YASKAWA

YASKAWA AC Drive L1000V

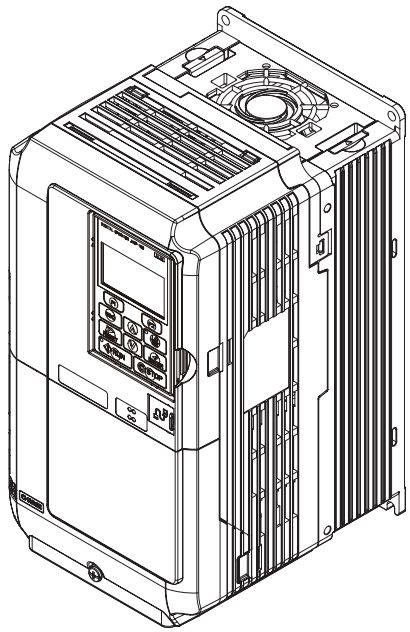
AC Drive for Elevator Applications

Technical Manual

Type: CIMR-LC□V □□□□□□□

Models: 200 V Class: 4.0 to 15 kW
400 V Class: 4.0 to 15 kW

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



MANUAL NO. SIEP C710606 50A

◆ Quick Reference

Perform Auto-Tuning
Automatic tuning sets motor parameters. *Refer to Types of Auto-Tuning on page 80*.

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 195*.

Fault Display and Troubleshooting
Refer to Drive Alarms, Faults, and Errors on page 166 and *Refer to Setup Troubleshooting and Possible Solutions on page 95*.

Standards Compliance	
Refer to European Standards on page 254 and*Refer to UL and CSA Standards on page 258 Refer to UL and CSA Standards on page 258*.	CE c UL us LISTED

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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.

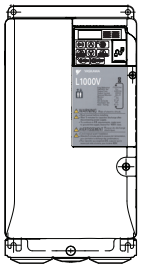
i.1 Preface

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 L1000V-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 L1000V series drives:

	L1000V 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.
	L1000V Series AC Drive Technical Manual (this book)
	This manual provides detailed information on parameter settings and drive functions. 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.

Indicates a term or definition used in this manual.

◆ Terms and Abbreviations

- **Drive**: Yaskawa L1000-Series Drive
- **BCD:** Binary Coded Decimal
- **H:** Hexidecimal Number Format
- **IGBT**: Insulated Gate Bipolar Transistor
- **LED:** Light Emitting Diode
- **LCD:** Liquid Crystal Display
- **MAC:** Media Access Control
- **PG:** Pulse Generator
- **r/min:** Revolutions per Minute
- **V/f:** V/f Control
- **V/f w/PG:** V/f Control with Simple PG Speed Feedback
- **OLV:** Open Loop Vector Control
- **OLV w/PG:** Open Loop Vector Control with Simple PG Speed Feedback

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.

Stay clear of the motor during rotational Auto-Tuning. The motor may start operating suddenly.

During automatic starting of equipment, the machine may start moving suddenly, which could result in death or serious injury.

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.

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.

⚠ WARNING

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.

Never short the output circuits of the drive.

Do not short the output circuits of the drive. Failure to comply could result in death or serious injury.

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

When an EMC filter is installed, leakage current exceeds 3.5 mA. Therefore according to IEC 61800-5-1 automatic power supply interruption in case of a discontinuity of the protective earthing conductor must be provided or a protective earthing conductor with a cross section of at least 10mm^2 (Cu) or 16mm^2 (Al) must be used.

Use appropriate equipment for residual current monitoring / detection (RCM / RCD).

The 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 RCM or RCD of type B according to IEC 60755.

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.

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.

⚠ CAUTION

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.

Crush Hazard

Do not carry the drive by the front cover.

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

Burn Hazard

Do not touch the heatsink or braking resistor hardware until a powered-down cooling period has elapsed.

NOTICE

Equipment Hazard

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.

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 perform a withstand voltage test on any part of the drive.

Failure to comply could result in damage to the sensitive devices within the drive.

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.

Install adequate branch circuit short circuit protection per applicable codes.

Failure to comply could result in damage to the drive.

The drive is suitable for circuits capable of delivering not more than 30,000 RMS symmetrical Amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400 V Class).

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 the braking option instruction manual 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 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.

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.

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

Using unapproved filters could result in damage to the drive or motor equipment.

Check the motor rotation and elevator movement direction prior to starting up the drive.

The drive puts out voltage in phase sequence U-V-W with an Up command. Make sure the elevator moves up if the motor is supplied with this phase sequence.

Always remove the ropes when performing Rotational Auto-Tuning.

During Rotational Auto-Tuning the drive turns the motor for a certain time. Not removing the ropes might result in damage to the equipment.

NOTICE

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.

◆ Precautions for CE Low Voltage Directive Compliance

This drive has been tested according to European standard EN61800-5-1, and it fully complies with the Low Voltage Directive. The following conditions must be met to maintain compliance when combining this drive with other devices:

- Do not use drives in areas with pollution higher than severity 2 and overvoltage category 3 in accordance with IEC664.
- Ground the neutral point of the main power supply for 400 V Class drives.

◆ Precautions for UL/cUL Standards Compliance

This drive is tested in accordance with UL standard UL508C and complies with UL requirements. The following conditions must be met to maintain compliance when using this drive in combination with other equipment:

- Do not install the drive to an area greater than pollution severity 2 (UL standard)
- Use UL-listed copper wires (rated at 75°C) and closed-loop connectors or CSA-certified ring connectors.
- Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national, state, or local codes for wiring. Use a class 2 (UL regulations) power supply for the control circuit terminal.
- This drive has undergone the UL short-circuit test, which certifies that during a short-circuit in the power supply the current flow will not rise above 30,000 amps maximum at 240 V for 200 V class drives and 480 V for 400 V class drives.
- The drive internal motor overload protection is UL listed and in accordance with the NEC and CEC. The setup can be done using the parameters L1-01/02.

◆ General Application Precautions

■ Motor Selection

Drive Capacity

The output current should not exceed 165% of the drive rated current. 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 (165% rated current for 30 s).

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

Emergency 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. Some type of mechanical brake may be needed if it is necessary to halt the motor faster than the Fast Stop function is able to.

Mechanical Brake

When the drive faults out, the output shuts off but the motor does not stop when elevator is in unbalanced weight condition. A mechanical brake is required.

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. The expected lifetime for the IGBTs is about 3 million start and stop cycles with a 8 kHz carrier frequency and 165% peak current.

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 165%. 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 supplier for details.

Installation Direction

NOTICE: *Install the drive upright as specified in the manual.* ***Refer to Mechanical Installation on page 31*** *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 overheat.*

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 RCD/RCM Devices

Where an RCD (residual current device) or RCM (residual current monitor) at the drive power supply side is used for protection in case of direct or indirect contact, only an RCD or RCM of type B according to IEC 60755 is allowed.

Select a MCCB (Molded Case Circuit Breaker) or RCD/RCM 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 208***.

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 210****. Failure to comply may cause resistor overheating, fire, and injury to personnel.*

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.*

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, phethalate ester, and other such harmful chemicals.*

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.*

◆ 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 problems may occur with the motor bearings and dynamic balance of the machine when operating a motor beyond its rated speed. Contact the motor or machine manufacturer.*

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 around the base of the motor and enable the Jump frequency selection to prevent continuous operation in the resonant frequency range.

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.

◆ Drive Label Warnings

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

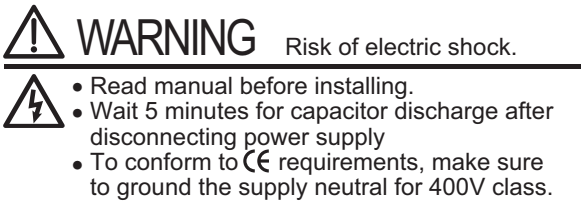


Figure i.1 Warning Information

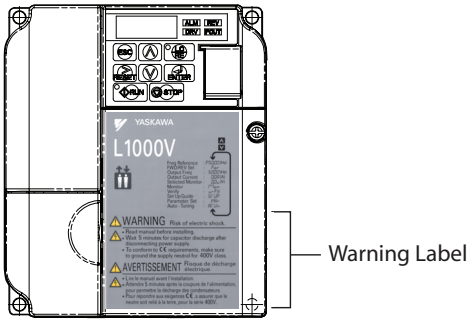


Figure i.2 Warning Label Position

1

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 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

◆ L1000V Model Overview

Motor Power kW	3-Phase 200 V Class		3-Phase 400 V Class	
	Model CIMR-LC	Rated Output Current (A) <1>	Model CIMR-LC	Rated Output Current (A) <1>
4.0	2V0018	17.5	4V0009	9.2
5.5	2V0025	25	4V0015	14.8
7.5	2V0033	33	4V0018	18
11	2V0047	47	4V0024	24
15	2V0060	60	4V0031	31

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

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

◆ Control Mode Selection

Table 1.1 gives an overview of the L1000V motor control methods (control modes) and their various features.

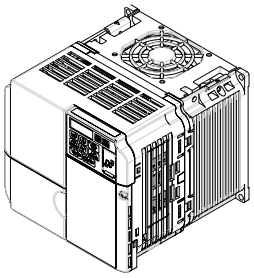
Table 1.1 Control Modes and their Features

Motor Type		Induction Motors				Comments
Control Mode		V/f	V/f with PG	OLV	OLV with PG	–
Parameter Setting		A1-02 = 0 H6-01 = F	A1-02 = 0 H6-01 = 3	A1-02 = 2 H6-01 = F	A1-02 = 2 H6-01 = 3	Default Setting is V/f Control.
Basic Description		V/f control	V/f control with simple PG feedback	Open Loop Vector control	Open Loop Vector control with simple PG feedback	PG feedback is only one channel input to the drive pulse train input terminal. Cannot determine motor direction.
Type of Applications	Motor Type	IM	IM	IM	IM	–
PG Feedback		N/A	YES, 1CH	N/A	YES, 1CH	–
Control Characteristics	Speed Control Range	1:40	1:40	1:100	1:100	May fluctuate with characteristics and motor temperature.
	Speed Accuracy	±2.0%	±0.03%	±0.2%	±0.03%	Speed deviation when operating at constant speed. May fluctuate with characteristics and motor temperature.
	Speed Response	3 Hz	3 Hz	5 Hz	5 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	150% at 3 Hz	200% at 0.5 Hz	200% at 0.5 Hz	May fluctuate with characteristics and motor temperature. Performance may differ by capacity.
Application-Specific	Auto-Tuning	Line to line resistance	Line to Line resistance	• Rotational • Stationary • Line to line resistance	• Rotational • Stationary • Line to line resistance	Automatically adjusts parameter settings that concern electrical characteristics of the motor.
	Torque Limit	N/A	N/A	YES	YES	Sets the maximum torque for the motor to protect the load and connected machinery.
	DC Injection at Start and Stop	YES	YES	YES	YES	Builds up motor torque when stopped 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	Torque boost at start.
	Slip compensation	YES	YES	YES	YES	Adjusts the leveling speed reference in order to improve the stopping accuracy.

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	Quick Start Guide
		
Quantity	1	1

◆ Nameplate

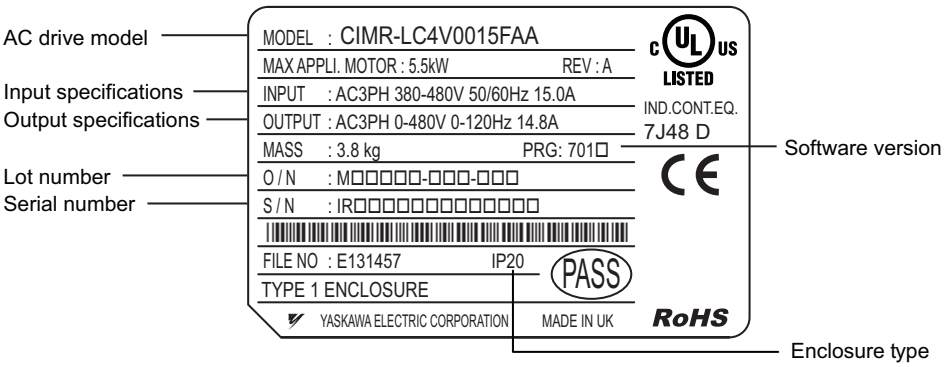


Figure 1.1 Nameplate Information

◆ Model Identification

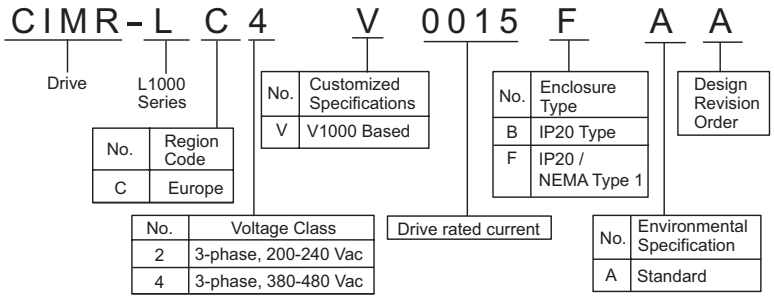


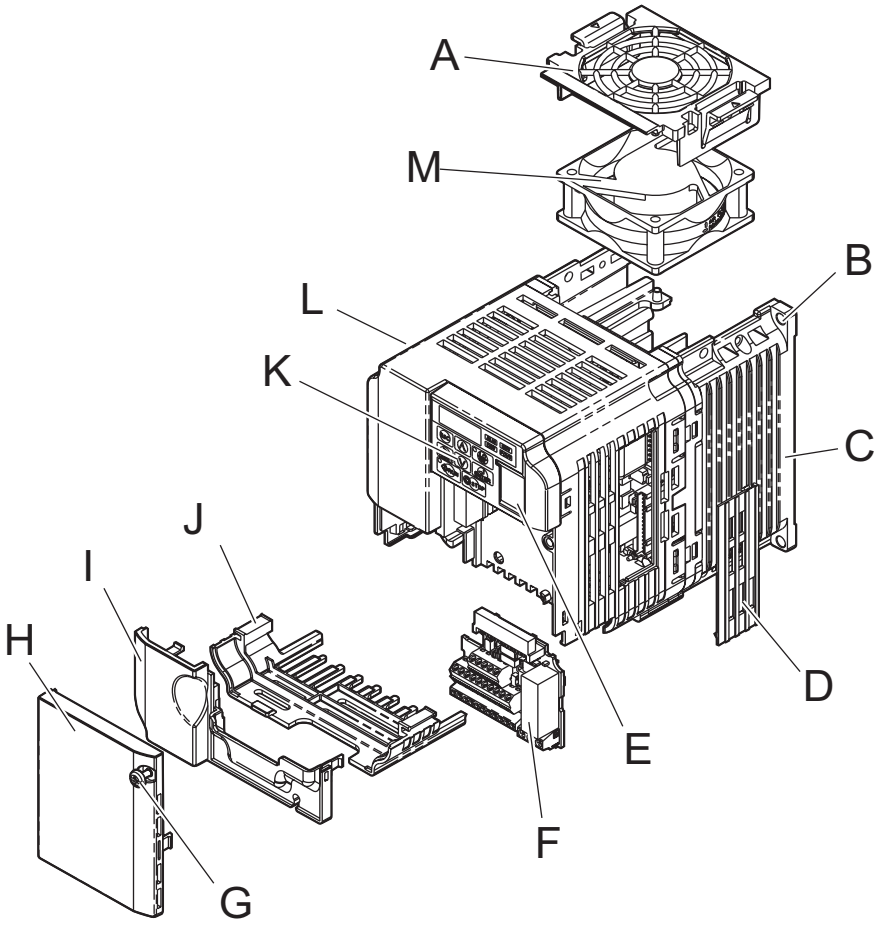
Figure 1.2 Model Code Interpretation

1.4 Component Names

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

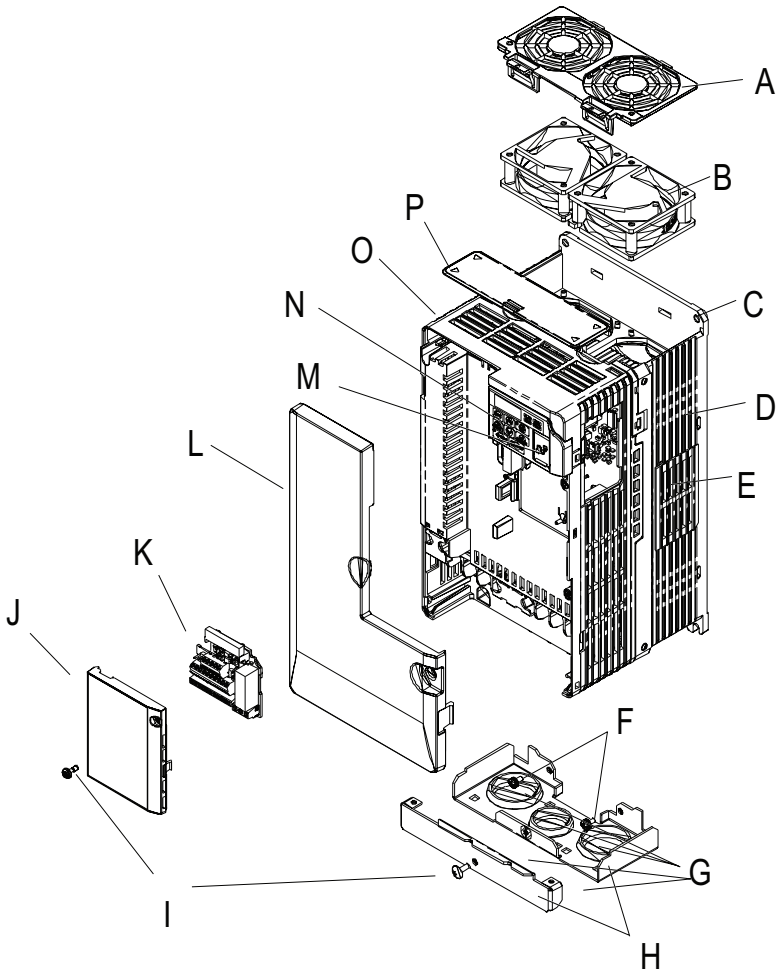
◆ Exploded Views of Drive Components

■ Three-Phase AC200 V CIMR-LC2V0018B (IP20 / Open-Chassis)
Three-Phase AC400 V CIMR-LC4V0009B (IP20 / Open-Chassis)



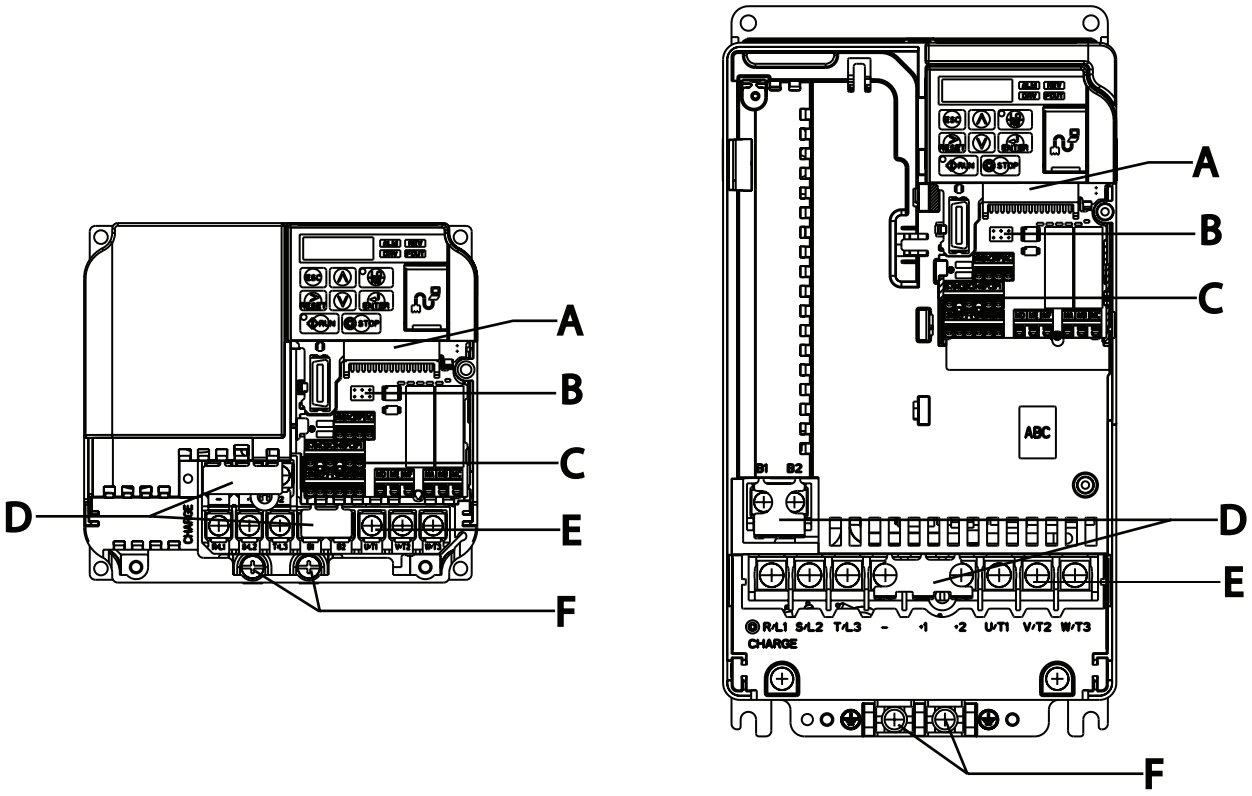
A – Fan cover
B – Mounting hole
C – Heatsink
D – Optional 24 V DC power supply connector cover
E – Comm port
F – Terminal board
G – Front cover screw
H – Front cover
I – Terminal cover
J – Bottom cover
K – LED operator
L – Case
M – Cooling fan

■ Three-Phase AC200 V CIMR-LC2V0025F to 2V0060F (IP20 / NEMA Type 1)
Three-Phase AC400 V CIMR-LC4V0015F to 4V0031F (IP20 / NEMA Type 1)



A – Fan cover
B – Cooling fan
C – Mounting hole
D – Case and Heatsink
E – Optional 24 V DC power supply connection cover
F – Cover screws
G – Rubber bushing
H – Bottom cover
I – Front cover screws
J – Terminal cover
K – Terminal board
L – Front cover
M – Comm port
N – LED operator
O – Top cover

◆ Front Views



A – Terminal board connector
B – Jumper CN1
C – Control Circuit Terminals
D – Protective Covers
E – Main Circuit Terminals
F – Ground Terminals

Figure 1.3 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 50 °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

For optimum performance life of the drive, install the drive in an environment that meets the conditions listed below.

Table 2.1 Installation Environment

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	-10 °C to +50 °C (IP20 enclosure) -10 °C to +40 °C (IP20 / NEMA Type 1 enclosure) 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 220*)
Vibration	10 to 20 Hz at 9.8 m/s² 20 to 55 Hz at 5.9 m/s²
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 50 °C.*

■ Installation Orientation

Install the drive upright as illustrated in *Figure 2.1* to maintain proper cooling. Refer to *Mechanical Installation on page 31* for details on installing the drive.

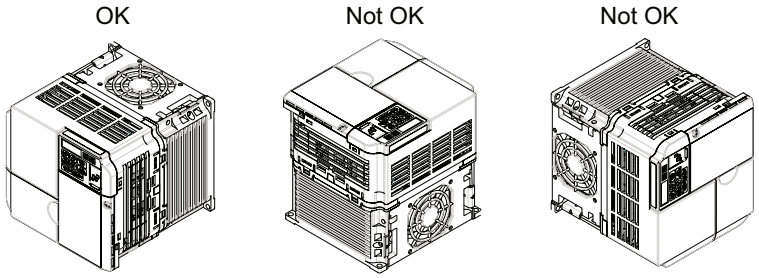
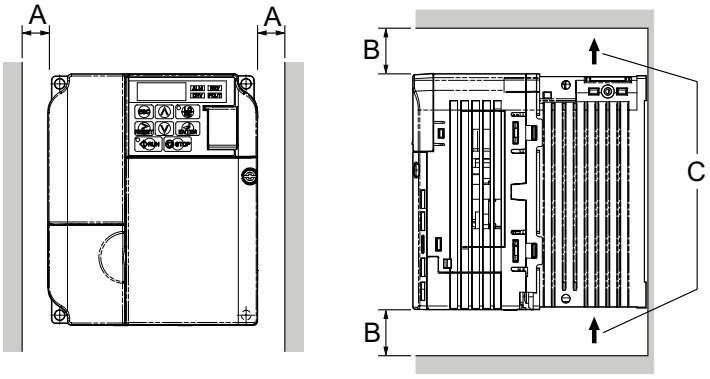


Figure 2.1 Correct Installation Orientation

■ Installation Spacing

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



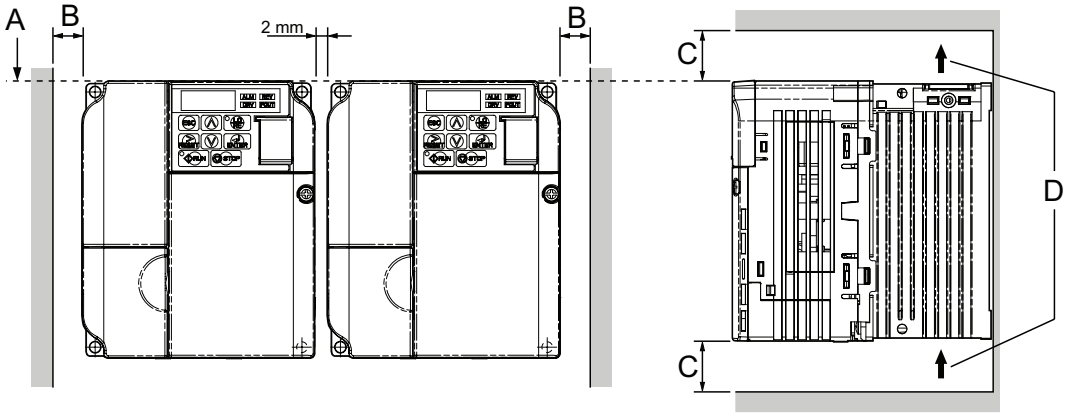
A – 30 mm
B – 100 mm
C – Airflow direction

Figure 2.2 Minimum Installation Spacing

Note: IP20/Open-Chassis and IP20/NEMA Type 1 models require the same amount of space above and below the drive for installation.

■ Multiple Drive Installation

When installing multiple drives into the same enclosure panel, mount the drives according to *Figure 2.2*. When mounting drives with a minimum side-by-side clearance of 2 mm as in *Figure 2.3*, derating must be considered and parameter L8-35 must be set accordingly. *Refer to L8: Drive Protection on page 144* for more details.



A – Line up the tops of the drives
B – 30 mm
C – 100 mm
D – Airflow direction

Figure 2.3 Minimum Space Between Drives (Side-by-Side Mounting)

Note: When installing drives of different heights in the same enclosure panel, the tops of the drives should line up. Leave space between the top and bottom of stacked drives for cooling fan replacement if required. Using this method, it is possible to replace the cooling fans later without removing the drive from the panel.

◆ Digital Operator Remote Usage

■ Remote Operation

An optional digital LCD operator (JVOP-180) can be 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 digital operator 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 206* for information on extension cables and installation support sets.

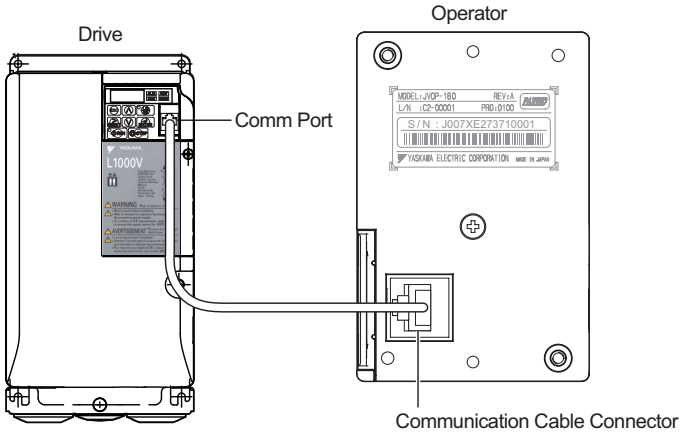


Figure 2.4 Digital LCD Operator Connection

■ Digital Operator Remote Installation

Digital Operator Dimensions

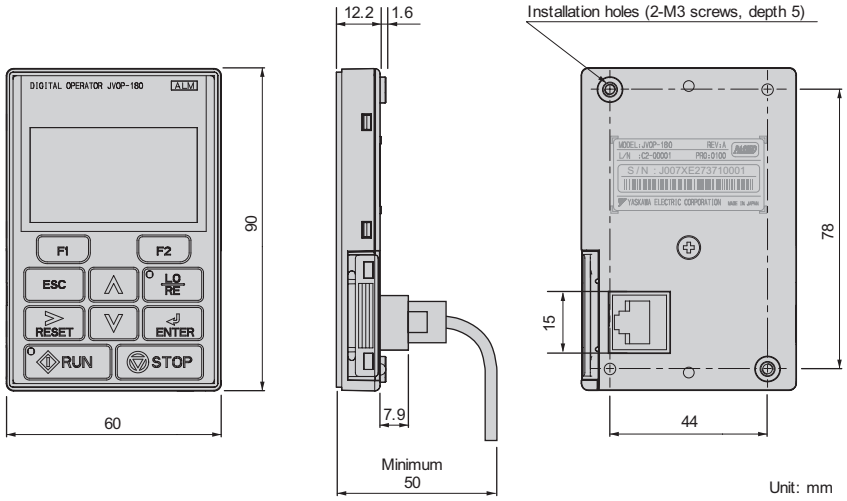


Figure 2.5 Digital Operator Dimensions

Installation Types and Required Materials

The digital operator can be mounted to an enclosure in 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 Digital Operator Installation Methods and Required Tools

Installation Method	Description	Installation Support Sets	Model	Required Tools
External/Face-Mount	Simplified installation with the digital operator 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 digital operator as shown in ***Figure 2.7***.
2. Position the digital operator so the display faces outwards, and mount it to the enclosure panel as shown in ***Figure 2.6***.

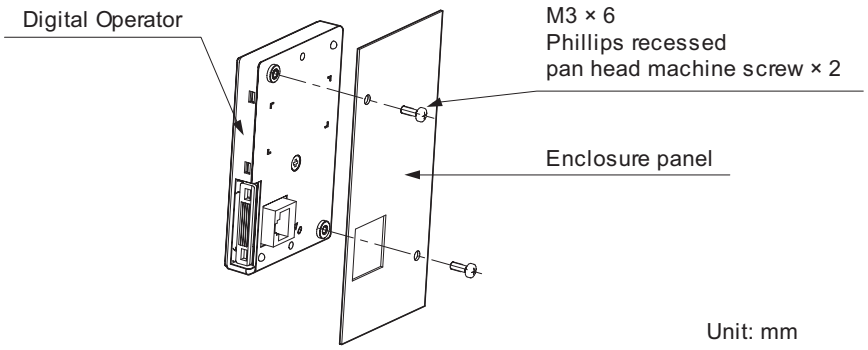


Figure 2.6 External/Face-Mount Installation

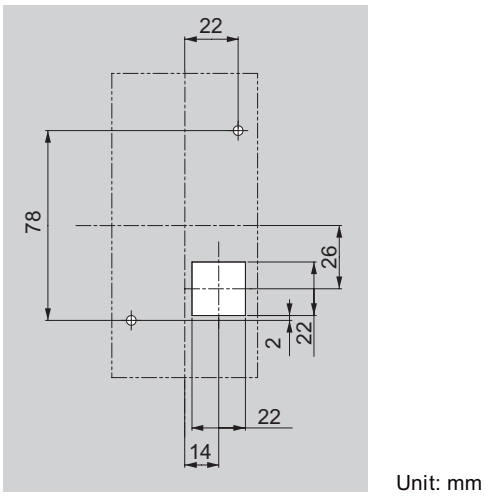


Figure 2.7 Panel Cut-Out Dimensions (External/Face-Mount Installation)

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 2.8*** illustrates how to attach Installation Support Set A.

1. Cut an opening in the enclosure panel for the digital operator as shown in *Figure 2.9*.
2. Mount the digital operator to the installation support.
3. Mount the installation support set and digital operator to the enclosure panel.

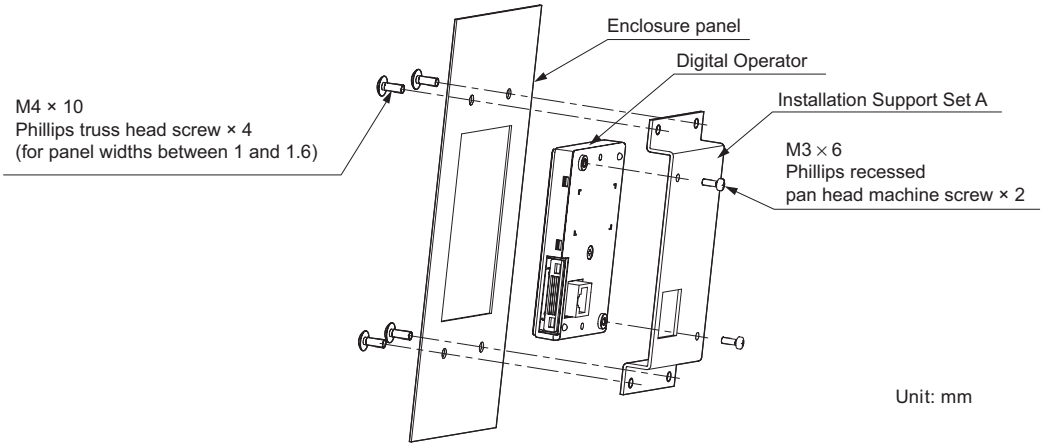


Figure 2.8 Internal/Flush Mount Installation

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

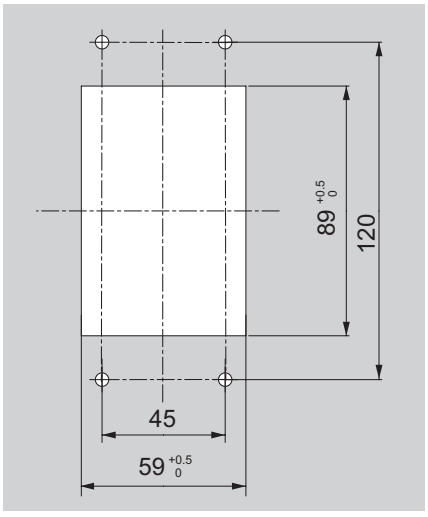
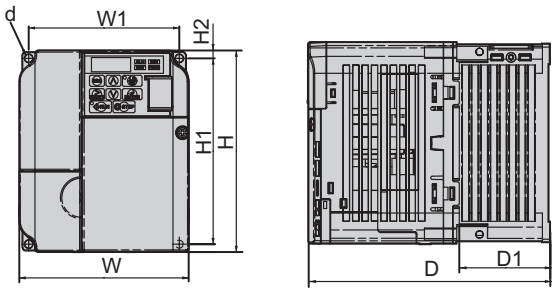


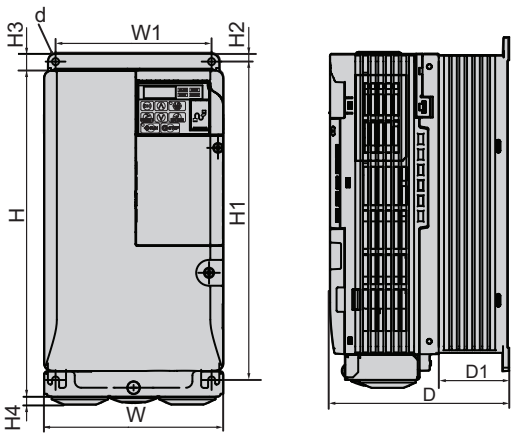
Figure 2.9 Panel Cut-Out Dimensions (Internal/Flush-Mount Installation)

◆ Exterior and Mounting Dimensions



A

IP20 / Open Chassis



B

IP20 / NEMA Type 1

Table 2.3 Dimensions for three-phase 200V class drives

Model CIMR-LC□	Dimensions (mm)											Weight (kg)
	Fig.	W	H	D	W1	H1	H2	H3	H4	D1	d	
2V0018B	A	140	128	143	128	118	5	-	-	65	M4	2.6
2V0025F	B	140	254	140	122	248	6	13	6.2	55	M5	3.8
2V0033F		140	254	140	122	248	6	13	6.2	55	M5	3.8
2V0047F		180	290	163	160	284	8	15	6.2	75	M5	5.5
2V0060F		220	350	187	192	336	7	15	7.2	78	M6	9.2

Table 2.4 Dimensions for three-phase 400V class drives

Model CIMR-LC□	Dimensions (mm)											Weight (kg)
	Fig.	W	H	D	W1	H1	H2	H3	H4	D1	d	
4V0009B	A	140	128	143	128	118	5	-	-	65	M4	2.6
4V0015F	B	140	254	140	122	248	6	13	6	55	M5	3.8
4V0018F		140	254	140	122	248	6	13	6.2	55	M5	3.8
4V0024F		180	290	143	160	284	8	15	6	55	M5	5.2
4V0031F		180	290	163	160	284	8	15	6	75	M5	5.5

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 from electric shock.

⚠ WARNING

Sudden Movement Hazard

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

Verify all emergency stop wiring and 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.

If holding brake circuits are not configured properly, 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.

When an EMC filter is installed, the leakage current exceeds 3.5 mA. Therefore according to IEC61800-5, an automatic power supply interruption in case of a broken earthing conductor must be provided. Alternatively a protective earthing conductor with a cross section of at least 10 mm^2 (Cu) or 16 mm^2 (Al) must be used.

Use appropriate equipment for residual current monitoring/detection (RCM/RCD).

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 RCM or RCD of type B according to IEC 60755.

⚠ WARNING

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.

Make sure all ground terminals have been properly grounded.

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

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.

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).

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

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). Inadequate branch short circuit protection could result in damage to the drive.

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.

⚠ 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

Do not carelessly connect parts or devices to the drives braking transistor terminals.

Failure to comply could result in damage to the drive or braking circuit. Carefully review instruction manual TOBPC72060000 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.

Use care when connecting parts or devices to the drives braking transistor terminals.

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

Carefully review instruction manual TOBPC72060000 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 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.

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). Inadequate branch short circuit protection damage or serious injury by fire.

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.

NOTICE

Fire Hazard

When the input voltage is 480 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.

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.

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 63*** for instructions on operating the drive.

WARNING! *Sudden Movement Hazard. If holding brake circuits are not configured properly, 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 external safety measures 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.*

NOTICE: *Do not connect control circuit ground (AC) to drive enclosure. Improper drive grounding can cause control circuit malfunction.*

NOTICE: *The minimum load for the relay outputs MA-MB-MC and MD-ME-MF is 10 mA.*

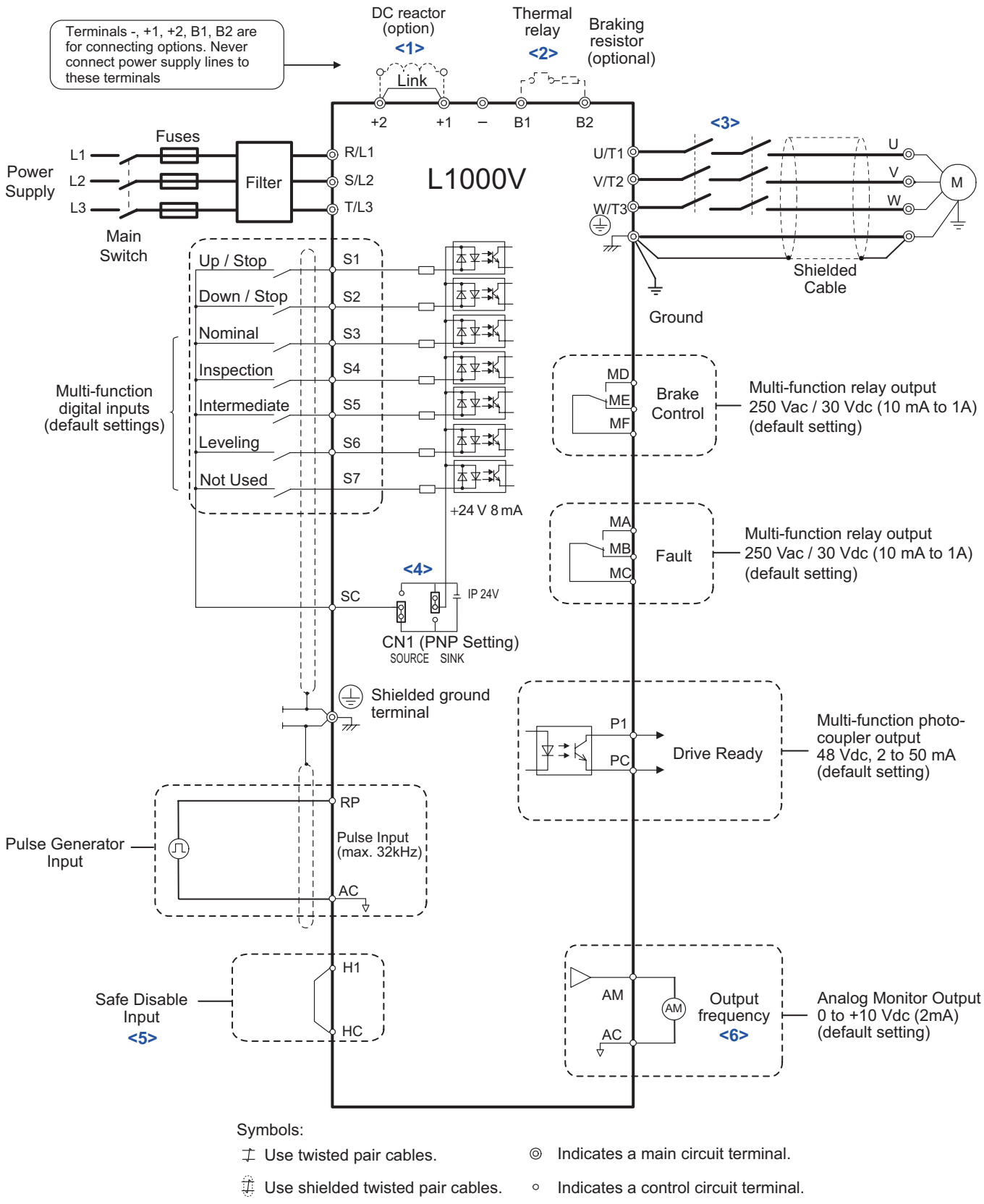


Figure 3.1 Drive Standard Connection Diagram

<1> Remove the jumper when installing a DC reactor.
<2> Set up a thermal relay sequence to disconnect drive main power in the event of an overheat condition on the dynamic braking option.
<3> The drive provides a stop function in compliance with Stop Category 0 (EN60204-1) and "Safe Torque Off" (IEC61800-5-2). It has been designed to meet the requirements of the EN954-1/ISO13849-1, Category 3 and IEC61508, SIL 2. Using this function the number of motor contactors can be reduced to one. ***Refer to Safe Disable Input Function on page 262*** for details.
<4> The drive's digital inputs are configured in Sink mode (0 Vdc common / NPN) by default using the internal power supply. To change input polarity or to use an external power supply, ***Refer to Control I/O Configuration on page 59***.
<5> Disconnect the wire jumper between H1 and HC when using the Safe Disable input.
<6> 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.

