# YASKAWA

YASKAWA AC Drive-A1000
High Performance Vector Control Drive
Quick Start Guide

Type: CIMR-AU☐A☐☐☐

Models: 200 V Class: 0.4 to 110 kW (3/4 to 175 HP ND)
400 V Class: 0.4 to 630 kW (3/4 to 1000 HP ND)
600 V Class: 0.75 to 185 kW (1 to 250 HP ND)

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.
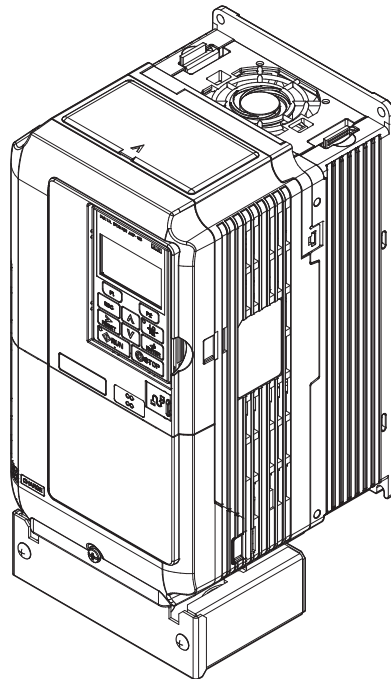
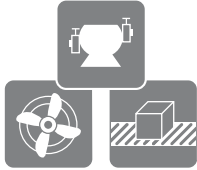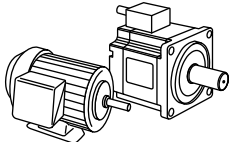|	
Receiving	**1**
Mechanical Installation	**2**
Electrical Installation	**3**
Start-Up Programming & Operation	**4**
Troubleshooting	**5**
Periodic Inspection & Maintenance	**6**
Peripheral Devices & Options	**7**
Specifications	**A**
Parameter List	**B**
Standards Compliance	**C**

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◆ Quick Reference

Easily Set Parameters for Specific Applications
Preset parameter defaults are available for setting up applications. *Refer to Application Selection on page 134*.

Run a Motor One Frame Larger
This drive can operate a motor one frame size larger when running variable torque loads such as fans and pumps. *Refer to C6-01: Drive Duty Mode Selection on page 144*.

Drive a Synchronous PM Motor
The drive can operate synchronous PM motors. *Refer to Subchart A-3: Operation with Permanent Magnet Motors on page 131*.

Perform Auto-Tuning
Automatic tuning sets motor parameters. *Refer to Auto-Tuning on page 164*.

Maintenance Check Using Drive Monitors
Use drive monitors to check if fans, capacitors, or other components require maintenance. *Refer to Performance Life Monitors Maintenance Monitors on page 217*.

Fault Display and Troubleshooting
Refer to Drive Alarms, Faults, and Errors on page 178.

Standards Compliance
Refer to European Standards on page 330 and *Refer to UL and CSA Standards on page 340*.

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Table of Contents

i

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.
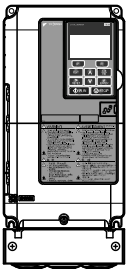
i.1 Preface

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 A1000-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 A1000 series drives:

	A1000 Series AC Drive Quick Start Guide (TOEPC71061641)
	Read this guide first. This guide is packaged together with the product and contains basic information on safety precautions, model list, and wiring. Use this manual for basic settings and trial operation. The purpose of this guide is to prepare the drive for a trial run with an application and for basic operation. This manual is available for download on our documentation website, www.yaskawa.com.
	A1000 Series AC Drive Technical Manual (SIEPC71061641)
	The manual contains information required to install and wire the drive, in addition to an overview of fault diagnostics, maintenance safety, and parameter settings. Contact a Yaskawa representative to obtain the manual. The most recent version of this manual is available for download on our documentation website, www.yaskawa.com.

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 Yaskawa or a Yaskawa representative and provide the manual number shown on the front cover.
• If nameplate becomes worn or damaged, order a replacement from Yaskawa or a Yaskawa representative.

⚠ 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

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, measure for unsafe voltages to confirm the drive is safe prior to servicing.

Failure to comply will result in death or serious injury.

⚠ WARNING

Sudden Movement Hazard

System may start unexpectedly upon application of power, resulting in death or serious injury.

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

When using DriveWorksEZ to create custom programming, the drive I/O terminal functions change from factory settings and the drive will not perform as outlined in this manual.

Unpredictable equipment operation may result in death or serious injury.

Take special note of custom I/O programming in the drive before attempting to operate equipment.

Electrical Shock Hazard

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

Failure to comply could result in death or serious injury.

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

Do not allow unqualified personnel to use equipment.

Failure to comply could result in death or serious injury.

Installation, maintenance, inspection, and service must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

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

Failure to comply could result in death or serious injury.

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

Because the leakage current exceeds 3.5 mA in models 4A0414 and larger, IEC/EN 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 mm^2 (Cu) or 16 mm^2 (Al) must be used. Failure to comply may result in death or serious injury.

Always use appropriate equipment for Ground Fault Circuit Interrupters (GFCIs).

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 a type B GFCI according to IEC/EN 60755.

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

Install adequate branch circuit protection according to applicable local codes and this Installation Manual. Failure to comply could result in fire and damage to the drive or injury to personnel.

The device is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (200 V class) and 480 Vac maximum (400 V class), and 600 Vac maximum (600 V class) when protected by branch circuit protection devices specified in this document.

Crush Hazard

Do not use this drive in lifting applications without installing external safety circuitry to prevent accidental dropping of the load.

The drive does not possess built-in load drop protection for lifting applications.

Failure to comply could result in death or serious injury from falling loads.

Install electrical and/or mechanical safety circuit mechanisms independent of drive circuitry.

⚠ CAUTION

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.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards. Failure to comply may result in ESD damage to the drive circuitry.

Do not perform a withstand voltage test or megger 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.

If a fuse is blown or a Ground Fault Circuit Interrupter (GFCI) is tripped, check the wiring and the selection of the peripheral devices.

Check for short circuits or ground faults on the secondary side of fuses and GFCIs and check the wiring and the selection of peripheral devices. Remove the cause of the problem and then turn the power supply off and on again. If the cause cannot be identified, do not turn on the power supply or attempt to operate the equipment.

Do not restart the drive immediately operate the peripheral devices if a fuse is blown or a GFCI is tripped.

Check the wiring and the selection of peripheral devices to identify the cause. Contact Yaskawa or a Yaskawa representative before restarting the drive or the peripheral devices if the cause cannot be identified.

Do not expose the drive to halogen group disinfectants.

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

Do not pack the drive in wooden materials that have been fumigated or sterilized. Do not sterilize the entire package after the product is packed.

◆ General Application Precautions

■ Selection

Installing a Reactor

Use an AC reactor or DC link choke in the following situations:

• to suppress harmonic current.
• to smooth peak current that results from capacitor switching.

- when the power supply is above 600 kVA.
- when the drive is running from a power supply system with thyristor converters.

  Note: A DC link choke is built in to drive models 2A0110 to 2A0415, 4A0058 to 4A1200, and 5A0041 to 5A0242.
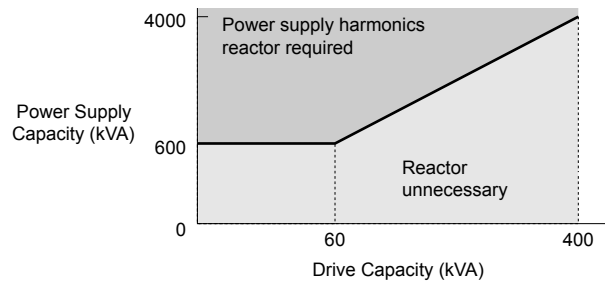
Figure i.1 Installing a Reactor

Drive Capacity

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

When running more than one motor in parallel from a single drive, the capacity of the drive should be larger than [total motor rated current × 1.1].

Starting Torque

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 achieve a higher starting torque, use a larger drive or a drive and motor with larger capacity.

Emergency Stop

During a drive fault condition, the output shuts off but the motor does not stop immediately. A mechanical brake may be required when it is necessary to stop the motor faster than the ability of the Fast Stop function of the drive.

Options

NOTICE: *The B1, B2, ⊖, ⊕1, ⊕2, and ⊕3 terminals are used to connect optional drive-specific compatible devices only. Connecting non-Yaskawa-approved devices to these terminals may damage the drive.*

Repetitive Starting/Stopping

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

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

◼ Installation

Enclosure Panels

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

Installation Direction

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

◼ Settings

Motor Code

When using OLV/PM, set the proper motor code to parameter E5-01 before performing a trial run.

Upper Limits

NOTICE: *The drive is capable of running the motor up to 400 Hz. Be sure to set the upper limit for the frequency of the drive to prevent the possible danger of accidentally operating equipment at higher than rated speed. The default setting for the maximum output frequency is 60 Hz.*

DC Injection Braking

NOTICE: *Excessive current during DC Injection Braking and excessive duration of DC Injection Braking can cause motor overheat.*

Acceleration/Deceleration Times

Acceleration and deceleration times are affected by the amount of torque generated by the motor, the load torque, and the moment of inertia. 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

Wiring Check

NOTICE: *Do not connect power supply lines to output terminals U/T1, V/T2, or W/T3. Failure to comply will destroy the drive. Be sure to perform a final check of all sequence wiring and other connections before turning on the power and also check for short circuits on the control terminals, which may damage the drive.*

Selecting a Circuit Breaker or Circuit Interrupter

Yaskawa recommends installing a Ground Fault Circuit Interrupter (GFCI) to the power supply side. The GFCI should be designed for use with AC drives (e.g., Type B according to IEC/EN 60755).

Select a Molded Case Circuit Breaker (MCCB) or GFCI with a rated current 1.5 to 2 times higher than the drive rated input current to avoid nuisance trips caused by harmonics in the drive input current.

NOTICE: *Prevent Equipment Damage. Install a fuse and a GFCI in models 4A0930 and 4A1200. Failure to comply may result in serious damage to the facilities if the drive is defective.*

Magnetic Contactor Installation

WARNING! *Fire Hazard. Shut off the drive with a magnetic contactor (MC) when a fault occurs in any external equipment such as braking resistors. Failure to comply may cause resistor overheating, fire, and injury to personnel.*

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

Inspection and Maintenance

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

WARNING! *Electrical Shock Hazard. When a drive is running a PM motor, voltage continues to be generated at the motor terminals after the drive is shut off while the motor coasts to stop. Take the precautions described below to prevent shock and injury:*
· In applications where the machine can still rotate after the drive has fully stopped a load, install a switch to the drive output side to disconnect the motor and the drive.
· Do not allow an external force to rotate the motor beyond the maximum allowable speed or to rotate the motor when the drive has been shut off.
· Wait for at least the time specified on the warning label after opening the load switch on the output side before inspecting the drive or performing any maintenance.
· Do not open and close the load switch while the motor is running.
· If the motor is coasting, make sure the power to the drive is turned on and the drive output has completely stopped before closing the load switch.

WARNING! *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. Drive models 2A0069 to 2A0415 and 4A0058 to 4A1200 require the use of use ring terminals for UL/cUL compliance. Use only the tools recommended by the terminal manufacturer for crimping.

Transporting the Drive

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

◆ Motor Application Precautions

■ Standard Induction Motors

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 decreases 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. *Figure i.2* shows the allowable load characteristics for a Yaskawa standard motor. Use a motor designed specifically for operation with a drive when 100% continuous torque is needed at low speeds.
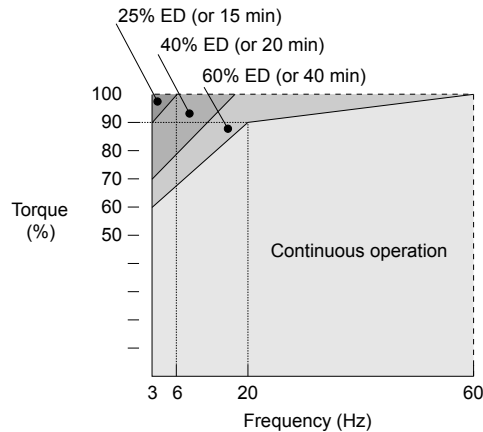
Figure i.2 Allowable Load Characteristics for a Yaskawa Motor

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.*

High-Speed Operation

NOTICE: *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.*

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. Selecting high carrier PWM can help reduce motor oscillation.

- Take particular caution when adding a variable speed drive to an application running a motor from line power at a constant speed. 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.
- Mechanical resonance can occur with long motor shafts and in applications such as turbines, blowers, and fans with high inertia loads. Use Closed Loop Vector Control when these applications experience mechanical resonance problems.

Audible Noise

The audible noise of the motor varies based on the carrier frequency setting. However, drive current derating may be required. When using a high carrier frequency, audible noise from the motor is comparable to the motor noise generated when running from line power.

■ Synchronous Motors

- Contact Yaskawa or a Yaskawa agent when planning to use a synchronous motor not endorsed by Yaskawa.
- Use a standard induction motor when running multiple synchronous motors simultaneously. A single drive does not have this capability.
- A synchronous motor may rotate slightly in the opposite direction of the Run command at start depending on parameter settings and rotor position.
- The amount of generated starting torque differs depending on the control mode and motor type. Set up the motor with the drive after verifying the starting torque, allowable load characteristics, impact load tolerance, and speed control range.

Contact Yaskawa or a Yaskawa agent when planning to use a motor that does not fall within these specifications:

• In Open Loop Vector Control for PM motors, braking torque is less than 125% when running between 20% and 100% speed, even with a braking resistor. Braking torque drops to less than 50% when running at less than 20% speed.

• In Open Loop Vector Control for PM motors, the allowable load inertia moment is approximately 50 times higher than the motor inertia moment.

Contact Yaskawa or a Yaskawa agent for questions concerning applications with a larger inertia moment.

• When using a holding brake in Open Loop Vector Control for PM motors, release the brake prior to starting the motor. Failure to set the proper timing can cause speed loss.

• To restart a coasting motor rotating over 200 Hz while in V/f Control, first use the Short Circuit Braking function to bring the motor to a stop. Short Circuit Braking requires a special braking resistor. Contact Yaskawa or a Yaskawa agent for details.

• To restart a coasting motor rotating below 200 Hz, use the Speed Search function if the motor cable is not too long. If the motor cable is relatively long, stop the motor using Short Circuit Braking.

• If oC (Overcurrent), STo (Pull-Out Detection), or LSo (LSo Fault) occur, retry Speed Search and use the Short Circuit Braking function when starting to adjust the motor.

Specialized Motors

Multi-Pole Motor

The rated current of a multi-pole motor differs from that of a standard motor, so be sure to check the maximum current when selecting a drive. Always stop the motor before switching between the number of motor poles. The motor will coast to stop if a regenerative overvoltage (ov) fault occurs or if overcurrent (oC) protection is triggered.

Submersible Motor

The rated current of a submersible motor is greater than that of a standard motor, so select the drive accordingly. Use a motor cable large enough to avoid decreasing the maximum torque level from voltage drop caused by a long motor cable.

Explosion-Proof Motor

The motor and the drive must be tested together to be certified as explosion-proof. The drive is not designed for explosion-proof areas.

When attaching an encoder to an explosion-proof motor, make sure the encoder is also explosion-proof. Use an insulating signal converter to connect the encoder signal lines to the speed feedback option card.

Geared Motor

Make sure that the gear and the lubricant are rated for the desired speed range to avoid gear damage when operating at low speeds or very high speeds. Consult with the manufacturer for applications that require operation outside the rated speed range of the motor or gear box.

Single-Phase Motor

Variable speed drives are not designed to operate with single phase motors. Using capacitors to start the motor causes a high-frequency current to flow to the capacitors and can damage the capacitors. A split-phase start or a repulsion start can burn out the starter coils because the internal centrifugal switch is not activated. The drive is for use with three-phase motors only.

Motor with Brake

Take caution when using the drive to operate a motor with a built-in holding brake. If the brake is connected to the output side of the drive, it may not release at start due to low voltage levels, so be sure to install a separate power supply for the motor brake. Note that motors with built-in brakes tend to generate a fair amount of noise when running at low speeds.

◼ Notes on Power Transmission Machinery

Installing an AC drive in machinery that was previously connected directly to the power supply will allow the machine to operate at variable speeds. Continuous operation outside of the rated speeds can wear out lubrication material in gear boxes and other power transmission parts. Make sure that lubrication is sufficient within the entire speed range to avoid machine damage. Note that operation above the rated speed can increase the noise generated by the machine.

◆ Drive Label Warning Example

Always heed the warning information listed in *Figure i.3* in the position shown in *Figure i.4*.

⚠ WARNING

⚡ • Risk of electric shock.
   • Read manual before installing.
   • Wait 5 minutes for capacitor discharge after disconnecting power supply.
   • To conform to CE requirements, make sure to ground the supply neutral for 400V class.
   • After opening the manual switch between the drive and motor, please wait 5 minutes before inspecting, performing maintenance or wiring the drive.

♨ Hot surfaces
   • Top and Side surfaces may become hot. Do not touch.

Figure i.3 Warning Information Example
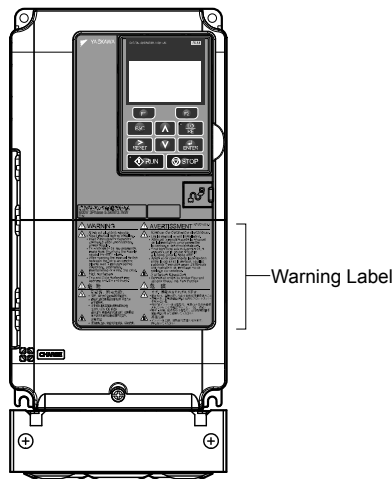
Figure i.4 Warning Information Position

◆ Warranty Information

■ Restrictions

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

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

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

1

Receiving

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

1.1   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 Yaskawa or a Yaskawa representative.

◆ Nameplate
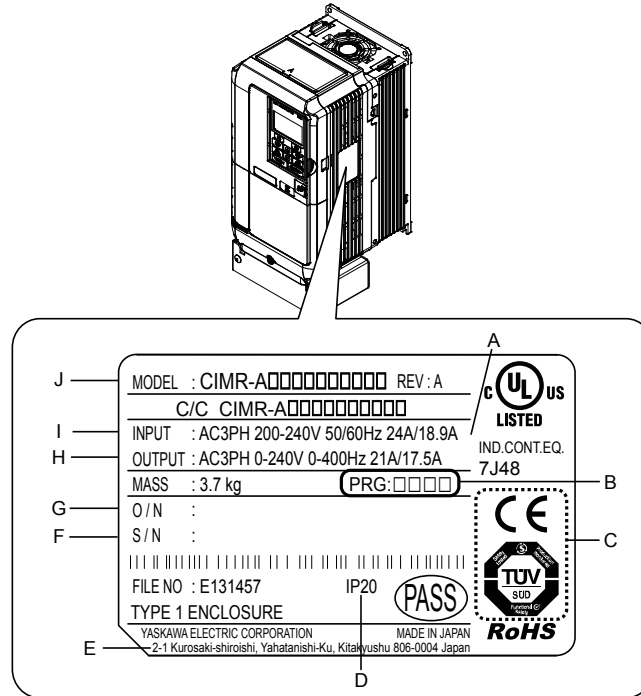
A – **Normal Duty Amps / Heavy Duty**
     Amps
B – **Software version**
C – **CE and TÜV Certification** *[1]*
D – **Enclosure type**
E – **Address** *[2]*

F – **Serial number**
G – **Lot number**
H – **Output specifications**
I – **Input specifications**
J – **AC drive model**

Figure 1.1 Nameplate Information Example

<1>   Certification is model-dependent. ***Refer to UL and CSA Standards on page 340*** for details.

<2>   The address of the head office of Yaskawa Electric Corporation (responsible for product liability) is shown on the nameplate.

CIMR – A U 2 A 0021 F A A

Drive | A1000 Series

No.	Region Code
A	Japan
B	China
C	Europe
D	India
T	Asia
U	USA

No.	Customized Specifications
A	Standard model
T	6-Phase/ 12-Pulse Input <1>

No.	Voltage Class
2	3-phase, 200-240 Vac
4	3-phase, 380-480 Vac
5	3-phase, 500-600 Vac

No.	Enclosure Type <2>
A	IP00/Open Type
F	IP20/NEMA 1, UL Type 1
U	Flange Type <3>

No.	Environmental Specification <4>
A	Standard
K	Gas-resistant
M	Humidity- and dust-resistant
N	Oil-resistant
S	Vibration-resistant

Design Revision Order

Refer to the tables below

<1> Refer to manual TOEP C710616 50 for information on 12-pulse models.

<2> *Refer to Mechanical Installation on page 28* for differences regarding enclosure protection types and component descriptions.

<3> Provides method of mounting drive with backside (heatsink) external to enclosure, with NEMA 12, UL Type 12 integrity.

<4> Drives with these specifications do not guarantee complete protection for the environmental conditions indicated.

■ **Three-Phase 200 V**

Table 1.1 Model Number and Specifications (200 V)

Normal Duty (ND) C6-01 = 1			Heavy Duty (HD) C6-01 = 0		
Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A	Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A
2A0004	0.75 (0.75)	3.5	2A0004	0.4 (0.75)	3.2
2A0006	1.1 (1)	6.0	2A0006	0.75 (1)	5
2A0008	1.5 (2)	8.0	2A0008	1.1 (2)	6.9
2A0010	2.2 (3)	9.6	2A0010	1.5 (2)	8
2A0012	3.0 (3)	12	2A0012	2.2 (3)	11
2A0018	3.7 (5)	17.5	2A0018	3.0 (3)	14.0
2A0021	5.5 (7.5)	21	2A0021	3.7 (5)	17.5
2A0030	7.5 (10)	30	2A0030	5.5 (7.5)	25
2A0040	11 (15)	40	2A0040	7.5 (10)	33
2A0056	15 (20)	56	2A0056	11 (15)	47
2A0069	18.5 (25)	69	2A0069	15 (20)	60
2A0081	22 (30)	81	2A0081	18.5 (25)	75
2A0110	30 (40)	110	2A0110	22 (30)	85
2A0138	37 (50)	138	2A0138	30 (40)	115
2A0169	45 (60)	169	2A0169	37 (50)	145
2A0211	55 (75)	211	2A0211	45 (60)	180
2A0250	75 (100)	250	2A0250	55 (75)	215
2A0312	90 (125)	312	2A0312	75 (100)	283
2A0360	110 (150)	360	2A0360	90 (125)	346
2A0415	110 (175)	415	2A0415	110 (150)	415

Receiving

1

■ **Three-Phase 400 V**

Table 1.2 Model Number and Specifications (400 V)

Normal Duty (ND) C6-01 = 1			Heavy Duty (HD) C6-01 = 0		
Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A	Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A
4A0002	0.75 (0.75)	2.1	4A0002	0.4 (0.75)	1.8
4A0004	1.5 (2)	4.1	4A0004	0.75 (2)	3.4
4A0005	2.2 (3)	5.4	4A0005	1.5 (3)	4.8
4A0007	3.0 (3)	6.9	4A0007	2.2 (3)	5.5
4A0009	3.7 (5)	8.8	4A0009	3.0 (5)	7.2
4A0011	5.5 (7.5)	11.1	4A0011	3.7 (5)	9.2
4A0018	7.5 (10)	17.5	4A0018	5.5 (7.5)	14.8
4A0023	11 (15)	23	4A0023	7.5 (10)	18
4A0031	15 (20)	31	4A0031	11 (15)	24
4A0038	18.5 (25)	38	4A0038	15 (20)	31
4A0044	22 (30)	44	4A0044	18.5 (25-30)	39
4A0058	30 (40)	58	4A0058	22 (25-30)	45
4A0072	37 (50)	72	4A0072	30 (40)	60
4A0088	45 (60)	88	4A0088	37 (50-60)	75
4A0103	55 (75)	103	4A0103	45 (50-60)	91
4A0139	75 (100)	139	4A0139	55 (75)	112
4A0165	90 (125)	165	4A0165	75 (100)	150
4A0208	110 (150)	208	4A0208	90 (125-150)	180
4A0250	132 (200)	250	4A0250	110 (150)	216
4A0296	160 (250)	296	4A0296	132 (200)	260
4A0362	185 (300)	362	4A0362	160 (250)	304
4A0414	220 (350)	414	4A0414	185 (300)	370
4A0515	250 (400-450)	515	4A0515	220 (350)	450
4A0675	355 (500-550)	675	4A0675	315 (400-450-500)	605
4A0930	500 (750)	930	4A0930	450 (650)	810
4A1200	630 (1000)	1200	4A1200	560 (900)	1090

■ **Three-Phase 600 V**

Table 1.3 Model Number and Specifications (600 V)

Normal Duty (ND) C6-01 = 1			Heavy Duty (HD) C6-01 = 0		
Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A	Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A
5A0003	1.5 (2)	2.7	5A0003	0.75 (1)	1.7
5A0004	2.2 (3)	3.9	5A0004	1.5 (2)	3.5
5A0006	3.7 (5)	6.1	5A0006	2.2 (3)	4.1
5A0009	5.5 (7.5)	9	5A0009	3.7 (5)	6.3
5A0011	7.5 (10)	11	5A0011	5.5 (7.5)	9.8
5A0017	11 (15)	17	5A0017	7.5 (10)	12.5
5A0022	15 (20)	22	5A0022	11 (15)	17
5A0027	18.5 (25)	27	5A0027	15 (20)	22
5A0032	22 (30)	32	5A0032	18.5 (25)	27
5A0041	30 (40)	41	5A0041	22 (25-30)	32
5A0052	37 (50)	52	5A0052	30 (40)	41
5A0062	45 (60)	62	5A0062	37 (50-60)	52

Normal Duty (ND) C6-01 = 1			Heavy Duty (HD) C6-01 = 0		
Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A	Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A
5A0077	55 (75)	77	5A0077	45 (50-60)	62
5A0099	75 (100)	99	5A0099	55 (75)	77
5A0125	90 (125)	125	5A0125	75 (100)	99
5A0145	110 (150)	145	5A0145	90 (125)	130
5A0192	160 (200)	192	5A0192	110 (150)	172
5A0242	185 (250)	242	5A0242	160 (200)	200

Receiving

1

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2

Mechanical Installation

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

2.1 Mechanical Installation

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

◆ Installation Environment

Install the drive in an environment matching the specifications in *Table 2.1* to help prolong the optimum performance life of the drive.

Table 2.1 Installation Environment

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	IP20/NEMA 1, UL Type 1 enclosure: -10 °C to +40 °C (14 °F to 104 °F) IP00/Open Type enclosure: -10 °C to +50 °C (14 °F to 122 °F) Finless Type: IP20/IP00 enclosure: -10 °C to +45 °C (14 °F to 113 °F) 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 °C to +60 °C (-4 °F to +140 °F)
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 (3281 ft.) or lower, up to 3000 m (9843 ft.) with derating
Vibration	10 to 20 Hz at 9.8 m/s^2 (32.15 ft/s^2) [1] 20 to 55 Hz at 5.9 m/s^2 (19.36 ft/s^2) (Models 2A0004 to 2A0211, 4A0002 to 4A0165, and 5A0003 to 5A0099) or 2.0 m/s^2 (6.56 ft/s^2) (Models 2A0250 to 2A0415, 4A0208 to 4A1200, and 5A0125 to 5A0242)
Orientation	Install the drive vertically to maintain maximum cooling effects.

[1] Models 4A0930 and 4A1200 are rated at 5.9 m/s^2 (19.36 ft/s^2)

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 drive start-up, as the cover will reduce ventilation and cause the drive to overheat.*

◆ Installation Orientation and Spacing

NOTICE: *Install the drive upright as illustrated in Figure 2.1. Failure to comply may damage the drive due to improper cooling.*
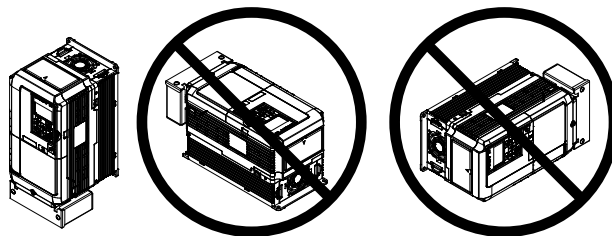
Figure 2.1 Correct Installation Orientation

NOTICE: *Install the drive upright as specified in the manual. Failure to comply may damage the drive due to improper cooling.*

■ **Single Drive Installation**

Figure 2.2 shows the installation distance required to maintain sufficient space for airflow and wiring. Install the heatsink against a closed surface to avoid diverting cooling air around the heatsink.

Side Clearance   Top/Bottom Clearance

A – 50 mm minimum   **C – 120 mm minimum**
B – 30 mm minimum   **D – Airflow direction**
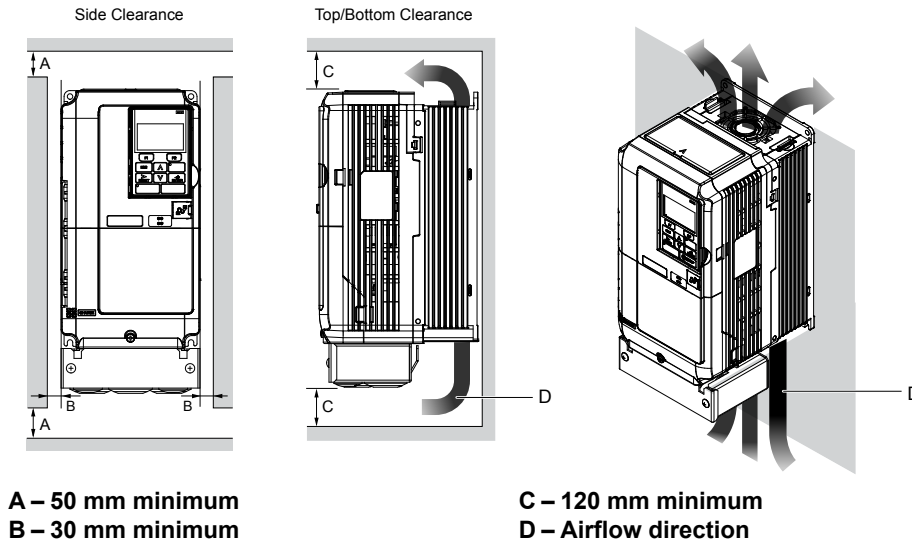
Figure 2.2 Correct Installation Spacing

Note: IP20/NEMA 1, UL Type 1 enclosure and IP00/Open Type enclosure models require the same amount of space above and below the drive for installation.

■ **Multiple Drive Installation (Side-by-Side Installation)**

Models 2A0004 to 2A0081, 4A0002 to 4A0044, and 5A0003 to 5A0032 can take advantage of Side-by-Side installation.

When installing multiple drives into the same enclosure panel, mount the drives according to *Figure 2.2* and set L8-35, Installation Method Selection, to 1 (Side-by-Side Mounting).

When mounting drives with the minimum clearance of 2 mm according to *Figure 2.3*, set parameter L8-35 to 1 while considering derating.

Line up the tops of the drives.

Side Clearance   Top/Bottom Clearance

A – 50 mm minimum   **C – 2 mm minimum**
B – 30 mm minimum   **D – 120 mm minimum**
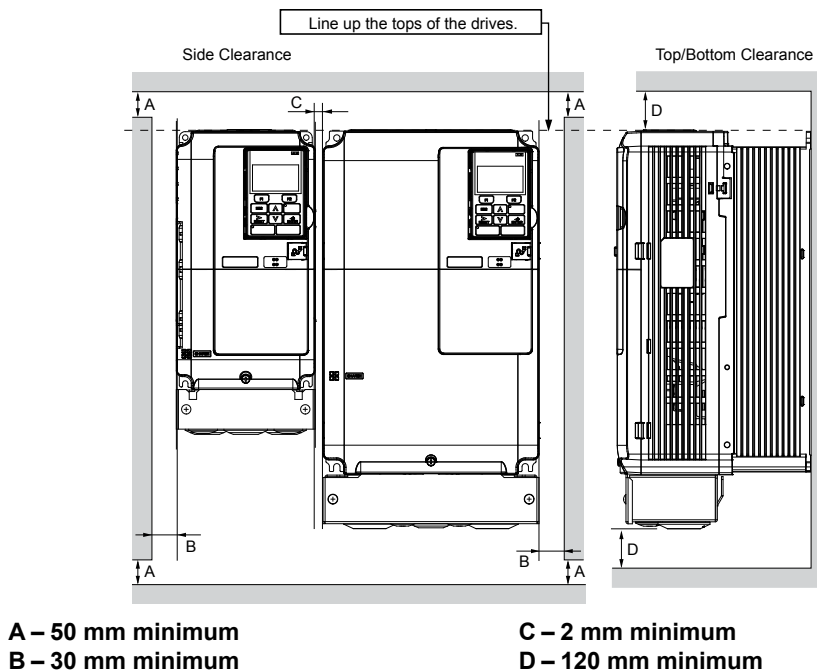
Figure 2.3 Space Between Drives (Side-by-Side Mounting)

Note: Align the tops of the drives when installing drives of different heights in the same enclosure panel. Leave space between the tops and bottoms of stacked drives for easier cooling fan replacement.

Mechanical Installation

2

Remove the top protective covers of all drives as shown in *Figure 2.4* when mounting IP20/NEMA 1, UL Type 1 enclosure drives side-by-side. *Refer to Top Protective Cover on page 92* to remove and reattach the top protective cover.
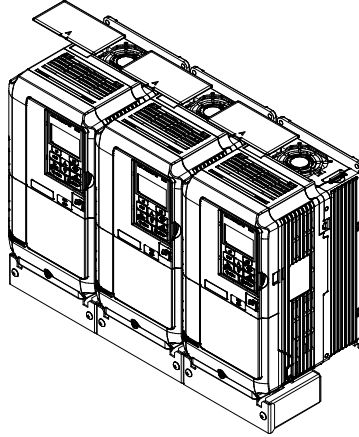
Figure 2.4 IP20/NEMA 1, UL Type 1 Side-by-Side Mounting in Enclosure

◆ Instructions on Installation Using the Eye Bolts

Eye bolts are used to install the drive or to temporarily lift the drive when replacing it. Using the eye bolts, the drive can be installed in an enclosure panel or on a wall. Do not leave the drive suspended by the wires in a horizontal or vertical position for long periods of time. Do not transport the drive over long distances. Read the following precautions and instructions before installing the drive.

WARNING! *Crush Hazard. Observe the following instructions and precautions. Failure to comply could result in serious injury or death from falling equipment.*
Only use vertical suspension to temporarily lift the drive during installation to an enclosure panel. Do not use vertical suspension to transport the drive.
Use screws to securely affix the drive front cover, terminal blocks, and other drive components prior to vertical suspension.
Do not subject the drive to vibration or impact greater than 1.96 m/s^2 (0.2 G) while it is suspended by the wires.
Do not leave the drive unattended while it is suspended by the wires.
Do not attempt to flip the drive over while it is suspended by the wires.

■ Horizontal Suspension of Drive Models 2A0360, 2A0415, and 4A0250 to 4A0675

To make a wire hanger or frame for use when lifting the drive with a crane, lay the drive in a horizontal position and pass a wire through the holes of the four eye bolts.

NOTICE: *Damage to Equipment. When lifting the drive, confirm that the spring washer is fully closed. Failure to comply may deform or damage the drive when lifted.*
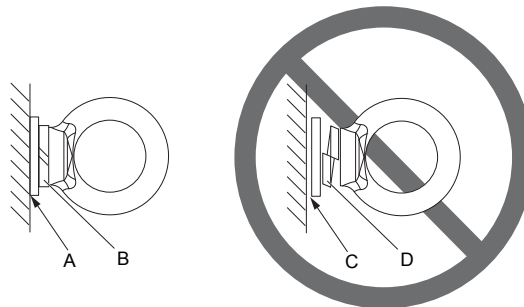
A – No space between drive and washer	C – Space between drive and washer
B – Spring washer fully closed	D – Spring washer open

Figure 2.5 Spring Washer

■ Vertical Suspension of Drive Models 2A0360, 2A0415, and 4A0250 to 4A1200

Models 2A0360, 2A0415, and 4A0250 to 4A0675
When vertical suspension of the drive is required in an enclosure panel, change the orientation of the eye bolts for these models by turning the eye bolts counterclockwise 90 degrees.
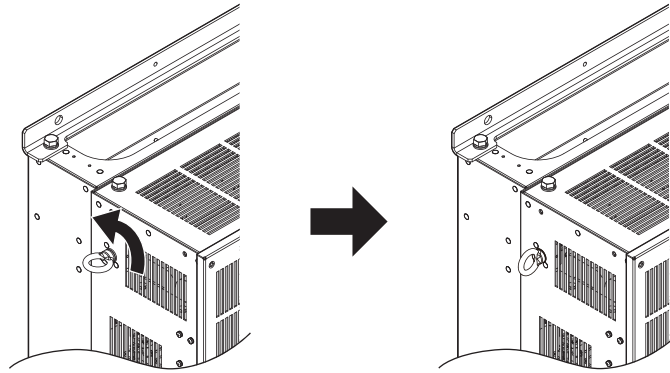
Figure 2.6 Adjusting Angle of Eye Bolts

Models 4A0930 and 4A1200

When suspending models 4A0930 or 4A1200 with wires, follow the procedure described below.

WARNING! *Crush Hazard. Use an adequate length of wire to ensure a 50° or wider suspension angle as illustrated in Figure 2.8. The maximum allowable load of the eye bolts cannot be guaranteed when the drive is suspended with the wires at angles less than 50°. Failure to comply may result in serious injury or death from falling equipment.*

1. Remove the four eye bolts from the drive side panels and fix them securely on the top panel.
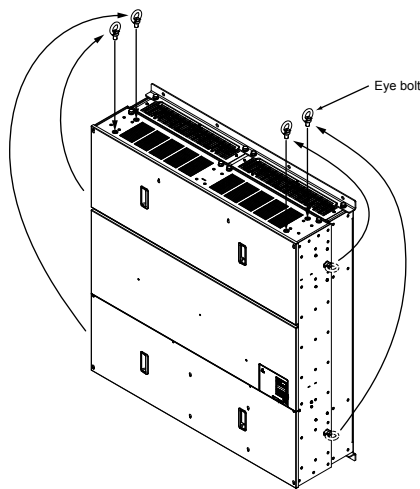
Figure 2.7 Eye Bolt Repositioning

2. Pass wire through the holes of all four eye bolts.
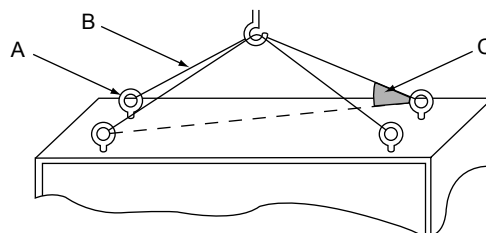
A – Eye bolt
B – Wires

C – Suspending angle: 50° or greater

Figure 2.8 Suspension Wire Angle Example

3. Gradually take up the slack in the wires and hoist the drive after the wires are stretched tight.

4. Lower the drive when ready to install in the enclosure panel. Stop lowering the drive when it is near the floor then begin lowering the drive again very slowly until the drive is placed correctly.

Mechanical Installation

2

■ IP20/NEMA 1, UL Type 1 Enclosure Drives

Note: Removing the top protective cover or bottom conduit bracket from an IP20/NEMA 1, UL Type 1 enclosure drive voids NEMA 1, UL Type 1 protection while maintaining IP20 conformity.
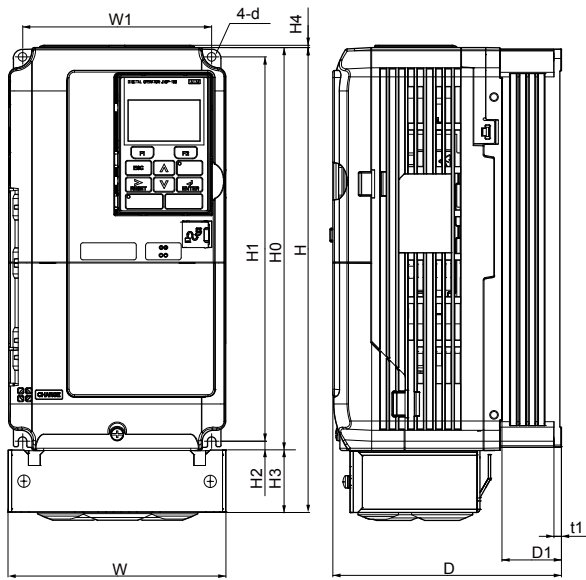
Figure 1
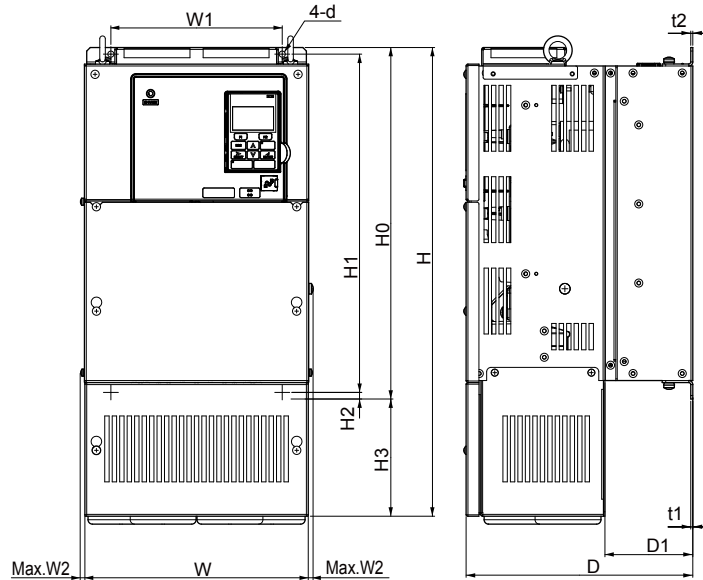
Figure 2

Table 2.2 Dimensions for IP20/NEMA 1, UL Type 1 Enclosure: 200 V Class

Drive Model	Figure	Dimensions mm (in)														Wt. kg (lb)
		W	H	D	W1	W2	H0	H1	H2	H3	H4	D1	t1	t2	d	
2A0004F	1 <1>	140 (5.51)	300 (11.81)	147 (5.79)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	38 (1.50)	5 (0.20)	–	M5	3.3 (7.3)
2A0006F		140 (5.51)	300 (11.81)	147 (5.79)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	38 (1.50)	5 (0.20)	–	M5	3.3 (7.3)
2A0008F		140 (5.51)	300 (11.81)	147 (5.79)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	38 (1.50)	5 (0.20)	–	M5	3.4 (7.5)
2A0010F		140 (5.51)	300 (11.81)	147 (5.79)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	38 (1.50)	5 (0.20)	–	M5	3.4 (7.5)
2A0012F		140 (5.51)	300 (11.81)	147 (5.79)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	38 (1.50)	5 (0.20)	–	M5	3.4 (7.5)
2A0018F		140 (5.51)	300 (11.81)	164 (6.46)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	3.8 (8.2)
2A0021F		140 (5.51)	300 (11.81)	164 (6.46)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	3.8 (8.2)
2A0030F		140 (5.51)	300 (11.81)	167 (6.57)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	4.2 (9.3)
2A0040F		140 (5.51)	300 (11.81)	167 (6.57)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	4.2 (9.3)
2A0056F		180 (7.09)	340 (13.39)	187 (7.36)	160 (6.30)	–	300 (11.81)	284 (11.18)	7.9 (0.31)	40 (1.57)	1.5 (0.06)	75 (2.95)	5 (0.20)	–	M5	5.9 (13.0)
2A0069F		220 (8.66)	400 (15.75)	197 (7.76)	192 (7.56)	–	350 (13.78)	335 (13.19)	7.9 (0.31)	50 (1.97)	1.5 (0.06)	78 (3.07)	5 (0.20)	–	M6	9 (20.1)
2A0081F		220 (8.66)	400 (15.75)	197 (7.76)	192 (7.56)	–	350 (13.78)	335 (13.19)	7.9 (0.31)	50 (1.97)	1.5 (0.06)	78 (3.07)	5 (0.20)	–	M6	10 (22.0)
2A0110F	2 <1>	254 (10.00)	534 (21.02)	258 (10.16)	195 (7.68)	7.9 (0.31)	400 (15.75)	385 (15.16)	7.7 (0.30)	134 (5.28)	1.5 (0.06)	100 (3.94)	2.2 (0.09)	2.286 (0.09)	M6	23 (50.7)
2A0138F		279 (10.98)	614 (24.17)	258 (10.16)	220 (8.66)	7.9 (0.31)	450 (17.72)	435 (17.13)	7.7 (0.30)	164 (6.46)	–	100 (3.94)	2.2 (0.09)	2.286 (0.09)	M6	28 (61.7)
2A0169F		329 (12.95)	730 (28.74)	283 (11.14)	260 (10.24)	7.9 (0.31)	550 (21.65)	535 (21.06)	7.7 (0.30)	180 (7.09)	–	110 (4.33)	2.2 (0.09)	2.286 (0.09)	M6	41 (90.4)
2A0211F		329 (12.95)	730 (28.74)	283 (11.14)	260 (10.24)	7.9 (0.31)	550 (21.65)	535 (21.06)	7.7 (0.30)	180 (7.09)	–	110 (4.33)	2.2 (0.09)	2.286 (0.09)	M6	42 (92.6)

Drive Model	Figure	Dimensions mm (in)														Wt. kg (lb)
		W	H	D	W1	W2	H0	H1	H2	H3	H4	D1	t1	t2	d	
Dimensions below are the dimensions of IP00/Open Type models after customer installation of the appropriate IP20/NEMA 1, UL Type 1 Kit.																
2A0250A	2	456 (17.95)	960 (37.80)	330 (12.99)	325 (12.80)	7.9 (0.31)	28 (27.76)	680 (26.77)	12 (0.49)	255 (10.04)	–	130 (5.12)	3.3 (0.13)	3.3 (0.13)	M10	83 (183.0)
2A0312A		456 (17.95)	960 (37.80)	330 (12.99)	325 (12.80)	7.9 (0.31)	28 (27.76)	680 (26.77)	12 (0.49)	255 (10.04)	–	130 (5.12)	3.3 (0.13)	3.30 (0.13)	M10	88 (194.0)
2A0360A		194 (19.84)	1168 (45.98)	35 (13.78)	370 (14.57)	7.9 (0.31)	800 (31.50)	773 (30.43)	13 (0.51)	368 (14.49)	–	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	108 (238.1)

<1> Removing the top protective cover from an IP20/NEMA 1, UL Type 1 enclosure drive voids NEMA 1, UL Type 1 protection while retaining IP20 conformity.

Table 2.3 Dimensions for IP20/NEMA 1, UL Type 1 Enclosure: 400 V Class

Drive Model	Figure	Dimensions mm (in)														Wt. kg (lb)
		W	H	D	W1	W2	H0	H1	H2	H3	H4	D1	t1	t2	d	
4A0002F	1 <1>	140 (5.51)	300 (11.81)	147 (5.79)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	38 (1.50)	5 (0.20)	–	M5	3.4 (7.5)
4A0004F		140 (5.51)	300 (11.81)	147 (5.79)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	38 (1.50)	5 (0.20)	–	M5	3.4 (7.5)
4A0005F		140 (5.51)	300 (11.81)	147 (5.79)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	38 (1.50)	5 (0.20)	–	M5	3.4 (7.5)
4A0007F		140 (5.51)	300 (11.81)	164 (6.46)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	3.6 (7.9)
4A0009F		140 (5.51)	300 (11.81)	164 (6.46)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	3.8 (8.2)
4A0011F		140 (5.51)	300 (11.81)	164 (6.46)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	3.8 (8.2)
4A0018F		140 (5.51)	300 (11.81)	167 (6.57)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	4.0 (9.0)
4A0023F		140 (5.51)	300 (11.81)	167 (6.57)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	4.0 (9.0)
4A0031F		180 (7.09)	340 (13.39)	167 (6.57)	160 (6.30)	–	300 (11.81)	284 (11.18)	7.9 (0.31)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	5.8 (12.6)
4A0038F		180 (7.09)	340 (13.39)	187 (7.36)	160 (6.30)	–	300 (11.81)	284 (11.18)	7.9 (0.31)	40 (1.57)	1.5 (0.06)	75 (2.95)	5 (0.20)	–	M5	6.0 (13.2)
4A0044F		220 (8.66)	400 (15.75)	197 (7.76)	195 (7.68)	–	35 (13.78)	335 (13.19)	7.9 (0.31)	50 (1.97)	1.5 (0.06)	78 (3.07)	5 (0.20)	–	M6	8.8 (19.2)
4A0058F	2 <1>	254 (10.00)	465 (18.31)	258 (10.16)	195 (7.68)	7.9 (0.31)	400 (15.75)	385 (15.16)	7.7 (0.30)	65 (2.56)	–	100 (3.94)	2.2 (0.09)	2.2 (0.09)	M6	23 (50.7)
4A0072F		279 (10.98)	515 (20.28)	258 (10.16)	220 (8.66)	7.9 (0.31)	450 (17.72)	435 (17.13)	7.7 (0.30)	65 (2.56)	–	100 (3.94)	2.2 (0.09)	2.2 (0.09)	M6	27 (59.5)
4A0088F		329 (12.95)	630 (24.80)	258 (10.16)	260 (10.24)	7.9 (0.31)	509 (20.08)	495 (19.49)	7.7 (0.30)	120 (4.72)	–	105 (4.13)	2.2 (0.09)	3.3 (0.13)	M6	39 (86.0)
4A0103F		329 (12.95)	630 (24.80)	258 (10.16)	260 (10.24)	7.9 (0.31)	509 (20.08)	495 (19.49)	7.7 (0.30)	120 (4.72)	–	105 (4.13)	2.2 (0.09)	3.3 (0.13)	M6	39 (86.0)
4A0139F		329 (12.95)	730 (28.74)	283 (11.14)	260 (10.24)	7.9 (0.31)	550 (21.65)	535 (21.06)	7.7 (0.30)	180 (7.09)	–	110 (4.33)	2.2 (0.09)	2.2 (0.09)	M6	45 (99.2)
4A0165F		329 (12.95)	730 (28.74)	283 (11.14)	260 (10.24)	7.9 (0.31)	550 (21.65)	535 (21.06)	7.7 (0.30)	180 (7.09)	–	110 (4.33)	2.2 (0.09)	2.2 (0.09)	M6	46 (101.4)
Dimensions below are the dimensions of IP00/Open Type models after customer installation of the appropriate IP20/NEMA 1, UL Type 1 Kit.																
4A0208A	2	456 (17.95)	960 (37.80)	330 (12.99)	325 (12.80)	7.9 (0.31)	28 (27.76)	680 (26.77)	12 (0.49)	255 (10.04)	–	130 (5.12)	3.3 (0.13)	3.3 (0.13)	M10	87 (191.8)
4A0250A		194 (19.84)	1168 (45.98)	35 (13.78)	370 (14.57)	7.9 (0.31)	800 (31.50)	773 (30.43)	13 (0.51)	368 (14.49)	–	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	106 (233.7)
4A0296A		194 (19.84)	1168 (45.98)	35 (13.78)	370 (14.57)	7.9 (0.31)	800 (31.50)	773 (30.43)	13 (0.51)	368 (14.49)	–	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	112 (246.9)
4A0362A		194 (19.84)	1168 (45.98)	35 (13.78)	370 (14.57)	7.9 (0.31)	800 (31.50)	773 (30.43)	13 (0.51)	368 (14.49)	–	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	117 (257.9)

<1> Removing the top protective cover from an IP20/NEMA 1, UL Type 1 enclosure drive voids NEMA 1, UL Type 1 protection while retaining IP20 conformity.

Mechanical Installation

2

Table 2.4 Dimensions for IP20/NEMA 1, UL Type 1 Enclosure: 600 V Class

Drive Model	Figure	Dimensions mm (in)														Wt. kg (lb)
		W	H	D	W1	W2	H0	H1	H2	H3	H4	D1	t1	t2	d	
5A0003F	1 <1>	140 (5.51)	300 (11.81)	147 (5.79)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	38 (1.50)	5 (0.20)	–	M5	3.4 (7.5)
5A0004F		140 (5.51)	300 (11.81)	147 (5.79)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	38 (1.50)	5 (0.20)	–	M5	3.4 (7.5)
5A0006F		140 (5.51)	300 (11.81)	164 (6.46)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	3.8 (8.2)
5A0009F		140 (5.51)	300 (11.81)	164 (6.46)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	3.8 (8.2)
5A0011F		140 (5.51)	300 (11.81)	167 (6.57)	122 (4.80)	–	260 (10.24)	248 (9.76)	6 (0.24)	40 (1.57)	1.5 (0.06)	55 (2.17)	5 (0.20)	–	M5	4.0 (9.0)
5A0017F		180 (7.09)	340 (13.39)	187 (7.36)	160 (6.30)	–	300 (11.81)	284 (11.18)	7.9 (0.31)	40 (1.57)	1.5 (0.06)	75 (2.95)	5 (0.20)	–	M5	6.0 (13.2)
5A0022F		180 (7.09)	340 (13.39)	187 (7.36)	160 (6.30)	–	300 (11.81)	284 (11.18)	7.9 (0.31)	40 (1.57)	1.5 (0.06)	75 (2.95)	5 (0.20)	–	M5	6.0 (13.2)
5A0027F		220 (8.66)	400 (15.75)	197 (7.76)	192 (7.56)	–	35 (13.78)	335 (13.19)	7.9 (0.31)	50 (1.97)	1.5 (0.06)	78 (3.07)	5 (0.20)	–	M6	8.8 (19.2)
5A0032F		220 (8.66)	400 (15.75)	197 (7.76)	192 (7.56)	–	35 (13.78)	335 (13.19)	7.9 (0.31)	50 (1.97)	1.5 (0.06)	78 (3.07)	5 (0.20)	–	M6	8.8 (19.2)
5A0041F	2	279 (10.98)	515 (20.28)	258 (10.16)	220 (8.66)	7.9 (0.31)	450 (17.72)	435 (17.13)	7.7 (0.30)	65 (2.56)	–	100 (3.94)	2.2 (0.09)	2.2 (0.09)	M6	27 (59.5)
5A0052F		279 (10.98)	515 (20.28)	258 (10.16)	220 (8.66)	7.9 (0.31)	450 (17.72)	435 (17.13)	7.7 (0.30)	65 (2.56)	–	100 (3.94)	2.2 (0.09)	2.2 (0.09)	M6	27 (59.5)
5A0062F		329 (12.95)	730 (28.74)	283 (11.14)	260 (10.24)	7.9 (0.31)	550 (21.65)	535 (21.06)	7.7 (0.30)	180 (7.09)	–	110 (4.33)	2.2 (0.09)	2.2 (0.09)	M6	45 (99.2)
5A0077F		329 (12.95)	730 (28.74)	283 (11.14)	260 (10.24)	7.9 (0.31)	550 (21.65)	535 (21.06)	7.7 (0.30)	180 (7.09)	–	110 (4.33)	2.2 (0.09)	2.2 (0.09)	M6	45 (99.2)
5A0099F		329 (12.95)	730 (28.74)	283 (11.14)	260 (10.24)	7.9 (0.31)	550 (21.65)	535 (21.06)	7.7 (0.30)	180 (7.09)	–	110 (4.33)	2.2 (0.09)	2.2 (0.09)	M6	45 (99.2)
Dimensions below are the dimensions of IP00/Open Type models after customer installation of the appropriate IP20/NEMA 1, UL Type 1 Kit.																
5A0125A	2	456 (17.95)	960 (37.80)	330 (12.99)	325 (12.80)	7.9 (0.31)	28 (27.76)	680 (26.77)	12 (0.49)	255 (10.04)	–	130 (5.12)	3.3 (0.13)	3.3 (0.13)	M10	87 (191.8)
5A0145A		456 (17.95)	960 (37.80)	330 (12.99)	325 (12.80)	7.9 (0.31)	28 (27.76)	680 (26.77)	12 (0.49)	255 (10.04)	–	130 (5.12)	3.3 (0.13)	3.3 (0.13)	M10	87 (191.8)
5A0192A		194 (19.84)	1168 (45.98)	35 (13.78)	370 (14.57)	7.9 (0.31)	800 (31.50)	773 (30.43)	13 (0.51)	368 (14.49)	–	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	106 (233.7)
5A0242A		194 (19.84)	1168 (45.98)	35 (13.78)	370 (14.57)	7.9 (0.31)	800 (31.50)	773 (30.43)	13 (0.51)	368 (14.49)	–	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	117 (257.9)

<1> Removing the top protective cover or bottom conduit bracket from an IP20/NEMA 1, UL Type 1 enclosure drive voids NEMA 1, UL Type 1 protection while maintaining IP20 conformity.

IP20/NEMA 1, UL Type 1 Enclosure Conduit Bracket Dimensions

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7
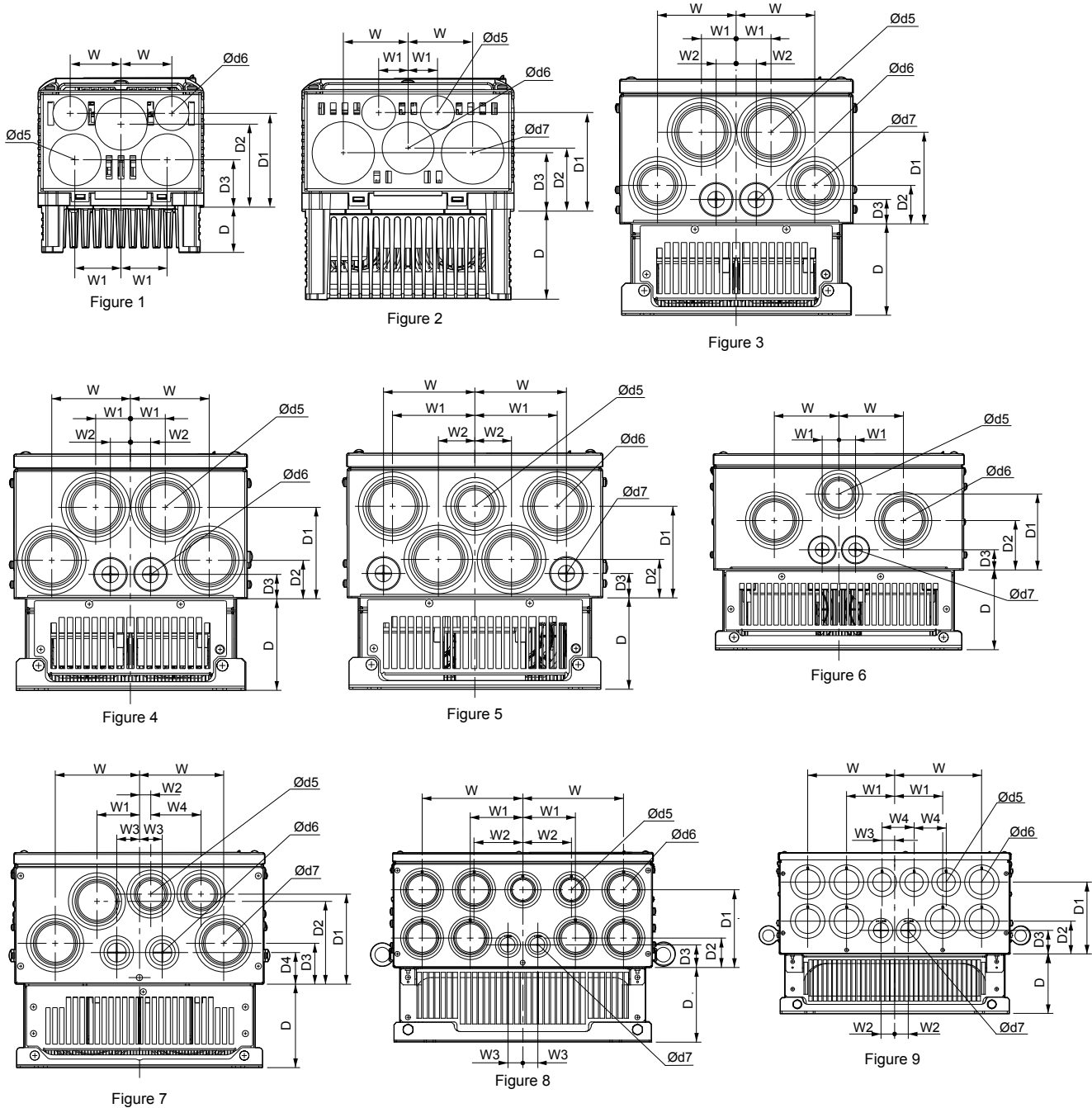
Figure 8

Figure 9

Table 2.5 Conduit Bracket Dimensions for IP20/NEMA 1, UL Type 1

Drive Model	Figure	Dimensions mm (in)										Diameter mm (in)		
		W	D	W1	W2	W3	W4	D1	D2	D3	D4	d5	d6	d7
200 V Class														
2A0004F		43 (1.7)	38 (1.5)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
2A0006F		43 (1.7)	38 (1.5)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
2A0008F	1	43 (1.7)	38 (1.5)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	–	–	–
2A0010F		43 (1.7)	38 (1.5)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
2A0012F		43 (1.7)	56 (2.2)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–

2.1 Mechanical Installation

Drive Model	Figure	Dimensions mm (in)										Diameter mm (in)		
		W	D	W1	W2	W3	W4	D1	D2	D3	D4	d5	d6	d7
2A0018F	2	43 (1.7)	56 (2.2)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	36 (1.4)	23 (0.9)	43 (1.7)
2A0021F		43 (1.7)	56 (2.2)	38 (1.5)		–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	36 (1.4)	23 (0.9)	43 (1.7)
2A0030F		43 (1.7)	56 (2.2)	38 (1.5)		–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	36 (1.4)	23 (0.9)	43 (1.7)
2A0040F		25 (1.0)	76 (3.0)	56 (2.2)		–	–	48 (1.9)	84 (3.3)	53 (2.1)	–	36 (1.4)	23 (0.9)	43 (1.7)
2A0056F		25 (1.0)	76 (3.0)	56 (2.2)		–	–	48 (1.9)	84 (3.3)	53 (2.1)	–	36 (1.4)	23 (0.9)	43 (1.7)
2A0069F		28 (1.1)	79 (3.1)	64 (2.5)		–	–	51 (2.0)	86 (3.4)	56 (2.2)	–	36 (1.4)	23 (0.9)	43 (1.7)
2A0081F		28 (1.1)	79 (3.1)	64 (2.5)	–	–	–	51 (2.0)	86 (3.4)	56 (2.2)	–	36 (1.4)	23 (0.9)	43 (1.7)
2A0110F	4	86 (3.4)	99 (3.9)	38 (1.5)	23 (0.9)	–	–	99 (3.9)	43 (1.7)	25 (1.0)	–	61 (2.4)	28 (1.1)	–
2A0138F	5	99 (3.9)	99 (3.9)	89 (3.5)	41 (1.6)	–	–	99 (3.9)	43 (1.7)	25 (1.0)	–	51 (2.0)	61 (2.4)	28 (1.1)
2A0169F	7	111 (4.4)	109 (4.3)	56 (2.2)	15 (0.6)	30 (1.2)	66 (2.6)	119 (4.7)	109 (4.3)	53 (2.1)	41 (1.6)	51 (2.0)	36 (1.4)	61 (2.4)
2A0211F		111 (4.4)	109 (4.3)	56 (2.2)	15 (0.6)	30 (1.2)	66 (2.6)	119 (4.7)	109 (4.3)	53 (2.1)	41 (1.6)	51 (2.0)	36 (1.4)	61 (2.4)
2A0250A	8	175 (6.9)	130 (5.1)	91 (3.6)	84 (3.3)	25 (1.0)	–	137 (5.4)	51 (2.0)	41 (1.6)	–	51 (2.0)	61 (2.4)	36 (1.4)
2A0312A		175 (6.9)	130 (5.1)	91 (3.6)	84 (3.3)	25 (1.0)	–	137 (5.4)	51 (2.0)	41 (1.6)	–	51 (2.0)	61 (2.4)	36 (1.4)
2A0360A	9	191 (7.5)	130 (5.1)	104 (4.1)	30 (1.2)	28 (1.1)	71 (2.8)	157 (6.2)	71 (2.8)	51 (2.0)	–	51 (2.0)	61 (2.4)	43 (1.7)
400 V Class														
4A0002F	1	43 (1.7)	38 (1.5)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
4A0004F		43 (1.7)	38 (1.5)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
4A0005F		43 (1.7)	38 (1.5)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
4A0007F		43 (1.7)	56 (2.2)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
4A0009F		43 (1.7)	56 (2.2)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
4A0011F		43 (1.7)	56 (2.2)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
4A0018F		43 (1.7)	56 (2.2)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
4A0023F	2	25 (1.0)	76 (3.0)	56 (2.2)	–	–	–	48 (1.9)	84 (3.3)	53 (2.1)	–	36 (1.4)	23 (0.9)	43 (1.7)
4A0031F		25 (1.0)	76 (3.0)	56 (2.2)	–	–	–	48 (1.9)	84 (3.3)	53 (2.1)	–	36 (1.4)	23 (0.9)	43 (1.7)
4A0038F		28 (1.1)	79 (3.1)	64 (2.5)	–	–	–	51 (2.0)	86 (3.4)	56 (2.2)	–	36 (1.4)	23 (0.9)	43 (1.7)
4A0044F		28 (1.1)	79 (3.1)	64 (2.5)	–	–	–	51 (2.0)	86 (3.4)	56 (2.2)	–	36 (1.4)	23 (0.9)	43 (1.7)
4A0058F	3	86 (3.4)	99 (3.9)	38 (1.5)	23 (0.9)	–	–	99 (3.9)	43 (1.7)	25 (1.0)	–	61 (2.4)	28 (1.1)	51 (2.0)
4A0072F		89 (3.5)	99 (3.9)	41 (1.6)	23 (0.9)	–	–	99 (3.9)	43 (1.7)	25 (1.0)	–	61 (2.4)	28 (1.1)	51 (2.0)
4A0088F	6	84 (3.3)	104 (4.1)	23 (0.9)	–	–	–	99 (3.9)	66 (2.6)	25 (1.0)	–	51 (2.0)	61 (2.4)	28 (1.1)
4A0103F		84 (3.3)	104 (4.1)	23 (0.9)	–	–	–	99 (3.9)	66 (2.6)	25 (1.0)	–	51 (2.0)	61 (2.4)	28 (1.1)

Drive Model	Figure	Dimensions mm (in)										Diameter mm (in)		
		W	D	W1	W2	W3	W4	D1	D2	D3	D4	d5	d6	d7
4A0139F	7	111 (4.4)	109 (4.3)	56 (2.2)	15 (0.6)	30 (1.2)	66 (2.6)	119 (4.7)	109 (4.3)	53 (2.1)	41 (1.6)	51 (2.0)	36 (1.4)	61 (2.4)
4A0165F		111 (4.4)	109 (4.3)	56 (2.2)	15 (0.6)	30 (1.2)	66 (2.6)	119 (4.7)	109 (4.3)	53 (2.1)	41 (1.6)	51 (2.0)	36 (1.4)	61 (2.4)
4A0208A	8	175 (6.9)	130 (5.1)	91 (3.6)	84 (3.3)	25 (1.0)	–	137 (5.4)	51 (2.0)	41 (1.6)	–	51 (2.0)	61 (2.4)	36 (1.4)
4A0250A	9	191 (7.5)	130 (5.1)	104 (4.1)	30 (1.2)	28 (1.1)	71 (2.8)	157 (6.2)	71 (2.8)	51 (2.0)	–	51 (2.0)	61 (2.4)	43 (1.7)
4A0296A		191 (7.5)	130 (5.1)	104 (4.1)	30 (1.2)	28 (1.1)	71 (2.8)	157 (6.2)	71 (2.8)	51 (2.0)	–	51 (2.0)	61 (2.4)	43 (1.7)
4A0362A		191 (7.5)	130 (5.1)	104 (4.1)	30 (1.2)	28 (1.1)	71 (2.8)	157 (6.2)	71 (2.8)	51 (2.0)	–	51 (2.0)	61 (2.4)	43 (1.7)
600 V Class														
5A0003F	1	43 (1.7)	38 (1.5)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
5A0004F		43 (1.7)	38 (1.5)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
5A0006F		43 (1.7)	56 (2.2)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
5A0009F		43 (1.7)	56 (2.2)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
5A0011F		43 (1.7)	56 (2.2)	38 (1.5)	–	–	–	41 (1.6)	71 (2.8)	79 (3.1)	–	23 (0.9)	36 (1.4)	–
5A0017F	2	25 (1.0)	76 (3.0)	56 (2.2)	–	–	–	48 (1.9)	84 (3.3)	53 (2.1)	–	36 (1.4)	23 (0.9)	43 (1.7)
5A0022F		25 (1.0)	76 (3.0)	56 (2.2)	–	–	–	48 (1.9)	84 (3.3)	53 (2.1)	–	36 (1.4)	23 (0.9)	43 (1.7)
5A0027F		28 (1.1)	79 (3.1)	64 (2.5)	–	–	–	51 (2.0)	86 (3.4)	56 (2.2)	–	36 (1.4)	23 (0.9)	43 (1.7)
5A0032F		28 (1.1)	79 (3.1)	64 (2.5)	–	–	–	51 (2.0)	86 (3.4)	56 (2.2)	–	36 (1.4)	23 (0.9)	43 (1.7)
5A0041F	3	89 (3.5)	99 (3.9)	41 (1.6)	23 (0.9)	–	–	99 (3.9)	43 (1.7)	25 (1.0)	–	61 (2.4)	28 (1.1)	51 (2.0)
5A0052F		89 (3.5)	99 (3.9)	41 (1.6)	23 (0.9)	–	–	99 (3.9)	43 (1.7)	25 (1.0)	–	61 (2.4)	28 (1.1)	51 (2.0)
5A0062F	7	111 (4.4)	109 (4.3)	56 (2.2)	15 (0.6)	30 (1.2)	66 (2.6)	119 (4.7)	109 (4.3)	53 (2.1)	41 (1.6)	51 (2.0)	36 (1.4)	61 (2.4)
5A0077F		111 (4.4)	109 (4.3)	56 (2.2)	15 (0.6)	30 (1.2)	66 (2.6)	119 (4.7)	109 (4.3)	53 (2.1)	41 (1.6)	51 (2.0)	36 (1.4)	61 (2.4)
5A0099F		111 (4.4)	109 (4.3)	56 (2.2)	15 (0.6)	30 (1.2)	66 (2.6)	119 (4.7)	109 (4.3)	53 (2.1)	41 (1.6)	51 (2.0)	36 (1.4)	61 (2.4)
5A0125A	8	175 (6.9)	130 (5.1)	91 (3.6)	84 (3.3)	25 (1.0)	–	137 (5.4)	51 (2.0)	41 (1.6)	–	51 (2.0)	61 (2.4)	36 (1.4)
5A0145A		175 (6.9)	130 (5.1)	91 (3.6)	84 (3.3)	25 (1.0)	–	137 (5.4)	51 (2.0)	41 (1.6)	–	51 (2.0)	61 (2.4)	36 (1.4)
5A0192A	9	191 (7.5)	130 (5.1)	104 (4.1)	30 (1.2)	28 (1.1)	71 (2.8)	157 (6.2)	71 (2.8)	51 (2.0)	–	51 (2.0)	61 (2.4)	43 (1.7)
5A0242A		191 (7.5)	130 (5.1)	104 (4.1)	30 (1.2)	28 (1.1)	71 (2.8)	157 (6.2)	71 (2.8)	51 (2.0)	–	51 (2.0)	61 (2.4)	43 (1.7)

Note: Removing the top protective cover or bottom conduit bracket from an IP20/NEMA 1, UL Type 1 enclosure drive voids NEMA 1, UL Type 1 protection while maintaining IP20 conformity.

