm Snooze Period

After a maintenance alarm output has been triggered, o4-15 determines the level that will trigger the next alarm for the same component. The same alarm will be triggered by the detection level that triggered the original alarm plus the level set in o4-15.

No.	Parameter Name	Setting Range	Default
o4-15	Maintenance Alarm Setting	0 to 20%	2% <1>

<1> Parameter setting value is not reset to the default value during drive initialization (A1-03).

■ o4-16: Maintenance Monitoring Selection

Selects the Maintenance Monitor by using bits 0 to 3.

No.	Parameter Name	Setting Range	Default
o4-16	Maintenance Monitoring Selection	0000 to 1111	1000 <1>

<1> Parameter setting value is not reset to the default value during drive initialization (A1-03).

All bits = 0: Maintenance Monitors are disabled
bit 0: LT1 (cooling fan)
bit 1: LT2 (DC bus capacitors)
bit 2: LT3 (soft-charge bypass relay)
bit 3: LT4 (IGBTs have passed 90% of the their life expectancy)

5.11 S: Elevator Parameters

This section describes various functions and faults needed to operate an elevator application: braking sequence, slip compensation, optimal adjustments at start and stop, Rescue Operation, and elevator-related faults.

◆ S1: Brake Sequence

The drive supports braking sequences using an analog input terminal to control torque compensation at start (H3-☐☐ = 14), and braking sequences that do not require an analog input to set the torque compensation level. ***Refer to Brake Sequence on page 125*** for details.

■ S1-01: Zero Speed Level at Stop

Determines the speed to begin applying DC Injection (or Position Lock) when the drive is ramping to stop (b1-03 = 0). Set as a percentage of the maximum output frequency (E1-04).

No.	Parameter Name	Setting Range	Default
S1-01	Zero Speed Level at Stop	0.000 to 9.999%	Determined by A1-02

The function set by S1-01 changes depending on the control mode:

- V/f Control or OLV Control (A1-02 = 0, 2)
  For these control modes, parameter S1-01 sets the starting speed for DC Injection Braking at stop. Once the output speed falls below the setting of S1-01, the amount of DC Injection Braking current set in S1-03 is injected into the motor for the time set in parameter S1-05.
- CLV Control or CLV/PM Control (A1-02 = 3, 7)
  For these control modes, parameter S1-01 sets the starting speed for Position Lock at stop. Once the motor speed falls below the setting of S1-01, Position Lock is enabled for the time set in parameter S1-05.

■ S1-02: DC Injection Current at Start

Determines the amount of current to use for DC Injection at start. Set as a percentage of the drive rated current.

No.	Parameter Name	Setting Range	Default
S1-02	DC Injection Current at Start	0 to 100%	50%

■ S1-03: DC Injection Current at Stop

Determines the amount of current to use for DC Injection at stop. Set as a percentage of the drive rated current.

No.	Parameter Name	Setting Range	Default
S1-03	DC Injection Current at Stop	0 to 100%	50%

■ S1-04: DC Injection / Position Lock Time at Start

Determines how long the drive should perform DC Injection at start. In CLV and CLV/PM, S1-04 determines how long Position Lock should be performed. During this time, the drive allows motor flux to develop, which is essential for applying torque quickly once the brake is released. A setting of 0.00 disables S1-04.

No.	Parameter Name	Setting Range	Default
S1-04	DC Injection / Position Lock Time at Start	0.00 to 10.00 s	0.40 s

■ S1-05: DC Injection / Position Lock Time at Stop

Determines how long the drive should perform DC Injection at stop. In CLV and CLV/PM, S1-05 determines how long Position Lock should be performed. A setting of 0.00 disables S1-05.

No.	Parameter Name	Setting Range	Default
S1-05	DC Injection / Position Lock Time at Stop	0.00 to 10.00 s	0.60 s

■ S1-06: Brake Release Delay Time

Determines the time that must pass after an Up/Down command is entered before the output terminal set for "Brake control" (H2-☐☐ = 50) is triggered.
Adjusting this delay time can help when there is not enough time to develop the appropriate amount of motor flux. Be sure to also increase the time S1-04 when setting S1-06 to relatively long delay time.

No.	Parameter Name	Setting Range	Default
S1-06	Brake Release Delay Time	0.00 to 10.00 s	0.20 s

■ S1-07: Brake Close Delay Time

Determines the time that must pass after zero speed is reached before the output terminal set for "Brake control" (H2-☐☐ = 50) is released.

No.	Parameter Name	Setting Range	Default
S1-07	Brake Close Delay Time	0.00 to [S1-05]	0.10 s

■ S1-10: Run Command Delay Time

Sets the time the drive waits after receiving an Up/Down command before starting operation. The time set should give the motor contactor enough time to close.

No.	Parameter Name	Setting Range	Default
S1-10	Run Command Delay Time	0.00 to 1.00 s	0.10 s

■ S1-11: Output Contactor Open Delay Time

Determines the time that must pass for an output terminal set for “Output contactor control” (H2-☐☐ = 51) to be released after the drive has stopped and drive output has been shut off.

No.	Parameter Name	Setting Range	Default
S1-11	Output Contactor Open Delay Time	0.00 to 1.00 s	0.10 s

■ S1-12: Motor Contactor Control During Auto-Tuning Selection

Determines the state of the output contactor control command (H2-☐☐ = 51) during Auto-Tuning. The contactor closes as soon as the Enter key is pressed in the Auto-Tuning start menu.

No.	Parameter Name	Setting Range	Default
S1-12	Motor Contactor Control during Auto-Tuning	0 to 2	0

WARNING! *Sudden Movement Hazard.Use parameter S1-12 to enable/disable automatic switching of the Motor Contactor Control output signal during Auto-Tuning. When using setting S1-12 = 1, ensure that the multi-function output terminals are properly wired and in the correct state before setting parameter S1-12. Failure to comply could result in damage to the drive, serious injury or death.*

Setting 0: Disabled
Setting 1: Enabled
Setting 2: Enabled during Auto-Tuning and HBB

■ S1-26: Emergency Stop Start Level

Sets the Emergency Stop Start Level as a percentage of the Maximum Output Frequency. This setting is available when the control mode is set to Closed Loop Vector Control (A1-02 = 3) or Closed Loop Vector Control for PM Motors (A1-02 = 7) and the stopping method is set to Elevator Emergency Stop (b1-03 = 4).

The drive coasts to a stop after the Up/Down command is cleared and when the value of U1-05 (Speed Feedback) is equal to or greater than the value of S1-26 (Emergency Stop Start Level).

The drive ramps to a stop after the Up/Down command is cleared and when the value of U1-05 (Speed Feedback) is lower than the value of S1-26 (Emergency Stop Start Level).

No.	Parameter Name	Setting Range	Default
S1-26	Emergency Stop Start Level	0.0 to 100.0 %	10.0 %

◆ S2: Slip Compensation for Elevators

The slip compensation function automatically adjusts the speed reference for leveling operation depending on the load measured at constant speed. S2 parameters tune the slip compensation function to improve the landing accuracy. Slip Compensation requires that the drive be set for V/f Control or Open Loop Vector Control.

■ S2-01: Motor Rated Speed

Sets the rated speed of the motor.

No.	Parameter Name	Setting Range	Default
S2-01	Motor Rated Speed	300 to 1800 rpm	1380 rpm

■ S2-02/S2-03: Slip Compensation Gain in Motoring Mode / Regenerative Mode

Slip compensation for leveling speed can be set separately for motoring and regenerative states to help improve the accuracy of leveling.

No.	Parameter Name	Setting Range	Default
S2-02	Slip Compensation Gain in Motoring Mode	0.0 to 5.0	0.7
S2-03	Slip Compensation Gain in Regenerative Mode	0.0 to 5.0	1.0

■ S2-05: Slip Compensation Torque Detection Delay Time

Sets a delay time before detecting torque for slip compensation.

No.	Parameter Name	Setting Range	Default
S2-05	Slip Compensation Torque Detection Delay Time	0 to 10000 ms	1000 ms

■ S2-06: Slip Compensation Torque Detection Filter Time Constant

Sets the filter time constant applied to the torque signal used for the slip compensation value calculation.

No.	Parameter Name	Setting Range	Default
S2-06	Slip Compensation Torque Detection Filter Time Constant	0 to 2000 ms	500 ms

◆ S3: Start/Stop Optimization

■ S3-01 / S3-02: Position Lock Gain at Start 1 / 2

Sets gain levels 1 and 2 for the Position Lock at start function. Position Lock at start adjusts the internal torque reference value depending on the position deviation to hold the car in place when the brake is released. S3-01 sets the gain used to adjust the speed reference During Position Lock. S3-02 sets gain to adjust the internal torque reference directly (Anti-Rollback function).

Increase S3-01 and S3-02 if there is a problem with rollback when the brake is released. Decrease S3-01 and S3-02 if motor oscillation occurs during Position Lock.

No.	Parameter Name	Setting Range	Default
S3-01	Position Lock Gain at Start 1	0 to 100	5
S3-02	Position Lock Gain at Start 2 (Anti-Rollback Gain)	0.00 to 100.00	0.00

Note: **1.** Check the C5-☐☐ parameters to make sure the speed control loop settings are correct before making any adjustments to the Position Lock gain.
2. Sometimes a fault may occur with detecting the direction of motor rotation (dv4) when using Closed Loop Vector for PM motors. To correct this, either increase the settings of S3-01 and S3-02, or increase the number of pulses needed to trigger dv4 (F1-19).

■ S3-03: Position Lock Gain at Stop

Sets the gain used by the Position Lock control loop at stop to hold the car in place while the brake is applied.

Setting S3-03 to a high value will increase the ability of the drive to hold the car in place. Setting S3-03 too high can cause motor oscillation and car vibration.

No.	Parameter Name	Setting Range	Default
S3-03	Position Lock Gain at Stop	0 to 100	5

Note: **1.** Check the C5-☐☐ parameters to make sure the speed control loop settings are correct before making any adjustments to the Position Lock gain.
2. Faults may occur when detecting the direction of motor rotation (dv4) when using CLV/PM. To correct this, either increase the settings of S3-01 and S3-02, or increase the number of pulses required to trigger dv4 (F1-19).

■ S3-04: Position Lock Bandwidth

Determines the bandwidth around the locked position to enable a digital output set for H2-☐☐ = 33 (within position lock bandwidth). The output will be triggered when the car moves from the Position Lock start point to plus or minus the number of pulses set to S3-04.

No.	Parameter Name	Setting Range	Default
S3-04	Position Lock Bandwidth	0 to 16383	10

■ S3-10: Starting Torque Compensation Increase Time

Sets a time constant for the torque reference to reach 300%. Enabled by setting an analog input terminal for torque compensation (H3-☐☐ = 14).

No.	Parameter Name	Setting Range	Default
S3-10	Starting Torque Compensation Increase Time	0 to 5000 ms	500 ms

■ S3-12: Starting Torque Compensation Bias in Down Direction

Adds a bias to torque compensation in Down direction.

Refer to Adjusting the Torque Compensation at Start on page 127 for details.

No.	Parameter Name	Setting Range	Default
S3-12	Starting Torque Compensation Bias in Down Direction	–40.0 to 40.0%	0.00%

■ S3-14: Torque Compensation Fade Out Speed

Sets the speed level for torque compensation to fade out during the time determined by S3-15. Set as a percentage of the maximum output frequency (E1-04). A setting of 0.0% disables this function.

No.	Parameter Name	Setting Range	Default
S3-14	Torque Compensation Fade Out Speed	0.0 to 100.0%	0.0%

■ S3-15: Torque Compensation Fade Out Time

Sets the time for torque compensation to fade out when motor speed reaches the level set in S3-14.

No.	Parameter Name	Setting Range	Default
S3-15	Torque Compensation Fade Out Time	0 to 5000 ms	1000 ms

■ S3-16: Torque Limit Reduction Time

After Position Lock at stop, S3-16 determines the length of time to reduce the torque limit rate = $\frac{\text{Torque 300\%}}{\text{S3-16}}$

No.	Parameter Name	Setting Range	Default
S3-16	Torque Limit Reduction Time	0 to 10000 ms	100 ms

■ S3-20: Dwell 2 Speed Reference

Sets the speed reference for the Dwell 2 function.

Note: Setting this parameter to 0.00 disables the Dwell 2 function.

No.	Parameter Name	Setting Range	Default
S3-20	Dwell 2 Speed Reference	0.00 to 100.00	0.00%

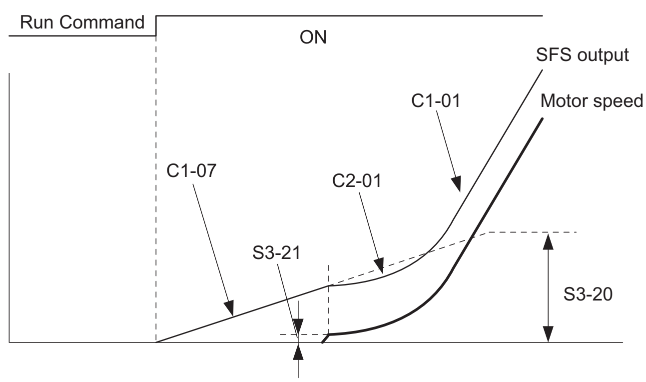


Figure 5.47 Dwell Speed Reference at Start

■ S3-21: Dwell 2 End Speed

The Dwell 2 function will end when the drive reaches this speed. A setting of 0.00 will disable the acceleration rate switch that occurs at the end of Dwell 2.

No.	Parameter Name	Setting Range	Default
S3-21	Dwell 2 End Speed	0.00 to 100.00%	0.00%

■ S3-25: Reserved

No.	Parameter Name	Setting Range	Default
S3-25	Reserved		-

■ S3-26: Reserved

No.	Parameter Name	Setting Range	Default
S3-26	Reserved		-

■ S3-27: Torque Compensation Value with Load Condition 1

Adjusts the analog signal from a load sensor for torque compensation. ***Refer to Adjusting the Torque Compensation at Start on page 127*** for details.

No.	Parameter Name	Setting Range	Default
S3-27	Torque Compensation Value with Load Condition 1	-100.0 to 100.0%	-50.0%

■ S3-28: Torque Compensation Value with Load Condition 2

Adjusts the analog signal from a load sensor for torque compensation. ***Refer to Adjusting the Torque Compensation at Start on page 127*** for details.

No.	Parameter Name	Setting Range	Default
S3-28	Torque Compensation Value with Load Condition 2	-100.0 to 100.0%	50.0%

■ S3-29: Analog Input from Load Sensor with Load Condition 1

Adjusts the analog signal from a load sensor for torque compensation. ***Refer to Adjusting the Torque Compensation at Start on page 127*** for details.

No.	Parameter Name	Setting Range	Default
S3-29	Analog Input from Load Sensor with Load Condition 1	-100.0 to 100.0%	0.0%

■ S3-30: Analog Input from Load Sensor with Load Condition 2

Adjusts the analog signal from a load sensor for torque compensation. ***Refer to Adjusting the Torque Compensation at Start on page 127*** for details.

No.	Parameter Name	Setting Range	Default
S3-30	Analog Input from Load Sensor with Load Condition 2	-100.0 to 100.0%	100.0%

■ S3-34: Anti-Rollback Torque Bias 1

Sets an intermediary value for the torque bias used for Anti-Rollback when Position Lock at start is performed. This setting rarely needs to be changed.

No.	Parameter Name	Setting Range	Default
S3-34	Anti-Rollback Torque Bias 1	0.0 to 100.0%	0.0%

■ S3-35: Anti-Rollback Torque Bias 2

Sets a maximum value for the torque bias used for Anti-Rollback when Position Lock at start is performed. This setting rarely needs to be changed.

No.	Parameter Name	Setting Range	Default
S3-35	Anti-Rollback Torque Bias 2	0.0 to 100.0%	0.0%

■ S3-37: Position Deviation Level to Apply Anti-Rollback Torque Bias 1

Sets the position deviation level to activate at Anti-Rollback Torque Bias 1 (S3-34). This setting rarely needs to be changed.

No.	Parameter Name	Setting Range	Default
S3-37	Position Deviation Level to Apply Anti-Rollback Torque Bias 1	0 to 32767	0

■ S3-38: Position Deviation Level to Apply Anti-Rollback Torque Bias 2

Determines the position deviation level when the drive should switch from the Anti-Rollback torque bias set in S3-34 to the torque bias set in S3-35. This setting rarely needs to be changed.

No.	Parameter Name	Setting Range	Default
S3-38	Position Deviation Level to Apply Anti-Rollback Torque Bias 2	0 to 32767	0

■ S3-39: Anti-Rollback Integral Gain

Determines the drive responsiveness for Anti-Rollback during Position Lock.

Increasing the value set to S3-39 may help if there is still too much deviation from the Position Lock start position after Position Lock gain 1 and gain 2 have already been adjusted. Lower S3-39 if oscillation occurs. This parameter rarely needs to be changed.

No.	Parameter Name	Setting Range	Default
S3-39	Anti-Rollback Integral Gain	-30.00 to 30.00	0.00

■ S3-40: Anti-Rollback Movement Detection

Sets the amount of speed feedback signal pulses to detect a movement of the rotor.

No.	Parameter Name	Setting Range	Default
S3-40	Anti-Rollback Movement Detection	0 to 100 pulses	1 pulse

■ S3-41: Position Lock Gain at Start 2 Reduction

Sets a reduction factor for the Position Lock Gain at Start 2 (Anti Rollback Gain) set in parameter S3-02.

If the motor rotation (i.e., car movement) is below the movement detection level set to S3-40, the drive will reduce the Anti-Rollback gain according to the gain reduction level set in S3-41.

No.	Parameter Name	Setting Range	Default
S3-41	Position Lock Gain at Start 2 Reduction	0.00 to 1.00	0.50

◆ S4: Rescue Operation

Rescue Operation switches to a backup battery or some other UPS during a power outage. ***Refer to Rescue Operation on page 135*** for details.

■ S4-01: Light Load Direction Search Selection

Enables and disables the Light Load Direction Search.

No.	Parameter Name	Setting Range	Default
S4-01	Light Load Direction Search Selection	0 to 2	0

Setting 0: Disabled
Setting 1: Enabled
Setting 2: Enabled for motor 1 only

■ S4-02: Light Load Direction Search Method

Determines the method used to perform Light Load Direction Search.

No.	Parameter Name	Setting Range	Default
S4-02	Light Load Direction Search Method	0 or 1	1

Setting 0: Output current
Setting 1: Detect direction of regeneration

■ S4-03: Light Load Direction Search Time

Sets the time to perform Light Load Direction Search.

No.	Parameter Name	Setting Range	Default
S4-03	Light Load Direction Search Time	0.0 to 5.0 s	1.0 s

■ S4-04: Light Load Direction Search Speed Reference

Sets the speed reference to use during Light Load Direction Search.

No.	Parameter Name	Setting Range	Default
S4-04	Light Load Direction Search Speed Reference	0.00 to 20.00%	Determined by A-02

■ S4-05: Rescue Operation Torque Limit

Sets the torque limit used during Rescue Operation.

No.	Parameter Name	Setting Range	Default
S4-05	Rescue Operation Torque Limit	0 to 300%	100%

■ S4-06: Rescue Operation Power Supply Selection

Specifies the type of backup power supply the drive should switch to when the power goes out.

No.	Parameter Name	Setting Range	Default
S4-06	Rescue Operation Power Supply Selection	0 to 2	0

Setting 0: Battery
Setting 1: UPS (single-phase)
Setting 2: UPS (three-phase)

■ S4-07: UPS Power

Sets the capacity of the UPS.

No.	Parameter Name	Setting Range	Default
S4-07	UPS Power	0.0 to 100.0 kVA	0.0 kVA

■ S4-08: UPS Operation Speed Limit Selection

Determines how a speed limit should be applied to the Rescue Operation speed (d1-25) when operating from a UPS. The drive calculates the appropriate speed limit based on the UPS capacity set in S4-07. This speed limit helps prevent voltage saturation and motor stall during Rescue Operation.

No.	Parameter Name	Setting Range	Default
S4-08	UPS Operation Speed Limit Selection	0 to 2	2

Setting 0: Disabled
Setting 1: Enabled until Light Load Direction Search is complete
Setting 2: Enabled until stop

■ S4-12: DC Bus Voltage during Rescue Operation

Sets the DC bus voltage during Rescue Operation.

No.	Parameter Name	Setting Range	Default
S4-12	DC Bus Voltage during Rescue Operation	0 to 800 V	0 V

■ S4-13: Rescue Operation Power Supply Deterioration Detection Level

Determines at which level of backup power supply deterioration a PF5 fault is triggered. The following conditions will trigger PF5:

- During Rescue Operation, DC bus voltage < [S4-12 × (S4-13 - 10%)]
- 100 ms after Rescue Operation has been triggered, the DC bus voltage does not rise above S4-12 × S4-13 before the motor starts

No.	Parameter Name	Setting Range	Default
S4-13	Rescue Operation Power Supply Deterioration Detection Level	10 to 100%	80%

■ S4-15: Speed Reference Selection at Rescue Operation

Selects the speed reference used for Rescue Operation.

No.	Parameter Name	Setting Range	Default
S4-15	Speed Reference Selection for Rescue Operation	0, 1	0

Setting 0: The setting of parameter d1-25 is used as speed reference for Rescue Operation
Setting 1: The speed selected by digital inputs is used as speed reference

◆ S5: Short Floor Operation

■ Short Floor Function

Short Floor automatically adjusts the speed in order to reduce the leveling time if leveling speed was activated before the selected speed was reached. Short Floor is enabled setting S5-01 = 1. The drive calculates the distance to decelerate from rated speed to the leveling speed, then controls the stop so that the stopping time is shortened. In ***Figure 5.48*** below, area S indicates the distance for a stop from nominal speed.

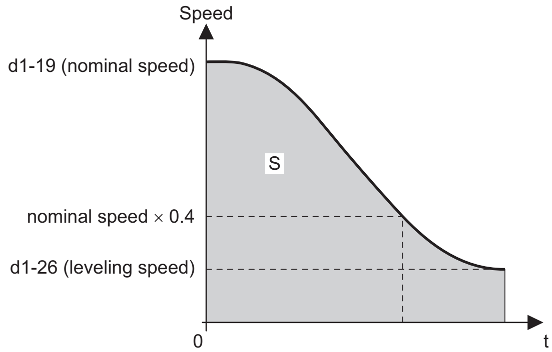


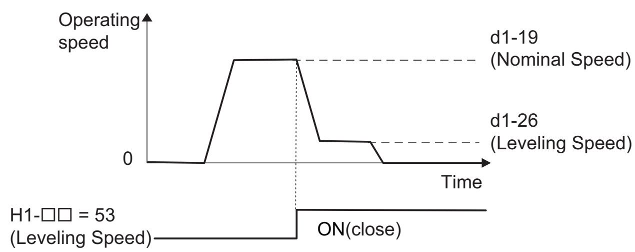
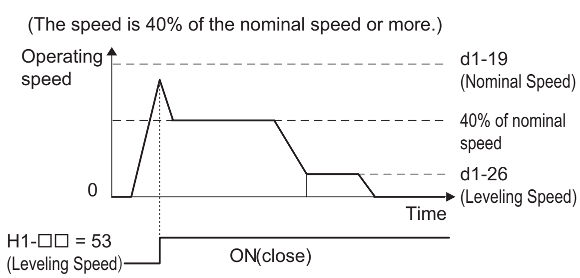
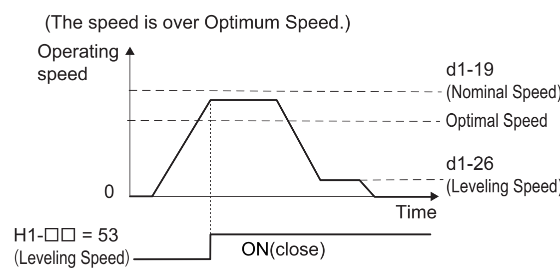
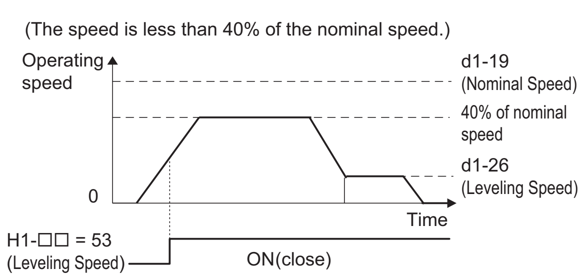
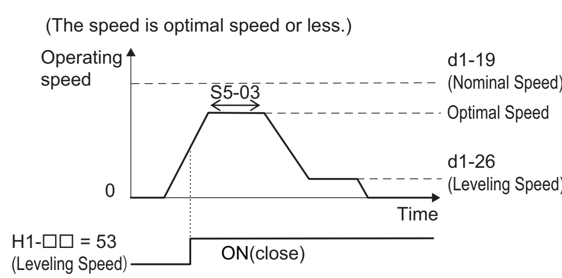
Figure 5.48 Speed During Normal Operation

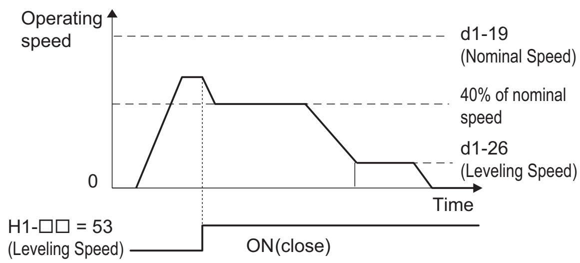
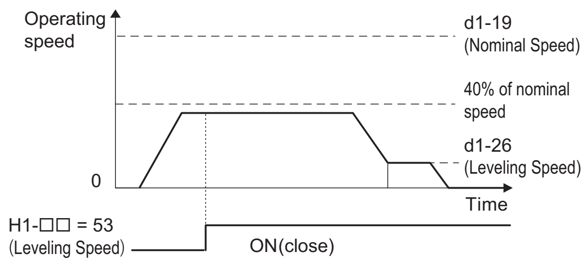
Advance Short Floor

Advanced Short Floor minimizes the operation time to arrive at a designated floor. It uses the leveling speed once the leveling speed command is entered via one of the multi-function inputs (H1-□□ = 53). Advance Short Floor calculates optimal speed based on the Short Floor Minimum Constant Speed Time (S5-03) and the currently selected deceleration rate.

Table 5.14 explains the Short Floor and Advance Short Floor functions.

Table 5.14 Short Floor Operation Example

Leveling Speed Input Timing	Short Floor	Advanced Short Floor
Constant speed operation at rated speed (normal stop sequence)		
During acceleration		
		

<table>
<tr><th>Leveling Speed Input Timing</th><th>Short Floor</th><th>Advanced Short Floor</th></tr>
<tr><td rowspan="2">Constant speed operation at less than the rated speed</td><td>(The speed is 40% of the nominal speed or more.)

</td><td rowspan="2">Not Available.</td></tr>
<tr><td>(The speed is less than 40% of the nominal speed.)

</td></tr>
<tr><td>Before start</td><td colspan="2">Operates at the leveling speed.</td></tr>
</table>

■ S5-01: Short Floor Operation Selection

Enables and disables the Short Floor function.

Note:
1. The Short Floor and Advanced Short Floor functions cannot be used during Rescue Operation.
2. Do not use Short Floor or Advanced Short Floor when the analog input terminals are configured to supply the speed reference.
3. The drive will accelerate or decelerate to the specified speed reference at the specified Accel/Decel rate if the speed priority is set for multi-step speed reference (d1-18 = 0 or 3) and the leveling speed reference is selected during Short Floor or Advanced Short Floor.

No.	Parameter Name	Setting Range	Default
S5-01	Short Floor Operation Selection	0 to 2	0

Setting 0: Disabled

Setting 1: Enabled (Short Floor Operation)

Setting 2: Enabled (Advanced Short Floor Operation)

■ S5-02: Nominal Speed for Short Floor Calculation

Determines the rated speed used to calculate the distance for the Short Floor function when speed priority is set for Multi-step Speed Reference (d1-18 = 0 or 3).

No.	Parameter Name	Setting Range	Default
S5-02	Nominal Speed for Short Floor Calculation	0.0 to 100.0%	0.0%

■ S5-03: Short Floor Minimum Constant Speed Time

Sets the minimum time of the constant speed operation when the Advanced Short Floor function is enabled (S5-01 = 2).

No.	Parameter Name	Setting Range	Default
S5-03	Short Floor Minimum Constant Speed Time	0 to 2.0 s	0.0 s

■ S5-04: Distance Calculation Acceleration Time Gain

Sets the gain used to adjust the jerk at acceleration for an optimum speed calculation when Short Floor Operation Selection (S5-01) is set to 2.

- Increase the gain level set to S5-04 and S5-05 if the leveling time is too short or if the optimum speed calculated by the drive is too fast.
- Decrease the gain level set to S5-04 and S5-05 if the leveling time is too long or if the optimum speed calculated by the drive is too slow.

No.	Parameter Name	Setting Range	Default
S5-04	Distance Calculation Acceleration Time Gain	50.0 to 200.0%	150.0%

Note: Setting S5-04 too low may trigger an overrun due to faster optimum speeds and shortened leveling times. Avoid setting this gain less than 100%.

■ S5-05: Distance Calculation Deceleration Time Gain

Sets the gain used to adjust the jerk at deceleration and optimum speed calculation when Short Floor Operation Selection (S5-01) is set to 2.

- Increase the gain level set to S5-04 and S5-05 if the leveling time is too short or if the optimum speed calculated by the drive is too fast.
- Decrease the gain level set to S5-04 and S5-05 if the leveling time is too long or if the optimum speed calculated by the drive is too slow.

No.	Parameter Name	Setting Range	Default
S5-05	Distance Calculation Deceleration Time Gain	50.0 to 200.0%	150.0%

Note: Setting S5-05 too low may trigger an overrun due to faster optimum speeds and shortened leveling times. Avoid setting this gain less than 100%.

■ Leveling Distance Control

Leveling Distance Control uses the accel/decel rate, jerk settings, and stopping distance to automatically calculate a speed sequence and arrive at the designated floor with increased accuracy. Two types of Leveling Distance Control are available that allow the user to select the Stopping Method (S5-10).

WARNING! *Inadvertent Movement Hazard. The elevator will not stop at the designated location and an overrun will occur which may cause injury to personnel if parameters o1-20, S5-11, and S5-12 are set incorrectly. Before using Leveling Distance Control, make sure that parameters for Traction Sheave Diameter (o1-20), Deceleration Distance (S5-11) and the Stop Distance (S5-12) are set to the correct units.*

Note: Leveling Distance Control should be used only for elevators with a constant stopping distance. Do not use Leveling Distance Control in elevators where the stopping distance changes frequently.

The following functions are disabled when Leveling Distance Control is selected:

- Switching between deceleration times
- Droop Control (b7 parameters)
- Shoot Floor, Advanced Short Floor (S5-01 = 1, 2)

Leveling Distance Control is disabled when any one of the following functions are selected:

- Analog frequency reference
- Rescue Operation
- Inspection Operation
- During Motor 2 selection

Direct Landing

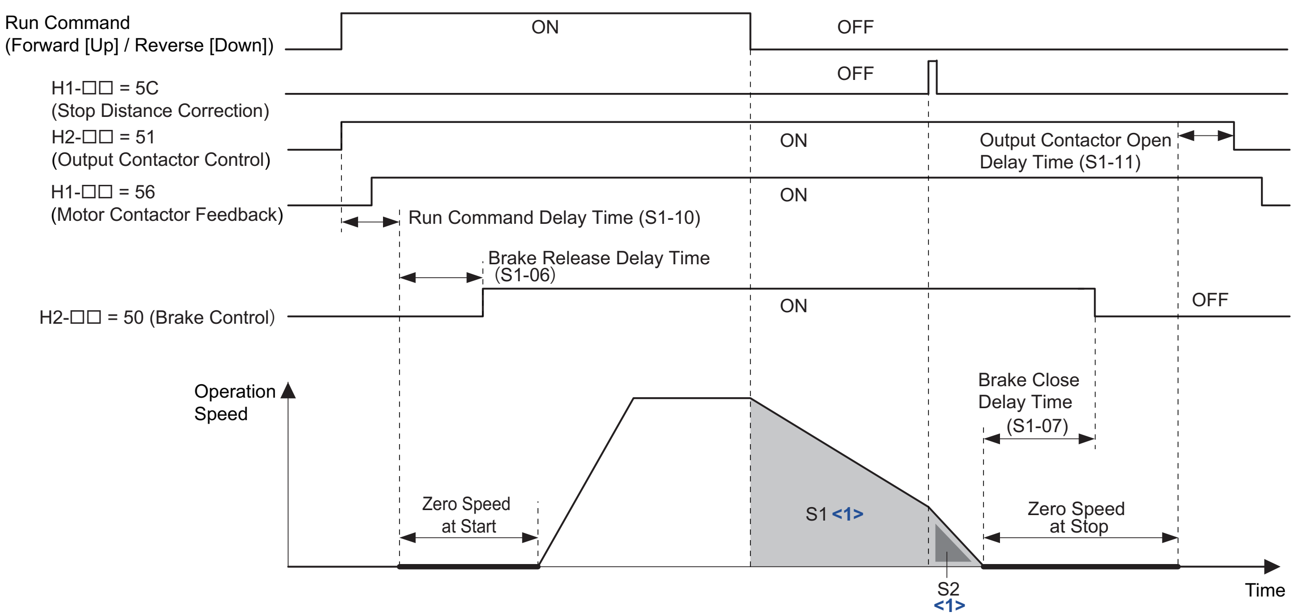
Direct Landing (S5-10 = 1) is activated at the start of deceleration, and brings the elevator car to the designated floor without the use of the leveling speed.

Direct Landing disables Leveling Distance Control, and uses a speed reference calculated by multiplying E1-04 times S5-13. If a Stop distance correction command (H1-☐☐ = 5C) is triggered during Direct Landing, then the drive will switch to the stop distance set in S5-12 for the remaining distance. Direct Landing will end once data from the encoder indicates that the stopping distance is 0.

Figure 5.49 illustrates a Direct Landing Operation example.

Table 5.15 Conditions for Direct Landing

Speed Priority	Direct Landing Start Conditions
Multi-step speed sequence (d1-18 = 0, 3)	Speed reference ≥ E1-04 × S5-13 and the Up/Down command is not active or the speed reference is 0.
High speed reference has priority (d1-18 = 1)	The Up/Down command is not active, the speed reference is 0, or the leveling speed reference has been selected by one of the multi-function input terminals (H1-☐☐).
Leveling speed reference has priority (d1-18 = 2)	



<1> Area S1 is the deceleration distance (S5-11) from the start of deceleration to stop. Area S2 is the stopping distance (S5-12) from the point at which the stopping distance compensation signal is entered to when the car arrives at the designated floor.

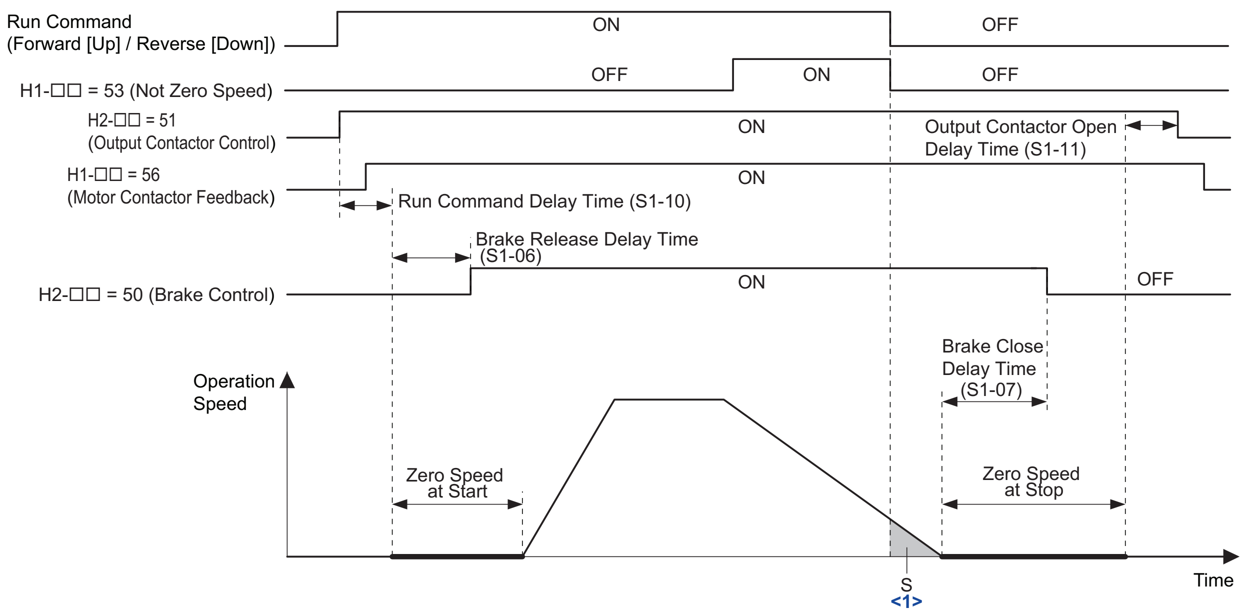
Figure 5.49 Direct Landing Operation Example

Leveling Distance Control

Leveling Distance Control (S5-10 = 2) uses the leveling speed reference for the remaining distance to arrive at the designated floor. Leveling Distance Control is activated when the conditions listed in *Table 5.16* are met.

Table 5.16 Leveling Distance Control Operation

Speed Priority Selection	Multi-Function Input Terminal Settings	Leveling Distance Control Start Conditions
Multi-step speed sequence (d1-18 = 0, 3)	–	The Up/Down command is not active or the speed reference is 0.
High speed reference has priority (d1-18 = 1)	Leveling speed reference is selected (H1-☐☐ = 53).	The Up/Down command is not active, or all input terminals set for H1-☐☐ = 50 to 53 are open.
	Leveling speed reference is not selected (H1-☐☐ ≠ 53).	Up/Down command is not active.
Multi-step speed sequence (d1-18 = 2)	Rated speed reference is selected (H1-☐☐ = 50).	The Up/Down command is not active, or all input terminals set for H1-☐☐ = 50 to 53 are open.
	Rated speed reference is not selected (H1-☐☐ ≠ 50).	Up/Down command is not active.



<1> Area S is the stopping distance (S5-12) from the point at which leveling operation is complete to when the car arrives at the designated floor.

Figure 5.50 Operation Sequence Example for Leveling Distance Control

■ S5-10: Stopping Method Selection

Selects the stopping method.

No.	Parameter Name	Setting Range	Default
S5-10	Stopping Method Selection	0 to 2	0

Setting 0: Disable
Setting 1: Direct Landing
Setting 2: Leveling Distance Control

■ S5-11: Deceleration Distance

Sets the deceleration distance when Stop Distance Control is enabled. *Refer to Direct Landing on page 264* for details.

No.	Parameter Name	Setting Range	Default
S5-11	Deceleration Distance	0 to 32767 mm <1>	0 mm

<1> The setting range becomes 0.00 to 650.00 inches when the length units are set for inches (o1-12 = 1).

■ S5-12: Stop Distance

Sets the stopping distance when Stop Distance Control is enabled. Refer to **Direct Landing** *on page 264* and **Leveling Distance Control** *on page 265* for details.

No.	Parameter Name	Setting Range	Default
S5-12	Stop Distance	0 to 10000 mm <1>	0 mm

<1> The setting range becomes 0.00 to 393.00 inches when the length units are set for inches (o1-12 = 1).

■ S5-13: Direct Landing Minimum Speed Level

Sets the speed level for the start of Direct Landing. Direct Landing is disabled if the starting speed for Direct Landing is less than the maximum output speed multiplied by this parameter (E1-04 × S5-13).

No.	Parameter Name	Setting Range	Default
S5-13	Direct Landing Minimum Speed Level	0 to 100%	20%

◆ S6: Faults for Elevator Applications

■ S6-01: Motor Contactor Response Error (SE1) Detection/Reset Selection

Determines when the drive should detect a motor contactor response error (SE1). SE1 is triggered if there is no response from the motor contactor within the time set in S6-10 after the contactor control output has been set.

No.	Parameter Name	Setting Range	Default
S6-01	Motor Contactor Response Error (SE1) Detection/Reset Selection	0 to 2	0

Setting 0: Detect during stop, SE1 must be manually reset
Setting 1: Detect during stop, SE1 can be automatically reset
Setting 2: No SE1 detection

■ S6-02: Starting Current Error (SE2) Detection Delay Time

Sets a delay time for starting current error (SE2). SE2 is detected when the drive output current is below 25% after the Up/Down command has been entered and the brake release time and the time set to S6-02 have both passed. The brake control command will not be issued (brake stays applied).

No.	Parameter Name	Setting Range	Default
S6-02	Starting Current Error (SE2) Detection Delay Time	0.00 to [S1-04 - S1-06]	200 ms

■ S6-03: SE2 Detect Current Level

Sets the level of current applied to the motor when the Brake Control command is activated, as a percentage of the Motor No-load Current (E2-03). A Starting Current Error (SE2) occurs when the drive's output current is less than the value in S6-03 after both the Brake Release Delay Time (S1-06) and the SE2 Detection Delay Time (S6-02) have passed after a RUN command.

No.	Parameter Name	Setting Range	Default
S6-03	SE2 Detect Current Level	0 to 100 %	25 %

■ S6-04: Output Current Error (SE3) Detection Delay Time

Sets a delay time for detecting an output current fault (SE3). SE3 is detected when the drive output current drops below 25% after the brake has released.

No.	Parameter Name	Setting Range	Default
S6-04	Output Current Error (SE3) Detection Delay Time	0 to 5000 ms	200 ms

■ S6-05: Brake Response Error (SE4) Detection Time

Sets a delay time for detecting a brake response error (SE4). SE4 is detected when an output terminal set for "Brake release" (H2-□□ = 50) and an input terminal set for "Brake feedback" (H1-□□ = 79) do not match for the time set to S6-05.

No.	Parameter Name	Setting Range	Default
S6-05	Brake Response Error (SE4) Detection Time	0 to 10000 ms	500 ms

■ S6-10: Overacceleration Detection Level

If the elevator car accelerates at an abnormal rate, the drive triggers an overacceleration fault (dv6) and the motor coasts to stop. Parameter S6-10 determines the acceleration rate that triggers the dv6 fault. A setting of 0.0 m/s^2 disables overacceleration detection.

No.	Parameter Name	Setting Range	Default
S6-10	Overacceleration Detection Level	0.0 to 20.0 m/s^2	1.5 m/s^2 <1>

<1> Default setting is determined by parameter o1-03. If o1-03 is set to 0 through 5, the default is 1.5 m/s^2. If o1-03 is set to 6, the default is 5.0 ft/s^2 (setting range: 0.0 to 50.0 ft/s^2).

■ S6-11: Overacceleration Detection Time

Sets the time that the acceleration must exceed the overacceleration detection level before as fault is triggered.

No.	Parameter Name	Setting Range	Default
S6-11	Overacceleration Detection Time	0 to 5000 ms	50 ms

■ S6-12: Overacceleration Detection Selection

Determines the conditions for detecting an overacceleration situation.

No.	Parameter Name	Setting Range	Default
S6-12	Overacceleration Detection Selection	0 or 1	0

Setting 0: Always enabled

Setting 1: During run only

■ S6-15: Speed Reference Loss Detection

Enabled or disables detection for missing speed reference (FrL).

No.	Parameter Name	Setting Range	Default
S6-15	Speed Reference Loss Detection	0 or 1	1

Setting 0: Disabled

Setting 1: Enabled

■ S6-16: Restart after Baseblock Selection

Allows the drive to restart the motor after returning to normal operation from Baseblock state (H1-□□ = 8/9) or from Safe Torque-Off state (Safe Disable inputs H1 and H2 enabled) while the Up/Down command is still active.

No.	Parameter Name	Setting Range	Default
S6-16	Restart after Baseblock Selection	0 or 1	0

Setting 0: No restart after Baseblock or Safe Torque-Off

Do not restart the motor when leaving the Baseblock or Safe Torque-Off state even if an Up/Down command is still active.

Setting 1: Restart after Baseblock or Safe Torque-Off

Restart when the Up/Down command is still active while the Baseblock or Safe Torque-Off state is left. To use this function with the Safe Disable function, parameter L8-88 must be set to 1.

◆ T: Motor Tuning

Auto-Tuning automatically sets and tunes parameters required for optimal motor performance. ***Refer to Auto-Tuning on page 109*** for details on Auto-Tuning parameters.

5.12 U: Monitor Parameters

Monitor parameters let the user view various aspects of drive performance using the digital operator display. Some monitors can be output from terminals FM and AM by assigning the specific monitor parameter number (U☐-☐☐) to H4-01 and H4-04. ***Refer to H4-01, H4-04: Terminal FM, AM Monitor Selection on page 210*** for details on assigning functions to an analog output.

◆ U1: Operation Status Monitors

Status monitors display drive status data such as output speed and output current. ***Refer to U1: Operation Status Monitors on page 404*** for a complete list of U1-☐☐ monitors and descriptions.

◆ U2: Fault Trace

Use these monitor parameters to view the status of various drive aspects when a fault occurs.

This information is helpful for finding out why a fault occurred. Refer to ***Refer to U2: Fault Trace on page 406*** for a complete list of U2-☐☐ monitors and descriptions.

U2-☐☐ monitors are not reset when the drive is initialized. ***Refer to o4-11: U2, U3 Initialization on page 246*** for instructions on how to reset these monitor values.

Note: Fault trace (i.e., the fault history) is not kept when CPF00, CPF01, CPF06, CPF24, oFA00, oFb00, oFC00, Uv1, Uv2, and Uv3 occur.

◆ U3: Fault History

These parameters display faults that have occurred during operation as well as the drive operation time when those faults occurred. Refer to ***Refer to U3: Fault History on page 407*** for a complete list of U3-☐☐ monitors and descriptions.

U3-☐☐ monitors are not reset when the drive is initialized. ***Refer to o4-11: U2, U3 Initialization on page 246*** for instructions on how to reset these monitor values.

Note: Fault trace (i.e., the fault history) is not kept when CPF00, CPF01, CPF06, CPF24, oFA00, oFb00, oFC00, Uv1, Uv2, and Uv3 occur.

◆ U4: Maintenance Monitors

Maintenance monitors show:

- Runtime data of the drive and cooling fans and number of Up/Down commands issued
- Maintenance data and replacement information for various drive components
- kWh data
- Highest peak current that has occurred and output speed at the time the peak current occurred
- Motor overload status information
- Detailed information about the present Up/Down command and speed reference source selection

Refer to U4: Maintenance Monitors on page 407 for a complete list of U4-☐☐ monitors and descriptions.

◆ U6: Control Monitors

Control monitors show:

- Reference data for the output voltage and vector control
- Data on PM motor rotor synchronization, forward phase compensation, and flux positioning
- Pulse data from the motor encoder
- Pulse data for Position Lock control
- Speed Loop and Inertia Compensation control monitors
  Refer to *Figure 5.10* on page *169* for details and an illustration showing where monitors are located in the speed control loop block.

6

Troubleshooting

This chapter provides descriptions of the drive faults, alarms, errors, related displays, and guidance for troubleshooting.

6.1 Section Safety

DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring or service the drive while the power is on.

Failure to comply will result in death or serious injury.

Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.

WARNING

Sudden Movement Hazard

Ensure there are no short circuits between the main circuit terminals (R/L1, S/L2, and T/L3) or between the ground and main circuit terminals before restarting the drive.

Failure to comply may result in serious injury or death and will cause damage to equipment.

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may illustrate drives without covers or safety shields to display details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Do not allow unqualified personnel to use equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Do not perform work on the drive while wearing loose clothing, jewelry, or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing and wear eye protection before beginning work on the drive.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Improperly tightened terminal screws can also cause erroneous equipment operation.

WARNING

Do not connect the AC power line to the output motor terminals of the drive. Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.

Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.

- Do not connect AC line power to output terminals U, V, and W.
- Make sure that the power supply lines are connected to main circuit input terminals R/L1, S/L2, T/L3 (or R/L1 and S/L2 for single-phase power).

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

Do not allow unqualified personnel to use the product.

Failure to comply could result in damage to the drive or braking circuit.

Carefully review instruction manual TOBP C720600 00 when connecting a braking option to the drive.

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

Yaskawa is not responsible for modification of the product made by the user.

Check all the wiring after installing the drive and connecting other devices to ensure that all connections are correct.

Failure to comply could result in damage to the drive.

Equipment Hazard

Do not check or test control circuit signals while the drive is running.

Improper use of test equipment could result in damage to the drive circuitry by short circuit.

Do not perform a withstand voltage test on any part of the unit.

Failure to comply could result in damage to the sensitive devices within the drive.

6.2 Drive Alarms, Faults, and Errors

◆ Types of Alarms, Faults, and Errors

Check the digital operator for information about possible faults if the drive or motor fails to operate. ***Refer to Using the LED Monitor/Digital Operator on page 93***.

If problems occur that are not covered in this manual, contact the nearest Yaskawa representative with the following information:

- Drive model
- Software version
- Date of purchase
- Description of the problem

Table 6.1 contains descriptions of the various types of alarms, faults, and errors that may occur while operating the drive.

Contact Yaskawa in the event of drive failure.

Table 6.1 Types of Alarms, Faults, and Errors

Type	Drive Response
Faults	When the drive detects a fault: • The digital operator displays text indicating the specific fault and the ALM indicator LED remains lit until the fault is reset. • The fault interrupts drive output and the motor coasts to a stop. • Some faults allow the user to select the stopping method when the fault occurs. • Fault output terminals MA-MC will close, and MB-MC will open. The drive will remain inoperable until the fault is cleared. ***Refer to Fault Reset Methods on page 309***.
Minor Faults and Alarms	When the drive detects an alarm or a minor fault: • The digital operator displays text indicating the specific alarm or minor fault, and the ALM indicator LED flashes. • The drive continues running the motor, although some alarms allow the user to select a stopping method when the alarm occurs. • A multi-function contact output set to be tripped when a minor fault (H2- ☐☐ = 10) closes. If the output is set to be tripped. • The digital operator displays text indicating a specific alarm and ALM indicator LED flashes. To reset the a minor fault or alarm, remove whatever is causing the problem.
Operation Errors	An operation error occurs when parameter settings conflict or do not match hardware settings (such as with an option card). When the drive detects an operation error: • The digital operator displays text indicating the specific error. • Multi-function contact outputs do not operate. The drive will not operate the motor until the error has been reset. Correct the settings that caused the operation error to clear the error.
Tuning Errors	Tuning errors occur while performing Auto-Tuning. When the drive detects a tuning error: • The digital operator displays text indicating the specific error. • Multi-function contact outputs do not operate. • Motor coasts to stop. Remove the cause of the error and repeat the Auto-Tuning process.
Copy Function Errors	Copy Function Errors occur when using the digital operator or the USB Copy Unit to copy, read, or verify parameter settings. • The digital operator displays text indicating the specific error. • Multi-function contact outputs do not operate. Pressing any key on the digital operator will clear the fault. Investigate the cause of the problem (such as model incompatibility) and try again.

◆ Alarm and Error Displays

■ Faults

Table 6.2 gives an overview of possible fault codes. Conditions such as overvoltages can trip faults and alarms. It is important to distinguish between faults and alarms to determine the proper corrective actions.

When the drive detects a fault, the ALM indicator LED lights, the fault code appears on the digital operator, and the fault contact MA-MB-MC triggers. An alarm is present if the ALM LED blinks and the fault code on the digital operator flashes. Refer to *Minor Faults and Alarms on page 276* for a list of alarm codes.

Table 6.2 Fault Displays (1)

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
boL	boL	Braking Transistor Overload	280
bUS	bUS	Option Communication Error	280
CE	CE	MEMOBUS/Modbus Communication Error	280
CF	CF	Control Fault	280
CPF00, CPF01 <1>	CPF00, CPF01	Control Circuit Error	280
CPF02	CPF02	A/D Conversion Error	280
CPF03	CPF03	Control Board Connection Error	281
CPF06	CPF06	EEPROM Data Error	281
CPF07, CPF08	CPF07, CPF08	Terminal Board Connection Error	281
CPF11 to CPF14, CPF16 to CPF21 <1>	CPF11 to CPF14, CPF16 to CPF21	Control Circuit Error	281
CPF22	CPF22	Hybrid IC Failure	281
CPF23	CPF23	Control Board Connection Error	281
CPF24	CPF24	Drive Unit Signal Fault	281
CPF25	CPF25	Terminal Board not Connected	281
CPF26 to CPF34	CPF26 to CPF34	Control Circuit Error	282
CPF35	CPF35	A/D Conversion Error	282
dEv	dEv	Speed Deviation (for Control Mode with Encoder)	282
dv1	dv1	Encoder Z Pulse Fault	282
dv2	dv2	Z Pulse Noise Fault Detection	282
dv3	dv3	Inversion Detection	282
dv4	dv4	Inversion Prevention Detection	282
dv6	dv6	Overacceleration Detection	283
dv7	dv7	Rotor Polarity Detection Timeover	283
dv8	dv8	PM Rotor Position Estimation Error	283
EF0	EF0	Option Card External Fault	283
EF3 to EF8	EF3 to EF8	External Fault (input terminal S3 to S8)	283
Err	Err	EEPROM Write Error	284
FrL	FrL	Speed Reference Missing	284
GF	GF	Ground Fault	284
LF	LF	Output Phase Loss	284
LF2	LF2	Output Current Imbalance	284
oC	oC	Overcurrent	285
oFA00	oFA00	Option Card Connection Error at Option Connector CN5-A, Option Card Fault at Option Connector CN5-A	285
oFA01	oFA01	Option Card Fault at Option Connector CN5-A	285
oFA05, oFA06	oFA05, oFA06	Option Card Error Occurred at Option Port CN5-A	285
oFA10, oFA11	oFA10, oFA11	Option Card Error Occurred at Option Port CN5-A	285
oFA12 to oFA17	oFA12 to oFA17	Option Card Error Occurred at Option Port CN5-A	285
oFA30 to oFA43	oFA30 to oFA43	Option Card Error Occurred at Option Port CN5-A	285
oFb00	oFb00	Option Card Connection Error (CN5-B)	286
oFb01	oFb01	Option Card Fault (CN5-B)	286
oFb02	oFb02	Option Card Fault (CN5-B)	286
oFb03, oFb11	oFb03, oFb11	Option Card Error (CN5-B)	286
oFb12 to oFb17	oFb12 to oFb17	Option Card Connection Error (CN5-B)	286

Table 6.3 Fault Displays (2)

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
oFC00	oFC00	Option Card Connection Error (CN5-C)	*286*
oFC01	oFC01	Option Card Fault (CN5-C)	*286*
oFC02	oFC02	Option Card Fault (CN5-C)	*286*
oFC03, oFC11	oFC03, oFC11	Option Card Error (CN5-C)	*286*
oFC12 to oFC17	oFC12 to oFC17	Option Card Connection Error (CN5-C)	*286*
oFC50	oFC50	Encoder Option AD Conversion Error	*287*
oFC51	oFC51	Encoder Option Analog Circuit Error	*287*
oFC52	oFC52	Encoder Communication Timeout	*287*
oFC53	oFC53	Encoder Communication Data Error	*287*
oFC54	oFC54	Encoder Error	*287*
oH	oH	Heatsink Overheat	*287*
oH1	oH1	Heatsink Overheat	*287*
oH3	oH3	Motor Overheat Alarm (PTC thermistor input)	*287*
oH4	oH4	Motor Overheat Fault (PTC thermistor input)	*287*
oL1	oL1	Motor Overload	*288*
oL2	oL2	Drive Overload	*288*
oL3	oL3	Overtorque Detection 1	*288*
oL4	oL4	Overtorque Detection 2	*289*
oPr	oPr	Operator Connection Fault	*289*

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
oS	oS	Overspeed	*289*
ov	ov	DC Bus Overvoltage	*289*
PF	PF	Input Phase Loss	*289*
PF5	PF5	Rescue Operation Power Supply Deterioration Error	*290*
PGo	PGo	Encoder Disconnected (for Control Mode with Encoder)	*290*
PGoH	PGoH	Encoder Disconnected (when using encoder)	*290*
rF	rF	Braking Resistor Fault	*290*
rr	rr	Dynamic Braking Transistor Fault	*290*
SC	SC	IGBT Short Circuit	*290*
SE1	SE1	Motor Contactor Response Error	*290*
SE2	SE2	Starting Current Error	*290*
SE3	SE3	Output Current Error	*290*
SE4	SE4	Brake Response Error	*291*
SvE	SvE	Position Lock Error	*291*
UL3	UL3	Undertorque Detection 1	*291*
UL4	UL4	Undertorque Detection 2	*291*
Uv1	Uv1	DC Bus Undervoltage	*291*
Uv2	Uv2	Control Power Supply Voltage Fault	*291*
Uv3	Uv3	Soft Charge Circuit Fault	*291*
voF	voF	Output Voltage Detection Error	*292*

<1> Displayed as CPF00, CPF20 when occurring at drive power up. When one of the faults occurs after successfully starting the drive, the display will show CPF01, CPF21.

■ Minor Faults and Alarms

Refer to ***Table 6.4*** for an overview of possible alarm codes. Conditions such as overvoltages can trip faults and alarms.

It is important to distinguish between faults and alarms to determine the proper corrective actions. When the drive detects an alarm, the ALM indicator LED blinks and the alarm code display flashes. Most alarms trigger a digital output programmed for alarm output (H2-☐☐ = 10). A fault (not an alarm) is present if the ALM LED lights without blinking. Refer to ***Faults on page 275*** for information on fault codes.

Table 6.4 Minor Fault and Alarm Displays

Digital Operator Display		Name	Minor Fault Output (H2-☐☐ = 10)	Page
LED Operator	LCD Operator			
AEr	AEr	Node ID Setting Error (CANopen)	YES	293
bb	bb	Drive Baseblock	No output	293
boL	boL	Braking Transistor Overload	YES	293
bUS	bUS	Option Communication Error	YES	293
CALL	CALL	Serial Communication Stand By	YES	293
CE	CE	MEMOBUS/Modbus Communication Error	YES	294
CrST	CrST	Cannot Reset	YES	294
dEv	dEv	Speed Deviation (for Control Mode with Encoder)	YES	294
EF	EF	Up/Down Command Error	YES	294
EF0	EF0	Option Card External Fault	YES	294
EF3 to EF8	EF3 to EF8	External Fault (input terminal S3 to S8)	YES	294
Hbb	Hbb	Safe Disable Circuit Fault Signal (H1-HC, H2-HC) Release	L8-88 = 0: YES L8-88 = 1: No (default)	295
HbbF	HbbF	Safe Disable Circuit Fault Signal (H1-HC, H2-HC) Release	L8-88 = 0: YES L8-88 = 1: No (default)	295
HCA	HCA	High Current Alarm	YES	295
LT-1	LT-1	Cooling Fan Maintenance Time	No output <1>	295
LT-2	LT-2	Capacitor Maintenance Time	No output <1>	295
LT-3	LT-3	Soft Charge Bypass Relay Maintenance Time	No output <1>	295
LT-4	LT-4	IGBT Maintenance Time (90%)	No output <1>	295
oH	oH	Heatsink Overheat	YES	296
oL3	oL3	Overtorque Detection 1	YES	296
oL4	oL4	Overtorque Detection 2	YES	296
oS	oS	Overspeed (for Control Mode with Encoder)	YES	296
ov	ov	DC Bus Overvoltage	YES	296
PASS	PASS	MEMOBUS/Modbus Comm. Test Mode Complete	No output	297
PGo	PGo	Encoder Disconnected (for Control Mode with Encoder)	YES	297
PGoH	PGoH	Encoder Disconnected (when using an encoder)	YES	297
SE	SE	MEMOBUS/Modbus Self Test Failed	YES	297
TrPC	TrPC	IGBT Maintenance Time (90%)	YES	297
UL3	UL3	Undertorque Detection 1	YES	297
UL4	UL4	Undertorque Detection 2	YES	297
Uv	Uv	Undervoltage	YES	297
voF	voF	Output Voltage Detection Error	YES	298

<1> Output when H2-☐☐ = 2F.

■ Operation Errors

Table 6.5 Operation Error Displays

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
oPE01	oPE01	Drive Capacity Setting Error	299
oPE02	oPE02	Parameter Setting Range Error	299
oPE03	oPE03	Multi-function Digital Input Setting Error	299
oPE04	oPE04	Terminal Board Mismatch Error	299
oPE05	oPE05	Reference Source Selection Error	299
oPE06	oPE06	Control Mode Selection Error	299
oPE07	oPE07	Multi-function Analog Input Selection Error	299

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
oPE08	oPE08	Parameter Selection Error	300
oPE10	oPE10	V/f Pattern Setting Error	300
oPE16	oPE16	Energy Saving Constants Error	300
oPE18	oPE18	Parameter Setting Error, Online Tuning Parameter Setting Error	300
oPE20	oPE20	PG-F3 Setting Error	300
oPE21	oPE21	Elevator Parameter Setting Fault	300
–	–	–	–

■ Auto-Tuning Errors

Table 6.6 Auto-Tuning Error Displays

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
End1	End1	Excessive V/f Setting	301
End2	End2	Motor Iron Core Saturation Coefficient Error	301
End3	End3	Rated Current Setting Alarm	301
End4	End4	Adjusted Slip Calculation Error	301
End5	End5	Resistance Tuning Error	301
End6	End6	Leakage Inductance Alarm	301
End7	End7	No-Load Current Alarm	301
End8	End8	Rescue Operation Speed Warning	302
End9	End9	Rescue Operation Rotor Pole Position Search Warning	302
End10	End10	Rescue Operation Rotor Polarity Detection Warning	302
Er-01	Er-01	Motor Data Error	302
Er-02	Er-02	Alarm	302
Er-03	Er-03	STOP Button Input	302
Er-04	Er-04	Line-to-Line Resistance Error	302

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
Er-05	Er-05	No-Load Current Error	302
Er-08	Er-08	Rated Slip Error	302
Er-09	Er-09	Acceleration Error	303
Er-10	Er-10	Motor Direction Error	303
Er-11	Er-11	Motor Speed Error	303
Er-12	Er-12	Current Detection Error	303
Er-13	Er-13	Leakage Inductance Error	303
Er-18	Er-18	Induction Voltage Error	303
Er-19	Er-19	PM Inductance Error	303
Er-20	Er-20	Stator Resistance Error	303
Er-21	Er-21	Z Pulse Correction Error	304
Er-22	Er-22	Initial Rotor Pole Search Error	304
Er-23	Er-23	Non-rotating Encoder Offset Tuning Warning	304
Er-24	Er-24	Auto-Tuning Error for PG-E3 Encoder Characteristics	304

■ Errors and Displays When Using the Copy Function

Table 6.7 Copy Errors

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
CoPy	CoPy	Writing parameter settings (flashing)	305
CPEr	CPEr	Control mode mismatch	305
CPyE	CPyE	Error writing data	305
CSEr	CSEr	Copy unit error	305
dFPS	dFPS	Drive model mismatch	305
ECE	ECE	Copy Error	305
ECS	ECS	Checksum Error	305
EdE	EdE	Write Impossible	305
EiF	EiF	Write Data Error	306
End	End	Task completed	306
EPE	EPE	ID Mismatch	306
ErE	ErE	Data Error	306
EvE	EvE	Verify Error	306
iFEr	iFEr	Communication error	306
ndAT	ndAT	Model, voltage class, capacity mismatch	306
rdEr	rdEr	Error reading data	306
rEAd	rEAd	Reading parameter settings (flashing)	306
vAEr	vAEr	Voltage class, capacity mismatch	306
vFyE	vFyE	Parameter setting mismatch	306
vrFy	vrFy	Comparing parameter settings (flashing)	307

6.3 Fault Detection

◆ Fault Displays, Causes, and Possible Solutions

Faults are detected for drive protection, and cause the drive to stop while triggering the fault output terminal MA-MB-MC. Remove the cause of the fault and manually clear the fault before attempting to run the drive again.

Table 6.8 Detailed Fault Displays, Causes, and Possible Solutions

Digital Operator Display		Fault Name
boL	boL	Braking Transistor Overload The braking transistor has reached its overload level.
Cause		**Possible Solution**
The wrong braking resistor is installed.		Make sure the rating of the braking resistor fits drive and application. Use an external braking transistor if necessary.
Digital Operator Display		**Fault Name**
bUS	bUS	Option Communication Error • The connection was lost after establishing initial communication. • Only detected when the Up/Down command speed reference is assigned to an option card.
Cause		**Possible Solution**
No signal was received from the PLC. Faulty communications wiring or an existing short circuit.		• Check for faulty wiring. • Correct the wiring. • Check for disconnected cables and short circuits and repair as needed.
A communications data error occurred due to noise.		• Check the various options available to minimize the effects of noise. • Counteract noise in the control circuit, main circuit, and ground wiring. • Ensure that other equipment such as switches or relays do not cause noise. Use surge absorbers if necessary. • Use only recommended cables or other shielded line. Ground the shield on the controller side or on the drive input power side. • Separate all communication wiring from drive power lines. Install an EMC noise filter to the drive power supply input.
The option card is damaged.		Replace the option card if there are no problems with the wiring and the error continues to occur.
The option card is not properly connected to the drive.		• The connector pins on the option card do not line up properly with the connector pins on the drive. • Reinstall the option card.
Digital Operator Display		**Fault Name**
CE	CE	MEMOBUS/Modbus Communication Error Communication data was not received for the amount of time set in parameter, H5-09 Communication Fault Detection Time.
Cause		**Possible Solution**
Faulty communications wiring or an existing short circuit.		• Check for faulty wiring. • Correct the wiring. • Check for disconnected cables and short circuits and repair as needed.
Communication data error occurred due to noise.		• Check the various options available to minimize the effects of noise. • Counteract noise in the control circuit, main circuit, and ground wiring. • Use only recommended cables or other shielded line. Ground the shield on the controller side or on the drive input power side. • Ensure that other equipment such as switches or relays do not cause noise. Use surge absorbers if required. • Separate all communication wiring from drive power lines. Install an EMC noise filter to the drive power supply input.
Digital Operator Display		**Fault Name**
CF	CF	Control Fault The torque limit was reached continuously for three seconds or longer while ramping to stop in OLV Control.
Cause		**Possible Solution**
Motor parameters are improperly set.		Check the motor parameter settings and repeat Auto-Tuning.
Torque limit is too low.		Set the torque limit to the most appropriate setting (L7-01 through L7-04).
Load inertia is too big.		• Adjust the deceleration ramp (C1-02, -04, -06, -08). • Set the speed reference to the minimum value and interrupt the Up/Down command when the drive finishes decelerating.
Digital Operator Display		**Fault Name**
CPF00 or CPF01 <1>	CPF00 or CPF01	Control Circuit Error
Cause		**Possible Solution**
There is a self diagnostic error in control circuit.		• Cycle power to the drive. • Set the frequency to the minimum value and interrupt the Run command when the drive finishes decelerating.
Connector on the operator is damaged.		Replace the operator.
Digital Operator Display		**Fault Name**
CPF02	CPF02	A/D Conversion Error An A/D conversion error or control circuit error occurred.
Cause		**Possible Solution**
Control circuit is damaged.		• Cycle power to the drive. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.

Digital Operator Display		Fault Name
CPF03	CPF03	Control Board Connection Error Connection error between the control board and the drive
Cause		**Possible Solution**
There is a connection error.		• Turn off the power and check the connection between the control board and the drive • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Drive fails to operate properly due to noise interference.		• Check the various options available to minimize the effects of noise. • Counteract noise in the control circuit, main circuit, and ground wiring. • Use only recommended cables or other shielded line. Ground the shield on the controller side or on the drive input power side. • Ensure that other equipment such as switches or relays do not cause noise and use surge absorbers if required. • Separate all communication wiring from drive power lines. Install an EMC noise filter to the drive power supply input.
Digital Operator Display		**Fault Name**
CPF06	CPF06	EEPROM Memory Data Error An error in the data saved to EEPROM
Cause		**Possible Solution**
There is an error in EEPROM control circuit.		• Turn off the power and check the connection between the control board and the drive. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
The power supply was switched off while parameters were being saved to the drive.		Reinitialize the drive (A1-03).
Power to the control board was lost while writing parameter settings during Rescue Operation.		Reinitialize the drive (A1-03).
Digital Operator Display		**Fault Name**
CPF07	CPF07	Terminal Board Connection Error
CPF08	CPF08	Terminal Board Connection Error
Cause		**Possible Solution**
There is a faulty connection between the terminal board and control board.		• Turn off the power and check the connection between the control board and the drive. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Digital Operator Display		**Fault Name**
CPF11 to CPF14, CPF16 to CPF21 <1>	CPF11 to CPF14, CPF16 to CPF21	Control Circuit Error
Cause		**Possible Solution**
Hardware is damaged.		• Cycle power to the drive. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Digital Operator Display		**Fault Name**
CPF22	CPF22	Hybrid IC Failure
Cause		**Possible Solution**
Hybrid IC failure on the power board		• Cycle power to the drive. ***Refer to Diagnosing and Resetting Faults on page 308***. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Digital Operator Display		**Fault Name**
CPF23	CPF23	Control Board Connection Error Connection error between the control board and the drive
Cause		**Possible Solution**
Hardware is damaged.		• Turn the power off and check the connection between the control board and the drive. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Digital Operator Display		**Fault Name**
CPF24	CPF24	Drive Unit Signal Fault The drive capacity cannot be detected correctly (drive capacity is checked when the drive is powered up).
Cause		**Possible Solution**
Hardware is damaged.		If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Digital Operator Display		**Fault Name**
CPF25	CPF25	Terminal Board not Connected
Cause		**Possible Solution**
Terminal board is not connected correctly.		Reconnect the terminal board to the connector on the drive, then cycle the power to the drive.

Digital Operator Display		Fault Name
CPF26 to CPF34	CPF26 to CPF34	Control Circuit Error
		CPU error
Cause		**Possible Solution**
Hardware is damaged.		If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Digital Operator Display		**Fault Name**
CPF35	CPF35	A/D Conversion Error
		An A/D conversion error or control circuit error occurred.
Cause		**Possible Solution**
A/D conversion is damaged. Control circuit is damaged.		• Cycle power to the drive. • If the problem continues, replace the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Fault Name**
dEv	dEv	Speed Deviation (for Control Mode with Encoder)
		The deviation between the speed reference and speed feedback is greater than the setting in F1-10 for longer than the time set to F1-11.
Cause		**Possible Solution**
Load is too heavy.		Reduce the load.
Accel/decel ramp is too short.		Increase the acceleration and deceleration times (C1-01 through C1-08).
The load is locked up.		Check the machine.
Parameters are not set appropriately.		Check the settings of parameters F1-10 and F1-11.
The motor brake is not applied.		Ensure the motor brake operates properly with a brake control command from the drive.
During Rescue Operation, either the DC bus voltage dropped below S4-12 × (S4-13 - 10%), or 100 ms after triggering Rescue Operation, the DC bus voltage did not reach S4-12 × S4-13 before the motor started.		• Check the DC bus voltage setting for Rescue Operation (S4-12). • Lower the speed reference set for Rescue Operation (d1-25). • Check the backup power supply. It may need to be replaced with another UPS if it has become worn and can no longer provide enough power.
Digital Operator Display		**Fault Name**
dv1	dv1	Encoder Z Pulse Fault
		The motor turned one full rotation without the Z Pulse being detected.
Cause		**Possible Solution**
Encoder is not connected, not wired properly, or is damaged.		• Make sure the encoder is properly connected and all shielded lines are properly grounded. • If the problem continues after cycling power, then replace either the PG option card or the encoder itself.
Digital Operator Display		**Fault Name**
dv2	dv2	Z Pulse Noise Fault Detection
		The Z pulse is out of phase by more than 5 degrees for the number of times specified in parameter F1-17.
Cause		**Possible Solution**
Noise interference along the encoder cable.		Separate the encoder cable lines from the source of the noise.
Encoder cable is not wired properly.		Rewire the encoder and make sure all shielded lines are properly grounded.
PG option card or the encoder is damaged.		If the problem continues after cycling power, replace the PG option card or the encoder.
Digital Operator Display		**Fault Name**
dv3	dv3	Inversion Detection
		The torque reference and acceleration are in opposite directions and the speed reference and actual motor speed differ by over 30% for the number of times set to F1-18.
Cause		**Possible Solution**
The encoder offset is not set properly to E5-11.		Set the encoder offset to E5-11 as specified on the motor nameplate. Replacing the encoder or changing the motor/encoder rotation direction requires readjustment of the encoder offset.
An external force on the load side has caused the motor to move.		• Make sure the motor is rotating in the right direction. • Look for any problems on the load side that might cause the motor to rotate in the opposite direction.
Noise interference along the encoder cable is disturbing the encoder signals.		Properly rewire the PG encoder and connect all lines including shielded line.
Encoder is disconnected, not wired properly, or the PG option card or the encoder itself is damaged.		
Rotational direction for the encoder set to F1-05 is the opposite of the order of the motor lines.		Properly connect the motor lines for each phase (U/T1, V/T2, W/T3).
Digital Operator Display		**Fault Name**
dv4	dv4	Inversion Prevention Detection
		Pulses indicate that the motor is rotating in the opposite direction of the speed reference. Set the number of pulses to trigger inverse detection to F1-19. **Note:** Set F1-19 to 0 to disable inverse detection in applications where the motor may rotate in the opposite direction of the speed reference.
Cause		**Possible Solution**
The encoder offset is not set properly to E5-11.		• Set the encoder offset to E5-11 as specified on the motor nameplate. • If the problem continues after cycling power, then replace either the PG option card or the encoder itself. Replacing the encoder or changing the motor/encoder rotation direction requires readjustment of the encoder offset.
Noise interference along the encoder cable is disturbing the encoder signals.		• Make sure the motor is rotating in the correct direction. • Look for any problems on the load side that might be causing the motor to rotate in the opposite direction.