Note: Although no fault may be present, the drive cannot be started under certain conditions such as when the Digital Operator is left in the Programming Mode. Use the "Drive Ready" output (set by default to photocoupler terminals P1-PC) to interlock operation in such situations.

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 ***Figure 3.2*** when wiring the main circuit of the drive. The 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.*

NOTICE: *When installing an optional DC Reactor, remove the jumper between main circuit terminals +1 and +2.*

◆ Three-Phase 200 V Class (CIMR-LC2V0018B to 2V0060F) Three-Phase 400 V Class (CIMR-LC4V0009B to 4V0031F)

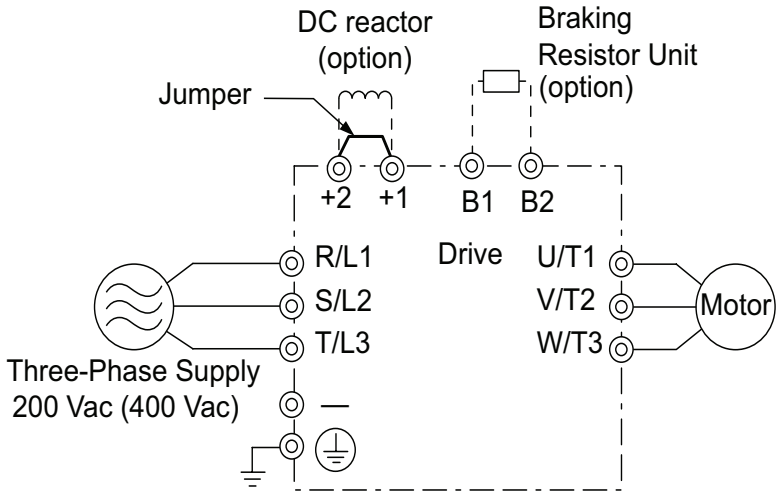


Figure 3.2 Connecting Main Circuit Terminals

3.4 Terminal Block Configuration

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

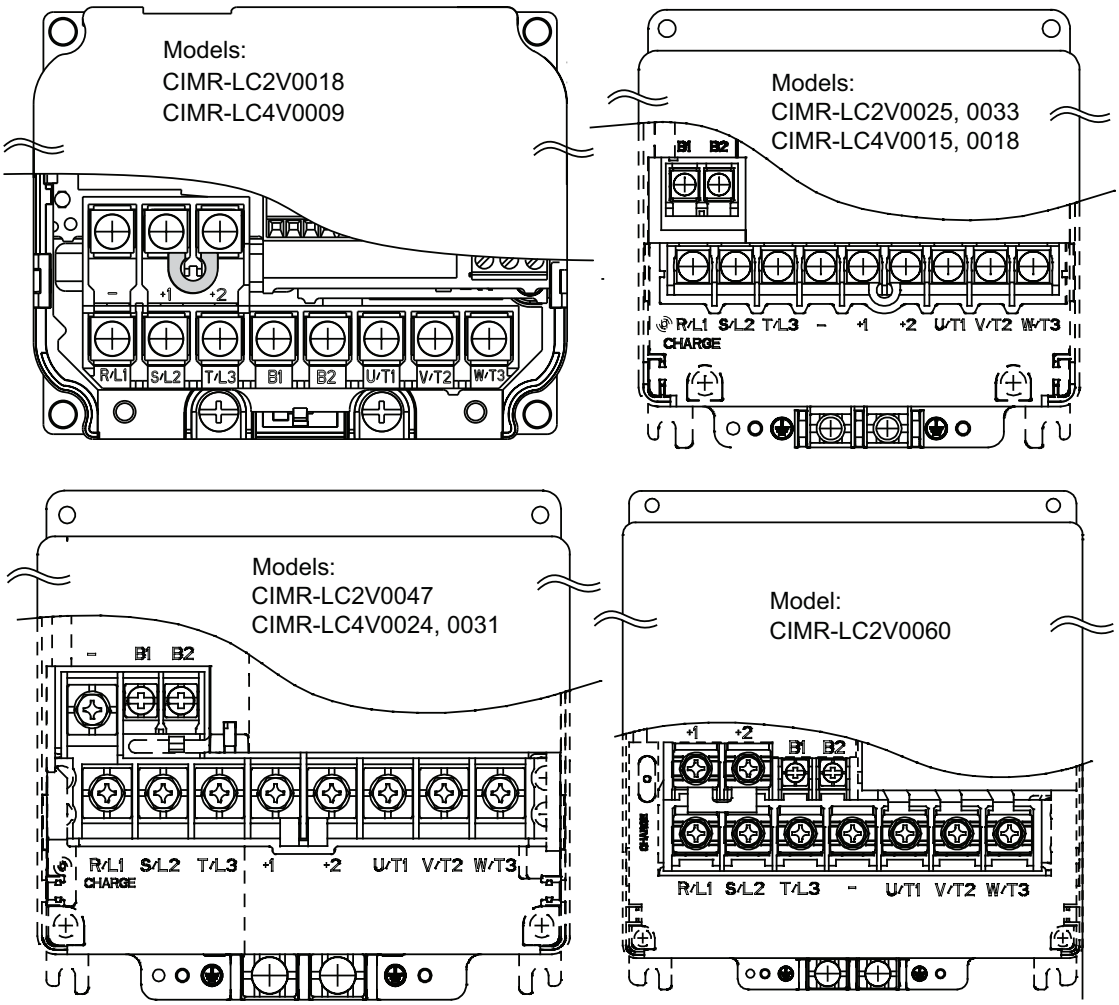


Figure 3.3 Main Circuit Terminal Block Configurations

3.5 Protective Covers

Follow the procedure below to remove the protective covers for wiring and to reattach the covers after completion.

◆ IP20 / Open-Chassis Cover Removal and Installation

Models CIMR-LC2V0018B and 4V0009B

■ Removing the Protective Covers

1. Loosen the screw on the front of the drive and remove the front cover.

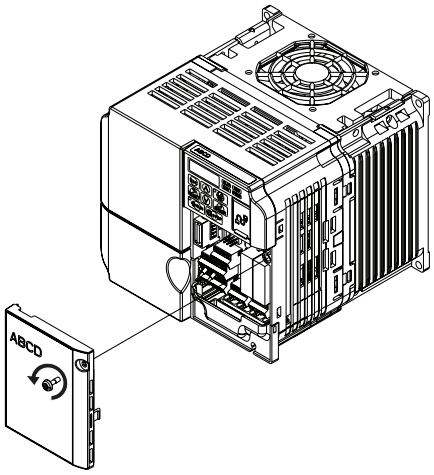
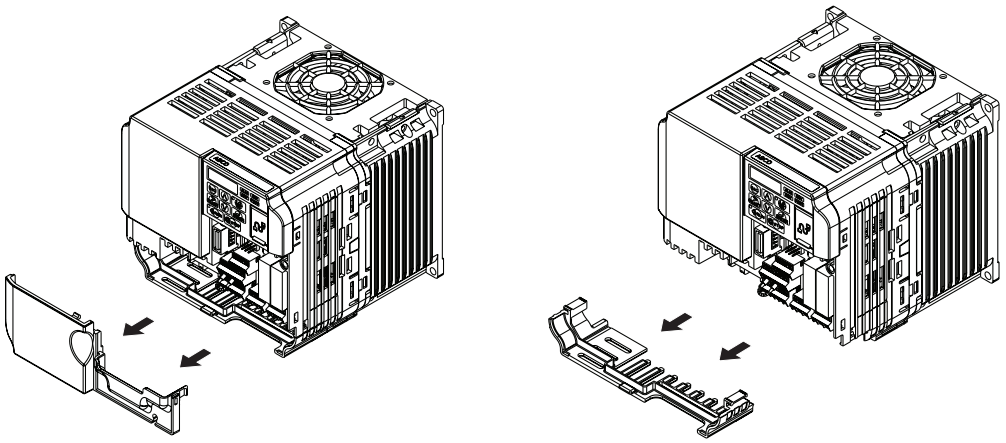


Figure 3.4 Removing the Front Cover

2. Apply pressure to the tabs on each side of the terminal cover. Pull the terminal cover away from the drive while pushing in on the tabs to remove it.



■ Reattaching the Protective Covers

Properly connect all wiring and route power wiring away from control signal wiring. Reattach all protective covers when wiring is complete. Apply only small amount of pressure to lock the cover back into place.

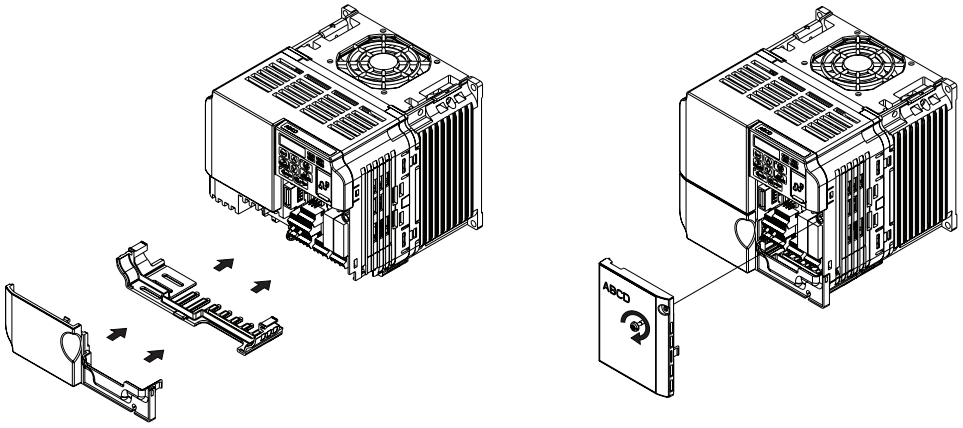


Figure 3.5 Reattaching the Drive Covers

◆ IP20 / NEMA Type 1 Cover Removal and Installation

Models CIMR-LC2V0025F to 0060F and 4V0015F to 0031F

■ Removing the Protective Covers

1. Loosen the screw that locks the front covers in place to remove them.

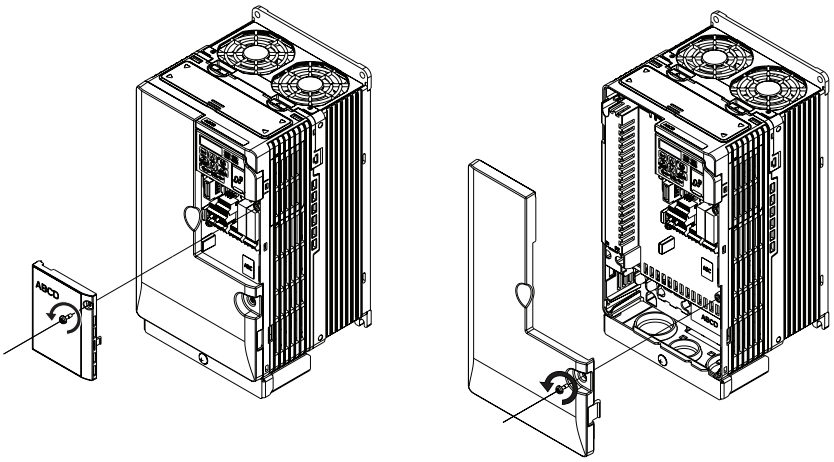


Figure 3.6 Removing the Front Covers

2. Loosen the screw on the terminal cover to remove it and expose the conduit bracket.

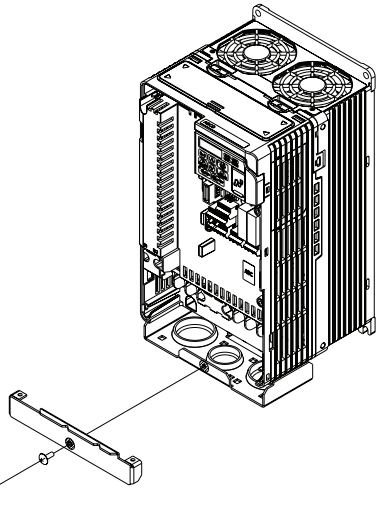


Figure 3.7 Removing the Screw to Expose Conduit Bracket

3. To remove the conduit bracket loosen the two screws that attach it to the drive enclosure.

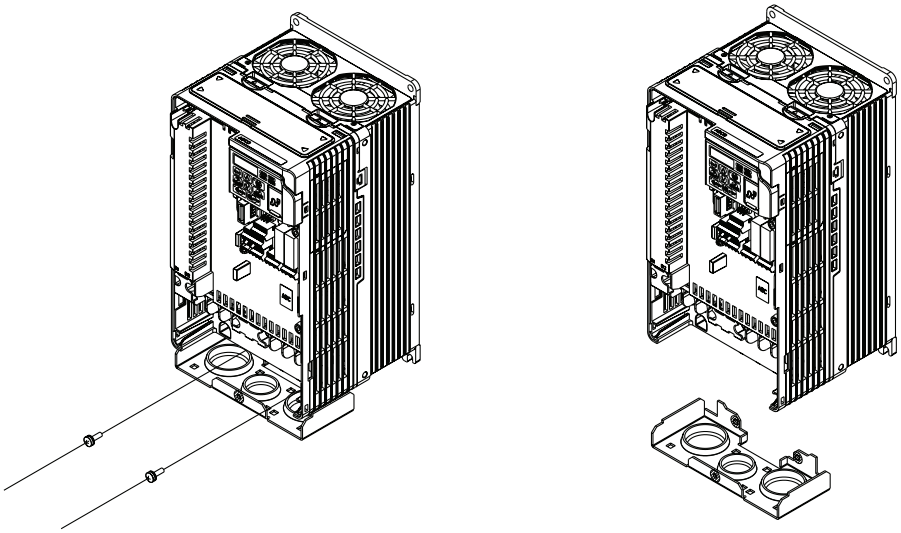


Figure 3.8 Removing the Conduit Bracket

■ Reattaching the Protective Covers

Pass power wiring and control signal wiring through the exit holes in the bottom of the conduit bracket of the drive. Place power wiring and control signal wiring in separate conduits. Properly connect all wiring after installing the drive and connecting other devices. Reattach all protective covers when wiring is complete.

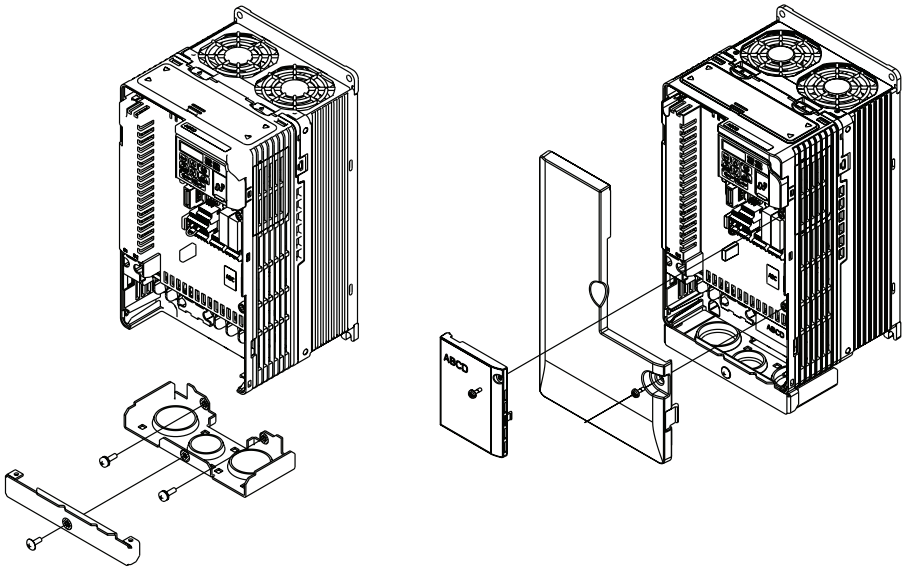


Figure 3.9 Reattaching the Protective Covers

3.6 Main Circuit Wiring

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

NOTICE: *Do not carelessly connect parts or devices to the drives braking transistor terminals. Failure to comply could result in damage to the drive or braking circuit. Carefully review instruction manual TOBPC72060000 when connecting a braking option to 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.*

NOTICE: *Do not solder the ends of wiring 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

Terminal	Description	Function	Reference
R/L1	Main circuit power supply input	For connection of three-phase AC line power to the drive. For 200V class drives, rated voltage is 200 to 240 VAC, -15/+10 % For 400V class drives, rated voltage is 380 to 480 VAC, -15/+10 %	*42*
S/L2			
T/L3			
U/T1	Drive output to motor	For connection to a three-phase asynchronous induction motor.	*42*
V/T2			
W/T3			
B1	Braking resistor connection	For connection to an optional external braking resistor.	*208*
B2			
+1	DC reactor connection	For connection of an optional DC bus reactor. These terminals are shorted at shipment. Remove the shorting jumper between +1 and +2 when installing a DC reactor.	*210*
+2			
–	DC bus negative terminal	Allows the drive to be supplied by a DC power supply connected to the +1 and – terminals.	-
⏚	Grounding terminals	Electrical ground.	*53*

◆ Wire Gauges and Tightening Torque

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

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, and +2 are for connecting a DC reactor, 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 braking transistor option or a regenerative unit.
- ***Refer to UL Standards Compliance on page 258*** for information on UL compliance.

Yaskawa recommends using closed-loop crimp terminals on all drive models. Use only the tools recommended by the terminal manufacturer for crimping. Refer to ***Closed-Loop Crimp Terminal Size (JIS C 2805) on page 258*** for closed-loop crimp terminal recommendations.

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)

Model CIMR-LC	Terminal	Recommended Gauge mm² (AWG)	Applicable Gauge mm² (AWG)	Screw Size	Tightening Torque N⋅m (lb.in.)
2V0018	R/L1, S/L2, T/L3U/T1, V/T2, W/T3 –, +1, +2 B1, B2⏚	6 (10)	2.5 to 6 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
2V0025	R/L1, S/L2, T/L3 U/T1, V/T2, W/T3 –, +1, +2	10 (8)	6 to 16 (10 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	B1, B2	6 (10)	2.5 to 6 (14 to 10)		
	⏚	10 (8)	6 to 16 (10 to 6)	M5	2 to 2.5 (17.7 to 22.1)
2V0033	R/L1, S/L2, T/L3 U/T1, V/T2, W/T3 –, +1, +2	16 (6)	6 to 16 (10 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	B1, B2	6 (10)	2.5 to 6 (14 to 10)		
	⏚	10 (8)	6 to 16 (10 to 6)	M5	2 to 2.5 (17.7 to 22.1)
2V0047	R/L1, S/L2, T/L3 U/T1, V/T2, W/T3 –, +1, +2	25 (4)	16 to 25 (6 to 4)	M6	4 to 6 (35.4 to 53.1)
	B1, B2	10 (8)	6 to 10 (10 to 8)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	25 (4)	16 to 25 (6 to 4)	M6	4 to 6 (35.4 to 53.1)
2V0060	R/L1, S/L2, T/L3 U/T1, V/T2, W/T3 –, +1, +2	35 (2)	10 to 35 (8 to 2)	M8	9 to11 (79.7 to 97.4)
	B1, B2	16 (6)	10 to 16 (8 to 6)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	25 (4)	10 to 25 (8 to 4)	M6	4 to 6 (35.4 to 53.1)

■ Three-Phase 400 V Class

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

Model CIMR-LC	Terminal	Recommended Gauge mm² (AWG)	Applicable Gauge mm² (AWG)	Screw Size	Tightening Torque N⋅m (lb.in.)
4V0009	R/L1, S/L2, T/L3U/T1, V/T2, W/T3 –, +1, +2 B1, B2	2.5 (14)	2.5 to 6 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	⏚	4 (12)	2.5 to 6 (14 to 10)		
4V0015	R/L1, S/L2, T/L3 U/T1, V/T2, W/T3 –, +1, +2 B1, B2	2.5 (14)	2.5 to 6 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	⏚	6 (10)	6 to 16 (10 to 6)	M5	2 to 2.5 (17.7 to 22.1)
4V0018	R/L1, S/L2, T/L3 U/T1, V/T2, W/T3 –, +1, +2	4 (12)	6 to 16 (10 to 6)	M4	1.2 to 1.5 (10.6 to 13.3)
	B1, B2	4 (12)	2.5 to 6 (14 to 10)		
	⏚	6 (10)	6 to 16 (10 to 6)	M5	2 to 2.5 (17.7 to 22.1)
4V0024	R/L1, S/L2, T/L3 U/T1, V/T2, W/T3 –, +1, +2	6 (10)	6 to 16 (10 to 6)	M5	2 to 2.5 (17.7 to 22.1)
	B1, B2	6 (10)	6 to 10 (10 to 8)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	10 (8)	6 to 16 (10 to 6)	M6	4 to 6 (35.4 to 53.1)
4A0031	R/L1, S/L2, T/L3 U/T1, V/T2, W/T3 –, +1, +2	10 (8)	6 to 16 (10 to 6)	M5	2 to 2.5 (17.7 to 22.1)
	B1, B2	10 (8)	6 to 10 (10 to 8)	M5	2 to 2.5 (17.7 to 22.1)
	⏚	10 (8)	6 to 16 (10 to 6)	M6	4 to 6 (35.4 to 53.1)

◆ 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. When the input voltage is 480 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 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: Carrier Frequency on page 116***.

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

■ Ground Wiring

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

WARNING! *When using an EMC filter, the leakage current exceeds 3.5 mA. Therefore, according to IEC61800-5-1, at least one of the conditions below must be satisfied:*
a) The cross-section of the protective earthing conductor must be at least 10 mm² (Cu) or 16 mm² (Al).
b) The power supply must be disconnected automatically in case of discontinuity of the protective earthing conductor.

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. Improper equipment grounding could result in death or serious injury by contacting ungrounded electrical equipment.*

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 3.11*** when using multiple drives. Do not loop the ground wire.

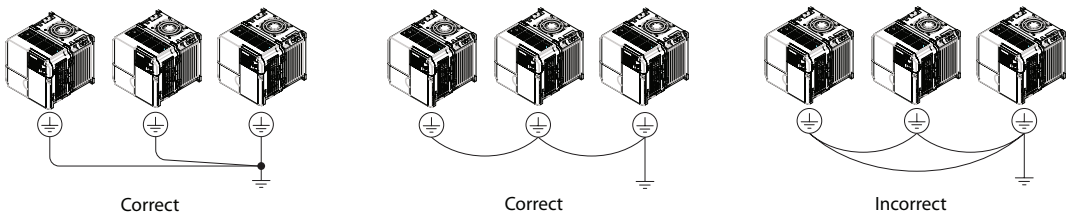


Figure 3.10 Multiple Drive Ground Wiring

■ 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.

All drives have a cover placed over the DC bus and braking circuit terminals prior to shipment to help prevent miswiring. On IP20 / Open-Chassis drives the cover can be removed with wire cutters. For IP20 / NEMA Type 1 drives the protective cover is held by the ground terminal screw.

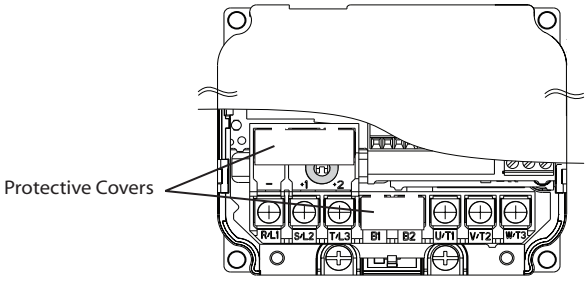


Figure 3.11 Protective Cover to Prevent Miswiring

Refer to Main Circuit Connection Diagram on page 45 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.*

3.7 Control Circuit Wiring

◆ Control Circuit Connection Diagram

Refer to Standard Connection Diagram on page 42 when wiring terminals on the drive's control circuit.

◆ Control Circuit Terminal Block Functions

Drive parameters determine which functions apply to the multi-function digital inputs (S3 to S7), multi-function digital output (MD-ME-MF), multi-function photocoupler output (P1-PC), and multi-function analog monitor output (AM). The default setting is listed next to each terminal in *Figure 3.1* on page *43*.

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: *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: *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 (Default Function)	Description	Page
Digital Inputs	S1	Input 1. **Up Command** (Closed: Up, Open: Stop)	Photocoupler 24 Vdc, 8 mA Use jumper CN1 to select sinking or sourcing, and to select the power supply.	*124*
	S2	Input 2. **Down Command** (Closed: Down, Open: Stop)		
	S3	Multi-function input 3 (**Nominal Speed**)		
	S4	Multi-function input 4 (**Inspection Operation**)		
	S5	Multi-function input 5 (**Intermediate Speed 1**)		
	S6	Multi-function input 6 (**Leveling Speed**)		
	S7	Multi-function input 7 (Not used)		
Digital Input Power Supply	SC	Multi-function input common	24 Vdc, 150 mA Use jumper CN1 to select sinking or sourcing, and to select the power supply.	*59*
Safe Disable Inputs	H1	Safe Disable input 1	24 Vdc, 8 mA Open: Drive output disabled Closed: Normal operation Internal impedance: 3.3 kΩ Off time of at least 1 ms	*262*
	HC	Safe Disable function common		
Pulse Train Inputs	RP	Pulse Train input	Response Frequency: 0.5 to 32kHz Duty Cycle: 30 to 70% High Level: 3.5 to 24 Vdc Low Level: 0.0 to 0.8 Vdc Input Impedance: 3kohm Used for single track PG speed feedback.	*135*
	AC	Pulse Train input common		

■ Output Terminals

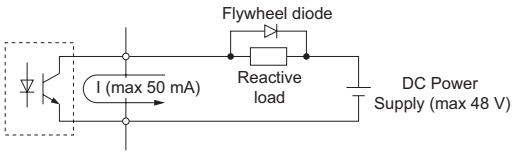
Table 3.6 lists the output terminals on the drive. Text in parenthesis indicates the default setting for each multi-function output.

Note: Relay output terminals are rated at a minimum of 10 mA. If less than 10 mA is required, use the photocoupler output (P1-PC). Using the wrong current output level may cause undesirable effects 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. output (Fault)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA	*127*
	MB	N.C. output (Fault)		
	MC	Fault output common		
Multi-Function Output Relay	MD	N.O. output (Brake control)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA	
	ME	N.C. output (Brake control)		
	MF	Output common		
Multi-Function Photocoupler Output	P1	Photocoupler output 1 (Drive ready)	48 Vdc, 2 to 50 mA	
	PC			
Monitor Output	AM	Analog monitor output 1 (Output speed)	-10 to +10 Vdc or 0 to +10 Vdc	*134*
	AC	Monitor common		

NOTICE: *When connecting a reactive load such as a relay coil to the photocoupler output, attach a flywheel diode to the load (relay coil) like shown below. Be sure that the diode is rated for voltages and currents higher than those present in the circuit.*



◆ Terminal Configuration

Control circuit terminals are arranged as shown in *Figure 3.13*.

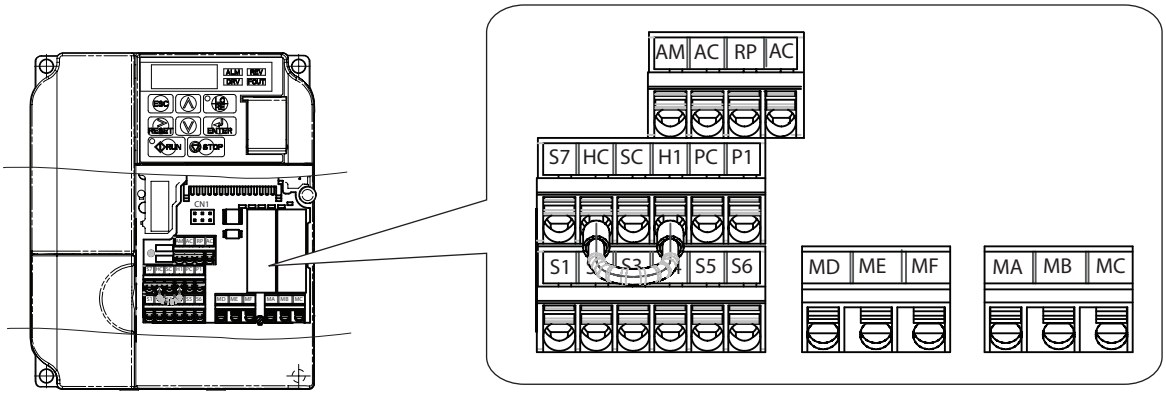


Figure 3.12 Control Circuit Terminal Arrangement

■ Wire Size

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 3.7***. For simpler and more reliable wiring, use crimp ferrules on the wire ends. Refer to ***Table 3.8*** for ferrule terminal types and sizes.

Table 3.7 Wire Gauges

Terminal	Tightening Torque N⩍m (lb.in.)	Bare Wire Terminal		Ferrule-Type Terminal		Wire Type
		Applicable wire size mm² (AWG)	Recommended wire size mm² (AWG)	Applicable wire size mm² (AWG)	Recommended wire size mm² (AWG)	
S1 to S7, SC, AC, AM, P1-PC, HC, H1, MA, MB, MC, MD, ME, MF	0.22 to 0.25 (1.9 to 2.2)	Stranded 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 3.8*** for dimensions.

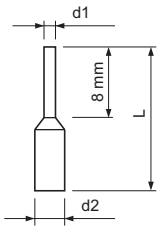


Figure 3.13 Ferrule Dimensions

Table 3.8 Ferrule Terminal Types and Sizes

Size mm² (AWG)	Type	L (mm)	d1 (mm)	d2 (mm)	Manufacturer
0.25 (24)	AI 0.25-8YE	12.5	0.8	1.8	PHOENIX CONTACT
0.34 (22)	AI 0.34-8TQ	10.5	0.8	1.8	
0.5 (20)	AI 0.5-8WH or AI 0.5-8OG	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 emergency stop wiring and 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 stop circuits separately from the drive emergency 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 digital output terminals MA, MB, MC and M1 to M6 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.*

Wire the control circuit only after terminals have been properly grounded and main circuit wiring is complete. Refer to ***Figure 3.14*** and ***Figure 3.15*** for details. Prepare the ends of the control circuit wiring as shown in ***Figure 3.16***. Refer to ***Wire Size on page 56***.

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 3.14***:

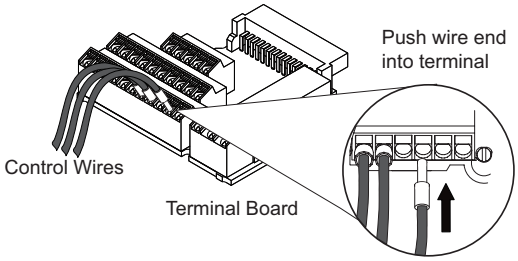


Figure 3.14 Terminal Board Wiring Guide

To disconnect control wires from the terminals use the procedure described in ***Figure 3.15***. Grasp the wire where it enters the terminal with a pair of pliers, then use a straight-edge screw driver to release the terminal and pull the wire out. If it fits tightly, e.g. if ferrules are used, turn the wire for about 45° and then pull it gently out. Use this procedure to remove the wire jumper between terminals HC and H1 that is preinstalled at shipping.

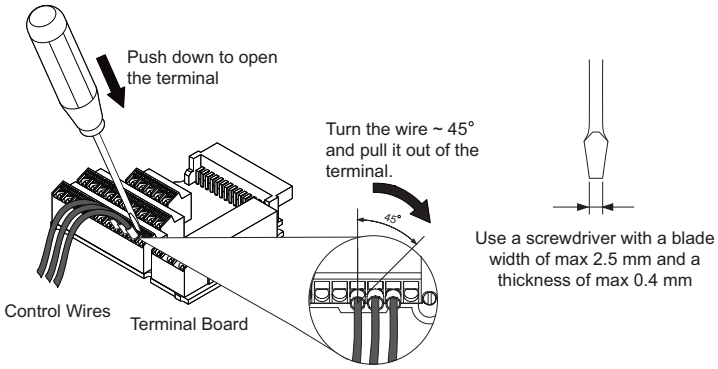
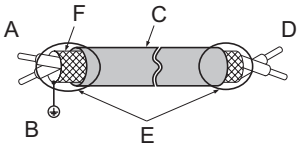


Figure 3.15 Removing Wires from the Terminal Board

When connecting control wires to the terminals, use shielded twisted-pair wires (treating wire ends as shown in *Figure 3.16* and connect the shield to the ground terminal of the drive.



A – Drive side
B – Connect shield to ground terminal of drive.
C – Insulation
D – Control device side
E – Shield sheath (insulate with tape or heat-shrink tubing)
F – Shield

Figure 3.16 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 a jumper used to adapt the drive I/Os to the external control signals. *Figure 3.18* shows the location of this jumper. Refer to *Control I/O Configuration on page 59* for setting instructions.

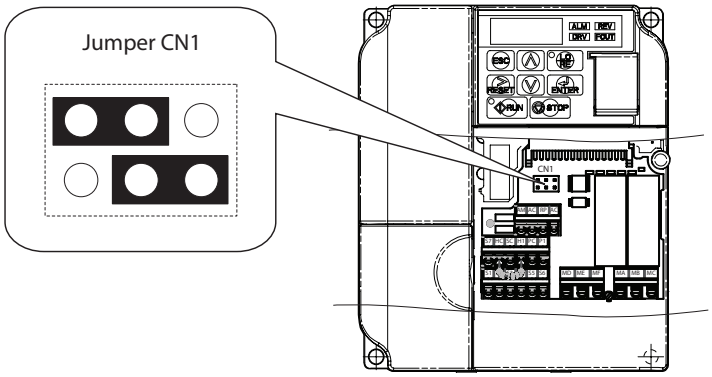


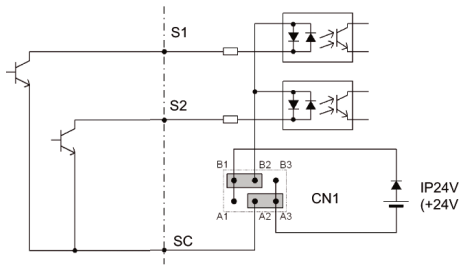
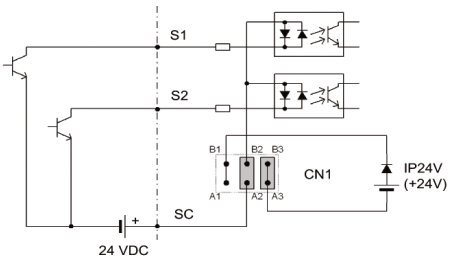
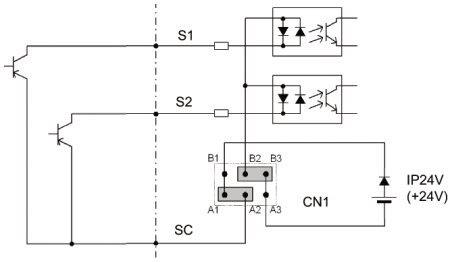
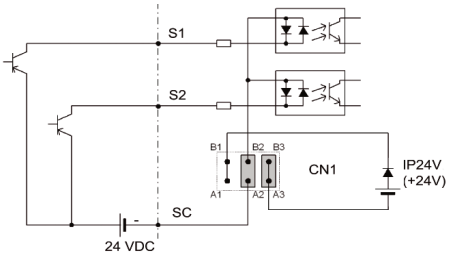
Figure 3.17 Jumper CN1 Location on Terminal Board

3.8 Control I/O Configuration

◆ Setting Sink/Source with Jumper CN1

Use jumper CN1 to select between Sink mode, Source mode or external power supply for the digital inputs S1 to S7 as shown in *Table 3.9* (Default: Sink mode, internal power supply).

Table 3.9 Digital Input Sink / Source / External Power Supply Selection

	Drive Internal Power Supply	External 24 Vdc Power Supply
Sinking Mode (NPN)		
Sourcing Mode (PNP)		

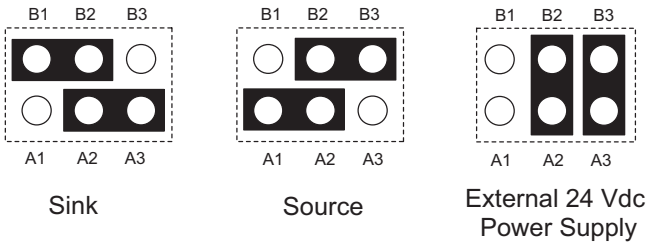


Figure 3.18 Jumper CN1 Setting Possibilities

3.9 Connect to a PC

This drive is equipped with an RS-232 serial communications port through an RJ45 connector on the front panel.

The drive can connect directly to a PC that is equipped with a serial port. Alternatively, an RS-232 to USB converter such as the optional Yaskawa Copy Unit (JVOP-181) can be used to connect to PCs not equipped with a serial port. After connection, Yaskawa DriveWizard Plus software can be used to monitor drive performance and manage parameter settings. DriveWizard Plus software is available for download free of charge at the Yaskawa Europe website (www.yaskawa.eu.com). For more information concerning DriveWizard Plus please contact Yaskawa.

If using the Yaskawa Copy Unit make sure to install the USB driver, which can also be downloaded from the Yaskawa Europe website (www.yaskawa.eu.com).

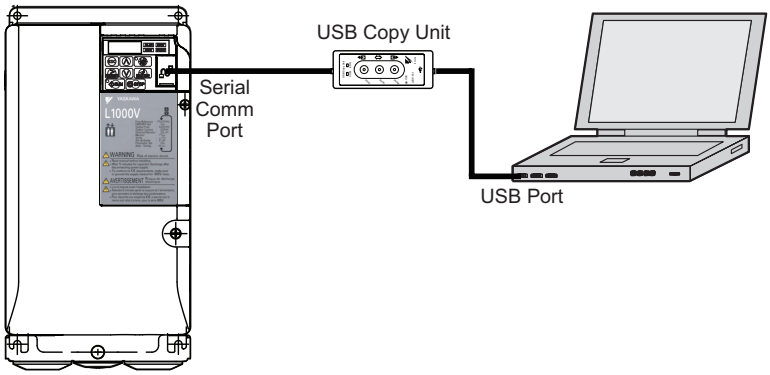


Figure 3.19 Connecting the Drive to a PC using the Copy Unit

3.10 Wiring Checklist

☑	No.	Item	Page
		Drive, peripherals, option cards	
☐	1	Check drive model number to ensure receipt of correct model.	*24*
☐	2	Make sure you have the correct braking resistors, DC reactors, noise filters, and other peripheral devices.	*206*
		Installation area and physical setup	
☐	3	Ensure that the area surrounding the drive complies with specifications.	*31*
		Power supply voltage, output voltage	
☐	4	The voltage from the power supply should be within the input voltage specification range of the drive.	*216* *217*
☐	5	The voltage rating for the motor should match the drive output specifications.	
☐	6	Verify that the drive is properly sized to run the motor.	
		Main circuit wiring	
☐	7	Confirm proper branch circuit protection as specified by national and local codes.	*252*
☐	8	Properly wire the power supply to drive terminals R/L1, S/L2, and T/L3.	*45*
☐	9	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.	*45*
☐	10	Use 600 Vac vinyl-sheathed wire for the power supply and motor lines.	*50*
☐	11	Use the correct wire gauges for the main circuit. *Refer to Wire Gauges and Tightening Torque on page 50*. • 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) = 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.	*50*
☐	12	Properly ground the drive. *Refer to Ground Wiring on page 53*.	*53*
☐	13	Tightly fasten all terminal screws (control circuit terminals, grounding terminals). *Refer to Wire Gauges and Tightening Torque on page 50*.	*50*
☐	14	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.	*210*
☐	15	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	
☐	16	Use twisted-pair line for all drive control circuit wiring.	*56*
☐	17	Connect the shields of shielded wiring to the GND ⏚ terminal.	*56*
☐	18	Check for any other wiring mistakes. Only use a multimeter to check wiring.	-
☐	19	Pick up all wire clippings.	-
☐	20	Ensure that no frayed wires on the terminal block are touching other terminals or connections.	-
☐	21	Properly separate control circuit wiring and main circuit wiring.	-
☐	22	Analog signal line wiring should not exceed 50 m (164 ft.).	-
☐	23	Safe Disable input wiring should not exceed 30 m (98 ft.).	*262*

4

Start-Up Programming & 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 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)

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.

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.

If holding brake circuits are not configured properly, 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 stop circuits separately from the drive emergency 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.

⚠ 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 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

Preventing Injury

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.

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

Sudden Movement Hazard

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 autotuning.

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 overtemperature 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 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 Operator

Use the LED operator to enter Run and Stop commands, edit parameters, and display data including fault and alarm information.

◆ Keys, Displays, and LEDs

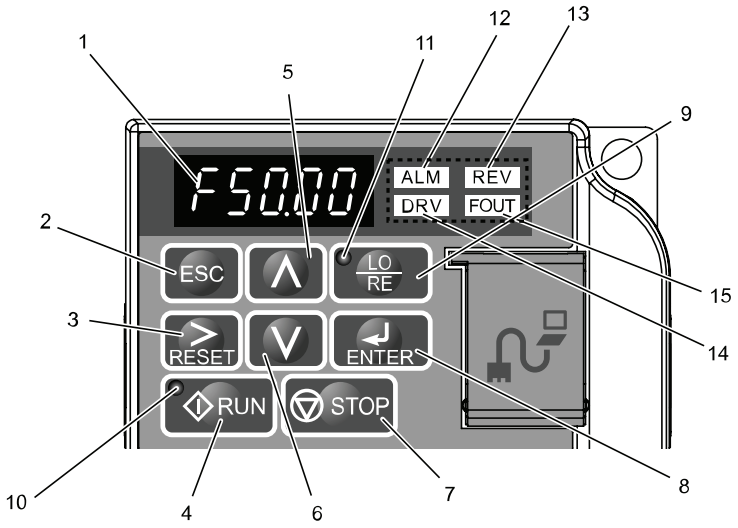


Figure 4.1 Keys and Displays on the Digital Operator

No.	Display	Name	Function
1	F50.00	Data Display Area	Displays the frequency reference, parameter numbero, etc.
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 when 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 an emergency 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 next item, select parameter numbers, and increment 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). **LO/RE key functionality is disabled by default. To enable it use parameter o2-01**.
10	RUN	RUN Light	Lit while the drive is operating the motor. Refer to page *68* for details.
11	LO RE	LO/RE Light	Lit while the operator is selected to run the drive (LOCAL mode). Refer to page *68* for details.
12	ALM	ALM LED Light	Refer to LED Message Indicators on page 67
12	REV	REV LED Light	
12	DRV	DRV LED Light	
12	FOUT	FOUT LED Light	

<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 Text Display

Text appers on the LED Operator as shown below. This section explains the meaning of text as it appears on the display screen.