Mechanical Installation

2

■ IP00/Open Type Enclosure Drives
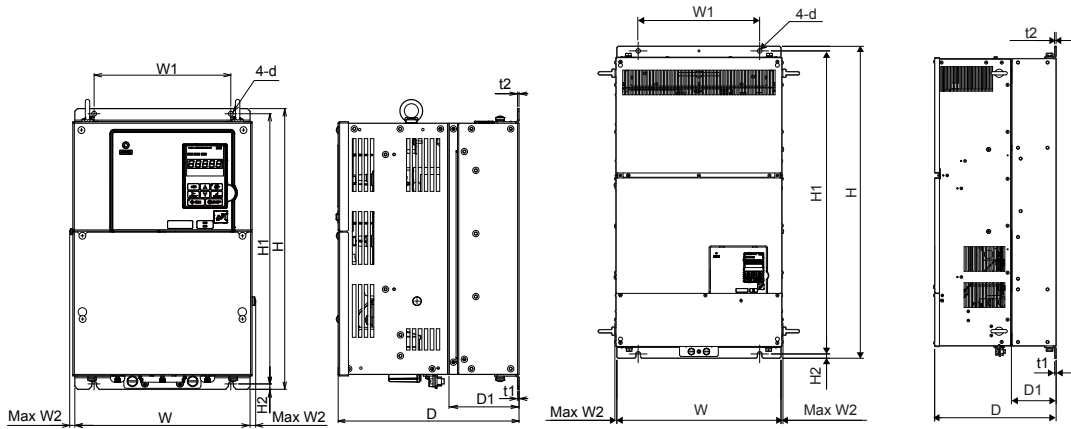
Figure 1

Figure 2
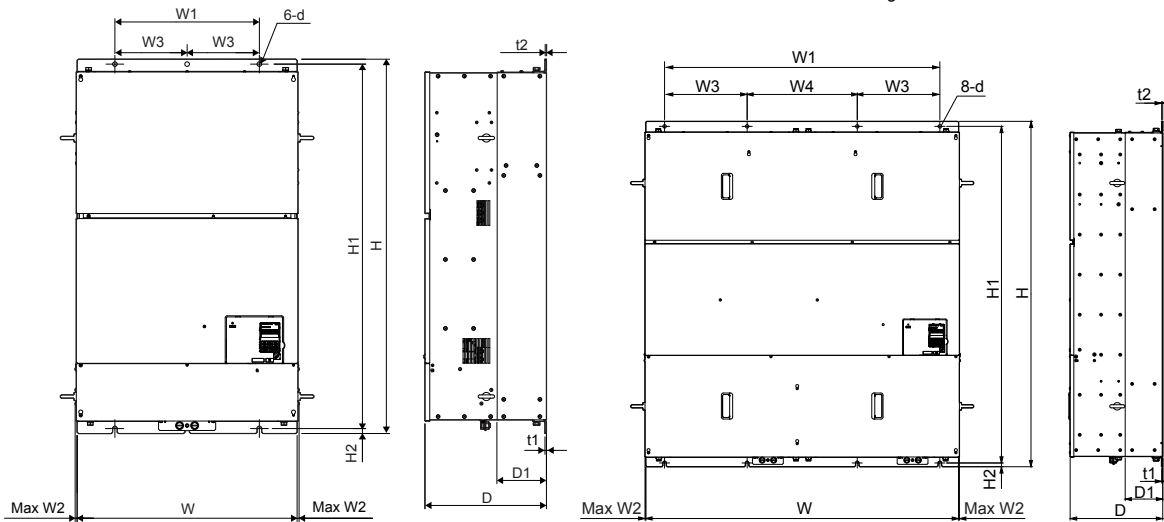
Figure 3

Figure 4

Table 2.6 Dimensions for IP00/Open Type Enclosure: 200 V Class

Drive Model	Figure	Dimensions mm (in)											Wt. kg (lb)
		W	H	D	W1	W2	H1	H2	D1	t1	t2	d	
2A0250A *<1>*	1	450 (17.72)	705 (27.76)	330 (12.99)	325 (12.80)	10 (0.39)	680 (26.77)	12 (0.49)	130 (5.12)	3.3 (0.13)	3.3 (0.13)	M10	76 (167.6)
2A0312A *<1>*		450 (17.72)	705 (27.76)	330 (12.99)	325 (12.80)	10 (0.39)	680 (26.77)	12 (0.49)	130 (5.12)	3.3 (0.13)	3.3 (0.13)	M10	80 (176.4)
2A0360A *<1>*		500 (19.69)	800 (31.50)	350 (13.78)	370 (14.57)	10 (0.39)	773 (30.43)	13 (0.51)	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	98 (216.1)
2A0415A		500 (19.69)	800 (31.50)	350 (13.78)	370 (14.57)	10 (0.39)	773 (30.43)	13 (0.51)	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	99 (218.3)

<1>   Customers may convert these models to IP20/NEMA 1, UL Type 1 enclosures using an IP20/NEMA 1, UL Type 1 Kit.

Table 2.7 Dimensions for IP00/Open Type Enclosure: 400 V Class

Drive Model	Figure	Dimensions mm (in)													Wt. kg (lb)
		W	H	D	W1	W2	W3	W4	H1	H2	D1	t1	t2	d	
4A0208A *<1>*	1	450 (17.72)	705 (27.76)	330 (12.99)	325 (12.80)	10 (0.39)	–	–	680 (26.77)	12.4 (0.49)	130 (5.12)	3.3 (0.13)	3.3 (0.13)	M10	79 (174.2)
4A0250A *<1>*		500 (19.69)	800 (31.50)	350 (13.78)	370 (14.57)	10 (0.39)	–	–	773 (30.43)	13 (0.51)	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	96 (211.6)
4A0296A *<1>*		500 (19.69)	800 (31.50)	350 (13.78)	370 (14.57)	10 (0.39)	–	–	773 (30.43)	13 (0.51)	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	102 (224.9)
4A0362A *<1>*		500 (19.69)	800 (31.50)	350 (13.78)	370 (14.57)	10 (0.39)	–	–	773 (30.43)	13 (0.51)	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	107 (235.9)
4A0414A	2	500 (19.69)	950 (37.40)	370 (14.57)	370 (14.57)	7.9 (0.31)	–	–	923 (36.34)	13 (0.51)	135 (5.31)	4.6 (0.18)	4.6 (0.18)	M12	125 (275.6)
4A0515A	3	670 (26.38)	1140 (44.88)	370 (14.57)	440 (17.32)	6 (0.24)	220 (8.66)	–	1110 (43.70)	15 (0.59)	150 (5.91)	4.6 (0.18)	4.6 (0.18)	M12	216 (476.2)
4A0675A		670 (26.38)	1140 (44.88)	370 (14.57)	440 (17.32)	6 (0.24)	220 (8.66)	–	1110 (43.70)	15 (0.59)	150 (5.91)	4.6 (0.18)	4.6 (0.18)	M12	221 (487.2)
4A0930A	4	1250 (49.21)	1380 (54.33)	370 (14.57)	1110 (43.70)	6 (0.24)	330 (13.00)	440 (17.32)	1345 (52.95)	15 (0.59)	150 (5.91)	4.6 (0.18)	4.6 (0.18)	M12	545 (1201.5)
4A1200A	4	1250 (49.21)	1380 (54.33)	370 (14.57)	1110 (43.70)	6 (0.24)	330 (13.00)	440 (17.32)	1345 (52.95)	15 (0.59)	150 (5.91)	4.6 (0.18)	4.6 (0.18)	M12	555 (1223.6)

<1>   Customers may convert these models to IP20/NEMA 1, UL Type 1 enclosures using an IP20/NEMA 1, UL Type 1 Kit.

Table 2.8 Dimensions for IP00/Open Type Enclosure: 600 V Class

Drive Model	Figure	Dimensions mm (in)													Wt. kg (lb)
		W	H	D	W1	W2	W3	W4	H1	H2	D1	t1	t2	d	
5A0125A *<1>*	1	450 (17.72)	705 (27.76)	330 (12.99)	325 (12.80)	10 (0.39)	–	–	680 (26.77)	12.4 (0.49)	130 (5.12)	3.3 (0.13)	3.3 (0.13)	M10	79 (174.2)
5A0145A *<1>*		450 (17.72)	705 (27.76)	330 (12.99)	325 (12.80)	10 (0.39)	–	–	680 (26.77)	12.4 (0.49)	130 (5.12)	3.3 (0.13)	3.3 (0.13)	M10	79 (174.2)
5A0192A *<1>*		500 (19.69)	800 (31.50)	350 (13.78)	370 (14.57)	10 (0.39)	–	–	773 (30.43)	13 (0.51)	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	107 (235.9)
5A0242A *<1>*		500 (19.69)	800 (31.50)	350 (13.78)	370 (14.57)	10 (0.39)	–	–	773 (30.43)	13 (0.51)	130 (5.12)	4.6 (0.18)	4.6 (0.18)	M12	107 (235.9)

<1>   Customers may convert these models to IP20/NEMA 1, UL Type 1 enclosures using an IP20/NEMA 1, UL Type 1 Kit.

Mechanical Installation

2

IP20/NEMA 1, UL Type 1 Kit Selection

Customers may convert IP00/Open Type models to IP20/NEMA 1, UL Type 1 enclosures. Refer to *Table 2.9* to select the appropriate IP20/NEMA 1, UL Type 1 Kit when performing the conversion.

Contact a Yaskawa representative for IP20/NEMA 1, UL Type 1 Kit availability for IP00/Open Type models not listed.

Table 2.9 IP20/NEMA 1, UL Type 1 Kit Selection

IP00/Open Type Drive Model	IP20/NEMA 1, UL Type 1 Kit Code	Comments
2A0250A	100-054-503	*Refer to IP20/NEMA 1, UL Type 1 Enclosure Drives on page 32* for drive dimensions with the IP20/NEMA 1, UL Type 1 Kit installed.
2A0312A		
2A0360A		
4A0208A		
4A0250A	100-054-504	
4A0296A		
4A0362A		
5A0125A	100-054-503	
5A0145A		
5A0192A	100-054-504	
5A0242A		

2.2 Flange Type Enclosure (NEMA 12 Backside) Dimensions & Heat Loss

<table>
<tr><td align="center">**NOTICE**</td></tr>
<tr><td>Refer to the A1000 6-Phase/12-Pulse Input Installation Manual TOEPYAIA1U02 for information on 12-pulse Flange and non-Flange models. This manual is posted on the Yaskawa website, www.yaskawa.com.</td></tr>
</table>

◆ Flange Type Models 2A0004 to 2A0012, 4A0002 to 4A0005, and 5A0003 and 5A0004

■ Flange Type Exterior and Mounting Dimensions

NOTE: Maximum surrounding air temperature is 50 °C [122 °F]

Unit: in. [mm]
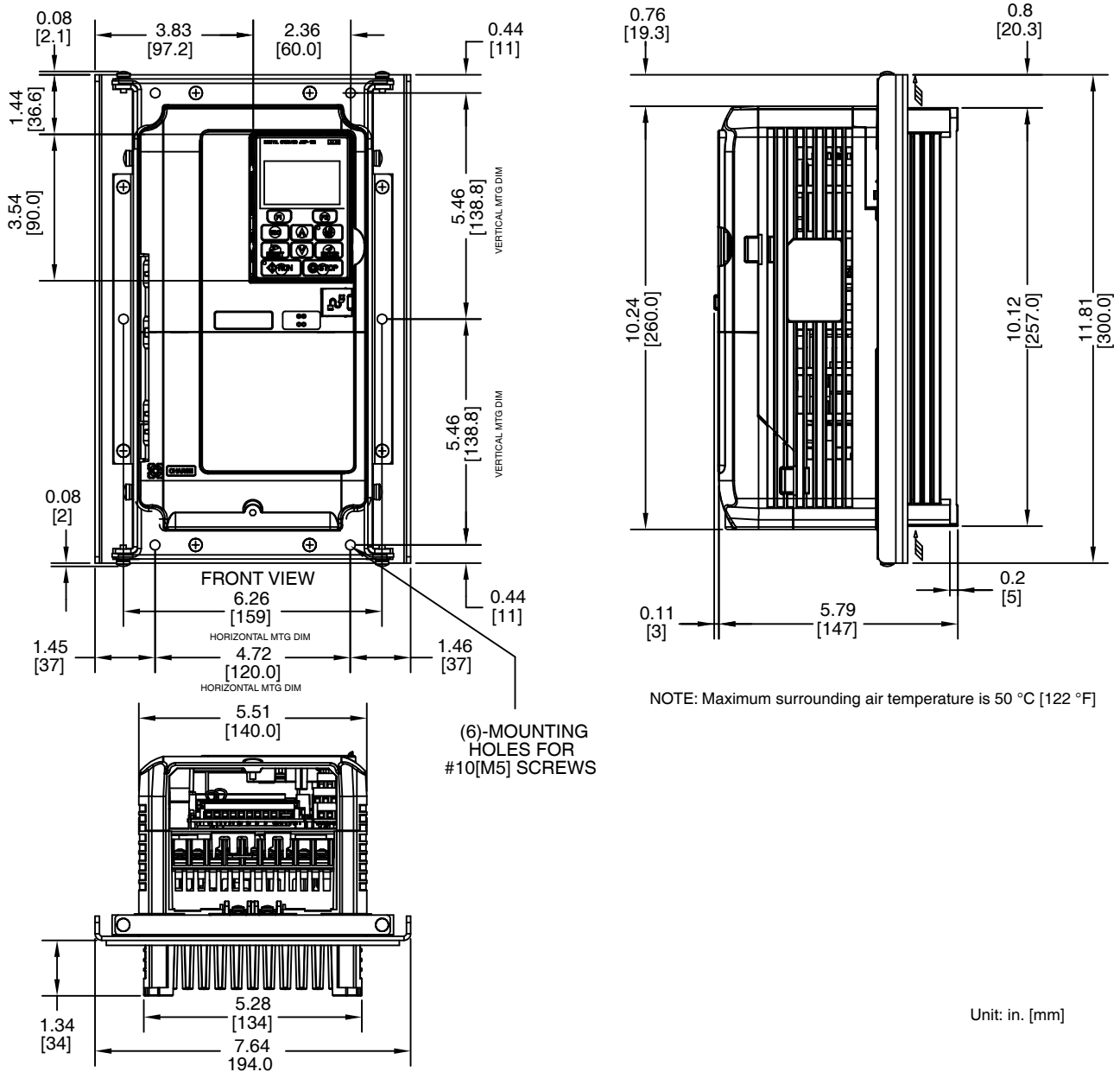
Figure 2.9 Models 2A0004 to 2A0012, 4A0002 to 4A0005, and 5A0003 and 5A0004

Mechanical Installation

2

■ **Flange Type Heat Loss Data**

Table 2.10 Models 2A0004 to 2A0012, 4A0002 to 4A0005, and 5A0003 and 5A0004

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
2A0004	200	47.3	18.4	65.7	44.4	14.8	59.2	3.3 (7.3)
2A0006		51.4	30.8	82.2	47.6	24.1	71.7	3.3 (7.3)
2A0008		52.1	42.9	95.0	48.9	34.8	83.7	3.4 (7.5)
2A0010		58.4	56.7	115.1	52.1	42.9	95.0	3.4 (7.5)
2A0012		64.4	76.9	141.3	57.9	63.7	121.6	3.4 (7.5)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
4A0002	400	47.9	19.8	67.7	44.7	15.9	60.6	3.4 (7.5)
4A0004		49.2	32.1	81.3	45.7	24.6	70.3	3.4 (7.5)
4A0005		52.8	44.6	97.4	49.4	37.4	86.8	3.4 (7.5)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
5A0003	600	23.3	21.5	44.8	19.8	28.9	48.7	3.4 (7.5)
5A0004		33.6	27.5	61.1	27.6	54.3	81.9	3.4 (7.5)

■ Flange Type Panel Cutout Dimensions for External Heatsink Mounting

6.26
[159.0]

5.51
[140.0]

(6)-#10
[M5]

0.23
[5.8]

5.46
[138.8]

CUTOUT

10.35
[263.0]

12.6
[320.0]

5.46
[138.8]

0.35
[8.8]

4.72
[120.0]

0.83
[21.2]

8.43
[214.0]

NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK
   RECOMMENDED CLEARANCE
   D=1.97 in. [50 mm] MINUS PANEL THICKNESS

Unit: in. [mm]

Figure 2.10 Models 2A0004 to 2A0012, 4A0002 to 4A0005, and 5A0003 and 5A0004

Mechanical Installation

2

◆ **Flange Type Models 2A0018 and 2A0021, 4A0007 to 4A0011, and 5A0006 and 5A0009**

■ **Flange Type Exterior and Mounting Dimensions**

(1) EXTERNAL COOLING FAN

(6)-MOUNTING HOLES FOR #10[M5] SCREWS

FRONT VIEW

AIR

AIR

NOTE: Maximum surrounding air temperature is 50 °C [122 °F]

Unit: in. [mm]
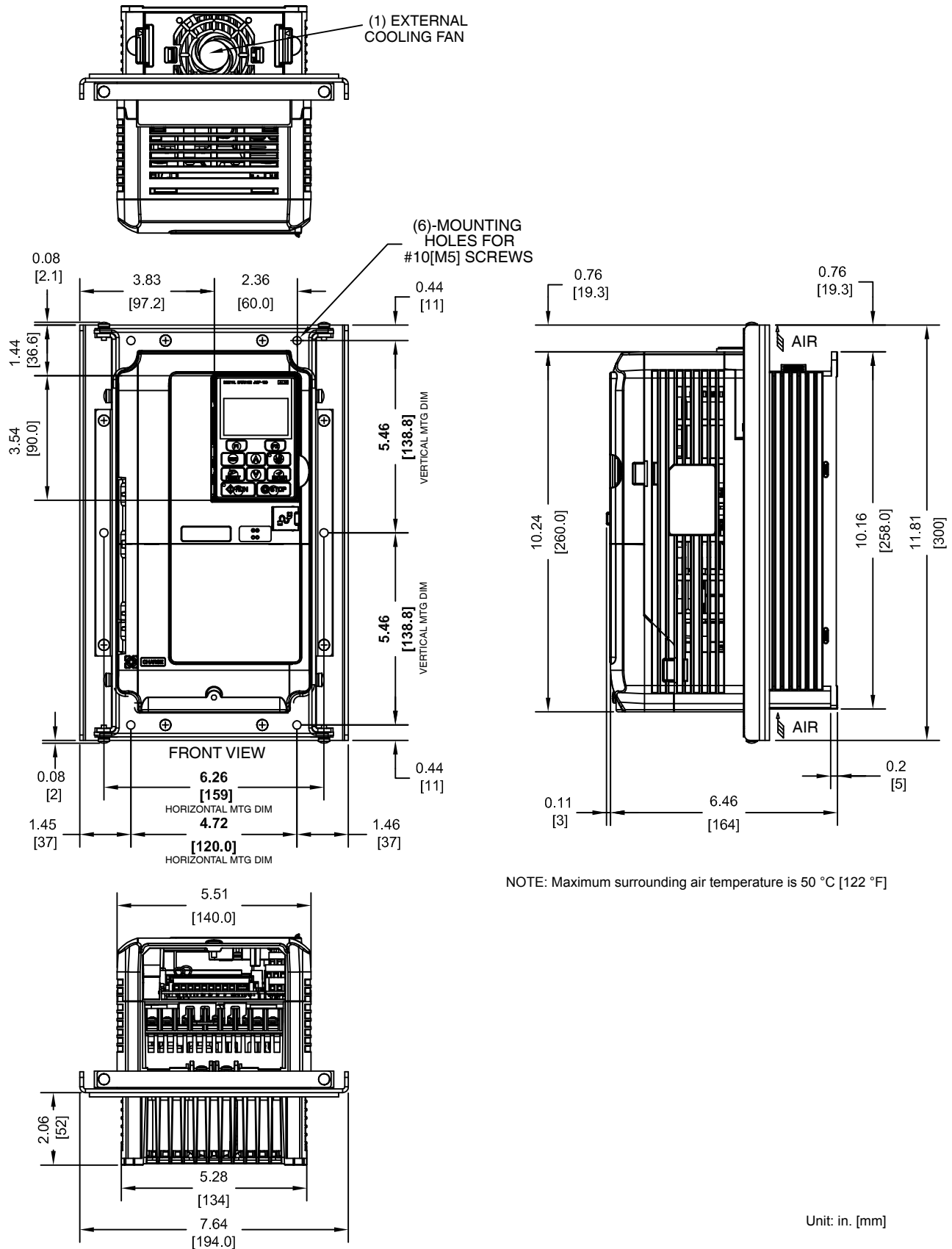
Figure 2.11 Models 2A0018 and 2A0021, 4A0007 to 4A0011, and 5A0006 and 5A0009

■ Flange Type Heat Loss Data

Table 2.11 Models 2A0018 and 2A0021, 4A0007 to 4A0011, and 5A0006 and 5A0009

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
2A0018	200	67.4	100.7	168.1	60.0	77.0	137.0	3.7 (8.1)
2A0021		83.3	138.4	221.7	67.4	100.7	168.1	3.7 (8.1)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
4A0007	400	59.0	62.1	121.1	53.0	47.7	100.7	3.6 (7.9)
4A0009		60.4	65.8	126.2	55.3	53.1	108.4	3.7 (8.1)
4A0011		73.0	88.7	161.7	61.0	68.5	129.5	3.7 (8.1)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
5A0006	600	43.7	28.1	71.8	27.0	53.0	80.0	3.7 (8.1)
5A0009		68.9	43.4	112.3	36.4	78.7	115.1	3.7 (8.1)

Mechanical Installation

2

■ Flange Type Panel Cutout Dimensions for External Heatsink Mounting
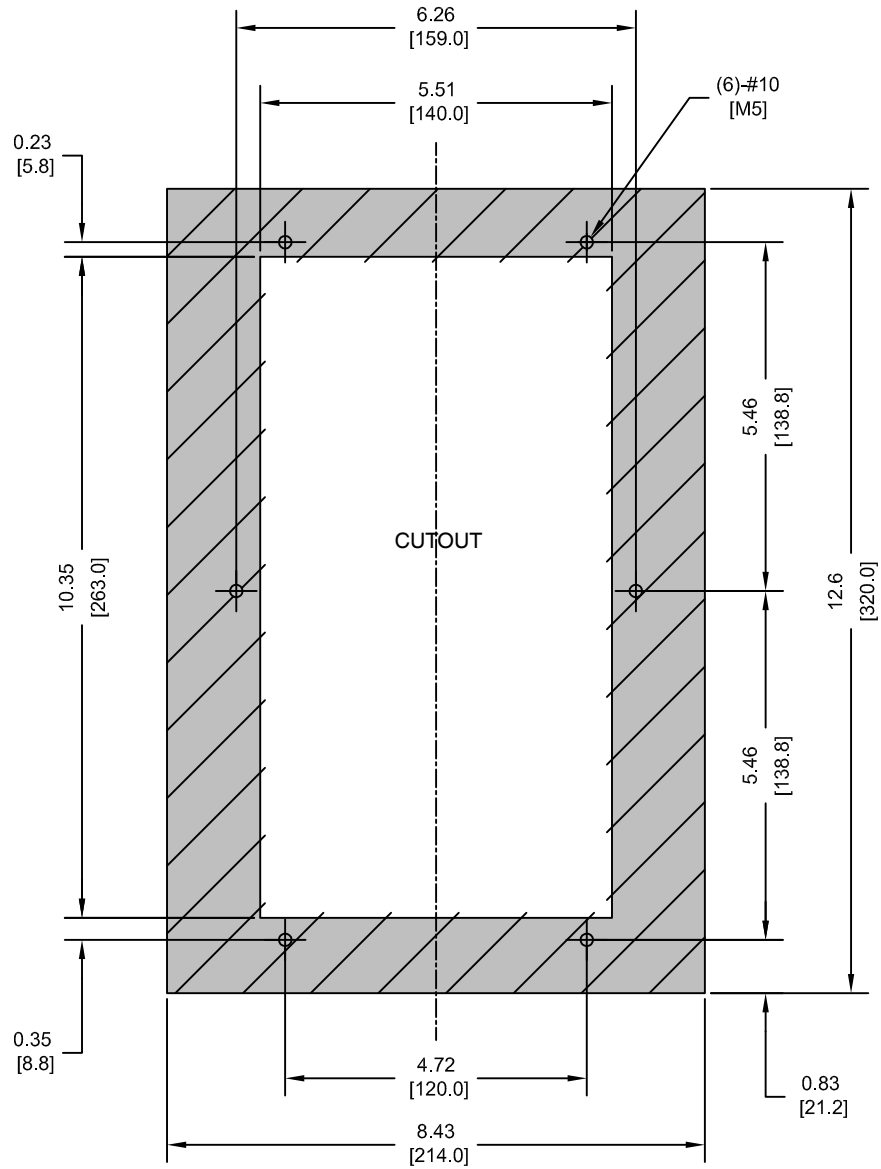
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK
   RECOMMENDED CLEARANCE
   D=2.36 in. MINUS PANEL THICKNESS

Unit: in. [mm]

Figure 2.12 Models 2A0018 and 2A0021, 4A0007 to 4A0011, and 5A0006 and 5A0009

◆ Flange Type Models 2A0030 and 2A0040, 4A0018 and 4A0023, and 5A0011

■ Flange Type Exterior and Mounting Dimensions

[2] EXTERNAL COOLING FANS

(6)-MOUNTING HOLES FOR #10[M5] SCREWS

0.08 [2.1]

3.83 [97.2]

2.36 [60.0]

0.44 [11]

1.44 [36.6]

3.54 [90.0]

5.46 [138.8] VERTICAL MTG DIM

5.46 [138.8] VERTICAL MTG DIM

FRONT VIEW

6.26 [159] HORIZONTAL MTG DIM
4.72 [120.0] HORIZONTAL MTG DIM

0.08 [2]

1.45 [37]

0.44 [11]

1.46 [37]

0.76 [19.3]

0.76 [19.3]

AIR

10.24 [260.0]

10.16 [258.0]

11.81 [300]

AIR

0.11 [3]

6.58 [167]

0.2 [5]

NOTE: Maximum surrounding air temperature is 50 °C [122 °F]

5.51 [140.0]

2.07 [52]

5.28 [134]

7.64 [194.0]

Unit: in. [mm]

Figure 2.13 Models 2A0030 and 2A0040, 4A0018 and 4A0023, and 5A0011

■ **Flange Type Heat Loss Data**

Table 2.12 Models 2A0030 and 2A0040, 4A0018 and 4A0023, and 5A0011

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
2A0030	200	117.1	261.5	378.6	92.3	194.4	286.7	4.2 (9.2)
2A0040		144.5	292.8	437.3	104.8	213.8	318.6	4.2 (9.2)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
4A0018	400	108.0	177.3	285.3	85.7	135.4	221.1	4.1 (9.0)
4A0023		138.1	215.9	354.0	97.0	149.9	246.9	4.1 (9.0)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
5A0011	600	88.0	56.1	144.1	49.5	110.9	160.4	4.1 (9.0)

■ Flange Type Panel Cutout Dimensions for External Heatsink Mounting
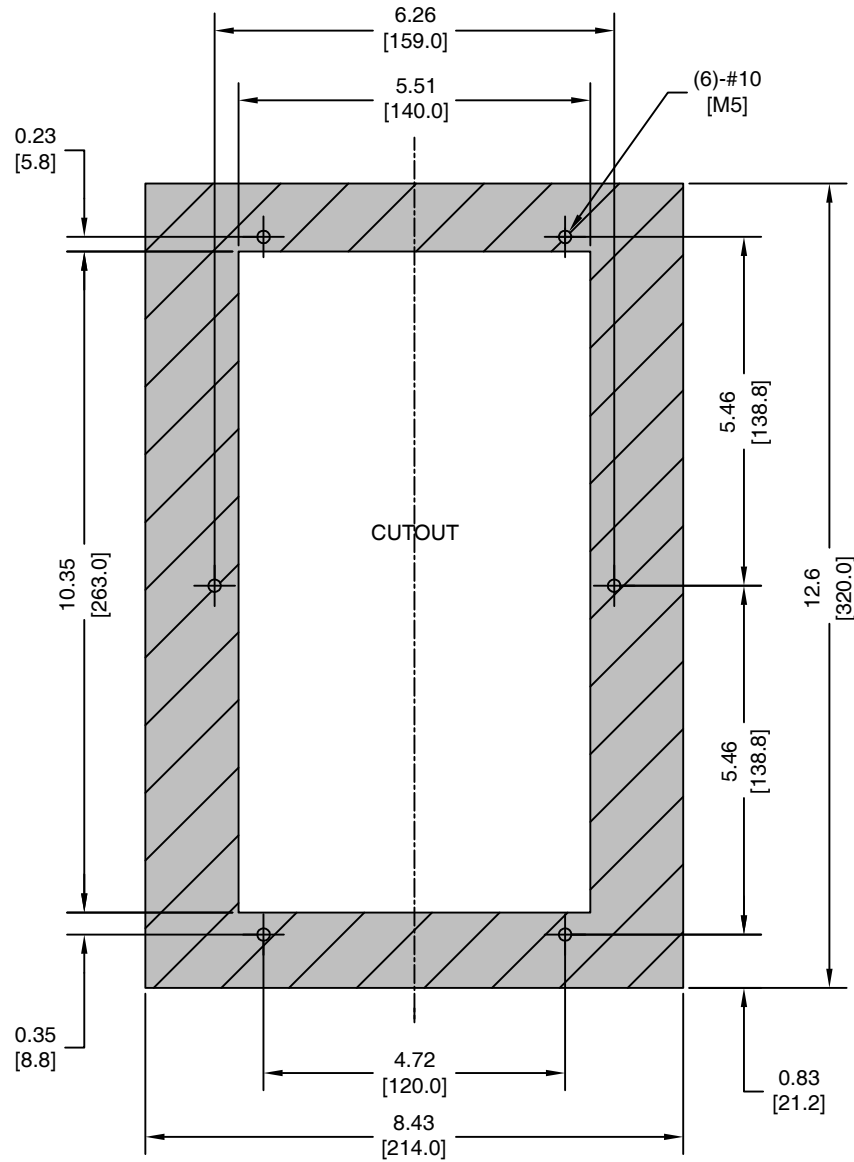
NOTES:
 1. CUTOUT TOLERANCES:
    =/- 0.02 in. [0.5 mm]
 2. EXPOSED HEATSINK
    RECOMMENDED CLEARANCE
    D=2.36 in. [60 mm] MINUS PANEL THICKNESS

Unit: in. [mm]

Figure 2.14 Models 2A0030 and 2A0040, 4A0018 and 4A0023, and 5A0011

Mechanical Installation

2

◆ Flange Type Model 4A0031

■ Flange Type Exterior and Mounting Dimensions

(2) EXTERNAL
COOLING FANS

(6)-MOUNTING
HOLES FOR
#10 [M5] SCREWS

0.05
[1.3]

5.42
[137.6]

2.36
[60]

0.45
[11]

0.79
[20.0]

0.79
[20.0]

1.55
[39.3]

3.54
[90]

6.27
[159.2]
VERTICAL MTG DIM

AIR

11.81
[300.0]

11.69
[297]

13.39
[340]

6.21
[157.8]
VERTICAL MTG DIM

FRONT VIEW

7.91
[201]
HORIZONTAL MTG DIM

5.51
[140.0]
HORIZONTAL MTG DIM

1.85
[47]

0.45
[11]

AIR

0.2
[5]

0.11
[3]

6.57
[167]

NOTE: Maximum surrounding air temperature is 50 °C (122 °F)

7.09
[180.0]

2.04
[52]

6.85
[174]

9.21
[234.0]

Unit: in. [mm]
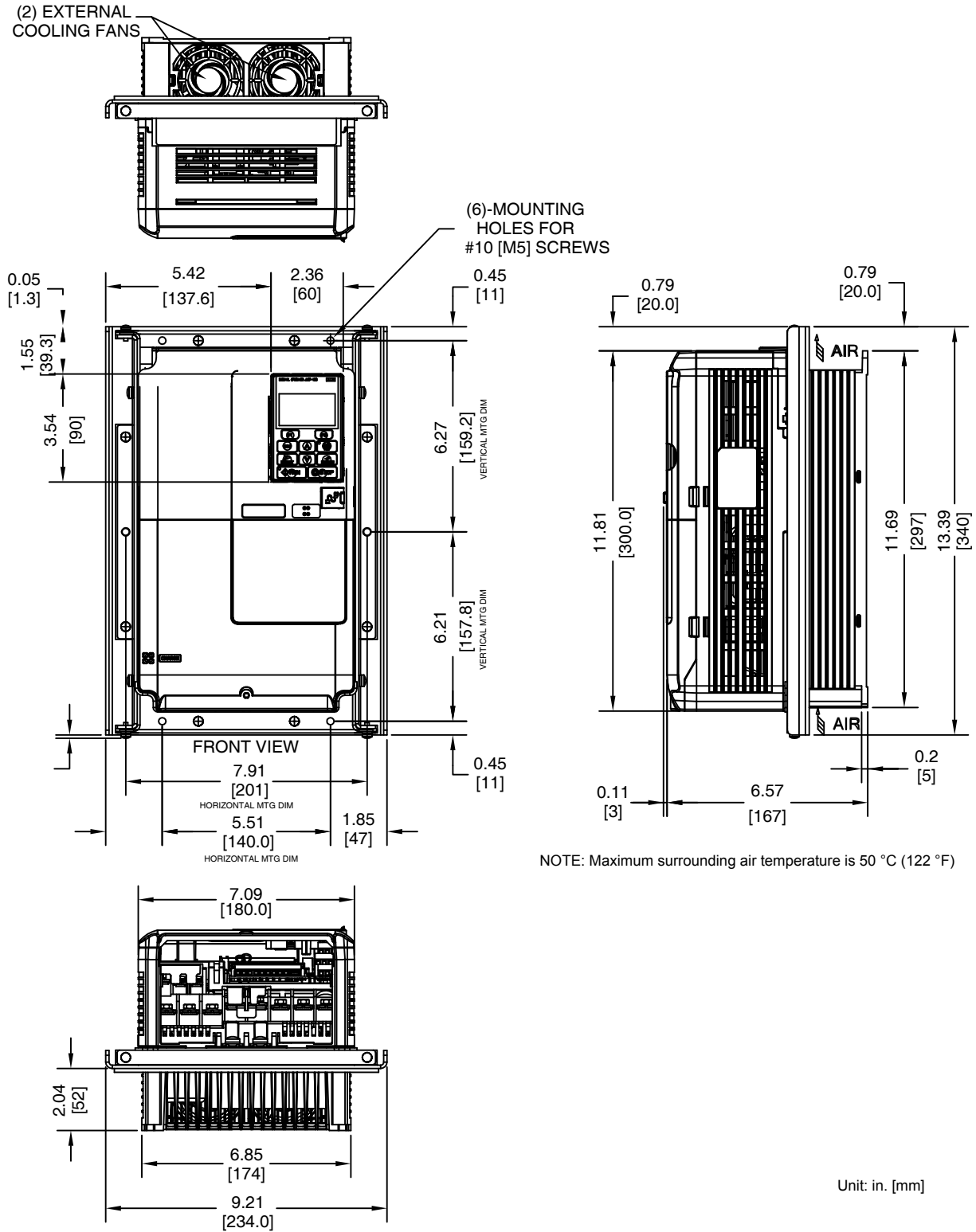
Figure 2.15 Model 4A0031

■ **Flange Type Heat Loss Data**

Table 2.13 Model 4A0031

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
4A0031	400	160.5	294.6	455.1	115.1	208.0	323.1	5.7 (12.5)

■ **Flange Type Panel Cutout Dimensions for External Heatsink Mounting**
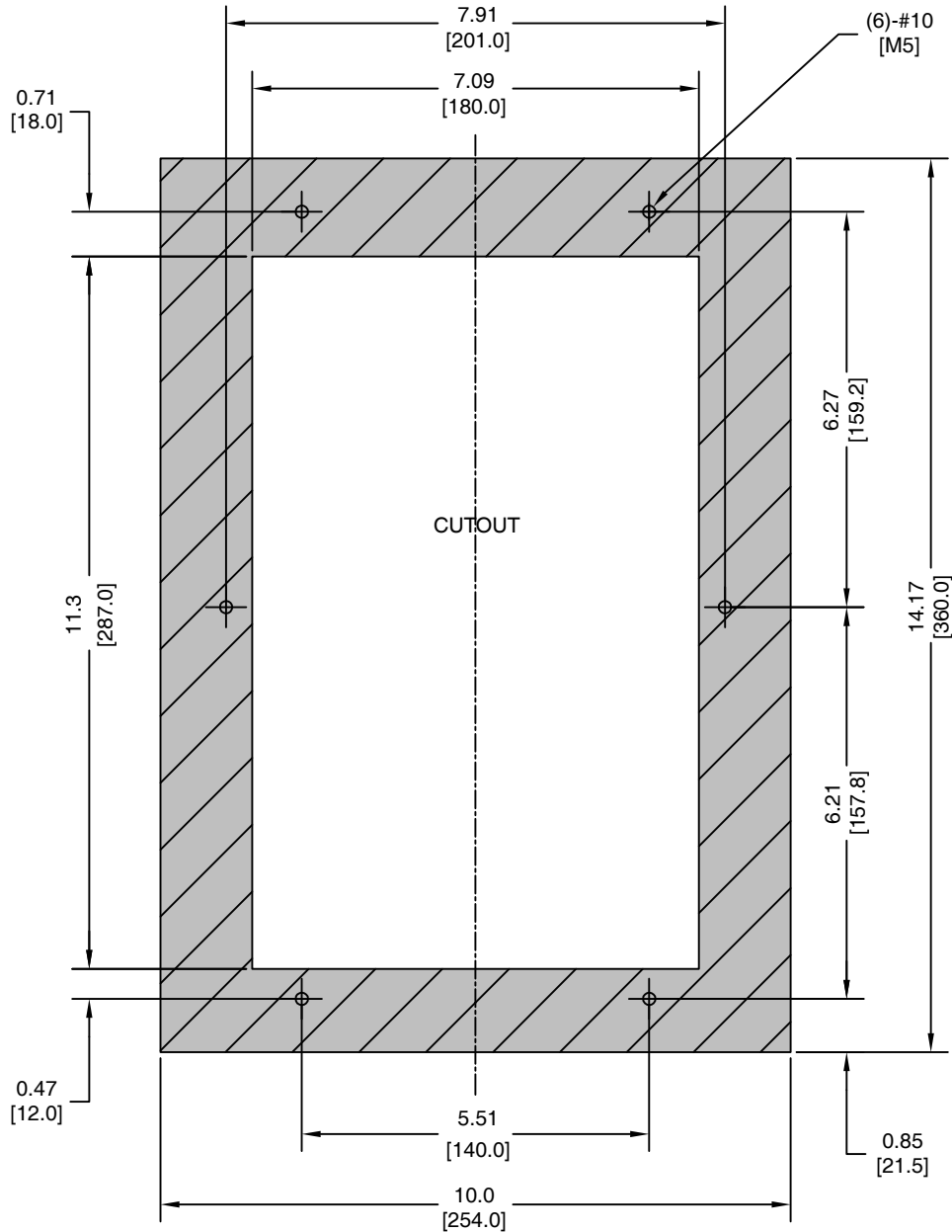
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK
   RECOMMENDED CLEARANCE
   D=1.97 in. [50 mm] MINUS PANEL THICKNESS

Unit: in. [mm]

Figure 2.16 Model 4A0031

Mechanical Installation

2

◆ **Flange Type Models 2A0056, 4A0038, and 5A0017 and 5A0022**

■ **Flange Type Exterior and Mounting Dimensions**
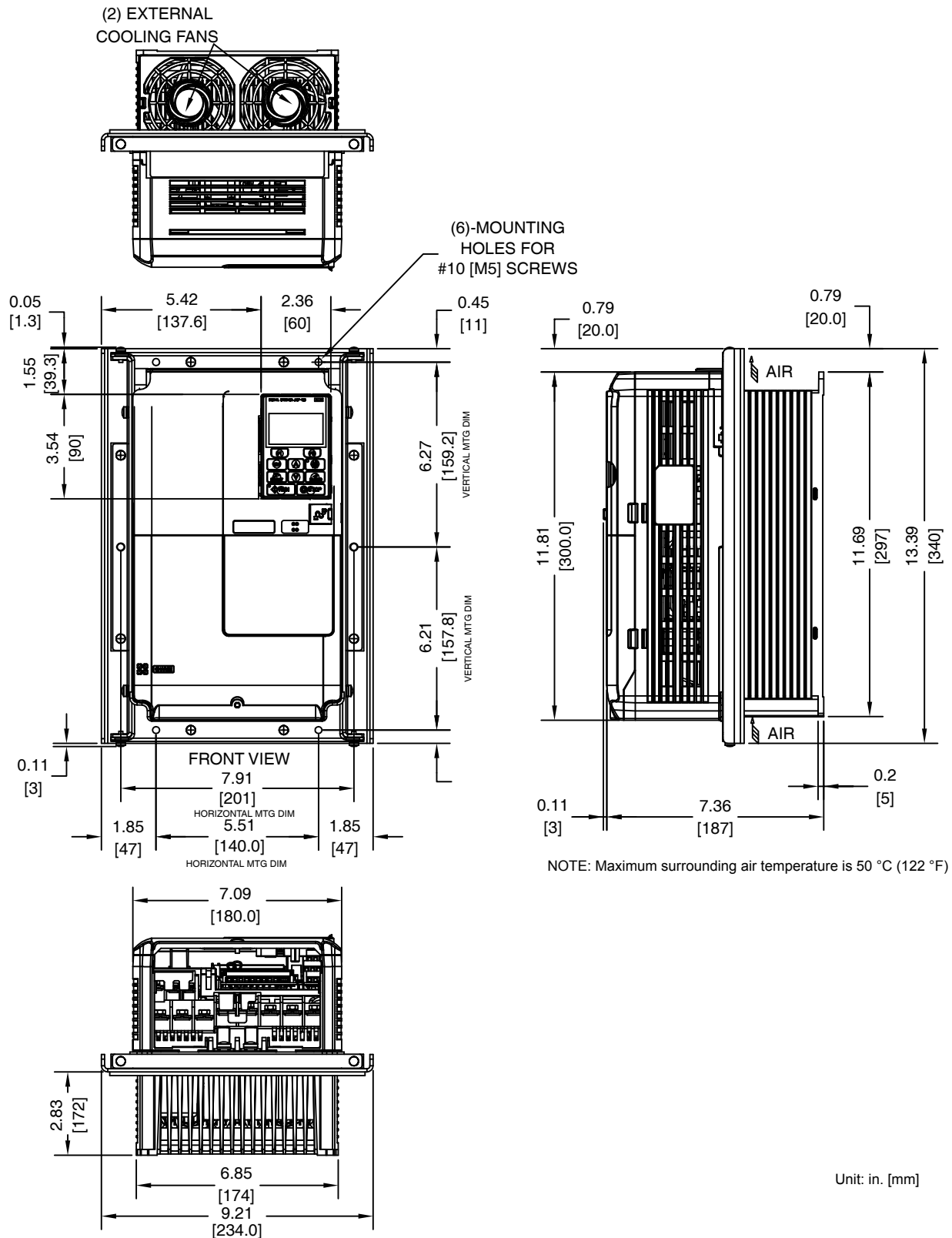
Figure 2.17 Models 2A0056, 4A0038, and 5A0017 and 5A0022

NOTE: Maximum surrounding air temperature is 50 °C (122 °F)

Unit: in. [mm]

■ Flange Type Heat Loss Data

Table 2.14 Models 2A0056, 4A0038, and 5A0017 and 5A0022

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
2A0056	200	175.4	370.7	546.1	129.9	280.2	410.1	5.9 (13.0)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
4A0038	400	181.6	339.6	521.2	140.8	262.6	403.4	6.0 (13.2)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
5A0017	600	146.7	96.6	243.3	67.5	144.7	212.2	6.0 (13.2)
5A0022		178.3	99.4	277.7	81.1	203.8	284.9	6.0 (13.2)

Mechanical Installation

2

■ **Flange Type Panel Cutout Dimensions for External Heatsink Mounting**
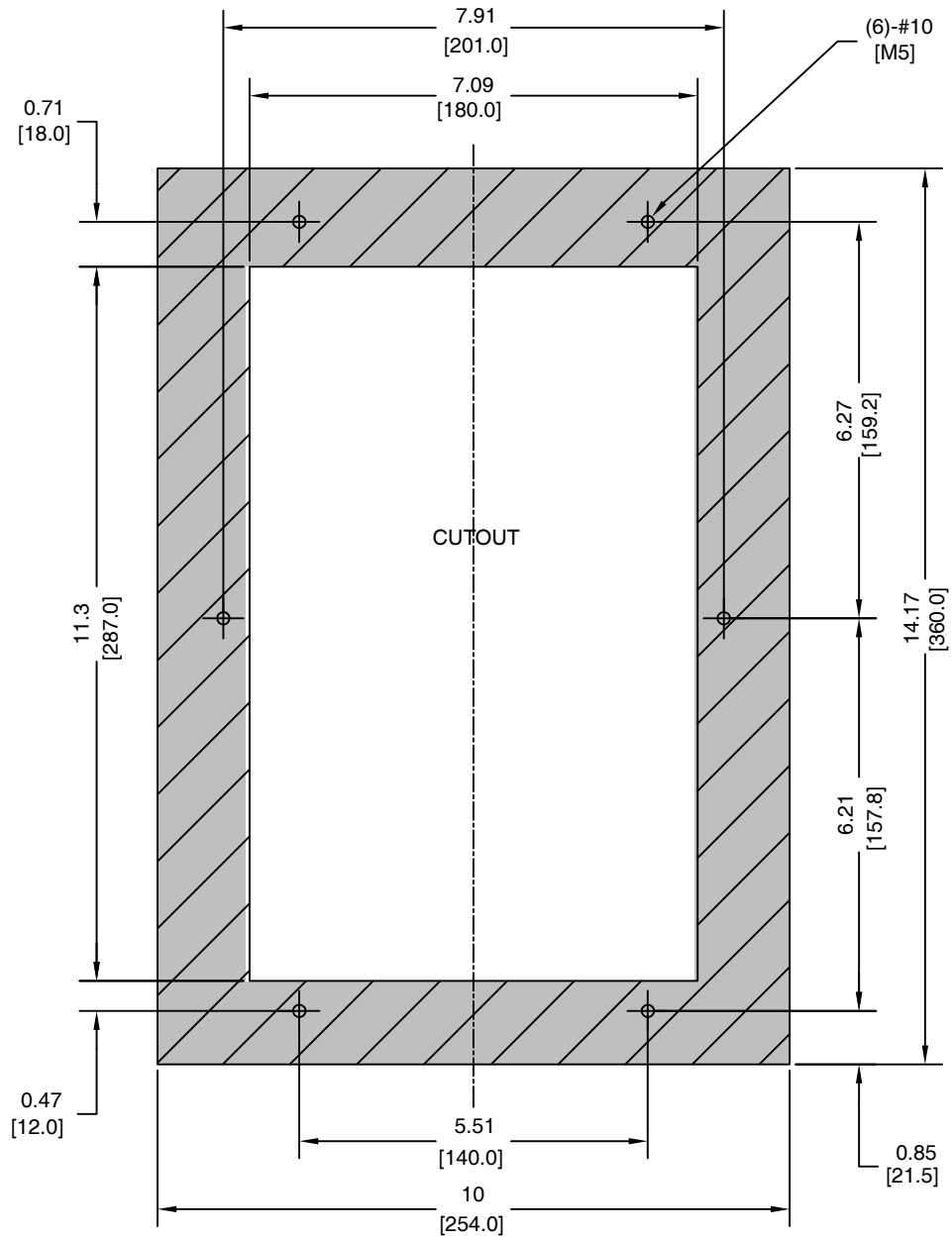
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.021 in. [0.5 mm]
2. EXPOSED HEATSINK
   RECOMMENED CLEARANCE
   D=3.5 in. [88.9 mm] MINUS PANEL THICKNESS

Unit: in. [mm]

Figure 2.18 Models 2A0056, 4A0038, and 5A0017 and 5A0022

◆ Flange Type Models 2A0069 and 2A0081, 4A0044, and 5A0027 and 5A0032

■ Flange Type Exterior and Mounting Dimensions

(2) EXTERNAL
COOLING FANS

7.41 [188.3]   2.36 [60]   0.68 [17.2]

0.13 [3.4]

2.08 [52.9]

3.54 [90]

7.59 [192.8]   VERTICAL MOUNTING DIM

7.47 [189.8]   VERTICAL MOUNTING DIM

(6)-MOUNTING
HOLES FOR
1/4 in. [M6] SCREWS

FRONT VIEW
9.96
[253]
HORIZONTAL MOUNTING DIM
7.09
[180]
HORIZONTAL MOUNTING DIM

0.14 [3.5]

2.28 [58]   2.28 [58]

0.79 [20.1]

1.32 [33.5]   1.32 [33.5]

AIR

13.78 [350]   13.66 [347]   16.54 [420]

AIR

0.11 [3]   7.76 [197]   0.2 [5]

NOTE: Maximum surrounding air temperature id 50 °C (122 °F)

8.66 [220]

2.91 [74]

8.43 [214]

11.65 [296]

Unit: in. [mm]

Figure 2.19 Models 2A0069 and 2A0081, 4A0044, and 5A0027 and 5A0032

Mechanical Installation

2

■ **Flange Type Heat Loss Data**

Table 2.15 Models 2A0069 and 2A0081, 4A0044, and 5A0027 and 5A0032

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
2A0069	200	204.5	491.3	695.8	162.8	394.9	557.7	9.1 (20.0)
2A0081		257.4	527.4	784.8	220.9	459.8	680.7	10.0 (22.0)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
4A0044	400	208.9	389.6	598.5	179.4	329.8	509.2	8.7 (19.1)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
5A0027	600	227.2	132.1	359.3	113.9	267.2	381.1	8.7 (19.1)
5A0032		279.9	141.6	421.5	132.2	332.9	465.1	8.7 (19.1)

■ Flange Type Panel Cutout Dimensions for External Heatsink Mounting
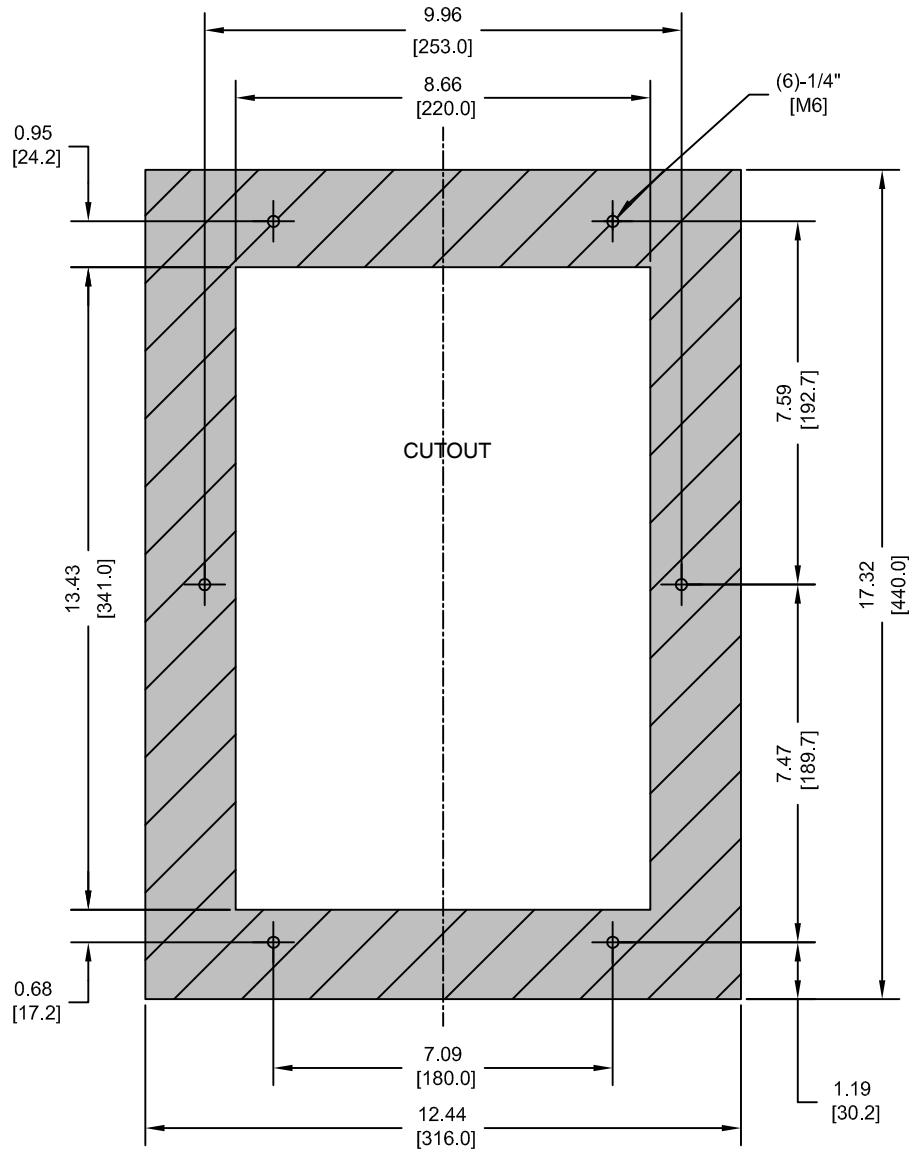
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK
   RECOMMENDED CLEARANCE
   D=3.35 in. [85 mm] MINUS PANEL THICKNESS

Unit: in. [mm]

Figure 2.20 Models 2A0069 and 2A0081, 4A0044, and 5A0027 and 5A0032

Mechanical Installation

2

◆ Flange Type Models 2A0110 and 4A0058

■ Flange Type Exterior and Mounting Dimensions

(2) EXTERNAL COOLING FANS

LIFTING AND EYEBOLT DETAILS

Ø0.79 [Ø20]

1.31 [33.3]

M8 THREAD

NOTE: Spreader bar required to avoid damage during lifting.

7.29 [185.3]

2.36 [60]

(8) MOUNTING HOLES FOR 1/4 in. [M6] SCREWS

2.29 [58.2]

8.43 [214]

0.35 [9]

3.54 [90]

3.46 [88] VERTICAL MOUNTING DIM

8.66 [220] VERTICAL MOUNTING DIM

3.46 [88] VERTICAL MOUNTING DIM

0.35 [9]

1.72 [43.8] HORIZONTAL MOUNTING DIM

7.7 [195.7] HORIZONTAL MOUNTING DIM

1.72 [43.8] HORIZONTAL MOUNTING DIM

6.05 [153.6]

0.32 [8.2]

1.1 [28]

1.02 [25.9]

AIR

14.26 [362.2]

14.09 [358]

16.3 [414]

AIR

0.11 [3]

10.16 [258]

(2) MOUNTING BRACKETS USED DURING TRANSPORT ONLY REMOVE BEFORE INSTALLING

NOTE: Maximum surrounding air temperature is 50 °C (122 °F)

10.05 [255.2]

3.82 [97]

9.06 [230]

12.13 [308]

Unit: in. [mm]

Figure 2.21 Models 2A0110 and 4A0058

■ Flange Type Heat Loss Data

Table 2.16 Models 2A0110 and 4A0058

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
2A0110	200	286	719	1005	211	510	721	23 (50.6)

Drive Model	Voltage Class	Input Type	Heat Loss (W)						Wt. kg (lb)
			ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
			Internal	External	Total	Internal	External	Total	
4A0058	400	6-Pulse	215	471	686	170	349	519	23 (50.6)

■ Flange Type Panel Cutout Dimensions for External Heatsink Mounting
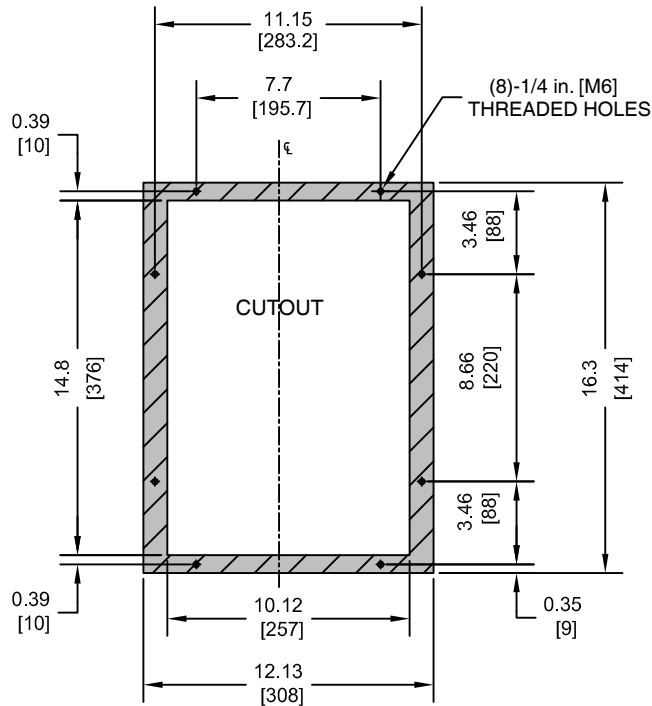
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK DEPTH
   D=3.82 in. [97 mm] MINUS PANEL THICKNESS
3. MINIMUM RECOMMENDED PANEL
   THICKNESS: 12 GA

Unit: in. [mm]

Figure 2.22 Models 2A0110 and 4A0058

Mechanical Installation

2

◆ **Flange Type Models 2A0138, 4A0072, and 5A0041 and 5A0052**

■ **Flange Type Exterior and Mounting Dimensions**

NOTE: Spreader bar required to avoid damage during lifting.

NOTE: Maximum surrounding air temperature is 50 °C (122 °F)

Unit: in. [mm]
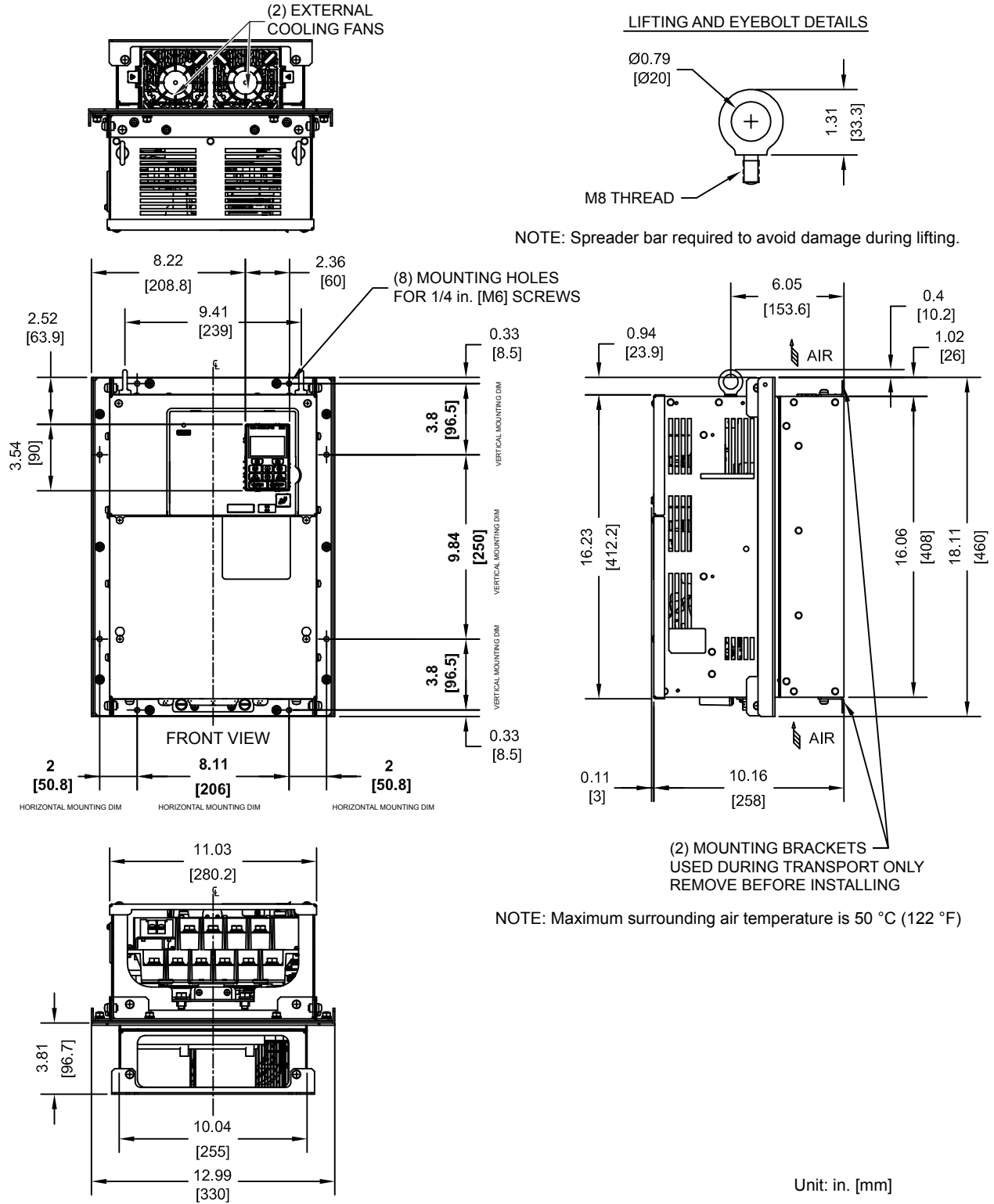
Figure 2.23 Models 2A0138, 4A0072, and 5A0041 and 5A0052

■ Flange Type Heat Loss Data

Table 2.17 Models 2A0138, 4A0072, and 5A0041 and 5A0052

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
2A0138	200	312	842	1154	250	662	912	28 (61.6)

Drive Model	Voltage Class	Input Type	Heat Loss (W)						Wt. kg (lb)
			ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
			Internal	External	Total	Internal	External	Total	
4A0072	400	6-Pulse	265	605	870	217	484	701	27 (59.4)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
5A0041	600	136	331	467	128	406	534	27 (59.4)
5A0052		166	428	594	161	527	688	27 (59.4)

■ Flange Type Panel Cutout Dimensions for External Heatsink Mounting
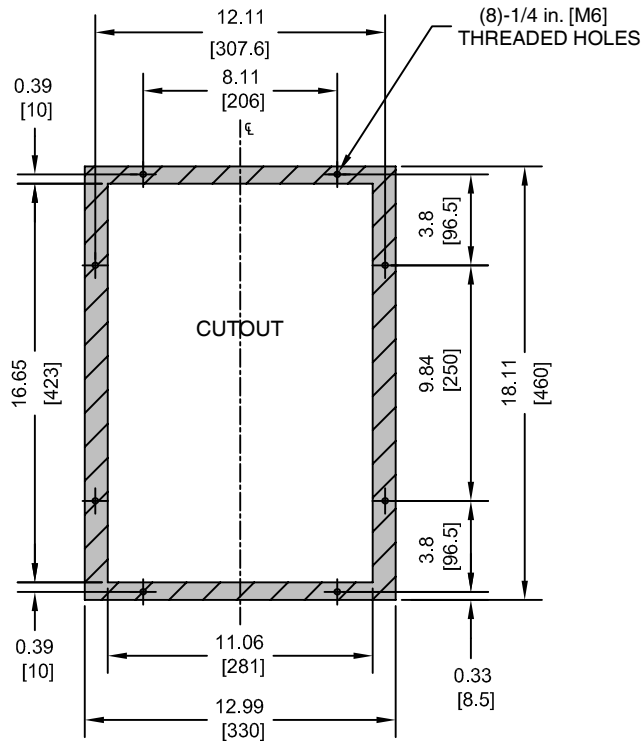
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK DEPTH
   D=3.81 in. [97 mm] MINUS PANEL THICKNESS
3. MINIMUM RECOMMENDED PANEL
   THICKNESS: 12 GA   Unit: in. [mm]

Figure 2.24 Models 2A0138, 4A0072, and 5A0041 and 5A0052

Mechanical Installation

2

◆ **Flange Type Models 4A0088 and 4A0103**

■ **Flange Type Exterior and Mounting Dimensions**

LIFTING AND EYEBOLT DETAILS

Ø0.79 [Ø20]

1.31 [33.3]

M8 THREAD

NOTE: Spreader bar required to avoid damage during lifting.

(2) EXTERNAL COOLING FANS

10.72 [272.3]

2.36 [60]

(12) MOUNTING HOLES FOR 1/4 in. [M6] SCREWS

11.5 [292]

1.0 [25.5]

5.07 [128.9]

5.91 [150] VERTICAL MOUNTING DIM

6.69 [170] VERTICAL MOUNTING DIM

3.54 [90]

5.91 [150] VERTICAL MOUNTING DIM

0.41 [10.5]

FRONT VIEW

[25.5]

2.08 [52.7]
HORIZONTAL MOUNTING DIM

9.76 [248]
HORIZONTAL MOUNTING DIM

2.08 [52.7]
HORIZONTAL MOUNTING DIM

6.43 [163.3]

0.45 [11.5]

1.78 [45.1]

1.88 [47.7]

AIR

18.63 [473.2]

18.43 [468]

21.34 [542]

AIR

0.11 [3]

10.16 [258]

(2) MOUNTING BRACKETS USED DURING TRANSPORT ONLY REMOVE BEFORE INSTALLING

NOTE: Maximum surrounding air temperature is 50 °C (122 °F)

13 [330.2]

3.97 [101]

12.01 [305]

15.35 [390]

Unit: in. [mm]

Figure 2.25 Models 4A0088 and 4A0103

■ Flange Type Heat Loss Data

Table 2.18 Models 4A0088 and 4A0103

Drive Model	Voltage Class	Input Type	Heat Loss (W)						Wt. kg (lb)
			ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
			Internal	External	Total	Internal	External	Total	
4A0088	400	6-Pulse	308	684	992	254	563	817	39 (85.8)
4A0103			357	848	1205	299	723	1022	39 (85.8)

■ Flange Type Panel Cutout Dimensions for External Heatsink Mounting
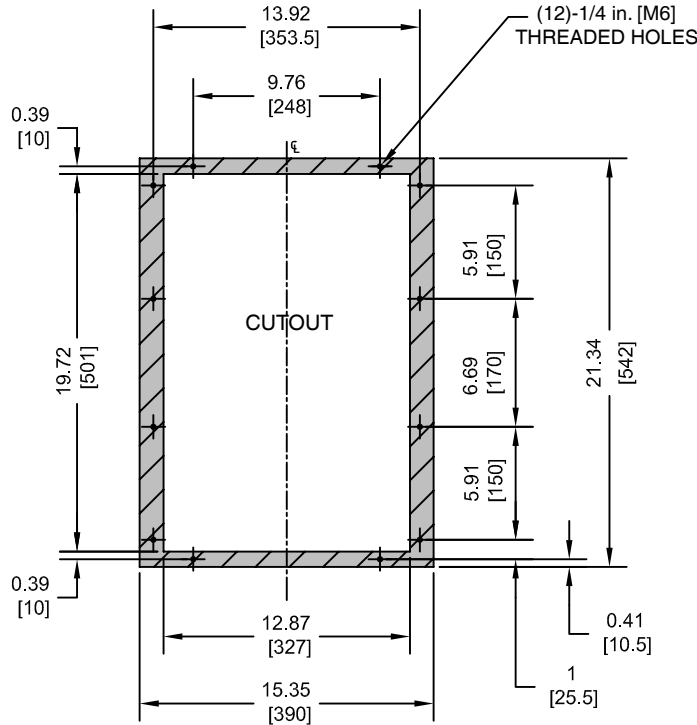
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK DEPTH
   D=3.97 in. [101 mm] MINUS PANEL THICKNESS
3. MINIMUM RECOMMENDED PANEL
   THICKNESS: 12 GA

Unit: in. [mm]

Figure 2.26 Models 4A0088 and 4A0103

Mechanical Installation

2

◆ **Flange Type Models 2A0169 and 2A0211, 4A0139 and 4A0165, and 5A0062 to 5A0099**

■ **Flange Type Exterior and Mounting Dimensions**

(2) EXTERNAL COOLING FANS

LIFTING AND EYEBOLT DETAILS

Ø0.79 [Ø20]

1.31 [33.3]

M8 THREAD

NOTE: Spreader bar required to avoid damage during lifting.

10.4 [264.3]
2.36 [60]
3.66 [93]
7.87 [200]
(12) MOUNTING HOLES FOR 1/4 in. [M6] SCREWS
1.06 [27]

10.57 [268.5]
3.54 [90]

6.5 [165] VERTICAL MOUNTING DIM
6.34 [161] VERTICAL MOUNTING DIM
6.5 [165] VERTICAL MOUNTING DIM

0.33 [8.5]

FRONT VIEW

1.06 [27]

1.91 [48.6]
HORIZONTAL MOUNTING DIM

10.28 [261]
HORIZONTAL MOUNTING DIM

1.91 [48.6]
HORIZONTAL MOUNTING DIM

5.22 [132.6]
0.36 [9.2]
0.99 [25.1]
AIR
1.06 [27]

20.19 [512.7]
20 [508]
22.13 [562]

AIR

0.11 [3]
11.14 [283]

(2)-MOUNTING BRACKETS USED DURING TRANSPORT ONLY REMOVE BEFORE INSTALLING

NOTE: Maximum surrounding air temperature is 50 °C (122 °F)

13 [330.2]

4.21 [107]

12.01 [305]
15.2 [386]

Unit: in. [mm]

Figure 2.27 Models 2A0169 and 2A0211, 4A0139 and 4A0165, and 5A0062 to 5A0099

■ Flange Type Heat Loss Data

Table 2.19 Models 2A0169 and 2A0211, 4A0139 and 4A0165, and 5A0062 to 5A0099

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = [1])			
		Internal	External	Total	Internal	External	Total	
2A0169	200	380	1014	1394	306	816	1122	41 (90.2)
2A0211		473	1218	1691	378	976	1354	42 (92.4)

<1> Carrier frequency is set to 8 kHz in model 2A0169 and set to 5 kHz in model 2A0211.

Drive Model	Voltage Class	Input Type	Heat Loss (W)						Wt. kg (lb)
			ND (Fc = 2 kHz)			HD (Fc = [1])			
			Internal	External	Total	Internal	External	Total	
4A0139	400	6-Pulse	534	1215	1749	416	908	1324	45 (99.0)
4A0165			668	1557	2225	580	1340	1920	46 (101.2)

<1> Carrier frequency is set to 8 kHz in model 4A0139 and set to 5 kHz in model 4A0165.

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = [1])			
		Internal	External	Total	Internal	External	Total	
5A0062	600	279	791	1070	335	1272	1607	45 (99.0)
5A0077		329	959	1288	379	1457	1836	45 (99.0)
5A0099		412	1253	1665	352	1267	1619	45 (99.0)

<1> Carrier frequency is set to 8 kHz in models 5A0062 and 5A0077 and set to 5 kHz in model 5A0099.

Mechanical Installation

2

◼ Flange Type Panel Cutout Dimensions for External Heatsink Mounting
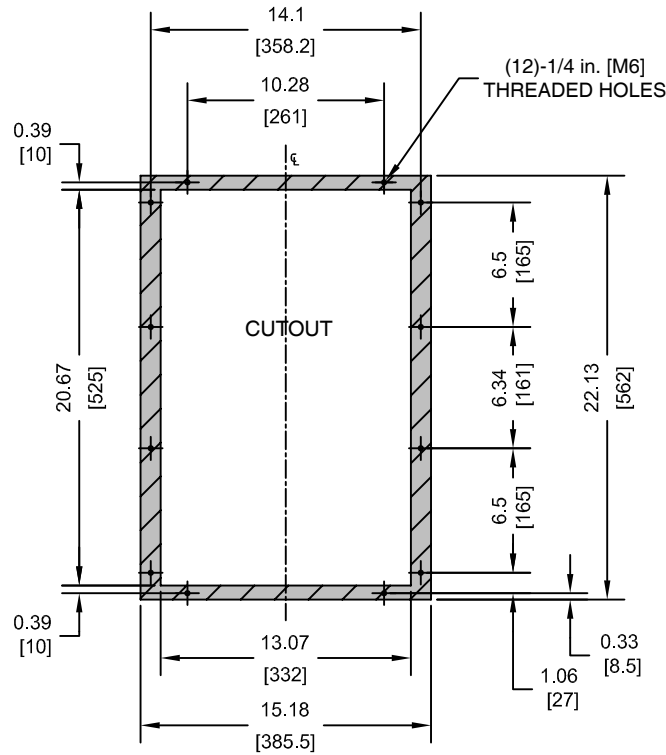
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK DEPTH
   D=4.21 in. [107 mm] MINUS PANEL THICKNESS
3. MINIMUM RECOMMENDED PANEL
   THICKNESS: 12 GA

Unit: in. [mm]

Figure 2.28 Models 2A0169 and 2A0211, 4A0139 and 4A0165, and 5A0062 to 5A0099

◆ Flange Type Models 2A0250 and 2A0312, 4A0208, and 5A0125 and 5A0145

■ Flange Type Exterior and Mounting Dimensions

(2) EXTERNAL COOLING FANS

LIFTING AND EYEBOLT DETAILS

Ø0.98 [Ø25]

1.63 [41.5]

M10 THREAD

NOTE: Spreader bar required to avoid damage during lifting.

15.6 [396.2]

2.36 [60]

(13)-MOUNTING HOLES FOR 3/8 in. [M10] SCREWS

0.59 [15]
HORIZONTAL MOUNTING DIM

1.42 [36]

16.64 [422.7]

8.58 [218]
VERTICAL MOUNTING DIM

7.48 [190]
VERTICAL MOUNTING DIM

3.54 [90]

8.58 [218]
VERTICAL MOUNTING DIM

0.53 [13.5]

FRONT VIEW

1.42 [36]

3.15 [80]
HORIZONTAL MOUNTING DIM

13.39 [340]
HORIZONTAL MOUNTING DIM

3.15 [80]
HORIZONTAL MOUNTING DIM

1.54 [39.1]

3.17 [80.5]

6 [152.5]

AIR

1.67 [42.5]

25.48 [647.2]

22.44 [570]

25.2 [640]

28.54 [725]

AIR

0.13 [3]

12.99 [330]

(2) MOUNTING BRACKETS USED DURING TRANSPORT ONLY REMOVE BEFORE INSTALLING

NOTE: Maximum surrounding air temperature is 50 °C (122 °F)

17.92 [455.2]

5 [127]

16.93 [430]

22.05 [560]

Unit: in. [mm]

Figure 2.29 Models 2A0250 and 2A0312, 4A0208, and 5A0125 and 5A0145

Mechanical Installation

2

■ **Flange Type Heat Loss Data**

Table 2.20 Models 2A0250 and 2A0312, 4A0208, and 5A0125 and 5A0145

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 5 kHz)			
		Internal	External	Total	Internal	External	Total	
2A0250	200	594	1764	2358	466	1514	1980	83 (183)
2A0312		665	2020	2685	588	1936	2524	88 (194)

Drive Model	Voltage Class	Input Type	Heat Loss (W)						Wt. kg (lb)
			ND (Fc = 2 kHz)			HD (Fc = 5 kHz)			
			Internal	External	Total	Internal	External	Total	
4A0208	400	6-Pulse	607	1800	2407	541	1771	2312	87 (191)

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 2 kHz)			
		Internal	External	Total	Internal	External	Total	
5A0125	600	537	1641	2178	422	1328	1750	87 (191)
5A0145		603	1860	2463	508	1638	2146	87 (191)

■ **Flange Type Panel Cutout Dimensions for External Heatsink Mounting**
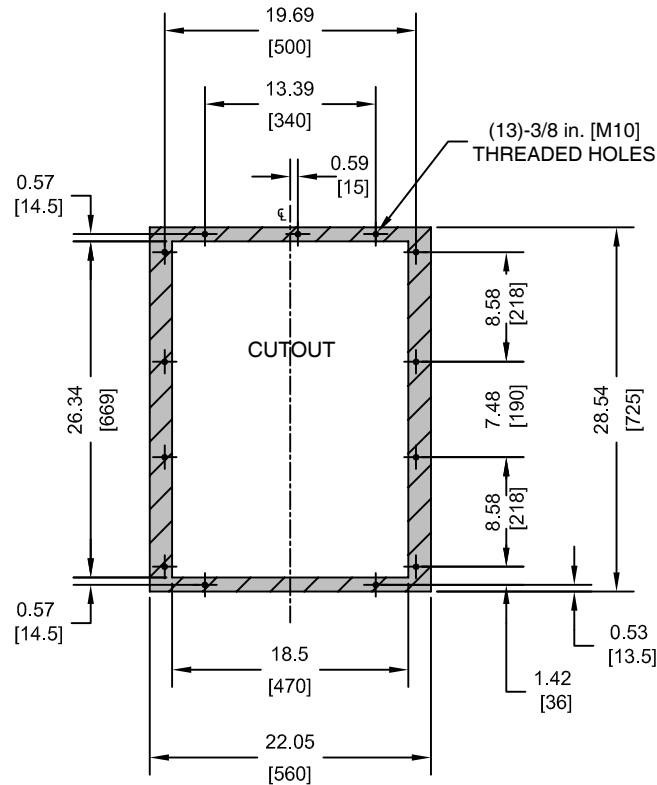
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK DEPTH
   D=5.00 in. [127 mm] MINUS PANEL THICKNESS
3. MINIMUM RECOMMENDED PANEL
   THICKNESS: 10 GA

Unit: in. [mm]

Figure 2.30 Models 2A0250 and 2A0312, 4A0208, and 5A0125 and 5A0145

◆ **Flange Type Models 2A0360 and 2A0415, 4A0250 to 4A0362, and 5A0192 and 5A0242**

■ **Flange Type Exterior and Mounting Dimensions**

(3) EXTERNAL
COOLING FANS

LIFTING AND EYEBOLT DETAILS

Ø0.98
[Ø25]

1.63
[41.5]

M10 THREAD

NOTE: Spreader bar required to avoid damage during lifting.