Encoder is disconnected, not wired properly, or the PG option card or the encoder itself is damaged.		• Rewire the encoder and make sure all lines including shielded line are properly connected. • If the problem continues after cycling power, replace the PG option card or the encoder.
Digital Operator Display		**Fault Name**
dv6	dv6	Overacceleration Detection
		The acceleration of the elevator car exceeds the overacceleration detection level (S6-10)
Cause		**Possible Solution**
The encoder offset (E5-11) is incorrect.		Set E5-11 to the encoder offset value written on the motor nameplate. The encoder offset needs to be adjusted whenever the encoder is replaced or when reversing the direction of the motor.
Noise along the encoder cable.		Check the encoder wiring for any loose connections. Make sure that the shielded line is properly grounded.
Cables for the motor encoder are not wired properly, or the PG option card (or the encoder itself) is damaged.		
Incorrect motor data has been set to the E5 parameters.		Check the values set to the E5 parameters to make sure they match the information on the motor nameplate.
Mechanical data for the elevator have not been set up correctly.		Check parameters o1-20, o1-21, and o1-22 and set them to the correct values for the elevator.
The acceleration is too fast.		Check and adjust the acceleration rate and the jerk at acceleration start set in parameter C2-01.
Digital Operator Display		**Fault Name**
dv7	dv7	Rotor Polarity Detection Timeover
		Unable to detect the magnetic poles within the designated time.
Cause		**Possible Solution**
Battery voltage is too low.		Charge the battery.
The output cable is disconnected.		• Check for wiring errors and ensure the output cable is connected properly. • Correct the wiring.
The motor winding is damaged.		• Check the resistance between motor lines. • Replace the motor if the winding is damaged.
The output terminal is loose.		Apply the tightening torque specified in this manual to fasten the terminals.
Digital Operator Display		**Fault Name**
dv8	dv8	PM Rotor Position Estimation Error
		An invalid value resulted from Initial Pole Search. **Note:** Reset the fault and try Initial Pole Search again.
Cause		**Possible Solution**
Motor characteristics have changed.		Repeat the setup process. Perform Stationary Auto-Tuning or Initial Pole Search Auto-Tuning.
Parameters that control Initial Pole Search are set incorrectly (set up may be incomplete).		
Parameters for the motor encoder are set to the wrong values (set up may be incomplete).		
Brake was released during Initial Pole Search or during power loss.		Check the brake sequence. The brake must remain applied during Initial Pole Search and whenever the power supply is interrupted.
Initial Pole Search cannot be performed on the motor being used.		Use a PG option card that is compatible with both the drive and an absolute encoder.
Digital Operator Display		**Fault Name**
EF0	EF0	Option Card External Fault
		An external fault condition is present.
Cause		**Possible Solution**
An external fault was received from the PLC with other than F6-03 = 3 “alarm only” (the drive continued to run after external fault).		• Remove the cause of the external fault. • Remove the external fault input from the PLC.
Problem with the PLC program.		Check the PLC program and correct problems.
Digital Operator Display		**Fault Name**
EF3	EF3	External Fault (input terminal S3)
		External fault at multi-function input terminal S3.
EF4	EF4	External Fault (input terminal S4)
		External fault at multi-function input terminal S4.
EF5	EF5	External Fault (input terminal S5)
		External fault at multi-function input terminal S5.
EF6	EF6	External Fault (input terminal S6)
		External fault at multi-function input terminal S6.
EF7	EF7	External Fault (input terminal S7)
		External fault at multi-function input terminal S7
EF8	EF8	External Fault (input terminal S8)
		External fault at multi-function input terminal S8
Cause		**Possible Solution**
An external device has tripped an alarm function.		Remove the cause of the external fault and reset the fault.
Wiring is incorrect.		• Ensure the signal lines have been connected properly to the terminals assigned for external fault detection (H1-☐☐ = 20 to 2B). • Reconnect the signal line.

Incorrect multi-function contact input setting		• Check for unused terminals set for H1-□□ = 20 to 2B (External Fault). • Change the terminal settings.
Digital Operator Display		**Fault Name**
Err	Err	EEPROM Write Error
		Data cannot be written to the EEPROM.
Cause		**Possible Solution**
Noise has corrupted data while writing to the EEPROM.		• Press ENTER. • Correct the parameter setting. • Cycle power to the drive. ***Refer to Diagnosing and Resetting Faults on page 308***. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Hardware problem.		If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Digital Operator Display		**Fault Name**
FrL	FrL	Speed Reference Missing
		Parameter d1-18 is set to 1, leveling speed detection is not assigned to a digital input (H1-□□≠ 53) and no speed was selected while an Up or Down command was entered.
Cause		**Possible Solution**
Parameter d1-18 is set to 1, H1-□□ is not set to 53 and no speed was selected at start.		• Make sure the selected speed selection method matches the elevator controller sequence. Check parameter d1-18 and H1-□□ settings. • Make sure the elevator controller is connected properly. • Make sure the elevator controller selects the speed properly.
Digital Operator Display		**Fault Name**
GF	GF	Ground Fault
		A current short to ground exceeded 50% of rated current on the output side of the drive.
Cause		**Possible Solution**
Motor insulation is damaged.		• Check the insulation resistance of the motor. • Replace the motor.
A damaged motor cable is creating a short circuit.		• Check the motor cable. • Remove the short circuit and turn the power back on.
		• Check the resistance between the cable and the ground terminal ⏚. • Replace the cable.
The leakage current at the drive output is too high.		• Reduce the carrier frequency. • Reduce the amount of stray capacitance.
The drive started to run during a current offset fault or while coasting to a stop.		The value set exceeds the allowable setting range while the drive automatically adjusts the current offset (this happens only when attempting to restart a PM motor that is coasting to stop).
Hardware problem.		If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Digital Operator Display		**Fault Name**
LF	LF	Output Phase Loss
		• Phase loss on the output side of the drive. • Setting L8-07 to 1 or 2 enables Phase Loss Detection.
Cause		**Possible Solution**
The output cable is disconnected.		• Check for wiring errors and properly connect the output cable. • Correct the wiring.
The motor winding is damaged.		• Check the resistance between motor lines. • Replace the motor if the winding is damaged.
The output terminal is loose.		Apply the tightening torque specified in this manual to fasten the terminals.
The rated current of the motor being used is less than 5% of the drive rated current.		Check the drive and motor capacities.
An output transistor is damaged.		If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
A single-phase motor is being used.		The drive cannot operate a single phase motor.
Digital Operator Display		**Fault Name**
LF2	LF2	Output Current Imbalance (detected when L8-29 = 1)
		One or more of the phases in the output current is lost.
Cause		**Possible Solution**
Phase loss has occurred on the output side of the drive.		• Check for faulty wiring or poor connections on the output side of the drive. • Correct the wiring.
Terminal wires on the output side of the drive are loose.		Apply the tightening torque specified in this manual to fasten the terminals.
The output circuit is damaged.		If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Motor impedance or motor phases are uneven.		• Measure the line-to-line resistance for each motor phase. Ensure all values are the same. • Replace the motor.

Digital Operator Display		Fault Name
oC	oC	Overcurrent
		Drive sensors have detected an output current greater than the specified overcurrent level.

Cause	Possible Solution
The motor has been damaged due to overheating or the motor insulation is damaged.	• Check the insulation resistance. • Replace the motor.
One of the motor cables has shorted out or there is a grounding problem.	• Check the motor cables. • Remove the short circuit and reapply power to the drive.
	• Check the resistance between the motor cables and the ground terminal ⏚. • Replace damaged cables.
The drive is damaged.	• Check the drive output side short circuit for broken output transistor. B1 and U/V/W - (negative) and U/V/W • Contact your Yaskawa representative or nearest Yaskawa sales office.
The load is too heavy.	• Measure the current flowing into the motor. • Replace the drive with a larger capacity drive if the current value exceeds the rated current. • Determine if there is sudden fluctuation in the current level. • Reduce the load to avoid sudden changes in the current level or switch to a larger drive.
Accel/decel ramp is too fast.	Calculate the amount of torque required for the desired acceleration and/or deceleration ramp relative to the inertia moment of the load. If the drive is not capable of producing that much torque in time, try the following setting changes: • Reduce the acceleration and/or deceleration ramp (i.e., increase the accel/decel time). • Use a larger capacity drive.
The drive is attempting to operate a specialized motor or a motor larger than the maximum size allowed.	• Check the motor capacity. • Ensure that the rated capacity of the drive is greater than or equal to the capacity rating found on the motor nameplate.
Magnetic contactor (MC) on the output side of the drive has turned on or off.	Set up the operation sequence so that the MC is not tripped while the drive is outputting current.
V/f setting is not operating as expected.	• Check the ratios between the voltage and frequency. • Set parameters E1-04 through E1-10 appropriately (E3-04 through E3-10 for motor 2). • Lower the voltage if it is too high relative to the frequency.
Excessive torque compensation.	• Check the amount of torque compensation. • Reduce the torque compensation gain (C4-01) until there is no speed loss and less current.
Drive fails to operate properly due to noise interference.	• Review the possible solutions provided for handling noise interference. • Review the section on handling noise interference and check the control circuit lines, main circuit lines, and ground wiring.
The overcurrent level has exceeded the value set to L8-27. (PM control modes)	Correct the value set to overcurrent detection gain (L8-27).
The motor control method and motor do not match.	• Check which motor control method the drive is set to (A1-02). • For IM motors, set A1-02 = “0”, “2”, or “3”. • For PM motors, set A1-02 = “7”.
The rated output current of the drive is too small	Use a larger drive.

Digital Operator Display		Fault Name
oFA00	oFA00	Option Card Connection Error at Option Connector CN5-A, Option Card Fault at Option Connector CN5-A
		Option compatibility error

Cause	Possible Solution
The option card installed into port CN5-A is incompatible with the drive.	Check if the drive supports the option card to be installed. Contact Yaskawa for assistance.
A PG option card is connected to option port CN5-A	PG option cards are supported by option ports CN5-B and CN5-C only. Place the PG option card into the correct option port.

Digital Operator Display		Fault Name
oFA01	oFA01	Option Card Fault at Option Connector CN5-A
		Option not properly connected

Cause	Possible Solution
The option board connection to port CN5-A is faulty.	• Turn the power off and reconnect the option card. • Check if the option card is properly plugged into the option port. Make sure the card is fixed properly. • If the option is not a communication option card, try to use the card in another option port. If the option card works properly in a different option port, replace the drive because port CN5-A is damaged. If the error persists (oFb01 or oFC01 occur), replace the option card.

Digital Operator Display		Fault Name
oFA05 , oFA06	oFA05, oFA06	Option card error occurred at option port CN5-A
oFA10, oFA11	oFA10, oFA11	
oFA12 to oFA17	oFA12 to oFA17	
oFA30 to oFA43	oFA30 to oFA43	

Cause	Possible Solution
Option card or hardware is damaged.	• Cycle power to the drive. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.

Digital Operator Display		Fault Name
oFb00	oFb00	Option Card Fault at Option Port CN5-B Option compatibility error
Cause		**Possible Solution**
The option card installed into port CN5-B is incompatible with the drive.		Make sure the drive supports the option card to be installed. Contact Yaskawa for assistance.
A communication option card has been installed in option port CN5-B.		Communication option cards are only supported by option port CN5-A. It is not possible to install more than one comm. option.
Digital Operator Display		**Fault Name**
oFb01	oFb01	Option Card Fault at Option Port CN5-B Option not properly connected
Cause		**Possible Solution**
The option board connection to port CN5-B is faulty.		• Turn off the power and reconnect the option card. • Check if the option card is properly plugged into the option port. Make sure the card is fixed properly. • Try to use the card in another option port (in case of a PG option use port CN5-C). If the option cards works in the other port, replace the drive because port CN5-B is damaged. If the error persists (oFA01 or oFC01 occur), replace the option board.
Digital Operator Display		**Fault Name**
oFb02	oFb02	Option Card Fault at Option Port CN5-B Same type of option card already connected
Cause		**Possible Solution**
An option card of the same type is already installed in option port CN5-A.		Except for PG options, each option card type can only be installed once. Make sure only one type of option card is connected.
An input option card is already installed in option port CN5-A.		Install a comm. option, a digital input option, or an analog input option. The same type of card cannot be installed twice.
Digital Operator Display		**Fault Name**
oFb03 to oFb11	oFb03 to oFb11	Option card error occurred at Option Port CN5-B
oFb12 to oFb17	oFb12 to oFb17	
Cause		**Possible Solution**
Option card or hardware is damaged.		• Cycle power to the drive. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.
Digital Operator Display		**Fault Name**
oFC00	oFC00	Option Card Connection Error at Option Port CN5-C Option compatibility error
Cause		**Possible Solution**
The option card installed into port CN5-C is incompatible with the drive.		Confirm that the drive supports the option card to be installed. Contact Yaskawa for assistance.
A communication option card has been installed in option port CN5-C.		Communication option cards are only supported by option port CN5-A. It is not possible to install more than one comm. option.
Digital Operator Display		**Fault Name**
oFC01	oFC01	Option Card Fault at Option Port CN5-C Option not properly connected
Cause		**Possible Solution**
The option board connection to port CN5-C is faulty.		• Turn the power off and reconnect the option card. • Check if the option card is properly plugged into the option port. Make sure the card is fixed properly. • Try to use the card in another option port (in case of a PG option use port CN5-B). If the option card works in a different port, replace the drive because port CN5-C is damaged. If the error persists (oFA01 or oFb01 occur), replace the option board.
Digital Operator Display		**Fault Name**
oFC02	oFC02	Option Card Fault at Option Port CN5-C A maximum of two PG option boards can be used simultaneously. Remove the PG option board installed into option port CN5-A.
Cause		**Possible Solution**
An option card of the same type is already installed in option port CN5-A or CN5-B.		Except for PG options, each option card type can only be installed once. Make sure only one type of option card is connected.
An input option card is already installed in option port CN5-A or CN5-B.		Make sure that a comm. option, a digital input option, or an analog input option is installed. The same type of card cannot be installed twice.
Three PG option boards are installed.		A maximum of two PG option boards can be used simultaneously. Remove the PG option board installed into option port CN5-A.
Digital Operator Display		**Fault Name**
oFC03 to oFC11	oFC03 to oFC11	Option card error occurred at option port CN5-C
oFC12 to oFC17	oFC12 to oFC17	
Cause		**Possible Solution**
Option card or hardware is damaged.		• Cycle power to the drive. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.

Digital Operator Display		Fault Name
oFC50	oFC50	Encoder Option AD Conversion Error
		Error with the A/D conversion level (VCC level), or A/D conversion timed out.
Cause		**Possible Solution**
The PG option card is damaged.		Replace the PG option card.
Digital Operator Display		**Fault Name**
oFC51	oFC51	Encoder Option Analog Circuit Error
		Incorrect signal level (+2.5 V signal)
Cause		**Possible Solution**
The PG option card is damaged.		Replace the PG option card.
Digital Operator Display		**Fault Name**
oFC52	oFC52	Encoder Communication Timeout
		Signal encoder timed out waiting to receive data
Cause		**Possible Solution**
Encoder cable wiring is wrong.		Correct the wiring.
Encoder cable is disconnected.		Reconnect the cable.
Digital Operator Display		**Fault Name**
oFC53	oFC53	Encoder Communication Data Error
		Serial encoder CRC checksum error
Cause		**Possible Solution**
Encoder cable wiring is wrong.		Correct the wiring.
Encoder cable is disconnected.		Reconnect the cable.
Digital Operator Display		**Fault Name**
oFC54	oFC54	Encoder Error
		Alarm reading EnDat absolute position data from encoder (OR flag from EnDat error for overvoltage, undervoltage, etc.)
Cause		**Possible Solution**
Power supply to encoder is wired incorrectly.		Correct the wiring.
The power supply circuit of the PG option card is damaged.		Replace the PG option card.
Digital Operator Display		**Fault Name**
oH	oH	Heatsink Overheat
		The temperature of the heatsink exceeded the overheat pre-alarm level set to L8-02. Default value for L8-02 is determined by drive capacity (o2-04).
Cause		**Possible Solution**
Surrounding temperature is too high.		• Check the temperature surrounding the drive. Verify temperature is within drive specifications. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool the surrounding area. • Remove anything near the drive that might be producing excessive heat.
Load is too heavy.		• Measure the output current. • Decrease the load. • Lower the carrier frequency (C6-03).
Internal cooling fan is stopped.		• Replace the cooling fan. *Refer to Cooling Fan Component Names on page 320*. • After replacing the drive, reset the cooling fan maintenance parameter (o4-03 = 0).
Digital Operator Display		**Fault Name**
oH1	oH1	Heatsink Overheat
		The temperature of the heatsink exceeded the drive overheat level. The overheat level is determined by drive capacity (o2-04).
Cause		**Possible Solution**
Surrounding temperature is too high.		• Check the temperature surrounding the drive. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool the surrounding area. • Remove anything near the drive that might be producing excessive heat.
Load is too heavy.		• Measure the output current. • Lower the carrier frequency (C6-03). • Reduce the load.
Digital Operator Display		**Fault Name**
oH3	oH3	Motor Overheat Alarm (PTC thermistor input)
		• The motor overheat signal to analog input terminal A1 or A2 exceeded the alarm detection level. • Detection requires multi-function analog input H3-02 or H3-10 be set to “E”.
Cause		**Possible Solution**
Motor thermostat wiring is fault (PTC thermistor input).		Repair the PTC thermistor input wiring.
There is a fault on the machine side (e.g., the machine is locked up).		• Check the status of the machine. • Remove the cause of the fault.

Motor has overheated	• Check the status of the machine. • Decrease the load. • Increase the acceleration and deceleration times (C1-01 through C1-08).
	• Adjust the preset V/f pattern (E1-04 through E1-10). This will mainly involve reducing E1-08 and E1-10. • Be careful not to lower E1-08 and E1-10 too much, as this reduces load tolerance at low speeds.
	• Check the motor rated current. • Enter the motor rated current as indicated on the motor nameplate (E2-01). • Ensure the motor cooling system is operating normally. • Repair or replace the motor cooling system.
Digital Operator Display	**Fault Name**
oH4 — oH4	Motor Overheat Fault (PTC thermistor input)
	• The motor overheat signal to analog input terminal A1 or A2 exceeded the fault detection level. • Detection requires multi-function analog input H3-02 or H3-10 be set to “E”.
Cause	**Possible Solution**
Motor thermostat wiring is fault (PTC thermistor input).	Repair the PTC thermistor input wiring.
There is a fault on the machine side (e.g., the machine is locked up).	• Check the status of the machine. • Remove the cause of the fault.
Motor has overheated	• Check the status of the machine. • Decrease the load. • Increase the acceleration and deceleration times (C1-01 through C1-08).
	• Adjust the preset V/f pattern (E1-04 through E1-10). This will mainly involve reducing E1-08 and E1-10. • Be careful not to lower E1-08 and E1-10 too much, as this reduces load tolerance at low speeds.
	• Check the motor rated current. • Enter the motor rated current as indicated on the motor nameplate (E2-01). • Ensure the motor cooling system is operating normally. • Repair or replace the motor cooling system.
Digital Operator Display	**Fault Name**
oL1 — oL1	Motor Overload
	The electronic motor overload protection tripped.
Cause	**Possible Solution**
Load is too heavy.	Reduce the load.
Cycle times are too short during acceleration and deceleration.	Increase the acceleration and deceleration times (C1-01 through C1-08).
A general purpose motor is driven below the rated speed with too high load.	• Reduce the load. • Increase the speed. • If the motor is supposed to operate at low speeds, either increase the motor capacity or use a motor specifically designed to operate in the desired speed range.
The output voltage is too high.	• Adjust the user-set V/f pattern (E1-04 through E1-10) by reducing E1-08 and E1-10. • Do not set E1-08 and E1-10 too low. This reduces load tolerance at low speeds.
The wrong motor rated current is set to E2-01.	• Check the motor-rated current. • Enter the value written on the motor nameplate to parameter E2-01.
The Base Frequency is set incorrectly.	• Check the rated frequency indicated on the motor nameplate. • Enter the rated frequency to E1-06 (Base Frequency).
Multiple motors are running off the same drive.	Disable the motor protection function (L1-01 = 0) and install a thermal relay to each motor.
The electrical thermal protection characteristics and motor overload characteristics do not match.	• Check the motor characteristics. • Correct the type of motor protection that has been selected (L1-01). • Install an external thermal relay.
The electrical thermal relay is operating at the wrong level.	• Check the current rating listed on the motor nameplate. • Check the value set for the motor rated current (E2-01).
Output current fluctuation due to power supply loss	Check the power supply for phase loss.
Digital Operator Display	**Fault Name**
oL2 — oL2	Drive Overload
	The thermal sensor of the drive triggered overload protection.
Cause	**Possible Solution**
Load is too heavy.	Reduce the load.
Accel/decel ramp is too short.	Increase the settings for the acceleration and deceleration times (C1-01 through C1-08).
The output voltage is too high.	• Adjust the preset V/f pattern (E1-04 through E1-10) by reducing E1-08 and E1-10. • Do not lower E1-08 and E1-10 excessively. This reduces load tolerance at low speeds.
Drive capacity is too small.	Replace the drive with a larger model.
Overload occurred when operating at low speeds.	• Reduce the load when operating at low speeds. • Replace the drive with a model that is one frame size larger. • Lower the carrier frequency (C6-03).
Excessive torque compensation.	Reduce the torque compensation gain (C4-01) until there is no speed loss but less current.
Output current fluctuation due to input phase loss	Check the power supply for phase loss.
Digital Operator Display	**Fault Name**
oL3 — oL3	Overtorque Detection 1
	The current has exceeded the value set for torque detection (L6-02) for longer than the allowable time (L6-03).
Cause	**Possible Solution**
Parameter settings are not appropriate for the load.	Check the settings of parameters L6-02 and L6-03.

Fault on the machine side (e.g., machine is locked up).		Check the status of the load. Remove the cause of the fault.
Digital Operator Display		**Fault Name**
oL4	oL4	Overtorque Detection 2
		The current has exceeded the value set for Overtorque Detection 2 (L6-05) for longer than the allowable time (L6-06).
Cause		**Possible Solution**
Parameter settings are not appropriate for the load.		Check the settings of parameters L6-05 and L6-06.
Digital Operator Display		**Fault Name**
oPr	oPr	External Digital Operator Connection Fault
		• The external operator has been disconnected from the drive. **Note:** An oPr fault will occur when all of the following conditions are true: • Output is interrupted when the operator is disconnected (o2-06 = 1). • The Up/Down command is assigned to the operator (b1-02 = 0 and LOCAL has been selected).
Cause		**Possible Solution**
External operator is not properly connected to the drive.		• Check the connection between the operator and the drive. • Replace the cable if damaged. • Turn off the drive input power and disconnect the operator. Then reconnect the operator and turn the drive input power back on.
Digital Operator Display		**Fault Name**
oS	oS	Overspeed
		The motor speed feedback exceeded the F1-08 setting.
Cause		**Possible Solution**
Overshoot is occurring.		• Reduce the settings for C5-01 (Speed Control Proportional Gain 1) and increase C5-02 (Speed Control Integral Time 1). • If using a closed loop vector mode, enable Inertia Compensation.
Inappropriate parameter settings.		Check the setting for the overspeed detection level and the overspeed detection time (F1-08 and F1-09).
Digital Operator Display		**Fault Name**
ov	ov	DC Bus Overvoltage
		Voltage in the DC bus has exceeded the overvoltage detection level. • For 200 V class: approximately 410 V • For 400 V class: approximately 820 V
Cause		**Possible Solution**
Deceleration ramp is too short and regenerative energy is flowing from the motor into the drive.		• Increase the deceleration ramp (C1-02, C1-04, C1-06, C1-08). • Make sure the braking resistor rating/external braking transistor rating fits the application. • If an external braking transistor is used, make sure it is connected properly and working as expected.
Fast acceleration ramp causes the motor to overshoot the speed reference.		• Check if sudden drive acceleration triggers an overvoltage alarm. • Increase the acceleration ramp (C1-01, C1-03, C1-05, C1-07). • Increase the jerk setting in C2-02 (decrease if o1-03 > 3)
Surge voltage entering from the drive input power.		Install a DC link choke. **Note:** Voltage surge can result from a thyristor convertor and phase advancing capacitor using the same input power supply.
Ground fault in the output circuit causes the DC bus capacitor to overcharge.		• Check the motor wiring for ground faults. • Correct grounding shorts and turn the power back on.
Drive input power voltage is too high.		• Check the voltage. • Lower drive input power voltage within the limits listed in the specifications.
The braking transistor is wired incorrectly.		• Check braking transistor wiring for errors. • Properly rewire the braking resistor device.
Encoder cable is disconnected.		Reconnect the cable.
Encoder cable wiring is wrong.		Correct the wiring.
Noise interference along the encoder wiring.		Separate the wiring from the source of the noise (often the output lines from the drive).
Drive fails to operate properly due to noise interference.		• Review the list of possible solutions provided for controlling noise. • Review the section on handling noise interference and check the control circuit lines, main circuit lines, and ground wiring.
Motor hunting occurs.		• Adjust the parameters that control hunting. • Adjust the AFR time constant (n2-02 and n2-03).
Digital Operator Display		**Fault Name**
PF	PF	Input Phase Loss
		Drive input power has an open phase or has a large imbalance of voltage between phases. Detected when L8-05 = 1 (enabled).
Cause		**Possible Solution**
There is phase loss in the drive input power.		• Check for wiring errors in the main circuit drive input power. • Correct the wiring.
There is loose wiring in the drive input power terminals.		• Ensure the terminals are tightened properly. • Apply the tightening torque as specified in this manual. *Refer to Wire Gauges and Tightening Torque on page 68*
There is excessive fluctuation in the drive input power voltage.		• Check the voltage from the drive input power. • Review the possible solutions for stabilizing the drive input power.
There is poor balance between voltage phases.		• Stabilize drive input power or disable phase loss detection.
The main circuit capacitors are worn.		• Check the maintenance time for the capacitors (U4-05). • Replace the capacitor if U4-05 is greater than 90%. For instructions on replacing the capacitor, contact Yaskawa or a Yaskawa representative.
		Check for problems with the drive input power. If drive input power appears normal but the alarm continues to occur, replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.

Digital Operator Display		Fault Name
PF5	PF5	Rescue Operation Power Supply Deterioration Error
Cause		**Possible Solution**
During Rescue Operation, either the DC bus voltage dropped below S4-12 × (S4-13 - 10%), or 100 ms after triggering Rescue Operation, the DC bus voltage did not reach S4-12 × S4-13 before the motor started.		• Check the DC bus voltage setting for Rescue Operation (S4-12). • Lower the speed reference set for Rescue Operation (d1-25). • Check the backup power supply. It may need to be replaced with another UPS if it has become worn and can no longer provide enough power.
Digital Operator Display		**Fault Name**
PGo	PGo	Encoder Disconnected (for Control Mode with Encoder) No encoder pulses are received for longer than the time set to F1-14.
Cause		**Possible Solution**
Encoder cable is disconnected.		Reconnect the cable.
Encoder cable wiring is wrong.		Correct the wiring.
Encoder has no power.		Check the power line to the encoder.
Motor brake is not released.		Ensure the motor brake releases properly.
During Rescue Operation, either the DC bus voltage dropped below S4-12 × (S4-13 - 10%), or 100 ms after triggering Rescue Operation, the DC bus voltage did not reach S4-12 × S4-13 before the motor started.		• Check the DC bus voltage setting for Rescue Operation (S4-12). • Lower the speed reference set for Rescue Operation (d1-25). • Check the backup power supply. It may need to be replaced with another UPS if it has become worn and can no longer provide enough power.
Digital Operator Display		**Fault Name**
PGoH	PGoH	Encoder Disconnected (detected when using an encoder) Encoder cable is not connected properly.
Cause		**Possible Solution**
Encoder cable is disconnected.		Reconnect the cable.
Digital Operator Display		**Fault Name**
rF	rF	Braking Resistor Fault The resistance of the braking resistor being used is too low.
Cause		**Possible Solution**
The proper braking resistor option has not been installed.		Select the braking resistor option so that fits to the drives braking transistor specification.
A regenerative converter, regenerative unit or braking unit is being used and the +1 or +3 terminal is connected to - terminal.		Disable the braking transistor protection selection (set L8-55 to 1).
Digital Operator Display		**Fault Name**
rr	rr	Dynamic Braking Transistor Fault The built-in dynamic braking transistor failed.
Cause		**Possible Solution**
The braking transistor is damaged. The control circuit is damaged.		• Cycle power to the drive and check if the fault reoccurs. *Refer to Diagnosing and Resetting Faults on page 308*. • Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.
Digital Operator Display		**Fault Name**
SC	SC	IGBT Short Circuit Short Circuit or Ground Fault is detected
Cause		**Possible Solution**
IGBT fault. IGBT short circuit detection circuit fault.		• Check the wiring to the motor. • Turn the power supply off and then on again to check operation. If the problem continues, contact your Yaskawa representative or nearest Yaskawa sales office.
The drive is damaged.		• Check the drive output side short circuit for broken output transistor. B1 and U/V/W - (negative) and U/V/W • Contact your Yaskawa representative or nearest Yaskawa sales office.
Digital Operator Display		**Fault Name**
SE1	SE1	Motor Contactor Response Error Motor contactor does not respond within the time set to S1-10 (Run Command Delay Time).
Cause		**Possible Solution**
There is a problem with the motor contactor or auxiliary switch.		Check the motor contactor, auxiliary switches and the wiring of the contactor feedback signal.
Digital Operator Display		**Fault Name**
SE2	SE2	Starting Current Error The output current was lower than 25% of the motor no-load current at start.
Cause		**Possible Solution**
The motor contactor is open.		Check the contactor for any problems.
Digital Operator Display		**Fault Name**
SE3	SE3	Output Current Error The output current was lower than 25% of the motor no-load current during operation.
Cause		**Possible Solution**

The motor contactor opened.		Check the contactor for any problems.
Digital Operator Display		**Fault Name**
SE4	SE4	Brake Feedback Error
		The input terminal set for “Brake feedback” (H1-□□ = 79) or “Brake feedback 2” (H2-□□ = 5B) did not respond within the SE4 error time set to S6-05 after an output terminal set for “Brake release” (H2-□□ = 50) closed.
Cause		**Possible Solution**
The feedback contact on the brake is broken or the wiring is incorrect.		Check the brake feedback contact and the wiring.
The brake control circuit does not work properly.		Ensure the motor brake operates properly with a brake control command from the drive.
Digital Operator Display		**Fault Name**
SvE	SvE	Position Lock Error
		Position deviation during Position Lock.
Cause		**Possible Solution**
Torque limit is set too low.		Set the torque limit to an appropriate value using parameters L7-01 to L7-04.
Excessive load torque.		Reduce the amount of load torque.
Noise interference along encoder wiring.		Check the encoder signal for noise interference.
Digital Operator Display		**Fault Name**
UL3	UL3	Undertorque Detection 1
		The current has fallen below the minimum value set for torque detection (L6-02) for longer than the allowable time (L6-03).
Cause		**Possible Solution**
Parameter settings are not appropriate for the load.		Check the settings of parameters L6-02 and L6-03.
There is a fault on the machine side.		Check the load for any problems.
Digital Operator Display		**Fault Name**
UL4	UL4	Undertorque Detection 2
		The current has fallen below the minimum value set for torque detection (L6-05) for longer than the allowable time (L6-06).
Cause		**Possible Solution**
Parameter settings are not appropriate for the load.		Check the settings of parameters L6-05 and L6-06.
There is a fault on the machine side.		Check the load for any problems.
Digital Operator Display		**Fault Name**
Uv1	Uv1	DC Bus Undervoltage
		One of the following conditions occurred while the drive was running: • Voltage in the DC bus fell below the undervoltage detection level (L2-05) • For 200 V class: approximately 190 V • For 400 V class: approximately 380 V (350 V when E1-01 is less than 400)
Cause		**Possible Solution**
Input power phase loss.		• The main circuit drive input power is wired incorrectly. • Correct the wiring.
One of the drive input power wiring terminals is loose.		• Ensure there are no loose terminals. • Apply the tightening torque specified in this manual to fasten the terminals. ***Refer to Wire Gauges and Tightening Torque on page 68***.
There is a problem with the voltage from the drive input power.		• Check the voltage. • Correct the voltage to be within the range listed in drive input power specifications. • If there is no problem with the power supply to the main circuit, check for problems with the main circuit magnetic contactor.
The power has been interrupted.		Correct the drive input power.
The main circuit capacitors are worn.		• Check the maintenance time for the capacitors (U4-05). • Replace either the control board or the entire drive if U4-05 exceeds 90%. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.
The relay or contactor on the soft-charge bypass circuit is damaged.		• Cycle power to the drive and see if the fault reoccurs. • If the problem continues, replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative. • Check monitor U4-06 for the performance life of the soft-charge bypass. • Replace either the control board or the entire drive if U4-06 exceeds 90%. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.
Digital Operator Display		**Fault Name**
Uv2	Uv2	Control Power Supply Voltage Fault
		Voltage is too low for the control drive input power.
Cause		**Possible Solution**
Control power supply wiring is damaged.		• Cycle power to the drive. Check if the fault reoccurs. • If the problem continues, replace the control board, the entire drive, or the control power supply. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.
Internal circuitry is damaged.		• Cycle power to the drive. Check if the fault reoccurs. • If the problem continues, replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.
Digital Operator Display		**Fault Name**
Uv3	Uv3	Soft-Charge Bypass Circuit Fault
		The soft-charge bypass circuit failed.
Cause		**Possible Solution**

The relay or contactor on the soft-charge bypass circuit is damaged.		• Cycle power to the drive and see if the fault reoccurs. • If the problem continues, replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative. • Check monitor U4-06 for the performance life of the soft-charge bypass. • Replace either the control board or the entire drive if U4-06 exceeds 90%. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.
Digital Operator Display		**Fault Name**
voF	voF	Output Voltage Detection Error
		Problem detected with the voltage on the output side of the drive.
Cause		**Possible Solution**
Hardware is damaged.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.

<1> Displayed as CPF00 or CPF20 when occurring at drive power up. When one of the faults occurs after successfully starting the drive, the display will show CPF01 or CPF21.

6.4 Alarm Detection

◆ Alarm Codes, Causes, and Possible Solutions

Alarms are drive protection functions that do not necessarily cause the drive to stop. Once the cause of an alarm is removed, the drive will return to the same status as before the alarm occurred.

When an alarm has been triggered, the ALM light on the digital operator display blinks and the alarm code display flashes. If a multi-function output is set for an alarm (H2-□□ = 10), that output terminal will be triggered for certain alarms. ***Refer to Minor Faults and Alarms on page 276*** for information on alarm that trigger an alarm output.

Note: If a multi-function output is set to close when an alarm occurs (H2-□□ = 10), it will also close when maintenance periods are reached, triggering alarms LT-1 through LT-4 (triggered only if H2-□□ = 2F).

Table 6.9 Alarm Codes, Causes, and Possible Solutions

Digital Operator Display		**Minor Fault Name**
AEr	AEr	Communication Option Node ID Setting Error (CANopen)
		Option card node address is outside the acceptable setting range.
Cause		**Possible Solutions**
Station number is set outside the possible setting range.		Set parameter F6-35 to the proper value if a CANopen option card is used.
Digital Operator Display		**Minor Fault Name**
bb	bb	Baseblock
		Drive output interrupted as indicated by an external baseblock signal.
Cause		**Possible Solutions**
External baseblock signal was entered via one of the multi-function input terminals (S3 to S8).		Check external sequence and baseblock signal input timing.
Digital Operator Display		**Minor Fault Name**
boL	boL	Braking Transistor Overload
		The braking transistor in the drive has been overloaded.
Cause		**Possible Solutions**
The proper braking resistor has not been installed.		Select the optimal braking resistor.
Digital Operator Display		**Minor Fault Name**
bUS	bUS	Option Communication Error
		• After initial communication was established, the connection was lost. • Assign a Up/Down command or speed reference to the option card.
Cause		**Possible Solutions**
Connection is broken or master controller stopped communicating.		• Check for faulty wiring. • Correct the wiring. • Check for disconnected cables and short circuits. Repair as needed.
Option card is damaged.		If there are no problems with the wiring and the fault continues to occur, replace the option card.
The option card is not properly connected to the drive.		• The connector pins on the option card are not properly lined up with the connector pins on the drive. • Reinstall the option card.
A data error occurred due to noise.		• Check options available to minimize the effects of noise. • Take steps to counteract noise in the control circuit wiring, main circuit lines and ground wiring. • Try to reduce noise on the controller side. • Use surge absorbers on magnetic contactors or other equipment causing the disturbance. • Use recommended cables or some other type of shielded line. Ground the shield to the controller side or on the input power side. • All wiring for comm. devices should be separated from drive input power lines. Install an EMC noise filter to the drive input power.
Digital Operator Display		**Minor Fault Name**
CALL	CALL	Serial Communication Stand By
		Communication has not yet been established.
Cause		**Possible Solutions**
Communications wiring is faulty, there is a short circuit, or something is not connected properly.		• Check for wiring errors. • Correct the wiring. • Check for disconnected cables and short circuits. Repair as needed.
Programming error on the master side.		Check communications at start-up and correct programming errors.
Communications circuitry is damaged.		• Perform a self-diagnostics check. • If the problem continues, replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Termination resistor setting is incorrect.		A termination resistor must be installed at both ends of a communication line. Slave drives must have the internal termination resistor switch set correctly. Place DIP switch S2 to the ON position.

Digital Operator Display		Minor Fault Name
CE	CE	MEMOBUS/Modbus Communication Error
		Control data was not received correctly for two seconds.
Cause		**Possible Solutions**
A data error occurred due to noise.		• Check options available to minimize the effects of noise. • Take steps to counteract noise in the control circuit wiring, main circuit lines, and ground wiring. • Reduce noise on the controller side. • Use surge absorbers for the magnetic contactors or other components that may be causing the disturbance. • Use only recommended shielded line. Ground the shield on the controller side or on the drive input power side. • Separate all wiring for comm. devices from drive input power lines. Install an EMC noise filter to the drive input power supply.
Communication protocol is incompatible.		• Check the H5 parameter settings as well as the protocol setting in the controller. • Ensure settings are compatible.
The Communication Fault Detection Time (H5-09) is set shorter than the time required for a communication cycle to take place.		• Check the PLC. • Change the software settings in the PLC. • Set a longer Communication Fault Detection Time (H5-09).
Incompatible PLC software settings or there is a hardware problem.		• Check the PLC. • Remove the cause of the error on the controller side.
Communications cable is disconnected or damaged.		• Check the connector to make sure the cable has a signal. • Replace the communications cable.
Digital Operator Display		**Minor Fault Name**
CrST	CrST	Cannot Reset
Cause		**Possible Solutions**
A fault reset command was entered while the Up/Down command was still present.		• Ensure that a Up/Down command cannot be entered from the external terminals or option card during fault reset. • Turn off the Up/Down command.
Digital Operator Display		**Minor Fault Name**
dEv	dEv	Speed Deviation (when using a PG option card)
		The deviation between the speed reference and speed feedback is greater than the setting in F1-10 for longer than the time in F1-11.
Cause		**Possible Solutions**
Load is too heavy		Reduce the load.
Accel/decel ramp is too short.		Increase the acceleration and deceleration times (C1-01 through C1-08).
The load is locked up.		Check the machine.
Parameter settings are inappropriate.		Check the settings of parameters F1-10 and F1-11.
The motor brake is not applied.		Ensure the motor brake operates properly with a brake control command from the drive.
Digital Operator Display		**Minor Fault Name**
EF	EF	Up/Down Command Error
		Both forward run and reverse run closed simultaneously for over 0.5 s.
Cause		**Possible Solutions**
Sequence error		Check the forward and reverse command sequence and correct the problem. **Note:** When minor fault EF detected, motor ramps to stop.
Digital Operator Display		**Minor Fault Name**
EF0	EF0	Option Card External Fault
		An external fault condition is present.
Cause		**Possible Solutions**
An external fault was received from the PLC with F6-03 = 3 (causing the drive to continue running when an external fault occurs).		• Remove the cause of the external fault. • Remove the external fault input from the PLC.
There is a problem with the PLC program.		Check the PLC program and correct problems.
Digital Operator Display		**Minor Fault Name**
EF3	EF3	External fault (input terminal S3)
		External fault at multi-function input terminal S3.
EF4	EF4	External fault (input terminal S4)
		External fault at multi-function input terminal S4.
EF5	EF5	External fault (input terminal S5)
		External fault at multi-function input terminal S5.
EF6	EF6	External fault (input terminal S6)
		External fault at multi-function input terminal S6.
EF7	EF7	External fault (input terminal S7)
		External fault at multi-function input terminal S7.
EF8	EF8	External fault (input terminal S8)
		External fault at multi-function input terminal S8.
Cause		**Possible Solutions**
An external device has tripped an alarm function.		Remove the cause of the external fault and reset the multi-function input value.
Wiring is incorrect.		• Ensure the signal lines have been connected properly to the terminals assigned for external fault detection (H1-□□ = 2C to 2F). • Reconnect the signal line.

Multi-function contact inputs are set incorrectly.		• Check if the unused terminals have been set for H1-□□ = 2C to 2F (External Fault). • Change the terminal settings.
Digital Operator Display		**Minor Fault Name**
Hbb	Hbb	Safe Disable Circuit Fault Signal (H1-HC, H2-HC) Release
		Both Safe Disable Input channels are open.
Cause		**Possible Solutions**
Both Safe Disable Inputs H1 and H2 are open.		• Check signal status at the input terminals H1 and H2. • Check the Sink/Source Selection for the digital inputs. • If the Safe Disable function is not utilized, check if the terminals H1-HC, and H2-HC are linked.
Internally, both Safe Disable channels are broken.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Minor Fault Name**
HbbF	HbbF	Safe Disable Circuit Fault Signal (H1-HC, H2-HC) Release
		One Safe Disable channel is open while the other one is closed.
Cause		**Possible Solutions**
The signals to the Safe Disable inputs are wrong or the wiring is incorrect.		Check signal status at the input terminals H1 and H2. If the Safe Disable function is not utilized, the terminals H1-HC, and H2-HC must be linked.
One of the Safe Disable channels is faulty.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Minor Fault Name**
HCA	HCA	High Current Alarm
		Drive current exceeded overcurrent warning level (150% of the rated current).
Cause		**Possible Solutions**
Load is too heavy.		Either reduce the load for applications with repetitive operation (repetitive stops and starts, etc.), or replace the drive.
Accel/decel ramp is too short.		Calculate the amount of torque required for the desired acceleration and/or deceleration ramp relative to the inertia moment of the load. If the torque level is not right for the load, take the following steps: • Increase the acceleration and deceleration times (C1-01 through C1-08). • Increase the capacity of the drive.
A special-purpose motor is being used, or the drive is attempting to run a motor greater than the maximum allowable capacity.		• Check the motor capacity. • Use a motor appropriate for the drive. Ensure the motor is within the allowable capacity range.
The current level increased due to a momentary power loss or while attempting to perform a fault reset.		The alarm will appear only briefly. There is no need to take action to prevent the alarm from occurring in such instances.
Digital Operator Display		**Minor Fault Name**
LT-1	LT-1	Cooling Fan Maintenance Time
		The cooling fan has reached its expected maintenance period and may need to be replaced. **Note:** An alarm output (H2-□□ = 10) will only be triggered if H2-□□ = 2F.
Cause		**Possible Solutions**
The cooling fan has reached 90% of its expected performance life.		Replace the cooling fan and reset the Maintenance Monitor by setting o4-03 to 0.
Digital Operator Display		**Minor Fault Name**
LT-2	LT-2	Capacitor Maintenance Time
		The main circuit and control circuit capacitors are nearing the end of their expected performance life. **Note:** An alarm output (H2-□□ = 10) will only be triggered if H2-□□ = 2F.
Cause		**Possible Solutions**
The main circuit and control circuit capacitors have reached 90% of their expected performance life.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Minor Fault Name**
LT-3	LT-3	Soft Charge Bypass Relay Maintenance Time
		The DC bus soft charge relay is nearing the end of its expected performance life. **Note:** An alarm output (H2-□□ = 10) will only be triggered if H2-□□ = 2F.
Cause		**Possible Solutions**
The DC bus soft charge relay has reached 90% of expected performance life.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Minor Fault Name**
LT-4	LT-4	IGBT Maintenance Time (90%)
		IGBTs have reached 90% of their expected performance life. **Note:** An alarm output (H2-□□ = 10) will only be triggered if H2-□□ = 2F.
Cause		**Possible Solutions**
IGBTs have reached 90% of their expected performance life.		Check the load, carrier frequency, and output speed. NOTICE: Optimize Performance Life. To maximize drive performance life, make sure the drive output current does not exceed 150% of the drive rated current. Expected performance life estimates the number of drive starts at three million times if output current does not exceed 150%. This assumes the frequency is at its default setting (8 kHz for models 2A0018 to 2A0144, 4A0009 to 4A0075, 5 kHz for models 2A0181 to 2A0354, 4A0094 to 4A0225, and 2 kHz for models 2A0432 and 4A0225) and a peak current of less than 150% of the drive rated current.

Digital Operator Display		Minor Fault Name
oH	oH	Heatsink Overheat
		The temperature of the heatsink exceeded the overheat pre-alarm level set to L8-02 (90-100 °C). Default value for L8-02 is determined by drive capacity (o2-04).
Cause		**Possible Solutions**
Surrounding temperature is too high		• Check the surrounding temperature. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool surrounding area. • Remove anything near drive that may cause extra heat.
Internal cooling fan has stopped.		• Replace the cooling fan. *Refer to Cooling Fan Component Names on page 320*. • After replacing the drive, reset the cooling fan maintenance parameter to (o4-03 = “0”).
Airflow around the drive is restricted.		• Provide proper installation space around the drive as indicated in the manual. *Refer to Installation Orientation and Spacing on page 44*. • Allow for the specified space and ensure that there is sufficient circulation around the control panel.
		• Check for dust or foreign materials clogging cooling fan. • Clear debris caught in the fan that restricts air circulation.
Digital Operator Display		**Fault Name**
oH3	oH3	Motor Overheat Alarm (PTC thermistor input)
		• The motor overheat signal to analog input terminal A1 or A2 exceeded the alarm detection level. • Detection requires multi-function analog input H3-02 or H3-10 be set to “E”.
Cause		**Possible Solution**
Motor thermostat wiring is fault (PTC thermistor input).		Repair the PTC thermistor input wiring.
There is a fault on the machine side (e.g., the machine is locked up).		• Check the status of the machine. • Remove the cause of the fault.
Motor has overheated		• Check the status of the machine. • Decrease the load. • Increase the acceleration and deceleration times (C1-01 through C1-08).
		• Adjust the preset V/f pattern (E1-04 through E1-10). This will mainly involve reducing E1-08 and E1-10. • Be careful not to lower E1-08 and E1-10 too much, as this reduces load tolerance at low speeds.
		• Check the motor rated current. • Enter the motor rated current as indicated on the motor nameplate (E2-01). • Ensure the motor cooling system is operating normally. • Repair or replace the motor cooling system.
Digital Operator Display		**Minor Fault Name**
oL3	oL3	Overtorque Detection 1
		Drive output current (or torque in OLV, CLV, CLV/PM) was greater than L6-02 for longer than the time set in L6-03.
Cause		**Possible Solutions**
Inappropriate parameter settings.		Check parameters L6-02 and L6-03.
There is a fault on the machine side (e.g., the machine is locked up).		• Check the status of the machine. • Remove the cause of the fault.
Digital Operator Display		**Minor Fault Name**
oL4	oL4	Overtorque Detection 2
		Drive output current (or torque in OLV, CLV, CLV/PM) was greater than L6-05 for longer than the time set in L6-06.
Cause		**Possible Solutions**
Parameter settings are not appropriate.		Check parameters L6-05 and L6-06.
There is a fault on the machine side (e.g., the machine is locked up).		• Check the status of the machine being used. • Remove the cause of the fault.
Digital Operator Display		**Minor Fault Name**
oS	oS	Overspeed (for Control Mode with Encoder)
		The motor speed feedback exceeded the F1-08 setting.
Cause		**Possible Solutions**
Inappropriate parameter settings.		Check the setting for the overspeed detection level and the overspeed detection time (F1-08 and F1-09).
Digital Operator Display		**Minor Fault Name**
ov	ov	DC Bus Overvoltage
		The DC bus voltage exceeded the trip point. For 200 V class: approximately 410 V For 400 V class: approximately 820 V
Cause		**Possible Solutions**
Surge voltage present in the drive input power.		• Install a DC link choke or an AC reactor. • Voltage surge can result from a thyristor convertor and a phase advancing capacitor operating on the same drive input power system.
The motor is short-circuited.		• Check the motor power cable, relay terminals and motor terminal box for short circuits. • Correct grounding shorts and turn the power back on.
Ground current has over-charged the main circuit capacitors via the drive input power.		
Noise interference causes the drive to operate incorrectly.		• Review possible solutions for handling noise interference. • Review section on handling noise interference and check control circuit lines, main circuit lines and ground wiring. • If the magnetic contactor is identified as a source of noise, install a surge protector to the MC coil.
		Set number of fault reset (L5-01) to a value other than 0.

Encoder cable is disconnected.		Reconnect the cable.
Encoder cable wiring is wrong.		Correct the wiring.
Noise interference along encoder wiring.		Separate encoder wiring from the source of the noise (often output wiring from the drive).
Digital Operator Display		**Minor Fault Name**
PASS	PASS	MEMOBUS/Modbus Communication Test Mode Complete
Cause		**Possible Solutions**
MEMOBUS/Modbus test has finished normally.		This verifies that the test was successful.
Digital Operator Display		**Minor Fault Name**
PGo	PGo	Encoder Disconnected (for Control Mode with Encoder)
		Detected when no encoder signal is received for a time longer than setting in F1-14.
Cause		**Possible Solutions**
Encoder cable is disconnected.		Reconnect the cable.
Encoder cable wiring is wrong.		Correct the wiring.
Encoder does not have enough power.		Make sure the correct power supply is properly connected to the encoder.
Motor brake is not released.		Ensure the brake releases properly
Digital Operator Display		**Minor Fault Name**
PGoH	PGoH	Encoder Disconnected (detected when using an encoder)
		Encoder cable has become disconnected.
Cause		**Possible Solutions**
Encoder cable is disconnected.		Reconnect the cable.
Digital Operator Display		**Minor Fault Name**
SE	SE	MEMOBUS/Modbus Self Test Failed
Cause		**Possible Solutions**
A digital input set to 67H (MEMOBUS/Modbus test) was closed while the drive was running.		Stop the drive and run the test again.
Digital Operator Display		**Minor Fault Name**
TrPC	TrPC	IGBT Maintenance Time (90%)
		IGBTs have reached 90% of their expected performance life. **Note:** This alarm will not trigger a multi-function output terminal that is set for alarm output (H2-□□ = 10).
Cause		**Possible Solutions**
IGBTs have reached 90% of their expected performance life.		Replace the drive.
Digital Operator Display		**Minor Fault Name**
UL3	UL3	Undertorque Detection 1
		Drive output current (or torque in OLV, CLV, CLV/PM) less than L6-02 for longer than L6-03 time.
Cause		**Possible Solutions**
Inappropriate parameter settings.		Check parameters L6-02 and L6-03.
Load has dropped or decreased significantly.		Check for broken parts in the transmission system.
Digital Operator Display		**Minor Fault Name**
UL4	UL4	Undertorque Detection 2
		Drive output current (or torque in OLV, CLV, CLV/PM) less than L6-05 for longer than L6-06 time.
Cause		**Possible Solutions**
Inappropriate parameter settings.		Check parameters L6-05 and L6-06.
The load has dropped or decreased significantly.		Check for broken parts in the transmission system.
Digital Operator Display		**Minor Fault Name**
Uv	Uv	Undervoltage
		One of the following conditions was true when the drive was stopped and a Up/Down command was entered: • DC bus voltage dropped below the level specified in L2-05. • Contactor to suppress inrush current in the drive was opened. • Low voltage in the control drive input power. This alarm outputs only if L2-01 is not 0 and DC bus voltage is under L2-05.
Cause		**Possible Solutions**
Phase loss in the drive input power.		Check for wiring errors in the main circuit drive input power. Correct the wiring.
Loose wiring in the drive input power terminals.		• Ensure the terminals have been properly tightened. • Apply the tightening torque to the terminals as specified. *Refer to Wire Gauges and Tightening Torque on page 68*.
There is a problem with the drive input power voltage.		• Check the voltage. • Lower the voltage of the drive input power so that it is within the limits listed in the specifications.
Drive internal circuitry is worn.		• Check the maintenance time for the capacitors (U4-05). • Replace either the control board or the entire drive if U4-05 exceeds 90%. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
The drive input power transformer is too small and voltage drops when the power is switched on.		• Check for an alarm when the magnetic contactor, line breaker, and leakage breaker are closed. • Check the capacity of the drive input power transformer.
Air inside the drive is too hot.		• Check the temperature inside the drive.

The CHARGE light is broken or disconnected.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Minor Fault Name**
voF	voF	Output Voltage Detection Error
		There is a problem with the output voltage.
Cause		**Possible Solutions**
Hardware is damaged.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.

6.5 Operator Programming Errors

◆ oPE Codes, Causes, and Possible Solutions

An Operator Programming Error (oPE) occurs when a contradictory parameter is set or an individual parameter is set to an inappropriate value.

The drive will not operate until the parameter or parameters causing the problem are set correctly. An oPE, however, does not trigger an alarm or fault output. If an oPE occurs, investigate the cause and refer to *Table 6.10* for the appropriate action. When an oPE appears on the operator display, press the ENTER button to view U1-18 and see which parameter is causing the oPE.

Table 6.10 oPE Codes, Causes, and Possible Solutions

<table>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE01</td><td rowspan="2">oPE01</td><td>Drive Capacity Setting Fault</td></tr>
<tr><td>Drive capacity and the value set to o2-04 do not match.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">The drive model selection (o2-04) and the actual capacity of the drive are not the same.</td><td>Correct the value set to o2-04.</td></tr>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE02</td><td rowspan="2">oPE02</td><td>Parameter Range Setting Error</td></tr>
<tr><td>Use U1-18 to find parameters set outside the range.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Parameters were set outside the possible setting range.</td><td>Set parameters to the proper values.</td></tr>
<tr><td colspan="3">Note: When multiple errors occur at the same time, other errors are given precedence over oPE02.</td></tr>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE03</td><td rowspan="2">oPE03</td><td>Multi-function Digital Input Selection Error</td></tr>
<tr><td>A contradictory setting is assigned to multi-function contact inputs H1-03 to H1-08.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">• The same function is assigned to two multi-function inputs.
• Excludes “Brake feedback” and “Brake feedback 2.”</td><td rowspan="2">• Ensure all multi-function inputs are assigned to different functions.
• Re-enter the multi-function settings to ensure this does not occur.</td></tr>
<tr><td colspan="2">The Brake Feedback (H1-□□ = 79) or Brake Feedback 2 (H1-□□ = 5B) function is assigned to three or more multi-function inputs.</td></tr>
<tr><td colspan="2">Motor contactor feedback and Motor contactor feedback 2 (56 vs. 5A) are selected simultaneously.</td><td>Check for contradictory settings assigned to the multi-function input terminals at the same time. Correct setting errors.</td></tr>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td>oPE04</td><td>oPE04</td><td>Terminal Board Mismatch Error</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">The drive, control board, or terminal board has been replaced and the parameter settings between the control board and the terminal board no longer match.</td><td>To load the parameter settings to the drive that are stored in the terminal board, set A1-03 to 5550. Initialize parameters after drive replacement by setting A1-03 to 1110 or 2220.</td></tr>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td>oPE05</td><td>oPE05</td><td>Reference Source Selection Error</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Speed reference is assigned to an option card (b1-01 = 3) but an input option card is not connected to the drive.</td><td rowspan="2">Reconnect the input option card to the drive.</td></tr>
<tr><td colspan="2">The Up/Down command is assigned to an option card (b1-02 = 3) but an input option card is not connected to the drive.</td></tr>
<tr><td colspan="2">Although the digital card input is set for BCD special for a 5 digit input (F3-01 = 6), the data length is set for 8 bit or 12 bit (F3-03 = 0, 1).</td><td>Set the input data for 16 bit (F3-03 = 2).</td></tr>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE06</td><td rowspan="2">oPE06</td><td>Control Mode Selection Error</td></tr>
<tr><td>Correct the setting for the control method.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">A control mode has been selected that requires a PG option card to be installed, but no option card is installed (A1-02 = 3 or 7).</td><td>• Connect a PG option card.
• Correct the value set to A1-02.</td></tr>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE07</td><td rowspan="2">oPE07</td><td>Multi-function Analog Input Selection Error</td></tr>
<tr><td>A contradictory setting is assigned to multi-function analog inputs H3-02 and H3-10.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">At least two analog input terminals are set to the same function (i.e., parameters H3-02 and H3-10 have the same setting).</td><td>Change the settings to H3-02 and H3-10 so that functions no longer conflict.
Note: Both 0 (speed reference bias) and F (not used) can be set to H3-02 and H3-10 at the same time.</td></tr>
</table>

Digital Operator Display		Error Name
oPE08	oPE08	Parameter Selection Error A function has been set that cannot be used in the motor control method selected.
Cause		**Possible Solutions**
Attempted to use a function that is not valid for the selected control mode.		Check the motor control method and the functions available.
In Open Loop Vector Control, n2-02 is greater than n2-03		Correct parameter settings so that n2-02 is less than n2-03.
b1-14 (Phase Order Selection) is set to 1 (Switch phase order) when in using a PG option card.		Correct the parameter settings.
Note: Use U1-18 to find parameters that are set outside the specified setting range. Other errors are given precedence over oPE08 when multiple errors occur simultaneously.		
Digital Operator Display		**Error Name**
oPE10	oPE10	V/f Pattern Setting Error The following setting errors have occurred where: E1-04 is greater than or equal to E1-06, E1-06 is greater than or equal to E1-07, E1-07 is greater than or equal to E1-09, or E1-09 is greater than or equal to E1-11.
Cause		**Possible Solutions**
–		Correct the settings for E1-04, E1-06, E1-07, E1-09, and E1-11 (for motor 2, correct E3-04, E3-06, E3-07, E3-09, and E3-11).
Digital Operator Display		**Error Name**
oPE16	oPE16	Energy Savings Constants Error
Cause		**Possible Solutions**
Energy saving coefficients are out of the allowable range.		Check and correct the motor data in E5 parameters.
Digital Operator Display		**Error Name**
oPE18	oPE18	Parameter Setting Error, Online Tuning Parameter Setting Error • The input from load cell with load condition 1 (S3-29) is set to the same value as load condition 2 (S3-30). • DWELL 2 related parameters are not set correctly. • Parameters that control Online Tuning are not set correctly.
Cause		**Possible Solutions**
S3-29 and S3-30 are set to the same value, meaning that the input from load cell with load condition 1 (S3-29) is set to the same value as load condition 2 (S3-30).		Correct the values set to S3-29 and S3-30.
The Dwell 2 speed reference in S3-20 is greater than 0.00 but is still less than the Dwell 2 End Speed in S3-21.		Correct the values set to S3-20 and S3-21.
Open Loop Vector Control is selected (A1-02 = 2), Online Tuning is enabled (n6-01 = 2), and one of the following contradictory settings exists: • E2-02 is set to 30% or less of its factory default. • E2-06 is set to 50% or less of its factory default. • E2-03 = 0		Correct the values set to E2-02, E2-03, or/and E2-06.
Digital Operator Display		**Error Name**
oPE20	oPE20	PG-F3 Setting Error The encoder signal frequency is too high.
Cause		**Possible Solutions**
With the entered encoder resolution (F1-01), maximum output frequency (E1-04), and motor pole number (E5-04,) the calculation encoder signal frequency exceeds 50 kHz (with PG-F3 option) or 20 kHz (with PG-E3 option).		• Set F1-01 to the correct encoder resolution. • Reduce the maximum output frequency of the drive in parameter E1-04 so the encoder signal frequency at maximum speed is lower than 50 kHz.
Digital Operator Display		**Error Name**
oPE21	oPE21	Elevator Parameter Setting Fault Elevator parameters are not set correctly.
Cause		**Possible Solutions**
The DC Injection / Position Lock Time at Stop (S1-05) is set to a value lower than the Brake Close Delay Time (S1-07).		Correct parameter settings so that S1-05 > S1-07.
• The deceleration distance (S5-11) is set to value lower than the minimum deceleration distance (U4-43). • The stop distance (S5-12) is set to a value lower than the minimum stop distance (U4-44).		• Correct parameter settings so that S5-11 > U4-43. • Correct parameter settings so that S5-12 > U4-44.
Both S5-10 and S5-01 are enabled at the same time.		Correct the setting in parameters S5-01 and S5-10.

6.6 Auto-Tuning Fault Detection

When the Auto-Tuning faults shown below are detected, the fault is displayed on the digital operator and the motor coasts to a stop. Auto-Tuning faults do not trigger a multi-function terminal set for fault or alarm output.

An End□ error indicates that although Auto-Tuning has successfully completed, there is some discrepancy in the calculations.

If an End□ error occurs, check for the cause of the error using the table below, and perform Auto-Tuning again after fixing the problem. Start the application if no problem can be diagnosed despite the existence of the End□ error.

◆ Auto-Tuning Codes, Causes, and Possible Solutions

Table 6.11 Auto-Tuning Codes, Causes, and Possible Solutions

Digital Operator Display		Error Name
End1	End1	Excessive V/f Setting (detected only during Rotational Auto-Tuning, and displayed after Auto-Tuning is complete)
Cause		**Possible Solutions**
The torque reference exceeded 20% during Auto-Tuning.		• Before Auto-Tuning the drive, verify the information written on the motor nameplate and enter that data to T1-03 through T1-05. • Enter proper information to parameters T1-03 to T1-05 and repeat Auto-Tuning.
The results from Auto-Tuning the no-load current exceeded 80%.		
Digital Operator Display		**Error Name**
End2	End2	Motor Iron-Core Saturation Coefficient (detected only during Rotational Auto-Tuning and displayed after Auto-Tuning is complete)
Cause		**Possible Solutions**
Motor data entered during Auto-Tuning was incorrect.		• Make sure the data entered to the T1 parameters match the information written on the motor nameplate. • Restart Auto-Tuning and enter the correct information.
Results from Auto-Tuning are outside the parameter setting range, assigning the iron-core saturation coefficient (E2-07, E2-08) a temporary value.		Check and correct faulty motor wiring.
Digital Operator Display		**Error Name**
End3	End3	Rated Current Setting Alarm (displayed after Auto-Tuning is complete)
Cause		**Possible Solutions**
The correct current rating printed on the nameplate was not entered into T1-04.		• Check the setting of parameter T1-04. • Check the motor data and repeat Auto-Tuning.
Digital Operator Display		**Error Name**
End4	End4	Adjusted Slip Calculation Error
Cause		**Possible Solutions**
The slip that was calculated is outside the allowable range.		• Make sure the data entered for Auto-Tuning is correct. • Execute Rotational Auto-Tuning instead. If not possible, try Stationary Auto-Tuning 2.
Digital Operator Display		**Error Name**
End5	End5	Resistance Tuning Error
Cause		**Possible Solutions**
The resistance value that was calculated is outside the allowable range.		• Double-check the data that was entered for the Auto-Tuning process. • Check the motor and motor cable connection for faults.
Digital Operator Display		**Error Name**
End6	End6	Leakage Inductance Alarm
Cause		**Possible Solutions**
A1-02 setting error		• Check the setting of parameter A1-02. • Check the control mode and repeat Auto-Tuning.
The leakage inductance value that was calculated is outside the allowable range.		Double-check the data that was entered for the Auto-Tuning process.
Digital Operator Display		**Error Name**
End7	End7	No-Load Current Alarm
Cause		**Possible Solutions**
The entered no-load current value was outside the allowable range.		Check and correct faulty motor wiring.
Auto-Tuning results were less than 5% of the motor rated current.		Double-check the data that was entered for the Auto-Tuning process.

6.6 Auto-Tuning Fault Detection

Digital Operator Display		Error Name
End8	End8	Rescue Operation Speed Warning
Cause		**Possible Solutions**
High frequency injection calculations for the battery power supply were below 10 Hz.		For Rescue Operation, either switch to a larger battery (at least 280 Vdc for a 200 V class drive, 560 Vdc for the 400 V class) or switch to an absolute encoder and the PG-F3 option card.
Digital Operator Display		**Error Name**
End9	End9	Rescue Operation Rotor Pole Position Search Warning
Cause		**Possible Solutions**
While operating from the backup battery, pole diversion exceeded 40 degrees.		For Rescue Operation, either switch to a larger battery (at least 280 Vdc for a 200 V class drive, 560 Vdc for the 400 V class) or switch to an absolute encoder and the PG-F3 option card.
Digital Operator Display		**Error Name**
End10	End10	Rescue Operation Rotor Polarity Detection Warning
Cause		**Possible Solutions**
While operating from the backup battery, the Id value between poles was less than 5%.		For Rescue Operation, either switch to a larger battery (at least 280 Vdc for a 200 V class drive, 560 Vdc for the 400 V class) or switch to an absolute encoder and the PG-F3 option card.
Digital Operator Display		**Error Name**
Er-01	Er-01	Motor Data Error
Cause		**Possible Solutions**
Motor data or data entered during Auto-Tuning was incorrect.		• Check that the motor data entered to T1 parameters matches motor nameplate input before Auto-Tuning. • Start Auto-Tuning over again and enter the correct information.
Motor output power and motor-rated current settings (T1-02 and T1-04) do not match.		• Check the drive and motor capacities. • Correct the settings of parameters T1-02 and T1-04.
Motor rated current and detected no-load current are not consistent with another.		• Check the motor rated current and no-load current. • Correct the settings of parameters T1-04 and E2-03.
Base frequency and motor rated speed (T1-05 and T1-07) do not match.		• Set T1-05 and T1-07 to the correct value. • Check if the correct pole number was entered to T1-06.
Digital Operator Display		**Error Name**
Er-02	Er-02	Alarm
Cause		**Possible Solutions**
An alarm was triggered during Auto-Tuning.		Exit the Auto-Tuning menu, check the alarm code, remove the alarm cause, and repeat Auto-Tuning.
Digital Operator Display		**Error Name**
Er-03	Er-03	STOP Button Input
Cause		**Possible Solutions**
Auto-Tuning canceled by pressing STOP button.		Auto-Tuning did not complete properly and will have to be performed again.
Digital Operator Display		**Error Name**
Er-04	Er-04	Line-to-Line Resistance Error
Cause		**Possible Solutions**
Motor data entered during Auto-Tuning was incorrect.		• Make sure the data entered to the T1 parameters match the information written on the motor nameplate. • Restart Auto-Tuning and enter the correct information.
Results from Auto-Tuning are outside the parameter setting range or the tuning process took too long.		Check and correct faulty motor wiring.
Motor cable or cable connection faulty.		
Digital Operator Display		**Error Name**
Er-05	Er-05	No-Load Current Error
Cause		**Possible Solutions**
Motor data entered during Auto-Tuning was incorrect.		• Make sure the data entered to the T1 parameters match the information written on the motor nameplate. • Restart Auto-Tuning and enter the correct information.
Results from Auto-Tuning are outside the parameter setting range or the tuning process took too long.		• Check and correct faulty motor wiring. • Perform Rotational Auto-Tuning. Remember that the rope must be fully removed from the motor and the brake must be released to perform Rotational Auto-Tuning.
The load during Rotational Auto-Tuning was too high.		• Disconnect the motor from machine and restart Auto-Tuning. If motor and load cannot be uncoupled make sure the load is lower than 30%. • If a mechanical brake is installed, make sure it is fully lifted during tuning.
Digital Operator Display		**Error Name**
Er-08	Er-08	Rated Slip Error
Cause		**Possible Solutions**
Motor data entered during Auto-Tuning was incorrect.		• Make sure the data entered to the T1 parameters match the information written on the motor nameplate. • Restart Auto-Tuning and enter the correct information.
Drive-calculated values outside parameter setting range or the tuning process took too long.		• Check and correct faulty motor wiring. • Perform Rotational Auto-Tuning. Remember that the rope must be fully removed from the motor and the brake must be released to perform Rotational Auto-Tuning.

The load during rotational Auto-Tuning was too high.		• Disconnect the motor from machine and restart Auto-Tuning. If motor and load cannot be uncoupled make sure the load is lower than 30%. • If a mechanical brake is installed, make sure it is fully lifted during tuning.
Digital Operator Display		**Error Name**
Er-09	Er-09	Acceleration Error
Cause		**Possible Solutions**
The motor did not accelerate for the specified acceleration ramp.		Lengthen the acceleration ramp (C1-01).
Torque limit when motoring is too low (L7-01 and L7-02).		• Check the settings of parameters L7-01 and L7-02. • Increase the setting of L7-01 and L7-02.
The load during Rotational Auto-Tuning was too high.		• Disconnect the motor from machine and restart Auto-Tuning. If motor and load cannot be uncoupled make sure the load is lower than 30%. • If a mechanical brake is installed, make sure it is fully lifted during tuning.
Digital Operator Display		**Error Name**
Er-10	Er-10	Motor Direction Error
Cause		**Possible Solutions**
The encoder signal lines are not properly connected to the drive.		Check and correct wiring to the PG encoder.
Motor and PG direction are opposite.		Check the motor speed monitor U1-05 while turning the motor manually in forward direction. If the sign displayed is negative, change the setting of parameter F1-05.
The load pulled the motor in the opposite direction of the speed reference and the torque exceeded 100%.		Uncouple the motor from the load and repeat Auto-Tuning.
Digital Operator Display		**Error Name**
Er-11	Er-11	Motor Speed Fault
Cause		**Possible Solutions**
Torque reference is too high.		• Lengthen the acceleration ramp set to C1-01 (i.e., increase the acceleration time.) • Disconnect the machine from the motor, if possible.
Digital Operator Display		**Error Name**
Er-12	Er-12	Current Detection Error
Cause		**Possible Solutions**
One of the motor phases is missing: (U/T1, V/T2, W/T3).		Check motor wiring and correct any problems.
Current exceeded the current rating of the drive.		• Check the motor wiring for a short between motor lines. • Make sure the motor contactor is closed during tuning. • Replace either the control board or the entire drive. For instructions on replacing the control board, The current is too low. contact Yaskawa or your nearest sales representative.
The current is too low.		
Attempted Auto-Tuning without motor connected to the drive.		Connect the motor and perform Auto-Tuning.
Current detection signal error.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Error Name**
Er-13	Er-13	Leakage Inductance Error
Cause		**Possible Solutions**
Drive was unable to complete tuning for leakage inductance within 300 seconds.		• Check all wiring and correct any mistakes. • Double-check the motor rated current value that was entered to T1-04 for Auto-Tuning. • Check the motor rated current value written on the motor nameplate and enter the correct value.
Digital Operator Display		**Error Name**
Er-18	Er-18	Induction Voltage Error
Cause		**Possible Solutions**
The induced voltage constant attempted to set a value outside the allowable setting range.		Double-check the data entered to the T2-□□ parameters, and perform Auto-Tuning again.
Digital Operator Display		**Error Name**
Er-19	Er-19	Inductance Error
Cause		**Possible Solutions**
The induced voltage constant attempted to set a value to E5-08 or E5-09 outside the allowable range.		Double-check the data entered to the T2-□□ parameters, and perform Auto-Tuning again.
Digital Operator Display		**Error Name**
Er-20	Er-20	Stator Resistance Error
Cause		**Possible Solutions**
Stator resistance tuning attempted to set a value to E5-06 that is outside the allowable setting range.		Double-check the data entered to the T2-□□ parameters, and perform Auto-Tuning again.

<table>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-21</td><td>Er-21</td><td>Z Pulse Correction Error</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Motor was coasting when Auto-Tuning was performed.</td><td>Make sure the motor has stopped completely. Repeat Auto-Tuning.</td></tr>
<tr><td colspan="2">Either the motor or the encoder on the motor is not properly wired.</td><td>Check the wiring for the motor and the encoder. Repeat Auto-Tuning.</td></tr>
<tr><td colspan="2">The direction for the encoder is set incorrectly, or the number of pulses set for the encoder is wrong.</td><td>Check the direction setting by F1-05 and b1-14 and number of pulses (F1-01) set for the encoder. Repeat Auto-Tuning.</td></tr>
<tr><td colspan="2">Encoder is damaged.</td><td>Check the signal output from the encoder attached to the motor. Replace the encoder if damaged.</td></tr>
<tr><td colspan="2">Excess position error detected for the PG-E3 speed-control option card with the ERN1387 encoder.</td><td>If other possible solutions are not successful, perform Auto-Tuning of PG-E3 encoder characteristics.</td></tr>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-22</td><td>Er-22</td><td>Initial Rotor Pole Search Error</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Parameters set by Initial Rotor Pole Search Tuning were outside the acceptable range.</td><td rowspan="2">Switch to an absolute encoder and to the PG-F3 option card.</td></tr>
<tr><td colspan="2">During normal operation, pole diversion exceeded 20 degrees.</td></tr>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-23</td><td>Er-23</td><td>Non-rotating Encoder Offset Tuning Warning</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Pole diversion exceeded 15 degrees three times.</td><td rowspan="2">Remove the ropes and conduct Rotational Auto-Tuning for Encoder Offset (T2-01 = 3).</td></tr>
<tr><td colspan="2">Parameters set by Encoder Offset Tuning were outside the acceptable range.</td></tr>
<tr><th colspan="2">Digital Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-24</td><td>Er-24</td><td>Auto-Tuning Error for PG-E3 Encoder Characteristics</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">The signal lines between the PG-E3 option card and encoder are disconnected at the R+ and R- terminals.</td><td rowspan="2">Refer to the installation manual for the PG-E3 option card for information on correct connection of signal lines.</td></tr>
<tr><td colspan="2">Excessive electrical interference at the PG-E3 option card</td></tr>
<tr><td colspan="2">The software for the PG-E3 option card does not support the Auto-Tuning of PG-E3 encoder characteristics.</td><td>Check the software version (PRG) for the PG-E3 option card. The software version PRG: 1102 and later support Auto-Tuning of PG-E3 encoder characteristics.</td></tr>
</table>

6.7 Copy Function Related Displays

◆ Tasks, Errors, and Troubleshooting

The table below lists the messages and errors that may appear when using the Copy function.

When executing the tasks offered by the Copy function, the operator will indicate the task being performed. When an error occurs, a code appears on the operator to indicate the error. Note that errors related to the Copy function do not trigger a multi-function output terminal that has been set up to close when a fault or alarm occurs. To clear an error, simply press any key on the operator and the error display will disappear.

Table 6.12 lists the corrective action that can be taken when an error occurs.

Note: **1.** Whenever using the copy function, the drive should be fully stopped.
2. The drive will not accept an Up/Down command while the Copy function is being executed.
3. Parameters can only be saved to a drive when the voltage class, capacity, control mode, and software version match.