Lit	Flashing
	

Table 4.1 Digital Text Display

Text	LED	Text	LED	Text	LED	Text	LED
0		9		I		R	
1		A		J		S	
2		B		K		T	
3		C		L		U	
4		D		M		V	
5		E		N		W	
6		F		O		X	none
7		G		P		Y	
8		H		Q		Z	none

◆ LED Message Indicators

LED	Lit 	Flashing 	Off 
ALM	When the drive detects an alarm or fault.	• When an alarm occurs • When an operator fault (oPE) is detected • When a fault occurs during Auto-Tuning	Normal state (no alarm or fault)
REV	Motor is rotating in reverse.	-	Motor is rotating forward.
DRV	• Drive mode is active. • Auto-Tuning	When DriveWorksEZ is used	Drive is in programming mode.
FOUT	Drive is currently displaying the output frequency.	-	Drive is currently not displaying the output frequency.

◆ LO/RE and Run LED Indicators

LED	Lit	Flashing	Flashing Quickly	Off
RUN	Durnig Run	• During deceleration to stop. • When there is a Run command but the frequency reference is 0.	• During deceleration at Fast-Stop. • During deceleration. • During Stop by interlock operation.	During Stop
LO RE	The drive is in local mode. The Run command can be entered from the LED Operator.	-	-	Drive is in remote mode. Run command is entered from a remote source.

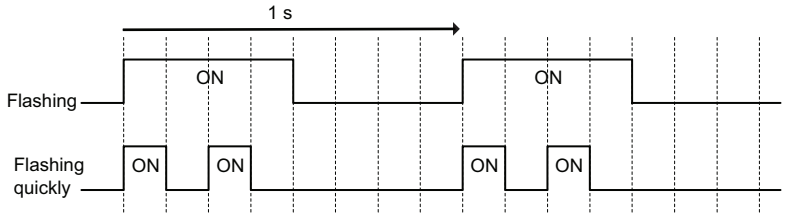


Figure 4.2 LED Flashing Speeds

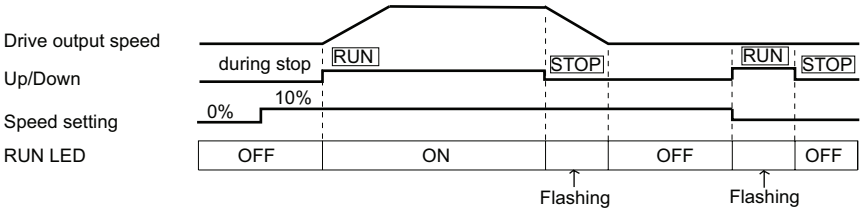


Figure 4.3 Run LED Behaviour

◆ Menu Structure for LED Operator

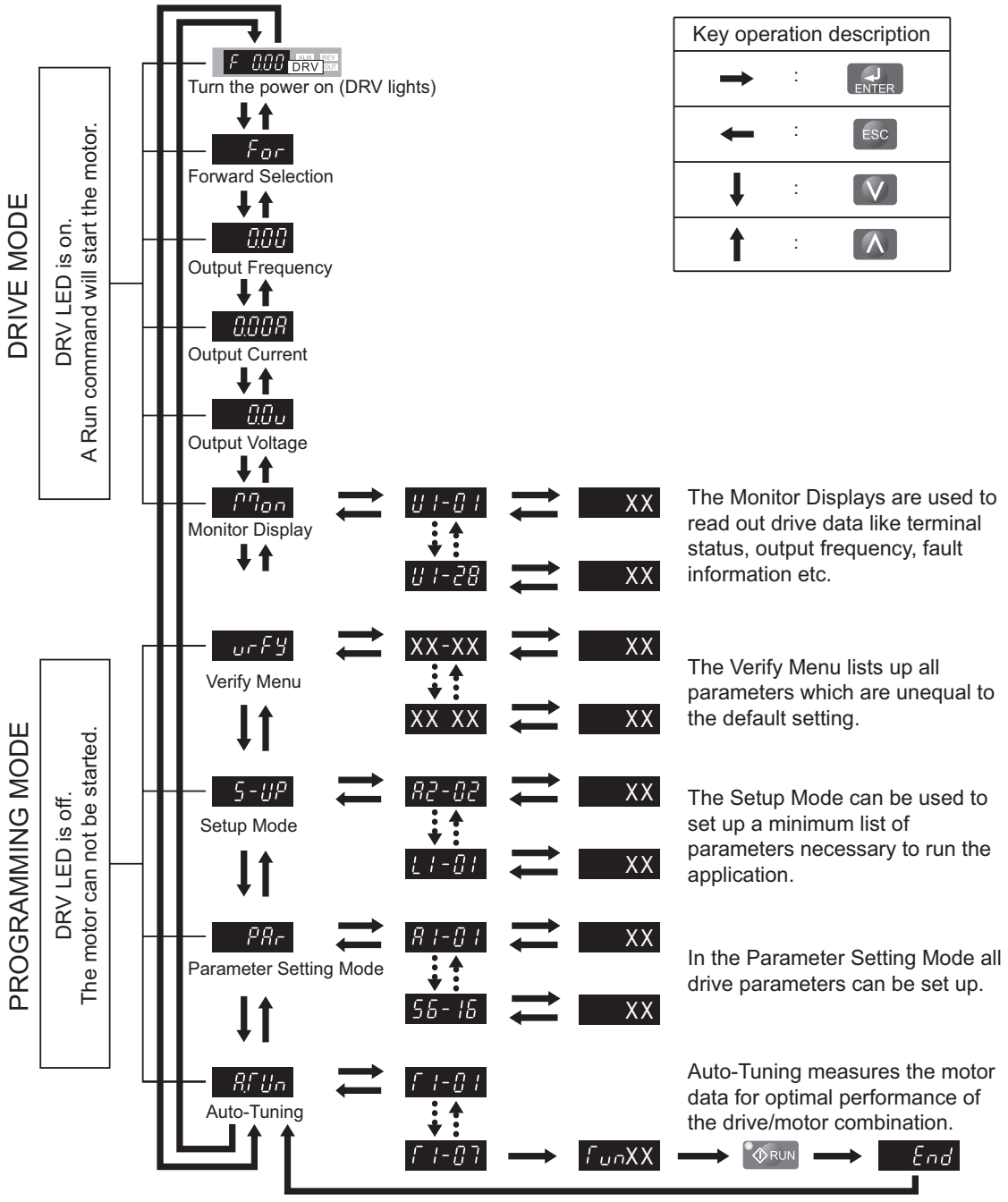


Figure 4.4 LED Operator Menu Structure

4.3 The Drive and Programming Modes

The L1000V 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: 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.

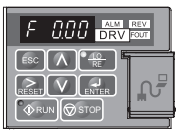
Note: Set b1-08 to 1 to allow the drive to run the motor while in Programming Mode.

Table 4.2 Summary of Drive Modes

Mode Group	Description	Key Press	LED Operator Display
Drive Mode Functions (Motor Operation and Monitoring)	Frequency Reference Display (**Initial power-up state**)	∧	F 0.00 DRV
	Forward / Reverse	∧	For DRV
	Output Frequency Display	∧	0.00 DRV FOUT
	Output Current Display	∧	0.00 A DRV
	Output Voltage Reference	∧	0.0 U DRV
	Monitor Display	∧	Mon DRV
Programming Mode Functions (Changing parameters)	Verify Function	∧	vrFy
	Setup Group Parameters	∧	SrUP
	All Parameters	∧	PAr
	Auto-Tuning	∧	ATUn

◆ 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)		This display screen shows the currently selected frequency reference. When the drive is in LOCAL mode, the frequency reference can be modified directly from this screen. **Note:** The user can select the data displayed when the drive is first powered up with parameter o1-02.
Drive Mode		∧ ↓ ↑ ∨	
	Forward/Reverse		For : The motor is rotating in the forward direction. rEv : The motor is rotating in the reverse direction.

Mode	Contents	Operator Display	Description
Drive Mode			
	Output Frequency		Displays the drive output frequency.
			
	Output Current		Displays the drive output current.
			
	Output Voltage		Displays the drive output voltage. This monitor can be changed with the o1-01 parameter.
			
	Monitor Display		Monitor menu with access to all drive monitors (U parameter group). Refer to U: Monitors on page 243 for more details.
			
Programming Mode	Verify Function		Lists all parameters that have been edited or modified from their default settings. Refer to Verifying Parameter Changes: Verify Menu on page 73 for more details.
			
	Setup Parameters		Lists commonly used parameters for quick drive commissioning. Refer to Simplified Setup Using the Setup Group on page 74 for more details.
			
	Parameter Setting		Allows the user to access and edit all paramter settings. Refer to Parameter Details on page 101 for more details.
			
	Auto-Tuning		Procedure that calculates and sets the motor parameters automatically. Refer to Auto-Tuning on page 80 for more details.
			
Drive Mode	Frequency Reference		Returns to the frequency 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 4.5 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.

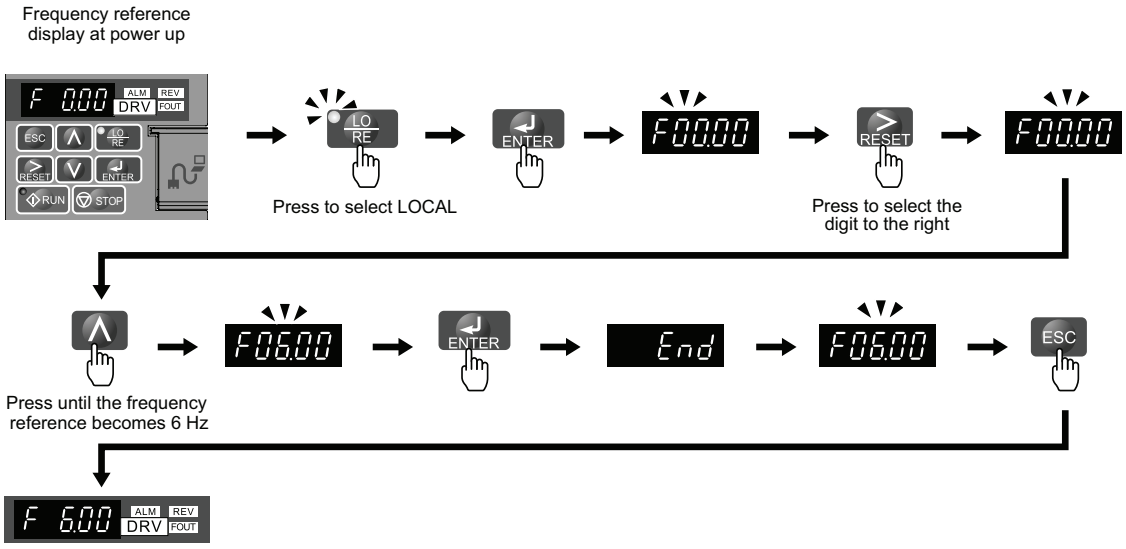


Figure 4.5 Setting the Speed Reference while in the Drive Mode

Note: 1. 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.

2. The LO/RE (Local/Remote) key's functionality is disabled by default, to prevent inadvertent switching to LOCAL mode while the elevator is in operation. To enable the LO/RE key set the o2-01 parameter to 1.

■ Programming Mode Details

The following actions are possible in the Programming Mode:

- **Verify Function:** Verify paramter setting changes from original default values.
- **Setup Group:** Access a list of commonly used parameters to simplify setup.
- **Parameter Setting Mode:** Access and edit all parameter settings.
- **Auto-Tuning Mode:** Automatically calculate and set motor parameters to optimize drive performance.

◆ Changing Parameter Settings or Values

This example explains changing C1-01 (Acceleration 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.	→	F 0.00 DRV
2.	Press ∧ or ∨ until the Parameter Setting Mode screen appears.	→	PAr
3.	Press ENTER to enter the parameter menu tree.	→	A1-01
4.	Press ∧ or ∨ to select the C parameter group.	→	C1-01
5.	Press ENTER or RESET until the "01" flashes.	→	C1-01
6.	Press ∧ or ∨ to select the parameter C1-02.	→	C1-02
7.	Press ENTER to view the current setting value (1.50 s). The left most digit flashes.	→	001.50

	Step		Display/Result
8.	Press RESET until the desired digit is selected. In this case, "1" flashes.	→	001.50
9.	Press ∧ to increase the value of the selected digit. In this case, "002.50" should appear.	→	002.50
10.	Press ENTER to confirm the change. If it is accepted, "End" should appear. If it is out of range, the parameter will flash twice and return to its previous value.	→	End
11.	The display automatically returns to the screen shown in Step 6. If needed, repeat steps 5 through 10 to modify other parameters.	→	C1-02
12.	Press ESC as many times as necessary to return to the frequency reference display.	→	F 0.00 DRV

◆ 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 troubleshooting or 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) even if those parameters have been changed from their default settings.

The following example is a continuation of the steps above. Here, parameter C1-01 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.	→	F 0.00 DRV
2.	Press ∧ or ∨ until the display shows the top of the Verify Menu.	→	vrFy
3.	Press ENTER to view the list of parameters that have been edited from their original default settings. If parameters other than C1-01 have been changed, use ∧ or ∨ to scroll and view them.	→	C1-01
4.	Press ENTER to access the setting value. Left digit flashes.	→	002.50
5.	Repeat steps 8 through 10 of the previous table to change the value of the parameter. Press ESC as many times as necessary to return to the frequency reference display.	→	F 0.00 DRV

◆ 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 by showing only the most commonly used parameters in lift commissioning.

■ Using the Setup Group

Figure 4.6 illustrates how to enter and how to change parameters in the Setup Group.

In this example, the Setup Group is accessed to change D1-02 from 0.00 Hz to 20.00 Hz. This changes the multi-step frequency 2 which can be selected using the drive's digital inputs.

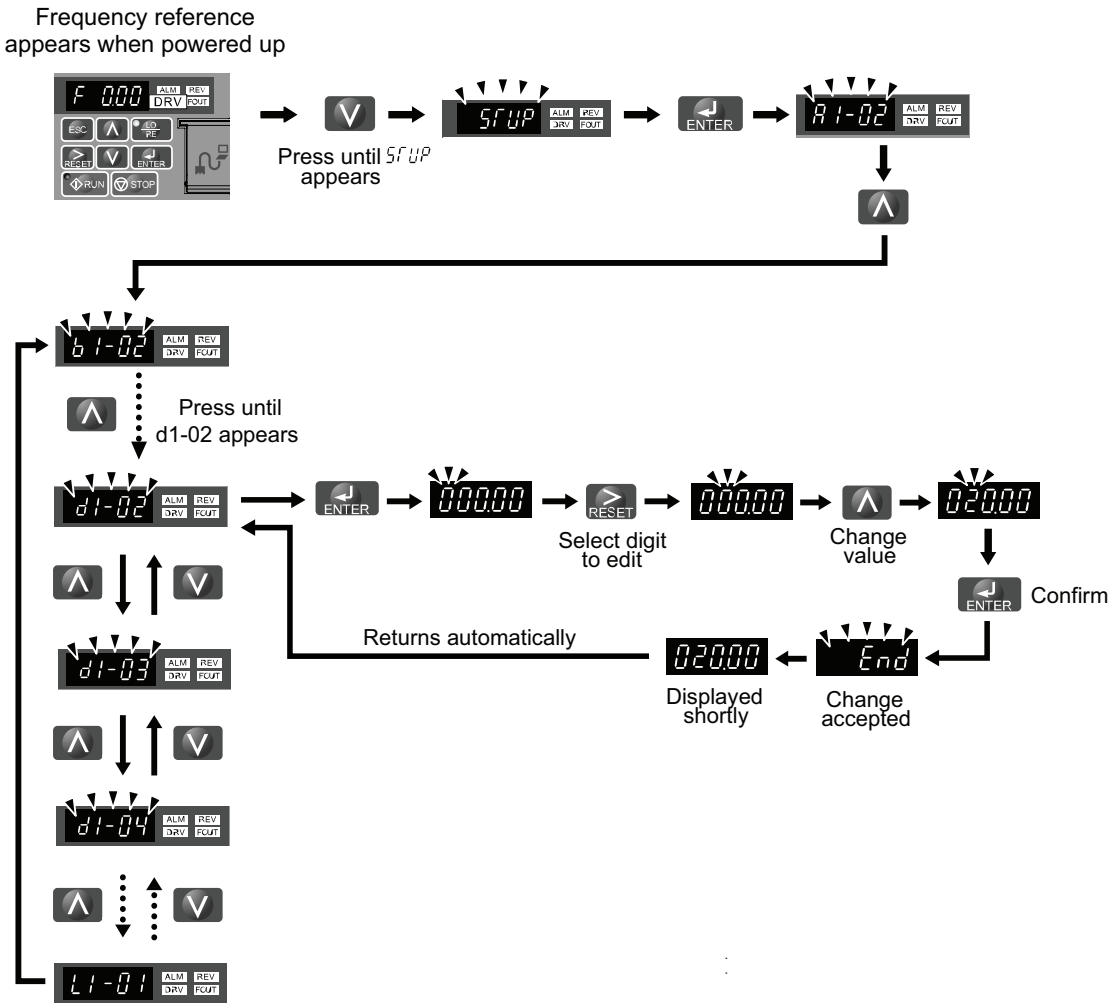


Figure 4.6 Setup Group Example

■ Setup Group Parameters

Table 4.3 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 4.3 Setup Group Parameters

Parameter	Name
A1-02	Control Method Selection
b1-02	Speed Reference Selection
b1-03	Stopping Method Selection
C1-01	Acceleration Ramp 1
C1-02	Deceleration Ramp 1
C6-02	Carrier Frequency Selection
d1-01	Speed Reference 1
d1-02	Speed Reference 2
d1-03	Speed Reference 3
d1-04	Speed Reference 4
d1-17	Jog Frequency Reference

Parameter	Name
E1-01	Input Voltage Setting
E1-04	Maximum Output Frequency
E1-05	Maximum Voltage
E1-06	Base Frequency
E1-09	Minimum Output Frequency
E1-13	Base Voltage
E2-01	Motor Rated Current
E2-04	Number of Motor Poles
E2-11	Motor Rated Power
H4-02	Analog Output Terminal AM Gain
L1-01	Motor Overload Protection Selection

Note: Parameter availability depends on the control mode set in A1-02. The parameters listed above are available for the default control mode.

◆ Switching Between LOCAL and REMOTE

LOCAL mode is when the drive is set to accept the Up/Down command from the LED operator keys. 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 drive between LOCAL and REMOTE using the LO/RE key on the digital operator or via a digital input programmed with this function. The LO/RE key is disabled by default, but can be enabled through parameter o2-01.

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 LED Operator

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

4.4 Start-Up Flowcharts

This section covers basic setup for the drive, including Auto-Tuning procedures and corresponding flowcharts. Refer to *Types of Auto-Tuning on page 80* 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.	*76*
B	Auto-Tuning for induction motors.	*79*

◆ 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.

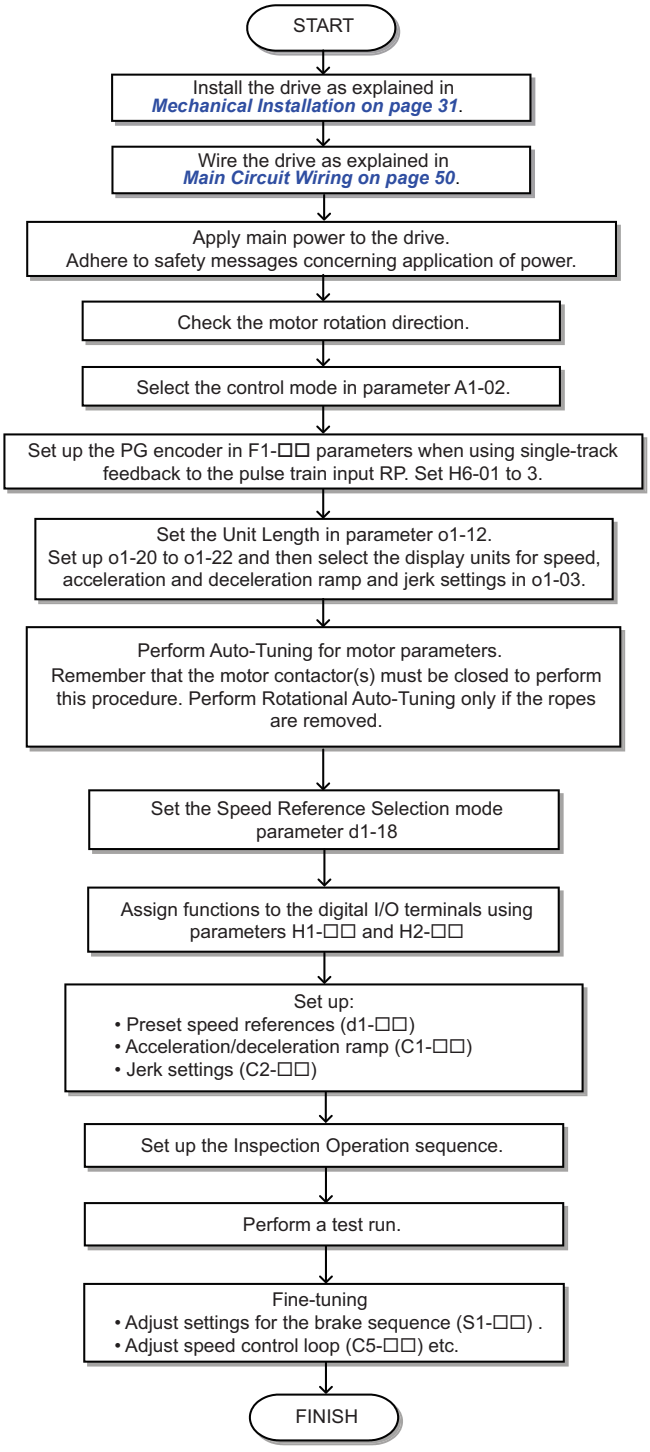


Figure 4.7 Installation, Wiring, Basic Setup for Motor and Elevator

◆ 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 any emergency circuits after they are wired. Emergency 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, 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 power, the drive mode display should appear and no fault or alarm should be displayed. In the event of a drive fault or error code, refer to ***Drive Alarms, Faults, and Errors on page 166***.

◆ Control Mode Selection

Select one of the four motor control modes after applying power to the drive according to the table below.

Machine Type	Control Mode	A1-02 setting	H6-01 setting
Induction Motor	V/f Control	0	F
	V/f Control with PG	0	3
	Open Loop Vector (OLV) Control	2	F
	Open Loop Vector Control with PG	2	3

◆ 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 check 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 motor rotation is incorrect, rewire the drive output to the motor.

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.*

◆ Digital LCD 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 when using the optional JVOP-180 LCD operator. Select the speed units using parameter o1-03 as shown below.

o1-03 Setting	Display Unit		
	Speed Setting/Monitors (d1-□□, U1-02, U1-02,...)	Accel/Decel Ramp (C1-□□)	Jerk Settings (C2-□□)
0	0.01 Hz	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.	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.
1 (default)	0.01%		
2	1 rpm		
3	User defined		
4	0.01 m/s		
5	0.01 m/s	0.01 m/s^2 (Set as accel/decel ramp)	0.01 m/s^3 (set as jerk value)
6	0.1 ft/min	0.01 ft/s^2 (Set as accel/decel ramp)	0.01 ft/s^3 (set as jerk value)

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 is 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.
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.

◆ Flowchart B: Auto-Tuning for Induction Motors

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

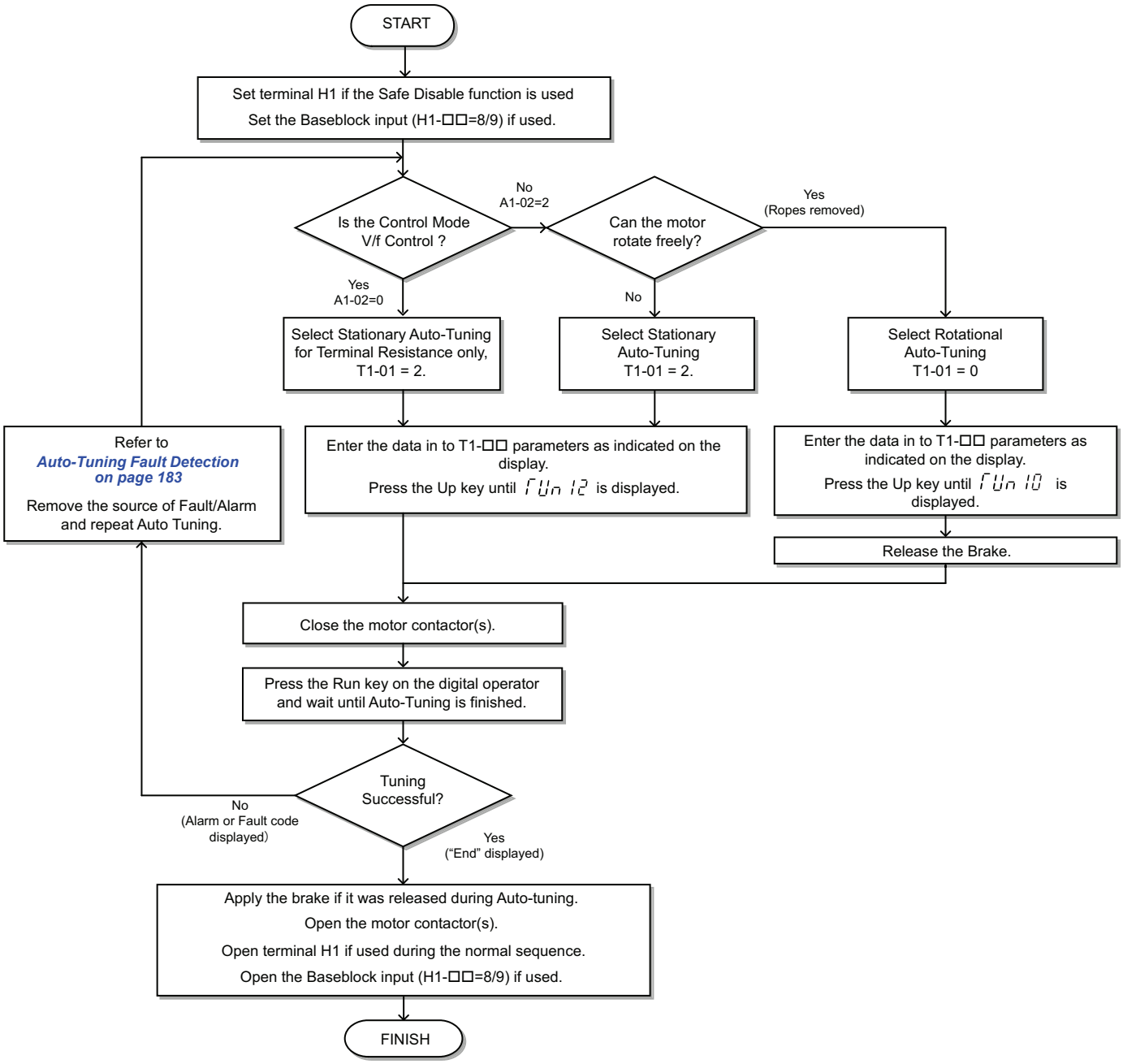


Figure 4.8 Auto-Tuning for Induction Motors

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.*

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 two different types of Auto-Tuning for induction motors. The type of Auto-Tuning used differs 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 76*.

Note: The drive will only show Auto-Tuning parameters that are valid for the control mode that has been set in A1-02.

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

This feature automatically sets the V/f pattern and motor parameters E1-□□ and E2-□□ for an induction motor.

Table 4.4 Types of Auto-Tuning for Induction Motors

Type	Setting	Requirements and Benefits	Control Mode (A1-02)	
			V/f (0)	OLV (2)
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
Stationary Auto-Tuning for Line-to-Line Resistance	T1-01 = 2	• Used when the motor cable exceeds 50 m. • Used in V/f control if drive and motor capacities differ. • Perform when the ropes cannot be removed from the installation for rotational auto-tuning.	Yes	Yes

Table 4.5 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 pages *76* and *79* for details on Auto-Tuning process and selections.

Table 4.5 Auto-Tuning Input Data

Input Value	Input Parameter	Unit	Tuning Type (T1-01)	
			0 Rotational	2 Stationary for Line-to-Line Resistance
Motor Rated Power	T1-02	kW	Yes	Yes
Motor Rated Voltage	T1-03	Vac	Yes	No
Motor Rated Current	T1-04	A	Yes	Yes
Motor Rated Frequency	T1-05	Hz	Yes	No
Number of Motor Poles	T1-06	-	Yes	No
Motor Rated Speed	T1-07	r/min	Yes	No

The number of motor poles (T1-06) is usually not found on the motor nameplate, but it can be calculated by:

$$p = (120 \times f) / n_s$$

Where **f** is the motor rated frequency and $\mathbf{n}_s$ is the motor synchronous speed.

◆ 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, 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. The holding brake must remain engaged for the entire Stationary Auto-Tuning sequence. Ensure a brake release digital output signal cannot be issued by the drive. Failure to comply could result in serious injury or death.*

WARNING! *Sudden Movement Hazard. 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 exclusively.*

- Rotational Auto-Tuning is the preferred tuning method because it gives more accurate results than Stationary Auto-Tuning. Perform Rotational Auto-Tuning when the motor can be uncoupled from the elevator mechanical system (remove ropes from traction sheave). 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. Make sure to release the brake for all Rotational Auto-Tuning methods.
- When using a motor contactor, make sure it is closed throughout the Auto-Tuning process.
- The H1 signal must be ON when performing Auto-Tuning.
- A digital input programmed for Baseblock (H1-□□ = 8/9) must be set so that the drive is not in a baseblock condition.
- Confirm that the motor is mechanically fixed.
- To cancel Auto-Tuning, press the STOP key on the digital operator.
- Auto-Tuning requires the user to input data from the motor nameplate or motor test report. Make sure this data is available before Auto-Tuning the drive.
- For best performance, the drive input supply voltage must be greater than the motor rated voltage.

  Note: Improved performance is possible when using a motor with a base voltage that is 20 V (40 V for 400 V class models) lower than the input supply voltage. This is particularly important when operating the motor above 90% of base speed, where high torque precision is required.

DANGER! *Sudden Movement Hazard. Stay clear of the motor during rotational autotuning. The motor may start operating suddenly. During automatic starting of equipment, the machine may start moving suddenly, which could result 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 4.6 describes digital input and output terminal operation while Auto-Tuning is executed.

Table 4.6 Digital Input and Output Operation During Auto-Tuning

Auto-Tuning Type	Digital Input	Digital Output
Rotational Auto-Tuning	Digital input functions are disabled.	Functions the same as during normal operation
Stationary Auto-Tuning for Line-to-Line Resistance	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning

◆ 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 LED operator.

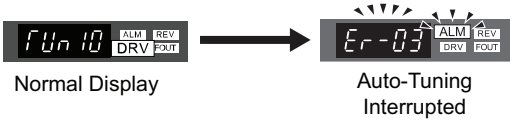


Figure 4.9 Auto-Tuning Interrupted Display

◆ 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.	→	F 0.00 DRV
2.	Press ∧ or ∨ until the Auto-Tuning display appears.	→	AUto ALM REV DRV FOUT
3.	Press ENTER to begin setting parameters.	→	T1-01
4.	Press ENTER to display the value for T1-01.	→	02
5.	Press RESET to select the digit to be modified.	→	02
6.	Press ∨ to select Rotational Auto-Tuning.	→	00
7.	Save the setting by pressing ENTER.	→	End
8.	The display automatically returns to the display shown in Step 3.	→	T1-01

■ 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 8 in “Selecting the Type of Auto-Tuning”.

Step			Display/Result
1.	Press ∧ to access the motor output power parameter T1-02.	→	T1-02
2.	Press ENTER to view the default setting.	→	004.00
3.	Using RESET to select the correct digit and ∧ or ∨ to change the digit value, enter the motor power nameplate data in kW.	→	End → 004.20
4.	Press ENTER to save the setting.	→	
5.	The display automatically returns to the display in Step 1.	→	T1-02
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	→	T1-03 ⋮ T1-07

Note: *Refer to Input Data for Motor Auto-Tuning: T1 on page 83* 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, 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 ENTER 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 ENTER to confirm.	→	
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.	→	
3.	Auto-Tuning finishes in approximately one to two minutes if no errors occur.	→	

◆ Input Data for Motor Auto-Tuning: T1

The T1-□□ parameters are used to set the Auto-Tuning input data.

Note: **1.** Cycling drive power after setting the T1 parameters will reset these parameters to default values.
2. 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 Types of Auto-Tuning on page 80* for details on the different types of Auto-Tuning.

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

Setting 0: Rotational Auto-Tuning

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

■ T1-02: Motor Rated Power

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

No.	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 voltage at base speed if the motor will operate 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.	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. Enter the current at the motor base speed.

No.	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.	Name	Setting Range	Default
T1-05	Motor Base Frequency	0.0 to 120.0 Hz	50.0 Hz

■ T1-06: Number of Motor Poles

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

No.	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.	Name	Setting Range	Default
T1-07	Motor Base Speed	0 to 24000 r/min	1450 r/min

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.*

■ Speed Reference Selection

Parameter b1-01 determines the source of the speed reference. On the L1000V drive the speed reference can only be modified through the digital operator or using digital inputs to switch between reference values. Therefore, this parameter cannot be modified from its default value of 0.

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.

■ 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

■ 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 signal at terminal H1 must 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 input is 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.

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)	
0	1	0	Speed reference 3 (d1-03)	
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)
S4	H1-04	54	Inspection speed (d1-24)
S5	H1-05	51	Intermediate speed (d1-20)
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.

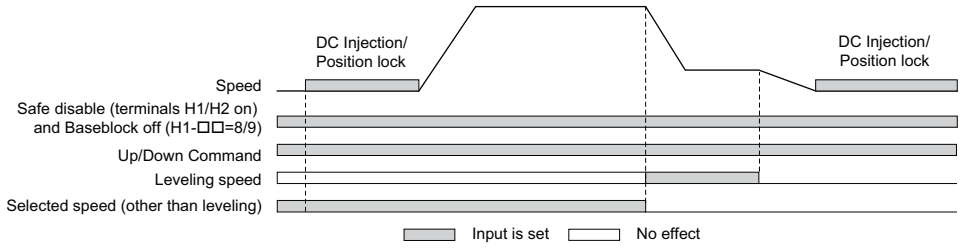
Note: Parameters d1-19 through d1-26 are displayed only if d1-18 is set to 1 or 2.

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)

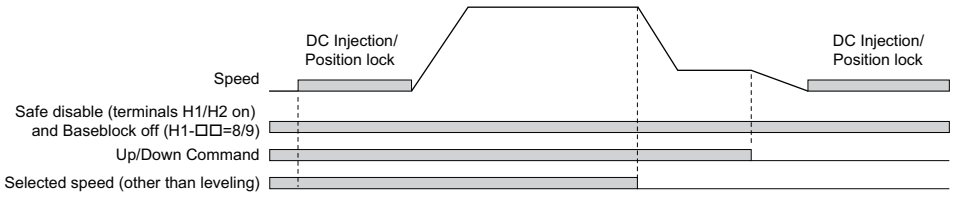
The higher speed has priority over the leveling speed. The leveling signal is disregarded as long as any other speed selection input is active. The drive decelerates to the leveling speed (d1-26) when the selected speed reference signal is removed.



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

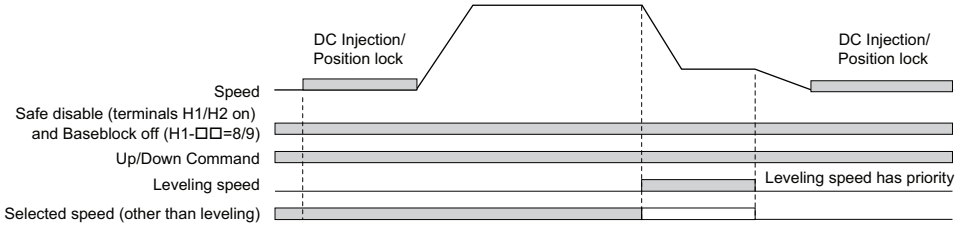
The drive decelerates to the leveling speed (d1-26) when the selected speed reference signal is removed.

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)

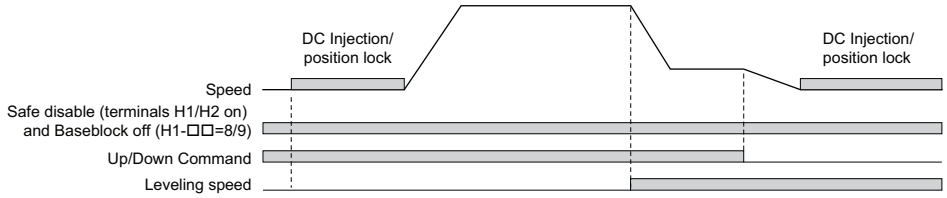
The leveling signal has priority over other speed references. The drive decelerates to the leveling speed (d1-26) when the leveling speed selection input is activated. The drive stops when either the leveling input or the Up/Down command is released.



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.

CAUTION! *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 Inputs (Terminals S3 to S7)

The H1 parameters assign functions to digital input terminals S3 to S7 digital input terminal functions, refer to *H1-03 to H1-07: Functions for Terminals S3 to S7 on page 124*.

■ Multi-Function Digital Outputs

The H2 parameters assign functions to digital output terminals MD-ME-MF and P1-PC. Refer to *H2-01 to H2-03: Terminals MA-MB-MC, MD-ME-MF and P1-PC Function Selection on page 127*.

■ Multi-Function Analog Output

The H4 parameters assign a function to analog output terminal AM. Select the function for this terminals by entering the last three digits of the desired U monitor. For a list of analog output functions, refer to *U: Monitors on page 243*.

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

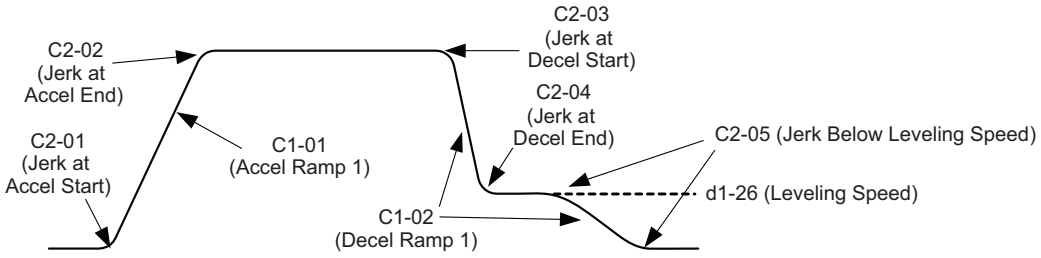


Figure 4.10 Accel/Decel Ramp and the Jerk Function

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 LCD Operator Display Unit Selection on page 78* for details.

◆ Inspection Operation

■ Start Condition in Inspection Operation

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

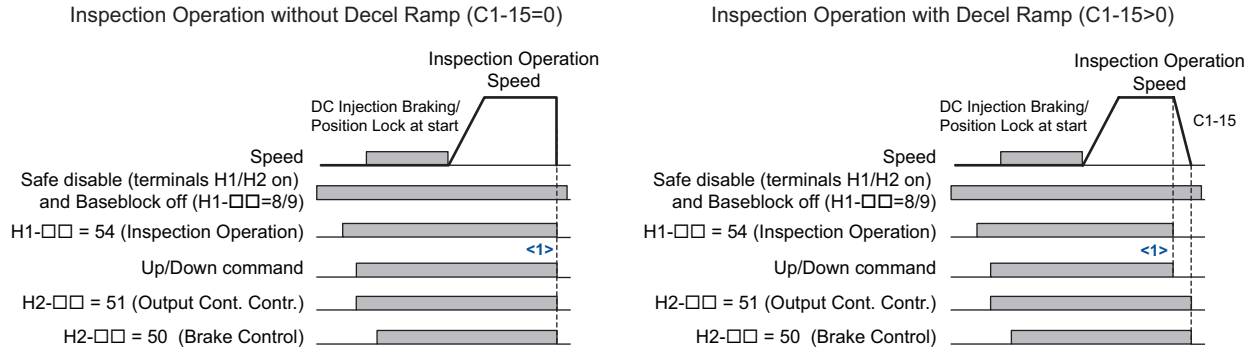
To stop the drive during Inspection Operation, either remove the Up or Down command or reset the input terminal for Inspection Operation.

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 4.11***.



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

Figure 4.11 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, EmergencyStop Ramp, when using the fast-stop feature.*

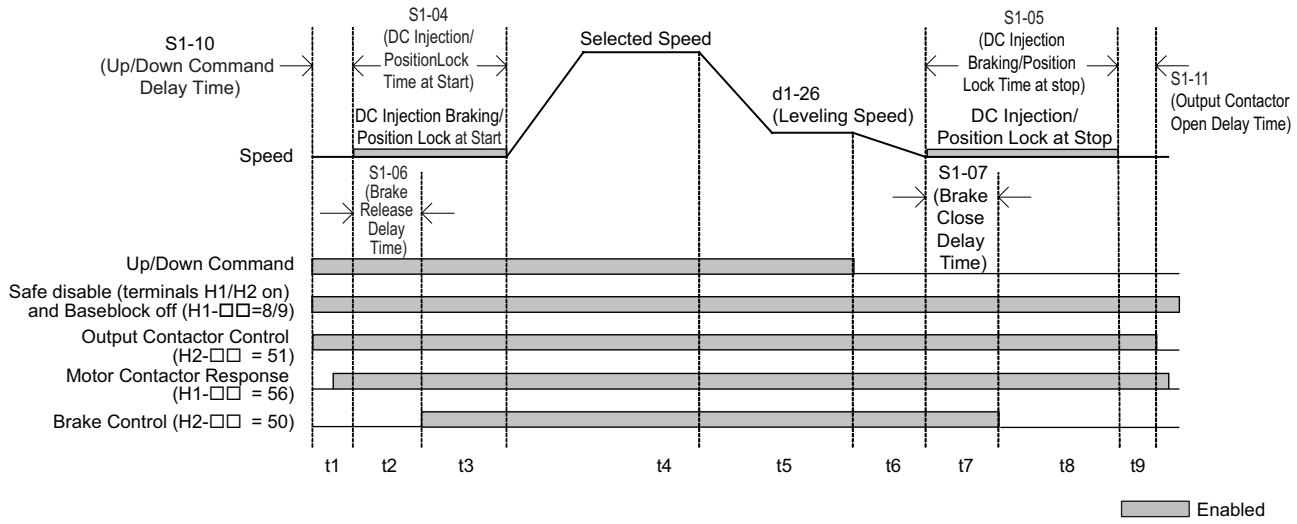


Figure 4.12 Brake Sequence Timing Diagram

Figure 4.12 is divided into time zones. *Table 4.7* explains the sequence in each time zone.