17.61
[447.3]

2.36
[60]

0.59
[15]

(13)-MOUNTING HOLES
FOR 3/8 in. [M10] SCREWS

1.47
[37.4]

18.39
[467.2]

8.86
[225]
VERTICAL MOUNTING DIM

9.5
[241.4]
VERTICAL MOUNTING DIM

3.54
[90]

8.86
[225]
VERTICAL MOUNTING DIM

1.06
[26.9]

FRONT VIEW

1.47
[37.4]

3.76
[95.6]

13.78
[350]

3.76
[95.6]

HORIZONTAL MOUNTING DIM

HORIZONTAL MOUNTING DIM

HORIZONTAL MOUNTING DIM

1.77
[44.9]

6.7
[170.1]

5.22
[132.5]

AIR

1.87
[47.5]

28.77
[730.7]

21.85
[555]

28.54
[725]

32.28
[820]

AIR

0.11
[3]

13.78
[350]

(2) MOUNTING BRACKETS
USED DURING TRANSPORT ONLY
REMOVE BEFORE INSTALLING

NOTE: Maximum surrounding air temperature is 50 °C (122 °F)

19.97
[507.2]

4.99
[126.8]

18.9
[480]

23.62
[600]

Unit: in. [mm]

Figure 2.31 Models 2A0360 and 2A0415, 4A0250 to 4A0362, and 5A0192 and 5A0242

Mechanical Installation

2

�■ Flange Type Heat Loss Data

Table 2.21 Models 2A0360 and 2A0415, 4A0250 to 4A0362, and 5A0192 and 5A0242

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = [1])			
		Internal	External	Total	Internal	External	Total	
2A0360	200	894	2698	3592	783	2564	3347	108 (238)
2A0415		954	2672	3626	954	2672	3626	–

<1> Carrier frequency is set to 5 kHz in model 2A0360 and set to 2 kHz in model 2A0415.

Drive Model	Voltage Class	Input Type	Heat Loss (W)						Wt. kg (lb)
			ND (Fc = 2 kHz)			HD (Fc = [1])			
			Internal	External	Total	Internal	External	Total	
4A0250	400	6-Pulse	803	2379	3182	715	2360	3075	106 (233)
4A0296			905	2448	3353	787	2391	3178	112 (246)
4A0362			1130	3168	4298	985	3075	4060	117 (257)

<1> Carrier frequency is set to 5 kHz in models 4A0250 and 4A0296, and set to 2 kHz in model 4A0362.

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 2 kHz)			
		Internal	External	Total	Internal	External	Total	
5A0192	600	769	2420	3189	648	2114	2762	117 (257)
5A0242		1131	3100	4231	896	2526	3422	117 (257)

■ **Flange Type Panel Cutout Dimensions for External Heatsink Mounting**
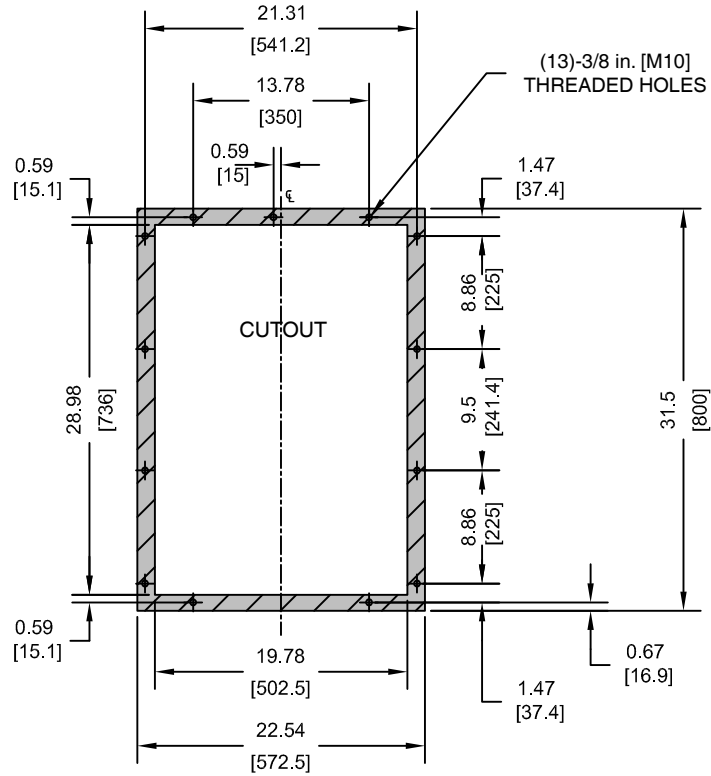
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK DEPTH
   D=4.99 in. [127 mm] MINUS PANEL THICKNESS
3. MINIMUM RECOMMENDED PANEL
   THICKNESS: 10 GA

Unit: in. [mm]

Figure 2.32 Models 2A0360 and 2A0415, 4A0250 to 4A0362, and 5A0192 and 5A0242

Mechanical Installation

2

◆ Flange Type Model 4A0414

■ Flange Type Exterior and Mounting Dimensions

LIFTING AND EYEBOLT DETAILS

Ø1.18 [Ø30]

2.01 [51]

M12 THREAD

NOTE: Spreader bar required to avoid damage during lifting.

(3) EXTERNAL COOLING FANS

18.1 [459.8]   2.36 [60]

(20)-MOUNTING HOLES FOR 3/8 in. [M10] SCREWS

26.35 [669.2]

3.54 [90]

6.3 [160]
6.59 [167.5]
6.59 [167.5]
6.59 [167.5]
6.59 [167.5]
6.59 [167.5]
6.3 [160]

VERTICAL MOUNTING DIM

FRONT VIEW

0.79 [20]

5.95 [151.3]   5.95 [151.3]   5.95 [151.3]   5.95 [151.3]

HORIZONTAL MOUNTING DIM

19.89 [505.2]

5.19 [131.8]

18.9 [480]

25.39 [645]

2.94 [74.6]   4.81 [122.2]   6.84 [173.7]   3.05 [77.5]

AIR

34.65 [880]   30.92 [785.5]

34.45 [875]   40.55 [1030]

0.11 [3]   14.57 [370]

AIR

(2) MOUNTING BRACKETS USED DURING TRANSPORT ONLY REMOVE BEFORE INSTALLING

NOTE: Maximum surrounding air temperature is 50 °C (122 °F)

Unit: in. [mm]

Figure 2.33 Model 4A0414

■ Flange Type Heat Loss Data

Table 2.22 Model 4A0414

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
4A0414	400	1295	3443	4738	1164	3578	4742	138 (304)

■ Flange Type Panel Cutout Dimensions for External Heatsink Mounting
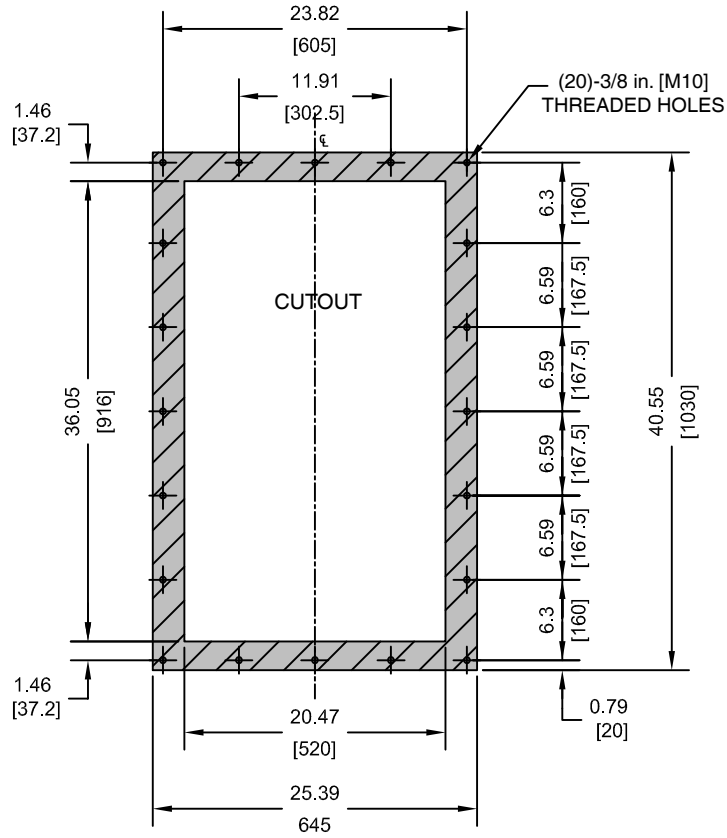
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK DEPTH
   D=5.19 in. [132 mm] MINUS PANEL THICKNESS
3. MINIMUM RECOMMENDED PANEL
   THICKNESS: 10 GA

Unit: in. [mm]

Figure 2.34 Model 4A0414

Mechanical Installation

2

◆ **Flange Type Models 4A0515 and 4A0675**

■ **Flange Type Exterior and Mounting Dimensions**
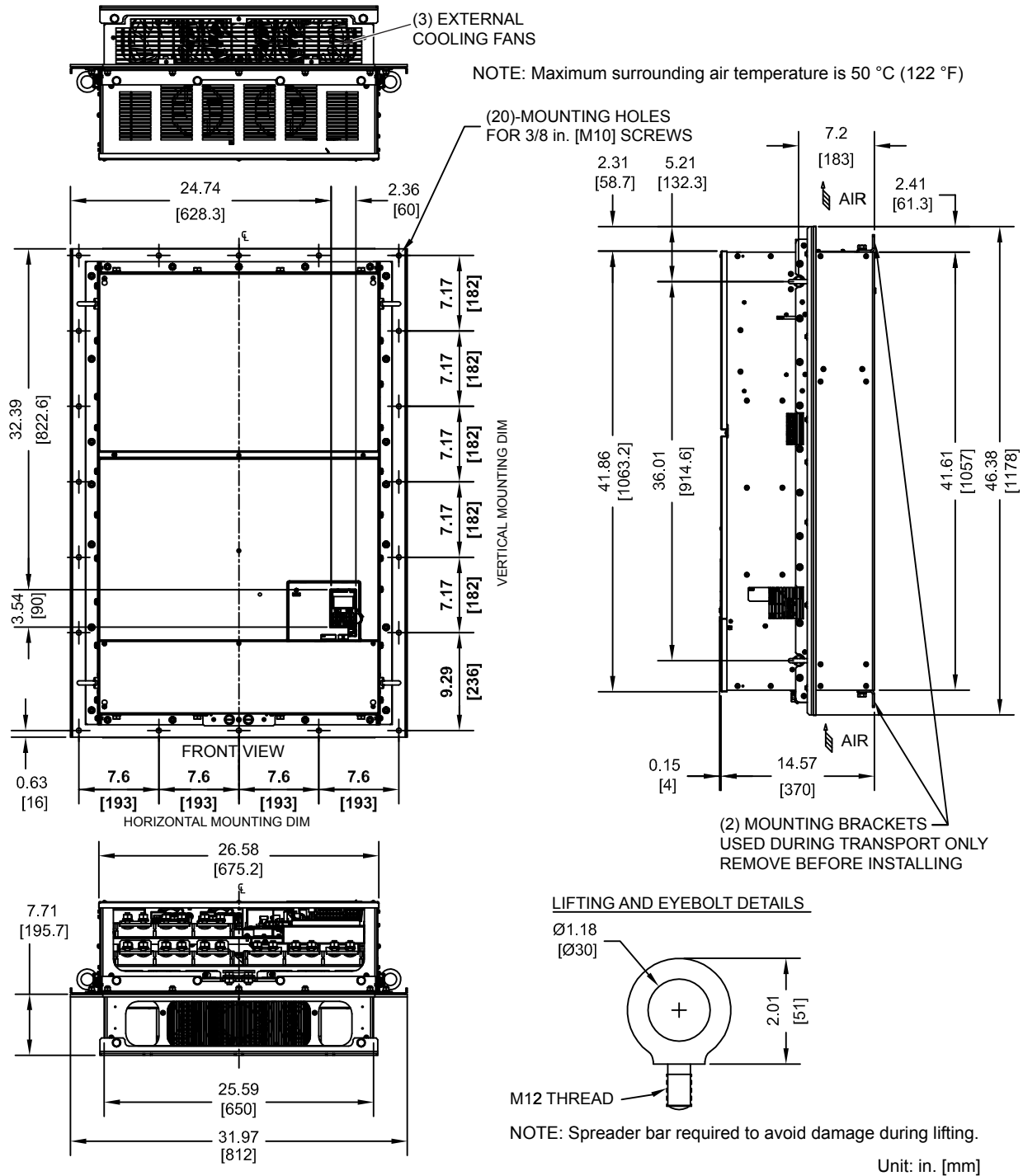
Figure 2.35 Models 4A0515 and 4A0675

■ **Flange Type Heat Loss Data**

Table 2.23 Models 4A0515 and 4A0675

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
4A0515	400	1668	4850	6518	1386	3972	5358	223 (492)
4A0675		2037	4861	6898	1685	4191	5876	228 (503)

■ **Flange Type Panel Cutout Dimensions for External Heatsink Mounting**
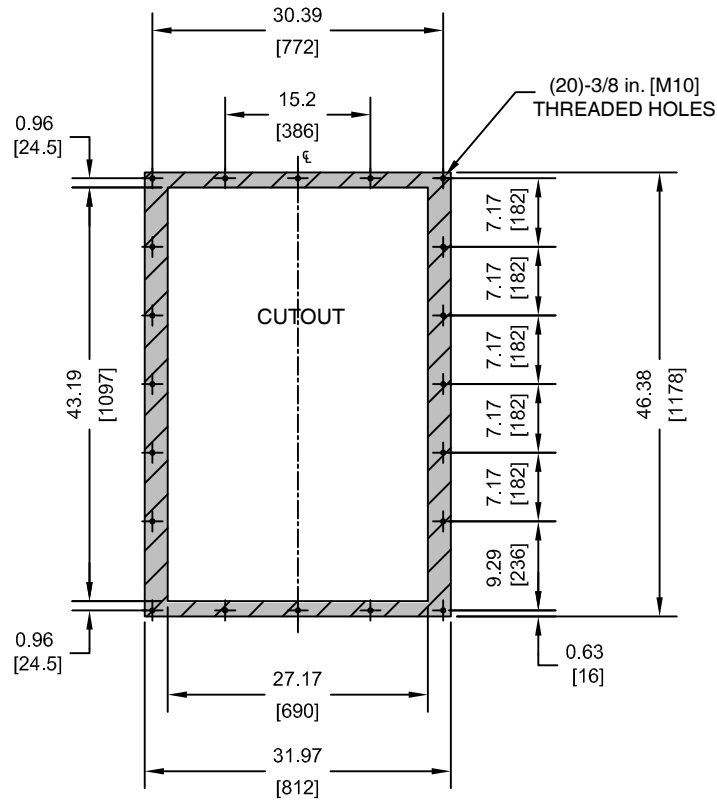
NOTES:
1. CUTOUT TOLERANCES:
   +/- 0.02 in. [0.5 mm]
2. EXPOSED HEATSINK DEPTH
   D=7.71 in. [196 mm] MINUS PANEL THICKNESS
3. MINIMUM RECOMMENDED PANEL
   THICKNESS: 10 GA

Unit: in. [mm]

Figure 2.36 Models 4A0515 and 4A0675

Mechanical Installation

2

◆ Flange Type Models 4A0930 and 4A1200

■ Flange Type Exterior and Mounting Dimensions
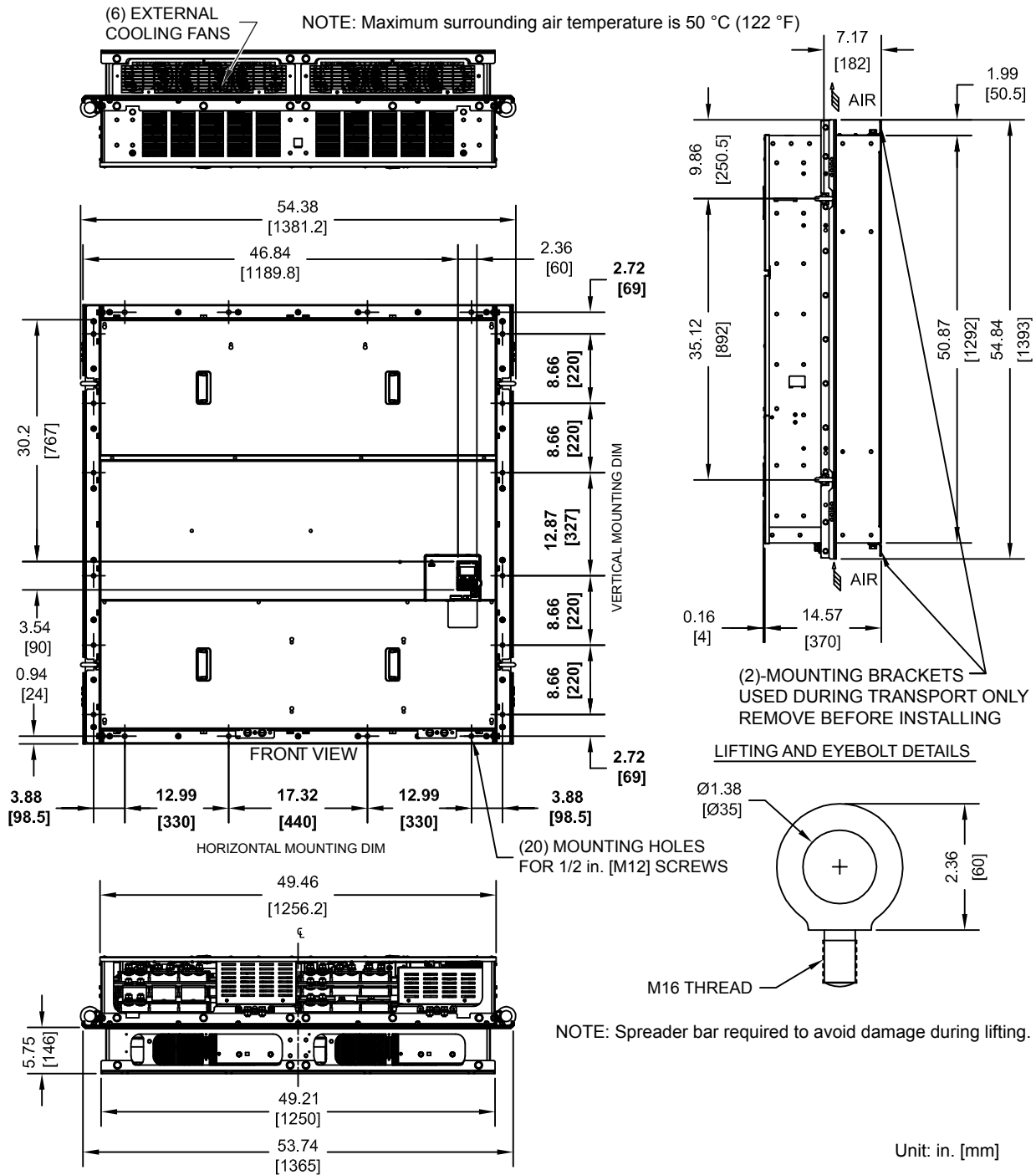
Figure 2.37 Models 4A0930 and 4A1200

■ Flange Type Heat Loss Data

Table 2.24 Models 4A0930 and 4A1200

Drive Model	Voltage Class	Heat Loss (W)						Wt. kg (lb)
		ND (Fc = 2 kHz)			HD (Fc = 8 kHz)			
		Internal	External	Total	Internal	External	Total	
4A0930	400	2952	8476	11428	2455	6912	9367	575 (1265)
4A1200		3612	8572	12184	3155	7626	10781	587 (1291)

■ **Flange Type Panel Cutout Dimensions for External Heatsink Mounting**

NOTES:
1. EXPOSED HEATSINK DEPTH
   D=5.75 in. [146 mm] MINUS PANEL THICKNESS
2. MINIMUM RECOMMENDED PANEL
   THICKNESS: 10 GA

Unit: in. [mm]

Figure 2.38 Models 4A0930 and 4A1200

Mechanical Installation

2

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3

Electrical Installation

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

3.1 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 119* for instructions on operating the drive.

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), 480 Vac maximum (400 V class), 600 Vac maximum (600 V class).*

NOTICE: *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 duty motor. Failure to comply could lead to motor insulation breakdown.*

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

NOTICE: *Route motor leads U/T1, V/T2, and W/T3 separate from all other leads to reduce possible interference related issues. Failure to comply may result in abnormal operation of drive and nearby equipment.*

NOTICE: *Correctly set Sink/Source jumper S3 for internal power supply. Failure to comply may result in damage to the drive. Refer to Control I/O Connections on page 110 for details.*

Note: The minimum load for the relay outputs M1-M2, M3-M4, M5-M6, and MA-MB-MC is 10 mA.
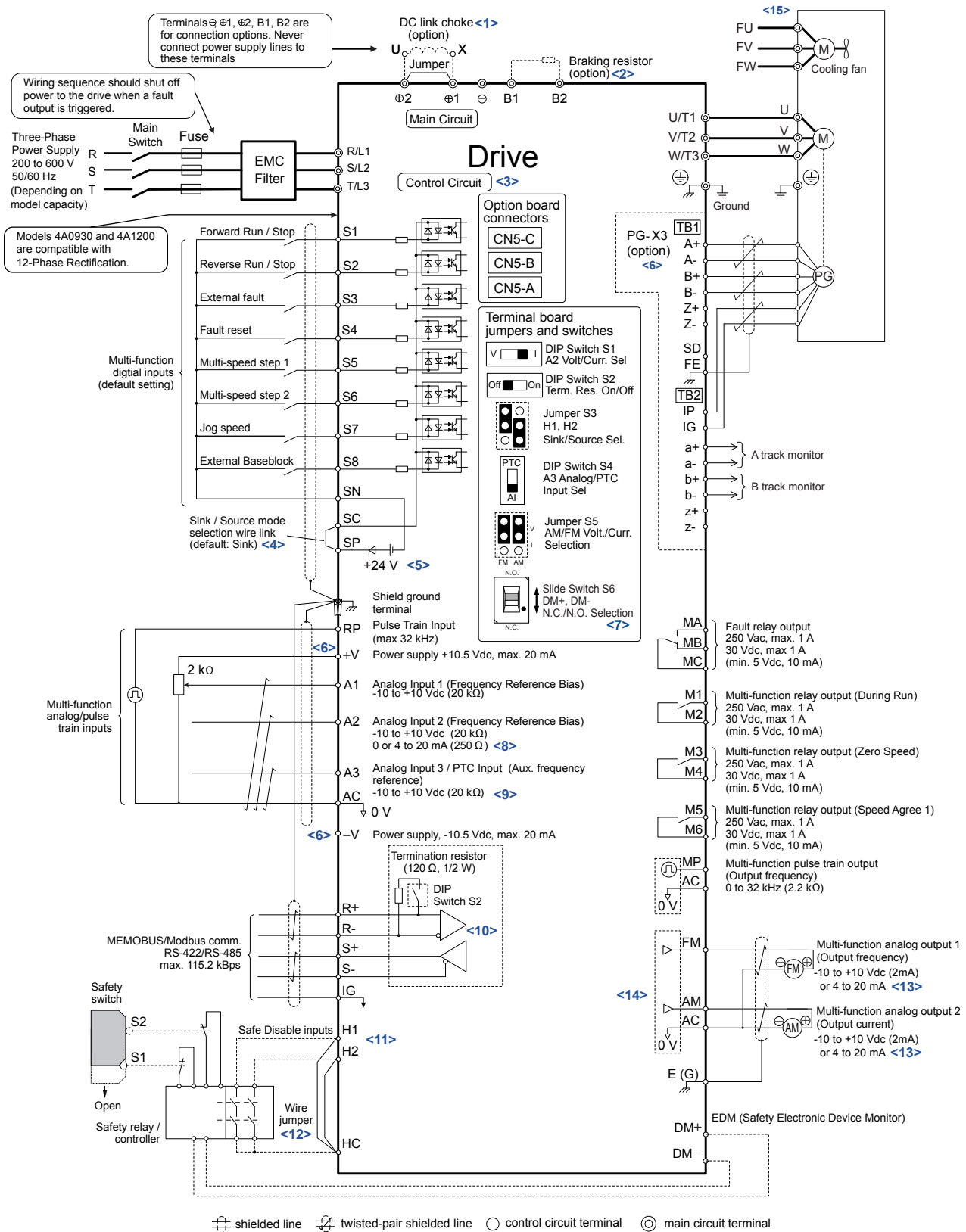
Figure 3.1 Drive Standard Connection Diagram (example: model 2A0040)

<1> Remove the jumper when installing a DC link choke. Models 2A0110 to 2A0415 and 4A0058 to 4A1200 come with a built-in DC link choke.

Electrical Installation

3

<2>   Set L8-55 to 0 to disable the protection function of the built-in braking transistor of the drive when using an optional regenerative converter or dynamic braking option. Leaving L8-55 enabled may cause a braking resistor fault (rF). Additionally, disable Stall Prevention (L3-04 = 0) when using an optional regenerative converter, regenerative or braking units, or dynamic braking option. Leaving If L3-04 enabled may prevent the drive from stopping within the specified deceleration time.

<3>   Supplying power to the control circuit separately from the main circuit requires 24 V power supply (option).

<4>   This figure illustrates an example of a sequence input to S1 through S8 using a non-powered relay or an NPN transistor. Install the wire link between terminals SC-SP for Sink mode, between SC-SN for Source mode, or leave the link out for external power supply. Never short terminals SP and SN, as it will damage the drive. *Refer to Sinking/Sourcing Mode for Digital Inputs on page 110* for details.

<5>   This voltage source supplies a maximum current of 150 mA when not using a digital input card DI-A3.

<6>   The maximum output current capacity for the +V and -V terminals on the control circuit is 20 mA. Never short terminals +V, -V, and AC, as it can cause erroneous operation or damage the drive.

<7>   Slide switch S6 selects N.C. or N.O. as the state of the DM+ and DM- terminals for EDM output. Slide switch S6 is available on removable terminal circuit boards ETC740300, ETC740301 and later.

N.O.   N.O.

N.C.   N.C.

ETC740300   ETC740301 and later
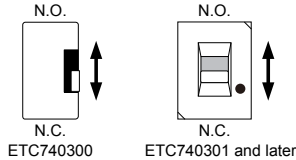
<8>   Set DIP switch S1 to select between a voltage or current input signal to terminal A2. The default setting is for current input.

<9>   Set DIP switch S4 to select between analog or PTC input for terminal A3.

<10> Set DIP switch S2 to the ON position to enable the termination resistor in the last drive in a MEMOBUS/Modbus network.

<11> Use jumper S3 to select between Sink mode, Source mode, and external power supply for the Safe Disable inputs.

<12> Disconnect the wire jumper between H1 - HC and H2 - HC when utilizing the Safe Disable input.

<13> Monitor outputs work with devices such as analog frequency meters, ammeters, voltmeters, and wattmeters. They are not intended for use as a feedback-type signal.

<14> Use jumper S5 to select between voltage or current output signals at terminals AM and FM. Set parameters H4-07 and H4-08 accordingly.

<15> Self-cooling motors do not require the same wiring necessary for motors with cooling fans.

WARNING! *Sudden Movement Hazard. Do not close the wiring for the control circuit unless the multifunction input terminal parameters are properly set. Improper sequencing of run/stop circuitry could result in death or serious injury from moving equipment.*

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. When programmed for 3-Wire control, a momentary closure on terminal S1 may cause the drive to start.*

WARNING! *Sudden Movement Hazard. When using a 3-Wire sequence, set the drive to 3-Wire sequence prior to wiring the control terminals and set parameter b1-17 to 0 so the drive will not accept a Run command at power up (default). If the drive is wired for a 3-Wire sequence but set up for a 2-Wire sequence (default), and parameter b1-17 is set to 1 so the drive accepts a Run command at power up, the motor will rotate in reverse direction at drive power up and may cause injury.*

WARNING! *Sudden Movement Hazard. Confirm the drive I/O signals and external sequence before executing the application preset function. Executing the application preset function or setting A1-06 ≠ 0 will change the drive I/O terminal functions and may cause unexpected equipment operation. Failure to comply may cause death or serious injury.*

NOTICE: *When using the automatic fault restart 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 restart (L5-02 = 0, default). Failure to comply will prevent the automatic fault restart function from working properly.*

NOTICE: *Do not connect more than one multi-function input to one terminal. Improper wiring may result in drive malfunction. Use an external power supply when sharing a terminal with more than one input. Do not use the built-in +24 V power supply.*

3.2 Main Circuit Connection Diagram

Refer to diagrams in this section when wiring the main circuit of the drive. Connections may vary based on drive capacity. The DC power supply for the main circuit also provides power to the control circuit.

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

NOTICE: *Route motor leads U/T1, V/T2 and W/T3 separate from all other leads to reduce possible interference and noise related issues. Failure to comply may result in abnormal operation of drive and nearby equipment.*

◆ Three-Phase 200 V Class Models 2A0004 to 2A0081
Three-Phase 400 V Class Models 4A0002 to 4A0044
Three-Phase 600 V Class Models 5A0003 to 5A0032
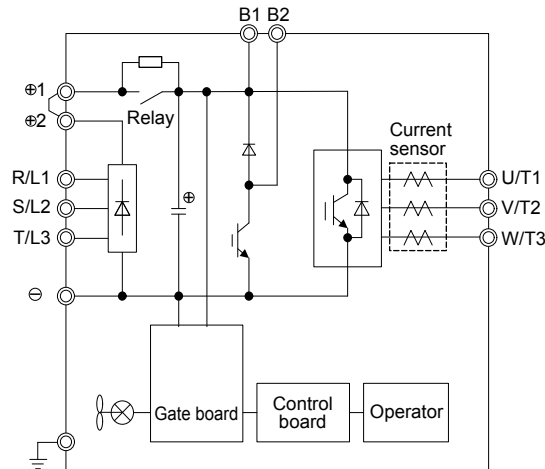
Figure 3.2 Connecting Main Circuit Terminals

◆ Three-Phase 200 V Class Models 2A0110, 2A0138
Three-Phase 400 V Class Models 4A0058, 4A0072
Three-Phase 600 V Class Models 5A0041, 5A0052
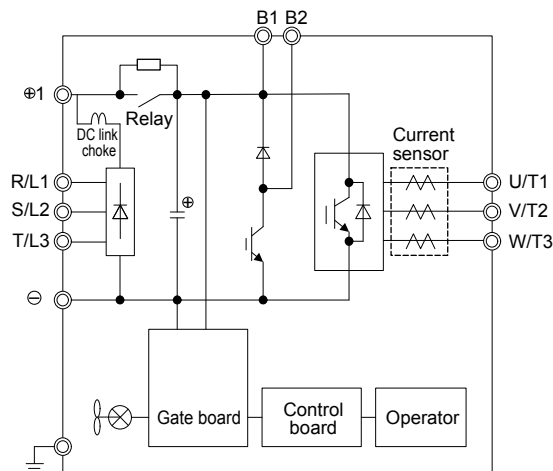
Figure 3.3 Connecting Main Circuit Terminals

Electrical Installation

3

◆ **Three-Phase 200 V Class Models 2A0169 to 2A0211**
Three-Phase 400 V Class Models 4A0088 to 4A0139
Three-Phase 600 V Class Models 5A0062 to 5A0099
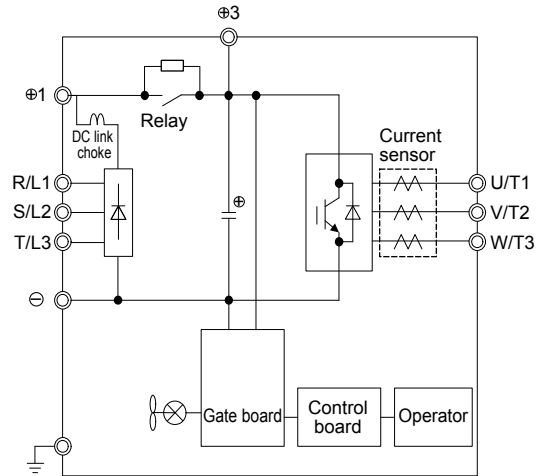
Figure 3.4 Connecting Main Circuit Terminals

◆ **Three-Phase 200 V Class Models 2A0250 to 2A0415**
Three-Phase 400 V Class Models 4A0165 to 4A0675
Three-Phase 600 V Class Models 5A0125 to 5A0242
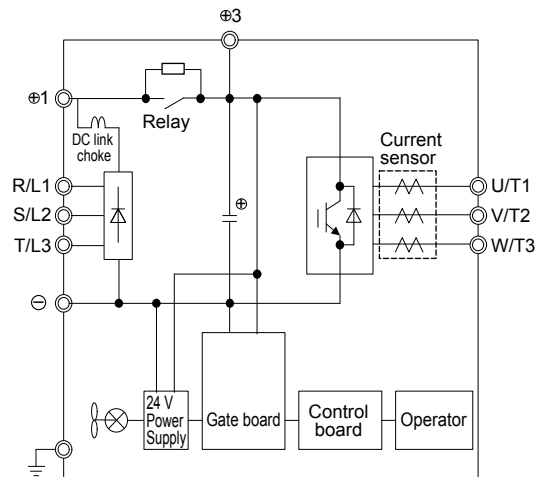
Figure 3.5 Connecting Main Circuit Terminals

◆ Three-Phase 400 V Class Models 4A0930, 4A1200
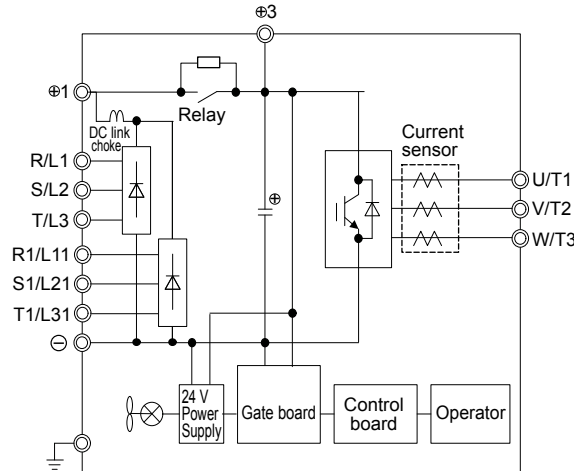
Figure 3.6 Connecting Main Circuit Terminals

Note: Models 4A0930 and 4A1200 are compatible for operation with 12-pulse rectification. *Refer to 12-Pulse Rectification on page 85* for details.

◆ 12-Pulse Rectification

■ Removing the Jumper

Models 4A0930 and 4A1200 are compatible for operation with 12-pulse rectification. Operation with 12-pulse rectification requires the user to separately prepare a 3-winding transformer for the power supply. Contact Yaskawa or your nearest sales representative for transformer specifications.

WARNING! *Fire Hazard. Failure to remove jumpers shorting the power supply terminals on the main circuit when operating with 12-pulse rectification may cause death or serious injury by fire.*

■ Application Notes

Models 4A0930 and 4A1200 are shipped from the factory with jumpers short-circuiting terminals R/L1-R1/L11, S/L2-S1/L21, and T/L3-T1/L31.

Remove M5 screws and jumpers as shown in *Figure 3.7* to operate with 12-pulse rectification.
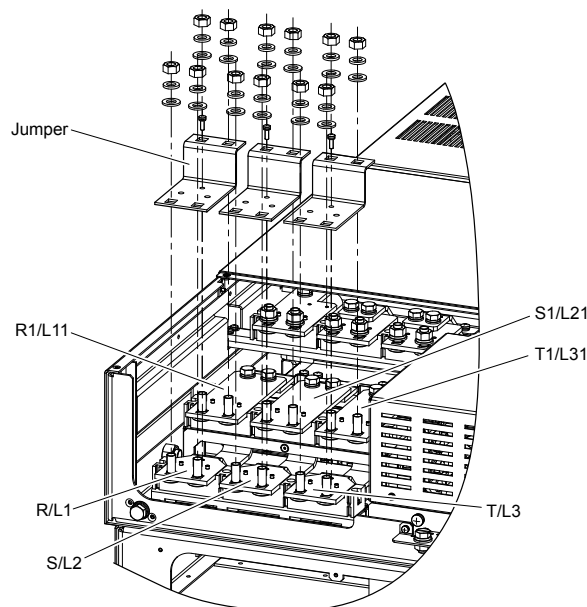
Figure 3.7 Removing the Jumper

Electrical Installation

3

■ Connection Diagram
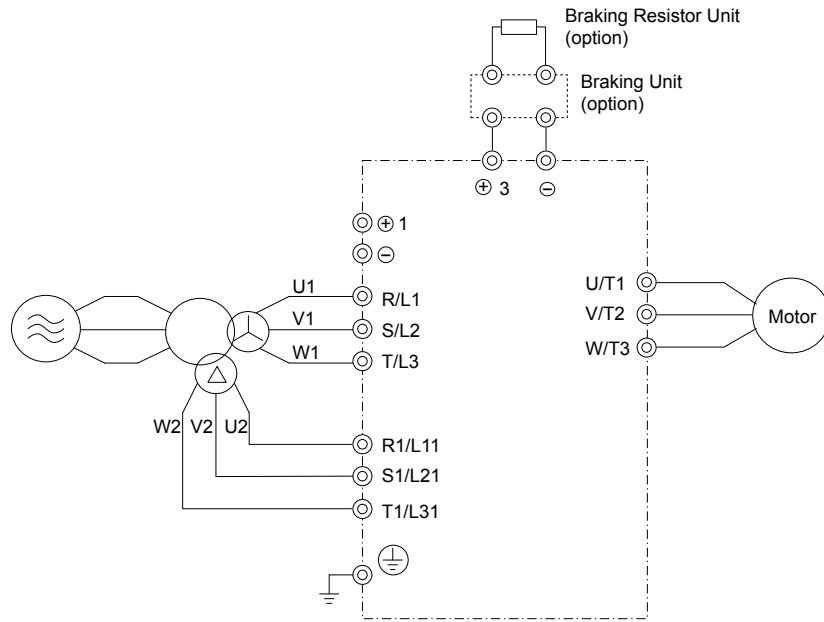
Figure 3.8 Connecting Main Circuit Terminals

3.3 Terminal Cover

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

◆ Models 2A0004 to 2A0081, 4A0002 to 4A0044, 5A0003 to 5A0032 (IP20/NEMA 1, UL Type 1 Enclosure)

■ Removing the Terminal Cover

1. Loosen the terminal cover screw using a #2 Phillips screwdriver. Screw sizes vary by drive model.
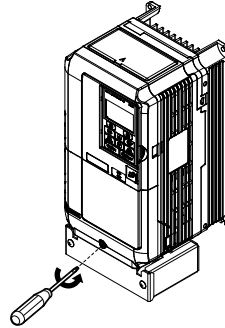
Figure 3.9 Removing the Terminal Cover on an IP20/NEMA 1, UL Type 1 Enclosure Drive

2. Push in on the tab located on the bottom of the terminal cover and gently pull forward to remove the terminal cover.
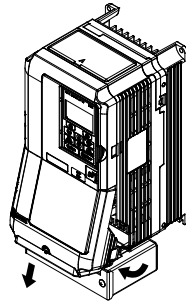
Figure 3.10 Removing the Terminal Cover on an IP20/NEMA 1, UL Type 1 Enclosure Drive

■ Reattaching the Terminal Cover

Power lines and signal wiring should pass through the opening provided. *Refer to Wiring the Main Circuit Terminal on page 104* and *Wiring the Control Circuit Terminal* on page *108* for details on wiring.

Reattach the terminal cover after completing the wiring to the drive and other devices.
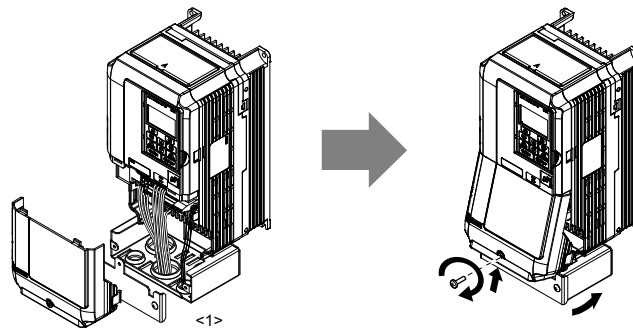
Figure 3.11 Reattaching the Terminal Cover on an IP20/NEMA 1, UL Type 1 Enclosure Drive

<1> Connect the ground wiring first, then the main circuit wiring, and finally the control circuit wiring.

Electrical Installation

3

◆ Models 2A0110 to 2A0250, 4A0208 to 4A1200, and 5A0125 to 5A0242 (IP00/Open Type Enclosure)

■ Removing the Terminal Cover

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

Note: The terminal cover and the number of terminal cover screws differ depending on the drive model.

CAUTION! *Do not completely remove the cover screws, just loosen them. If the cover screws are removed completely, the terminal cover may fall off causing an injury.*
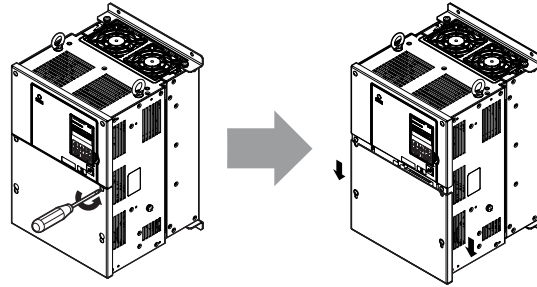
Figure 3.12 Removing the Terminal Cover on an IP00/Open Type Enclosure Drive

2. Pull forward on the terminal cover to free it from the drive.
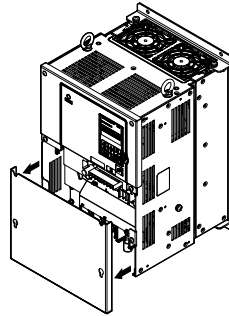
Figure 3.13 Removing the Terminal Cover on an IP00/Open Type Enclosure Drive

■ Reattaching the Terminal Cover

After wiring the terminal board and other devices, double-check connections and reattach the terminal cover. *Refer to Wiring the Main Circuit Terminal on page 104* and *Wiring the Control Circuit Terminal* on page *108* for details on wiring.
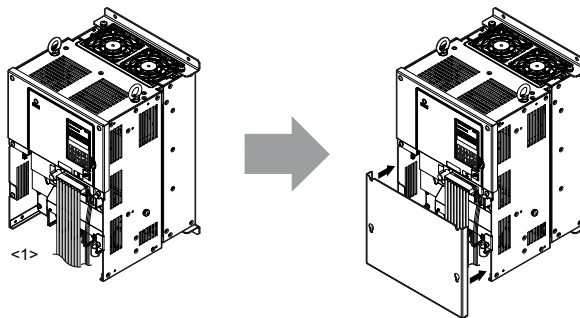
Figure 3.14 Reattaching the Terminal Cover on an IP00/Open Type Enclosure Drive

<1> Connect the ground wiring first, then the main circuit wiring, and finally the control circuit wiring.

3.4 Digital Operator and Front Cover

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

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

◆ Removing/Reattaching the Digital Operator

■ Removing the Digital Operator

While pressing on the tab located on the right side of the digital operator, pull the digital operator forward to remove it from the drive.
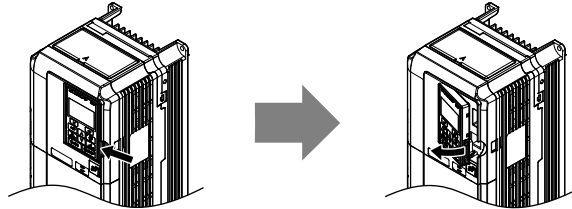
Figure 3.15 Removing the Digital Operator

■ Reattaching the Digital Operator

Insert the digital operator into the opening in the top cover while aligning it with the notches on the left side of the opening. Next, press gently on the right side of the operator until it clicks into place.
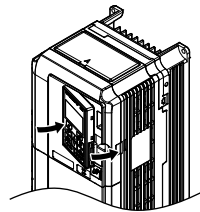
Figure 3.16 Reattaching the Digital Operator

◆ Removing/Reattaching the Front Cover

■ Removing the Front Cover

Models 2A0004 to 2A0081, 4A0002 to 4A0044, and 5A0003 to 5A0032

After removing the terminal cover and the digital operator, loosen the screw that affixes the front cover (models 2A0056, 4A0038, 5A0022, and 5A0027 do not use a screw to affix the front cover) . Pinch in on the tabs found on each side of the front cover, then pull forward to remove it from the drive.
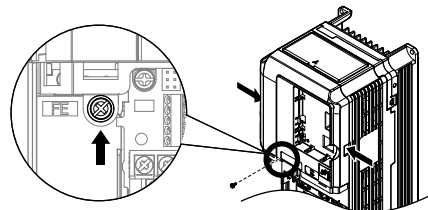
Figure 3.17 Remove the Front Cover (2A0004 to 2A0081, 4A0002 to 4A0044, and 5A0003 to 5A0032)

Models 2A0110 to 2A0415 and 4A0058 to 4A1200

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

Electrical Installation

3
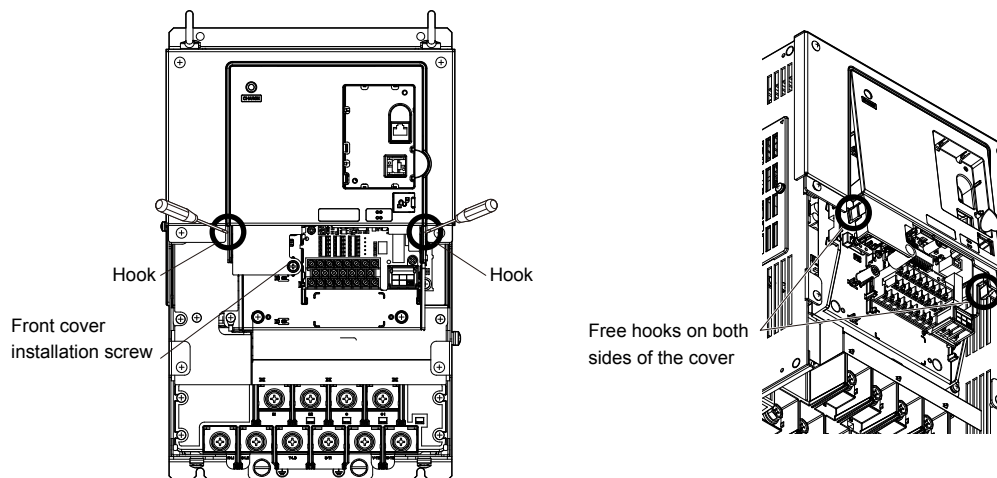
Figure 3.18 Remove the Front Cover (2A0010 to 2A0415 and 4A0058 to 4A1200)

4. Unhook the left side of the front cover then swing the left side towards you as shown in *Figure 3.19* until the cover comes off.
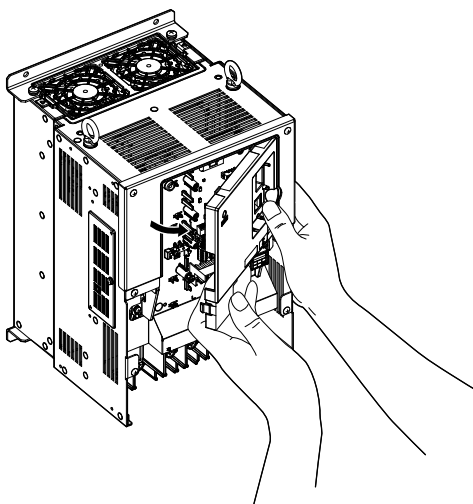
Figure 3.19 Remove the Front Cover (2A0010 to 2A0415 and 4A0058 to 4A1200)

■ **Reattaching the Front Cover**

Models 2A0004 to 2A0081, 4A0002 to 4A0044, and 5A0003 to 5A0032

Reverse the instructions given in *Remove the Front Cover (2A0004 to 2A0081, 4A0002 to 4A0044, and 5A0003 to 5A0032)* on page *89* to reattach the front cover. Pinch inwards on the hooks found on each side of the front cover while guiding it back into the drive. Make sure it clicks firmly into place.

Models 2A0110 to 2A0415 and 4A0058 to 4A1200

1. Slide the front cover so the hooks on the top connect to the drive.
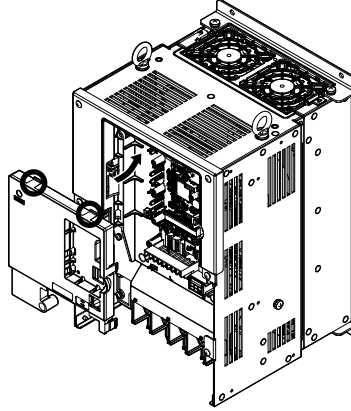
Figure 3.20 Reattach the Front Cover (2A0110 to 2A0415 and 4A0058 to 4A1200)

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

Electrical Installation

3

3.5   Top Protective Cover

Drive models 2A0004 to 2A0081, 4A0002 to 4A0044, and 5A0003 to 5A0032 are designed to IP20/NEMA 1, UL Type 1 specifications with a protective cover on the top. Removing this top protective cover or the bottom conduit bracket from an IP20/NEMA 1, UL Type 1 enclosure drive voids the NEMA 1, UL Type 1 protection while maintaining IP20 conformity.

◆ Removing the Top Protective Cover

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

Note: Removing the top protective cover or the bottom conduit bracket from an IP20/NEMA 1, UL Type 1 enclosure drive voids the NEMA 1, UL Type 1 protection while maintaining IP20 conformity.
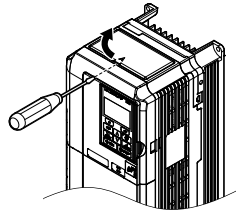
Figure 3.21 Removing the Top Protective Cover

◆ Reattaching the Top Protective Cover

Insert the two small protruding hooks on the rear side of the top protective cover into the provided mounting holes near the back of the drive, then press down on the front side of the top protective cover to fasten the cover into place.

Protective Cover
Mounting Holes
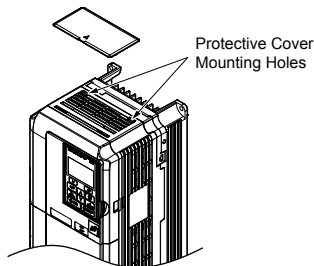
Figure 3.22 Reattaching the Protective Cover

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 solder the ends of wire connections to the drive. Soldered wiring connections can loosen over time. Improper wiring practices could result in drive malfunction due to loose terminal connections.*

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

Refer to Factory Recommended Branch Circuit Protection for UL Compliance on page 344 for details on fuse selection.

◆ Main Circuit Terminal Functions

Table 3.1 Main Circuit Terminal Functions

Terminal		Type				Function	Page
200 V Class	**Drive Model**	**2A0004 to 2A0081**	**2A0110, 2A0138**	**2A0169 to 2A0415**	**–**	**Function**	**Page**
400 V Class		**4A0002 to 4A0044**	**4A0058, 4A0072**	**4A0088 to 4A0675**	**4A0930, 4A1200**		
600 V Class		**5A0003 to 5A0032**	**5A0041, 5A0052**	**5A0062 to 5A0242**	**–**		
R/L1		Main circuit power supply input				Connects line power to the drive	
S/L2							
T/L3							81
R1-L11		Not available			Main circuit power supply input	Connects line power to the drive. Remove the shorting bars connecting R/L1-R1/L11, S/L2-S1/L21, T/L3-T1/L31 when using 12-pulse rectification.	
S1-L21							
T1-L31							
U/T1		Drive output				Connects to the motor	81
V/T2							
W/T3							
B1		Braking resistor		Not available		Available for connecting a braking resistor or a braking resistor unit option	–
B2							
⊕2	• DC link choke connection (⊕1, ⊕2) (remove the shorting bar between ⊕1 and ⊕2) • DC power supply input (⊕1, ⊖)	Not available				For connecting: • the drive to a DC power supply • dynamic braking options • a DC link choke	–
⊕1			DC power supply input (⊕1, ⊖)				
⊖				• DC power supply input (⊕1, ⊖) • Braking unit connection (⊕3, ⊖)			
⊕3		Not available					
⏚		For 200 V class: 100 Ω or less For 400 V class: 10 Ω or less For 600 V class: 10 Ω or less				Grounding terminal	103

Note: Use terminals B1 and ⊖ when installing a CDBR-type braking unit on drives with built-in braking transistors (Models 2A0004 to 2A0138, 4A0002 to 4A0072, and 5A0003 to 5A0052).

Wiring Fuses for Models 4A0930 and 4A1200

NOTICE: *If a fuse is blown or an Ground Fault Circuit Interrupter (GFCI) is tripped, check the wiring and the selection of peripheral devices to identify the cause. Contact Yaskawa before restarting the drive or the peripheral devices if the cause cannot be identified.*

Install a fuse on the input side to protect drive wiring and prevent other secondary damage. Wire the fuse so that leakage current in the upper controller power supply will trigger the fuse and shut off the power supply.

Select the appropriate fuse from *Table 3.2*.

Electrical Installation

3

Table 3.2 Input Fuses for Models 4A0930 and 4A1200

Voltage Class	Model	Selection			Input Fuse (Example)			
		Input Voltage	Current	Pre-arc I^2t (A^{2}s)	Model	Manufacturer	Rating	Pre-arc I^2t (A^{2}s)
Three-Phase 400 V Class	4A0930	480 V	1500 A	140000 to 3100000	CS5F-1200	Fuji Electric	AC500 V, 1200 A	276000
	4A0930 with 12-pulse rectification				FWH-1200A	Bussman	AC500 V, 1200 A	–
					FWH-1000A	Bussman	AC500 V, 1000 A	–
	4A1200	480 V	1500 A	320000 to 3100000	CS5F-1500	Fuji Electric	AC500 V, 1500 A	351000
	4A1200 with 12-pulse rectification				FWH-1600A	Bussman	AC500 V, 1600 A	–
					FWH-1200A	Bussman	AC500 V, 1200 A	–

◆ Protecting Main Circuit Terminals

■ Insulation Caps or Sleeves

Use insulation caps or sleeves when wiring the drive with crimp terminals. Take particular care to ensure that the wiring does not touch nearby terminals or the surrounding case.

■ Insulation Barrier

Insulation barriers are packaged with drive models 4A0414 through 4A1200 to provide added protection between terminals. Yaskawa recommends using the provided insulation barriers to ensure proper wiring. Refer to *Figure 3.23* for instructions on placement of the insulation barriers.

Insulation Barrier
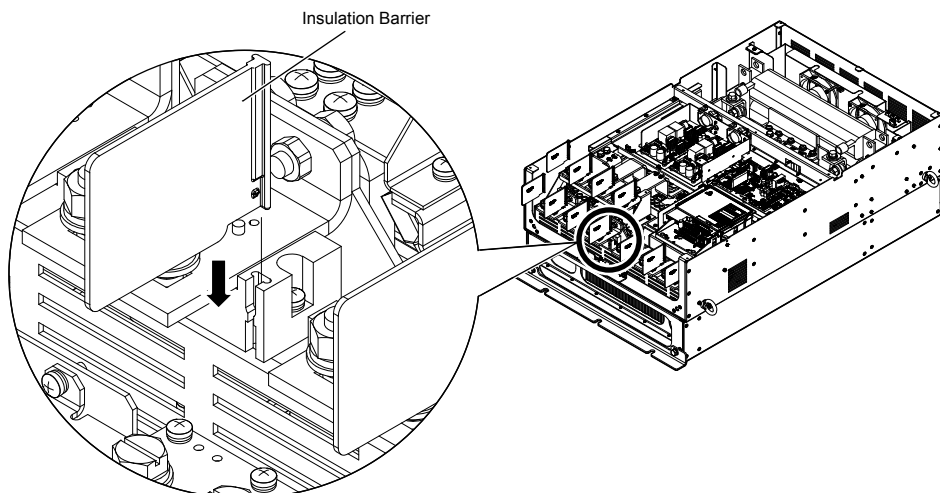
Figure 3.23 Installing Insulation Barriers

◆ Main Circuit Wire Gauges and Tightening Torques

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

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

Note:
1. Wire gauge recommendations based on drive continuous current ratings (ND) using 75 °C 600 Vac vinyl-sheathed wire assuming ambient temperature within 40 °C and wiring distance less than 100 m.
2. Terminals ⊕1, ⊕2, ⊕3, ⊖, B1 and B2 are for connecting optional power devices. Use caution to connect only approved devices to the correct terminal(s).

• 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 TOBPC72060000 or TOBPC72060001 for braking transistor option or braking resistor option wire gauges.

• Use terminals ⊕1 and ⊖ when connecting a regenerative converter or a regen unit.

NOTICE: *Do not connect a braking resistor to terminals ⊕1 or ⊖. Failure to comply may cause damage to the drive circuitry.*

- Use terminals B1 and ⊖ when installing a CDBR-type braking unit on drives with built-in braking transistors (models 2A0004 to 2A0138, 4A0002 to 4A0072, and 5A0003 to 5A0052).

NOTICE: *Do not connect a braking resistor to terminals ⊕1 or ⊖. Failure to comply may cause damage to the drive circuitry.*

- *Refer to UL Standards Compliance on page 340* for information on UL compliance.

Yaskawa recommends using closed-loop crimp terminals on all drive models. UL/cUL approval requires the use of closed-loop crimp terminals when wiring the drive main circuit terminals on models 2A0110 to 2A0415 and 4A0058 to 4A1200. Use only the tools recommended by the terminal manufacturer for crimping. *Refer to Closed-Loop Crimp Terminal Size on page 340* 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 3.3 Wire Gauge and Torque Specifications (Three-Phase 200 V Class)

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb.in.)
2A0004 2A0006 2A0008 2A0010	R/L1, S/L2, T/L3	14	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10 [1]	14 to 10		
2A0012	R/L1, S/L2, T/L3	12	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10 [1]	14 to 10		
2A0018	R/L1, S/L2, T/L3	10	12 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	10	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10 [1]	14 to 10		
2A0021	R/L1, S/L2, T/L3	10	12 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	10	12 to 10		
	⊖, ⊕1, ⊕2	–	12 to 10		
	B1, B2	–	14 to 10		
	⏚	10 [1]	12 to 10		
2A0030	R/L1, S/L2, T/L3	8	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	8	10 to 6		
	⊖, ⊕1, ⊕2	–	10 to 6		
	B1, B2	–	14 to 10		
	⏚	8 [2]	10 to 8	M5	2.0 to 2.5 (17.7 to 22.1)
2A0040	R/L1, S/L2, T/L3	6	8 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	8	8 to 6		
	⊖, ⊕1, ⊕2	–	6		
	B1, B2	–	12 to 10		
	⏚	8 [2]	10 to 8	M5	2.0 to 2.5 (17.7 to 22.1)

Electrical Installation

3

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb.in.)
2A0056	R/L1, S/L2, T/L3	4	6 to 4	M6	5.4 to 6.0 (47.8 to 53.1)
	U/T1, V/T2, W/T3	4	6 to 4		
	⊖, ⊕1, ⊕2	−	6 to 4		
	B1, B2	−	10 to 6	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	6	8 to 6	M6	5.4 to 6.0 (47.8 to 53.1)
2A0069	R/L1, S/L2, T/L3	3	4 to 3	M8	9.9 to 11.0 (87.6 to 97.4)
	U/T1, V/T2, W/T3	3	4 to 3		
	⊖, ⊕1, ⊕2	−	4 to 3		
	B1, B2	−	8 to 6	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	6	6 to 4	M6	5.4 to 6.0 (47.8 to 53.1)
2A0081	R/L1, S/L2, T/L3	2	3 to 2	M8	9.9 to 11.0 (87.6 to 97.4)
	U/T1, V/T2, W/T3	2	3 to 2		
	⊖, ⊕1, ⊕2	−	3 to 2		
	B1, B2	−	6	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	6	6 to 4	M6	5.4 to 6.0 (47.8 to 53.1)
2A0110	R/L1, S/L2, T/L3	1/0	3 to 1/0	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	1/0	3 to 1/0		
	⊖, ⊕1	−	2 to 1/0		
	B1, B2	−	6 to 1/0		
	⏚	6	6 to 4		
2A0138	R/L1, S/L2, T/L3	2/0	1 to 2/0	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	2/0	1 to 2/0		
	⊖, ⊕1	−	1/0 to 3/0		
	B1, B2	−	4 to 2/0		
	⏚	4	4	M8	9 to 11 (79.7 to 97.4)
2A0169	R/L1, S/L2, T/L3	4/0	2/0 to 4/0	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	4/0	3/0 to 4/0		
	⊖, ⊕1	−	1 to 4/0		
	⊕3	−	1/0 to 4/0		
	⏚	4	4 to 2		
2A0211	R/L1, S/L2, T/L3	1/0 × 2P	1/0 to 2/0	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	1/0 × 2P	1/0 to 2/0		
	⊖, ⊕1	−	1 to 4/0		
	⊕3	−	1/0 to 4/0		
	⏚	4	4 to 1/0		
2A0250	R/L1, S/L2, T/L3	3/0 × 2P	3/0 to 300	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	3/0 × 2P	3/0 to 300		
	⊖, ⊕1	−	3/0 to 300		
	⊕3	−	2 to 300	M10	18 to 23 (159 to 204)
	⏚	3	3 to 300	M12	32 to 40 (283 to 354)

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb.in.)
2A0312	R/L1, S/L2, T/L3	4/0 × 2P	3/0 to 300	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	3/0 × 2P	3/0 to 300		
	⊖, ⊕1	–	3/0 to 300		
	⊕3	–	3/0 to 300	M10	18 to 23 (159 to 204)
	⏚	2	2 to 300	M12	32 to 40 (283 to 354)
2A0360	R/L1, S/L2, T/L3	250 × 2P	4/0 to 600	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	4/0 × 2P	4/0 to 600		
	⊖, ⊕1	–	250 to 600		
	⊕3	–	3/0 to 600	M10	18 to 23 (159 to 204)
	⏚	1	1 to 350	M12	32 to 40 (283 to 354)
2A0415	R/L1, S/L2, T/L3	350 × 2P	250 to 600	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	300 × 2P	300 to 600		
	⊖, ⊕1	–	300 to 600		
	⊕3	–	3/0 to 600	M10	18 to 23 (159 to 204)
	⏚	1	1 to 350	M12	32 to 40 (283 to 354)

<1> Install a GFCI when using this wire gauge in accordance with IEC/EN 61800-5-1.

<2> Install a GFCI, or use 10 mm² (AWG 8) copper wire when using this wire gauge in accordance with IEC/EN 61800-5-1.

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

■ Three-Phase 400 V Class

Table 3.4 Wire Gauge and Torque Specifications (Three-Phase 400 V Class)

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb.in.)
4A0002 4A0004	R/L1, S/L2, T/L3	14	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	12 <1>	14 to 12		
4A0005 4A0007 4A0009	R/L1, S/L2, T/L3	14	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10 <1>	14 to 10		
4A0011	R/L1, S/L2, T/L3	12	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10 <1>	14 to 10		
4A0018	R/L1, S/L2, T/L3	10	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	10	12 to 6		
	⊖, ⊕1, ⊕2	–	12 to 6		
	B1, B2	–	12 to 10		
	⏚	10 <1>	14 to 10	M5	2.0 to 2.5 (17.7 to 22.1)

Electrical Installation

3

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb.in.)
4A0023	R/L1, S/L2, T/L3	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	10	10 to 6		
	⊖, ⊕1, ⊕2	–	12 to 6		
	B1, B2	–	12 to 10		
	⏚	10 [1]	12 to 10	M5	2.0 to 2.5 (17.7 to 22.1)
4A0031	R/L1, S/L2, T/L3	8	8 to 6	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	8	10 to 6		
	⊖, ⊕1, ⊕2	–	10 to 6		
	B1, B2	–	10 to 8		2.7 to 3.0 (23.9 to 26.6)
	⏚	8 [2]	10 to 8	M6	5.4 to 6.0 (47.8 to 53.1)
4A0038	R/L1, S/L2, T/L3	6	8 to 6	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	8	8 to 6		
	⊖, ⊕1, ⊕2	–	6		
	B1, B2	–	10 to 8		2.7 to 3.0 (23.9 to 26.6)
	⏚	6	10 to 6	M6	5.4 to 6.0 (47.8 to 53.1)
4A0044	R/L1, S/L2, T/L3	6	6 to 4	M6	5.4 to 6.0 (47.8 to 53.1)
	U/T1, V/T2, W/T3	6	6 to 4		
	⊖, ⊕1, ⊕2	–	6 to 4		
	B1, B2	–	10 to 8	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	6	8 to 6	M6	5.4 to 6.0 (47.8 to 53.1)
4A0058	R/L1, S/L2, T/L3	4	6 to 4	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	4	6 to 4		
	⊖, ⊕1	–	6 to 1		
	B1, B2	–	8 to 4		
	⏚	6	8 to 6		
4A0072	R/L1, S/L2, T/L3	3	4 to 3	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	3	4 to 3		
	⊖, ⊕1	–	4 to 1		
	B1, B2	–	6 to 3		
	⏚	6	6		
4A0088	R/L1, S/L2, T/L3	2	3 to 1/0	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	2	3 to 1/0		
	⊖, ⊕1	–	3 to 1/0		
	⊕3	–	6 to 1/0		
	⏚	4	6 to 4		
4A0103	R/L1, S/L2, T/L3	1/0	2 to 1/0	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	1	2 to 1/0		
	⊖, ⊕1	–	3 to 1/0		
	⊕3	–	4 to 1/0		
	⏚	4	6 to 4		
4A0139	R/L1, S/L2, T/L3	3/0	1/0 to 4/0	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	2/0	1/0 to 4/0		
	⊖, ⊕1	–	1/0 to 4/0		
	⊕3	–	3 to 4/0		
	⏚	4	4		

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb.in.)
4A0165	R/L1, S/L2, T/L3	4/0	3/0 to 4/0	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	4/0	3/0 to 4/0		
	⊖, ⊕1	–	1 to 4/0		
	⊕3	–	1/0 to 4/0		
	⏚	4	4 to 2		
4A0208	R/L1, S/L2, T/L3	300	2 to 300	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	300	2 to 300		
	⊖, ⊕1	–	1 to 250		
	⊕3	–	3 to 3/0		
	⏚	4	4 to 300		
4A0250	R/L1, S/L2, T/L3	400	1 to 600	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	400	1/0 to 600		
	⊖, ⊕1	–	3/0 to 600		
	⊕3	–	1 to 325		
	⏚	2	2 to 350		
4A0296	R/L1, S/L2, T/L3	500	2/0 to 600	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	500	2/0 to 600		
	⊖, ⊕1	–	3/0 to 600		
	⊕3	–	1 to 325	M10	18 to 23 (159 to 204)
	⏚	2	2 to 350	M12	32 to 40 (283 to 354)
4A0362	R/L1, S/L2, T/L3	4/0 × 2P	3/0 to 600	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	4/0 × 2P	3/0 to 600		
	⊖, ⊕1	–	4/0 to 600		
	⊕3	–	3/0 to 600	M10	18 to 23 (159 to 204)
	⏚	1	1 to 350	M12	32 to 40 (283 to 354)
4A0414	R/L1, S/L2, T/L3	300 × 2P	4/0 to 300	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	300 × 2P	4/0 to 300		
	⊖, ⊕1	–	3/0 to 300		
	⊕3	–	3/0 to 300		
	⏚	1	1 to 3/0		
4A0515	R/L1, S/L2, T/L3	3/0 × 4P	3/0 to 300	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	4/0 × 4P	3/0 to 300		
	⊖, ⊕1	–	1/0 to 300		
	⊕3	–	1/0 to 300		
	⏚	1/0	1/0 to 300		
4A0675	R/L1, S/L2, T/L3	300 × 4P	4/0 to 300	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	300 × 4P	4/0 to 300		
	⊖, ⊕1	–	1/0 to 300		
	⊕3	–	1/0 to 300		
	⏚	2/0	2/0 to 300		
4A0930	R/L1, S/L2, T/L3, R1/L11, S1/L21, T1/L31	4/0 × 4P×2	3/0 to 300	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	4/0 × 4P×2	3/0 to 300		
	⊖, ⊕1	–	4/0 to 300		
	⊕3	–	4/0 to 300		
	⏚	3/0	3/0 to 250		

Electrical Installation

3

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N·m (lb.in.)
4A1200	R/L1, S/L2, T/L3, R1/L11, S1/L21, T1/L31	300 × 4P×2	4/0 to 300	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	300 × 4P×2	4/0 to 300		
	⊖, ⊕1	–	250 to 300		
	⊕3	–	4/0 to 300		
	⏚	4/0	4/0 to 250		

<1> Install a GFCI when using this wire gauge in accordance with IEC/EN 61800-5-1.

<2> Install a GFCI or use 10 mm^2 (AWG 8) copper wire when using this wire gauge in accordance with IEC/EN 61800-5-1.

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

■ Three-Phase 600 V Class

Table 3.5 Wire Gauge and Torque Specifications (Three-Phase 600 V Class)

Drive Model	Terminal	Recomm. Gauge mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N·m (lb.in.)
5A0003 5A0004 5A0006	R/L1, S/L2, T/L3	2.5 (14)	2.5 to 6.0 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2.5 (14)	2.5 to 6.0 (14 to 10)		
	⊖, ⊕1, ⊕2	–	2.5 to 6.0 (14 to 10)		
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	6.0 (10)	2.5 to 6.0 (14 to 10)		
5A0009	R/L1, S/L2, T/L3	2.5 (14)	2.5 to 6.0 (14 to 10)	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2.5 (14)	2.5 to 6.0 (14 to 10)		
	⊖, ⊕1, ⊕2	–	2.5 to 6.0 (14 to 10)		
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	6.0 (10)	4.0 to 6.0 (12 to 10)		
5A0011	R/L1, S/L2, T/L3	6.0 (10)	2.5 to 16 (14 to 6)	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	2.5 (14)	2.5 to 16 (14 to 6)		
	⊖, ⊕1, ⊕2	–	2.5 to 16 (14 to 6)		
	B1, B2	–	2.5 to 6.0 (14 to 10)		
	⏚	10 (8)	4.0 to 6.0 (12 to 8)	M5	2.0 to 2.5 (17.7 to 22.1)
5A0017	R/L1, S/L2, T/L3	6.0 (10)	6.0 to 16 (10 to 6)	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	6.0 (10)	6.0 to 16 (10 to 6)		
	⊖, ⊕1, ⊕2	–	6.0 to 16 (10 to 6)		
	B1, B2	–	6.0 to 10 (10 to 8)		2.7 to 3.0 (23.9 to 26.6)
	⏚	10 (8)	6.0 to 10 (12 to 8)	M6	5.4 to 6.0 (47.8 to 53.1)

Drive Model	Terminal	Recomm. Gauge mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N·m (lb.in.)
5A0022	R/L1, S/L2, T/L3	10 (8)	6.0 to 16 (10 to 6)	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	6.0 (10)	6.0 to 16 (10 to 6)		
	⊖, ⊕1, ⊕2	–	6.0 to 16 (10 to 6)		
	B1, B2	–	6.0 to 10 (10 to 8)		2.7 to 3.0 (23.9 to 26.6)
	⏚	10 (8)	6.0 to 10 (10 to 6)	M6	5.4 to 6.0 (47.8 to 53.1)
5A0027 5A0032	R/L1, S/L2, T/L3	16 (6)	16 to 25 (6 to 4)	M6	5.4 to 6.0 (47.8 to 53.1)
	U/T1, V/T2, W/T3	16 (6)	16 to 25 (6 to 4)		
	⊖, ⊕1, ⊕2	–	16 to 25 (6 to 4)		
	B1, B2	–	6.0 to 10 (10 to 8)	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	16 (6)	10 to 16 (10 to 6)	M6	5.4 to 6.0 (47.8 to 53.1)
5A0041	R/L1, S/L2, T/L3	16 (6)	6.0 to 25 (10 to 3)	M8	9.0 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	16 (6)	6.0 to 25 (10 to 3)		
	⊖, ⊕1	–	(6 to 1)		
	B1, B2	–	4.0 to 25 (12 to 3)		
	⏚	16 (6)	10 to 16 (6)		
5A0052	R/L1, S/L2, T/L3	25 (4)	6.0 to 25 (10 to 3)	M8	9.0 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	16 (6)	6.0 to 25 (10 to 3)		
	⊖, ⊕1	–	16 to 35 (6 to 1)		
	B1, B2	–	10 to 25 (8 to 3)		
	⏚	16 (6)	10 to 16 (6)		
5A0062	R/L1, S/L2, T/L3	25 (4)	6.0 to 95 (10 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	25 (4)	6.0 to 95 (10 to 4/0)		
	⊖, ⊕1	–	25 to 95 (4 to 4/0)		
	⊕3	–	16 to 95 (6 to 4/0)		
	⏚	25 (4)	25 (4)		
5A0077	R/L1, S/L2, T/L3	25 (3)	6.0 to 95 (10 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	25 (3)	6.0 to 95 (10 to 4/0)		
	⊖, ⊕1	–	25 to 95 (3 to 4/0)		
	⊕3	–	16 to 95 (6 to 4/0)		
	⏚	25 (4)	25 (4)		

Electrical Installation

3

3.6 Main Circuit Wiring

Drive Model	Terminal	Recomm. Gauge mm² (AWG, kcmil)	Wire Range mm² (AWG, kcmil)	Screw Size	Tightening Torque N·m (lb.in.)
5A0099	R/L1, S/L2, T/L3	70 (1/0)	6.0 to 95 (10 to 4/0)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	50 (1)	6.0 to 95 (10 to 4/0)		
	⊖, ⊕1	–	35 to 95 (2 to 4/0)		
	⊕3	–	25 to 95 (4 to 4/0)		
	⏚	25 (4)	25 (4)		
5A0125	R/L1, S/L2, T/L3	70 (2/0)	35 to 150 (1 to 300)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	70 (2/0)	35 to 150 (1 to 300)		
	⊖, ⊕1	–	70 (2/0 to 3/0)		
	⊕3	–	35 to 50 (1 to 1/0)		
	⏚	35 (3)	35 to 150 (3 to 300)		
5A0145	R/L1, S/L2, T/L3	95 (3/0)	95 to 150 (2/0 to 300)	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	95 (3/0)	95 to 150 (2/0 to 300)		
	⊖, ⊕1	–	70 to 95 (3/0 to 4/0)		
	⊕3	–	70 to 95 (1/0 to 2/0)		
	⏚	35 (3)	35 to 150 (3 to 300)		
5A0192	R/L1, S/L2, T/L3	185 (300)	95 to 300 (2/0 to 600)	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	150 (250)	95 to 300 (2/0 to 600)		
	⊖, ⊕1	–	95 to 185 (2/0 to 400)		
	⊕3	–	95 to 120 (2/0 to 250)	M10	18 to 23 (159 to 204)
	⏚	50 (1)	35 to 300 (1 to 350)	M12	32 to 40 (283 to 354)
5A0242	R/L1, S/L2, T/L3	240 (400)	95 to 300 (2/0 to 600)	M12	32 to 40 (283 to 354)
	U/T1, V/T2, W/T3	185 (350)	95 to 300 (2/0 to 600)		
	⊖, ⊕1	–	95 to 240 (2/0 to 500)		
	⊕3	–	150 (250 to 300)	M10	18 to 23 (159 to 204)
	⏚	50 (1)	35 to 300 (1 to 350)	M12	32 to 40 (283 to 354)

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

◆ Main Circuit Terminal and Motor Wiring

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

WARNING! *Electrical Shock Hazard. Do not connect the AC power line to the output 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: *When connecting the motor to the drive output terminals U/T1, V/T2, and W/T3, the phase order for the drive and motor should match. Failure to comply with proper wiring practices may cause the motor to run in reverse if the phase order is backward.*

NOTICE: *Route motor leads U/T1, V/T2, and W/T3 separate from all other leads to reduce possible interference related issues. Failure to comply may result in abnormal operation of drive and nearby equipment.*

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.*

■ 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 3.6*. If the motor wiring distance exceeds 100 m because of the system configuration, reduce the ground currents. *Refer to C6-02: Carrier Frequency Selection on page 145*.