Table 6.12 Copy Function Task and Error Displays

Digital Operator Display		Task
CoPy	CoPy	Writing Parameter Settings (flashing)
Cause		**Possible Solutions**
Parameters are being written to the drive.		Not an error.
Digital Operator Display		**Task**
CPEr	CPEr	Control Mode Mismatch
Cause		**Possible Solutions**
Control mode of the parameters to be loaded onto the drive and the control mode already set to the drive don’t match.		Check the control mode for the parameters that are to be loaded onto the drive and the control mode set to the drive those parameters will be written to. Set the same control mode using parameter A1-02 and try again.
Digital Operator Display		**Task**
CPyE	CPyE	Error Writing Data
Cause		**Possible Solutions**
Failed writing parameters.		Try writing parameters again.
Digital Operator Display		**Task**
CSEr	CSEr	Copy Unit Error
Cause		**Possible Solutions**
Hardware fault		Replace the operator or the USB Copy Unit.
Digital Operator Display		**Task**
dFPS	dFPS	Drive Model Mismatch
Cause		**Possible Solutions**
• The drives used in the copy and write process are not the same model. • The drive from which the parameters were copied is a different model. • The drive to be written to is a different model.		Check the model number of the drive from which the parameters were copied and the model of the drive to which you are attempting to write the parameters. Make sure the two drives are the same model and have the same software version.
Digital Operator Display		**Task**
ECE	ECE	Copy Error
Cause		**Possible Solutions**
Attempted to read data from the encoder during undervoltage.		Make sure there is no undervoltage fault or alarm, then try reading the data again.
Digital Operator Display		**Task**
ECS	ECS	Checksum Error
Cause		**Possible Solutions**
Checksum error occurred when attempting to read data from the encoder.		Try copying the data again.
Digital Operator Display		**Task**
EdE	EdE	Write Impossible
Cause		**Possible Solutions**
Drive settings do not permit writing to the encoder (F1-51 = 0), or there was a CPF24 while attempting to write to the encoder.		Set the drive to allow encoder to be written to (F1-51 = 1) and try writing the data again.

Troubleshooting
6

Digital Operator Display		Task
EiF	EiF	Write Data Error
Cause		**Possible Solutions**
Communication error occurred while attempting to write to the encoder.		Make sure communications are normal and try writing to the encoder again.
Digital Operator Display		**Task**
End	End	Task Complete
Cause		**Possible Solutions**
Finished reading, writing, or verifying parameters.		Not an error.
Digital Operator Display		**Task**
EPE	EPE	ID Mismatch
Cause		**Possible Solutions**
Attempted to acquire machine data from an encoder that does not have any machine data written to it yet.		Try again after writing machine data to the encoder.
Digital Operator Display		**Task**
ErE	ErE	Data Error
Cause		**Possible Solutions**
Attempted to write data to the encoder during undervoltage.		Make sure there is no undervoltage fault or alarm and try again.
Digital Operator Display		**Task**
EvE	EvE	Verify Error
Cause		**Possible Solutions**
Drive parameters and the data saved to the encoder do not match.		Use the Verify Menu to check parameter settings and try again.
Digital Operator Display		**Task**
iFEr	iFEr	Communication Error
Cause		**Possible Solutions**
A communication error occurred between the drive and the operator or the USB copy unit.		Check the cable connection.
A non-compatible cable is being used to connect the USB Copy Unit and the drive.		Use the cable originally packaged with the USB Copy Unit.
Digital Operator Display		**Task**
ndAT	ndAT	Model, Voltage Class, Capacity Mismatch
Cause		**Possible Solutions**
The drive from which the parameters were copied and the drive to which you are attempting to write have different electrical specifications, capacities, are set to different control modes, or are different models.		Make sure model numbers and specifications are the same for both drives.
The device being used to write the parameters is blank and does not have any parameters saved on it.		Making sure all connections are correct, and copy the parameter settings onto the USB Copy Unit or the operator.
Digital Operator Display		**Task**
rdEr	rdEr	Error Reading Data
Cause		**Possible Solutions**
Failed while attempting to read parameter settings from the drive.		Press and hold the READ key on the USB Copy Unit for at least one second to have the unit read parameters from the drive.
Digital Operator Display		**Task**
rEAd	rEAd	Reading Parameter Settings (flashing)
Cause		**Possible Solutions**
Displayed while the parameter settings are being read onto the USB Copy Unit.		Not an error.
Digital Operator Display		**Task**
vAEr	vAEr	Voltage Class, Capacity Mismatch
Cause		**Possible Solutions**
The drive the parameters were copied from and the drive you performing the Verify mode on have different electrical specifications or are a different capacity.		Make sure electrical specifications and capacities are the same for both drives.
Digital Operator Display		**Task**
vFyE	vFyE	Parameter settings in the drive and those saved to the copy function are not the same
Cause		**Possible Solutions**
Indicates that parameter settings that have been Read and loaded onto the Copy Unit or Digital Operator are different.		To synchronize parameters, either write the parameters saved on the USB Copy Unit or LCD digital operator onto the drive, or Read the parameter settings on the drive onto the USB Copy Unit.

Digital Operator Display		Task
vrFy	vrFy	Comparing Parameter Settings (flashing)
Cause		**Possible Solutions**
The Verify mode has confirmed that parameters settings on the drive and parameters read to the copy device are identical.		Not an error.

6.8 Diagnosing and Resetting Faults

When a fault occurs and the drive stops, follow the instructions below to remove whatever conditions triggered the fault, then restart the drive.

◆ Fault Occurs Simultaneously with Power Loss

WARNING! *Electrical Shock Hazard. Ensure there are no short circuits between the main circuit terminals (R/L1, S/L2, and T/L3) or between the ground and main circuit terminals before restarting the drive. Failure to comply may result in serious injury or death and will cause damage to equipment.*

1. Turn on the drive input power.
2. Use monitor parameters U2-□□ to display data on the operating status of the drive just before the fault occurred.
3. Remove the cause of the fault and reset.

Note: **1.** To find out what faults were triggered, check the fault history in U2-02. Information on drive status when the fault occurred such as the output speed, current, and voltage can be found in U2-03 through U2-20. ***Refer to Viewing Fault Trace Data After Fault on page 308*** for information on how to view fault data.
2. When the fault continues to be displayed after cycling power, remove the cause of the fault and reset.

◆ If the Drive Still has Power After a Fault Occurs

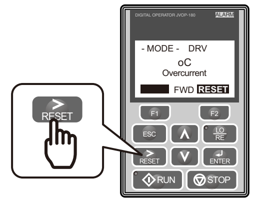
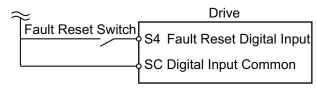
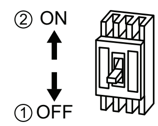
1. Look at the digital operator for information on the fault that occurred.
2. ***Refer to Fault Displays, Causes, and Possible Solutions on page 280***
3. Reset the fault. ***Refer to Fault Reset Methods on page 309***.

◆ Viewing Fault Trace Data After Fault

	Step		Display/Result
1.	Turn on the drive input power. The first screen displays.	➡	- MODE - DRV Rdy Speed Ref (OPR) U1-01= 0.00% U1-02= 0.00% RSEQ U1-03= 0.00A LREF FWD
2.	Press Λ or V until the monitor screen is displayed.	➡	- MODE - DRV Rdy Monitor Menu U1-01= 0.00% U1-02= 0.00% RSEQ U1-03= 0.00A LREF FWD
3.	Press ENTER to display the parameter setting screen.	➡	-MONITR- DRV Rdy Monitor U1-01= 0.00% U1-02= 0.00% RSEQ U1-03= 0.00A LREF FWD
4.	Press Λ and RESET to scroll to monitor U2-02. The fault code shown in U2-02 is the fault that occurred last.	➡	- MONITR - DRV Rdy Last Fault U2-02= oC U2-03= 0.00% RSEQ U2-04= 0.00% LREF FWD
7.	Press Λ to view drive status information when fault occurred. Parameters U2-03 through U2-20 help determine the cause of a fault. Parameters to be monitored differ depending on the control mode.	➡	- MONITR - DRV Rdy Frequency Ref U2-03= 0.00% U2-04= 0.00% RSEQ U2-05= 0.00A LREF FWD ⇅ - MONITR - DRV Rdy Heatsink Temp U2-20= XX °C U2-01= ----- RSEQ U2-02= ----- LREF FWD

◆ Fault Reset Methods

When a fault occurs, the cause of the fault must be removed and the drive must be restarted. The table below lists the different ways to restart the drive.

After the Fault Occurs	Procedure	
Fix the cause of the fault, restart the drive, and reset the fault	Press  on the digital operator when error code is displayed.	
Resetting via Fault Reset Digital Input S4	Close then open the fault signal digital input via terminal S4. S4 is set for “Fault Reset” as default (H1-04 = 14).	
If the above methods do not reset the fault, turn off the drive main power supply. Reapply power after the digital operator display is out.		

Note: If the Up/Down command is present, the drive will disregard any attempts to reset the fault. Remove the Up/Down command before attempting to clear a fault situation.

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7

Periodic Inspection & Maintenance

This chapter describes the periodic inspection and maintenance of the drive to ensure that it receives the proper care to maintain overall performance.

7.1 Section Safety

DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury. Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait for at least the time specified on the warning label once all indicators are OFF, and then measure the DC bus voltage level to confirm it has reached a safe level.

WARNING

Ensuring Safety during Auto-Tuning

When using a PM motor for the first time, or when replacing the drive or PM motor, always make sure that motor parameter have been set properly and the speed detection function accurately prior to operation. Using a PM motor requires that the encoder offset be set correctly in addition to entering motor data to corresponding parameters. If the motor, encoder, or drive is ever replaced, be sure to perform Encoder Offset Auto-Tuning.

Insufficient torque can cause the elevator car to move in the direction of the load, or cause the motor to behave erratically (reverse operation, stand still, sudden accelerations, etc.).
For more information, refer to the instruction manual included with the motor.

Electrical Shock Hazard

Do not connect or disconnect wiring to the drive or motor while the power is on. Failure to comply will result in death or serious injury.
Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are OFF and measure the DC bus voltage level to confirm safe level.

Do not operate equipment with covers removed.
Failure to comply could result in death or serious injury.
The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Do not attempt to modify or alter the drive in any way not explained in this manual. Yaskawa is not responsible damage caused by modification of the product made by the user. Failure to comply could result in death or serious injury from operation of damaged equipment.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Improper equipment grounding could result in death or serious injury by contacting ungrounded electrical equipment.

Always ground the ground terminal. (200 V Class: Ground to 100 Ω or less, 400 V Class: Ground to 10 Ω or less) motor case.

WARNING

Verify motor wiring bare wire ends do not contact the drive chassis or enclosure when wiring drive terminals U/T1, V/T2, W/T3.

Failure to comply may result in serious injury or death due to electrical shock.

Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.

Do not allow unqualified personnel to use the equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Before servicing, disconnect all power to the equipment and lock out the power source.

Failure to comply may result in injury from electrical shock. Wait at least five minutes after all indicators are OFF and measure the DC bus voltage level and main circuit terminals to confirm the circuit is safe before wiring.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

Do not use improper combustible materials in drive installation, repair or maintenance.

Failure to comply could result in death or serious injury by fire. Attach the drive or braking resistors to metal or other noncombustible material.

CAUTION

Burn Hazard

Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury.

Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and make sure heatsink has cooled down.

NOTICE

Equipment Hazard

Never connect or disconnect the motor from the drive while the drive is outputting voltage. Improper sequencing of output motor circuits could result in damage to the drive.

Do not connect electromagnetic switches or magnetic contactors to the output motor circuits without proper sequencing. Do not open the main circuit between the drive and the motor while the PM motor is rotating.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Do not connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Follow cooling fan replacement instructions. The cooling fan cannot operate properly when it is installed incorrectly and could seriously damage the drive.

Follow the instructions in this manual to replace the cooling fan, making sure that the label is on top before inserting the cooling fan into the drive. To ensure maximum useful product life, replace both cooling fans when performing maintenance.

Do not connect the AC power line to the output motor terminals of the drive.

Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals. could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive.

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

Yaskawa is not responsible for any modification of the product made by the user. This product must not be modified.

Check all the wiring to ensure that all connections are correct after installing the drive and connecting any other devices.

Failure to comply could result in damage to the drive.

Make sure wiring to motor terminals U, V, and W connect the corresponding U/T1, V/T2, and W/T3 output terminals on the drive.

Wiring to the wrong terminals will reverse the phase order, causing the motor to operate in reverse. This could cause the elevator car to fall when attempting to go up.

Never use a magnet contactor on the input side of the drive.

Refrain from switching an input contactor more often than once every 30 minutes. Normally the drive I/O should be used to stop and start the motor.

Do not operate damaged equipment.

Failure to comply could result in further damage to the equipment.
Do not connect or operate any equipment with visible damage or missing parts.

7.2 Inspection

Power electronics have limited life and may exhibit changes in characteristics or performance deterioration after years of use under normal conditions. To help avoid such problems, it is important to perform preventive maintenance and periodic inspection on the drive.

Drives contain a variety of power electronics such as power transistors, semiconductors, capacitors, resistors, fans, and relays. The electronics in the drive serve a critical role in maintaining proper motor control.

Follow the inspection lists provided in this chapter as a part of a regular maintenance program.

Note: The drive will require more frequent inspection if it is placed in harsh environments, such as:

- High ambient temperatures
- Frequent starting and stopping
- Fluctuations in the AC supply or load
- Excessive vibrations or shock loading
- Dust, metal dust, salt, sulfuric acid, chlorine atmospheres
- Poor storage conditions.

Perform the first equipment inspection one to two years after installation.

◆ Recommended Daily Inspection

Table 7.1 outlines the recommended daily inspection for Yaskawa drives. Check the following items on a daily basis to avoid premature deterioration in performance or product failure. Copy this checklist and mark the "Checked" column after each inspection.

Table 7.1 General Recommended Daily Inspection Checklist

Inspection Category	Inspection Points	Corrective Action	Checked
Motor	Inspect for abnormal oscillation or noise coming from the motor.	• Check the load coupling. • Measure motor vibration. • Tighten all loose components.	
Cooling	Inspect for abnormal heat generated from the drive or motor and visible discoloration.	Check for excessive load. • Excessive load. • Loose connections. • Dirty heatsink or motor. • Ambient temperature.	
	Inspect drive cooling fan and circulation fan operation.	Check for the following: • Clogged or dirty fan. • Correct fan operation parameter setting.	
Environment	Verify the drive environment complies with the specifications listed in *Installation Environment on page 44*.	Eliminate the source of contaminants or correct poor environment.	
Load	The drive output current should not be higher than the motor or drive rating for an extended period of time.	Check for the following: • Excessive load. • Correct motor parameter settings.	
Power Supply Voltage	Check main power supply and control voltages.	• Correct the voltage or power supply to within nameplate specifications. • Verify all main circuit phases.	

◆ Recommended Periodic Inspection

Table 7.2 outlines the recommended periodic inspections for Yaskawa drive installations. Although periodic inspections should generally be performed once a year, the drive may require more frequent inspection in harsh environments or with rigorous use. Operating and environmental conditions, along with experience in each application, will determine the actual inspection frequency for each installation. Periodic inspection will help to avoid premature deterioration in performance or product failure. Copy this checklist and mark the "Checked" column after each inspection.

■ Periodic Inspection

WARNING! *Electrical Shock Hazard. Do not inspect, connect, or disconnect any wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

Table 7.2 Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Main Circuit Periodic Inspection			
General	• Inspect equipment for discoloration from overheating or deterioration. • Inspect for damaged or deformed parts.	• Replace damaged components as required. • The drive has few serviceable parts and may require complete drive replacement.	
	Inspect for dirt, foreign particles, or dust collection on components.	• Inspect enclosure door seal if used. • Remove foreign particles and dust by sucking them out with a vacuum cleaner to avoid touching parts. • Replace components if cleaning is not possible.	
Conductors and Wiring	• Inspect wiring and connections for discoloration, damage, or heat stress. • Inspect wire insulation and shielding for wear.	Repair or replace damaged wiring.	
Terminals	Inspect terminals for stripped, damaged, or loose connections.	Tighten loose screws and replace damaged screws or terminals.	
Relays and Contactors	• Inspect contactors and relays for excessive noise during operation. • Inspect coils for signs of overheating such as melted or cracked insulation.	• Check coil voltage for overvoltage or undervoltage conditions. • Replace damaged removable relays contactors or circuit board.	
Braking Resistors	Inspect for discoloration of heat stress on or around resistors.	• Minor discoloration may be acceptable. • Check for loose connections if discoloration exists.	
Electrolytic Capacitor	• Inspect for leaking, discoloration, or cracks. • Check if the cap has come off, for any swelling, or if the sides have burst open.	The drive has few serviceable parts and may require complete drive replacement.	
Diode, IGBT (Power Transistor)	Inspect for dust or other foreign material collected on the surface.	Remove foreign particles and dust by sucking them out with a vacuum cleaner to avoid touching parts.	
Motor Periodic Inspection			
Operation Check	Check for increased vibration or abnormal noise.	Stop the motor and contact qualified maintenance personnel as required.	
Control Circuit Periodic Inspection			
General	• Inspect terminals for stripped, damaged, or loose connections. • Make sure all terminals have been properly tightened.	• Tighten loose screws and replace damaged screws or terminals. • If terminals are integral to a circuit board, then board or drive replacement may be required.	
Circuit Boards	Check for any odor, discoloration, and rust. Make sure connections are properly fastened and that no dust or oil mist has accumulated on the surface of the board.	• Fix any loose connections. • If an antistatic cloth or vacuum plunger cannot be used, replace the board. • Do not use any solvents to clean the board. • Remove foreign particles and dust by sucking them out with a vacuum cleaner to avoid touching parts. • The drive has few serviceable parts and may require complete drive replacement.	
Cooling System Periodic Inspection			
Cooling Fan, Circulation Fan, Control Board Cooling Fan	• Check for abnormal oscillation or unusual noise. • Check for damaged or missing fan blades.	• Replace as required. • ***Refer to Drive Cooling Fans and Circulation Fans on page 319*** for information on cleaning or replacing the fan.	
Heatsink	Inspect for dust or other foreign material collected on the surface.	Remove foreign particles and dust by sucking them out with a vacuum cleaner to avoid touching parts.	
Air Duct	Inspect air intake and exhaust openings. They must be free from obstruction and properly installed.	• Visually inspect the area. • Clear obstructions and clean air duct as required.	
Display Periodic Inspection			
Digital Operator	• Make sure data appears on the operator properly. • Inspect for dust or other foreign material that may have collected on surrounding components.	• Contact a Yaskawa representative if there is any trouble with the display or keypad. • Clean the digital operator.	

7.3 Periodic Maintenance

The drive has Maintenance Monitors that keep track of component wear. This feature provides advance maintenance warning and eliminates the need to shut down the entire system for unexpected problems. The drive allows the user to check predicted maintenance periods for the components listed below.

- Cooling Fan, Circulation Fan, Control Board Cooling Fan
- Electrolytic Capacitors
- Inrush Prevention Circuit
- IGBTs

For replacement parts, contact the distributor where the drive was purchased or contact Yaskawa directly.

◆ Replacement Parts

Table 7.3 contains the estimated performance life of components that require replacement during the life of the drive. Only use Yaskawa replacement parts for the appropriate drive model and revision.

Table 7.3 Estimated Performance Life

Component	Estimated Performance Life
Cooling Fan, Circulation Fan	10 years
Electrolytic Capacitors	10 years <1>

<1> The drive has few serviceable parts and may require complete drive replacement.

NOTICE: *Estimated performance life based on specific usage conditions. These conditions are provided for the purpose of replacing parts to maintain performance. Some parts may require more frequent replacement due to poor environments or rigorous use. Usage conditions for estimated performance life:*
Ambient temperature: Yearly average of 40 °C (IP00 enclosure)
Load factor: 80% maximum
Operation time: 24 hours a day

■ Performance Life Monitors Maintenance Monitors

The drive calculates the maintenance period for components that may require replacement during the life of the drive. A percentage of the maintenance period is displayed on the digital operator by viewing the appropriate monitor parameter.

When the maintenance period reaches 100%, there is increased risk that the drive may malfunction. Yaskawa recommends checking the maintenance period regularly to ensure maximum performance life.

Refer to Recommended Periodic Inspection on page 316 for more details.

Table 7.4 Performance Life Monitors Used for Component Replacement

Parameter	Component	Contents
U4-03	Cooling Fan, Circulation Fan, Control Board Cooling Fan	Displays the accumulated operation time of the fan, from 0 to 99999 hours. This value is automatically reset to 0 once it reaches 99999.
U4-04		Displays the accumulated fan operation time as a percentage of the specified maintenance period.
U4-05	DC Bus Capacitors	Displays the accumulated time the capacitors are used as a percentage of the specified maintenance period.
U4-06	Inrush (pre-charge) Relay	Displays the number of times the drive is powered up as a percentage of the performance life of the inrush circuit.
U4-07	IGBT	Displays the percentage of the maintenance period reached by the IGBTs.

■ Alarm Outputs for Maintenance Monitors

An output can be set up to inform the user when a specific components has neared its expected performance life.

When one of multi-function digital output terminals has been assigned the maintenance monitor function (H2-☐☐ = 2F), the terminal will close when the cooling fan, DC bus capacitors, or DC bus pre-charge relay reach 90% of the expected performance life, or when the IGBTs have reached 50% of their expected performance life. Additionally the digital operator will display an alarm like shown in *Table 7.5* to indicate the specific components that may need maintenance.

Table 7.5 Maintenance Alarms

Alarm Display		Function	Corrective Action
LED Operator	LCD Operator		
LT-1 <1>	LT-1	The cooling fans have reached 90% of their designated lifetime.	Replace the cooling fan.
LT-2 <1>	LT-2	The DC bus capacitors have reached 90% of their designated lifetime.	Replace the drive.
LT-3 <1>	LT-3	The DC bus charge circuit has reached 90% of its designated lifetime.	Replace the drive.
LT-4 <1>	LT-4	The IGBTs have reached 50% of their designated lifetime.	Check the load, carrier frequency, and output frequency.
TrPC <2>	TrPC	The IGBTs have reached 90% of their designated lifetime.	Replace the drive.

<1> This alarm message will be output only if the Maintenance Monitor function is assigned to one of the digital outputs (H2-☐☐ = 2F). The alarm will also trigger a digital output that is programmed for alarm indication (H2-☐☐ = 10).
<2> This alarm message will always be output, even if the Maintenance Monitor function is not assigned to any of the digital outputs (H2-☐☐ = 2F). The alarm will also trigger a digital output that is programmed for alarm indication (H2-☐☐ = 10).

■ Related Drive Parameters

Use parameters o4-03, o4-05, o4-07, and o4-09 to reset a Maintenance Monitor to zero after replacing a specific component. *Refer to Parameter List on page 367* for details on parameter settings.

NOTICE: *If these parameters are not reset after the corresponding parts have been replaced, the Maintenance Monitor function will continue to count down the performance life from the value that was reached with the old part. If the Maintenance Monitor is not reset, the drive will not have the correct value of the performance life for the new component.*

7.4 Drive Cooling Fans and Circulation Fans

Follow the instructions in this manual to replace the cooling fan, making sure that the label is on top before inserting the cooling fan into the drive.

NOTICE: *Follow cooling fan replacement instructions. The cooling fan cannot operate properly when installed incorrectly and could seriously damage the drive. To ensure maximum useful product life, replace all cooling fans when performing maintenance.*

Contact your Yaskawa representative or the nearest Yaskawa sales office to order replacement cooling fans as required.

For drives with multiple cooling fans, replace all the fans when performing maintenance to ensure maximum product performance life.

◆ Number of Cooling Fans

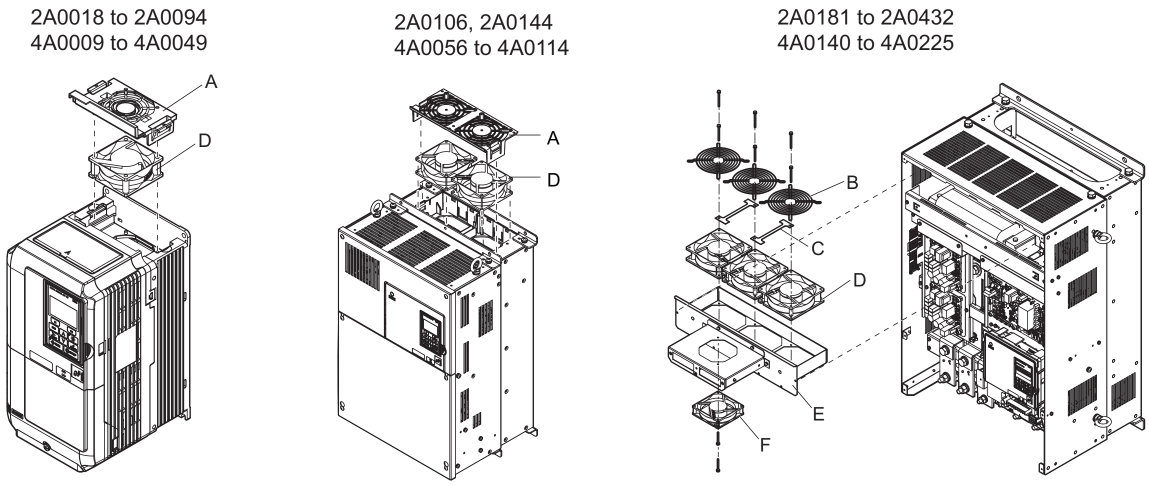
Three-Phase 200 V Class				Three-Phase 400 V Class		
Model	Cooling Fans	Circulation Fans	Page	Model	Cooling Fans	Page
2A0018	1	–	321	4A0009	1	321
2A0022	1	–		4A0012	1	
2A0031	2	–		4A0019	2	
2A0041	2	–		4A0023	2	
2A0059	2	–		4A0030	2	
2A0075	2	–		4A0039	2	
2A0094	2	–		4A0049	2	
2A0106	2	–	323	4A0056	2	323
2A0144	2	–		4A0075	2	
2A0181	2	–	328	4A0094	2	325
2A0225	2	–		4A0114	2	
2A0269	2	–		4A0140	2	328
2A0354	2	–		4A0188	2	
2A0432	3	1		4A0225	2	

◆ Cooling Fan Component Names

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

NOTICE: *Follow cooling fan and circulation fan replacement instructions. Improper fan replacement may cause damage to equipment. When installing the replacement fan into the drive, make sure the fan is facing upwards. Replace all fans when performing maintenance to help ensure maximum useful product life.*



A – Fan Cover
B – Fan finger guard
C – Cable Cover
D – Cooling Fan
E – Fan Unit Case
F – Circulation Fan

Figure 7.1 Cooling Fan Replacement

◆ Cooling Fan Replacement: 2A0018 to 2A0094 and 4A0009 to 4A0049

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

NOTICE: *Equipment Hazard. Follow cooling fan replacement instructions. The cooling fan cannot operate properly when it is installed incorrectly and could seriously damage the drive. Follow the instructions in this manual to replace the cooling fan, making sure that the label is on top before inserting the cooling fan into the drive. To ensure maximum useful product life, replace both cooling fans when performing maintenance.*

■ Removing the Cooling Fan

1. Depress the right and left sides of the fan cover hooks and pull upward. Remove the fan cover from the top of the drive. The following figure illustrates a drive with a single cooling fan.

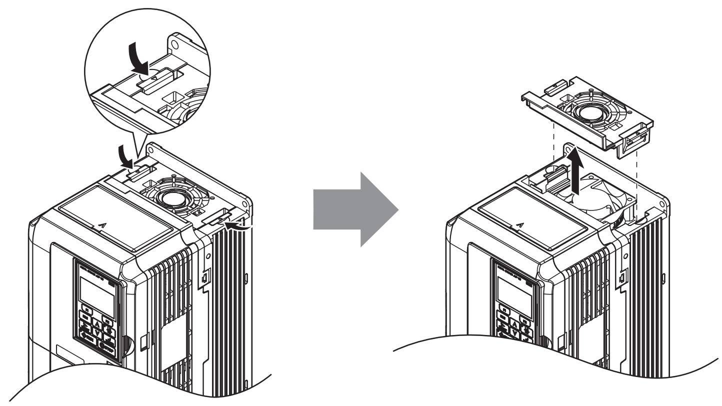


Figure 7.2 Removing the Fan Cover: 2A0018 to 2A0094, 4A0009 to 4A0049

2. Remove the cooling fan cartridge. Disconnect the pluggable connector and remove the fan.

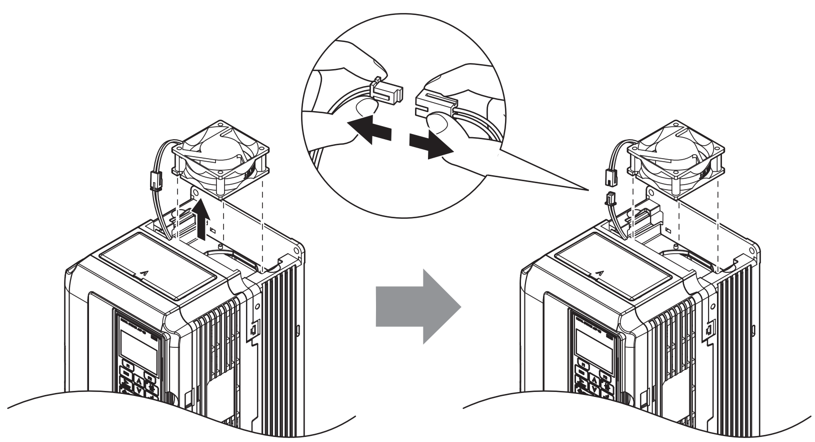


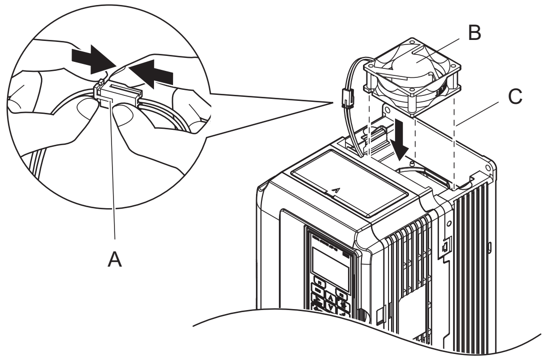
Figure 7.3 Removing the Cooling Fan: 2A0018 to 2A0094, 4A0009 to 4A0049

■ Installing the Cooling Fan

NOTICE: *Prevent Equipment Damage. Follow cooling fan replacement instructions. Improper cooling fan replacement could result in damage to equipment. When installing the replacement cooling fan into the drive, make sure the fan is facing upwards. To ensure maximum useful product life, replace all cooling fans when performing maintenance.*

Reverse the procedure described above to reinstall the cooling fan.

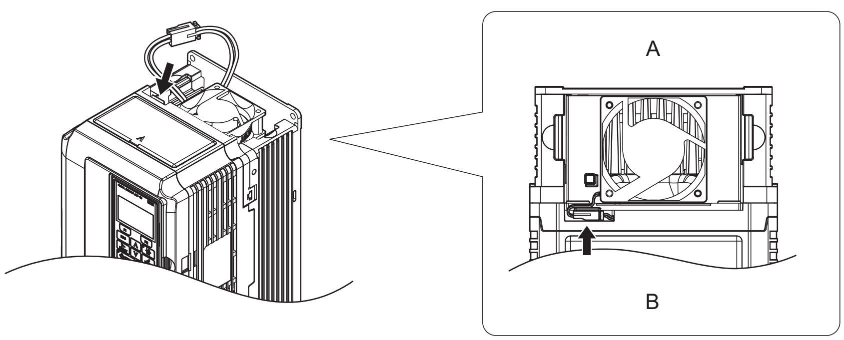
1. Install the replacement fan into the drive, ensuring the alignment pins line up as shown in the figure below.



A – Push the connectors together completely
B – Label facing up
C – Make sure the pins align properly.

Figure 7.4 Installing the Cooling Fan: 2A0018 to 2A0094, 4A0009 to 4A0049

2. Properly connect the fan power lines, then place the cable back into the recess of the drive.



A – Back **B – Front**

Figure 7.5 Cooling Fan Power Supply Connectors: 2A0018 to 2A0094, 4A0009 to 4A0049

3. While pressing in on the hooks on the left and right sides of the fan finger guard, guide the fan finger guard until it clicks back into place.

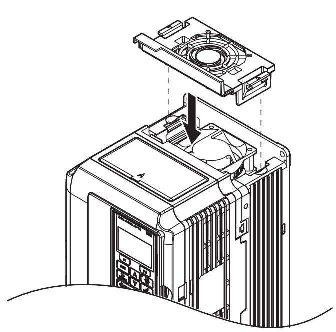


Figure 7.6 Reattach the Fan Cover: 2A0018 to 2A0094, 4A0009 to 4A0049

4. Turn the power supply back on and reset the cooling fan operation time for the Maintenance Monitor by setting o4-03 to 0.

◆ Cooling Fan Replacement: 2A0106, 2A0144, 4A0056, and 4A0075

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

NOTICE: *Equipment Hazard. Follow cooling fan replacement instructions. The cooling fan cannot operate properly when it is installed incorrectly and could seriously damage the drive. Follow the instructions in this manual to replace the cooling fan, making sure that the label is on top before inserting the cooling fan into the drive. To ensure maximum useful product life, replace both cooling fans when performing maintenance.*

■ Removing the Cooling Fan

1. While pressing in on the hooks located on the left and right sides of the fan finger guard, free the fan finger guard leading by lifting the back end first.

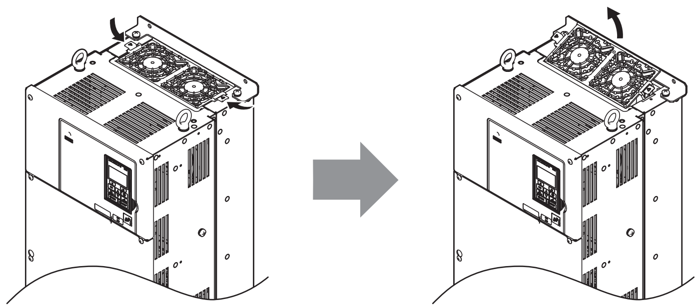


Figure 7.7 Removing the Cooling Fan Cover: 2A0106, 2A0144, 4A0056, and 4A0075

2. Lift out the back end of the fan finger guard first. Unplug the replay connector and free the fan finger guard from the drive.

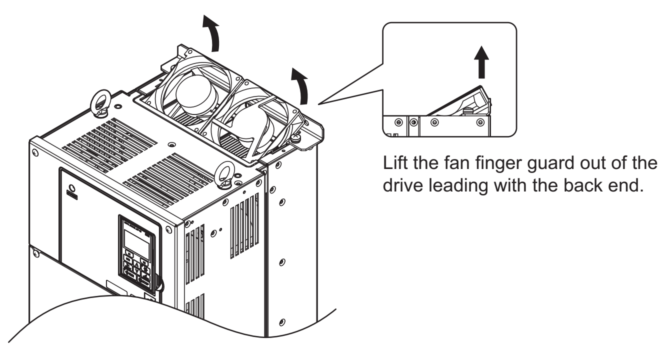


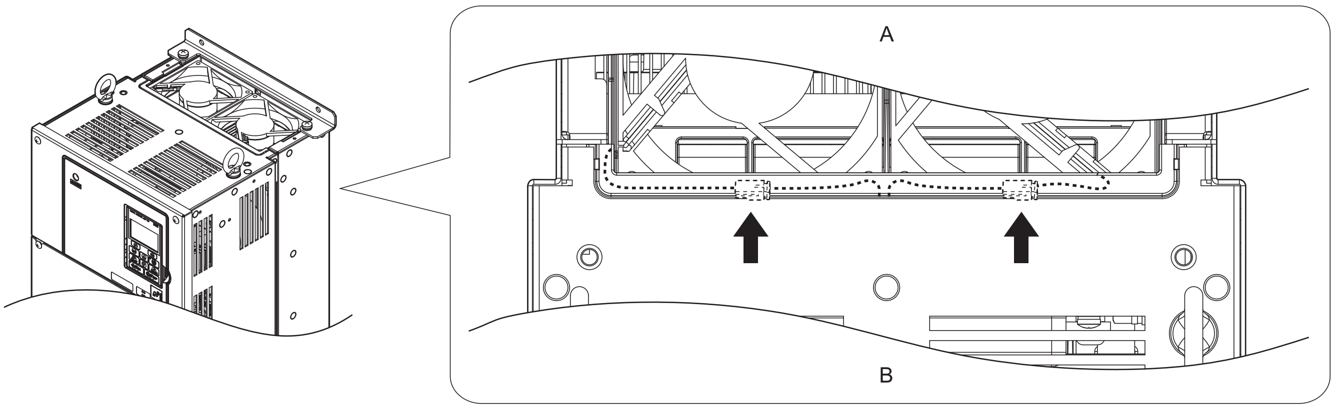
Figure 7.8 Removing the Cooling Fan: 2A0106, 2A0144, 4A0056, and 4A0075

Periodic Inspection & Maintenance

7

■ Installing the Cooling Fan

1. Properly connect the fan power lines.
2. Place the power supply connectors and cable back into the recess of the drive.



A – Back **B – Front**

Figure 7.9 Cooling Fan Power Supply Connectors: 2A0106, 2A0144, 4A0056, and 4A0075

3. Install the replacement fan into the drive.

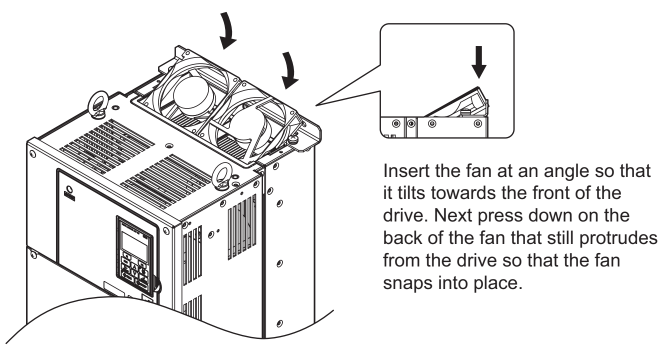


Figure 7.10 Installing the Cooling Fan: 2A0106, 2A0144, 4A0056, and 4A0075

4. Tilt up the back end of the fan finger guard and slide the fan finger guard into the opening near the front of the drive, then guide the fan finger guard into place.

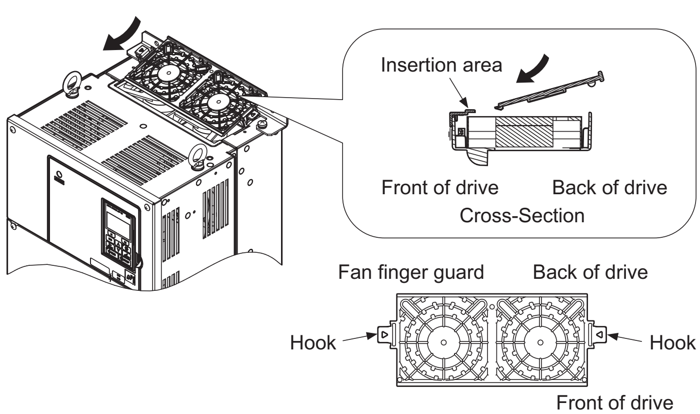


Figure 7.11 Reattach the Fan Cover: 2A0106, 2A0144, 4A0056, and 4A0075

5. While pressing in on the hooks located on the left and right sides of the fan cover, free the fan cover by lifting the back end first.

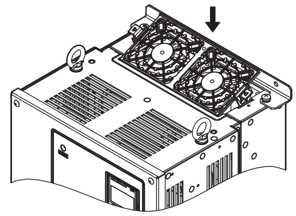


Figure 7.12 Reattach the Fan Cover: 2A0106, 2A0144, 4A0056, and 4A0075

6. Turn the power supply back on and reset the cooling fan operation time for the Maintenance Monitor by setting o4-03 to 0.

◆ Cooling Fan Replacement: 4A0094, 4A0114

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

NOTICE: *Equipment Hazard. Follow cooling fan replacement instructions. The cooling fan cannot operate properly when it is installed incorrectly and could seriously damage the drive. Follow the instructions in this manual to replace the cooling fan, making sure that the label is on top before inserting the cooling fan into the drive. To ensure maximum useful product life, replace both cooling fans when performing maintenance.*

■ Removing the Cooling Fan

1. While pressing in on the hooks located on the left and right sides of the fan finger guard, free the fan finger guard by lifting the back end first.

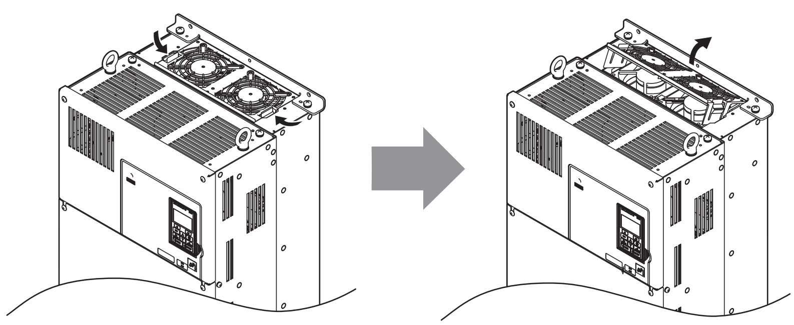


Figure 7.13 Removing the Cooling Fan Cover: 4A0094, 4A0114

2. Lift up directly on the cooling fan as shown in *Figure 7.14*. Unplug the relay connector and release the fan from the drive.

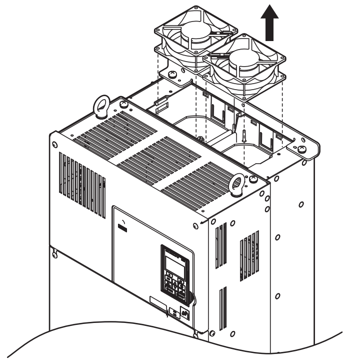


Figure 7.14 Removing the Cooling Fan: 4A0094, 4A0114

■ Installing the Cooling Fan

Reverse the procedure described above to reinstall the cooling fan.

1. Install the replacement fan into the drive. Align the pins as shown in *Figure 7.15*.

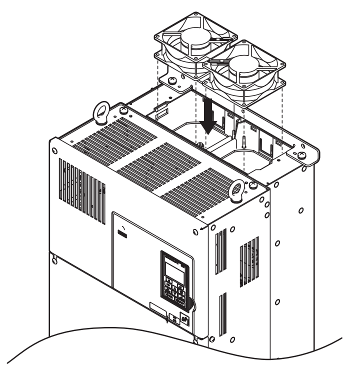
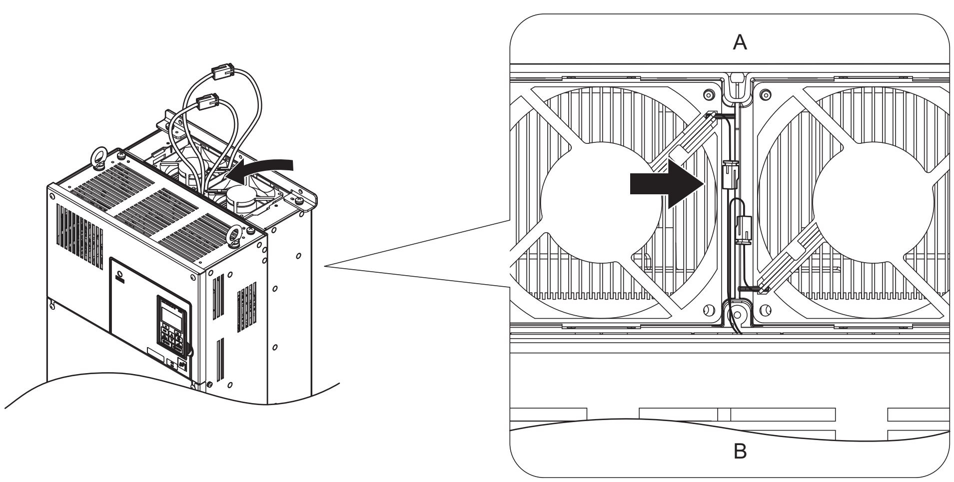


Figure 7.15 Installing the Cooling Fan: 4A0094, 4A0114

2. Properly connect the fan power lines then replace the power supply connectors and cables into the recess of the drive.



A – Back **B – Front**

Figure 7.16 Cooling Fan Power Supply Connectors: 4A0094, 4A0114

3. Angle the fan cover as shown in *Figure 7.15* and insert the connector tabs into the corresponding holes on the drive.

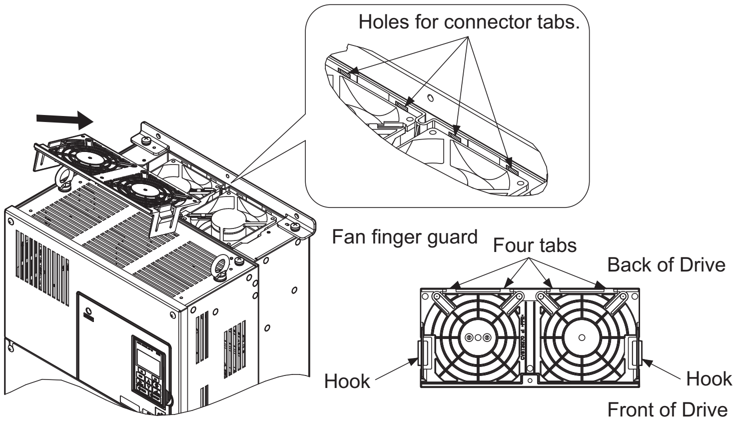


Figure 7.17 Reattach the Fan Cover: 4A0094, 4A0114

4. While pressing in on the hooks of the left and right sides of the fan cover, guide the fan finger guard until it clicks back into place.

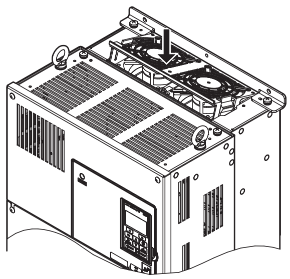


Figure 7.18 Reattach the Fan Cover: 4A0094, 4A0114

5. Turn the power supply back on and reset the cooling fan operation time for the Maintenance Monitor by setting o4-03 to 0.

◆ Cooling Fan Replacement: 2A0181 to 2A0432, 4A0140 to 4A0225

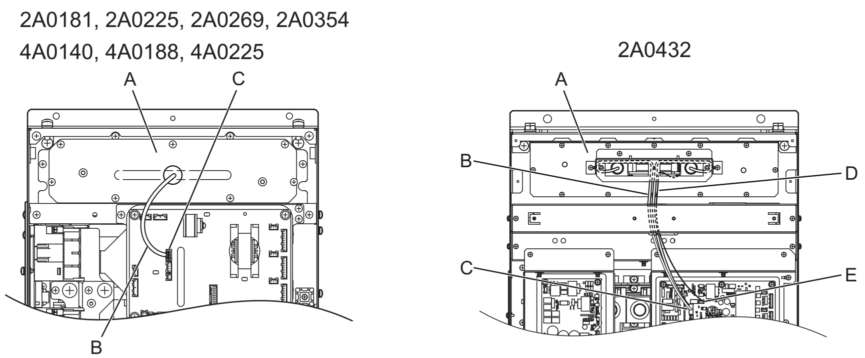
WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

NOTICE: *Equipment Hazard. Follow cooling fan replacement instructions. The cooling fan cannot operate properly when it is installed incorrectly and could seriously damage the drive. Follow the instructions in this manual to replace the cooling fan, making sure that the label is on top before inserting the cooling fan into the drive. To ensure maximum useful product life, replace both cooling fans when performing maintenance.*

■ Removing and Disassembling the Cooling Fan Unit

1. Remove the terminal cover and front cover.
2. Remove the fan connector (CN6). Remove the fan connectors (CN6, CN7) in model 2A0432.



A – Fan Unit
B – Fan Relay Cable
C – Fan Connector (CN6)
D – Circulation Fan Relay Cable
E – Fan Connector (CN7)

Figure 7.19 Cooling Fan Replacement: Fan Unit and Connectors

3. Remove the screws holding the fan unit in place and slide the fan unit out of the drive.

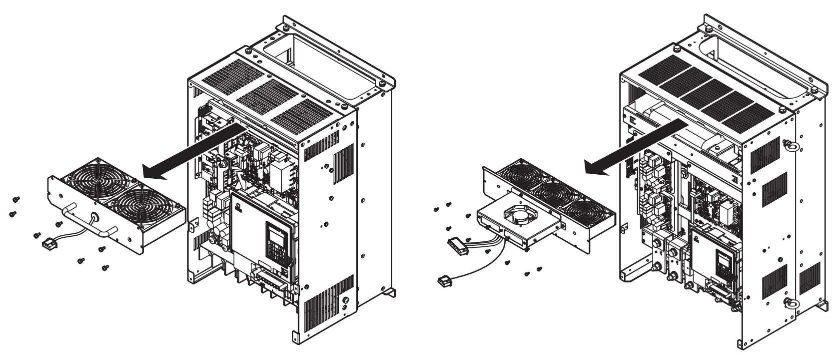
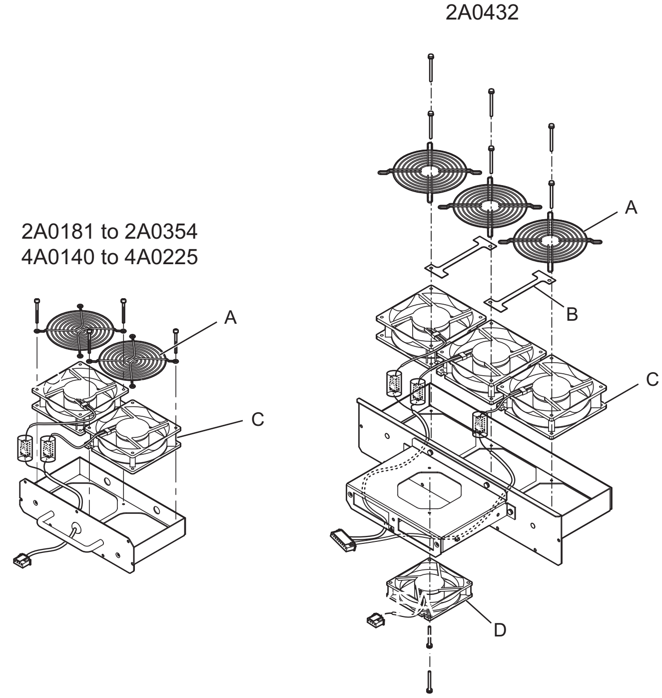


Figure 7.20 Removing the Fan Unit: 2A0181 to 2A0432, and 4A0140 to 4A0225

4. Remove the fan guard and replace the cooling fans.

Note: Do not pinch the fan cable between parts when reassembling the fan unit.

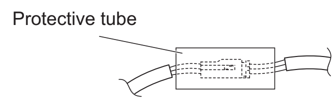


A – Fan guard
B – Cable Cover
C – Cooling Fan
D – Circulation Fan

Figure 7.21 Fan Unit Disassembly: 2A0181 to 2A0432, and 4A0140 to 4A0225

■ Cooling Fan Wiring: 2A0181, 2A0225, 4A0140, and 4A0188

1. Position the protective tube so that the fan connector sits in the center of the protective tube.



2. Place the fan connector covered by the tube as shown in *Figure 7.22*.

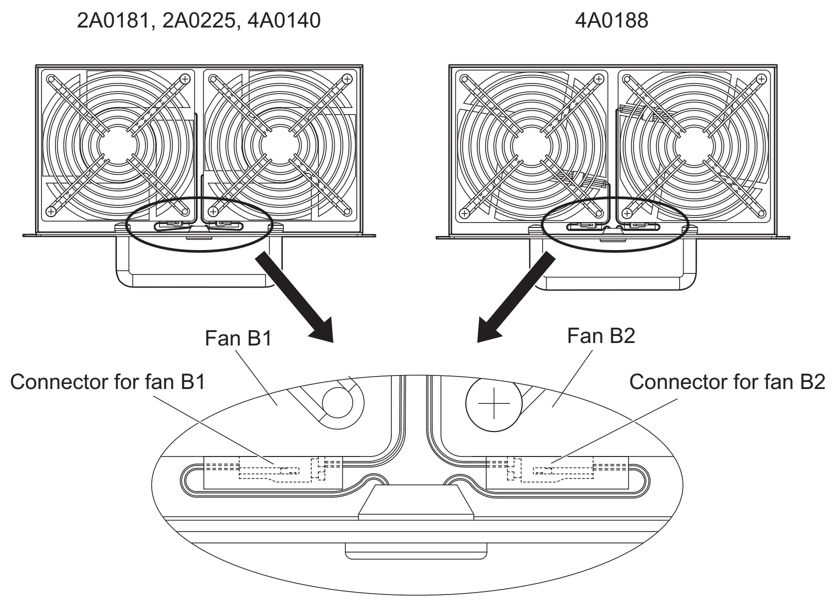
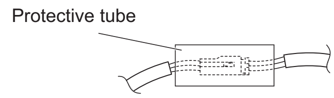


Figure 7.22 Cooling Fan Wiring for Models 2A0181, 2A0225, 4A0140 and 4A0188

3. Make sure that the protective tube does not stick out beyond the fan guard.
4. Double-check the relay connector to ensure that it is properly connected.

■ Cooling Fan Wiring: 2A0269, 2A0354, and 4A0225

1. Position the protective tube so that the fan connector sits in the center of the protective tube.



2. Insert the connector for fan B2 and guide the lead wire for fan B2 so the cable hook holds it in place. Insert the connector for fan B1.

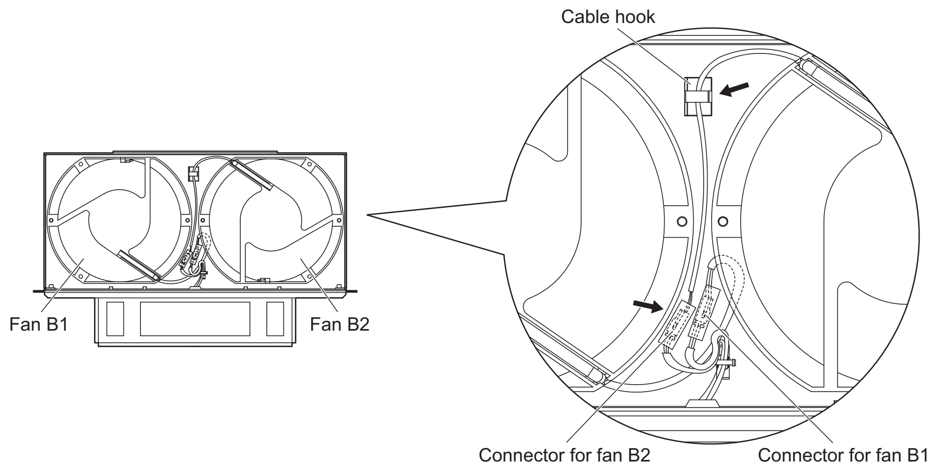
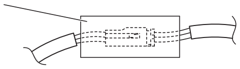


Figure 7.23 Cooling Fan Wiring: 2A0269, 2A0354, and 4A0225

3. Make sure that the protective tube does not stick out beyond the fan guard.

■ Cooling Fan Wiring: 2A0432

1. Position the protective tube so that the fan connector sits in the center of the protective tube.



2. In the space between fans 1 and 2, place the fan connector for fan B2 in front of the fan connector for fan B1.
3. Place the connector for fan B3 between fans B2 and B3.

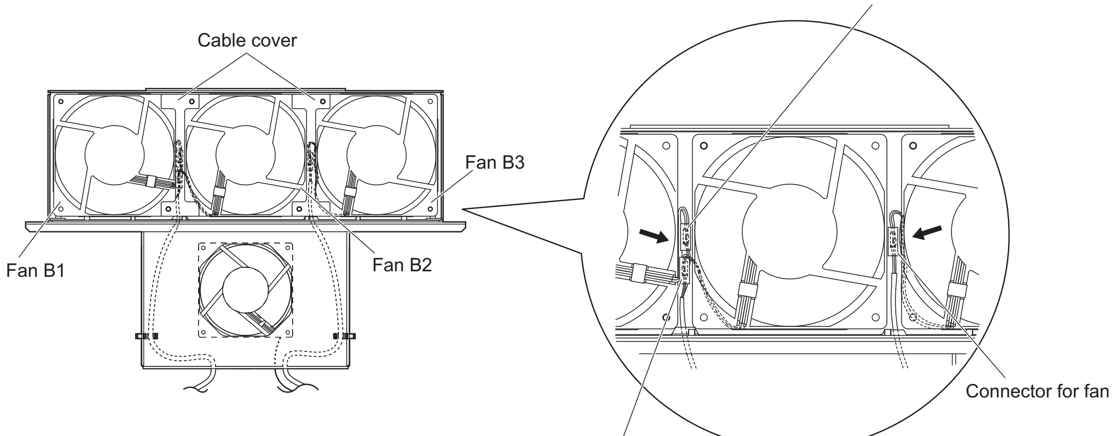


Figure 7.24 Cooling Fan Wiring: 2A0432

4. Double-check the relay connector to ensure that it is properly connected.
5. Reattach the cable cover to its original position and tighten the screws so that the fan guard holds the cable cover in place.

Note: Do not pinch the fan cable between parts when reassembling the fan unit.

■ Installing the Cooling Fan Unit

1. Reverse the procedure described above to reinstall the cooling fan unit.

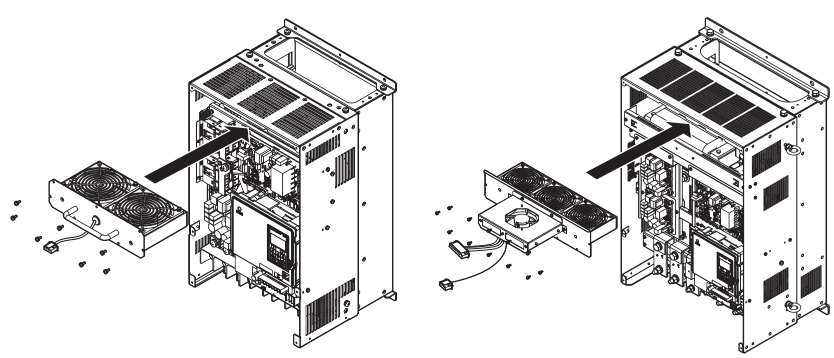


Figure 7.25 Installing the Cooling Fan Unit: 2A0181 to 2A0432 and 4A0140 to 4A0225

2. Reattach the covers and digital operator.
3. Turn the power supply back on and reset the cooling fan operation time for the Maintenance Monitor by setting o4-03 to 0.

7.5 Drive Replacement

◆ Serviceable Parts

The drive contains some serviceable parts. The following parts can be replaced over the life span of the drive:

- Terminal board I/O PCBs
- Cooling fan(s)
- Front cover

Replace the drive if the main power circuitry is damaged. Contact your local Yaskawa representative before replacing parts if the drive is still under warranty. Yaskawa reserves the right to replace or repair the drive according to Yaskawa warranty policy.

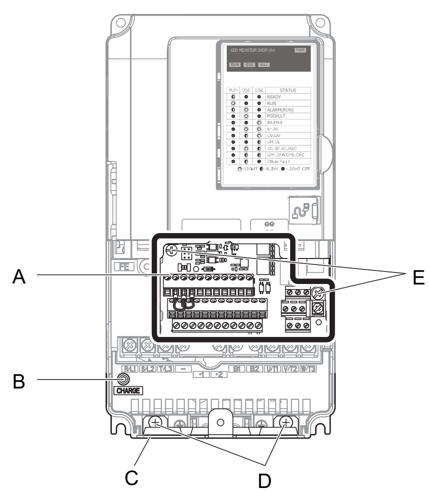
◆ Terminal Board

CAUTION! *Crush Hazard. Carrying the drive by the front cover may cause the main body of the drive to fall, resulting in minor or moderate injury. Always hold the case when carrying the drive.*

NOTICE: *Correctly set parameter o2-04 when replacing the control terminal board. Failure to comply may result in drive damage due to lack of protective functions and poor drive performance.*

The drive has a modular I/O terminal block that facilitates quick drive replacement. The terminal board contains on-board memory that stores all drive parameter settings and allows the parameters to be saved and transferred to the replacement drive. To transfer the terminal board, disconnect the terminal board from the damaged drive then reconnect it to the replacement drive. Once transferred, there is no need to manually reprogram the replacement drive.

Note: If the damaged drive and the new replacement drive are have different capacities, the data stored in the control terminal board cannot be transferred to the new drive and an oPE01 error will appear on the display. The control terminal board can still be used, but parameter setting from the old drive cannot be transferred. The replacement drive must be initialized and manually programmed.



A – Removable terminal board
B – Charge LED
C – Bottom cover
D – Bottom cover screws
E – Control terminal board locking screws

Figure 7.26 Terminal Board

◆ Replacing the Drive

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

WARNING! *Electrical Shock Hazard. Do not allow unqualified personnel to perform work on the drive. Failure to comply could result in serious injury. Installation, maintenance, inspection and servicing must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.*

NOTICE: *Damage to Equipment. Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards. Failure to comply may result in ESD damage to the drive circuitry.*

The following procedure explains how to replace a drive. This section provides instructions for drive replacement only. To install option cards or other types of options, refer to the specific manuals for those options.

NOTICE: *When transferring a braking transistor, braking resistor, or other type of option from a damaged drive to a new replacement drive, make sure they are working properly before reconnecting them to the new drive. Replace broken options to prevent immediate break down of the replacement drive.*

1. Remove the terminal cover. ***Refer to Terminal Cover on page 63*** for details.

Note: The shape of the terminal covers and the numbers of the screws differ depending on the drive models. ***Refer to Component Names on page 36*** for details.

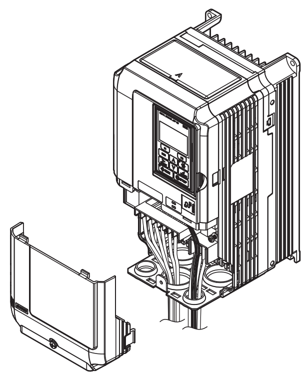


Figure 7.27 Drive Replacement: Removing the Terminal Cover

2. Loosen the screws holding the terminal board in place. Remove the screw securing the bottom cover and remove the bottom cover from the drive.

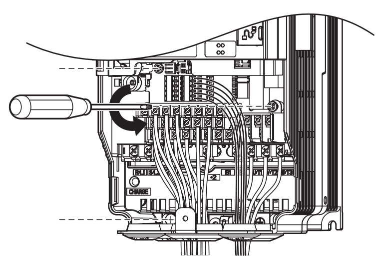


Figure 7.28 Drive Replacement: Removing the Control Terminal Board

3. Slide the terminal board as illustrated by the arrows to remove it from the drive along with the bottom cover.

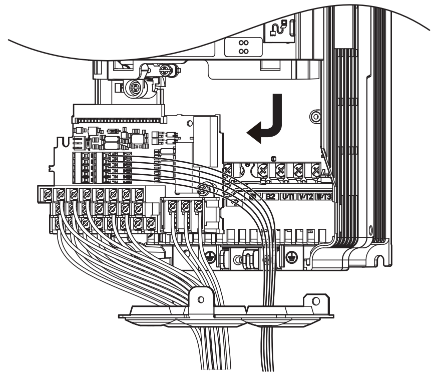


Figure 7.29 Drive Replacement: Remove the Control Terminal Board

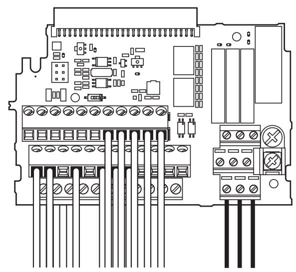


Figure 7.30 Drive Replacement: Removable Control Terminal Board Disconnected from the Drive

4. Disconnect all option cards and options. Make sure they are intact before reusing them.
5. Replace the drive and wire the main circuit.

■ Installing the Drive

1. After wiring the main circuit, connect the terminal block to the drive as shown in ***Figure 7.31***. Use the installation screw to fasten the terminal block into place.

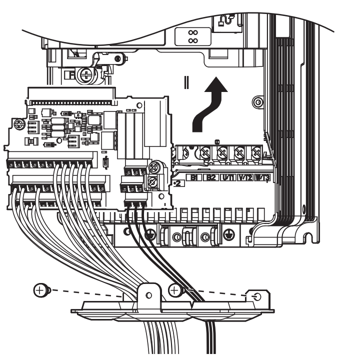


Figure 7.31 Drive Replacement: Installing the Control Terminal Board

2. Reconnect all options to the new drive in the same way they were installed in the old drive. Connect option boards to the same option ports in the new drive that were used in the old drive.
3. Put the terminal cover back into its original place.
4. After powering on the drive, all parameter settings are transferred from the terminal board to the drive memory. If an oPE04 error occurs, load the parameter settings saved on the terminal board to the new drive by setting parameter A1-03 to 5550. Reset the Maintenance Monitor function timers by setting parameters o4-01 through o4-12 to 0, and parameter o4-13 to 1.

8

Peripheral Devices & Options

This chapter explains the installation of peripheral devices and options available for the drive.

8.1 Section Safety

DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Do not change wiring, remove covers, connectors or options cards, or attempt to service the drive with power applied to the drive.

Failure to comply could result in death or serious injury. Disconnect all power to the drive and check for unsafe voltages before servicing.

Do not allow unqualified personnel to use the equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing and wear eye protection before beginning work on the drive.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Always properly ground the motor-side grounding terminal.

Fire Hazard

Always use braking resistors that are equipped with a thermal overload relay contact, and utilize this contact to switch off the drive in case of braking resistor overheat.

When connecting the braking resistors to the drive internal braking transistor, make sure the braking transistor will not be overloaded with the required duty cycle and the selected resistance value. Failure to comply could result in death or serious injury by fire from overheating resistors.

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

WARNING

Applications using a braking option should wire a thermal relay so that the output contactor opens when the thermal relay trips.

Inadequate braking circuit protection could result in death or serious injury by fire from overheating resistors.

Confirm an actual motor overload condition is not present prior to increasing the thermal oL trip detection setting.

Check local electrical codes before making adjustments to motor thermal overload settings.

Sudden Movement Hazard

Install a properly controlled contactor on the input-side of the drive for applications where power should be removed from the drive during a fault condition.

Improper equipment sequencing could result in death or serious injury.

NOTICE

Equipment Hazard

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Do not connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Insulate shields with heat shrink tubing or tape to prevent contact with other signal lines and equipment.

Improper wiring practices could result in drive or equipment malfunction due to short circuit.

Use a class 2 power supply (UL standard) when connecting to the control terminals.

Improper application of peripheral devices could result in drive performance degradation due to improper power supply.

Only connect recommended devices to the drives braking transistor terminals.

Failure to comply could result in damage to the drive or braking circuit.

Carefully review instruction manual TOBP C720600 00 when connecting a braking option to the drive.

Never use a magnet contactor on the input side of the drive frequently to start and stop the motor.

Failure to comply could result in damage to the drive.

Properly integrate auxiliary contacts into the control logic circuit to avoid unnecessary fault displays caused by contactors or output switches placed between drive and motor.

Improper installation of input and output contactors could result in damage to the drive.

Improper application of devices on drive output circuits can damage the drive

Do not connect unapproved LC or RC interference suppression filters, capacitors, ground fault circuits, or overvoltage protection devices to the drive.

NOTICE

Improper application of peripheral devices could result in malfunction of drive due to electrical interference.

Follow manufacturer recommendations when installing electrical devices near the drive and take precautions to shield the drive from electrical interference.

Properly integrate auxiliary contacts into the control logic circuit to avoid unnecessary fault displays caused by contactors or output switches placed between drive and motor.

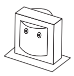
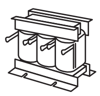
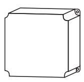
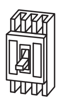
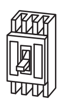
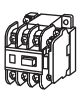
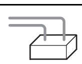
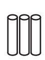
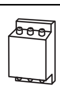
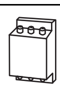
Improper installation of input and output contactors could result in damage to the drive.

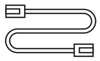
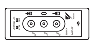
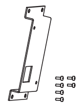
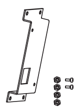
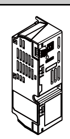
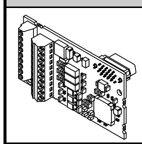
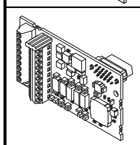
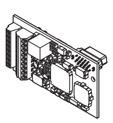
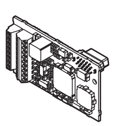
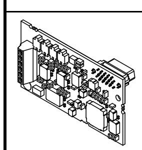
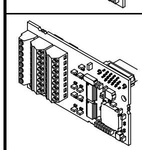
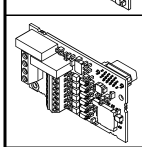
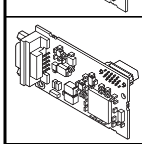
8.2 Drive Options and Peripheral Devices

The following table of peripheral devices lists the names of the various accessories and options available for Yaskawa drives. Contact Yaskawa or your Yaskawa agent to order these peripheral devices.

- **Peripheral Device Selection**: Refer to the Yaskawa catalog for selection and part numbers.
- **Peripheral Device Installation**: Refer to the corresponding option manual for installation instructions.

Table 8.1 Available Peripheral Devices

Option		Model Number	Description
Power Options			
	DC Link Choke	UZDA Series	Improves the power factor by suppressing harmonic distortion from the power supply.
	AC Reactor	UZBA Series	Protects the drive when operating from a large power supply and improves the power factor by suppressing harmonic distortion. Highly recommended for power supplies that exceed 600 kVA.
	Braking Resistor Unit	LKEB Series	For use with systems requiring dynamic braking with up to 10% ED.
	Braking Unit	CDBR Series	External braking transistor
	Molded Case Circuit Breaker	NF Series	Circuit breaker for short circuit or over load protection **Note**: Yaskawa recommends installing an MCCB to the power supply side to protect drive wiring and prevent other damage in the event of component failure. Install an MCCB if permitted by the power system.
	Electric Leakage Circuit Breaker (ELCB)	NV, EG, or SG Series	Provides protection against potentially harmful leakage current. **Note**: Yaskawa recommends installing an ELCB to the power supply side to protect drive wiring and prevent other damage in the event of component failure. An MCCB can also be used if permitted by the power system.
	Magnetic Contactor (Input)	SC Series	Ensures that power to drive is completely shut off when necessary, preventing potential damage to the braking resistor and other internal circuitry. Install an MCCB when using a braking resistor to prevent the braking resistor from overheating. To protect internal components from sudden high levels of input current, the MC should be wired so that it opens when a fault output terminal is triggered.
	Surge Protector	200 V class: DCR2-□A 400 V class: RFN3AL-504KD	Suppresses surge voltage caused by magnetic contactor switching.
	Zero Phase Reactor	F6045GB, F11080GB	Reduces electromagnetic noise.
	Fuse	200 V class: CR2LS or CR2L Series, FWX Series 400 V class: CR6L Series, FWH Series	Protects the drive in case of short circuit.
	Input Noise Filter	LNFB, LNFD, FN Series	Reduces electromagnetic noise flowing back from the drive into power supply.
	Output Noise Filter	LF-310 Series	Reduces electromagnetic noise generated by the drive output.
—	Isolator	DGP□□□	Isolates the drive analog I/Os for improved noise tolerance.
Reference Setting / Monitor Options			
—	Frequency Meter / Ammeter	DCF-6A	External meter for displaying the output speed or current using an analog signal from the drive
—	Frequency Meter Potentiometer (20 kΩ)	RH000850	External potentiometer for adjusting the frequency meter scaling
—	Output Voltage Meter	SDF-12NH	External meter for displaying the output voltage using an analog signal from the drive
—	Frequency Setting Potentiometer (2 kΩ)	RH000739	External potentiometer for setting the speed reference by an analog input
—	Control Dial for Frequency Setting Potentiometer	CM-3S	Control dial for frequency setting potentiometer
—	Meter Plate	NPJT41561-1	Plate with scale for frequency setting potentiometer

Option		Model Number	Description
Interface Options			
	Remote Operator Cable	WV001/WV003	Extension cable (1 m or 3 m) to connect the digital operator for remote operation RJ-45, 8 pin straight through, UTP CAT5e cable
	USB Copy Unit	JVOP-181	Allows the user to copy and verify parameter settings between drives. Can also be used as an adapter to connect the drive to the USB port on a PC.
Attachment			
	Installation Support Set A	EZZ020642A	For installing the digital operator keypad on the outside of an enclosure panel that houses the drive. Uses screws to secure the operator.
	Installation Support Set B	EZZ020642B	For installing the digital operator keypad on the outside of an enclosure panel that houses the drive. Uses nuts to secure the operator for installations where screws are not practical.
Others			
	24 V Power Supply	200 V class: PS-A10LB 400 V class: PS-A10HB	Provides power to the control circuit and option boards in the event of power loss. Allows the user to monitor drive settings and fault information when the main circuit has no power.
—	DriveWizard Plus	—	PC tool for drive setup and parameter management
Communication Options			
	Complementary Signal Encoder	PG-B3	For speed feedback input by connecting a motor encoder Input: 3 track (can be used with one or two tracks), for HTL encoder connection, 50 kHz max Output: 3 track, open collector Encoder power supply: 12 V, max current 200 mA
	Line Driver Encoder	PG-X3	For speed feedback input by connecting a motor encoder Input: 3 track (can be used with one or two tracks), line driver, 300 kHz max Output: 3 track, line driver Encoder power supply: 5 V or 12 V, max current 200 mA
	EnDat Encoder	PG-F3	Encoder type: EnDat 2.1/01, EnDat 2.2/01, EnDat 2.2/22 (HEIDENHAIN) Maximum input frequency: 20 kHz Pulse monitor: Matches RS-422 level Output voltage: 5 V±5%, 8 V±10% Maximum output current: 200 mA Wiring length: 20 m max. for the encoder, 30 m max. for the pulse monitor
	ERN1387 Encoder	PG-E3	Encoder type: ERN1387 (HEIDENHAIN) Maximum input frequency: 20 kHz Pulse monitor: Matches RS-422 level Output voltage: 5 V±5% Maximum output current: 200 mA Wiring length: 20 m max. for the encoder, 10 m max. for the pulse monitor
	Analog Monitor	AO-A3	Provides extra analog output terminals for monitoring drive status. Output channels: 2 Output voltage: -10 to 10 V, 11 bit (signed)
	Digital Input	DI-A3	Used to set the speed reference by digital inputs Input channels: 18 (including SET signal and SIGN signal) Input signal type: BCD 16 bit (4 digit), 12 bit (3 digit), 8 bit (2 digit) Input signal: 24 Vdc, 8 mA
	Digital Output	DO-A3	Provides extra insulated digital outputs for monitoring drive status. Photocoupler relays: 6 (48 V, up to 50 mA) Contact relays: 2 (250 Vac/up to 1 A, 30 Vdc/up to 1 A)
	CANopen	SI-S3	Connects to a CANopen network

8.3 Connecting Peripheral Devices

Figure 8.1 illustrates how to configure the drive and motor to operate with various peripheral devices.