Table 4.7 Time Zones for Brake Sequence Timing Diagram

Time Zone	Description
t1	Up or Down command is issued.
	Safe Disable terminals H1-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 apply 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.

◆ 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 overtemperature 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: *In L1000V drives with software version 7010 power to the drive must be cycled after setting a digital input terminal to Rescue Operation (H1-□□=55) for the setting to take effect.*

■ 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 4.8***.

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 is supplied directly from the drive's DC bus.

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 4.8***.

Table 4.8 Power Supply Ratings for Rescue Operation

Motor Type	DC Bus Voltage	Control Circuit Voltage
Induction Motor	200 V class drives: 115 to 300 Vdc 400 V class drives: 230 to 600 Vdc	Same as DC Bus Voltage.

■ 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 should be detected, also set up parameters S4-12 and S4-13. Measure the DC bus voltage during operation with 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 to select if light load direction search should be automatically performed when Rescue Operation is started and to configure the light load search function.

■ 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 4.13*** for a wiring diagram.

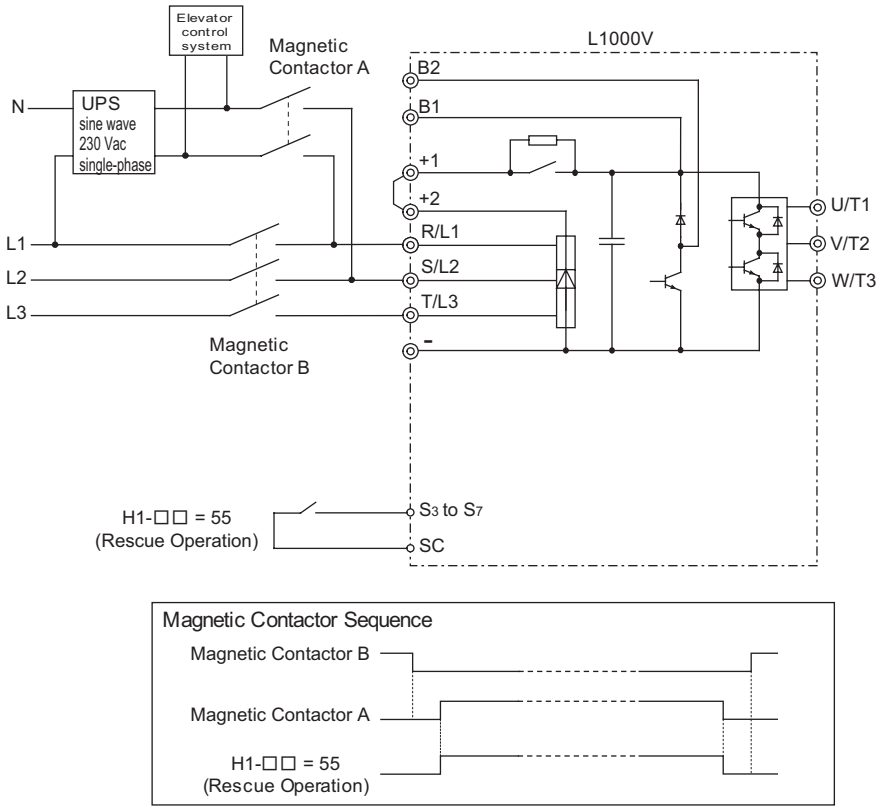


Figure 4.13 Using a Single-Phase 230 V UPS

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.

■ Using a Single Battery with Minimum 115 Vdc (230 Vdc)

Follow the instructions when using one battery to supply both, main circuit and controller. The battery voltage must be at least 115 Vdc for 200 V class drives or 230 Vdc for 400 V class drives.

Wiring

Following the wiring diagram show in ***Figure 4.14***.

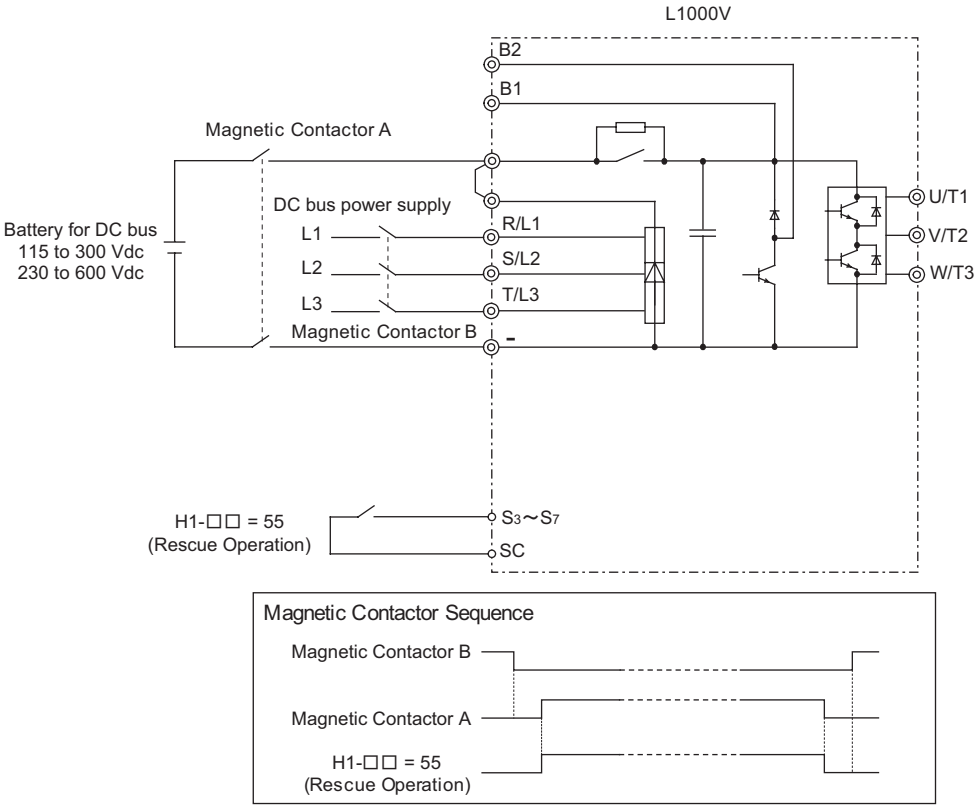


Figure 4.14 Using a Backup Battery With Minimum 115 Vdc (230 Vdc)

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.

■ 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.

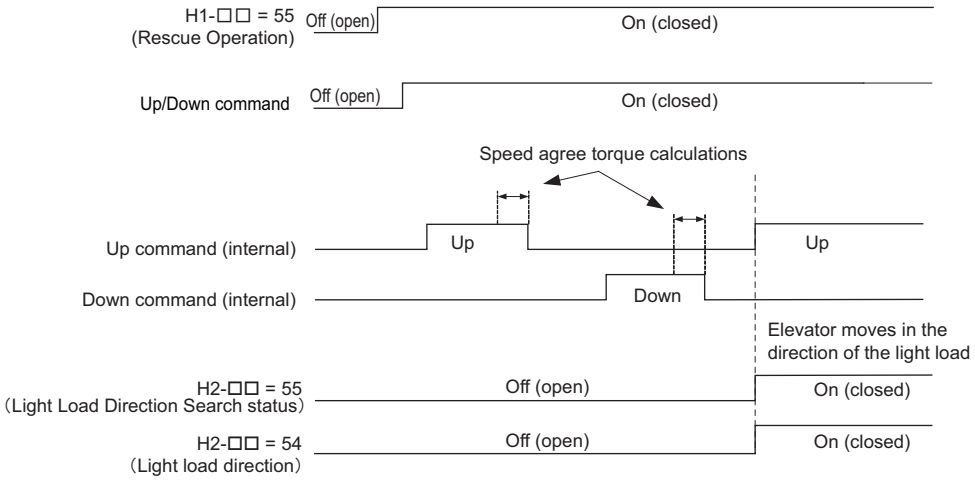


Figure 4.15 Light Load Direction Detection (Up)

- 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.

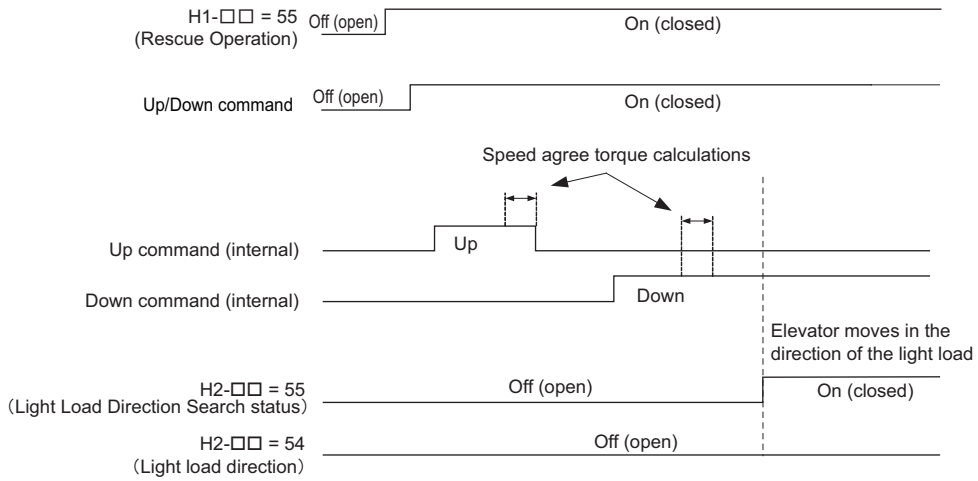


Figure 4.16 Light Load Direction Detection (Down)

4.7 Setup Troubleshooting and Possible Solutions

This section describes troubleshooting problems that do not trip an alarm or fault.

◆ 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 70*.
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. • Ensure that the drive is not being energized by the UPS, i.e. Rescue Operation.

◆ 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 70*.
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 70*.
An Emergency Stop was executed and is not reset.	Reset the Emergency 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)
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).
Selection for the sink/source mode and the internal/external power supply is incorrect.	Check the position of jumper CN1. *Refer to Control I/O Configuration on page 59*
Speed reference is too low.	• Check the speed reference monitor (U1-01). • Increase the speed reference above the minimum output speed (E1-09).
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 77*.
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 120*. • 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 (600 V for 200 V class, and 1200 V for 400 V class). • Use a motor with a voltage tolerance higher than the max voltage surge. • Use a motor designed to work specifically with a drive when using a 400 V class unit. • 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 80*. • 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. *Refer to Input-Side Noise Filter on page 212*. • Install a noise filter on the output side of the drive. *Refer to Output-Side Noise Filter on page 212*. • 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.

◆ A Residual Current Device (RCD, RCM) Trips during Run

Cause	Possible Solutions
Excessive leakage current trips RCD/RCM.	• Decrease the RCD/RCM sensitivity or use one with a higher threshold. • Lower the carrier frequency (C6-02). • 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.

◆ 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	All	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.
		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.
	OLV	The slip or torque compensation function acts too slowly.	• Decrease the Torque Compensation Time (C4-02). • Decrease the Slip Compensation Time (C3-02).
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 Apply 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.
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).
	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.
Motor stops shortly (undershoot) when the leveling speed is reached.	All	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.
		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.
	OLV	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.	
Motor or machine vibrates at high speed or top speed	OLV	Torque compensation responds too quickly.	Increase the Torque Compensation Delay Time (C4-02).
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).
		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.
Vibrations with the frequency equal to the motor speed occur.	All	Mechanical problems.	Check bearings and gearbox.
		Rotational parts (motor armature, handwheel, brake disk/drum) are not properly balanced.	Properly balance rotating parts.
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.
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.
		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	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	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 73*.

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:

- **JVOP-180 LCD Operator (optional)**
  The LCD operator used to operate the drive supports copying, importing, and verifying parameter settings. *Refer to o3: Copy Function on page 153* for details.
- **JVOP-181 USB Copy Unit and CopyUnit Manager**
  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. It is also possible to use the copy unit to connect the drive to a PC. Refer to the manual supplied with the USB Copy Unit for instructions.
  CopyUnit Manager 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 CopyUnit Manager for instructions.
- **DriveWizard Plus**
  DriveWizard Plus 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: **1.** This parameter is not reset when the drive is initialized using parameter A1-03.
2. This parameter only affects the language shown on the optional LCD operator JVOP-180.

No.	Parameter Name	Setting Range	Default
A1-00	Language Selection	0 to 7	0

Setting 0: English
Setting 1: Japanese
Setting 2: German
Setting 3: French
Setting 4: Italian
Setting 5: Spanish
Setting 6: Portuguese
Setting 7: Chinese

■ 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.

■ A1-02: Control Method Selection

Selects the Control Method (also referred to as the control mode) that the drive uses to operate the motor.

No.	Parameter Name	Setting Range	Default
A1-02	Control Method Selection	0, 2	0

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.

Setting 2: Open Loop Vector Control

Use this mode for general, variable-speed applications that require precise speed control, quick torque response, and high torque at low speed without using a speed feedback signal from the motor.

Note: To set up single channel encoder feedback to the drive usnig the pulse train input for simple closed loop control, *Refer to H6: Pulse Train Input on page 135*.

■ 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
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

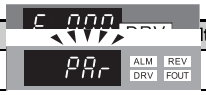
Step			Display/Result
1.	Turn on the power to the drive. The initial display appears.	→	
2.	Press ∧ or ∨ until the Parameter Setting Mode screen appears.	→	
3.	Press ENTER to enter the parameter menu tree.	→	
4.	Press ENTER or RESET to change the flashing digit.	→	
5.	Select A1-04 by pressing ∧.	→	
6.	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 ∧.	→	
7.	Press ENTER.	→	
8.	Use RESET, ∨ and ∧ to enter the password.	→	
9.	Press ENTER to save what was entered.	→	
10.	The operator screen automatically returns to the display shown in step 5.	→	

Table 5.3 Check to see if A1-02 is locked (continuing from step 10 above)

Step			Display/Result
1.	Press ∨ until A1-01 is displayed.	→	
2.	Press ENTER to display the value set to A1-01.	→	
2.	Use RESET, ∨ and ∧ to try to change the value of the parameter to a valid alternative. Make sure that changing this parameter is not possible.		
3.	Press ESC to return to the parameter settings display.	→	

Table 5.4 Enter the Password to Unlock Parameters (continuing from step 3 above)

Step			Display/Result
1.	Press ENTER to enter the parameter menu tree.	→	
2.	Press ENTER or RESET to change the flashing digit.	→	
3.	Press ∧ to scroll to A1-04.	→	
4.	Press ENTER and Enter the password “1234”.	→	
5.	Press ENTER to save the new password.	→	

Step			Display/Result
6.	Drive returns to the parameter display.	→	A1-04
7.	Press V and scroll to A1-01.	→	A1-01
8.	Press ENTER to display the value set to A1-01. If the first "0" blinks, parameter settings are unlocked.	→	0002
9.	Use RESET, V and Λ to change the value if desired.	→	
10.	Press ENTER to save the setting, or press ESC to return to the previous display without saving changes.	→	End
11.	The display automatically returns to the parameter display.	→	A1-01

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 o4-13	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-oo 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

■ b1-02: 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 1	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.

■ 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 or 1	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.

■ 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	1

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: Make sure that the elevator moves in the correct direction when an Up or Down command is issued.

◆ 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.	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 5.1* illustrates the timer function operation:

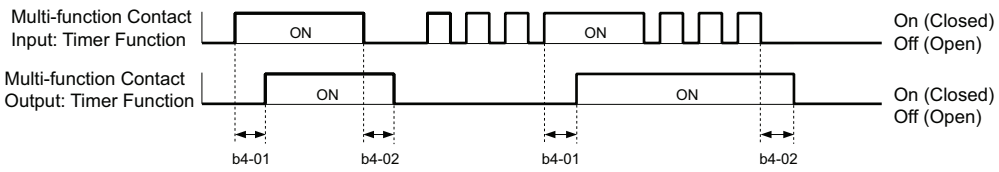


Figure 5.1 Timer Operation

◆ 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 5.2 shows how the Dwell function works.

Note: Set the stopping method to "Ramp to Stop" (b1-03 = 0) to use the Dwell function.

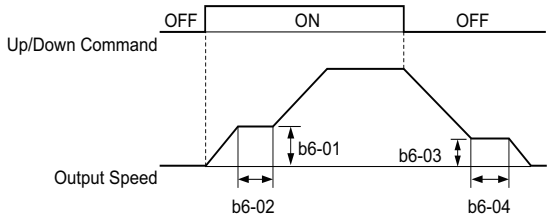


Figure 5.2 Dwell Function at Start and Stop

■ 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.	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.	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.

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		
C1-06	Deceleration Ramp 3		
C1-07	Acceleration Ramp 4		
C1-08	Deceleration Ramp 4		

<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/s² or ft/s². 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 5.5*.

Table 5.5 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 5.3 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).

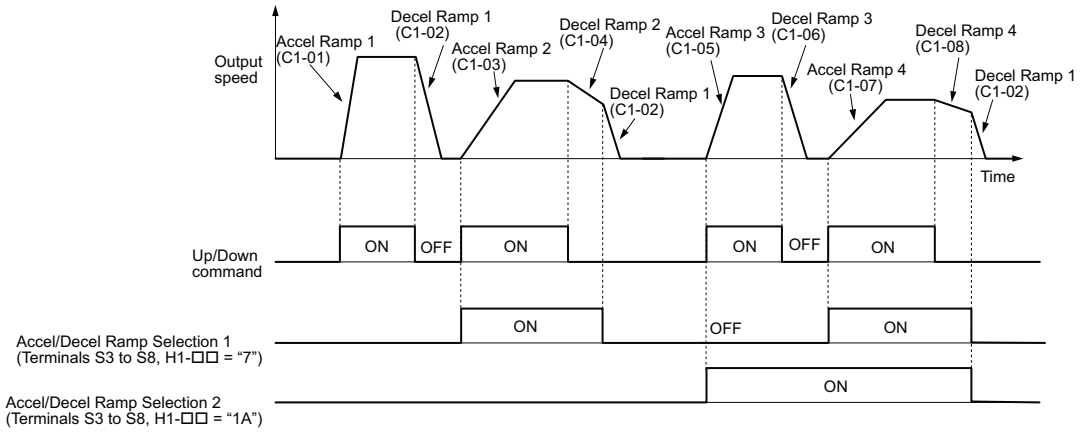


Figure 5.3 Timing Diagram of Accel/Decel Ramp Change

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 5.4* 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.

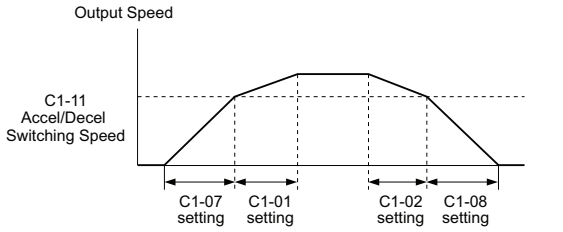


Figure 5.4 Accel/Decel Switching Speed

■ 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 110*.

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: Emergency 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 Emergency Stop operation; it does not have to be closed continuously. The drive cannot be restarted after initiating an Emergency Stop operation until after completing deceleration, clearing the Emergency Stop input, and cycling the Up/Down command.

An Emergency 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	Emergency 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/s² or ft/s². If the drive is in V/f control mode, the Emergency 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 Emergency 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

■ C1-15: Inspection Deceleration Ramp

Sets the deceleration ramp during Inspection Run. Refer to *Inspection Operation on page 89* 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.

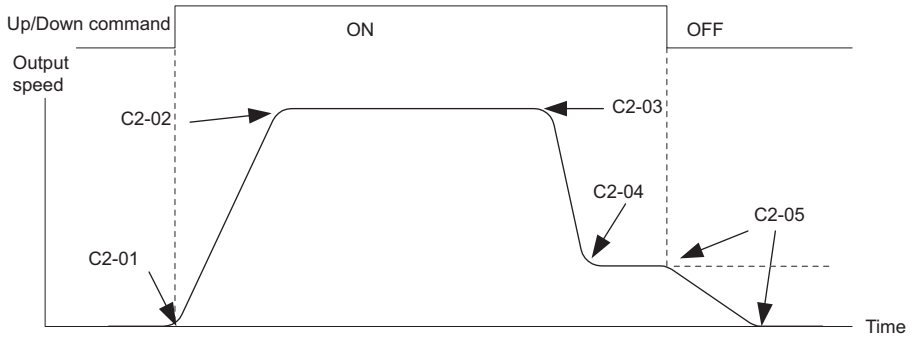


Figure 5.5 Jerk Settings

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 5.6***.

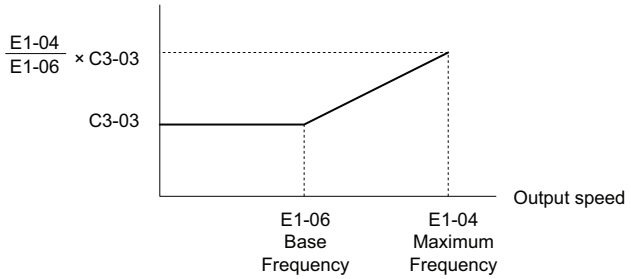


Figure 5.6 Slip Compensation Limit

■ 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	0

Setting 0: Disabled

Setting 1: Enabled

◆ 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

◆ C5: Speed Control Loop

The Speed Control Loop controls the motor speed in OLV and in simple closed loop (V/f and OLV) control modes. It adjusts torque reference in order to minimize the difference between speed reference and actual motor speed.

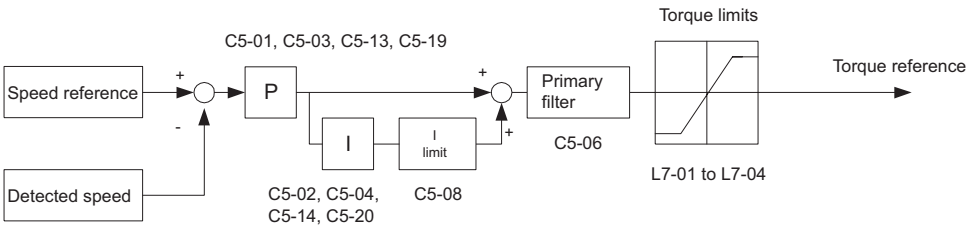


Figure 5.7 Speed Control Block Diagram

■ 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 *H4: Multi-Function Analog Outputs on page 134* 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%. 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.

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 115*.

Perform the following steps for adjusting Speed Control Loop parameters:

1. Check parameter C5-07 and set a speed loop setting switching point.
2. Start a trip and check for any problems like rollback, vibration, overshoot, etc.
3. Adjust C5-03/04 in order to improve the performance at start. Increase C5-03, then shorten C5-04 if the speed response is slow. Set them in the opposite way if vibration occurs.
4. 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.
5. 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.
6. Repeat steps 2 to 5 until the desired riding comfort has been reached. Also refer to *Riding Comfort Related Problems on page 97*.

■ 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	Determined by A1-02
C5-13	Speed Control Loop Proportional Gain 3	0.00 to 300.00	0.20 s
C5-14	Speed Control Loop Integral Time 3	0.000 to 10.000 s	0.200 s

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.

■ C5-05: Speed Control Loop Upper Limit

Sets the upper limit for the speed control loop (ASR) as a percentage of the maximum output frequency (E1-04).

No.	Parameter Name	Setting Range	Default
C5-05	Speed Control Loop Upper Limit	0.0 to 20.0 %	5.0 %

■ 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 5.8* and *Figure 5.9*.

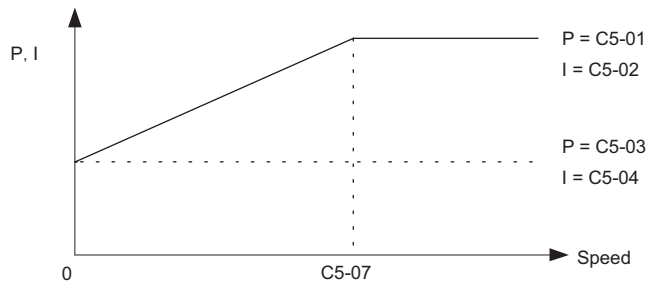


Figure 5.8 Settings at Low and High Speed during Acceleration

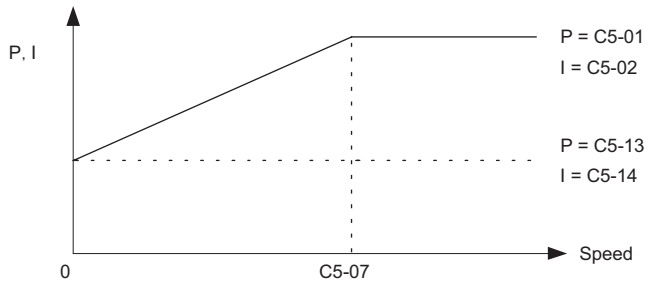


Figure 5.9 Settings at Low and High Speed during Deceleration (Leveling Speed is Selected)

■ C5-40: ASR Start Speed

Sets the speed level from which the ASR Slip Compensation starts to operate while the Standard Slip Compensation (C3-☐☐) is shut down. This function is only activated when in simple closed loop control (H6-01=3)

No.	Parameter Name	Setting Range	Default
C5-40	**ASR Start Speed**	0.0 to 100.00 %	2.50 %

◆ C6: Carrier Frequency

■ C6-02: Carrier Frequency Selection

Sets the carrier frequency for the PWM output.

No.	Parameter Name	Setting Range	Default
C6-02	Carrier Frequency Selection	1 to 6	3

1: 2.0 kHz
2: 5.0 kHz
3: 8.0 kHz
4: 10.0 kHz
5: 12.5 kHz
6: 15.0 kHz

Note: *Refer to Carrier Frequency Derating on page 220* when using a carrier frequency setting above 8.0 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 120.00 Hz <1>	0.00 Hz <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 250* for details.

Refer to *Multi-Speed Inputs 1, 2 (d1-18 = 0 or 3) on page 86* for details.

■ d1-18: Speed Reference Selection Mode

Sets the priority of the speed reference inputs.

No.	Parameter Name	Setting Range	Default
d1-18	Speed Reference Selection Mode	0 to 2	1

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 86* 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 86* 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 86* for details.

■ d1-19: Nominal Speed

Sets the nominal speed when a multi-function input terminal is programmed for “Nominal speed” (H1-☐☐ = 50).

No.	Name	Setting Range	Default
d1-19	Nominal Speed	0.00 to 120.00 Hz <1>	50.00 Hz <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 250* for details.

■ d1-20, d1-21, d1-22: Intermediate Speeds 1 to 3

Sets intermediate speeds 1 through 3.

No.	Name	Setting Range	Default
d1-20	Intermediate Speed 1	0.00 to 120.00 Hz <1>	0.00 Hz <1>
d1-21	Intermediate Speed 2	0.00 to 120.00 Hz <1>	0.00 Hz <1>
d1-22	Intermediate Speed 3	0.00 to 120.00 Hz <1>	0.00 Hz <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 250* for details.

■ d1-23: Releveling Speed

Sets the releveling speed when a multi-function input terminal is programmed for “Releveling speed” (H1-□□ = 52).

No.	Name	Setting Range	Default
d1-23	Releveling Speed	0.00 to 120.00 Hz <1>	0.00 Hz <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 250* 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 89*.

No.	Name	Setting Range	Default
d1-24	Inspection Operation Speed	0.00 to 120.00 Hz <1>	0.00 Hz <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 250* for details.

■ d1-25: Rescue Operation Speed

Determines the speed during Rescue Operation. Refer to *Rescue Operation on page 91* for details.

No.	Name	Setting Range	Default
d1-25	Rescue Operation Speed	0.00 to 15.00 Hz <1>	5.00 Hz <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 250* for details.

■ d1-26: Leveling Speed

Sets the inspection speed when a multi-function input terminal is programmed for “Leveling speed” (H1-□□ = 53).

No.	Name	Setting Range	Default
d1-26	Leveling Speed	0.00 to 120.00 Hz <1>	4.00 Hz <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 250* for details.

■ 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 114* for details.

No.	Name	Setting Range	Default
d1-28	Leveling Speed Detection Level	0.00 to 120.00 Hz	0.00 Hz

■ 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 89* for details.

No.	Name	Setting Range	Default
d1-29	Inspection Speed Detection Level	0.00 to 120.00 Hz	0.00 Hz

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	200 V

<1> Values shown here are specific to 200 V class drives; double the values for 400 V class drives.

E1-01 Related Values

The input voltage setting determines the overvoltage and undervoltage detection levels.

Voltage	Setting Value of E1-01	(Approximate Values)		
		ov Detection Level	Braking Transistor Operation Level	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

Note: 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.

■ V/f Pattern Settings E1-04 to E1-13

Figure 5.10 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>
E1-05	Maximum Voltage	0.0 to 255.0 V <2>	190.0 V <2>
E1-06	Base Frequency	0.0 to 120.0 Hz	<1>
E1-07	Middle Output Frequency	0.0 to 120.0 Hz	<1>
E1-08	Middle Output Frequency Voltage	0.0 to 255.0 V <2>	<1> <2> <4>
E1-09	Minimum Output Frequency	0.0 to 120.0 Hz	<1>
E1-10	Minimum Output Frequency Voltage	0.0 to 255.0 V <2>	<2> <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 <2>	0.0 V <2>
E1-13	Base Voltage	0.0 to 255.0 V <2>	0.0 V <2> <6>

<1> Default setting is determined by the control mode (A1-02).
<2> 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.

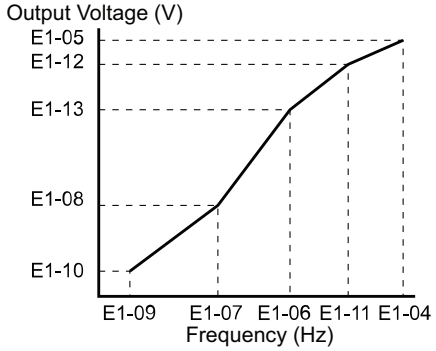


Figure 5.10 V/f Pattern

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 and Stationary Auto-Tuning). If Auto-Tuning cannot be performed, then manually enter the motor data directly to these parameters.

■ 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: 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).

No.	Parameter Name	Setting Range	Default
E2-02	Motor Rated Slip	0.00 to 20.00 Hz	Determined by o2-04

If Auto-Tuning cannot be performed, calculate the motor slip using the information on the motor nameplate and the formula below:

E2-02 = f - (n . p) / 120

f: rated frequency [Hz], n: motor rated speed [r/min], p: number of motor poles

■ 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, Stationary Auto-Tuning). 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

■ 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).

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

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.

5.6 F: Simple FeedbackSettings

◆ F1: Encoder/PG Feedback Settings

The F1 parameters are used to set the drive up for single channel simlpe closed loop operation using the pulse train input.

■ 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)

5.7 H: Terminal Functions

H parameters are used to assign functions to the external terminals.

◆ H1: Multi-Function Digital Inputs

■ H1-03 to H1-07: Functions for Terminals S3 to S7

These parameters assign functions to the multi-function digital inputs. The various functions and their settings are listed in *Table 5.6*.

No.	Parameter Name	Setting Range	Default
H1-03	Terminal S3 Function Selection	3 to 79	50: Nominal Speed
H1-04	Terminal S4 Function Selection	3 to 79	51: Intermediate Speed
H1-05	Terminal S5 Function Selection	3 to 79	52: Releveling Speed
H1-06	Terminal S6 Function Selection	3 to 79	53: Leveling Speed
H1-07	Terminal S7 Function Selection	3 to 79	F: Not Used

Table 5.6 Multi-Function Digital Input Terminal Settings

Setting	Function	Page	Setting	Function	Page
3	Multi-Step Speed Reference 1	*124*	20 to 2F	External Fault	*125*
4	Multi-Step Speed Reference 2		40	Forward Run/Stop	*126*
5	Multi-Step Speed Reference 3		41	Reverse Run/Stop	*126*
7	Accel/decel Ramp Selection 1	*124*	50	Nominal Speed	*126*
8	Baseblock Command (N.O.)	*124*	51	Intermediate Speed	*126*
9	Baseblock Command (N.C.)		52	Releveling Speed	*126*
F	Not used (Through Mode)	*124*	53	Leveling Speed	*126*
14	Fault Reset	*125*	54	Inspection Operation	*126*
15	Emergency Stop (N.O.)	*125*	55	Rescue Operation	*126*
17	Emergency Stop (N.C.)	*125*	56	Motor Contactor Feedback	*126*
18	Timer Function Input	*125*	79	Brake Feedback	*127*
1A	Accel/decel Ramp Selection 2	*125*	-		-

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 86* for details.

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 109* for details.

Setting 8, 9: Baseblock command (N.O., N.C.)

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.C.)	Baseblock (Interrupt output)	Normal operation
Setting 9 (N.O.)	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 using the terminal in a 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.

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: Emergency Stop Ramp on page 110*). 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 5.11 shows an operation example of Emergency Stop.

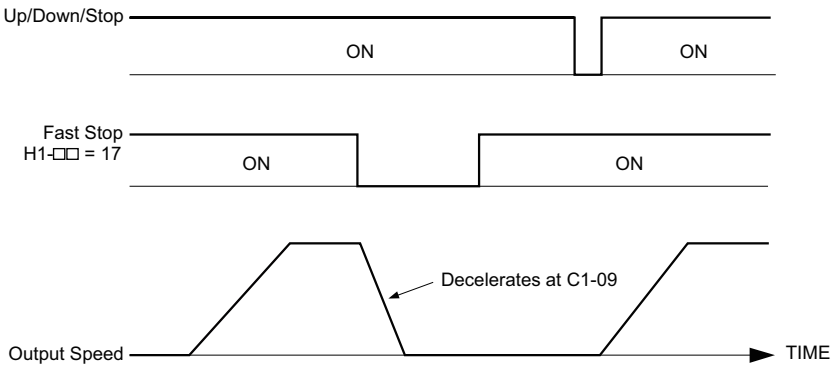


Figure 5.11 Fast Stop Sequence

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 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 107* 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 109* 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)	Emergency 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 40: Forward Run/Stop

Closing a terminal set for Forward Run/Stop will initiate the drive starting sequence in the forward direction. Opening the terminal will initiate the drive stopping sequence. This function is set by default to digital input S1. If more than one digital input is assigned this function an oPE fault will occur.

Setting 41: Reverse Run/Stop

Closing a terminal set for Reverse Run/Stop will initiate the drive starting sequence in the reverse direction. Opening the terminal will initiate the drive stopping sequence. This function is set by default to digital input S2. If more than one digital input is assigned this function an oPE fault will occur.

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 86* 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 86*. 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 86* 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 86* 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 89* for details.

Setting 55: Rescue operation

Initiates Rescue Operation when the terminal closes. Refer to *Rescue Operation on page 91* 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 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 H2-03: Terminals MA-MB-MC, MD-ME-MF and P1-PC Function Selection

The drive has three multi-function output terminals. Two are relay outputs (M☐) and one is a photocoupler output (P1-PC). *Table 5.7* lists the functions available for theses terminals using H2-01 through H2-03.

No.	Parameter Name	Setting Range	Default
H2-01	Terminals MA-MB-MC Function Selection	0 to 158	E: Fault
H2-02	Terminals P1-PC Function Selection	0 to 158	6: Drive Ready
H2-03	Terminals MD-ME-MF Function Selection	0 to 158	50: Brake Control

Table 5.7 Multi-Function Digital Output Terminal Settings

Setting	Function	Page	Setting	Function	Page
0	During Run	*127*	15	Speed Detection 3	*131*
1	Zero Speed	*127*	16	Speed Detection 4	*131*
2	Speed Agree 1	*128*	18	Torque Detection 2	*130*
3	User-set Speed Agree 1	*128*	1A	During Reverse	*132*
4	Speed Detection 1	*128*	1B	During Baseblock 2 (N.C.)	*132*
5	Speed Detection 2	*129*	1E	Restart Enabled	*132*
6	Drive Ready	*129*	1F	Motor Overload Alarm (oL1)	*132*
7	DC Bus Undervoltage	*129*	20	Drive Overheat Pre-alarm (oH)	*132*
8	During Baseblock (N.O.)	*130*	2F	Maintenance Period	*133*
B	Torque Detection 1	*130*	30	During Torque Limit	*133*
E	Fault	*130*	37	During Frequency Output	*133*
F	Not used (Through Mode)	*130*	50	Brake Control	*133*
10	Minor Fault	*130*	51	Output Contactor Control	*133*
11	Fault Reset Command Active	*130*	54	Light Load Direction	*133*
12	Timer Output	*130*	55	Light Load Direction Detection Status	*133*
13	Speed Agree 2	*130*	58	Safe Disable Status	
14	User-set Speed Agree 2	*131*	100 to 158	Functions 0 to 58 with Inverse Output	*133*

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 (simple closed loop) falls below the minimum output speed set to E1-09 or S1-01.

Status	Description
Open	The operating speed is faster than the minimum output frequency (E1-09) and the zero speed level at stop (S1-01).
Closed	The operating speed is below the minimum output frequency (E1-09) and the zero speed level at stop (S1-01).

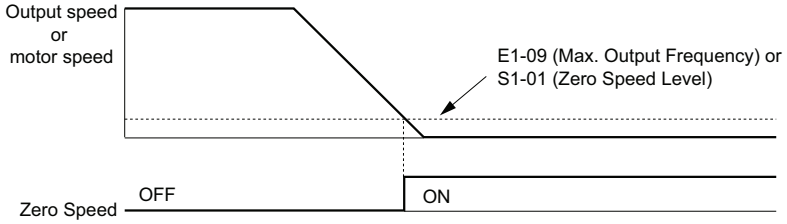


Figure 5.12 Zero-Speed Time Chart

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.

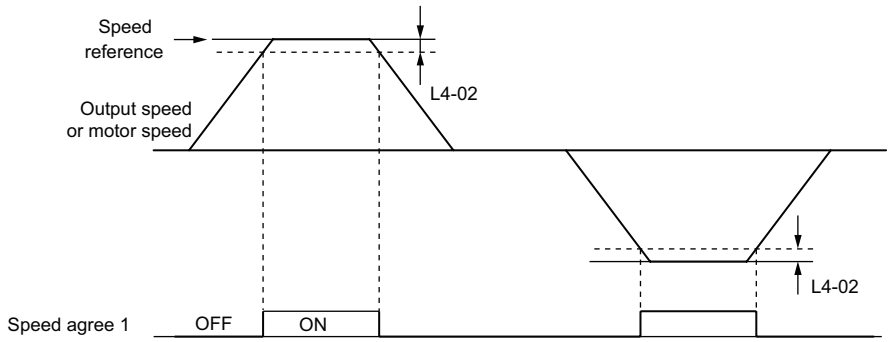


Figure 5.13 Speed Agree 1 Time Chart

Refer to *L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 140* 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.

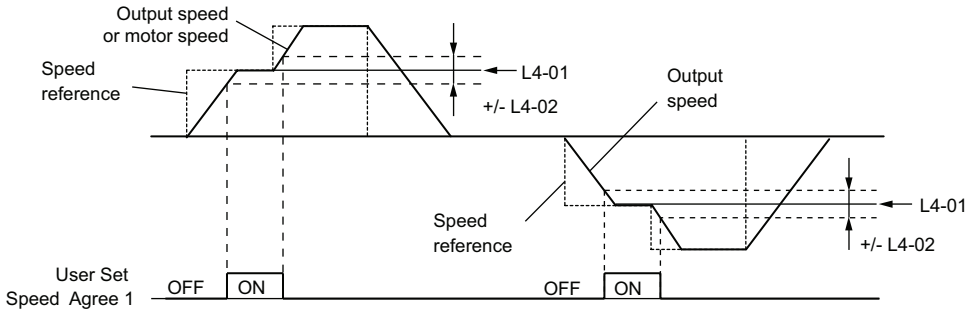


Figure 5.14 User Set Speed Agree 1 Time Chart

Refer to *L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 140* for more instructions.

Setting 4: Speed Detection 1

Output opens when the output speed 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.

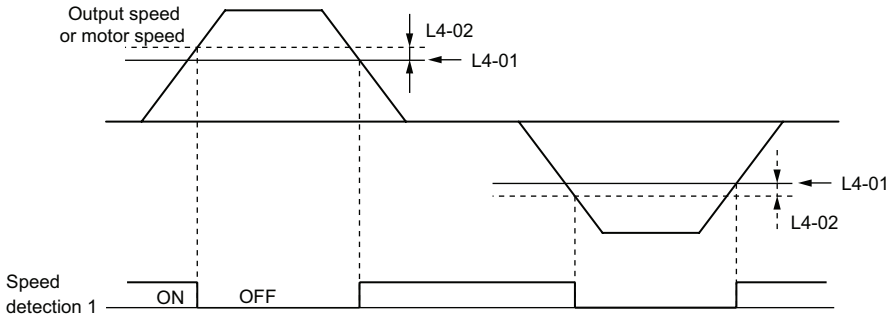


Figure 5.15 Speed Detection 1 Time Chart

Refer to *L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 140* for more details.

Setting 5: Speed Detection 2

Output closes whenever the output speed or motor speed 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.

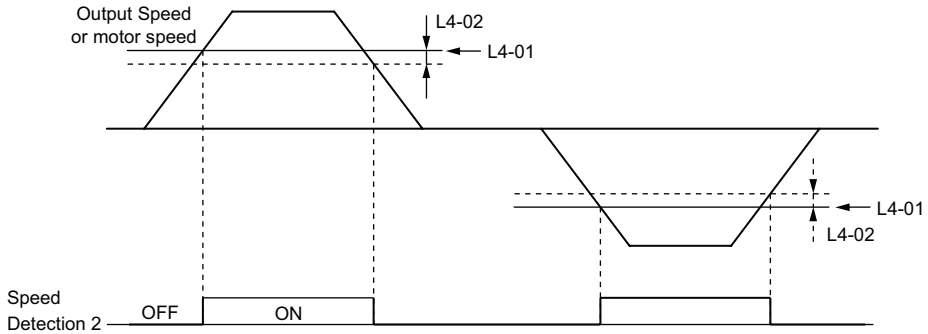


Figure 5.16 Speed Detection 2 Time Chart

Refer to *L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 140* for more details.