Table 3.6 Cable Length Between Drive and Motor

Cable Length	50 m or less	100 m or less	Greater than 100 m
Carrier Frequency	15 kHz or less	5 kHz or less	2 kHz or less

Note:
1. When setting carrier frequency for drives running multiple motors, calculate cable length as the total wiring distance to all connected motors.
2. The maximum cable length when using OLV/PM (A1-02 = 5) or AOLV/PM (A1-02 = 6) is 100 m.

■ Ground Wiring

Follow the precautions below when wiring the ground for one drive or a series of drives.

WARNING! *Electrical Shock Hazard. Make sure the protective earthing conductor complies with technical standards and local safety regulations. Because the leakage current exceeds 3.5 mA in models 4A0414 and larger, IEC/EN 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. Failure to comply may result in death or serious injury.*

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

WARNING! *Electrical Shock Hazard. Be sure to ground the drive ground terminal (200 V class: ground to 100 Ω or less; 400 V class: ground to 10 Ω or less; 600 V class: ground to 10 Ω or less). 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 3.24* when using multiple drives. Do not loop the ground wire.
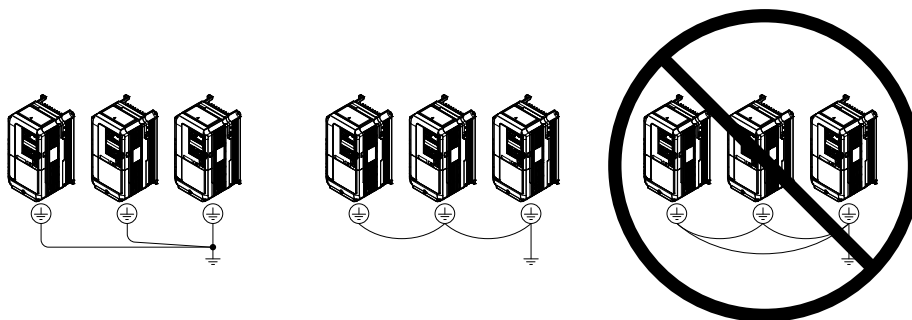
Figure 3.24 Multiple Drive Wiring

■ 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.

Models 2A0004 to 2A0081, 4A0002 to 4A0044, and 5A0003 to 5A0032 have a cover placed over the DC bus and braking circuit terminals prior to shipment to help prevent miswiring. Use wire cutters to cut away covers as needed for terminals.
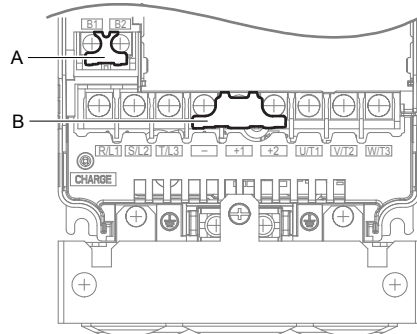
A – Braking circuit protective cover   B – DC bus protective cover

Figure 3.25 Protecting Cover to Prevent Miswiring (Model 5A0011)

■ Main Circuit Connection Diagram

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 Terminal Block Functions

Drive parameters determine which functions apply to the multi-function digital inputs (S1 to S8), multi-function digital outputs (M1 to M6), multi-function analog inputs (A1 to A3), and multi-function analog monitor output (FM, AM). The default setting is listed next to each terminal in *Figure 3.1* on page *81*.

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. Setting parameter A1-06 may change the I/O terminal function automatically from the factory setting. **Refer to Application Selection on page 134**. Failure to comply may result in death or serious injury.*

■ Input Terminals

Table 3.7 lists the input terminals on the drive. Text in parenthesis indicates the default setting for each multi-function input.

Table 3.7 Control Circuit Input Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting	Page
Multi-Function Digital Inputs	S1	Multi-function input 1 (Closed: Forward run, Open: Stop)	• Photocoupler • 24 Vdc, 8 mA • *Refer to Sinking/Sourcing Mode for Digital Inputs on page 110*.	*288*
	S2	Multi-function input 2 (Closed: Reverse run, Open: Stop)		
	S3	Multi-function input 3 (External fault, N.O.)		
	S4	Multi-function input 4 (Fault reset)		
	S5	Multi-function input 5 (Multi-step speed reference 1)		
	S6	Multi-function input 6 (Multi-step speed reference 2)		
	S7	Multi-function input 7 (Jog reference)		
	S8	Multi-function input 8 (Baseblock command (N.O.))		
	SC	Multi-function input common	Multi-function input common	
	SP	Digital input power supply +24 Vdc	24 Vdc power supply for digital inputs, 150 mA max (only when not using digital input option DI-A3)	*110*
	SN	Digital input power supply 0 V	**NOTICE:** *Do not jumper or short terminals SP and SN. Failure to comply will damage the drive.*	*110*
Safe Disable Inputs	H1	Safe Disable input 1	• 24 Vdc, 8 mA • One or both open: Output disabled • Both closed: Normal operation • Internal impedance: 3.3 kΩ • Off time of at least 1 ms • Disconnect the wire jumpers shorting terminals H1, H2, and HC to use the Safe Disable inputs. Set the S3 jumper to select between sinking, sourcing mode, and the power supply as explained on page *110*.	*352*
	H2	Safe Disable input 2		
	HC	Safe Disable function common	Safe disable function common	

Electrical Installation

3

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting	Page
Analog Inputs / Pulse Train Input	RP	Multi-function pulse train input (Frequency reference)	• Input frequency range: 0 to 32 kHz • Signal Duty Cycle: 30 to 70% • High level: 3.5 to 13.2 Vdc, low level: 0.0 to 0.8 Vdc • Input impedance: 3 kΩ	*138 298*
	+V	Power supply for analog inputs	10.5 Vdc (max allowable current 20 mA)	*136*
	-V	Power supply for analog inputs	-10.5 Vdc (max allowable current 20 mA)	–
	A1	Multi-function analog input 1 (Frequency reference bias)	-10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ)	*136 155*
	A2	Multi-function analog input 2 (Frequency reference bias)	• -10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ) • 4 to 20 mA, 0 to 20 mA (input impedance: 250 Ω) • Voltage or current input must be selected by DIP switch S1 and H3-09.	*136 157*
	A3	Multi-function analog input 3 (Auxiliary frequency reference)/PTC Input	• -10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ) • Use DIP switch S4 on the terminal board to select between analog and PTC input.	*136*
	AC	Frequency reference common	0 V	*136*
	E (G)	Ground for shielded lines and option cards	–	–

■ Output Terminals

Table 3.8 lists the output terminals on the drive. Text in parenthesis indicates the default setting for each multi-function output.

Table 3.8 Control Circuit Output Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting	Page
Fault Relay Output	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	*153*
	MB	N.C. output (Fault)		
	MC	Fault output common		
Multi-Function Digital Output *<1>*	M1	Multi-function digital output (During run)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA	*153*
	M2			
	M3	Multi-function digital output (Zero speed)		
	M4			
	M5	Multi-function digital output (Speed Agree 1)		
	M6			
Monitor Output	MP	Pulse train output (Output frequency)	32 kHz (max)	*298*
	FM	Analog monitor output 1 (Output frequency)	-10 to +10 Vdc, 0 to +10 Vdc, or 4 to 20 mA. *Refer to Terminal AM/FM Signal Selection on page 113* for details.	*296*
	AM	Analog monitor output 2 (Output current)		
	AC	Monitor common	0 V	–
Safety Monitor Output	DM+	Safety monitor output	Outputs status of Safe Disable function. Closed when both Safe Disable channels are closed. Up to +48 Vdc 50 mA	*353*
	DM-	Safety monitor output		

<1> Refrain from assigning functions to digital relay outputs that involve frequent switching, as doing so may shorten relay performance life. Switching life is estimated at 200,000 times (assumes 1 A, resistive load).

■ Serial Communication Terminals

Table 3.9 Control Circuit Terminals: Serial Communications

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

<1> Enable the termination resistor in the last drive in a MEMOBUS/Modbus network by setting DIP switch S2 to the ON position. Refer to the manual section on *Control I/O Connections* for more information.

◆ **Terminal Configuration**

The control circuit terminals should be arranged as shown in *Figure 3.26*.

A – Terminal Block (TB 2)   D – Terminal Block (TB 3)
B – Terminal Block (TB 5)   E – Terminal Block (TB 4)
C – Terminal Block (TB 1)
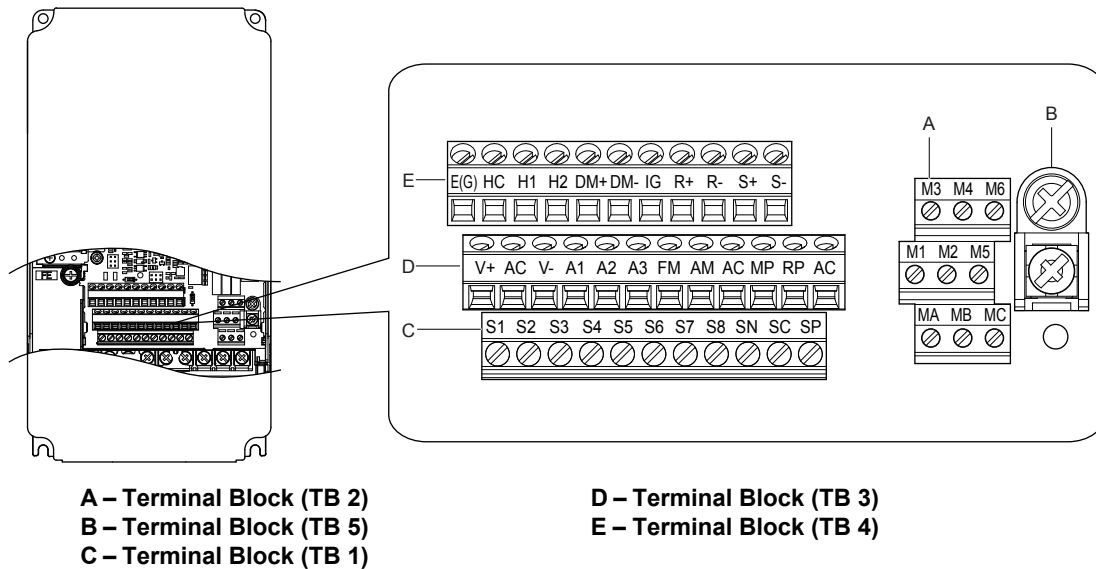
Figure 3.26 Control Circuit Terminal Arrangement

■ **Wire Size and Torque Specifications**

Select appropriate wire type and gauges from *Table 3.10*. For simpler and more reliable wiring, use crimp ferrules on the wire ends.

Table 3.10 Wire Gauges

Terminal Block	Terminal	Screw Size	Tightening Torque N•m (lb. in)	Bare Wire Terminal		Ferrule-Type Terminal		Wire Type
				Recomm. wire size mm² (AWG)	Applicable wire size mm² (AWG)	Recomm. wire size mm² (AWG)	Applicable wire size mm² (AWG)	
TB1, TB2, TB3, TB4	S1-S8, SN, SC, SP, MA, MB, MC, M1-M6, V+, V-, AC, A1, A2, FM, AM, P1, P2, C1, C2, HC, H1, H2, DM+, DM-, IG, R+, R-, S+, S-	M3	0.5 to 0.6 (4.4 to 5.3)	0.75 (18)	Stranded wire: 0.2 to 1.0 (24 to 17) Solid wire: 0.2 to 1.5 (24 to 16)	0.5 (20)	0.25 to 0.5 (24 to 20)	Shielded wire, etc.
	E(G)			1.0 (16)				
TB5	E(G)	M3.5	0.5 to 1.0 (4.4 to 8.9)	1.25 (12)	0.5 to 2 (20 to 14)	–	–	

Electrical Installation

3

■ 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. See ***Table 3.11*** for dimensions.
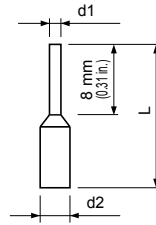
Figure 3.27 Ferrule Dimensions

Table 3.11 Ferrule Terminal Types and Sizes

Size mm² (AWG)	Type	L mm (in)	d1 mm (in)	d2 mm (in)	Manufacturer
0.25 (24)	AI 0.25-8YE	12.5 (0.49)	0.8 (0.03)	2.0 (0.08)	PHOENIX CONTACT
0.34 (22)	AI 0.34-8TQ	12.5 (0.49)	0.8 (0.03)	2.0 (0.08)	
0.5 (20)	AI 0.5-8WH AI 0.5-8OG	14.0 (0.55)	1.1 (0.04)	2.5 (0.10)	

◆ Wiring the Control Circuit Terminal

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

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.*

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: *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: *Use a class 2 power supply 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.*

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

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: *Do not tighten screws beyond the specified tightening torque. Failure to comply may result in erroneous operation, damage to the terminal block, or cause a fire.*

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.*

Wire the control circuit only after terminals have been properly grounded and main circuit wiring is complete. ***Refer to Terminal Board Wiring Guide on page 109*** for details. Prepare the ends of the control circuit wiring as shown in ***Figure 3.30***. ***Refer to Wire Gauges on page 107***.

Connect control wires as shown in ***Figure 3.28*** and ***Figure 3.29***.
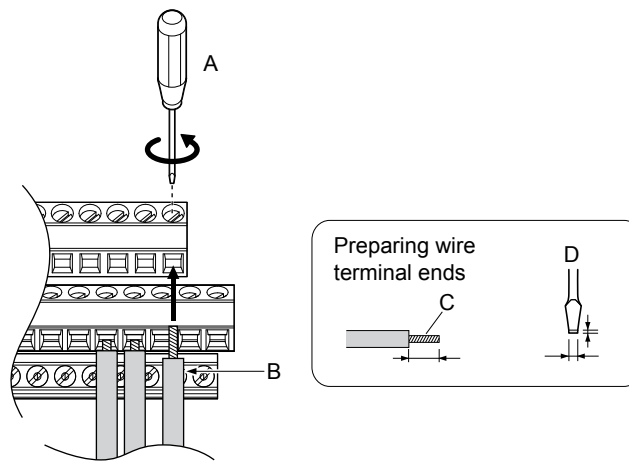
A – Loosen screw to insert wire.
B – Single wire or stranded wire

C – Avoid fraying wire strands when stripping insulation from wire. Strip length 5.5 mm.
D – Blade depth of 0.4 mm or less Blade width of 2.5 mm or less

Figure 3.28 Terminal Board Wiring Guide
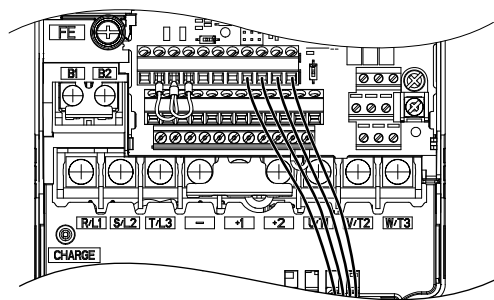
Figure 3.29 Terminal Board Location Inside the Drive

When setting the frequency by analog reference from an external potentiometer, use shielded twisted-pair wires (preparing wire ends as shown in *Figure 3.30*) and connect the shield to the ground terminal of the drive.
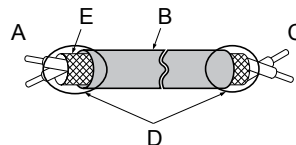
A – Drive side
B – Insulation
C – Control device side

D – Shield sheath (insulate with tape)
E – Shield

Figure 3.30 Preparing the Ends of Shielded Cables

NOTICE: *The analog signal wiring between the drive and the operator station or peripheral equipment should not exceed 50 meters when using an analog signal from a remote source to supply the frequency reference. Failure to comply could result in poor system performance.*

Electrical Installation

3

3.8 Control I/O Connections

◆ Sinking/Sourcing Mode for Digital Inputs

Use the wire jumper between terminals SC and SP or SC and SN to select between Sink mode, Source mode or external power supply for the digital inputs S1 to S8 as shown in *Table 3.12* (Default: Sink mode, internal power supply).

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

Table 3.12 Digital Input Sink/Source/External Power Supply Selection

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

◆ Sinking/Sourcing Mode Selection for Safe Disable Inputs

Use jumper S3 on the terminal board to select between Sink mode, Source mode or external power supply for the Safe Disable inputs H1 and H2 as shown in *Table 3.13* (Default: Source mode, internal power supply).

Remove the jumper wire connected to the HC terminals and connect terminals H1 and H2 as shown in *Table 3.13* to use an external power supply for a sequence input without using a safety input.

WARNING! *Electrical Shock Hazard. Be sure to remove the jumper wire connected to the HC terminals if using en external power supply for a sequence input without using a safety input. Failure to comply will short circuit the external power supply.*

Table 3.13 Safe Disable Input Sink/Source/External Power Supply Selection

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

◆ Using the Pulse Train Output

The pulse train output terminal MP can supply power or be used with an external power supply.

NOTICE: *Connect peripheral devices in accordance with the specifications. Failure to comply may cause unexpected drive operation, and can damage the drive or connected circuits.*

■ Using Power from the Pulse Output Terminal (Source Mode)

The high voltage level of the pulse output terminal depends on the load impedance.

Load Impedance R_L (kΩ)	Output Voltage V_{MP} (V) (insulated)
1.5 kΩ	5 V
4 kΩ	8 V
10 kΩ	10 V

Note: The load resistance needed in order to get a certain high level voltage V_{MP} can be calculated by: $R_L = V_{MP} \cdot 2 / (12 - V_{MP})$
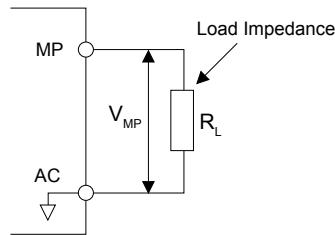
Figure 3.31 Pulse Output Connection Using Internal Voltage Supply

■ Using External Power Supply (Sink Mode)

The high voltage level of the pulse output signal depends on the external voltage applied. The voltage must be between 12 and 15 Vdc. The load resistance must be adjusted so that the current is lower than 16 mA.

External Power Supply (V)	Load Impedance (kΩ)
12 to 15 Vdc ±10%	1.0 kΩ or higher
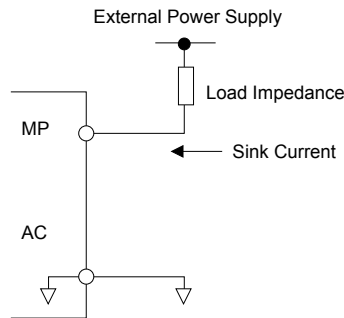
Figure 3.32 Pulse Output Connection Using External Voltage Supply

◆ Terminal A2 Input Signal Selection

Terminal A2 can be used to input either a voltage or a current signal. Select the signal type using switch S1 as explained in *Table 3.14*. Set parameter H3-09 accordingly as shown in *Table 3.15*.

Note: If terminals A1 and A2 are both set for frequency bias (H3-02 = 0 and H3-10 = 0), both input values will be combined to create the frequency reference.

Table 3.14 DIP Switch S1 Settings

Setting	Description
V (left position)	Voltage input (-10 to +10 V or 0 to 10 V)
I (right position)	Current input (4 to 20 mA or 0 to 20 mA): default setting

Table 3.15 Parameter H3-09 Details

No.	Parameter Name	Description	Setting Range	Default Setting
H3-09	Terminal A2 Signal Level Selection	Selects the signal level for terminal A2. 0: 0 to 10 Vdc 1: -10 to 10 Vdc 2: 4 to 20 mA 3: 0 to 20 mA	0 to 3	2

◆ Terminal A3 Analog/PTC Input Selection

Terminal A3 can be configured either as multi-function analog input or as PTC input for motor thermal overload protection. Use switch S4 to select the input function as described in *Table 3.16*.

Table 3.16 DIP Switch S4 Settings

Setting	Description
AI (lower position) (default)	Analog input for the function selected in parameter H3-06
PTC (upper position)	PTC input. Parameter H3-06 must be set to E (PTC input)

◆ Terminal AM/FM Signal Selection

The signal type for terminals AM and FM can be set to either voltage or current output using jumper S5 on the terminal board as explained in *Table 3.17*. When changing the setting of jumper S5, parameters H4-07 and H4-08 must be set accordingly. The default selection is voltage output for both terminals.

Table 3.17 Jumper S5 Settings

Terminal	Voltage Output	Current Output
Terminal AM		
Terminal FM		

Table 3.18 Parameter H4-07 and H4-08 Details

No.	Parameter Name	Description	Setting Range	Default Setting
H4-07	Terminal FM signal level selection	0: 0 to 10 Vdc 1: -10 to 10 Vdc 2: 4 to 20 mA	0 to 2	0
H4-08	Terminal AM signal level selection			

Electrical Installation

3

◆ Terminal DM+ and DM- Output Signal Selection

Slide switch S6 selects N.C. or N.O. as the state of the DM+ and DM- terminals for EDM output. The switch is initially set to N.C. Slide switch S6 is available on terminal board ETC74030☐.

Table 3.19 EDM Switch Settings

S2 Position	Description
N.O.	Normally open
N.C.	Normally closed (default setting)

Note: *Refer to Safe Disable Input Function on page 352* for details on EDM.

3.9 Connect to a PC

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

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

Figure 3.33 Connecting to a PC (USB)

3.10 Wiring Checklist

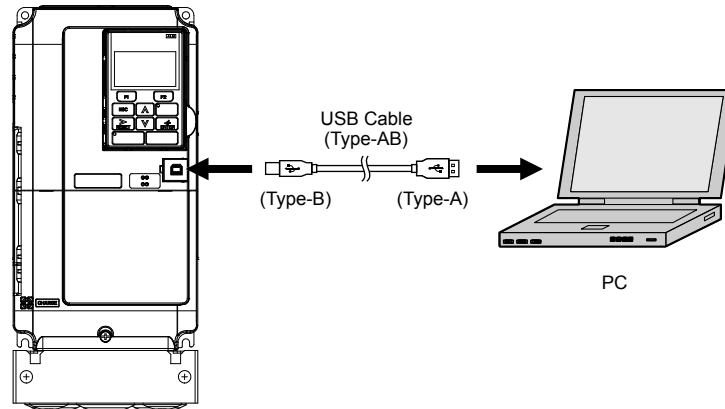| ☑	No.	Item	Page(s)
		Drive, Peripherals, Option Cards	
☐	1	Check drive model number to ensure receipt of correct model.	*22*
☐	2	Make sure you have the correct braking resistors, DC link chokes, noise filters, and other peripheral devices.	–
☐	3	Check the option card model number.	–
		Installation Area and Physical Setup	
☐	4	Ensure that the area surrounding the drive complies with specifications.	*28*
		Power Supply Voltage, Output Voltage	
☐	5	The voltage from the power supply should be within the input voltage specification range of the drive.	*147*
☐	6	The voltage rating for the motor should match the drive output specifications.	*22*
☐	7	Verify that the drive is properly sized to run the motor.	*316*
		Main Circuit Wiring	
☐	8	Confirm proper branch circuit protection as specified by national and local codes.	*80*
☐	9	Properly wire the power supply to drive terminals R/L1, S/L2, and T/L3. **Note:** Confirm the following when wiring models 4A0930 and 4A1200: • Remove the jumpers shorting terminals R/L1-R1/L11, S/L2-S1/L21, and T/L3-T1/L31 when operating with 12-phase rectification. • When operating without 12-phase rectification, properly wire terminals R1/L11, S1/L21, and T1/L31 in addition to terminals R/L1, S/L2, and T/L3.	*83*
☐	10	Properly wire the drive and motor together. The motor lines and drive output terminals U/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.	*103*
☐	11	Use 600 Vac vinyl-sheathed wire for the power supply and motor lines.	*94*
☐	12	Use the correct wire gauges for the main circuit. ***Refer to Main Circuit Wire Gauges and Tightening Torques on page 94***. • Consider the amount of voltage drop when selecting wire gauges. Increase the wire gauge when the voltage drop is greater than 2% of motor rated voltage. Ensure the wire gauge is suitable for the terminal block. Use the following formula to calculate the amount of voltage drop: Line drop voltage (V) = $\sqrt{3}$ × wire resistance (Ω/km) × wire length (m) × current (A) × 10^{-3} • If the cable between the drive and motor exceeds 50 m, adjust the carrier frequency set to C6-02 accordingly.	*94* *103*
☐	13	Properly ground the drive. Review page *103*.	*103*
☐	14	Tighten control circuit and grounding terminal screws. ***Refer to Main Circuit Wire Gauges and Tightening Torques on page 94***.	*94*
☐	15	Set up overload protection circuits when running multiple motors from a single drive. **Note:** Close MC1 – MCn before operating the drive. MC1 – MCn cannot be switched off during run.	–
☐	16	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.	–
☐	17	Verify phase advancing capacitors, input noise filters, or GFCIs are NOT installed on the output side of the drive.	–
		Control Circuit Wiring	
☐	18	Use twisted-pair line for all drive control circuit wiring.	*108*
☐	19	Ground the shields of shielded wiring to the GND ⏚ terminal.	*108*
☐	20	For 3-Wire sequence, set parameters for multi-function contact input terminals S1 – S8, and wire control circuits.	–
☐	21	Properly wire any option cards.	*108*
☐	22	Check for any other wiring mistakes. Only use a multimeter to check wiring.	–
☐	23	Properly fasten drive control circuit terminal screws. ***Refer to Main Circuit Wire Gauges and Tightening Torques on page 94***.	*94*

☑	No.	Item	Page(s)
☐	24	Pick up all wire clippings.	–
☐	25	Ensure that no frayed wires on the terminal block are touching other terminals or connections.	–
☐	26	Properly separate control circuit wiring and main circuit wiring.	–
☐	27	Analog signal line wiring should not exceed 50 m.	–
☐	28	Safe Disable input wiring should not exceed 30 m.	–

Electrical Installation

3

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4

Start-Up Programming & Operation

This chapter explains the functions of the digital operator and how to program the drive for initial operation.

4.1 Using the Digital Operator

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

◆ Digital Operator Keys and Displays
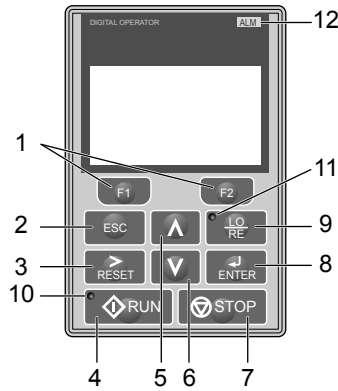
Figure 4.1 Keys and Displays on the Digital Operator

No.	Display	Name	Function
1	F1 F2	Function Key (F1, F2)	The functions assigned to F1 and F2 vary depending on the currently displayed menu. The name of each function appears in the lower half of the display window.
2	ESC	ESC Key	• Returns to the previous display. • Moves the cursor one space to the left. • Pressing and holding this button will return to the Frequency Reference display.
3	RESET	RESET Key	• Moves the cursor to the right. • Resets the drive to clear a fault situation.
4	RUN	RUN Key	Starts the drive in LOCAL mode.
5	∧	Up Arrow Key	Scrolls up to display the next item, selects parameter numbers, and increments setting values.
6	∨	Down Arrow Key	Scrolls down to display the previous item, selects parameter numbers, and decrements setting values.
7	STOP	STOP Key [1]	Stops drive operation.
8	ENTER	ENTER Key	• Enters parameter values and settings. • Selects a menu item to move between displays
9	LO/RE	LO/RE Selection Key [2]	Switches drive control and frequency setting between the operator (LOCAL) and an external source (REMOTE).
10	RUN	RUN Light	Lit while the drive is operating the motor. Refer to page *122* for details.
11	LO/RE	LO/RE Light	Lit while the operator is selected to run the drive (LOCAL mode). Refer to page *122* for details.
12	ALM	ALM LED Light	*Refer to ALARM (ALM) LED Displays on page 122*.

[1] The STOP key has highest priority. Pressing the STOP key will always cause the drive to stop the motor, even if a Run command is active at any external Run 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. To disable the LO/RE key to prohibit switching between LOCAL and REMOTE, set parameter o2-01 to 0.

◆ LCD Display
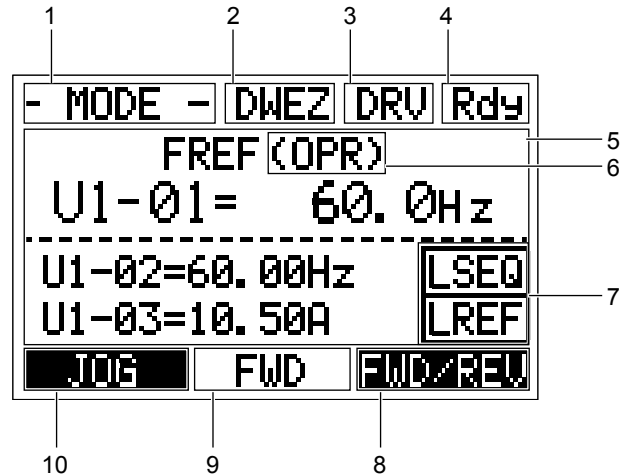
Figure 4.2 LCD Display

Table 4.1 Display and Contents

No.	Name	Display	Content
1	Operation Mode Menus	MODE	Displayed when in Mode Selection.
		MONITR	Displayed when in Monitor Mode.
		VERIFY	Indicates the Verify Menu.
		PRMSET	Displayed when in Parameter Setting Mode.
		A.TUNE	Displayed during Auto-Tuning.
		SETUP	Displayed when in Setup Mode.
2	DriveWorksEZ Function Selection	DWEZ	Displayed when DriveWorksEZ is set to enable. (A1-07 = 1 or 2)
3	Mode Display Area	DRV	Displayed when in Drive Mode.
		PRG	Displayed when in Programming Mode.
4	Ready	Rdy	Indicates the drive is ready to run.
5	Data Display	—	Displays specific data and operation data.
6	Frequency Reference Assignment [1]	OPR	Displayed when the frequency reference is assigned to the LCD Operator Option.
		AI	Displayed when the frequency reference is assigned to the Analog Input of the drive.
		COM	Displayed when the frequency reference is assigned to the MEMOBUS/Modbus Communication Inputs of the drive.
		OP	Displayed when the frequency reference is assigned to an Option Unit of the drive.
		RP	Displayed when the frequency reference is assigned to the Pulse Train Input of the drive.
7	LO/RE Display [2]	RSEQ	Displayed when the run command is supplied from a remote source.
		LSEQ	Displayed when the run command is supplied from the operator keypad.
		RREF	Displayed when the frequency reference is supplied from a remote source.
		LREF	Displayed when the frequency reference is supplied from the operator keypad.
8	Function Key 2 (F2)	FWD/REV	Pressing [F2] switches between forward and reverse.
		DATA	Pressing [F2] scrolls to the next display.
		→	Pressing [F2] scrolls the cursor to the right.
		RESET	Pressing [F2] resets the existing drive fault error.
9	FWD/REV	FWD	Indicates forward motor operation.
		REV	Indicates reverse motor operation.
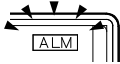
No.	Name	Display	Content
10	Function Key 1 (F1)	JOG	Pressing [F1] runs the motor at the Jog frequency.
		HELP	Pressing [F1] displays the Help menu.
		←	Pressing [F1] scrolls the cursor to the left.
		HOME	Pressing [F1] returns to the top menu (Frequency Reference).
		ESC	Pressing [F1] returns to the previous display.

<1> Displayed when in Frequency Reference Mode.

<2> Displayed when in Frequency Reference Mode and Monitor Mode.

◆ ALARM (ALM) LED Displays

Table 4.2 ALARM (ALM) LED Status and Contents

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

◆ LO/RE LED and RUN LED Indications

Table 4.3 LO/RE LED and RUN LED Indications

LED	Lit	Flashing	Flashing Quickly <1>	Off
LO/RE	When the operator is selected for Run command and frequency reference control (LOCAL)	—	—	When a device other than the operator is selected for Run command and frequency reference control (REMOTE)
RUN	During run	• During deceleration to stop • When a Run command is input and frequency reference is 0 Hz	• While the drive was set to LOCAL, a Run command was entered to the input terminals then the drive was switched to REMOTE. • A Run command was entered via the input terminals while the drive was not in Drive Mode. • During deceleration or stop when a Fast Stop command was entered. • The drive output is shut off by the Safe Disable function. • The STOP key was pressed while drive was running in REMOTE. • The drive was powered up with b1-17 = 0 (default) while the Run command is active.	During stop
Examples	RUN	RUN	RUN	RUN

<1> The drive cannot start operation.

◆ Menu Structure for Digital Operator
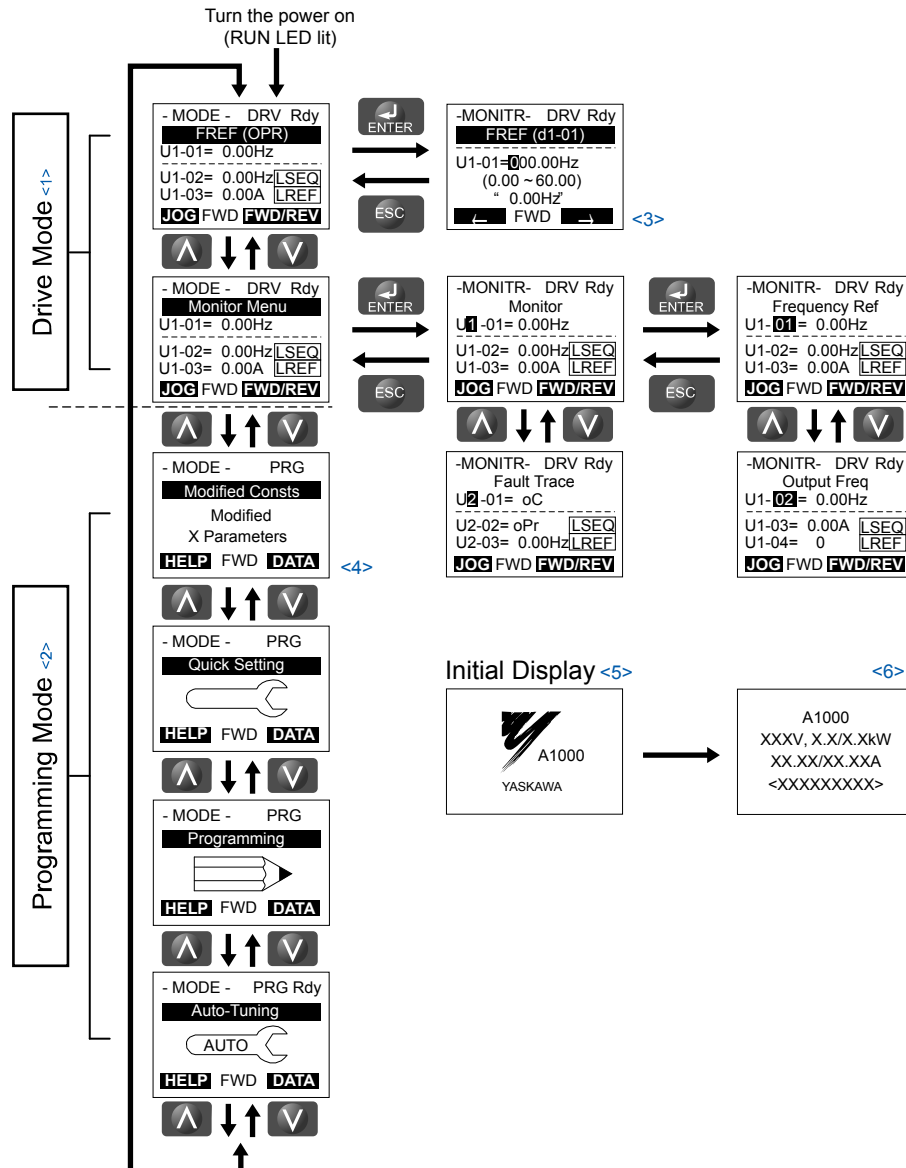
Figure 4.3 Digital Operator Menu and Screen Structure

<1> Pressing ⟨RUN⟩ will start the motor.

<2> Drive cannot operate motor.

<3> Flashing characters are shown as **0**.

<4> "X" characters are used as examples in this manual. The LCD Operator will display the actual setting values.

<5> The Frequency Reference appears after the initial display that shows the product name.

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

4.2 The Drive and Programming Modes

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

Drive Mode: In Drive Mode the user can operate the motor and observe U Monitor parameters. Parameter settings cannot be edited or changed when in Drive Mode.
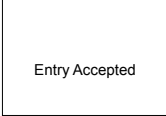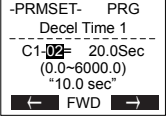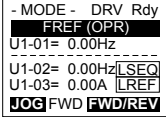
Programming Mode: In Programming Mode the user can edit and verify parameter settings and perform Auto-Tuning. When the drive is in Programming Mode it will not accept a Run command unless b1-08 is set to 1.

Note: 1. If b1-08 is set to 0, the drive will only accept a Run command in Drive Mode. After editing parameters, the user must exit the Programming Mode and enter Drive Mode before operating the motor.

                2. Set b1-08 to 1 to allow motor operation from the drive while in Programming Mode.

◆ Changing Parameter Settings or Values

This example explains changing C1-02 (Deceleration Time 1) from 10.0 seconds (default) to 20.0 seconds.

Step		Display/Result
1.	Turn on the power to the drive. The initial display appears.	- MODE - DRV Rdy FREF (OPR) U1-01= 0.00Hz U1-02= 0.00Hz LSEQ U1-03= 0.00A LREF JOG FWD FWD/REV
2.	Press ∧ or ∨ until the Parameter Setting Mode screen appears.	- MODE - PRG Programming HELP FWD DATA
3.	Press ENTER to enter the parameter menu tree.	-PRMSET- PRG Initialization A1-00= 0 Select Language ← FWD →
4.	Press ∧ or ∨ to select the C parameter group.	-PRMSET- PRG Basic Setup C1-01= 10.0 sec Accel Time 1 ← FWD →
5.	Press ENTER two times.	-PRMSET- PRG Accel/Decel C1-01= 10.0 sec Accel Time 1 ← FWD → -PRMSET- PRG Accel Time 1 C1-01= 10.0Sec (0.0~6000.0) "10.0 sec" ← FWD →
6.	Press ∧ or ∨ to select parameter C1-02.	-PRMSET- PRG Decel Time 1 C1-02= 10.0Sec (0.0~6000.0) "10.0 sec" ← FWD →
7.	Press ENTER to view the current setting value (10.0 s). The leftmost digit flashes.	-PRMSET- PRG Decel Time 1 C1-02= 0010.0Sec (0.0~6000.0) "10.0 sec" ← FWD →
8.	Press F1, F2, or RESET until the desired number is selected. "1" flashes.	-PRMSET- PRG Decel Time 1 C1-02=0010.0Sec (0.0~6000.0) "10.0 sec" ← FWD →
9.	Press ∧ and enter 0020.0.	-PRMSET- PRG Decel Time 1 C1-02=0020.0Sec (0.0~6000.0) "10.0 sec" ← FWD →

Step		Display/Result
10. Press [ENTER] to confirm the change.	→	Entry Accepted
11. The display automatically returns to the screen shown in Step 4.	→	-PRMSET- PRG Decel Time 1 C1-**02**= 20.0Sec (0.0~6000.0) "10.0 sec" ← FWD →
12. Press [ESC] as many times as necessary to return to the initial display.	→	- MODE - DRV Rdy **FREF (OPR)** U1-01= 0.00Hz U1-02= 0.00Hz LSEQ U1-03= 0.00A LREF **JOG** FWD **FWD/REV**

■ Setup Group Parameters

Table 4.4 lists the parameters available by default in the Setup Group. Selecting an Application Preset in parameter A1-06 or from the Application Selection Menu of the Setup Group automatically changes the parameters selected for the Setup Group. *Refer to Application Selection on page 134* for more information.

Use the Programming Mode to access parameters not displayed in the Setup Group.

Table 4.4 Setup Group Parameters

Parameter	Name	Parameter	Name
A1-02	Control Method Selection	E1-01	Input Voltage Setting
b1-01	Frequency Reference Selection 1	E1-03	V/f Pattern Selection
b1-02	Run Command Selection 1	E1-04	Maximum Output Frequency
b1-03	Stopping Method Selection	E1-05	Maximum Voltage
C1-01	Acceleration Time 1	E1-06	Base Frequency
C1-02	Deceleration Time 1	E1-09	Minimum Output Frequency
C6-01	Drive Duty Mode	E1-13	Base Voltage
C6-02	Carrier Frequency Selection	E2-01	Motor Rated Current
d1-01	Frequency Reference 1	E2-04	Number of Motor Poles
d1-02	Frequency Reference 2	E2-11	Motor Rated Power
d1-03	Frequency Reference 3	H4-02	Multi-Function Analog Output Terminal FM Gain
d1-04	Frequency Reference 4	L1-01	Motor Overload Protection Function Selection
d1-17	Jog Frequency Reference	L3-04	Stall Prevention Selection during Deceleration

Note: **1.** Parameter availability depends on the control mode set in A1-02; some parameters listed above may not be accessible in all control modes.

2. Parameters listed in *Table 4.4* are set in alphanumeric order as User Parameters in A2-01 to A2-26.

Start-Up Programming
& Operation

4

◆ Switching Between LOCAL and REMOTE
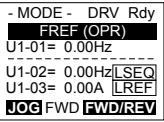
LOCAL mode is when the drive is set to accept the Run command from the digital operator RUN key. REMOTE mode is when the drive is set to accept the Run command from an external device (i.e., input terminals or serial communications).

WARNING! *Sudden Movement Hazard. The drive may start unexpectedly if the Run command is already applied when switching from LOCAL mode to REMOTE mode when b1-07 = 1, resulting in death or serious injury. Be sure all personnel are clear of rotating machinery.*

Switch the operation between LOCAL and REMOTE using the LO/RE key on the digital operator or via a digital input.

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

■ Using the LO/RE Key on the Digital Operator

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

■ Using Input Terminals S1 through S8 to Switch between LOCAL and REMOTE

It is possible to switch between LOCAL and REMOTE modes using one of the digital input terminals S1 through S8 (set the corresponding parameter H1-□□ to "1").

Setting H1-□□ to 1 disables the LO/RE key on the digital operator. * for details.

4.3 Start-Up Flowcharts

These flowcharts summarize steps required to start the drive. Use the flowcharts to determine the most appropriate start-up method for a given application. The charts are quick references to help familiarize the user with start-up procedures.

Note:
1. *Refer to Application Selection on page 134* to set up the drive using one of the Application Presets.
2. Function availability differs for drive models 4A0930 and 4A1200. *Refer to Parameter List on page 249* for details.

Flowchart	Subchart	Objective	Page
A	–	Basic start-up procedure and motor tuning	*128*
–	A-1	Simple motor setup using V/f mode	*129*
	A-2	High-performance operation using Open Loop Vector or Closed Loop Vector motor control	*130*
	A-3	Setting up the drive to run a permanent magnet (PM) motor	*131*

Start-Up Programming & Operation

4

◆ Flowchart A: Basic Start-Up and Motor Tuning

Flowchart A in *Figure 4.4* describes a basic start-up sequence that varies slightly depending on the application. Use the drive default parameter settings in simple applications that do not require high precision.
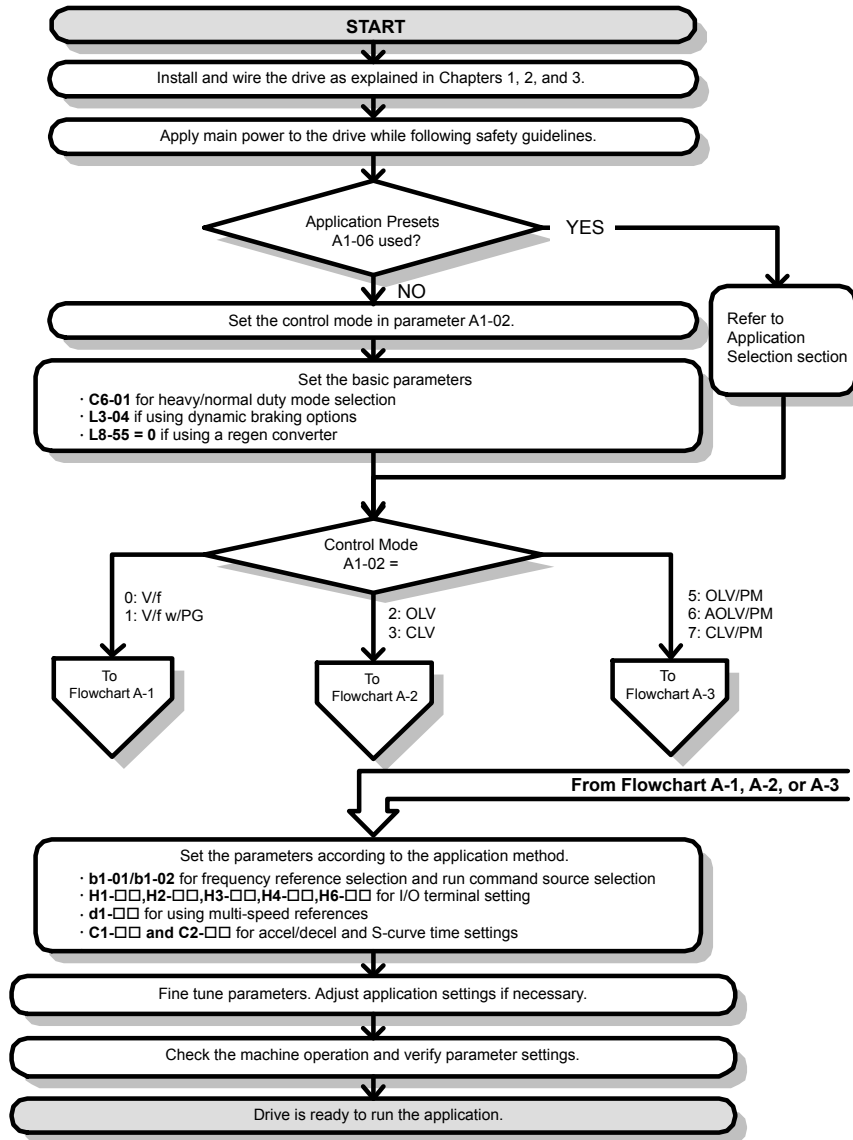
Figure 4.4 Basic Start-Up

Note: 1. Execute Stationary Auto-Tuning for Line-to-Line Resistance if the drive has been Auto-Tuned and then moved to a different location where the motor cable length exceeds 50 m.
2. Perform Auto-Tuning again after installing an AC reactor or other such components to the output side of the drive.

◆ Subchart A-1: Simple Motor Setup Using V/f Control

Flowchart A1 in *Figure 4.5* describes simple motor setup for V/f Control, with or without PG feedback. V/f Control is suited for more basic applications such as fans and pumps. This procedure illustrates Energy Savings and Speed Estimation Speed Search.
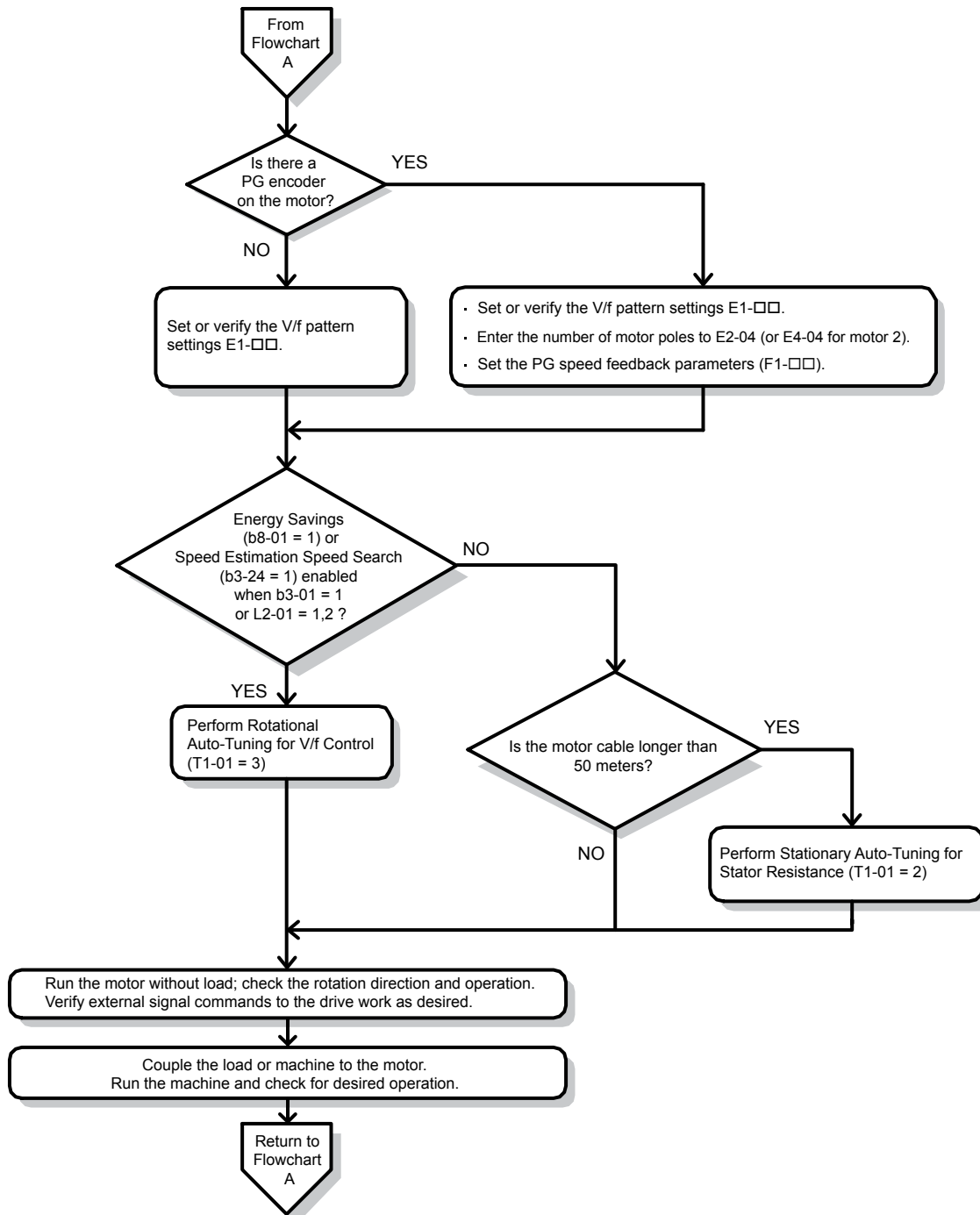
Figure 4.5 Simple Motor Setup with Energy Savings or Speed Search

◆ Subchart A-2: High Performance Operation Using OLV or CLV

Flowchart A2 in *Figure 4.6* describes the setup procedure for high-performance with Open Loop Vector Control or Closed Loop Vector Control, which is appropriate for applications requiring high starting torque and torque limits.

Note: Although the drive sets parameters for the PG encoder during Auto-Tuning, sometimes the direction of the motor and direction of the PG get reversed. Use parameter F1-05 to switch the direction of the PG so that it matches the motor direction.
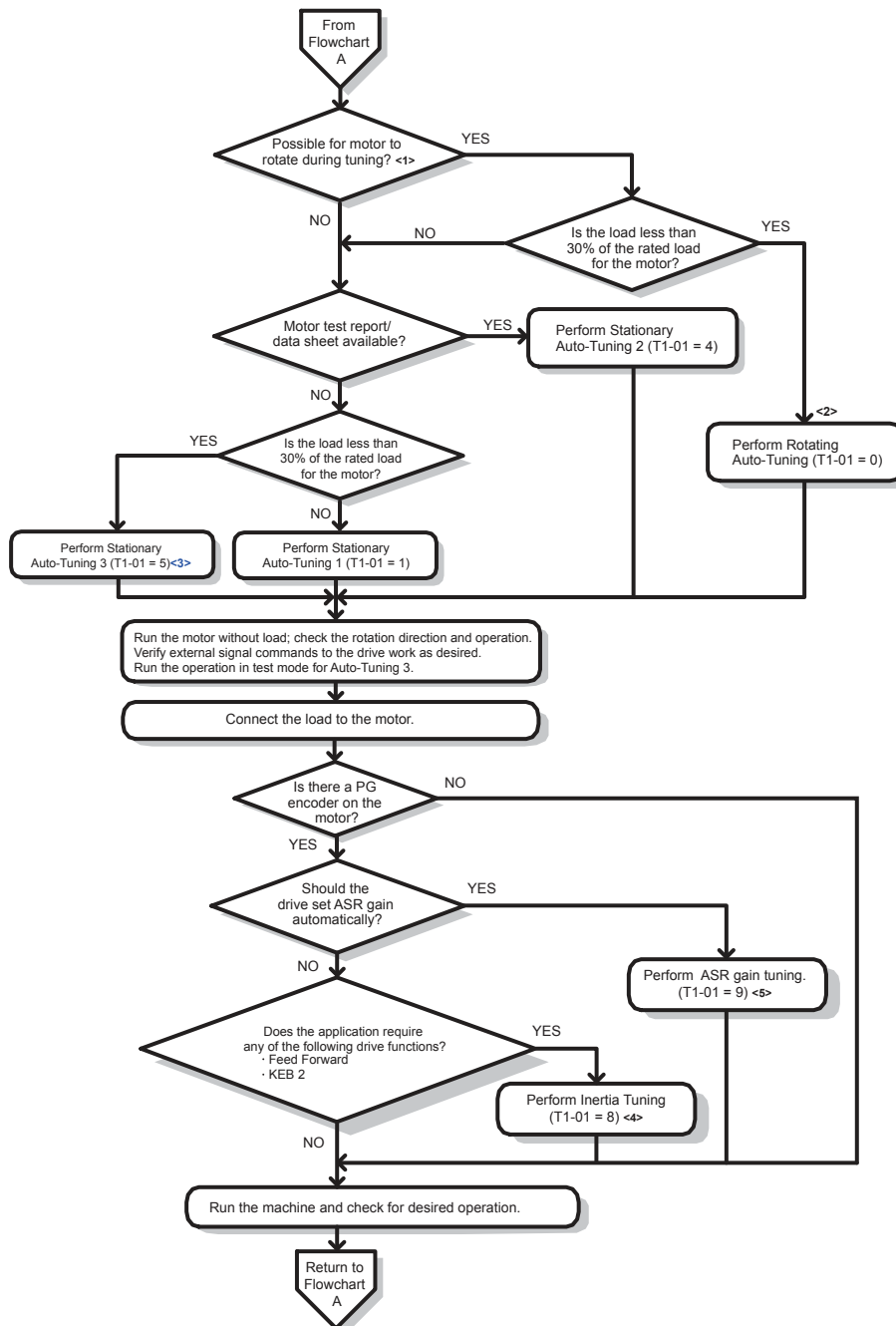
Figure 4.6 Flowchart A2: High Performance Operation Using OLV or CLV

<1>   Decouple the load from the motor to properly perform Rotational Auto-Tuning.

<2>   Rotational Auto-Tuning can still be performed if the load is 30% or less, though Stationary Auto-Tuning may yield better control performance.

<3>   Make sure the motor and load can run freely (i.e., if a brake is mounted, make sure it is released).

<4>   ASR Gain Tuning automatically performs Inertia Tuning and sets parameters related to Feed Forward and the KEB Ride-Thru function.

◆ Subchart A-3: Operation with Permanent Magnet Motors

Flowchart A3 in *Figure 4.7* describes the setup procedure for running a PM motor in Open Loop Vector Control. PM motors can be used for more energy-efficient operation in reduced or variable torque applications.

Note:
1. Although the drive sets parameters for the PG encoder during Auto-Tuning, sometimes the direction of the motor and direction of the PG get reversed. Use parameter F1-05 to switch the direction of the PG so that it matches the motor direction.
2. Realign the Z Pulse if the PG encoder is replaced. Set T2-01 to 3 to recalibrate the drive for the new encoder.

4.3 Start-Up Flowcharts
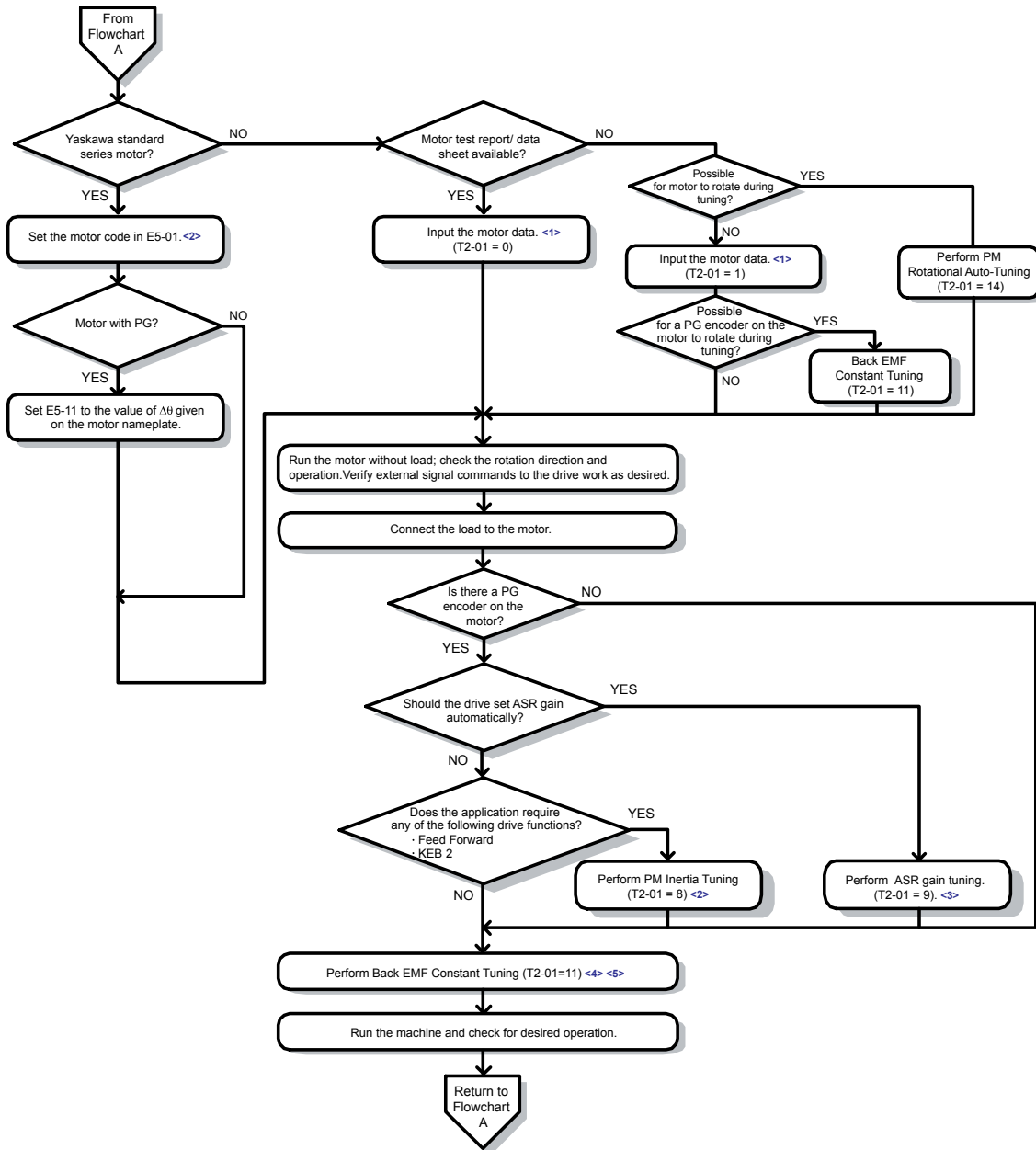
Figure 4.7 Operation with Permanent Magnet Motors

<1> Enter the motor code to E5-01 when using a Yaskawa PM motor (SMRA Series, SSR1 Series, and SST4 Series). If using a motor from another manufacturer, enter "FFFF".

<2> Set E5-01 to the motor code to eliminate the need to perform tuning. Refer to Parameters Changed by Motor Code Selection (for PM Motors) in the drive Technical Manual for details.

<3> Make sure the motor and load can run freely (i.e., if a brake is mounted, make sure it is released).

<4> ASR Gain Tuning automatically performs Inertia Tuning and sets parameters related to Feed Forward and the KEB Ride-Thru function.

<5> Back EMF Constant Tuning automatically measures motor induced voltage and then sets E5-09 when the motor report or data sheets are not available.

<6> This type of Auto-Tuning is available in drive software versions PRG: 1015 and later.

4.4 Powering Up the Drive

◆ Powering Up the Drive and Operation Status Display

■ Powering Up the Drive
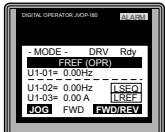
Review the following checklist before turning the power on.

Item to Check	Description
Power supply voltage	200 V class: Three-phase 200 to 240 Vac 50/60 Hz 400 V class: Three-phase 380 to 480 Vac 50/60 Hz 600 V class: Three-phase 500 to 600 Vac 50/60 Hz
	Properly wire the power supply input terminals (R/L1, S/L2, T/L3).
	Check for proper grounding of drive and motor.
Drive output terminals and motor terminals	Properly wire drive output terminals U/T1, V/T2, and W/T3 with motor terminals U, V, and W.
Control circuit terminals	Check control circuit terminal connections.
Drive control terminal status	Open all control circuit terminals (off).
Status of the load and connected machinery	Decouple the motor from the load.

<1> Confirm the following when connecting models CIMR-A☐4A0930 and 4A1200: Remove the jumpers on R1/L11, S1/L21, and T1/L31 when using 12-phase rectification. When operating without 12-phase rectification, properly wire terminals R1/L11, S1/L21, and T1/L31 in addition to terminals R/L1, S/L2, and T/L3.

■ Status Display

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

Status	Name	Description
Normal Operation	DIGITAL OPERATOR JVOP-180 [ALARM] - MODE - DRV Rdy FREF (OPR) U1-01= 0.00Hz U1-02= 0.00Hz [LSEQ] U1-03= 0.00 A [LREF] [JOG] FWD [FWD/REV]	The data display area displays the frequency reference. [DRV] is lit.
Fault	DIGITAL OPERATOR JVOP-180 [ALM] - MODE - DRV EF3 Ext Fault S3 FWD [RESET] External fault (example)	Data displayed varies by the type of fault. *Refer to Fault Displays, Causes, and Possible Solutions on page 179* for more information. [ALM] and [DRV] are lit.

4.5   Application Selection

Several Application Presets are available to facilitate drive setup for commonly used applications. Selecting one of these Application Presets automatically assigns functions to the input and output terminals and sets a predefined group of parameters to values appropriate for the selected application.

In addition, the parameters most likely to be changed are assigned to the group of User Parameters, A2-01 through A2-16. User Parameters are part of the Setup Group, which provides quicker access by eliminating the need to scroll through multiple menus.

An Application Preset can either be selected from the Application Selection menu in the Setup Group or in parameter A1-06. The following presets can be selected:

Note:

1. Application Presets can only be selected if all drive parameters are at their original default settings. It may be necessary to initialize the drive by setting A1-03 to "2220" or "3330" prior to selecting an Application Preset.

2. Do not set any value outside the allowable range for A1-06 (Application Presets). If an out-of-range value is set, "APPL" will be displayed flashing in the Setup group and the up and down arrow keys cannot be used. If this happens, press the ESC key to return to the Setup group. It will then be possible to switch to another mode using the up and down arrow keys. Setting values to A1-06 out of the setting range will not affect drive operation.

WARNING! *Sudden Movement Hazard. Confirm the drive I/O signals and external sequence before performing a test run. Setting parameter A1-06 may automatically change the I/O terminal function from the default setting. Failure to comply may result in death or serious injury.*

No.	Parameter Name	Setting Range	Default
A1-06	Application Preset	0: General-purpose 1: Water supply pump 2: Conveyor 3: Exhaust fan 4: HVAC fan 5: Air compressor	0

4.6 Basic Drive Setup Adjustments

This section explains the basic settings required for initial drive operation. Checking these basic parameter settings will help to ensure a successful drive start-up. ***Refer to Parameter List on page 249*** for a complete listing of drive parameters if more information is required for parameters not listed in this section.

◼ A1-02: Control Method Selection

Selects the Control Method (also referred to as the control mode) that the drive uses to operate the motor. Parameter A1-02 determines the control mode for motor 1 when the drive is set up to run two motors.

Note: When changing control modes, all parameter settings depending upon the setting of A1-02 will be reset to the default.

No.	Parameter Name	Setting Range	Default
A1-02	Control Method Selection	0, 1, 2, 3, 5, 6, 7	2

Control Modes for Induction Motors (IM)

Setting 0: V/f Control for Induction Motors

Use this mode for simple speed control and for multiple motor applications with low demands to dynamic response or speed accuracy. This control mode is also used when the motor parameters are unknown and Auto-Tuning cannot be performed. The speed control range is 1:40.

Setting 1: V/f Control with PG Speed Feedback

Use this mode for general-purpose applications that require high speed accuracy but do not require high dynamic response. This control mode is also used when the motor parameters are unknown and Auto-Tuning cannot be performed. The speed control range is 1:40.

Setting 2: Open Loop Vector Control

Use this mode for general, variable-speed applications with a speed control range of 1:200 that require precise speed control, quick torque response, and high torque at low speed without using a speed feedback signal from the motor.

Setting 3: Closed Loop Vector Control

Use this mode for general, variable-speed applications that require precise speed control down to zero speed, quick torque response or precise torque control, and a speed feedback signal from the motor. The speed control range is up to 1:1500.

Control Modes for Permanent Magnet Motors (SPM or IPM)

Setting 5: Open Loop Vector Control for PM

Use this mode for general, variable-speed applications with low demands on dynamic response or speed accuracy. The drive can control an SPM or IPM motor with a speed range of 1:20 in this control mode.

Setting 6: Advanced Open Loop Vector Control for PM

Use this mode for general, variable speed applications that require precise speed control and torque limit. Set High Frequency Injection parameter n8-57 to 1 to achieve a speed control range as high as 1:100. In this case, perform High Frequency Injection Parameter Tuning after setting the motor parameters. High Frequency Injection cannot be used with an SPM motor.

Setting 7: Closed Loop Vector Control for PM

Use this mode for high-precision control of a PM motor in constant torque or variable torque applications. The speed control range reaches 1:1500. A speed feedback signal is required.

◼ A1-03: Initialize Parameters

Resets parameters to 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, 3330, 5550	0

Setting 0: No Initialize

Setting 1110: User Initialize

Resets parameters to the 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 parameters except parameters listed in *Table 4.5* to default settings with digital inputs S1 and S2 configured as Forward run and Reverse run, respectively.

Setting 3330: 3-Wire Initialization

Resets parameters except parameters listed in *Table 4.5* to default settings with digital inputs S1, S2, and S5 configured as Run, Stop, and Forward/Reverse 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 A1-03 to 5550 to use the parameter settings saved to the terminal block memory.

Notes on Parameter Initialization

The parameters shown in *Table 4.5* 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 4.5 Parameters Not Changed by Drive Initialization

No.	Parameter Name
A1-00	Language Selection
A1-02	Control Method Selection
E1-03	V/f Pattern Selection
E5-01	Motor Code Selection (for PM Motors)
E5-02	Motor Rated Power (for PM Motors)
E5-03	Motor Rated Current (for PM Motors)
E5-04	Number of Motor Poles (for PM Motors)
E5-05	Motor Stator Resistance (r1) (for PM Motors)
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)
E5-07	Motor d-Axis Inductance (Lq) (for PM Motors)
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)
F6-□□/F7-□□	Communication Parameters (Initialized when F6-08 = 1)
L8-35	Installation Method Selection
o2-04	Drive Model Selection

◼ b1-01: Frequency Reference Selection 1

Selects the frequency reference source 1 for the REMOTE mode.

Note: **1.** If a Run command is input to the drive but the frequency reference entered is 0 or below the minimum frequency, the RUN indicator LED on the digital operator will light and the STOP indicator will flash. However, the RUN indicator LED will light in zero speed control when A1-02 is set to 3, 6, or 7.

2. Press the LO/RE key to set the drive to LOCAL and use the operator keypad to enter the frequency reference.

No.	Parameter Name	Setting Range	Default
b1-01	Frequency Reference Selection 1	0 to 4	1

Setting 0: Operator keypad

Input the frequency reference using the operator keypad with this setting.

Setting 1: Terminals (analog input terminals)

Using this setting, an analog frequency reference can be entered as a voltage or current signal from terminals A1, A2, or A3.

Voltage Input

Voltage input can be used at any of the three analog input terminals. Make the settings as described in *Table 4.6* for the input used.

Table 4.6 Analog Input Settings for Frequency Reference Using Voltage Signals

Terminal	Signal Level	Parameter Settings				Notes
		Signal Level Selection	Function Selection	Gain	Bias	
A1	0 to 10 Vdc	H3-01 = 0	H3-02 = 0 (Frequency Reference Bias)	H3-03	H3-04	–
	-10 to +10 Vdc	H3-01 = 1				
A2	0 to 10 Vdc	H3-09 = 0	H3-10 = 0 (Frequency Reference Bias)	H3-11	H3-12	Set DIP switch S1 on the terminal board to "V" for voltage input.
	-10 to +10 Vdc	H3-09 = 1				
A3	0 to 10 Vdc	H3-05 = 0	H3-06 = 0 (Frequency Reference Bias)	H3-07	H3-08	Set DIP switch S4 on the terminal board to "AI".
	-10 to +10 Vdc	H3-05 = 1				
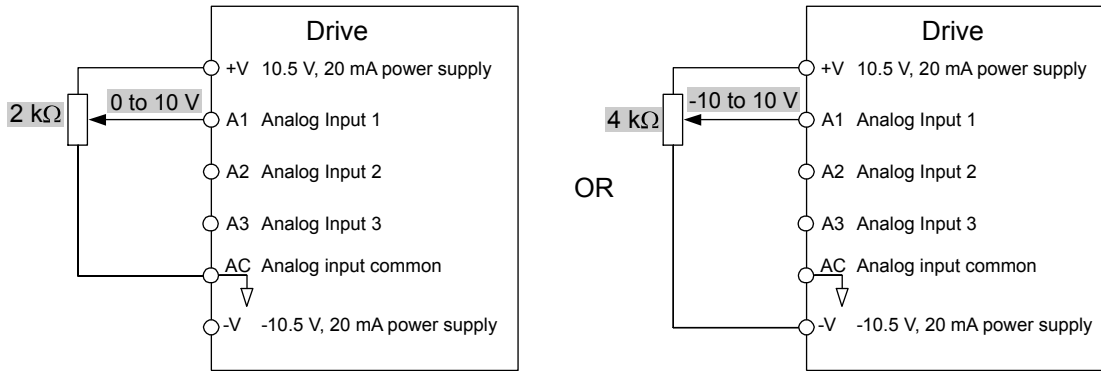
Figure 4.8 Setting the Frequency Reference as a Voltage Signal at Terminal A1

Use the wiring example shown in the figure above for any other analog input terminals. When using input A2 make sure DIP switch S1 is set for voltage input.