Refer to the specific manual for the devices shown below for more detailed installation instructions.

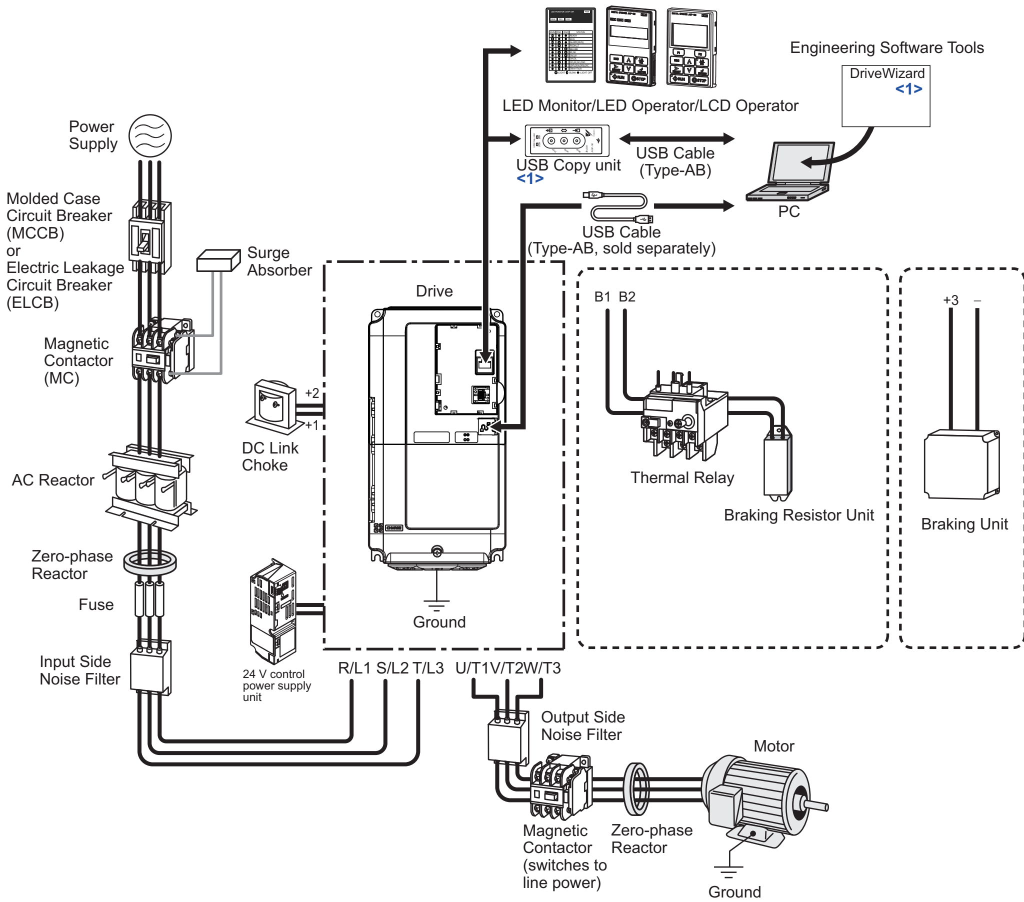


Figure 8.1 Connecting Peripheral Devices

<1> To obtain the driver and software of USB Copy Unit, CopyUnitManager and DriveWizardPlus, access the Yaskawa website at http://www.yaskawa.com

Note: If the drive is set to trigger a fault output when the fault reset function is activated (L5-02 = 1), then a sequence to interrupt power on a fault will shut off power to the drive when the drive attempts to restart. The default setting for L5-02 is 0 (fault output active during restart attempt).

8.4 Option Card Installation

This section provides instructions on installing the option cards listed in *Table 8.2*.

◆ Prior to Installing the Option

Prior to installing the option, wire the drive, make the necessary connections to the drive terminals, and verify that the drive functions normally. Refer to the *Table 8.2* for information on wiring and connecting the drive.

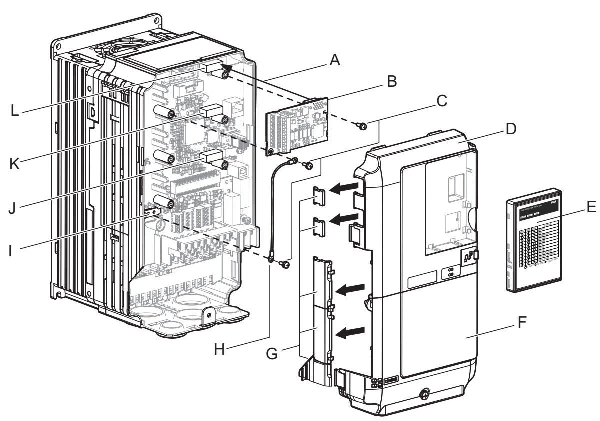
Table 8.2 below lists the number of option cards that can be connected to the drive and the drive connectors for connecting those option cards.

Table 8.2 Option Card Installation

Option Card	Connector	Number of Cards Possible
PG-B3, PG-X3	CN5-C	2 <1>
DO-A3, AO-A3	CN5-A, B, C	1
PG-F3, PG-E3	CN5-C	1
SI-S3, DI-A3 <2>	CN5-A	1

<1> If two PG option cards are connected, use both CN5-B and CN5-C. If only one PG option card is connected to the drive, use the CN5-C connector.
<2> When DI-A3 is to be used as monitors, the card can be connected to any of CN5-A, B or C. The input status of DI-A3 can then be viewed using U1-17.

Figure 8.2 shows an exploded view of the drive with the option and related components for reference.



A – Insertion point for CN5
B – Option card
C – Included screws
D – Front cover
E – Digital operator
F – Terminal cover
G – Removable tabs for wire routing
H – Ground wire
I – Drive grounding terminal (FE)
J – Connector CN5-A
K – Connector CN5-B
L – Connector CN5-C

Figure 8.2 Installing an Option Card

◆ Installing the Option

Refer to the instructions below to install the option.

DANGER! *Electrical Shock Hazard. Disconnect all power to the drive and wait at least the amount of time specified on the drive front cover safety label. After all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing to prevent electric shock. The internal capacitor remains charged even after the power supply is turned off.*

WARNING! *Electrical Shock Hazard. Do not allow unqualified personnel to perform work on the drive. Failure to comply could result in death or serious injury. Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives and Option Cards.*

NOTICE: *Damage to Equipment. Observe proper electrostatic discharge procedures (ESD) when handling the option, drive, and circuit boards. Failure to comply may result in ESD damage to circuitry.*

NOTICE: *Damage to Equipment. Tighten all terminal screws to the specified tightening torque. Failure to comply may cause the application to operate incorrectly or damage the drive.*

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the digital operator (E) and front covers (D, F). ***Refer to LED Monitor Operator and Front Cover on page 65***.

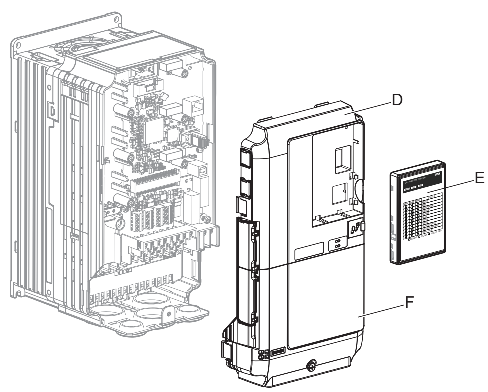


Figure 8.3 Remove the Front Covers and Digital Operator

2. Insert the option card (B) into the CN5-A (J), CN5-B (K) or CN5-C (L) connectors located on the drive and fasten it into place using one of the included screws (C).

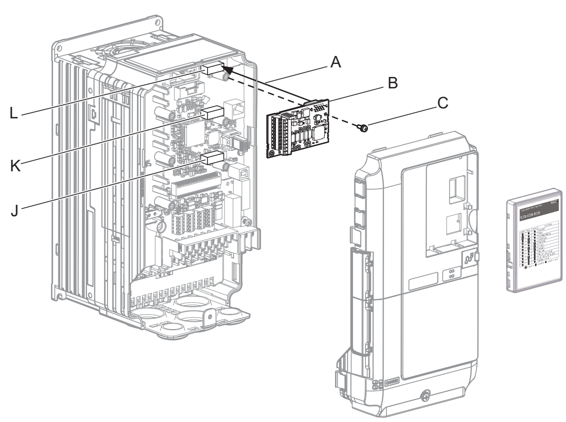


Figure 8.4 Insert the Option Card

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3. Connect one end of the ground wire (H) to the ground terminal (I) using one of the remaining screws (C). Connect the other end of the ground wire (H) to the remaining ground terminal and installation hole on the option (B) using the last remaining provided screw (C).

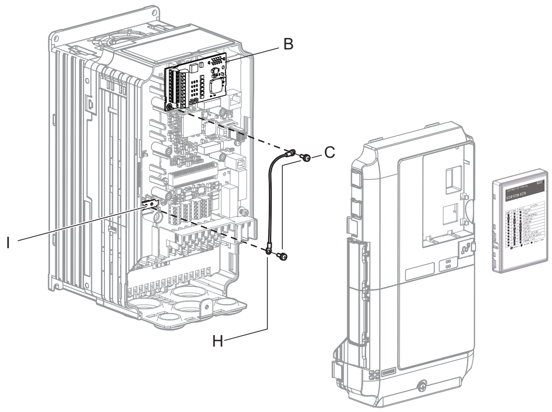


Figure 8.5 Connect the Ground Wire

Note: 1. The option package includes two ground wires. Use the longer wire when plugging the option into connector CN5-C on the drive side. Use the shorter wire when plugging the option into connector CN5-B. Refer to the option card instruction manual for more information.

2. There are two screw holes on the drive for use as ground terminals (I). When connecting three options, two ground wires will need to share the same drive ground terminal.

4. Prepare and connect the wire ends as shown in *Figure 8.6* and *Figure 8.7*. *Refer to Wire Gauges, Tightening Torque, and Crimp Terminals on page 349* to confirm that the proper tightening torque is applied to each terminal. Take particular precaution to ensure that each wire is properly connected and wire insulation is not accidentally pinched into electrical terminals.

WARNING! *Fire Hazard. Tighten all terminal screws according to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating electrical connections. Tightening screws beyond the specified tightening torque may result in erroneous operation, damage to the terminal block, or cause a fire.*

NOTICE: *Heat shrink tubing or electrical tape may be required to ensure that cable shielding does not contact other wiring. Insufficient insulation may cause a short circuit and damage the option or drive.*

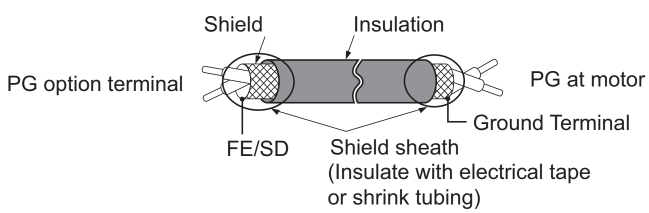


Figure 8.6 Preparing Ends of Shielded Cable

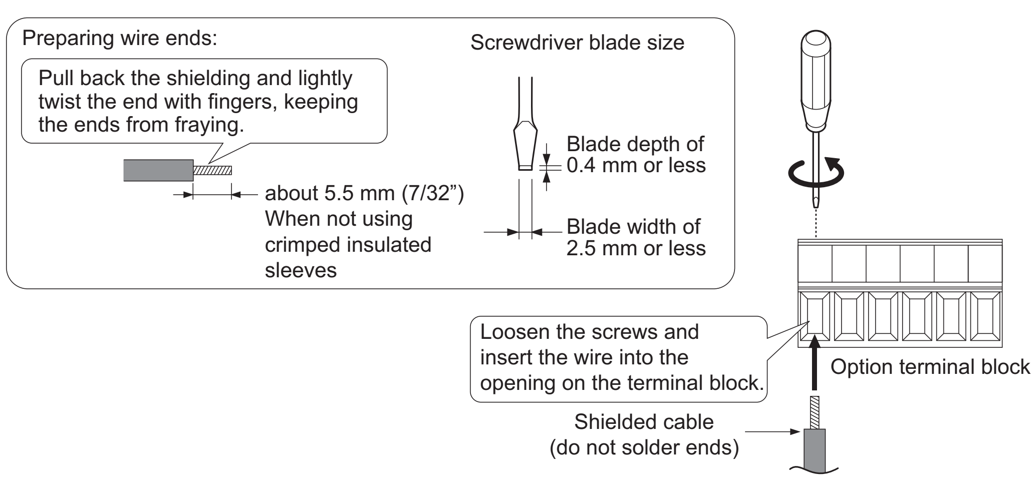
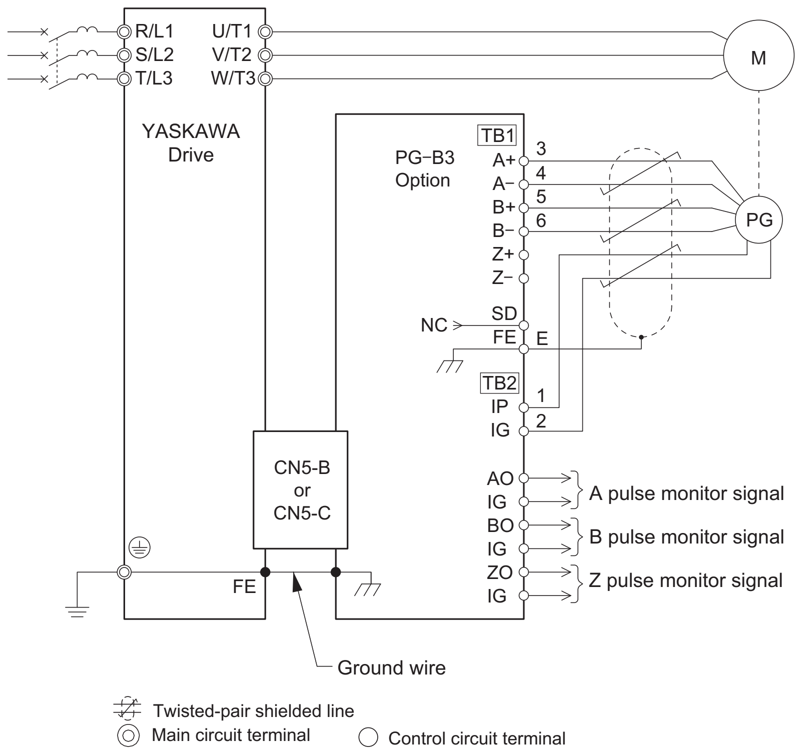


Figure 8.7 Preparing and Connecting Cable Wiring

5. For the PG-B3 and PG-X3 Option, wire the motor PG encoder to the terminal block. Refer to ***Figure 8.8*** and ***Figure 8.9*** for wiring instructions.
Refer to Terminal Functions of PG-B3 and PG-X3 Option on page 350 for a detailed description of the option terminal functions.

Connection Diagram of PG-B3

Refer to ***Table 8.9*** for a detailed description of the option board terminal functions.



<1> The PG-B3 Option reads a maximum input frequency from the PG encoder of 50 kHz. Be sure to select an PG encoder with a maximum output pulse frequency of 50 kHz when operating at maximum speed.

Figure 8.8 PG-B3 Option and Encoder Connection Diagram

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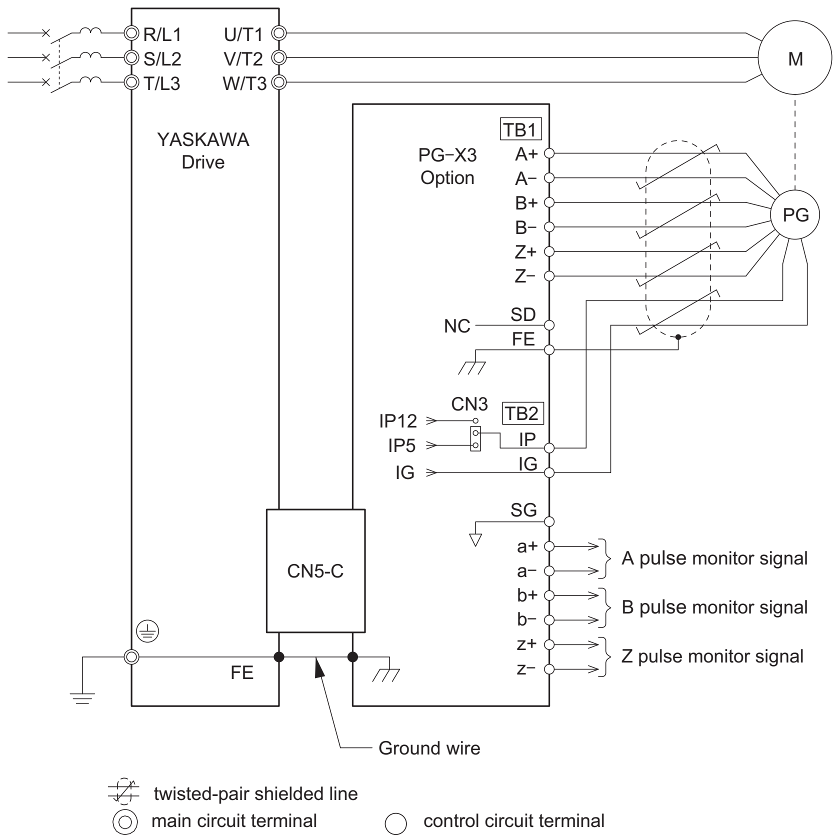
Connection Diagram of PG-X3

Refer to *Table 8.10* for a detailed description of the option board terminal functions.



<1> The PG-X3 Option reads a maximum input frequency from the PG of 300 kHz. Be sure to select a PG with a maximum output pulse frequency of 300 kHz when operating at maximum speed.

Figure 8.9 PG-X3 Option and PG Encoder Connection Diagram

PG Encoder Cables for PG-B3 Option

Yaskawa recommends using a LMA-☐☐B-S185Y (complementary output) for cables running between the PG-B3 Option and the PG as show in ***Figure 8.10***.

For instructions on wiring the terminal block, refer to ***Table 8.9***.

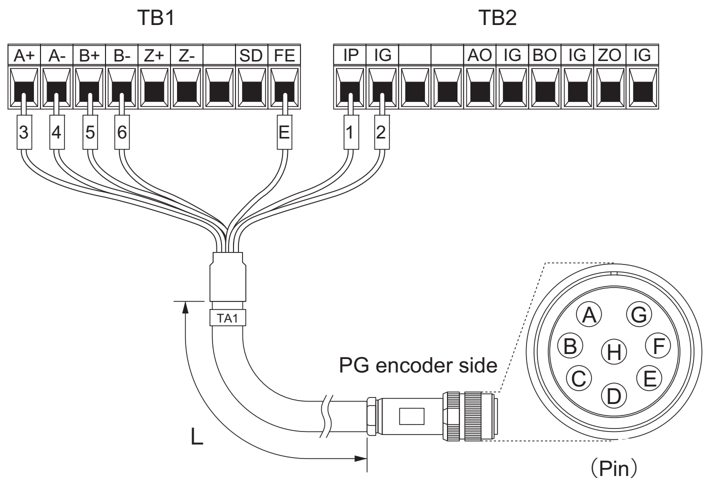


Figure 8.10 Wiring PG Encoder Cable

Table 8.3 Connecting the PG Encoder Cable Specification

Option Terminal	PG Encoder Cable		
	Wire	Color	Pin
IP	1	Blue	C
IG	2	White	H
A+	3	Yellow	B
A–	4	White	G
B+	5	Green	A
B–	6	White	F
FE	E	N/A (shield)	D

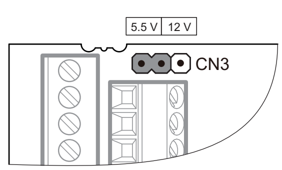
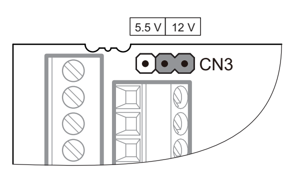
Table 8.4 PG Encoder Cable Types

Length	Type	Length	Type
10 m (32 ft.)	W5010	50 m (164 ft.)	W5050
30 m (98 ft.)	W5030	100 m (328 ft.)	W5100

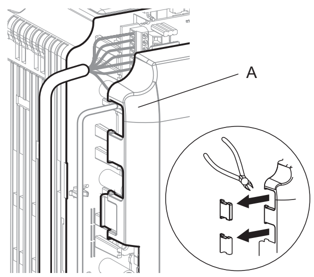
6. For the PG-X3 Option, set the voltage for the PG encoder power supply using jumper CN3 located on the option. Position the jumper as shown in ***Table 8.5*** to select the voltage level.

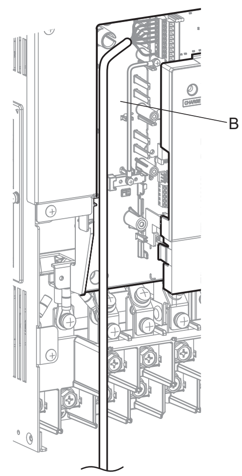
NOTICE: *The positioning of jumper CN3 selects the PG encoder power supply voltage (5.5 V or 12 V). Select the voltage level for the PG encoder connected to the option and motor. If the wrong voltage is selected, the PG encoder may not operate properly or may become damaged as a result.*

Table 8.5 Setting the PG Encoder Power Supply Voltage (IP) with Jumper CN3

Voltage Level	5.5 V ± 5% (default)	12.0 V ± 5%
Jumper CN3		

7. Route the option wiring.
Depending on the drive model, some drives may require routing the wiring through the side of the front cover to the outside. For drive models 2A0018 through 2A0041 and 4A0009 through 4A0023, cut out the perforated openings on the left side of the drive front cover as shown in *Figure 8.11*-A and leave no sharp edges to damage wiring.
Route the wiring inside the enclosure as shown in *Figure 8.11*-B for drive models 2A0059 through 2A0432 and 4A0030 through 4A0225 that do not require routing through the front cover.





A – Route wires through the openings provided on the left side of the front cover. *<1>*
(2A0018 to 2A0041 and 4A0009 to 4A0023)

B – Use the open space provided inside the drive to route option wiring.
(2A0059 to 2A0432 and 4A0030 to 4A0225)

<1> The drive will not meet NEMA1, UL Type 1 requirements if wiring is exposed outside the enclosure.

Figure 8.11 Wire Routing Examples

8. Replace and secure the front covers of the drive (D, F) and replace the digital operator (E).

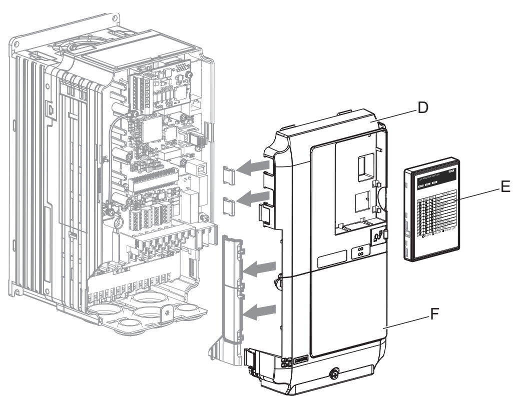


Figure 8.12 Replace the Front Covers and Digital Operator

Note: Take proper precautions when wiring the option so that the front covers will easily fit back onto the drive. Make sure cables are not pinched between the front covers and the drive when replacing the covers.

9. For the PG-B3 and PG-X3 Option, set drive parameters ***A1-02: Control Method Selection on page 155*** and ***F1: PG Speed Control Card on page 380*** for proper motor rotation.
With a two-pulse or three-pulse PG encoder, the leading pulse determines the motor rotation direction. A PG encoder signal with leading A pulse is considered to be rotating forward (counter-clockwise when viewing rotation from motor load side).

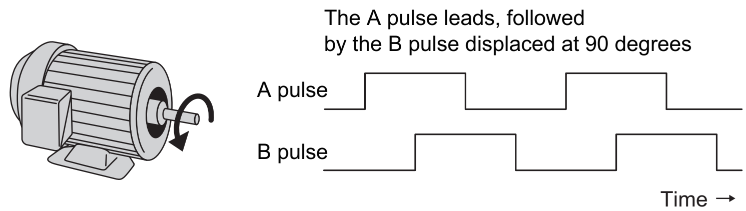


Figure 8.13 Displacement of A and B Pulses

10. After connecting the PG encoder outputs to the option, apply power to the drive and manually rotate the motor and check the rotation direction by viewing monitor U1-05 on the digital operator.
Reverse motor rotation is indicated by a negative value for U1-05; forward motor rotation is indicated by a positive value.
If monitor U1-05 indicates that the forward direction is opposite of what is intended, set F1-05 to 1, or reverse the two A pulse wires with the two B pulse wires on option terminal TB1 as shown in ***Figure 8.14***.

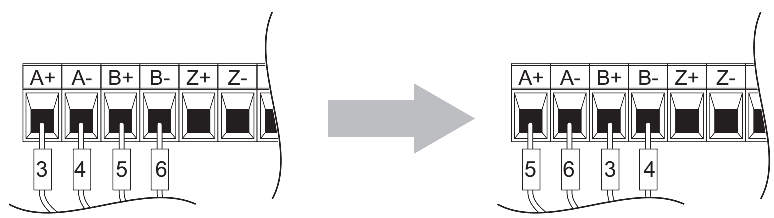


Figure 8.14 A Channel and B Channel Wire Switching

11. If switching the wires is inconvenient, set drive parameter F1-05 to 1 to switch the direction of how the option reads pulses from the PG encoder output.
Please note that when the drive is initialized using A1-03 =1110, 2220, 3330, the value for F1-05 will reset to factory default and the parameter will need to be adjusted again to switch the direction.

◆ Wire Gauges, Tightening Torque, and Crimp Terminals

■ Wire Gauges and Tightening Torques of PG-B3 and PG-X3 Option

Wire gauge and torque specifications are listed in ***Table 8.6*** and ***Table 8.7***.

Table 8.6 Wire Gauges and Tightening Torques of PG-B3 Option

Terminal Signal	Screw Size	Tightening Torque N·m (in·lb)	Bare Cable		Crimp Terminals		Wire Type
			Applicable Gauges mm²	Recomm. Gauge mm²	Applicable Gauges mm²	Recomm. Gauge mm²	
A+, A–, B+, B–, Z+, Z–, FE, IP, IG	M2	0.22 to 0.25 (1.95 to 2.21)	Stranded wire: 0.25 to 1.0 (24 to 17 AWG) Solid wire: 0.25 to 1.5 (24 to 16 AWG)	0.75 (18 AWG)	0.25 to 0.5 (24 to 20 AWG)	0.5 (20 AWG)	Shielded twisted pair, etc.
AO, IG, BO, IG, ZO, IG							Shielded cable, etc.

Table 8.7 Wire Gauges and Tightening Torques of PG-X3 Option

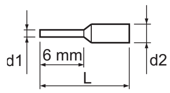
Terminal Signal	Screw Size	Tightening Torque N·m (in·lb)	Bare Cable		Crimp Terminals		Wire Type
			Applicable Gauges mm²	Recomm. Gauge mm²	Applicable Gauges mm²	Recomm. Gauge mm²	
A+, A–, B+, B–, Z+, Z–, SD, FE, IP, IG	M2	0.22 to 0.25 (1.95 to 2.21)	Stranded wire: 0.25 to 1.0 (24 to 17 AWG) Solid wire: 0.25 to 1.5 (24 to 16 AWG)	0.75 (18 AWG)	0.25 to 0.5 (24 to 20 AWG)	0.5 (20 AWG)	Shielded twisted pair, etc.
a+, a–, b+, b–, z+, z–, SG							Shielded cable, etc.

■ Crimp Terminals

Yaskawa recommends using CRIMPFOX 6 by Phoenix Contact or equivalent crimp terminals with the specifications listed in *Table 8.8* for wiring to ensure proper connections.

Note: Properly trim wire ends so loose wire ends do not extend from the crimp terminals.

Table 8.8 Crimp Terminal Sizes



	Wire Gauge mm²	Phoenix Contact Model	L mm (in)	d1 mm (in)	d2 mm (in)
	0.25 (24 AWG)	AI 0.25 - 6YE	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.34 (22 AWG)	AI 0.34 - 6TQ	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.5 (20 AWG)	AI 0.5 - 6WH	14 (9/16)	1.1 (3/64)	2.5 (3/32)

◆ Terminal Functions of PG-B3 and PG-X3 Option

Table 8.9 PG-B3 Option Terminal Functions

Terminal Block	Terminal	Function	Description
TB1	A+	A+ pulse signal input	• Pulse signal inputs from the PG. • Signal inputs from complementary and open-collector outputs • Signal level H level: 8 to 12 V L level: 2.0 V or less
	A–	A– pulse signal input	
	B+	B+ pulse signal input	
	B–	B– pulse signal input	
	Z+	Z+ pulse signal input	
	Z–	Z– pulse signal input	
	SD	NC pin (open)	For use when cables shields should not be grounded
	FE	Ground	Used for grounding shielded lines
TB2	IP	PG power supply	• Output voltage: 12.0 V ± 5% • Max output current: 200 mA <1>
	IG	PG power supply common	
	AO	A pulse monitor signal	• Outputs the monitor signal for the A, B, and Z pulses from the PG speed control card • For open collector outputs from the option • Max voltage: 24 V • Max current: 30 mA
	BO	B pulse monitor signal	
	ZO	Z pulse monitor signal	
	IG	Monitor signal common	

<1> A separate UL-listed class 2 power supply is necessary when the PG requires more than 200 mA to operate.

Table 8.10 PG-X3 Option Terminal Functions

Terminal Block	Terminal	Function	Description
TB1	A+	A+ pulse signal input	• Inputs for the A channel, B channel, and Z pulses from the PG encoder • Signal level matches RS-422
	A–	A– pulse signal input	
	B+	B+ pulse signal input	
	B–	B– pulse signal input	
	Z+	Z+ pulse signal input	
	Z–	Z– pulse signal input	
	SD	NC pin (open)	Open connection connectors for use when cable shields should not be grounded
	FE	Ground	Used as the shield ground termination point.
TB2	IP	PG encoder power supply	• Output voltage: 12.0 V ± 5% or 5.5 V ± 5% • Max. output current: 200 mA <1>
	IG	PG encoder power supply common	
	SG	Monitor signal common	• Output signal for monitoring A channel, B channel, and Z pulses from the PG encoder • Signal level matches RS-422
	a+	A+ pulse monitor signal	
	a–	A- pulse monitor signal	
	b+	B+ pulse monitor signal	
	b–	B- pulse monitor signal	
	z+	Z+ pulse monitor signal	
	z–	Z- pulse monitor signal	

<1> A separate UL-listed class 2 power supply is necessary when the PG requires more than 200 mA to operate.

8.5 Installing Peripheral Devices

This section describes the proper steps and precautions to take when installing or connecting various peripheral devices to the drive.

NOTICE: *Use a class 2 power supply (UL standard) when connecting to the control terminals. Improper application of peripheral devices could result in drive performance degradation due to improper power supply. Refer to NEC Article 725 Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power Limited Circuits for requirements concerning class 2 power supplies.*

◆ Dynamic Braking Options

A braking resistor or an external braking transistor combined with a braking resistor must be installed in order to dissipate the energy fed back to the drive during regenerative operation.

NOTICE: *Do not allow unqualified personnel to use the product. Failure to comply could result in damage to the drive or braking circuit. Carefully review the braking resistor instruction manual when connecting a braking resistor option to the drive.*

Note: The braking circuit must be sized properly in order to dissipate the power required to decelerate the load in the desired time. Ensure that the braking circuit can dissipate the energy for the set deceleration time prior to running the drive.

WARNING! *Fire Hazard. The braking resistor connection terminals are B1 and B2. Do not connect a braking resistor directly to any other terminals. Improper wiring connections could result in death or serious injury by fire. Failure to comply may result in damage to the braking circuit or drive.*

NOTICE: *Connect braking circuits to the drive as shown in the I/O wiring examples. Improperly wiring braking circuits could result in damage to the drive or equipment.*

■ Installing Braking Resistors

WARNING! *Fire hazard. Always use braking resistors that are equipped with a thermal overload relay contact, and utilize this contact to switch off the drive in case of braking resistor overheat. When connecting the braking resistors to the drive internal braking transistor, make sure the braking transistor will not be overloaded with the required duty cycle and the selected resistance value. Failure to comply could result in death or serious injury by fire from overheating resistors.*

Always use braking resistors equipped with a thermal overload relay contact, and utilize this contact to switch off the drive in case of braking resistor overheat. When connecting the braking resistors to the drive internal braking transistor, make sure the braking transistor will not be overloaded with the required duty cycle and the selected resistance value.

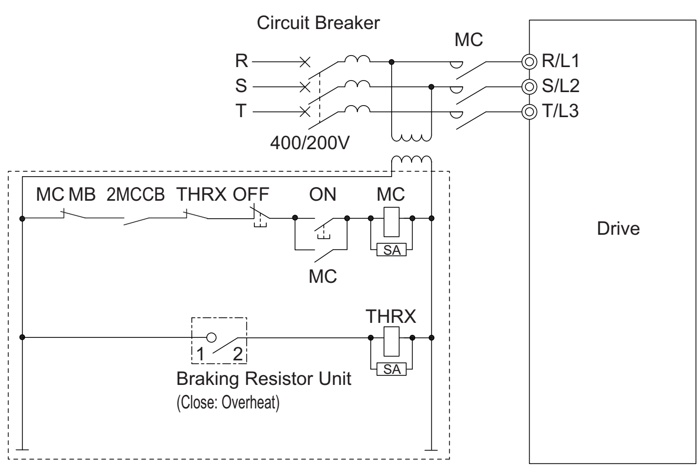


Figure 8.15 Power Supply Interrupt for Overheat Protection (Example)

Peripheral Devices & Options
8

■ Installing a Braking Unit: CDBR Type

When using a CDBR braking unit or any other external braking transistor or a regenerative converter, disable the internal braking transistor protection function by setting parameter L8-55 to 0.
To install a CDBR type braking unit, connect either the B1 terminal of the drive (2A0018 through 2A0144 and 4A0009 through 4A0075) or +3 terminal of the drive (2A0181 to 2A0432 and 4A0094 to 4A0225) to the positive terminal on the braking unit. Then, wire the negative terminals on the drive and braking unit together. Terminal +2 is not used.

Connect the braking resistor to CDBR terminals +0 and -0.

Wire the thermal overload relay contact of the CDBR and the braking resistor in series, and connect this signal to a drive digital input. Use this input to trigger a fault in the drive in case a CDBR or braking resistor overload occurs.

Disable dynamic braking transistor protection by setting L8-55 = 0.

Note: To install a CDBR type braking unit to the drive with built-in dynamic braking transistor (2A0018 through 2A0144 and 4A0009 through 4A0075), connect the B1 terminal on the drive to the positive terminal on the braking unit. Then wire the negative terminals on the drive and braking unit together. Terminal B2 is not used.

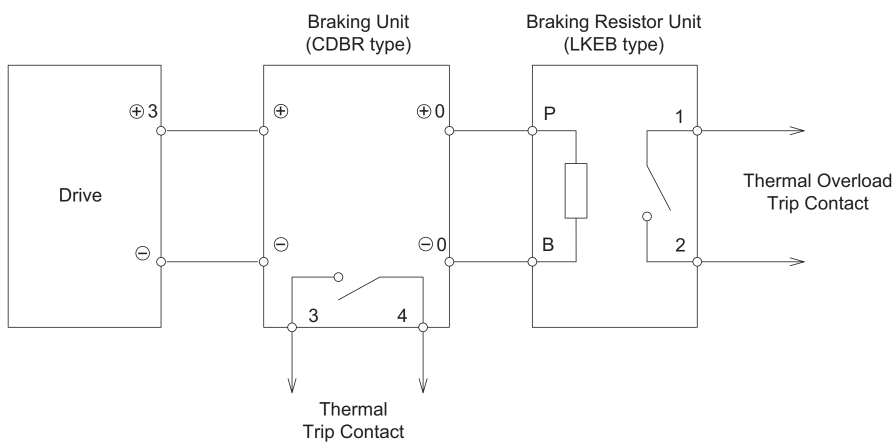


Figure 8.16 Connecting a Braking Unit (CDBR type) and Braking Resistor Unit (2A0181 to 2A0432 and 4A0094 to 4A0225)

■ Using Braking Units in Parallel

When multiple braking units are used, they must be installed with a master-slave configuration with a single braking unit acting as the master. *Figure 8.17* illustrates how to wire braking units in parallel.

Wire the thermal overload contacts of all CDBRs and all braking resistors in series, then connect this signal to a drive digital input. This input can be used to trigger a fault in the drive in case of overload in any of the CDBRs or braking resistors.

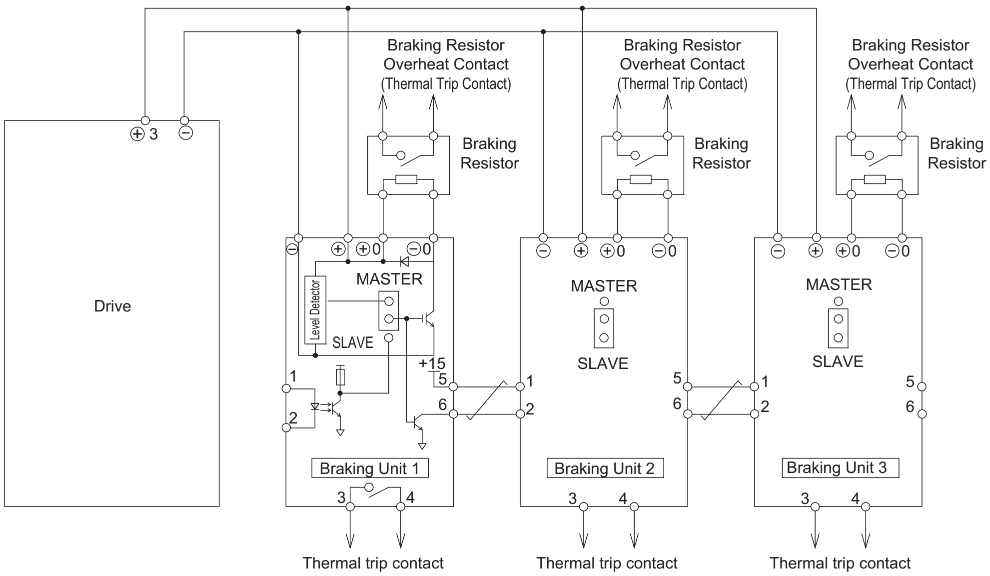


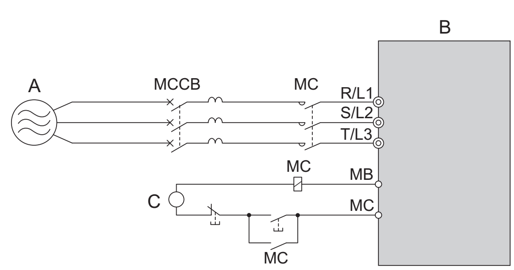
Figure 8.17 Connecting Braking Units in Parallel

◆ Installing a Molded Case Circuit Breaker (MCCB)

Install a MCCB for line protection between the power supply and the main circuit power supply input terminals R/L1, S/L2, and T/L3. This protects the main circuit and devices wired to the main circuit while also providing overload protection.

Consider the following when selecting and installing a MCCB:

- The capacity of the MCCB should be 1.5 to 2 times the rated output current of the drive. Use a MCCB with an operation characteristics so that the MCCB does not trip faster than the drive overload protection works (shuts off the drive after 1 min. operation at 150% of the drive rated current).
- If several drives are connected to one MCCB, use a sequence that shuts the power OFF when an error occurs in one drive by using magnetic contactor (MC) as shown in the following figure.



A – Power supply
B – Drive
C – Control Power Supply

Figure 8.18 Power Supply Interrupt Wiring (Example)

■ Installing a Ground Fault Circuit Interrupter (GFCI)

Note: Use appropriate equipment for Ground Fault Circuit Interrupter (GFCI). This drive can cause a residual current with a DC component in the protective earthing conductor. Where a residual current operated protective or monitoring device is used for protection in case of direct or indirect contact, always use a GFCI of type B according to IEC 60755.

Residual currents occurring in drive installations can contain AC, DC, and high frequency components that may prevent a normal GFCI from operating as desired. If a GFCI is required in the installation, always use an all-current-sensitive device (Type B according to IEC 60755) to ensure proper ground fault interruption.

Leakage currents generated by the drive during normal operation may trip a GFCI even if a ground fault is not present.

Factors that influence the leakage current are:

- Size of the AC drive
- AC drive carrier frequency
- Motor cable type and length
- EMI/RFI filter

If the GFCI trips spuriously consider changing these items or use a GFCI with a higher trip level.

Note: Choose a GFCI designed specifically for an AC drive. The operation time should be at least 0.1 s with sensitivity amperage of at least 200 mA per drive. The output waveform of the drive may cause an increase in leakage current. This may in turn cause the leakage breaker to malfunction. Increase the sensitivity amperage or lower the carrier frequency to correct the problem.

◆ Installing a Magnetic Contactor at the Power Supply Side

Install a magnetic contactor (MC) to the drive input for the purposes explained below.

■ Disconnecting from the Power Supply

Shut off the drive with an MC when a fault occurs in any external equipment such as braking resistors.

NOTICE: *Do not connect electromagnetic switches or MCs to the output motor circuits without proper sequencing. Improper sequencing of output motor circuits could result in damage to the drive.*

NOTICE: *Install an MC on the input side of the drive when the drive should not automatically restart after power loss. To get the full performance life out of the electrolytic capacitors and circuit relays, refrain from switching the drive power supply off and on more than once every 30 minutes. Frequent use can damage the drive. Use the drive to stop and start the motor.*

NOTICE: *Use a magnetic contactor (MC) to ensure that power to the drive can be completely shut off when necessary. The MC should be wired so that it opens when a fault output terminal is triggered.*

Note:
1. Install an MC to the drive input side to prevent the drive from restarting automatically when power is restored after momentary power loss.
2. Set up a delay that prevents the MC from opening prematurely to continue operating the drive through a momentary power loss.

■ Protecting the Braking Resistor or Braking Resistor Unit

Use an MC on the input side of the drive to protect a braking resistor or braking resistor unit from overheat or fire.

WARNING! *Fire Hazard. Applications using a braking option should wire a thermal relay so that the output contactor opens when the thermal relay trips. Inadequate braking circuit protection could result in death or serious injury by fire from overheating resistors.*

WARNING! *Fire Hazard. Confirm an actual motor overload condition is not present prior to increasing the thermal oL trip detection setting. Check local electrical codes before making adjustments to motor thermal overload settings. Failure to comply can result in death or serious injury by fire.*

◆ Connecting an AC Reactor or a DC Link Choke

■ Placement

When connecting to a power supply transformer with greater than 600 kVA capacity, or when switching a phase advance capacitor, large peak current can flow through the input power supply circuit and damage converter components in the drive.

As a preventive measure, install an AC reactor or a DC link choke to the input side of the drive. Installing an AC reactor or a DC link choke will also help improve the power factor.

Install an AC reactor or a DC link choke if a DC drive or another type of thyristor converter is running from the same power system, regardless of the power supply conditions shown in *Figure 8.19*.

Note: A DC link choke is built in to the drive models 2A0106 to 2A0432 and 4A0056 to 4A0225.

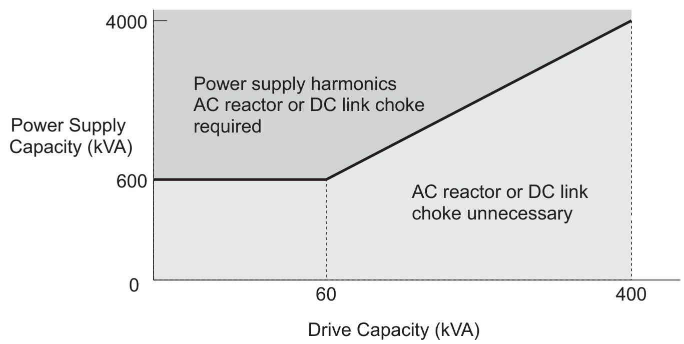
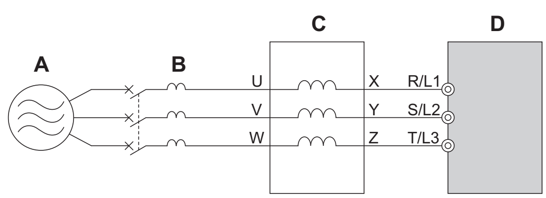


Figure 8.19 Installing an AC Reactor or DC Link Choke

■ Connecting an AC Reactor

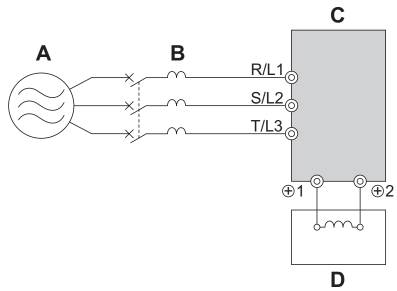


A – Power supply
B – MCCB
C – AC reactor
D – Drive

Figure 8.20 Connecting an AC Reactor

■ Connecting a DC Link Choke

A DC link choke can be installed to drive models 2A0018 to 2A0094 and 4A0009 to 4A0049. When installing a DC link choke, remove the jumper between terminals +1 and +2 (terminals are jumpered for shipment). The jumper must be installed if not using a DC link choke. Refer to ***Figure 8.21*** for an example of DC link choke wiring.



A – Power supply
B – MCCB
C – Drive
D – DC Link Choke

Figure 8.21 Connecting a DC Link Choke

◆ Connecting a Surge Absorber

A surge absorber suppresses surge voltage generated from switching an inductive load near the drive. Inductive loads include magnetic contactors, relays, valves, solenoids, and brakes. Always use a surge absorber or diode when operating with an inductive load.

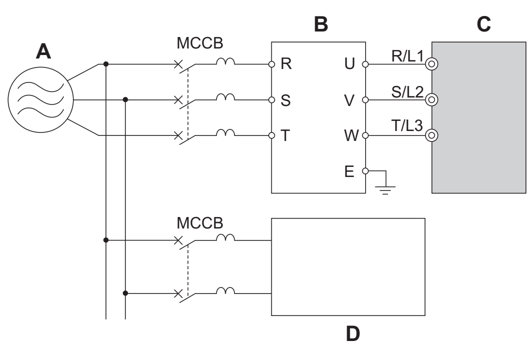
WARNING! *Fire Hazard. Due to surge absorber short circuit on drive output terminals U/T1, V/T2, and W/T3, do not connect surge absorbers to the drive output power terminals. Failure to comply may result in serious injury or death by fire or flying debris.*

◆ Connecting a Noise Filter

■ Input-Side Noise Filter

Drive outputs generate noise as a result of high-speed switching. This noise flows from inside the drive back to the power supply, possibly affecting other equipment. Installing a noise filter to the input side of the drive can reduce the amount of noise flowing back into the power supply. This also prevents noise from entering the drive from the power supply.

- Use a noise filter specifically designed for AC drives.
- Install the noise filter as close as possible to the drive.



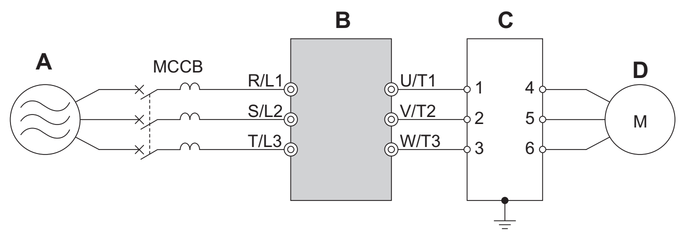
A – Power supply
B – Input-side noise filter (model LNFD-□□)
C – Drive
D – Other control device

Figure 8.22 Input-Side Noise Filter (Three-Phase 200/400 V)

■ Output-Side Noise Filter

A noise filter on the output side of the drive reduces inductive noise and radiated noise. *Figure 8.23* illustrates an example of output-side noise filter wiring.

NOTICE: *Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits. Improper application of noise filters could result in damage to the drive.*



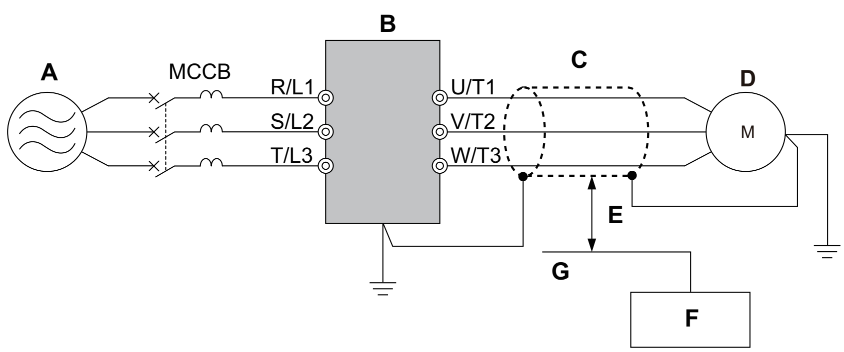
A – Power supply
B – Drive
C – Output-side noise filter
D – Motor

Figure 8.23 Output-Side Noise Filter

- **Radiated Noise:** Electromagnetic waves radiated from the drive and cables create noise throughout the radio bandwidth that can affect surrounding devices.
- **Induced Noise:** Noise generated by electromagnetic induction can affect the signal line and may cause the controller to malfunction.

Preventing Induced Noise

Use a noise filter on the output side or use shielded cables. Lay the cables at least 30 cm away from the signal line to prevent induced noise.



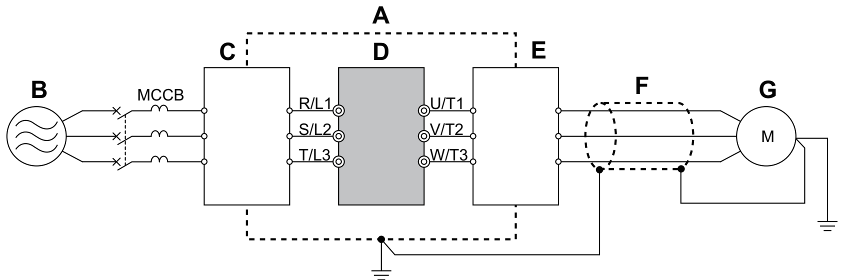
A – Power supply
B – Drive
C – Shielded motor cable
D – Motor
E – Separate at least 30 cm
F – Controller
G – Signal line

Figure 8.24 Preventing Induced Noise

Reducing Radiated and Radio Frequency Noise

The drive, input lines, and output lines generate radio frequency noise. Use noise filters on input and output sides and install the drive in a metal enclosure panel to reduce radio frequency noise.

Note: The cable running between the drive and motor should be as short as possible.



A – Metal enclosure
B – Power supply
C – Noise filter
D – Drive
E – Noise filter
F – Shielded motor cable
G – Motor

Figure 8.25 Reducing Radio Frequency Noise

◆ Fuse/Fuse Holder

Yaskawa recommends installing a fuse to the input side of the drive to prevent damage to the drive if a short circuit occurs.

Select the appropriate fuse from the table below.

Table 8.11 Input Fuses

Drive Model CIMR-LE	L1000E					
	Nominal Output Power HP	AC Drive Input Amps	MCCB Rating Amps <1>	Time Delay Fuse Rating Amps <2>	Non-time Delay Fuse Rating Amps <3>	Bussmann Semi-conductor Fuse Rating (Fuse Ampere) <4>
240 V Models						
2A0018	5	15.6	25	25	40	FWH-90B (90)
2A0022	7.5	18.9	35	30	50	FWH-90B (90)
2A0031	10	28	50	40	75	FWH-100B (100)
2A0041	15	37	60	60	100	FWH-200B (200)
2A0059	20	52	100	90	150	FWH-200B (200)
2A0075	25	68	125	110	200	FWH-200B (200)
2A0094	30	80	150	125	225	FWH-300A (300)
2A0106	40	82	150	125	225	FWH-300A (300)
2A0144	50	111	200	175	250	FWH-350A (350)
2A0181	60	136	250	225	350	FWH-400A (400)
2A0225	75	164	300	250	450	FWH-400A (400)
2A0269	100	200	400	350	600	FWH-600A (600)
2A0354	125	271	500	450	800	FWH-700A (700)
2A0432	150	324	600	500	900 <5>	FWH-800A (800)
480 V Models						
4A0009	5	8.2	15	12	20	FWH-90B (90)
4A0012	7.5	10.4	20	17.5	30	FWH-90B (90)
4A0019	10	15	30	25	40	FWH-80B (80)
4A0023	15	20	40	35	60	FWH-100B (100)
4A0030	20	29	50	50	80	FWH-125B (125)
4A0039	25	39	75	60	110	FWH-200B (200)
4A0049	30	44	75	75	125	FWH-250A (250)
4A0056	40	43	75	75	125	FWH-250A (250)
4A0075	50	58	100	100	150	FWH-250A (250)
4A0094	60	71	125	110	200	FWH-250A (250)
4A0114	75	86	150	150	250	FWH-250A (250)
4A0140	100	105	175	175	300	FWH-350A (350)
4A0188	125	142	225	225	400	FWH-400A (400)
4A0225	150	170	250	250	500	FWH-500A (500)

<1> Maximum MCCB Rating is 15 A, or 200% of drive input current rating, whichever is larger. MCCB voltage rating must be 600 VAC or greater.
<2> Maximum Time Delay fuse is 175% of drive input current rating. This covers any Class CC, J or T class fuse.
<3> Maximum Non-time Delay fuse is 300% of drive input current rating. This covers any CC, J or T class fuse.
<4> When using semiconductor fuses, Bussmann FWH is required for UL compliance.
<5> Class L fuse is also approved for this rating.

◆ Attachment for External Heatsink Mounting

An external attachment can be used to project the heatsink outside of an enclosure to ensure that there is sufficient air circulation around the heatsink. Contact a Yaskawa sales representative or Yaskawa directly for more information on this attachment.

◆ Installing a Motor Thermal Overload (oL) Relay on the Drive Output

Motor thermal overload relays protect the motor by disconnecting power lines to the motor due to a motor overload condition.

Install a motor thermal overload relay between the drive and motor:

- When operating multiple motors on a single AC drive.
- When using a power line bypass to operate the motor directly from the power line.

It is not necessary to install a motor thermal overload relay when operating a single motor from a single AC drive. The AC drive has UL recognized electronic motor overload protection built into the drive software.

Note: **1.** Disable the motor protection function (L1-01 = 0) when using an external motor thermal overload relay.
2. The relay should shut off main power on the input side of the main circuit when triggered.

■ General Precautions when Using Thermal Overload Relays

The following application precautions should be considered when using motor thermal overload relays on the output of AC drives in order to prevent nuisance trips or overheat of the motor at low speeds:

1. Low speed motor operation
2. Use of multiple motors on a single AC drive
3. Motor cable length
4. Nuisance tripping resulting from high AC drive carrier frequency

Low Speed Operation and Motor Thermal oL Relays

Generally, thermal relays are applied on general-purpose motors. When general-purpose motors are driven by AC drives, the motor current is approximately 5% to 10% greater than if driven by a commercial power supply. In addition, the cooling capacity of a motor with a shaft-driven fan decreases when operating at low speeds. Even if the load current is within the motor rated value, motor overheating may occur. A thermal relay cannot effectively protect the motor due to the reduction of cooling at low speeds. For this reason, apply the UL recognized electronic thermal overload protection function built into the drive whenever possible.

UL recognized electronic thermal overload function of the drive: Speed-dependent heat characteristics are simulated using data from standard motors and force-ventilated motors. The motor is protected from overload using this function.

Using a Single Drive to Operate Multiple Motors

Set parameter L1-01 to 0 to disable the drive's electronic thermal overload protection.

Note: The UL recognized electronic thermal overload function cannot be applied when operating multiple motors with a single drive.

Long Motor Cables

When a high carrier frequency and long motor cables are used, nuisance tripping of the thermal relay may occur due to increased leakage current. To avoid this, reduce the carrier frequency or increase the tripping level of the thermal overload relay.

Nuisance Tripping Due to a High AC Drive Carrier Frequency

Current waveforms generated by high carrier frequency PWM drives tend to increase the temperature in overload relays. It may be necessary to increase the trip level setting when encountering nuisance triggering of the relay.

WARNING! *Fire Hazard. Confirm an actual motor overload condition is not present prior to increasing the thermal oL trip setting. Check local electrical codes before making adjustments to motor thermal overload settings.*

Appendix: A

Specifications

A.1 Three-Phase 200 V Class Drives

Table A.1 Power Ratings (Three-Phase 200 V Class)

Item		Specification													
CIMR-LE2A		0018	0022	0031	0041	0059	0075	0094	0106	0144	0181	0225	0269	0354	0432
Maximum Applicable Motor Capacity kW (HP) <1>		3.7 (5)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)	22.0 (30)	30.0 (40)	37.0 (50)	45.0 (60)	55.0 (75)	75.0 (100)	90.0 (125)	110.0 (150)
Input	Input Current (A) <2>	15.6	18.9	28	37	52	68	80	82	111	136	164	200	271	324
	Rated Voltage Rated Frequency	Three-phase 200 to 240 Vac 50/60 Hz/270 to 340 Vdc <3>													
	Allowable Voltage Fluctuation	-15 to 10%													
	Allowable Frequency Fluctuation	±5%													
	Input Power (kVA)	7.8	9.5	14	18	27	36	44	37	51	62	75	91	124	148
Output	Rated Output Capacity (kVA) <4>	5.3 <5>	6.7 <5>	9.5 <5>	12.6 <5>	17.9 <5>	23 <5>	29 <5>	32 <5>	44 <5>	55 <6>	69 <6>	82 <6>	108 <6>	132 <7>
	Rated Output Current (3 minutes, 50% ED) (A)	17.5 <5>	21.9 <5>	31.3 <5>	41.3 <5>	58.8 <5>	75.0 <5>	93.8 <5>	106.3 <5>	143.8 <5>	181.3 <6>	225.0 <6>	268.8 <6>	353.8 <6>	432.5 <7>
	Overload Tolerance	133% of rated output current for 30 s													
	Carrier Frequency	User adjustable between 1 and 15 kHz									User adjustable between 1 and 10 kHz				
	Maximum Output Voltage (V)	Three-phase 200 to 240 V (proportional to input voltage)													
	Maximum Output Speed (Hz)	120 Hz (user-set)													

<1> The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.
<2> Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.
<3> DC is not available for UL standards.
<4> Rated motor capacity is calculated with a rated output voltage of 220 V.
<5> Carrier frequency can be set up to 8 kHz while keeping this current rating. Higher carrier frequency settings require derating.
<6> Carrier frequency can be set up to 5 kHz while keeping this current rating. Higher carrier frequency settings require derating.
<7> Carrier frequency can be set up to 2 kHz while keeping this current rating. Higher carrier frequency settings require derating.

A.2 Three-Phase 400 V Class Drives

Table A.2 Power Ratings (Three-Phase 400 V Class)

Item		Specification													
CIMR-LE4A		0009	0012	0019	0023	0030	0039	0049	0056	0075	0094	0114	0140	0188	0225
Maximum Applicable Motor Capacity kW (HP) <1>		3.7 (5)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)	22.0 (30)	30.0 (40)	37.0 (50)	45.0 (60)	55.0 (75)	75.0 (100)	90.0 (125)	110.0 (150)
Input	Input Current (A) <2>	8.2	10.4	15	20	29	39	44	43	58	71	86	105	142	170
	Rated Voltage Rated Frequency	Three-phase 380 to 480 Vac 50/60 Hz 510 to 680 Vdc <3>													
	Allowable Voltage Fluctuation	-15 to 10%													
	Allowable Frequency Fluctuation	±5%													
	Input Power (kVA)	8.1	10.0	14.6	19.2	28.4	37.5	46.6	39.3	53.0	64.9	78.6	96.0	129.9	155
Output	Rated Output Capacity (kVA) <4>	5.5 <5>	7 <5>	11.3 <5>	13.7 <5>	18.3 <5>	24 <5>	30 <5>	34 <5>	48 <5>	57 <6>	69 <6>	85 <6>	114 <6>	137 <7>
	Rated Output Current (3 minutes, 50% ED) (A)	9.0 <5>	11.5 <5>	18.5 <5>	22.5 <5>	30.0 <5>	38.8 <5>	48.8 <5>	56.3 <5>	75.0 <5>	93.8 <6>	113.8 <6>	140.0 <6>	187.5 <6>	225.0 <7>
	Overload Tolerance	133% of rated output current for 30 s													
	Carrier Frequency	User adjustable between 1 and 15 kHz											User adjustable between 1 and 10 kHz		
	Maximum Output Voltage (V)	Three-phase 380 to 480 V (proportional to input voltage)													
	Maximum Output Speed (Hz)	120 Hz (user-adjustable)													

<1> The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.
<2> Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring conditions, and power supply impedance.
<3> DC is not available for UL standards.
<4> Rated motor capacity is calculated with a rated output voltage of 440 V.
<5> Carrier frequency can be set up to 8 kHz while keeping this current rating. Higher carrier frequency settings require derating.
<6> Carrier frequency can be set up to 5 kHz while keeping this current rating. Higher carrier frequency settings require derating.
<7> Carrier frequency can be set up to 2 kHz while keeping this current rating. Higher carrier frequency settings require derating.

A.3 Drive Specifications

Note: **1.** Perform rotational Auto-Tuning to obtain the performance specifications given below.
2. For optimum performance life of the drive, install the drive in an environment that meets the required specifications.

Item		Specification
Control Characteristics	Control Method	The following control methods can be set using drive parameters: • V/f Control (V/f) • Open Loop Vector Control (OLV) • Closed Loop Vector Control (CLV) • Closed Loop Vector Control for PM (CLV/PM)
	Frequency Control Range	0.01 to 120 Hz
	Frequency Accuracy (Temperature Fluctuation)	Digital input: within ±0.01% of the max output speed (-10 to +40 °C) Analog input: within ±0.1% of the max output speed (25 °C ±10 °C)
	Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/2048 of the maximum output speed setting (11 bit plus sign)
	Output Speed Resolution	0.001 Hz
	Frequency Setting Signal	Main speed frequency reference: DC -10 to +10 V (20 kΩ), DC 0 to +10 V (20 kΩ), 4 to 20 mA (250 Ω), 0 to 20 mA (250 Ω)
	Starting Torque <1>	V/f: 150% at 3 Hz OLV: 200% at 0.3 Hz CLV, CLV/PM: 200% at 0 r/min
	Speed Control Range <1>	V/f: 1:40 OLV: 1:200 CLV, CLV/PM: 1:1500
	Speed Control Accuracy <1>	OLV: ±0.2% (25 °C ±10 °C) CLV: ±0.02% (25 °C ±10 °C)
	Speed Response <1>	OLV: 10 Hz (25 °C ±10 °C) CLV: 50 Hz (25 °C ±10 °C)
	Torque Limit	Parameters setting allow separate limits in four quadrants (available in OLV, CLV, CLV/PM)
Control Characteristics	Accel/Decel Ramp	0.0 to 6000.0 s (4 selectable combinations of independent acceleration and deceleration settings, unit changeable to m/s^2 or ft/s^2)
	Braking Transistor	Models CIMR-LE2A0018 to 2A0144, 4A0009 to 4A0075 have a built-in braking transistor.
	V/f Characteristics	Freely programmable
	Main Control Functions	Inertia Compensation, Position Lock at Start and Stop/Anti-Rollback Function, Overtorque/Undertorque Detection, Torque Limit, Speed Reference, Accel/decel Switch, 5 Zone Jerk Settings, Auto-Tuning (Stationary and Rotational Motor/Encoder Offset Tuning), Dwell, Cooling Fan on/off Switch, Slip Compensation, Torque Compensation, DC Injection Braking at Start and Stop, MEMOBUS/Modbus Comm. (RS-422/485 max, 115.2 kbps), Fault Reset, Removable Terminal Block with Parameter Backup Function, Online Tuning, High Frequency Injection, Short Floor, Rescue Operation (Light Load Direction Search Function), Inspection Run, Brake Sequence, Speed related parameters with elevator units display, etc.
Protection Functions	Motor Protection	Electronic thermal overload relay
	Momentary Overcurrent Protection	Drive stops when output current exceeds 200% of rated output current
	Overload Protection	Drive stops after 30 s at 133% of rated output current <2>
	Overvoltage Protection	200 V class: Stops when DC bus voltage exceeds approx. 410 V 400 V class: Stops when DC bus voltage exceeds approx. 820 V
	Undervoltage Protection	200 V class: Stops when DC bus voltage falls below approx. 190 V 400 V class: Stops when DC bus voltage falls below approx. 380 V
	Heatsink Overheat Protection	Thermistor
	Stall Prevention	Stall Prevention is available during acceleration, and during run.
	Ground Protection	Electronic circuit protection <3>
	DC Bus Charge LED	Remains lit until DC bus voltage falls below 50 V
Environment	Area of Use	Indoors
	Ambient Temperature	IP00 enclosure with top protective cover: -10 to +40 °C IP00 enclosure: -10 to +50 °C
	Humidity	95 RH% or less (no condensation)
	Storage Temperature	-20 to 60 °C (short-term temperature during transportation)
	Altitude	Up to 1000 meters without derating, up to 3000 m with output current and voltage derating
	Vibration/Shock	10 to 20 Hz: 9.8 m/s^2 20 to 55 Hz: 5.9 m/s^2 (2A0018 to 2A0225 and 4A0009 to 4A0188) or 2.0 m/s^2 (2A0269 to 2A0432 and 4A0225)
Standards		• UL Underwriters Laboratories Inc: UL508C Power Conversion Equipment
Protection Design		IP00 enclosure with top protective cover, IP00

<1> The accuracy of these values depends on motor characteristics, ambient conditions, and drive settings. Specifications may vary with different motors and with changing motor temperature. Contact Yaskawa for consultation.
<2> Overload protection may be triggered when operating with 133% of the rated output current if the output speed is less than 6 Hz.
<3> Ground protection cannot be provided when the impedance of the ground fault path is too low, or when the drive is powered up while a ground fault is present at the output.

A.4 Drive Watt Loss Data

Table A.3 Watt Loss 200 V Class Three-Phase Models

Drive Model	Carrier Frequency 8 kHz			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
2A0018	17.5 <1>	77.0	60.0	137.0
2A0022	21.9 <1>	100.7	67.4	168.1
2A0031	31.3 <1>	194.4	92.3	286.6
2A0041	41.3 <1>	213.8	104.8	318.7
2A0059	58.8 <1>	280.2	129.9	410.2
2A0075	75.0 <1>	394.9	162.8	557.7
2A0094	93.8 <1>	459.8	220.9	680.7
2A0106	106.3 <1>	510.3	210.9	721.2
2A0144	143.8 <1>	662.4	250.0	912.4
2A0181	181.3 <2>	815.9	306.3	1122.2
2A0225	225.0 <2>	976.0	378.1	1354.1
2A0269	268.8 <2>	1514.0	466.1	1980.2
2A0354	353.8 <2>	1936.2	587.8	2523.9
2A0432	432.5 <2>	2563.9	782.9	3346.8

<1> These values assume the carrier frequency is set to 8 kHz or less.
<2> These values assume the carrier frequency is set to 5 kHz or less.

Table A.4 Watt Loss 400 V Class Three-Phase Models

Drive Model	Carrier Frequency 8 kHz			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
4A0009	9.0 <1>	53.0	55.0	108.0
4A0012	11.5 <1>	68.5	61.0	129.5
4A0019	18.5 <1>	135.4	85.7	221.1
4A0023	22.5 <1>	149.9	97.0	246.9
4A0030	30.0 <1>	208.0	115.1	323.2
4A0039	38.8 <1>	262.6	140.8	403.4
4A0049	48.8 <1>	329.8	179.4	509.2
4A0056	56.3 <1>	348.5	169.6	518.1
4A0075	75.0 <1>	484.1	217.2	701.3
4A0094	93.8 <1>	563.4	254.0	817.4
4A0114	113.8 <1>	722.6	299.0	1021.7
4A0140	140.0 <2>	908.2	416.4	1324.6
4A0188	187.5 <2>	1340.3	580.1	1920.3
4A0225	225.0 <2>	1771.4	541.0	2312.5

<1> These values assume the carrier frequency is set to 8 kHz or less.
<2> These values assume the carrier frequency is set to 5 kHz or less.

A.5 Drive Derating Data

The drive can be operated at above the rated temperature, altitude, and default carrier frequency by derating the drive capacity.

◆ Carrier Frequency Derating

Refer to Selecting an L1000E AC Drive for Elevator Applications on page 31.

◆ Temperature Derating

To ensure the maximum performance life, the drive output current must be derated as shown in *Figure A.1* when the drive is installed in areas with high ambient temperature or if drives are mounted side-by-side in a cabinet. In order to ensure reliable drive overload protection, set parameters L8-12 and L8-35 according to the installation conditions.

■ Parameter Settings

No.	Name	Description	Range	Default
L8-12	Ambient Temperature Setting	Adjust the drive overload (oL2) protection level when the drive is installed in an environment that exceeds its ambient temperature rating.	-10 to 50	40 °C
L8-35	Installation Method Selection	0: IP00 Enclosure 2: IP00 Enclosure with Top Protective Cover	0 or 2	Determined by o2-04

IP00 Enclosure

Drive operation between -10 °C and 50 °C allows 100% continuous current without derating.

IP00 Enclosure with Top Protective Cover

Drive operation between -10 °C and 40 °C allows 100% continuous current without derating. Operation between 40 °C and 50 °C requires output current derating.

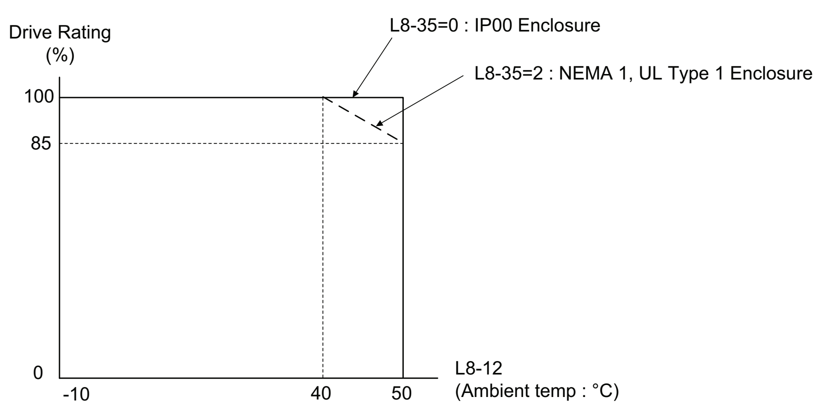


Figure A.1 Ambient Temperature and Installation Method Derating

◆ Altitude Derating

The drive standard ratings are valid for an installation altitude up to 1000 m. If the altitude exceeds 1000 m both the drive rated voltage and the rated output current must be derated for 1% per 100 m. The maximum altitude is 3000 m.

Appendix: B

Parameter List

This appendix contains a full listing of all parameters and settings available in the drive.

B.1 Understanding the Parameter Table

◆ Control Modes, Symbols, and Terms

The table below lists terms and symbols used in this section to indicate which parameters are available in which control modes.

Note: *Refer to Control Mode Selection on page 28* for detailed instructions on each control mode.

Table B.1 Symbols and Icons Used in the Parameter Table

Symbol	Description
All Modes	Parameter is available in all control modes.
V/f	Parameter is available when operating the drive with V/f Control.
OLV	Parameter is available when operating the drive with Open Loop Vector.
CLV	Parameter is available when operating the drive with Closed Loop Vector.
CLV/PM	Parameter is available when operating the drive with Closed Loop Vector for PM motors.
RUN	Parameter can be changed during run.
Motor 2	Refers to a second motor when the drive is operating two motors. Switch between these motors using the multi-function input terminals.

Note: If a parameter is not available in a certain control mode, the symbol for that control mode is grayed out.

B.2 Parameter Groups

Parameter Group	Name	Page	Parameter Group	Name	Page
A1	Initialization	370	L1	Motor Protection	391
A2	User Parameters	370	L2	Undervoltage Detection	391
b1	Operation Mode Selection	371	L3	Stall Prevention	391
b2	Magnetic Flux Compensation	371	L4	Speed Detection	392
b4	Delay Timers	371	L5	Fault Reset	392
b6	Dwell Function	372	L6	Torque Detection	392
b7	Droop Control	372	L7	Torque Limit	393
b8	Energy Saving	372	L8	Drive Protection	393
C1	Acceleration and Deceleration Ramps	372	n1	Hunting Prevention	395
C2	Jerk Settings	373	n2	Speed Feedback Detection Control (AFR) Tuning	395
C3	Slip Compensation	373	n5	Inertia Compensation	395
C4	Torque Compensation	374	n6	Online Tuning	396
C5	Speed Control Loop Settings	374	n8	PM Motor Control Tuning	396
C6	Carrier Frequency	375	n9	Current Detection Adjustments	397
d1	Speed Reference	376	o1	Digital Operator Display Selection	397
d6	Field Forcing	377	o2	Digital Operator Keypad Functions	398
E1	V/f Pattern	377	o3	Copy Function	398
E2	Motor Parameters	378	o4	Maintenance Monitor Settings	399
E3	V/f Pattern for Motor 2	379	S1	Brake Sequence	399
E4	Motor 2 Parameters	379	S2	Slip Compensation for Elevators	400
E5	PM Motor Settings	380	S3	Start/Stop Optimization	401
F1	Encoder/PG Feedback Settings	380	S4	Rescue Operation	402
F3	Digital Input Card (DI-A3)	382	S5	Short Floor Operation	403
F4	Analog Monitor Card (AO-A3)	382	S6	Error Detection	403
F5	Digital Output Card (DO-A3)	383	T1	Induction Motor Auto-Tuning	404
F6	Communication Option Card	383	T2	PM Motor Auto-Tuning	405
H1	Multi-Function Digital Inputs	384	U1	Operation Status Monitors	406
H2	Multi-Function Digital Outputs	386	U2	Fault Trace	408
H3	Multi-Function Analog Inputs	388	U3	Fault History	409
H4	Multi-Function Analog Outputs	389	U4	Maintenance Monitors	409
H5	MEMOBUS/Modbus Serial Communication	390	U6	Control Monitors	411

B.3 Parameter Table

◆ A: Initialization Parameters

The A parameter group creates the operating environment for the drive. This includes the parameter Access Level, Motor Control Method, Password, User Parameters and more.