Setting 6: Drive 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 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 142* 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 107* for details.

Setting 13: Speed agree 2 (f_{ref} /f_{out} agree 2)

Closes whenever the actual output speed or motor speed (simple closed loop) 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.

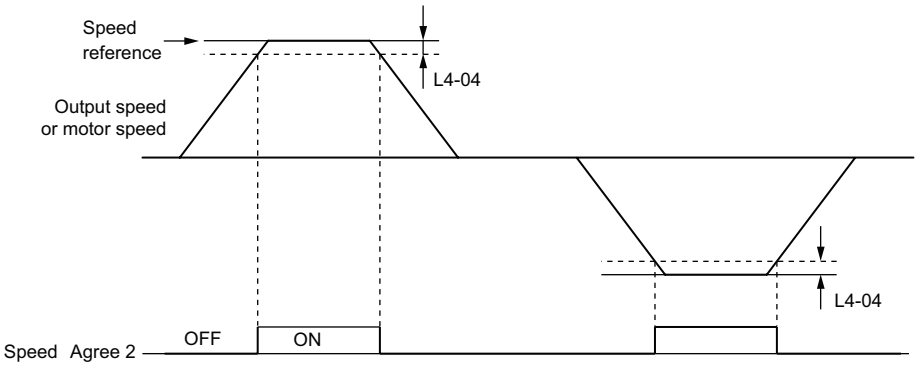


Figure 5.17 Speed Agree 2 Time Chart

Refer to *L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 140* 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 (simple closed loop) 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

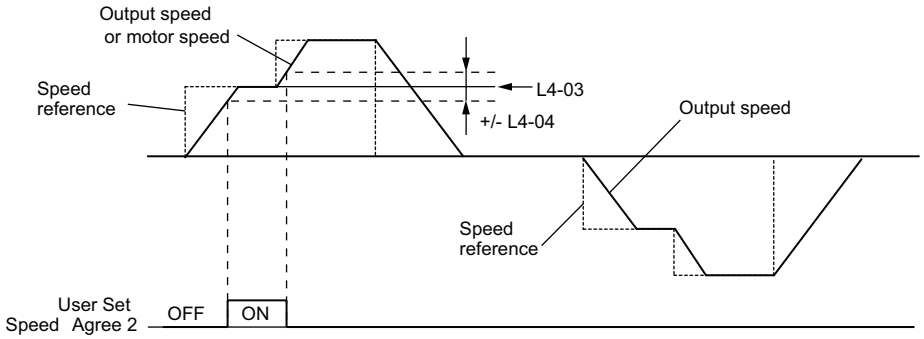


Figure 5.18 User Set Speed Agree 2 Example with a Positive L3-04 Value

Refer to *L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 140* for more details.

Setting 15: Speed detection 3

Output opens when the output speed or motor speed (simple closed loop) 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.

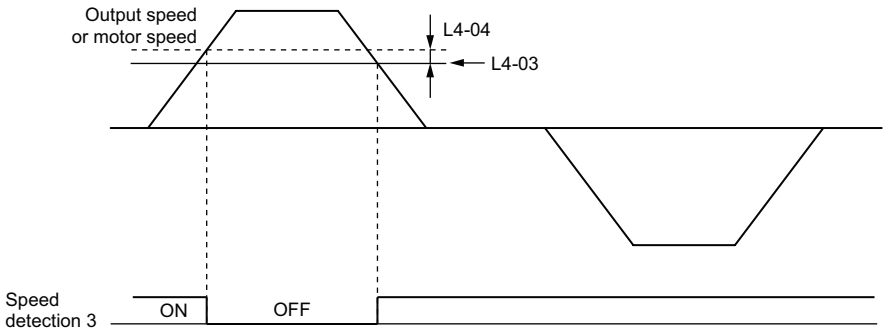


Figure 5.19 Speed Detection 3 Example with a Positive L3-04 Value

Refer to *L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 140* for more details.

Setting 16: Speed detection 4

Output closes whenever the output speed or motor speed (simple closed loop) 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.

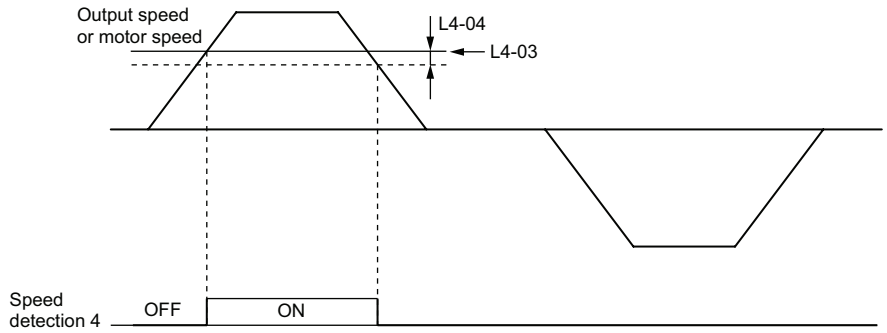


Figure 5.20 Speed Detection 4 Example with Positive L3-04 Value

Refer to *L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 140* 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.

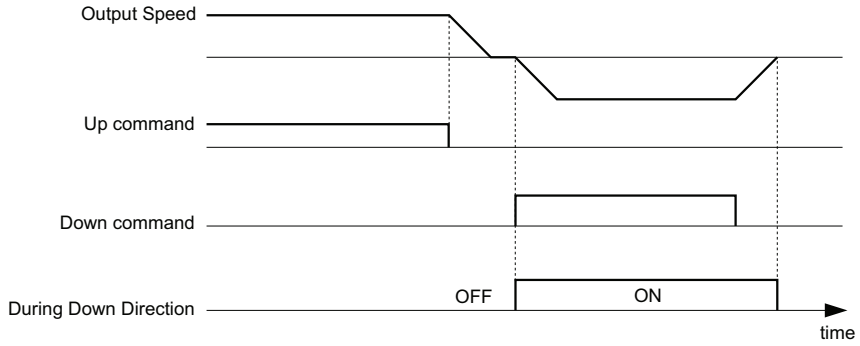


Figure 5.21 Down Direction Output Example Time Chart

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 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 140* 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 144* 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 195* 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 144* for details.

Setting 37: During frequency output

Output closes when the drive is outputting a frequency.

Status	Description
Open	Drive is stopped or one of the following functions is being performed: baseblock, DC Injection Braking, Short Circuit Braking.
Closed	Drive is outputting frequency.

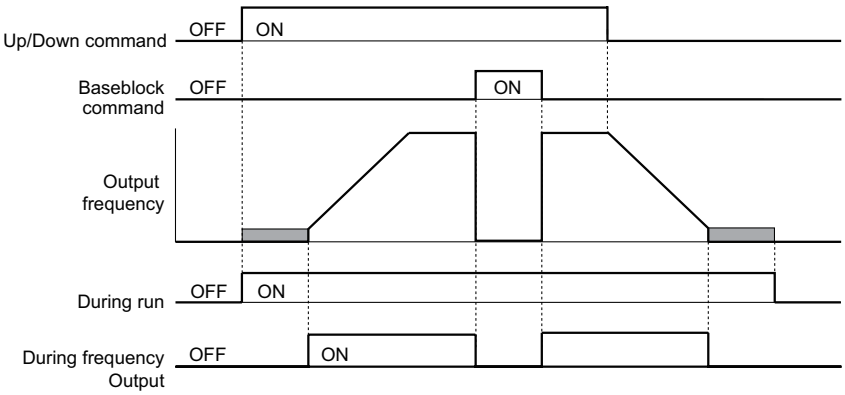


Figure 5.22 During Frequency Output Time Chart

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 90* 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 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 94* 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 94* for details.

Setting 58: Safe disable status

This terminal closes if the Safe Disable inputs H1-HC are closed and opens when terminals H1-HC are open.

Note: This digital output function is only available on L1000V drives with firmware version 7011 and later.

Setting 100 to 158: Functions 0 to 58 with Inverse Output

These settings have the same function as settings 0 to 58 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.

◆ H4: Multi-Function Analog Outputs

These parameters assign a function to analog output terminal AM for monitoring a specific aspect of drive performance.

■ H4-01: Terminal AM Monitor Selection

Sets the desired drive monitor parameter U☐-☐☐ to output as an analog value via terminal AM. Refer to *U: Monitor Parameters on page 161* 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.	Name	Setting Range	Default
H4-01	Terminal FM Monitor Selection	000 to 999	102

A setting of 031 or 000 applies no drive monitor to the analog output. With this setting, terminal functions as well as 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 AM Gain and Bias

Parameter H4-02 sets the terminal AM output signal level equal to 100% of the monitor (gain). Parameter H4-03 sets the bias added to the monitor output for terminal 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.

No.	Name	Setting Range	Default
H4-02	Terminal AM Gain	-999.9 to 999.9%	100.0%
H4-03	Terminal AM Bias	-999.9 to 999.9%	0.0%

Using Gain and Bias to Adjust Output Signal Level

When viewing a gain setting parameter (H4-02) on the digital operator, the analog output will supply a voltage signal equal to 100% of the monitor value (including changes made from bias and gain settings). When viewing a bias setting parameter (H4-03), the analog output voltage will supply a signal equal to 0% monitor value (including changes made from bias and gain settings).

Example 1: Set H4-02 to 50% for an output signal of 5 V at terminal AM when the monitored value is at 100%.

Example 2: Set H4-02 to 150% for an output signal of 10 V at terminal AM when the monitored value is at 76.7%.

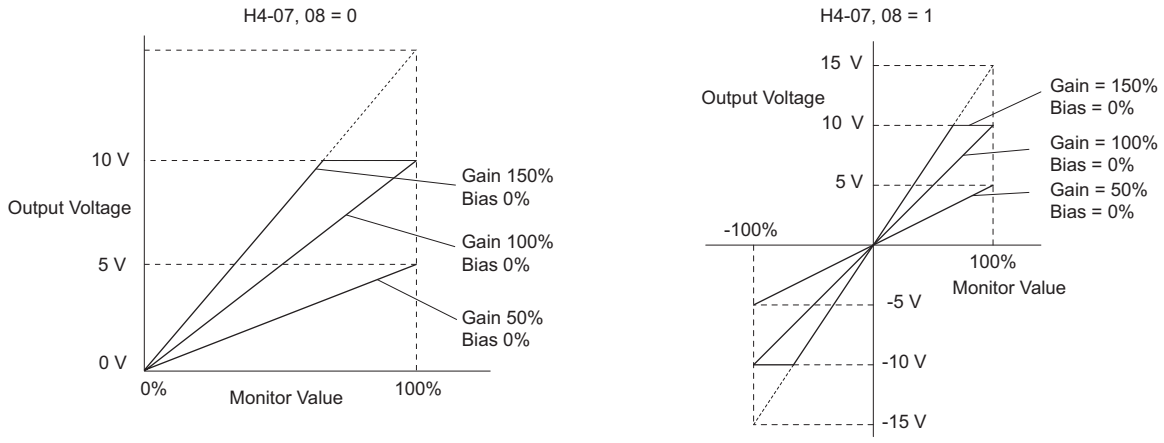


Figure 5.23 Analog Output Gain and Bias Setting Example 1 and 2

Example 3: Set H4-03 to 30% for an output signal of 3 V at terminal AM when the monitored value is at 0%.

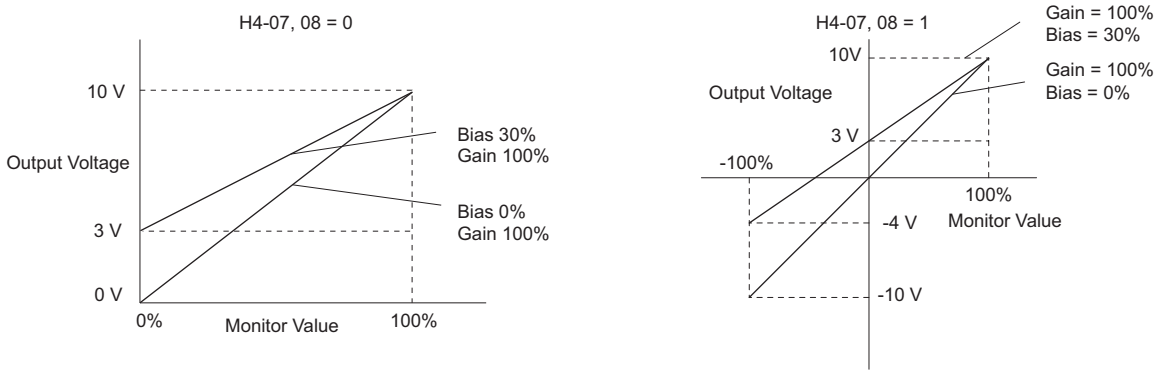


Figure 5.24 Analog Output Gain and Bias Setting Example 3

◆ H6: Pulse Train Input

A one track pulse train signal with a maximum frequency of 32 kHz can be input to the drive at terminal RP. This pulse train signal can be used as the speed feedback signal for simple closed loop control.

Use parameters H6-□□ to set up this function.

■ H6-01: Terminal RP Function Selection

Selects the function for pulse train input terminal RP.

No.	Name	Setting Range	Default
H6-01	Terminal RP Function Selection	3, F	F

Setting 3: PG Feedback

The signal received at the pulse train input RP is interpreted as a single track encoder signal for simple closed loop control. When using this function remember to set the encoder pulse count in paramter H6-09.

Setting F: Not Used

■ H6-03: Pulse Train Input Gain

Sets the output level when the pulse train input is at 100 % as a percentage of maximum output frequency (E1-04).

No.	Name	Setting Range	Default
H6-03	Pulse Train Input Gain	0.0 to 1000.0 %	100.0 %

■ H6-04: Pulse Train Input Bias

Sets the level of the value selected in H6-01 when a 0 Hz signal is input to terminal RP.

No.	Name	Setting Range	Default
H6-04	Pulse Train Input Bias	-100.0 to 100.0 %	0.0 %

■ H6-05: Pulse Train Input Filter Time

Sets the pulse train input filter time constant in seconds.

The pulse train input filter time is useful for preventing noise interference from causing erroneous operation when operating the drive with the pulse train signal. Increasing the filter time constant makes the noise suppression more efective but lengthens drive speed response time.

No.	Name	Setting Range	Default
H6-05	Pulse Train Input Filter Time	0.00 to 2.00 s	0.10 s

■ H6-09: PG Pulse Number

Sets the number of pulses per revolution of the encoder used for feedback.

No.	Name	Setting Range	Default
H6-09	PG Pulse Number	500 to 10000 ppr	1024 ppr

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.	Name	Setting Range	Default
L1-01	Motor Overload Protection Selection	0 to 3	1

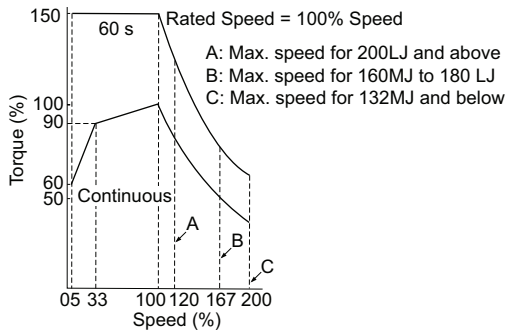
Note: **1.** When the motor protection function is enabled (L1-01≠ 0), an oL1 alarm can be output through one of the multi-function outputs by setting H2-01 to 1F. The output will close when the motor overload level reaches 90% of the oL1 detection level.
2. Set L1-01 to a value between 1 and 5 when 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.

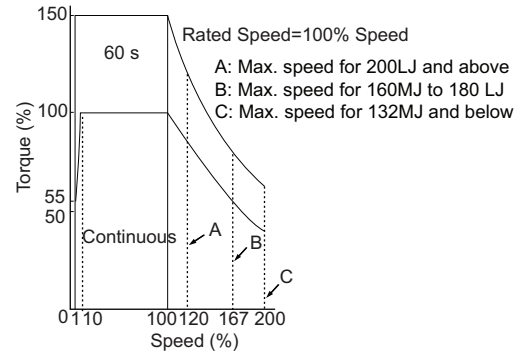
Setting 1: General-purpose motor (standard self-cooled)

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.

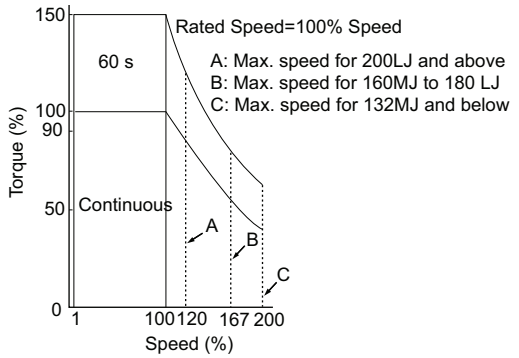
Setting 2: Drive dedicated motor (speed range for constant torque: 1:10)

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.

■ L1-02: Motor Overload Protection Time

Sets the detection time of motor overheat due to overload. This setting rarely requires adjustment, but should correlate with the motor overload tolerance protection time for performing a hot start.

No.	Name	Setting Range	Default
L1-02	Motor Overload Protection Time	0.1 to 5.0 minutes	1.0 minutes

Defaulted to operate with an allowance of 150% overload operation for one minute in a hot start.

Figure 5.25 illustrates 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.

During normal operation, motor overload protection operates in the area between a cold start and a hot start.

- Cold start: Motor protection operation time in response to an overload situation that was suddenly reached when starting a stationary motor.
- Hot start: Motor protection operation time in response to an overload situation that occurred during sustained operation at rated current.

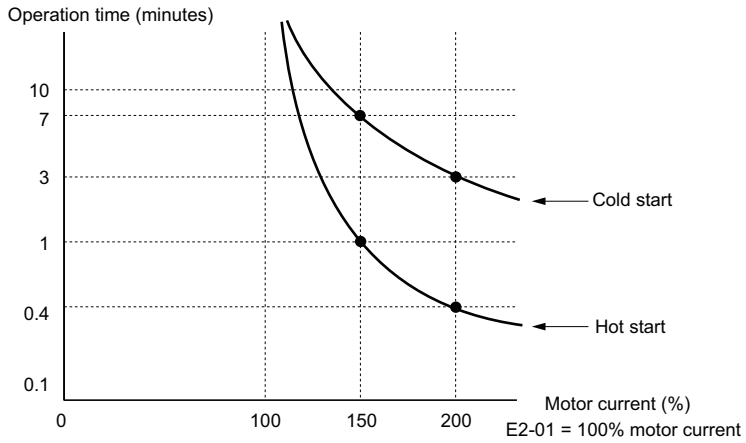


Figure 5.25 Motor Protection Operation Time

■ 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.	Name	Setting Range	Default
L1-13	Continuous Electrothermal Operation Selection	0 or 1	1

Setting 0: Disabled
Setting 1: Enabled

◆ 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.	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 and operating at constant speeds.

■ 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 should used during acceleration.

No.	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.

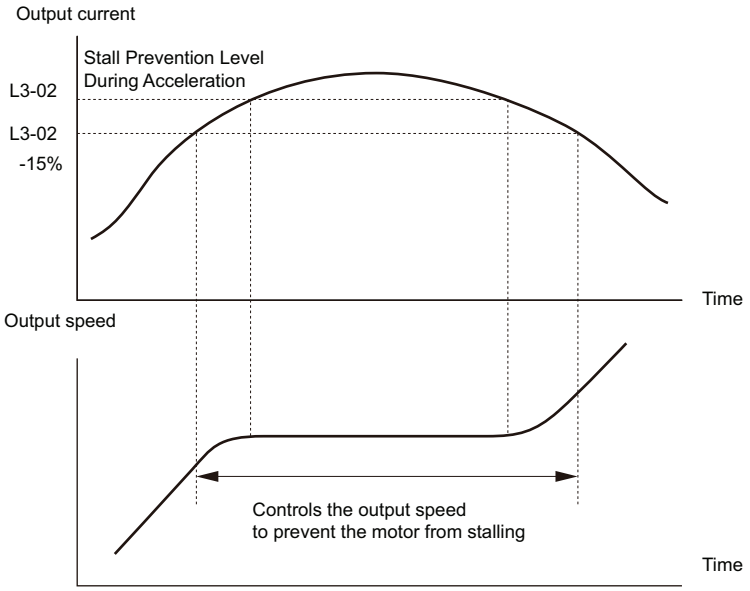


Figure 5.26 Stall Prevention During Acceleration for Induction Motors

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.	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.

■ L3-03: Stall Prevention Limit during Acceleration

Sets the lower limit for stall prevention during acceleration, as a percentage of the drive's rated current, when operating in the constant power region (output frequency above E1-06).

No.	Name	Setting Range	Default
L3-03	Stall Prevention Limit during Acceleration	0 to 100%	50%

■ 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.	Name	Setting Range	Default
L3-05	Stall Prevention Selection during Run	0 to 1	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.

■ L3-06: Stall Prevention Level during Run

Sets the Stall Prevention level during run as a percentage of the drive rate output current.

No.	Name	Setting Range	Default
L3-06	Stall Prevention Level during Run	30 to 165%	<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.	Name	Setting Range	Default
L4-01	Speed Agreement Detection Level	0.0 to 120.0 Hz	0.0 Hz
L4-02	Speed Agreement Detection Width	0.0 to 20.0 Hz	2.0 Hz

For more details on speed agree and speed detection settings, refer to *H2-01 to H2-03: Terminals MA-MB-MC, MD-ME-MF and P1-PC Function Selection on page 127*.

■ 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.	Name	Setting Range	Default
L4-03	Speed Agreement Detection Level (+/-)	-120.0 to 120.0 Hz	0.0 Hz
L4-04	Speed Agreement Detection Width (+/-)	0.0 to 20.0 Hz	2.0 Hz

For more details on speed agree and speed detection settings, refer to *H2-01 to H2-03: Terminals MA-MB-MC, MD-ME-MF and P1-PC Function Selection on page 127*.

◆ 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. The maximum number of resets can be selected as well as the operation mode of the fault relay.

WARNING! *Sudden Movement Hazard. Do not use the fault reset function in lifting applications. Fault reset may cause the machine to drop the load, which could result in death or serious injury.*

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.

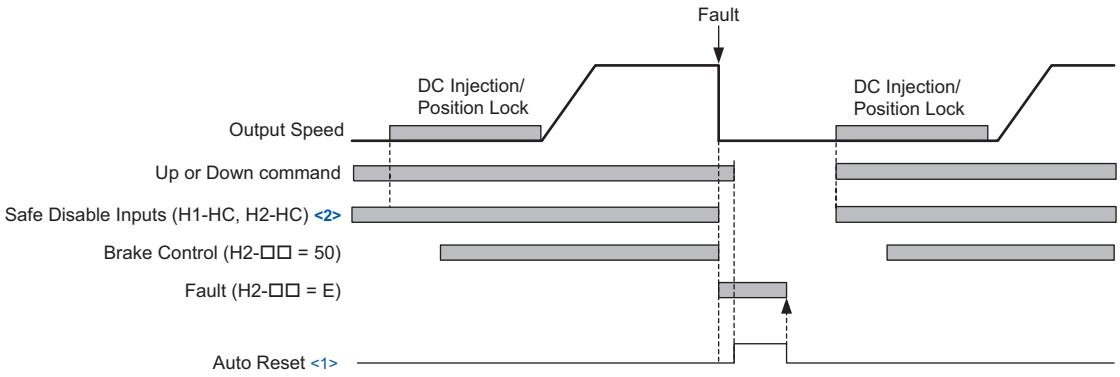


Figure 5.27 Fault Reset Time Chart

<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 parameters L5-04 and 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.	Name	Setting Range	Default
L5-01	Number of Auto Reset Attempts	0 to 10 Times	2 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.	Name	Setting Range	Default
L5-02	Fault Output Operation during Auto Reset	0 or 1	1

Setting 0: No fault output

Setting 1: Fault output is set

■ L5-04: Fault Reset Interval Time

Sets a time interval that must pass before another reset attempt can be made. A setting of 0.0 disables this parameter.

No.	Name	Setting Range	Default
L5-04	Fault Reset Interval Time	0.5 to 600.0 s	10.0 s

■ L5-06: Undervoltage Fault Reset Selection

Determines whether a limit should be placed on the number of reset attempts after a Uv1 fault.

No.	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 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 5.28 and *Figure 5.29* show the function of overtorque and undertorque detection.

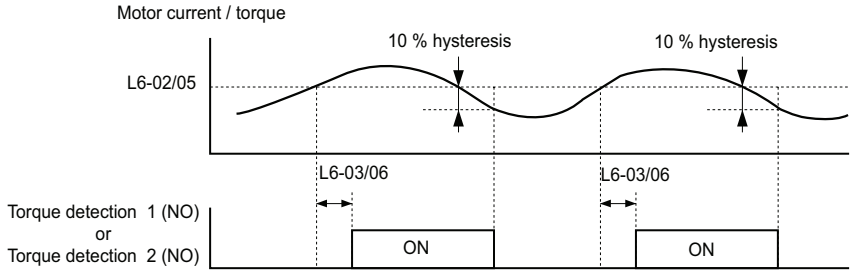


Figure 5.28 Overtorque Detection Operation

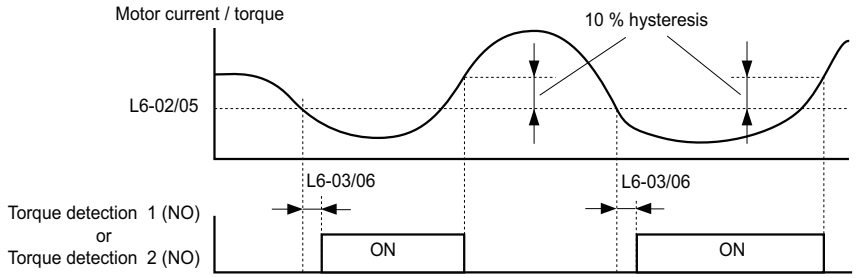


Figure 5.29 Undertorque Detection Operation

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.	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.

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.	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.	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 vector 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 5.30* 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.

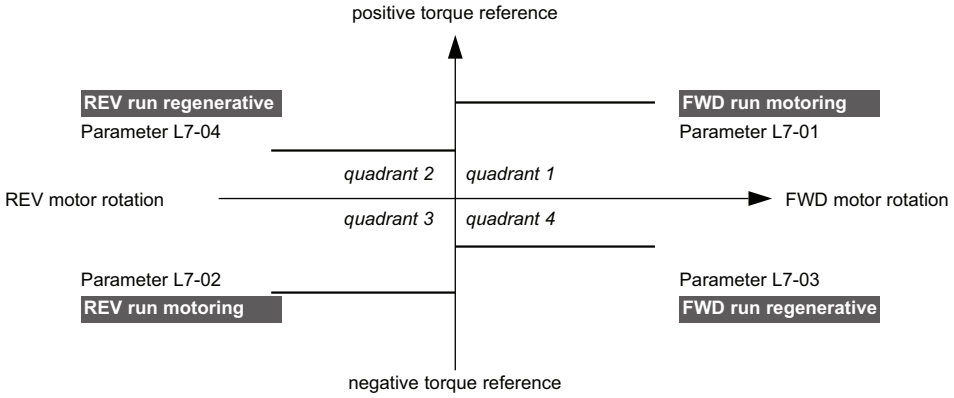


Figure 5.30 Torque Limit Parameters

■ L7-01 to L7-04: Torque Limits

These parameters set the torque limits in each operation mode.

No.	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%

■ L7-06: Torque Limit Integral Time

Sets the integral time constant for the torque limit. Increasing this value will reduce the degree to which the frequency reference changes when the torque limit is reached.

No.	Name	Setting Range	Default
L7-06	Torque Limit Integral Time	5 to 10000 ms	200 ms

■ L7-07: Torque Limit Control Method during Accel/Decel

Sets the method of torque limit controls during acceleration and deceleration. Adjustment of this parameter is usually not required. When torque limits are applied, accel/decel time may increase and the motor may not run at the indicated speed reference.

No.	Name	Setting Range	Default
L7-07	Torque Limit Control Method	0 to 1	0

Setting 0: Proportional Control (uses Integral control at constant speed)
Setting 1: Intergal Control

◆ 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.	Name	Setting Range	Default
L8-02	Overheat Alarm Level	50 to 130 °C	Determined by o2-04

■ L8-03: Overheat Pre-Alarm Operation Selection

Sets the operation when an overheat pre-alarm is detected.

No.	Name	Setting Range	Default
L8-03	Overheat Pre-Alarm Operation Selection	0 to 4	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.

Setting 4: Run at Frequency set to L8-19
If an overheat alarm occurs, the drive will lower the output frequency according to the rate set in parameter L8-19.

■ L8-05: Input Phase Loss Protection Selection

Enables or disables the input phase loss detection.

No.	Name	Setting Range	Default
L8-05	Input Phase Loss Protection Selection	0 to 1	Determined by o2-04

Setting 0: Disabled
Setting 1: Enabled

■ L8-07: Output Phase Loss Protection

Enables or disables the output phase loss detection, which is triggered when the output current falls below 5% of the drive rated current.

Note: 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.

No.	Name	Setting Range	Default
L8-07	Output Phase Loss Protection	0 to 2	1

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.

■ L8-09: Output Ground Fault Detection Selection

Enables or disables the output ground fault detection.

No.	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.	Name	Setting Range	Default
L8-10	Heatsink Cooling Fan Operation Selection	0 to 1	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.

■ 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.	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.	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.	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.

■ L8-18: Software Current Limit Selection

The Software Current Limit (CLA) is a drive protection function theat prevents output transistor failures caused by high current. Parameter L8-18 enables or disables this function.

Note: This setting should not be changed unless absolutely necessary. For proper drive protection and operation leave the Software CLA function enabled.

No.	Name	Setting Range	Default
L8-18	Software Current Limit Selection	0 or 1	1

Setting 0: Disabled

The drive may trip on an oC fault if the load is too heavy or the acceleration is too short.

Setting 1: Enabled

When the soft CLA current level is reached, the drive reduces output voltage in order to reduce the current. If the current level drops below the software CLA level, the normal operation will resume.

■ L8-19: Frequency Reduction Rate during oH Pre-Alarm

Defines the output frequency reduction factor when an oH Pre-Alarm is triggered and L8-03 is set to 4.

No.	Name	Setting Range	Default
L8-19	Frequency Reduction Rate During oH Pre-Alarm	0.1 to 0.9	0.8

■ 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.	Name	Setting Range	Default
L8-35	Installation Selection	0 to 3	Determined by o2-04

Setting 0: IP20 enclosure

For an IP20 enclosure drive installed with at a minimum of 30 mm space to the next drive or a cabinet wall.

Setting 1: Side-by-Side Installation

For a drive installed with less than 30 mm space to the next drive or a cabinet wall.

Setting 2: NEMA Type 1 enclosure

For drives compliant with NEMA Type 1 enclosure specifications.

Setting 3: Finless Installation

For finless drives.

■ L8-38: Carrier Frequency Reduction Selection

The drive can reduce the carrier frequency when the output current exceeds a certain level. This temporarily increases the overload capability (oL2 detection) and the drive can run through transient load peaks without tripping.

L8-38 selects the operation of the carrier frequency reduction function.

Note: Automatically lowering the carrier frequency increases motor noise.

No.	Name	Setting Range	Default
L8-38	Carrier Frequency Reduction Selection	0 to 2	Determined by o2-04

Setting 0: Disabled

The carrier frequency is not automatically reduced.

Setting 1: Enabled for Output Frequencies below 6 Hz

The carrier frequency is reduced at speeds below 6 Hz when output current exceeds 100% of drive rated current. The drive returns to its normal carrier frequency when output current falls below 88% of drive rated current or when the output frequency exceeds 7 Hz.

Setting 2: Enabled for Entire Frequency Range

The carrier frequency is reduced at the following speeds:

- At or below 6 Hz when output current exceeds 100% of drive rated current.
- Above 6 Hz when output current exceeds 112% of drive rated current.

The drive uses the delay time set in parameter L8-40 and a hysteresis of 12% when switching the carrier frequency back to its normal value.

■ L8-40: Carrier Frequency Reduction Off-Delay Time

Sets the delay time which is used to switch back to the normal carrier frequency. The carrier frequency reduction function is disabled if this value is 0 s.

No.	Name	Setting Range	Default
L8-40	Carrier Frequency Reduction Off-Delay Time	0.00 to 2.00 s	0.50 s

■ L8-41: High Current Alarm Selection

The drive can be set to trigger a high current alarm (HCA) when the output current rises too high.

No.	Name	Setting Range	Default
L8-41	High Current Alarm Selection	0 or 1	0

Setting 0: Disabled

No alarm is triggered.

Setting 1: Enabled

An alarm is triggered when the output current exceeds 150% of the drive rated current. A digital output indicating an alarm (H2-□□ = 10) can be programmed.

■ L8-43: Output Phase Loss Detection Time

Sets the amount of time that an Output Phase Loss condition has to be present before a fault is triggered.

No.	Name	Setting Range	Default
L8-43	Ouput Phase Loss DetectionTime	0.0 to 2.0 s	0.5 s

■ L8-88: Safe Disable Operation Mode

Determines the operation performed by the drive when the Safe Disable input is activated.

No.	Name	Setting Range	Default
L8-88	Safe Disable Operation Mode	0 or 1	1

Setting 0: Mode 0

Setting 1: Mode 1 (L7 compatible)

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

5.9 n: Special Adjustments

These parameters handle a variety of specialized adjustments and functions, including AFR Control, resistance between motor lines, and current detection adjustments.

◆ 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. Available in vector control modes.

No.	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.	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.

◆ 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.	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).

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 the drive is powered up, the monitor selected in parameter o1-02 appears first on the display. If o1-02 is set to 5, o1-01 can be used to change the content of this monitor.

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. There is no effect like this on an LCD operator.

No.	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. This is done by entering the 1□□ part of U1-□□. Certain monitors are not available in some control modes. *Refer to U: Monitor Parameters on page 161* for a list of monitors.

No.	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)

■ 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 LCD Operator Display Unit Selection on page 78*.

No.	Name	Setting Range	Default
o1-03	Digital Operator Display Unit Selection	0 to 3	0

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).

■ o1-10: User-Set Display Units Maximum Value

Determines the display value that is equal to the maximum output frequency.

No.	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.	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

◆ 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.	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.	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 103* for details on drive initialization.

No.	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 249*.

NOTICE: *Drive performance will suffer and protective functions will not operate properly if the correct drive capacity is not set to o2-04.*

No.	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.	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.

■ 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.	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.

■ o2-07: Motor Direction at Power Up when Using Operator

Determines the direction in which the motor will rotate after the drive is powered up when the Run command is set to be given from the operator.

Note: This parameter is effective only when the Run command is set to be given from the digital operator (b1-02 or b1-16 = 0)

No.	Name	Setting Range	Default
o2-07	Motor Direction at Power Up when Using Operator	0 or 1	0

Setting 0: Forward
Setting 1: Reverse

◆ o3: Copy Function

These parameters control the Copy function of the optional LCD operator (JVOP-180). 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 185* for a description of errors and displays.

■ o3-01 Copy Function Selection

Instructs the drive to Read, Write, or Verify parameter settings.

No.	Name	Setting Range	Default
o3-01	Copy Function Selection	0 to 3	0

0: Copy Select (no function)
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 o3-01 to 1 to unlock copy protection.

2: OP --> INV WRITE
Compares the parameters in the drive with the parameter settings saved on the digital operator for matches.

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.	Name	Setting Range	Default
o3-02	Copy Allowed Selection	0 or 1	0

0: Disabled
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.	Name	Setting Range	Default
o4-01	Cumulative Operation Time Setting	0 to 9999 H	0 H

■ 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.	Name	Setting Range	Default
o4-02	Cumulative Operation Time Selection	0 or 1	1

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.	Name	Setting Range	Default
o4-03	Cooling Fan Operation Time Setting	0 to 9999 H	0 H

■ 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.	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.	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.	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.	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.	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.	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.

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 90* for details.

■ S1-01: Zero Speed Level at Stop

Determines the speed to begin applying DC Injection 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

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.

■ 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 75%	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. When using OLV Control, the DC injection current is determined by multiplying S1-03 by S3-25 or S3-26.

No.	Parameter Name	Setting Range	Default
S1-03	DC Injection Current at Stop	0 to 100%	50%

■ S1-04: DC Injection Time at Start

Determines how long the drive should perform DC Injection at start. 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 Time at Stop

Determines how long the drive should perform DC Injection at stop. 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 Apply 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 Apply Delay Time	0.00 to 10.00 s	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 10.00 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

◆ 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

◆ S4: Rescue Operation

Rescue Operation switches to a backup battery or some other UPS during a power outage. Refer to *Rescue Operation on page 91* 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

0: Disabled
1: Enabled

■ 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	0

0: Output current
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 a time limit for Light Load Direction Search.

No.	Parameter Name	Setting Range	Default
S4-05	Rescue Operation Torque Limit	0 to 300%	100%

◆ 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

0: Detect during stop, SE1 must be manually reset
1: Detect during stop, SE1 can be automatically reset
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

■ S6-04: 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 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

■ S6-15: 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

0: Disabled
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

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.

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.

■ S6-20: Operation Selection at Rollback (RBK)

Sets the drive stopping method when a rollback (RBK) fault is triggered.

No.	Parameter Name	Setting Range	Default
S6-20	Operation Selection at Rollback (RBK)	0 to 5	4

0: Ramp to Stop

The drive decelerates to stop with the active deceleration time.

1: Coast to Stop

The motor will coast to stop and the brake control output terminal will immediately open, closing the brake.

2: Fast Stop

The motor will decelerate to stop using the fast stop deceleration time in parameter C1-09.

3: Alarm Only

The drive continues to run and will only trigger an oH alarm.

4: Fault After Stop

The drive continues to run and will trigger a fault after stopping.

5: No Detection

Rollback detection is disabled.

◆ T: Motor Tuning

Auto-Tuning automatically sets and tunes parameters required for optimal motor performance. *Refer to Auto-Tuning on page 80* 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 terminal AM by assigning the specific monitor parameter number (U□-□□) to H4-01. *Refer to H4-01: Terminal AM Monitor Selection on page 134* 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 243* 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 *U2: Fault Trace on page 244* 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 154* for instructions on how to reset these monitor values.

◆ 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 *U3: Fault History on page 245* 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 154* for instructions on how to reset these monitor values.

◆ 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 245 for a complete list of U4-□□ monitors and descriptions.

◆ U6: Control Monitors

Control monitors show:

- Reference data for the output voltage and vector control
- Speed Loop and Inertia Compensation control monitors
  Refer to *Figure 5.7* on page *114* 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 TOBPC72060000 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 LED operator for information about possible faults if the drive or motor fails to operate. *Refer to Using the LED Operator on page 66*.

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 188*.
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 output terminal set to be tripped by a minor fault (H2- □□ = 10) closes. • 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 changes state. 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 168* for a list of alarm codes.

Table 6.2 Fault Displays (1)

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
CF	CF	Control Fault	170
CoF	CoF	Current Offset Fault	170
CPF00, CPF01	CPF00, CPF01	Control Circuit Error	170
CPF02	CPF02	A/D Conversion Error	170
CPF03	CPF03	Control Board Connection Error	170
CPF06	CPF06	EEPROM Data Error	170
CPF07, CPF08	CPF07, CPF08	Terminal Board Connection Error	170
CPF11	CPF11	RAM Fault	171
CPF12	CPF12	FLASH Memory Fault	171
CPF13	CPF13	Watchdog Circuit Exception	171
CPF14	CPF14	Control Circuit Fault	171
CPF16	CPF16	Clock Fault	171
CPF17	CPF17	Timing Fault	171
CPF18	CPF18	Control Circuit Error	
CPF19	CPF19	Control Circuit Error	171
CPF20, CPF21	CPF20, CPF21	Control Circuit Error	171
CPF22	CPF22	A/D Conversion Error	171
CPF23	CPF23	Control Board Connection Error	171
CPF24	CPF24	Drive Unit Signal Fault	171
dEv	dEv	Excessive Speed Deviation (simple PG feedback control modes)	171
EF3 to EF7	EF3 to EF7	External Fault (input terminal S3 to S7)	172
Err	Err	EEPROM Write Error	172

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
GF	GF	Ground Fault	172
LF	LF	Output Phase Loss	172
LF2	LF2	Output Current Imbalance	172
oC	oC	Overcurrent	173
oH	oH	Heatsink Overheat	173
oH1	oH1	Heatsink Overheat	173
oL1	oL1	Motor Overload	173
oL2	oL2	Drive Overload	174
oL3	oL3	Overtorque Detection 1	174
oL4	oL4	Overtorque Detection 2	174
oPr	oPr	Operator Connection Fault	174
oS	oS	Overspeed (simple PG feedback control modes)	174
ov	ov	DC Bus Overvoltage	174
PF	PF	Input Phase Loss	175
PGo	PGo	Encoder Disconnected (simple PG feedback control modes)	175
rr	rr	Dynamic Braking Transistor Fault	175
SE1	SE1	Motor Contactor Response Error	175
SE2	SE2	Starting Current Error	175
SE3	SE3	Output Current Error	175
SE4	SE4	Brake Response Error	175
UL3	UL3	Undertorque Detection 1	176
UL4	UL4	Undertorque Detection 2	176
Uv1	Uv1	DC Bus Undervoltage	176
Uv2	Uv2	Control Power Supply Voltage Fault	176
Uv3	Uv3	Soft Charge Circuit Fault	176
voF	voF	Output Voltage Detection Error	176

■ Minor Faults and Alarms

Refer to *Table 6.3* 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 167* for information on fault codes.