Current Input

Input terminal A2 can accept a current input signal. Refer to *Table 4.7* to set terminal A2 for current input.

Table 4.7 Analog Input Settings for Frequency Reference Using a Current Signal

Terminal	Signal Level	Parameter Settings				Notes
		Signal Level Selection	Function Selection	Gain	Bias	
A2	4 to 20 mA	H3-09 = 2	H3-10 = 0 (Frequency Bias)	H3-11	H3-12	Make sure to set DIP switch S1 on the terminal board to "I" for current input.
	0 to 20 mA	H3-09 = 3				
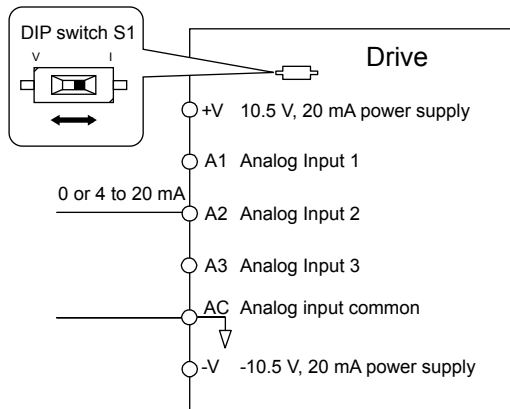
Figure 4.9 Setting the Frequency Reference as a Current Signal to Terminal A2

Switching between Main/Auxiliary Frequency References

The frequency reference input can be switched between the analog terminals A1, A2, and A3 using multi-speed inputs. *Refer to Multi-Step Speed Selection on page 146* for details on using this function.

Setting 2: MEMOBUS/Modbus Communications

This setting requires entering the frequency reference via the RS-485//RS-422 serial communications port (control terminals R+, R-, S+, S-).

Setting 3: Option card

This setting requires entering the frequency reference via an option board plugged into connector CN5-A on the drive control board. Consult the option board manual for instructions on integrating the drive with the communication system.

Note: If the frequency reference source is set for Option PCB (b1-01 = 3), but an option board is not installed, an oPE05 operation error will be displayed on the digital operator and the drive will not run.

Setting 4: Pulse Train Input

This setting requires a pulse train signal to terminal RP to provide the frequency reference. Follow the directions below to verify that the pulse signal is working properly.

Verifying the Pulse Train is Working Properly

• Set b1-01 to 4 and set H6-01 to 0.

• Set the H6-02 to the pulse train frequency value that equals 100% of the frequency reference.

• Enter a pulse train signal to terminal RP and check for the correct frequency reference on the display.

■ b1-02: Run Command Selection 1

Determines the Run command source 1 in the REMOTE mode.

No.	Parameter Name	Setting Range	Default
b1-02	Run Command Selection 1	0 to 3	1

Setting 0: Operator

This setting will illuminate the LO/RE light to indicate that the Run command source is assigned to the digital operator. Use the digital operator RUN and STOP keys to start and stop operation.

Setting 1: Control Circuit Terminal

This setting requires entering the Run command via the digital input terminals using one of following sequences:

• 2-Wire sequence 1:

Setting A1-03 to 2220 initializes the drive and presets terminals S1 and S2 to FWD/Stop and REV/Stop. These are the default settings of the drive.

• 2-Wire sequence 2:

Two inputs (Start/Stop-FWD/REV).

• 3-Wire sequence:

Setting A1-03 to 3330 initializes the drive and presets terminals S1, S2, and S5 to Start, Stop, and FWD/REV.

Setting 2: MEMOBUS/Modbus Communications

This setting requires entering the Run command via serial communications by connecting the RS-485/RS-422 serial communication cable to control terminals R+, R-, S+, and S- on the removable terminal block.

Setting 3: Option Card

This setting requires entering the Run command via the communication option board by plugging a communication option board into the CN5-A port on the control PCB. Refer to the option board manual for instructions on integrating the drive into the communication system.

Note: If b1-02 is set to 3, but an option board is not installed in CN5-A, an oPE05 operation error will be displayed on the digital operator and the drive will not run.

■ b1-03: Stopping Method Selection

Selects how the drive stops the motor when the Run command is removed or when a Stop command is entered.

No.	Parameter Name	Setting Range	Default
b1-03	Stopping Method Selection	0 to 3 [1]	0

<1>   The setting range is 0, 1, or 3 in CLV, OLV/PM, AOLV/PM, and CLV/PM.

Setting 0: Ramp to Stop

When the Run command is removed, the drive will decelerate the motor to stop. The deceleration rate is determined by the active deceleration time. The default deceleration time is set to parameter C1-02.

When the output frequency falls below the level set in parameter b2-01, the drive will start DC injection, Zero Speed Control, or Short Circuit Braking, depending on the selected control mode. *Refer to b2-01: DC Injection Braking Start Frequency on page 141* for details.

V/f, V/f w/PG and OLV (A1-02 = 0, 1, 2)

For these control modes, parameter b2-01 sets the starting frequency for DC Injection Braking at Stop. When the output frequency falls below the setting of b2-01, DC Injection Braking is enabled for the time set in parameter b2-04.
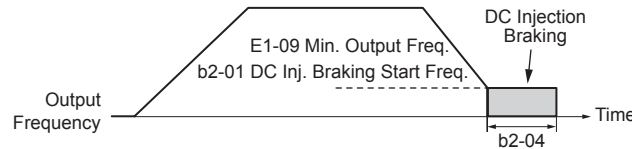
Figure 4.10 DC Injection Braking at Stop for V/f, V/f w/PG, and OLV

Note: If b2-01 is set to a smaller value than E1-09 (Minimum Frequency), then DC Injection Braking will begin when the frequency falls to the E1-09 value.

OLV/PM and AOLV/PM (A1-02 = 5, 6)

For these control modes, parameter b2-01 sets the starting frequency for Short-Circuit Braking at Stop. When the output frequency falls below the setting of b2-01, Short-Circuit Braking is enabled for the time set in parameter b2-13.

If DC Injection Braking Time is enabled at stop, then DC Injection Braking is performed for the time set in b2-04 after Short-Circuit Braking is complete.
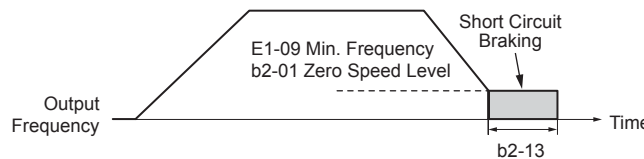
Figure 4.11 Short-Circuit Braking at Stop in OLV/PM and AOLV/PM

Note: If b2-01 is set to a smaller value than E1-09 (Minimum Frequency), then DC Injection Braking will begin when the frequency falls to the E1-09 value.
The drive will not perform short-circuit braking when b2-01 = E1-09 = 0 Hz.

CLV and CLV/PM (A1-02 = 3, 7)

For these control modes, parameter b2-01 sets the starting frequency for Zero Speed Control (not position lock) at Stop. When the output frequency falls below the setting of b2-01, Zero Speed Control is enabled for the time set in parameter b2-04.
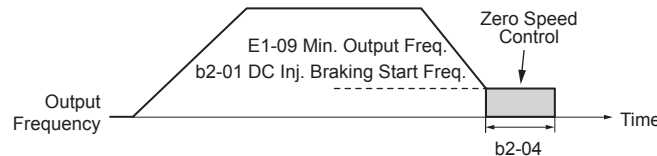
Figure 4.12 Zero Speed Control at Stop in CLV and CLV/PM

Note: If b2-01 is set to lower than E1-09 (Minimum Frequency), then Zero Speed Control begins at the frequency set to E1-09.

Setting 1: Coast to Stop

When the Run command is removed, the drive will shut off its output and the motor will coast (uncontrolled deceleration) to stop. The stopping time is determined by the inertia and the friction in the driven system.

Start-Up Programming & Operation

4
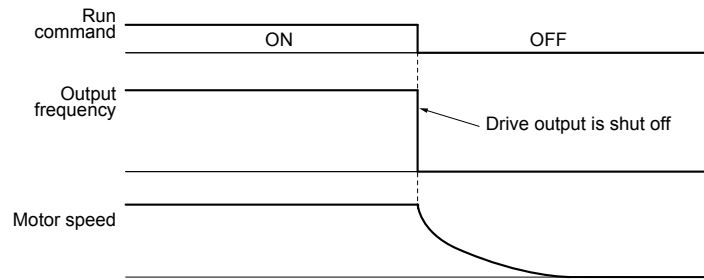
Figure 4.13 Coast to Stop

Note: After a stop is initiated, any subsequent Run command entered will be ignored until the minimum baseblock time (L2-03) has expired. Do not enter Run command until it has come to a complete stop. Use DC Injection at Start (*Refer to b1-02: Run Command Selection 1 on page 138*) or Speed Search (*Refer to b3: Speed Search on page 253*) to restart the motor before it has completely stopped.

Setting 2: DC Injection Braking to Stop

When the Run command is removed, the drive will enter baseblock (turn off its output) for the minimum baseblock time (L2-03). When the minimum baseblock time has expired, the drive will inject the amount DC Injection Braking is set in parameter b2-02 into the motor windings to brake the motor. The stopping time in DC Injection Braking to Stop is significantly faster compared to Coast to Stop.

Note: This function is not available in CLV or in control modes for PM motors (A1-02 = 5, 6, 7).
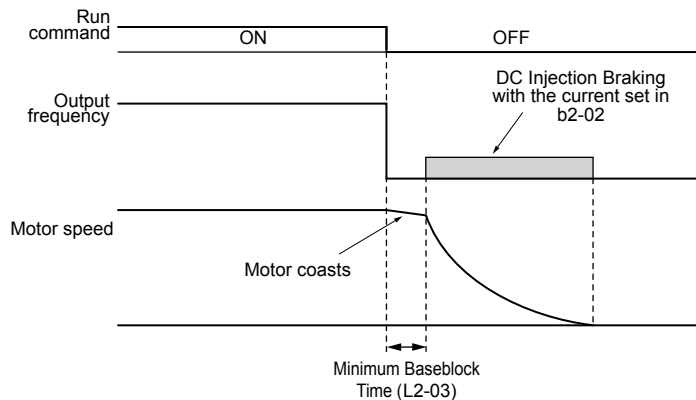
Figure 4.14 DC Injection Braking to Stop

DC Injection Braking time is determined by the value set to b2-04 and the output frequency at the time the Run command is removed. It can be calculated by:

$$\text{DC Injection brake time} = \frac{(\text{b2-04}) \times 10 \times \text{Output frequency}}{\text{Maximum output frequency (E1-04)}}$$
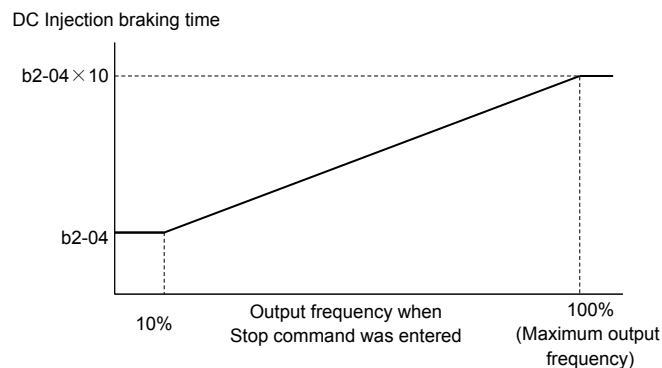
Figure 4.15 DC Injection Braking Time Depending on Output Frequency

Note: If an overcurrent (oC) fault occurs during DC Injection Braking to Stop, lengthen the minimum baseblock time (L2-03) until the fault no longer occurs.

Setting 3: Coast to Stop with Timer

When the Run command is removed, the drive will turn off its output and the motor will coast to stop. The drive will not start if a Run command is input before the time t (C1-02) has expired. Cycle the Run command that was activated during time t after t has expired to start the drive.
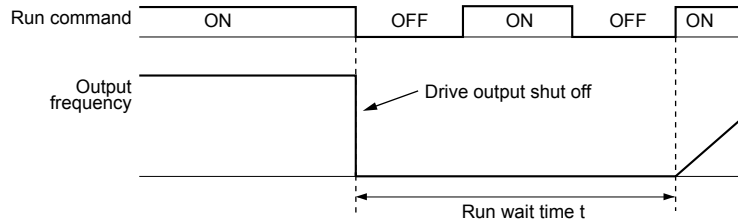
Figure 4.16 Coast to Stop with Timer

The wait time t is determined by the output frequency when the Run command is removed and by the active deceleration time.
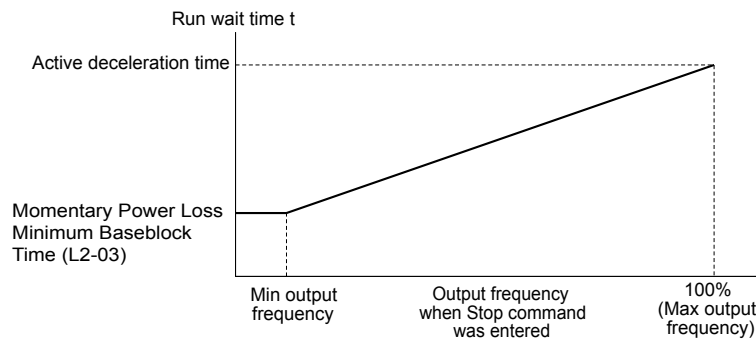
Figure 4.17 Run Wait Time Depending on Output Frequency

■ b2-01: DC Injection Braking Start Frequency

Active when "Ramp to Stop" is selected as the stopping method (b1-03 = 0).

No.	Name	Setting Range	Default
b2-01	DC Injection Braking Start Frequency	0.0 to 10.0 Hz	Determined by A1-02

The function triggered by parameter b2-01 depends on the control mode that has been selected.

V/f, V/f w/PG and OLV (A1-02 = 0, 1, 2)

For these control modes, parameter b2-01 sets the starting frequency for DC Injection Braking at Stop. When the output frequency falls below the setting of b2-01, DC Injection Braking is enabled for the time set in parameter b2-04.

Figure 4.18 DC Injection Braking at Stop for V/f, V/f w/PG, and OLV

Note: If b2-01 is set to a smaller value than E1-09 (Minimum Frequency), then DC Injection Braking will begin when the frequency falls to the E1-09 value.

OLV/PM and AOLV/PM (A1-02 = 5, 6)

For these control modes, parameter b2-01 sets the starting frequency for Short-Circuit Braking at Stop. When the output frequency falls below the setting of b2-01, Short-Circuit Braking is enabled for the time set in parameter b2-13.

If DC Injection Braking Time is enabled at stop, then DC Injection Braking is performed for the time set in b2-04 after Short-Circuit Braking is complete.

Figure 4.19 Short-Circuit Braking at Stop in OLV/PM and AOLV/PM

Note: If b2-01 is set to a smaller value than E1-09 (Minimum Frequency), then DC Injection Braking will begin when the frequency falls to the E1-09 value. The drive will not perform short-circuit braking when b2-01 = E1-09 = 0 Hz.

CLV and CLV/PM (A1-02 = 3, 7)

For these control modes, parameter b2-01 sets the starting frequency for Zero Speed Control (not position lock) at Stop. When the output frequency falls below the setting of b2-01, Zero Speed Control is enabled for the time set in parameter b2-04.

Figure 4.20 Zero Speed Control at Stop in CLV and CLV/PM

Note: If b2-01 is set to lower than E1-09 (Minimum Frequency), then Zero Speed Control begins at the frequency set to E1-09.

■ b3-01: Speed Search Selection at Start

Determines if Speed Search is automatically performed when a Run command is issued.

No.	Parameter Name	Setting Range	Default
b3-01	Speed Search Selection at Start	0, 1	Determined by A1-02

Setting 0: Disabled

This setting starts operating the drive at the minimum output frequency when the Run command is entered. If external Speed Search 1 or 2 is already enabled by a digital input, the drive will start operating with Speed Search.

Setting 1: Enabled

This setting performs Speed Search when the Run command is entered. The drive begins running the motor after Speed Search is complete.

■ C1-01 to C1-08: Accel, Decel Times 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 time parameters always set the time to accelerate from 0 Hz to the maximum output frequency (E1-04). Deceleration time parameters always set the time to decelerate from maximum output frequency to 0 Hz. C1-01 and C1-02 are the default active accel/decel settings.

No.	Parameter Name	Setting Range	Default
C1-01	Acceleration Time 1		
C1-02	Deceleration Time 1		
C1-03	Acceleration Time 2		
C1-04	Deceleration Time 2		
C1-05	Acceleration Time 3 (Motor 2 Accel Time 1)	0.0 to 6000.0 s [1]	10.0 s
C1-06	Deceleration Time 3 (Motor 2 Decel Time 1)		
C1-07	Acceleration Time 4 (Motor 2 Accel Time 2)		
C1-08	Deceleration Time 4 (Motor 2 Decel Time 2)		

[1] The setting range for the acceleration and deceleration times is determined by the accel/decel time setting units in C1-10. For example, if the time is set in units of 0.01 s (C1-10 = 0), the setting range becomes 0.00 to 600.00 s.

Switching Acceleration Times by Digital Input

Accel/decel times 1 are active by default if no input is set. Activate accel/decel times 2, 3, and 4 by digital inputs (H1-□□ = 7 and 1A) as explained in *Table 4.8*.

Table 4.8 Accel/Decel Time Selection by Digital Input

Accel/Decel Time Sel. 1 H1-□□ = 7	Accel/Decel Time Sel. 2 H1-□□ = 1A	Active Times	
		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 4.21 shows an operation example for changing accel/decel. times. The example below requires that the stopping method be set for "Ramp to stop" (b1-03 = 0).
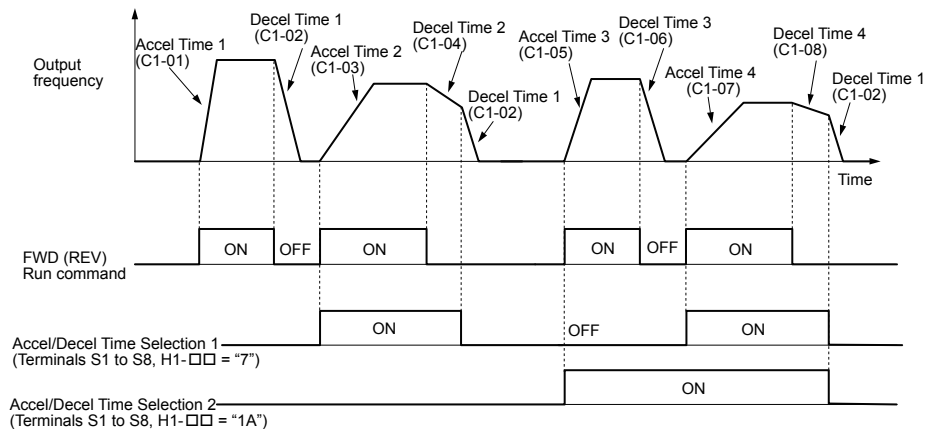
Figure 4.21 Timing Diagram of Accel/Decel Time Change

Switching Acceleration and Deceleration Times by Motor Selection

When switching between motor 1 and 2 using a digital input (H1-□□= 16), parameters C1-01 to C1-04 become accel/decel times 1 and 2 for motor 1, while C1-05 to C1-08 become accel/decel times 1 and 2 for motor 2. Accel/decel times 1 and 2 can be switched for each motor using a digital inputs set to H1-□□ = 7 like shown in *Table 4.9*.

Note:
1. The motor 2 selection function cannot be used with PM motors.
2. Attempting to use the digital input setting "Accel/Decel time 2 selection" (H1-□□ = 1A) together with motor 1/2 switching triggers an oPE03 error, indicating contradictory multifunction input settings.

Table 4.9 Motor Switching and Accel/Decel Time Combinations

Accel/Decel Time 1 (H1-□□ = 7)	Motor 1 Selected (Terminal set to H1-□□ = 16 OFF)		Motor 2 Selected (Terminal set to H1-□□ = 16 ON)	
	Accel	Decel	Accel	Decel
Open	C1-01	C1-02	C1-05	C1-06
Closed	C1-03	C1-04	C1-07	C1-08

Switching Accel/Decel Times by a Frequency Level

The drive can switch between different acceleration and deceleration times automatically. The drive will switch from accel/decel time 4 in C1-07 and C1-08 to the default accel/decel time in C1-01 and C1-02 (C1-05 and C1-06 for motor 2) when the output frequency exceeds the frequency level set to parameter C1-11. When the frequency falls below this level, the accel/decel times are switched back. *Figure 4.22* shows an operation example.

Note: Acceleration and deceleration times selected by digital inputs have priority over the automatic switching by the frequency level set to C1-11. For example, if accel/decel time 2 is selected, the drive will use only accel/decel time 2; it will not switch from accel/decel time 4 to the selected one.

$$C1-03 = \frac{(\text{accel time from 0 Hz to C1-11}) \times (E1-04)}{C1-11}$$

$$C1-01 = \frac{(\text{accel time between C1-11 and E1-04}) \times (E1-04)}{(E1-04 - C1-11)}$$

$$C1-02 = \frac{(\text{decel time between E1-04 and C1-11}) \times (E1-04)}{(E1-04 - C1-11)}$$

$$C1-04 = \frac{(\text{decel time from C1-11 to 0 Hz}) \times (E1-04)}{C1-11}$$

C1-11
Accel/Decel Time
Switch Frequency

C1-03 setting   C1-01 setting   C1-02 setting   C1-04 setting

When the output frequency ≥ C1-11, drive uses Accel/Decel Time 1 (C1-01, -02)
When the output frequency < C1-11, drive uses Accel/Decel Time 2 (C1-03, -04)

Figure 4.22 Accel/Decel Time Switching Frequency

■ C6-01: Drive Duty Mode Selection

The drive has two different duty modes from which to select based on the load characteristics. The drive rated current, overload capacity, and maximum output frequency will change depending upon the duty mode selection. Use parameter C6-01 to select Heavy Duty (HD) or Normal Duty (ND) for the application. *Refer to Heavy Duty and Normal Duty Ratings on page 234* for details about the rated current.

No.	Parameter Name	Setting Range	Default
C6-01	Duty Mode Selection	0, 1	1 (ND)

Table 4.10 Differences between Heavy Duty and Normal Duty

Characteristics	Heavy Duty Rating (HD)	Normal Duty Rating (ND)
C6-01	0	1
Performance	150 % Overload / 100 % Rated Load (Motor Speed 0 to 100 %)	120 % Overload / 100 % Rated Load (Motor Speed 0 to 100 %)
Application	Use Heavy Duty Rating for applications requiring a high overload tolerance with constant load torque, such as extruders and conveyors.	Use Normal Duty Rating for applications in which the torque requirements drop along with the speed, such as fans and pumps where a high overload tolerance is not required.
Overload capability (oL2)	150% of drive rated Heavy Duty current for 60 s	120% of drive rated Normal Duty current for 60 s
Stall Prevention during Acceleration (L3-02)	150%	120%
Stall Prevention during Run (L3-06)	150%	120%
Default Carrier Frequency	2 kHz	2 kHz Swing PWM

Note: Changing the Duty Mode selection automatically changes the maximum size motor that the drive can run, sets the E2-□□ parameters to appropriate values (E4-□□ for motor 2), and recalculates parameter settings determined by motor capacity (e.g., b8-04, L2-03, n5-02, L3-24, C5-17, and C5-37).

◼ C6-02: Carrier Frequency Selection

Sets the switching frequency of the drive output transistors. Changes to the switching frequency lower audible noise and reduce leakage current.

Note:
1. Increasing the carrier frequency above the default value automatically lowers the drive current rating.
2. When using a PM motor, the default carrier frequency is 5.0 kHz. The default is 2 kHz when the drive is set for Heavy Duty performance, and "Swing PWM1" when set for Normal Duty performance.

No.	Parameter Name	Setting Range	Default
C6-02	Carrier Frequency Selection	Determined by A1-02 and o2-04	Determined by A1-02, o2-04. Reset when C6-01 is changed.

Settings:

C6-02	Carrier Frequency	C6-02	Carrier Frequency	C6-02	Carrier Frequency
1	2.0 kHz	5	12.5 kHz (10.0 kHz)	9	Swing PWM 3
2	5.0 kHz (4.0 kHz)	6	15.0 kHz (12.0 kHz)	A	Swing PWM 4
3	8.0 kHz (6.0 kHz)	7	Swing PWM 1	F	User defined (C6-03 to C6-05)
4	10.0 kHz (8.0 kHz)	8	Swing PWM 2		

Note:
1. Swing PWM uses a carrier frequency of 2.0 kHz as a base, then applies a special PWM pattern to reduce the audible noise.
2. The value in parenthesis indicates the carrier frequency for AOLV/PM.

Guidelines for Carrier Frequency Parameter Setup

Symptom	Remedy
Speed and torque are unstable at low speeds	Lower the carrier frequency.
Noise from the drive affects peripheral devices	
Excessive leakage current from the drive	
Wiring between the drive and motor is too long [1]	
Audible motor noise is too loud	Increase the carrier frequency or use Swing PWM. [2]

<1> The carrier frequency may need to be lowered if the motor cable is too long. Refer to *Table 4.11*.

<2> The default carrier frequency in ND is Swing PWM (C6-02 = 7), using a 2 kHz base. Increasing the carrier frequency is permissible when the drive is set for Normal Duty, however the drive rated current is reduced when the carrier frequency is increased.

Table 4.11 Wiring Distance and Carrier Frequency

Wiring Distance	Up to 50 m	Up to 100 m	Greater than 100 m
Recommended setting value for C6-02	1 to F (up to 15 kHz)	1 to 2 (up to 5 kHz), 7 (Swing PWM)	1 (up to 2 kHz), 7 (Swing PWM)

Note: The maximum cable length is 100 m when using OLV/PM (A1-02 = 5) or AOLV/PM (A1-02 = 6).

◼ d1-01 to d1-17: Frequency Reference 1 to 16 and Jog Frequency Reference

The drive lets the user switch between up to 17 preset frequency references during run (including the Jog reference) through the digital input terminals. The drive uses the acceleration and deceleration times that have been selected when switching between each frequency reference.

The Jog frequency overrides all other frequency references and must be selected by a separate digital input.

The multi-speed references 1, 2, and 3 can be provided by analog inputs.

No.	Parameter Name	Setting Range	Default
d1-01 to d1-16	Frequency Reference 1 to 16	0.00 to 400.00 Hz [1] [2]	0.00 Hz [2]
d1-17	Jog Frequency Reference	0.00 to 400.00 Hz [1] [2]	6.00 Hz [2]

<1> The upper limit is determined by the maximum output frequency (E1-04) and upper limit for the frequency reference (d2-01).

<2> Setting units are determined by parameter o1-03. The default is "Hz" (o1-03 = 0) in V/f, V/f w/PG, OLV, CLV, and OLV/PM control modes. The default for AOLV/PM and CLV/PM control modes expresses the frequency reference as a percentage (o1-03 = 1).

Start-Up Programming & Operation

4

Multi-Step Speed Selection

To use several speed references for a multi-step speed sequence, set the H1-☐☐ parameters to 3, 4, 5, and 32. To assign the Jog reference to a digital input, set H1-☐☐ to 6.

Notes on using analog inputs as Multi-Speed 1, 2, and 3:

- **Multi-Step Speed 1**

  Set b1-01 to 1 to set terminal A1 analog input to Multi-Step Speed 1.

  Set b1-01 to 0 when setting d1-01, Frequency Reference 1, to Multi-Step Speed 1.

- **Multi-Step Speed 2**

  Set H3-06, Terminal A3 Function Selection, to 2 (Auxiliary Frequency Reference 1) when setting terminal A3 analog input to Multi-Step Speed 2.

  Set H3-06 to F (Through mode) when setting d1-02, Frequency Reference 2, to Multi-Step Speed 2.

- **Multi-Step Speed 3**

  Set H3-10, Terminal A2 Function Selection, to 3 (Auxiliary Frequency Reference 2) when setting terminal A2 analog input to Multi-Step Speed 3.

  Set H3-10 to F (Through mode) when setting d1-03, Frequency Reference 3, to Multi-Step Speed 3.

  Set H3-09 to 0 and set DIP switch S1 on the control circuit terminal board to V (voltage) when inputting 0 to 10 V to terminal A2 analog input.

Select the different speed references as shown in *Table 4.12*. *Figure 4.23* illustrates the multi-step speed selection.

Table 4.12 Multi-Step Speed Reference and Terminal Switch Combinations

Reference	Multi-Step Speed Reference H1-☐☐ = 3	Multi-Step Speed Reference 2 H1-☐☐ = 4	Multi-Step Speed Reference 3 H1-☐☐ = 5	Multi-Step Speed Reference 4 H1-☐☐ = 32	Jog Reference Selection H1-☐☐ = 6
Frequency Reference 1 (set in b1-01)	OFF	OFF	OFF	OFF	OFF
Frequency Reference 2 (d1-02 or input terminal A1, A2, A3)	ON	OFF	OFF	OFF	OFF
Frequency Reference 3 (d1-03 or input terminal A1, A2, A3)	OFF	ON	OFF	OFF	OFF
Frequency Reference 4 (d1-04)	ON	ON	OFF	OFF	OFF
Frequency Reference 5 (d1-05)	OFF	OFF	ON	OFF	OFF
Frequency Reference 6 (d1-06)	ON	OFF	ON	OFF	OFF
Frequency Reference 7 (d1-07)	OFF	ON	ON	OFF	OFF
Frequency Reference 8 (d1-08)	ON	ON	ON	OFF	OFF
Frequency Reference 9 (d1-09)	OFF	OFF	OFF	ON	OFF
Frequency Reference 10 (d1-10)	ON	OFF	OFF	ON	OFF
Frequency Reference 11 (d1-11)	OFF	ON	OFF	ON	OFF
Frequency Reference 12 (d1-12)	ON	ON	OFF	ON	OFF
Frequency Reference 13 (d1-13)	OFF	OFF	ON	ON	OFF
Frequency Reference 14 (d1-14)	ON	OFF	ON	ON	OFF
Frequency Reference 15 (d1-15)	OFF	ON	ON	ON	OFF
Frequency Reference 16 (d1-16)	ON	ON	ON	ON	OFF
Jog Frequency Reference (d1-17) [1]	–	–	–	–	ON

<1>   The Jog frequency overrides all other frequency references.
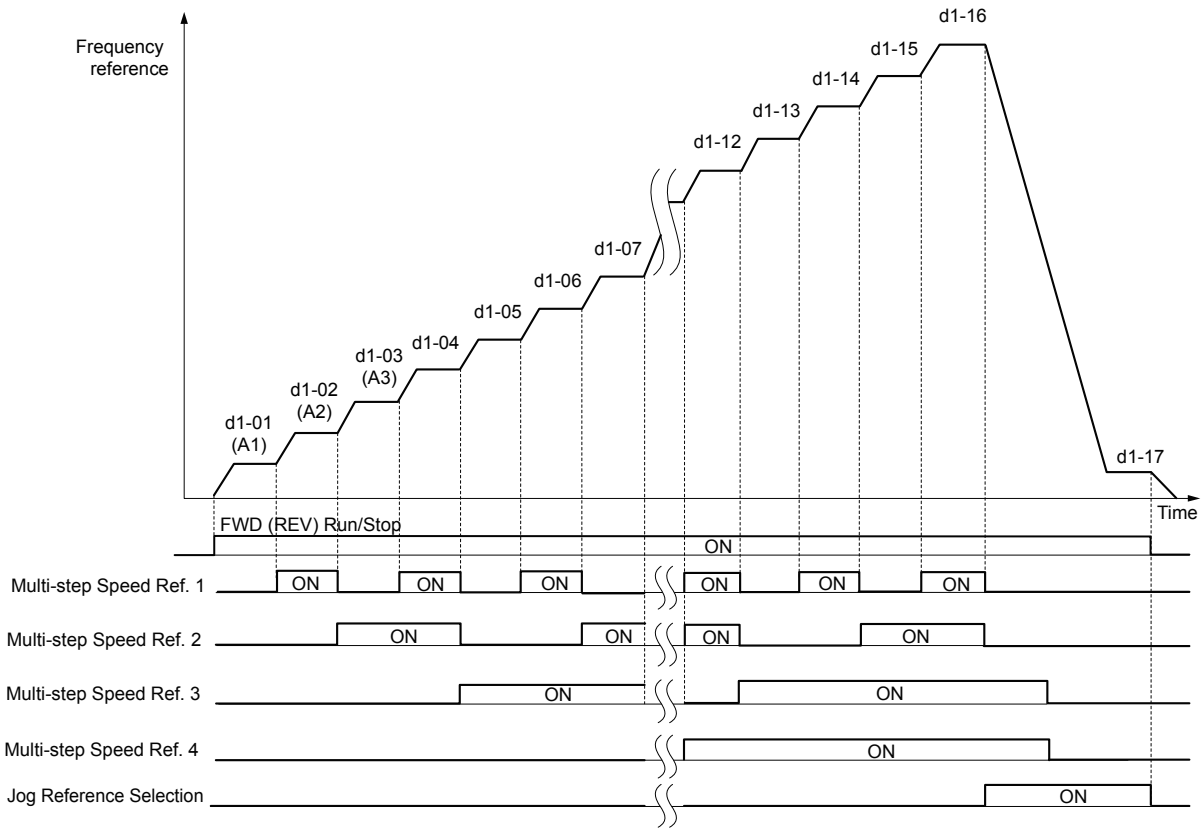
Figure 4.23 Preset Reference Timing Diagram

■ 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. 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	Input Voltage Setting	155 to 255 V [1]	230 V [1]

<1> Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives.

E1-01 Related Values

The input voltage setting determines the overvoltage and undervoltage detection levels, the operation levels of the braking transistor, the KEB function, and the overvoltage suppression function.

Voltage	Setting Value of E1-01	ov Detection Level/Dynamic Braking Transistor Detection Level [1] (rr Detection Level)	(Approximate Values)		
			Uv Detection Level (L2-05)	Desired DC Bus Voltage during KEB (L2-11)	ov Suppression / Stall Prevention Level (L3-17)
200 V Class	All settings	410 V / 394 V	190 V	260 V	375 V
400 V Class	setting ≥ 400 V	820 V / 788 V	380 V	500 V	750 V
	setting < 400 V	820 V / 788 V	350 V	460 V	750 V
600 V Class	All settings	1178 V / 1132 V	475 V	635 V	930 V

<1> The braking transistor operation levels are valid for the drive internal braking transistor. When using a CDBR braking unit, refer to instruction manual TOBPC72060000 or TOBPC72060001.

Start-Up Programming
& Operation

4

■ V/f Pattern Settings (E1-03)

The drive uses a V/f pattern to adjust the output voltage relative to the frequency reference. There are 15 different predefined V/f patterns (setting 0 to E) from which to select, each with varying voltage profiles, saturation levels (frequency at which maximum voltage is reached), and maximum frequencies. Additionally, one custom V/f pattern is available (setting F) that requires the user to create the pattern using parameters E1-04 through E1-10.

■ E1-03: V/f Pattern Selection

Selects the V/f pattern for the drive and motor from 15 predefined patterns or creates a custom V/f pattern.

No.	Parameter Name	Setting Range	Default
E1-03	V/f Pattern Selection	0 to F [2]	F [1]

<1> Parameter is not reset to the default value when the drive is initialized using A1-03.

<2> Settings 0 through E are not available when A1-02 = 2, 3, 5, 6, or 7.

Setting a Predefined V/f Pattern (Setting 0 to E)

Choose the V/f pattern that best meets the application demands from *Table 4.13*. These settings are available only in V/f Control modes. Set the correct value to E1-03. Parameters E1-04 to E1-13 can only be monitored, not changed.

Note: 1. Setting an improper V/f pattern may result in low motor torque or increased current due to overexcitation.
         2. Drive initialization does not reset parameter E1-03.

Table 4.13 Predefined V/f Patterns

Setting	Specification	Characteristic	Application
0	50 Hz	Constant torque	For general purpose applications. Torque remains constant regardless of changes to speed.
1	60 Hz		
2	60 Hz (with 50 Hz base)		
3	72 Hz (with 60 Hz base)		
4	50 Hz, Variable torque 1	Variable torque	For fans, pumps, and other applications where the required torque changes as a function of the speed.
5	50 Hz, Variable torque 2		
6	60 Hz, Variable torque 1		
7	60 Hz, Variable torque 2		
8	50 Hz, mid starting torque	High starting torque	Select high starting torque when: • Wiring between the drive and motor exceeds 150 m. • A large amount of starting torque is required. • An AC reactor is installed.
9	50 Hz, high starting torque		
A	60 Hz, mid starting torque		
B	60 Hz, high starting torque		
C	90 Hz (with 60 Hz base)	Constant output	Output voltage is constant when operating at greater than 60 Hz.
D	120 Hz (with 60 Hz base)		
E	180 Hz (with 60 Hz base)		
F [1]	60 Hz	Constant torque	For general purpose applications. Torque remains constant regardless of changes to speed.

<1> Setting F enables a custom V/f pattern by changing parameters E1-04 to E1-13. When the drive is shipped, the default values for parameters E1-04 to E1-13 are the same as those of setting 1.

Predefined V/f Patterns for Models 2A0004 to 2A0021 (HD), 2A0004 to 2A0018 (ND), 4A0002 to 4A0011 (HD), 4A0002 to 4A0009 (ND), 5A0003 to 5A0009 (HD), and 5A0003 to 5A0006 (ND)

The following tables show details on predefined V/f patterns.

The voltage values in the following graphs are specific to 200 V class drives. Double the values for 400 V class drives. Multiply the values by 2.875 for 600 V drives.

Table 4.14 Constant Torque Characteristics, Settings 0 to 3, F

Setting = 0	50 Hz	Setting = 1, F	60 Hz	Setting = 2	60 Hz	Setting = 3	72 Hz
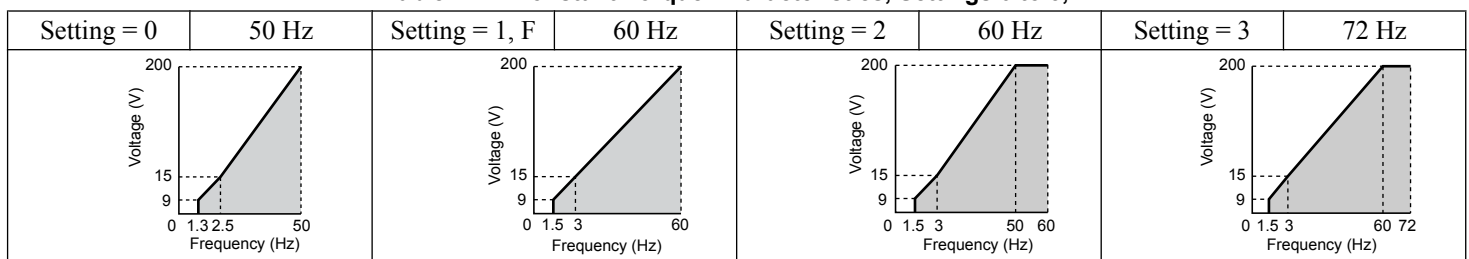
Table 4.15 Derated Torque Characteristics, Settings 4 to 7

Setting = 4	50 Hz	Setting = 5	50 Hz	Setting = 6	60 Hz	Setting = 7	60 Hz
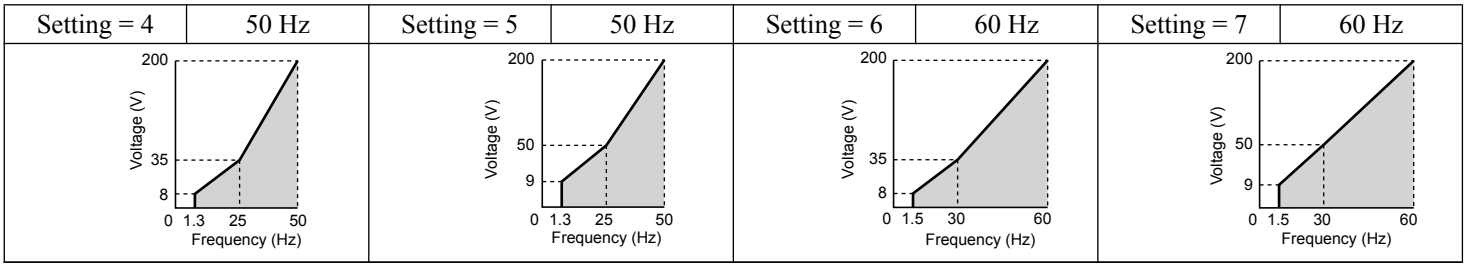
Table 4.16 High Starting Torque, Settings 8 to B

Setting = 8	50 Hz	Setting = 9	50 Hz	Setting = A	60 Hz	Setting = B	60 Hz
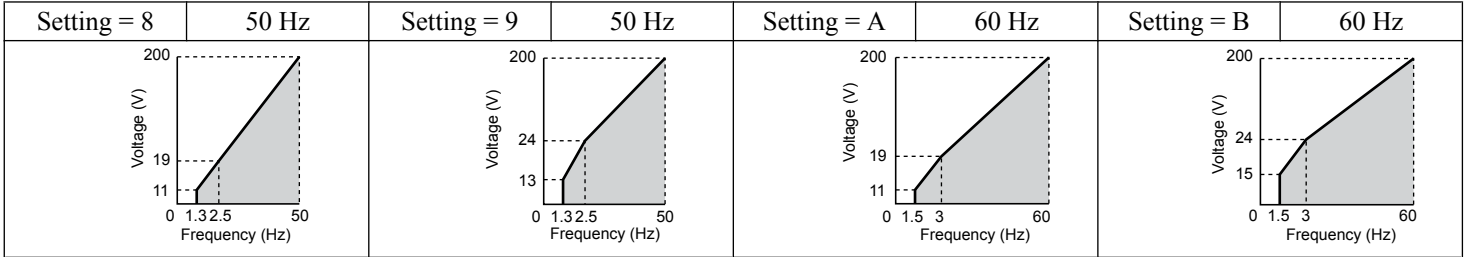
Table 4.17 Rated Output Operation, Settings C to E

Setting = C	90 Hz	Setting = D	120 Hz	Setting = E	180 Hz
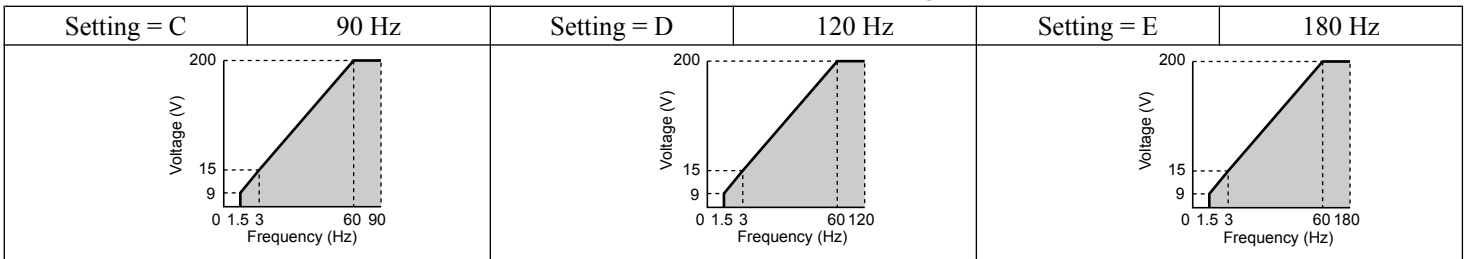
Predefined V/f Patterns for Models 2A0030 to 2A0211 (HD), 2A0021 to 2A0169 (ND), 4A0018 to 4A0103 (HD), 4A0011 to 4A0088 (ND), 5A0011 to 5A0077 (HD), and 5A0009 to 5A0062 (ND)

The voltage values in the following graphs are specific to 200 V class drives. Double the values for 400 V class drives. Multiply the values by 2.875 for 600 V class drives.

Table 4.18 Rated Torque Characteristics, Settings 0 to 3, F

Setting = 0	50 Hz	Setting = 1, F	60 Hz	Setting = 2	60 Hz	Setting = 3	72 Hz
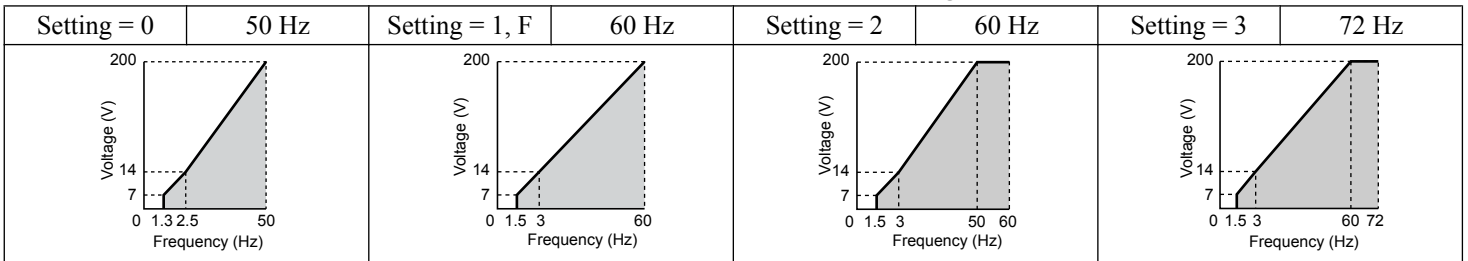
Table 4.19 Derated Torque Characteristics, Settings 4 to 7

Setting = 4	50 Hz	Setting = 5	50 Hz	Setting = 6	60 Hz	Setting = 7	60 Hz

Start-Up Programming & Operation

4
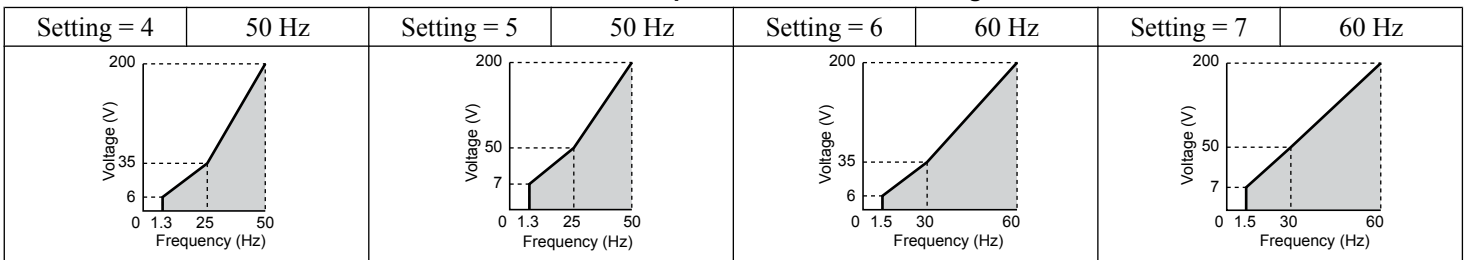
Table 4.20 High Starting Torque, Settings 8 to B

Setting = 8	50 Hz	Setting = 9	50 Hz	Setting = A	60 Hz	Setting = B	60 Hz
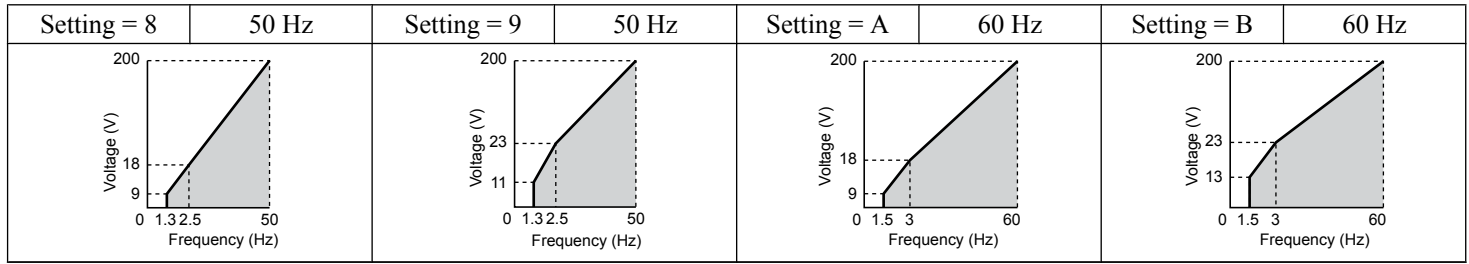
Table 4.21 Constant Output, Settings C to E

Setting = C	90 Hz	Setting = D	120 Hz	Setting = E	180 Hz
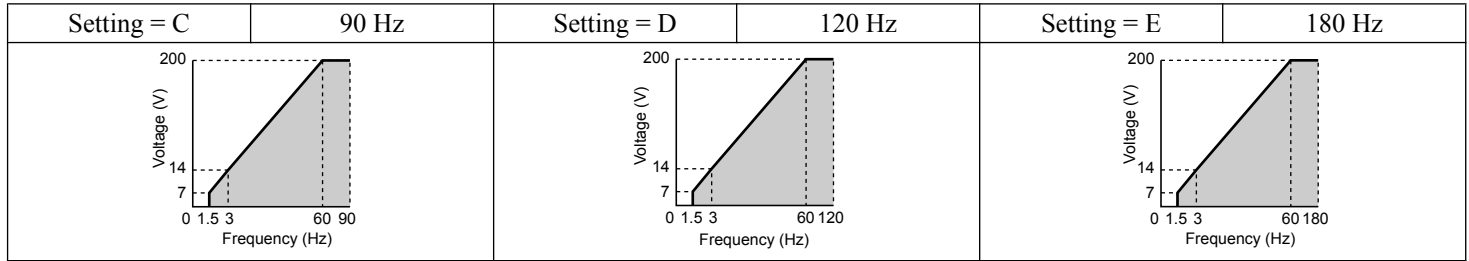
Predefined V/f Patterns for Models 2A0250 to 2A0415 (HD), 2A0211 to 2A0415 (ND), 4A0139 to 4A1200 (HD), 4A0103 to 4A1200 (ND), 5A0099 to 5A0242 (HD), and 5A0077 to 5A0242 (ND)

The voltage values in the following graphs are specific to 200 V class drives. Double the values for 400 V class drives. Multiply the values by 2.875 for 600 V class drives.

Table 4.22 Rated Torque Characteristics, Settings 0 to 3, F

Setting = 0	50 Hz	Setting = 1, F	60 Hz	Setting = 2	60 Hz	Setting = 3	72 Hz
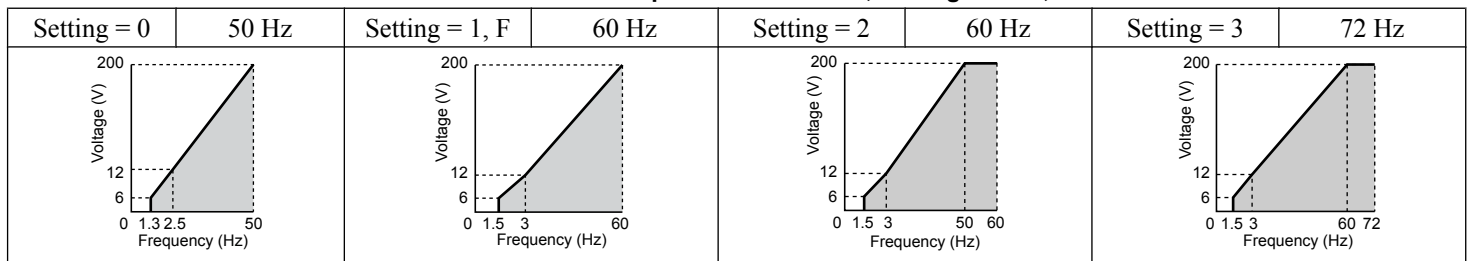
Table 4.23 Derated Torque Characteristics, Settings 4 to 7

Setting = 4	50 Hz	Setting = 5	50 Hz	Setting = 6	60 Hz	Setting = 7	60 Hz
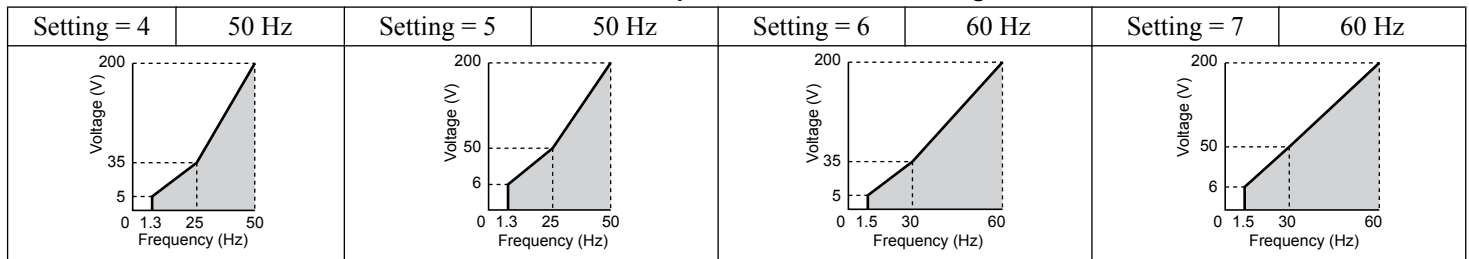
Table 4.24 High Starting Torque, Settings 8 to B

Setting = 8	50 Hz	Setting = 9	50 Hz	Setting = A	60 Hz	Setting = B	60 Hz
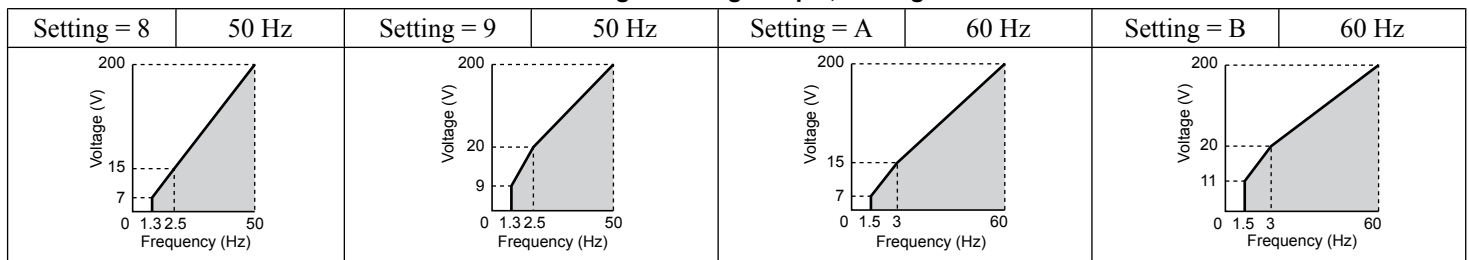
Table 4.25 Constant Output, Settings C to E

Setting = C	90 Hz	Setting = D	120 Hz	Setting = E	180 Hz
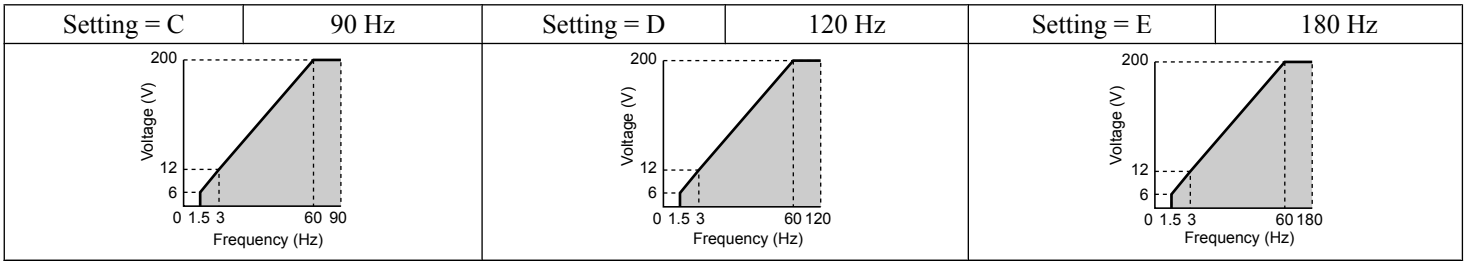
Setting a Custom V/f Pattern (Setting F: Default)

Setting parameter E1-03 to F allows the user to set up a custom V/f pattern by changing parameters E1-04 to E1-13.

■ V/f Pattern Settings E1-04 to E1-13

Set E1-03 ≤ E to monitor, but not change, the V/f pattern using parameters E1-04 to E1-13. To create a new V/f pattern, set E1-03 to F. *Refer to V/f Pattern on page 151* for an example custom V/f pattern.

Note: Certain E1-□□ parameters might not be visible depending on the control mode. *Refer to Parameter List on page 249* for details.

No.	Parameter Name	Setting Range	Default
E1-04	Maximum Output Frequency	40.0 to 400.0 Hz [1]	[2] [3]
E1-05	Maximum Voltage	0.0 to 255.0 V [4]	[2]
E1-06	Base Frequency	0.0 to [E1-04]	[2] [3]
E1-07	Middle Output Frequency	0.0 to [E1-04]	[2]
E1-08	Middle Output Frequency Voltage	0.0 to 255.0 V [4]	[2]
E1-09	Minimum Output Frequency	0.0 to [E1-04] [1]	[2] [3]
E1-10	Minimum Output Frequency Voltage	0.0 to 255.0 V [4]	[2]
E1-11	Middle Output Frequency 2	0.0 to [E1-04]	0.0 Hz [6]
E1-12	Middle Output Frequency Voltage 2	0.0 to 255.0 V [4]	0.0 V [5] [6]
E1-13	Base Voltage	0.0 to 255.0 V [4]	0.0 V [5] [7]

[1] Default setting is determined by E5-01 in OLV/PM. When E5-01 is set to FFFF the setting range for E1-04 and E1-06 is 10.0 to 400.0 Hz and the setting range for E1-09 is 0.0 to 400.0 Hz.

[2] Default setting is determined by the control method, drive model, and drive duty rating.

[3] When using PM motors, the default setting is determined by the motor code set to E5-01.

[4] Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives.

[5] The drive changes these settings when Auto-Tuning is performed (Rotational Auto-Tuning, Stationary Auto-Tuning 1, 2).

[6] Parameter ignored when E1-11 and E1-12 are set to 0.0.

[7] E1-13 and E1-05 are set to the same value when Auto-Tuning is performed.
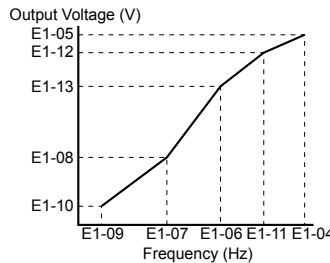
Figure 4.24 V/f Pattern

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 equal to E1-07. In this case the E1-08 setting is disregarded.

3. E1-03 is unaffected when the drive is initialized, but E1-04 through E1-13 return to their default values.

4. Only use E1-11, E1-12, and E1-13 to fine-tune the V/f pattern in the constant output range. These parameters rarely need to be changed.

■ E2-01: Motor Rated Current

Provides motor control, protects the motor, and calculates 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 [1]	Determined by C6-01 and o2-04

<1> Display is in the following units:
  2A0004 to 2A0040, 4A0002 to 4A0023, and 5A0007 to 5A0017: 0.01 A units.
  2A0056 to 2A0415, 4A0031 to 4A0675, and 5A0022 to 5A0242: 0.1 A units.
  4A0930 and 4A1200: 1 A units.

Note: An oPE02 error will occur if E2-01 ≤ E2-03. Set E2-03 correctly to prevent this error.

■ H1-01 to H1-08: Functions for Terminals S1 to S8

These parameters assign functions to the multi-function digital inputs. The various functions and settings are listed in **Table 4.26**.

No.	Parameter Name	Setting Range	Default
H1-01	Multi-Function Digital Input Terminal S1 Function Selection	1 to 9F	40 (F) [1] : Forward Run Command (2-Wire sequence)
H1-02	Multi-Function Digital Input Terminal S2 Function Selection	1 to 9F	41 (F) [1] : Reverse Run Command (2-Wire sequence)
H1-03	Multi-Function Digital Input Terminal S3 Function Selection	0 to 9F	24: External Fault
H1-04	Multi-Function Digital Input Terminal S4 Function Selection	0 to 9F	14: Fault Reset
H1-05	Multi-Function Digital Input Terminal S5 Function Selection	0 to 9F	3 (0) [1] : Multi-Step Speed Reference 1
H1-06	Multi-Function Digital Input Terminal S6 Function Selection	0 to 9F	4 (3) [1] : Multi-Step Speed Reference 2
H1-07	Multi-Function Digital Input Terminal S7 Function Selection	0 to 9F	6 (4) [1] : Jog Reference Selection
H1-08	Multi-Function Digital Input Terminal S8 Function Selection	0 to 9F	8: External Baseblock Command

<1> Number appearing in parenthesis is the default value after performing a 3-Wire initialization (A1-03 = 3330).

Table 4.26 Multi-Function Digital Input Terminal Settings

Setting	Function	Page	Setting	Function	Page
0	3-Wire Sequence	**153**	1A	Accel/Decel Time Selection 2	–
1	LOCAL/REMOTE Selection	–	1B	Program Lockout	–
2	External Reference 1/2 Selection	–	1E	Reference Sample Hold	–
3	Multi-Step Speed Reference 1		20 to 2F	External Fault	–
4	Multi-Step Speed Reference 2	–	30	PID Integral Reset	–
5	Multi-Step Speed Reference 3		31	PID Integral Hold	–
6	Jog reference Selection	–	32	Multi-Step Speed Reference 4	–
7	Accel/Decel Time Selection 1	–	34	PID Soft Starter Cancel	–
8	Baseblock Command (N.O.)		35	PID Input Level Selection	–
9	Baseblock Command (N.C.)	–	40	Forward Run Command (2-Wire sequence)	
A	Accel/Decel Ramp Hold	–	41	Reverse Run Command (2-Wire sequence)	–
B	Drive Overheat Alarm (oH2)	–	42	Run Command (2-Wire sequence 2)	
C	Analog Terminal Input Selection	–	43	FWD/REV Command (2-Wire sequence 2)	–
D	PG Encoder Disable	–	44	Offset Frequency 1	
E	ASR integral reset	–	45	Offset Frequency 2	
F	Through Mode	–	46	Offset Frequency 3	–
10	Up Command		47	Node Setup	–
11	Down Command	–	60	DC Injection Braking Command	–
12	Forward Jog		61	External Speed Search Command 1	–
13	Reverse Jog	–	62	External Speed Search Command 2	–
14	Fault Reset	–	63	Field Weakening	–
15	Fast Stop (N.O.)	–	65	KEB Ride-Thru 1 (N.C.)	
16	Motor 2 Selection	–	66	KEB Ride-Thru 1 (N.O.)	–
17	Fast Stop (N.C.)	–	67	Communications Test Mode	–
18	Timer Function Input	–	68	High Slip Braking (HSB)	–
19	PID Disable	–	6A	Drive Enabled	–

Setting	Function	Page
71	Speed/Torque Control Switch	–
72	Zero Servo	–
75	Up 2 Command	–
76	Down 2 Command	
77	ASR Gain Switch	–
78	External Torque Reference Polarity Inversion	–
7A	KEB Ride-Thru 2 (N.C.)	–
7B	KEB Ride-Thru 2 (N.O.)	

Setting	Function	Page
7C	Short Circuit Braking (N.O.)	–
7D	Short Circuit Braking (N.C.)	
7E	Forward/Reverse Detection	–
7F	PID Bi-directional Enable (No function)	–
90 to 97	DriveWorksEZ Digital Input 1 to 8	–
9F	DriveWorksEZ Disabled	–

Setting 0: 3-Wire Sequence

The digital input programmed for 3-Wire control becomes the forward/reverse directional input, S1 becomes the Run command input, and S2 becomes the Stop command input.

The drive starts the motor when the input S1 set for the Run command closes for longer than 2 ms. The drive stops the operation when the Stop input S2 is released. When the digital input programmed for a forward/reverse operation is open, the drive is set for forward operation. When the digital input is closed, the drive is set for reverse operation.

Note: Input the Run and Stop commands via S1 and S2 when selecting a 3-Wire sequence.
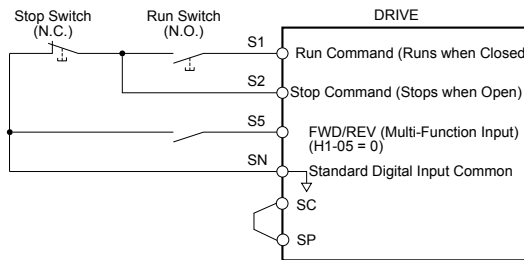
Figure 4.25   3-Wire Sequence Wiring Diagram
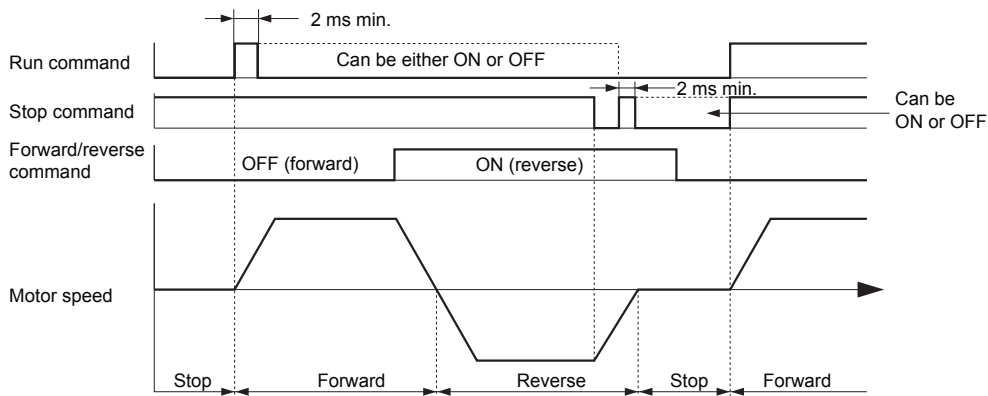
Figure 4.26   3-Wire Sequence

Note:
1. The Run command must be closed for more than 2 ms.
2. If the Run command is active at power up and b1-17 = 0 (Run command at power up not accepted), the Run LED will flash to indicate that protective functions are operating. If required by the application, set b1-17 to 1 to automatically issue the Run command upon drive power up.

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

WARNING! *Sudden Movement Hazard. The drive may start unexpectedly in reverse direction after power up if it is wired for 3-Wire sequence but set up for 2-Wire sequence (default). Make sure b1-17 is set to "0" (drive does not accept a Run command active at power up). When initializing the drive use 3-Wire initialization. Failure to comply could result in death or serious injury from moving equipment.*

■ H2-01 to H2-03: Terminal M1-M2, M3-M4, and M5-M6 Function Selection

The drive has three multi-function output terminals. *Table 4.27* lists the functions available for theses terminals using H2-01, H2-02, and H2-03.

Start-Up Programming & Operation

4

No.	Parameter Name	Setting Range	Default
H2-01	Terminal M1-M2 Function Selection (relay)	0 to 192	0: During run
H2-02	Terminal M3-M4 Function Selection (relay)	0 to 192	1: Zero Speed
H2-03	Terminal M5-M6 Function Selection (relay)	0 to 192	2: Speed agree 1

Table 4.27 Multi-Function Digital Output Terminal Settings

Setting	Function	Page	Setting	Function	Page
0	During Run	—	1F	Motor Overload Alarm (oL1)	—
1	Zero Speed	—	20	Drive Overheat Pre-Alarm (oH)	—
2	Speed Agree 1	*154*	22	Mechanical Weakening Detection	—
3	User-Set Speed Agree 1	*155*	2F	Maintenance Period	—
4	Frequency Detection 1	—	30	During Torque Limit	—
5	Frequency Detection 2	—	31	During Speed Limit	—
6	Drive Ready	—	32	During Speed Limit in Torque Control	—
7	DC Bus Undervoltage	—	33	Zero Servo Complete	—
8	During Baseblock (N.O.)	—	37	During Frequency Output	—
9	Frequency Reference Source	—	38	Drive Enabled	—
A	Run Command Source	—	39	Watt Hour Pulse Output	—
B	Torque Detection 1 (N.O.)	—	3C	LOCAL/REMOTE Status	—
C	Frequency Reference Loss	—	3D	During Speed Search	—
D [1]	Braking Resistor Fault	—	3E	PID Feedback Low	—
E	Fault	—	3F	PID Feedback High	—
F	Through Mode	—	4A	During KEB Operation	—
10	Minor Fault	—	4B	During Short Circuit Braking	—
11	Fault Reset Command Active	—	4C	During Fast Stop	—
12	Timer Output	—	4D	oH Pre-Alarm Time Limit	—
13	Speed Agree 2	—	4E [2]	Braking Transistor Fault (rr)	—
14	User-Set Speed Agree 2	—	4F [2]	Braking Resistor Overheat (rH)	—
15	Frequency Detection 3	—	60	Internal Cooling Fan Alarm	—
16	Frequency Detection 4	—	61	Rotor Position Detection Completed	—
17	Torque Detection 1 (N.C.)	—	62	MEMOBUS Register 1 (Selected with H2-07 and H2-08)	—
18	Torque Detection 2 (N.O.)	—			
19	Torque Detection 2 (N.C.)	—	63	MEMOBUS Register 2 (Selected with H2-09 and H2-10)	—
1A	During Reverse	—			
1B	During Baseblock (N.C.)	—	90	DriveWorksEZ Digital Output 1	—
1C	Motor 2 Selection	—	91	DriveWorksEZ Digital Output 2	—
1D	During regeneration	—	92	DriveWorksEZ Digital Output 3	—
1E	Restart Enabled	—	100 to 192	Functions 0 to 92 with Inverse Output	—

[1] Not available in models CIMR-A□4A0930 amd 4A1200.

[2] Not available in models CIMR-A□2A0169 to 2A0415 and 4A0088 to 4A1200.

Setting 2: Speed Agree 1 (f_{ref}/f_{out} Agree 1)

Closes when the actual output frequency or motor speed (CLV, CLV/PM) is within the Speed Agree Width (L4-02) of the current frequency reference regardless of the direction.

Status	Description
Open	Output frequency or motor speed is outside the range of frequency reference ±L4-04.
Closed	Output frequency or motor speed is within the range of frequency reference ±L4-02.

Note: Detection works in forward and reverse.
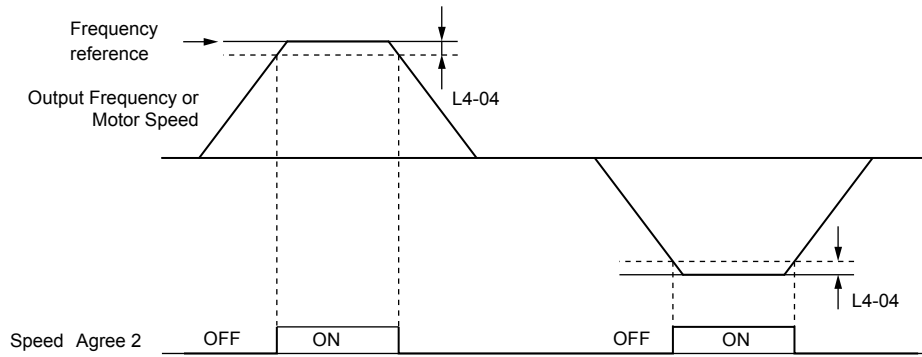
Figure 4.27 Speed Agree 1 Time Chart

Setting 3: User-Set Speed Agree 1 (f_{ref}/f_{set} Agree 1)

Closes when the actual output frequency or motor speed (CLV, CLV/PM) and the frequency reference are within the speed agree width (L4-02) of the programmed speed agree level (L4-01).

Status	Description
Open	Output frequency or motor speed and frequency reference are not both within the range of L4-01 ±L4-02.
Closed	Output frequency or motor speed and the frequency reference are both within the range of L4-01 ±L4-02.

Note: Frequency detection works in forward and reverse. The value of L4-01 is used as the detection level for both directions.
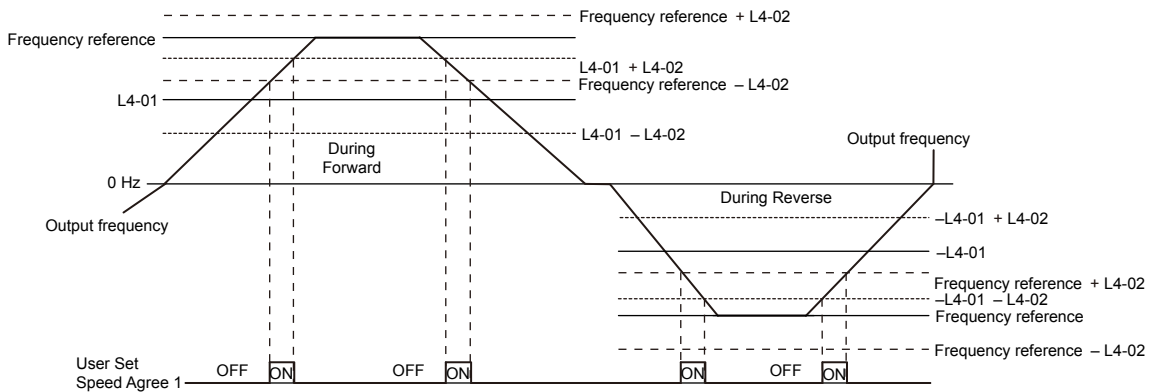
Figure 4.28 User Set Speed Agree 1 Time Chart

■ H3-01: Terminal A1 Signal Level Selection

Selects the input signal level for analog input A1.

No.	Name	Setting Range	Default
H3-01	Terminal A1 Signal Level Selection	0 to 1	0

Setting 0: 0 to 10 Vdc

The input level is 0 to 10 Vdc. The minimum input level is limited to 0%, so that a negative input signal due to gain and bias settings will be read as 0%.

Setting 1: -10 to 10 Vdc

The input level is -10 to 10 Vdc. If the resulting voltage is negative after being adjusted by gain and bias settings, then the motor will rotate in reverse.

■ H3-02: Terminal A1 Function Selection

Selects the input signal level for analog input A1.