■ A1: Initialization Parameters

No.(Addr.)	Name	Description	Setting	Page
A1-00 (100H) RUN <1>	Language Selection	All Modes 0: English 1: Japanese 2: German 3: French 4: Italian 5: Spanish 6: Portuguese 7: Chinese 8: Czech 9: Russian 10: Turkish 11: Polish 12: Greek	Default: 0 Min: 0 Max: 12 <2>	154
A1-01 (101H) RUN	Access Level Selection	All Modes 0: View and set A1-01 and A1-04. U□-□□ parameters can also be viewed. 1: User Parameters (access to a set of parameters selected by the user, A2-01 to A2-32) 2: Advanced Access (access to view and set all parameters)	Default: 2 Min: 0 Max: 2	154
A1-02 (102H) <1>	Control Method Selection	All Modes 0: V/f Control 2: Open Loop Vector Control 3: Closed Loop Vector Control 7: Closed Loop Vector Control for PM Motors	Default: 2 Min: 0 Max: 7	155
A1-03 (103H)	Initialize Parameters	All Modes 0: No initialization 1110: User Initialize (parameter values must be stored using parameter o2-03) 2220: 2-wire initialization 5550: oPE04 error reset	Default: 0 Min: 0 Max: 5550	155
A1-04 (104H)	Password	All Modes When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 through A1-03, and A2-01 through A2-33 cannot be changed.	Default: 0000 Min: 0000 Max: 9999	156
A1-05 (105H)	Password Setting			156

<1> Parameter setting value is not reset to the default value when the drive is initialized.
<2> Settings 8 to 12 can only be selected from an LCD operator with software version 0102 or later. The version number of the LCD operator PRG software is shown on the back of the LCD operator.

■ A2: User Parameters

No.(Addr.)	Name	Description	Setting	Page
A2-01 to A2-32 (106 to 125H)	User Parameters 1 to 32	All Modes Parameters that were recently edited are listed here. The user can also select parameters to appear here for quick access.	Default: <5> Min: A1-00 Max: o4-16	159
A2-33 (126H)	User Parameter Automatic Selection	All Modes 0: Parameters A2-01 through A2-32 are reserved for the user to create a list of User Parameters. 1: Save history of recently viewed parameters. Recently edited parameters will be saved to A2-17 through A2-32 for quick access.	Default: 1 Min: 0 Max: 1	159

<5> Default setting is determined by the control mode (A1-02).

◆ b: Application

Application parameters configure the source of the Up/Down command, timer functions, the Dwell function, the Droop Control function, Energy Savings, and a variety of other application-related settings.

■ b1: Operation Mode Selection

No.(Addr.)	Name	Description	Setting	Page
b1-01 (180H)	Speed Reference Selection	All Modes 0: Digital operator 1: Analog input terminals 2: MEMOBUS/Modbus communications 3: Option card	Default: 0 Min: 0 Max: 3	160
b1-02 (181H)	Up/Down Command Selection	All Modes 0: Digital operator 1: Digital input terminals 2: MEMOBUS/Modbus communications 3: Option card	Default: 1 Min: 0 Max: 3	161
b1-03 (182H)	Stopping Method Selection	All Modes 0: Ramp to stop 1: Coast to stop 4: Elevator Emergency Stop	Default: 0 Min: 0 Max: 4 <1>	161
b1-06 (185H)	Digital Input Reading	All Modes 0: Input status is read once and processed immediately (for quick response). 1: Input is read twice and processed only if the status is the same in both readings (robust against noisy signals).	Default: 1 Min: 0 Max: 1	162
b1-08 (187H)	Up/Down Command Selection while in Programming Mode	All Modes 0: Up/Down command not accepted while in the Programming Mode. 1: Up/Down command accepted while in the Programming Mode. 2: Prohibit entering Programming Mode during run.	Default: 0 Min: 0 Max: 2	162
b1-14 (1C3H)	Phase Order Selection	All Modes 0: U-V-W 1: U-W-V	Default: 0 Min: 0 Max: 1	162

<1> Maximum setting value is 1 in V/f Control and OLV Control.

■ b2: Magnetic Flux Compensation

No.(Addr.)	Name	Description	Setting	Page
b2-08 (190H)	Magnetic Flux Compensation Value	All Modes Sets the magnetic flux compensation as a percentage of the no-load current value (E2-03).	Default: 0% Min: 0% Max: 1000%	163

■ b4: Delay Timers

No.(Addr.)	Name	Description	Setting	Page
b4-01 (1A3H)	Timer Function On-Delay Time	All Modes Used to set the on-delay and off-delay times for a digital timer output (H2-☐☐=12). The output is triggered by a digital input programmed to H1-☐☐=18.	Default: 0.0 s Min: 0.0 s Max: 3000.0 s	163
b4-02 (1A4H)	Timer Function Off-Delay Time		Default: 0.0 s Min: 0.0 s Max: 3000.0 s	

b6: Dwell Function

No.(Addr.)	Name	Description	Setting	Page
b6-01 (1B6H)	Dwell Speed at Start	All Modes Parameters b6-01 and b6-02 set the speed to hold and the time to maintain that speed at start. Parameters b6-03 and b6-04 set the speed to hold and the time to maintain that speed at stop.	Default: 0.0% Min: 0.0% Max: 100.0%	164
b6-02 (1B7H)	Dwell Time at Start		Default: 0.0 s Min: 0.0 s Max: 10.0 s	
b6-03 (1B8H)	Dwell Speed at Stop		Default: 0.0% Min: 0.0% Max: 100.0%	164
b6-04 (1B9H)	Dwell Time at Stop		Default: 0.0 s Min: 0.0 s Max: 10.0 s	

b7: Droop Control

No.(Addr.)	Name	Description	Setting	Page
b7-01 (1CAH) RUN	Droop Control Gain	V/f OLV CLV CLV/PM Sets the speed reduction gain applied at a torque reference of 100%. Set as a percentage of motor base speed.	Default: 0.0% Min: 0.0% Max: 100.0%	165
b7-02 (1CBH) RUN	Droop Control Delay Time	V/f OLV CLV CLV/PM Used to adjust the responsiveness of Droop Control.	Default: 0.05 s Min: 0.03 s Max: 2.00 s	165

b8: Energy Saving

No.(Addr.)	Name	Description	Setting	Page
b8-01 (1CCH)	Energy Saving Control Selection	V/f OLV CLV CLV/PM 0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1	165
b8-16 (1F8H)	Energy Saving Control Constant (Ki)	V/f OLV CLV CLV/PM Enter the Energy Saving value (Ki) as specified on the motor name plate. (for IPM motors only)	Default: 0.10 Min: 0.00 Max: 2.00	165
b8-17 (1F9H)	Energy Saving Control Constant (Kt)	V/f OLV CLV CLV/PM Enter the Energy Saving value (Kt) as specified on the motor name plate. (for IPM motors only)	Default: 1.00 Min: 0.00 Max: 2.00	165

C: Tuning

C parameters are used to adjust the acceleration and deceleration ramps, jerk settings, slip compensation, torque compensation, and carrier frequency selections.

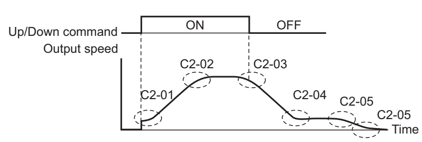
C1: Acceleration and Deceleration Ramps

No. (Addr.)	Name	Description	Setting	Page
C1-01 (200H) RUN	Acceleration Ramp 1	All Modes Sets the ramp to accelerate from 0 to maximum speed.	Default: 1.50 s <6> <8> Min: 0.00 s Max: 600.00 s <6> <8>	166
C1-02 (201H) RUN	Deceleration Ramp 1	All Modes Sets the ramp to decelerate from maximum speed to 0.		
C1-03 (202H) RUN	Acceleration Ramp 2	All Modes Sets the ramp to accelerate from 0 to maximum speed.		
C1-04 (203H) RUN	Deceleration Ramp 2	All Modes Sets the ramp to decelerate from maximum speed to 0.		
C1-05 (204H) RUN	Acceleration Ramp 3 (Motor 2 Accel Time 1)	All Modes Sets the ramp to accelerate from 0 to maximum speed.		

No. (Addr.)	Name	Description	Setting	Page
C1-06 (205H) RUN	Deceleration Ramp 3 (Motor 2 Decel Time 1)	All Modes Sets the ramp to decelerate from maximum speed to 0.		
C1-07 (206H) RUN	Acceleration Ramp 4 (Motor 2 Accel Time 2)	All Modes Sets the ramp to accelerate from 0 to maximum speed.	Default: 1.50 s <6> <8> Min: 0.00 s Max: 600.00 s <6> <8>	166
C1-08 (207H) RUN	Deceleration Ramp 4 (Motor 2 Decel Time 2)	All Modes Sets the ramp to decelerate from maximum speed to 0.		
C1-09 (208H)	Fast Stop Ramp	All Modes Sets the ramp for the Fast Stop function.		167
C1-10 (209H)	Accel/Decel Setting Resolution	All Modes 0: 0.01 s unit 1: 0.1 s unit	Default: 0 Min: 0 Max: 1	168
C1-11 (20AH)	Accel/Decel Switching Speed	All Modes Sets the speed to switch between accel/decel ramp settings.	Default: 0.0% Min: 0.0% Max: 100.0%	167
C1-12 (246H)	Motor 2 Acceleration Time	V/f OLV CLV CLV/PM Sets the acceleration time for motor 2. **Note:** Parameter C1-12 determines the acceleration time for motor 2 as long as d1-27 is not set to 0.00 Hz.	Default: 1.0 s Min: 0.0 s Max: 600.0 s	168
C1-13	Motor 2 Acceleration Time	V/f OLV CLV CLV/PM Sets the deceleration time for motor 2.	Default: 1.0 s Min: 0.0 s Max: 600.0 s	
C1-15 (260H)	Inspection Deceleration Ramp	All Modes Sets the deceleration ramp used for inspection run.	Default: 0.00 s <6> <8> Min: 0.00 s Max: 2.00 s <6> <8>	168

<6> Setting ranges and defaults vary by the setting units determined by parameter o1-03.
Refer to Defaults and Setting Ranges by Display Unit Selection (o1-03) on page 420.
<8> When C1-10 = 0, the range of C1-15 is 0.00 to 2.00. When C1-10 = 1, the range of C1-15 is 0.0 to 20.0. When C1-10 = 1 (units of 0.1 seconds), the setting range becomes 0.0 to 6000.0 seconds.

■ C2: Jerk Settings

No.(Addr.)	Name	Description	Setting	Page
C2-01 (20BH)	Jerk at Accel Start	All Modes Five different jerk values can be set. They are automatically applied as shown in the figure below. 	Default: 0.50 s <6> Min: 0.00 s Max: 10.00 s <6>	
C2-02 (20CH)	Jerk at Accel End		Default: 0.50 s <6> Min: 0.00 s Max: 10.00 s <6>	
C2-03 (20DH)	Jerk at Decel Start		Default: 0.50 s <6> Min: 0.00 s Max: 10.00 s <6>	168
C2-04 (20EH)	Jerk at Decel End		Default: 0.50 s <6> Min: 0.00 s Max: 10.00 s <6>	
C2-05 (25FH)	Jerk below Leveling Speed	All Modes Sets the jerk used when the speed reference is lower than the leveling speed setting	Default: 0.50 s <6> Min: 0.00 s Max: 10.00 s <6>	

<6> Setting ranges and defaults vary by the setting units determined by parameter o1-03.
Refer to Defaults and Setting Ranges by Display Unit Selection (o1-03) on page 420

■ C3: Slip Compensation

No.(Addr.)	Name	Description	Setting	Page
C3-01 (20FH) RUN	Slip Compensation Gain	V/f OLV CLV CLV/PM Sets the gain for the motor slip compensation function.	Default: 1.0 Min: 0.0 Max: 2.5	169
C3-02 (210H) RUN	Slip Compensation Primary Delay Time	V/f OLV CLV CLV/PM Adjusts the slip compensation function delay time.	Default: 2000 ms Min: 0 ms Max: 10000 ms	169

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No.(Addr.)	Name	Description	Setting	Page
C3-03 (211H)	Slip Compensation Limit	V/f **OLV** CLV CLV/PM Sets an upper limit for the slip compensation function as a percentage of motor rated slip for motor 1 (E2-02).	Default: 200% Min: 0% Max: 250%	169
C3-04 (212H)	Slip Compensation Selection during Regeneration	V/f **OLV** CLV CLV/PM 0: Disabled. 1: Enabled above 6 Hz. 2: Enabled whenever slip compensation is possible.	Default: 0 Min: 0 Max: 2	170
C3-05 (213H)	Output Voltage Limit Operation Selection	V/f **OLV** **CLV** **CLV/PM** 0: Disabled. 1: Enabled. Automatically decreases motor flux when output voltage saturation is reached.	Default: <1> Min: 0 Max: 1	170
C3-21 (000H)	Motor 2 Slip Compensation Gain	V/f **OLV** **CLV** **CLV/PM** Improves speed accuracy for motor 2.	Default: <2> Min: 0.0 Max: 2.5	170
C3-22 (000H)	Motor 2 Slip Compensation Primary Delay Time	V/f **OLV** **CLV** **CLV/PM** Adjusts the slip compensation function delay time for motor 2.	Default: <1> Min: 0 ms Max: 10000 ms	170
C3-23 (000H)	Motor 2 Slip Compensation Limit	V/f **OLV** **CLV** **CLV/PM** Sets the upper limit for the slip compensation function as a percentage of the motor rated slip (E4-02).	Default: 200% Min: 0% Max: 250%	171

<1> Default setting is determined by the control mode (A1-02).
<2> Default setting is determined by the motor 2 maximum output frequency (E3-01).

■ C4: Torque Compensation

No.(Addr.)	Name	Description	Setting	Page
C4-01 (215H) RUN	Torque Compensation Gain	**V/f** **OLV** CLV CLV/PM Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque.	Default: 1.00 Min: 0.00 Max: 2.50	171
C4-02 (216H) RUN	Torque Compensation Primary Delay Time	**V/f** **OLV** CLV CLV/PM Sets the torque compensation filter time.	Default: <5> Min: 0 ms Max: 60000 ms	172
C4-03 (217H)	Torque Compensation at Forward Start	V/f **OLV** CLV CLV/PM Sets torque compensation at forward start as a percentage of motor torque.	Default: 0.0% Min: 0.0% Max: 200.0%	172
C4-04 (218H)	Torque Compensation at Reverse Start	V/f **OLV** CLV CLV/PM Sets torque compensation at reverse start as a percentage of motor torque.	Default: 0.0% Min: -200.0% Max: 0.0%	172
C4-05 (219H)	Torque Compensation Time Constant	V/f **OLV** CLV CLV/PM Sets the time constant for torque compensation at forward start and reverse start (C4-03 and C4-04).	Default: 10 ms Min: 0 ms Max: 200 ms	172
C4-07 (000H)	Motor 2 Torque Compensation Gain	**V/f** **OLV** CLV CLV/PM Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque for motor 2.	Default: 1.00 Min: 0.00 Max: 2.50	172

<5> Default setting is determined by the control mode (A1-02).

■ C5: Speed Control Loop Settings

No.(Addr.)	Name	Description	Setting	Page
C5-01 (21BH) RUN	Speed Control Loop Proportional Gain 1	V/f OLV **CLV** **CLV/PM** Sets the proportional gain 1 of the speed control loop.	Default: <1> Min: 0.00 Max: 300.00	174
C5-02 (21CH) RUN	Speed Control Loop Integral Time 1	V/f OLV **CLV** **CLV/PM** Sets the integral time 1 of the speed control loop.	Default: <1> Min: 0.000 s Max: 10.000 s	
C5-03 (21DH) RUN	Speed Control Loop Proportional Gain 2	V/f OLV **CLV** **CLV/PM** Sets the proportional gain 2 of the speed control loop.	Default: <1> Min: 0.00 Max: 300.00	
C5-04 (21EH) RUN	Speed Control Loop Integral Time 2	V/f OLV **CLV** **CLV/PM** Sets the integral time 2 of the speed control loop.	Default: 0.500 s Min: 0.000 s Max: 10.000 s	

No.(Addr.)	Name	Description	Setting	Page
C5-06 (220H)	Speed Control Loop Primary Delay Time Constant	V/f OLV **CLV** **CLV/PM** Sets the filter time constant for the time from the speed loop to the torque command output.	Default: 0.004 s Min: 0.000 s Max: 0.500 s	174
C5-07 (221H)	Speed Control Settings Switching Speed	V/f OLV **CLV** **CLV/PM** Sets the speed for switching between proportional gain 1, 2, 3 and integral time 1, 2, 3.	Default: <1> Min: 0.0% Max: 100.0%	174
C5-08 (222H)	Speed Control Loop Integral Limit	V/f OLV **CLV** **CLV/PM** Sets the speed control loop integral upper limit as a percentage of rated torque.	Default: 400% Min: 0% Max: 400%	175
C5-13 (272H) RUN	Speed Control Loop Proportional Gain 3	V/f OLV **CLV** **CLV/PM** Sets the proportional gain 3 of the speed control loop.	Default: <1> Min: 0.00 Max: 300.00	174
C5-14 (273H) RUN	Speed Control Loop Integral Time 3	V/f OLV **CLV** **CLV/PM** Sets the integral time 3 of the speed control loop.	Default: <1> Min: 0.000 s Max: 10.000 s	
C5-16 (271H)	Speed Control Loop Delay Time during Position Lock	V/f OLV CLV **CLV/PM** Sets a delay to the torque command output from speed control loop during Position Lock.	Default: 0.000 s Min: 0.000 s Max: 0.500 s	175
C5-17 (276H)	Motor Inertia	V/f OLV **CLV** **CLV/PM** Sets the motor inertia.	Default: <2> Min: 0.0001 kgm^2 Max: 600.00 kgm^2	175
C5-18 (277H)	Load Inertia Ratio	V/f OLV **CLV** **CLV/PM** Sets the ratio between the motor and load inertia.	Default: 1.0 Min: 0.0 Max: 6000.0	
C5-19 (274H) RUN	Speed Control Loop Proportional Gain Time during Position Lock	V/f OLV **CLV** **CLV/PM** Sets the Speed Control Loop Proportional gain used during Position Lock	Default: <1> Min: 0.00 Max: 300.00	175
C5-20 (275H) RUN	Speed Control Loop Integral Time during Position Lock	V/f OLV **CLV** **CLV/PM** Sets the Speed Control Loop Integral time used during Position Lock.	Default: 0.100 s Min: 0.000 s Max: 10.000 s	
C5-50 (B14H)	Set Vibrational Frequency	V/f OLV **CLV** **CLV/PM** Sets the mechanical vibration filter frequency. NOTICE: Test equipment may be required to determine the mechanical resonance frequency. Setting C5-50 to an improper frequency will result in ineffective filtering of the effects of mechanical resonance.	Default: 0 Hz <3> Min: 0 Hz Max: 1000 Hz s	175

<1> Default setting is determined by the control mode (A1-02).
<2> Default setting value varies by the drive model (o2-04).
<3> Set this parameter to 0 to disable the notch filter. Frequencies from 1 to 19 Hz cannot be set.

■ C6: Carrier Frequency

No.(Addr.)	Name	Description	Setting	Page
C6-03 (225H)	Carrier Frequency	**All Modes** Sets the carrier frequency.	Default: <4> Min: 1.0 kHz Max: 15.0 kHz	176
C6-06 (228H)	PWM Method	**All Modes** Selects PWM modulation method. 0: 2-phase/3-phase conversion 1: 2-phase modulation 2: 3-phase modulation	Default: 0 Min: 0 Max: 2	176
C6-09 (22BH)	Carrier Frequency during Rotational Auto-Tuning	V/f **OLV** **CLV** **CLV/PM** 0: Carrier Frequency = 5 kHz 1: Setting value for C6-03	Default: 0 Min: 0 Max: 1	176
C6-21 (245H)	Inspection Operation Carrier Frequency	**All Modes** Sets the carrier frequency during Inspection Run. 0: Setting value for C6-03 1: Carrier Frequency = 2 kHz	Default: 1 Min: 0 Max: 1	176
C6-23 (25EH)	Carrier Frequency during Initial Motor Pole Search	V/f OLV CLV **CLV/PM** Sets the carrier frequency when estimating the initial polarity. 0: Carrier Frequency = 2 kHz 1: Setting value for C6-03	Default: 0 Min: 0 Max: 1	176

No.(Addr.)	Name	Description	Setting	Page
C6-31 (77AH)	Carrier Frequency during Rescue Operation	All Modes Sets the carrier frequency during Rescue Operation. 0: C6-03 setting 1: 2 kHz	Default: 0 Min: 0 Max: 1	177

<4> Default setting value varies by the drive model (o2-04).

◆ d: Speed References

Speed Reference parameters are used to set the various speed reference values during operation.

■ d1: Speed Reference

No.(Addr.)	Name	Description	Setting	Page
d1-01 (280H) RUN	Speed Reference 1	All Modes Sets the Speed reference for the drive when d1-18 is set to 0 or 3. Setting units are determined by parameter o1-03.	Default: 0.00% <6> Min: 0.00% Max: 100.00% <6>	178
d1-02 (281H) RUN	Speed Reference 2			
d1-03 (282H) RUN	Speed Reference 3			
d1-04 (283H) RUN	Speed Reference 4			
d1-05 (284H) RUN	Speed Reference 5			
d1-06 (285H) RUN	Speed Reference 6			
d1-07 (286H) RUN	Speed Reference 7			
d1-08 (287H) RUN	Speed Reference 8			
d1-18 (2C0H)	Speed Reference Selection Mode	All Modes Sets the mode of speed reference selection by digital inputs. 0: Use multi-speed references (d1-01 to d1-08) 1: High speed reference has priority (d1-19 to d1-23, d1-26) 2: Leveling speed reference has priority (d1-19 to d1-23, d1-26) 3: Use multi-speed references d1-02 to d1-08, no speed selection stops the drive. Drive will stop when all input terminals programmed for speed references (H1-□□ = 3, 4, 5) are open.	Default: 0 Min: 0 Max: 3	178
d1-19 (2C1H) RUN	Nominal Speed	All Modes Sets the nominal speed reference when d1-18 = 1 or 2.	Default: 100.00% <6> Min: 0.00% Max: 100.00% <6>	179
d1-20 (2C2H) RUN	Intermediate Speed 1	All Modes Sets intermediate speed reference 1 when d1-18 = 1 or 2.	Default: 0.00% <6> Min: 0.00% Max: 100.00% <6>	179
d1-21 (2C3H) RUN	Intermediate Speed 2	All Modes Sets intermediate speed reference 2 when d1-18 = 1 or 2.	Default: 0.00% <6> Min: 0.00% Max: 100.00% <6>	
d1-22 (2C4H) RUN	Intermediate Speed 3	All Modes Sets intermediate speed reference 3 when d1-18 = 1 or 3.	Default: 0.00% <6> Min: 0.00% Max: 100.00% <6>	

No.(Addr.)	Name	Description	Setting	Page
d1-23 (2C5H) RUN	Releveling Speed	All Modes Sets speed reference for releveling when d1-18 = 1 or 2.	Default: 0.00% <6> Min: 0.00% Max: 100.00% <6>	179
d1-24 (2C6H) RUN	Inspection Operation Speed	All Modes Sets speed reference when inspection operation is enabled.	Default: 50.00% <6> Min: 0.00% Max: 100.00% <6>	179
d1-25 (2C7H) RUN	Rescue Operation Speed	All Modes Sets the speed reference during inspection operation.	Default: 10.00% <6> Min: 0.00% Max: 100.00% <6>	179
d1-26 (2C8H) RUN	Leveling Speed	All Modes Sets leveling speed reference when d1-18 = 1 or 2.	Default: 8.00% <6> Min: 0.00% Max: 100.00% <6>	179
d1-27 (2C9H)	Motor 2 Speed Reference	V/f OLV CLV CLV/PM Sets the speed reference for motor 2. **Note:** 1. If set to 0.00, the drive will control motor 1 instead. 2. When using motor 2, be sure that the accel/decel times are set in parameters C1-12 and C1-13.	Default: 0.00 Hz Min: 0.00 Hz Max: 200.00 Hz	180
d1-28 (2CAH)	Leveling Speed Detection Level	All Modes Used when d1-18 = 0 or 3. If the speed reference selected is lower than d1-28, then the drive uses the leveling speed as the speed reference.	Default: 0.0% Min: 0.0% Max: 100.0%	180
d1-29 (2CBH)	Inspection Speed Detection Level	All Modes Used when d1-18 = 0 or 3. If the speed reference selected is higher than d1-28 but lower or equal to d1-29, then the drive uses inspection speed as the speed reference.	Default: 0.0% Min: 0.0% Max: 100.0%	180

<6> Setting ranges and defaults vary by the setting units determined by parameter o1-03.
Refer to Defaults and Setting Ranges by Display Unit Selection (o1-03) on page 420.

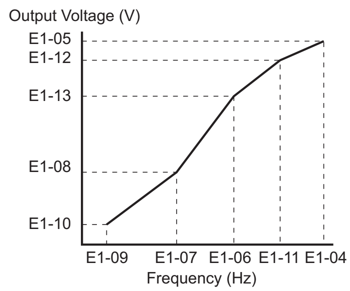
■ d6: Field Forcing

No.(Addr.)	Name	Description	Setting	Page
d6-03 (2A2H)	Field Forcing Selection	V/f OLV CLV CLV/PM 0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1	181
d6-06 (2A5H)	Field Forcing Limit	V/f OLV CLV CLV/PM Sets the upper limit of the excitation current command during magnetic field forcing. A setting of 100% is equal to motor no-load current. Disabled only during DC Injection Braking.	Default: 400% Min: 100% Max: 400%	181

◆ E: Motor Parameters

■ E1: V/f Pattern

No.(Addr.)	Name	Description	Setting	Page
E1-01 (300H)	Input Voltage Setting	All Modes This parameter must be set to the power supply voltage. **WARNING!** Electrical Shock Hazard. Drive input voltage (not motor voltage) must be set in E1-01 for the protective features of the drive to function properly. Failure to do so may result in equipment damage and/or death or personal injury.	Default: 230 V <9> Min: 155 V Max: 255 V <9>	182
E1-03 (302H)	V/f Pattern Selection	V/f OLV CLV CLV/PM F: Custom V/f, E1-04 through E1-13 settings define the V/f pattern	Default: F Min: – Max: F	182

No.(Addr.)	Name	Description	Setting	Page
E1-04 (303H)	Maximum Output Frequency	All Modes To set linear V/f characteristics, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Ensure that the five frequencies are set according to these rules: E1-09 ≤ E1-07 < E1-06 ≤ E1−11 ≤ E1-04 Note that if E1-11 = 0, then both E1-11 and E1-12 are disabled, and the above conditions do not apply.  **Note:** Some parameters may not be available depending on the control mode. • E1-07, E1-08 and E1-10 are available only in the V/f control and Open Loop Vector control modes. • E1-11, E1-12 and E-13 are available only in the V/f control and Closed Loop Vector control modes.	Default: <5> Min: <23> Max: 200.0 Hz	182
E1-05 (304H)	Maximum Voltage		Default: 230.0 V <9> Min: 0.0 V Max: 255.0 V <9>	
E1-06 (305H)	Base Frequency		Default: <5> Min: 0.0 Hz Max: 200.0 Hz	
E1-07 (306H)	Middle Output Frequency		Default: 3.0 Hz Min: 0.0 Hz Max: 200.0 Hz	
E1-08 (307H)	Middle Output Frequency Voltage		Default: <2> <9> Min: 0.0 V Max: 255.0 V <9>	
E1-09 (308H)	Minimum Output Frequency		Default: <5> Min: 0.0 Hz Max: 200.0 Hz	
E1-10 (309H)	Minimum Output Frequency Voltage		Default: <2> <9> Min: 0.0 V Max: 255.0 V <9>	
E1-11 (30AH) <11>	Middle Output Frequency 2		Default: 0.0 Hz Min: 0.0 Hz Max: 120.0 Hz	
E1-12 (30BH) <11>	Middle Output Frequency Voltage 2		Default: 0.0 V <9> Min: 0.0 V Max: 255.0 V <9>	
E1-13 (30CH) <13>	Base Voltage		Default: 0.0 V <9> Min: 0.0 V Max: 255.0 V <9>	

<2> Default setting is dependent on the control mode (A1-02) and the drive model (o2-04).
<5> Default setting is determined by the control mode (A1-02).
<9> Values shown here are for 200 V class drives. The default is 400 V when using a 400 V class drive.
<11> Parameter is ignored when E1-11 and E1-12 are set to 0.0.
<13> When E1-13 (Base Voltage) is set to 0.0, output voltage is controlled with E1-05 (Maximum Voltage) = E1-13. When Auto-Tuning is performed, E1-05 and E1-13 are automatically set to the same value.
<23> Setting range depends on the type of motor being used. CLV allows a setting range of 10.0 to 120.0 Hz, while CLV/PM allows a setting range of 4.0 to 120.0 Hz.

■ E2: Motor Parameters

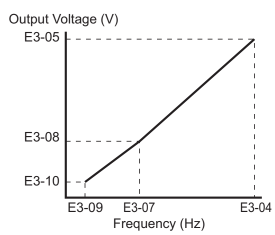
No.(Addr.)	Name	Description	Setting	Page
E2-01 (30EH)	Motor Rated Current	V/f OLV CLV CLV/PM Sets the motor nameplate full load current in Amps. Automatically set during Auto-Tuning.	Default: <4> Min: 10% of drive rated current Max: 200% of drive rated current <10>	183
E2-02 (30FH)	Motor Rated Slip	V/f OLV CLV CLV/PM Sets the motor rated slip. Automatically set during Auto-Tuning.	Default: <4> Min: 0.00 Hz Max: 20.00 Hz	183
E2-03 (310H)	Motor No-Load Current	V/f OLV CLV CLV/PM Sets the no-load current for the motor. Automatically set during Auto-Tuning.	Default: <4> Min: 0 A Max: E2-01 <10>	183
E2-04 (311H)	Number of Motor Poles	V/f OLV CLV CLV/PM Sets the number of motor poles. Automatically set during Auto-Tuning.	Default: 4 Min: 2 Max: 48	184
E2-05 (312H)	Motor Line-to-Line Resistance	V/f OLV CLV CLV/PM Sets the phase-to-phase motor resistance. Automatically set during Auto-Tuning.	Default: <4> Min: 0.000 Ω Max: 65.000 Ω	184
E2-06 (313H)	Motor Leakage Inductance	V/f OLV CLV CLV/PM Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage. Automatically set during Auto-Tuning.	Default: <4> Min: 0.0% Max: 40.0%	184
E2-07 (314H)	Motor Iron-Core Saturation Coefficient 1	V/f OLV CLV CLV/PM Sets the motor iron saturation coefficient at 50% of magnetic flux. Automatically set during Auto-Tuning.	Default: 0.50 Min: 0.00 Max: 0.50	184
E2-08 (315H)	Motor Iron-Core Saturation Coefficient 2	V/f OLV CLV CLV/PM Sets the motor iron saturation coefficient at 75% of magnetic flux. Automatically set during Auto-Tuning.	Default: 0.75 Min: E2-07 Max: 0.75	184

No.(Addr.)	Name	Description	Setting	Page
E2-09 (316H)	Motor Mechanical Loss	V/f **OLV** **CLV** CLV/PM Sets the motor mechanical loss as a percentage of motor rated power (kW).	Default: 0.0% Min: 0.0% Max: 10.0%	184
E2-10 (317H)	Motor Iron Loss for Torque Compensation	**V/f** OLV CLV CLV/PM Sets the motor iron loss.	Default: <4> Min: 0 W Max: 65535 W	185
E2-11 (318H)	Motor Rated Power	**V/f** **OLV** **CLV** CLV/PM Sets the motor rated power in kilowatts (1 HP = 0.746 kW). Automatically set during Auto-Tuning.	Default: <4> Min: 0.00 kW Max: 650.00 kW	185

<4> Default setting value varies by the drive model (o2-04).
<10> The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.

■ E3: V/f Pattern for Motor 2

These parameters are hidden when a PM motor control mode has been selected for motor 1 (A1-02 = 7).

No.(Addr.)	Name	Description	Setting	Page
E3-04 (31AH)	Motor 2 Maximum Output Frequency	**V/f** **OLV** **CLV** CLV/PM These parameters are only applicable when E1-03 is set to F. To set linear V/f characteristics, set the same values for E3-07 and E3-09. In this case, the setting for E3-08 will be disregarded. Ensure that the three frequencies are set according to these rules or an oPE10 fault will occur: E3-09 ≤ E3-07 < E3-06 ≤ E3-04  	Default: 60.0 Hz Min: 10.0 Hz Max: 200.0 Hz	186
E3-05 (31BH)	Motor 2 Maximum Voltage		Default: 230.0 V Min: 0.0 V Max: 255.0 V <9>	
E3-06 (31CH)	Motor 2 Base Frequency		Default: 60.0 Hz Min: 0.0 Hz Max: 200.0 Hz	
E3-07 (31DH)	Motor 2 Mid Output Frequency		Default: 3.0 Hz Min: 0.0 Hz Max: 200.0 Hz	
E3-08 (31EH)	Motor 2 Mid Output Frequency Voltage		Default: <4> Min: 0.0 V Max: 255.0 V <9>	
E3-09 (31FH)	Motor 2 Minimum Output Frequency		Default: 1.5 Hz Min: 0.0 Hz Max: 200.0 Hz	
E3-10 (320H)	Motor 2 Minimum Output Frequency Voltage		Default: <4> Min: 0.0 V Max: 255.0 V <9>	

<4> Default setting value is dependent on the drive model (o2-04).
<9> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

■ E4: Motor 2 Parameters

These parameters are hidden when a PM motor control mode has been selected for motor 1 (A1-02 = 7).

No.(Addr.)	Name	Description	Setting	Page
E4-01 (321H)	Motor 2 Rated Current	**V/f** **OLV** **CLV** CLV/PM Sets the full load current for motor 2. Automatically set during Auto-Tuning.	Default: <4> Min: 10% of drive rated current Max: 200% of drive rated current <10>	187
E4-02 (322H)	Motor 2 Rated Slip	**V/f** **OLV** **CLV** CLV/PM Sets the rated slip for motor 2. Automatically set during Auto-Tuning.	Default: <4> Min: 0.00 Hz Min: 20.00 Hz	187
E4-03 (323H)	Motor 2 Rated No-Load Current	**V/f** **OLV** **CLV** CLV/PM Sets the no-load current for motor 2. Automatically set during Auto-Tuning.	Default: <4> Min: 0 A Min: [E4-01] <10>	187
E4-04 (324H)	Motor 2 Motor Poles	**V/f** **OLV** **CLV** CLV/PM Sets the number of poles of motor 2. Automatically set during Auto-Tuning.	Default: 4 Min: 2 Max: 48	187
E4-05 (325H)	Motor 2 Line-to-Line Resistance	**V/f** **OLV** **CLV** CLV/PM Sets the phase-to-phase resistance for motor 2. Automatically set during Auto-Tuning.	Default: <4> Min: 0.000 Ω Max: 65.000 Ω	188
E4-06 (326H)	Motor 2 Leakage Inductance	**V/f** **OLV** **CLV** CLV/PM Sets the voltage drop for motor 2 due to motor leakage inductance as a percentage of rated voltage. Automatically set during Auto-Tuning.	Default: <4> Min: 0.0% Max: 40.0%	188

<4> Default setting value is dependent on the drive model (o2-04).
<10> The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.

■ E5: PM Motor Settings

No.(Addr.)	Name	Description	Setting	Page
E5-02 (32AH) <1>	Motor Rated Power	V/f OLV CLV CLV/PM Sets the rated capacity of the motor.	Default: <2> Min: 0.10 kW Max: 650.00 kW	188
E5-03 (32BH) <1>	Motor Rated Current	V/f OLV CLV CLV/PM Sets the motor rated current.	Default: <2> Min: 10% of drive rated current Max: 200% of drive rated current <3>	188
E5-04 (32CH) <1>	Number of Motor Poles	V/f OLV CLV CLV/PM Sets the number of motor poles.	Default: 12 Min: 2 Max: 120 <4>	188
E5-05 (32DH) <1>	Motor Stator Resistance (Single Phase)	V/f OLV CLV CLV/PM Sets the stator resistance (1 phase value).	Default: <2> Min: 0.000 Ω Max: 65.000 Ω	188
E5-06 (32EH) <1>	Motor d-Axis Inductance	V/f OLV CLV CLV/PM Sets the d-axis inductance.	Default: <2> Min: 0.00 mH Max: 600.00 mH	189
E5-07 (32FH) <1>	Motor q-Axis Inductance	V/f OLV CLV CLV/PM Sets the q-axis inductance.	Default: <2> Min: 0.00 mH Max: 600.00 mH	189
E5-09 (331H) <1>	Motor Induction Voltage Constant 1	V/f OLV CLV CLV/PM Sets the induced phase peak voltage in units of 0.1 mV (rad/s) [electrical angle]. When setting this parameter, E5-24 should be set to 0.0.	Default: <2> Min: 0.0 mV/(rad/s) Max: 6500.0 mV/(rad/s)	189
E5-11 (333H)	Encoder Offset	V/f OLV CLV CLV/PM Sets the offset between the rotor magnetic axis and the encoder zero position. Set during Encoder Offset Tuning.	Default: 0.0 deg Min: -180 deg Max: 180 deg	189
E5-24 (353H)	Motor Induction Voltage Constant 2	V/f OLV CLV CLV/PM Sets the induced phase-to-phase rms voltage in units of 0.1 mV/(r/min) [mechanical angle]. When setting this parameter, E5-09 should be set to 0.0.	Default: 0.0 mV/(r/min) Min: 0.0 mV/(r/min) Max: 6500.0 mV/(r/min)	189

<1> Parameter setting value is not reset to the default value when the drive is initialized.
<2> Default setting value is determined by the drive model (o2-04).
<3> The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.
<4> Maximum setting is 48 when PG-E3 option is connected.

◆ F: Option Settings

F parameters are used to program the drive for Encoder and PG feedback from the motor and to function with option cards.

■ F1: PG Speed Control Card

No.(Addr.)	Name	Description	Setting	Page
F1-01 (380H)	Encoder 1 Resolution	V/f OLV CLV CLV/PM Sets the encoder resolution (number of pulses per revolution)	Default: <1> Min: 1 ppr Max: 60000 ppr <2>	190
F1-02 (381H)	Operation Selection at PG Open Circuit (PGo)	V/f OLV CLV CLV/PM 0: Ramp to stop. Decelerate to stop using the deceleration ramp in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration ramp in C1-09. 3: Alarm only.	Default: 1 Min: 0 Max: 3	190

No.(Addr.)	Name	Description	Setting	Page
F1-03 (382H)	Operation Selection at Overspeed (oS)	V/f OLV CLV CLV/PM 0: Ramp to stop. Decelerate to stop using the deceleration ramp in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration ramp in C1-09. 3: Alarm only.	Default: 1 Min: 0 Max: 3	190
F1-04 (383H)	Operation Selection at Deviation	V/f OLV CLV CLV/PM 0: Ramp to stop. Decelerate to stop using the deceleration ramp in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration ramp in C1-09. 3: Alarm only.	Default: 3 Min: 0 Max: 3	190
F1-05 (384H)	Encoder 1 Rotation Direction Selection	V/f OLV CLV CLV/PM 0: A phase leads B in up direction 1: B phase leads A in up direction	Default: <1> Min: 0 Max: 1	191
F1-06 (385H)	PG 1 Pulse Monitor Output Division Ratio	V/f OLV CLV CLV/PM Sets the division ratio for the pulse monitor used of the PG option card installed to connector CN5-C. By setting "xyz", the division ratio becomes = [(1 + x) / yz]. If only using the A pulse for one track input, then the input ratio will be 1:1, regardless of what F1-06 is set to.	Default: 1 Min: 1 Max: 132	191
F1-08 (387H)	Overspeed Detection Level	V/f OLV CLV CLV/PM Sets the overspeed detection level as a percentage of the maximum output frequency.	Default: 115% Min: 0% Max: 120%	190
F1-09 (388H)	Overspeed Detection Delay Time	V/f OLV CLV CLV/PM Sets the time in seconds for an overspeed situation to trigger a fault (oS).	Default: 0.0 s Min: 0.0 s Max: 2.0 s	190
F1-10 (389H)	Excessive Speed Deviation Detection Level	V/f OLV CLV CLV/PM Sets the speed deviation detection level as a percentage of the maximum output frequency.	Default: 10% Min: 0% Max: 50%	190
F1-11 (38AH)	Excessive Speed Deviation Detection Delay Time	V/f OLV CLV CLV/PM Sets the time in seconds for a speed deviation situation to trigger a fault (dEv).	Default: 0.5 s Min: 0.0 s Max: 10.0 s	190
F1-14 (38DH)	PG Open-Circuit Detection Time	V/f OLV CLV CLV/PM Sets the time required to trigger a PG Open fault (PGo).	Default: 2.0 s Min: 0.0 s Max: 10.0 s	190
F1-18 (3ADH)	dv3 Detection Selection	V/f OLV CLV CLV/PM 0: Disabled n: Sets the number of dv3 situations that may be detected before triggering an actual dv3 fault.	Default: 10 Min: 0 Max: 10	191
F1-19 (3AEH)	dv4 Detection Selection	V/f OLV CLV CLV/PM 0: Disabled n: Number of pulses that the A and B pulse are reversed that triggers dv4 detection.	Default: 128 Min: 0 Max: 5000	191
F1-20 (3B4H)	PG Option Card Disconnect Detection 1	V/f OLV CLV CLV/PM 0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1	192
F1-29 (3BFH)	dEv Detection Condition Selection	V/f OLV CLV CLV/PM Selects when DEV is active. 0: After speed reference, soft starter output and motor speed have matched once. 1: After speed reference and soft starter output have matched once. 2: Always during Run	Default: 2 Min: 0 Max: 2	192
F1-50 (3D2H)	Encoder Selection	V/f OLV CLV CLV/PM Selects the encoder connected the PG-F3 option. 0: EnDat 2.1/01, 2.2/01 Serial Communication + Sin/Cos 1: EnDat 2.2/22 Serial Communication 2: Hiperface	Default: 0 Min: 0 Max: 2	192
F1-51 (3D3H)	PGoH Detection Level	V/f OLV CLV CLV/PM Sets the level for detecting PG Hardware Fault (PGoH). Available when F1-20 = 1	Default: 80% Min: 1% Max: 100%	192
F1-52 (3D4H)	Communication Speed of Serial Encoder Selection	V/f OLV CLV CLV/PM Selects the communication speed between the PG-F3 option and serial encoder. 0: 1M bps/9600 bps 1: 500k bps/19200 bps 2: 1M bps/38400 bps 3: 1M bps/38400 bps	Default: 0 Min: 0 Max: 3	193
F1-63 (2DFH)	PG-E3 R Track Selection	V/f OLV CLV CLV/PM 0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1	193

No.(Addr.)	Name	Description	Setting	Page
F1-66 to F1-81 (B9AH to BA9H)	PG-E3 Encoder Adjust 1 to 16	V/f OLV CLV **CLV/PM** Sets encoder offsets 1 to 16 for the PG-E3 option card. These parameters are automatically set by the execution of Auto-Tuning of PG-E3 encoder characteristics.	Default: 0 Min: 0 Max: FFFF	193

<1> Default setting is determined by the control mode (A1-02).
<2> Setting range is 1 to 15000 ppr when the drive is set for CLV/PM.

■ F3: Digital Input Card (DI-A3)

No.(Addr.)	Name	Description	Setting	Page
F3-01 (390H)	DI-A3 Option Card Input Selection	**All Modes** 0: BCD, 1% units 1: BCD, 0.1% units 2: BCD, 0.01% units 3: BCD, 1 Hz units 4: BCD, 0.1 Hz units 5: BCD, 0.01 Hz units 6: BCD customized setting (5 digit), 0.02 Hz units 7: Binary input The unit and the setting range are determined by F3-03. F3-03 = 0: 255/100% (-255 to +255) F3-03 = 1: 40961/100% (-4095 to +4095) F3-03 = 2: 30000/100% (-33000 to +33000) When the digital operator units are set to be displayed in Hertz or user-set units (o1-03 = 2 or 3), the units for F3-01 are determined by parameter o1-03.	Default: 0 Min: 0 Max: 7	193
F3-03 (3B9H)	DI-A3 Option Card Data Length Selection	**All Modes** 0: 8 bit 1: 12 bit 2: 16 bit	Default: 2 Min: 0 Max: 2	194

■ F4: Analog Monitor Card (AO-A3)

No.(Addr.)	Name	Description	Setting	Page
F4-01 (391H)	Terminal V1 Function Selection	**All Modes** Sets the monitor signal for output from terminal V1. Set this parameter to the last three digits of the desired U□-□□ monitor. Some U parameters are available only in certain control modes.	Default: 102 Min: 000 Max: 999	194
F4-02 (392H) RUN	Terminal V1 Gain	**All Modes** Sets the gain for voltage output via terminal V1.	Default: 100.0% Min: -999.9% Max: 999.9%	194
F4-03 (393H)	Terminal V2 Function Selection	**All Modes** Sets the monitor signal for output from terminal V2. Set this parameter to the last three digits of the desired U□-□□ monitor. Some U parameters are available only in certain control modes.	Default: 103 Min: 000 Max: 999	190
F4-04 (394H) RUN	Terminal V2 Gain	**All Modes** Sets the gain for voltage output via terminal V2.	Default: 50.0% Min: -999.9% Max: 999.9%	194
F4-05 (395H) RUN	Terminal V1 Bias	**All Modes** Sets the amount of bias added to the voltage output via terminal V1.	Default: 0.0% Min: -999.9% Max: 999.9%	
F4-06 (396H) RUN	Terminal V2 Bias	**All Modes** Sets the amount of bias added to the voltage output via terminal V2.	Default: 0.0% Min: -999.9% Max: 999.9%	
F4-07 (397H)	Terminal V1 Signal Level Selection	**All Modes** 0: 0 to 10 V 1: -10 to 10 V	Default: 1 Min: 0 Max: 1	195
F4-08 (398H)	Terminal V2 Signal Level Selection		Default: 1 Min: 0 Max: 1	

■ F5: Digital Output Card (DO-A3)

No.(Addr.)	Name	Description	Setting	Page
F5-01 (399H)	Terminal P1-PC Output Selection	All Modes Sets the function for contact output terminals M1-M2, M3-M4, and photocoupler output terminals P1 through P6.	Default: 0 Min: 0 Max: 161	195
F5-02 (39AH)	Terminal P2-PC Output Selection		Default: 1 Min: 0 Max: 161	
F5-03 (39BH)	Terminal P3-PC Output Selection		Default: 2 Min: 0 Max: 161	
F5-04 (39CH)	Terminal P4-PC Output Selection		Default: 4 Min: 0 Max: 161	
F5-05 (39DH)	Terminal P5-PC Output Selection		Default: 6 Min: 0 Max: 161	
F5-06 (39EH)	Terminal P6-PC Output Selection		Default: 37 Min: 0 Max: 161	
F5-07 (39FH)	Terminal M1-M2 Output Selection		Default: F Min: 0 Max: 161	
F5-08 (3A0H)	Terminal M3-M4 Output Selection		Default: F Min: 0 Max: 161	
F5-09 (3A1H)	DO-A3 Output Mode Selection	All Modes 0: Output terminals are each assigned separate output functions. 1: Binary code output 2: Use output terminal functions selected by parameters F5-01 through F5-08.	Default: 0 Min: 0 Max: 2	195

■ F6: Communication Option Card

For more details on a specific option card, refer to the instruction manual for the option card.

No.(Addr.)	Name	Description	Setting	Page
F6-01 (3A2H)	Operation Selection after Communications Error	All Modes 0: Ramp to stop. Decelerate to stop using the deceleration ramp in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration ramp in C1-09. 3: Alarm only.	Default: 1 Min: 0 Max: 3	195
F6-02 (3A3H)	External Fault from Communication Option Detection Selection	All Modes 0: Always detected 1: Detection during run only	Default: 0 Min: 0 Max: 1	196
F6-03 (3A4H)	External Fault from Communication Option Operation Selection	All Modes 0: Ramp to stop. Decelerate to stop using the deceleration ramp in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration ramp in C1-09. 3: Alarm only.	Default: 1 Min: 0 Max: 3	196
F6-04 (3A5H)	bUS Error Detection Time	All Modes Sets the delay time for error detection if a bus error occurs.	Default: 2.0 s Min: 0.0 s Max: 5.0 s	196
F6-06 (3A7H)	Torque Limit Selection from Communications Option	V/f OLV CLV CLV/PM 0: Disabled. Torque limit from option card disabled. 1: Enabled. Torque limit from option card enabled.	Default: 0 Min: 0 Max: 1	196
F6-08 (36AH) <1>	Reset Communication Parameter	All Modes 0: Communication-related parameters (F6-□□) are not reset when the drive is initialized using A1-03. 1: Reset all communication-related parameters (F6-□□) when the drive is initialized using A1-03.	Default: 0 Min: 0 Max: 1	196
F6-35 (3D0H)	CANopen Node ID	All Modes Sets the node address.	Default: 0 Min: 0 Max: 126	–

No.(Addr.)	Name	Description	Setting	Page
F6-36 (3D1H)	CANopen Communication Speed	All Modes 0: Auto-detection 1: 10 kbps 2: 20 kbps 3: 50 kbps 4: 125 kbps 5: 250 kbps 6: 500 kbps 7: 800 kbps 8: 1 Mbps	Default: 6 Min: 0 Max: 8	–

<1> Parameter setting value is not reset to the default value when the drive is initialized.

◆ H: Multi-Function Terminals

H parameters assign functions to the multi-function input and output terminals.

■ H1: Multi-Function Digital Inputs

No.(Addr.)	Name	Description	Setting	Page
H1-03 (400H)	Terminal S3 Function Selection	All Modes Assigns a function to the multi-function digital inputs. Refer to page ***384*** to page ***386*** for a description of setting values. **Note:** Unused terminals should be set to F.	Default: <19> Min: 3 Max: 79	197
H1-04 (401H)	Terminal S4 Function Selection		Default: <19> Min: 3 Max: 79	
H1-05 (402H)	Terminal S5 Function Selection		Default: <19> Min: 3 Max: 79	
H1-06 (403H)	Terminal S6 Function Selection		Default: <19> Min: 3 Max: 79	
H1-07 (404H)	Terminal S7 Function Selection		Default: <19> Min: 3 Max: 79	
H1-08 (405H)	Terminal S8 Function Selection		Default: F Min: 3 Max: 79	

<19> With the speed reference priority d1-18 is set to 0 or 3, the default settings for parameters H1-03 to H1-07 governing input terminals S3 to S7 are: 24, 14, 3, 4, and 5 respectively. When d1-18 is set to 1 or 2, the default settings for H1-03 to H1-07 become 50, 54, 51, 53, and F respectively.

H1 Multi-Function Digital Input Settings			
H1-□□ Setting	**Function**	**Description**	**Page**
3	Multi-Step Speed Reference 1	All Modes When input terminals are set to Multi-Step Speed References 1 through 3, switching combinations of those terminals will create a multi-step speed sequence using the speed references set in d1-01 through d1-08.	197
4	Multi-Step Speed Reference 2		
5	Multi-Step Speed Reference 3		
6	Jog reference selection	All Modes Closed: Jog frequency reference (d1-17) selected. The Jog frequency can be used when the speed reference selection is not assigned to input terminals (b1-01 ≠ 1) and the speed reference priority is set to use the multi-step speed reference (d1-18 = 0 or 3).	197
7	Accel/decel Ramp Selection 1	All Modes Used to switch between accel/decel ramp 1 (set in C1-01, C1-02) and accel/decel ramp 2 (set in C1-03, C1-04). When combined with another input terminal set for "Accel/Decel ramp 2" (H1-□□ = 1A), the drive can also switch between accel/decel ramp 3 (set in C1-05, C1-06) and accel/decel ramp 4 (set in C1-07, C1-08).	198
8	Baseblock Command (N.O.)	All Modes Closed: No drive output	198
9	Baseblock Command (N.C.)	All Modes Open: No drive output	
F	Not Used (Through Mode)	All Modes Select this setting when the terminal is not used or when using the terminal in the pass-through mode. The terminal does not trigger a drive function but can be used as digital input for the controller the drive is connected to.	198

H1 Multi-Function Digital Input Settings			
H1-□□ Setting	Function	Description	Page
14	Fault Reset	All Modes Closed: Resets faults if the cause is cleared and the Up/Down command is removed.	198
15	Fast Stop (N.O.)	All Modes Closed: Decelerates to stop at the Fast Stop ramp set to C1-09.	198
16	Motor 2 Selection	All Modes Open: Motor 1(E1-□□, E3-□□) Closed: Motor 2 (E2-□□, E4-□□)	199
17	Fast Stop (N.C.)	All Modes Open: Decelerates to stop at the Fast Stop ramp set to C1-09.	198
18	Timer Function Input	All Modes Triggers the timer set up by parameters b4-01 and b4-02. Must be set in conjunction with the timer function output (H2-□□ = 12).	199
1A	Accel/decel Ramp Selection 2	All Modes Used in conjunction with an input terminal set for “Accel/decel ramp selection 1” (H1-□□ = 7), and allows the drive to switch between accel/decel ramp 3 and 4.	199
20 to 2F	External Fault	All Modes 20: N.O., Always detected, ramp to stop 21: N.C., Always detected, ramp to stop 22: N.O., During run, ramp to stop 23: N.C., During run, ramp to stop 24: N.O., Always detected, coast to stop 25: N.C., Always detected, coast to stop 26: N.O., During run, coast to stop 27: N.C., During run, coast to stop 28: N.O., Always detected, Fast Stop 29: N.C., Always detected, Fast Stop 2A: N.O., During run, Fast Stop 2B: N.C., During run, Fast Stop 2C: N.O., Always detected, alarm only (continue running) 2D: N.C., Always detected, alarm only (continue running) 2E: N.O., During run, alarm only (continue running) 2F: N.C., During run, alarm only (continue running)	200
50	Nominal Speed	All Modes Closed: Activates the nominal speed (d1-19).	200
51	Intermediate Speed	All Modes Closed: Activates the Intermediate Speed (d1-20).	200
52	Releveling Speed	All Modes Closed: Activates the Releveling Speed (d1-23).	200
53	Leveling Speed	All Modes Closed: Activates the Leveling Speed (d1-26).	201
54	Inspection Operation	All Modes Closed: Activates Inspection operation using the speed set in d1-24.	201
55	Rescue Operation	All Modes Closed: Activates rescue operation.	201
56	Motor Contactor Feedback	All Modes Used for motor contactor supervision and fault detection.	201
57	High Speed Limit (Up)	All Modes Closed: Uses the leveling speed as the maximum speed when going up.	201
58	High Speed Limit (Down)	All Modes Closed: Uses the leveling speed as the maximum speed when going down.	201
5A	Motor Contactor Feedback 2	All Modes Open: Motor contactor closed (N.C.) <1> Closed: Motor contactor open	201
5B	Brake Feedback 2	All Modes Open: Brake open (N.C.) <2> Closed: Brake closed	201

H1 Multi-Function Digital Input Settings			
H1-□□ Setting	Function	Description	Page
5C	Floor Sensor	V/f OLV CLV CLV/PM Closed: Initiate Direct Landing (S5-10 = 1)	201
67	Communications Test Mode	All Modes Tests the MEMOBUS/Modbus RS-485/422 interface. Displays “PASS” if the test completes successfully.	201
79	Brake Feedback	All Modes Used for brake supervision and detection of incorrect operation.	201

<1> Motor Contactor Feedback (H1-□□ = 56) = Normally open (N.O.).
<2> Brake Feedback (H1-□□ = 79) = Normally open (N.O).

■ H2: Multi-Function Digital Outputs

No.(Addr.)	Name	Description	Setting	Page
H2-01 (40BH)	Terminals M1-M2 Function Selection (relay)	All Modes Refer to *H2 Multi-Function Digital Output Settings on page 386* for a description of setting values.	Default: 50 Min: 0 Max: 161	201
H2-02 (40CH)	Terminals M3-M4 Function Selection (relay)		Default: 51 Min: 0 Max: 161	
H2-03 (40DH)	Terminals M5-M6 Function Selection (relay)		Default: 6 Min: 0 Max: 161	
H2-04 (40EH)	Terminal P1-C1 Function Selection (photocoupler)		Default: 37 Min: 0 Max: 161	
H2-05 (40FH)	Terminal P2-C2 Function Selection (photocoupler)		Default: F Min: 0 Max: 161	

H2 Multi-Function Digital Output Settings			
H2-□□ Setting	Function	Description	Page
0	During Run	All Modes Closed: An Up/Down command is active or voltage is output.	202
1	Zero Speed	All Modes Open: Output speed is greater than the value of E1-09 (Minimum Output Frequency) or S1-01 (Zero Speed Level at Stop). Closed: Output frequency is less than or equal to the value of E1-09 (Minimum Output Frequency) or S1-01 (Zero Speed Level at Stop).	202
2	Speed Agree 1	All Modes Closed: Output speed equals the speed reference (plus or minus the hysteresis set to L4-02).	203
3	User-set Speed Agree 1	All Modes Closed: Output speed and speed reference equal L4-01 (plus or minus the hysteresis set to L4-02).	204
4	Speed Detection 1	All Modes Closed: Output speed is less than or equal to the value in L4-01 with hysteresis determined by L4-02.	204
5	Speed Detection 2	All Modes Closed: Output speed is greater than or equal to the value in L4-01 with hysteresis determined by L4-02.	204
6	Drive Ready (READY)	All Modes Closed: Power up is complete and the drive is ready to accept an Up/Down command.	205
7	DC Bus Undervoltage	All Modes Closed: DC bus voltage is below the Uv trip level set in L2-05.	205
8	During Baseblock (N.O.)	All Modes Closed: Drive has entered the baseblock state (no output voltage).	205
9	Speed Reference Source	All Modes Open: The speed reference is supplied by an external reference (set in b1-01). Closed: Digital operator supplies the speed reference.	205

H2-□□ Setting	Function	Description	Page
		H2 Multi-Function Digital Output Settings	
A	Up/Down Command Source	All Modes Open: The Up/Down command is supplied by an external reference (set in b1-02). Closed: Digital operator supplies the Up/Down command.	205
B	Torque Detection 1	All Modes Closed: An overtorque or undertorque situation has been detected.	206
E	Fault	All Modes Closed: Fault occurred. (excluding CPF00 and CPF01)	206
F	Not used (Through Mode)	All Modes Set this value when the terminal is not used or when using the terminal in the pass-through mode.	206
10	Minor Fault	All Modes Closed: An alarm has been triggered, or the IGBTs have reached 90% of their expected life span.	206
11	Fault Reset Command Active	All Modes Closed: The drive has received a reset command from the multi-function input terminals or from serial network, or the digital operator's RESET key has been pressed.	206
12	Timer Output	All Modes Closed: Timer output.	206
13	Speed Agree 2	All Modes Closed: When drive output frequency equals the speed reference ±L4-04.	206
14	User-set Speed Agree 2	All Modes Closed: When the drive output speed is equal to the value in L4-03 ±L4-04.	207
15	Speed Detection 3	All Modes Closed: When the drive output speed is less than or equal to the value in L4-03 ±L4-04.	207
16	Speed Detection 4	All Modes Closed: When the output speed is greater than or equal to the value in L4-03 ±L4-04.	208
18	Torque Detection 2	All Modes Closed: Overtorque or undertorque has been detected.	206
1A	During Down Direction	All Modes Closed: Drive is running in the down direction.	208
1B	During Baseblock 2 (N.C.)	All Modes Open: Drive has entered the baseblock state (no output voltage).	208
1C	Motor 2 Selection	V/f OLV CLV CLV/PM Open: Motor 1 is selected Closed: Motor 2 is selected	209
1D	During Regeneration	V/f OLV CLV CLV/PM Closed: Motor is operated in regenerative mode.	209
1E	Reset Enabled	All Modes Closed: An automatic reset is performed	209
1F	Motor Overload Alarm (oL1)	All Modes Closed: oL1 is at 90% of its trip point or greater. An oH3 situation also triggers this alarm.	209
20	Drive Overheat Pre-alarm (oH)	All Modes Closed: Heatsink temperature exceeds the parameter L8-02 value.	209
2F	Maintenance Period	All Modes Closed: Cooling fan, electrolytic capacitors, IGBTs, or the soft charge bypass relay may require maintenance.	209
30	During Torque Limit	V/f OLV CLV CLV/PM Closed: When the torque limit has been reached.	209
33	Within Position Lock Bandwidth	V/f OLV CLV CLV/PM Closed: Position deviation is within the Position Lock Bandwidth.	209

H2 Multi-Function Digital Output Settings			
H2-☐☐ Setting	Function	Description	Page
37	During Frequency Output	All Modes Open: No frequency output from drive when stopped with baseblock, stopped with DC injection braking during initial excitation, or stopped with short circuit braking. Closed: Drive is outputting a frequency.	209
47	Input Phase Loss	All Modes Closed: Input phase loss has occurred Open: Normal operation (no phase loss detected)	210
4E	Braking Transistor Fault (rr)	All Modes Closed: The built-in dynamic braking transistor failed. **Note:** This function is not available in models 2A0181 to 2A0432 and 4A0094 to 4A0225.	210
50	Brake Control	All Modes Close: Release brake Open: Apply brake	210
51	Output Contactor Control	All Modes Closed: Close output contactor	210
52	Door Zone Reached	All Modes Closed: Indicates that the door zone has been reached.	210
54	Light Load Direction	All Modes Closed: Light load direction is up Open: Light load direction is down	210
55	Light Load Direction Detection Status	All Modes Closed: Ready for Light Load Direction Search Open: Light Load Detection in progress	210
58	Safe Disable Status	All Modes Closed: Safe Disable terminals H1-HC and H2-HC are open, drive is in a baseblock state Open: Safe Disable terminals H1-HC and H2-HC are closed (normal operation)	210
5C	Motor Current Monitor	All Modes Open: Output current is greater than the value of L8-99 Closed: Output current is less than or equal to the value of L8-99	210
60	Internal Cooling Fan Alarm	All Modes Closed: Internal cooling fan alarm	210
61	Motor Pole Search Status	V/f OLV CLV CLV/PM Closed: Motor pole search successful	211
100 to 161	Function 0 to 61 with Inverse Output	All Modes Inverts the output switching of the multi-function output functions. Sets the last two digits of 1☐☐ to reverse the output signal of that specific function.	211

■ H3: Multi-Function Analog Inputs

No.(Addr.)	Name	Description	Setting	Page
H3-01 (410H)	Terminal A1 Signal Level Selection	All Modes 0: 0 to 10 V 1: –10 to 10 V	Default: 0 Min: 0 Max: 1	211
H3-02 (434H)	Terminal A1 Function Selection	All Modes Sets the function of terminal A1.	Default: 0 Min: 0 Max: 1F	211
H3-03 (411H) RUN	Terminal A1 Gain Setting	All Modes Sets the level of the input value selected in H3-02 when 10 V is input at terminal A1.	Default: 100.0% Min: -999.9% Max: 999.9%	212
H3-04 (412H) RUN	Terminal A1 Bias Setting	All Modes Sets the level of the input value selected in H3-02 when 0 V is input at terminal A1.	Default: 0.0% Min: -999.9% Max: 999.9%	212
H3-09 (417H)	Terminal A2 Signal Level Selection	All Modes 0: 0 to 10 V 1: –10 to 10 V **Note:** Use DIP switch S1 to set input terminal A2 for a current or a voltage input signal.	Default: 0 Min: 0 Max: 0	212

No.(Addr.)	Name	Description	Setting	Page
H3-10 (418H)	Terminal A2 Function Selection	All Modes Sets the function of terminal A2.	Default: 0 Min: 0 Max: 1F	213
H3-11 (419H) RUN	Terminal A2 Gain Setting	All Modes Sets the level of the input value selected in H3-10 when 10 V is input at terminal A2.	Default: 100.0% Min: -999.9% Max: 999.9%	213
H3-12 (41AH) RUN	Terminal A2 Bias Setting	All Modes Sets the level of the input value selected in H3-10 when 0 V is input at terminal A2.	Default: 0.0% Min: -999.9% Max: 999.9%	
H3-13 (41BH)	Analog Input Filter Time Constant	All Modes Sets a primary delay filter time constant for terminals A1 and A2. Used for noise filtering.	Default: 0.03 s Min: 0.00 s Max: 2.00 s	213
H3-16 (2F0H)	Offset for Terminal A1	All Modes Applies an offset to analog input A1. Can be used for zero adjustment of the analog input.	Default: 0 Min: -500 Max: 500	213
H3-17 (2F1H)	Offset for Terminal A2	All Modes Applies an offset to analog input A2. Can be used for zero adjustment of the analog input.	Default: 0 Min: -500 Max: 500	

H3 Multi-Function Analog Input Settings (H3-02 and H3-10)			
Setting	**Function**	**Description (For when output is 100%)**	**Page**
0	Speed Reference Bias (value added to input signal when multiple analog terminals supply the speed reference)	All Modes E1-04 (maximum output frequency)	214
2	Auxiliary Speed Reference 1 (used as a second speed reference)	All Modes E1-04 (maximum output frequency)	214
3	Auxiliary Speed Reference 2 (used as third speed reference)	All Modes E1-04 (maximum output frequency)	214
E	Motor Temperature (PTC thermistor input)	All Modes oH3 Alarm detection level: 1.18 V oH4 Fault detection level: 2.293 V	214
14	Torque Compensation (load cell input)	V/f OLV CLV CLV/PM 10 V = Motor rated torque	214
1F	Not used (Through Mode)	All Modes Sets this value when the terminal is not used or when using the terminal in the pass-through mode.	214

■ H4: Analog Outputs

No.(Addr.)	Name	Description	Setting	Page
H4-01 (41DH)	Terminal FM Monitor Selection	All Modes Selects the data to be output through multi-function analog output terminal FM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter “103” for U1-03.	Default: 102 Min: 000 Max: 999	214
H4-02 (41EH) RUN	Terminal FM Gain	All Modes Sets the signal level at terminal FM that is equal to 100% of the selected monitor value.	Default: 100.0% Min: -999.9% Max: 999.9%	215
H4-03 (41FH) RUN	Terminal FM Bias	All Modes Sets the bias value added to the terminal FM output signal.	Default: 0.0% Min: -999.9% Max: 999.9%	
H4-04 (420H)	Terminal AM Monitor Selection	All Modes Selects the data to be output through multi-function analog output terminal AM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter “103” for U1-03.	Default: 103 Min: 000 Max: 999	214
H4-05 (421H) RUN	Terminal AM Gain	All Modes Sets the signal level at terminal AM that is equal to 100% of the selected monitor value.	Default: 50.0% Min: -999.9% Max: 999.9%	215
H4-06 (422H) RUN	Terminal AM Bias	All Modes Sets the bias value added to the terminal AM output signal.	Default: 0.0% Min: -999.9% Max: 999.9%	215

No.(Addr.)	Name	Description	Setting	Page
H4-07 (423H)	Terminal FM Signal Level Selection	All Modes 0: 0 to 10 V 1: –10 to 10 V	Default: 0 Min: 0 Max: 1	216
H4-08 (424H)	Terminal AM Signal Level Selection	All Modes 0: 0 to 10 V 1: –10 to 10 V	Default: 0 Min: 0 Max: 1	

■ H5: MEMOBUS/Modbus Serial Communication

Note: The settings for MEMOBUS/Modbus communications become effective when the drive is restarted.

No.(Addr.)	Name	Description	Setting	Page
H5-01 (425H) <14>	Drive Node Address	All Modes Selects drive station node number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect.	Default: 1 Min: 0 Max: FF	426
H5-02 (426H)	Communication Speed Selection	All Modes 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps Cycle power for the setting to take effect.	Default: 3 Min: 0 Max: 8	426
H5-03 (427H)	Communication Parity Selection	All Modes 0: No parity 1: Even parity 2: Odd parity Cycle power for the setting to take effect.	Default: 0 Min: 0 Max: 2	426
H5-04 (428H)	Stopping Method After Communication Error (CE)	All Modes 0: Ramp to stop 1: Coast to stop 2: Fast Stop 3: Alarm only	Default: 3 Min: 0 Max: 3	426
H5-05 (429H)	Communication Fault Detection Selection	All Modes 0: Disabled 1: Enabled. If communication is lost for more than two seconds, a CE fault will occur.	Default: 1 Min: 0 Max: 1	427
H5-06 (42AH)	Drive Transmit Wait Time	All Modes Sets the wait time between receiving and sending data.	Default: 5 ms Min: 5 ms Max: 65 ms	427
H5-07 (42BH)	RTS Control Selection	All Modes 0: Disabled. RTS is always on. 1: Enabled. RTS turns on only when sending.	Default: 1 Min: 0 Max: 1	427
H5-09 (435H)	Communication Fault Detection Time	All Modes Sets the time required to detect a communications error. Adjustment may be needed when networking several drives.	Default: 2.0 s Min: 0.0 s Max: 10.0 s	427
H5-10 (436H)	Unit Selection for MEMOBUS/ Modbus Register 0025H	All Modes 0: 0.1 V units 1: 1 V units	Default: 0 Min: 0 Max: 1	428
H5-11 (43CH)	Communications ENTER Function Selection	All Modes 0: Drive requires an Enter command before accepting any changes to parameter settings. 1: Parameter changes are activated immediately without the Enter command.	Default: 0 Min: 0 Max: 1	428

<14> If this parameter is set to 0, the drive will be unable to respond to MEMOBUS/Modbus commands.

◆ L: Protection Functions

L parameters provide protection to the drive and motor, including control during momentary power loss, Stall Prevention, frequency detection, fault reset, overtorque detection, torque limits, and other types of hardware protection.

■ L1: Motor Protection

No. (Addr.)	Name	Description	Setting	Page
L1-01 (480H)	Motor Overload Protection Selection	All Modes 0: Disabled 1: General purpose motor (standard fan cooled) 2: Drive dedicated motor with a speed range of 1:10 3: Vector motor with a speed range of 1:100 5: PM motor with constant torque characteristics	Default: <1> Min: 0 Max: 5	217
L1-02 (481H)	Motor Overload Protection Time	All Modes Sets the motor thermal overload protection (oL1) time.	Default: 1.0 min Min: 0.1 min Max: 5.0 min	219
L1-03 (481H)	Motor Overheat Alarm Operation Selection (PTC thermistor input)	All Modes Sets operation when the motor temperature analog input (H3-02 or H3-10 = E) exceeds the oH3 alarm level. 0: Ramp to stop 1: Coast to stop 2: Emergency Stop (Fast Stop) (decelerate to stop using the deceleration time in C1-09) 3: Alarm only (“oH3” will flash)	Default: 3 Min: 0 Max: 3	220
L1-04 (481H)	Motor Overheat Fault Operation Selection (PTC thermistor input)	All Modes Sets stopping method when the motor temperature analog input (H3-02 or H3-10 = E) exceeds the oH4 fault level. 0: Ramp to stop 1: Coast to stop 2: Emergency Stop (Fast Stop) (decelerate to stop using the deceleration time in C1-09)	Default: 1 Min: 0 Max: 2	221
L1-05 (481H)	Motor Temperature Input Filter Time (PTC thermistor input)	All Modes Adjusts the filter for the motor temperature analog input (H3-02 or H3-10 = E).	Default: 0.20 s Min: 0.00 s Max: 10.00 s	221
L1-13 (46DH)	Continuous Electrothermal Operation Selection	All Modes 0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1	219

<1> Default setting is determined by the control mode (A1-02).

■ L2: Undervoltage Detection

No. (Addr.)	Name	Description	Setting	Page
L2-05 (489H)	Undervoltage Detection Level (Uv)	All Modes Sets the DC bus undervoltage trip level.	Default: <9> <15> Min: 150 Vdc Max: 210 Vdc <9>	221

<9> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<15> Default setting value is dependent on the setting for the input voltage (E1-01).

■ L3: Stall Prevention

No. (Addr.)	Name	Description	Setting	Page
L3-01 (48FH)	Stall Prevention Selection during Acceleration	V/f OLV CLV CLV/PM 0: Disabled. 1: General purpose. Acceleration is paused as long as the current is above the L3-02 setting. 2: Intelligent. Accelerate in the shortest possible time without exceeding the L3-02 level.	Default: 1 Min: 0 Max: 2	221
L3-02 (490H)	Stall Prevention Level during Acceleration	V/f OLV CLV CLV/PM Used when L3-01 = 1 or 2. 100% is equal to the drive rated current.	Default: <16> Min: 0% Max: 150% <16>	223
L3-05 (493H)	Stall Prevention Selection during Run	V/f OLV CLV CLV/PM 0: Disabled. Drive runs at a set frequency. A heavy load may cause speed loss. 1: Decel time 1. Uses the deceleration ramp set to C1-02 while Stall Prevention is performed. 2: Decel time 2. Uses the deceleration ramp set to C1-04 while Stall Prevention is performed.	Default: 1 Min: 0 Max: 2	223
L3-06 (494H)	Stall Prevention Level during Run	V/f OLV CLV CLV/PM Enabled when L3-05 is set to 1 or 2. 100% is equal to the drive rated current.	Default: <16> Min: 30% Max: 150% <16>	223

<16> The setting value is dependent on the setting for the carrier frequency reduction (L8-38).