Table 6.3 Minor Fault and Alarm Displays

Digital Operator Display		Name	Minor Fault Output (H2-□□ = 10)	Page
LED Operator	LCD Operator			
bb	bb	Drive Baseblock	No output	*177*
boL	boL	Braking Transistor Overload	YES	*177*
CrST	CrST	Cannot Reset	YES	*177*
dEv	dEv	Speed Deviation (simple PG feedback control modes)	YES	*177*
EF	EF	Up/Down Command Error	YES	*177*
EF3 to EF7	EF3 to EF7	External Fault (input terminal S3 to S7)	YES	*177*
Hbb	Hbb	Safe Disable Signal Input	L8-88 = 0: YES L8-88 = 1: No (default)	*178*
HbbF	HbbF	Safe Disable Circuit Fault Signal Input	L8-88 = 0: YES L8-88 = 1: No (default)	*178*
HCA	HCA	High Current Alarm	YES	*178*
LT-1	LT-1	Cooling Fan Maintenance Time	No output	*178*
LT-2	LT-2	Capacitor Maintenance Time	No output	*178*
LT-3	LT-3	Soft Charge Bypass Relay Maintenance Time	No output	*178*
LT-4	LT-4	IGBT Maintenance Time (90%)	No output	*178*
oH	oH	Heatsink Overheat	YES	*178*
oL3	oL3	Overtorque Detection 1	YES	*179*
oL4	oL4	Overtorque Detection 2	YES	*179*
oS	oS	Overspeed (for Control Mode with Encoder)	YES	*179*
ov	ov	DC Bus Overvoltage	YES	*180*
PGo	PGo	Encoder Disconnected (for Control Mode with Encoder)	YES	*180*
TrPC	TrPC	IGBT Maintenance Time (90%)	YES	*180*
UL3	UL3	Undertorque Detection 1	YES	*180*
UL4	UL4	Undertorque Detection 2	YES	*180*
Uv	Uv	Undervoltage	YES	*181*
voF	voF	Output Voltage Detection Error	YES	*181*

■ Operation Errors

Table 6.4 Operation Error Displays

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
oPE01	oPE01	Drive Capacity Setting Error	182
oPE02	oPE02	Parameter Setting Range Error	182
oPE03	oPE03	Multi-function Digital Input Setting Error	182
oPE04	oPE04	Terminal Board Mismatch Error	182

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
oPE05	oPE05	Run Command Source Selection Error	182
oPE08	oPE08	Parameter Selection Error	182
oPE10	oPE10	V/f Pattern Setting Error	182
oPE11	oPE11	Carrier Frequency Setting Error	182

■ Auto-Tuning Errors

Table 6.5 Auto-Tuning Error Displays

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
End1	End1	Excessive V/f Setting	183
End2	End2	Motor Iron Core Saturation Coefficient Error	183
End3	End3	Rated Current Setting Alarm	183
Er-01	Er-01	Motor Data Error	183
Er-02	Er-02	Alarm	183
Er-03	Er-03	STOP Button Input	183

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
Er-04	Er-04	Line-to-Line Resistance Error	183
Er-05	Er-05	No-Load Current Error	184
Er-08	Er-08	Rated Slip Error	184
Er-09	Er-09	Acceleration Error	184
Er-11	Er-11	Motor Speed Error	184
Er-12	Er-12	Current Detection Error	184

■ Errors and Displays When Using the Copy Function

Table 6.6 Copy Errors

Digital Operator Display		Name	Page
LED Operator	LCD Operator		
CoPy	CoPy	Writing parameter settings (flashing)	185
CPEr	CPEr	Control mode mismatch	185
CPyE	CPyE	Error writing data	185
CSEr	CSEr	Copy unit error	185
dFPS	dFPS	Drive model mismatch	185
End	End	Task completed	185
iFEr	iFEr	Communication error	185
ndAT	ndAT	Model, voltage class, capacity mismatch	185
rdEr	rdEr	Error reading data	186
rEAd	rEAd	Reading parameter settings (flashing)	186
vAEr	vAEr	Voltage class, capacity mismatch	186
vFyE	vFyE	Parameter setting mismatch	186
vrFy	vrFy	Comparing parameter settings (flashing)	186

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 6.7 Detailed Fault Displays, Causes, and Possible Solutions

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**
CoF	CoF	Current Offset Fault
		The current detection circuit is damaged, or there was residual induction voltage in the motor (such as during sudden deceleration or when coasting) when the drive attempted to start the motor.
Cause		**Possible Solution**
While the drive automatically adjusted the current offset, the calculated value exceeded the allowable setting range.		• Create a motor restart sequence that allows enough time for residual induction voltage to dissipate • Lengthen the active deceleration ramp (C1-02, -04, -06, -08)
Digital Operator Display		**Fault Name**
CPF00 or CPF01	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	
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	CPF11	RAM Fault
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
Digital Operator Display		**Fault Name**
CPF12	CPF12	Flash Memory Fault
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
Digital Operator Display		**Fault Name**
CPF13	CPF13	Self-Diagnostics Error. Watchdog Circuit Exception.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
Digital Operator Display		**Fault Name**
CPF14	CPF14	Control Circuit Fault. CPU Error.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
Digital Operator Display		**Fault Name**
CPF16	CPF16	**Clock Fault**.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
Digital Operator Display		**Fault Name**
CPF17	CPF17	**Timing Fault**. A timing error ocurred during an internal process.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
Digital Operator Display		**Fault Name**
CPF18	CPF18	**Control Circuit Fault. CPU Non-Maskable Interrupt Error**.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
Digital Operator Display		**Fault Name**
CPF19	CPF19	**Control Circuit Fault. CPU error**.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
Digital Operator Display		**Fault Name**
CPF20 or CPF21	CPF20 or 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	A/D Conversion Error
Cause		**Possible Solution**
Hybrid IC failure on the power board		• Cycle power to the drive. *Refer to Diagnosing and Resetting Faults on page 187*. • 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**
dEv	dEv	Speed Deviation (for simple PG feedback control modes) 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**
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
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 2F). • Reconnect the signal line.
Incorrect multi-function contact input setting	• Check for unused terminals set for H1-□□ = 20 to 2F (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 187*. • 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**
GF / GF	Ground Fault • A current short to ground exceeded 50% of rated current on the output side of the drive. • Setting L8-09 to 1 enables ground fault detection.
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. *Refer to Wire Size on page 56*.
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. *Refer to Wire Size on page 56*.
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	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 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 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**
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. • After replacing the drive, reset the cooling fan maintenance parameter (o4-03 = 0).
Digital Operator Display	**Fault Name**
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**
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 maximum output speed 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 input phase loss	Check the power supply for phase loss.
Digital Operator Display	**Fault Name**
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	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	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	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	Overspeed (for Control Mode with Encoder)
	The motor speed feedback exceeded the F1-08 setting.
Cause	**Possible Solution**
Overshoot is occurring.	Increase the settings for C5-01 (Speed Control Proportional Gain 1) and reduce C5-02 (Speed Control Integral Time 1).
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	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 reactor. **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	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 50*
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**
PGo	Encoder Disconnected (for simple PG feedback control modes)
	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**
rr	Dynamic Braking Transistor Fault
	The built-in dynamic braking transistor failed.
Cause	**Possible Solution**
The braking transistor is damaged.	• Cycle power to the drive and check if the fault reoccurs. *Refer to Diagnosing and Resetting Faults on page 187*. • Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.
The control circuit is damaged.	
Digital Operator Display	**Fault Name**
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	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	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	Brake Feedback Error
	The input terminal set for “Brake feedback” (H1-□□ = 79) 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**
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 stopped: • 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 50*
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.

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 168* 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 6.8 Alarm Codes, Causes, and Possible Solutions

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 S7).		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**
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 (for simple PG feedback control modes)
		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**
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.
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-□□ = 20 to 2F). • Reconnect the signal line.
Multi-function contact inputs are set incorrectly.		• Check if the unused terminals have been set for H1-□□ = 20 to 2F (External Fault). • Change the terminal settings.

Digital Operator Display		Minor Fault Name
Hbb	Hbb	Safe Disable Signal Input 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 Input 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 carrier frequency is at its default setting (8 kHz for models CIMR-L□2A0018 to 2A0115, 4A0009 to 4A0091, 5 kHz for models CIMR-L□2A0145 to 2A0283, 4A0112 to 4A216, and 2 kHz for models CIMR-L□2A0316, 2A0415) 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. • 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 31*. • 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	**Minor Fault Name**
oL3 / oL3	Overtorque Detection 1
	Drive output current (or torque in OLV) 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) 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 simple PG feedback control modes)
	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 reactor 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 Comm. 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**
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) 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) 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
Uu	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 50*
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**
uoF	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 6.9* 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 6.9 oPE Codes, Causes, and Possible Solutions

Digital Operator Display		Error Name
oPE01	oPE01	Drive Capacity Setting Fault Drive capacity and the value set to o2-04 do not match.
Cause		**Possible Solutions**
The drive model selection (o2-04) and the actual capacity of the drive are not the same.		Correct the value set to o2-04.
Digital Operator Display		**Error Name**
oPE02	oPE02	Parameter Range Setting Error Use U1-18 to find parameters set outside the range.
Cause		**Possible Solutions**
Parameters were set outside the possible setting range.		Set parameters to the proper values.
Note: When multiple errors occur at the same time, other errors are given precedence over oPE02.		
Digital Operator Display		**Error Name**
oPE03	oPE03	Multi-function Digital Input Selection Error A contradictory setting is assigned to multi-function contact inputs H1-03 to H1-08.
Cause		**Possible Solutions**
• The same function is assigned to two multi-function inputs. • Excludes “Not used” and “External Fault.”		• Ensure all multi-function inputs are assigned to different functions. • Re-enter the multi-function settings to ensure this does not occur.
Emergency Stop N.O. and Emergency Stop N.C. (15 vs. 17) were selected at the same time		Check for contradictory settings assigned to the multi-function input terminals at the same time. Correct setting errors.
Digital Operator Display		**Error Name**
oPE04	oPE04	Terminal Board Mismatch Error
Cause		**Possible Solutions**
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.		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.
Digital Operator Display		**Error Name**
oPE05	oPE05	Reference Source Selection Error
Cause		**Possible Solutions**
Speed reference is assigned to an option card (b1-01 = 3) but an input option card is not connected to the drive.		The L1000V does not support option cards. Assign the speed reference and run command to a permissible source.
The Up/Down command is assigned to an option card (b1-02 = 3) but an input option card is not connected to the drive.		
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.
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
Cause		**Possible Solutions**
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.		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**
oPE11	oPE11	Carrier Frequency Setting Error
Cause		**Possible Solutions**
C6-05 is greater than 6 and C6-04 is greater than C6-03 (carrier frequency lower limit is greater than the upper limit. If C6-05 is less than or equal to 6, the drive operates at C6-03.		Correct carrier frequency parameter settings.
Upper and lower limits between C6-02 and C6-05 contradict each other.		

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 Auto-Tuning has successfully completed with discrepancies 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.

An Er-□ error indicates that Auto-Tuning has not successfully completed. If an Er-□ error occurs, check for the cause of the error using the table below, and perform Auto-Tuning again after fixing the problem.

◆ Auto-Tuning Codes, Causes, and Possible Solutions

Table 6.10 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**
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-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.
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.

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 6.11 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 6.11 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**
End	End	Task Complete
Cause		**Possible Solutions**
Finished reading, writing, or verifying parameters.		Not an error.
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.*

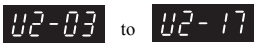
1. Turn on the drive input power.
2. Use monitor parameters U2-☐☐ to display data on the operating status of the drive just before the fault occurred.
3. Remove the cause of the fault and reset.

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 187* 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

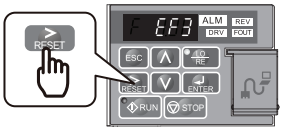
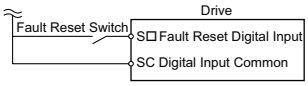
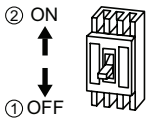
1. Look at the digital operator for information on the fault that occurred.
2. ***Refer to Fault Displays, Causes, and Possible Solutions on page 170***
3. Reset the fault. ***Refer to Fault Reset Methods on page 188***.

◆ Viewing Fault Trace Data After Fault

	Step		Display/Result
1.	Turn on the drive input power. The first screen displays.	→	
2.	Press ∧ or ∨ until the monitor screen is displayed.	→	
3.	Press ENTER to display the parameter setting screen.	→	
4.	Press ∧ and RESET to scroll to monitor U2-02. The fault code shown in U2-02 is the fault that occurred last.	→	
7.	Press ∧ to view drive status information when fault occurred. Parameters U2-03 through U2-17 help determine the cause of a fault. Parameters to be monitored differ depending on the control mode.	→	

◆ 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 RESET on the digital operator.	
Resetting via Fault Reset Digital Input	Close then open the fault signal digital input. Digital inputs S3 through S7 can be configured as fault reset (H1-□□=12).	
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.

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

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 connect or disconnect wiring while the power is on.

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.

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.

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.

Switch off and lock power supply and lock the switch before wiring terminals.

Failure to comply could result in serious injury or death.

⚠ 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.

⚠ 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.

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.

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.

NOTICE

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 a limited lifetime 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 3 months 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. • Exessive load. • Loose connections. • Dirty heatsink or motor. • Ambient temperature.	
	Inspect drive cooling 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 31*.	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. • Use dry air to clear away foreign matter. Use a pressure of 39.2×10^4 to 58.8×10^4 Pa (4 to 6 kg/cm^2 / 57 to 85 psi). • 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.	Use dry air to clear away foreign matter. Use a pressure of 39.2×10^4 to 58.8×10^4 Pa (4 to 6 kg/cm^2 / 57 to 85 psi).	
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. • Use dry air to clear away foreign matter. Use a pressure of 39.2×10^4 to 58.8×10^4 Pa (4 to 6 kg/cm^2 / 57 to 85 psi). • 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 on page 197* for information on cleaning or replacing the fan.	
Heatsink	Inspect for dust or other foreign material collected on the surface.	Use dry air to clear away foreign matter. Use a pressure of 39.2×10^4 to 58.8×10^4 Pa (4 to 6 kg/cm^2 / 57 to 85 psi).	
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

◆ 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 194 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 acumulated fan operation time as a percentage of the specified maintenance period.
U4-05	DC Bus Capacitors	Displays the acumulated 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.

Alarm Display		Function	Corrective Action
LED Operator	LCD Operator		
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 Table on page 224* 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

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 CIMR-L□	Cooling Fans	Page	Model CIMR-L□	Cooling Fans	Page
2V0018	1	197	4V0009	1	197
2V0025	2		4V0015	2	
2V0033	2		4V0018	2	
2V0047	2		4V0024	2	
2V0060	2		4V0031	2	

◆ Cooling Fan Replacement

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.

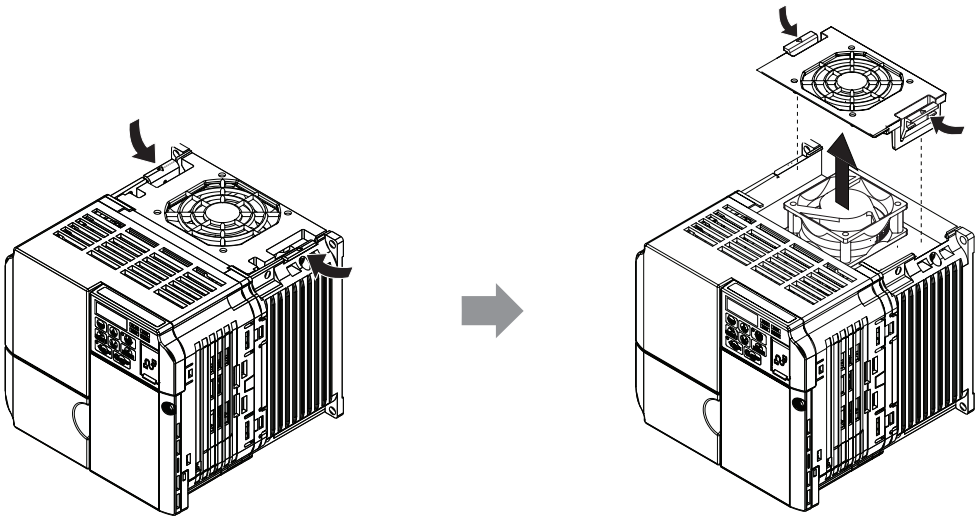


Figure 7.1 Removing the fan cover

2. Remove the cooling fan cartridge. Disconnect the pluggable connector and remove the fan.

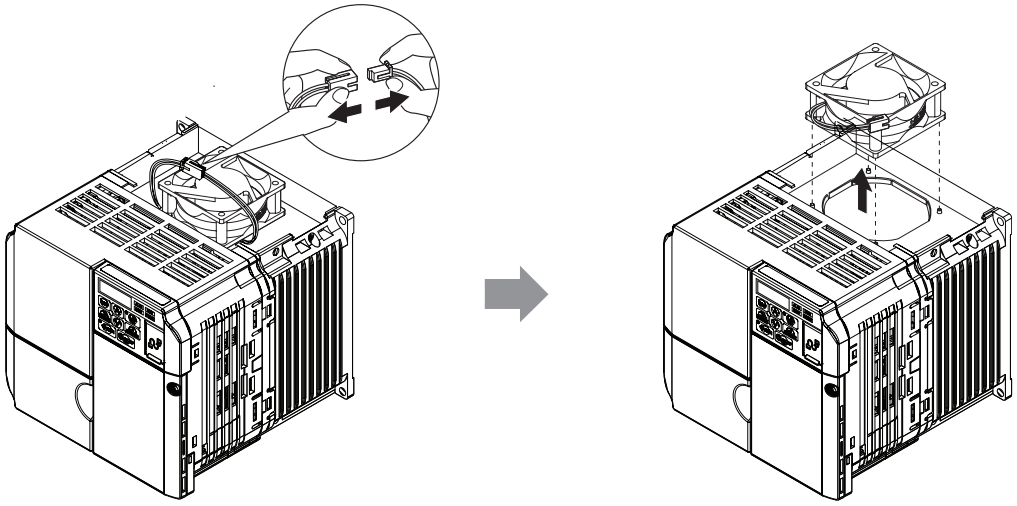


Figure 7.2 Removing the Cooling Fan

■ 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.

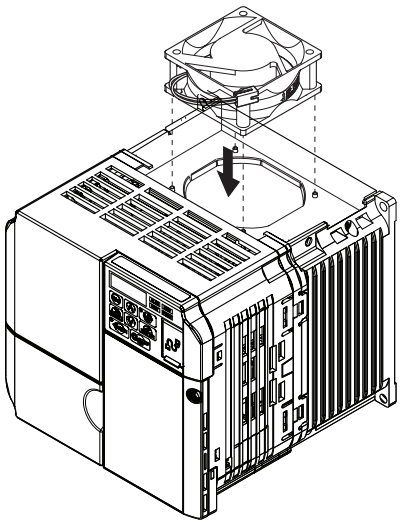


Figure 7.3 Installing the Cooling Fan

2. Properly connect the fan power lines, then place the cable back into the recess of the drive.

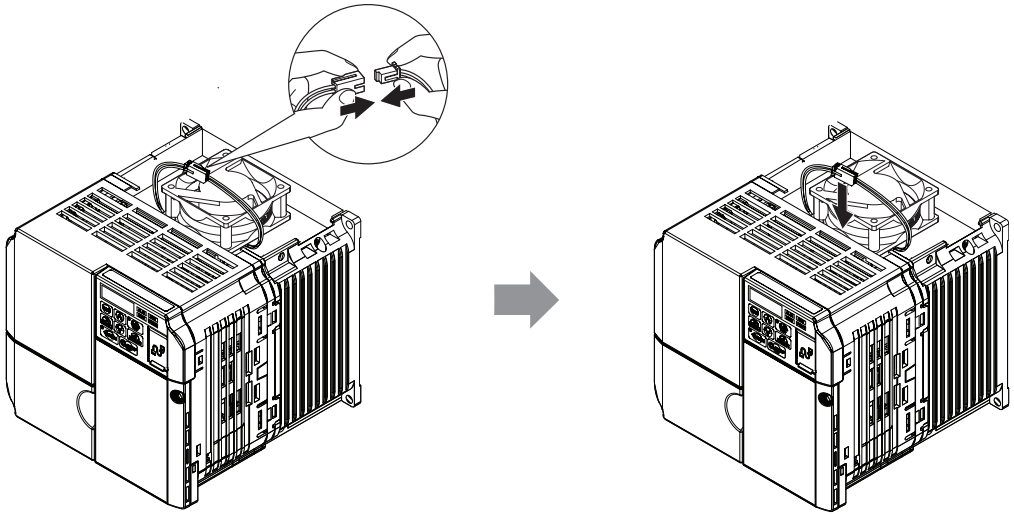


Figure 7.4 Connecting the Fan Cable

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.

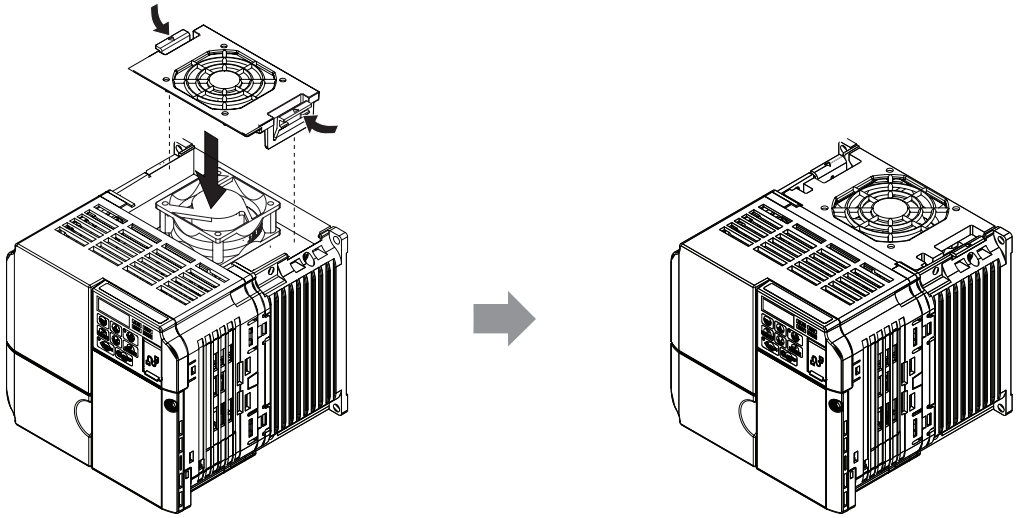


Figure 7.5 Reattach the Fan Cover

4. 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 few serviceable parts. The following parts can be replaced over the life span of the drive:

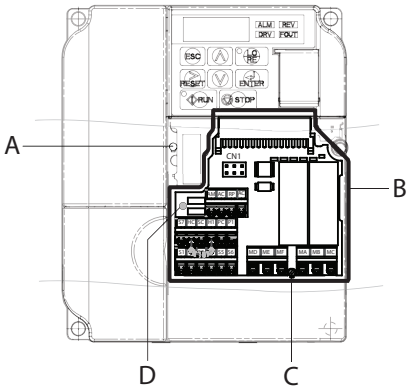
- Main Control board and I/O Terminal board PCBs
- Cooling fan(s)
- Front cover

◆ 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.*

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 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 – Charge LED
B – Removable Terminal Board
C – Terminal Board Locking Pin
D – Ground Cable Pin

Figure 7.6 Terminal Board Location

◆ 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. Loosen the screw on the front of the drive and remove the front cover.

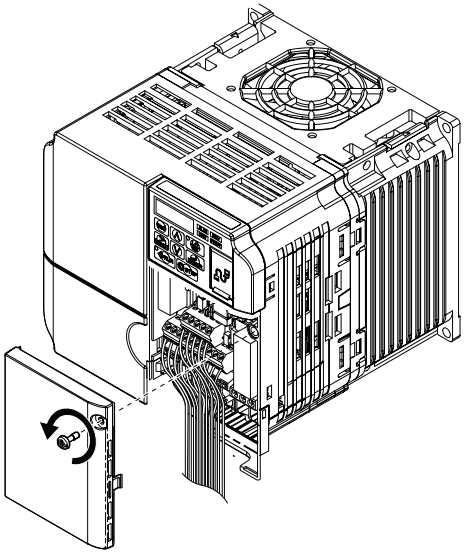


Figure 7.7 Remove the Front Cover

2. Pull the pin on the ground terminal out of the removable terminal block.

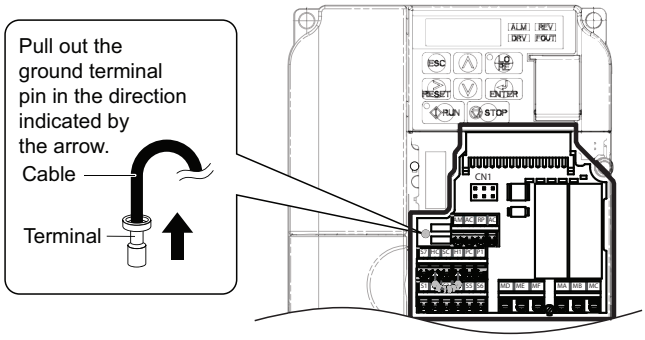


Figure 7.8 Removing the Ground Cable on the Terminal Board

3. Push down the installation pin on the terminal board with a screwdriver.

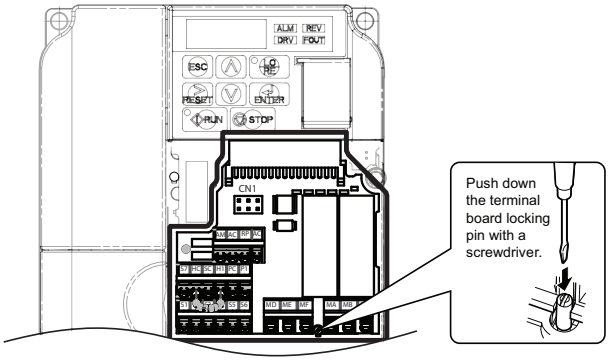


Figure 7.9 Terminal Board Locking Pin

4. While holding down the locking pin from step 3, slide the removable terminal block in the direction of the arrows.

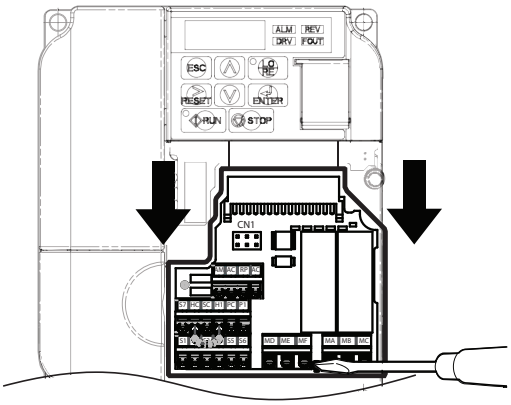


Figure 7.10 Terminal Board Removal

5. Replace the drive and wire the main circuit.

■ Terminal Board Replacement

1. Replace the removable terminal block on the new drive.
2. Ensure the terminal block is firmly fastened to the connector and that the locking pin is in place.
3. Connect the blue ground cable from the drive to the ground pin on the terminal board.
4. Put the front cover back in place and tighten the screw on the front of the drive.
5. 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.

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

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 durnig 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.

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.

Do not carelessly connect parts or devices to the drives braking transistor terminals.

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

Carefully review instruction manual TOBPC72060000 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.

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 this drive. Contact Yaskawa or your Yaskawa agent to order these peripheral devices. The L1000V drive does not support feedback, I/O, or communication option cards.

- **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 Reactor	-	Improves the power factor by suppressing harmonic distortion from the power supply.
AC Reactor	-	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 Transistor	CDBR Series	External braking transistor. Note that in most cases this is not required since the L1000V drive has an internal braking transistor.
Interface Options		
LCD Operator	JVOP-180	Remote operator with 8 languages, clear text LCD display, and copy function. Max. cable length for remote usage: 3 m
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. For USB drivers visit http://www.yaskawa.eu.com
Mechanical Options		
Heatsink External Mounting Kit	EZZ020568□	Installation kit for mounting the drive with the heatsink outside of the panel (side-by-side mounting possible)
DIN Rail Attachment	100-035-0□□ or EZZ08122□	Installation kit for mounting the drive on a DIN rail
Others		
24 V Power Supply	PS-V10S, PS-V10M	Provides power to the control circuit in the event of power loss. Allows the user to still monitor drive settings and fault information even if the main circuit has no power.
PC Software Tools		
DriveWizard Plus	-	PC tool for drive setup and parameter management. To download the software visit http://www.yaskawa.eu.com

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.

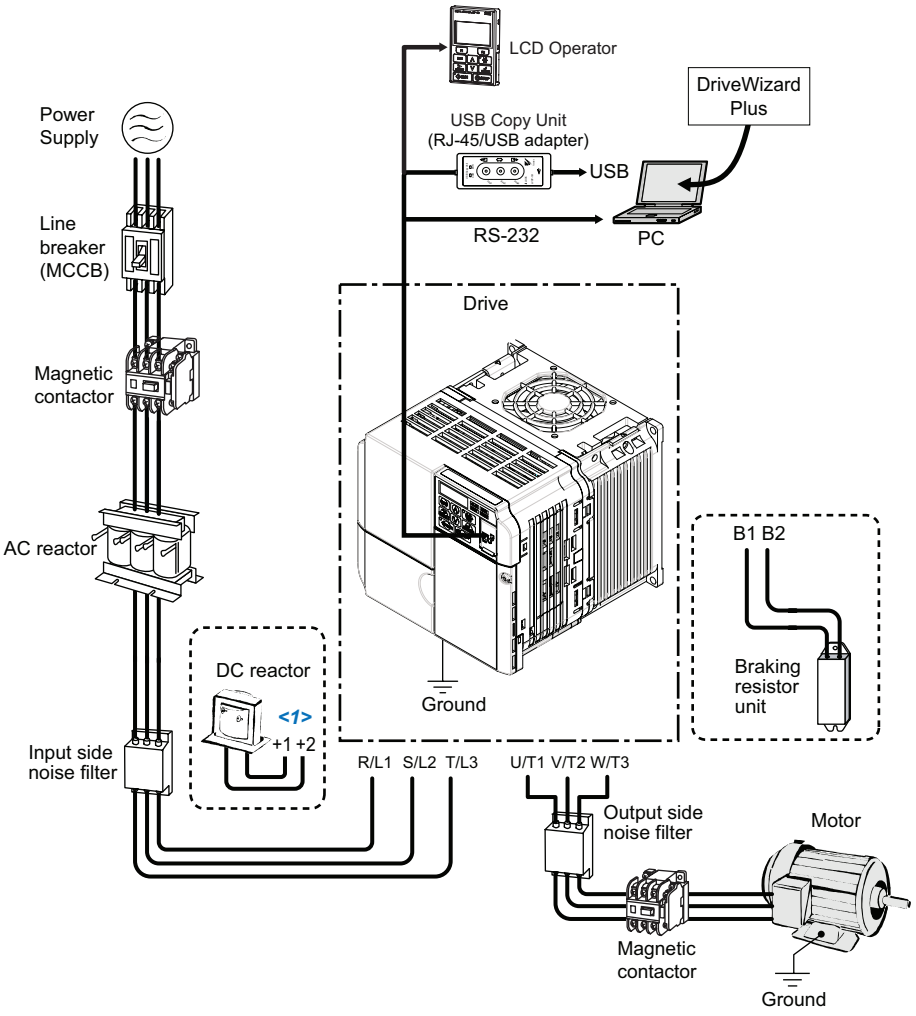


Figure 8.1 Connecting Peripheral Devices

<1> Remove the jumper when installing a DC reactor.

8.4 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 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 regenerative energy from the elevator system. The drive is likely to trip with DC bus overvoltage if the resistor value is too large. Connecting a too small braking resistor can damage the drive or braking transistor. Consult with you sales representative for proper braking option selection.

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.

◆ 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 30 sec. operation at 165% 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.

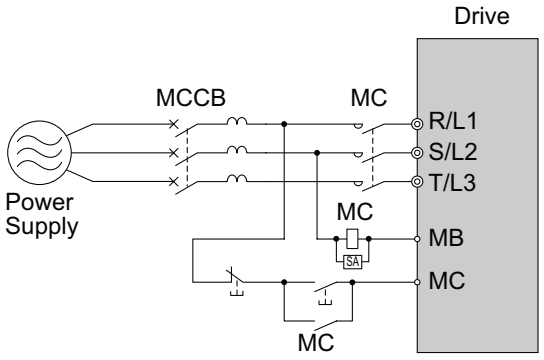


Figure 8.2 Power Supply Interrupt Wiring (Example)

WARNING! *Electrical Shock Hazard. Switch off and lock power supply and lock the switch before wiring terminals. Failure to comply could result in serious injury or death.*

■ Installing a Residual Current Device (RCD) or a Residual Current Monitoring Device (RCM)

Residual currents occurring in drive installations can contain AC, DC, and high frequency components that may prevent a normal RCD/RCM from operating as desired. If an RCD/RCM 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 an RCD or RCM 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 RCD/RCM trips spuriously consider changing these items or use an RCD/RCM with a higher trip level.

Note: Install a RCD/RCM designed specifically for AC drives. 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 braker 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 a 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 a 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 a 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 or DC Reactor

■ Reactor 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 or DC reactor to the input side of the drive. Installing an AC or DC reactor will also help improve the power factor.

Install an AC or DC reactor 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 8.3***.

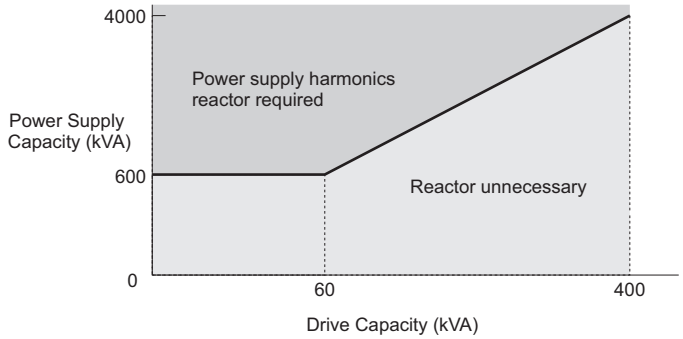
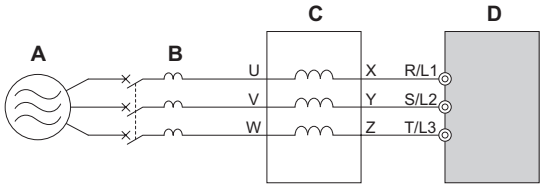


Figure 8.3 Installing a Reactor

■ Connecting an AC Reactor

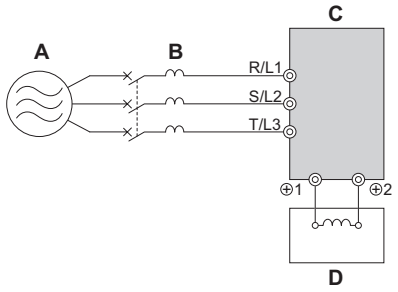


A – Power supply
B – MCCB
C – AC reactor
D – Drive

Figure 8.4 Connecting an AC Reactor

■ Connecting a DC Reactor

When installing a DC reactor, remove the jumper between terminals +1 and +2 (terminals are jumpered for shipment). The jumper must be installed if not using a DC reactor. Refer to *Figure 8.5* for an example of DC reactor wiring.



A – Power supply
B – MCCB
C – Drive
D – DC Reactor

Figure 8.5 Connecting a DC Reactor

◆ Connecting a Noise Filter

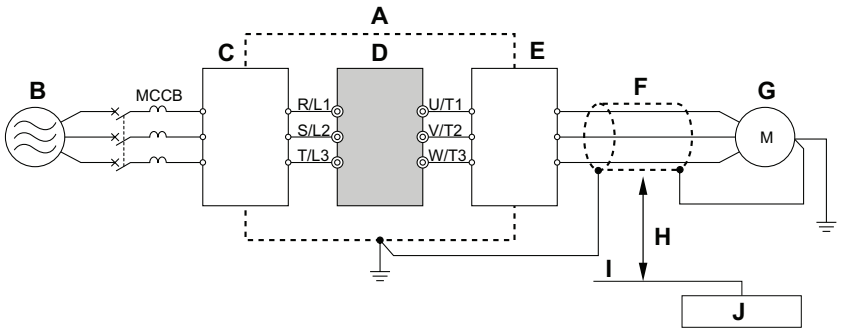
■ Reducing Radiated, Conducted, and Induced Noise

Drives generate noise that can potentially affect surrounding devices like PLCs, etc.

- **Radiated Noise:** Electromagnetic waves noise throughout the radio bandwidth radiated from the drive and cables.
- **Conducted Noise:** Noise generated by the drive and emitted to through the power lines.
- **Induced Noise:** Noise generated by electromagnetic induction can affect control signal lines.

Take the following measurements to prevent noise causing malfunction of other drives or devices:

- Install all components on a well grounded metal plate.
- Keep the motor cable as short as possible.
- Use noise filters on the input side of the drive to reduce conducted noise.
- Install noise filters on the input and output side of the drive, install the drive in a metal enclosure panel and use a shielded motor cable to reduce radiated noise.
- Use shielded motor and control circuit lines and lay control circuit lines at least 30 cm away from power lines in order to prevent malfunction due to induced noise.



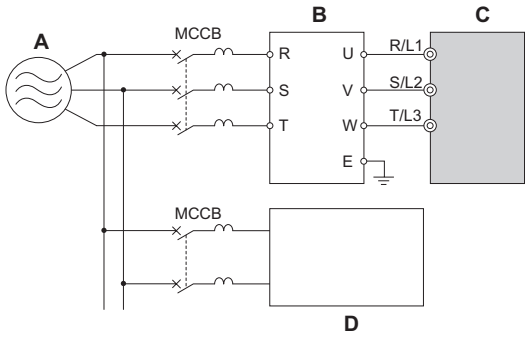
A – Metal enclosure
B – Power supply
C – Input noise filter
D – Drive
E – Output noise filter
F – Shielded motor cable
G – Motor
H – Separate at least 30 cm
I – Control signal lines
J – Controller

Figure 8.6 Reducing Radio Frequency Noise

■ 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
C – Drive
D – Other control device

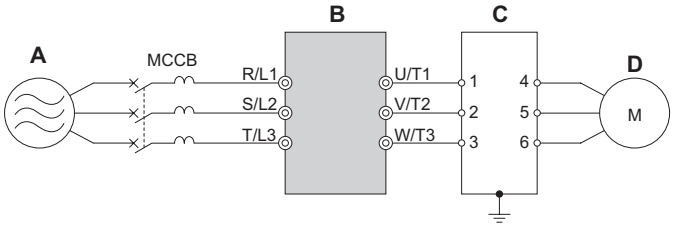
Figure 8.7 Input-Side Noise Filter (Three-Phase 200/400 V)

This drive is tested according to European standards IEC61800-5-1 and complies with the EMC guidelines. Refer to *EMC Guidelines Compliance on page 255* for details about EMC filter selection and installation.

■ Output-Side Noise Filter

A noise filter on the output side of the drive reduces inductive noise and radiated noise. ***Figure 8.8*** 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 8.8 Output-Side Noise Filter

◆ Installing Input Fuses

To protect the drive and avoid damage from a short-circuit, a fuse should be installed to the input side of the drive. Refer to *European Standards on page 254* and *UL and CSA Standards on page 258* for more details on input fuse installation.

◆ 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.

◆ EMC Filter Installation

This drive is tested according to european standards EN61800-3 and it complies with the EMC guidelines. *Refer to EMC Filter Installation on page 255* for more details on EMC filter selection and installation.

◆ Installing a Motor Thermal Overload (oL) Relay on the Drive Output

It is generally not necessary to install a motor thermal overload relay when operating a single motor from a single AC drive. The drive has a UL recognized electronic motor overload protection built into the drive software. However, when utilizing a thermal overload relay, follow the guidelines below.

Note: 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. Motor cable length
3. 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.

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-LC2V		0018	0025	0033	0047	0060
Maximum Applicable Motor Capacity (kW) <1>		4.0	5.5	7.5	11	15
Input	Input Current (A) <2>	18.9	26.0	35.9	51.9	70.8
	Rated Voltage Rated Frequency	Three-phase 200 to 240 V 50/60 Hz				
	Allowable Voltage Fluctuation	-15 to 10%				
	Allowable Frequency Fluctuation	±5%				
	Input Power (kVA)	9.5	14	18	27	36
Output	Rated Output Capacity (kVA) <3>	6.7	9.5	12.6	17.9	23
	Rated Output Current (A)	17.5 <4>	25 <4>	33 <4>	47 <4>	60 <4>
	Overload Tolerance	150% of rated output current for 60 s				
	Carrier Frequency	User adjustable between 2 and 15 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 (kW) refers to a Yaskawa 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor rated 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> Rated motor capacity is calculated with a rated output voltage of 220 V.
<4> Carrier frequency can be set up to 8 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-LC4V		0009	0015	0018	0024	0031
Maximum Applicable Motor Capacity (kW) <1>		4.0	5.5	7.5	11	15
Input	Input Current (A) <2>	10.4	15	20	29	39
	Rated Voltage Rated Frequency	Three-phase 380 to 480 Vac 50/60 Hz				
	Allowable Voltage Fluctuation	-15 to 10%				
	Allowable Frequency Fluctuation	±5%				
	Input Power (kVA)	10.0	14.6	19.2	28.4	37.5
Output	Rated Output Capacity (kVA) <3>	7	11.3	13.7	18.3	24
	Rated Output Current (A)	9.2 <4>	14.8 <4>	18 <4>	24 <4>	31 <4>
	Overload Tolerance	150% of rated output current for 60 s				
	Carrier Frequency	User adjustable between 2 and 15 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 (kW) refers to a Yaskawa 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor rated 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> Rated motor capacity is calculated with a rated output voltage of 440 V.
<4> Carrier frequency can be set up to 8 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, 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) • V/f Control with simple PG (V/f w/ PG) • Open Loop Vector Control (OLV) • Open Loop Vector Control with simple PG (OLV w/ PG)
	Frequency Control Range	0.01 to 120 Hz
	Frequency Accuracy (Temperature Fluctuation)	Digital input: within ±0.01% of the max output speed (-10 to +50 °C) Analog input: within ±0.1% of the max output speed (25°C ±10 °C)
	Frequency Setting Resolution	Digital inputs: 0.01 Hz
	Output Frequency Calculation Resolution	$1/2^{20}$ x Maximum Output Frequency (E1-04)
	Frequency Setting Signal	Digital Inputs (Multi-Step Speed Selection)
	Starting Torque <1>	V/f: 150% at 3 Hz OLV: 200% at 0.3 Hz
	Speed Control Range <1>	V/f: 1:40 OLV: 1:100
	Speed Control Accuracy <1>	V/f: ±2.0 % (25°C ±10 °C), V/f w/ PG: ±0,03 % (25°C ±10 °C) OLV: ±0.2% (25°C ±10 °C), OLV w/ PG: ±0.03% (25°C ±10 °C)
	Speed Response <1>	V/f: 3.0 Hz OLV: 10 Hz
	Torque Limit	Parameters setting allow separate limits in four quadrants (available in OLV only
	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	Built-in on all models.
	V/f Characteristics	Freely programmable
	Main Control Functions	Inertia Compensation, Overtorque/Undertorque Detection, Torque Limit, Speed Reference, Accel/decel Switch, 5 Zone Jerk Settings, Auto-Tuning (Stationary and Rotational), Dwell, Cooling Fan on/off Switch, Slip Compensation, Torque Compensation, DC Injection Braking at Start and Stop, Fault Reset, Removable Terminal Block with Parameter Backup Function, High Frequency Injection, Short Floor Operation, Rescue Operation (Light Load Direction Search Function), Inspection Run, Elevator 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 165% 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 (except in Rescue Operation) 400 V class: Stops when DC bus voltage falls below approx. 380 V (except in Rescue Operation)
	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	-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 3000m 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
Safety Standard		One Safe Disable input according to ISO13849-1 Cat.3 PLd, IEC61508 SIL2. Time from input open to drive output stop is less than 1 ms.
Protection Design		IP20 enclosure

<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.
<2> Overload protection may be triggered when operating with 165% 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

Model Number CIMR-LC	Carrier Frequency 8kHz			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
2V0018	17.5	110.5	43.3	153.8
2V0025	25.0	213.3	68.1	281.4
2V0033	33.0	239.5	79.6	319.1
2V0047	47.0	347.6	113.8	461.4
2V0060	60.0	473.9	156.7	630.6

Table A.4 Watt Loss 400 V Class Three-Phase Models

Model Number CIMR-LC	Carrier Frequency 8 kHz			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
4V0009	9.2	107.2	41.5	148.7
4V0015	14.8	166.0	61.7	227.7
4V0018	18.0	207.1	75.0	282.1
4V0024	24.0	266.9	102.1	369.0
4V0031	31.0	319.1	115.4	434.5

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

Derate the drive according to *Figure A.1* when the carrier frequency is increased above the factory default setting.