No.	Name	Setting Range	Default
H3-02	Terminal A1 Function Selection	0 to 32	0

■ H3-03, H3-04: Terminal A1 Gain and Bias Settings

Parameter H3-03 sets the level of the selected input value that is equal to 10 Vdc input at terminal A1 (gain).

Parameter H3-04 sets the level of the selected input value that is equal to 0 V input at terminal A1 (bias).

Use both parameters to adjust the characteristics of the analog input signal to terminal A1.

No.	Name	Setting Range	Default
H3-03	Terminal A1 Gain Setting	-999.9 to 999.9%	100.0%
H3-04	Terminal A1 Bias Setting	-999.9 to 999.9%	0.0%

Setting Examples

• Gain H3-03 = 200%, bias H3-04 = 0, terminal A1 as frequency reference input (H3-02 = 0):

A 10 Vdc input is equivalent to a 200% frequency reference and 5 Vdc is equivalent to a 100% frequency reference. Since the drive output is limited by the maximum frequency parameter (E1-04), the frequency reference will be equal to E1-04 above 5 Vdc.
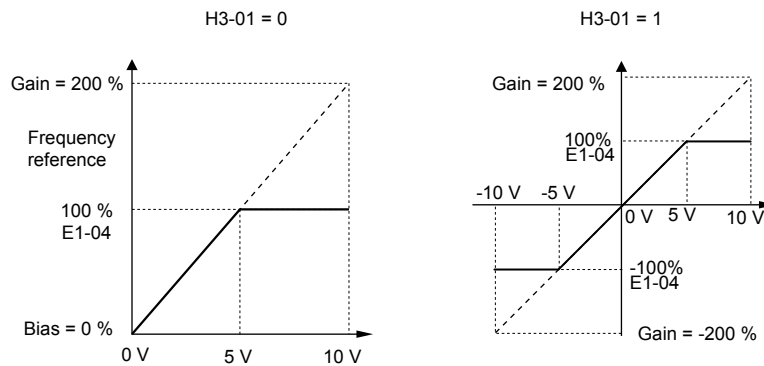
Figure 4.29 Frequency Reference Setting by Analog Input with Increased Gain

• Gain H3-03 = 100%, bias H3-04 = -25%, terminal A1 as frequency reference input:

An input of 0 Vdc will be equivalent to a -25% frequency reference.

When parameter H3-01 = 0, the frequency reference is 0% between 0 and 2 Vdc input.

When parameter H3-01 = 1, the motor will rotate in reverse between -10 and 2 Vdc input.
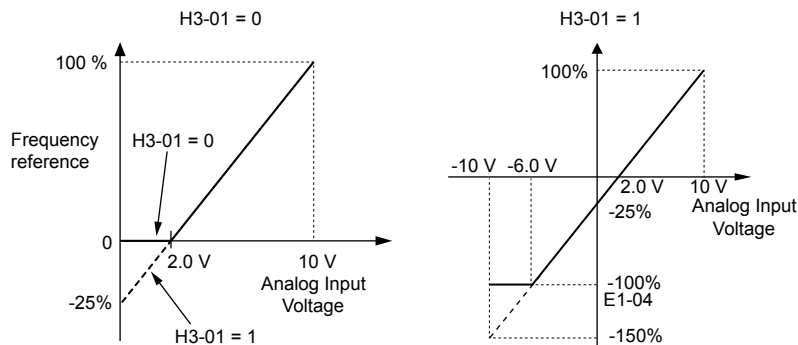
Figure 4.30 Frequency Reference Setting by Analog Input with Negative Bias

■ H3-05: Terminal A3 Signal Level Selection

Selects the input signal level for analog input A3.

Be sure to set DIP switch S4 on the terminal board accordingly for multi-function analog input or PTC input. Also *Refer to Terminal A3 Analog/PTC Input Selection on page 113*.

No.	Name	Setting Range	Default
H3-05	Terminal A3 Signal Level Selection	0, 1	0

Setting 0: 0 to 10 Vdc

The input level is 0 to 10 Vdc. See the explanation provided for H3-01. *Refer to Setting 0: 0 to 10 Vdc on page 155*.

Setting 1: -10 to 10 Vdc

The input level is -10 to 10 Vdc. See the explanation provided for H3-01. *Refer to Setting 1: -10 to 10 Vdc on page 155*.

■ H3-06: Terminal A3 Function Selection

Determines the function assigned to analog input terminal A3.

No.	Name	Setting Range	Default
H3-06	Terminal A3 Function Selection	0 to 32	2

■ H3-07, H3-08: Terminal A3 Gain and Bias Setting

Parameter H3-07 sets the level of the selected input value that is equal to 10 Vdc input at terminal A3 (gain).

Parameter H3-08 sets the level of the selected input value that is equal to 0 V input at terminal A3 (bias).

No.	Name	Setting Range	Default
H3-07	Terminal A3 Gain Setting	-999.9 to 999.9%	100.0%
H3-08	Terminal A3 Bias Setting	-999.9 to 999.9%	0.0%

■ H3-09: Terminal A2 Signal Level Selection

Selects the input signal level for analog input A2. Set DIP switch S1 on the terminal board accordingly for a voltage input or current input.

No.	Name	Setting Range	Default
H3-09	Terminal A2 Signal Level Selection	0 to 3	2

Setting 0: 0 to 10 Vdc

The input level is 0 to 10 Vdc. *Refer to Setting 0: 0 to 10 Vdc on page 155*.

Setting 1: 0 to 10 Vdc Bipolar

The input level is -10 to 10 Vdc. *Refer to Setting 1: -10 to 10 Vdc on page 155*.

Setting 2: 4 to 20 mA

The input level is 4 to 20 mA. Negative input values by negative bias or gain settings will be limited to 0%.

Setting 3: 0 to 20 mA

The input level is 0 to 20 mA. Negative input values by negative bias or gain settings will be limited to 0%.

■ H3-10: Terminal A2 Function Selection

Determines the function assigned to analog input terminal A2.

No.	Name	Setting Range	Default
H3-10	Terminal A2 Function Selection	0 to 32	0

■ H3-11, H3-12: Terminal A2 Gain and Bias Setting

Parameter H3-11 sets the level of the input value selected that is equal to 10 Vdc input or 20 mA input to terminal A2.

Parameter H3-12 sets the level of the input value selected that is equal to 0 V, 4 mA or 0 mA input at terminal A2.

Use both parameters to adjust the characteristics of the analog input signal to terminal A2. The setting works in the same way as parameters H3-03 and H3-04 for analog input A1.

No.	Name	Setting Range	Default
H3-11	Terminal A2 Gain Setting	-999.9 to 999.9%	100.0%
H3-12	Terminal A2 Bias Setting	-999.9 to 999.9%	0.0%

■ H4-01, H4-04: Multi-Function Analog Output Terminal FM, AM Monitor Selection

Sets the desired drive monitor parameter U□-□□ to output as an analog value via terminal FM and AM. *Refer to U1: Operation Status Monitors on page 320* for a list of all monitors. The "Analog Output Level" column indicates whether a monitor can be used for analog output.

Example: Enter "103" for U1-03.

Start-Up Programming & Operation

4

No.	Name	Setting Range	Default
H4-01	Multi-Function Analog Output Terminal FM Monitor Selection	000 to 999	102
H4-04	Multi-Function Analog Output Terminal AM Monitor Selection	000 to 999	103

A setting of 031 or 000 applies no drive monitor to the analog output. With either of these settings, the output level of the terminals FM and AM can be set by a PLC via a communication option or MEMOBUS/Modbus (through mode).

■ H4-02, H4-03: Multi-Function Analog Output Terminal FM Gain and Bias
H4-05, H4-06: Multi-Function Analog Output Terminal AM Gain and Bias

Parameters H4-02 and H4-05 set the terminal FM and AM output signal level when the value of the selected monitor is at 100%. Parameters H4-03 and H4-06 set the terminal FM and AM output signal level when the value of the selected monitor is at 0%. Both are set as a percentage, where 100% equals 10 Vdc or 20 mA analog output and 0% equals 0 V or 4 mA. The output voltage of both terminals is limited to +/-10 Vdc.

The output signal range can be selected between 0 to +10 Vdc or -10 to +10 Vdc, or 4 to 20 mA using parameter H4-07 and H4-08. *Figure 4.31* illustrates how gain and bias settings work.

No.	Name	Setting Range	Default
H4-02	Multi-Function Analog Output Terminal FM Gain	-999.9 to 999.9%	100.0%
H4-03	Multi-Function Analog Output Terminal FM Bias	-999.9 to 999.9%	0.0%
H4-05	Multi-Function Analog Output Terminal AM Gain	-999.9 to 999.9%	50.0%
H4-06	Multi-Function Analog Output Terminal AM Bias	-999.9 to 999.9%	0.0%

Using Gain and Bias to Adjust Output Signal Level

The output signal is adjustable while the drive is stopped.

Terminal FM

1. View the value set to H4-02 (Terminal FM Monitor Gain) on the digital operator. A voltage equal to 100% of the parameter being set in H4-01 will be output from terminal FM.

2. Adjust H4-02 viewing the monitor connected to the terminal FM.

3. View the value set to H4-03 on the digital operator; terminal FM will output a voltage equal to 0% of the parameter being set in H4-01.

4. Adjust H4-03 viewing the output signal on the terminal FM.

Terminal AM

1. View the value set to H4-05 (Terminal AM Monitor Gain) on the digital operator. A voltage equal to 100% of the parameter being set in H4-04 will be output from terminal AM.

2. Adjust H4-05 viewing the monitor connected to the terminal AM.

3. View the value set to H4-06 on the digital operator; terminal AM will output a voltage equal to 0% of the parameter being set in H4-04.

4. Adjust H4-06 viewing the output signal on the terminal AM.
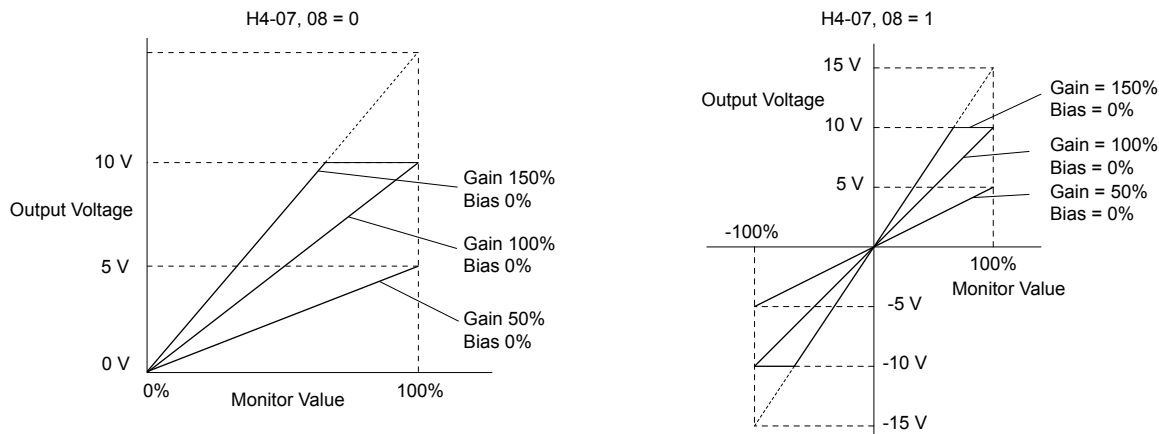
Figure 4.31 Analog Output Gain and Bias Setting Example 1 and 2

Set H4-03 to 30% for an output signal of 3 V at terminal FM when the monitored value is at 0%.
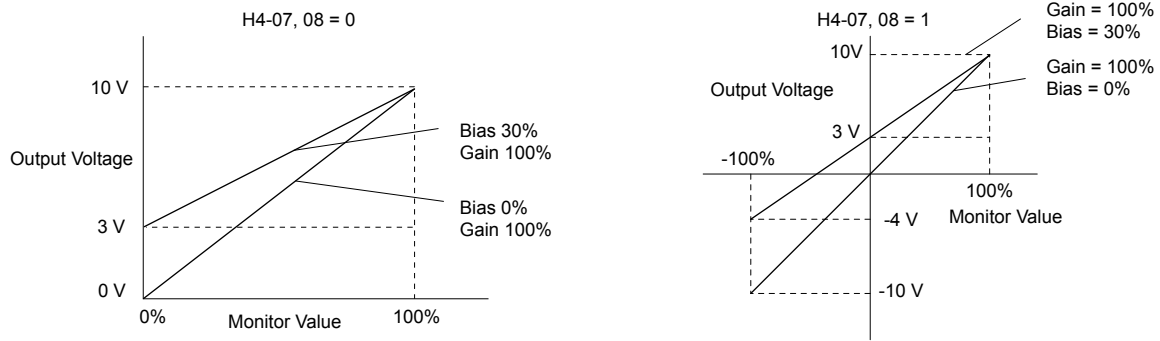
Figure 4.32 Analog Output Gain and Bias Setting Example 3

■ H4-07, H4-08: Multi-Function Analog Output Terminal FM, AM Signal Level Selection

Sets the voltage output level of U parameter (monitor parameter) data to terminal FM and terminal AM using parameters H4-07 and H4-08.

Set jumper S5 on the terminal board accordingly when changing these parameters. ***Refer to Terminal AM/FM Signal Selection on page 113*** for details on setting S5.

No.	Name	Setting Range	Default
H4-07	Multi-Function Analog Output Terminal FM Signal Level Selection	0 to 2	0
H4-08	Multi-Function Analog Output Terminal AM Signal Level Selection	0 to 2	0

Setting 0: 0 to 10 V

Setting 1: -10 V to 10 V

Setting 2: 4 to 20 mA

■ L3-01: Stall Prevention Selection during Acceleration

Stall Prevention during acceleration 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 use during acceleration.

No.	Name	Setting Range	Default
L3-01	Stall Prevention Selection during Acceleration	0 to 2 [1]	1

<1> Setting 2 is not available for OLV/PM.

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. Operation varies depending on the control mode.

• V/f Control, V/f Control with PG, and Open Loop Vector Control:

Acceleration is reduced when the output current value exceeds 85% of the level set to parameter L3-02 for a longer than the time set to L3-27. The acceleration stops when the current exceeds L3-02. Acceleration continues when the current falls below L3-02 for longer than the time set to L3-27.

The Stall Prevention level is automatically reduced in the constant power range. ***Refer to L3-03: Stall Prevention Limit during Acceleration on page 161***.

Start-Up Programming & Operation

4
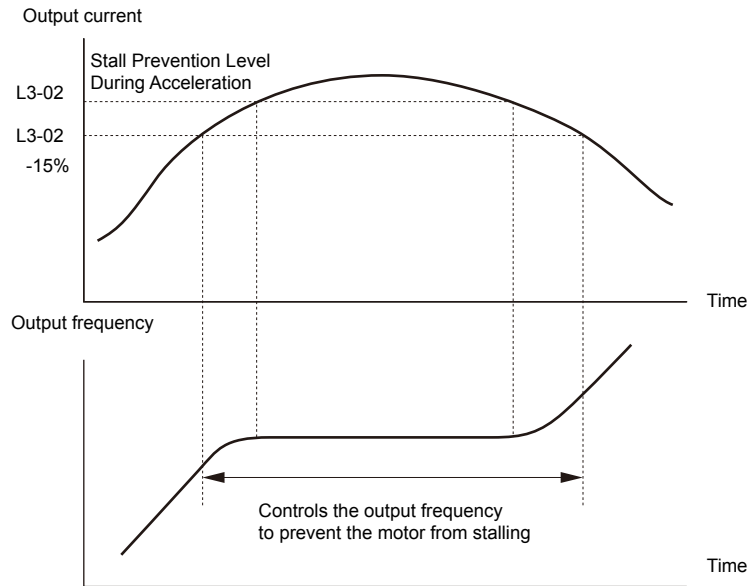
Figure 4.33 Stall Prevention During Acceleration for Induction Motors

- Open Loop Vector Control for PM:

Acceleration stops when the output current reaches the level set to parameter L3-02. When the time set to parameter L3-27 passes, the drive decelerates using the deceleration time set to L3-22. Deceleration stops when the current falls below 85% of L3-02,. The drive will attempt to reaccelerate after the time set to L3-27.
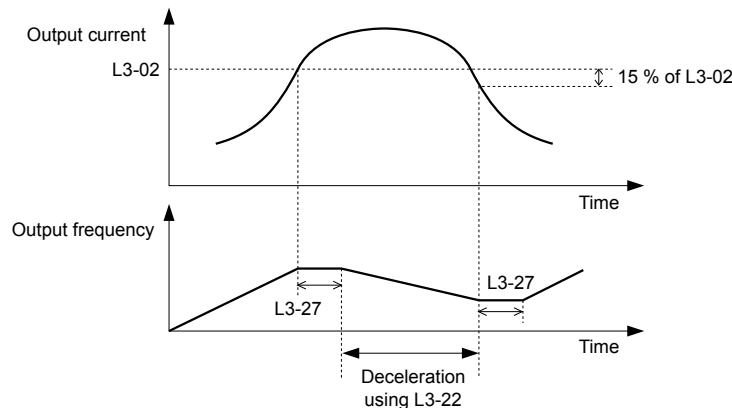
Figure 4.34 Stall Prevention During Acceleration for Permanent Magnet Motors

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 is determined by the duty rating and the carrier frequency derating selection (C6-01 and L8-38 respectively).

- 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

The Stall Prevention level is automatically reduced when the motor is operated in the constant power range. L3-03 sets the lower limit for this reduction as a percentage of the drive rated current.

No.	Name	Setting Range	Default
L3-03	Stall Prevention Limit during Acceleration	0 to 100%	50%
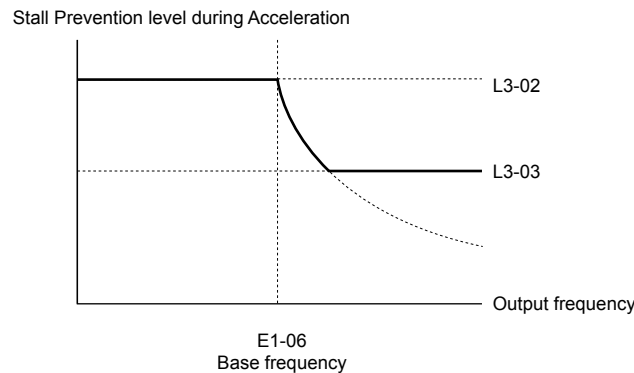
Figure 4.35 Stall Prevention Level and Limit During Acceleration

■ L3-04: Stall Prevention Selection during Deceleration

Stall Prevention during deceleration controls the deceleration based on the DC bus voltage and prevents an overvoltage fault caused by high inertia or rapid deceleration.

No.	Name	Setting Range	Default
L3-04	Stall Prevention Selection During Deceleration	0 to 5 [1]	1

<1> Settings 3 through 5 are not available in OLV/PM. Settings 2 through 5 are not available in AOLV/PM and CLV/PM.
Setting 3 is not available in models 4A0930 or 4A1200.

Setting 0: Disabled

The drive decelerates according to the set deceleration time. With high inertia loads or rapid deceleration, an overvoltage fault may occur. If an overvoltage fault occurs, use dynamic braking options or switch to another L3-04 selection.

Setting 1: General-purpose Stall Prevention

The drive tries to decelerate within the set deceleration time. The drive pauses deceleration when the DC bus voltage exceeds the Stall Prevention level and then continues deceleration when the DC bus voltage drops below that level. Stall Prevention may be triggered repeatedly to avoid an overvoltage fault. The DC bus voltage level for Stall Prevention depends on the input voltage setting E1-01.

Drive Input Voltage	Stall Prevention Level during Deceleration
200 V Class	377 Vdc
400 V Class	754 Vdc
600 V Class	1084 Vdc

Note: **1.** Do not use this setting in combination with a Dynamic Braking Resistor or other dynamic braking options. If Stall Prevention during deceleration is enabled, it will be triggered before the braking resistor option can operate.

   2. This method may lengthen the total deceleration time compared to the set value. If this is not appropriate for the application consider using a dynamic braking option.

Figure 4.36 illustrates the function of Stall Prevention during deceleration.
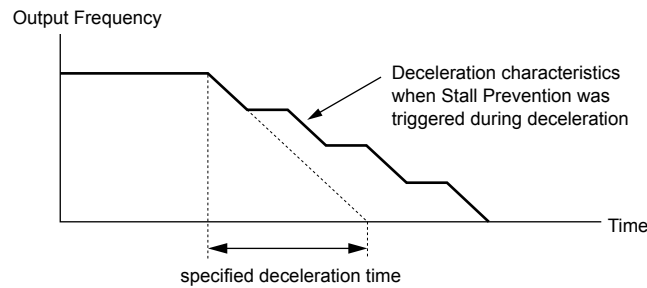
Figure 4.36 Stall Prevention During Deceleration

Setting 2: Intelligent Stall Prevention

The drive adjusts the deceleration rate to maintain the DC bus voltage at the level set to parameter L3-17. The drive ignores the selected deceleration time and uses the shortest possible deceleration time that will not cause the motor to stall.

This function uses the following parameters for adjusting the deceleration rate:

- DC bus voltage gain (L3-20)
- Deceleration rate calculations gain (L3-21)
- Inertia calculations for motor acceleration time (L3-24)
- Load inertia ratio (L3-25)

   Note: The deceleration time is not constant. Do not use Intelligent Stall Prevention in applications where stopping accuracy is a concern. Use dynamic braking options instead.

Setting 3: Stall Prevention with Dynamic Braking Option

Enables the Stall Prevention function while using a dynamic braking resistor. Overvoltage problems in the DC bus can occur if Stall Prevention during deceleration is disabled (L3-04) in OLV and a dynamic braking option is installed. Set L3-04 to 3 to remedy this situation.

Setting 4: Overexcitation Deceleration 1

Decelerates with the set deceleration rate in an overexcitation state (increasing the motor flux). The motor will decelerate when Stall Prevention is disabled (L3-04). Setting 4 changes the selected decel time and functions to provide protection from an overvoltage trip.

Setting 5: Overexcitation Deceleration 2

Overexcitation Deceleration 2 slows down the motor while trying to maintain the DC bus voltage at the level set to parameter L3-17. This function shortens the achievable deceleration time more than by using Overexcitation Deceleration 1. Setting 5 will shorten/lengthen the decel time to maintain the L3-17 bus level.

■ 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 2	1

   Note: 1. This parameter is available in V/f, V/f w/PG, and OLV/PM.
   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 frequency 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, the drive will decelerate at decel time 1 (C1-02). When the current level drops below the value of L3-06 minus 2% for 100 ms, the drive accelerates back to the frequency reference at the active acceleration time.

Setting 2: Decelerate Using C1-04

Same as setting 1 except the drive decelerates at decel time 2 (C1-04).

■ L3-06: Stall Prevention Level during Run

Sets the current level to trigger Stall Prevention during run. Depending on the setting of parameter L3-23, the level is automatically reduced in the constant power range (speed beyond base speed). A setting of 100% is equal to the drive rated current.

The Stall Prevention level can be adjusted using an analog input.

No.	Name	Setting Range	Default
L3-06	Stall Prevention Level During Run	30 to 150% [1]	[1]

<1> The upper limit and default for this setting is determined by C6-01 and L8-38.

■ L7-01 to L7-04: Torque Limits

These parameters set the torque limits in each quadrant.

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%

Note: If the multi-function analog input is programmed for "10: Forward torque limit", "11: Reverse torque limit", "12: Regenerative torque limit", or "15: General torque limit", the drive uses the lowest value from L7-01 through L7-04, or analog input torque limit.
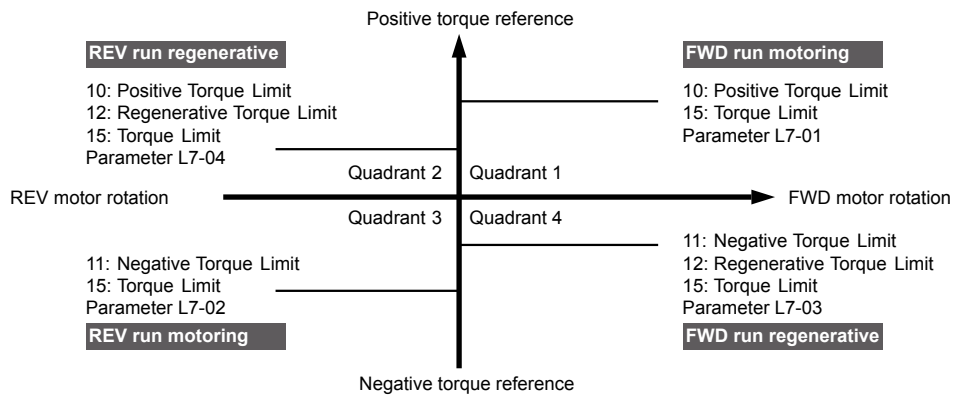
Figure 4.37 Torque Limit Parameters and Analog Input Settings

4.7 Auto-Tuning

◆ Types of Auto-Tuning

The drive offers different types of Auto-Tuning for induction motors and permanent magnet motors. The type of Auto-Tuning used differs further based on the control mode and other operating conditions. Refer to the tables below to select the type of Auto-Tuning that bests suits the application. *Refer to Start-Up Flowcharts on page 127* for directions on executing Auto-Tuning.

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

■ Auto-Tuning for Induction Motors

This feature automatically sets the V/f pattern and motor parameters E1-□□ and E2-□□ (E3-□□, E4-□□ for motor 2) for an induction motor. Additionally, the feature also sets some F1-□□ parameters for speed feedback detection in Closed Loop Vector.

Table 4.28 Types of Auto-Tuning for Induction Motors

Type	Setting	Application Conditions and Benefits	Control Mode			
			V/f	V/f w/ PG	OLV	CLV
Rotational Auto-Tuning	T1-01 = 0	• Motor can be decoupled from the load and rotate freely while Auto-Tuning is performed. • Motor and load cannot be decoupled but the motor load is below 30%. • Rotational Auto-Tuning gives the most accurate results, and is recommended if possible.	–	–	YES	YES
Stationary Auto-Tuning 1	T1-01 = 1	• Motor and load cannot be decoupled and the load is higher than 30%. • A motor test report listing motor data is not available. • Automatically calculates motor parameters needed for vector control.	–	–	YES	YES
Stationary Auto-Tuning 2	T1-01 = 4	• Motor and load cannot be decoupled and the load is higher than 30%. • A motor test report is available. After entering the no-load current and the rated slip, the drive calculates and sets all other motor-related parameters.	–	–	YES	YES
Stationary Auto-Tuning for Line-to-Line Resistance	T1-01 = 2	• The drive is used in V/f Control and other Auto-Tuning selections are not possible. • Drive and motor capacities differ. • Tunes the drive after the cable between the drive and motor has been replaced with a cable over 50 m long. Assumes Auto-Tuning has already been performed. • Should not be used for any vector control modes unless the motor cable has changed.	YES	YES	YES	YES
Rotational Auto-Tuning for V/f Control	T1-01 = 3	• Recommended for applications using Speed Estimation Speed Search or using the Energy Saving function in V/f Control. • Assumes motor can rotate while Auto-Tuning is executed. Increases accuracy for certain functions like torque compensation, slip compensation, Energy Saving, and Speed Search.	YES	YES	–	–
Stationary Auto-Tuning 3	T1-01 = 5	• A motor test report listing motor data is not available. • Motor can be driven with a normal duty mode after Auto-Tuning. A trial run is performed after Auto-Tuning to automatically calculate motor parameters needed for vector control.	–	–	YES	YES

Table 4.29 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. *Refer to Subchart A-1: Simple Motor Setup Using V/f Control on page 129* and *Refer to Subchart A-2: High Performance Operation Using OLV or CLV on page 130* for details on Auto-Tuning processes and selections.

Table 4.29 Auto-Tuning Input Data

Input Value	Input Parameter	Unit	Tuning Type (T1-01)					
			0 Standard	1 Stationary 1	2 Line-to-Line Resistance	3 Rotational for V/f Control	4 Stationary 2	5 Stationary 3
Control Mode	**A1-02**	**–**	2, 3	2, 3	0, 1, 2, 3	0, 1	2, 3	2, 3
Motor rated power	T1-02	kW	YES	YES	YES	YES	YES	YES
Motor rated voltage	T1-03	Vac	YES	YES	–	YES	YES	YES
Motor rated current	T1-04	A	YES	YES	YES	YES	YES	YES
Motor rated frequency	T1-05	Hz	YES	YES	–	YES	YES	YES
Number of motor poles	T1-06	-	YES	YES	–	YES	YES	YES
Motor rated Speed	T1-07	r/min	YES	YES	–	YES	YES	YES
PG Number of pulses per revolution	T1-08	-	YES [1]	YES [1]	–	–	YES [1]	YES [1]
Motor no-load current	T1-09	A	–	YES [2]	–	–	YES	YES
Motor rated Slip	T1-10	Hz	–	–	–	–	YES	–
Motor iron loss	T1-11	W	–	–	–	YES	–	–

[1] Input data is needed for CLV/PM only.

[2] Motor no-load current is required. If the no-load current is not shown on the motor nameplate, use the default value. The default value is set for Yaskawa standard motors.

■ Auto-Tuning for Permanent Magnet Motors

Automatically sets the V/f pattern and motor parameters E1-□□ and E5-□□ when a PM motor is used. Additionally, the feature also sets some F1-□□ parameters for speed feedback detection in Closed Loop Vector.

Table 4.30 Types of Auto-Tuning for Permanent Magnet Motors

Type	Setting	Application Conditions and Benefits	Control Mode		
			OLV/PM	AOLV/PM	CLV/PM
PM Motor Parameter Settings	T2-01 = 0	• Motor does not rotate during Auto-Tuning. • Motor data similar to *Table 4.31* are available from test report or motor nameplate.	YES	YES	YES
PM Stationary Auto-Tuning	T2-01 = 1	• A motor test report listing motor data is not available. • Drive automatically calculates and sets motor parameters.	YES	YES	YES
PM Stationary Auto-Tuning for Stator Resistance	T2-01 = 2	• Useful to tune the drive when the motor data were set up manually or by motor code and the cable is longer than 50 m. • Should also be performed if the cable length has changed after prior tuning.	YES	YES	YES
Z Pulse Offset Tuning	T2-01 = 3	• PG encoder has been replaced. Calculates the Z Pulse offset. • Requires the motor to rotate with no load or very low load.	–	–	YES
Back EMF Constant Tuning	T2-01 = 11	• Use when a motor test is not available. • Tunes the motor induction voltage only. • Should be performed after motor data are set and the encoder offset is adjusted. • The motor must be uncoupled from the mechanical system (remove loads).	–	–	YES
High Frequency Injection Parameter Tuning	T2-01 = 13	• Perform High Frequency Injection Parameter Tuning after setting motor parameters. *Refer to Auto-Tuning for Permanent Magnet Motors on page 165* for details. • The motor rotated in reverse or STo fault (Motor Step-Out) occurred at startup in OLV/PM. • Low speed and insufficient or no torque after activating the high frequency injection control (n8-57 = 1) in AOLV/PM. Note: High Frequency Injection cannot be used with an SPM motor.	–	YES	YES

Start-Up Programming & Operation

4

Type	Setting	Application Conditions and Benefits	Control Mode		
			OLV/PM	AOLV/PM	CLV/PM
PM Rotational Auto-Tuning	T2-01 = 14	• A motor test report listing motor data is not available. • Motor can be decoupled from the load and rotate freely while Auto-Tuning is performed. Drive automatically calculates and sets motor parameters. • PM Rotational Auto-Tuning gives more accurate results than Stationary Auto-Tuning.	YES	YES	YES

Table 4.31 lists the data that must be entered for Auto-Tuning. Make sure the 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. *Refer to Subchart A-3: Operation with Permanent Magnet Motors on page 131* for details on the Auto-Tuning process and selection.

Figure 4.38 Motor Nameplate Example

Table 4.31 Auto-Tuning Input Data

Input Value	Input Param.	Unit	Tuning Type (T2-01)											
			0 Motor Parameter Settings			1 Stationary		2 Stationary Stator Resis.	3 Z-Pulse Offset	11 Back EMF Const.	13 High Freq. Injection	14 Rotational		
Control Mode	A1-02	–	5, 6, 7	5	6, 7	5	6, 7	5, 6, 7	7	7	6, 7	5	6	7
Motor Code (Hex.)	T2-02	–	<1>	<1>	<1>	–	–	–	–	–	–	–	–	–
Motor Type	T2-03	–	–	–	–	YES	YES	–	–	–	–	YES	YES	YES
Motor Rated Power	T2-04	kW	–	YES	YES	YES	YES	–	–	–	–	YES	YES	YES
Motor Rated Voltage	T2-05	Vac	–	YES	YES	YES	YES	–	–	–	–	YES	YES	YES
Motor Rated Current	T2-06	A	–	YES	YES	YES	YES	YES	–	–	–	YES	YES	YES
Motor Rated Frequency	T2-07	Hz	–	YES	–	YES	–	–	–	–	–	YES	–	–
Number of Motor Poles	T2-08	–	–	YES	YES	YES	YES	–	–	–	–	YES	YES	YES
Motor Rated Speed	T2-09	r/min	–	–	YES	–	YES	–	–	–	–	–	YES	YES
Stator Single-phase Resistance	T2-10	Ω	YES	YES	YES	–	–	–	–	–	–	–	–	–
d-Axis Inductance	T2-11	mH	YES	YES	YES	–	–	–	–	–	–	–	–	–
q-Axis Inductance	T2-12	mH	YES	YES	YES	–	–	–	–	–	–	–	–	–
Induced Voltage Constant Unit Selection	T2-13	mVs/rad (elec.)	YES	YES	YES	–	–	–	–	–	–	–	–	–
Voltage Constant <3>	T2-14	mVmin (mech.)	YES	YES	YES	–	–	–	–	–	–	–	–	–
Tuning Pull-in Current	T2-15	%	–	–	–	YES	YES	–	–	–	–	YES	YES	YES

Input Value	Input Param.	Unit	Tuning Type (T2-01)											
			0 Motor Parameter Settings			1 Stationary		2 Stationary Stator Resis.	3 Z-Pulse Offset	11 Back EMF Const.	13 High Freq. Injection	14 Rotational		
Control Mode	A1-02	–	5, 6, 7	5	6, 7	5	6, 7	5, 6, 7	7	7	6, 7	5	6	7
Motor Code (Hex.)	T2-02	–	*<1>*	*<1>*	*<1>*	–	–	–	–	–	–	–	–	–
PG Number of Pulses Per Revolution	T2-16	ppr	YES *<2>*	–	YES *<2>*	–	YES *<2>*	–	–	–	–	–	–	YES
Z Pulse Offset	T2-17	deg (mech.)	YES *<2>*	–	YES *<2>*	–	YES *<2>*	–	–	–	–	–	–	–

<1> Input the motor code when using a Yaskawa motor. Select "FFFF" when using a motor from another manufacturer.

<2> Input data is needed for CLV/PM only.

<3> Dependent upon T2-13 setting.

■ Inertia Tuning and Speed Control Loop Auto-Tuning

Inertia Tuning can be performed when the drive is using CLV control for either IM or PM motors. Inertia Tuning automatically calculates load and motor inertia, and optimizes settings related to the KEB Ride-Thru function (KEB 2) and Feed Forward control.

ASR Gain Auto-Tuning performs the same operation as Inertia Tuning, while also optimizing speed control loop settings.

Table 4.32 Inertia and Speed Control Loop Tuning

Type	Setting		Control Mode	Application Conditions and Benefits
Inertia Tuning	IM Motor	T1-01 = 8	CLV	Allows the motor to rotate at a certain speed and applies a test signal. The response to the test signal is analyzed and the necessary adjustments are made to parameters controlling the Feed Forward and KEB Ride-Thru functions (KEB 2, L2-29 = 1).
	PM Motor	T2-01 = 8	CLV/PM	
ASR Gain Auto-Tuning	IM Motor	T1-01 = 9	CLV	Performs the same operation as Inertia Tuning, while also adjusting the ASR gain according to the test signal response.
	PM Motor	T2-01 = 9	CLV/PM	

Note: Inertia Tuning and ASR Gain Auto-Tuning may not be available when gears are between the machine and the motor shaft.

Table 4.33 explains the data that must be entered to perform the Inertia Tuning and ASR Gain Auto-Tuning. *Refer to Auto-Tuning for Permanent Magnet Motors on page 165* for details.

Table 4.33 Auto-Tuning Input Data

Input Value	Input Parameter	Unit	Tuning Type (T1-01 or T2-01)	
			8 Inertia Tuning	9 ASR Gain Tuning
Control Mode	A1-02	–	3, 7	3, 7
Test signal frequency	T3-01	Hz	YES	YES
Test signal amplitude	T3-02	rad	YES	YES
Motor inertia	T3-03	kgm^2	YES	YES
System response frequency	T3-04	Hz	–	YES

◆ Auto-Tuning Interruption and Fault Codes

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

Start-Up Programming & Operation

4

A – During Auto-Tuning   **B – Auto-Tuning Aborted**
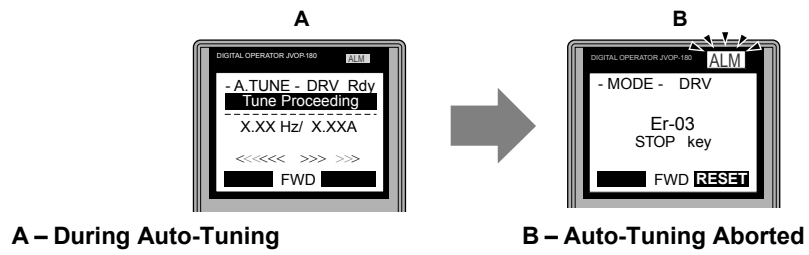
Figure 4.39 Auto-Tuning Aborted Display

◆ Auto-Tuning Operation Example

The following example demonstrates Rotational Auto-Tuning when using OLV (A1-02 = 2) and CLV (A1-02 = 3).

■ Selecting the Type of Auto-Tuning

	Step		Display/Result
1.	Turn on the power to the drive. The initial display appears.	➡	- MODE - DRV Rdy FREF (OPR) U1-01= 0.00Hz U1-02= 0.00Hz LSEQ U1-03= 0.00A LREF **JOG** FWD **FWD/REV**
2.	Press ∧ or ∨ until the Auto-Tuning display appears.	➡	- MODE - PRG Auto-Tuning AUTO **HELP** FWD **DATA**
3.	Press ENTER to begin setting parameters.	➡	- A.TUNE - PRG Rdy Tuning Mode Sel T1-**01**= 0 ∗0∗ StandardTuning **ESC** FWD **DATA**
4.	Press ENTER to display the value for T1-01. [1]	➡	- A.TUNE - PRG Rdy Tuning Mode Sel T1-01= **0** ∗0∗ StandardTuning "0" ← FWD →
5.	Save the setting by pressing ENTER.	➡	Entry Accepted
6.	The display automatically returns to the display shown in Step 3.	➡	- A.TUNE - PRG Rdy Tuning Mode Sel T1-**01**= 0 ∗0∗ StandardTuning **ESC** FWD **DATA**

[1] T1-00 will appear on the display when one of the multi-function inputs has been set to switch between motor 1 and motor 2 (H1-□□ = 16).

■ Enter Data from the Motor Nameplate

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

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

	Step		Display/Result
1.	Press ∧ to access the motor output power parameter T1-02.	➡	- A.TUNE - PRG Rdy Mtr Rated Power T1-**02**= 0.75kW (0.00 ~ 650.00) "0.75kW" **ESC** FWD **DATA**
2.	Press ENTER to view the default setting.	➡	- A.TUNE - PRG Rdy Mtr Rated Power T1-02= **0**00.75kW (0.00 ~ 650.00) "0.75kW" ← FWD →
3.	Press F1 left, F2 right, RESET, ∧, and ∨ to enter the motor power nameplate data in kW.	➡	- A.TUNE - PRG Rdy Mtr Rated Power T1-02= 000.4**0**kW (0.00 ~ 650.00) "0.75kW" ← FWD →
4.	Press ENTER to save the setting.	➡	Entry Accepted

Start-Up Programming & Operation

4

Step		Display/Result
5.	The display automatically returns to the display in Step 1.	➡	- A.TUNE - PRG Rdy Mtr Rated Power - - - - - - - - - - - - - - - T1-**02**= 0.40kW (0.00 ~ 650.00) "0.75kW" **ESC** FWD **DATA**
6.	Repeat Steps 1 through 5 to set the following parameters: • T1-03, Motor Rated Voltage • T1-04, Motor Rated Current • T1-05, Motor Base Frequency • T1-06, Number of Motor Poles • T1-07, Motor Base Frequency • T1-09, Motor No-Load Current (Stationary Auto-Tuning 1 or 2 only) • T1-10, Motor Rated Slip (Stationary Auto-Tuning 2 only)	➡	- A.TUNE - PRG Rated Voltage - - - - - - - - - - - - - - - T1-**03**= 200.0VAC (0.0 ~ 255.0) "200.0VAC" **ESC** FWD **DATA** ⋮ ⇓ - A.TUNE - PRG Mtr Rated Slip - - - - - - - - - - - - - - - T1-**10**= X.XX Hz (0.00 ~ 20.00) "X.XX Hz" **ESC** FWD **DATA**

Note: To execute Stationary Auto-Tuning for line-to-line resistance only, set parameters T1-02 and T1-04.

■ 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 area 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.*

NOTICE: *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 Auto-Tuning.*

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

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

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

4.8 No-Load Operation Test Run

◆ No-Load Operation Test Run

This section explains how to operate the drive with the motor decoupled from the load during a test run.

■ Before Starting the Motor

Check the following items before operation:
• Ensure the area around the motor is safe.
• Ensure external emergency stop circuitry is working properly and other safety precautions have been taken.

■ During Operation

Check the following items during operation:
• The motor should rotate smoothly (i.e., no abnormal noise or oscillation).
• The motor should accelerate and decelerate smoothly.
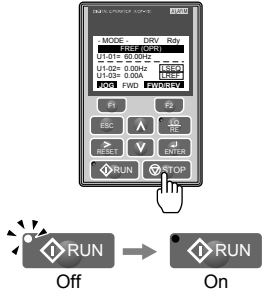
■ No-Load Operation Instructions

The following example illustrates a test run procedure using the digital operator.

Note: Before starting the motor, set the frequency reference d1-01 to 6 Hz.

	Step		Display/Result
1.	Turn on the power to the drive. The initial display appears.	➡	
2.	Press ⬛LO/RE to select LOCAL. The LO/RE light will turn on.	➡	Off On
3.	Press ◇RUN to give the drive a Run command. RUN will light and the motor will rotate at 6 Hz.	➡	Off On
4.	Ensure the motor is rotating in the correct direction and that no faults or alarms occur.	➡	Motor Forward
5.	If there is no error in step 4, press ⬛∧ to increase the frequency reference. Increase the frequency in increments of 10 Hz, verifying smooth operation at all speeds. For each frequency, check the drive output current using monitor U1-03. The current should be well below the motor rated current.	–	–

Start-Up Programming & Operation

4

Step		Display/Result
6.	The drive should operate normally. Press ⊘STOP to stop the motor. RUN flashes until the motor comes to a complete stop.	➡	

4.9 Test Run with Load Connected

◆ Test Run with the Load Connected

After performing a no-load test run, connect the motor and proceed to run the motor and load together.

■ Precautions for Connected Machinery

WARNING! *Sudden Movement Hazard. Clear all personnel from the drive, motor, and machine area before applying power. System may start unexpectedly upon application of power, causing death or serious injury.*

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

• The motor should come to a complete stop without problems.
• Connect the load and machinery to the motor.
• Fasten all installation screws properly and check that the motor and connected machinery are held in place.

■ Checklist Before Operation

• The motor should rotate in the proper direction.
• The motor should accelerate and decelerate smoothly.

■ Operating the Motor under Loaded Conditions

Test run the application similarly to the no-load test procedure when connecting the machinery to the motor.
• Monitor U1-03 for overcurrent during operation.
• If the application permits running the load in the reverse direction, change the motor direction and the frequency reference while watching for abnormal motor oscillation or vibration.
• Correct any problems that occur with hunting, oscillation, and other control-related issues.

Start-Up Programming
& Operation

4

4.10 Test Run Checklist

Review the checklist before performing a test run. Check each item that applies.

☑	No.	Checklist	Page
☐	1	Thoroughly read the manual before performing a test run.	–
☐	2	Turn the power on.	*133*
☐	3	Set the voltage for the power supply to E1-01.	*147*
☐	4	Select the correct duty rating (C6-01) for the application.	–

Check the items that correspond to the control mode being used.

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. When programmed for 3-Wire control, a momentary closure on terminal S1 may cause the drive to start.*

☑	No.	Checklist	Page
V/f Control (A1-02 = 0) and V/f Control with PG (A1-02 = 1)			
☐	5	Select the best V/f pattern according to the application and motor characteristics.	–
☐	6	Perform Rotational Auto-Tuning for V/f Control if using Energy Saving functions.	*164*
V/f Control with PG (A1-02 = 1)			
☐	7	Set up the PG feedback parameters correctly and make sure the encoder pulse counting direction is correct.	–
☐	8	Set the proportional gain for ASR speed control to C5-01 and the integral time to C5-02.	–
Open Loop Vector Control (A1-02 = 2) or Closed Loop Vector Control (A1-02 = 3)			
☐	9	Decouple motor shafts and machines when performing Rotational Auto-Tuning.	*164*
☐	10	Set the Auto-Tuning mode to T1-01 (0 for Rotational Auto-Tuning).	*164*
☐	11	Enter the following data according to the information listed on the motor nameplate: • Motor rated power to T1-02 (kW) • Motor rated voltage to T1-03 (V) • Motor rated current to T1-04 (A) • Motor base frequency to T1-05 (Hz) • Number of motor poles to T1-06 • Motor base speed to T1-07 (r/min)	*164*
Closed Loop Vector Control (A1-02 = 3)			
☐	12	Set F1-01 and F1-05.	–
☐	13	Set ASR proportional gain to C5-01 and ASR integral time to C5-02. Perform ASR Tuning if possible.	–
Open Loop Vector Control for PM (A1-02 = 5)			
☐	14	Perform Auto-Tuning as described.	*164*
Advanced Open Loop Vector Control for PM (A1-02 = 6)			
☐	15	Perform Auto-Tuning as described.	*164*
☐	16	Set the proportional gain for ASR speed control to C5-01 and the integral time to C5-02.	–
Closed Loop Vector Control for PM (A1-02 = 7)			
☐	17	Set PM motor data using E5-☐☐ parameters.	*164*
☐	18	Set ASR proportional gain to C5-01 and ASR integral time to C5-02. Perform ASR Tuning if possible.	–
☐	19	Set F1-01 and F1-05.	–
☐	20	Set the offset between the rotor magnetic axis and the Z-pulse of the connected encoder to E5-11.	–
☐	21	The DRV should be displayed on the LCD operator after giving a Run command.	–
☐	22	To give Run command and frequency reference from the digital operator, press "LO/RE" key to set to LOCAL.	*126*
☐	23	If the motor rotates in the opposite direction during test run, switch two of U/T1, V/T2, W/T3, or change b1-14.	*133*
☐	24	In accordance with load condition, set Heavy Duty or Normal Duty mode using parameter C6-01. Normal Duty is the default setting.	–

☑	No.	Checklist	Page
☐	25	Set motor rated current (E2-01, E4-01, E5-03) and motor protection (L1-01) values for motor thermal protection.	–
☐	26	Set the drive for REMOTE when control circuit terminals provide the Run command and frequency reference.	*126*
☐	27	If the control circuit terminals should supply the frequency reference, select the correct voltage input signal level (0 to 10 V or -10 to +10 V) or the correct current input signal level (4 to 20 mA or 0 to 20 mA).	*136*
☐	28	Apply the proper signal level to terminals A1 and A3 (0 to 10 V or -10 to +10 V).	*136*
☐	29	Apply the proper signal level (-10 to +10 V, 4 to 20 mA or 0 to 20 mA) to terminal A2.	*136*
☐	30	When current input is used, switch the built-in DIP switch S1 from the V-side to I-side. Set the level for current signal used to H3-09 (set "2" for 4 to 20 mA, or "3" for 0 to 20 mA).	*136*
☐	31	Set DIP Switch S1 on the drive to "I" when using terminal A2 as current input. Set DIP Switch S1 on the drive to "V" when using terminal A2 as voltage input.	–
☐	32	If an analog input supplies the frequency reference, make sure it produces the desired frequency reference. Make the following adjustments if the drive does not operate as expected: Gain adjustment: Set the maximum voltage/current signal and adjust the analog input gain (H3-03 for A1, H3-11 for A2, H3-07 for A3) until the frequency reference value reaches the desired value. Bias adjustment: Set the minimum voltage/current signal and adjust the analog input bias (H3-04 for A1, H3-12 for A2, H3-08 for A3) until the frequency reference value reaches the desired minimum value.	–

Start-Up Programming & Operation

4

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5

Troubleshooting

This chapter provides descriptions of the drive faults, alarms, errors, related displays, and guidance for troubleshooting. This chapter can also serve as a reference guide for tuning the drive during a trial run.

5.1 Drive Alarms, Faults, and Errors

◆ Types of Alarms, Faults, and Errors

Check the digital operator for information about possible faults if the drive or motor fails to operate. ***Refer to Using the Digital Operator on page 120***.

If problems occur that are not covered in this manual, contact Yaskawa or a Yaskawa representative with the following information:

- Drive model
- Software version
- Date of purchase
- Description of the problem

Table 5.1 contains descriptions of the various types of alarms, faults, and errors that may occur while operating the drive.

Table 5.1 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 211***.
Minor Faults and Alarms	When the drive detects an alarm or a minor fault: • The digital operator displays text indicating the specific alarm or minor fault, and the ALM indicator LED flashes. • The drive continues running the motor, although some alarms allow the user to select a stopping method when the alarm occurs. • A multi-function contact output set to be tripped by a minor fault (H2-□□ = 10) closes. If the output is set to be tripped by an alarm, the contact will not close. • The digital operator displays text indicating a specific alarm and the ALM indicator LED flashes. Remove the cause of the problem to reset a minor fault or alarm.
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.

5.2 Fault Detection

◆ Fault Displays, Causes, and Possible Solutions

Faults are detected for drive protection, and cause the drive to stop while toggling the form-C output associated with terminals MA-MB-MC. Remove the cause of the fault and manually clear the fault before attempting to run the drive again.

Table 5.2 Detailed Fault Displays, Causes, and Possible Solutions

Digital Operator Display		Fault Name
boL	boL	Braking Transistor Overload Fault
		The braking transistor reached its overload level.

Digital Operator Display		Fault Name
bUS	bUS	Option Communication Error
		• The connection was lost after establishing initial communication.
		• Only detected when the run command frequency reference is assigned to an option card.
Cause		**Possible Solution**
No signal was received from the PLC		• Check for faulty wiring.
Faulty communications wiring or an existing short circuit		• Correct the wiring.
		• Check for disconnected cables and short circuits and repair as needed.
Communication data error occurred due to noise		• Check the various options available to minimize the effects of noise.
		• Counteract noise in the control circuit, main circuit, and ground wiring.
		• Ensure that other equipment such as switches or relays do not cause noise. Use surge absorbers if necessary.
		• Use only recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side.
		• Separate all communication wiring from drive power lines. Install an EMC noise filter to the drive power supply input.
The option card is damaged		Replace the option card if there are no problems with the wiring and the error continues to occur.
The option card is not properly connected to the drive		• The connector pins on the option card do not line up properly with the connector pins on the drive.
		• Reinstall the option card.

Digital Operator Display		Fault Name
CE	CE	MEMOBUS/Modbus Communication Error
		Control data was not received for the CE detection time set to H5-09.
Cause		**Possible Solution**
Faulty communications wiring or an existing short circuit		• Check for faulty wiring.
		• Correct the wiring.
		• Check for disconnected cables and short circuits and repair as needed.
Communication data error occurred due to noise		• Check the various options available to minimize the effects of noise.
		• Counteract noise in the control circuit, main circuit, and ground wiring.
		• Use only recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side.
		• Ensure that other equipment such as switches or relays do not cause noise. Use surge suppressors if required.
		• Separate all communication wiring from drive power lines. Install an EMC noise filter to the drive power supply input.

Digital Operator Display		Fault Name
CF	CF	Control Fault
		The torque limit was reached continuously for three seconds after the Stop command was input and deceleration was not possible in OLV Control.

Digital Operator Display		Fault Name
CoF	CoF	Current Offset Fault
		Drive starts operation while the current-detection circuit failure, or the induced voltage remains in the motor (coasting and after rapid deceleration).

Troubleshooting

5

5.2 Fault Detection

Digital Operator Display		Fault Name
CPF00 or *CPF01*	CPF11 to CPF14 CPF16 to CPF19	Control Circuit Error
Cause		**Possible Solution**
There is a self-diagnostic error in the control circuit		• 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.
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 electrical signal 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 the drive input power side. • Ensure that other equipment such as switches or relays do not cause noise. Use surge suppressors 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
		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 = 2220, 3330).

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 the control board		• Turn off the power and reconnect the terminal board. • 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

Digital Operator Display		Fault Name
CPF12	CPF12	FLASH Memory Fault
		Problem with the ROM (FLASH memory)

Digital Operator Display		Fault Name
CPF 13	CPF13	Watchdog Circuit Exception
		Self-diagnostics problem.

Digital Operator Display		Fault Name
CPF 14	CPF14	Control Circuit Fault
		CPU error (CPU operates incorrectly due to interference, etc.)

Digital Operator Display		Fault Name
CPF 16	CPF16	Clock Fault
		Standard clock error.

Digital Operator Display		Fault Name
CPF 17	CPF17	Timing Fault
		A timing error occurred during an internal process.

Digital Operator Display		Fault Name
CPF 18	CPF18	Control Circuit Fault
		CPU error. Non-Maskable Interrupt (An unusual interrupt was triggered by interference, etc.)

Digital Operator Display		Fault Name
CPF 19	CPF19	Control Circuit Fault
		CPU error (Manual reset due to interference, etc.)

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	Hybrid IC Failure
Cause		**Possible Solution**
Hybrid IC failure on the power board		• Cycle power to the drive. • If the problem continues, replace the power board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the power 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 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
CPF24	CPF24	Drive Unit Signal Fault
		The drive capacity cannot be detected correctly (drive capacity is checked when the drive is powered up).
Cause		**Possible Solution**
Hardware is damaged		If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.

Digital Operator Display		Fault Name
CPF25	CPF25	Terminal Board Not Connected
Cause		**Possible Solution**
Terminal board is not connected correctly		Reconnect the terminal board to the connector on the drive, then cycle the power to the drive.

Troubleshooting

5

CPF26 to *CPF35* *CPF40* to *CPF45*	CPF26 to CPF35 CPF40 to CPF45	Control Circuit Error
		CPU 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**
dEu	dEv	Speed Deviation (for Control Mode with PG and AOLV/PM without PG)
		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.

du1	dv1	Z Pulse Fault (CLV/PM control mode only)
		The motor turned one full rotation without the Z Pulse being detected.

du2	dv2	Z Pulse Noise Fault Detection (CLV/PM control mode only)
		The Z Pulse is out of phase by more than 5 degrees for 10 consecutive revolutions.

du3	dv3	Inversion Detection (CLV/PM control mode only)
		The torque reference and acceleration are in opposite directions and the speed reference and actual motor speed differ by more than 30% for the number of times set to F1-18.

du4	dv4	Inversion Prevention Detection (CLV/PM control mode only)
		Pulses indicate that the motor is rotating in the opposite direction of the speed reference. Set the number of pulses to trigger inverse detection to F1-19.
		Note: Set F1-19 to 0 to disable inverse detection in applications where the motor may rotate in the opposite direction of the speed reference.

du7 *<1>*	dv7	Initial Polarity Estimation Timeout

<1> Available in drive software versions PRG: 1015 and later.

dUUAL	dWAL	DriveWorksEZ Fault
dUUFL	dWFL	

Digital Operator Display		**Fault Name**
dUUF1	dWF1	EEPROM Memory DriveWorksEZ Data Error
		There is an error in the DriveWorksEZ program saved to EEPROM.

Digital Operator Display		**Fault Name**
E5	E5	MECHATROLINK Watchdog Timer Error
		The watchdog timed out.

Cause	Possible Solution
Data has not been received from the PLC	Execute DISCONNECT or ALM_CLR, then issue a CONNECT command or SYNC_SET command and proceed to phase 3. Refer to the SI-T3 Option Technical Manual for more details on troubleshooting.

Digital Operator Display		**Fault Name**
EF0	EF0	Option Card External Fault
		An external fault condition is present.

Cause	Possible Solution
An external fault was received from the PLC and F6-03 is set to a value other than 3.	• Remove the cause of the external fault. • Remove the external fault input from the PLC.
Problem with the PLC program	Check the PLC program and correct problems.

Digital Operator Display		**Fault Name**
EF1	EF1	External Fault (input terminal S1)
		External fault at multi-function input terminal S1.

Digital Operator Display		Fault Name
EF2	EF2	External Fault (input terminal S2)
		External fault at multi-function input terminal S2.
EF3	EF3	External Fault (input terminal S3)
		External fault at multi-function input terminal S3.
EF4	EF4	External Fault (input terminal S4)
		External fault at multi-function input terminal S4.
EF5	EF5	External Fault (input terminal S5)
		External fault at multi-function input terminal S5.
EF6	EF6	External Fault (input terminal S6)
		External fault at multi-function input terminal S6.
EF7	EF7	External Fault (input terminal S7)
		External fault at multi-function input terminal S7.
EF8	EF8	External Fault (input terminal S8)
		External fault at multi-function input terminal S8.

Cause	Possible Solution
An external device tripped an alarm function	Remove the cause of the external fault and reset the fault.
Wiring is incorrect	• Properly connect the signal lines to the terminals assigned for external fault detection (H1-□□ = 20 to 2B). • Reconnect the signal line.
Multi-function contact input setting is incorrect	• Check for unused terminals set for H1-□□ = 20 to 2B (External Fault). • Change the terminal settings.

Digital Operator Display		Fault Name
Err	Err	EEPROM Write Error
		Data cannot be written to the EEPROM

Cause	Possible Solution
Noise has corrupted data while writing to the EEPROM	• Press "ENTER" on the digital operator. • Correct the parameter setting. • 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.
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
FAn	FAn	Internal Fan Fault
		Fan or magnetic contactor failure (detected when L8-32 = 0 to 2)

Cause	Possible Solution
Internal cooling fan has malfunctioned	• Cycle power to the drive. • Check for fan operation. • Verify the cumulative operation time of the fan with monitor U4-03, and verify the cumulative operation time of the fan maintenance timer with U4-04. • If the cooling fan has exceeded its expected performance life or is damaged in any other way, replace the fan.
Fault detected in the internal cooling fan or magnetic contactor to the power supply.	• Cycle power to the drive. • If the fault continues to occur, replace the power board/gate drive board or the entire drive. • Contact Yaskawa or a Yaskawa representative for instructions on replacing the power board/gate drive board.

Troubleshooting

5

Digital Operator Display		Fault Name
FbH	FbH	Excessive PID Feedback
		PID feedback input is greater than the level set to b5-36 for longer than the time set to b5-37. Set b5-12 to 2 or 5 to enable fault detection.
Cause		**Possible Solution**
Parameters are set inappropriately		Check b5-36 and b5-37 settings.
Incorrect PID feedback wiring		Correct the wiring.
There is a problem with the feedback sensor		• Check the sensor on the control side. • Replace the sensor if damaged.

Digital Operator Display		Fault Name
FbL	FbL	PID Feedback Loss
		PID feedback loss detection is programmed to trigger a fault (b5-12 = 2 or 5) and the PID feedback level is below the detection level set to b5-13 for longer than the time set to b5-14.
Cause		**Possible Solution**
Parameters are set inappropriately		Check b5-13 and b5-14 settings.
Incorrect PID feedback wiring		Correct the wiring.
There is a problem with the feedback sensor		• Check the sensor on the control side. • Replace the sensor if damaged.

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 reapply power to the drive
		• Check the resistance between the cable and the ground terminal ⏚. • Replace the cable.
Excessive leakage current at the drive output		• Reduce the carrier frequency. • Reduce the amount of stray capacitance.
The drive performed a current offset adjustment while the motor was rotating		• The set value exceeds the allowable setting range while the drive automatically adjusts the current offset. This generally only happens when attempting to restart a PM motor that is coasting to stop. • Set b3-01 to 1 to enable Speed Search at Start. • Perform Speed Search 1 or 2 (H1-☐☐ = 61 or 62) via one of the external terminals. Note: Speed Searches 1 and 2 are the same when using OLV/PM.
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 Main Circuit Wire Gauges and Tightening Torques on page 94*** for details.
The rated current of the motor being used is less than 5% of the drive rated current		Check the drive selection 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
		One or more of the phases in the output current are 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 are loose on the output side of the drive		Apply the tightening torque specified in this manual to fasten the terminals. ***Refer to Main Circuit Wire Gauges and Tightening Torques on page 94*** for details.
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 match. • Replace the motor.

Digital Operator Display		Fault Name
LF3 *<1>*	LF3	Power Unit Output Phase Loss 3
		• Phase loss occurred on the output side • Setting L8-78 to 1 enables Power Unit Output Phase Loss Protection
Cause		**Possible Solution**
The gate drive board in the power unit is damaged.		Cycle the power supply. If the fault continues to occur, replace the gate drive board or the drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the gate drive board.
Cable to the current detection circuit in the power unit is damaged or not connected properly.		Check for incorrect wiring and correct any wiring mistakes.
Cable between the output rector and the power unit is loose or not connected.		Contact Yaskawa or your nearest sales representative for instructions.

<1> Detected in models 4A0930 and 4A1200.

Digital Operator Display		Fault Name
LSo *<1>*	LSo	LSo Fault
		Pull-out has been detected at low speed.
Cause		**Possible Solution**
The incorrect motor code has been entered.		• Enter the correct motor code for the PM motor being used into E5-01. • For special-purpose motors, enter the correct data to all E5 parameters according to the test report provided for the motor.
The load is too heavy.		• Reduce the load. • Use a larger drive.
The drive incorrectly detected the position of the motor poles.		• Make sure some external force is not rotating the motor at start. • Enable Speed Search Selection at start. (b3-01 = 1). • If the value displayed in U6-57 is lower than 819, then set the polarity judge current (n8-84) higher than the default value. If the motor is to be operated at a speed higher than the rated speed, consult with the manufacturer.
Values set to parameters L8-93, L8-94, and L8-95 are incorrect.		• Increase the value set to L8-93. • Increase the value set to L8-94. • Increase the value set to L8-95.

<1> This function prevents continuous operation in reverse when using high frequency injection (n8-57 = 1) in AOLV/PM (A1-02 = 6) with a motor for which no motor code has been entered (it does not only prevent reverse operation). Set L8-93, L8-94, and L8-95 to low values within range of erroneous detection to quickly detect undesirable reverse operation.

Digital Operator Display		Fault Name
nSE	nSE	Node Setup Error
		A terminal assigned to the node setup function closed during run.
Cause		**Possible Solution**
Overcurrent occurred during Overexcitation Deceleration.		Reduce the overexcitation deceleration gain (n3–13).
The node setup terminal closed during run.		Stop the drive when using the node setup function.
A Run command was issued while the node setup function was active.		

Troubleshooting

5

5.2 Fault Detection

Digital Operator Display		Fault Name
oC	oC	Overcurrent
		Drive sensors detected an output current greater than the specified overcurrent level.

Cause	Possible Solution
The motor has been damaged due to overheating or the motor insulation is damaged	• Check the insulation resistance. • Replace the motor.
One of the motor cables has shorted out or there is a grounding problem	• Check the motor cables. • Remove the short circuit and reapply power to the drive.
	• Check the resistance between the motor cables and the ground terminal ⏚. • Replace damaged cables.
The drive is damaged	• Check the drive output side short circuit for a broken output transistor B1 and U/T1, V/T2, W/T3 – and U/T1, V/T2, W/T3 • Contact your Yaskawa representative or nearest Yaskawa sales office.
The load is too heavy	• Measure the current flowing into the motor. • Replace the drive with a larger capacity drive if the current value exceeds the rated current. • Determine if there is sudden fluctuation in the current level. • Reduce the load to avoid sudden changes in the current level or switch to a larger drive.
The acceleration or deceleration times are too short	Calculate the torque needed during acceleration relative to the load inertia and the specified acceleration time. If it is not possible to set the proper amount of torque, make the following changes: • Increase the acceleration time (C1-01, C1-03, C1-05, C1-07) • Increase the S-curve characteristics (C2-01 through C2-04) • Increase the capacity of the 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 the MC does not trip 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 electrical signal interference	• Review the possible solutions provided for handling electrical signal interference. • Review the section on handling noise interference and check the control circuit lines, main circuit lines, and ground wiring.
Overexcitation gain is set too high	• Check if the fault occurs simultaneously with overexcitation function operation. • Consider motor flux saturation and reduce the value of n3-13 (Overexcitation Deceleration Gain).
Run command was applied while motor was coasting	• Set b3-01 to 1 to enable Speed Search at Start. • Program the Speed Search command input through one of the multi-function contact input terminals (H1-□□ = 61 or 62).
The wrong motor code has been entered for OLV/PM (Yaskawa motors only) or the motor data are wrong	• Enter the correct motor code to E5-01. • Set E5-01 to FFFF if using a non-Yaskawa PM motor. Set the correct motor data to the E5-□□ parameters or perform Auto-Tuning.
The overcurrent level has exceeded the value set to L8-27 (PM control modes)	Correct the value set to overcurrent detection gain (L8-27).
The motor control method and motor do not match	• Check the control mode. • For IM motors, set A1-02 to 0, 1, 2, or 3. • For PM motors, set A1-02 to 5, 6, or 7.
The rated output current of the drive is too small	Use a larger drive.

Digital Operator Display		Fault Name
$oFA00$	oFA00	Option Card Connection Error at Option Port CN5-A
		Option compatibility error

Digital Operator Display		Fault Name
oFA01	oFA01	Option Card Fault at Option Port CN5-A
		Option not properly connected

Cause	Possible Solution
The option card connection to port CN5-A is faulty	• Turn off the power and reconnect the option card. • Check if the option card is properly plugged into the option port. Make sure the card is fixed properly. • If the option is not a communication option card, try to use the card in a different option port. If the option card works properly in a different option port, CN5-A is damaged, and the drive requires replacement. If the error persists (oFb01 or oFC01 occur), replace the option card.

Digital Operator Display		Fault Name
oFA03 to oFA06	oFA03 to oFA06	Option Card Error Occurred at Option Port CN5-A
oFA10, oFA11	oFA10, oFA11	
oFA12 to oFA17	oFA12 to oFA17	Option Card Connection Error (CN5-A)
oFA30 to oFA43	oFA30 to oFA43	Communication Option Card Connection Error (CN5-A)

Cause	Possible Solution
Option card or hardware is damaged	• Cycle power to the drive. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.

oFb00	oFb00	Option Card Fault at Option Port CN5-B
		Option compatibility error
oFb01	oFb01	Option Card Fault at Option Port CN5-B
		Option not properly connected
oFb02	oFb02	Option Card Fault at Option Port CN5-B
		Same type of option card is currently connected
oFb03 to oFb11	oFb03 to oFb11	Option card error occurred at Option Port CN5-B
oFb12 to oFb17	oFb12 to oFb17	
oFC00	oFC00	Option Card Connection Error at Option Port CN5-C
		Option compatibility error
oFC01	oFC01	Option Card Fault at Option Port CN5-C
		Option not properly connected
oFC02	oFC02	Option Card Fault at Option Port CN5-C
		Same type of option card is currently connected
oFC03 to oFC11	oFC03 to oFC11	Option Card Error Occurred at Option Port CN5-C
oFC12 to oFC17	oFC12 to oFC17	
oFC50 to oFC55	oFC50 to oFC55	Option Card Error Occurred at Option Port CN5-C

Digital Operator Display		Fault Name
oH	oH	Heatsink Overheat
		The heatsink temperature exceeded the overheat pre-alarm level set to L8-02. The default value for L8-02 is determined by drive model selection (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 selection (C6-02).

Digital Operator Display	Fault Name
Internal cooling fan is stopped	• Replace the cooling fan. • After replacing the cooling fan, set parameter o4-03 to 0 to reset the cooling fan maintenance.

Digital Operator Display		Fault Name
oH1	oH1	Overheat 1 (Heatsink Overheat)
		The heatsink temperature exceeded the drive overheat level. 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 selection (C6-02). • Reduce the load.

Digital Operator Display		Fault Name
oH3	oH3	Motor Overheat Alarm (PTC Input)
		• The motor overheat signal to analog input terminal A1, A2, or A3 exceeded the alarm detection level. • Detection requires setting multi-function analog inputs H3-02, H3-10, or H3-06 to E.

oH4	oH4	Motor Overheat Fault (PTC Input)
		• The motor overheat signal to analog input terminal A1, A2, or A3 exceeded the fault detection level. • Detection requires setting multi-function analog inputs H3-02, H3-10, or H3-06 to E.
Cause		**Possible Solution**
Motor has overheated		• Check the size of the load, the accel/decel times, and the cycle times. • Decrease the load. • Increase the acceleration and deceleration times (C1-01 through C1-08).
		• Adjust the preset V/f pattern (E1-04 through E1-10) by reducing E1-08 and E1-10. • Do not set E1-08 and E1-10 too low. This reduces load tolerance at low speeds.
		• Check the motor rated current. • Enter the motor rated current to parameter E2-01 as indicated on the motor nameplate. • Ensure the motor cooling system is operating normally. • Repair or replace the motor cooling system.

Digital Operator Display		Fault Name
oH5 *<1>*	oH5	Motor Overheat (NTC Input)
		The motor temperature exceeded the level set to L1-16 (or L1-18 for motor 2)
Cause		**Possible Solution**
Motor has overheated		• Reduce the load. • Check the ambient temperature.

<1> Detected in models 4A0930 and 4A1200.

Digital Operator Display		Fault Name
oL 1	oL1	Motor Overload
		The electronic motor overload protection tripped
Cause		**Possible Solution**
Load is too heavy		Reduce the load. **Note:** Reset oL1 when the U4-16 value falls below 100.0%. U4-16 value must be less than 100.0% before oL1 can be reset.
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 a 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.
V/f characteristics (voltage and frequency) are not suitable		Set the V/f pattern setting parameters (E1-04 to E1-10) to match the motor characteristics.
The wrong motor rated current is set to E2-01		• Check the motor-rated current. • Enter the motor rated current to parameter E2-01 as indicated on the motor nameplate.
Multiple motors are running off the same drive		Set L1-01 to 0 to disable the motor protection function and then 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).
Motor overheated by overexcitation operation		• Overexcitation increases the motor loss and the motor temperature. Excessive duration of overexcitation may cause motor damage. Prevent excessive overexcitation operation or apply proper cooling to the motor. • Reduce the excitation deceleration gain (n3-13). • Set L3-04 (Stall Prevention during Deceleration) to a value other than 4. • Set n3-23 (Overexcitation Operation Selection) to 0 (disabled).
Parameters related to Speed Search are set incorrectly		• Check values set to Speed Search related parameters. • Adjust the Speed Search current and Speed Search deceleration times (b3-02 and b3-03 respectively). • After Auto-Tuning, set b3-24 to 1 to enable Speed Estimation Speed Search.
Output current fluctuation due to power supply loss		Check the power supply for phase loss.

Digital Operator Display		Fault Name
oL 2	oL2	Drive Overload
		The thermal sensor of the drive triggered overload protection.
Cause		**Possible Solution**
Load is too heavy		Reduce the load.
Acceleration or deceleration time is too short		Increase the settings for the acceleration and deceleration times (C1-01 through C1-08).
V/f characteristics (voltage) are not suitable		Set the V/f pattern setting parameters (E1-04 to E1-10) to match the motor characteristics.
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 (C6-02).
Excessive torque compensation		Reduce the torque compensation gain in parameter C4-01 until there is no speed loss but less current.
Parameters related to Speed Search are set incorrectly		• Check the settings for all Speed Search related parameters. • Adjust the current used during Speed Search (b3-03) and the Speed Search deceleration time (b3-02). • After Auto-Tuning, set b3-24 to 1 to enable Speed Estimation Speed Search.
Output current fluctuation due to input phase loss		Check the power supply for phase loss.

Troubleshooting

5

Digital Operator Display		Fault Name
oL3	oL3	Overtorque Detection 1
		The current has exceeded the value set for Torque Detection Level 1 (L6-02) for longer than the allowable time (L6-03).
Cause		**Possible Solution**
Parameter settings are not appropriate for the load		Check L6-02 and L6-03 settings.
Fault on the machine side (e.g., machine is locked up)		Check the status of the load. Remove the cause of the fault.

Digital Operator Display		Fault Name
oL4	oL4	Overtorque Detection 2
		The current has exceeded the value set for Torque Detection Level 2 (L6-05) for longer than the allowable time (L6-06).

Digital Operator Display		Fault Name
oL5	oL5	Mechanical Weakening Detection 1
		Overtorque occurred, matching the conditions specified in L6-08.

Digital Operator Display		Fault Name
oL7	oL7	High Slip Braking oL
		The output frequency stayed constant for longer than the time set to n3-04 during High Slip Braking.

Digital Operator Display		Fault Name
oPr	oPr	External Digital Operator Connection Fault
		The external operator has been disconnected from the drive.
		Note: An oPr fault will occur when all of the following conditions are true: • Output is interrupted when the operator is disconnected (o2-06 = 1). • The Run 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. Reconnect the operator and reapply drive input power.

Digital Operator Display		Fault Name
oS	oS	Overspeed
		The motor speed feedback exceeded the F1-08 setting.