■ L4: Speed Detection

No. (Addr.)	Name	Description	Setting	Page
L4-01 (499H)	Speed Agreement Detection Level	All Modes L4-01 sets the speed detection level for digital output functions H2-□□ = 3, 4, 5. L4-02 sets the hysteresis or allowable margin for speed detection.	Default: 0.0% Min: 0.0% Max: 100.0%	223
L4-02 (49AH)	Speed Agreement Detection Width		Default: 4.0% Min: 0.0% Max: 40.0%	
L4-03 (49BH)	Speed Agreement Detection Level (+/-)	All Modes L4-03 sets the speed detection level for digital output functions H2-□□ = 13, 14, 15, 16. L4-04 sets the hysteresis or allowable margin for speed detection.	Default: 0.0% Min: –100.0% Max: 100.0%	224
L4-04 (49CH)	Speed Agreement Detection Width (+/-)		Default: 4.0% Min: 0.0% Max: 40.0%	
L4-05 (49DH)	Speed Reference Loss Detection Selection	All Modes 0: Stop. Drive stops when the speed reference is lost. 1: Run. Drive runs at a reduced speed when the speed reference is lost.	Default: 0 Min: 0 Max: 1	224
L4-06 (4C2H)	Speed Reference at Reference Loss	All Modes Sets the percentage of the speed reference that the drive should run with when the speed reference is lost.	Default: 80% Min: 0.0% Max: 100.0%	224
L4-07 (470H)	Speed Agree Detection Selection	All Modes 0: No detection during baseblock 1: Detection always enabled	Default: 0 Min: 0 Max: 1	224
L4-13 (4F6H)	Door Zone Level	All Modes Sets the door zone speed level. The "door zone" multi-function digital output is closed when the speed falls below this level.	Default: 0.0% Min: 0.0% Max: 100.0%	225

■ L5: Automatic Fault Reset

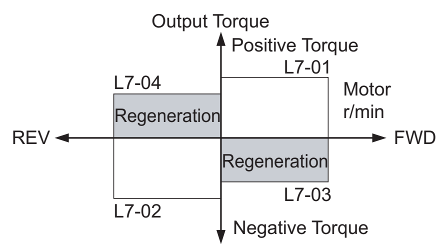
No. (Addr.)	Name	Description	Setting	Page
L5-01 (49EH)	Number of Auto Reset Attempts	All Modes Sets the number of times the drive may attempt to reset after the following faults occur: GF, LF, oC, ov, rr, oH1, oL1, oL2, oL3, oL4, UL3, UL4, UV1.	Default: 0 Min: 0 Max: 10	226
L5-02 (49FH)	Fault Output Operation during Auto Reset	All Modes 0: Fault output not active. 1: Fault output active during reset attempt.	Default: 0 Min: 0 Max: 1	226
L5-06 (522H)	Undervoltage Fault Reset Selection	All Modes 0: Same as L5-01 condition 1: Always automatically reset UV1	Default: 0 Min: 0 Max: 1	226

■ L6: Torque Detection

No. (Addr.)	Name	Description	Setting	Page
L6-01 (4A1H)	Torque Detection Selection 1	All Modes 0: Disabled 1: oL3 detection only active during speed agree, operation continues after detection 2: oL3 detection always active during run, operation continues after detection 3: oL3 detection only active during speed agree, output shuts down on an oL3 fault 4: oL3 detection always active during run, output shuts down on an oL3 fault 5: UL3 detection only active during speed agree, operation continues after detection 6: UL3 detection always active during run, operation continues after detection 7: UL3 detection only active during speed agree, output shuts down on an oL3 fault 8: UL3 detection always active during run, output shuts down on an oL3 fault	Default: 0 Min: 0 Max: 8	227
L6-02 (4A2H)	Torque Detection Level 1	All Modes Sets the overtorque and undertorque detection level.	Default: 150% Min: 0% Max: 300%	228
L6-03 (4A3H)	Torque Detection Time 1	All Modes Sets the time an overtorque or undertorque condition must exist to trigger torque detection 1.	Default: 0.1 s Min: 0.0 s Max: 10.0 s	228

No. (Addr.)	Name	Description	Setting	Page
L6-04 (4A4H)	Torque Detection Selection 2	All Modes 0: Disabled 1: oL4 detection only active during speed agree, operation continues after detection 2: oL4 detection always active during run, operation continues after detection 3: oL4 detection only active during speed agree, output shuts down on an oL4 fault 4: oL4 detection always active during run, output shuts down on an oL4 fault 5: UL4 detection only active during speed agree, operation continues after detection 6: UL4 detection always active during run, operation continues after detection 7: UL4 detection only active during speed agree, output shuts down on an oL4 fault 8: UL4 detection always active during run, output shuts down on an oL4 fault	Default: 0 Min: 0 Max: 8	227
L6-05 (4A5H)	Torque Detection Level 2	All Modes Sets the overtorque and undertorque detection level.	Default: 150% Min: 0% Max: 300%	228
L6-06 (4A6H)	Torque Detection Time 2	All Modes Sets the time an overtorque or undertorque condition must exist to trigger torque detection 2.	Default: 0.1 s Min: 0.0 s Max: 10.0 s	228

■ L7: Torque Limit

No. (Addr.)	Name	Description	Setting	Page
L7-01 (4A7H)	Forward Torque Limit	V/f OLV CLV CLV/PM Sets the torque limit value as a percentage of the motor rated torque. Four individual quadrants can be set. 	Default: 200% Min: 0% Max: 300%	229
L7-02 (4A8H)	Reverse Torque Limit		Default: 200% Min: 0% Max: 300%	
L7-03 (4A9H)	Forward Regenerative Torque Limit		Default: 200% Min: 0% Max: 300%	
L7-04 (4AAH)	Reverse Regenerative Torque Limit		Default: 200% Min: 0% Max: 300%	
L7-16 (44DH)	Torque Limit Process at Start	V/f OLV CLV CLV/PM 0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1	229

■ L8: Drive Protection

No. (Addr.)	Name	Description	Setting	Page
L8-02 (4AEH)	Overheat Alarm Level	All Modes An overheat alarm will occur if the heatsink temperature exceeds the level set in L8-02.	Default: <1> Min: 50 °C Max: 150 °C	229
L8-03 (4AFH)	Overheat Pre-Alarm Operation Selection	All Modes 0: Ramp to stop. A fault is triggered. 1: Coast to stop. A fault is triggered. 2: Fast Stop. Decelerate to stop using the deceleration ramp in C1-09. A fault is triggered. 3: Continue operation. An alarm is triggered.	Default: 3 Min: 0 Max: 3	229
L8-05 (4B1H)	Input Phase Loss Protection Selection	All Modes Selects the detection of input current phase loss, power supply voltage imbalance, or main circuit electrolytic capacitor deterioration. 0: Disabled 1: Enabled always 2: Enabled during operation 3: Enabled during constant speed	Default: 1 Min: 0 Max: 3	230
L8-06 (4B2H)	Input Phase Loss Detection Level	All Modes When ripple is observed in the DC bus, expansion of the input bias is calculated and becomes the input phase if the difference between the max and minimum values of the ripple are greater than L8-06. Detection Level = 100% = Voltage class × $\sqrt{2}$ (determines standards for setting values)	Default: <1> Min: 0.0% Max: 50.0%	230

No. (Addr.)	Name	Description	Setting	Page
L8-07 (4B3H)	Output Phase Loss Protection Selection	All Modes 0: Disabled 1: Enabled (triggered by a single phase loss) 2: Enabled (triggered when two phases are lost) 3: Enabled (triggered at phase loss at start or when two phases lost mid-operation) <3> Output phase loss fault (LF) is triggered when the output current falls below 5% of the drive rated output current. Output phase loss fault can mistakenly be triggered if the motor's rated current is very small compared to the drive rating. Disable this parameter in such cases.	Default: 0 Min: 0 Max: 3	230
L8-09 (4B5H)	Output Ground Fault Detection Selection	All Modes 0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1	231
L8-10 (4B6H)	Heatsink Cooling Fan Operation Selection	All Modes 0: Run with timer (Fan operates only during run and for L8-11 seconds after stop.) 1: Run always (Cooling fan operates whenever the drive is powered up.) 2: Temperature controlled (Cooling fan operated depending on the temperature of the drives heatsink.)	Default: 0 Min: 0 Max: 2	231
L8-11 (4B7H)	Heatsink Cooling Fan Off Delay Time	All Modes Sets a delay time to shut off the cooling fan after the Up/Down command is removed when L8-10 = 0.	Default: 60 s Min: 0 s Max: 300 s	231
L8-12 (4B8H)	Ambient Temperature Setting	All Modes Enter the ambient temperature. This value adjusts the oL2 detection level.	Default: 40 °C Min: -10 °C Max: 50 °C	231
L8-15 (4BBH)	oL2 (drive overload) Characteristics Selection at Low Speeds	All Modes 0: No oL2 level reduction below 6 Hz. 1: oL2 level is reduced linearly below 6 Hz. It is halved at 0 Hz.	Default: 1 Min: 0 Max: 1	232
L8-27 (4DDH)	Overcurrent Detection Gain	V/f OLV CLV CLV/PM Sets the gain for overcurrent detection as a percentage of the motor rated current. Overcurrent is detected using the drive's overcurrent level or the value set to L8-27, whichever is lower.	Default: 300.0% Min: 0.0% Max: 300.0%	232
L8-29 (4DFH)	Current Unbalance Detection (LF2)	V/f OLV CLV CLV/PM 0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1	232
L8-35 (4ECH) <4>	Installation Selection	All Modes 0: IP00 enclosure drive 2: IP00 enclosure drive with top protective cover	Default: <1> Min: 0 Max: 2	232
L8-38 (4EFH)	Automatic Torque Boost Selection	All Modes Torque Boost increases the output current limit while decreasing the carrier frequency when the output current exceeds a certain value. 0: Disabled 3: Enabled	Default: 0 Min: 0 Max: 3	233
L8-39 (4F0H)	Reduced Carrier Frequency	All Modes Sets the reduced carrier frequency used by the Torque Boost function.	Default: 3.0 kHz Min: 1.0 kHz Max: 15.0 kHz	233
L8-55 (45FH)	Internal Braking Transistor Protection	All Modes 0: Disabled. L8-55 should be disabled when using a regen converter or an optional braking unit. 1: Protection enabled.	Default: 1 Min: 0 Max: 1	233
L8-62 (529H)	Operation Selection at Input Phase Loss	All Modes Sets stopping method when a Input phase loss fault (PF) occurs. See parameter L8-05. 0: Ramp to Stop - Decelerate to stop using the deceleration ramp in C1-02. 1: Coast to Stop 2: Fast Stop - Decelerate to stop using the deceleration ramp in C1-09. 3: Alarm only - Drive continues operation.	Default: 1 Min: 0 Max: 3	230
L8-77 (61EH)	Oscillation Suppression	All Modes Used to suppress speed oscillations that occur with an unloaded motor and that have the same frequency as the output frequency.	Default: 0 Min: -100 Max: 100	234
L8-88 (2F5H)	Safe Disable Operation Mode	All Modes 0: Mode 0 1: Mode 1	Default: 1 Min: 0 Max: 1	234
L8-89 (B97H)	Current Monitoring Selection	All Modes Enables and disables the Current Monitoring function. 0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1	235

No. (Addr.)	Name	Description	Setting	Page
L8-99 (B98H)	Current Monitoring Level	**All Modes** Sets the current monitoring level as a percentage of the drive's rated current. Sets the level of current used to monitor the status of the current (H2-□□. = 5C) when the Current Monitoring Selection (L8-89) is enabled and set to 1.	Default: 10.0% Min: 0.0% Max: 50.0%	235

<1> Default setting is determined by the drive model (o2-04).
<3> Setting 3 available in V/f and OLV control only.
<4> Parameter setting value is not reset to the default value when the drive is initialized.

◆ n: Advanced Performance Set-Up

The n parameters are used to adjust more advanced performance characteristics such as speed feedback detection, Online Tuning for motor line-to-line resistance, and PM motor control tuning.

■ n1: Hunting Prevention

No. (Addr.)	Name	Description	Setting	Page
n1-08 (1105H)	Leakage Current Vibration Control Selection	**All Modes** 0: Method 1 1: Method 2 Parameter does not normally require adjustment.	Default: 0 Min: 0 Max: 1	236

■ n2: Speed Feedback Detection Control (AFR) Tuning

No. (Addr.)	Name	Description	Setting	Page
n2-01 (584H)	Speed Feedback Detection Control (AFR) Gain	V/f **OLV** CLV CLV/PM Sets the internal speed feedback detection control gain in the automatic frequency regulator (AFR). If hunting occurs, increase the set value. If response is low, decrease the set value.	Default: 1.00 Min: 0.00 Max: 10.00	236
n2-02 (585H)	Speed Feedback Detection Control (AFR) Time Constant 1	V/f **OLV** CLV CLV/PM Sets the time constant used for speed feedback detection control (AFR).	Default: 50 ms Min: 0 ms Max: 2000 ms	236
n2-03 (586H)	Speed Feedback Detection Control (AFR) Time Constant 2	V/f **OLV** CLV CLV/PM Sets the AFR time constant to be used during regen.	Default: 750 ms Min: 0 ms Max: 2000 ms	

■ n5: Inertia Compensation

No. (Addr.)	Name	Description	Setting	Page
n5-01 (5B0H)	Inertia Compensation Selection	V/f OLV **CLV** **CLV/PM** 0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1	237
n5-02 (5B1H)	Motor Acceleration Time	V/f OLV **CLV** **CLV/PM** Sets the time required to accelerate the motor at 100% torque from 0 to the nominal speed.	Default: <4> Min: 0.001 s Max: 10.000 s	237
n5-03 (5B2H)	Inertia Compensation Gain	V/f OLV **CLV** **CLV/PM** Sets the ratio between motor and load inertia. Lower this setting if overshoot occurs at the end of acceleration.	Default: 1.00 Min: 0.00 Max: 100.00	238
n5-07 (170H)	Speed Feedback Compensation Selection	V/f OLV CLV **CLV/PM** 0: Disabled 1: Enabled 2: Test Mode	Default: 1 Min: 0 Max: 2	239
n5-08 (171H)	Speed Feedback Compensation Gain (P)	V/f OLV CLV **CLV/PM** Sets the proportional gain for the Speed Feedback Compensation.	Default: 12.00 Min: 0.00 Max: 300.00	239

<4> Default setting value is dependent on the drive model (o2-04).

■ n6: Online Tuning

No. (Addr.)	Name	Description	Setting	Page
n6-01 (570H)	Online Tuning Selection	V/f OLV CLV CLV/PM 0: Disabled 1: Line-to-line resistance tuning 2: Voltage correction.	Default: 2 Min: 0 Max: 2	239
n6-05 (5C7H)	Online Tuning Gain	V/f OLV CLV CLV/PM Decrease this setting for motors with a relatively large rotor time constant. If overload occurs, increase this setting slowly in increments of 0.1.	Default: 1.0 Min: 0.1 Max: 50.0	240

■ n8: PM Motor Control Tuning

No. (Addr.)	Name	Description	Setting	Page
n8-01 (540H)	Initial Polarity Estimation Current	V/f OLV CLV CLV/PM Sets the current used for initial rotor position estimation as a percentage of the motor rated current (E5-03). If the motor nameplate lists an “Si” value, that value should be entered here.	Default: 50% Min: 0% Max: 100%	240
n8-02 (541H)	Pole Attraction Current	V/f OLV CLV CLV/PM Sets the current during initial polar attraction as a percentage of the motor rated current. Enter a high value when attempting to increase starting torque.	Default: 80% Min: 0% Max: 150%	240
n8-29 (55CH)	q-Axis Current Control Gain during Normal Operation	V/f OLV CLV CLV/PM Sets the q axis proportional gain for the normal control range.	Default: 1000 rad/s Min: 0 rad/s Max: 2000 rad/s	242
n8-30 (55DH)	q-Axis Current Control Integral Time during Normal Operation	V/f OLV CLV CLV/PM Sets the q axis integral time for the normal control range.	Default: 10.0 ms Min: 0.0 ms Max: 100.0 ms	242
n8-32 (55FH)	d-Axis Current Control Gain during Normal Operation	V/f OLV CLV CLV/PM Sets the d axis proportional gain for the normal control range.	Default: 1000 rad/s Min: 0 rad/s Max: 2000 rad/s	242
n8-33 (560H)	d-Axis Current Control Integral Time during Normal Operation	V/f OLV CLV CLV/PM Sets the d axis integral time for the normal control range.	Default: 10.0 ms Min: 0.0 ms Max: 100.0 ms	242
n8-35 (562H)	Initial Rotor Position Detection Selection	V/f OLV CLV CLV/PM 1: High frequency injection 2: Pulse injection	Default: 1 Min: 1 Max: 2	240
n8-36 (563H)	High Frequency Injection Level	V/f OLV CLV CLV/PM Sets the frequency in Hz for the superimposed signal used for superimposed harmonics.	Default: 500 Hz Min: 25 Hz Max: 1000 Hz	241
n8-37 (564H)	High Frequency Injection Amplitude	V/f OLV CLV CLV/PM Sets the amplitude for superimposed harmonics according to the voltage class of the motor. Adjust this value when there is too much or too little current as a result of the settings assigned to motor parameters.	Default: 20.0% Min: 0.0% Max: 99.9%	241
n8-62 (57DH)	Output Voltage Limit	V/f OLV CLV CLV/PM Prevents output voltage saturation. Should be set just below the voltage provided by the input power supply.	Default: 200.0 V <9> Min: 0.0 V Max: 230.0 V <9>	242
n8-81 (2D0H)	High Frequency Injection during Rescue Operation	V/f OLV CLV CLV/PM Sets the frequency used for Polar Detection Method 1 during Rescue Operation.	Default: 90 Hz Min: 25 Hz Max: 1000 Hz	241
n8-82 (2D1H)	High Frequency Injection Amplitude during Rescue Operation	V/f OLV CLV CLV/PM Sets the amplitude for High Frequency Injection during Rescue Operation as a percentage of the voltage (200 V or 400 V).	Default: 15.0% Min: 0.1% Max: 99.9%	241
n8-84 (2D3H)	Polarity Detection Current	V/f OLV CLV CLV/PM Sets the current level (E5-03) as a percentage for detecting polarity during Initial Polarity Estimation.	Default: 100% Min: 0% Max: 150%	241
n8-86 (2D5H)	Magnet Pole Search Error Detection Selection	V/f OLV CLV CLV/PM 0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1	241

<9> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

■ n9: Current Detection Adjustments

No. (Addr.)	Name	Description	Setting	Page
n9-60 (64DH)	A/D Conversion Start Delay	V/f OLV CLV **CLV/PM** Sets a delay time for starting the current signal A/D conversion. This value seldom needs to be changed.	Default: <4> Min: 0.0 µs Max: 40.0 µs	242

<4> Default setting is determined by the drive model (o2-04).

◆ o: Operator Related Parameters

The o parameters set up the digital operator displays.

■ o1: Digital Operator Display Selection

Refer to Digital Operator Display Unit Selection on page 109 for details on digital operator displays.

No. (Addr.)	Name	Description	Setting	Page
o1-01 (500H) RUN	Drive Mode Unit Monitor Selection	**All Modes** Switches the display after the power has been turned on. When using an LED operator, pressing the up arrow key will display the following data: frequency reference → rotational direction → output frequency → output current → output voltage → U1-□□.	Default: 106 (Monitor U1-06) Min: 105 Max: 699	243
o1-02 (501H) RUN	User Monitor Selection after Power Up	**All Modes** o1-02 selects the information that is displayed when the power is turned on. 1: Speed reference (U1-01) 2: Direction 3: Output speed (U1-02) 4: Output current (U1-03) 5: User-selected monitor (set by o1-01)	Default: 1 Min: 1 Max: 5	243
o1-03 (502H)	Digital Operator Display Unit Selection	**All Modes** Sets the units the drive should use to display the frequency reference and motor speed monitors. 0: 0.01 Hz 1: 0.01% (100% = E1-04) 2: r/min (calculated using the number of motor poles setting in E2-04, E4-04, or E5-04) 3: User-selected units (set by o1-10 and o1-11) 4: Elevator units 1 (speed in m/s, accel/decel rate and jerk in s) 5: Elevator units 2 (speed in m/s, accel/decel rate in m/s^2, jerk in m/s^3) 6: Elevator units 3 (speed in ft/min, accel/decel rate in ft/s^2, jerk in ft/s^3)	Default: 1 Min: 0 Max: 6 <1>	243
o1-04 (503H)	V/f Pattern Setting Units	V/f OLV **CLV** **CLV/PM** 0: Hz 1: r/min	Default: <2> Min: 0 Max: 1	244
o1-05 (504H)	LCD Contrast Control	**All Modes** Adjusts the brightness and contrast of the LCD screen on the digital operator.	Default: 3 Min: 0 Max: 5	244
o1-06 (517H)	User Monitor Selection Mode	**All Modes** 0: 3 Monitor Sequential (Displays the next 2 sequential monitors) 1: 3 Monitor Selectable (o1-07 and o1-08 selected monitor is displayed)	Default: 0 Min: 0 Max: 1	244
o1-07 (517H)	Second Line Monitor Selection	**All Modes** Selects the monitor displayed on the second line.	Default: 102 Min: 101 Max: 699	244
o1-08 (517H)	Third Line Monitor Selection	**All Modes** Selects the monitor displayed on the third line.	Default: 103 Min: 101 Max: 699	244
o1-10 (520H)	User-Set Display Units Maximum Value	**All Modes** These settings define the display values when o1-03 is set to 3. o1-10 sets the display value that is equal to the maximum output frequency. o1-11 sets the position of the decimal position.	Default: <5> Min: 1 Max: 60000	244
o1-11 (521H)	User-Set Display Units Decimal Display		Default: <5> Min: 0 Max: 3	245
o1-12 (739H)	Length Units	V/f OLV **CLV** **CLV/PM** 0: Millimeter unit 1: Inch unit	Default: 0 Min: 0 Max: 1	245
o1-20 (575H)	Traction Sheave Diameter	V/f OLV **CLV** **CLV/PM** Sets the traction sheave diameter for display unit calculations.	Default: 400 mm <6> Min: 100 mm Max: 2000 mm <6>	245

No. (Addr.)	Name	Description	Setting	Page
o1-21 (576H)	Roping Ratio	V/f OLV CLV CLV/PM Sets the roping ratio. 1: 1:1 2: 1:2 3: 1:3 4: 1:4	Default: 2 Min: 1 Max: 4	245
o1-22 (577H)	Mechanical Gear Ratio	V/f OLV CLV CLV/PM Sets the ratio of the gear installed for display unit calculations.	Default: <2> Min: 0.10 Max: 100.00	245
o1-23 (174H)	HBB Non Display Select	All Modes Shows and hides HBB on the digital operator while the safety signal is being input. 0: Show HBB 1: Hide HBB	Default: 0 Min: 0 Max: 1	246

<1> The control mode determines the selections available. In V/f Control, only settings 1 through 3 are permitted.
<2> Default setting is determined by the control mode (A1-02).
<5> This parameter appears when the drive displays user-set units (o1-03 = 3).
<6> Default setting and setting range changes when inches are selected for the length units (o1-12 = 1). The setting range becomes 3.70 to 78.00 inches, and the default becomes 15.70 inches.

■ o2: Digital Operator Keypad Functions

No. (Addr.)	Name	Description	Setting	Page
o2-01 (505H)	LO/RE Key Function Selection	All Modes 0: Disabled 1: Enabled. LO/RE key switches between LOCAL and REMOTE operation.	Default: 0 Min: 0 Max: 1	246
o2-02 (506H)	STOP Key Function Selection	All Modes 0: Disabled. STOP key is disabled in REMOTE operation. 1: Enabled. STOP key is always enabled.	Default: 0 Min: 0 Max: 1	246
o2-03 (507H)	User Parameter Default Value	All Modes 0: No change. 1: Set defaults. Saves parameter settings as default values for a User Initialization. 2: Clear all. Clears the default settings that have been saved for a User Initialization.	Default: 0 Min: 0 Max: 2	247
o2-04 (508H) <1>	Drive Model Selection	All Modes Enter the drive model. Setting required only if installing a new control board.	Default: Determined by drive capacity Min: – Max: –	247
o2-05 (509H)	Speed Reference Setting Method Selection	All Modes 0: ENTER key must be pressed to enter a speed reference. 1: ENTER key is not required. The speed reference can be adjusted using the up and down arrow keys only.	Default: 0 Min: 0 Max: 1	247
o2-06 (50AH)	Operation Selection when Digital Operator is Disconnected	All Modes 0: The drive continues operating if the digital operator is disconnected. 1: A fault is triggered (oPr) and the motor coasts to stop.	Default: 0 Min: 0 Max: 1	248
o2-09 (50DH)	Reserved	–	–	–

<1> Parameter setting value is not reset to the default value when the drive is initialized.

■ o3: Copy Function

No. (Addr.)	Name	Description	Setting	Page
o3-01 (515H)	Copy Function Selection	All Modes 0: Copy select 1: INV → OP READ (Read parameters from the drive, saving them onto the digital operator.) 2: OP → INV WRITE (Copy parameters from the digital operator, writing them to the drive.) 3: OP ↔ INV VERIFY (Verify parameter settings on the drive to check if they match the data saved on the operator.) To read the drive's parameter settings into the digital operator, set o3-02 to 1 (to allow reading).	Default: 0 Min: 0 Max: 3	248
o3-02 (516H)	Copy Allowed Selection	All Modes Selects whether the read operation (o3-01 = 1) is enabled or disabled. 0: Read operation prohibited 1: Read operation allowed	Default: 0 Min: 0 Max: 1	248

■ o4: Maintenance Monitor Settings

No. (Addr.)	Name	Description	Setting	Page
o4-01 (50BH)	Cumulative Operation Time Setting	All Modes Sets the value for the cumulative operation time of the drive in units of 10 h.	Default: 0 Min: 0 Max: 9999	249
o4-02 (50CH)	Cumulative Operation Time Selection	All Modes 0: Logs power-on time 1: Logs operation time when the drive output is active (output operation time).	Default: 0 Min: 0 Max: 1	249
o4-03 (50EH)	Cooling Fan Operation Time Setting	All Modes Sets the value of the fan operation time monitor U4-03 in units of 10 h.	Default: 0 h Min: 0 h Max: 9999 h	249
o4-05 (51DH)	Capacitor Maintenance Setting	All Modes Sets the value of the Maintenance Monitor for the capacitors. See U4-05 to check when the capacitors may need to be replaced.	Default: 0% Min: 0% Max: 150%	249
o4-07 (523H)	DC bus Pre-charge Relay Maintenance Setting	All Modes Sets the value of the Maintenance Monitor for the soft charge bypass relay. See U4-06 to check when the bypass relay may need to be replaced.	Default: 0% Min: 0% Max: 150%	249
o4-09 (525H)	IGBT Maintenance Setting	All Modes Sets the value of the Maintenance Monitor for the IGBTs. See U4-07 to check when the IGBTs may need to be replaced.	Default: 0% Min: 0% Max: 150%	250
o4-11 (510H)	U2, U3 Initialization	All Modes 0: U2-□□ and U3-□□ monitor data is not reset when the drive is initialized (A1-03). 1: Resets the data for the U2-□□ and U3-□□ monitors. Once o4-11 is set to 1 and the ENTER key is pressed, fault data is erased and the display returns to 0.	Default: 0 Min: 0 Max: 1	250
o4-12 (512H)	kWh Monitor Initialization	All Modes 0: U4-10 and U4-11 monitor data is not reset when the drive is initialized (A1-03). 1: Resets the kWh counter. The monitors U4-10 and U4-11 will display "0" after they are initialized. Once o4-12 is set to 1 and the ENTER key is pressed, kWh data is erased and the display returns to 0.	Default: 0 Min: 0 Max: 1	250
o4-13 (528H)	Number of Travels Counter Reset	All Modes 0: Keep the number of travels counter value. The counter is not reset when the drive is initialized (A1-03). 1: Resets the number 0 travels counter. The monitor U4-24/25 will show 0. Once o4-13 is set to 1 and the ENTER key is pressed, the counter value is erased and the display returns to 0.	Default: 0 Min: 0 Max: 1	250
o4-15 (537H) <1>	Maintenance Alarm Snooze Period	All Modes After a maintenance alarm output has been triggered, o4-15 determines the level that will trigger the next alarm for the same component. The same alarm will be triggered by the detection level that triggered the original alarm plus the level set in o4-15.	Default: 2% Min: 0% Max: 20%	251
o4-16 (176H) <1>	Maintenance Monitoring Selection	All Modes Selects the Maintenance Monitor using bits 0 to 3. 0: LT1 (cooling fan) 1: LT2 (DC bus capacitors) 2: LT3 (soft-charge bypass relay) 3: LT4 (IGBTs have passed 90% of the their life expectancy)	Default: 1000 Min: 0000 Max: 1111	251

<1> Parameter setting value is not reset to the default value during drive initialization (A1-03).

◆ S: Elevator Parameters

This section describes various functions and faults needed to operate an elevator application: braking sequence, slip compensation for elevators, start/stop optimization, Rescue Operation, and elevator-related faults.

■ S1: Brake Sequence

No. (Addr.)	Name	Description	Setting	Page
S1-01 (680H)	Zero Speed Level at Stop	All Modes Determines the speed to begin applying DC Injection (or Position Lock) when the drive is ramping to stop (b1-03 = 0). Set as a percentage of the maximum output frequency (E1-04).	Default: <1> Min: 0.000% Max: 9.999%	252
S1-02 (681H)	DC Injection Current at Start	V/f OLV CLV CLV/PM Determines the amount of current to use for DC Injection at start. Set as a percentage of the drive rated current.	Default: 50% Min: 0% Max: 100%	252

No. (Addr.)	Name	Description	Setting	Page
S1-03 (682H)	DC Injection Current at Stop	**V/f** **OLV** CLV CLV/PM Determines the amount of current to use for DC Injection at stop. Set as a percentage of the drive rated current.	Default: 50% Min: 0% Max: 100%	252
S1-04 (683H)	DC Injection/Position Lock Time at Start	**All Modes** Determines how long the drive should perform DC Injection at start. In CLV and CLV/PM, S1-04 determines how long Position Lock should be performed. A setting of 0.00 disables S1-04.	Default: 0.40s Min: 0.00 s Max: 10.00 s	252
S1-05 (684H)	DC Injection/Position Lock Time at Stop	**All Modes** Determines how long the drive should perform DC Injection at stop. In CLV and CLV/PM, S1-05 determines how long Position Lock should be performed. A setting of 0.00 disables S1-05.	Default: 0.60s Min: 0.00 s Max: 10.00 s	253
S1-06 (685H)	Brake Release Delay Time	**All Modes** Determines the delay time between the start of DC injection/Position Lock and setting the brake control command (H2-□□=50) in order to release the brake at the beginning of the ride.	Default: 0.20s Min: 0.00 s Max: 10.00 s	253
S1-07 (686H)	Brake Close Delay Time	**All Modes** Determines the delay time between reaching Zero Speed (S1-01) and resetting the brake control command (H2-□□ = 50) in order to apply the brake at the end of the ride.	Default: 0.10s Min: 0.00 s Max: [S1-05]	253
S1-10 (687H)	Run Command Delay Time	**All Modes** Sets the time that must pass after the Up/Down command is entered until the drive internal Run command is set and the ride is started.	Default: 0.10s Min: 0.00 s Max: 1.00 s	253
S1-11 (688H)	Output Contactor Open Delay Time	**All Modes** Determines the delay time between shutting off the output of the drive and resetting the contactor control command (H2-□□ = 51) in order to release the motor contactor after a ride has finished.	Default: 0.10s Min: 0.00 s Max: 1.00 s	253
S1-12 (6E0H)	Motor Contactor Control During Auto-Tuning	**All Modes** Determines the state of the output contactor control command (H2-□□ = 51) during Auto-Tuning. 0: Disabled 1: Enabled 2: Enabled during Auto-Tuning and HBB	Default: 0 Min: 0 Max: 2	253
S1-26 (6D7H)	Emergency Stop Start Level	V/f OLV **CLV** **CLV/PM** Sets the Emergency Stop Start Level as a percentage of the Maximum Output Frequency.	Default: 10.0% Min: 0.0% Max: 100.0%	254

<1> Default setting is determined by the control mode (A1-02).

■ S2: Slip Compensation for Elevators

No. (Addr.)	Name	Description	Setting	Page
S2-01 (68FH)	Motor Rated Speed	**V/f** OLV CLV CLV/PM Sets the motor rated speed.	Default: 1380 rpm Min: 300 rpm Max: 1800 rpm	254
S2-02 (690H) RUN	Slip Compensation Gain in Motoring Mode	**V/f** **OLV** CLV CLV/PM Slip compensation for leveling speed can be set separately for motoring and regenerative states. This can help improve the accuracy of leveling.	Default: 0.7 Min: 0.0 Max: 5.0	254
S2-03 (691H) RUN	Slip Compensation Gain in Regenerative Mode		Default: 1.0 Min: 0.0 Max: 5.0	
S2-05 (693H)	Slip Compensation Torque Detection Delay Time	**V/f** **OLV** CLV CLV/PM Sets a delay time before detecting torque for slip compensation.	Default: 1000 ms Min: 0 ms Max: 10000 ms	254
S2-06 (694H)	Slip Compensation Torque Detection Filter Time Constant	**V/f** **OLV** CLV CLV/PM Sets the filter time constant applied to the torque signal used for the slip compensation value calculation.	Default: 500 ms Min: 0 ms Max: 2000 ms	254

■ S3: Start/Stop Optimization

No. (Addr.)	Name	Description	Setting	Page
S3-01 (697H) RUN	Position Lock Gain at Start 1	V/f OLV CLV CLV/PM Sets gain levels 1 and 2 for the Position Lock function. Position Lock at start attempts to keep the car position when opening the brake in order to avoid roll back.	Default: 5 Min: 0 Max: 100	255
S3-02 (698H) RUN	Position Lock Gain at Start 2 (Anti Rollback Gain)		Default: 0.00 Min: 0.00 Max: 100.00	
S3-03 (699H) RUN	Position Lock Gain at Stop	V/f OLV CLV CLV/PM Sets the Position Lock gain at stop. Position Lock at stop keeps the car in position until the brake has been applied entirely.	Default: 5 Min: 0 Max: 100	255
S3-04 (69AH)	Position Lock Bandwidth	V/f OLV CLV CLV/PM Determines the bandwidth around the stop position in which a digital output programmed for "Within Position Lock Bandwidth" (H2-□□ = 33) is closed.	Default: 10 Min: 0 Max: 16383	255
S3-10 (69BH)	Starting Torque Compensation Increase Time	V/f OLV CLV CLV/PM Sets a time constant for the torque reference to reach 300%. Enabled by setting an analog input terminal for torque compensation (H3-□□ = 14).	Default: 500 ms Min: 0 ms Max: 5000 ms	255
S3-12 (69DH)	Starting Torque Compensation Bias in Down Direction	V/f OLV CLV CLV/PM Adds a bias to torque compensation value from the load cell when moving in down direction.	Default: 0 Min: -40.0% Max: 40.0%	256
S3-14 (69FH)	Torque Compensation Fade Out Speed	V/f OLV CLV CLV/PM Sets the speed level for torque compensation to fade out during the time determined by S3-15. Sets as a percentage of the maximum output frequency (E1-04). A setting of 0.0% essentially disables this function.	Default: 0.0% Min: 0.0% Max: 100.0%	256
S3-15 (6A0H)	Torque Compensation Fade Out Time	V/f OLV CLV CLV/PM Sets the time for torque compensation to fade out once motor speed reaches the level set in S3-14.	Default: 1000 ms Min: 0 ms Max: 5000 ms	256
S3-16 (6A1H)	Torque Limit Reduction Time	V/f OLV CLV CLV/PM Determines the reduction rate used bring the internal torque reference value down to zero after Position Lock at Stop has finished. $\text{Rate} = \frac{\text{Torque 300\%}}{\text{S3-16}}$	Default: 100 ms Min: 0 ms Max: 10000 ms	256
S3-20 (6A2H)	Dwell 2 Speed Reference	All Modes Sets the speed reference for the Dwell 2 function. **Note:** A setting of 0.00 essentially disables the Dwell 2 function.	Default: 0.00% Min: 0.00% Max: 100.00%	256
S3-21 (6A5H)	Dwell 2 End Speed	All Modes The Dwell 2 function will end when the drive reaches this speed. **Note:** A setting of 0.00 will disable the acceleration rate switch that occurs at the end of Dwell 2.	Default: 0.00% Min: 0.00% Max: 100.00%	257
S3-25 (6A3H)	Reserved	-	-	-
S3-26 (6A4H)	Reserved	-	-	-
S3-27 (6BDH)	Torque Compensation Value with Load Condition 1	V/f OLV CLV CLV/PM Used for starting torque compensation utilizing a load cell signal. Sets the torque compensation value for load condition 1.	Default: –50% Min: –100% Max: 100%	257
S3-28 (6BEH)	Torque Compensation Value with Load Condition 2	V/f OLV CLV CLV/PM Used for starting torque compensation utilizing a load cell signal. Sets the torque compensation value for load condition 2.	Default: 50% Min: –100% Max: 100%	257
S3-29 (6BFH)	Analog Input from Load Cell with Load Condition 1	V/f OLV CLV CLV/PM Used for starting torque compensation utilizing a load cell signal. Sets the analog signal level from the load cell for load condition 1.	Default: 0.0% Min: –100% Max: 100%	257
S3-30 (6C0H)	Analog Input from Load Cell with Load Condition 2	V/f OLV CLV CLV/PM Used for starting torque compensation utilizing a load cell signal. Sets the analog signal level from the load cell for load condition 2.	Default: 100.0% Min: –100.0% Max: 100%	257
S3-34 (6C4H)	Anti-Rollback Torque Bias 1	V/f OLV CLV CLV/PM Sets the Anti-Rollback Bias applied at small position deviations during Position Lock at start.	Default: 0.0% Min: 0.0% Max: 100.0%	257
S3-35 (6C5H)	Anti-Rollback Torque Bias 2	V/f OLV CLV CLV/PM Sets the Anti-Rollback Bias applied at large position deviations during Position Lock at start.	Default: 0.0% Min: 0.0% Max: 100.0%	258

No. (Addr.)	Name	Description	Setting	Page
S3-37 (6C7H)	Position Deviation Level to Apply ARB Torque Bias 1	V/f OLV CLV CLV/PM Sets the position deviation level to active at Anti-Rollback Torque Bias 1 (S3-34).	Default: 0 Min: 0 Max: 32767	258
S3-38 (6C8H)	Position Deviation Level to Apply ARB Torque Bias 2	V/f OLV CLV CLV/PM Determines the position deviation level for when the drive should switch from the torque bias set in S3-34 to the torque bias set in S3-35.	Default: 0 Min: 0 Max: 32767	258
S3-39 (6C9H)	Anti-Rollback Integral Gain	V/f OLV CLV CLV/PM Determines the drive's responsiveness for Anti-Rollback during Position Lock.	Default: 0.00 Min: –30.00 Max: 30.00	258
S3-40 (6CAH)	Anti-Rollback Movement Detection	V/f OLV CLV CLV/PM Sets the amount of pulses for movement detection during Anti-Rollback.	Default: 1 pulse Min: 0 pulse Max: 100 pulses	258
S3-41 (6CBH)	Position Lock Gain at Start 2 Reduction	V/f OLV CLV CLV/PM Sets a reduction factor for the Position Lock Gain at Start 2 (Anti-Rollback Gain) set in parameter S3-02.	Default: 0.50 Min: 0.00 Max: 1.00	258

■ S4: Rescue Operation

No. (Addr.)	Name	Description	Setting	Page
S4-01 (6A6H)	Light Load Direction Search Selection	All Modes 0: Disabled 1: Enabled 2: Enabled for Motor 1 only	Default: 0 Min: 0 Max: 2	259
S4-02 (6A7H)	Light Load Direction Search Method	V/f OLV CLV CLV/PM Determines how the drive detects the light load direction. 0: Output Current 1: Regenerative direction detection	Default: 1 Min: 0 Max: 1	259
S4-03 (6A8H)	Light Load Direction Search Time	All Modes Sets the time to perform Light Load Direction Search.	Default: 1.0 s Min: 0.0 s Max: 5.0 s	259
S4-04 (6A9H)	Light Load Direction Search Speed Reference	All Modes Sets the speed reference to use during Light Load Direction Search.	Default: <5> Min: 0.00% Max: 20.00%	259
S4-05 (6AAH)	Rescue Operation Torque Limit	All Modes Sets the torque limit used during Rescue Operation.	Default: 100% Min: 0% Max: 300%	259
S4-06 (6CCH)	Rescue Operation Power Supply Selection	All Modes 0: Battery 1: UPS (single-phase) 2: UPS (3-phase)	Default: 0 Min: 0 Max: 2	259
S4-07 (6CDH)	UPS Power	All Modes Sets the capacity of the UPS.	Default: 0.0 kVA Min: 0.0 kVA Max: 100.0 kVA	260
S4-08 (6CEH)	UPS Operation Speed Limit Selection	All Modes Determines how a speed limit should be applied to the Rescue Operation speed (d1-25) when operating from a UPS. 0: Disabled 1: Enabled until Light Load Direction Search is complete 2: Enabled until stop	Default: 2 Min: 0 Max: 2	260
S4-12 (6D2H)	DC Bus Voltage during Rescue Operation	All Modes Sets the DC bus voltage during Rescue Operation.	Default: 0 V Min: 0 V Max: 800 V	260
S4-13 (6D3H)	Rescue Operation Power Supply Deterioration Detection Level	All Modes Determines at which level of backup power supply deterioration a PF5 fault is triggered.	Default: 80% Min: 10% Max: 100%	260
S4-15 (6DAH)	Speed Reference Selection for Rescue Operation	All Modes Selects the speed reference used for Rescue Operation.	Default: 0 Min: 0 Max: 1	260

<5> Default setting is determined by the control mode (A1-02).

■ S5: Short Floor Operation

No. (Addr.)	Name	Description	Setting	Page
S5-01 (6ABH)	Short Floor Operation Selection	All Modes 0: Disabled 1: Enabled (Short Floor) 2: Enabled (Advance Short Floor)	Default: 0 Min: 0 Max: 2	262
S5-02 (6ACH)	Nominal Speed for Short Floor Calculation	All Modes When d1-18 (Speed Priority Selection) is set to 0 or 3, S5-02 determines the rated speed used during Short Floor.	Default: 0.0% Min: 0.0% Max: 100.0%	262
S5-03 (6ADH)	Short Floor Minimum Constant Speed Time	All Modes Sets the minimum operation time when the Advanced Short Floor function is enabled (S5-01 = 2).	Default: 0.0 s Min: 0.0 s Max: 2.0 s	262
S5-04 (6AEH)	Distance Calculation Acceleration Time Gain	All Modes Set for acceleration jerk compensation in Distance Calculation.	Default: 150.0% Min: 50.0% Max: 200.0%	263
S5-05 (6AFH)	Distance Calculation Deceleration Time Gain	All Modes Set for deceleration jerk compensation in Distance Calculation.	Default: 150.0% Min: 50.0% Max: 200.0%	263
S5-10 (6B0H)	Stopping Method Selection	V/f OLV CLV CLV/PM 0: Disabled 1: Direct Landing 2: Leveling Distance Control	Default: 0 Min: 0 Max: 2	265
S5-11 (6B1H)	Deceleration Distance	V/f OLV CLV CLV/PM Sets the deceleration distance when Stop Distance Control is enabled.	Default: 0 mm Min: 0 mm Max: 32767 mm <36>	265
S5-12 (6B2H)	Stop Distance	V/f OLV CLV CLV/PM Sets the stopping distance when Stop Distance Control is enabled.	Default: 0 mm Min: 0 mm Max: 10000 mm <37>	266
S5-13 (6D6H)	Direct Landing Minimum Speed Level	V/f OLV CLV CLV/PM Sets the speed level for the start of Direct Landing. Direct Landing is essentially disabled if the starting speed for Direct Landing is less than the maximum output speed multiplied by this parameter (E1-04 × S5-13).	Default: 20% Min: 0% Max: 100%	266

<36> When the length units are set for inches (o1-12 = 1), the setting range becomes 0.00 to 650.00 inches.
<37> When the length units are set for inches (o1-12 = 1), the setting range becomes 0.00 to 393.00 inches.

■ S6: Error Detection

No. (Addr.)	Name	Description	Setting	Page
S6-01 (6B3H)	Motor Contactor Response Error (SE1) Detection/Reset Selection	All Modes 0: Detect during stop, SE1 must be manually reset 1: Detect during stop, SE1 can be automatically reset 2: No SE1 detection	Default: 0 Min: 0 Max: 2	266
S6-02 (6B4H)	Starting Current Error (SE2) Detection Delay Time	V/f OLV CLV CLV/PM Sets a delay time for detecting SE2.	Default: 200 ms Min: 0.00 ms Max: [S1-04]-[S1-06]	266
S6-03 (6B5H)	SE2 Detect Current Level	V/f OLV CLV CLV/PM Sets the level of current applied to the motor when the Brake Control command is activated, as a percentage of the Motor No-load Current (E2-03).	Default: 25% Min: 0% Max: 100%	266
S6-04 (6B6H)	Output Current Error (SE3) Detection Delay Time	V/f OLV CLV CLV/PM Sets a delay time for detecting SE3.	Default: 200 ms Min: 0 ms Max: 5000 ms	266
S6-05 (6B7H)	Brake Response Error (SE4) Detection Time	All Modes Sets a delay time for detecting SE4.	Default: 500 ms Min: 0 ms Max: 10000 ms	267
S6-10 (6B8H)	Overacceleration Detection Level	V/f OLV CLV CLV/PM If the elevator car accelerates at an abnormal rate, the drive triggers an overspeed fault (dv6) and has the motor coast to stop. Parameter S6-10 determines the acceleration rate that triggers a fault.	Default: <1> Min: 0.0 m/s^2 Max: 20.0 m/s^2 <1>	267
S6-11 (6B9H)	Overacceleration Detection Time	V/f OLV CLV CLV/PM Sets a primary delay for detecting overacceleration.	Default: 50 ms Min: 0 ms Max: 5000 ms	267
S6-12 (6BAH)	Overacceleration Detection Selection	V/f OLV CLV CLV/PM 0: Always enabled 1: During run only	Default: 0 Min: 0 Max: 1	267

No. (Addr.)	Name	Description	Setting	Page
S6-15 (6BBH)	Speed Reference Loss Detection	All Modes Enabled or disables detection for speed reference missing (FrL). 0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1	267
S6-16 (6BCH)	Restart after Baseblock Selection	All Modes 0: No restart after Baseblock/Safe Torque-Off 1: Restart after Baseblock/Safe Torque-Off	Default: 0 Min: 0 Max: 1	267

<1> Default setting value is determined by the digital operator display unit selection (o1-03). The default is normally 1.5 m/s2, but when o1-03 = 6, the default becomes 5.0 ft/s^2 (Setting Range: 0.0 to 50.0 ft/s^2).

◆ T: Motor Tuning

Enter data into the following parameters to tune the motor and drive for optimal performance.

■ T1: Induction Motor Auto-Tuning

No. (Addr.)	Name	Description	Setting	Page
T1-01 (701H)	Auto-Tuning Mode Selection	V/f OLV CLV CLV/PM 0: Rotational Auto-Tuning 1: Stationary Auto-Tuning 1 2: Stationary Auto-Tuning for Line-to-Line Resistance 4: Stationary Auto-Tuning 2	Default: 0 <5> Min: 0 Max: 4 <18>	119
T1-02 (702H)	Motor Rated Power	V/f OLV CLV CLV/PM Sets the motor rated power as specified on the motor nameplate. **Note:** Use the following formula to convert horsepower into kilowatts: kW = HP × 0.746.	Default: <4> Min: 0.00 kW Max: 650.00 kW	119
T1-03 (703H)	Motor Rated Voltage	V/f OLV CLV CLV/PM Sets the motor rated voltage as specified on the motor nameplate.	Default: 200.0 V <9> Min: 0.0 V Max: 255.0 V <9>	119
T1-04 (704H)	Motor Rated Current	V/f OLV CLV CLV/PM Sets the motor rated current as specified on the motor nameplate.	Default: <4> Min: 10% of drive rated current Max: 200% of drive rated current <10>	120
T1-05 (705H)	Motor Base Frequency	V/f OLV CLV CLV/PM Sets the rated frequency of the motor as specified on the motor nameplate.	Default: 50.0 Hz Min: 0.0 Hz Max: 200.0 Hz	120
T1-06 (706H)	Number of Motor Poles	V/f OLV CLV CLV/PM Sets the number of motor poles as specified on the motor nameplate.	Default: 4 Min: 2 Max: 48	120
T1-07 (707H)	Motor Base Speed	V/f OLV CLV CLV/PM Sets the rated speed of the motor as specified on the motor nameplate.	Default: 1450 r/min Min: 0 r/min Max: 24000 r/min	120
T1-08 (708H)	Encoder Resolution (pulses per revolution)	V/f OLV CLV CLV/PM Set the number of pulses per revolution for the PG being used (pulse generator or encoder).	Default: 1024 ppr Min: 0 ppr Max: 60000 ppr	120
T1-09 (709H)	Motor No-Load Current (Stationary Auto-Tuning 1 and 2)	V/f OLV CLV CLV/PM Sets the no-load current for the motor. After setting the motor capacity to T1-02 and the motor rated current to T1-04, this parameter will automatically display the no-load current for a standard 4 pole Yaskawa motor. Enter the no-load current as indicated on the motor test report.	Default: – Min: 0 A Max: Up to T1-04 <10>	120
T1-10 (70AH)	Motor Rated Slip (Stationary Auto-Tuning 2)	V/f OLV CLV CLV/PM Sets the motor rated slip. After setting the motor capacity to T1-02, this parameter will automatically display the motor slip for a standard 4 pole Yaskawa motor. Enter the motor slip as indicated on the motor test report.	Default: – Min: 0.00 Hz Max: 20.00 Hz	121

<4> Default setting value varies by the drive model (o2-04).
<5> Default setting is determined by the control mode (A1-02).
<9> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<10> The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.
<18> The variety of Auto-Tuning methods depends on the control mode setting. V/f Control allows T1-01 to be set to 2 or 3, while vector control modes (OLV and CLV) allow T1-01 to be set to 0 through 4.

■ T2: PM Motor Auto-Tuning

No. (Addr.)	Name	Description	Setting	Page
T2-01 (750H)	Motor Auto-Tuning Mode Selection	V/f OLV CLV CLV/PM 0: Motor Data input 1: Stationary Auto-Tuning 2: Stationary stator resistance Auto-Tuning 3: Initial magnet pole search parameters Auto-Tuning 4: Encoder offset stationary Auto-Tuning 10: Encoder offset rotational Auto-Tuning 11: Rotational back EMF constant Auto-Tuning 12: Auto-Tuning of PG-E3 encoder characteristics <6>	Default: 0 Min: 0 Max: 12	121
T2-04 (730H)	Motor Rated Power	V/f OLV CLV CLV/PM Sets the motor rated power as indicated on the motor nameplate.	Default: <1> Min: 0.00 kW Max: 650.00 kW	121
T2-05 (732H)	Motor Rated Voltage	V/f OLV CLV CLV/PM Enter the motor rated voltage as indicated on the motor nameplate.	Default: 200.0 V <2> Min: 0.0 V Max: 255.0 V <2>	121
T2-06 (733H)	Motor Rated Current	V/f OLV CLV CLV/PM Enter the motor rated current as indicated on the motor nameplate.	Default: <1> Min: 10% of drive rated current Max: 200% of drive rated current <3>	121
T2-08 (734H)	Number of Motor Poles	V/f OLV CLV CLV/PM Enter the number of motor poles for the motor as indicated on the motor nameplate.	Default: 6 Min: 2 Max: 120 <5>	122
T2-09 (731H)	Motor Base Speed	V/f OLV CLV CLV/PM Enter the base speed for the motor as indicated on the motor nameplate.	Default: 150 r/min Min: 0 r/min Max: 24000 r/min	122
T2-10 (754H)	Single Phase Stator Resistance	V/f OLV CLV CLV/PM Enter the 1-phase resistance of the stator winding.	Default: – Min: 0.000 Ω Max: 65.000 Ω	122
T2-11 (735H)	Motor d-Axis Inductance	V/f OLV CLV CLV/PM Enter the d-axis inductance for the motor as indicated on the motor nameplate.	Default: – Min: 0.00 mH Max: 600.00 mH	122
T2-12 (736H)	Motor q-Axis Inductance	V/f OLV CLV CLV/PM Enter the q-axis inductance for the motor as indicated on the motor nameplate.	Default: – Min: 0.00 mH Max: 600.00 mH	122
T2-13 (755H)	Induced Voltage Constant Unit Selection	V/f OLV CLV CLV/PM 0: mV/(r/min). E5-09 will automatically be set to 0.0, and E5-24 will be used. 1: mV/(rad/sec). E5-24 will automatically be set to 0.0, and E5-09 will be used.	Default: 1 Min: 0 Max: 1	122
T2-14 (737H)	Motor Induced Voltage Constant	V/f OLV CLV CLV/PM Enter the induced voltage coefficient for the motor as indicated on the motor nameplate.	Default: – Min: 0.0 Max: 6500.0 <4>	122
T2-16 (738H)	Encoder Resolution	V/f OLV CLV CLV/PM Sets the number of pulses per revolution for the PG being used (pulse generator or encoder).	Default: 1024 ppr Min: 1 ppr Max: 15000 ppr	123
T2-17 (757H)	Encoder Offset	V/f OLV CLV CLV/PM Sets the offset between encoder offset and the rotor magnetic axis.	Default: 0.0 deg Min: -180.0 deg Max: 180.0 deg	123
T2-18 (BB0H)	Speed Reference for Auto-Tuning of PG-E3 Encoder Characteristics	V/f OLV CLV CLV/PM Sets the speed reference for execution of Auto-Tuning of PG-E3 encoder characteristics (T2-01 = 12).	Default: 10 r/min Min: 1 r/min Max: 30 r/min	123
T2-19 (BB1H)	Rotation Direction for Auto-Tuning of PG-E3 Encoder Characteristics	V/f OLV CLV CLV/PM Sets the direction of motor rotation for execution of Auto-Tuning of PG-E3 encoder characteristics (T2-01 = 12). 0: Forward (Up) 1: Reverse (Down)	Default: 0 Min: 0 Max: 1	123

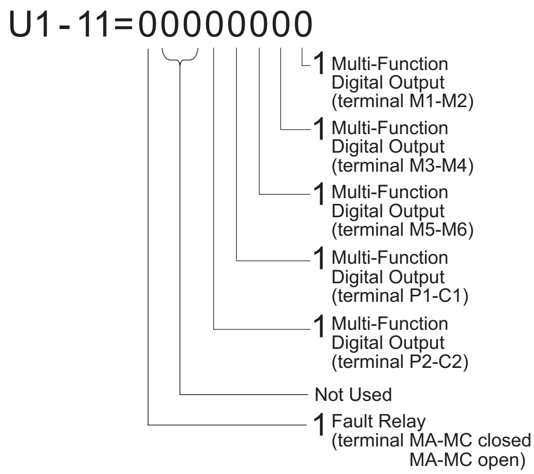
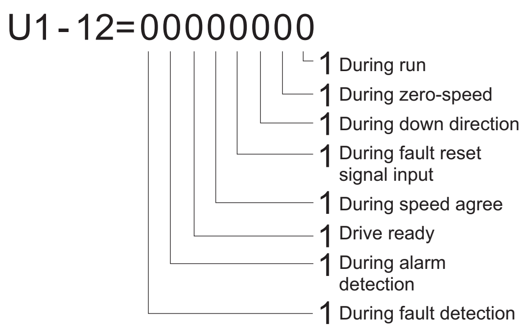
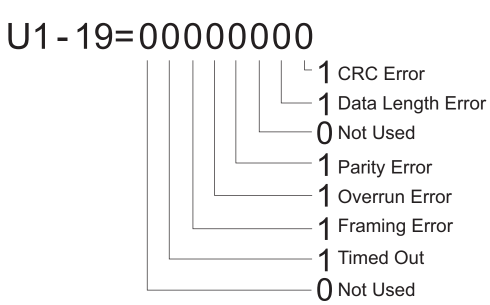
<1> Default setting value varies by the drive model (o2-04).
<2> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<3> The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.
<4> Setting units are determined by the induced voltage constant unit selection for PM motors set to T2-13.
<5> Maximum value is 48 when a PG-E3 option is connected.
<6> Setting 12 requires a PG-E3 option with software version 1102 or later. To identify the PG-E3 software version, refer to the PG-E3 label on the option in the field designated “C/N” (S + four-digit number).

◆ U: Monitors

Monitor parameters allow the user to view drive status, fault information, and other data concerning drive operation.

■ U1: Operation Status Monitors

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U1-01 (40H)	Speed Reference	All Modes Monitors the speed reference.	10 V: Max frequency (-10 to +10 V)	0.01% <31>	–
U1-02 (41H)	Output Speed	All Modes Displays the output speed.	10 V: Max frequency (-10 to +10 V)	0.01% <31>	–
U1-03 (42H)	Output Current	All Modes Displays the output current.	10 V: Drive rated current	<10> <40>	–
U1-04 (43H)	Control Method	All Modes 0: V/f Control 2: Open Loop Vector Control 3: Closed Loop Vector Control 7: Closed Loop Vector Control for PM	No signal output available	–	–
U1-05 (44H)	Speed Feedback	V/f OLV CLV CLV/PM Displays the motor speed feedback.	10 V: Max Frequency (-10 to +10 V)	0.01% <31>	–
U1-06 (45H)	Output Voltage Reference	All Modes Displays the output voltage.	10 V: 200 Vrms <9>	0.1 Vac	–
U1-07 (46H)	DC Bus Voltage	All Modes Displays the DC bus voltage.	10 V: 400 V <9>	1 Vdc	–
U1-08 (47H)	Output Power	All Modes Displays the output power (this value is calculated internally).	10 V: Drive rated power (kW) (-10 to +10 V)	<12>	–
U1-09 (48H)	Torque Reference	V/f OLV CLV CLV/PM Monitors the internal torque reference.	10 V: Motor rated torque (-10 to +10 V)	0.1%	–
U1-10 (49H)	Input Terminal Status	All Modes Displays the input terminal status. U1-10=00000000 1 Digital input 1 (terminal S1 enabled) 1 Digital input 2 (terminal S2 enabled) 1 Digital input 3 (terminal S3 enabled) 1 Digital input 4 (terminal S4 enabled) 1 Digital input 5 (terminal S5 enabled) 1 Digital input 6 (terminal S6 enabled) 1 Digital input 7 (terminal S7 enabled) 1 Digital input 8 (terminal S8 enabled)	No signal output available	–	–

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U1-11 (4AH)	Output Terminal Status	**All Modes** Displays the output terminal status. 	No signal output available	–	–
U1-12 (4BH)	Drive Status	**All Modes** Displays the drive operation status. 	No signal output available	–	–
U1-13 (4EH)	Terminal A1 Input Voltage	**All Modes** Displays the voltage input to terminal A1.	10 V: 100% (-10 to +10 V)	0.1%	–
U1-14 (4FH)	Terminal A2 Input Voltage	**All Modes** Displays the voltage input to terminal A2.	10 V: 100% (-10 to +10 V)	0.1%	–
U1-16 (53H)	Output Speed after Soft Start	**All Modes** Displays output speed with ramp time and jerk settings. Units determined by o1-03.	10 V: Max frequency (-10 to +10 V)	0.01% <31>	–
U1-17 (58H)	DI-A3 Option Card Input Status	**All Modes** Displays the reference value input from the DI-A3 option card. Display will appear in hexadecimal as determined by the digital card input selection in F3-01. 3FFFF: Set (1 bit) + sign (1 bit) + 16 bit	No signal output available	–	–
U1-18 (61H)	oPE Fault Parameter	**All Modes** Displays the parameter number that caused the oPE02 or oPE08 (Operation error).	No signal output available	–	–
U1-19 (66H)	MEMOBUS/Modbus Error Code	**All Modes** Displays the contents of a MEMOBUS/Modbus error. 	No signal output available	–	–

Parameter List

B

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U1-25 (4DH)	Software Number (Flash)	All Modes FLASH ID	No signal output available	–	–
U1-26 (5BH)	Software No. (ROM)	All Modes ROM ID	No signal output available	–	–

<9> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<10> The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.
<12> The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 kW units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 kW units.
<31> Setting units are determined by the digital operator display unit selection (o1-03). When o1-03 = 0, the value is set in Hertz. When o1-03 = 4 or 5, the value is displayed in m/s. When o1-03 = 6, the value is displayed in ft/min.
<40> When checking the values of U1-03, U2-05 and U4-13 with the digital operator they are displayed in units of amperes, but when they are checked using MEMOBUS communications, the monitor value in MEMOBUS communications is: displayed numeric value / 8192 × drive's rated current (A), from the condition "8192 (maximum value) = drive's rated current (A)".

■ U2: Fault Trace

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U2-01 (80H)	Current Fault	All Modes Displays the current fault.	No signal output available	–	–
U2-02 (81H)	Previous Fault	All Modes Displays the previous fault.	No signal output available	–	–
U2-03 (82H)	Speed Reference at Previous Fault	All Modes Displays the speed reference at the previous fault.	No signal output available	0.01% <31>	–
U2-04 (83H)	Output Speed at Previous Fault	All Modes Displays the output speed at the previous fault.	No signal output available	0.01% <31>	–
U2-05 (84H)	Output Current at Previous Fault	All Modes Displays the output current at the previous fault.	No signal output available	<10> <40>	–
U2-06 (85H)	Motor Speed at Previous Fault	V/f OLV CLV CLV/PM Displays the motor speed at the previous fault.	No signal output available	0.01% <31>	–
U2-07 (86H)	Output Voltage at Previous Fault	All Modes Displays the output voltage at the previous fault.	No signal output available	0.1 Vac	–
U2-08 (87H)	DC Bus Voltage at Previous Fault	All Modes Displays the DC bus voltage at the previous fault.	No signal output available	1 Vdc	–
U2-09 (88H)	Output Power at Previous Fault	All Modes Displays the output power at the previous fault.	No signal output available	0.1 kW	–
U2-10 (89H)	Torque Reference at Previous Fault	V/f OLV CLV CLV/PM Displays the torque reference at the previous fault.	No signal output available	0.1%	–
U2-11 (8AH)	Input Terminal Status at Previous Fault	All Modes Displays the input terminal status at the previous fault. Displayed as in U1-10.	No signal output available	–	–
U2-12 (8BH)	Output Terminal Status at Previous Fault	All Modes Displays the output status at the previous fault. Displayed as in U1-11.	No signal output available	–	–
U2-13 (8CH)	Drive Operation Status at Previous Fault	All Modes Displays the operation status of the drive at the previous fault. Displayed as in U1-12.	No signal output available	–	–
U2-14 (8DH)	Cumulative Operation Time at Previous Fault	All Modes Displays the cumulative operation time at the previous fault.	No signal output available	1 h	–
U2-15 (7E0H)	Soft Starter Output at Previous Fault	All Modes Displays the run speed after a soft start when a previous fault occurred. Displayed as in U1-16.	No signal output available	0.01% <31>	–
U2-16 (7E1H)	Motor q-Axis Current at Previous Fault	V/f OLV CLV CLV/PM Displays the q-axis current for the motor at the previous fault. Displayed as in U6-01.	No signal output available	0.1%	–
U2-17 (7E2H)	Motor d-Axis Current at Previous Fault	V/f OLV CLV CLV/PM Displays the d-axis current for the motor at the previous fault. Displayed as in U6-02.	No signal output available	0.1%	–

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U2-20 (8EH)	Heatsink Temperature at Previous Fault	All Modes Displays the temperature of the heatsink when the most recent fault occurred. Displayed as in U4-08.	No signal output available	1 °C	–
U2-21 (7E6H)	Peak Hold Current during Fault	All Modes Displays the peak current that occurred just prior to the previous fault.	No signal output available	0.01 A	–
U2-22 (7E7H)	Peak Hold Frequency during Fault	All Modes Displays the output frequency when the peak current displayed in U2-21 occurred.	No signal output available	0.01 Hz	–

<10> The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.
<31> Setting units are determined by the digital operator display unit selection (o1-03). When o1-03 = 0, the value is set in Hertz. When o1-03 = 4 or 5, the value is displayed in m/s. When o1-03 = 6, the value is displayed in ft/min.
<40> When checking the values of U1-03, U2-05 and U4-13 with the digital operator they are displayed in units of amperes, but when they are checked using MEMOBUS communications, the monitor value in MEMOBUS communications is: displayed numeric value / 8192 × drive's rated current (A), from the condition "8192 (maximum value) = drive's rated current (A)".

■ U3: Fault History

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U3-01 to U3-04 (90H to 93H (800H to 803H))	First to 4th Most Recent Fault	All Modes Displays the first to the fourth most recent faults.	No signal output available	–	–
U3-05 to U3-10 (804H to 809H)	5th to 10th Most Recent Fault	All Modes Displays the fifth to the tenth most recent faults. After ten faults have occurred in the drive, data for the oldest fault is deleted. The most recent fault appears in U3-01, with the next most recent fault appearing in U3-02. The data is moved to the next monitor parameter every time a fault occurs.	No signal output available	–	–
U3-11 to U3-14 (94H to 97H (80AH to 80DH))	Cumulative Operation Time at 1st to 4th Most Recent Fault	All Modes Displays the cumulative operation time when the first to the fourth most recent faults occurred.	No signal output available	1 h	–
U3-15 to U3-20 (80EH to 813H)	Cumulative Operation Time at 5th to 10th Most Recent Fault	All Modes Displays the cumulative operation time when the fifth to the tenth most recent faults occurred.	No signal output available	1 h	–

■ U4: Maintenance Monitors

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U4-01 (4CH, 98H, 99H) <41>	Cumulative Operation Time	All Modes Displays the cumulative operation time of the drive. The value for the cumulative operation time counter can be reset in parameter o4-01. Use parameter o4-02 to determine if the operation time should start as soon as the power is switched on or only while the Up/Down command is present. The maximum number displayed is 99999, after which the value is reset to 0.	No signal output available	1 h	–
U4-03 (67H, 94H, 9BH) <42>	Cooling Fan Operation Time	All Modes Displays the cumulative operation time of the cooling fan. The default value for the fan operation time is reset in parameter o4-03. This value will reset to 0 and start counting again after reaching 99999.	No signal output available	1 h	–
U4-04 (7EH)	Cooling Fan Maintenance	All Modes Displays main cooling fan usage time in as a percentage of its expected performance life. Parameter o4-03 can be used to reset this monitor. The fan should be replaced when this monitor reaches 90%.	No signal output available	1%	–
U4-05 (7CH)	Capacitor Maintenance	All Modes Displays main circuit capacitor usage time in as a percentage of their expected performance life. The capacitors should be replaced when this monitor reaches 90%. Parameter o4-05 can be used to reset this monitor.	No signal output available	1%	–
U4-06 (7D6H)	Soft Charge Bypass Relay Maintenance	All Modes Displays the soft charge bypass relay maintenance time as a percentage of its estimated performance life. The soft charge relay should be replaced when this monitor reaches 90%. Parameter o4-07 can be used to reset this monitor.	No signal output available	1%	–

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U4-07 (7D7H)	IGBT Maintenance	All Modes Displays IGBT usage time as a percentage of the expected performance life. The IGBTs should be replaced when this monitor reaches 90%. Parameter o4-09 can be used to reset this monitor.	No signal output available	1%	–
U4-08 (68H)	Heatsink Temperature	All Modes Displays the heatsink temperature.	10 V: 100°C	1 °C	–
U4-09 (5EH)	LED Check	All Modes Lights all segments of the LED to verify that the display is working properly.	No signal output available	–	–
U4-10 (5CH)	kWh, Lower 4 Digits	All Modes Monitors the drive output power. The value is shown as a 9 digit number displayed across two monitor parameters, U4-10 and U4-11. Example: 12345678.9 kWh is displayed as: U4-10: 678.9 kWh U4-11: 12345 MWh	No signal output available	1 kWh	–
U4-11 (5DH)	kWh, Upper 5 Digits		No signal output available	1 MWh	–
U4-13 (7CFH)	Peak Hold Current	All Modes Displays the highest current value that occurred during a ride.	No signal output available	0.01 A <40>	–
U4-14 (7D0H)	Peak Hold Output Frequency	All Modes Displays the output frequency when the current value shown in U4-13 occurred.	No signal output available	0.01 Hz	–
U4-16 (7D8H)	Motor Overload Estimate (oL1)	All Modes Shows the value of the motor overload detection accumulator. 100% is equal to the oL1 detection level.	10 V: 100%	0.1%	–
U4-17 (7D9H)	Drive Overload Calculations (OL2)	All Modes Displays the level of the drive overload detection (oL2). A value of 100% is equal to the oL2 detection level.	10 V = 100%	0.1%	–
U4-18 (7DAH)	Speed Reference Selection Results	All Modes Displays the source for the speed reference as XY-nn. X: indicates which reference is used: 1 = Reference 1 (b1-01) Y-nn: indicates the reference source 0-01 = Digital operator 1-01 = Analog (terminal A1) 1-02 = Analog (terminal A2) 2-02 to 8 = Digital Inputs (d1-02 to 8) 3-01 = MEMOBUS/Modbus communications 4-01 = Communication option card	No signal output available	–	–
U4-19 (7DBH)	Speed Reference from MEMOBUS/Modbus Comm.	All Modes Displays the speed reference provided by MEMOBUS/Modbus (decimal).	No signal output available	0.01% <31>	–
U4-20 (7DCH)	Speed Reference From Option Card	All Modes Displays the speed reference input by an option card (decimal).	No signal output available	0.01% <31>	–
U4-21 (7DDH)	Up/Down Command Source Selection	All Modes Displays the source for the Up/Down command as XY-nn. X: Indicates which Up/Down command source is used: 1 = Reference 1 (b1-02) Y: Input power supply data 0 = Digital operator 1 = External terminals 3 = MEMOBUS/Modbus communications 4 = Communication option card nn: Up/Down command limit status data 00: No limit status. 01: Up/Down command was left on when stopped in the PRG mode 02: Up/Down command was left on when switching from LOCAL to REMOTE operation 03: Waiting for soft charge bypass contactor after power up (Uv or Uv1 flashes after 10 s) 04: Waiting for "Up/Down Command Prohibited" time period to end 05: Fast Stop (multi-function input, operator) 07: During baseblock while coast to stop with timer 08: Speed reference is below minimal reference during baseblock 09: Waiting for Enter command	No signal output available	–	–
U4-22 (7DEH)	MEMOBUS/Modbus Communications Reference	All Modes Displays the drive control data set by MEMOBUS/Modbus communications register no. 0001H as a four-digit hexadecimal number.	No signal output available	–	–
U4-23 (7DFH)	Communication Option Card Reference	All Modes Displays drive control data set by an option card as a four-digit hexadecimal number.	No signal output available	–	–

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U4-24 (7E6H)	Number of Travels (Lower 4 digit)	**All Modes** Displays the lower four digits for the number of trips the drive has made.	No signal output available	1 time	–
U4-25 (7E7H)	Number of Travels (Higher 4 digit)	**All Modes** Displays the upper four digits for the number of trips the drive has made.	No signal output available	1 time	–
U4-26 (7E8H)	Max. Current during Acceleration	**All Modes** Shows the maximum current that occurred during acceleration.	No signal output available	0.1 A	–
U4-27 (7E9H)	Max. Current during Deceleration	**All Modes** Shows the maximum current that occurred during deceleration.	No signal output available	0.1 A	–
U4-28 (7EAH)	Max. Current during Constant Speed	**All Modes** Shows the maximum current that occurred during ride at top speed.	No signal output available	0.1 A	–
U4-29 (7EDH)	Max. Current during Leveling Speed	**All Modes** Shows the maximum current that occurred during ride at leveling speed.	No signal output available	0.1 A	–
U4-30 (7EEH)	Slip Compensation Value	**V/f** **OLV** CLV CLV/PM Shows the slip compensation value.	No signal output available	0.01%	–
U4-31 (7EFH)	Car Acceleration Rate	V/f OLV CLV **CLV/PM** Shows the car acceleration rate.	No signal output available	0.01 m/s^2	–
U4-40 (7FDH)	Speed Reference Limit at Rescue Operation	**All Modes** Displays the speed limit for Rescue Operation based on how much power the backup battery or UPS has. Displays 0% when Rescue Operation is not being performed.	No signal output available	1%	–
U4-42 (855H) <35>	Remaining Distance	V/f OLV **CLV** **CLV/PM** Displays the remaining distance according to the stopping method selected.	10 V: S5-10 = 1: S5-11 S5-10 = 2: S5-12	1 mm	–
U4-43 (856H) <35>	Minimum Deceleration Distance	V/f OLV **CLV** **CLV/PM** Displays the Minimum Deceleration Distance calculated by E1-04.	No signal output available	1 mm	–
U4-44 (857H) <35>	Minimum Stop Distance	V/f OLV **CLV** **CLV/PM** Displays the Minimum Stop Distance calculated by d1-26.	No signal output available	1 mm	–

<31> Setting units are determined by the digital operator display unit selection (o1-03). When o1-03 = 0, the value is set in Hertz. When o1-03 = 4 or 5, the value is displayed in m/s. When o1-03 = 6, the value is displayed in ft/min.
<35> o1-12 (Length Units) determines the units. When o1-12 is set to 0, the unit is millimeters. When o1-12 is set to 1, the unit is inch.
<40> When checking the values of U1-03, U2-05 and U4-13 with the digital operator they are displayed in units of amperes, but when they are checked using MEMOBUS communications, the monitor value in MEMOBUS communications is: displayed numeric value / 8192 × drive's rated current (A), from the condition "8192 (maximum value) = drive's rated current (A)".
<41> The MEMOBUS communications data is in 10 h units. If data in 1 h units are also required, refer to register number 0099H.
<42> The MEMOBUS communications data is in 10 h units. If data in 1 h units are also required, refer to register number 009BH.

Note: Fault trace (i.e., the fault history) is not maintained when CPF00, CPF01, CPF06, CPF24, oFA00, oFb00, oFC00, Uv1, Uv2, or Uv3 occur.

■ U6: Control Monitors

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U6-01 (51H)	Motor Secondary Current (Iq)	**All Modes** Displays the value of the motor secondary current (Iq). Motor rated secondary current is 100%.	10 V: Motor secondary rated current (-10 to +10 V)	0.1%	–
U6-02 (52H)	Motor Excitation Current (Id)	V/f **OLV** **CLV** **CLV/PM** Displays the value calculated for the motor excitation current (Id). Motor rated secondary current is 100%.	10 V: Motor secondary rated current (-10 to +10 V)	0.1%	–
U6-03 (54H)	Speed Control Loop Input	V/f OLV **CLV** **CLV/PM** Displays the input and output values of the speed control loop.	10 V: Max frequency (-10 to +10 V)	0.01%	–
U6-04 (55H)	Speed Control Loop Output		10 V: Motor secondary rated current (-10 to +10 V)		
U6-05 (59H)	Output Voltage Reference (Vq)	V/f **OLV** **CLV** **CLV/PM** Output voltage reference (Vq) for the q-axis.	10 V: 200 Vrms <9> (-10 to +10 V)	0.1 Vac	–

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U6-06 (5AH)	Output Voltage Reference (Vd)	V/f OLV CLV CLV/PM Output voltage reference (Vd) for the d-axis.	10 V: 200 Vrms <9> (-10 to +10 V)	0.1 Vac	–
U6-07 (5FH)	q-Axis Current Controller Output	V/f OLV CLV CLV/PM Displays the output value for current control relative to motor secondary current (q-axis).	10 V: 200 Vrms <9> (-10 to +10 V)	0.1%	–
U6-08 (60H)	d-Axis Current Controller Output	V/f OLV CLV CLV/PM Displays the output value for current control relative to motor secondary current (d-axis).	10 V: 200 Vrms <9> (-10 to +10 V)	0.1%	–
U6-13 (7CAH)	Flux Position Detection (sensor)	V/f OLV CLV CLV/PM Monitors the value of the flux position detection (sensor).	10 V: 180 deg -10 V: -180 deg	0.1 deg	
U6-18 (7CDH)	Speed Detection PG1 Counter	All Modes Monitors the number of pulses for speed detection (PG1).	10 V: 65536	1 pulse	
U6-22 (62H)	Position Lock Deviation Counter	V/f OLV CLV CLV/PM Displays how far the rotor has moved from its last position in PG pulses (multiplied by 4).	10 V: No. of pulses per revolution (-10 to +10 V)	1 pulse	–
U6-25 (6BH)	Feedback Control Output	V/f OLV CLV CLV/PM Output monitor for the speed control loop.	10 V: Motor secondary rated current (-10 to +10 V)	0.01%	–
U6-26 (6CH)	Inertia Compensation Output	V/f OLV CLV CLV/PM Output monitor for Inertia Compensation.	10 V: Motor secondary rated current (-10 to +10 V)	0.01%	–
U6-56 (7C3H)	Speed Feedback Compensation Output	V/f OLV CLV CLV/PM Displays observed speed when n5-07=1 or 2.	10 V: Max output frequency	0.01%	–
U6-80 to U6-99 (7B0 to 7B9, 7F0 to 7F9H)	Option Monitor 1 to 20	All Modes Monitors reserved to display data from option cards.	No signal output available	–	–

<9> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

B.4 Control Mode Dependent Parameter Default Values

The tables below list parameters that depend on the control mode selection (A1-02 for motor 1, E3-01 for motor 2). Changing the control mode initializes these parameters to the values shown here.