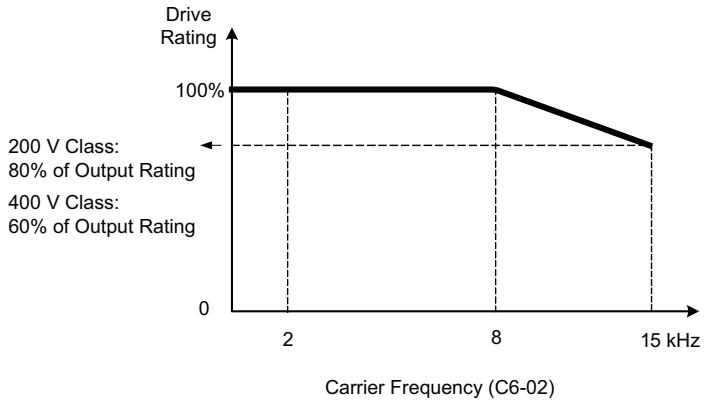


Figure A.1 Carrier Frequency Derating

◆ Temperature Derating

To ensure the maximum performance life, the drives output current must be derated when the drive is installed in areas with high ambient temperature. In order to ensure reliable drive overload protection, the parameters L8-12 and L8-35 must also be set according to the installation conditions.

■ Parameter Settings

No.	Name	Description	Range	Def.
L8-12	Ambient Temperature Setting	Adjusts 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: IP20 Enclosure 1: Side-by-Side Mounting 2: NEMA Type 1 Enclosure 3: Finless Drive or External Heatsink Installation	0 to 3	Drive model (o2-04) dependent

According to the settings of parameters L8-12 and L8-35, the drive will be derated as shown in *Figure A.2*.

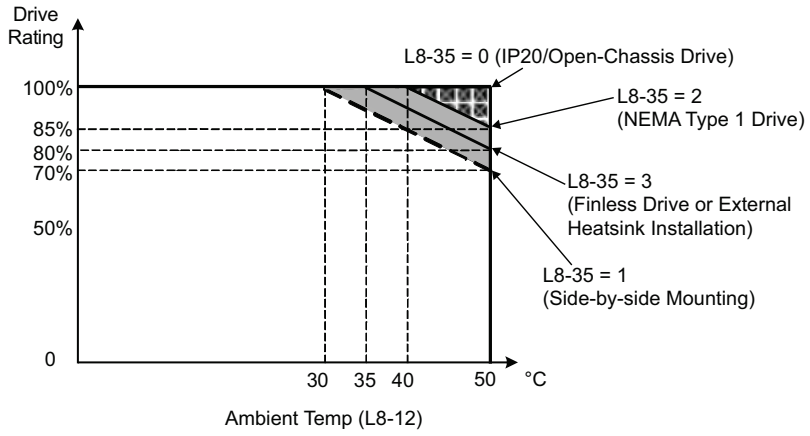


Figure A.2 Temperature Derating

◆ 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 input voltage and the rated output current must be derated by 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 23* 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.
RUN	Parameter can be changed during run.

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
A1	Initialization	*224*
A2	User Parameters	*224*
b1	Operation Mode Selection	*224*
b4	Delay Timers	*225*
b6	Dwell Function	*225*
C1	Acceleration and Deceleration Ramps	*225*
C2	Jerk Settings	*226*
C3	Slip Compensation	*226*
C4	Torque Compensation	*227*
C5	Speed Control Loop Settings	*227*
C6	Carrier Frequency	*227*
d1	Speed Reference	*228*
E1	V/f Pattern	*229*
E2	Motor Parameters	*229*
F1	Encoder/PG Feedback Settings	*230*
H1	Multi-Function Digital Inputs	*231*
H2	Multi-Function Digital Outputs	*232*
H4	Multi-Function Analog Outputs	*234*
H6	Pulse Train Input	
L1	Motor Protection	*235*
L2	Undervoltage Detection	*235*
L3	Stall Prevention	*235*

Parameter Group	Name	Page
L4	Speed Detection	*235*
L5	Fault Reset	*236*
L6	Torque Detection	*236*
L7	Torque Limit	*236*
L8	Drive Protection	*237*
n2	Speed Feedback Detection Control (AFR) Tuning	*238*
n6	Online Tuning	*238*
o1	Digital Operator Display Selection	*238*
o2	Digital Operator Keypad Functions	*239*
o3	Copy Function	*239*
o4	Maintenance Monitor Settings	*239*
S1	Brake Sequence	*240*
S2	Slip Compensation for Elevators	*240*
S4	Rescue Operation	*241*
S6	Error Detection	*241*
T1	Induction Motor Auto-Tuning	*242*
U1	Operation Status Monitors	*243*
U2	Fault Trace	*244*
U3	Fault History	*245*
U4	Maintenance Monitors	*245*
U6	Control Monitors	*247*
-	-	-

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>	LCD Operator Language Selection	All Modes 0: English 1: Japanese 2: German 3: French 4: Italian 5: Spanish 6: Portuguese 7: Chinese	Default: 0 Min: 0 Max: 7	102
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	102
A1-02 (102H) <1>	Control Method Selection	All Modes 0: V/f Control 2: Open Loop Vector Control	Default: 0 Min: 0 Max: 7	102
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	103
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	103
A1-05 (105H)	Password Setting			

<1> Parameter setting value is not reset to the default value when the drive is initialized.

■ 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: b1-01 Max: S6-16	105
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	105

<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
b1-02 (181H)	Up/Down Command Selection	All Modes 0: Digital operator 1: Digital input terminals	Default: 1 Min: 0 Max: 1	106
b1-03 (182H)	Stopping Method Selection	All Modes 0: Ramp to stop 1: Coast to stop	Default: 0 Min: 0 Max: 1	106

No.(Addr.)	Name	Description	Setting	Page
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: 1 Min: 0 Max: 2	106
b1-14 (1C3H)	Phase Order Selection	All Modes 0: U-V-W 1: U-W-V	Default: 0 Min: 0 Max: 1	107

■ 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	107
b4-02 (1A4H)	Timer Function Off-Delay Time		Default: 0.0 s Min: 0.0 s Max: 3000.0 s	107

■ 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%	108
b6-02 (1B7H)	Dwell Time at Start		Default: 0.0 s Min: 0.0 s Max: 10.0 s	108
b6-03 (1B8H)	Dwell Speed at Stop		Default: 0.0% Min: 0.0% Max: 100.0%	108
b6-04 (1B9H)	Dwell Time at Stop		Default: 0.0 s Min: 0.0 s Max: 10.0 s	108

◆ C: Tuning

C parameters are used to adjust the acceleration and deceleration ramps, jerk settings, slip compensation, torque compensation, and carrier frequency selections.

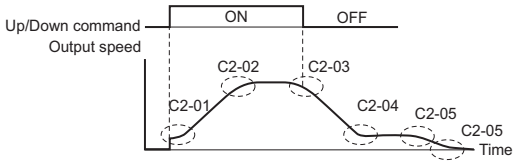
■ C1: Acceleration and Deceleration Ramps

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>	*109*
C1-02 (201H) RUN	Deceleration Ramp 1	All Modes Sets the ramp to decelerate from maximum speed to 0.		*109*
C1-03 (202H) RUN	Acceleration Ramp 2	All Modes Sets the ramp to accelerate from 0 to maximum speed.		*109*
C1-04 (203H) RUN	Deceleration Ramp 2	All Modes Sets the ramp to decelerate from maximum speed to 0.		*109*
C1-05 (204H) RUN	Acceleration Ramp 3	All Modes Sets the ramp to accelerate from 0 to maximum speed.		*109*
C1-06 (205H) RUN	Deceleration Ramp 3	All Modes Sets the ramp to decelerate from maximum speed to 0.		*109*
C1-07 (206H) RUN	Acceleration Ramp 4	All Modes Sets the ramp to accelerate from 0 to maximum speed.		*109*
C1-08 (207H) RUN	Deceleration Ramp 4	All Modes Sets the ramp to decelerate from maximum speed to 0.		*109*

No.(Addr.)	Name	Description	Setting	Page
C1-09 (208H)	Emergency Stop Ramp	All Modes Sets the ramp for the Emergency Stop function.	Default: 1.50 s <6> <8> Min: 0.00 s Max: 600.00 s <6> <8>	110
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	110
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%	110
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>	110

<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 250*
<8> Setting range value is dependent on parameter C1-10, Accel/Decel Setting Resolution. When C1-10 = 0 (units of 0.01 seconds), the setting range becomes 0.00 to 600.00 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>	111
C2-02 (20CH)	Jerk at Accel End			111
C2-03 (20DH)	Jerk at Decel Start			111
C2-04 (20EH)	Jerk at Decel End			111
C2-05 (25FH)	Jerk below Leveling Speed	All Modes Sets the jerk used when the speed reference is lower than the leveling speed setting		111

<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 250*

■ C3: Slip Compensation

No.(Addr.)	Name	Description	Setting	Page
C3-01 (20FH) RUN	Slip Compensation Gain	V/f OLV Sets the gain for the motor slip compensation function.	Default: 1.0 Min: 0.0 Max: 2.5	111
C3-02 (210H) RUN	Slip Compensation Primary Delay Time	V/f OLV Adjusts the slip compensation function delay time.	Default: 2000 ms Min: 0 ms Max: 10000 ms	112
C3-03 (211H)	Slip Compensation Limit	V/f OLV 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%	112
C3-04 (212H)	Slip Compensation Selection during Regeneration	V/f OLV 0: Disabled. 1: Enabled above 6 Hz. 2: Enabled whenever slip compensation is possible.	Default: 0 Min: 0 Max: 2	112
C3-05 (213H)	Output Voltage Limit Operation Selection	V/f OLV 0: Disabled. 1: Enabled. Automatically decreases motor flux when output voltage saturation is reached.	Default: 0 Min: 0 Max: 1	112

■ C4: Torque Compensation

No.(Addr.)	Name	Description	Setting	Page
C4-01 (215H) RUN	Torque Compensation Gain	All Modes Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque.	Default: <5> Min: 0.00 Max: 2.50	113
C4-02 (216H) RUN	Torque Compensation Primary Delay Time	All Modes Sets the torque compensation filter time.	Default: <5> Min: 0 ms Max: 60000 ms	113
C4-03 (217H)	Torque Compensation at Forward Start	V/f OLV Sets torque compensation at forward start as a percentage of motor torque.	Default: 0.0% Min: 0.0% Max: 200.0%	113
C4-04 (218H)	Torque Compensation at Reverse Start	V/f OLV Sets torque compensation at reverse start as a percentage of motor torque.	Default: 0.0% Min: -200.0% Max: 0.0%	113
C4-05 (219H)	Torque Compensation Time Constant	V/f OLV 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	114

<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 V/f w PG OLV w PG Sets the proportional gain 1 of the speed control loop.	Default: <5> Min: 0.00 Max: 300.00	115
C5-02 (21CH) RUN	Speed Control Loop Integral Time 1	V/f OLV V/f w PG OLV w PG Sets the integral time 1 of the speed control loop.	Default: <5> Min: 0.000 s Max: 10.000 s	115
C5-03 (21DH) RUN	Speed Control Loop Proportional Gain 2	V/f OLV V/f w PG OLV w PG Sets the proportional gain 2 of the speed control loop.	Default: <5> Min: 0.00 Max: 300.00	115
C5-04 (21EH) RUN	Speed Control Loop Integral Time 2	V/f OLV V/f w PG OLV w PG Sets the integral time 2 of the speed control loop.	Default: <5> Min: 0.000 s Max: 10.000 s	115
C5-05 (21FH)	ASR Limit	V/f OLV V/f w PG OLV w PG Sets the upper limit for the speed control loop (ASR) as a percentage of maximum output frequency (E1-04).	Default: 5.0% Min: 0.0% Max: 20.0%	115
C5-06 (220H)	Speed Control Loop Primary Delay Time Constant	V/f OLV V/f w PG OLV w PG 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	115
C5-07 (221H)	Speed Control Settings Switching Speed	V/f OLV V/f w PG OLV w PG Sets the speed for switching between proportional gain 1, 2, 3 and integral time 1, 2, 3.	Default: <5> Min: 0.0% Max: 100.0%	115
C5-13 (272H) RUN	Speed Control Loop Proportional Gain 3	V/f OLV V/f w PG OLV w PG Sets the proportional gain 3 of the speed control loop.	Default: 0.20 Min: 0.00 Max: 300.00	115
C5-14 (273H) RUN	Speed Control Loop Integral Time 3	V/f OLV V/f w PG OLV w PG Sets the integral time 3 of the speed control loop.	Default: 0.200 s Min: 0.000 s Max: 10.000 s	115
C5-40 (27CH)	ASR Start Speed	V/f OLV V/f w PG OLV w PG Sets the speed level from which the ASR Slip Compensation starts to operate while the Standard Slip Compensation (C3-☐☐) is shut down.	Default: 2.50 % Min: 0.0 % Max: 100.0 %	116

<5> Default setting is determined by the control mode (A1-02).

■ C6: Carrier Frequency

No.(Addr.)	Name	Description	Setting	Page
C6-02 (224H)	Carrier Frequency	All Modes Sets the carrier frequency. 1: 2.0 kHz 2: 5.0 kHz 3: 8.0 kHz 4: 10.0 kHz 5: 12.5 kHz 6: 15.0 kHz	Default: 3 Min: 1 Max: 6	116

◆ d: Speed References

Speed Reference parameters are used to set the various speed reference values during operation.

■ d1: Speed Reference

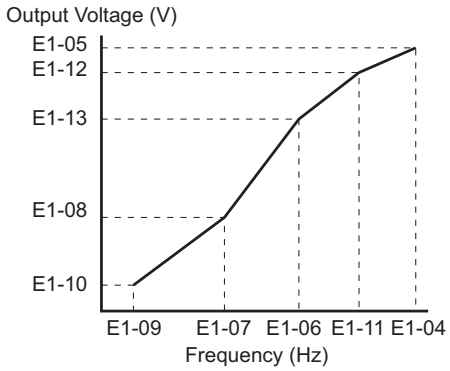
No.(Addr.)	Name	Description	Setting	Page
d1-01 (280H) RUN	Speed Reference 1	All Modes Sets the Speed reference for the drive when d1-18 is set to 0. Setting units are determined by parameter o1-03.	Default: 0.00 Hz <6> Min: 0.00 Hz Max: 120.00 Hz <6> <10>	117
d1-02 (281H) RUN	Speed Reference 2			117
d1-03 (282H) RUN	Speed Reference 3			117
d1-04 (283H) RUN	Speed Reference 4			117
d1-05 (284H) RUN	Speed Reference 5			117
d1-06 (285H) RUN	Speed Reference 6			117
d1-07 (286H) RUN	Speed Reference 7			117
d1-08 (287H) RUN	Speed Reference 8			117
d1-17 (292H) RUN	Jog Speed	All Modes Sets the frequency reference when “Jog Speed” is selected via multi-function digital input terminals.	Default: 6.00 Hz <6> Min: 0.00 Hz Max: 120.00 Hz <6> <10>	117
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)	Default: 1 Min: 0 Max: 2	117
d1-19 (2C1H) RUN	Nominal Speed	All Modes Sets the nominal speed reference when d1-18 = 1 or 2.	Default: 50.00 Hz <6> Min: 0.00 Hz Max: 120.00 Hz <6> <10>	117
d1-20 (2C2H) RUN	Intermediate Speed 1	All Modes Sets intermediate speed reference 1 when d1-18 = 1 or 2.	Default: 0.00 Hz <6> Min: 0.00 Hz Max: 120.00 Hz <6> <10>	118
d1-21 (2C3H) RUN	Intermediate Speed 2	All Modes Sets intermediate speed reference 2 when d1-18 = 1 or 2.		118
d1-22 (2C4H) RUN	Intermediate Speed 3	All Modes Sets intermediate speed reference 3 when d1-18 = 1 or 3.		118
d1-23 (2C5H) RUN	Releveling Speed	All Modes Sets speed reference for releveling when d1-18 = 1 or 2.		118
d1-24 (2C6H) RUN	Inspection Operation Speed	All Modes Sets speed reference when inspection operation is enabled.		118
d1-25 (2C7H) RUN	Rescue Operation Speed	All Modes Sets the speed reference during inspection operation.	Default: 5.00 Hz <6> Min: 0.00 Hz Max: 15.00 Hz <6> <10>	118

No.(Addr.)	Name	Description	Setting	Page
d1-26 (2C8H) RUN	Leveling Speed	All Modes Sets leveling speed reference when d1-18 = 1 or 2.	Default: 4.00 Hz <6> Min: 0.00 Hz Max: 120.00 Hz <6> <10>	118
d1-28 (2CAH)	Leveling Speed Detection Level	All Modes Used when d1-18 = 0. If the speed reference selected is lower than d1-28, then the drive uses the leveling speed as the speed reference.	Default: 0.00 Hz <6> Min: 0.00 Hz Max: 120.00 Hz <6> <10>	118
d1-29 (2CBH)	Inspection Speed Detection Level	All Modes Used when d1-18 = 0. 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.		118

<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 250*
<10> Setting range is limited by the maximum output frequency (E1-04).

◆ 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: 200 V <9> Min: 155 V Max: 255 V <9>	119
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 four 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.  	Default: <5> Min: 0.0 Hz Max: 120.0 Hz	119
E1-05 (304H)	Maximum Voltage		Default:190.0 V <9> Min: 0.0 V Max: 255.0 V <9>	119
E1-06 (305H)	Base Frequency		Default: <5> Min: 0.0 Hz Max: 120.0 Hz	119
E1-07 (306H)	Middle Output Frequency		Default: <5> Min: 0.0 Hz Max: 120.0 Hz	119
E1-08 (307H)	Middle Output Frequency Voltage		Default: <2> <9> Min: 0.0 V Max: 255.0 V <9>	119
E1-09 (308H)	Minimum Output Frequency		Default: <5> Min: 0.0 Hz Max: 120.0 Hz	119
E1-10 (309H)	Minimum Output Frequency Voltage		Default: <2> <9> Min: 0.0 V Max: 255.0 V <9>	119
E1-11 (30AH) <11>	Middle Output Frequency 2		Default: 0.0 Hz Min: 0.0 Hz Max: 120.0 Hz	119
E1-12 (30BH) <11>	Middle Output Frequency Voltage 2		Default: 0.0 V <9> Min: 0.0 V Max: 255.0 V <9>	119
E1-13 (30CH)	Base Voltage		Default: 0.0 V <9> <13> Min: 0.0 V Max: 255.0 V <9>	119

<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. Double the value when using a 400 V class drive.
<11> Parameter is ignored when E1-11 and E1-12 are set to 0.0.
<13> Auto-Tuning will set E1-13 to the same value as E1-05.

■ E2: Motor Parameters

No.(Addr.)	Name	Description	Setting	Page
E2-01 (30EH)	Motor Rated Current	All Modes 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	120
E2-02 (30FH)	Motor Rated Slip	All Modes Sets the motor rated slip. Automatically set during Auto-Tuning.	Default: <4> Min: 0.00 Hz Max: 20.00 Hz	120

No.(Addr.)	Name	Description	Setting	Page
E2-03 (310H)	Motor No-Load Current	All Modes Sets the no-load current for the motor. Automatically set during Auto-Tuning.	Default: <4> Min: 0 A Max: E2-01	120
E2-04 (311H)	Number of Motor Poles	All Modes Sets the number of motor poles. Automatically set during Auto-Tuning.	Default: 4 Min: 2 Max: 48	121
E2-05 (312H)	Motor Line-to-Line Resistance	All Modes Sets the phase-to-phase motor resistance. Automatically set during Auto-Tuning.	Default: <4> Min: 0.000 Ω Max: 65.000 Ω	121
E2-06 (313H)	Motor Leakage Inductance	All Modes 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%	121
E2-07 (314H)	Motor Iron-Core Saturation Coefficient 1	V/f OLV 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	121
E2-08 (315H)	Motor Iron-Core Saturation Coefficient 2	V/f OLV 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	121
E2-09 (316H)	Motor Mechanical Loss	V/f OLV Sets the motor mechanical loss as a percentage of motor rated power (kW).	Default: 0.0% Min: 0.0% Max: 10.0%	121
E2-10 (317H)	Motor Iron Loss for Torque Compensation	V/f OLV Sets the motor iron loss.	Default: <4> Min: 0 W Max: 65535 W	121
E2-11 (318H)	Motor Rated Power	All Modes 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	122

<4> Default setting value varies by the drive model (o2-04).

◆ F: Simple Feedback Settings

■ F1: PG Settings

These parameters determine drive behaviour when using the simple PG feedback function. Note that the pulse signal is input to the pulse train input terminal RP and must be configured in the H6-□□ parameter group.

No.(Addr.)	Name	Description	Setting	Page
F1-02 (381H)	Operation Selection at PG Open Circuit (PGo)	V/f OLV V/f w PG OLV w PG 0: Ramp to stop. Decelerate to stop using the deceleration ramp in C1-02. 1: Coast to stop. 2: Emergency Stop. Decelerate to stop using the deceleration ramp in C1-09. 3: Alarm only.	Default: 1 Min: 0 Max: 3	123
F1-03 (382H)	Operation Selection at Overspeed (oS)	V/f OLV V/f w PG OLV w PG 0: Ramp to stop. Decelerate to stop using the deceleration ramp in C1-02. 1: Coast to stop. 2: Emergency Stop. Decelerate to stop using the deceleration ramp in C1-09. 3: Alarm only.	Default: 1 Min: 0 Max: 3	123
F1-04 (383H)	Operation Selection at Deviation	V/f OLV V/f w PG OLV w PG 0: Ramp to stop. Decelerate to stop using the deceleration ramp in C1-02. 1: Coast to stop. 2: Emergency Stop. Decelerate to stop using the deceleration ramp in C1-09. 3: Alarm only.	Default: 3 Min: 0 Max: 3	123
F1-08 (387H)	Overspeed Detection Level	V/f OLV V/f w PG OLV w PG Sets the overspeed detection level as a percentage of the maximum output frequency.	Default: 115% Min: 0% Max: 120%	123
F1-09 (388H)	Overspeed Detection Delay Time	V/f OLV V/f w PG OLV w PG 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	123
F1-10 (389H)	Excessive Speed Deviation Detection Level	V/f OLV V/f w PG OLV w PG Sets the speed deviation detection level as a percentage of the maximum output frequency.	Default: 10% Min: 0% Max: 50%	123
F1-11 (38AH)	Excessive Speed Deviation Detection Delay Time	V/f OLV V/f w PG OLV w PG 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	123
F1-14 (38DH)	PG Open-Circuit Detection Time	V/f OLV V/f w PG OLV w PG Sets the time required to trigger a PG Open fault (PGo).	Default: 2.0 s Min: 0.0 s Max: 10.0 s	123

◆ 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 *231* to page *232* for a description of setting values. **Note:** Unused terminals should be set to F.	Default: *<19>* Min: 3 Max: 79	124
H1-04 (401H)	Terminal S4 Function Selection		Default: *<19>* Min: 3 Max: 79	124
H1-05 (402H)	Terminal S5 Function Selection		Default: *<19>* Min: 3 Max: 79	124
H1-06 (403H)	Terminal S6 Function Selection		Default: *<19>* Min: 3 Max: 79	124
H1-07 (404H)	Terminal S7 Function Selection		Default: *<19>* Min: 3 Max: 79	124

<19> With the speed reference priority d1-18 set to 0, the default settings for parameters H1-03 to H1-07 governing input terminals S3 to S7 are: 24, 13, 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.	124
4	Multi-Step Speed Reference 2		124
5	Multi-Step Speed Reference 3		124
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).	124
8	Baseblock Command (N.O.)	All Modes Closed: No drive output	124
9	Baseblock Command (N.C.)	All Modes Open: No drive output	124
F	Not Used (Through Mode)	All Modes Select this setting when using the terminal in a 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.	124
14	Fault Reset	All Modes Closed: Resets faults if the cause is cleared and the Up/Down command is removed.	125
15	Emergency Stop (N.O.)	All Modes Closed: Decelerates to stop at the Emergency Stop ramp set to C1-09.	125
17	Emergency Stop (N.C.)	All Modes Open: Decelerates to stop at the Emergency Stop ramp set to C1-09.	125
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).	125
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.	125

H1 Multi-Function Digital Input Settings			
H1-□□ Setting	Function	Description	Page
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, Emergency Stop 29: N.C., Always detected, Emergency Stop 2A: N.O., During run, Emergency Stop 2B: N.C., During run, Emergency 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)	125
40	Forward Run/Stop	All Modes Closed: Activates Run in the forward direction.	126
41	Reverse Run/Stop	All Modes Closed: Activates Run in the reverse direction.	126
50	Nominal Speed	All Modes Closed: Activates the nominal speed (d1-19).	126
51	Intermediate Speed	All Modes Closed: Activates the Intermediate Speed (d1-20).	126
52	Releveling Speed	All Modes Closed: Activates the Releveling Speed (d1-23).	126
53	Leveling Speed	All Modes Closed: Activates the Leveling Speed (d1-26).	126
54	Inspection Operation	All Modes Closed: Activates Inspection operation using the speed set in d1-24.	126
55	Rescue Operation	All Modes Closed: Activates rescue operation.	126
56	Motor Contactor Feedback	All Modes Used for motor contactor supervision and fault detection.	126
79	Brake Feedback	All Modes Used for brake supervision and detection of incorrect operation.	127

■ H2: Multi-Function Digital Outputs

No.(Addr.)	Name	Description	Setting	Page
H2-01 (40BH)	Terminals MA-MB-MC Function Selection (relay)	All Modes Refer to *H2 Multi-Function Digital Output Settings on page 232* for a description of setting values.	Default: E Min: 0 Max: 158	127
H2-02 (40CH)	Terminals P1-PC Function Selection (relay)		Default: 6 Min: 0 Max: 158	127
H2-03 (40DH)	Terminals MD-ME-MF Function Selection (relay)		Default: 50 Min: 0 Max: 158	127

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.	127
1	Zero Speed	All Modes Open: Output speed is above the minimum output speed set in E1-09. Closed: Output speed is below the minimum output speed set in E1-09.	127
2	Speed Agree 1	All Modes Closed: Output speed equals the speed reference (plus or minus the hysteresis set to L4-02).	128
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).	128

H2 Multi-Function Digital Output Settings			
H2-□□ Setting	Function	Description	Page
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.	128
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.	129
6	Drive Ready	All Modes Closed: Power up is complete and the drive is ready to accept an Up/Down command.	129
7	DC Bus Undervoltage	All Modes Closed: DC bus voltage is below the Uv trip level set in L2-05.	129
8	During Baseblock (N.O.)	All Modes Closed: Drive has entered the baseblock state (no output voltage).	130
B	Torque Detection 1	All Modes Closed: An overtorque or undertorque situation has been detected.	130
E	Fault	All Modes Closed: Fault occurred.	130
F	Not used (Through Mode)	All Modes Set this value when using the terminal in the pass-through mode.	130
10	Minor Fault	All Modes Closed: An alarm has been triggered, or the IGBTs have reached 90% of their expected life span.	130
11	Fault Reset Command Active	All Modes Closed: A command has been entered to clear a fault via the input terminals or from the serial network.	130
12	Timer Output	All Modes Closed: Timer output.	130
13	Speed Agree 2	All Modes Closed: When drive output frequency equals the speed reference ±L4-04.	130
14	User-set Speed Agree 2	All Modes Closed: When the drive output speed is equal to the value in L4-03 ±L4-04.	131
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.	131
16	Speed Detection 4	All Modes Closed: When the output speed is greater than or equal to the value in L4-03 ±L4-04.	131
18	Torque Detection 2	All Modes Closed: Overtorque or undertorque has been detected.	130
1A	During Down Direction	All Modes Closed: Drive is running in the down direction.	132
1B	During Baseblock 2 (N.C.)	All Modes Open: Drive has entered the baseblock state (no output voltage).	132
1E	Reset Enabled	All Modes Closed: An automatic reset is performed	132
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.	132
20	Drive Overheat Pre-alarm (oH)	All Modes Closed: Heatsink temperature exceeds the parameter L8-02 value.	132
2F	Maintenance Period	All Modes Closed: Cooling fan, electrolytic capacitors, IGBTs, or the soft charge bypass relay may require maintenance.	133
30	During Torque Limit	V/f OLV CLV CLV/PM Closed: When the torque limit has been reached.	133
37	During Frequency Output	All Modes Open: Either the drive has stopped or baseblock, DC Injection Braking, or Initial Excitation is being performed. Closed: Drive is running the motor (not in a baseblock state and DC Injection is not being performed).	133
50	Brake Control	All Modes Close: Release brake Open: Apply brake	133

H2 Multi-Function Digital Output Settings			
H2-□□ Setting	Function	Description	Page
51	Output Contactor Control	All Modes Closed: Close output contactor	133
54	Light Load Direction	All Modes Closed: Light load direction is up Open: Light load direction is down	133
55	Light Load Direction Detection Status	All Modes Closed: Ready for Light Load Direction Search Open: Light Load Detection in progress	133
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)	133
100 to 158	Functions 0 to 58 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.	133

■ H4: Analog Outputs

No.(Addr.)	Name	Description	Setting	Page
H4-01 (41DH)	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: 102 Min: 000 Max: 999	134
H4-02 (41EH) RUN	Terminal AM Gain	All Modes Sets the signal level at terminal AM that is equal to 100% of the selected monitor value.	Default: 100.0% Min: -999.9% Max: 999.9%	134
H4-03 (41FH) RUN	Terminal AM Bias	All Modes Sets the signal level at terminal AM that is equal to 0% of the selected monitor value.	Default: 0.0% Min: -999.9% Max: 999.9%	134

■ H6: Pulse Train Input

No.(Addr.)	Name	Description	Setting	Page
H6-01 (42CH)	Terminal RP Function Selection	All Modes Selects the function of pulse train input terminal RP. 3: One Channel PG Feedback F: Not Used	Default: F Min: 3 Max: F	134
H6-03 (42EH) RUN	Terminal RP Gain	All Modes Sets the output level when the pulse train input is at 100%, as a percentage of maximum output frequency..	Default: 100.0% Min: 0.0% Max: 1000.0%	134
H6-04 (42FH) RUN	Terminal RP Bias	All Modes Sets the level of the value selected in H6-01 when a 0 Hz signal is input to terminal RP.	Default: 0.0% Min: -100.0% Max: 100.0%	134
H6-05 (430H) RUN	Pulse Train Input Filter Time	All Modes Sets the pulse train input filter time constant in seconds.	Default: 0.10s Min: 0.00s Max: 2.00s	134
H6-09 (444H)	PG Pulse Number	All Modes Sets the number of pulses per revolution of the encoder used for feedback.	Default: 1024 Min: 500 Max: 10000	134

◆ 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	Default: <5> Min: 0 Max: 5	136
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	137
L1-13 (46DH)	Continuous Electrothermal Operation Selection	All Modes 0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1	138

<5> 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>	138

<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	All Modes 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	138
L3-02 (490H)	Stall Prevention Level during Acceleration	All Modes Used when L3-01 = 1 or 2. 100% is equal to the drive rated current.	Default: <16> Min: 0% Max: 165% <16>	139
L3-03 (491H)	Stall Prevention Limit during Acceleration	All Modes Sets the lower limit for Stall Prevention during acceleration as a percentage of drive rated current.	Default: 50% Min: 0% Max: 100%	139
L3-05 (493H)	Stall Prevention Selection during Run	V/f OLV 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	139
L3-06 (494H)	Stall Prevention Level during Run	V/f OLV Enabled when L3-05 is set to 1 or 2. 100% is equal to the drive rated current.	Default: <16> Min: 30% Max: 165%	140

<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 Hz Min: 0.0 Hz Max: 120.0 Hz	140
L4-02 (49AH)	Speed Agreement Detection Width		Default: 2.0 Hz Min: 0.0 Hz Max: 20.0 Hz	140
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 Hz Min: –120.0 Hz Max: 120.0 Hz	140
L4-04 (49CH)	Speed Agreement Detection Width (+/-)		Default: 2.0 Hz Min: 0.0 Hz Max: 20.0 Hz	140

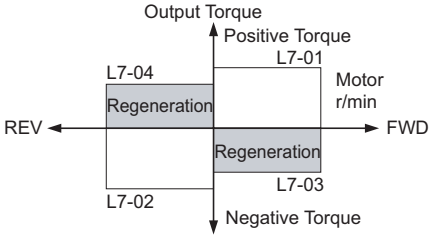
■ L5: Automatic Fault Reset

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.	Default: 2 Min: 0 Max: 10	141
L5-02 (49FH)	Fault Output Operation during Auto Reset	All Modes 0: Fault output not active. 1: Fault output active during reset attempt.	Default: 1 Min: 0 Max: 1	141
L5-04 (46CH)	Fault Reset Interval Time	All Modes Sets the amount of time to wait between performing fault reset.	Default: 10.0 s Min: 0.5 s Max: 600.0 s	141
L5-06 (522H)	Undervoltage Fault Reset Selection	All Modes 0: Restrict auto-reset attempts to L5-01 after UV1 1: No limit on auto-reset attempts after UV1	Default: 0 Min: 0 Max: 1	141

■ 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	142
L6-02 (4A2H)	Torque Detection Level 1	All Modes Sets the overtorque and undertorque detection level.	Default: 150% Min: 0% Max: 300%	143
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	143
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	142
L6-05 (4A5H)	Torque Detection Level 2	All Modes Sets the overtorque and undertorque detection level.	Default: 150% Min: 0% Max: 300%	143
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	143

■ L7: Torque Limit

No. (Addr.)	Name	Description	Setting	Page
L7-01 (4A7H)	Forward Torque Limit	V/f OLV 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%	144
L7-02 (4A8H)	Reverse Torque Limit		Default: 200% Min: 0% Max: 300%	144
L7-03 (4A9H)	Forward Regenerative Torque Limit		Default: 200% Min: 0% Max: 300%	144
L7-04 (4AAH)	Reverse Regenerative Torque Limit		Default: 200% Min: 0% Max: 300%	144
L7-06 (4ACH)	Torque Limit Integral Time	V/f OLV Sets the integral time constant for the torque limit.	Default: 200 ms Min: 0 ms Max: 10000 ms	143

No. (Addr.)	Name	Description	Setting	Page
L7-07 (4C9H)	Torque Limit Control Method Selection during Accel/Decel	V/f OLV Selects the method of torque limit controls during accel/decel. 0: Proportional Control 1: Integral Control	Default: 0 Min: 0 Max: 1	143

■ 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: <4> Min: 50°C Max: 130°C	144
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: Emergency Stop. Decelerate to stop using the deceleration ramp in C1-09. A fault is triggered. 3: Continue operation. An alarm is triggered. 4: Derated operation. Run at L8-19 rate.	Default: 3 Min: 0 Max: 4	145
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	Default: <4> Min: 0 Max: 1	145
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)	Default: 1 Min: 0 Max: 2	145
L8-09 (4B5H)	Output Ground Fault Detection Selection	All Modes 0: Disabled 1: Enabled	Default: <4> Min: 0 Max: 1	146
L8-10 (4B6H)	Heatsink Cooling Fan Operation Selection	All Modes 0: During run only. Fan operates only during run and for L8-11 seconds after stop. 1: Fan always on. Cooling fan operates whenever the drive is powered up.	Default: 0 Min: 0 Max: 1	146
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	146
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	146
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	146
L8-18 (4BEH)	Soft CLA Selection	All Modes 0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1	146
L8-19 (4BFH)	Frequency Reduction Rate during oH Pre-Alarm	All Modes Datermines the factor with which the frequency is reduced when an oH pre-alarm is triggered and L8-03 is set to 4.	Default: 0,8 Min: 0,1 Max: 0,9	146
L8-35 (4ECH) <1>	Installation Selection	All Modes 0: IP20 enclosure drive 1: Side by Side Installation 2: NEMA Type 1 enclosure drive 3: Finless / Fin Outside	Default: <4> Min: 0 Max: 3	147
L8-38 (4EFH)	Carrier Frequency Reduction	All Modes 0: Disabled 1: Enabled below 6 Hz 2: Enabled in whole speed range	Default: <4> Min: 0 Max: 2	147
L8-40 (4F1H)	Carrier Frequency Reduction Off-Delay Time	All Modes Sets the delay time before the Carrier Frequency returns to its normal level	Default: 0.5 s Min: 0.0 s Max: 2.0 s	147
L8-41 (4F2H)	High Current Alarm Selection	All Modes Enables or disables an alarm when output current exceeds 150% of drive rated current. 0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1	147
L8-43 (4F4H)	Output Phase Loss Detection Time	All Modes Sets the amount of time that an output phase loss condition must be present before a fault is triggered.	Default: 0.5 s Min: 0.0 s Max: 2.0 s	147

No. (Addr.)	Name	Description	Setting	Page
L8-88 (2F5H)	Safe Disable Operation Mode	All Modes 0: Mode 0 (conventional) 1: Mode 1 (L7 compatible)	Default: 1 Min: 0 Max: 1	148

<1> Parameter setting value is not reset to the default value when the drive is initialized.
<4> Default setting is determined by the drive model (o2-04).
<5> Default setting is determined by the control mode (A1-02).

◆ n: Advanced Performance Set-Up

The n parameters are used to adjust more advanced performance characteristics.

■ 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 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	149
n2-02 (585H)	Speed Feedback Detection Control (AFR) Time Constant 1	V/f OLV Sets the time constant used for speed feedback detection control (AFR).	Default: 50 ms Min: 0 ms Max: 2000 ms	149
n2-03 (586H)	Speed Feedback Detection Control (AFR) Time Constant 2	V/f OLV Sets the AFR time constant to be used during regen.	Default: 750 ms Min: 0 ms Max: 2000 ms	149

■ n6: Online Tuning

No. (Addr.)	Name	Description	Setting	Page
n6-01 (570H)	Online Tuning Selection	V/f OLV 0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1	149

◆ o: Operator Related Parameters

The o parameters set up the digital operator displays.

■ o1: Digital Operator Display Selection

No. (Addr.)	Name	Description	Setting	Page
o1-01 (500H) RUN	Drive Mode Unit Monitor Selection	All Modes Selects the content of the last monitor that is shown when scrolling through Drive Mode display. Enter the last three digits of the monitor parameter number to be displayed: U□-□□.	Default: 106 (Monitor U1-06) Min: 105 Max: 699	150
o1-02 (501H) RUN	User Monitor Selection after Power Up	All Modes 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	150
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)	Default: 1 Min: 0 Max: 3	150
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: <20> Min: 1 Max: 60000	151
o1-11 (521H)	User-Set Display Units Decimal Display		Default: <20> Min: 0 Max: 3	151

<20> This parameter appears when the drive displays user-set units (o1-03 = 3).