		Overvoltage
⚆⊔	ov	Voltage in the DC bus has exceeded the overvoltage detection level. • For 200 V class drives: approximately 410 V • For 400 V class drives: approximately 820 V (740 V when E1-01 is less than 400) • For 600 V class drives: approximately 1040 V
Cause		**Possible Solution**
Deceleration time is too short and regenerative energy is flowing from the motor into the drive		• Increase the deceleration time (C1-02, C1-04, C1-06, C1-08). • Install a dynamic braking resistor or a dynamic braking resistor unit. • Set L3-04 to 1 to enable stall prevention during deceleration. Stall Prevention is enabled as the default setting.
Fast acceleration time causes the motor to overshoot the speed reference		• Check if sudden drive acceleration triggers an overvoltage alarm. • Increase the acceleration time. • Use longer S-curve acceleration and deceleration times. • Enable the Overvoltage Suppression function (L3-11 = 1). • Lengthen the S-curve at acceleration end.
Excessive braking load		The braking torque was too high, causing regenerative energy to charge the DC bus. Reduce the braking torque, use a dynamic braking option, or lengthen decel time.
Surge voltage entering from the drive input power		Install a DC link choke. **Note:** Voltage surge can result from a thyristor convertor and phase advancing capacitor using the same input power supply.
Ground fault in the output circuit causes the DC bus capacitor to overcharge		• Check the motor wiring for ground faults. • Correct grounding shorts and reapply power.
Improper parameters related to Speed Search (including Speed Search after a momentary power loss and after a fault restart)		• Check the settings for Speed Search-related parameters. • Enable Speed Search restart function (b3-19 greater than or equal to 1, up to 10). • Adjust the current level during Speed Search and the deceleration time (b3-02 and b3-03 respectively). • Perform Stationary Auto-Tuning for line-to-line resistance and then set b3-14 to 1 to enable Speed Estimation Speed Search.
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 or braking resistor are wired incorrectly		• Check braking transistor and braking resistor wiring for errors. • Properly rewire the braking resistor device.
PG cable is disconnected		Reconnect the cable.
PG cable wiring is wrong		Correct the wiring.
Electrical signal interference along the PG encoder wiring		Separate the wiring from the source of the electrical signal interference. Often, the source is the output lines from the drive.
Drive fails to operate properly due to electrical signal interference		• Review the list of possible solutions provided for controlling electrical signal interference. • Review the section on handling electrical signal interference and check the control circuit lines, main circuit lines, and ground wiring.
Load inertia is set incorrectly		• Check the load inertia settings when using KEB, overvoltage suppression, or Stall Prevention during deceleration. • Adjust the load inertia ratio in L3-25 to better match the load.
Braking function is being used in OLV/PM		Connect a braking resistor.
Motor hunting occurs		• Adjust the parameters that control hunting. • Set the gain for Hunting Prevention (n1-02). • Adjust the AFR time constant (n2-02 and n2-03). • Adjust the speed feedback detection suppression gain for PM motors (n8-45) and the time constant for pull-in current (n8-47).

Digital Operator Display		Fault Name
PF	PF	Input Phase Loss
		Drive input power has an open phase or has a large imbalance of voltage between phases. Detected when L8-05 is set 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 Main Circuit Wire Gauges and Tightening Torques on page 94*** for details.
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 main capacitor(s) if U4-05 is greater than 90%. For instructions on replacing the capacitor(s), 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	PGo	PG Disconnect (for any control modes using a PG option card)
		No PG pulses are received for longer than the time set to F1-14.

PGoH	PGoH	PG Hardware Fault (detected when using a PG-X3 option card)
		PG cable is not connected properly.

Digital Operator Display		Fault Name
rF	rF	Braking Resistor Fault
		The resistance of the braking resistor is too low.
Cause		**Possible Solution**
The proper braking resistor option has not been installed		Select a braking resistor option that it fits the drive braking transistor specification.
A regenerative converter, regenerative unit, or braking unit is being used and the ⊕1 or ⊕3 terminal is connected to ⊖ terminal		Set L8-55 to 0 to disable the braking transistor protection selection.

rH	rH	Braking Resistor Overheat
		Braking resistor protection was triggered. Fault detection is enabled when L8-01 = 1 (disabled as a default).
Cause		**Possible Solution**
Deceleration time is too short and excessive regenerative energy is flowing back into the drive		• Check the load, deceleration time, and speed. • Reduce the load inertia. • Increase the deceleration times (C1-01 to C1-08). • Replace the dynamic braking option with a larger device that can handle the power that is discharged.
The duty cycle is too high		Check the duty cycle. Maximum of 3% duty cycle is available when L8-01 = 1.
Excessive braking inertia		Recalculate braking load and braking power. Reduce the braking load by adjusting braking resistor settings.
The braking operation duty cycle is too high		Check the braking operation duty cycle. Braking resistor protection for ERF-type braking resistors (L8-01 = 1) allows a braking duty cycle of maximum 3%.
The proper braking resistor has not been installed		• Check the specifications and conditions for the braking resistor device. • Select the optimal braking resistor.
Note:		The magnitude of the braking load trips the braking resistor overheat alarm, NOT the surface temperature. Using the braking resistor more frequently than its rating permits will trip the alarm even when the braking resistor surface is not very hot.

Digital Operator Display		Fault Name
rr	rr	Dynamic Braking Transistor
		The built-in dynamic braking transistor failed.

Digital Operator Display		Fault Name
Cause		**Possible Solution**
The braking transistor is damaged		• Cycle power to the drive and check for reoccurrence of the fault.
The control circuit is damaged		• Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.

Digital Operator Display		Fault Name
_SC_ *<1>*	SC	Output Short Circuit or IGBT Fault
		Short circuit or ground fault is detected.
		Note: Fault reset will not be received to prevent a short-circuit of the internal circuitry caused by the IGBP fault.

<1> Available in drive software versions PRG: 1015 and later.

Digital Operator Display		Fault Name
SEr	SEr	Too Many Speed Search Restarts
		The number of Speed Search restarts exceeded the value set to b3-19.
Cause		**Possible Solution**
Parameters related to Speed Search are set to the wrong values		• Reduce the detection compensation gain during Speed Search (b3-10). • Increase the current level when attempting Speed Search (b3-17). • Increase the detection time during Speed Search (b3-18). • Repeat Auto-Tuning.
The motor is coasting in the opposite direction of the Run command		Set b3-14 to 1 to enable Bi-Directional Speed Search.

STo	STo	Pull-Out Detection
		Motor pull out or step out has occurred. Motor has exceeded its pull-out torque.

SvE	SvE	Zero Servo Fault
		Position deviation during zero servo.

THo *<1>*	THo	Thermistor Disconnect
		The thermistor that detects motor temperature has become disconnected.

<1> Detected in models 4A0930 and 4A1200.

Digital Operator Display		Fault Name
_UL3_	UL3	Undertorque Detection 1
		The current has fallen below the minimum value set for Torque Detection Level 1 (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 Level 2 (L6-05) for longer than the allowable time (L6-06).

_UL5_	UL5	Mechanical Weakening Detection 2
		The operation conditions matched the conditions set to L6-08.

UnbC *<1>*	UnbC	Current Unbalance
		Current flow has become unbalanced.

<1> Detected in models 4A0930 and 4A1200.

Troubleshooting

5

Digital Operator Display		Fault Name
Uv1	Uv1	DC Bus Undervoltage
		One of the following conditions occurred while the drive was running: • Voltage in the DC bus fell below the undervoltage detection level (L2-05). • For 200 V class drives: approximately 190 V • For 400 V class drives: approximately 380 V (350 V when E1-01 is less than 400) • For 600 V class drives: approximately 475 V The fault is output only if L2-01 is set to 0 or 1 and the DC bus voltage has fallen below the level set to L2-05 for longer than the time set to L2-02.
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 Main Circuit Wire Gauges and Tightening Torques on page 94*** for details.
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 relay is damaged		• Cycle power to the drive and see if the fault reoccurs. • Check monitor U4-06 for the performance life of the soft-charge bypass relay. • 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**
In drive models 2A0004 to 2A0056 or 4A0002 to 4A0031, L2-02 was changed from its default value without installing a Momentary Power Loss Ride-Thru unit		Correct the setting to L2-02 or install an optional Momentary Power Loss Ride-Thru unit.
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	Undervoltage 3 (Soft-Charge Bypass Relay Fault)
		The soft-charge bypass relay failed.
Cause		**Possible Solution**
The relay or contactor on the soft-charge bypass relay is damaged		• Cycle power to the drive and see if the fault reoccurs. • Check monitor U4-06 for the performance life of the soft-charge bypass relay. • 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.

Uv4 *<1>*	Uv4	Gate Drive Board Undervoltage
		Voltage drop in the gate drive board circuit

<1> Detected in models 4A0930 and 4A1200.

Digital Operator Display		Fault Name
$ \sqcup \mathit{o} F $	voF	Output Voltage Detection Fault
		Problem detected with the voltage on the output side of the drive.
Cause		**Possible Solution**
Hardware is damaged. Internal drive module MC / FAN overheat protection circuit board is due to abnormal ambient operating power.		• Lower ambient temperature. • Replace the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.

5.3   Alarm Detection

◆ Alarm Codes, Causes, and Possible Solutions

Alarms are drive protection functions that do not necessarily cause the drive to stop. After removing the cause of an alarm, the drive will return to the same status is was 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.

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 5.3 Alarm Codes, Causes, and Possible Solutions

Digital Operator Display		Minor Fault Name
AEr	AEr	Station Address Setting Error (CC-Link, CANopen, MECHATROLINK)
		Option card node address is outside of the acceptable setting range.

Digital Operator Display		Minor Fault Name
_bb_	bb	Baseblock
		Drive output interrupted as indicated by an external baseblock signal.

Digital Operator Display		Minor Fault Name	
boL	boL	Braking Transistor Overload Fault	
		The braking transistor in the drive has been overloaded.	
Cause		**Possible Solutions**	
The proper braking resistor has not been installed.		Select the proper braking resistor.	
Use a regen converter, regen unit, braking unit, or other device to connect the +1 or +3 terminal to the - terminal.		Set L8-55 to 0 to disable Internal Braking Transistor Protection.	
The use rate of the braking transistor is high (i.e., the regen converter is large or the repetition frequency is high).		• Change to a CDBR type braking unit. • Change to a regen converter. • Increase the deceleration time.	
The braking transistor inside the drive is faulty.		Replace the drive.	

Digital Operator Display		Minor Fault Name
bUS	bUS	Option Communication Error
		• The connection was lost after initial communication was established. • Assign a Run command frequency reference to the option.
Cause		**Possible Solutions**
Connection is broken or master controller stopped communicating.		• Check for faulty wiring. • Correct the wiring. • Check for disconnected cables and short circuits. Repair as needed.
Option is damaged.		If there are no problems with the wiring and the fault continues to occur, replace the option.
The option is not properly connected to the drive.		• The connector pins on the option are not properly lined up with the connector pins on the drive. • Reinstall the option.
A data error occurred due to noise.		• Check options available to minimize the effects of noise. • Take steps to counteract noise in the control circuit wiring, main circuit lines and ground wiring. • Try to reduce noise on the controller side. • Use surge absorbers on magnetic contactors or other equipment causing the disturbance. • Use recommended cables or some other type of shielded line. Ground the shield to the controller side or on the input power side. • Separate the wiring for communication devices from the drive input power lines. Install an EMC noise filter to the drive input power.

Digital Operator Display		Minor Fault Name
CALL	CALL	Serial Communication Transmission Error
		Communication has not yet been established.
Cause		**Possible Solutions**
Communications wiring is faulty, there is a short circuit, or something is not connected properly.		• Check for wiring errors. • Correct the wiring. • Check for disconnected cables and short circuits. Repair as needed.
Programming error on the master side.		Check communications at start-up and correct programming errors.
Communications circuitry is damaged.		• Perform a self-diagnostics check. • If the problem continues, replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.
Termination resistor setting is incorrect.		Install a termination resistor at both ends of a communication line. Set the internal termination resistor switch correctly on slave drives. Place DIP switch S2 to the ON position.

Digital Operator Display		Minor Fault Name
CE	CE	MEMOBUS/Modbus Communication Error
		Control data was not received correctly for two seconds.
Cause		**Possible Solutions**
A data error occurred due to noise.		• Check options available to minimize the effects of noise. • Take steps to counteract noise in the control circuit wiring, main circuit lines, and ground wiring. • Reduce noise on the controller side. • Use surge absorbers for the magnetic contactors or other components that may be causing the disturbance. • Use only recommended shielded line. Ground the shield on the controller side or on the drive input power side. • Separate all wiring for communication devices from drive input power lines. Install an EMC noise filter to the drive input power supply.
Communication protocol is incompatible.		• Check the H5 parameter settings and the protocol setting in the controller. • Ensure settings are compatible.
The CE detection time (H5-09) is set shorter than the time required for a communication cycle to take place.		• Check the PLC. • Change the software settings in the PLC. • Set a longer CE detection time using parameter H5-09.
Incompatible PLC software settings or there is a hardware problem.		• Check the PLC. • Remove the cause of the error on the controller side.
Communications cable is disconnected or damaged.		• Check the connector to make sure the cable has a signal. • Replace the communications cable.

Digital Operator Display		Minor Fault Name
CrST	CrST	Cannot Reset
Cause		**Possible Solutions**
Fault reset was being executed when a Run command was entered.		• Ensure that a Run command cannot be entered from the external terminals or option during fault reset. • Turn off the Run command.

CYC	CyC	MECHATROLINK Comm. Cycle Setting Error
		Comm. Cycle Setting Error was detected.

dEv	dEv	Speed Deviation (when using a PG option card and AOLV/PM without PG)
		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.

Digital Operator Display		Minor Fault Name
dnE	dnE	Drive Disabled
Cause		**Possible Solutions**
"Drive Enable" is set to a multi-function contact input (H1-□□ = 6A) and that signal was switched off.		Check the operation sequence.

Troubleshooting

5

5.3 Alarm Detection

Digital Operator Display		Minor Fault Name
EF	EF	Forward/Reverse Run Command Input Error
		Both forward run and reverse run closed simultaneously for longer than 0.5 s.
Cause		**Possible Solutions**
Sequence error		Check the forward and reverse command sequence and correct the problem.
		Note: When minor fault EF detected, motor ramps to stop.

Digital Operator Display		Minor Fault Name
EF0	EF0	Option Card External Fault
		An external fault condition is present.
Cause		**Possible Solutions**
An external fault was received from the PLC with F6-03 set to 3, which allows the drive to continue running after an external fault occurs.		• Remove the cause of the external fault. • Remove the external fault input from the PLC.
There is a problem with the PLC program.		Check the PLC program and correct problems.

EF1	EF1	External Fault (Input Terminal S1)
		External fault at multi-function input terminal S1.
EF2	EF2	External fault (input terminal S2)
		External fault at multi-function input terminal S2.
EF3	EF3	External fault (input terminal S3)
		External fault at multi-function input terminal S3.
EF4	EF4	External fault (input terminal S4)
		External fault at multi-function input terminal S4.
EF5	EF5	External fault (input terminal S5)
		External fault at multi-function input terminal S5.
EF6	EF6	External fault (input terminal S6)
		External fault at multi-function input terminal S6.
EF7	EF7	External fault (input terminal S7)
		External fault at multi-function input terminal S7.
EF8	EF8	External fault (input terminal S8)
		External fault at multi-function input terminal S8.

FAn	FAn	Internal Fan Fault
		Fan or magnetic contactor failure (detected when L8-32 = 3 or 4)
Cause		**Possible Solution**
Internal cooling fan has malfunctioned		• Cycle power to the drive. • Check for fan operation. • Verify the cumulative operation time of the fan with monitor U4-03, and verify the cumulative operation time of the fan maintenance timer with U4-04. • If the cooling fan has exceeded its expected performance life or is damaged in any other way, replace the fan.
Fault detected in the internal cooling fan or magnetic contactor to the power supply.		• Cycle power to the drive. • If the fault continues to occur, replace the power board/gate drive board or the entire drive. • Contact Yaskawa or a Yaskawa representative for instructions on replacing the power board/gate drive board.

Digital Operator Display		Minor Fault Name
FbH	FbH	Excessive PID Feedback
		The PID feedback input is higher than the level set to b5-36 for longer than the time set to b5-37, and b5-12 is set to 1 or 4.
Cause		**Possible Solutions**
Parameter settings for b5-36 and b5-37 are incorrect.		Check parameters b5-36 and b5-37.
PID feedback wiring is faulty.		Correct the wiring.

Digital Operator Display	Minor Fault Name
Feedback sensor has malfunctioned.	Check the sensor and replace it if damaged.
Feedback input circuit is damaged.	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		Minor Fault Name
FbL	FbL	PID Feedback Loss
		The PID feedback input is lower than the level set to b5-13 for longer than the time set to b5-14.
Cause		**Possible Solutions**
Parameter settings for b5-13 and b5-14 are incorrect.		Check parameters b5-13 and b5-14.
PID feedback wiring is faulty.		Correct the wiring.
Feedback sensor has malfunctioned.		Check the sensor and replace it if damaged.
Feedback input circuit is damaged.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.

Hbb	Hbb	Safe Disable Signal Input
		Both Safe Disable Input channels are open.

HbbF	HbbF	Safe Disable Signal Input
		One Safe Disable channel is open while the other channel is closed.

HCA	HCA	Current Alarm
		Drive current exceeded overcurrent warning level (150% of the rated current).

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: The signal closes when the maintenance period ends if H2-□□ = 2F. The signal will not close if H2-□□ = 10.
Cause		**Possible Solutions**
The cooling fan has reached 90% of its expected performance life.		Replace the cooling fan and set o4-03 to 0 to reset the Maintenance Monitor.

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: The signal closes when the maintenance period ends if H2-□□ = 2F. The signal will not close if H2-□□ = 10.
Cause		**Possible Solutions**
The main circuit and control circuit capacitors have reached 90% of their expected performance lives.		Replace the drive.

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: The signal closes when the maintenance period ends if H2-□□ = 2F. The signal will not close if H2-□□ = 10.
Cause		**Possible Solutions**
The DC bus soft charge relay has reached 90% of expected performance life.		Replace the drive.

Troubleshooting

5

5.3 Alarm Detection

Digital Operator Display		Minor Fault Name
LT-4	LT-4	IGBT Maintenance Time (50%)
		IGBTs have reached 50% of their expected performance life.
		Note: The signal closes when the maintenance period ends if H2-□□ = 2F. The signal will not close if H2-□□ = 10.
Cause		**Possible Solutions**
IGBTs have reached 50% of their expected performance life.		Check the load, carrier frequency, and output frequency.

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 model selection (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, set parameter o4-03 to 0 to reset the cooling fan operation time.
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 28*** for details. • Allow for the proper space and ensure that there is sufficient circulation around the control panel. • Check for dust or other foreign materials clogging the cooling fan. • Clear debris caught in the fan that restricts air circulation.

oH2	oH2	Heatsink Overheat Warning
		"Heatsink Overheat Warning" was input to a multi-function input terminal, S1 through S8 (H1-□□= B).

oH3	oH3	Motor Overheat
		The motor overheat signal entered to a multi-function analog input terminal exceeded the alarm level (H3-02, H3-06 or H3-10 = E).

oH5 <1>	oH5	Motor Overheat (NTC Input)
		The motor temperature exceeded the level set to L1-16 (or L1-18 for motor 2)

<1> Detected in models 4A0930 and 4A1200.

oL3	oL3	Overtorque 1
		Drive output current (or torque in OLV, CLV, AOLV/PM, and CLV/PM) was greater than L6-02 for longer than the time set to L6-03.

oL4	oL4	Overtorque 2
		Drive output current (or torque in OLV, CLV, AOLV/PM, CLV/PM) was greater than L6-05 for longer than the time set to L6-06.

oL5	oL5	Mechanical Weakening Detection 1
		Overtorque occurred, matching the conditions specified in L6-08.

oS	oS	Overspeed
		The motor speed feedback exceeded the F1-08 setting.

ov	ov	DC Bus Overvoltage
		The DC bus voltage exceeded the trip point. • For 200 V class drives: approximately 410 V • For 400 V class drives: approximately 820 V (740 V when E1-01 is less than 400) • For 600 V class drives: approximately 1040 V

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	PG Disconnect (for Control Mode with PG)
		Detected when no PG pulses are received for a time longer than setting in F1-14.

Digital Operator Display		Minor Fault Name
PGoH	PGoH	PG Hardware Fault (detected when using a PG-X3 option card)
		PG cable has become disconnected.

Digital Operator Display		Minor Fault Name
rUn	rUn	Motor Switch during Run
		A command to switch motors was entered during run.

Digital Operator Display		Minor Fault Name
SE	SE	MEMOBUS/Modbus Communication Test Mode Error **Note:** This alarm will not trigger a multi-function output terminal that is set for alarm output (H2-□□ = 10).
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
THo <1>	THo	Thermistor Disconnect
		The thermistor used to detect motor temperature has become disconnected.

<1> Detected in models 4A0930 and 4A1200.

Digital Operator Display		Minor Fault Name
TrPC	TrPC	IGBT Maintenance Time (90%)
		IGBTs have reached 90% of their expected performance life.
Cause		**Possible Solutions**
IGBTs have reached 90% of their expected performance life.		Replace the drive.

Digital Operator Display		Minor Fault Name
UL3	UL3	Undertorque Detection 1
		Drive output current (or torque in OLV, CLV, AOLV/PM, and CLV/PM) less than L6-02 for longer than L6-03 time.

Digital Operator Display		Minor Fault Name
UL4	UL4	Undertorque Detection 2
		Drive output current (or torque in OLV, CLV, AOLV/PM, and CLV/PM) less than L6-05 for longer than L6-06 time.

Troubleshooting

5

Digital Operator Display		Minor Fault Name
_Uu_	Uv	Undervoltage
		One of the following conditions was true when the drive was stopped and a Run 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 Main Circuit Wire Gauges and Tightening Torques on page 94***.
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.

uoF	voF	Output Voltage Detection Fault
		There is a problem with the output voltage.

5.4 Operator Programming Errors

◆ Operator Programming Error 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 5.4* for the appropriate action. When oPE02 or oPE08 appear on the operator display, press the ENTER button to view U1-18 and see which parameter is causing the oPE.

Table 5.4 oPE Codes, Causes, and Possible Solutions

oPE01	oPE01	Drive Capacity Setting Fault
		Drive capacity and the value set to o2-04 do not match.
oPE02	oPE02	Parameter Range Setting Error
		Use U1-18 to find parameters set outside the range.
oPE03	oPE03	Multi-Function Input Selection Error
		A contradictory setting is assigned to multi-function contact inputs H1-01 to H1-08.
oPE04	oPE04	Initialization Required
oPE05	oPE05	Run Command/Frequency Reference Source Selection Error
oPE06	oPE06	Control Method Selection Error
		Correct the setting for the control method.
oPE07	oPE07	Multi-Function Analog Input Selection Error
		A contradictory setting is assigned to multi-function analog inputs H3-02, H3-10, or H3-06 and PID functions conflict.
oPE08	oPE08	Parameter Selection Error
		A function has been set that cannot be used in the motor control method selected.
oPE09	oPE09	PID Control Selection Fault
		PID control function selection is incorrect. Requires that PID control is enabled (b5-01 = 1 to 4).
oPE10	oPE10	V/f Data Setting Error
		One or more of the parameters listed below are not set according to the formula: • E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04 • E3-09 ≤ E3-07 < E3-06 ≤ E3-11 ≤ E3-04
oPE11	oPE11	Carrier Frequency Setting Error
		Correct the setting for the carrier frequency.
oPE13	oPE13	Pulse Monitor Selection Error
		Incorrect setting of monitor selection for pulse train (H6-06).
oPE15	oPE15	Torque Control Setting Error
		Parameter settings that are not allowed in combination with Torque Control have been set.
oPE16	oPE16	Energy Savings Constants Error
oPE18	oPE18	Online Tuning Parameter Setting Error
		Parameters controlling online tuning are not set correctly.

Troubleshooting

5

| $oPE20$ | oPE20 | PG-F3 Setting Error |
| | | The encoder signal frequency is too high. |

◆ Causes and Possible Solutions for a Blank and Unresponsive Digital Operator

Table 5.5 Causes and Possible Solutions for a Blank and Unresponsive Digital Operator

Cause	Possible Solutions
A short circuit between +V, -V, and AC terminals.	Correct wiring
Control circuit terminal overload.	Check the resistance and wiring for the frequency setting potentiometer, etc. Check that the current for terminals +V and -V is 20 mA or less.
The short circuit bar between terminals +1 and +2 in the main circuit has been removed.	Attach the short circuit bar.
Braking unit terminals P and N are connected in reverse.	• Check the Braking unit wiring including cables connected to the Braking unit and relay terminals. • Replace the drive.
Control power circuit failure	Charge indicator is lit: • Replace the digital operator • Replace the drive control board. Charge indicator is not lit: • Check the input power supply voltage • Replace the drive.
Malfunction occurred in the control power circuit.	Turn OFF the power, wait for 5 minutes, then turn ON the power again.
Digital operator contact failure	Turn OFF the power, remove the digital operator, then replace the digital operator.

5.5 Auto-Tuning Fault Detection

Auto-Tuning faults in this section are displayed on the digital operator and will cause the motor to coast to a stop. Auto-Tuning faults do not trigger a multi-function digital output set for fault or alarm output.

An End☐ error on the digital operator display indicates Auto-Tuning has successfully completed with discrepancies in the calculations. Restart Auto-Tuning after fixing the cause of the End☐ error.

The drive may be used in the application if no cause can be identified despite the existence of an End☐ error.

An Er☐ error indicates that Auto-Tuning has not completed successfully. Check for the cause of the error using the tables in this section, and perform Auto-Tuning again after fixing the cause.

◆ Auto-Tuning Codes, Causes, and Possible Solutions

Table 5.6 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.		• Prior to Auto-Tuning, verify the information on the motor nameplate. • Enter proper values from motor nameplate to parameters T1-03 to T1-05 and repeat Auto-Tuning.
The results from Auto-Tuning the no-load current exceeded 80%.		• If possible, disconnect the motor from the load and perform Auto-Tuning. If the load cannot be uncoupled, use the current Auto-Tuning results.

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 coefficients (E2-07 and E2-08) to temporary values.		• Check and correct faulty motor wiring. • Disconnect the motor from machine and perform Rotational Auto-Tuning.

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 motor nameplate was not entered into T1-04.		• Check the setting of parameter T1-04. • Check the motor data and repeat Auto-Tuning.

Digital Operator Display		Error Name
End4	End4	Adjusted Slip Calculation Error
Cause		**Possible Solutions**
The calculated slip is outside the allowable range.		• Make sure the data entered for Auto-Tuning is correct. • If possible, perform Rotational Auto-Tuning. If not possible, perform Stationary Auto-Tuning 2.

Digital Operator Display		Error Name
End5	End5	Resistance Tuning Error
Cause		**Possible Solutions**
The calculated resistance value is outside the allowable range.		• Double-check the data entered for the Auto-Tuning process. • Check the motor and motor cable connection for faults.

Digital Operator Display		Error Name
End6	End6	Leakage Inductance Alarm
Cause		**Possible Solutions**
A1-02 setting error.		• Double-check the data entered for the Auto-Tuning process. • Check the setting of A1-02. • Check the control mode and repeat Auto-Tuning.

Troubleshooting

5

5.5 Auto-Tuning Fault Detection

Digital Operator Display		Error Name
End7	End7	No-Load Current Alarm
Cause		**Possible Solutions**
The entered no-load current value was outside the allowable range.		Check and correct faulty motor wiring.
Auto-Tuning results were less than 5% of the motor rated current.		Double-check the data entered for the Auto-Tuning process.

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. • Restart Auto-Tuning and enter the correct information.
Motor rated 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 inconsistent.		• 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.		• Correct the settings of parameters T1-05 and T1-07. • Check that the correct number of poles were entered to T1-06.

Digital Operator Display		Error Name
Er-02	Er-02	Minor Fault
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.
Motor data entered during Auto-Tuning was incorrect.		• Check that the motor data entered matches the motor nameplate input before performing Auto-Tuning (T1-02 to T1-07). • Restart Auto-Tuning and enter the correct information.
Faulty cable connection The load is too heavy		• Check and correct faulty motor wiring. • Check the vicinity of the machine. • Check the load conditions. • Investigate and correct the cause and then reset the fault.

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. Restart Auto-Tuning.

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.
Faulty motor cable or cable connection.		

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.
The load was too high during Rotational Auto-tuning.		• 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.
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.
The load was too high during rotational Auto-tuning.		• 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 time.		• Increase the acceleration time (C1-01). • Disconnect the machine from the motor if possible.
Torque limit when motoring is too low (L7-01 and L7-02).		• Check L7-01 and L7-02 settings. • Increase the setting.
The load was too high during Rotational Auto-Tuning.		• Disconnect the motor from machine and restart Auto-Tuning. If motor and load cannot be uncoupled make sure the load is lower than 30%. • If a mechanical brake is installed, make sure it is fully lifted during tuning.

Digital Operator Display		Error Name
Er-10	Er-10	Motor Direction Error
Cause		**Possible Solutions**
The encoder signal lines are not properly connected to the drive.		Check and correct wiring to the PG encoder.
Motor direction and PG direction are opposite.		Check the motor speed monitor U1-05 while manually turning the motor forward. If the sign displayed is negative, change the setting of parameter F1-05.
The load pulled the motor in the opposite direction of the speed reference and the torque exceeded 100%.		Uncouple the motor from the load and restart Auto-Tuning.

Digital Operator Display		Error Name
Er-11	Er-11	Motor Speed Error
Cause		**Possible Solutions**
Torque reference is too high.		• Increase the acceleration time 1 (C1-01). • Disconnect the machine from the motor if possible.

Troubleshooting

5

5.5 Auto-Tuning Fault Detection

Digital Operator Display		Error Name
Er - $l\bar{c}$	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.
The current exceeded the current rating of the drive.		• Check motor wiring for a short between motor lines.
		• Close any magnetic contactors used between motors.
The current is too low.		• Replace the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.
Attempted Auto-Tuning without motor connected to the drive.		Connect the motor and restart Auto-Tuning.
Current detection signal error.		Replace the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or a Yaskawa representative.

Digital Operator Display		Error Name
$Er-13$	Er-13	Leakage Inductance Error
Cause		**Possible Solutions**
Drive was unable to complete tuning for leakage inductance within 300 seconds.		• Check all wiring and correct any mistakes. • Check the motor rated current value written on the motor nameplate and enter the correct value to T1-04.

Digital Operator Display		Error Name
$Er-14$	Er-14	Motor Speed Error 2
Cause		**Possible Solutions**
The motor speed exceeded twice the amplitude of speed reference during Inertia Tuning.		Reduce the ASR gain set to C5-01.

Digital Operator Display		Error Name
$Er-15$	Er-15	Torque Saturation Error
Cause		**Possible Solutions**
The output torque reached the torque limit set in L7-01 through L7-04 during Inertia Tuning.		• Increase the torque limits in L7-01 through L7-04 within reasonable limits. • Reduce the test signal frequency in T3-01 and restart Auto-Tuning. If necessary, reduce the test signal amplitude (T3-02) and restart Auto-Tuning.

Digital Operator Display		Error Name
$Er-16$	Er-16	Inertia ID Error
Cause		**Possible Solutions**
The inertia identified by the drive was abnormally small or abnormally large during Inertia Tuning.		• Reduce the test signal frequency in T3-01 and restart Auto-Tuning. If necessary, reduce the test signal amplitude (T3-02) and restart Auto-Tuning. • Check the basic motor inertia value entered to T3-03.

Digital Operator Display		Error Name
$Er-17$	Er-17	Reverse Prohibited Error
Cause		**Possible Solutions**
Drive is prohibited from rotating the motor in reverse while attempting to perform Inertia Tuning.		• Inertia Auto-Tuning cannot be performed if the drive is restricted from rotating in reverse. • Assuming it is acceptable for the application to rotate in reverse, set b1-04 to 0 and then perform Inertia Tuning.

Digital Operator Display		Error Name
$Er-18$	Er-18	Induction Voltage Error
Cause		**Possible Solutions**
The result of Back EMF Constant Tuning (induced voltage) exceeds the allowable setting range.		Double-check the data entered to the T2-□□ parameters and restart Auto-Tuning.

Digital Operator Display		Error Name
$Er-19$	Er-19	PM Inductance Error
Cause		**Possible Solutions**
The induced voltage constant attempted to set a value to E5-08 or E5-09 that is outside the allowable range.		Double-check the data entered to the T2-□□ parameters and restart Auto-Tuning.

Digital Operator Display		Error Name
$Er-20$	Er-20	Stator Resistance Error
Cause		**Possible Solutions**
Stator resistance tuning attempted to set a value to E5-06 that is outside the allowable setting range.		Double-check the data entered to the T2-□□ parameters and restart Auto-Tuning.

Troubleshooting

5

5.5 Auto-Tuning Fault Detection

Digital Operator Display		Error Name
Er-21	Er-21	Z Pulse Correction Error

Cause	Possible Solutions
Motor was coasting when Auto-Tuning was performed.	Make sure the motor comes to a complete stop. Repeat Auto-Tuning.
Either the motor or the PG encoder on the motor are not properly wired.	Check the wiring for the motor and the PG encoder. Restart Auto-Tuning.
The direction for the PG encoder is set incorrectly, or the number of pulses set for the PG encoder is wrong.	Check the direction and number of pulses set for the PG encoder. Restart Auto-Tuning.
PG encoder is damaged.	Check the signal output from the PG encoder attached to the motor. Replace the PG if damaged.
Motor inertia is large.	Increase the setting of n8-02 (Pole Attraction Current).
Z-Pulse Offset Tuning was performed when b1-04 was set to 1.	• Z-Pulse Offset Tuning cannot be performed for a machine with reverse operation prohibited. • If the machine allows reverse operation, set b1-04 to 0 to enable Reverse Operation Selection and then perform Z-Pulse Offset Tuning.
Motor vibrates during tuning.	• Increase the setting of n8-03, Current Startup Time, and n8-04, Pole Attraction Time. • Decrease the setting of n8-02, Pole Attraction Current.

Digital Operator Display		Error Name
Er-25	Er-25	High Frequency Injection Parameter Tuning Error

Cause	Possible Solutions
Motor data was incorrect.	Perform Stationary Auto-Tuning and then perform High Frequency Injection Parameter Tuning again. If the problem continues, high frequency injection control might not be possible with that motor. **Note:** Auto-Tuning is not applicable for SPM motors.

5.6 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 5.7 lists the corrective action that can be taken when an error occurs.
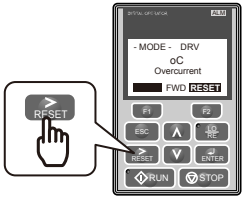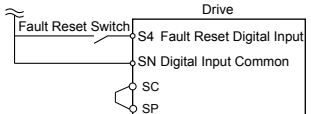
Note: 1. Whenever using the copy function, the drive should be fully stopped.
　　2. The drive will not accept a Run command while the Copy function is being executed.
　　3. Parameters can only be saved to a drive when the voltage class, capacity, control mode, and software version match.

Table 5.7 Copy Function Task and Error Displays
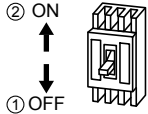
Digital Operator Display		Task
CoPy	CoPy	Writing Parameter Settings (flashing)
CPEr	CPEr	Control Mode Mismatch
CPyE	CPyE	Error Writing Data
CSEr	CSEr	Copy Unit Error
dFPS	dFPS	Drive Model Mismatch
End	End	Task Complete
iFEr	iFEr	Communication Error
ndAT	ndAT	Model, Voltage Class, Capacity Mismatch
rdEr	rdEr	Error Reading Data
rEAd	rEAd	Reading Parameter Settings (flashing)
vAEr	vAEr	Voltage Class, Capacity Mismatch
vFyE	vFyE	Parameter settings in the drive and those saved to the copy function are not the same
vrFy	vrFy	Comparing Parameter Settings (flashing)

◆ 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 when the error code is displayed.	
Resetting via Fault Reset Digital Input S4	Close then open the fault signal digital input via terminal S4. S4 is set for "Fault Reset" as default (H1-04 = 14).	

Troubleshooting

5

After the Fault Occurs	Procedure
Turn off the main power supply if the above methods do not reset the fault. Reapply power after the digital operator display has turned off.	② ON ① OFF

Note: If the Run command is present, the drive will disregard any attempts to reset the fault. Remove the Run command before attempting to clear a fault situation.

6

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.

6.1 Inspection

Power electronics have limited life and may exhibit changes in characteristics or performance deterioration after years of use under normal conditions. To help avoid such problems, it is important to perform preventive maintenance and periodic inspection on the drive.

Drives contain a variety of power electronics such as power transistors, semiconductors, capacitors, resistors, fans, and relays. The electronics in the drive serve a critical role in maintaining proper motor control.

Follow the inspection lists provided in this chapter as a part of a regular maintenance program.

Note: The drive will require more frequent inspection if it is placed in harsh environments, such as:
• High ambient temperatures
• Frequent starting and stopping
• Fluctuations in the AC supply or load
• Excessive vibrations or shock loading
• Dust, metal dust, salt, sulfuric acid, chlorine atmospheres
• Poor storage conditions.

Perform the first equipment inspection one to two years after installation.

◆ Recommended Daily Inspection

Table 6.1 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 6.1 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 the following: • Excessive load. • Loose connections. • Dirty heatsink or motor. • Ambient temperature.	
	Inspect drive cooling fan and circulation fan operation.	Check for the following: • Clogged or dirty fan. • Correct Fan operation parameter setting.	
Environment	Verify the drive environment complies with the specifications listed in *Installation Environment* on page *28*.	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

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, 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; after all indicators are OFF, measure for unsafe voltages to confirm the drive is safe prior to servicing.*

Table 6.2 Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Main Circuit Periodic Inspection			
General	• Inspect equipment for discoloration from overheating or deterioration. • Inspect for damaged or deformed parts.	• Replace damaged components as required. • The drive has few serviceable parts and may require complete drive replacement.	
	Inspect for dirt, foreign particles, or dust collection on components.	• Inspect enclosure door seal if used. • Remove foreign particles and dust with a vacuum cleaner to avoid touching parts. • Replace components if cleaning is not possible.	
Conductors and Wiring	• Inspect wiring and connections for discoloration, damage, or heat stress. • Inspect wire insulation and shielding for wear.	Repair or replace damaged wiring.	
Terminals	Inspect terminals for stripped, damaged, or loose connections.	Tighten loose screws and replace damaged screws or terminals.	
Relays and Contactors	• Inspect contactors and relays for excessive noise during operation. • Inspect coils for signs of overheating such as melted or cracked insulation.	• Check coil voltage for overvoltage or undervoltage conditions. • Replace damaged removable relays, contactors, or circuit board.	
Electrolytic Capacitor	• Inspect for leaking, discoloration, or cracks. • Check if the cap has come off, for any swelling, or if the sides have burst open.	The drive has few serviceable parts and may require complete drive replacement.	
Diode, IGBT (Power Transistor)	Inspect for dust or other foreign material collected on the surface.	Remove foreign particles and dust with a vacuum cleaner to avoid touching parts.	
Motor Periodic Inspection			
Operation Check	Check for increased vibration or abnormal noise.	Stop the motor and contact qualified maintenance personnel as required.	
Control Circuit Periodic Inspection			
General	• Inspect terminals for stripped, damaged, or loose connections. • Make sure all terminals have been properly tightened.	• Tighten loose screws and replace damaged screws or terminals. • If terminals are integral to a circuit board, then board or drive replacement may be required.	
Circuit Boards	Check for any odor, discoloration, and rust. Make sure connections are properly fastened and that no dust or oil mist has accumulated on the surface of the board.	• Fix any loose connections. • If an antistatic cloth or vacuum plunger cannot be used, replace the board. • Do not use any solvents to clean the board. • Remove foreign particles and dust with a vacuum cleaner to avoid touching parts. The drive has few serviceable parts and may require complete drive replacement.	
Cooling System Periodic Inspection			
Cooling Fan, Circulation Fan, Control Board Cooling Fan	• Check for abnormal oscillation or unusual noise. • Check for damaged or missing fan blades.	Replace as required.	
Heatsink	Inspect for dust or other foreign material collected on the surface.	Remove foreign particles and dust with a vacuum cleaner to avoid touching parts.	

Periodic Inspection & Maintenance

6

Inspection Area	Inspection Points	Corrective Action	Checked
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 display properly. • Inspect for dust or other foreign material that may have collected on surrounding components.	• Contact the nearest sales office if there is any trouble with the display or keypad. • Clean the digital operator.	

◆ Storage Guidelines

The drive contains electrolytic capacitors and fine electronic parts that undergo chemical changes. Observe the following precautions to help maintain the expected performance life and reliability during long-term storage.

■ Storage Location

Temperature and Humidity

Store the drive in a location that is between -10 and +40 °C with a relative humidity of 95% or less. Do not store the drive in direct sunlight or where condensation or ice will form.

Storage temperatures between -20 to +60 °C are allowed when storing the drive for approximately one month.

Note: Package and store the drive during shipping to protect it from vibration and shock.

Dust and Oil Mist

Do not store the drive in a dusty location or a location subject to oil mist.

Corrosive Gas

Do not store the drive in a location subject to corrosive gas.

Salt Damage

Do not store the drive in a location subject to salt damage, such as near the ocean.

Do not store the drive in adverse environments. Store all drives in storage rooms that are not subjected to adverse environmental elements.

Periodic Power Application

Yaskawa recommends applying power to the drive once per year for at least 30 minutes to prevent the capacitors from deteriorating.

When applying power after power has not been applied for more than two years, Yaskawa recommends using a variable power source and gradually increasing the power from 0 V to the rated drive voltage over a period of 2 to 3 minutes. Apply power for at least 1 hour with no load to age the main circuit electrolytic capacitor.

Wire the drive normally and check for drive faults, overcurrents, motor vibration, speed fluctuations, and other abnormalities during operation after performing the above procedure.
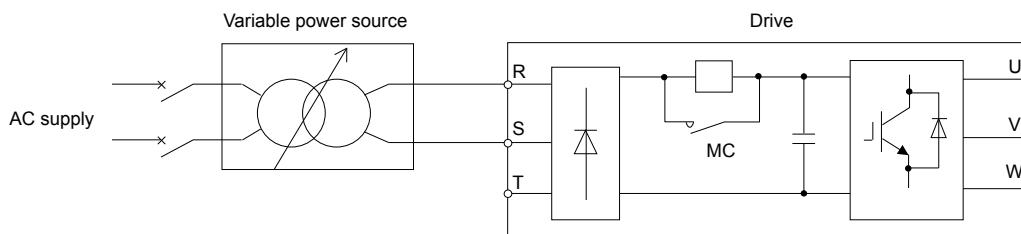
Figure 6.1 Power Distribution Method

6.2 Periodic Maintenance

The drive has Maintenance Monitors that keep track of component wear. This feature provides advance maintenance warning and eliminates the need to shut down the entire system for unexpected problems. The drive allows the user to check predicted maintenance periods for the components listed below.

• Cooling Fan, Circulation Fan, Control Board Cooling Fan
• Electrolytic Capacitors
• Inrush Prevention Circuit
• IGBTs

For replacement parts, contact the distributor where the drive was purchased or contact Yaskawa directly.

◆ Replacement Parts

Table 6.3 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 6.3 Estimated Performance Life

Component	Estimated Performance Life
Cooling Fan, Circulation Fan	10 years
Electrolytic Capacitors	10 years [1]

<1> Electrolytic capacitors cannot be replaced on some lower capacity models. Complete drive replacement may be required for these models.

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 (IP20/IP00 enclosure)
Yearly average of 30 °C (side-by-side mounting/NEMA 1, UL type 1 enclosure drive or external heatsink installation)

■ 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.

Set parameters L8-12 (Ambient Temperature Setting) and L8-35 (Installation Method Selection) for use with the installation environment when using maintenance monitors.

Table 6.4 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 after it reaches 99999.
U4-04		Displays the accumulated fan operation time as a percentage of the specified maintenance period.
U4-05	DC Bus Capacitors	Displays the accumulated time the capacitors are used as a percentage of the specified maintenance period.
U4-06	Pre-charge Circuit	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.

Periodic Inspection & Maintenance

6

■ 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 6.5* to indicate the specific components that may need maintenance.

Table 6.5 Maintenance Alarms

Digital Operator Alarm Display		Function	Corrective Action
LT-1 [1]	LT-1	The cooling fans have reached 90% of their designated life time.	Replace the cooling fan.
LT-2 [1]	LT-2	The DC bus capacitors have reached 90% of their designated life time.	Contact a Yaskawa representative or the nearest Yaskawa sales office on possible drive replacement.
LT-3 [1]	LT-3	The pre-charge circuit has reached 90% of its designated life time.	Contact a Yaskawa representative or the nearest Yaskawa sales office on possible drive replacement.
LT-4 [1]	LT-4	The IGBTs have reached 50% of their designated life time.	Check the load, carrier frequency, and output frequency.
TrPC [2]	TrPC	The IGBTs have reached 90% of their designated life time.	Contact a Yaskawa representative or the nearest Yaskawa sales office on possible drive replacement.

<1> This alarm message will be output only if the Maintenance Monitor function is assigned to one of the digital outputs (H2-□□ = 2F). The alarm will also trigger a digital output that is programmed for alarm indication (H2-□□ = 10).

<2> This alarm message will always be output, even if the Maintenance Monitor function is not assigned to any of the digital outputs (H2-□□ = 2F). The alarm will also trigger a digital output that is programmed for alarm indication (H2-□□ = 10).

■ Related Drive Parameters

Use parameters o4-03, o4-05, o4-07, and o4-09 to reset a Maintenance Monitor to zero after replacing a specific component. *Refer to Parameter List on page 249* 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.*

6.3 Drive Replacement

◆ 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: *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 boards 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 it is working properly before reconnecting it to the new drive. Replace broken options to prevent immediate breakdown of the replacement drive.*

1. Remove the terminal cover.
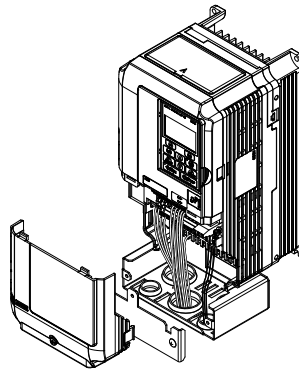
Figure 6.2 Remove the Terminal Cover

2. Loosen the screws holding the terminal board in place. Remove the screw securing the bottom cover and remove the bottom cover from the drive.

Note: IP00/Open Type enclosure drives do not have a bottom cover or conduit.
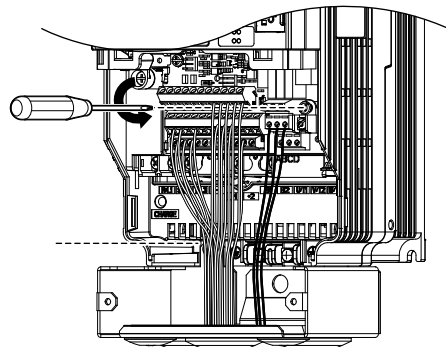
Figure 6.3 Unscrew the Terminal Board and Remove the Bottom Cover

3. Slide the terminal board as illustrated by the arrows to remove it from the drive along with the bottom cover.

Periodic Inspection & Maintenance

6
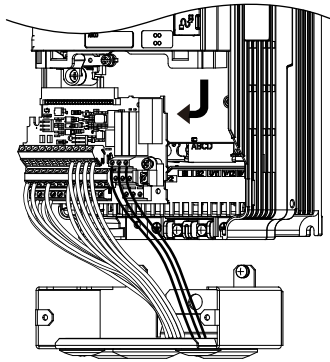
Figure 6.4 Remove the Terminal Board
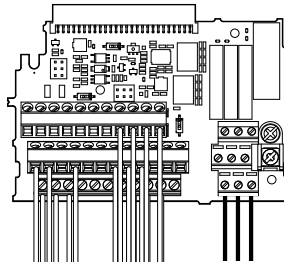
Figure 6.5 Disconnected Removable Terminal Board

4. Disconnect all option cards and options, making sure they are intact before reusing.

5. Replace the drive and wire the main circuit.

■ Installing the Drive

1. After wiring the main circuit, connect the terminal block to the drive as shown in *Figure 6.6*. Use the installation screw to fasten the terminal block into place.
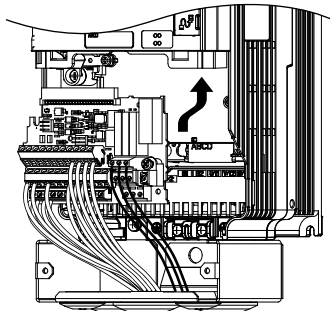
Figure 6.6 Install the Terminal Board

2. Reconnect options for the new drive the same way the options were connected in the old drive. Connect option boards to the same option ports in the new drive that were used in the old drive.

3. Replace the terminal cover.

4. After powering on the drive, all parameter settings are transferred from the terminal board to the drive memory. If an oPE04 error occurs, load the parameter settings saved on the terminal board to the new drive by setting parameter A1-03 to 5550. Reset the Maintenance Monitor function timers by setting parameters o4-01 through o4-12 to 0, and parameter o4-13 to 1.

7

Peripheral Devices & Options

This chapter explains option installation procedures for the drive.

7.1 Option Card Installation

This section provides instructions on installing option cards.

◆ Prior to Installing the Option

Prior to installing the option, wire the drive, make necessary connections to the drive terminals, and verify that the drive functions normally without the option installed.

Table 7.1 below lists the number of options that can be connected to the drive and the drive ports for connecting those options.

Table 7.1 Option Installation

Option	Port/Connector	Number of Options Possible
PG-B3, PG-X3	CN5-C (CN5-B) [1]	2 [1]
PG-F3 [2] [3] , PG-RT3 [2] [3]	CN5-C	1
AO-A3, DO-A3	CN5-A, B, C	1
SI-B3, SI-C3, SI-EN3, SI-EM3, SI-EP3, SI-ES3, SI-ET3, SI-N3, SI-P3, SI-S3, SI-T3, SI-W3, AI-A3 [4] , DI-A3 [4]	CN5-A	1

[1] When connecting only one PG option card, use the CN5-C connector. When connecting two PG option cards, use both CN5-B and CN5-C.

[2] Not available for the application with Motor 2 Selection.

[3] Not available with models 4A0930 and 4A1200.

[4] When using AI-A3 and DI-A3 as monitors, the card can be connected to any of CN5-A, CN5-B or CN5-C. The input status of AI-A3 can then be viewed using U1-21, U1-22, and U1-23, and the input status of DI-A3 can then be viewed using U1-17.

Figure 7.1 shows an exploded view of the drive with the option and related components for reference.

A – Drive front cover
B – Digital operator
C – LED label (for communication options)
D – Drive terminal cover
E – Removable tabs for wire routing
F – Included screws
G – Ground wire
H – Drive grounding terminal (FE)
I – Connector CN5-C
J – Connector CN5-B
K – Connector CN5-A
L – Insertion point for CN5 connector
M – Option
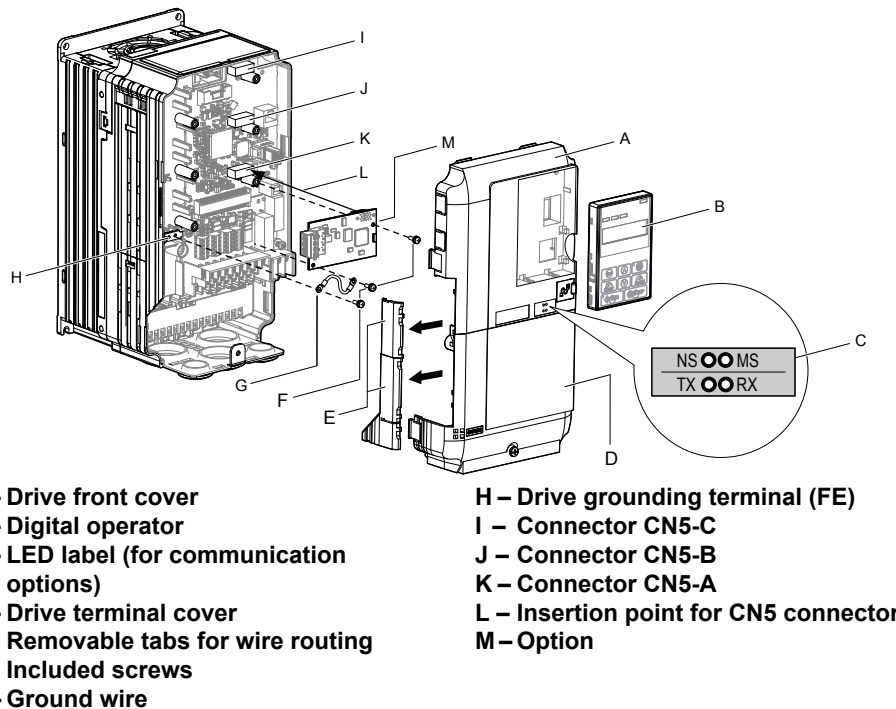
Figure 7.1 Drive Components with Option

◆ PG Option Installation Example

Remove the front covers of the drive before installing the option. PG options can inserted into the CN5-B or CN5-C connectors located on the drive control board.

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the digital operator (B) and front covers (A, D). Front cover removal varies by model.

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 installing the option, disconnect all power to the drive. 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.*

NOTICE: *Damage to Equipment. Observe proper electrostatic discharge procedures (ESD) when handling the option, drive, and circuit boards. Failure to comply may result in ESD damage to circuitry.*
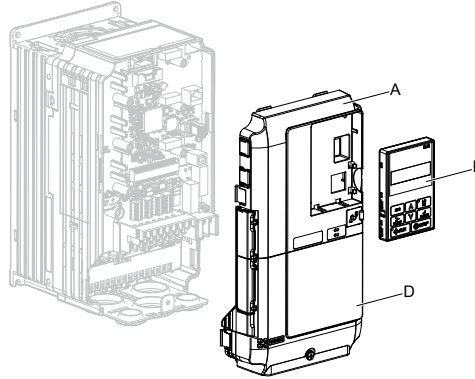
Figure 7.2 Remove the Front Covers and Digital Operator

2. Insert the option (M) into the **CN5-B or CN5-C** connector (I, J) located on the drive and fasten it using one of the included screws (F). Use the **CN5-C** connector when connecting only one PG option. *Refer to Option Card Installation on page 222* for more information.
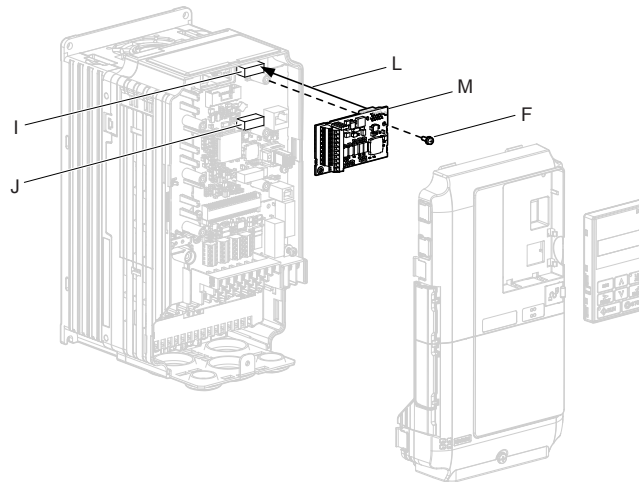
Figure 7.3 Insert the Option

3. Connect the ground wire (G) to the ground terminal (H) using one of the remaining provided screws (F). Connect the other end of the ground wire (G) to the remaining ground terminal and installation hole on the option (M) using the last remaining provided screw (F) and tighten both screws to 0.5 ~ 0.6 N m or (4.4 ~ 5.3 in lbs).

Peripheral Devices & Options

7
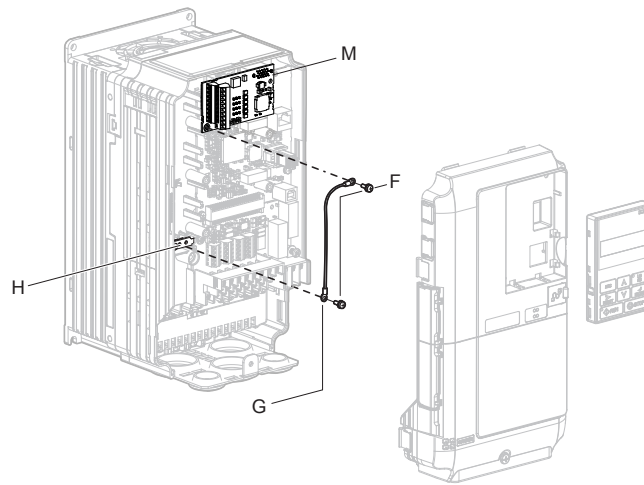
Figure 7.4 Connect the Ground Wire

Note: **1.** The option package includes two ground wires. Use the longer wire when plugging the option into connector CN5-C on the drive side. Use the shorter wire when plugging the option into connector CN5-B. Refer to the Option Installation manual for more information.

2. There are two screw holes on the drive for use as ground terminals (H). When connecting three options, two ground wires will need to share the same drive ground terminal.

4. Prepare and connect the wire ends as shown in *Figure 7.5* and *Figure 7.6*. *Refer to Wire Gauges and Tightening Torques of PG-X3 Option on page 230* or *Refer to Wire Gauges and Tightening Torques of PG-X3 Option on page 230* to confirm that the proper tightening torque is applied to each terminal. Take particular precaution to ensure that each wire is properly connected and that wire insulation is not accidentally pinched into electrical terminals.

WARNING! *Fire Hazard. Tighten all terminal screws according to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating electrical connections. Tightening screws beyond the specified tightening torque may result in erroneous operation, damage to the terminal block, or cause a fire.*

NOTICE: *Heat shrink tubing or electrical tape may be required to ensure that cable shielding does not contact other wiring. Insufficient insulation may cause a short circuit and damage the option or drive.*
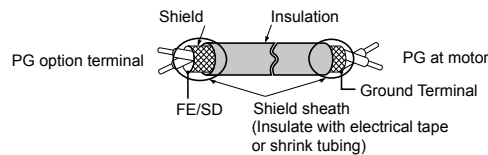
Figure 7.5 Preparing Ends of Shielded Cable
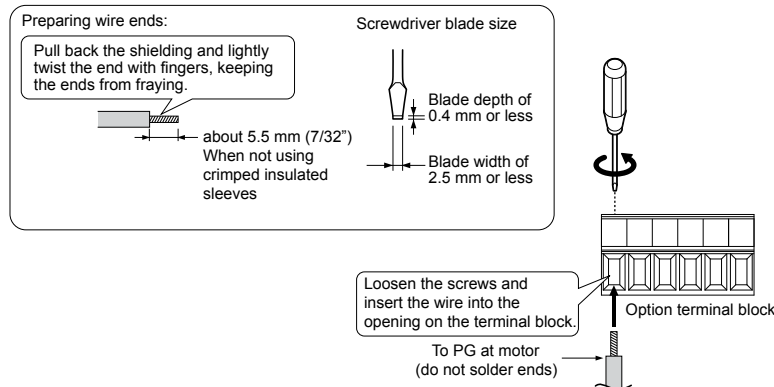
Figure 7.6 Preparing and Connecting Cable Wiring

5. Wire the motor PG encoder to the terminal block on the option. Refer to *Figure 7.7* and *Figure 7.11* for wiring instructions.

Refer to PG-B3 Option Terminal Functions on page 226 for a detailed description of the option terminal functions.

PG-B3 Parameter Settings

- Connecting a Single-Pulse Encoder in V/f with PG Control Mode: Connect the pulse output from the PG to the option and set F1-21 to 0.
- Connecting a Two-Pulse Encoder: Connect the A and B pulse outputs on the PG to the option and set F1-21 to 1.

  When using a two-pulse encoder in CLV control mode, connect pulse outputs A and B from the encoder to the corresponding terminals on the option.

- Connecting a Two-Pulse Encoder with Z Marker Pulse: Connect the A, B, and Z pulse outputs to the corresponding terminals on the option.

Control Method	V/f with PG		Closed Loop Vector	
No. of Encoders	1 (CN5-C)	2 (CN5-B)	1 (CN5-C)	2 (CN5-B)
Single Pulse (A)	F1-21 = 0	F1-37 = 0	N/A	N/A
Two Pulse (AB Quadrature)	F1-21 = 1	F1-37 = 1	No setting required	No setting required
Two Pulse with Marker (ABZ)	F1-21 = 1	F1-37 = 1	No setting required	No setting required

PG-B3 Connection Diagram

Refer to PG-B3 Option Terminal Functions on page 226 for a detailed description of the option board terminal functions.

Refer to Wire Gauges and Tightening Torques of PG-B3 Option on page 227 for information on making cables.
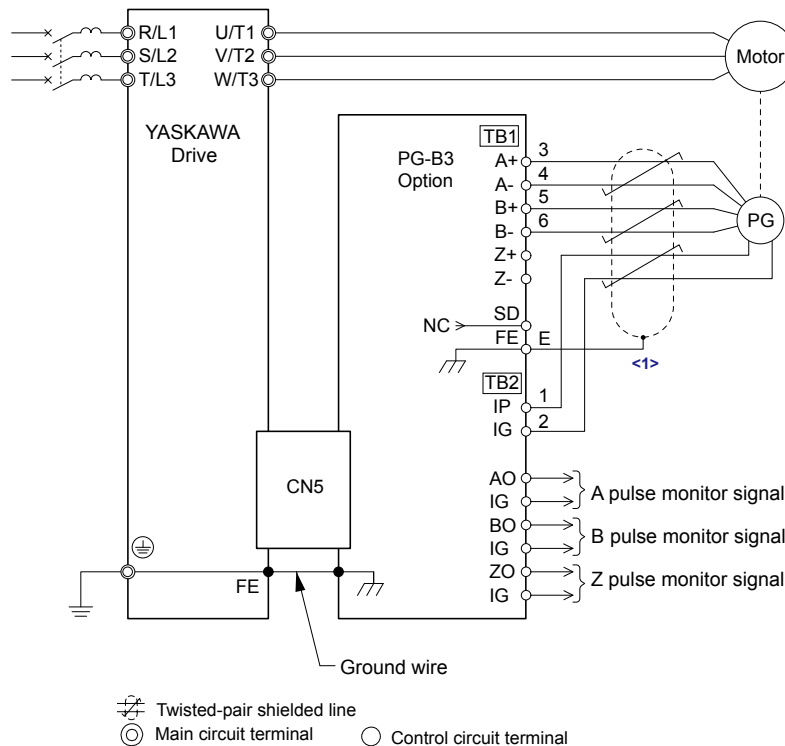
Figure 7.7 PG-B3 Option and Encoder Connection Diagram

<1> Ground the shield on the PG side and the drive side. If electrical signal interference problems arise in the PG signal, remove the shield ground from one end of the signal line or remove the shield ground connection on both ends.

Note: The PG-B3 option reads a maximum input frequency of 50 kHz from the PG encoder. Select a PG encoder with an output pulse frequency of maximum 50 kHz when operating at maximum speed.

Take the following steps to prevent erroneous operation caused by noise interference:

- Use shielded wire for the PG encoder signal lines.
- Limit the length of all motor output power cables to less than 100 m. Limit the length of open-collector output lines to less than 50 m.
- Use separate conduit or cable tray dividers to separate option control wiring, main circuit input power wiring, and motor output power cables.

PG-B3 Interface Circuit

Complementary Output
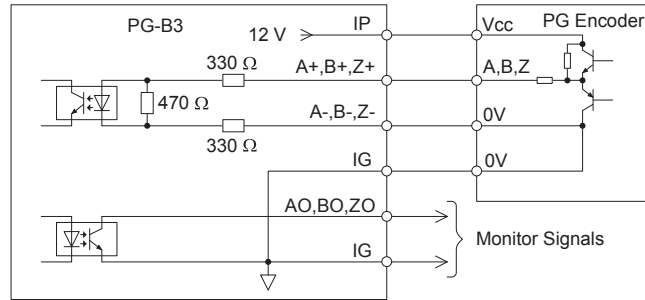
Figure 7.8 Complementary Outputs for the Interface Circuit

Open-Collector Outputs
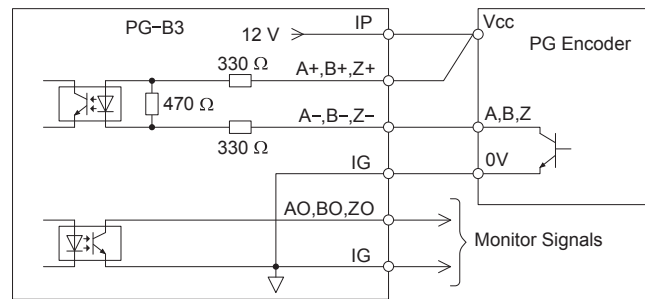
Figure 7.9 Open-Collector Outputs for the Interface Circuit

PG-B3 Terminal Functions

Table 7.2 PG-B3 Option Terminal Functions

Terminal Block		Terminal	Function	Description
	TB1	A+	A+ pulse signal input	• Pulse signal inputs from the PG • Signal inputs from complementary and open-collector outputs • Signal level H level: 8 to 12 V L level: 2.0 V or less
		A–	A– pulse signal input	
		B+	B+ pulse signal input	
		B–	B– pulse signal input	
		Z+	Z+ pulse signal input	
		Z–	Z– pulse signal input	
		SD	NC pin (open)	For use when cables shields should not be grounded
		FE	Ground	Used for grounding shielded lines
	TB2	IP	PG power supply	• Output voltage: 12.0 V ± 5% • Max output current: 200 mA [1]
		IG	PG power supply common	
		AO	A pulse monitor signal	• Outputs the monitor signal for the A, B, and Z pulses from the PG speed control card • For open collector outputs from the option • Max voltage: 24 V • Max current: 30 mA
		BO	B pulse monitor signal	
		ZO	Z pulse monitor signal	
		IG	Monitor signal common	

<1> A separate UL Listed class 2 power supply is necessary when the PG requires more than 200 mA to operate.

PG-B3 Wire Gauges and Tightening Torques

Wire gauge and torque specifications are listed in *Table 7.3*. For simpler and more reliable wiring, use crimp ferrules on the wire ends. Refer to the option manuals for the wire size and torque specifications of other options.

Table 7.3 Wire Gauges and Tightening Torques of PG-B3 Option

| Terminal Signal | Screw Size | Tightening Torque N·m (in·lb) | Bare Cable | | Crimp Terminals | | Wire Type |
			Recomm. Gauge mm²	Applicable Gauges mm²	Recomm. Gauge mm²	Applicable Gauges mm²	
A+, A–, B+, B–, Z+, Z–, FE, IP, IG	M2	0.22 to 0.25 (1.95 to 2.21)	0.75 (18 AWG)	Stranded wire: 0.25 to 1.0 (24 to 17 AWG) Solid wire: 0.25 to 1.5 (24 to 16 AWG)	0.5 (20 AWG)	0.25 to 0.5 (24 to 20 AWG)	Shielded twisted pair, etc.
AO, IG, BO, IG, ZO, IG							Shielded cable, etc.

PG-B3 Crimp Terminals

Yaskawa recommends using CRIMPFOX 6 by Phoenix Contact or equivalent crimp terminals with the specifications listed in *Table 7.4* for wiring to ensure proper connections.

Note: Properly trim wire ends so loose wire ends do not extend from the crimp terminals.

Table 7.4 Crimp Terminal Sizes

	Wire Gauge mm²	Phoenix Contact Model	L mm (in)	d1 mm (in)	d2 mm (in)
	0.25 (24 AWG)	AI 0.25 - 6YE	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.34 (22 AWG)	AI 0.34 - 6TQ	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.5 (20 AWG)	AI 0.5 - 6WH	14 (9/16)	1.1 (3/64)	2.5 (3/32)

PG Encoder Cables for PG-B3 Option

Yaskawa recommends using a LMA-☐☐B-S185Y (complementary output) for cables running between the option and the PG as shown in *Figure 7.10*.

Refer to PG-B3 Option Terminal Functions on page 226 for instructions on wiring the terminal block.
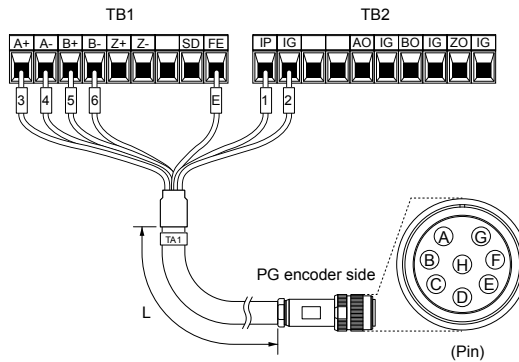
Figure 7.10 Wiring the PG Encoder Cable

Table 7.5 Connecting the PG Encoder Cable Specification

| Option Terminal | PG Encoder Cable | | |
	Wire	Color	Pin
IP	1	Blue	C
IG	2	White	H
A+	3	Yellow	B
A–	4	White	G
B+	5	Green	A
B–	6	White	F
FE	E	N/A (shield)	D

Table 7.6 PG Encoder Cable Types

Length	Type	Length	Type
10 m (32 ft.)	W5010	50 m (164 ft.)	W5050
30 m (98 ft.)	W5030	100 m (328 ft.)	W5100

PG-X3 Parameter Settings

- Connecting a Single-Pulse Encoder in V/f with PG Control Mode: Connect the pulse output from the PG to the option and set F1-21 to 0.
- Connecting a Two-Pulse Encoder: Connect the A and B pulse outputs on the PG to the option and set F1-21 to 1.

  When using a two-pulse encoder in CLV control mode, connect pulse outputs A and B from the encoder to the corresponding terminals on the option.

- Connecting a Two-Pulse Encoder with Z Marker Pulse: Connect the A, B, and Z pulse outputs to the corresponding terminals on the option.

Control Method	V/f with PG		Closed Loop Vector	
No. of Encoders	1 (CN5-C)	2 (CN5-B)	1 (CN5-C)	2 (CN5-B)
Single Pulse (A)	F1-21 = 0	F1-37 = 0	N/A	N/A
Two Pulse (AB Quadrature)	F1-21 = 1	F1-37 = 1	No setting required	No setting required
Two Pulse with Marker (ABZ)	F1-21 = 1	F1-37 = 1	No setting required	No setting required

PG-X3 Connection Diagram

Refer to PG-X3 Option Terminal Functions on page 229 for a detailed description of the option board terminal functions.
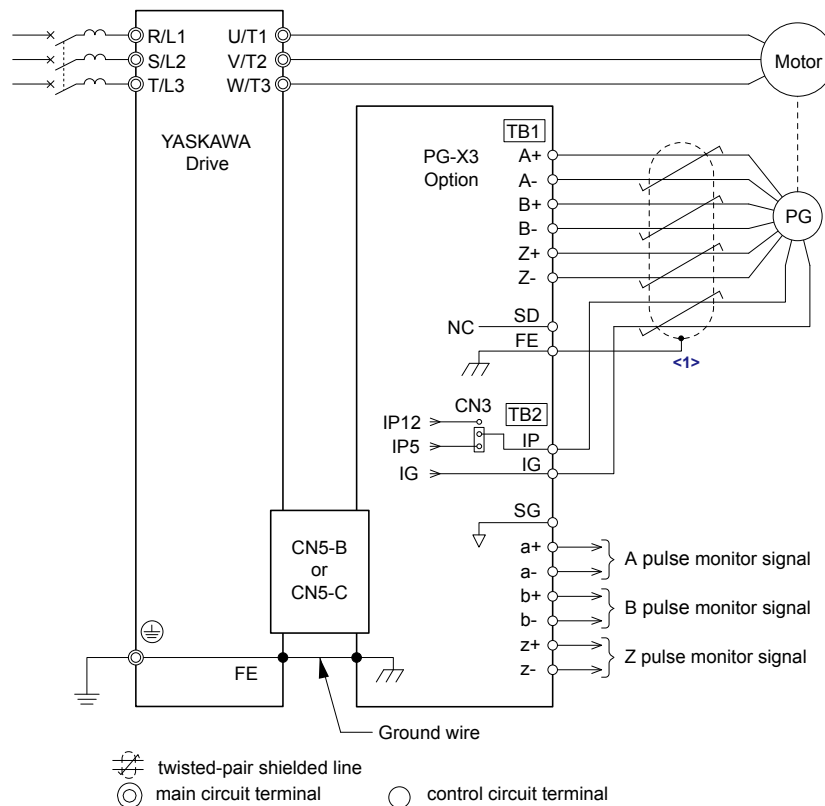
Figure 7.11 PG-X3 Option and Encoder Connection Diagram

<1> Ground the shield on the PG side and the drive side. If electrical signal interference problems arise in the PG signal, remove the shield ground from one end of the signal line or remove the shield ground connection on both ends.

Note: The PG-X3 option reads a maximum input frequency of 300 kHz from the PG encoder. Select a PG encoder with an output pulse frequency of maximum 300 kHz when operating at maximum speed.

Take the following steps to prevent erroneous operation caused by noise interference:

- Use shielded wire for the PG encoder signal lines.

- Use separate conduit or cable tray dividers to separate option control wiring, main circuit input power wiring, and motor output power cables.

PG-X3 Interface Circuit
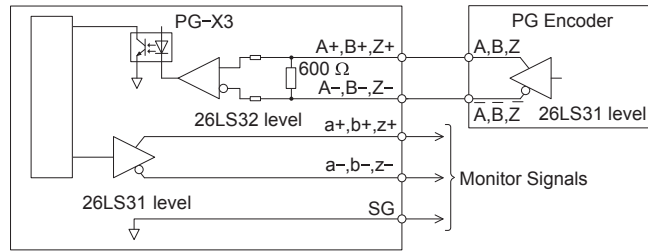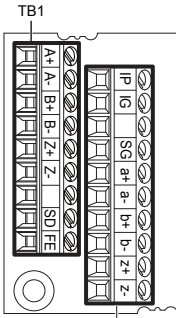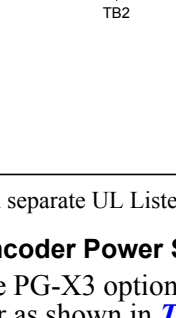
Figure 7.12 PG-X3 Interface Circuit

PG-X3 Terminal Functions

Table 7.7 PG-X3 Option Terminal Functions

Terminal Block		Terminal	Function	Description
	TB1	A+	A pulse signal input	• Inputs for the A channel, B channel, and Z pulses from the PG encoder • Signal level matches RS-422
		A–	A inverse pulse signal input	
		B+	B pulse signal input	
		B–	B inverse pulse signal input	
		Z+	Z pulse signal input	
		Z–	Z inverse pulse signal input	
		SD	NC pin (open)	Open connection port for use when cable shields should not be grounded
		FE	Ground	Used as the shield ground termination point.
	TB2	IP	PG encoder power supply	• Output voltage: 12.0 V ± 5% or 5.5 V ± 5% • Max. output current: 200 mA [1]
		IG	PG encoder power supply common	
		SG	Monitor signal common	• Output signal for monitoring A channel, B channel, and Z pulses from the PG encoder • Signal level matches RS-422
		a+	A pulse monitor signal	
		a–	A pulse inverse monitor signal	
		b+	B pulse monitor signal	
		b–	B pulse inverse monitor signal	
		z+	Z pulse monitor signal	
		z–	Z pulse inverse monitor signal	
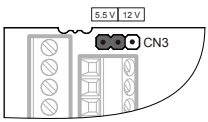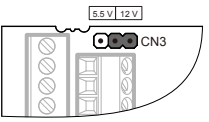
<1> A separate UL Listed class 2 power supply is necessary when the PG requires more than 200 mA to operate.