◆ A1-02 (Control Mode) Dependent Parameters

Table B.2 A1-02 (Control Mode) Dependent Parameters and Default Values

No.	Name	Setting Range	Resolution	Control Modes (A1-02)			
				V/f (0)	OLV (2)	CLV (3)	CLV/PM (7)
C3-05	Output Voltage Limit Operation Selection	0, 1	–	–	1	1	0
C4-02	Torque Compensation Primary Delay Time	0 to 60000	1 ms	200 <22>	50	–	–
C5-01	Speed Control Loop Proportional Gain 1	0.00 to 300.00	0.01	–	–	40.00	3.00
C5-02	Speed Control Loop Integral Time 1	0.000 to 10.000	0.001 s	–	–	0.500	0.300
C5-03	Speed Control Loop Proportional Gain 2	0.00 to 300.00	0.01	–	–	20.00	3.00
C5-07	Speed Control Loop Gain Switching Speed	0.0 to 100.0	0.1%	–	–	0.0	2.0
C5-13	Speed Control Loop Proportional Gain 3	0.00 to 300.00	0.01	–	–	40.00	3.00
C5-14	Speed Control Loop Integral Time 3	0.000 to 10.000	0.001 s	–	–	0.500	0.300
C5-19	Speed Control Loop Proportional Gain Time during Position Lock	0.00 to 300.00	0.01	–	–	40.00	10.00
E1-04	Maximum Output Frequency	<23>	0.1 Hz/1 rpm	50.0 Hz	50.0 Hz	50.0 Hz	150 rpm
E1-06	Base Frequency	0.0 to 120.0	0.1 Hz/1 rpm	50.0 Hz	50.0 Hz	50.0 Hz	150 rpm
E1-07	Middle Output Frequency	0.0 to 120.0	0.1 Hz	2.5	3.0	–	–
E1-08	Middle Output Frequency Voltage <9>	0.0 to 255.0	0.1 V	<3>	12.6 Hz	–	–
E1-09	Minimum Output Frequency	0.0 to 120.0	0.1 Hz/1 rpm	0.5 Hz	0.5 Hz	0.0 Hz	0 rpm
E1-10	Minimum Output Frequency Voltage <9>	0.0 to 255.0	0.1 V	<3>	2.3 Hz	–	–
F1-01	Encoder 1 Resolution	1 to 60000	1 ppr	–		1024	2048
F1-05	Encoder 1 Rotation Direction Selection	0, 1	–	–	–	0	1
L1-01	Motor Overload Protection Selection	0 to 3, 5	–	1	1	1	5
o1-04	V/f Pattern Setting Units	0, 1	–	–	–	0	1
o1-22	Mechanical Gear Ratio	0.10 to 50.00	0.01	–	–	14.00	1.00
S1-01	Zero Speed Level at Stop	0.0000 to 9.999	0.001%	2.400	1.000	0.200	0.350
S4-04	Light Load Direction Search Speed Reference	0.00 to 20.00	0.01%	5.00	5.00	5.00	10.00

<3> For models 2A0018 to 2A0225 and 4A0009 to 4A0114, the default setting is 16.1 for E1-08, and 8.0 for E1-10. For models 2A0269 to 2A0432 and 4A0140 to 4A0225, the default setting is 13.8 for E1-08 and, 6.9 for E1-10.
<9> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<22> Default setting value varies by drive model (o2-04).The default setting for models 2A0144 to 2A0432 and 4A0140 to 4A0225 is 1000 ms when using V/f control.
<23> Setting range depends on the type of motor being used. An induction motor has a setting range of 10.0 to 120.0 Hz, while a PM motor has a setting range of 4.0 to 120.0 Hz.

◆ Motor 2 Control Parameters

Table B.3 Motor 2 Control Parameters and Default Values

No.	Name	Setting Range	Resolution	Control Mode: V/f
E3-04	Motor 2 Maximum Output Frequency	40.0 to 400.0	0.1 Hz	The default settings of these parameters depend on drive capacity. ***Refer to E3: V/f Pattern for Motor 2 on page 186***
E3-05	Motor 2 Maximum Output Voltage <18>	0.0 to 255.0	0.1 V	
E3-06	Motor 2 Base Frequency	0.0 to 400.0	0.1 Hz	
E3-07	Motor 2 Mid Output Frequency	0.0 to 400.0	0.1 Hz	
E3-08	Motor 2 Mid Output Frequency Voltage <18>	0.0 to 255.0	0.1 V	
E3-09	Motor 2 Minimum Output Frequency	0.0 to 400.0	0.1 Hz	
E3-10	Motor 2 Minimum Output Voltage <18>	0.0 to 255.0	0.1 V	

<18> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

B.5 Defaults by Drive Model Selection (o2-04)

The following tables show parameters and default settings that change with the drive model selection (o2-04). Parameter numbers shown in parenthesis are valid for motor 2.

Refer to the drive nameplate to determine the software version. *Refer to Nameplate on page 29*.

Table B.4 200 V Class Drives Default Settings by Drive Model Selection (Software Version PRG: 7600 and Prior)

No.	Name	Unit	Default Settings						
–	Model CIMR-LE	–	2A0018	2A0022	2A0031	2A0041	2A0059	2A0075	2A0094
o2-04	Drive Model Selection	Hex.	67	68	6A	6B	6D	6E	6F
E2-11 E4-11	Motor Rated Output Motor 2 Rated Output	kW (HP)	3.7 (5)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)	22.0 (30)
C5-17	Motor Inertia	kgm^2	0.0158	0.0158	0.026	0.037	0.053	0.076	0.138
C6-03	Carrier Frequency	kHz	8	8	8	8	8	8	8
E2-01 (E4-01)	Motor Rated Current	A	11.4	14	19.6	26.6	39.7	53	65.8
E2-02 (E4-02)	Motor Rated Slip	Hz	2.7	2.73	1.5	1.3	1.7	1.6	1.67
E2-03 (E4-03)	Motor No-Load Current	A	3.7	4.5	5.1	8	11.2	15.2	15.7
E2-05 (E4-05)	Motor Line-to-Line Resistance	Ω	1.034	0.771	0.399	0.288	0.23	0.138	0.101
E2-06 (E4-06)	Motor Leakage Inductance	%	19	19.6	18.2	15.5	19.5	17.2	20.1
E2-10 (E4-10)	Motor Iron Loss for Torque Compensation	W	91	112	172	262	245	272	505
E3-08	Motor 2 Mid Output Frequency Voltage	V	16.1	16.1	16.1	16.1	16.1	16.1	16.1
E3-10	Motor 2 Minimum Output Frequency Voltage	V	8.0	8.0	8.0	8.0	8.0	8.0	8.0
E5-02	Motor Rated Power	kW (HP)	2.2 (3)	3.7 (5)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)
E5-03	Motor Rated Current	A	14	14.6	20	29.3	37.9	53.2	65
E5-05	Motor Stator Resistance	Ω	0.645	0.331	0.37	0.223	0.153	0.095	0.069
E5-06	Motor d-Axis Inductance	mH	7.03	4.78	5.39	3.58	3.46	2.46	1.99
E5-07	Motor q-Axis Inductance	mH	9.71	6.52	7.36	4.89	4.96	3.7	2.99
E5-09	Motor Induction Voltage Constant 1	mV/(rad/sec)	235.3	239.3	254.3	237	270	254.3	256.7
L8-02	Overheat Alarm Level	°C	110	110	120	125	120	120	125
L8-06	Input Phase Loss Detection Level	%	14.0	14.0	18.0	20.0	22.0	20.0	21.0
L8-35	Installation Method Selection	–	2	2	2	2	2	2	2
n5-02	Motor Acceleration Time	s	0.145	0.154	0.168	0.175	0.265	0.244	0.317
n9-60	A/D Conversion Start Delay	µsec	14.0	14.0	14.0	14.0	14.0	14.0	14.0

No.	Name	Unit	Default Settings						
–	Model CIMR-LE	–	2A0106	2A0144	2A0181	2A0225	2A0269	2A0354	2A0432
o2-04	Drive Model Selection	Hex.	70	72	73	74	75	76	77
E2-11 E4-11	Motor Rated Output Motor 2 Rated Output	kW (HP)	30.0 (40)	37.0 (50)	45.0 (60)	55.0 (75)	75.0 (100)	90.0 (125)	110.0 (150)
C5-17	Motor Inertia	kgm2	0.165	0.220	0.273	0.333	0.49	0.90	1.10
C6-03	Carrier Frequency	kHz	8	8	5	5	5	5	2
E2-01 (E4-01)	Motor Rated Current	A	77.2	105	131	160	190	260	260
E2-02 (E4-02)	Motor Rated Slip	Hz	1.7	1.8	1.33	1.6	1.43	1.39	1.39
E2-03 (E4-03)	Motor No-Load Current	A	18.5	21.9	38.2	44	45.6	72	72
E2-05 (E4-05)	Motor Line-to-Line Resistance	Ω	0.079	0.064	0.039	0.03	0.022	0.023	0.023
E2-06 (E4-06)	Motor Leakage Inductance	%	19.5	20.8	18.8	20.2	20.5	20	20
E2-10 (E4-10)	Motor Iron Loss for Torque Compensation	W	538	699	823	852	960	1200	1200
E3-08	Motor 2 Mid Output Frequency Voltage	V	16.1	16.1	16.1	16.1	13.8	13.8	13.8
E3-10	Motor 2 Minimum Output Frequency Voltage	V	8.0	8.0	8.0	8.0	6.9	6.9	6.9
E5-02	Motor Rated Power	kW (HP)	22.0 (30)	30.0 (40)	37.0 (50)	45.0 (60)	55.0 (75)	75.0 (100)	90.0 (125)
E5-03	Motor Rated Current	A	76.4	103.5	133.1	149.4	181.6	181.6	181.6
E5-05	Motor Stator Resistance	Ω	0.054	0.041	0.027	0.022	0.016	0.016	0.016
E5-06	Motor d-Axis Inductance	mH	1.7	1.29	0.91	0.9	0.72	0.72	0.72
E5-07	Motor q-Axis Inductance	mH	2.55	2	1.41	1.39	1.11	1.11	1.11
E5-09	Motor Induction Voltage Constant 1	mV/(rad/sec)	261.1	260.4	245.1	276	0.317	0.533	0.592
L8-02	Overheat Alarm Level	°C	130	130	130	125	115	120	120
L8-06	Input Phase Loss Detection Level	%	21.0	17.0	27.0	28.0	17	16	24
L8-35	Installation Method Selection	–	2	2	2	2	0	0	0
n5-02	Motor Acceleration Time	s	0.355	0.323	0.32	0.387	0.317	0.533	0.592
n9-60	A/D Conversion Start Delay	µsec	14.0	14.0	14.0	14.0	14.0	14.0	14.0

Table B.5 400 V Class Drives Default Settings by Drive Capacity (Software Version PRG: 7600 and Prior)

No.	Name	Unit	Default Settings						
–	Model CIMR-LE	–	4A0009	4A0012	4A0019	4A0023	4A0030	4A0039	4A0049
o2-04	Drive Model Selection	Hex.	96	97	99	9A	9C	9D	9E
E2-11 E4-11	Motor Rated Output Motor 2 Rated Output	kW (HP)	3.7 (5)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)	22.0 (30)
C5-17	Motor Inertia	kgm^2	0.0158	0.0158	0.026	0.037	0.053	0.076	0.138
C6-03	Carrier Frequency	kHz	8	8	8	8	8	8	8
E2-01 (E4-01)	Motor Rated Current	A	5.7	7	9.8	13.3	19.9	26.5	32.9
E2-02 (E4-02)	Motor Rated Slip	Hz	2.7	2.7	1.5	1.3	1.7	1.6	1.67
E2-03 (E4-03)	Motor No-Load Current	A	1.9	2.3	2.6	4	5.6	7.6	7.8
E2-05 (E4-05)	Motor Line-to-Line Resistance	Ω	4.36	3.333	1.595	1.152	0.922	0.55	0.403
E2-06 (E4-06)	Motor Leakage Inductance	%	19	19.3	18.2	15.5	19.6	17.2	20.1
E2-10 (E4-10)	Motor Iron Loss for Torque Compensation	W	105	130	193	263	385	440	508
E3-08	Motor 2 Mid Output Frequency Voltage	V	32.2	32.2	32.2	32.2	32.2	32.2	32.2
E3-10	Motor 2 Minimum Output Frequency Voltage	V	16.0	16.0	16.0	16.0	16.0	16.0	16.0
E5-02	Motor Rated Power	kW (HP)	3 (2)	3.7 (5)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)
E5-03	Motor Rated Current	A	7.2	7.3	10	14.6	19	26.6	32.5
E5-05	Motor Stator Resistance	Ω	2.658	1.326	1.479	0.892	0.613	0.378	0.276
E5-06	Motor d-Axis Inductance	mH	28.12	19.11	21.58	14.33	13.84	9.85	7.95
E5-07	Motor q-Axis Inductance	mH	38.85	26.08	29.44	19.56	19.83	14.79	11.94
E5-09	Motor Induction Voltage Constant 1	mV/(rad/sec)	470.6	478.6	508.4	473.9	540	508.4	513.7
L8-02	Overheat Alarm Level	°C	110	110	110	115	120	120	115
L8-06	Input Phase Loss Detection Level	%	14.0	14.0	26.0	26.0	21.0	22.0	26.0
L8-35	Installation Method Selection	–	2	2	2	2	2	2	2
n5-02	Motor Acceleration Time	s	0.145	0.154	0.168	0.175	0.265	0.244	0.317
n9-60	A/D Conversion Start Delay	μsec	14.0	14.0	14.0	14.0	14.0	14.0	114.0

No.	Name	Unit	Default Settings						
–	Model CIMR-LE	–	4A0056	4A0075	4A0094	4A0114	4A0140	4A0188	4A0225
o2-04	Drive Model Selection	Hex.	9F	A1	A2	A3	A4	A5	A6
E2-11 E4-11	Motor Rated Output Motor 2 Rated Output	kW (HP)	30.0 (40)	37.0 (50)	45.0 (60)	55.0 (75)	75.0 (100)	90.0 (125)	110.0 (150)
C5-17	Motor Inertia	kgm2	0.165	0.220	0.273	0.333	0.49	0.90	1.10
C6-03	Carrier Frequency	kHz	8	8	5	5	5	5	2
E2-01 (E4-01)	Motor Rated Current	A	38.6	52.3	65.6	79.7	95	130	156
E2-02 (E4-02)	Motor Rated Slip	Hz	1.7	1.8	1.33	1.6	1.46	1.39	1.4
E2-03 (E4-03)	Motor No-Load Current	A	9.2	10.9	19.1	22	24	36	40
E2-05 (E4-05)	Motor Line-to-Line Resistance	Ω	0.316	0.269	0.155	0.122	0.088	0.092	0.056
E2-06 (E4-06)	Motor Leakage Inductance	%	23.5	20.7	18.8	19.9	20	20	20
E2-10 (E4-10)	Motor Iron Loss for Torque Compensation	W	586	750	925	1125	1260	1600	1760
E3-08	Motor 2 Mid Output Frequency Voltage	V	32.2	32.2	32.2	32.2	27.6	27.6	27.6
E3-10	Motor 2 Minimum Output Frequency Voltage	V	16.0	16.0	16.0	16.0	13.8	13.8	13.8
E5-02	Motor Rated Power	kW (HP)	22.0 (30)	30.0 (40)	37.0 (50)	45.0 (60)	55.0 (75)	75.0 (100)	90.0 (125)
E5-03	Motor Rated Current	A	38.2	51.8	66.6	74.7	90.8	130	130
E5-05	Motor Stator Resistance	Ω	0.217	0.165	0.107	0.087	0.064	0.022	0.022
E5-06	Motor d-Axis Inductance	mH	6.8	5.15	3.62	3.59	2.87	1.80	1.80
E5-07	Motor q-Axis Inductance	mH	10.22	8	5.63	5.55	4.44	2.80	2.80
E5-09	Motor Induction Voltage Constant 1	mV/(rad/sec)	522.3	520.8	490.2	552	554.4	1280.0	1280.0
L8-02	Overheat Alarm Level	°C	120	120	110	120	130	130	120
L8-06	Input Phase Loss Detection Level	%	18.0	17.0	18.0	20.0	20.0	29.0	17
L8-35	Installation Method Selection	–	2	2	2	2	2	2	0
n5-02	Motor Acceleration Time	s	0.355	0.323	0.32	0.387	0.317	0.533	0.592
n9-60	A/D Conversion Start Delay	μsec	14.0	14.0	14.0	14.0	14.0	14.0	14.0

Table B.6 200 V Class Drives Default Settings by Drive Model Selection (Software Version PRG: 7601)

No.	Name	Unit	Default Settings						
–	Model CIMR-LE	–	2A0018	2A0022	2A0031	2A0041	2A0059	2A0075	2A0094
o2-04	Drive Model Selection	Hex.	67	68	6A	6B	6D	6E	6F
E2-11 E4-11	Motor Rated Output Motor 2 Rated Output	kW (HP)	3.7 (5)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)	22.0 (30)
C5-17	Motor Inertia	kgm^2	0.0158	0.0158	0.026	0.037	0.053	0.076	0.138
C6-03	Carrier Frequency	kHz	8	8	8	8	8	8	8
E2-01 (E4-01)	Motor Rated Current	A	14	19.6	26.6	39.7	53	65.8	77.2
E2-02 (E4-02)	Motor Rated Slip	Hz	2.73	1.5	1.3	1.7	1.6	1.67	1.7
E2-03 (E4-03)	Motor No-Load Current	A	4.5	5.1	8	11.2	15.2	15.7	18.5
E2-05 (E4-05)	Motor Line-to-Line Resistance	Ω	0.771	0.399	0.288	0.230	0.138	0.101	0.079
E2-06 (E4-06)	Motor Leakage Inductance	%	19.6	18.2	15.5	19.5	17.2	20.1	19.5
E2-10 (E4-10)	Motor Iron Loss for Torque Compensation	W	112	172	262	245	272	505	538
E3-08	Motor 2 Mid Output Frequency Voltage	V	16.1	16.1	16.1	16.1	16.1	16.1	16.1
E3-10	Motor 2 Minimum Output Frequency Voltage	V	8.0	8.0	8.0	8.0	8.0	8.0	8.0
E5-02	Motor Rated Power	kW (HP)	3.7 (5)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)	22.0 (30)
E5-03	Motor Rated Current	A	14.6	20	29.3	37.9	53.2	65	76.4
E5-05	Motor Stator Resistance	Ω	0.331	0.37	0.223	0.153	0.095	0.069	0.054
E5-06	Motor d-Axis Inductance	mH	4.78	5.39	3.58	3.46	2.46	1.99	1.70
E5-07	Motor q-Axis Inductance	mH	6.52	7.36	4.89	4.96	3.7	2.99	2.55
E5-09	Motor Induction Voltage Constant 1	mV/(rad/sec)	239.3	254.3	237	270	254.3	256.7	261.1
L8-02	Overheat Alarm Level	°C	110	110	120	125	120	120	125
L8-06	Input Phase Loss Detection Level	%	14.0	14.0	18.0	20.0	22.0	20.0	21.0
L8-35	Installation Method Selection	–	2	2	2	2	2	2	2
n5-02	Motor Acceleration Time	s	0.145	0.154	0.168	0.175	0.265	0.244	0.317
n9-60	A/D Conversion Start Delay	μsec	14.0	14.0	14.0	14.0	14.0	14.0	14.0

No.	Name	Unit	Default Settings						
–	Model CIMR-LE	–	2A0106	2A0144	2A0181	2A0225	2A0269	2A0354	2A0432
o2-04	Drive Model Selection	Hex.	70	72	73	74	75	76	77
E2-11 E4-11	Motor Rated Output Motor 2 Rated Output	kW (HP)	30.0 (40)	37.0 (50)	45.0 (60)	55.0 (75)	75.0 (100)	90.0 (125)	110.0 (150)
C5-17	Motor Inertia	kgm2	0.165	0.220	0.273	0.333	0.49	0.90	1.10
C6-03	Carrier Frequency	kHz	8	8	5	5	5	5	2
E2-01 (E4-01)	Motor Rated Current	A	105	131	160	190	260	260	260
E2-02 (E4-02)	Motor Rated Slip	Hz	1.8	1.33	1.6	1.43	1.39	1.39	1.39
E2-03 (E4-03)	Motor No-Load Current	A	21.9	38.2	44	45.6	72	72	72
E2-05 (E4-05)	Motor Line-to-Line Resistance	Ω	0.064	0.039	0.03	0.022	0.023	0.023	0.023
E2-06 (E4-06)	Motor Leakage Inductance	%	20.8	18.8	20.2	20.5	20	20	20
E2-10 (E4-10)	Motor Iron Loss for Torque Compensation	W	699	823	852	960	1200	1200	1200
E3-08	Motor 2 Mid Output Frequency Voltage	V	16.1	16.1	16.1	16.1	13.8	13.8	13.8
E3-10	Motor 2 Minimum Output Frequency Voltage	V	8.0	8.0	8.0	8.0	6.9	6.9	6.9
E5-02	Motor Rated Power	kW (HP)	30.0 (40)	37.0 (50)	45.0 (60)	55.0 (75)	75.0 (100)	75.0 (100)	75.0 (100)
E5-03	Motor Rated Current	A	103.5	133.1	149.4	181.6	181.6	181.6	181.6
E5-05	Motor Stator Resistance	Ω	0.041	0.027	0.022	0.016	0.016	0.016	0.016
E5-06	Motor d-Axis Inductance	mH	1.29	0.91	0.90	0.72	0.72	0.72	0.72
E5-07	Motor q-Axis Inductance	mH	2	1.41	1.39	1.11	1.11	1.11	1.11
E5-09	Motor Induction Voltage Constant 1	mV/(rad/sec)	260.4	245.1	276	277.1	277.1	277.1	277.1
L8-02	Overheat Alarm Level	°C	130	130	130	125	115	120	120
L8-06	Input Phase Loss Detection Level	%	21.0	17.0	27.0	28.0	17	16	24
L8-35	Installation Method Selection	–	2	2	2	2	0	0	0
n5-02	Motor Acceleration Time	s	0.355	0.323	0.32	0.387	0.317	0.533	0.592
n9-60	A/D Conversion Start Delay	μsec	14.0	14.0	14.0	14.0	14.0	14.0	14.0

Table B.7 400 V Class Drives Default Settings by Drive Capacity (Software Version PRG: 7601)

No.	Name	Unit	Default Settings						
–	Model CIMR-LE	–	4A0009	4A0012	4A0019	4A0023	4A0030	4A0039	4A0049
o2-04	Drive Model Selection	Hex.	96	97	99	9A	9C	9D	9E
E2-11 E4-11	Motor Rated Output Motor 2 Rated Output	Kw (HP)	3.7 (5)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)	22.0 (30)
C5-17	Motor Inertia	kgm^2	0.0158	0.0158	0.026	0.037	0.053	0.076	0.138
C6-03	Carrier Frequency	kHz	8	8	8	8	8	8	8
E2-01 (E4-01)	Motor Rated Current	A	7	9.8	13.3	19.9	26.5	32.9	38.6
E2-02 (E4-02)	Motor Rated Slip	Hz	2.7	1.5	1.3	1.7	1.6	1.67	1.7
E2-03 (E4-03)	Motor No-Load Current	A	2.3	2.6	4.0	5.6	7.6	7.8	9.2
E2-05 (E4-05)	Motor Line-to-Line Resistance	Ω	3.333	1.595	1.152	0.922	0.550	0.403	0.316
E2-06 (E4-06)	Motor Leakage Inductance	%	19.3	18.2	15.5	19.6	17.2	20.1	23.5
E2-10 (E4-10)	Motor Iron Loss for Torque Compensation	W	130	193	263	385	440	508	586
E3-08	Motor 2 Mid Output Frequency Voltage	V	32.2	32.2	32.2	32.2	32.2	32.2	32.2
E3-10	Motor 2 Minimum Output Frequency Voltage	V	16.0	16.0	16.0	16.0	16.0	16.0	16.0
E5-02	Motor Rated Power	kW (HP)	3.7 (5)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)	22.0 (30)
E5-03	Motor Rated Current	A	7.3	10	14.6	19	26.6	32.5	38.2
E5-05	Motor Stator Resistance	Ω	1.326	1.479	0.892	0.613	0.378	0.276	0.217
E5-06	Motor d-Axis Inductance	mH	19.11	21.58	14.33	13.84	9.85	7.95	6.80
E5-07	Motor q-Axis Inductance	mH	26.08	29.44	19.56	19.83	14.79	11.94	10.22
E5-09	Motor Induction Voltage Constant 1	mV/(rad/sec)	478.6	508.4	473.9	540	508.4	513.7	522.3
L8-02	Overheat Alarm Level	°C	110	110	110	115	120	120	115
L8-06	Input Phase Loss Detection Level	%	14.0	14.0	26.0	26.0	21.0	22.0	26.0
L8-35	Installation Method Selection	–	2	2	2	2	2	2	2
n5-02	Motor Acceleration Time	s	0.145	0.154	0.168	0.175	0.265	0.244	0.317
n9-60	A/D Conversion Start Delay	µsec	14.0	14.0	14.0	14.0	14.0	14.0	114.0

No.	Name	Unit	Default Settings						
–	Model CIMR-LE	–	4A0056	4A0075	4A0094	4A0114	4A0140	4A0188	4A0225
o2-04	Drive Model Selection	Hex.	9F	A1	A2	A3	A4	A5	A6
E2-11 E4-11	Motor Rated Output Motor 2 Rated Output	kW (HP)	30.0 (40)	37.0 (50)	45.0 (60)	55.0 (75)	75.0 (100)	90.0 (125)	110.0 (150)
C5-17	Motor Inertia	kgm2	0.165	0.220	0.273	0.333	0.49	0.90	1.10
C6-03	Carrier Frequency	kHz	8	8	5	5	5	5	2
E2-01 (E4-01)	Motor Rated Current	A	52.3	65.6	79.7	95	130	156	190
E2-02 (E4-02)	Motor Rated Slip	Hz	1.8	1.33	1.6	1.46	1.39	1.40	1.40
E2-03 (E4-03)	Motor No-Load Current	A	10.9	19.1	22	24	36	40	49
E2-05 (E4-05)	Motor Line-to-Line Resistance	Ω	0.269	0.155	0.122	0.088	0.092	0.056	0.046
E2-06 (E4-06)	Motor Leakage Inductance	%	20.7	18.8	19.9	20	20	20	20
E2-10 (E4-10)	Motor Iron Loss for Torque Compensation	W	750	925	1125	1260	1600	1760	2150
E3-08	Motor 2 Mid Output Frequency Voltage	V	32.2	32.2	32.2	32.2	27.6	27.6	27.6
E3-10	Motor 2 Minimum Output Frequency Voltage	V	16.0	16.0	16.0	16.0	13.8	13.8	13.8
E5-02	Motor Rated Power	kW (HP)	30.0 (40)	37.0 (50)	45.0 (60)	55.0 (75)	75.0 (100)	75.0 (100)	75.0 (100)
E5-03	Motor Rated Current	A	51.8	66.6	74.7	90.8	130	130	130
E5-05	Motor Stator Resistance	Ω	0.165	0.107	0.087	0.064	0.022	0.022	0.022
E5-06	Motor d-Axis Inductance	mH	5.15	3.62	3.59	2.87	1.80	1.80	1.80
E5-07	Motor q-Axis Inductance	mH	8	5.63	5.55	4.44	2.80	2.80	2.80
E5-09	Motor Induction Voltage Constant 1	mV/(rad/sec)	520.8	490.2	552	554.4	1280.0	1280.0	1280.0
L8-02	Overheat Alarm Level	°C	120	120	110	120	130	130	120
L8-06	Input Phase Loss Detection Level	%	18.0	17.0	18.0	20.0	20.0	29.0	17
L8-35	Installation Method Selection	–	2	2	2	2	2	2	0
n5-02	Motor Acceleration Time	s	0.355	0.323	0.32	0.387	0.317	0.533	0.592
n9-60	A/D Conversion Start Delay	µsec	14.0	14.0	14.0	14.0	14.0	14.0	14.0

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B.6 Defaults and Setting Ranges by Display Unit Selection (o1-03)

Table B.8 shows parameters, default settings, and setting ranges that change according to parameter o1-03, Display Unit Selection.

Table B.8 Defaults and Setting Ranges by Display Unit Selection (o1-03)

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Name</th><th colspan="7">o1-03 (Digital Operator Display Unit Selection)</th><th rowspan="2">Default</th></tr>
<tr><th>0
(0.01 Hz)</th><th>1
(0.01%)</th><th>2
(r/min)</th><th>3
(User-set)</th><th>4
(Elevator units 1)</th><th>5
(Elevator units 2)</th><th>6
(Elevator units 3)</th></tr>
<tr><td>C1-01</td><td>Acceleration Ramp 1</td><td colspan="5" rowspan="10">0.00 to 600.00 s</td><td rowspan="10">0.00 to <1> m/s^2</td><td rowspan="10">0.00 to <1> ft/s^2</td><td rowspan="9">1.50 s</td></tr>
<tr><td>C1-02</td><td>Deceleration Ramp 1</td></tr>
<tr><td>C1-03</td><td>Acceleration Ramp 2</td></tr>
<tr><td>C1-04</td><td>Deceleration Ramp 2</td></tr>
<tr><td>C1-05</td><td>Acceleration Ramp 3</td></tr>
<tr><td>C1-06</td><td>Deceleration Ramp 3</td></tr>
<tr><td>C1-07</td><td>Acceleration Ramp 4</td></tr>
<tr><td>C1-08</td><td>Deceleration Ramp 4</td></tr>
<tr><td>C1-09</td><td>Fast Stop Time</td></tr>
<tr><td>C1-15</td><td>Inspection Run Deceleration Ramp</td><td>0.00 s</td></tr>
<tr><td>C2-01</td><td>Jerk at Accel Start</td><td colspan="5" rowspan="5">0.00 to 10.00 s</td><td rowspan="5">0.00 to <1> m/s^3</td><td rowspan="5">0.00 to <1> ft/s^3</td><td rowspan="5">0.50 s</td></tr>
<tr><td>C2-02</td><td>Jerk at Accel End</td></tr>
<tr><td>C2-03</td><td>Jerk at Decel Start</td></tr>
<tr><td>C2-04</td><td>Jerk at Decel End</td></tr>
<tr><td>C2-05</td><td>Jerk below leveling speed</td></tr>
<tr><td>C1-11</td><td>Accel/Decel Switching Speed</td><td rowspan="17">0.00 to [E1-04] Hz</td><td rowspan="17">0.00 to 100.00%</td><td rowspan="17">0.00 to <2> r/min</td><td rowspan="17">User define</td><td colspan="2" rowspan="17">0.00 to <1> m/s</td><td rowspan="17">0.00 to <1> ft/min</td><td>0.0%</td></tr>
<tr><td>d1-01</td><td>Speed Reference 1</td><td rowspan="8">0.00%</td></tr>
<tr><td>d1-02</td><td>Speed Reference 2</td></tr>
<tr><td>d1-03</td><td>Speed Reference 3</td></tr>
<tr><td>d1-04</td><td>Speed Reference 4</td></tr>
<tr><td>d1-05</td><td>Speed Reference 5</td></tr>
<tr><td>d1-06</td><td>Speed Reference 6</td></tr>
<tr><td>d1-07</td><td>Speed Reference 7</td></tr>
<tr><td>d1-08</td><td>Speed Reference 8</td></tr>
<tr><td>d1-19</td><td>Nominal Speed</td><td>100.0%</td></tr>
<tr><td>d1-20</td><td>Intermediate Speed 1</td><td rowspan="4">0.00%</td></tr>
<tr><td>d1-21</td><td>Intermediate Speed 2</td></tr>
<tr><td>d1-22</td><td>Intermediate Speed 3</td></tr>
<tr><td>d1-23</td><td>Releveling Speed</td></tr>
<tr><td>d1-24</td><td>Inspection Operation Speed</td><td>50.00%</td></tr>
<tr><td>d1-25</td><td>Rescue Operation Speed</td><td>10.00%</td></tr>
<tr><td>d1-26</td><td>Leveling Speed</td><td>8.00%</td></tr>
</table>

<1> Automatically calculated according to the values set to o1-20, o1-21, o1-22, and E2-□□ / E5-□□ parameters.
<2> Automatically calculated according to the values set to the E2-□□ / E5-□□ parameters.

Appendix: C

MEMOBUS/Modbus Communications

C.1 MEMOBUS/Modbus Configuration

Drives can be controlled from a PLC or other master device via serial communications using the MEMOBUS/Modbus protocol.

MEMOBUS/Modbus communications can be configured using one master (PLC) and up to 255 slaves. The drive has slave functionality only, meaning that serial communication is normally initiated from the master and responded to by the slaves.

The master communicates to the specified slave drive. The address or node for each slave must be set beforehand so that the master can communicate with the slave at that address. A slave that receives a command from the master will perform the specified function and then send a response back to the master.

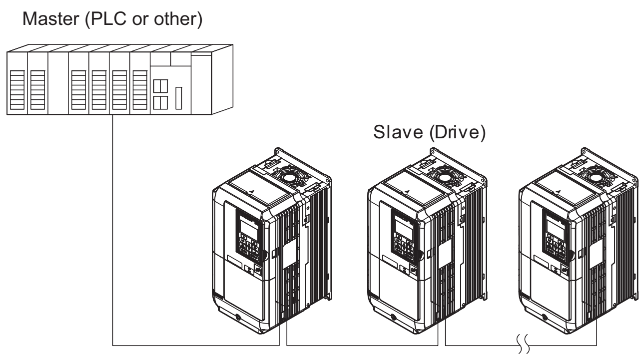


Figure C.1 Connecting Multiple Drives to a PLC

C.2 Communication Specifications

MEMOBUS/Modbus specifications appear in the following table:

Item	Specifications	
Interface	RS-422, RS-485	
Communications Cycle	Asynchronous (Start-stop synchronization)	
Communication Parameters	Communication Speeds Available	1.2; 2.4; 4.8; 9.6; 19.2; 38.4; 57.6; 76.8; 115.2 kbps
	Data length	8 bit (fixed)
	Parity	Select even, odd, or none
	Stop bit	1 bit (fixed)
Protocol	MEMOBUS/Modbus (using RTU mode only)	
Max Number of Slaves	255 drives (RS-485)	

C.3 Connecting to a Network

This section explains how to connect the drive to a MEMOBUS/Modbus network and the network termination required for a connection.

◆ Network Cable Connection

Follow the instructions below to connect the drive to a MEMOBUS/Modbus network.

1. With the power shut off, connect the communications cable to the drive and the master. Use terminals R+/S+ and R–/S– for MEMOBUS/Modbus.

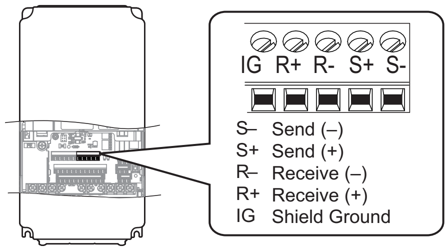


Figure C.2 Serial Communications Cable Connection Terminals

Note: Separate the communications cables from the main circuit cables and other wiring and power cables. Use shielded cables for the communications cables, and properly shielded clamps to prevent problems with noise. When using RS-485 communications, connect S+ to R+, and S- to R- as shown in the diagram below.

2. Check or set the termination resistor selection at all slaves. Use the description in ***Network Termination on page 425*** for slaves that are L1000E drives.
3. Switch the power on.
4. Set the parameters needed for serial communications (H5-01 through H5-11) using the digital operator.
5. Shut the power off and wait until the display on the digital operator goes out completely.
6. Turn the power back on.
7. The drive is now ready to begin communicating with the master.

◆ Wiring Diagram for Multiple Connection

Figure C.3 and ***Figure C.4*** explain the wiring diagrams for multiple connections using MEMOBUS/Modbus communication.

■ RS-485 Interface

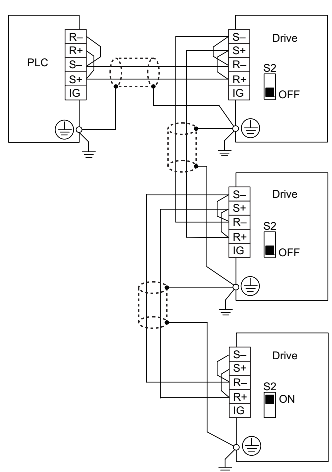


Figure C.3 RS-485 Interface

Note: **1.** Turn on the DIP switch on the drive that is located at the end of the network. All other slave devices must have this DIP switch set to the OFF position.
2. Set H5-07 to 1 when using the RS-485 interface.

■ RS-422 Interface

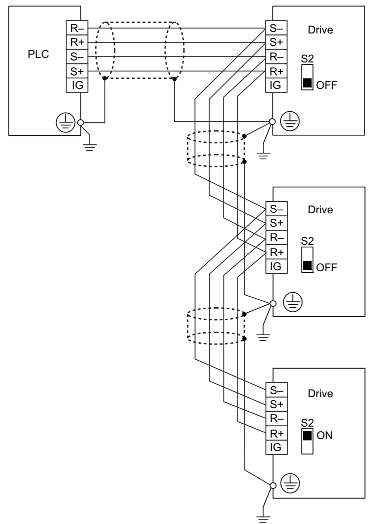


Figure C.4 RS-422 Interface

Note: **1.** Turn on the DIP switch on the drive that is located at the end of the network. All other slave devices must have this DIP switch set to the OFF position.

2. Set H5-07 to 0 when using the RS-485 interface.
Set H5-07 to 1 when using the RS-422 interface in multi-drop circuit. Set H5-07 to 0 when using the RS-422 interface in point-to-point circuit.

◆ Network Termination

The two ends of the MEMOBUS/Modbus network line have to be terminated. The drive has a built in termination resistor that can be enabled or disabled using DIP switch S2. If a drive is located at the end of a network line, enable the termination resistor by setting DIP switch S2 to the ON position. Disable the termination resistor on all slaves that are not located at the network line end.

Figure C.5 illustrates the setting of DIP switch S2.

To set the DIP switch on the terminal board, use an appropriate sized tool with a tip of approximately 8 mm (5/16 in.) in width.

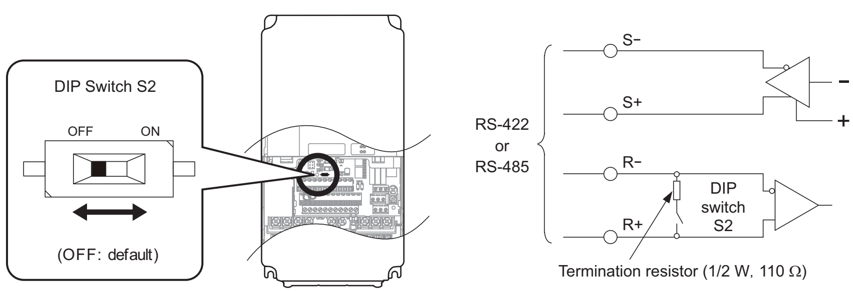


Figure C.5 Serial Communications Terminal and DIP Switch S2

C.4 MEMOBUS/Modbus Setup Parameters

◆ MEMOBUS/Modbus Serial Communication

This section describes parameters necessary to set up MEMOBUS/Modbus communications.

■ H5-01: Drive Slave Address

Sets the drive slave address used for MEMOBUS/Modbus communications.

Note: Cycle the power after changing this parameter to enable the new setting.

No.	Parameter Name	Setting Range	Default
H5-01	Drive Slave Address	0 to FFH <1>	1FH

<1> If the address is set to 0, no response will be provided during communications.

Each slave drive must be assigned a unique slave address for serial communications to work. Setting H5-01 to any value besides 0 assigns the drive its address in the network. Slave addresses do not need to be assigned in sequential order, but no two drives may share the same address.

■ H5-02: Communication Speed Selection

Sets the MEMOBUS/Modbus communications speed.

Note: Cycle the power after changing this parameter to enable the new setting.

No.	Parameter Name	Setting Range	Default
H5-02	Communication Speed Selection	0 to 5	3

H5-02	Communication Speed	H5-02	Communication Speed
0	1200 bps	5	38400 bps
1	2400 bps	6	57600 bps
2	4800 bps	7	76800 bps
3	9600 bps	8	115200 bps
4	19200 bps	–	–

■ H5-03: Communication Parity Selection

Sets the parity used for MEMOBUS/Modbus communications.

Note: Cycle the power after changing this parameter to enable the new setting.

No.	Parameter Name	Setting Range	Default
H5-03	Communication Parity Selection	0 to 2	0

Setting 0: No parity

Setting 1: Even parity

Setting 2: Odd parity

■ H5-04: Stopping Method after Communication Error

Selects the stopping method after a communications error (CE) has occurred.

No.	Parameter Name	Setting Range	Default
H5-04	Stopping Method after Communication Error	0 to 3	3

Setting 0: Ramp to stop (uses the deceleration ramp currently enabled)

Setting 1: Coast to stop

Setting 2: Fast Stop

Setting 3: Alarm only (continue operation)

■ H5-05: Communication Fault Detection Selection

Enables or disabled the communication error (CE) detection for MEMOBUS/Modbus communications.

No.	Parameter Name	Setting Range	Default
H5-05	Communication Fault Detection Selection	0 or 1	1

Setting 0: Disabled

No communication error detection. The drive continues operation.

Setting 1: Enabled

If the drive does not receive data from the master for longer than the time set to H5-09, then a CE fault will be triggered and the drive will operate as determined by parameter H5-04.

■ H5-06: Drive Transmit Wait Time

Sets the time the drive waits after receiving data from a master before responding.

No.	Parameter Name	Setting Range	Default
H5-06	Drive Transmit Wait Time	5 to 65 ms	5 ms

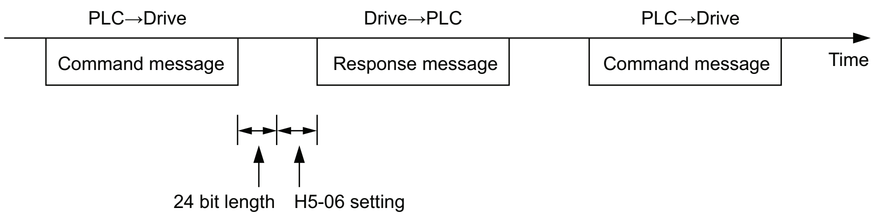


Figure C.6 Drive Transmit Wait Time Setting

■ H5-07: RTS Control Selection

Enables or disables RTS control.

No.	Parameter Name	Setting Range	Default
H5-07	RTS Control Selection	0 or 1	1

Setting 0: Disabled. RTS is always on.

Use this setting when using RS-485 signals for communications or when using RS-422 signals for point-to-point communications.

Setting 1: Enabled. RTS switches while sending.

Use this setting when using RS-422 signals for multi-drop communications.

■ H5-09: Communication Fault Detection Time

Sets the time the communications must be lost before the drive triggers a CE fault.

No.	Parameter Name	Setting Range	Default
H5-09	Communication Fault Detection Time	0.0 to 10.0 s	2.0 s

■ H5-10: Unit Selection for MEMOBUS/Modbus Register 0025H

Sets the unit for the output voltage monitor value in MEMOBUS/Modbus register 0025H.

No.	Parameter Name	Setting Range	Default
H5-10	Unit Selection for MEMOBUS/Modbus Register 0025H	0 or 1	0

Setting 0: 0.1 V units

Setting 1: 1 V units

■ H5-11: Communications Enter Function Selection

Selects whether an Enter command is necessary is needed to change parameter values via MEMOBUS/Modbus communications. ***Refer to Enter Command on page 446***.

No.	Parameter Name	Setting Range	Default
H5-11	Communications Enter Function Selection	0 or 1	0

Setting 0: Enter command necessary

Parameter changes become effective after an Enter command. An Enter command must only be sent after the last parameter change, not for each single parameter.

Setting 1: Enter command not necessary

Parameter value changes become effective immediately without the need to send an Enter command.

C.5 Drive Operations by MEMOBUS/Modbus

The drive operations that can be performed by MEMOBUS/Modbus communication depend on drive parameter settings. This section explains the functions that can be used and related parameter settings.

◆ Observing the Drive Operation

A PLC can perform the following actions with MEMOBUS/Modbus communications at any time regardless of parameter settings (except H5-□□).

- Observe drive status and drive control terminal status from a PLC.
- Read and write parameters.
- Set and reset faults.
- Set multi-function inputs.

Note: Input settings from the input terminals S□ and from MEMOBUS/Modbus communications are both linked by a logical OR operation.

◆ Controlling the Drive

Select an external reference and adjust the parameters in *Table C.1* accordingly to start and stop the drive or set the frequency reference using MEMOBUS/Modbus communications.

Table C.1 Setting Parameters for Drive Control from MEMOBUS/Modbus

Reference Source	Parameter	Name	Required Setting
External Reference	b1-01	Speed Reference Selection	2
	b1-02	Up/Down command Selection	2

Refer to b1-01: Speed Reference Selection on page 160 and *Refer to b1-02: Up/Down Command Selection on page 161* for details on operation mode parameter selections.

C.6 Communications Timing

To prevent overrun in the slave drive, the master should wait a certain time between sending messages to the same drive. In the same way, the slave drive must wait before sending response messages to prevent an overrun in the master. This section explains the message timing.

◆ Command Messages from Master to Drive

The master must wait for a specified time between receiving a response and re-sending the same type of command to the same slave drive to prevent overrun and data loss. The minimum wait time depends on the command as shown in the table below.

Table C.2 Minimum Wait Time for Sending Messages

Command Type	Example	Minimum Wait Time
1	• Control command (Run, Stop) • Set inputs/outputs • Read monitors and parameter values	5 ms
2	• Write parameters	H5-11 = 0: 50 ms H5-11 = 1: 200ms <1>
3	• Save changes using an Enter command	200 ms to 2 s, depending on the number of parameters that were changed <1>

<1> If the drive receives command type 1 data during the minimum wait time, it will perform the command and then respond. However, if it receives a command type 2 or 3 during that time, either a communication error will result or the command will be ignored.

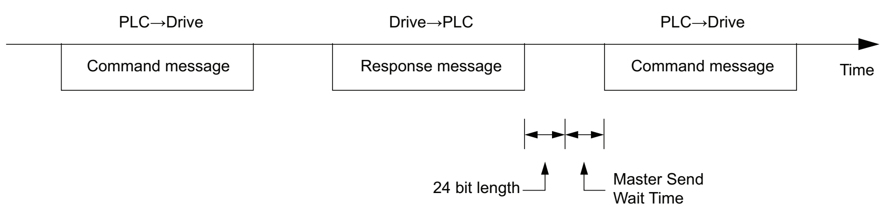


Figure C.7 Minimum Wait Time for Sending Messages

A timer should be set in the master to check how long it takes for the slave drive(s) to respond to the master. If no response is received within a certain amount of time, the master should try resending the message.

◆ Response Messages from Drive to Master

If the drive receives a command from the master, it will process the data received and wait for the time set in H5-06 until it responds. Increase H5-06 if the drive response causes overrun in the master.

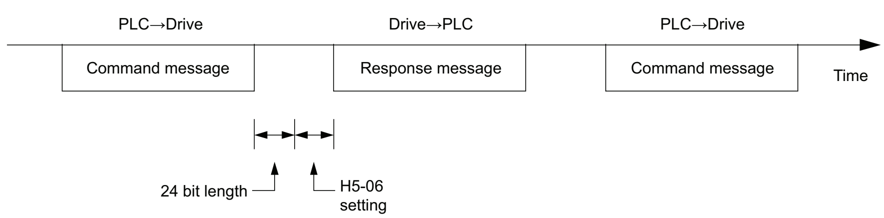
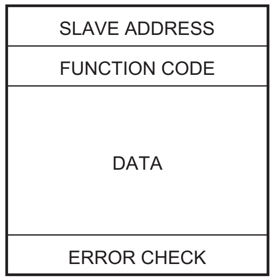


Figure C.8 Minimum Response Wait Time

C.7 Message Format

◆ Message Content

In MEMOBUS/Modbus communications, the master sends commands to the slave, and the slave responds. The message format is configured for both sending and receiving as shown below, and the length of data packets depends on the command (function) content.



◆ Slave Address

The slave address in the message defines the note the message is sent to. Use addresses between 0 and FF (hex). If a message with slave address 0 is sent (broadcast), the command from the master will be received by all slaves. The slaves do not provide a response to a broadcast type message.

◆ Function Code

The three types of function codes are shown in the table below.

Function Code	Function Name	Data Length (bytes)			
		Command Message		Response Message	
		Minimum	Maximum	Minimum	Maximum
03H	Read MEMOBUS/Modbus registers	8	8	7	37
08H	Loopback test	8	8	8	8
10H	Write to multiple MEMOBUS/Modbus registers	11	41	8	8

◆ Data

Configure consecutive data by combining the MEMOBUS/Modbus register address (test code in case of a loopback test) and the data the register contains. The data length changes depending on the command details.

A drive MEMOBUS/Modbus register always has a data length of two bytes. Therefore data written into drive registers must also always have a length of two bytes. Register data read out from the drive will always consist of two bytes.

◆ Error Check

The drive uses a CRC-16 (cyclic redundancy check, checksum method) for checking data validity. Use the procedure described below when calculating the CRC-16 checksum for command data or when verifying response data.

■ Command Data

When the drive receives data, it calculates the CRC-16 checksum from the data and compares it to the CRC-16 value received within the message. Both must match before a command is processed.

An initial value of FFFFH (i.e., all 16 bits equal 1) must be used for CRC-16 calculations in the MEMOBUS/Modbus protocol.

Calculate the CRC-16 checksum using the following steps:

1. The starting value is FFFFH.
2. Perform an XOR operation of this value and the slave address.
3. Right shift the result.
4. When the overflow bit of the shift operation becomes 1, perform an XOR operation of the result from step 3 above and the fix value A001H.
5. Repeat steps 3 and 4 until eight shift operations have been performed.
6. After eight shift operations, perform an XOR operation with the result and the next data in the message (function code, register address, data). Continue with steps 3 to 5 until the last data has been processed.
7. The result of the last shift or XOR operation is the checksum.

The example in *Table C.3* shows the CRC-16 calculation of the slave address 02H and the function code 03H, yielding the result 40D1H.

Note: This example does not show the calculation for a complete MEMOBUS/Modbus command. Normally data would follow in the calculation.

Table C.3 CRC-16 Checksum Calculation Example

Description	Calculation	Overflow	Description	Calculation	Overflow
Initial Value (FFFFH)	1111 1111 1111 1111		Function Code 03H	0000 0000 0000 0011	
Address 02H	0000 0000 0000 0010		XOR w result	1000 0001 0011 1101	
XOR w initial value	1111 1111 1111 1101		Shift 1	0100 0000 1001 1110	1
Shift 1	0111 1111 1111 1110	1	XOR w A001H	1010 0000 0000 0001	
XOR w A001H	1010 0000 0000 0001		XOR result	1110 0000 1001 1111	
XOR result	1101 1111 1111 1111		Shift 2	0111 0000 0100 1111	1
Shift 2	0110 1111 1111 1111	1	XOR w A001H	1010 0000 0000 0001	
XOR w A001H	1010 0000 0000 0001		XOR result	1101 0000 0100 1110	
XOR result	1100 1111 1111 1110		Shift 3	0110 1000 0010 0111	0
Shift 3	0110 0111 1111 1111	0	Shift 4	0011 0100 0001 0011	1
Shift 4	0011 0011 1111 1111	1	XOR w A001H	1010 0000 0000 0001	
XOR w A001H	1010 0000 0000 0001		XOR result	1001 0100 0001 0010	
XOR result	1001 0011 1111 1110		Shift 5	0100 1010 0000 1001	0
Shift 5	0100 1001 1111 1111	0	Shift 6	0010 0101 0000 0100	1
Shift 6	0010 0100 1111 1111	1	XOR w A001H	1010 0000 0000 0001	
XOR w A001H	1010 0000 0000 0001		XOR result	1000 0101 0000 0101	
XOR result	1000 0100 1111 1110		Shift 7	0100 0010 1000 0010	1
Shift 7	0100 0010 0111 1111	0	XOR w A001H	1010 0000 0000 0001	
Shift 8	0010 0001 0011 1111	1	XOR result	1110 0010 1000 0011	
XOR w A001H	1010 0000 0000 0001		Shift 8	0111 0001 0100 0001	1
XOR result	1000 0001 0011 1110		XOR w A001H	1010 0000 0000 0001	
Perform operations with next data (function code)			XOR result	1101 0001 0100 0000	
			CRC-16	1101 0001 0100 0000	
				D 1 4 0 (upper) (lower)	
			Continue from here with next data.		

■ Response Data

Perform a CRC-16 calculation on the response message data as described above as a validation check. The result should match the CRC-16 checksum received within the response message.

C.8 Message Examples

Below are some examples of command and response messages.

◆ Reading Drive MEMOBUS/Modbus Register Contents

Using the function code 03H (Read), a maximum of 16 MEMOBUS/Modbus registers can be read out at a time.

The following table shows message examples when reading status signals, error details, data link status, and speed references from the slave 2 drive.

Command Message			Response Message (normal)			Response Message (fault)		
Slave Address		02H	Slave Address		02H	Slave Address		02H
Function Code		03H	Function Code		03H	Function Code		83H
Starting No.	Upper	00H	Data Quantity		08H	Error Code		03H
	Lower	20H	1st storage register	Upper	00H	CRC-16	Upper	F1H
Data Quantity	Upper	00H		Lower	65H		Lower	31H
	Lower	04H	Next storage register	Upper	00H			
CRC-16	Upper	45H		Lower	00H			
	Lower	F0H	Next storage register	Upper	00H			
				Lower	00H			
			Next storage register	Upper	01H			
				Lower	F4H			
			CRC-16	Upper	AFH			
				Lower	82H			

◆ Loopback Test

Function code 08H performs a loopback test. This test returns a response message with exactly the same content as the command message and can be used to check communications between the master and slave. User-defined test code and data values can be set.

The following table shows a message example when performing a loopback test with the slave 1 drive.

Command Message			Response Message (normal)			Response Message (fault)		
Slave Address		01H	Slave Address		01H	Slave Address		01H
Function Code		08H	Function Code		08H	Function Code		88H
Test Code	Upper	00H	Test Code	Upper	00H	Error Code		01H
	Lower	00H		Lower	00H	CRC-16	Upper	86H
Data	Upper	A5H	Data	Upper	A5H		Lower	50H
	Lower	37H		Lower	37H			
CRC-16	Upper	DAH	CRC-16	Upper	DAH			
	Lower	8DH		Lower	8DH			

◆ Writing to Multiple Registers

Function code 10H allows the user to write multiple drive MEMOBUS/Modbus registers with one message. This process works similar to reading registers, in that the address of the first register to be written and the data quantity are set in the command message. The data to be written must be consecutive so that the register addresses are in order, starting from the specified address in the command message. The data order must be high byte then lower byte.

The following table shows an example of a message where a forward (Up) operation has been set with a speed reference of 100.00% for the slave 1 drive.

If parameter values are changed using the Write command, an Enter command may be necessary to activate or save the data depending on the setting of H5-11. ***Refer to H5-11: Communications Enter Function Selection on page 428*** and ***Refer to Enter Command on page 446*** for detailed descriptions.

Command Message		
Slave Address		01H
Function Code		10H
Starting No.	Upper	00H
	Lower	01H
Data Quantity	Upper	00H
	Lower	02H
Number of Bytes		04H
Starting Data	Upper	00H
	Lower	01H
Next Data	Upper	27H
	Lower	10H
CRC-16	Upper	79H
	Lower	9FH

Response Message (normal)		
Slave Address		01H
Function Code		10H
Starting No.	Upper	00H
	Lower	01H
Data Quantity	Upper	00H
	Lower	02H
CRC-16	Upper	10H
	Lower	08H

Response Message (fault)		
Slave Address		01H
Function Code		90H
Error Code		02H
CRC-16	Upper	CDH
	Lower	C1H

Note: Double the number of the data quantity for the number of bytes in the command message.

◆ Torque Compensation Through MEMOBUS/Modbus Communications

Perform the steps below to utilize Torque Compensation Through MEMOBUS/Modbus Communications.

■ Torque Compensation Set-up via MEMOBUS/Modbus

1. Set H3-01, H3-02: to 14 Torque Compensation.
2. Set MEMOBUS/Modbus Register 0F, bit 3 = Enable Torque Compensation.
3. MEMOBUS/Modbus Register 0005H = Torque Compensation, signed
   a. Setting value Pre-Run, w/Run, or Post-Run per application needs.

■ Troubleshooting Torque Compensation Set-up via MEMOBUS/Modbus

1. If an error message occurs when sending the Torque Compensation value.
   a. Set H5-07 (RTS): 1 0.
2. Modbus Register 0F, bit 3 = Enable Torque Limit and Torque Comp (H3-02 = 1F).
   a. Runaway condition
3. Modbus Register 0005H should be signed (-3000 to +3000)
   a. Register has internal limit from 0 to positive values.
   i. Negative values are set to "0".

C.9 MEMOBUS/Modbus Data Table

Table below lists all MEMOBUS/Modbus data. There are three types of data: command data, monitor data, and broadcast data.

◆ Command Data

It is possible to both read and write command data.

Note: Bits that are not used should be set to 0. Refrain from writing to reserved registers.

Register No.	Contents	
0000H	Reserved	
0001H	Operation Commands and Multi-function Inputs	
	bit 0	Up command
	bit 1	Down command
	bit 2	External Fault (EF0)
	bit 3	Fault Reset
	bit 4	ComRef **Note:** When the bit at ComCtrl is turned on, commands from MEMOBUS communications take control of the operation. However, when a communications option card is connected, that option card is given priority.
	bit 5	ComCtrl
	bit 6	Multi-Function Input 3
	bit 7	Multi-Function Input 4
	bit 8	Multi-Function Input 5
	bit 9	Multi-Function Input 6
	bit A	Multi-Function Input 7
	bit B	Multi-Function Input 8
	bit C to F	Reserved
0002H	Speed Reference	Units are determined by parameter o1-03.
0003H	Reserved	
0004H	Torque Limit, 0.1% units, signed	
0005H	Torque Compensation, 0.1% units, signed	
0006H	Reserved	
0007H	Analog Output Terminal FM Setting (10 V/4000 H)	
0008H	Analog Output Terminal AM Setting (10 V/4000 H)	
0009H	Settings for Multi-Function Digital Outputs	
	bit 0	Multi-Function Relay Output 1 (terminal M1-M2)
	bit 1	Multi-Function Relay Output 2 (terminal M3-M4)
	bit 2	Multi-Function Relay Output 3 (terminal M5-M6)
	bit 3	Multi-Function Photocoupler Output 1 (terminal P1-C1)
	bit 4	Multi-Function Photocoupler Output 2 (terminal P2-C2)
	bit 5	Reserved
	bit 6	Enables the function in bit 7
	bit 7	Fault Contact Output (terminal MA/MB-MC)
	bit 8 to F	Reserved
000AH to 000EH	Reserved	
000FH	Control Selection Setting	
	bit 0, 1	Reserved
	bit 2	Torque limit input (enables the setting from MEMOBUS/Modbus)
	bit 3	Torque compensation input (enables the setting from MEMOBUS/Modbus)
	bit 4 to B	Reserved
	bit C	Enable Terminal S5 Input for Broadcast Data
	bit D	Enable Terminal S6 Input for Broadcast Data
	bit E	Enable Terminal S7 Input for Broadcast Data
	bit F	Enable Terminal S8 Input for Broadcast Data
0010H to 001AH	Reserved	
001BH	Analog Monitor Option AO-A3 Analog Output 1 (10 V/4000 H)	
001CH	Analog Monitor Option AO-A3 Analog Output 2 (10 V/4000 H)	
001DH	Digital Output Option DO-A3 Output (Binary)	
001EH to 001FH	Reserved	

<1> To enable torque compensation function by serial communications, set H3-10 to 14.

◆ Monitor Data

Monitor data can be read only.

Register No.	Contents	
0020H	Drive Status 1	
	bit 0	During Run
	bit 1	During Reverse
	bit 2	Drive Ready
	bit 3	Fault
	bit 4	Data Setting Error
	bit 5	Multi-Function Relay Output (terminal M1-M2)
	bit 6	Multi-Function Relay Output (terminal M3-M4)
	bit 7	Multi-Function Relay Output (terminal M5-M6)
	bit 8	Multi-Function Photocoupler Output 1 (terminal P1-C1)
	bit 9	Multi-Function Photocoupler Output 2 (terminal P2-C2)
	bit A to bit D	Reserved
	bit E	When ComRef has been enabled
	bit F	When ComCtrl has been enabled
0021H	Fault Contents 1	
	bit 0	Overcurrent (oC), Ground fault (GF)
	bit 1	Overvoltage (ov)
	bit 2	Drive Overload (oL2)
	bit 3	Overheat 1 (oH1)
	bit 4	Dynamic Braking Transistor Fault (rr)
	bit 5, 6	Reserved
	bit 7	EF0, EF3 to EF8: External Fault
	bit 8	CPF□□: Hardware Fault (includes oFx)
	bit 9	Motor Overload (oL1), Overtorque Detection 1/2 (oL3/oL4), Undertorque Detection 1/2 (UL3/UL4)
	bit A	Encoder Disconnected (PGo), Option Card Hardware Fault (PGoH), Overspeed (oS), Excessive Speed Deviation (dEv)
	bit B	Main Circuit Undervoltage (Uv)
	bit C	Undervoltage (Uv1), Control Power Supply Undervoltage (Uv2), Soft Charge Circuit Fault (Uv3)
	bit D	Output Phase Loss (LF), Input Phase Loss (PF)
	bit E	MEMOBUS/Modbus Communication Error (CE), Option Communication Error (bUS)
	bit F	Operator Connection Fault (oPr)
0022H	Data Link Status	
	bit 0	Writing data or switching motors
	bit 1, 2	Reserved
	bit 3	Upper or lower limit error
	bit 4	Data conformity error
	bit 5	Writing to EEPROM
	bit 6 to bit F	Reserved
0023H	Speed Reference, <1>	
0024H	Output Speed, <1>	
0025H	Output Voltage Reference, 0.1 V units (units are determined by parameter H5-10)	
0026H	Output Current, 0.1 A units	
0027H	Output Power	
0028H	Torque Reference	
0029H	Fault Contents 2	
	bit 0	Reserved
	bit 1	Ground Fault (GF)
	bit 2	Input Phase Loss (PF)
	bit 3	Output Phase Loss (LF)
	bit 4 to bit F	Reserved

Register No.	Contents	
002AH	Alarm Contents1	
	bit 0, 1	Reserved
	bit 2	Up/Down command Input Error (EF)
	bit 3	Drive Baseblock (bb)
	bit 4	Overtorque Detection 1/2 (oL3/4)
	bit 5	Heatsink Overheat (oH)
	bit 6	Overvoltage (ov)
	bit 7	Undervoltage (Uv)
	bit 8	Cooling Fan Error (FAn)
	bit 9	MEMOBUS/Modbus Communication Error (CE)
	bit A	Option Communication Error (bUS)
	bit B	Undertorque Detection 1/2 (UL3/UL4)
	bit C to E	Reserved
	bit F	Serial Communication Transmission Error (CALL)
002BH	Input Terminal Status	
	bit 0	Terminal S1 Closed
	bit 1	Terminal S2 Closed
	bit 2	Terminal S3 Closed
	bit 3	Terminal S4 Closed
	bit 4	Terminal S5 Closed
	bit 5	Terminal S6 Closed
	bit 6	Terminal S7 Closed
	bit 7	Terminal S8 Closed
	bit 8 to bit F	Reserved
002CH	Drive Status 2	
	bit 0	During Run
	bit 1	Zero Speed
	bit 2	Speed Agree
	bit 3	User Speed Agree
	bit 4	Speed Detection 1
	bit 5	Speed Detection 2
	bit 6	Drive Ready
	bit 7	During Undervoltage
	bit 8	During Baseblock
	bit 9	Speed Reference from Operator Keypad
	bit A	Up/Down command from Operator Keypad
	bit B	Over/Undertorque 1, 2
	bit C	Speed Reference Loss
	bit D	During Fault Reset
	bit E	Fault
	bit F	Communication Timeout
002DH	Output Terminal Status	
	bit 0	Multi-Function Relay Output (terminal M1-M2)
	bit 1	Multi-Function Relay Output (terminal M3-M4)
	bit 2	Multi-Function Relay Output (terminal M5-M6)
	bit 3	Multi-Function Photocoupler Output 1 (terminal P1-C1)
	bit 4	Multi-Function Photocoupler Output 2 (terminal P2-C2)
	bit 3 to 6	Reserved
	bit 7	Fault Contact Output (terminal MA/MB-MC)
	bit 8 to F	Reserved
002EH to 0030H	Reserved	
0031H	DC Bus Voltage, 1 Vdc units	
0032H	Torque Reference (U1-09), 1% units	
0033H	Reserved	
0034H	Product Code 1 [ASCII], Product Type (LE for L1000E)	
0035H	Product Code 2 [ASCII], Region Code	
0036H to 003CH	Reserved	

Register No.	Contents	
003DH	Communications Error Contents <3>	
	bit 0	CRC Error
	bit 1	Data Length Error
	bit 2	Reserved
	bit 3	Parity Error
	bit 4	Overrun Error
	bit 5	Framing Error
	bit 6	Timeout
	bit 7 to bit F	Reserved
003EH	Output Speed	r/min <4>
003FH		0.01% units
0040H to 004AH	Used for various monitors U1-□□. *Refer to U: Monitors on page 406* for parameter details.	
004BH	Drive status (U1-12)	
	bit 0	During Run
	bit 1	During Zero Speed
	bit 2	During Reverse Run
	bit 3	During Fault Reset Signal Input
	bit 4	During Speed Agree
	bit 5	Drive Ready
	bit 6	Alarm
	bit 7	Fault
	bit 8	During Operation Error (oPE□□)
	bit 9	During Momentary Power Loss
	bit A	Motor 2 Selected
	bit B to D	Reserved
	bit E	ComRef status, NetRef status
	bit F	ComCtrl status, NetCtrl status
004CH to 007EH	Used for various monitors U1-□□, U4-□□, and U6-□□. *Refer to U: Monitors on page 406* for parameter details.	
007FH	Alarm Code, *Refer to Alarm Register Contents on page 445* for alarm codes.	
0080H to 0097H	Used for monitors U2-□□, U3-□□. *Refer to U: Monitors on page 406* for parameter details and *Refer to Fault Trace Contents on page 443* for register value descriptions.	
0098H, 0099H	U4-01 (Cumulative Operation Time) Example: When U4-01 (Cumulative Operation Time) is 12345 hours, then 0098H = 1234 and 0099H = 5.	
009AH, 009BH	U4-03 (Cooling Fan Operation Time) Example: When U4-03 (Cooling Fan Operation Time) is 12345 hours, then 009AH = 1234 and 009BH = 5.	
009CH to 00AAH	Reserved	
00ABH	Drive Rated Current <2>	
00ACH	Speed Feedback (U1-05)	r/min units <4>
00ADH		0.01% units
00AEH, 00AFH	Reserved	
00B0H	Option Code Connected to CN5-A	Register contains ASCII code of the option card. DI-A3 = 0x01 DO-A3 = 0x02 AO-A3 = 0x04 PG-B3 = 0x11 PG-X3 = 0x12 PG-F3 = 0x21 PG-E3 = 0x22 Communication Option: Register contains ASCII code of 1st and 3rd digit of the option card type number. Example: Register value is 5353H for "SS" if a SI-S3 option card is installed.
00B1H	Reserved	
00B2H	Option Code Connected to CN5-B	
00B3H	Option Code Connected to CN5-C	
00B4H	Reserved	
00B5H	Output Speed After Soft Start (U1-16)	r/min units <4>
00B6H		0.01% units
00B7H	Speed Reference	r/min units <4>
00B8H		0.01% units
00B9H to 00BEH	Reserved	
00BFH	Lists the last to digits of operation error code oPE□□.	