■ 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	151
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	151
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	151
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: –	152
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	152
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	152
o2-07 (527H)	Motor Direction at Power Up when using Operator	All Modes 0: Forward 1: Reverse	Default: 0 Min: 0 Max: 1	152
o2-09 (50DH)	Initialization Specification	2: European Spec	Default: 2 Min: 2 Max: 2	–

<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: No action 1: Read parameters from the drive, saving them onto the digital operator. 2: Copy parameters from the digital operator, writing them to the drive. 3: Verify parameter settings on the drive to check if they match the data saved on the operator.	Default: 0 Min: 0 Max: 3	153
o3-02 (516H)	Copy Allowed Selection	All Modes 0: Read operation prohibited 1: Read operation allowed	Default: 0 Min: 0 Max: 1	153

■ 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 h Min: 0 h Max: 9999 h	153
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	153
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	154
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%	154
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%	154
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%	154

No. (Addr.)	Name	Description	Setting	Page
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	154
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	154
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	155

◆ 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: <5> Min: 0.000% Max: 9.999%	156
S1-02 (681H)	DC Injection Current at Start	All Modes 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: 75%	156
S1-03 (682H)	DC Injection Current at Stop	All Modes 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: 75%	156
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	156
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	156
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	156
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]	157
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: 10.00 s	157
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	157

<5> 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 V/f w PG OLV w PG Sets the motor rated speed.	Default: 1380 rpm Min: 300 rpm Max: 1800 rpm	157
S2-02 (690H) RUN	Slip Compensation Gain in Motoring Mode	V/f OLV V/f w PG OLV w PG 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	157
S2-03 (691H) RUN	Slip Compensation Gain in Regenerative Mode		Default: 1.0 Min: 0.0 Max: 5.0	157

No. (Addr.)	Name	Description	Setting	Page
S2-05 (693H)	Slip Compensation Torque Detection Delay Time	V/f OLV V/f w PG OLV w PG Sets a delay time before detecting torque for slip compensation.	Default: 1000 ms Min: 0 ms Max: 10000 ms	157
S2-06 (694H)	Slip Compensation Torque Detection Filter Time Constant	V/f OLV V/f w PG OLV w PG 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	157

■ S4: Rescue Operation

No. (Addr.)	Name	Description	Setting	Page
S4-01 (6A6H)	Light Load Direction Search Selection	All Modes 0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 2	158
S4-02 (6A7H)	Light Load Direction Search Method	All Modes Determines how the drive detects the light load direction. 0: Output Current 1: Regenerative direction detection	Default: 0 Min: 0 Max: 1	158
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	158
S4-04 (6A9H)	Light Load Direction Search Speed Reference	All Modes Sets the speed reference to use during Light Load Direction Search.	Default: 5.00 Hz Min: 0.00 Hz Max: 20.00 Hz	158
S4-05 (6AAH)	Rescue Operation Torque Limit	V/f OLV Sets a time limit for Light Load Direction Search.	Default: 100% Min: 0% Max: 300%	158

■ 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	158
S6-02 (6B4H)	Starting Current Error (SE2) Detection Delay Time	All Modes Sets a delay time for detecting SE2.	Default: 200 ms Min: 0 ms Max: 1000 ms	159
S6-04 (6B6H)	Output Current Error (SE3) Detection Delay Time	All Modes Sets a delay time for detecting SE3.	Default: 200 ms Min: 0 ms Max: 1000 ms	159
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	159
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	159
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	159
S6-20 (6CBH)	Rollback Detection Operation Selection	V/f OLV V/f w PG OLV w PG 0: Ramp to Stop 1: Coast to Stop 2: Fast Stop 3: Alarm Only 4: Fault After Stop 5: Detection Disabled	Default: 4 Min: 0 Max: 5	159

◆ T: Motor Tuning

Enter data into the following parameters to tune the motor and drive for optimal performance

■ T1: Induction Motor Auto-Tuning

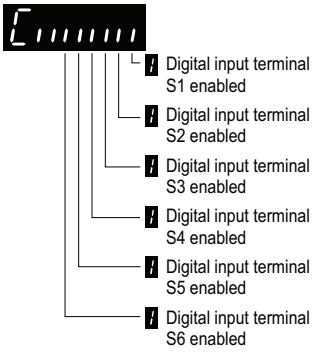
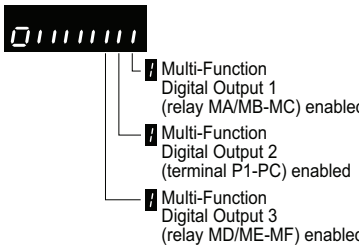
No. (Addr.)	Name	Description	Setting	Page
T1-01 (701H)	Auto-Tuning Mode Selection	All Modes 0: Rotational Auto-Tuning 2: Stationary Auto-Tuning for Line-to-Line Resistance	Default: 0 <5> Min: 0 Max: 2 <18>	83
T1-02 (702H)	Motor Rated Power	All Modes Sets the motor rated power as specified on the motor nameplate. **Note:** Use the following formula to convert horsepower into kilowatts: kW = HP x 0.746.	Default: <4> Min: 0.00 kW Max: 650.00 kW	83
T1-03 (703H)	Motor Rated Voltage	All Modes 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>	84
T1-04 (704H)	Motor Rated Current	All Modes 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	84
T1-05 (705H)	Motor Base Frequency	All Modes Sets the rated frequency of the motor as specified on the motor nameplate.	Default: 50.0 Hz Min: 0.0 Hz Max: 120.0 Hz	84
T1-06 (706H)	Number of Motor Poles	All Modes Sets the number of motor poles as specified on the motor nameplate.	Default: 4 Min: 2 Max: 48	84
T1-07 (707H)	Motor Base Speed	All Modes Sets the rated speed of the motor as specified on the motor nameplate.	Default: 1380 r/min Min: 0 r/min Max: 1800 r/min	84

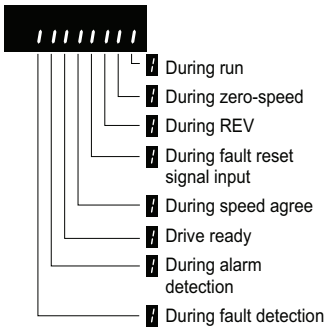
<4> Default setting value varies by the drive model (o2-04).
<5> Default setting is determined by the control mode (A1-02).
<9> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<18> The variety of Auto-Tuning methods depends on the control mode setting. V/f Control allows T1-01 to be set to 2, while vector control allows T1-01 to be set to 0 or 2.

◆ 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	0.01 Hz <31>	–
U1-02 (41H)	Output Speed	All Modes Displays the output speed.	10 V: Max frequency	0.01 Hz <31>	–
U1-03 (42H)	Output Current	All Modes Displays the output current.	10 V: Drive rated current	0.01 A	–
U1-04 (43H)	Control Method	All Modes 0: V/f Control 2: Open Loop Vector Control	No signal output available	–	–
U1-05 (44H)	Motor Speed	V/f OLV V/f w PG OLV w PG Displays the motor speed feedback.	10 V: Max Frequency	0.01 Hz <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)	<12>	–
U1-09 (48H)	Torque Reference	V/f OLV Monitors the internal torque reference.	10 V: Motor rated torque	0.1%	–
U1-10 (49H)	Input Terminal Status	All Modes Displays the input terminal status. 	No signal output available	–	–
U1-11 (4AH)	Output Terminal Status	All Modes Displays the output terminal status. 	No signal output available	–	–

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U1-12 (4BH)	Drive Status	All Modes Verifies the drive operation status.  	No signal output available	–	–
U1-16 (53H)	Output Speed after Soft Start	All Modes Displays output speed with ramp time and jerk settings.	10 V: Max frequency	0.01 Hz <31>	–
U1-18 (61H)	oPE Fault Parameter	All Modes Displays the parameter number that caused the oPE□□ or Err (EEPROM write error) error.	No signal output available	–	–
U1-24 (7DH)	Input Pulse Monitor	All Modes Displays the frequency of the signal at the pulse train input terminal.	No signal output available	–	–
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.
<12> The display resolution depends on drive model (o2-04).
<31> Setting units are determined by the digital operator display unit selection (o1-03).

■ 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 Hz <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 Hz <31>	–
U2-05 (84H)	Output Current at Previous Fault	All Modes Displays the output current at the previous fault.	No signal output available	0.01 A	–
U2-06 (85H)	Motor Speed at Previous Fault	V/f OLV V/f w PG OLV w PG Displays the motor speed at the previous fault.	No signal output available	0.01 Hz <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 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. Displays the same status displayed in U1-11.	No signal output available	–	–

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U2-13 (8CH)	Drive Operation Status at Previous Fault	All Modes Displays the operation status of the drive at the previous fault. Displays the same status displayed 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 speed reference for the soft starter at the previous fault. Displayed in the same way as U1-16.	No signal output available	0.01 Hz <31>	–
U2-16 (7E1H)	Motor q-Axis Current at Previous Fault	V/f OLV Displays the q-axis current for the motor at the previous fault. Displayed in the same way as U6-01.	No signal output available	0.10%	–
U2-17 (7E2H)	Motor d-Axis Current at Previous Fault	V/f OLV Displays the d-axis current for the motor at the previous fault. Displayed in the same way as U6-02.	No signal output available	0.10%	–

<31> Setting units are determined by the digital operator display unit selection (o1-03).

■ U3: Fault History

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
U3-01 to U3-04 (90H to 93H)	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)	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)	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	–
U4-02 (75H)	Number of Run Commands	All Modes Displays the number of run commands that the drive has received. This counter can be reset using parameter o4-13. The maximum number displayed is 65535, after which the value is reset to 0.	No signal output available	1 h	–
U4-03 (67H)	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.	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. 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. Parameter o4-07 can be used to reset this monitor.	No signal output available	1%	–
U4-07 (7D7H)	IGBT Maintenance	All Modes Displays IGBT usage time as a percentage of the expected performance life. 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	–

No. (Addr.)	Name	Description	Analog Output Level	Unit	Page
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	–
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	–
U4-15 (7E4H)	CASE SW Number	All Modes Displays the CASE Software number.	No signal output available	–	–
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	–	–
U4-21 (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: Emergency 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	–	–

■ 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	0.1%	–
U6-02 (52H)	Motor Excitation Current (Id)	V/f OLV Displays the value calculated for the motor excitation current (Id) as a percentage of motor rated secondary current.	10 V: Motor secondary rated current	0.1%	–
U6-03 (54H)	Speed Control Loop Input	V/f OLV V/f w PG Displays the input and output values of the speed control loop.	10 V: Max frequency	0.01%	–
U6-04 (55H)	Speed Control Loop Output		10 V: Motor secondary rated current		
U6-05 (59H)	Output Voltage Reference (Vq)	V/f OLV Output voltage reference (Vq) for the q-axis.	10 V: 200 Vrms <9>	0.1 Vac	–
U6-06 (5AH)	Output Voltage Reference (Vd)	V/f OLV Output voltage reference (Vd) for the d-axis.	10 V: 200 Vrms <9>	0.1 Vac	–
U6-07 (5FH)	q-Axis Current Controller Output	V/f OLV Displays the output value for current control relative to motor secondary current (q-axis).	10 V: 200 Vrms <9>	0.1%	–
U6-08 (60H)	d-Axis Current Controller Output	V/f OLV Displays the output value for current control relative to motor secondary current (d-axis).	10 V: 200 Vrms <9>	0.1%	–

<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 / H6-01). Changing the control mode initializes these parameters to the values shown below.

◆ Control Mode Dependent Parameters

Table B.2 Control Mode Dependent Parameters and Default Values

No.	Name	Setting Range	Resolution	Control Mode			
				V/f	OLV	V/f w PG	OLV w PG
C3-01	Slip Compensation Gain	0.0 to 2.5	0.1	0.0	1.0	0.0	1.0
C3-02	Slip Compensation Primary Delay Time	0 to 10000	1 ms	2000	200	0	200
C3-05	Output Voltage Limit Operation Selection	0, 1	–	–	0	–	0
C4-02	Torque Compensation Primary Delay Time	0 to 60000	1 ms	200	20	200	20
C5-01	Speed Control Loop Proportional Gain 1	0.00 to 300.00	0.01	–	0.20	0.20	0.20
C5-02	Speed Control Loop Integral Time 1	0.000 to 10.000	0.001 s	–	0.200	0.200	0.200
C5-03	Speed Control Loop Proportional Gain 2	0.00 to 300.00	0.01	–	0.02	0.02	0.02
C5-04	ASR Integral Time 2	0.000 to 10.000	0.001 s	–	0.05	0.05	0.05
C5-05	ASR Limit	0.0 to 20.0	0.1%	–	5.0	5.0	5.0
C5-06	ASR Primary Delay Time Constant	0.000 to 0.500	0.001 s	–	0.004	0.004	0.004
C5-07	Speed Control Loop Gain Switching Speed	0.0 to 100.0	0.1%	–	0.0	0.0	0.0
C5-13	Speed Control Loop Proportional Gain 3	0.00 to 300.00	0.01	–	0.20	0.20	0.20
C5-14	Speed Control Loop Integral Time 3	0.000 to 10.000	0.001 s	–	0.200	0.200	0.200
C5-40	ASR Start Speed	0.00 to 100.00	0.01%	–	2.50	2.50	2.50
E1-08	Middle Output Frequency Voltage <9>	0.0 to 255.0	0.1 V	20.0	12.5	20.0	12.5
E1-09	Minimum Output Frequency	0.0 to 120.0	0.1 Hz	0.5	0.3	0.5	0.3
E1-10	Minimum Output Frequency Voltage <9>	0.0 to 255.0	0.1 V	12.5	2.5	12.5	2.5
S1-01	Zero Speed Level at Stop	0.0000 to 9.999	0.001%	1.000	2.400	1.000	2.400

<9> 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.

Table B.3 200 V Class Drives Default Settings by Drive Model Selection

No.	Name	Unit	Default Settings				
–	Model CIMR-LC2V	–	0018	0025	0033	0047	0060
o2-04	Drive Model Selection	Hex.	68	6A	6B	6D	6E
E2-11	Motor Rated Output	kW	3.7	5.5	7.5	11	15
C6-02	Carrier Frequency	kHz	8	8	8	8	8
E2-01	Motor Rated Current	A	14	19.6	26.6	39.7	53.0
E2-02	Motor Rated Slip	Hz	2.73	1.50	1.30	1.70	1.60
E2-03	Motor No-Load Current	A	4.5	5.1	8.0	11.2	15.2
E2-05	Motor Line-to-Line Resistance	Ω	0.771	0.399	0.288	0.230	0.138
E2-06	Motor Leakage Inductance	%	19.6	18.2	15.5	19.5	17.2
E2-10	Motor Iron Loss for Torque Compensation	W	112	172	262	245	272
L2-05	Undervoltage Detection Level	Vdc	190	190	190	190	190
L8-02	Overheat Alarm Level	°C	110	115	121	120	120
L8-09	Output Ground Fault Detection Selection	-	0	1	1	1	1
L8-38	Carrier Frequency Reduction	-	1	2	2	2	2
T1-02	Motor Rated Power	kW	3.7	5.5	7.5	11	15
T1-04	Motor Rated Current	A	14.0	19.6	26.6	39.7	53.0

Table B.4 400 V Class Drives Default Settings by Drive Capacity

No.	Name	Unit	Default Settings				
–	Model CIMR-LC4V	–	0009	0015	0018	0024	0031
o2-04	Drive Model Selection	Hex.	72	73	74	75	76
E2-11	Motor Rated Output	kW	4.0	5.5	7.5	11	15
C6-02	Carrier Frequency	kHz	8	8	8	8	8
E2-01	Motor Rated Current	A	7.0	9.8	13.3	19.9	26.5
E2-02	Motor Rated Slip	Hz	2.70	1.50	1.30	1.70	1.60
E2-03	Motor No-Load Current	A	2.3	2.6	4.0	5.6	7.6
E2-05	Motor Line-to-Line Resistance	Ω	3.333	1.595	1.152	0.922	0.550
E2-06	Motor Leakage Inductance	%	19.3	18.2	15.5	19.6	17.2
E2-10	Motor Iron Loss for Torque Compensation	W	130	193	263	385	440
L2-05	Undervoltage Detection Level	Vdc	380	380	380	380	380
L8-02	Overheat Alarm Level	°C	100	110	110	110	110
L8-09	Output Ground Fault Detection Selectionl	-	0	1	1	1	1
L8-38	Carrier Frequency Reduction	-	1	2	2	2	2
T1-02	Motor Rated Power	s	4.0	5.5	7.5	11	15
T1-04	Motor Rated Current	A	7.0	9.8	13.3	19.9	26.5

B.6 Defaults and Setting Ranges by Display Unit Selection (o1-03)

Table B.5 shows parameters, default settings, and setting ranges that change according to parameter o1-03, Display Unit Selection.

Table B.5 Defaults and Setting Ranges by Display Unit Selection (o1-03)

No.	Name	o1-03 (Digital Operator Display Unit Selection)				Default
		0 (0.01 Hz)	1 (0.01%)	2 (r/min)	3 (User-set)	
d1-01	Speed Reference 1	0.00 to [E1-04] Hz	0.00 to 100.00%	0.00 to <1> r/min	User defined	0.00Hz
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					
d1-17	Jog Speed					6.00Hz
d1-19	Nominal Speed					50.00Hz
d1-20	Intermediate Speed 1					0.00Hz
d1-21	Intermediate Speed 2					
d1-22	Intermediate Speed 3					
d1-23	Releveling Speed					
d1-24	Inspection Operation Speed					
d1-25	Rescue Operation Speed					5.00Hz
d1-26	Leveling Speed					4.00Hz

<1> Automatically calculated according to the values set to the E2-□□ parameters.

Appendix: C

Standards Compliance

This appendix explains the guidelines and criteria for maintaining CE and UL standards.

C.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 TOBPC72060000 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.

C.2 European Standards

Figure C.1 CE Mark

The CE mark indicates compliance with European safety and environmental regulations. It is required for engaging in business and commerce in Europe.

European standards include the Machinery Directive for machine manufacturers, the Low Voltage Directive for electronics manufacturers, and the EMC guidelines for controlling noise.

This drive displays the CE mark based on the EMC guidelines and the Low Voltage Directive.

- **Low Voltage Directive:** 2006/95/EC
- **EMC Guidelines:** 2004/108/EC

Devices used in combination with this drive must also be CE certified and display the CE mark. When using drives displaying the CE mark in combination with other devices, it is ultimately the responsibility of the user to ensure compliance with CE standards. After setting up the device, verify that conditions meet European standards.

◆ CE Low Voltage Directive Compliance

This drive has been tested according to European standard IEC61800-5-1, and it fully complies with the Low Voltage Directive.

To comply with the Low Voltage Directive, be sure to meet the following conditions when combining this drive with other devices:

■ Area of Use

Do not use drives in areas with pollution higher than severity 2 and overvoltage category 3 in accordance with IEC664.

■ Installing Fuses on the Input Side

Always install input fuses. Select fuses according to *Table C.1*.

Table C.1 Recommended Input Fuse Selection

Model CIMR-LC	Fuse Data		
	Fuse Type	Fuse Model	Current Rating [A]
Three-Phase 200 V Class			
2V0018	Time Delay Class RK5 600 Vac, 200 kAIR	TRS60R	60
2V0025	Non-Time Delay Class T 600 Vac, 200 kAIR	A6T70	70
2V0033		A6T100	100
2V0047		A6T150	150
2V0060		A6T200	200
Three-Phase 400 V Class			
4V0009	Time Delay Class RK5 600 Vac, 200 kAIR	TRS30R	30
4V0015	Non-Time Delay Class T 600 Vac, 200 kAIR	A6T50	50
4V0018		A6T60	60
4V0024		A6T70	70
4V0031		A6T80	80

■ 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.

◆ EMC Guidelines Compliance

This drive is tested according to European standards EN61800-3: 2004, and complies with the European standards EN12015 (requires an optional AC reactor) and EN12016.

Note: Make sure the protective earthing conductor complies with technical standards and local safety regulations. Due to the fact that the leakage current exceeds 3.5 mA when an EMC filter is installed, IEC 61800-5-1 states that either the power supply must be automatically disconnected in case of discontinuity of the protective earthing conductor or a protective earthing conductor with a cross-section of at least 10 mm² (Cu) or 16 mm² (Al) must be used.

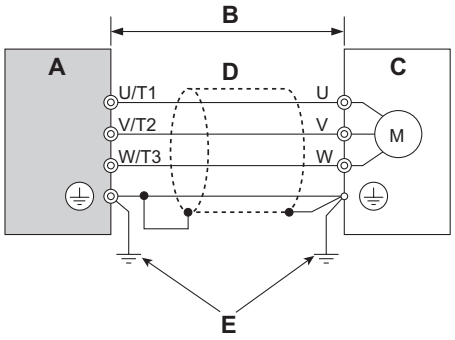
■ EMC Filter Installation

The following conditions must be met to ensure continued compliance with European standards EN12015 and EN12016. *Refer to EMC Filters on page 257* for EMC filter selection.

Installation Method

Verify the following installation conditions to ensure that other devices and machinery used in combination with this drive also comply with EMC guidelines.

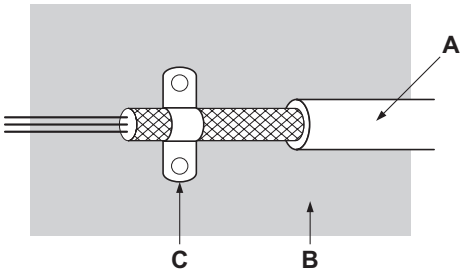
1. Install an EMC noise filter to the input side specified by Yaskawa for compliance with European standards.
2. Place the drive and EMC noise filter in the same enclosure.
3. Use braided shield cable for the drive and motor wiring, or run the wiring through a metal conduit.
4. Keep wiring as short as possible. Ground the shield on both the drive side and the motor side.



A – Drive
B – 10 m max cable length between drive and motor
C – Motor
D – Metal conduit
E – Ground wire should be as short as possible.

Figure C.2 Installation Method

5. Make sure the ground conductor complies with technical standards and local safety rules. When an EMC filter is installed, the leakage current exceeds 3.5 mA. Therefore according to IEC61800-5-1, at least one of the conditions below must be satisfied:
   a) The cross-section of the protective earthing conductor must be at least 10 mm² (Cu) or 16 mm² (Al).
   b) The power supply must be disconnected automatically in case of discontinuity of the protective earthing conductor.

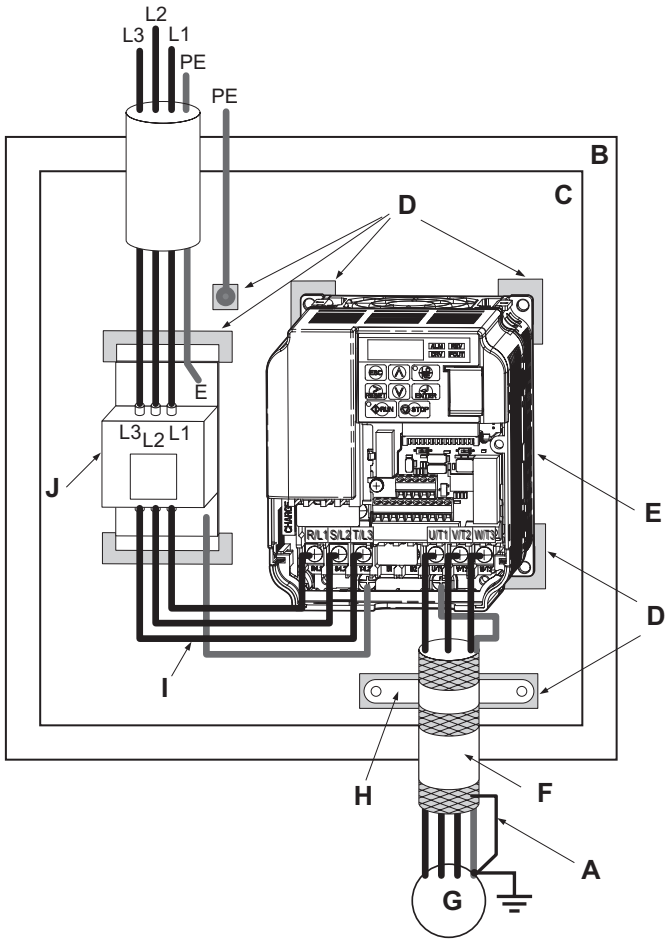


A – Braided shield cable
B – Metal panel
C – Cable clamp (conductive)

Figure C.3 Ground Area

6. Connect an AC or DC reactor to minimize harmonic distortion.

Three-Phase 200 V / 400 V Class



A – Ground the cable shield
B – Enclosure panel
C – Metal plate
D – Grounding surface
E – Drive
F – Motor cable (Braided shield cable, max. 20 m)
G – Motor
H – Cable clamp
I – Wiring distance as short as possible
J – EMC noise filter

Figure C.4 EMC Filter and Drive Installation for CE Compliance (Three Phase 200/400 V Class)

■ EMC Filters

Install the drive with the EMC filters listed below to comply with the EN61800-3/EN12015 requirements.

Table C.2 EN61800-3 Class C1 Filters

Model CIMR-LC	Filter Data (Manufacturer: Schaffner)						
	Type	Rated Current (A)	Weight (kg)	Dimensions [W x D x H] (mm)	Y x X	Drive Mounting Screw A	Filter Mounting Screw
Three-Phase 200 V Class							
2V0018	FS23637-24-07	24	0.9	**144** × **174** × **50**	**120** × **161**	M4	M5
2V0025	FS23637-52-07	52	2.0	137 × 304 × 56	100 × 289	M5	M5
2V0033							
2V0047	FS23637-68-07	**68**	**2.6**	175 × 340 × 65	130 × 325	M5	M6
2V0060	FS23637-80-07	80	3.1	**212** × **393** × **65**	**167** × **378**	M6	M8
Three-Phase 400 V Class							
4V0009	FS23639-15-07	15	0.9	144 × 174 × 50	120 × 161	M4	M5
4V0015	FS23639-30-07	30	1.8	137 × 304 × 56	100 × 289	M5	M5
4V0018							
4V0024	FS23639-50-07	50	2.7	175 × 340 × 65	130 × 325	M5	M6
4V0031							

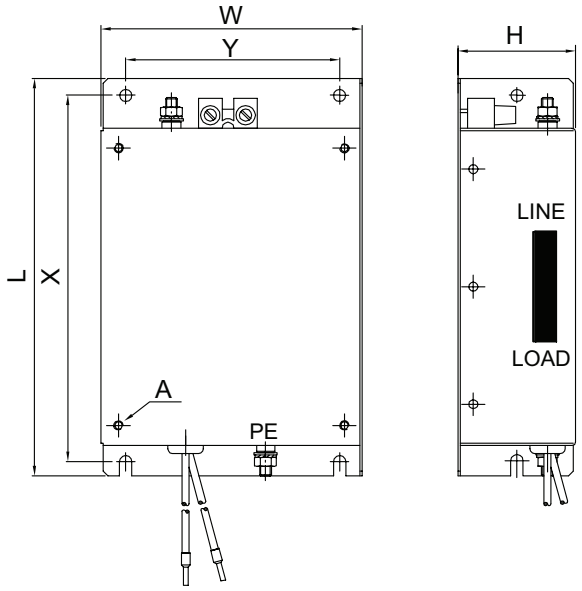


Figure C.5 EMC Filter Dimensions

■ AC Reactors for EN 12015 Compliance

For compliance with EN 12015 select an input reactor according to *Table C.3*.

Table C.3 AC Reactor Selection for EN 12015 Compliance

Model CIMR-LC	Reactor Data (Manufacturer: Block)			
	Reactor Model (IP00)	Reactor Model (IP20)	Inductance [mH]	Nominal Current [A]
Three-Phase 200 V Class				
2V0018	LR3 40-4/20	Available as option, same model as IP00, plus IP20 request.	1.47	20
2V0025	LR3 40-4/45		0.65	45
2V0033				
2V0047	LR3 40-4/70		0.42	70
2V0060				
Three-Phase 400 V Class				
4V0009	B 0903084	B 0903088	10.0	8
4V0015	B 0903085	B 0903089	5.10	16
4V0018				
4V0024	B 0903086	B 0903090	4.70	21
4V0031	B 0903087	B 0903091	3.15	27

C.3 UL and CSA 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 C.6 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).

■ Main Circuit Terminal Wiring

Yaskawa recommends using UL-listed copper wires (rated at 75°C) and closed-loop connectors or CSA-certified ring connectors sized for the selected wire gauge to maintain proper clearances when wiring the drive. Use the correct crimp tool to install connectors per manufacturer recommendation. The following table lists a suitable closed-loop connector manufactured by JST Corporation.

Table C.4 Closed-Loop Crimp Terminal Size (JIS C 2805)

Wire Gauge mm² (AWG)	Terminal Screws	Crimp Terminal Model	Tightening Torque N.m (lb-in)
2.0 (14)	M3.5	R2-3.5	0.8 to 1.0 (7.1 to 8.9)
	M4	R2-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R2-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R2-6	4.0 to 5.0 (35.4 to 44.3)
3.5/5.5 (12/10)	M4	R5.5-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R5.5-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R5.5-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R5.5-8	9.0 to 11.0 (79.7 to 97.4)
8 (8)	M4	R8-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R8-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R8-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R8-8	9.0 to 11.0 (79.7 to 97.4)
14 (6)	M4	R14-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R14-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R14-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R14-8	9.0 to 11.0 (79.7 to 97.4)
22 (4)	M6	R22-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R22-8	9.0 to 11.0 (79.7 to 97.4)
30/38 (3/2)	M8	R38-8	9.0 to 11.0 (79.7 to 97.4)

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.

Input Fuse Installation

Always install fuses at the drive input side. For UL compliance select the fuses according to *Table C.5*.

Table C.5 Recommended Input Fuse Selection

Model CIMR-LC	Fuse Data		
	Fuse Type	Fuse Model	Current Rating [A]
Three-Phase 200 V Class			
2V0018	Time Delay Class RK5 600 Vac, 200 kAIR	TRS60R	60
2V0025	Non-Time Delay Class J 600 Vac, 200 kAIR	A6T110	110
2V0033		A6T150	150
2V0047		A6T200	200
2V0060		A6T225	225
Three-Phase 400 V Class			
4V0009	Time Delay Class RK5 600 Vac, 200 kAIR	TRS30R	30
4V0015	Non-Time Delay Class J 600 Vac, 200 kAIR	A6T60	60
4V0018		A6T70	70
4V0024		A6T110	110
4V0031		A6T125	125

■ 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. Use a class 2 (UL recognized) power supply for the control circuit terminal when not using the internal control power supply of the drive. 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 C.6 Control Circuit Terminal Power Supply

Input / Output	Terminal Signal	Power Supply Specifications
Open Collector Outputs	P1, PC	Requires class 2 power supply
Digital inputs	S1, S2, S3, S4, S5, S6, S7, SC, H1, HC	Use the internal LVLC power supply of the drive. Use class 2 for external power supply.
Analog inputs / outputs	RP, AC, AM, AC	

■ Drive Short Circuit Rating

This drive is suitable for use on a circuit capable of delivering not more than 30,000 RMS symmetrical amperes, 480 V AC maximum (Up to 240 V in 200 V class drives , up to 480 V for 400 V class drives), when protected by fuses as specified in *Table C.5*.

◆ CSA Standards Compliance

■ CSA for Industrial Control Equipment

The L1000V is CSA certified as Industrial Control Equipment Class 3211.

Specifically, the L1000V is certified to: CAN/CSA C22.2 No.04-04 and CAN/CSA C22.2 No.14-05.

Figure C.7 CSA Mark

■ CSA for Elevator Equipment

The L1000V is tested and complies with CSA B44.1-04/ASME A17.5-2004 standard. This standard is used by CSA to evaluate the L1000V to Class 2411 (Elevator Equipment).

Figure C.8 CSA B44.1-04/ASME A17.5-2004 Mark

◆ Drive Motor Overload Protection

Set parameter E2-01 (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: Motor Rated Current

Setting Range: Model Dependent

Default Setting: Model Dependent

Parameter E2-01 (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 is automatically written into parameter E2-01. If Auto-Tuning has not been performed, manually enter the correct motor rated current to parameter E2-01.

■ 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 C.7 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.

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) 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) 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.

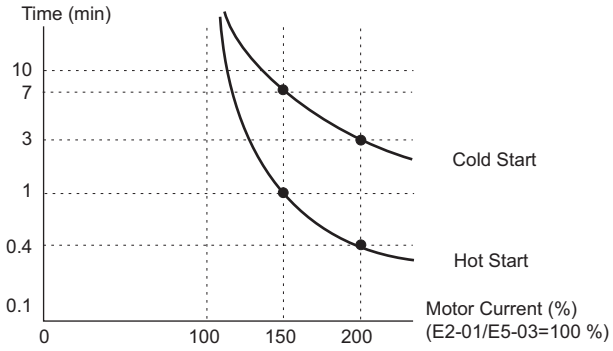


Figure C.9 Motor Overload Protection Time

C.4 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 input provides a stop function in compliance with “Safe Torque Off” as defined in the IEC61800-5-2. The Safe Disable input has 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 can also be programmed to a digital output.

Inputs / Outputs		One Safe Disable input 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 = 6.0 E^{-6}
	Demand Rate High or Continuous	PFH = 3.4E^{-10}
Performance Level		The Safe Disable inputs satisfy all requirements of Performance Level (PL) d according to ISO13849-1.

◆ Precautions

DANGER! *Sudden Movement Hazard. Improper use of the Safe Disable function will result in serious injury or death. Make sure the whole system or machinery that the Safe Disable function is used in complies with safety requirements. When implementing the Safe Disable function into the safety system of a machine, a thorough risk assessment for the whole system has to be carried out to assure it complies with relevant safety norms (e.g., EN954/ISO13849, IEC61508, EN/IEC62061).*

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 input, make sure to remove the wire link between terminals H1 and HC that was installed prior to shipment. Failing to do so will keep the Safe Disable circuit from operating properly and can cause injury or even death.*

NOTICE: *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.*

NOTICE: *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.*

NOTICE: *From the moment terminal input H1 is opened, it takes up to 1 ms for drive output to shut off completely. The sequence set up to trigger terminal H1 should make sure that the terminal remains open for at least 1 ms in order to properly interrupt drive output.*

NOTICE: *The Safe Disable Monitor function (H2-□□=58) 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 one input channel that can block the output transistors (terminal H1). The input can use the drive internal power supply only.

An output function (H2-□□=58) is available to monitor the status of the Safe Disable terminal. ***Refer to Output Terminals on page 55*** for signal specifications of the drive’s digital output terminals.

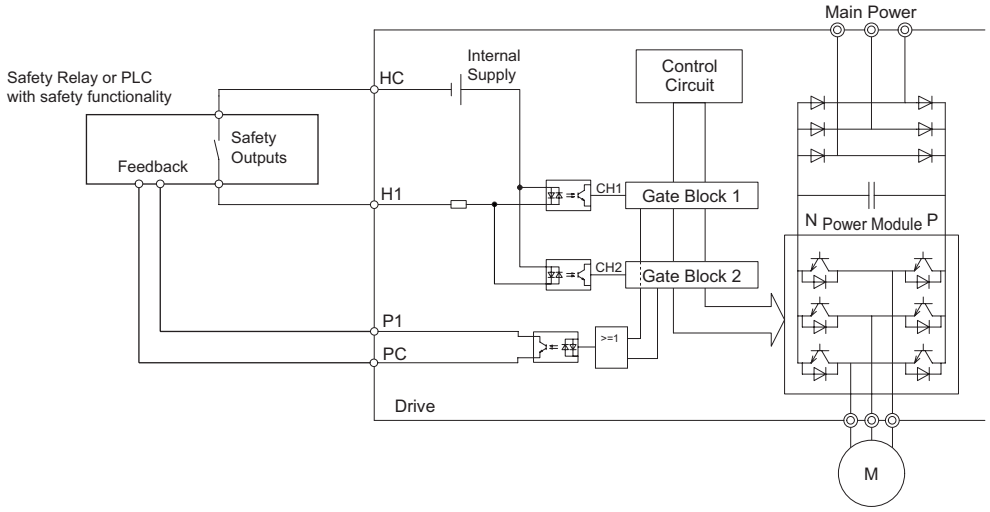


Figure C.10 Safe Disable Function Wiring Example

■ Disabling and Enabling the Drive Output ("Safe Torque Off")

Figure C.11 illustrates a Safe Disable input operation example.

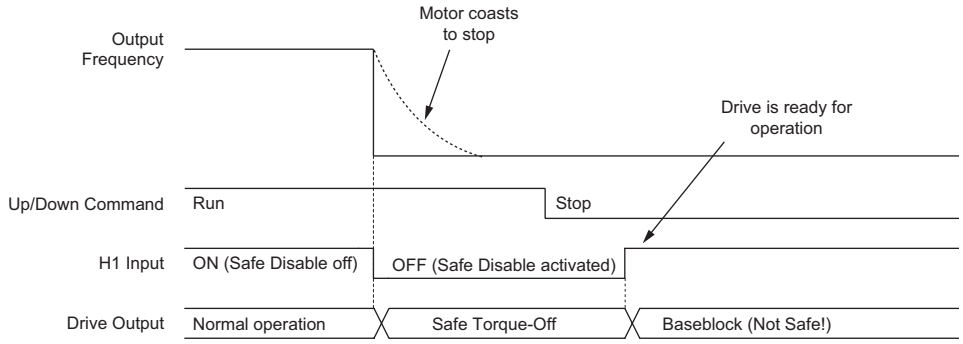


Figure C.11 Safe Disable Operation

Entering the "Safe Torque Off" State

Whenever the Safe Disable input opens, the motor torque is shut off by switching off the drive output. If the motor was running before the Safe Disable input 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 the Safe-Disable input.
If the Up/Down command is issued before the Safe-Disable input is 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 input is 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 input is 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 input is 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. Internally, the L1000V drive has two Safe Disable input channels which are bridged and connected to the H1 terminal.

Safe Disable Input Status		Safe Disable Status Monitor, H2-□□ = 58	Drive Output Status	Digital Operator Display
Input 1, H1-HC	Input 2, H2-HC			
Off	Off	On	Safely disabled, “Safe Torque Off”	Hbb (flashes)
On	Off	On	Safely disabled, “Safe Torque Off”	HbbF (flashes)
Off	On	On	Safely disabled, “Safe Torque Off”	HbbF (flashes)
On	On	Off	Baseblock, ready for operation	Normal display

Safe Disable Status Monitor

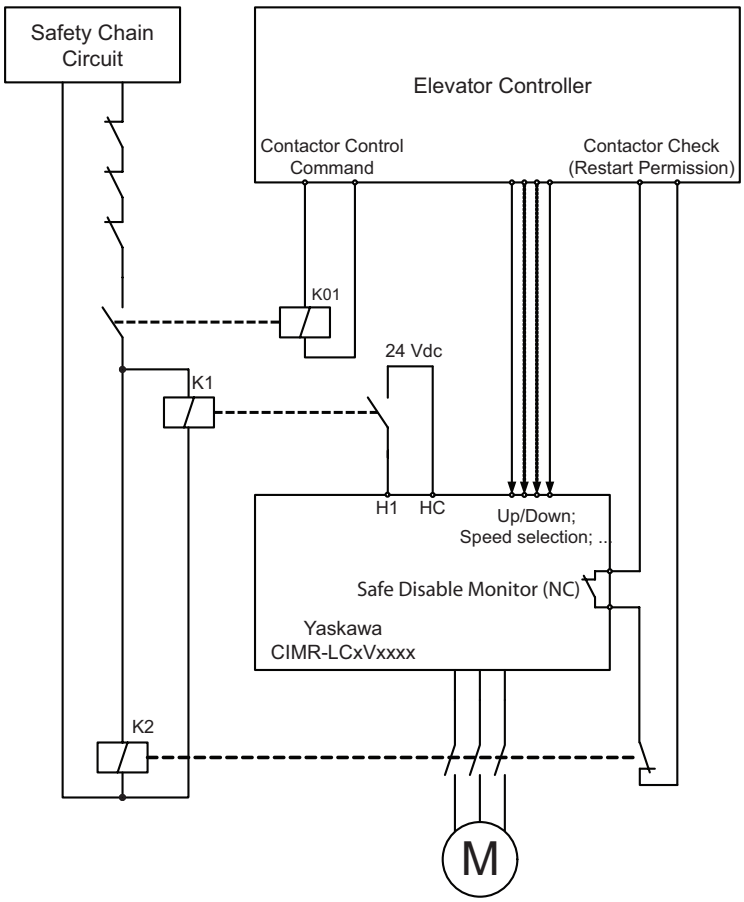
With the Safe Disable monitor output (digital output programmed to H2-□□=58), the drive provides a status feedback signal. This signal should be read by the device that controls the Safe Disable inputs (PLC or a safety relay) in order to prohibit leaving the “Safe Torque Off” status in case the safety circuit malfunctions. This 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.

C.5 EN81-1 Conform Circuit with one Motor Contactor

The safe disable circuit can be used 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 input H1 is 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 figure below shows a wiring example.



Note: **1.** The drive output will immediately shut off when input H1 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., terminal H1 must be closed prior to setting the Up/Down command.

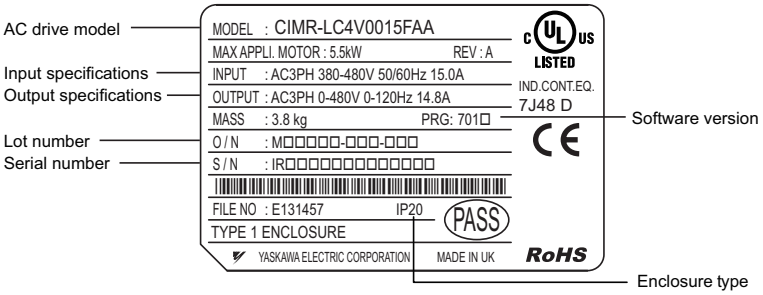
Appendix: D

Quick Reference Sheet

This section provides tables to keep record of the drive specification, motor specification and drive settings. Fill in the data after commissioning the application and have them ready when contacting Yaskawa for technical assistance.

D.1 Drive and Motor Specifications

◆ Drive Specifications



Items	Value
Model	CIMR-LC
Serial Number	
Software Version (PRG)	
Options used (Option cards, braking transistor, etc.)	

◆ Motor Specifications

■ Induction Motor

Items	Value	Items	Value
Manufacturer		**Motor Rated Current**	A
Model		**Motor Base Frequency**	Hz
Motor Rated Power	kW	**Number of Motor Poles**	
Motor Rated Voltage	V	**Motor Rated Speed**	r/min

■ Motor Speed Encoder (if used)

Items	Value	Items	Value
Manufacturer		**Type Number**	
Interface		**Resolution**	

D.2 Basic Parameter Settings

Use these tables to keep record of the most important parameters. Have this data available when contacting technical support.

◆ Basic Setup

Item	Setting Value	Memo	Item	Setting Value	Memo
Control Mode	A1-02 =		Up/Down Command Selection	b1-02 =	
Speed Reference Selection	b1-01 =		Speed Reference Selection Mode	d1-18 =	

◆ V/f Pattern Setup

Item	Setting Value	Memo	Item	Setting Value	Memo
V/f Pattern Selection	E1-03 =		Middle Output Frequency	E1-07 =	
Max. Output Frequency	E1-04 =		Mid. Output Freq. Voltage	E1-08 =	
Maximum Voltage	E1-05 =		Min. Output Frequency	E1-09 =	
Base Frequency	E1-06 =		Min. Output Freq. Voltage	E1-10 =	

◆ Motor Setup

	Item	Setting Value	Memo	Item	Setting Value	Memo
Induction Motor	Motor Rated Current	E2-01 =		Number of Motor Poles	E2-04 =	
	Motor Rated Slip	E2-02 =		Motor Line-to-Line Resistance	E2-05 =	
	Motor No-Load Current	E2-03 =		Motor Leakage Inductance	E2-06 =	

◆ Multi-Function Digital Inputs

Terminal	Input Used	Setting Value and Function Name	Memo	Terminal	Input Used	Setting Value and Function Name	Memo
S3		H1-03 =		S6		H1-06 =	
S4		H1-04 =		S7		H1-07 =	
S5		H1-05 =					

◆ Multi-Function Digital Outputs

Terminal	Output Used	Setting Value and Function Name	Memo
MA-MB-MC		H2-01 =	
P1-PC		H2-02 =	
MD-ME-MF		H2-03 =	

◆ Monitor Output

Terminal	Output Used	Setting Value and Function Name	Memo
AM		H4-01 =	

D.3 User Setting Table

Use the Verify Menu to see which parameters have been changed from their original default settings.

- The diamond below 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**	
b1-08	Up/Down Command Selection while in Programming Mode	
b1-14	Phase Order Selection	
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	
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	Emergency Stop Ramp	
C1-10	Accel/Decel Setting Resolution	
C1-11	Accel/Decel Switching Speed	
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	
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	
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	
C5-05	Speed Control Loop Upper Limit	
C5-06	Speed Control Loop Primary Delay Time Constant	
C5-07	Speed Control Loop Settings Switching Speed	
C5-13 ◆	Speed Control Loop Proportional Gain 3	
C5-14 ◆	Speed Control Loop Integral Time 3	

No.	Name	User Setting
C5-40	ASR Start Speed	
C6-02	Carrier Frequency Selection	
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	
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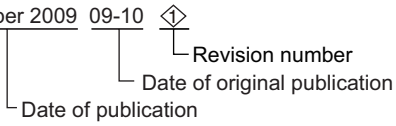

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