Register No.	Contents	
00C0H	Fault contents 3	
	bit 1	Undervoltage (Uv1)
	bit 2	Control Power Supply Undervoltage (Uv2)
	bit 3	Soft Charge Circuit Fault (Uv3)
	bit 4	Short Circuit (SC)
	bit 5	Ground Fault (GF)
	bit 6	Overcurrent (oC)
	bit 7	Overvoltage (ov)
	bit 8	Heatsink Overheat (oH)
	bit 9	Heatsink Overheat (oH1)
	bit A	Motor Overload (oL1)
	bit B	Drive Overload (oL2)
	bit C	Overtorque Detection 1 (oL3)
	bit D	Overtorque Detection 2 (oL4)
	bit E	Dynamic Braking Transistor Fault (rr)
	bit F	Reserved
00C1H	Fault contents 4	
	bit 0	External Fault at input terminal S3 (EF3)
	bit 1	External Fault at input terminal S4 (EF4)
	bit 2	External Fault at input terminal S5 (EF5)
	bit 3	External Fault at input terminal S6 (EF6)
	bit 4	External Fault at input terminal S7 (EF7)
	bit 5	External Fault at input terminal S8 (EF8)
	bit 6	Reserved
	bit 7	Overspeed (os)
	bit 8	Excessive Speed Deviation (dEv)
	bit 9	Encoder Disconnected (PGo)
	bit A	Input Phase Loss (PF)
	bit B	Output Phase Loss (LF)
	bit C	Reserved
	bit D	Digital Operator Connection Fault (oPr)
	bit E	EEPROM Write Error (Err)
	bit F	Reserved
00C2H	Fault contents 5	
	bit 0	MEMOBUS/Modbus Communication Error (CE)
	bit 1	Option Communication Error (bUS)
	bit 2, 3	Reserved
	bit 4	Control Fault (CF)
	bit 5	Position Lock Error (SvE)
	bit 6	Option External Fault (EF0)
	bit 7	Reserved
	bit 8	Undertorque Detection 1 (UL3)
	bit 9	Undertorque Detection 2 (UL4)
	bit A to E	Reserved
	bit F	Hardware Fault (includes oFx)
00C3H	Fault contents 6	
	bit 0	Reserved
	bit 1	Z Pulse Fault Detection (dv1)
	bit 2	Z Pulse Noise Fault Detection (dv2)
	bit 3	Inversion Detection (dv3)
	bit 4	Inversion Prevention Detection (dv4)
	bit 5	Current Imbalance (LF2)
	bit 6	Pullout Detection (STo)
	bit 7	Option Card Hardware Fault (PGoH)
	bit 8 to F	Reserved
00C4H	Fault contents 7	
	bit 0 to 4	Reserved
	bit 5	Current Offset Fault (CoF)
	bit 6 to B	Reserved
	bit C	Output Voltage Detection Fault (voF)
	bit D	Reserved
	bit E	Braking Transistor Overload Fault (boL)
	bit F	Reserved

Register No.	Contents	
00C5H	bit 0 to 3	Reserved
	bit 4	Overacceleration (dv6)
	bit 5 to F	Reserved
00C6H, 00C7H	Reserved	
00C8H	Alarm contents 2	
	bit 0	Undervoltage (Uv)
	bit 1	Overvoltage (ov)
	bit 2	Heatsink Overheat (oH)
	bit 3	Reserved
	bit 4	Overtorque 1 (oL3)
	bit 5	Overtorque 2 (oL4)
	bit 6	Up/Down commands Input Error (EF)
	bit 7	Drive Baseblock (bb)
	bit 8	External Fault 3, input terminal S3 (EF3)
	bit 9	External Fault 4, input terminal S4 (EF4)
	bit A	External Fault 5, input terminal S5 (EF5)
	bit B	External Fault 6, input terminal S6 (EF6)
	bit C	External Fault 7, input terminal S7 (EF7)
	bit D	External Fault 8, input terminal S8 (EF8)
	bit E	Reserved
	bit F	Overspeed (oS)
00C9H	Alarm contents 3	
	bit 0	Excessive Speed Deviation (dEv)
	bit 1	Encoder Disconnected (PGo)
	bit 2	Digital Operator Connection Fault (oPr)
	bit 3	MEMOBUS/Modbus Communication Error (CE)
	bit 4	Option Communication Error (bUS)
	bit 5	Serial Communication Transmission Error (CALL)
	bit 6	Motor Overload (oL1)
	bit 7	Drive Overload (oL2)
	bit 8	Reserved
	bit 9	Option Card External fault (EF0)
	bit A	Motor 2 Switch command input during run (rUn)
	bit B	Reserved
	bit C	Serial Communication Transmission Error (CALL)
	bit D	Undertorque Detection 1 (UL3)
	bit E	Undertorque Detection 2 (UL4)
	bit F	MEMOBUS/Modbus Test Mode Fault (SE)
00CAH	Alarm contents 4	
	bit 0 to 9	Reserved
	bit A	Encoder Disconnected (PGo)
	bit B to F	Reserved
00CBH	Alarm Contents 5	
	bit 0 to 2	Reserved
	bit 3	High Current Alarm (HCA)
	bit 4	Cooling Fan Maintenance Time (LT-1)
	bit 5	Soft Charge Bypass Relay Maintenance Time (LT-2)
	bit 6	Reserved
	bit 7	SI-S EEPROM Error (EEP)
	bit 8 to 9	Reserved
	bit A	Safe Disable Input (HbbF)
	bit B	Safe Disable Input (Hbb)
	bit C to F	Reserved
00CCH	Alarm Contents 6	
	bit 0	Output Voltage Detection Fault (VoF)
	bit 1	Reserved
	bit 2	Capacitor Maintenance Time (LT-3)
	bit 3	IGBT Maintenance Time (50%) (LT-4)
	bit 4	Braking Transistor Overload Fault (boL)
	bit 5 to F	Reserved
00CDH to 00CFH	Reserved	

Register No.	Contents	
00D0H	CPF Contents 1	
	bit 0, 1	Reserved
	bit 2	A/D Conversion Error (CPF02)
	bit 3	PWM Data Fault (CPF03)
	bit 4, 5	Reserved
	bit 6	EEPROM Memory Data Error (CPF06)
	bit 7	Terminal Board Connection Error (CPF07)
	bit 8	EEPROM Serial Communications Fault (CPF08)
	bit 9, A	Reserved
	bit B	RAM Fault (CPF11)
	bit C	FLASH Memory Fault (CPF12)
	bit D	Watchdog Circuit Exception (CPF13)
	bit E	Control Circuit Fault (CPF14)
	bit F	Reserved
00D1H	CPF Contents 2	
	bit 0	Clock Fault (CPF16)
	bit 1	Timing Fault (CPF17)
	bit 2	Control Circuit Fault (CPF18)
	bit 3	Control Circuit Fault (CPF19)
	bit 4	Hardware fault at power up (CPF20)
	bit 5	Hardware fault at communication start up (CPF21)
	bit 6	A/D Conversion Fault (CPF22)
	bit 7	PWM Feedback Fault (CPF23)
	bit 8	Drive Unit Signal Fault (CPF24)
	bit 9	Terminal board is not properly connected. (CPF25)
	bit A	ASIC BB Circuit Error (CPF26)
	bit B	ASIC PWM Setting Register Error (CPF27)
	bit C	ASIC PWM Pattern Error (CPF28)
	bit D	ASIC On-delay Error (CPF29)
	bit E	ASIC BBON Error (CPF30)
	bit F	ASIC Code Error (CPF31)
00D2H	bit 0	ASIC Start-up Error (CPF32)
	bit 1	Watch-dog Error (CPF33)
	bit 2	ASIC Power/Clock Error (CPF34)
	bit 3	External A/D Converter Error (CPF35)
	bit 4 to F	Reserved
00D3H to 00D7H	oFA0x Contents (CN5-A)	
00D8H	oFA0x Contents (CN5-A)	
	bit 0	Option Compatibility Error (oFA00)
	bit 1	Option not properly connected (oFA01)
	bit 2	Same type of option card already connected (oFA02)
	bit 3, 4	Reserved
	bit 5	A/D Conversion Error (oFA05)
	bit 6	Option Response Error (oFA06)
	bit 7 to F	Reserved
00D9H	oFA1x Contents (CN5-A)	
	bit 0	Option RAM Fault (oFA10)
	bit 1	Option Operation Mode Fault (SLMOD) (oFA11)
	bit 2	Drive Receive CRC Error (oFA12)
	bit 3	Drive Receive Frame Error (oFA13)
	bit 4	Drive Receive Abort Error (oFA14)
	bit 5	Option Receive CRC Error (oFA15)
	bit 6	Option Receive Frame Error (oFA16)
	bit 7	Option Receive Abort Error (oFA17)
	bit 8 to F	Reserved
00DAH to 00DBH	Reserved	

Register No.	Contents	
00DBH	oFA3x Contents (CN5-A)	
	bit 0	Comm. ID Error (oFA30)
	bit 1	Model Code Error (oFA31)
	bit 2	Sumcheck Error (oFA32)
	bit 3	Comm. option timeout waiting for response (oFA33)
	bit 4	MEMOBUS Timeout (oFA34)
	bit 5	Drive timeout waiting for response (oFA35)
	bit 6	CI Check Error (oFA36)
	bit 7	Drive timeout waiting for response (oFA37)
	bit 8	Control Command Selection Error (oFA38)
	bit 9	Drive timeout waiting for response (oFA39)
	bit A	Control Response Selection 1 Error (oFA40)
	bit B	Drive timeout waiting for response (oFA41)
	bit C	Control Response Selection 2 Error (oFA42)
	bit D	Control Response Selection Error (oFA43)
	bit E, F	Reserved
00DCH	oFb0x Contents (CN5-B)	
	bit 0	Option compatibility error (oFb00)
	bit 1	Option not properly connected (oFb01)
	bit 2	Same type of option card already connected (oFb02)
	bit 3, 4	Reserved
	bit 5	A/D Conversion Fault (oFb05)
	bit 6	Option Response Error (oFb06)
	bit 7 to F	Reserved
00DDH	oFb1x Contents (CN5-B)	
	bit 0	Option RAM Fault (oFb10)
	bit 1	Option Operation Mode Fault (SLMOD) (oFb11)
	bit 2	Drive Receive CRC Error (oFb12)
	bit 3	Drive Receive Frame Error (oFb13)
	bit 4	Drive Receive Abort Error (oFb14)
	bit 5	Option Receive CRC Error (oFb15)
	bit 6	Option Receive Frame Error (oFb16)
	bit 7	Option Receive Abort Error (oFb17)
	bit 8 to F	Reserved
00DEH to 00DFH	Reserved	
00E0H	oFb3x Contents (CN5-B)	
	bit 0	Comm. ID Error (oFb30)
	bit 1	Model Code Error (oFb31)
	bit 2	Sumcheck Error (oFb32)
	bit 3	Comm. option timeout waiting for response (oFb33)
	bit 4	MEMOBUS Timeout (oFb34)
	bit 5	Drive timeout waiting for response (oFb35)
	bit 6	CI Check Error (oFb36)
	bit 7	Drive timeout waiting for response (oFb37)
	bit 8	Control Command Selection Error (oFb38)
	bit 9	Drive timeout waiting for response (oFb39)
	bit A	Control Response Selection 1 Error (oFb40)
	bit B	Drive timeout waiting for response (oFb41)
	bit C	Control Response Selection 2 Error (oFb42)
	bit D	Control Response Selection Error (oFb43)
	bit E, F	Reserved
00E1H	oFC0x Contents (CN5-C)	
	bit 0	Option compatibility error (oFC00)
	bit 1	Option not properly connected (oFC01)
	bit 2	Same type of option card already connected (oFC02)
	bit 3, 4	Reserved
	bit 5	A/D Conversion Fault (oFC05)
	bit 6	Option Response Error (oFC06)
	bit 7 to F	Reserved

Register No.	Contents	
00E2H	oFC1x Contents (CN5-C)	
	bit 0	Option RAM Fault (oFC10)
	bit 1	Option Operation Mode Fault (SLMOD) (oFC11)
	bit 2	Drive Receive CRC Error (oFC12)
	bit 3	Drive Receive Frame Error (oFC13)
	bit 4	Drive Receive Abort Error (oFC14)
	bit 5	Option Receive CRC Error (oFC15)
	bit 6	Option Receive Frame Error (oFC16)
	bit 7	Option Receive Abort Error (oFC17)
	bit 8 to F	Reserved
00E3H	Reserved	
00E4H	oFC5x Contents (CN5-C)	
	bit 0	oFC50 (Encoder Option AD Conversion Error)
	bit 1	oFC51 (Encoder Option Analog Circuit Error)
	bit 2	oFC52 (Encoder Communication Timeout)
	bit 3	oFC53 (Encoder Communication Data Error)
	bit 4	oFC54 (Encoder Error)
	bit 5 to F	Reserved
00E5H to 00FFH	Reserved	

<1> Parameter o1-03, Digital Operator Display Selection, determines the units.
<2> The display resolution depends on the rated output power of the drive. Models 2A0018 to 2A0041 and 4A0009 to 4A0023 display values in 0.01 A units, while models 2A0059 to 2A0432 and 4A0030 to 4A0225 display values in 0.1 A units.
<3> Communication error contents are saved until the fault is reset.
<4> Set the number of motor poles to parameter E2-04, E4-04, or E5-05 depending on the motor being used.

◆ Broadcast Messages

Data can be written from the master to all slave devices at the same time.

The slave address in a broadcast command message must be set to 00H. All slaves will receive the message, but will not respond.

Register No.	Contents	
0001H	Digital Input Command	
	bit 0	Up/Down Command (0: Run 1: Stop)
	bit 1	Direction Command (0: Down, 1: Up)
	bit 2, 3	Reserved
	bit 4	External Fault
	bit 5	Fault Reset
	bit 6 to B	Reserved
	bit C	Multi-Function Digital Input S5
	bit D	Multi-Function Digital Input S6
	bit E	Multi-Function Digital Input S7
	bit F	Multi-Function Digital Input S8
0002H	Speed Reference	100%

◆ Fault Trace Contents

The table below shows the fault codes that can be read out by MEMOBUS/Modbus commands from the U2-□□ monitor parameters.

Table C.4 Fault Trace / History Register Contents

Fault Code	Fault Name	Fault Code	Fault Name
0002H	Undervoltage (Uv1)	009DH	ASIC PWM Pattern Error (CPF28)
0003H	Control Power Supply Undervoltage (Uv2)	009EH	ASIC On-Delay Error (CPF29)
0004H	Soft Charge Circuit Fault (Uv3)	009FH	ASIC BBON Error (CPF30)
0005H	Short Circuit (SC)	00A0H	ASIC Code Error (CPF31)
0006H	Ground Fault (GF)	00A1H	ASIC Start-p Error (CPF32)
0007H	Overcurrent (oC)	00A2H	Watch-dog Error (CPF33)
0008H	Overvoltage (ov)	00A3H	ASIC Power/Clock Error (CPF34)

Fault Code	Fault Name	Fault Code	Fault Name
0009H	Heatsink Overheat (oH)	00A4H	External A/D Converter Error (CPF35)
000AH	Heatsink Overheat (oH1)	0101H	Option compatibility error (oFA00)
000BH	Motor Overload (oL1)	0102H	Option not properly connected (oFA01)
000CH	Drive Overload (oL2)	0103H	Same type of option card already connected (oFA02)
000DH	Overtorque Detection 1 (oL3)	0106H	A/D Conversion Error (oFA05)
000EH	Overtorque Detection 2 (oL4)	0107H	Option Response Error (oFA06)
000FH	Dynamic Braking Transistor (rr)	009CH	ASIC PWM Setting Register Error (CPF27)
0011H	External Fault at input terminal S3 (EF3)	0111H	Option RAM Fault (oFA10)
0012H	External Fault at input terminal S4 (EF4)	0112H	Option Operation Mode Fault (SLMOD) (oFA11)
0013H	External Fault at input terminal S5 (EF5)	0113H	Drive Receive CRC Error (oFA12)
0014H	External Fault at input terminal S6 (EF6)	0114H	Drive Receive Frame Error (oFA13)
0015H	External Fault at input terminal S7 (EF7)	0115H	Drive Receive Abort Error (oFA14)
0016H	External Fault at input terminal S8 (EF8)	0116H	Option Receive CRC Error (oFA15)
0018H	Overspeed (oS)	0117H	Option Receive Frame Error (oFA16)
0019H	Excessive Speed Deviation (dEv)	0118H	Option Receive Abort Error (oFA17)
001AH	Encoder Disconnect (PGo)	0131H	Comm. ID Error (oFA30)
001BH	Input Phase Loss (PF)	0132H	Model Code Error (oFA31)
001CH	Output Phase Loss (LF)	0133H	Sumcheck Error (oFA32)
001EH	Digital Operator Connection (oPr)	0134H	Comm. option timeout waiting for response (oFA33)
001FH	EEPROM Write Error (Err)	0135H	MEMOBUS Timeout (oFA34)
0021H	MEMOBUS/Modbus Communication Error (CE)	0136H	Drive timeout waiting for response (oFA35)
0022H	Option Communication Error (bUS)	0137H	CI Check Error (oFA36)
0025H	Control fault (CF)	0138H	Drive timeout waiting for response (oFA37)
0026H	Position Lock Error (SvE)	0139H	Control Command Selection Error (oFA38)
0027H	Option External Fault (EF0)	013AH	Drive timeout waiting for response (oFA39)
0029H	Undertorque Detection 1 (UL3)	013BH	Control Response Selection 1 Error (oFA40)
002AH	Undertorque Detection 2 (UL4)	013CH	Drive timeout waiting for response (oFA41)
0030H	Hardware Fault (including oFx)	013DH	Control Response Selection 2 Error (oFA42)
0032H	Z Pulse Fall Detection (dv1)	013EH	Control Response Selection Error (oFA43)
0033H	Z Pulse Noise Fault Detection (dv2)	0201H	Option Connection Error (oFb01)
0034H	Inversion Detection (dv3)	0202H	Same type of option card already connected (oFb02)
0035H	Inversion Prevention Detection (dv4)	0205H	A/D Conversion Error (oFb05)
0036H	Output Current Imbalance (LF2)	0206H	Option Response Error (oFb06)
0037H	Pullout Detection (Sto)	0210H	Option RAM Fault (oFb10)
0038H	PG Option Card Hardware Fault	0211H	Option Operation Mode Fault (SLMOD) (oFb11)
0046H	Current Offset Fault (CoF)	0212H	Drive Receive CRC Error (oFb12)
004DH	Output Voltage Detection Fault (voF)	0213H	Drive Receive Frame Error (oFb13)
0054H	Overacceleration (dv6)	0214H	Drive Receive Abort Error (oFb14)
0055H	Motor Contactor Response Error (SE1)	0215H	Option Receive CRC Error (oFb15)
0056H	Starting Current Error (SE2)	0216H	Option Receive Frame Error (oFb16)
0057H	Output Current Error (SE3)	0217H	Option Receive Abort Error (oFb17)
0058H	Brake Feedback Error (SE4)	0231H	Comm. ID Error (oFb30)
0059H	Reference Missing (FrL)	0232H	Model Code Error (oFb31)
005BH	Initial magnet Pole Search Overtime (dv7)	0233H	Sumcheck Error (oFb32)
005DH	Initial magnet Pole Search Error (dv8)	0234H	Comm. option timeout waiting for response (oFb33)
0083H	A/D Conversion Error (CPF02)	0235H	MEMOBUS Timeout (oFb34)
0084H	PWM Data Fault (CPF03)	0236H	Drive timeout waiting for response (oFb35)
0087H	EEPROM Memory Data Error (CPF06)	0237H	CI Check Error (oFb36)
0088H	Terminal Board Connection Error (CPF07)	0238H	Drive timeout waiting for response (oFb37)
0089H	EEPROM Serial Communication Fault (CPF08)	0239H	Control Command Selection Error (oFb38)
008CH	RAM Fault (CPF11)	023AH	Drive timeout waiting for response (oFb39)
008DH	Flash Memory Circuit Exception (CPF12)	023BH	Control Response Selection 1 Error (oFb40)
008EH	Watchdog Circuit Exception (CPF13)	023CH	Drive timeout waiting for response (oFb41)
008FH	Control Circuit Fault (CPF14)	023DH	Control Response Selection 2 Error (oFb42)
0091H	Clock Fault (CPF16)	023EH	Control Response Selection Error (oFb43)
0092H	Timing Fault (CPF17)	0300H	Option Compatibility Error (oFC00)
0093H	Control Circuit Fault (CPF18)	0301H	Option not properly connected (oFC01)
0094H	Control Circuit Fault (CPF19)	0302H	Same type of option card already connected (oFC02)
0095H	Hardware fault at power up (CPF20)	0305H	A/D Conversion Error (oFC05)
0096H	Hardware fault at communication start up (CPF21)	0306H	Option Response Error (oFC06)
0097H	A/D Conversion Fault (CPF22)	0351H	Encoder Option A/D Conversion Error (OFC50)

Fault Code	Fault Name	Fault Code	Fault Name
0098H	PWM Feedback Fault (CPF23)	0352H	Encoder Option Analog Circuit Error (OFC51)
0099H	Drive Unit Signal Fault (CPF24)	0353H	Encoder Communications Timeout (OFC52)
009AH	Terminal board is not properly connected. (CPF25)	0354H	Encoder Communications Data Error (OFC53)
009BH	ASIC BB Circuit Error (CPF26)	0355H	Encoder Error (OFC54)

◆ Alarm Register Contents

The table below shows the alarm codes that can be read out from MEMOBUS/Modbus register 007FH.

Table C.5 Alarm Register 007FH Contents

Alarm Code	Fault Name	Alarm Code	Fault Name
0001H	Undervoltage (Uv)	0017H	Motor Overload (oL1)
0002H	Overvoltage (ov)	0018H	Drive Overload (oL2)
0003H	Heatsink Overheat (oH)	001AH	Option Card External Fault (EF0)
0005H	Overtorque 1 (oL3)	001DH	Serial Communication Transmission Error (CALL)
0006H	Overtorque 2 (oL4)	001EH	Undertorque Detection 1 (UL3)
0007H	Up/Down commands input error (EF)	001FH	Undertorque Detection 2 (UL4)
0008H	Drive Baseblock (bb)	0020H	MEMOBUS/Modbus Test Mode Fault (SE)
0009H	External Fault at input terminal S3 (EF3)	002BH	Encoder Disconnected (PGo)
000AH	External Fault at input terminal S4 (EF4)	0034H	High Current Alarm (HCA)
000BH	External Fault at input terminal S5 (EF5)	0035H	Cooling Fan Maintenance Time (LT-1)
000CH	External Fault at input terminal S6 (EF6)	0036H	Capacitor Maintenance Time (LT-2)
000DH	External Fault at input terminal S7 (EF7)	0038H	SI-S EEPROM Error (EEP)
000EH	External Fault at input terminal S8 (EF8)	003BH	Safe Disable Input (HbbF)
0010H	Overspeed (oS)	003CH	Safe Disable Input (Hbb)
0011H	Excessive Speed Deviation (dEv)	0041H	Output Voltage Detection Fault (voF)
0012H	Encoder Disconnected (PGo)	0043H	Soft Charge Bypass Relay Maintenance Time (LT-3)
0014H	MEMOBUS/Modbus Communication Error (CE)	0044H	IGBT Maintenance Time (50%) (LT-4)
0015H	Option Communication Error (bUS)	0045H	Braking Transistor Overload (boL)
0016H	Serial Communication Transmission Error (CALL)	–	–

C.10 Enter Command

When writing parameters to the drive from the PLC using MEMOBUS/Modbus communication, parameter H5-11 determines whether an Enter command must be issued to enable these parameters. This section describes the types and functions of the Enter commands.

◆ Enter Command Types

The drive supports two types of Enter commands as shown in the table below. An Enter command is enabled by writing 0 to register numbers 0900H or 0910H. These registers can only be written to; attempting to read from these registers will cause an error.

Table C.6 Enter Command Types

Register No.	Description
0900H	Simultaneously writes data into the EEPROM (non-volatile memory) of the drive and enables the data in RAM. Parameter changes remain after cycling power.
0910H	Writes data in the RAM only. Parameter changes are lost when the drive is shut off.

Note: Limit the number of times writing to the EEPROM because the EEPROM can only be written to 100,000 times. The Enter command registers are write-only and if these registers are read, the register address will be invalid (Error code: 02H). An Enter command is not required when reference or broadcast data are sent to the drive.

◆ Parameter H5-11 and the Enter Command

When changing parameters via MEMOBUS/Modbus, H5-11 determines whether an Enter command is necessary to activate parameter changes in the drive.

H5-11 Settings	H5-11 = 0	H5-11 = 1
How parameter settings are enabled	When the Enter command is received from the master.	As soon as the value is changed.
Upper/lower limit check	Upper/lower limit check is performed, taking the settings of related parameters into account.	Checks only the upper/lower limits of the parameters that were changed.
Default value of related parameters	Not affected. The settings of related parameters remain unchanged. They must be changed manually if needed.	Default settings of related parameters are changed automatically.
Error handling when setting multiple parameters	Data is accepted even if one setting is invalid. The invalid setting will be discarded. No error message occurs.	Error occurs if only one setting is invalid. All data that was sent are discarded.

C.11 Communication Errors

◆ MEMOBUS/Modbus Error Codes

A list of MEMOBUS/Modbus errors appears below.

When an error occurs, remove whatever caused the error and restart communications.

Error Code	Error Name / Cause
01H	Function Code Error
	• Attempted to set a function code from a PLC other than 03H, 08H, and 10H.
02H	Register Number Error
	• A register number specified in the command message does not exist. • Attempted to send a broadcast message using other register numbers than 0001H or 0002H.
03H	Bit Count Error
	• Read data or write data is greater than 16 bits. Invalid command message quantity. • In a write message, the "Number of Data Items" contained within the message does not equal twice the amount of data words (i.e., the total of Data 1+ Data 2, etc.).
21H	Data Setting Error
	• Control data or parameter write data is outside the allowable setting range. • Attempted to write a contradictory parameter setting.
22H	Write Mode Error
	• During run, the user attempted to write a parameter that cannot be written to during run. • During an EEPROM memory data error (CPF06), the master attempted to write to a parameter other than A1-00 to A1-05, E1-03, or o2-04. • Attempted to write to read-only data.
23H	DC Bus Undervoltage Write Error
	• During an undervoltage situation, the master attempted to write to parameters that cannot be written to during undervoltage.
24H	Write Error During Parameter Process
	• Master attempted writing to the drive while the drive was processing parameter data.

◆ Slave Not Responding

In the following situations, the slave drive will ignore the command message sent from the master, and not send a response message:

- When a communications error (overrun, framing, parity, or CRC-16) is detected in the command message.
- When the slave address in the command message and the slave address in the drive do not match (remember to set the slave address for the drive using H5-01).
- When the gap between two blocks (8-bit) of a message exceeds 24 bits.
- When the command message data length is invalid.

Note: If the slave address specified in the command message is 00H, all slaves execute the write function, but do not return response messages to the master.

MEMOBUS/Modbus Communications

C

C.12 Self-Diagnostics

The drive has a built-in self-diagnosing function of the serial communication interface circuits. To perform the self-diagnosis function, use the following procedure.

DANGER! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply will result in death or serious injury. Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are OFF and measure the DC bus voltage level to confirm safe level.*

1. Turn on the power to the drive.
2. Note the present terminal S6 function selection setting (H1-06) and set it for the communications test mode (H1-06 = 67).
3. Turn off the power to the drive.
4. With the power off, wire the drive as shown in the following diagram, connecting terminals R+ and S+, R- and S-, and S6 and SC.

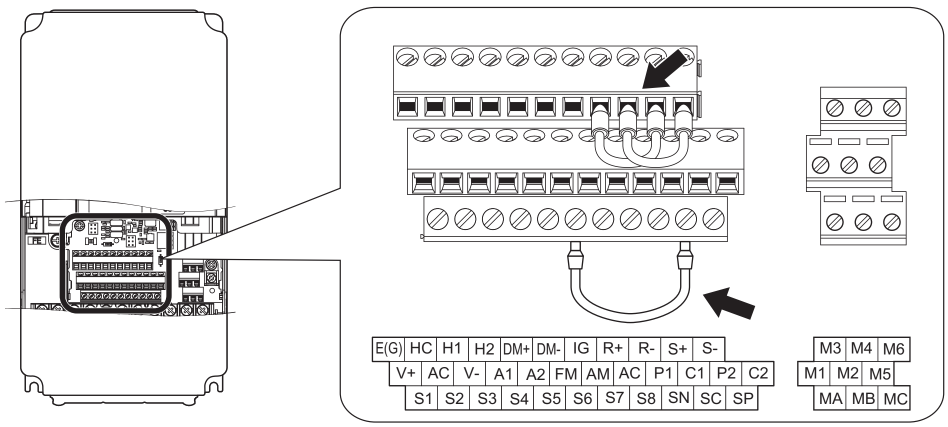


Figure C.9 Terminal Connections for Communication Self-Diagnostics

5. Set jumper S3 to source mode (internal power supply).
6. Turn the power to the drive back on.
7. Turn off the power supply.
8. Remove the wire jumpers from terminal R+, R-, S+, S-, and S6-SC. Set back jumper S3 to its original position. Set terminal S6 to its original function.
9. Return to normal operation.

Appendix: D

Standards Compliance

This appendix explains the guidelines and criteria for maintaining UL standards.

D.1 Section Safety

⚠ DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring or service the drive while the power is on.

Failure to comply will result in death or serious injury.

Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.

⚠ WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Do not allow unqualified personnel to use the equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

WARNING

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

Do not use improper combustible materials in drive installation, repair or maintenance.

Failure to comply could result in death or serious injury by fire. Attach the drive or braking resistors to metal or other noncombustible material.

NOTICE

Equipment Hazard

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded wire for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

Do not allow unqualified personnel to use the product.

Failure to comply could result in damage to the drive or braking circuit.
Carefully review instruction manual TOBP C720600 00 when connecting a braking option to the drive.

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

Yaskawa is not responsible for modification of the product made by the user. This product must not be modified.

Check all the wiring to ensure that all connections are correct after installing the drive and connecting other devices.

Failure to comply could result in damage to the drive.

D.2 UL Standards

◆ UL Standards Compliance

The UL/cUL mark applies to products in the United States and Canada. It indicates that UL has performed product testing and evaluation, and determined that their stringent standards for product safety have been met. For a product to receive UL certification, all components inside that product must also receive UL certification.

Figure D.1 UL/cUL Mark

This drive is tested in accordance with UL standard UL508C and complies with UL requirements. To ensure continued compliance when using this drive in combination with other equipment, meet the following conditions:

■ Installation Area

Do not install the drive to an area greater than pollution severity degree 2 (UL standard).

■ Ambient Temperature

IP00 enclosure with top protective cover: -10 to +40 °C

IP00 enclosure: -10 to +50 °C

■ Main Circuit Terminal Wiring

Yaskawa recommends using closed-loop crimp terminals on all drive models. UL/cUL approval requires the use of UL Listed closed-loop crimp terminals when wiring the drive main circuit terminals on models 2A0106 to 2A0432 and 4A0056 to 4A0225. Use only the tools recommended by the terminal manufacturer for crimping.

The wire gauges listed in *Table D.1* and *Table D.2* are Yaskawa recommendations. Refer to local codes for proper wire gauge selections.

Note: The mark ⏚ indicates the terminals for protective ground connection. (as defined in IEC60417-5019)
Grounding impedance;
200 V: 100 Ω or less
400 V: 10 Ω or less

Table D.1 Wire Gauge and Torque Specifications (Three-Phase 200 V Class)

Drive Model	Terminal	Recommended Wire Size mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
	R/L1, S/L2, T/L3	6.0 (10)	2.5 to 6.0 (14 to 10)		
	U/T1, V/T2, W/T3	6.0 (10)	2.5 to 6.0 (14 to 10)		
2A0018	–, +1, +2	–	2.5 to 6.0 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	6.0 (10)	2.5 to 6.0 (14 to 10)		

Drive Model	Terminal	Recommended Wire Size mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
2A0022	R/L1, S/L2, T/L3	6.0 (10)	2.5 to 6.0 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	6.0 (10)	2.5 to 6.0 (14 to 10)		
	–, +1, +2	–	4.0 to 6.0 (12 to 10)		
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	6.0 (10)	4.0 to 6.0 (12 to 10)		
2A0031	R/L1, S/L2, T/L3	10 (8)	2.5 to 16 (12 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	10 (8)	2.5 to 16 (12 to 6)		
	–, +1, +2	–	6.0 to 16 (10 to 6)		
	B1, B2	–	4.0 to 6.0 (12 to 10)		
	⏚	10 (8)	6.0 to 10 (10 to 8)	M5	2 to 2.5 (17.7 to 22.1)
2A0041	R/L1, S/L2, T/L3	16 (6)	2.5 to 16 (12 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	16 (6)	2.5 to 16 (12 to 6)		
	–, +1, +2	–	16 (6)		
	B1, B2	–	4.0 to 6.0 (12 to 10)		
	⏚	10 (8)	6.0 to 10 (10 to 8)	M5	2 to 2.5 (17.7 to 22.1)
2A0059	R/L1, S/L2, T/L3	25 (4)	16 to 25 (6 to 4)	M6	4 to 6 (35.4 to 53.1)
	U/T1, V/T2, W/T3	25 (4)	16 to 25 (6 to 4)		
	–, +1, +2	–	16 to 25 (6 to 4)		
	B1, B2	–	6.0 to 10 (10 to 6)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	16 (6)	10 to 16 (8 to 6)	M6	4 to 6 (35.4 to 53.1)
2A0075	R/L1, S/L2, T/L3	35 (3)	6.0 to 35 (10 to 2)	M8	9 to11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	35 (3)	6.0 to 35 (10 to 2)		
	–, +1, +2	–	16 to 25 (4 to 3)		
	B1, B2	–	10 to 16 (8 to 6)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	16 (6)	16 to 25 (6 to 4)	M6	4 to 6 (35.4 to 53.1)
2A0094	R/L1, S/L2, T/L3	35 (2)	6.0 to 35 (10 to 2)	M8	9 to11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	16 × 2P (6 × 2P)	6.0 to 35 (10 to 2)		
	–, +1, +2	–	25 to 35 (3 to 2)		
	B1, B2	–	16 (6)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	16 (6)	16 to 25 (6 to 4)	M6	4 to 6 (35.4 to 53.1)

Drive Model	Terminal	Recommended Wire Size mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
2A0106	R/L1, S/L2, T/L3	70 (1/0)	6.0 to 50 (10 to 1/0)	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	70 (1/0)	6.0 to 50 (10 to 1/0)		
	–, +1	–	35 to 50 (2 to 1/0)		
	B1, B2	–	16 to 50 (6 to 1/0)		
	⏚	16 (6)	16 to 25 (6 to 4)		
2A0144	R/L1, S/L2, T/L3	70 (2/0)	6.0 to 95 (10 to 3/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	95 (3/0)	6.0 to 95 (10 to 3/0)		
	–, +1	–	50 to 70 (1/0 to 3/0)		
	B1, B2	–	25 to 70 (4 to 2/0)		
	⏚	25 (4)	25 (4)	M8	9 to 11 (79.7 to 97.4)
2A0181	R/L1, S/L2, T/L3	95 (4/0)	70 to 95 (1/0 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	95 (4/0)	70 to 95 (1/0 to 4/0)		
	–, +1	–	50 to 95 (1 to 4/0)		
	+3	–	70 to 95 (1/0 to 4/0)		
	⏚	25 (4)	25 to 35 (4 to 2)		
2A0225	R/L1, S/L2, T/L3	70 × 2P (1/0 × 2P)	70 to 95 (1/0 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	70 × 2P (1/0 × 2P)	70 to 95 (1/0 to 4/0)		
	–, +1	–	50 to 95 (1 to 4/0)		
	+3	–	70 to 95 (1/0 to 4/0)		
	⏚	25 (4)	25 to 50 (4 to 1/0)		
2A0269	R/L1, S/L2, T/L3	95 × 2P (3/0 × 2P)	95 to 150 (3/0 to 300)	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	95 × 2P (3/0 × 2P)	95 to 150 (3/0 to 300)		
	–, +1	–	95 to 150 (3/0 to 300)		
	+3	–	35 to 150 (2 to 300)	M10	18 to 23 (159 to 204)
	⏚	35 (3)	35 to 150 (2 to 300)	M12	32 to 40 (283 to 354)
2A0354	R/L1, S/L2, T/L3	120 × 2P (4/0 × 2P)	95 to 150 (3/0 to 300)	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	120 × 2P (4/0 × 2P)	95 to 150 (3/0 to 300)		
	–, +1	–	95 to 150 (3/0 to 300)		
	+3	–	95 to 150 (3/0 to 300)	M10	18 to 23 (159 to 204)
	⏚	35 (2)	35 to 150 (2 to 300)	M12	32 to 40 (283 to 354)

Drive Model	Terminal	Recommended Wire Size mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N•m (lb.in.)
2A0432	R/L1, S/L2, T/L3	150 × 2P (250 × 2P)	95 to 300 (4/0 to 600)	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	185 × 2P (300 × 2P)	95 to 300 (4/0 to 600)		
	–, +1	–	120 to 300 (250 to 600)		
	+3	–	70 to 300 (3/0 to 600)	M10	18 to 23 (159 to 204)
	⏚	50 (1)	120 to 240 (1 to 350)	M12	32 to 40 (283 to 354)

Note: Use crimp insulated terminals or insulated tubing for wiring these connections. Wires should have a continuous maximum allowable temperature of 75 °C 600 V UL approved vinyl sheathed insulation. Ambient temperature should not exceed 40 °C.

Table D.2 Wire Gauge and Torque Specifications (Three-Phase 400 V Class)

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N•m (lb.in.)
4A0009	R/L1, S/L2, T/L3	2.5 (14)	2.5 to 6.0 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2.5 (14)	2.5 to 6.0 (14 to 10)		
	–, +1, +2	–	2.5 to 6.0 (14 to 10)		
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	6.0 (10)	2.5 to 6.0 (14 to 10)		
4A0012	R/L1, S/L2, T/L3	4.0 (12)	2.5 to 6.0 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2.5 (14)	2.5 to 6.0 (14 to 10)		
	–, +1, +2	–	2.5 to 6.0 (14 to 10)		
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	6.0 (10)	2.5 to 6.0 (14 to 10)		
4A0019	R/L1, S/L2, T/L3	6.0 (10)	2.5 to 16 (12 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	6.0 (10)	2.5 to 16 (12 to 6)		
	–, +1, +2	–	4.0 to 16 (12 to 6)		
	B1, B2	–	4.0 to 6.0 (12 to 10)		
	⏚	6.0 (10)	2.5 to 6.0 (14 to 10)	M5	2 to 2.5 (17.7 to 22.1)
4A0023	R/L1, S/L2, T/L3	6.0 (10)	2.5 to 16 (12 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	6.0 (10)	2.5 to 16 (12 to 6)		
	–, +1, +2	–	4.0 to 16 (12 to 6)		
	B1, B2	–	4.0 to 6.0 (12 to 10)		
	⏚	6.0 (10)	4.0 to 6.0 (12 to 10)	M5	2 to 2.5 (17.7 to 22.1)
4A0030	R/L1, S/L2, T/L3	10 (8)	6.0 to 16 (10 to 6)	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	10 (8)	6.0 to 16 (10 to 6)		
	–, +1, +2	–	6.0 to 16 (10 to 6)		
	B1, B2	–	6.0 to 10 (10 to 8)	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	10 (8)	6.0 to 10 (10 to 8)	M6	4 to 6 (35.4 to 53.1)

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N•m (lb.in.)
4A0039	R/L1, S/L2, T/L3	16 (6)	6.0 to 16 (10 to 6)	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	10 (8)	6.0 to 16 (10 to 6)		
	–, +1, +2	–	16 (6)		
	B1, B2	–	6.0 to 10 (10 to 8)	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	16 (6)	6.0 to 16 (10 to 6)	M6	4 to 6 (35.4 to 53.1)
4A0049	R/L1, S/L2, T/L3	16 (6)	16 to 25 (6 to 4)	M6	4 to 6 (35.4 to 53.1)
	U/T1, V/T2, W/T3	16 (6)	16 to 25 (6 to 4)		
	–, +1, +2	–	16 to 25 (6 to 4)		
	B1, B2	–	6.0 to 10 (10 to 8)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	16 (6)	10 to 16 (8 to 6)	M6	4 to 6 (35.4 to 53.1)
4A0056	R/L1, S/L2, T/L3	25 (4)	6.0 to 50 (10 to 1/0)	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	25 (4)	6.0 to 50 (10 to 1/0)		
	–, +1	–	16 to 35 (6 to 1)		
	B1, B2	–	10 to 16 (8 to 4)		
	⏚	16 (6)	10 to 16 (8 to 6)		
4A0075	R/L1, S/L2, T/L3	35 (3)	6.0 to 70 (10 to 3/0)	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	35 (3)	6.0 to 70 (10 to 3/0)		
	–, +1	–	25 to 35 (4 to 1)		
	B1, B2	–	16 to 25 (6 to 3)		
	⏚	16 (6)	16 to 25 (6)		
4A0094	R/L1, S/L2, T/L3	35 (2)	16 to 120 (6 to 250)	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	50 (1)	16 to 120 (6 to 250)		
	–, +1	–	25 to 50 (3 to 1/0)		
	+3	–	16 to 50 (6 to 1/0)		
	⏚	25 (4)	16 to 25 (6 to 4)		
4A0114	R/L1, S/L2, T/L3	70 (1/0)	16 to 120 (6 to 250)	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	70 (1/0)	16 to 120 (6 to 250)		
	–, +1	–	25 to 50 (3 to 1/0)		
	+3	–	25 to 50 (4 to 1/0)		
	⏚	25 (4)	16 to 25 (6 to 4)		

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N•m (lb.in.)
4A0140	R/L1, S/L2, T/L3	95 (3/0)	50 to 95 (1/0 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	70 (2/0)	50 to 95 (1/0 to 4/0)		
	–, +1	–	50 to 95 (1/0 to 4/0)		
	+3	–	25 to 95 (3 to 4/0)		
	⏚	25 (4)	25 (4)		
4A0188	R/L1, S/L2, T/L3	95 (4/0)	50 to 95 (1/0 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	95 (4/0)	50 to 95 (1/0 to 4/0)		
	–, +1	–	35 to 95 (1 to 4/0)		
	+3	–	50 to 95 (1/0 to 4/0)		
	⏚	25 (4)	25 to 35 (4 to 2)		
4A0225	R/L1, S/L2, T/L3	50 × 2P (1 × 2P)	35 to 150 (2 to 300)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	70 × 2P (1/0 × 2P)	35 to 150 (2 to 300)		
	–, +1	–	50 to 150 (1 to 250)		
	+3	–	25 to 70 (3 to 3/0)		
	⏚	25 (4)	25 to 150 (4 to 300)		

Note: Use crimp insulated terminals or insulated tubing for wiring these connections. Wires should have a continuous maximum allowable temperature of 75 °C 600 V UL approved vinyl sheathed insulation. Ambient temperature should not exceed 40 °C.

Closed-Loop Crimp Terminal Recommendations

Yaskawa recommends using closed-loop crimp terminals on all drive models. UL approval requires the use of UL Listed crimp terminals when wiring the drive main circuit terminals on models 2A0106 to 2A0432 and 4A0056 to 4A0225. Use only crimping tools as specified by the crimp terminal manufacturer. Yaskawa recommends crimp terminals made by JST and Tokyo DIP (or equivalent) for the insulation cap.

Table D.3 matches the wire gauges and terminal screw sizes with Yaskawa - recommended crimp terminals, tools, and insulation caps. Refer to the appropriate Wire Gauge and Torque Specifications table for the wire gauge and screw size for your drive model. Place orders with a Yaskawa representatives the Yaskawa sales department.

Table D.3 Closed-Loop Crimp Terminal Size

Wire Gauge	Terminal Screws	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code <1>
			Machine No.	Die Jaw		
14 AWG	M4	R2-4	YA-4	AD-900	TP-003	100-054-028
12 / 10 AWG	M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	M5	R5.5-5	YA-4	AD-900	TP-005	100-054-030
8 AWG	M4	8-4	YA-4	AD-901	TP-008	100-054-031
	M5	R8-5	YA-4	AD-901	TP-008	100-054-032
6 AWG	M4	14-NK4	YA-4	AD-902	TP-014	100-054-033
	M5	R14-5	YA-4	AD-902	TP-014	100-054-034
	M6	R14-6	YA-5	AD-952	TP-014	100-051-261
	M8	R14-8	YA-5	AD-952	TP-014	100-054-035
4 AWG	M6	R22-6	YA-5	AD-953	TP-022	100-051-262
	M8	R22-8	YA-5	AD-953	TP-022	100-051-263
3/2/1 AWG	M8	R38-8	YA-5	AD-954	TP-038	100-051-264
	M10	R38-10	YA-5	AD-954	TP-038	100-061-114
1/0 AWG 1/0 AWG × 2P	M8	R60-8	YA-5	AD-955	TP-060	100-051-265
	M10	R60-10	YF-1, YET-300-1	TD-321, TD-311	TP-060	100-051-266
2/0 AWG 2/0 AWG × 2P	M10	70-10	YF-1, YET-300-1	TD-323, TD-312	TP-080	100-054-036

Wire Gauge	Terminal Screws	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code <1>
			Machine No.	Die Jaw		
1 AWG × 2P 2 AWG × 2P	M10	38-L10	YF-1, YET-150-1	TD-224, TD-212	TP-038	100-051-556
3/0 AWG	M10	80-10	YF-1, YET-300-1	TD-323, TD-312	TP-080	100-051-267
3/0 AWG × 2P	M10	80-L10	YF-1, YET-150-1	TD-227, TD-214	TP-080	100-051-557
	M12	80-L12	YF-1, YET-300-1	TD-323, TD-312	TP-080	100-051-558
4/0 AWG	M10	R100-10	YF-1, YET-300-1 YF-1, YET-150-1	TD-324, TD-312 TD-228, TD-214	TP-100	100-051-269
4/0 AWG × 2P	M10	100-L10	YF-1, YET-150-1	TD-228, TD-214	TP-100	100-051-559
	M12	100-L12	YF-1, YET-300-1	TD-324, TD-312	TP-100	100-051-560
250 / 300 kcmil	M10	R150-10	YF-1. YET-150-1	TD-229, TD-215	TP-150	100-051-272
	M12	R150-12	YF-1, YET-300-1	TD-325, TD-313	TP-150	100-051-273
250 kcmil × 2P 300 kcmil × 2P	M10	150-L10	YF-1, YET-150-1	TD-229, TD-215	TP-150	100-051-561
	M12	150-L12	YF-1, YET-300-1	TD-325, TD-313	TP-150	100-051-562
350 kcmil	M10	180-10	YF-1, YET-300-1	TD-326, TD-313	TP-200	100-066-687
400 kcmil	M10	200-10	YF-1, YET-300-1	TD-327, TD-314	TP-200	100-051-563
350 kcmil × 2P	M12	180-L12	YF-1, YET-300-1	TD-326, TD-313	TP-200	100-066-688
400 kcmil × 2P	M12	200-L12	YF-1, YET-300-1	TD-327, TD-314	TP-200	100-051-564
500 kcmil 600 / 650 kcmil 500 kcmil × 2P 600 kcmil × 2P	M10	325-10	YF-1, YET-300-1	TD-328, TD-315	TP-325	100-051-565
	M12	325-12	YF-1, YET-300-1	TD-328, TD-315	TP-325	100-051-277

<1> Codes refer to a set of three crimp terminals and three insulation caps. Prepare input and output wiring using two sets for each connection.
Example 1: Models with 300 kcmil for both input and output require one set for input terminals and one set for output terminals, so the user should order two sets of [100-051-272].
Example 2: Models with 4/0 AWG × 2P for both input and output require two sets for input terminals and two sets for output terminals, so the user should order four sets of [100-051-560].

Note: Use crimp insulated terminals or insulated shrink tubing for wiring connections. Wires should have a continuous maximum allowable temperature of 75 °C 600 Vac UL-approved vinyl-sheathed insulation.

■ Branch Circuit Protection Devices

Table D.4 Recommended Input Fuse Selection

Drive Model CIMR-LE	L1000E					
	Nominal Output Power HP	AC Drive Input Amps	MCCB Rating Amps <1>	Time Delay Fuse Rating Amps <2>	Non-time Delay Fuse Rating Amps <3>	Bussmann Semi-conductor Fuse Rating (Fuse Ampere) <4>
240 V Models						
2A0018	5	15.6	25	25	40	FWH-90B (90)
2A0022	7.5	18.9	35	30	50	FWH-90B (90)
2A0031	10	28	50	40	75	FWH-100B (100)
2A0041	15	37	60	60	100	FWH-200B (200)
2A0059	20	52	100	90	150	FWH-200B (200)
2A0075	25	68	125	110	200	FWH-200B (200)
2A0094	30	80	150	125	225	FWH-300A (300)
2A0106	40	82	150	125	225	FWH-300A (300)
2A0144	50	111	200	175	250	FWH-350A (350)
2A0181	60	136	250	225	350	FWH-400A (400)
2A0225	75	164	300	250	450	FWH-400A (400)
2A0269	100	200	400	350	600	FWH-600A (600)
2A0354	125	271	500	450	800	FWH-700A (700)
2A0432	150	324	600	500	900 <5>	FWH-800A (800)
480 V Models						
4A0009	5	8.2	15	12	20	FWH-90B (90)
4A0012	7.5	10.4	20	17.5	30	FWH-90B (90)
4A0019	10	15	30	25	40	FWH-80B (80)
4A0023	15	20	40	35	60	FWH-100B (100)
4A0030	20	29	50	50	80	FWH-125B (125)
4A0039	25	39	75	60	110	FWH-200B (200)
4A0049	30	44	75	75	125	FWH-250A (250)
4A0056	40	43	75	75	125	FWH-250A (250)
4A0075	50	58	100	100	150	FWH-250A (250)

Drive Model CIMR-LE	L1000E					
	Nominal Output Power HP	AC Drive Input Amps	MCCB Rating Amps <1>	Time Delay Fuse Rating Amps <2>	Non-time Delay Fuse Rating Amps <3>	Bussmann Semi-conductor Fuse Rating (Fuse Ampere) <4>
4A0094	60	71	125	110	200	FWH-250A (250)
4A0114	75	86	150	150	250	FWH-250A (250)
4A0140	100	105	175	175	300	FWH-350A (350)
4A0188	125	142	225	225	400	FWH-400A (400)
4A0225	150	170	250	250	500	FWH-500A (500)

<1> Maximum MCCB Rating is 15 A, or 200% of drive input current rating, whichever is larger. MCCB voltage rating must be 600 Vac or greater.
<2> Maximum Time Delay fuse is 175% of drive input current rating. This covers any Class CC, J or T class fuse.
<3> Maximum Non-time Delay fuse is 300% of drive input current rating. This covers any CC, J or T class fuse.
<4> When using semiconductor fuses, Bussmann FWH is required for UL compliance.
<5> Class L fuse is also approved for this rating.

■ Grounding

The drive is designed to be used in T-N (grounded neutral point) networks. If installing the drive in other types of grounded systems, contact your Yaskawa representative for instructions.

■ Guarding Against Harmful Materials

When installing IP00 enclosure drives, use an enclosure that prevents foreign material from entering the drive from above or below.

■ Low Voltage Wiring for Control Circuit Terminals

Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national state or local codes for wiring. If external power supply used, it shall be UL Listed Class 2 power source only or equivalent. Refer to NEC Article 725 Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power Limited Circuits for requirements concerning class 1 circuit conductors and class 2 power supplies.

Table D.5 Control Circuit Terminal Power Supply

Input / Output	Terminal Signal	Power Supply Specifications
Open Collector Outputs	P1, C1, P2, C2, DM+, DM-	Requires class 2 power supply
Digital inputs	S1-S8, SN, SC, SP, HC, H1, H2	Use the internal LVLC power supply of the drive. Use class 2 for external power supply.
Analog inputs / outputs	+V, -V, A1, A2, AC, AM, FM	

■ Drive Short Circuit Rating

This drive is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 480 Vac maximum (Up to 240 V in 200 V class drives, up to 480 V for 400 V class drives), when protected by fuses or circuit breakers as specified in *Table D.4*.

◆ Drive Motor Overload Protection

Set parameter E2-01/E5-03 (motor rated current) to the appropriate value to enable motor overload protection. The internal motor overload protection is UL listed and in accordance with the NEC and CEC.

■ E2-01/E5-03: Motor Rated Current (IM Motor/PM Motor)

Setting Range: Model Dependent

Default Setting: Model Dependent

Parameter E2-01/E5-03 (motor rated current) protects the motor if parameter L1-01 is not set to 0 (default is 1, enabling protection for standard induction motors).

If Auto-Tuning has been performed successfully, the motor data entered to T1-04/T2-04 is automatically written into parameter E2-01/E5-03. If Auto-Tuning has not been performed, manually enter the correct motor rated current to parameter E2-01/E5-03.

■ L1-01: Motor Overload Protection Selection

The drive has an electronic overload protection function (oL1) based on time, output current, and output speed, which protects the motor from overheating. The electronic thermal overload function is UL-recognized, so it does not require an external thermal relay for single motor operation.

This parameter selects the motor overload curve used according to the type of motor applied.

Table D.6 Overload Protection Settings

Setting	Description	
0	Disabled	Disabled the internal motor overload protection of the drive.
1	Standard fan-cooled motor (default)	Selects protection characteristics for a standard self cooled motor with limited cooling capabilities when running below the rated speed. The motor overload detection level (oL1) is automatically reduced when running below the motor rated speed.
2	Drive duty motor with a speed range of 1:10	Selects protection characteristics for a motor with self-cooling capability within a speed range of 10:1. The motor overload detection level (oL1) is automatically reduced when running below 1/10 of the motor rated speed.
3	Vector motor with a speed range of 1:100	Selects protection characteristics for a motor capable of cooling itself at any speed — including zero speed (externally cooled motor). The motor overload detection level (oL1) is constant over the entire speed range.
5	Permanent Magnet motor with constant torque	Selects protection characteristics for a constant torque PM motor. The motor overload detection level (oL1) is constant over the whole speed range.
6	Standard fan cooled motor (50 Hz)	Selects protection characteristics for a standard self cooled motor with limited cooling capabilities when running below the rated speed. The motor overload detection level (oL1) is automatically reduces when running below the motor rated speed.

When connecting the drive to more than one motor for simultaneous operation, disable the electronic overload protection (L1-01 = 0) and wire each motor with its own motor thermal overload relay.

Enable the motor overload protection (L1-01 = 1 to 3, 5) when connecting the drive to a single motor, unless another motor overload preventing device is installed. The drive electronic thermal overload function causes an oL1 fault, which shuts off the output of the drive and prevents additional overheating of the motor. The motor temperature is continually calculated while the drive is powered up.

■ L1-02: Motor Overload Protection Time

Setting Range: 0.1 to 5.0 min

Factory Default: 1.0 min

Parameter L1-02 determines how long the motor is allowed to operate before the oL1 fault occurs when the drive is running at 60 Hz and at 150% of the full load amp rating (E2-01/E5-03) of the motor. Adjusting the value of L1-02 can shift the set of oL1 curves up the y axis of the diagram below, but will not change the shape of the curves.

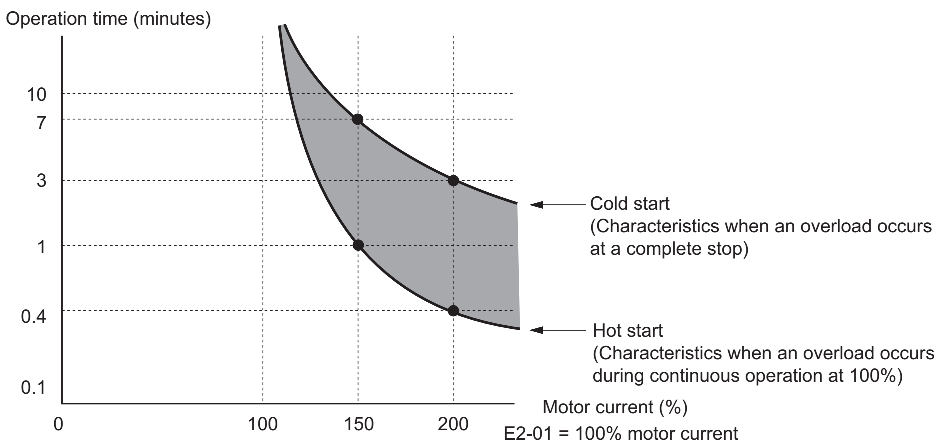


Figure D.2 Protection Operation Time for General Purpose Motors at the Rated Output Frequency

D.3 Safe Disable Input Function

This section explains the Safe Disable function and how to use it in an elevator installation. Contact Yaskawa if more information is required.

◆ Specifications

The Safe Disable inputs provide a stop function in compliance with “Safe Torque Off” as defined in the IEC61800-5-2. Safe Disable inputs have been designed to meet the requirements of the ISO13849-1, Cat. 3 PLd and IEC61508, SIL2.

A Safe Disable Status Monitor for error detection in the safety circuit is also provided.

Inputs / Outputs		Two Safe Disable inputs and one EDM output according to ISO13849-1 Cat.3 PLd, IEC61508 SIL2.
Operation Time		Time from input open to drive output stop is less than 1 ms.
Failure Probability	**Demand Rate Low**	PFD = $5.15E^{-5}$
	Demand Rate High or Continuous	PFH = $1.2E^{-9}$
Performance Level		The Safe Disable inputs satisfy all requirements of Performance Level (PL) d according to ISO13849-1 (DC from EDM considered).

◆ Precautions

DANGER! *Sudden Movement Hazard. Improper use of the Safe Disable function will result in serious injury or death. Make sure the entire system or machinery uses the Safe Disable function in compliance with safety requirements. When implementing the Safe Disable function into the safety system of a machine, a thorough risk assessment for the whole system must be carried out to ensure it complies with relevant safety norms (e.g., EN954/ISO13849, IEC61508, EN/IEC62061).*

DANGER! *Sudden Movement Hazard. When using a PM motor, even if the drive output is shut off by the Safe Disable function, a break down of two output transistors can cause current to flow through the motor winding, resulting in a rotor movement for a maximum angle of 180 degrees (electrically). Ensure this condition will not affect the safety of the application when using the Safe Disable function. Failure to comply will result in death or serious injury.*

DANGER! *Electrical Shock Hazard. The Safe Disable function can switch off the drive output, but does not cut the drive power supply and cannot electrically isolate the drive output from the input. Always shut off the drive power supply when performing maintenance or installations on the drive input side as well as the drive output side. Failure to comply will result in death or serious injury.*

WARNING! *Sudden Movement Hazard. When using the Safe Disable inputs, make sure to remove the wire links between terminals H1, H2, and HC that were installed prior to shipment. Failing to do so will keep the Safe Disable circuit from operating properly and can cause injury or even death.*

WARNING! *All safety features (including Safe Disable) should be inspected daily and periodically. If the system is not operating normally, there is a risk of serious personal injury.*

WARNING! *Only a qualified technician with a thorough understanding of the drive, the instruction manual, and safety standards should be permitted to wire, inspect, and maintain the Safe Disable input. Failure to comply may result in serious injury or death.*

NOTICE: *From the moment terminal inputs H1 and H2 have opened, it takes up to 1 ms for drive output to shut off completely. The sequence set up to trigger terminals H1 and H2 should make sure that both terminals remain open for at least 1 ms in order to properly interrupt drive output. This may result in the Safe Disable Input not activating.*

NOTICE: *The Safe Disable Monitor (output terminals DM+ and DM–) should not be used for any other purpose than to monitor the Safe Disable status or to discover a malfunction in the Safe Disable inputs. The monitor output is not considered a safe output.*

◆ Using the Safe Disable Function

■ Safe Disable Circuit

The Safe Disable circuit consists of two independent input channels that can block the output transistors (terminals H1 and H2). The input can either use the drive internal power supply or an external power supply. Use jumper S3 on the terminal board to select between Sink or Source mode with either internal or external power supply.

A photocoupler output is available to monitor the status of the Safe Disable terminals. *Refer to Output Terminals on page 78* for signal specifications when using this output.

Additionally a Safe Disable monitor function can be assigned to one of the digital outputs (H2-☐☐ = 58).

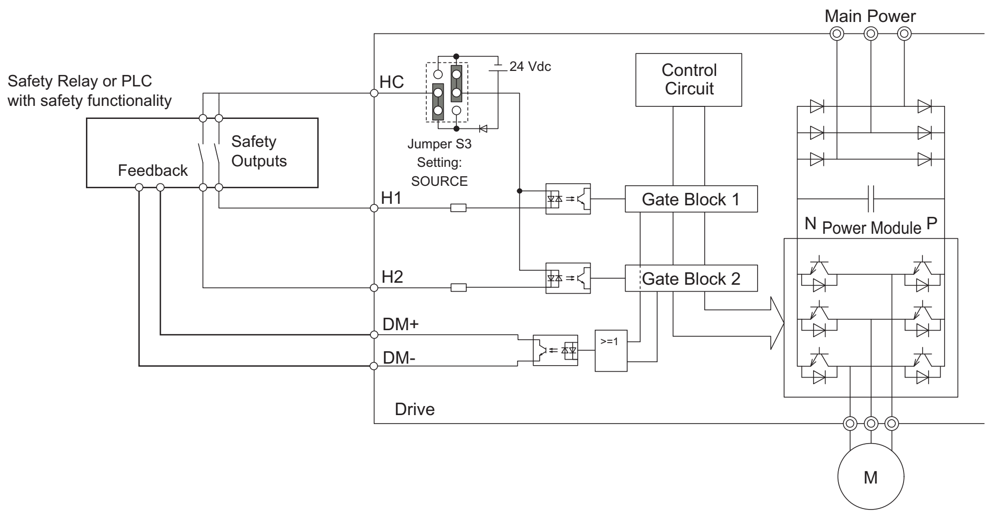


Figure D.3 Safe Disable Function Wiring Example (Source Mode)

■ Disabling and Enabling the Drive Output ("Safe Torque Off")

Figure D.4 illustrates a Safe Disable input operation example.

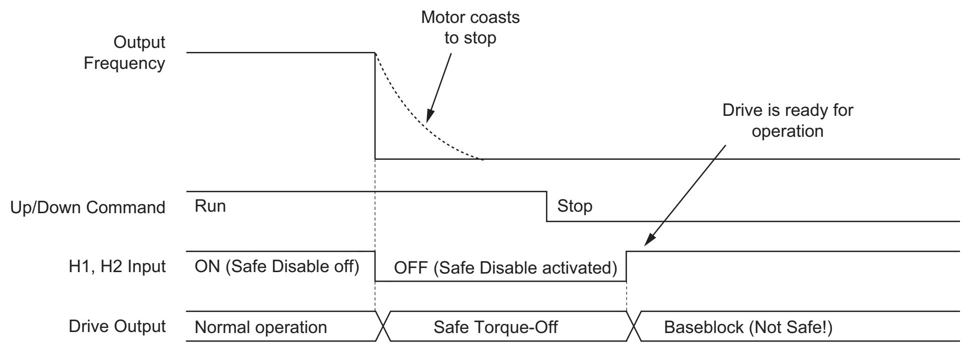


Figure D.4 Safe Disable Operation

Entering the "Safe Torque Off" State

Whenever either one Safe Disable input or both inputs open, the motor torque is shut off by switching off the drive output. If the motor was running before the Safe Disable inputs opened, it will coast to stop, regardless of the stopping method set in parameter b1-03.

Notice that the "Safe Torque Off" state can only be achieved using the Safe Disable function. Removing the Up/Down command stops the drive and shuts the output off (baseblock), but does not create a "Safe Torque Off" status.

Note: To avoid an uncontrolled stop during normal operation, make sure that the Safe Disable inputs are opened first when the motor has completely stopped.

Returning to Normal Operation after Safe Disable

The Safe Torque-Off state can be left by simply closing both Safe-Disable inputs.
If the Up/Down command is issued before the Safe-Disable inputs are closed, then the drive operation depends on the setting of parameter L8-88.

- If L8-88 is set to 0, the Up/Down command needs to be cycled in order to start the motor.
- If L8-88 is set to 1 (default), the drive will start the motor immediately when the Safe Torque-Off mode is left, i.e., the Safe Disable inputs are enabled.

Additionally when L8-88 is set to 1, then parameter S6-16 (Restart after Baseblock Selection) can be used to determine how the drive behaves when the Safe-Disable inputs are opened and closed while the Up/Down command is kept active. When S6-16 is set to 0, the drive will not restart (default) and the Up/Down command needs to be cycled. When S6-16 is set to 1, then the drive will restart as soon as the Safe-Disable inputs are closed.

■ Safe Disable Monitor Output Function and Digital Operator Display

The table below explains the drive output and Safe Disable monitor state depending on the Safe Disable inputs.

Safe Disable Input Status		Safe Disable Status Monitor, DM+ - DM–	Safe Disable Status Monitor, H2-☐☐ = 58	Drive Output Status	Digital Operator Display
Input 1, H1-HC	Input 2, H2-HC				
Off	**Off**	Off	On	Safely disabled, “Safe Torque Off”	Hbb (flashes)
On	**Off**	On	On	Safely disabled, “Safe Torque Off”	HbbF (flashes)
Off	**On**	On	On	Safely disabled, “Safe Torque Off”	HbbF (flashes)
On	**On**	On	Off	Baseblock, ready for operation	Normal display

Safe Disable Status Monitor

With the Safe Disable monitor output (terminals DM+ and DM–), the drive provides a safety status feedback signal. This signal should be read by the device that controls the Safe Disable inputs (PLC or a safety relay) in order to prohibit leaving the “Safe Torque Off” status in case the safety circuit malfunctions. Refer to the instruction manual of the safety device for details on this function.

Digital Operator Display

In contrast to terminals DM+/DM-, the safe disable monitor function that can be programmed for a digital output (H2-☐☐ = 58) is a software function and can be used for EN81-1 conform one contactor solutions but not as an EDM signal according to EN61800-5-1.

When both Safe Disable inputs are open, "Hbb" will flash in the digital operator display.

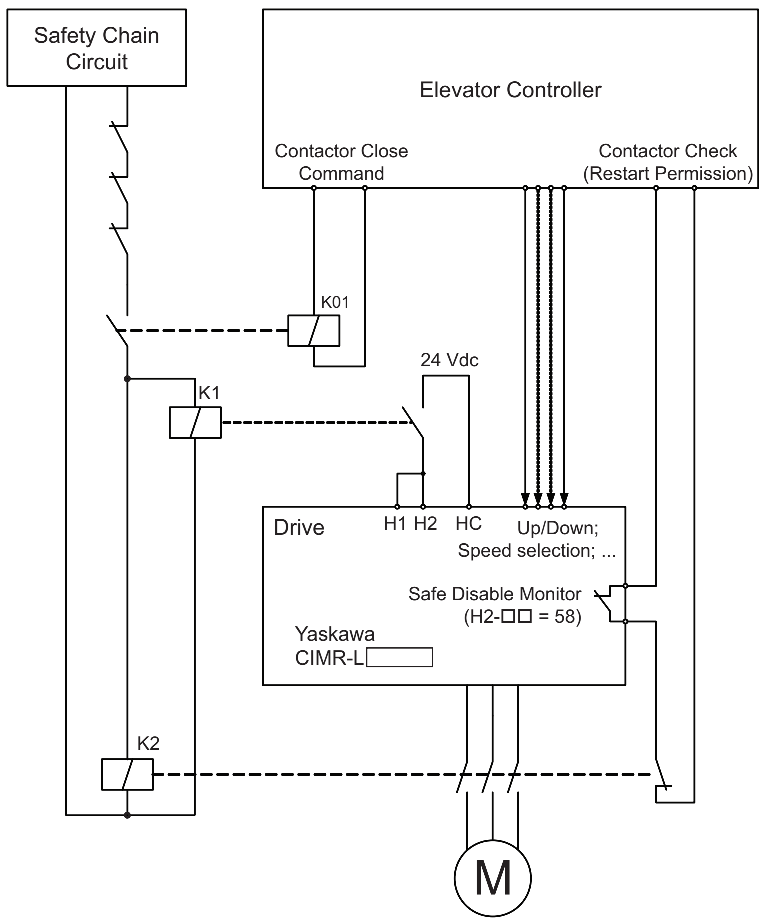
Should only one of the Safe Disable channels be on while the other is off, "HbbF" will flash in the display to indicate that there is a problem in the safety circuit or in the drive. This display should not appear under normal conditions if the Safe Disable circuit is utilized properly. *Refer to Alarm Codes, Causes, and Possible Solutions on page 293* to resolve possible errors.

D.4 EN81-1 Conform Circuit with one Motor Contactor

The safe disable circuit can be utilized to install the drive in an elevator system using only one motor contactor instead of two. In such a system the following guidelines have to be followed for compliance to EN81-1:1998:

- The circuit must be designed so that the inputs H1 and H2 are opened and the drive output shuts off when the safety chain is interrupted.
- A drive digital output must be programmed as Safe Disable feedback (H2-☐☐ = 58). This feedback signal must be implemented in the contactor supervision circuit of the controller that prevents a restart in case of a fault in the Safe Disable circuit or the motor contactor.
- All contactors and wiring must be selected and installed in compliance with the EN81-1:1998.
- The safe disable inputs H1 and H2 must be used to enable/disable the drive. The input logic must be set to Source Mode. ***Refer to Sinking/Sourcing Mode Selection for Safe Disable Inputs on page 84*** for details on setting jumper S3.

The figure below shows a wiring example.



Note: **1.** The drive output will immediately shut off when either of the inputs H1 or H2 is opened. In this case the brake should apply immediately in order to prevent uncontrolled movement of the elevator.

2. The drive output can only be activated when neither an Up nor a Down command is active, i.e., terminals H1 and H2 must be closed prior to setting the Up/Down command.

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Appendix: E

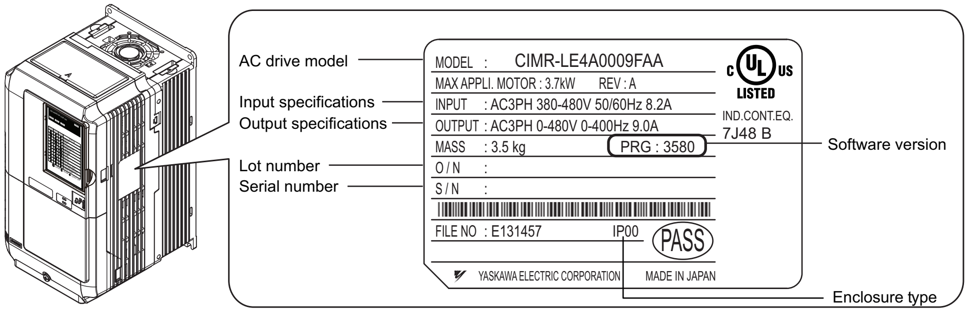
Quick Reference Sheet

The following tables have been provided for the convenience of the user. Fill in the cells that have been left blank as is appropriate for your drive, and keep this information as a quick reference guide for drive and motor data as well as parameter settings

E.1 Drive and Motor Specifications

◆ Drive

Keep a separate record listing drive and motor specifications.



Items	Description
Model	CIMR-LE
Serial Number	
Date of Usage	

◆ Motor

■ Induction Motor

Items	Description	Items	Description
Manufacturer		**Motor Rated Current (T1-04)**	A
Model		**Motor Base Frequency (T1-05)**	Hz
Motor Rated Power (T1-02)	kW	**Number of Motor Poles (T1-06)**	
Motor Rated Voltage (T1-03)	V	**Motor Base Speed**	r/min

Note: These values must be entered as part of the Auto-Tuning process.

■ Permanent Magnet Motor

Items	Description	Items	Description
Manufacturer		**Induction Voltage Constant**	mVs/rad
Model		**Induction Voltage Constant**	mV/(r/min)
PM Motor Rated Power (T2-04)	kW	**PM Motor Rated Current (T2-06)**	A
PM Motor Rated Voltage (T2-05)	V	**Number of PM Motor Poles (T2-08)**	
d-Axis Inductance	mH	**PM Motor Base Speed (T2-09)**	r/min
q-Axis Inductance	mH	**Encoder Offset**	

Note: These values must be entered as part of the Auto-Tuning process.

■ Motor Speed Encoder (if used)

Items	Value	Items	Value
Manufacturer		Resolution	
Interface			

E.2 Multi-Function I/O Terminal Settings Record

These tables have been provided for the customer to keep a record of the functions assigned to each multi-function terminal.

◆ Multi-Function Digital Inputs (SC Common)

Terminal	Used/Reserved	Setting Value and Function Name	Memo
S3		H1-03=	
S4		H1-04=	
S5		H1-05=	
S6		H1-06=	
S7		H1-07=	
S8		H1-08=	

◆ Analog Inputs (AC Common)

Terminal	Used/Reserved	Setting Value and Function Name	Memo
A1		H3-02=	
A2		H3-10=	

◆ Multi-Function Relay Outputs

Terminal	Used/Reserved	Setting Value and Function Name	Memo
M1-M2		H2-01=	
M3-M4		H2-02=	
M5-M6		H2-03=	

◆ Multi-Function Photocoupler Outputs (P1-C1, P2-C2)

Terminal	Used/Reserved	Setting Value and Function Name	Memo
P1-C1		H2-04=	
P2-C2		H2-05=	

◆ Monitor Outputs (AC Common)

Terminal	Used/Reserved	Setting Value and Function Name	Memo
FM		H4-01=	
AM		H4-04=	

E.3 User Setting Table

Use the Verify Menu to see which parameters have been changed from their original default settings.

- The diamond ◆ next to the parameter number indicates that the parameter setting can be changed during run.
- Parameter names in boldface type are included in the Setup Group of parameters.

No.	Name	User Setting
A1-00 ◆	Language Selection	
A1-01 ◆	Access Level Selection	
A1-02	**Control Method Selection**	
A1-03	Initialize Parameters	
A1-04	Password	
A1-05	Password Setting	
A2-01 to A2-32	User Parameters, 1 to 32	
A2-33	User Parameter Automatic Selection	
b1-01	**Speed Reference Selection**	
b1-02	**Up/Down Command Selection**	
b1-03	**Stopping Method Selection**	
b1-06	Digital Input Reading	
b1-08	Up/Down Command Selection while in Programming Mode	
b1-14	Phase Order Selection	
b2-08	Magnetic Flux Compensation Value	
b4-01	Timer Function On-Delay Time	
b4-02	Timer Function Off-Delay Time	
b6-01	Dwell Speed at Start	
b6-02	Dwell Time at Start	
b6-03	Dwell Speed at Stop	
b6-04	Dwell Time at Stop	
b7-01 ◆	Droop Control Gain	
b7-02 ◆	Droop Control Delay Time.	
b8-01	Energy Saving Control Selection	
b8-16	Energy Saving Control Constant (Ki)	
b8-17	Energy Saving Control Constant (Kt)	
C1-01 ◆	**Acceleration Ramp 1**	
C1-02 ◆	**Deceleration Ramp 1**	
C1-03 ◆	Acceleration Ramp 2	
C1-04 ◆	Deceleration Ramp 2	
C1-05 ◆	Acceleration Ramp 3 (Motor 2 Accel Time 1)	
C1-06 ◆	Deceleration Ramp 3 (Motor 2 Decel Time 1)	
C1-07 ◆	Acceleration Ramp 4 (Motor 2 Accel Time 2)	
C1-08 ◆	Deceleration Ramp 4 (Motor 2 Decel Time 2)	
C1-09	Fast Stop Ramp	
C1-10	Accel/Decel Setting Resolution	
C1-11	Accel/Decel Switching Speed	
C1-12	Motor 2 Acceleration Time	
C1-13	Motor 2 Deceleration Time	
C1-15	Inspection Deceleration Ramp	
C2-01	Jerk at Accel Start	
C2-02	Jerk at Accel End	
C2-03	Jerk at Decel Start	
C2-04	Jerk at Decel End	
C2-05	Jerk below Leveling Speed	
C3-01 ◆	Slip Compensation Gain	
C3-02 ◆	Slip Compensation Primary Delay Time	
C3-03	Slip Compensation Limit	
C3-04	Slip Compensation Selection during Regeneration	
C3-05	Output Voltage Limit Operation Selection	

No.	Name	User Setting
C3-21 ◆	Motor 2 Slip Compensation Gain	
C3-22 ◆	Motor 2 Slip Compensation Primary Delay Time	
C3-23	Motor 2 Slip Compensation Limit	
C3-24	Motor 2 Slip Compensation Selection during Regeneration	
C4-01 ◆	Torque Compensation Gain	
C4-02 ◆	Torque Compensation Primary Delay Time	
C4-03	Torque Compensation at Forward Start	
C4-04	Torque Compensation at Reverse Start	
C4-05	Torque Compensation Time Constant	
C4-07 ◆	Motor 2 Torque Compensation Gain	
C5-01 ◆	Speed Control Loop Proportional Gain 1	
C5-02 ◆	Speed Control Loop Integral Time 1	
C5-03 ◆	Speed Control Loop Proportional Gain 2	
C5-04 ◆	Speed Control Loop Integral Time 2	
C5-06	Speed Control Loop Primary Delay Time Constant	
C5-07	Speed Control Loop Settings Switching Speed	
C5-08	Speed Control Loop Integral Limit	
C5-13 ◆	Speed Control Loop Proportional Gain 3	
C5-14 ◆	Speed Control Loop Integral Time 3	
C5-16	Speed Control Loop Delay Time during Position Lock	
C5-17	Motor Inertia	
C5-18	Load Inertia Ratio	
C5-19 ◆	Speed Control Loop Proportional Gain Time during Position Lock	
C5-20 ◆	Speed Control Loop Integral Time during Position Lock	
C5-21 ◆	Motor 2 ASR Proportional Gain 1	
C5-22 ◆	Motor 2 ASR Integral Time 1	
C5-23 ◆	Motor 2 ASR Proportional Gain 2	
C5-24 ◆	Motor 2 ASR Integral Time 2	
C5-25	Motor 2 ASR Limit	
C5-26	Motor 2 ASR Primary Delay Time Constant	
C5-27	Motor 2 ASR Gain Switching Frequency	
C5-28	Motor 2 ASR Integral Limit	
C5-32	Integral Operation during Accel/Decel for Motor 2	
C5-37	Motor 2 Inertia	
C5-38	Motor 2 Load Inertia Ratio	
C5-50	Set Vibrational Frequency	
C6-03	Carrier Frequency	
C6-06	PWM Method	
C6-09	Carrier Frequency during Rotational Auto-Tuning	
C6-21	Inspection Operation Carrier Frequency	
C6-23	Carrier Frequency during Initial Motor Pole Search	
C6-31	Carrier Frequency during Rescue Operation	
d1-01 ◆	**Speed Reference 1**	
d1-02 ◆	**Speed Reference 2**	
d1-03 ◆	**Speed Reference 3**	
d1-04 ◆	**Speed Reference 4**	
d1-05 ◆	Speed Reference 5	
d1-06 ◆	Speed Reference 6	
d1-07 ◆	Speed Reference 7	
d1-08 ◆	Speed Reference 8	

E.3 User Setting Table

No.	Name	User Setting
d1-18	Speed Reference Selection Mode	
d1-19 ◆	Nominal Speed	
d1-20 ◆	Intermediate Speed 1	
d1-21 ◆	Intermediate Speed 2	
d1-22 ◆	Intermediate Speed 3	
d1-23 ◆	Releveling Speed	
d1-24 ◆	Inspection Operation Speed	
d1-25 ◆	Rescue Operation Speed	
d1-26 ◆	Leveling Speed	
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