PG Encoder Power Supply Voltage

For the PG-X3 option, set the voltage for the PG encoder power supply using jumper CN3 located on the option. Position the jumper as shown in *Table 7.8* to select the voltage level.

NOTICE: *The positioning of jumper CN3 selects the PG encoder power supply voltage (5.5 V or 12 V). Select the voltage level for the PG encoder connected to the option and motor. If the wrong voltage is selected, the PG encoder may not operate properly or may become damaged as a result.*

Table 7.8 Setting the PG Encoder Power Supply Voltage (IP) with Jumper CN3

Voltage Level	5.5 V ± 5% (default)	12.0 V ± 5%
Jumper CN3		

PG-X3 Wire Gauges and Tightening Torques

Wire gauge and torque specifications are listed in *Table 7.9*. For simpler and more reliable wiring, use crimp ferrules on the wire ends. Refer to the option manuals for the wire size and torque specifications of other options.

Table 7.9 Wire Gauges and Tightening Torques of PG-X3 Option
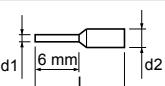
Terminal Signal	Screw Size	Tightening Torque N·m (in·lb)	Bare Cable		Crimp Terminals		Wire Type
			Recomm. Gauge mm²	Applicable Gauges mm²	Recomm. Gauge mm²	Applicable Gauges mm²	
A+, A–, B+, B–, Z+, Z–, SD, FE, IP, IG	M2	0.22 to 0.25 (1.95 to 2.21)	0.75 (18 AWG)	Stranded wire: 0.25 to 1.0 (24 to 17 AWG) Solid wire: 0.25 to 1.5 (24 to 16 AWG)	0.5 (20 AWG)	0.25 to 0.5 (24 to 20 AWG)	Shielded twisted pair, etc.
a+, a–, b+, b–, z+, z–, SG							Shielded cable, etc.

PG-X3 Crimp Terminals

Yaskawa recommends using CRIMPFOX 6 by Phoenix Contact or equivalent crimp terminals with the specifications listed in *Table 7.10* for wiring to ensure proper connections.

Note: Properly trim wire ends so loose wire ends do not extend from the crimp terminals.

Table 7.10 Crimp Terminal Sizes

	Wire Gauge mm²	Phoenix Contact Model	L mm (in)	d1 mm (in)	d2 mm (in)
d1 [6 mm] d2 L	0.25 (24 AWG)	AI 0.25 - 6YE	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.34 (22 AWG)	AI 0.34 - 6TQ	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.5 (20 AWG)	AI 0.5 - 6WH	14 (9/16)	1.1 (3/64)	2.5 (3/32)

Replacing the Drive Covers and Digital Operator and Checking for Proper Motor Rotation

1. Route the option wiring.

Depending on the drive model, some drives may require routing the wiring through the side of the front cover to the outside to provide adequate space for the wiring. In these cases, using diagonal cutting pliers, cut out the perforated openings on the left side of the drive front cover. Sharp edges along the cut out should be smoothed down with a file or sand paper to prevent any damage to the wires.

Route the communication wiring inside the enclosure for drives that do not require routing through the front cover. Refer to *Table 7.11* and *Figure 7.13* to determine the proper wire routing by drive model.

Table 7.11 Communication Wire Routing Selection

Drive Series	Model	Wire Routing <1>	
		Through Front Cover	Inside Drive
A1000	Models 2A0004 to 2A0040; 4A0002 to 4A0023; 5A0003 to 5A0011	*Figure 7.13* (A)	–
A1000	Models 2A0056 and above; 4A0031 and above; 5A0023 and above	–	*Figure 7.13* (B)

<1> Refer to *Figure 7.13* for examples of the different wire routing techniques.
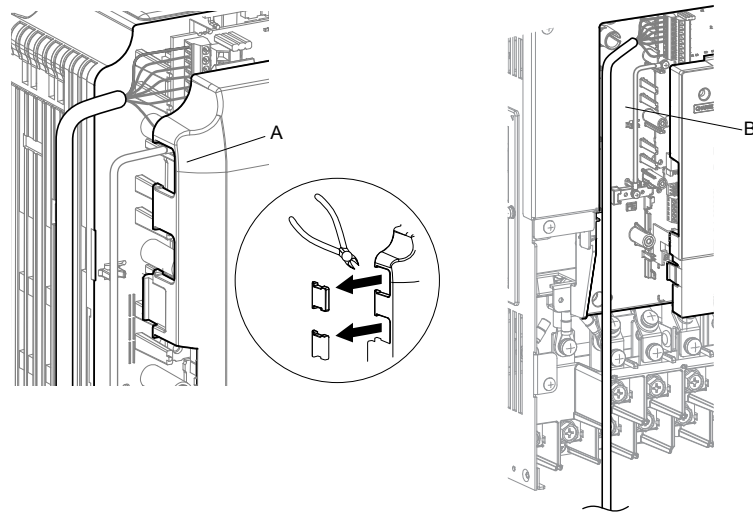
A – Route wires through the openings provided on the left side of the front cover. *<1>*

B – Use the open space provided inside the drive to route option wiring.

Figure 7.13 Wire Routing Examples

<1> The drive will not meet NEMA 1, UL Type 1 requirements if wiring is exposed outside the enclosure.

2. Replace and secure the front covers of the drive (A, D) and replace the digital operator (B).
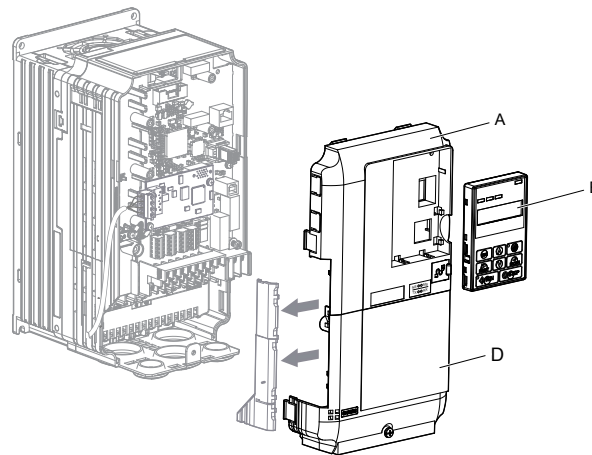
Figure 7.14 Replace the Front Covers and Digital Operator

Note: Take proper precautions when wiring the option so that the front covers will easily fit back onto the drive. Make sure no cables are pinched between the front covers and the drive when replacing the covers.

3. Set drive parameters for proper motor rotation. (*Refer to A1: Initialization on page 250* and *Refer to F1: PG Speed Control Card (PG-B3, PG-X3, PG-RT3, PG-F3) on page 278* for details on parameter settings) With a two-pulse or three-pulse PG encoder, the leading pulse determines the motor rotation direction. A PG encoder signal with leading A pulse is considered to be rotating forward (counterclockwise when viewing rotation from motor load side).
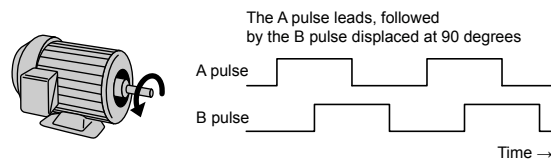
Figure 7.15 Displacement of A and B Pulses

After connecting the PG encoder outputs to the option, apply power to the drive and manually rotate the motor and check the rotation direction by viewing monitor U1-05 on the digital operator.

Reverse motor rotation is indicated by a negative value for U1-05; forward motor rotation is indicated by a positive value.

<div style="float:right">**Peripheral Devices & Options**

7</div>

If monitor U1-05 indicates that the forward direction is opposite of what is intended, set F1-05 or F1-32 to 1 or reverse the two A pulse wires with the two B pulse wires on option terminal TB1 as shown in *Figure 7.16*.
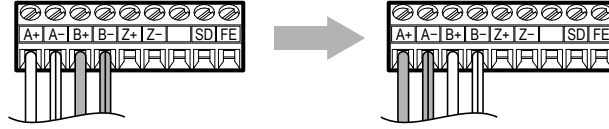
Figure 7.16 A Channel and B Channel Wire Switching

Please note that when the drive is initialized using A1-03 =1110, 2220, 3330, the value for F1-05/F1-32 will reset to factory default and the parameter will need to be readjusted to switch the direction.

Appendix: A

Specifications

A.1 Heavy Duty and Normal Duty Ratings

The capacity of the drive is based on two types of load characteristics: Heavy Duty (HD) and Normal Duty (ND).

Refer to the following table for the differences between HD and ND.

Table A.1 Selecting the Appropriate Load Rating

Setting Parameter C6-01	Rated Output Current	Overload Tolerance	Default Carrier Frequency
0: Heavy Duty	HD Rating varies by model [1]	150% rated output current for 60 s	2 kHz
1: Normal Duty (default)	ND Rating varies by model [1]	120% rated output current for 60 s varies by model	2 kHz, Swing PWM

<1> *Refer to Power Ratings on page 235* for information on rating changes based on drive model.

> **TERMS**
> - **HD and ND**: HD refers to applications requiring constant torque output, while ND refers to applications with variable torque needs. The drive allows the user to select HD or ND torque depending on the application. Fans, pumps, and blowers should use ND (C6-01 = 1), and other applications generally use HD (C6-01 = 0).
> - **Swing PWM**: Swing PWM equivalent to a 2 kHz audible noise. This function turns the motor noise into a less obtrusive white noise.

Note: Differences between HD ratings and ND ratings for the drive include rated input and output current, overload capacity, carrier frequency, and current limit. The default setting is for ND (C6-01 = 1).

A.2 Power Ratings

◆ Three-Phase 200 V Class Drive Models 2A0004 to 2A0030

Table A.2 Power Ratings (Three-Phase 200 V Class)

Item			Specification							
Drive Model			**2A0004**	**2A0006**	**2A0008**	**2A0010**	**2A0012**	**2A0018**	**2A0021**	**2A0030**
Maximum Applicable Motor Capacity (HP) [1]		**ND Rating**	0.75	1	2	3	3	5	7.5	10
		HD Rating	0.75	1	2	2	3	3	5	7.5
Input	**Input Current (A)** [2]	**ND Rating**	3.9	7.3	8.8	10.8	13.9	18.5	24	37
		HD Rating	2.9	5.8	7	7.5	11	15.6	18.9	28
	Rated Voltage Rated Frequency		Three-phase 200 to 240 Vac 50/60 Hz/270 to 340 Vdc [3]							
	Allowable Voltage Fluctuation		-15 to 10%							
	Allowable Frequency Fluctuation		±5%							
	Input Power (kVA)	**ND Rating**	1.8	3.3	4.0	4.9	6.4	8.5	11	17
		HD Rating	1.3	2.7	3.2	3.4	5.0	7.1	8.6	13
Output	**Rated Output Capacity (kVA)** [4]	**ND Rating** [5]	1.3	2.3	3	3.7	4.6	6.7	8	11.4
		HD Rating [6]	1.2	1.9	2.6	3	4.2	5.3	6.7	9.5
	Rated Output Current (A)	**ND Rating** [5]	3.5	6	8	9.6	12	17.5	21	30
		HD Rating [6]	3.2	5	6.9	8	11	14	17.5	25
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)							
	Carrier Frequency		User adjustable between 1 and 15 kHz							
	Maximum Output Voltage (V)		Three-phase 200 to 240 V (proportional to input voltage)							
	Maximum Output Frequency (Hz)		400 Hz (user-set)							

[1] The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.

[2] Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.

[3] DC input is not available for UL standards.

[4] Rated motor capacity is calculated with a rated output voltage of 220 V.

[5] Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.

[6] Carrier frequency can be increased to 8 kHz while keeping this current derating. Higher carrier frequency settings require derating..

Specifications

A

◆ Three-Phase 200 V Class Drive Models 2A0040 to 2A0211

Table A.3 Power Ratings Continued (Three-Phase 200 V Class)

Item			Specification							
Drive Model			**2A0040**	**2A0056**	**2A0069**	**2A0081**	**2A0110**	**2A0138**	**2A0169**	**2A0211**
Maximum Applicable Motor Capacity (HP) [1]	**ND Rating**		15	20	25	30	40	50	60	75
	HD Rating		10	15	20	25	30	40	50	60
Input	**Input Current (A)** [2]	**ND Rating**	52	68	80	92	111	136	164	200
		HD Rating	37	52	68	80	82	111	136	164
	Rated Voltage Rated Frequency		Three-phase 200 to 240 Vac 50/60 Hz/270 to 340 Vdc [3]							
	Allowable Voltage Fluctuation		-15 to 10%							
	Allowable Frequency Fluctuation		±5%							
	Input Power (kVA)	**ND Rating**	24	31	37	42	51	62	75	91
		HD Rating	17	24	31	37	37	51	62	75
Output	**Rated Output Capacity (kVA)** [4]	**ND Rating** [5]	15.2	21	26	31	42	53	64	80
		HD Rating	12.6 [6]	17.9 [6]	23 [6]	29 [6]	32 [6]	44 [6]	55 [7]	69 [7]
	Rated Output Current (A)	**ND Rating** [5]	40	56	69	81	110	138	169	211
		HD Rating	33 [6]	47 [6]	60 [6]	75 [6]	85 [6]	115 [6]	145 [7]	180 [7]
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)							
	Carrier Frequency		User adjustable between 1 and 15 kHz						User adjustable between 1 and 10 kHz	
	Maximum Output Voltage (V)		Three-phase 200 to 240 Vac (proportional to input voltage)							
	Maximum Output Frequency (Hz)		400 Hz (user-set)							

[1] The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.

[2] Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.

[3] DC input is not available for UL standards.

[4] Rated motor capacity is calculated with a rated output voltage of 220 V.

[5] Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.

[6] Carrier frequency can be increased to 8 kHz while keeping this current derating. Higher carrier frequency settings require derating.

[7] Carrier frequency can be increased to 5 kHz while keeping this current derating. Higher carrier frequency settings require derating.

◆ **Three-Phase 200 V Class Drive Models 2A0250 to 2A0415**

Table A.4 Power Ratings Continued (Three-Phase 200 V Class)

Item			Specification			
Drive Models			**2A0250**	**2A0312**	**2A0360**	**2A0415**
Maximum Applicable Motor Capacity (HP) [1]		**ND Rating**	100	125	150	175
		HD Rating	75	100	125	150
Input	**Input Current (A)** [2]	**ND Rating**	271	324	394	394
		HD Rating	200	271	324	394
	Rated Voltage Rated Frequency		Three-phase 200 to 240 Vac 50/60 Hz/270 to 340 Vdc [3]			
	Allowable Voltage Fluctuation		-15 to 10%			
	Allowable Frequency Fluctuation		±5%			
	Input Power (kVA)	**ND Rating**	124	148	180	215
		HD Rating	91	124	148	180
Output	**Rated Output Capacity (kVA)** [4]	**ND Rating** [5]	95	119	137	158
		HD Rating	82 [6]	108 [6]	132 [6]	158 [5]
	Rated Output Current (A)	**ND Rating** [5]	250	312	360	415
		HD Rating	215 [6]	283 [6]	346 [6]	415 [5]
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)			
	Carrier Frequency		User adjustable between 1 and 10 kHz			
	Maximum Output Voltage (V)		Three-phase 200 to 240 Vac (proportional to input voltage)			
	Maximum Output Frequency (Hz)		400 Hz (user-set)			

[1] The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.

[2] Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.

[3] DC input is not available for UL standards.

[4] Rated motor capacity is calculated with a rated output voltage of 220 V.

[5] Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.

[6] Carrier frequency can be increased to 5 kHz while keeping this current derating. Higher carrier frequency settings require derating.

Specifications

A

◆ Three-Phase 400 V Class Drive Models 4A0002 to 4A0031

Table A.5 Power Ratings (Three-Phase 400 V Class)

Item			Specification								
Drive Models			**4A0002**	**4A0004**	**4A0005**	**4A0007**	**4A0009**	**4A0011**	**4A0018**	**4A0023**	**4A0031**
Maximum Applicable Motor Capacity (HP) [1]	**ND Rating**		0.75	2	3	3	5	7.5	10	15	20
	HD Rating		0.75	2	3	3	5	5	7.5	10	15
Input	**Input Current (A)** [2]	**ND Rating**	2.1	4.3	5.9	8.1	9.4	14	20	24	38
		HD Rating	1.8	3.2	4.4	6	8.2	10.4	15	20	29
	Rated Voltage Rated Frequency		Three-phase: 380 to 480 Vac 50/60 Hz/510 to 680 Vdc [3]								
	Allowable Voltage Fluctuation		-15 to 10%								
	Allowable Frequency Fluctuation		±5%								
	Input Power (kVA)	**ND Rating**	1.9	3.9	5.4	7.4	8.6	12.8	18.3	22	35
		HD Rating	1.6	2.9	4.0	5.5	7.5	10	13.7	18.3	27
Output	**Rated Output Capacity (kVA)** [4]	**ND Rating** [5]	1.6	3.1	4.1	5.3	6.7	8.5	13.3	17.5	24
		HD Rating [6]	1.4	2.6	3.7	4.2	5.5	7	11.3	13.7	18.3
	Rated Output Current (A)	**ND Rating** [5]	2.1	4.1	5.4	6.9	8.8	11.1	17.5	23	31
		HD Rating [6]	1.8	3.4	4.8	5.5	7.2	9.2	14.8	18	24
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)								
	Carrier Frequency		User adjustable between 1 and 15 kHz								
	Maximum Output Voltage (V)		Three-phase: 380 to 480 Vac (proportional to input voltage)								
	Maximum Output Frequency (Hz)		400 Hz (user-adjustable)								

[1] The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.

[2] Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring conditions, and power supply impedance.

[3] DC input is not available for UL standards.

[4] Rated motor capacity is calculated with a rated output voltage of 440 V.

[5] Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.

[6] Carrier frequency can be increased to 8 kHz while keeping this current derating. Higher carrier frequency settings require derating.

◆ Three-Phase 400 V Class Drive Models 4A0038 to 4A0165

Table A.6 Power Ratings Continued (Three-Phase 400 V Class)

Item			Specification							
Drive Models			4A0038	4A0044	4A0058	4A0072	4A0088	4A0103	4A0139	4A0165
Maximum Applicable Motor Capacity (HP) [1]		ND Rating	25	30	40	50	60	75	100	125
		HD Rating	20	25-30	25-30	40	50-60	50-60	75	100
Input	Input Current (A) [2]	ND Rating	44	52	58	71	86	105	142	170
		HD Rating	39	44	43	58	71	86	105	142
	Rated Voltage Rated Frequency		Three-phase: 380 to 480 Vac 50/60 Hz/510 to 680 Vdc [3]							
	Allowable Voltage Fluctuation		-15 to 10%							
	Allowable Frequency Fluctuation		±5%							
	Input Power (kVA)	ND Rating	40	48	53	65	79	96	130	155
		HD Rating	36	40	39	53	65	79	96	130
Output	Rated Output Capacity (kVA) [4]	ND Rating [5]	29	34	44	55	67	78	106	126
		HD Rating	24	30	34	46	57	69	85 [7]	114 [7]
	Rated Output Current (A)	ND Rating [5]	38	44	58	72	88	103	139	165
		HD Rating	31 [6]	39 [6]	45 [6]	60 [6]	75 [6]	91 [6]	112 [7]	150 [7]
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)							
	Carrier Frequency		User adjustable between 1 and 15 kHz						User adjustable between 1 and 10 kHz	
	Maximum Output Voltage (V)		Three-phase: 380 to 480 Vac (proportional to input voltage)							
	Maximum Output Frequency (Hz)		400 Hz (user-adjustable)							

[1] The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.

[2] Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring conditions, and power supply impedance.

[3] DC input is not available for UL standards.

[4] Rated motor capacity is calculated with a rated output voltage of 440 V.

[5] Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.

[6] Carrier frequency can be increased to 8 kHz while keeping this current derating. Higher carrier frequency settings require derating.

[7] Carrier frequency can be increased to 5 kHz while keeping this current derating. Higher carrier frequency settings require derating.

Specifications

A

◆ Three-Phase 400 V Class Drive Models 4A0208 to 4A1200

Table A.7 Power Ratings Continued (Three-Phase 400 V Class)

Item			Specification								
Drive Models			**4A0208**	**4A0250**	**4A0296**	**4A0362**	**4A0414**	**4A0515**	**4A0675**	**4A0930**	**4A1200**
Maximum Applicable Motor Capacity (HP) [1]	**ND Rating**		150	200	250	300	350	400-450	500-550	750	1000
	HD Rating		125-150	150	200	250	300	350	400-450-500	650	900
Input	**Input Current (A)** [2]	**ND Rating**	207	248	300	346	410	465	657	922	1158
		HD Rating	170	207	248	300	346	410	584	830	1031
	Rated Voltage Rated Frequency		Three-phase: 380 to 480 Vac 50/60 Hz/510 to 680 Vdc [3]								
	Allowable Voltage Fluctuation		-15 to 10%								
	Allowable Frequency Fluctuation		±5%								
	Input Power (kVA)	**ND Rating**	189	227	274	316	375	425	601	843	1059
		HD Rating	155	189	227	274	316	375	534	759	943
Output	**Rated Output Capacity (kVA)** [4]	**ND Rating** [5]	189	227	274	316	375	425	601	843	1059
		HD Rating	137 [6]	165 [6]	198 [6]	232 [6]	282 [6]	343 [5]	461 [5]	617 [5]	831 [5]
	Rated Output Current (A)	**ND Rating** [5]	208	250	296	362	414	515	675	930	1200
		HD Rating	180 [6]	216 [6]	260 [6]	304 [6]	370 [7]	450 [5]	605 [5]	810 [5]	1090 [5]
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)								
	Carrier Frequency		User-adjustable between 1 and 10 kHz					User-adjustable between 1 and 5 kHz			
	Maximum Output Voltage (V)		Three-phase: 380 to 480 Vac (proportional to input voltage)						0.95 × [input voltage]		
	Maximum Output Frequency (Hz)		400 Hz (user-adjustable)								

[1] The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.

[2] Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring conditions, and power supply impedance.

[3] DC input is not available for UL standards.

[4] Rated motor capacity is calculated with a rated output voltage of 440 V.

[5] Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.

[6] Carrier frequency can be increased to 5 kHz while keeping this current derating. Higher carrier frequency settings require derating.

[7] Carrier frequency can be increased to 5 kHz while keeping this current derating. Higher carrier frequency settings require derating.

◆ **Three-Phase 600 V Class Drive Models 5A0003 to 5A0032**

Table A.8 Power Ratings (Three-Phase 600 V Class)

Item		Specification								
Drive Models		5A0003	5A0004	5A0006	5A0009	5A0011	5A0017	5A0022	5A0027	5A0032
Maximum Applicable Motor Capacity (HP) [1]	ND Rating	2	3	5	7.5	10	15	20	25	30
	HD Rating	1	2	3	5	7.5	10	15	20	25
Input Input Current (A) [2]	ND Rating	3.6	5.1	8.3	12	16	23	31	38	45
	HD Rating	1.9	3.6	5.1	8.3	12	16	23	31	38
Rated Voltage Rated Frequency		Three-phase 500 to 600 Vac 50/60 Hz								
Allowable Voltage Fluctuation		-10 (-15) to +10%								
Allowable Frequency Fluctuation		±5%								
Input Power (kVA)	ND Rating	4.1	5.8	9.5	14	18	26	35	43	51
	HD Rating	2.2	4.1	5.8	9.5	14	18	26	35	43
Output Rated Output Capacity (kVA) [3]	ND Rating [4]	2.7	3.9	6.1	9	11	17	22	27	32
	HD Rating [5]	1.7	3.5	4.1	6.3	9.8	12	17	22	27
Rated Output Current (A)	ND Rating [4]	2.7	3.9	6.1	9	11	17	22	27	32
	HD Rating [5]	1.7	3.5	4.1	6.3	9.8	12.5	17	22	27
Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)								
Carrier Frequency		User adjustable between 2 and 15 kHz				User adjustable between 2 and 10 kHz				
Maximum Output Voltage (V)		Three-phase 500 to 600 Vac (proportional to input voltage)								
Maximum Output Frequency (Hz)		400 Hz (user-set)								

[1] The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.

[2] Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.

[3] Rated motor capacity is calculated with a rated output voltage of 575 V.

[4] Carrier frequency is set to 2 kHz. Current derating is required to raise the carrier frequency.

[5] Carrier frequency can be increased to 8 kHz while keeping this current derating. Higher carrier frequency settings require derating.

Specifications

A

◆ Three-Phase 600 V Class Drive Models 5A0041 to 5A0099

Table A.9 Power Ratings Continued (Three-Phase 600 V Class)

Item		Specification				
Drive Models		**5A0041**	**5A0052**	**5A0062**	**5A0077**	**5A0099**
Maximum Applicable Motor Capacity (HP) [1]	**ND Rating**	40	50	60	75	100
	HD Rating	25-30	40	50-60	50-60	75
Input ‖ **Input Current (A)** [2]	**ND Rating**	44	54	66	80	108
	HD Rating	33	44	54	66	80
	Rated Voltage Rated Frequency	Three-phase 500 to 600 Vac 50/60 Hz				
	Allowable Voltage Fluctuation	-10 (-15) to +10%				
	Allowable Frequency Fluctuation	±5%				
	Input Power (kVA) ‖ **ND Rating**	50	62	75	91	123
	HD Rating	38	50	62	75	91
Output ‖ **Rated Output Capacity (kVA)** [3]	**ND Rating** [4]	41	52	62	77	99
	HD Rating	32 [5]	41 [5]	52 [5]	62 [5]	77 [6]
Rated Output Current (A)	**ND Rating** [4]	41	52	62	77	99
	HD Rating	32 [5]	41 [5]	52 [5]	62 [5]	77 [6]
Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)				
Carrier Frequency		User adjustable between 2 and 10 kHz				User adjustable between 2 and 8 kHz
Maximum Output Voltage (V)		Three-phase 500 to 600 Vac (proportional to input voltage)				
Maximum Output Frequency (Hz)		400 Hz (user-set)				

<1> The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.

<2> Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.

<3> Rated motor capacity is calculated with a rated output voltage of 575 V.

<4> Carrier frequency can be increased to 2 kHz while keeping this current derating. Higher carrier frequency settings require derating.

<5> Carrier frequency can be increased to 8 kHz while keeping this current derating. Higher carrier frequency settings require derating.

<6> Carrier frequency can be increased to 5 kHz while keeping this current derating. Higher carrier frequency settings require derating.

◆ Three-Phase 600 V Class Drive Models 5A0125 to 5A0242

Table A.10 Power Ratings Continued (Three-Phase 600 V Class)

Item			5A0125	5A0145	5A0192	5A0242
Item			**Specification**			
Drive Models			**5A0125**	**5A0145**	**5A0192**	**5A0242**
Maximum Applicable Motor Capacity (HP) [1]		**ND Rating**	125	150	200	250
		HD Rating	100	125	150	200
Input	**Input Current (A)** [2]	**ND Rating**	129	158	228	263
		HD Rating	108	129	158	228
	Rated Voltage / Rated Frequency		Three-phase 500 to 600 Vac 50/60 Hz			
	Allowable Voltage Fluctuation		-10 (-15) to +10%			
	Allowable Frequency Fluctuation		±5%			
	Input Power (kVA)	**ND Rating**	147	181	261	301
		HD Rating	123	147	181	261
Output	**Rated Output Capacity (kVA)** [3]	**ND Rating** [4]	124	144	191	241
		HD Rating [4]	99	129	171	199
	Rated Output Current (A)	**ND Rating** [4]	125	145	192	242
		HD Rating [4]	99	130	172	200
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)			
	Carrier Frequency		User adjustable between 2 and 3kHz			
	Maximum Output Voltage (V)		Three-phase 500 to 600 Vac (proportional to input voltage)			
	Maximum Output Frequency (Hz)		400 Hz (user-set)			

[1] The motor capacity (HP) refers to a NEC rated 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor current. Select the appropriate capacity drive if operating the motor continuously above motor nameplate current.

[2] Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.

[3] Rated motor capacity is calculated with a rated output voltage of 575 V.

[4] Carrier frequency can be increased to 2 kHz while keeping this current derating. Higher carrier frequency settings require derating.

[5] Carrier frequency can be increased to 8 kHz while keeping this current derating. Higher carrier frequency settings require derating.

[6] Carrier frequency can be increased to 5 kHz while keeping this current derating. Higher carrier frequency settings require derating.

Specifications

A

A.3 Drive Specifications

Note: **1.** Perform rotational Auto-Tuning to obtain the performance specifications given below.

2. For optimum performance life of the drive, install the drive in an environment that meets the required specifications.

Item		Specification
Control Characteristics	**Control Method**	The following control methods can be set using drive parameters: • V/f Control (V/f) • V/f Control with PG (V/f w/PG) • Open Loop Vector Control (OLV) • Closed Loop Vector Control (CLV) • Open Loop Vector Control for PM (OLV/PM) • Advanced Open Loop Vector Control for PM (AOLV/PM) • Closed Loop Vector Control for PM (CLV/PM)
	Frequency Control Range	0.01 to 400 Hz
	Frequency Accuracy (Temperature Fluctuation)	Digital input: within ±0.01% of the max output frequency (-10 to +40 °C) Analog input: within ±0.1% of the max output frequency (25 °C ±10 °C)
	Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/2048 of the maximum output frequency setting (11 bit plus sign)
	Output Frequency Resolution	0.001 Hz
	Frequency Setting Signal	Main speed frequency reference: DC -10 to +10 V (20 kΩ), DC 0 to +10 V (20 kΩ), 4 to 20 mA (250 Ω), 0 to 20 mA (250 Ω) Main speed reference: Pulse train input (max. 32 kHz)
	Starting Torque	V/f, V/f w/PG: 150% at 3 Hz OLV: 200% at 0.3 Hz [1] CLV, AOLV/PM, CLV/PM: 200% at 0.0 r/min [1] OLV/PM: 100% at 3 Hz
	Speed Control Range	V/f, V/f w/PG: 1:40 OLV: 1:200 CLV, CLV/PM: 1:1500 OLV/PM: 1:20 AOLV/PM: 1:100 [2] [3] [4]
	Speed Control Accuracy	OLV: ±0.2% (25 °C ±10 °C) CLV: ±0.02% (25 °C ±10 °C) [5]
	Speed Response	OLV, OLV/PM, AOLV/PM: 10 Hz (25 °C ±10 °C (77 °F ±50 °F)) CLV, CLV/PM: 50 Hz (25 °C ±10 °C (77 °F ±50 °F))
	Torque Limit	Parameter settings allow separate limits in four quadrants (OLV, CLV, AOLV/PM, CLV/PM)
	Accel/Decel Time	0.0 to 6000.0 s (4 selectable combinations of independent acceleration and deceleration settings)
	Braking Torque	Approx. 20% (approx. 125% when using braking resistor) [6] • Short-time decel torque [7] : over 100% for 0.4/ 0.75 kW motors, over 50% for 1.5 kW motors, and over 20% for 2.2 kW and above motors [8] (overexcitation/High Slip Braking: approx. 40%) • Continuous regenerative torque: approx. 20% [8] (approx. 125% with dynamic braking resistor option [6] : 10% ED, 10s)
	Braking Transistor	Models 2A0004 to 2A0138, 4A0002 to 4A0072, and 5A0003 to 5A0052 have a built-in braking transistor.
	V/f Characteristics	User-selected programs and V/f preset patterns possible
	Main Control Functions	Torque Control, Droop Control, Speed/torque Control Switching, Feed Forward Control, Zero Servo Function, Momentary Power Loss Ride-Thru, Speed Search, Overtorque/Undertorque Detection, Torque Limit, 17 Step Speed (max), Accel/decel Switch, S-curve Accel/decel, 3-wire Sequence, Auto-tuning (rotational, stationary tuning), Dwell, Cooling Fan on/off Switch, Slip Compensation, Torque Compensation, Frequency Jump, Upper/lower Limits for Frequency Reference, DC Injection Braking at Start and Stop, Overexcitation Braking, High Slip Braking, PID Control (with sleep function), Energy Saving Control, MEMOBUS/Modbus Comm. (RS-422/RS-485 max, 115.2 kbps), Fault Restart, Application Presets, DriveWorksEZ (customized function), Removable Terminal Block with Parameter Backup Function, Online Tuning, KEB, Overexcitation Deceleration, Inertia (ASR) Tuning, Overvoltage Suppression, High Frequency Injection.

Item		Specification
Protection Functions	**Motor Protection**	Electronic thermal overload relay
	Momentary Overcurrent Protection	Drive stops when output current exceeds 200% of Heavy Duty Rating
	Overload Protection	Drive stops after 60 s at 150% of rated Heavy Duty output current [9]
	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 600 V class: Stops when DC bus voltage exceeds approx. 1040 V
	Undervoltage Protection	200 V class: Stops when DC bus voltage falls below approx. 190 V 400 V class: Stops when DC bus voltage falls below approx. 380 V 600 V class: Stops when DC bus voltage falls below approx. 475 V
	Momentary Power Loss Ride-Thru	Immediately stop after 15 ms or longer power loss. [10] Continuous operation during power loss than 2 s (standard) [11]
	Heatsink Overheat Protection	Thermistor
	Braking Resistor Overheat Protection	Overheat input signal for braking resistor (Optional ERF-type, 3% ED)
	Stall Prevention	Stall Prevention is available during acceleration, deceleration, and during run.
	Ground Protection	Electronic circuit protection [12]
	DC Bus Charge LED	Remains lit until DC bus voltage falls below 50 V
Environment	**Area of Use**	Indoors
	Ambient Temperature	IP20/NEMA 1, UL Type 1 enclosure: -10 °C to +40 °C (14 °F to 104 °F) IP00 enclosure: -10 °C to +50 °C (14 °F to 122 °F) Finless Type: IP20/IP00 enclosure: -10 °C to +45 °C (14 °F to 113 °F)
	Humidity	95 RH% or less (no condensation)
	Storage Temperature	-20 °C to +60 °C (-4 °F to +140 °F) short-term temperature during transportation
	Altitude	Up to 1000 meters without derating, up to 3000 m with output current and voltage derating.
	Vibration/Shock	10 to 20 Hz: 9.8 m/s^2 [13] 20 to 55 Hz: 5.9 m/s^2 (2A0004 to 2A0211, 4A0002 to 4A0165, and 5A0003 to 5A0099) 2.0 m/s^2 (2A0250 to 2A0415, 4A0208 to 4A1200, and 5A0125 to 5A0242)
Standard		• UL508C • IEC/EN 61800-3, IEC/EN 61800-5-1 • Two Safe Disable inputs and one EDM output according to ISO/EN 13849-1 Cat. 3 PLd, IEC/EN 61508 SIL2 • CSA
Protection Design		IP00/Open Type enclosure, IP20/NEMA 1, UL Type 1 enclosure [14]

<1> Select control modes in accordance with drive capacity.

<2> High-frequency current superposition (n8-57=1) is available.

<3> Perform Rotational Auto Tuning.

<4> Contact Yaskawa or your nearest sales representative if using a PM motor other than Super Energy-saving Motors manufactured by Yaskawa Motor Co., Ltd. (SSR1 series and SST4 series with standard specifications).

<5> The accuracy of these values depends on motor characteristics, ambient conditions, and drive settings. Specifications may vary with different motors and with changing motor temperature. Contact Yaskawa for consultation.

<6> Disable Stall Prevention during deceleration (L3-04 = 0) when using a regenerative converter, a regenerative unit, a braking resistor or the Braking Resistor Unit. The default setting for the Stall Prevention function will interfere with the braking resistor.

<7> Instantaneous average deceleration torque refers to the torque required to decelerate the motor (uncoupled from the load) from the rated motor speed down to zero in the shortest time.

<8> Actual specifications may vary depending on motor characteristics.

<9> Overload protection may be triggered when operating with 150% of the rated output current if the output frequency is less than 6 Hz.

<10> May be shorter due to load conditions and motor speed.

<11> A separate Momentary Power Loss Ride-Thru Unit is required for models 2A0004 to 2A0056 and 4A0002 to 4A0031 if the application needs to continue running for up to 2 seconds during a momentary power loss.

<12> Ground protection is triggered when a ground short circuit occurs while the drive is running. The 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.

<13> Models 4A0930 and 4A1200 are rated at 5.9 m/s^2.

<14> Removing the top protective cover or bottom conduit bracket from an IP20/NEMA 1, UL Type 1 enclosure drive voids NEMA 1, UL Type 1 protection while maintaining IP20 conformity. This is applicable to models 2A0004 to 2A0211, 4A0002 to 4A0165, and 5A0003 to 5A0242.

A.4 Drive Watt Loss Data

Table A.11 Watt Loss 200 V Class Three-Phase Models

Drive Model	Normal Duty				Heavy Duty			
	Rated Amps (A) [3]	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
2A0004	3.5	18.4	47	66	3.2 [1]	14.8	44	59
2A0006	6.0	31	51	82	5.0 [1]	24	48	72
2A0008	8.0	43	52	95	6.9 [1]	35	49	84
2A0010	9.6	57	58	115	8.0 [1]	43	52	95
2A0012	12.0	77	64	141	11.0 [1]	64	58	122
2A0018	17.5	101	67	168	14.0 [1]	77	60	137
2A0021	21	138	83	222	17.5 [1]	101	67	168
2A0030	30	262	117	379	25 [1]	194	92	287
2A0040	40	293	145	437	33 [1]	214	105	319
2A0056	56	371	175	546	47 [1]	280	130	410
2A0069	69	491	205	696	60 [1]	395	163	558
2A0081	81	527	257	785	75 [1]	460	221	681
2A0110	110	719	286	1005	85 [1]	510	211	721
2A0138	138	842	312	1154	115 [1]	662	250	912
2A0169	169	1014	380	1394	145 [1]	816	306	1122
2A0211	211	1218	473	1691	180 [2]	976	378	1354
2A0250	250	1764	594	2358	215 [2]	1514	466	1980
2A0312	312	2020	665	2686	283 [2]	1936	588	2524
2A0360	360	2698	894	3591	346 [2]	2564	783	3347
2A0415	415	2672	954	3626	415 [3]	2672	954	3626

[1] Value assumes the carrier frequency is set to 8 kHz or less.

[2] Value assumes the carrier frequency is set to 5 kHz or less.

[3] Value assumes the carrier frequency is set to 2 kHz.

Table A.12 Watt Loss 400 V Class Three-Phase Models

Drive Model	Normal Duty				Heavy Duty			
	Rated Amps (A) [3]	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
4A0002	2.1	20	48	68	1.8 [1]	15.9	45	61
4A0004	4.1	32	49	81	3.4 [1]	25	46	70
4A0005	5.4	45	53	97	4.8 [1]	37	49	87
4A0007	6.9	62	59	121	5.5 [1]	48	53	101
4A0009	8.8	66	60	126	7.2 [1]	53	55	108
4A0011	11.1	89	73	162	9.2 [1]	69	61	130
4A0018	17.5	177	108	285	14.8 [1]	135	86	221
4A0023	23	216	138	354	18.0 [1]	150	97	247
4A0031	31	295	161	455	24 [1]	208	115	323
4A0038	38	340	182	521	31 [1]	263	141	403
4A0044	44	390	209	599	39 [1]	330	179	509
4A0058	58	471	215	686	45 [1]	349	170	518
4A0072	72	605	265	870	60 [1]	484	217	701

Drive Model	Normal Duty				Heavy Duty			
	Rated Amps (A) [3]	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
4A0088	88	684	308	993	75 [1]	563	254	817
4A0103	103	848	357	1205	91 [1]	723	299	1022
4A0139	139	1215	534	1749	112 [2]	908	416	1325
4A0165	165	1557	668	2224	150 [2]	1340	580	1920
4A0208	208	1800	607	2408	180 [2]	1771	541	2313
4A0250	250	2379	803	3182	216 [2]	2360	715	3075
4A0296	296	2448	905	3353	260 [2]	2391	787	3178
4A0362	362	3168	1130	4298	304 [2]	3075	985	4060
4A0414	414	3443	1295	4738	370 [2]	3578	1164	4742
4A0515	515	4850	1668	6518	450 [3]	3972	1386	5358
4A0675	675	4861	2037	6898	605 [3]	4191	1685	5875
4A0930	930	8476	2952	11428	810 [3]	6912	2455	9367
4A1200	1200	8572	3612	12184	1090 [3]	7626	3155	10781

<1> Value assumes the carrier frequency is set to 8 kHz or less.

<2> Value assumes the carrier frequency is set to 5 kHz or less.

<3> Value assumes the carrier frequency is set to 2 kHz.

Table A.13 Watt Loss Three-Phase 600 V Class Three-Phase Models

Drive Model	Normal Duty				Heavy Duty			
	Rated Amps (A) [3]	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
5A0003	2.7	23.3	21.5	44.8	1.7 [2]	28.9	19.8	48.7
5A0004	3.9	33.6	27.5	61.1	3.5 [2]	54.3	27.6	81.9
5A0006	6.1	43.7	28.1	71.8	4.1 [2]	53.0	27.0	80.0
5A0009	9.0	68.9	43.4	112.3	6.3 [2]	78.7	36.4	115.1
5A0011	11	88.0	56.1	144.0	9.8 [2]	110.9	49.5	160.3
5A0017	17	146.7	96.6	243.2	12.5 [2]	144.7	67.5	212.2
5A0022	22	178.3	99.4	277.7	17 [2]	203.8	81.1	284.8
5A0027	27	227.2	132.1	359.3	22 [1]	267.2	113.8	381.1
5A0032	32	279.9	141.6	421.5	27 [1]	332.9	132.2	465.1
5A0041	41	330.8	136.2	467.0	32 [1]	405.9	127.6	533.5
5A0052	52	427.8	166.2	594.0	41 [1]	527.2	161.4	688.5
5A0062	62	791.2	279.0	1070.2	52 [1]	1271.5	335.0	1606.5
5A0077	77	959.1	329.4	1288.6	62 [1]	1457.0	379.5	1836.5
5A0099	99	1253.2	411.7	1664.9	77 [2]	1267.0	352.0	1619.0
5A0125	125	1641	537	2178	99 [3]	1328	422	1750
5A0145	145	1860	603	2463	130 [3]	1638	508	2146
5A0192	192	2420	769	3189	172 [3]	2114	648	2762
5A0242	242	3100	1131	4231	200 [3]	2526	896	3422

<1> Value assumes the carrier frequency is set to 8 kHz or less.

<2> Value assumes the carrier frequency is set to 5 kHz or less.

<3> Value assumes the carrier frequency is set to 2 kHz.

Specifications

A

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Appendix: B

Parameter List

This appendix contains a full listing of all parameters and settings available in the drive.

B.1 A: Initialization Parameters

Table B.1 Symbols and Icons Used in Parameter Descriptions

Symbol	Description
RUN	Parameter can be changed during run.
Motor 2	Refers to a second motor when the drive is operating two motors. Use multi-function input terminals to switch between motors.

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

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
A1-00 (0100) RUN <1>	Language Selection	Select Language 0: English 1: ニホンゴ (Japanese) 2: Deutsch 3: Français 4: Italiano 5: Español 6: Português 7: 中文 8: Czech 9: Russian 10: Turkish 11: Polish 12: Greek	0: English 1: Japanese 2: German 3: French 4: Italian 5: Spanish 6: Portuguese 7: Chinese 8: Czech 9: Russian 10: Turkish 11: Polish 12: Greek **Note:** Settings 8 to 12 can only be selected from an LCD operator with version REV: F or later. The version is listed on the back of the operator.	Default: 0 Range: 0 to 12 <2>	–
A1-01 (0101) RUN <3>	Access Level Selection	Access Level 0: Operation Only 1: User Parameters 2: Advanced Level	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 Range: 0 to 2	–
A1-02 (0102) <1>	Control Method Selection	Control Method 0: V/f Control 1: V/f with PG 2: Open Loop Vector 3: Closed Loop Vect 5: PM OpenLoop Vect 6: PM AdvOpLoopVect 7: PM ClosedLoopVct	0: V/f Control 1: V/f Control with PG 2: Open Loop Vector Control 3: Closed Loop Vector Control 5: Open Loop Vector Control for PM 6: Advanced Open Loop Vector Control for PM 7: Closed Loop Vector Control for PM	Default: 2 Range: 0 to 3; 5 to 7	*135*
A1-03 (0103)	Initialize Parameters	Init Parameters 0: No Initialize 1110: User Initialize 2220: 2-Wire Initial 3330: 3-Wire Initial 5550: Term->Cntrl Int	0: No initialization 1110: User Initialize (parameter values must be stored using parameter o2-03) 2220: 2-Wire initialization 3330: 3-Wire initialization 5550: oPE04 error reset	Default: 0 Range: 0 to 3330; 5550	*135*
A1-04 (0104)	Password	Enter Password	When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 through A1-03, A1-06, A1-07, and A2-01 through A2-32 cannot be changed.	Default: 0000 Min.: 0000 Max.: 9999	–
A1-05 (0105)	Password Setting	Select Password	When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 through A1-03, A1-06, A1-07, and A2-01 through A2-32 cannot be changed.	Default: 0000 Min.: 0000 Max.: 9999	–
A1-06 (0127)	Application Preset	Application Sel 0: General 1: Pump 2: Conveyor 3: Exhaust Fan 4: Supply Fan 5: Compressor	0: General-purpose 1: Water supply pump 2: Conveyor 3: Exhaust fan 4: HVAC fan 5: Air compressor	Default: 0 Range: 0 to 5	–
A1-07 (0128)	DriveWorksEZ Function Selection	DWEZ Func Sel 0: Disabled 1: Enabled 2: Terminal Control	0: DWEZ Disabled 1: DWEZ Enabled 2: Digital input (enabled when H1-□□ = 9F)	Default: 0 Range: 0 to 2	–

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

<2>   Setting range is 0 to 7 in models 4A0930 and 4A1200.

<3>   Default setting value is determined by he Application Preset selected in parameter A1-06.

◆ **A2: User Parameters**

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
A2-01 to A2-32 (0106 to 0125)	User Parameters 1 to 32	User Param 1 - 32	Recently edited parameters are listed here. The user can also select parameters to appear here for quicker access.	Default: [1] Range: b1-01 to o4-13	–
A2-33 (0126)	User Parameter Automatic Selection	User Parms Sel 0: Disabled 1: Enabled	0: Parameters A2-01 to 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 quicker access.	Default: 1 [2] Range: 0, 1	–

<1>   Default setting value is determined by the Application Preset selected in parameter A1-06.

<2>   Default setting value is determined by parameter A1-06. Default is 0 when A1-06 = 0, and 1 when A1-06 ≠ 0.

Parameter List

B

B.2 b: Application

Application parameters configure the source of the Run command, DC Injection Braking, Speed Search, timer functions, PID control, the Dwell function, Energy Savings, and a variety of other application-related settings.

◆ b1: Operation Mode Selection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b1-01 (0180)	Frequency Reference Selection 1	Ref Source 1 0: Operator 1: Analog Input 2: Serial Com 3: Option PCB 4: Pulse Input	0: Digital operator 1: Analog input terminals 2: MEMOBUS/Modbus communications 3: Option PCB 4: Pulse input (terminal RP)	Default: 1 Range: 0 to 4	*136*
b1-02 (0181)	Run Command Selection 1	Run Source 1 0: Operator 1: Digital Inputs 2: Communication 3: Option PCB	0: Digital operator 1: Digital input terminals 2: MEMOBUS/Modbus communications 3: Option PCB	Default: 1 Range: 0 to 3	*138*
b1-03 (0182)	Stopping Method Selection	Stopping Method 0: Ramp to Stop 1: Coast to Stop 2: DCInj to Stop 3: Coast w/Timer	0: Ramp to stop 1: Coast to stop 2: DC Injection Braking to stop 3: Coast with timer	Default: 0 Range: 0 to 3 *<1>*	*138*
b1-04 (0183)	Reverse Operation Selection	Reverse Oper 0: Reverse Enabled 1: Reverse Disabled	0: Reverse enabled. 1: Reverse disabled.	Default: 0 Range: 0, 1	–
b1-05 (0184)	Action Selection below Minimum Output Frequency	Zero-Speed Oper 0: RUN at Freq Ref 1: STOP 2: RUN at Min Freq RUN at Zero PRM	0: Operates according to frequency reference (E1-09 is disabled). 1: Output shuts off (coast to stop if less than E1-09). 2: Operates according to E1-09 (frequency reference set to E1-09). 3: Zero speed (frequency reference becomes zero when less than E1-09).	Default: 0 Range: 0 to 3	–
b1-06 (0185)	Digital Input Reading	Cntl Input Scans 0: 1 Scan 1: 2 Scans	0: Input status is read once and processed immediately (for quicker response) 1: Input is read twice and processed only if the status is the same in both readings (robust against noisy signals)	Default: 1 Range: 0, 1	–
b1-07 (0186)	LOCAL/REMOTE Run Selection	LOC/REM Dur Run 0: Cycle Extrn RUN 1: Accept Extrn RUN	0: An external Run command must be cycled at the new source in order to be activated. 1: An external Run command at the new source is accepted immediately.	Default: 0 Range: 0, 1	–
b1-08 (0187)	Run Command Selection in Programming Mode	RUN dur PRG Mode 0: Run Disabled@PRG 1: Run Enabled@PRG 2: Prg only @ Stop	0: Run command is not accepted while in Programming Mode. 1: Run command is accepted while in Programming Mode. 2: Prohibit entering Programming Mode during run.	Default: 0 Range: 0 to 2	–
b1-14 (01C3)	Phase Order Selection	Rotation Sel 0: Standard 1: SwitchPhaseOrder	0: Standard 1: Switch phase order (reverses the direction of the motor)	Default: 0 Range: 0, 1	–
b1-15 (01C4)	Frequency Reference Selection 2	Ref Source 2 0: Operator 1: Analog Input 2: Serial Com 3: Option PCB 4: Pulse Input	Enabled when an input terminal set for "External reference" (H1-□□ = 2) closes. 0: Digital operator 1: Terminals (analog input terminals) 2: MEMOBUS/Modbus communications 3: Option card 4: Pulse train input	Default: 0 Range: 0 to 4	–
b1-16 (01C5)	Run Command Selection 2	Run Source 2 0: Operator 1: Digital Inputs 2: Communication 3: Option PCB	Enabled when a terminal set for "External reference" (H1-□□ = 2) closes. 0: Digital operator 1: Digital input terminals 2: MEMOBUS/Modbus communications 3: Option card	Default: 0 Range: 0 to 3	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b1-17 (01C6)	Run Command at Power Up	Run Cmd @ Pwr On 0: Cycle Ext Run 1: Accept Ext Run	0: Disregarded. A new Run command must be issued after power up. 1: Allowed. Motor will start immediately after power up if a Run command is already enabled.	Default: 0 Range: 0, 1	–
b1-21 (0748) [2]	Start Condition Selection at Closed Loop Vector Control	PG Start Sel 0: RejectRunCmd 1: AcceptRunCmd	Selects a condition to start CLV control. There is normally no need to change this parameter from the default value. 0: Run command is not accepted when b2-01 ≤ motor speed < E1-09 1: Run command is accepted when b2-01 ≤ motor speed < E1-09 Note: This parameter is not available in models 4A0930 and 4A1200.	Default: 0 Range: 0, 1	–

[1] Setting range is 0, 1, 3 in CLV, OLV/PM, AOLV/PM, and CLV/PM control modes.

[2] Available in drive software versions PRG: 1018 and later.

◆ b2: DC Injection Braking and Short Circuit Braking

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b2-01 (0189)	DC Injection Braking Start Frequency	DCInj Start Freq	Sets the frequency at which DC Injection Braking starts when "Ramp to stop" (b1-03 = 0) is selected.	Default: [1] Min.: 0.0 Hz Max.: 10.0 Hz	*141*
b2-02 (018A)	DC Injection Braking Current	DCInj Current	Sets the DC Injection Braking current as a percentage of the drive rated current. Note: This parameter is not available in AOLV/PM in models 4A0930 and 4A1200.	Default: 50% Min.: 0 Max.: 100	–
b2-03 (018B)	DC Injection Braking Time at Start	DCInj Time@Start	Sets DC Injection Braking (Zero Speed Control when in CLV and CLV/PM) time at start. Disabled when set to 0.00 seconds. Note: This parameter is not available in AOLV/PM in models 4A0930 and 4A1200.	Default: 0.00 s Min.: 0.00 Max.: 10.00	–
b2-04 (018C)	DC Injection Braking Time at Stop	DCInj Time@Stop	Sets DC Injection Braking (Zero Speed Control when in CLV and CLV/PM) time at stop. Note: This parameter is not available in AOLV/PM in models 4A0930 and 4A1200.	Default: [1] Min.: 0.00 s Max.: 10.00 s	–
b2-08 (0190)	Magnetic Flux Compensation Value	Field Comp	Sets the magnetic flux compensation as a percentage of the no-load current value (E2-03).	Default: 0% Min.: 0 Max.: 1000	–
b2-12 (01BA)	Short Circuit Brake Time at Start	SC Brake T@Start	Sets the time for Short Circuit Braking operation at start. [2]	Default: 0.00 s Min.: 0.00 Max.: 25.50	–
b2-13 (01BB)	Short Circuit Brake Time at Stop	SC Brake T@Stop	Sets the Short Circuit Braking operation time at stop. [2]	Default: 0.50 s Min.: 0.00 Max.: 25.50	–
b2-18 (0177)	Short Circuit Braking Current	Shrt Cir Brk I	Determines the current level for Short Circuit Braking. Set as a percentage of the motor rated current.	Default: 100.0% Min.: 0.0 Max.: 200.0	–

[1] Default setting is determined by parameter A1-02, Control Method Selection.

[2] A coasting motor may require a braking resistor circuit to bring the motor to a stop in the required time.

◆ b3: Speed Search

No. (Addr Hex.)	Name	LCD Display	Description	Values	Page
b3-01 (0191)	Speed Search Selection at Start	SpdSrch at Start 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: [1] Range: 0, 1	*142*
b3-02 (0192)	Speed Search Deactivation Current	SpdSrch DeactCur	Sets the current level at which the speed is assumed to be detected and Speed Search is ended. Set as a percentage of the drive rated current.	Default: [1] Min.: 0% Max.: 200%	–

Parameter List

B

No. (Addr Hex.)	Name	LCD Display	Description	Values	Page
b3-03 (0193)	Speed Search Deceleration Time	SpdSrch Dec Time	Sets output frequency reduction time during Speed Search.	Default: 2.0 s Min.: 0.1 Max.: 10.0	–
b3-04 (0194)	V/f Gain during Speed Search	SpdSrch V/f	Determines how much to lower the V/f ratio during Speed Search. Output voltage during Speed Search equals the V/f setting multiplied by b3-04. Note: Available control mode for parameter b3-04 varies by drive model: Models 2A0004 to 2A0415, 4A0002 to 4A0675, and 5A0003 to 5A0242: Available when A1-02 = 0 Models 4A0930 and 4A1200: Available when A1-02 = 0, 2	Default: _<2>_ Min.: 10% Max.: 100%	–
b3-05 (0195)	Speed Search Delay Time	Search Delay	When using an external contactor on the output side, b3-05 delays executing Speed Search after a momentary power loss to allow time for the contactor to close.	Default: 0.2 s Min.: 0.0 Max.: 100.0	–
b3-06 (0196)	Output Current 1 during Speed Search	Srch Im Lvl1	Sets the current injected to the motor at the beginning of Speed Estimation Speed Search. Set as a coefficient for the motor rated current.	Default: _<2>_ Min.: 0.0 Max.: 2.0	–
b3-07 (0197)	Output Current 2 during Speed Search (Speed Estimation Type)	Srch Im Lvl2	Sets the amount of output current during Speed Estimation Speed Search as a coefficient for the no-load current. Note: This parameter is only available in models 4A0930 and 4A1200.	Default: _<2>_ Min.: 0.0 Max.: 5.0	–
b3-08 (0198)	Current Control Gain during Speed Search (Speed Estimation Type)	Srch ACR P Gain	Sets the proportional gain for the current controller to adjust responsiveness during Speed Estimation Speed Search. There is normally no need to change this parameter from the default setting.	Default: _<3>_ Min.: 0.00 Max.: 6.00	–
b3-09 (0199)	Current Control Integral Time during Speed Search (Speed Estimation Type)	Srch ACR I Time	Sets the integral time for the current controller during to adjust responsiveness during Speed Estimation Speed Search. There is normally no need to change this parameter from the default value.	Default: _<1>_ Min.: 0.0 ms Max.: 1000.0 ms	–
b3-10 (019A)	Speed Search Detection Compensation Gain	Srch Detect Comp	Sets the gain which is applied to the speed detected by Speed Estimation Speed Search before the motor is reaccelerated. Increase this setting if ov occurs when performing Speed Search after a relatively long period of baseblock.	Default: 1.05 Min.: 1.00 Max.: 1.20	–
b3-12 (019C)	Minimum Current Detection Level during Speed Search	Srch I Deadband	Sets the minimum current detection level during Speed Search. Note: This parameter is only available in models 4A0930 and 4A1200.	Default: 6.0 Min.: 2.0 Max.: 10.0	–
b3-14 (019E)	Bi-Directional Speed Search Selection	Bidir Search Sel 0: Disabled 1: Enabled	0: Disabled (uses the direction of the frequency reference) 1: Enabled (drive detects which way the motor is rotating)	Default: _<1>_ Range: 0, 1	–
b3-17 (01F0)	Speed Search Restart Current Level	SrchRestart Lvl	Sets the Speed Search restart current level as a percentage of the drive rated current.	Default: 150% Min.: 0 Max.: 200	–
b3-18 (01F1)	Speed Search Restart Detection Time	SrchRestart Time	Sets the time to detect Speed Search restart.	Default: 0.10 s Min.: 0.00 Max.: 1.00	–
b3-19 (01F2)	Number of Speed Search Restarts	Num of SrchRestr	Sets the number of times the drive can attempt to restart when performing Speed Search.	Default: 3 Min.: 0 Max.: 10	–
b3-24 (01C0)	Speed Search Method Selection	SpdSrch Method 0: CurrentDetection 1: Speed Estimation	0: Current Detection 1: Speed Estimation	Default: 0 Range: 0, 1	–
b3-25 (01C8)	Speed Search Wait Time	SpdSrch WaitTime	Sets the time the drive must wait between each Speed Search restart attempt.	Default: 0.5 s Min.: 0.0 Max.: 30.0	–
b3-26 (01C7)	Direction Determining Level	Spd Search Meth	Sets the level that determines the direction of motor rotation. Note: This parameter is only available in models 4A0930 and 4A1200.	Default: _<2>_ Min.: 40 Max.: 60000	–

No. (Addr Hex.)	Name	LCD Display	Description	Values	Page
b3-27 (01C9)	Start Speed Search Select	SPD Search By AI 0: start from 0 1: start SPD	Selects a condition to activate Speed Search Selection at Start (b3-01) or External Speed Search Command 1 or 2 from the multi-function input. 0: Triggered when a Run command is issued (normal). 1: Triggered when an external baseblock is released.	Default: 0 Range: 0, 1	–
b3-29 (077C) <4>	Speed Search Induced Voltage Level	SpdSrch Ind Vlvl	Performs Speed Search when the motor induced voltage exceeds the set level. There is normally no need to change this parameter from the default value, but if changes are necessary, try lowering this value in small increments. When set too low, the drive will not perform Speed Search. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 10% Min.: 0 Max.: 10	–
b3-33 (0B3F) <5>	Speed Search Selection when Run Command is Given during Uv	SpdSrch Start UV 0: Disabled 1: Enabled	Activates and deactivates Speed Search at start in accordance with whether a Run command was issued during an undervoltage (Uv) condition. Function is active when a momentary power loss (L2-01 = 1 or 2), Speed Search at start (b3-01 = 1), and coasting to a stop (b1-03 = 1) are enabled. 0: Disabled 1: Enabled **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0 Range: 0, 1	–

<1> Default setting is determined by parameter A1-02, Control Method Selection.

<2> Default setting is determined by parameter o2-04, Drive Model Selection.

<3> Default setting is determined by parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.

<4> Available in drive software versions PRG: 1018 and later.

<5> Available in drive software versions PRG: 1019 and later.

◆ b4: Timer Function

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b4-01 (01A3)	Timer Function On-Delay Time	Delay-ON Timer	Sets 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 Max.: 3000.0	–
b4-02 (01A4)	Timer Function Off-Delay Time	Delay-OFF Timer		Default: 0.0 s Min.: 0.0 Max.: 3000.0	–
b4-03 (0B30) <1>	H2-01 ON Delay Time	H2-01 ON Delay	Sets the length of the delay time for contact outputs to open or close for the related functions set in H2-□□. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0 ms Min.: 0 Max.: 65535	–
b4-04 (0B31) <1>	H2-01 OFF Delay Time	H2-01 OFF Delay			
b4-05 (0B32) <1>	H2-02 ON Delay Time	H2-02 ON Delay			
b4-06 (0B33) <1>	H2-02 OFF Delay Time	H2-02 OFF Delay			
b4-07 (0B34) <1>	H2-03 ON Delay Time	H2-03 ON Delay			
b4-08 (0B35) <1>	H2-03 OFF Delay Time	H2-03 OFF Delay			

<1> Available in drive software versions PRG: 1019 and later.

Parameter List

B

◆ b5: PID Control

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b5-01 (01A5)	PID Function Setting	PID Mode 0: Disabled 1: Enabled D=Fdbk 2: Enabled D=Fdfwd 3: Fref+PID D=Fdbk 4: Fref+PID D=Fdfwd 5: Enabled D=Fdbk2 6: Enabled D=Fdfwd2 7: Fref+PID D=Fdbk2 8: Fref +PIDD=Fdfwd2	0: Disabled 1: Enabled (PID output becomes output frequency reference, deviation D controlled) 2: Enabled (PID output becomes output frequency reference, feedback D controlled) 3: Enabled (PID output added to frequency reference, deviation D controlled) 4: Enabled (PID output added to frequency reference, feedback D controlled) 5: Mode compatible with setting 1 of similar products from a previous product line 6: Mode compatible with setting 2 of similar products from a previous product line 7: Mode compatible with setting 3 of similar products from a previous product line 8: Mode compatible with setting 4 of similar products from a previous product line Note: 1. If the drive is replaced with Varispeed F7 drive or a similar product from a previous product line, use settings 5 to 8 instead of settings 1 to 4. 2. Settings 5 to 8 are not available in models 4A0930 and 4A1200.	Default: 0 [1] Range: 0 to 8 [2]	–
b5-02 (01A6)	Proportional Gain Setting (P)	PID Gain	Sets the proportional gain of the PID controller.	Default: 1.00 Min.: 0.00 Max.: 25.00	–
b5-03 (01A7)	Integral Time Setting (I)	PID I Time	Sets the integral time for the PID controller.	Default: 1.0 s Min.: 0.0 Max.: 360.0	–
b5-04 (01A8)	Integral Limit Setting	PID I Limit	Sets the maximum output possible from the integrator as a percentage of the maximum output frequency.	Default: 100.0% Min.: 0.0 Max.: 100.0	–
b5-05 (01A9)	Derivative Time (D)	PID D Time	Sets D control derivative time.	Default: 0.00 s Min.: 0.00 Max.: 10.00	–
b5-06 (01AA)	PID Output Limit	PID Limit	Sets the maximum output possible from the entire PID controller as a percentage of the maximum output frequency.	Default: 100.0% Min.: 0.0 Max.: 100.0	–
b5-07 (01AB)	PID Offset Adjustment	PID Offset	Applies an offset to the PID controller output. Set as a percentage of the maximum output frequency.	Default: 0.0% Min.: -100.0 Max.: 100.0	–
b5-08 (01AC)	PID Primary Delay Time Constant	PID Delay Time	Sets a low pass filter time constant on the output of the PID controller.	Default: 0.00 s Min.: 0.00 Max.: 10.00	–
b5-09 (01AD)	PID Output Level Selection	Output Level Sel 0: Normal Character 1: Rev Character	0: Normal output (direct acting) 1: Reverse output (reverse acting)	Default: 0 Range: 0, 1	–
b5-10 (01AE)	PID Output Gain Setting	Output Gain	Sets the gain applied to the PID output.	Default: 1.00 Min.: 0.00 Max.: 25.00	–
b5-11 (01AF)	PID Output Reverse Selection	Output Rev Sel 0: 0 limit 1: Reverse	0: Negative PID output triggers zero limit. 1: Rotation direction reverses with negative PID output. Note: When using setting 1, make sure reverse operation is permitted by b1-04.	Default: 0 Range: 0, 1	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b5-12 (01B0)	PID Feedback Loss Detection Selection	Fb loss Det Sel 0: Disabled 1: Alarm @ PID Enbl 2: Fault @ PID Enbl 3: DO Only - Always 4: Alarm - Always 5: Fault - Always	0: No fault. Digital output only. 1: Fault detection. Alarm output, drive continues operation. 2: Fault detection. Fault output, drive output is shut off. 3: No fault. Digital output only. No fault detection when PID control is disabled. 4: Fault detection. Alarm is triggered and drive continues to run. Fault detection even when PID is disabled. 5: Fault detection. Drive output shuts off. No fault detection when PID control is disabled.	Default: 0 Range: 0 to 5	–
b5-13 (01B1)	PID Feedback Loss Detection Level	Fb loss Det Lvl	Sets the PID feedback loss detection level as a percentage of the maximum output frequency.	Default: 0% Min.: 0 Max.: 100	–
b5-14 (01B2)	PID Feedback Loss Detection Time	Fb loss Det Time	Sets a delay time for PID feedback loss.	Default: 1.0 s Min.: 0.0 Max.: 25.5	–
b5-15 (01B3)	PID Sleep Function Start Level	PID Sleep Level	Sets the frequency level that triggers the sleep function.	Default: [3] Min.: 0.0 Hz Max.: 400.0 Hz	–
b5-16 (01B4)	PID Sleep Delay Time	PID Sleep Time	Sets a delay time before the sleep function is triggered.	Default: 0.0 s Min.: 0.0 Max.: 25.5	–
b5-17 (01B5)	PID Accel/Decel Time	PID Acc/Dec Time	Sets the acceleration and deceleration time to PID setpoint.	Default: 0.0 s Min.: 0.0 Max.: 6000.0	–
b5-18 (01DC)	PID Setpoint Selection	PID Setpoint Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 0 Range: 0, 1	–
b5-19 (01DD) ⟐RUN	PID Setpoint Value	PID Setpoint	Sets the PID target value when b5-18 = 1. Set as a percentage of the maximum PID feedback.	Default: 0.00% Min.: 0.00 Max.: 100.00	–
b5-20 (01E2)	PID Setpoint Scaling	PID Disp Scaling 0: 0.01Hz units 1: 0.01% units 2: r/min 3: User Units	Sets the units for setting/display b5-19. 0: 0.01 Hz units 1: 0.01% units (100% = max PID feedback) 2: r/min (number of motor poles must entered) 3: User-set (set scaling to b5-38 and b5-39)	Default: 1 Range: 0 to 3	–
b5-34 (019F) ⟐RUN	PID Output Lower Limit	PID Out Low Lim	Sets the minimum output possible from the PID controller as a percentage of the maximum output frequency.	Default: 0.00% Min.: -100.00 Max.: 100.00	–
b5-35 (01A0) ⟐RUN	PID Input Limit	PID Input Limit	Limits the PID control input (deviation signal) as a percentage of the maximum output frequency. Acts as a bipolar limit.	Default: 1000.0% Min.: 0.0 Max.: 1000.0	–
b5-36 (01A1)	PID Feedback High Detection Level	Fb High Det Lvl	Sets the PID feedback high detection level as a percentage of the maximum output frequency.	Default: 100% Min.: 0 Max.: 100	–
b5-37 (01A2)	PID Feedback High Detection Time	Fb High Dly Time	Sets the PID feedback high level detection delay time.	Default: 1.0 s Min.: 0.0 Max.: 25.5	–
b5-38 (01FE)	PID Setpoint User Display	PID UsrDspMaxVal	Sets the display value of U5-01 and U5-04 when the maximum frequency is output.	Default: [4] Min.: 1 Max.: 60000	–
b5-39 (01FF)	PID Setpoint Display Digits	PID UsrDspDigits 0: No Dec (XXXXX) 1: 1 Dec (XXXX.X) 2: 2 Dec (XXX.XX) 3: 3 Dec (XX.XXX)	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three decimal places	Default: [4] Range: 0 to 3	–
b5-40 (017F)	Frequency Reference Monitor Content during PID	Fref Mon Sel@PID 0: Fref Mon w PID 1: Fref Mon w/o PID	0: Display the frequency reference (U1-01) after PID compensation has been added. 1: Display the frequency reference (U1-01) before PID compensation has been added.	Default: 0 Range: 0, 1	–

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b5-47 (017D) [5]	Reverse Operation Selection 2 by PID Output	Output Rev Sel2 0: 0 limit 1: Reverse	Reverse operation selection when b5-01 = 3 or 4. 0: Zero limit when PID output is a negative value. 1: Reverse operation when PID output is a negative value (Zero limit if the reverse operation is prohibited by b1-04).	Default: 1 Range: 0, 1	–

<1> Default setting is determined by parameter o2-04, Drive Model Selection.

<2> Settings 5 to 8 are available in drive software versions PRG: 1019 and later.

<3> Default setting is determined by parameter A1-02, Control Method Selection.

<4> Default setting is determined by parameter b5-20, PID Setpoint Scaling.

<5> Available in drive software versions PRG: 1015 and later.

◆ b6: Dwell Function

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b6-01 (01B6)	Dwell Reference at Start	Dwell Ref @Start	Parameters b6-01 and b6-02 set the frequency to hold and the time to maintain that frequency at start.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	–
b6-02 (01B7)	Dwell Time at Start	Dwell Time@Start		Default: 0.0 s Min.: 0.0 Max.: 10.0	–
b6-03 (01B8)	Dwell Reference at Stop	Dwell Ref @Stop	Parameters b6-03 and b6-04 set the frequency to hold and the time to maintain that frequency at stop.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	–
b6-04 (01B9)	Dwell Time at Stop	Dwell Time @Stop		Default: 0.0 s Min.: 0.0 Max.: 10.0	–

◆ b7: Droop Control

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b7-01 (01CA) ⬧RUN	Droop Control Gain	DROOP Quantity	Sets the speed reduction gain applied at a torque reference of 100%. Set as a percentage of motor base speed.	Default: 0.0% Min.: 0.0 Max.: 100.0	–
b7-02 (01CB) ⬧RUN	Droop Control Delay Time	DROOP Delay Time	Adjusts the responsiveness of Droop Control.	Default: 0.05 s Min.: 0.03 Max.: 2.00	–
b7-03 (017E) <1>	Droop Control Limit Selection	Droop Limit Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 1 Range: 0, 1	–

<1> Available in drive software versions PRG: 1015 and later.

◆ b8: Energy Saving

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b8-01 (01CC)	Energy Saving Control Selection	Energy Save Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: <1> Range: 0, 1	–
b8-02 (01CD) ⬧RUN	Energy Saving Gain	Energy Save Gain	Sets the gain used for Energy Saving.	Default: <1> Min.: 0.0 Max.: 10.0	–
b8-03 (01CE) ⬧RUN	Energy Saving Control Filter Time Constant	Energy Save F.T	Sets a time constant for Energy Saving.	Default: <2> Min.: 0.00 s Max.: 10.00 s	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b8-04 (01CF)	Energy Saving Coefficient Value	Energy Save COEF	Determines the level of maximum motor efficiency. Setting range is 0.0 to 2000.0 for drives 3.7 kW and smaller. The display resolution depends on the rated output current after the Drive Duty has been set in parameter C6-01.	Default: [3] [4] Min.: 0.00 Max.: 655.00	–
b8-05 (01D0)	Power Detection Filter Time	kW Filter Time	Sets a time constant filter for output power detection.	Default: 20 ms Min.: 0 Max.: 2000	–
b8-06 (01D1)	Search Operation Voltage Limit	Search V Limit	Sets the limit for the voltage search operation as a percentage of the motor rated voltage.	Default: 0% Min.: 0 Max.: 100	–
b8-16 (01F8) [5]	Energy Saving Parameter (Ki) for PM Motors	PM Enrgy Save Ki	Coefficient to adjust torque linearity. Set to the Ki value on the motor nameplate. When parameter E5-01, Motor Code Selection (for PM Motors), is set to 1□□□ or 2□□□, the automatically calculated value will be set. This set value cannot be changed.	Default: 1.00 Min.: 0.00 Max.: 3.00 [6]	–
b8-17 (01F9) [5]	Energy Saving Parameter (Kt) for PM Motors	PM Enrgy Save Kt	Coefficient to adjust torque linearity. Set to the Kt value on the motor nameplate. When parameter E5-01, Motor Code Selection (for PM Motors), is set to 1□□□ or 2□□□, the automatically calculated value will be set. This set value cannot be changed.	Default: 1.00 Min.: 0.00 Max.: 3.00 [6]	–
b8-27 (0B52)	q-Axis Current Compensation Method when Output Voltage is Limited	Iq Comp Method 0: Priority OutVolt 1: Priority Iq	Sets a compensation method for the q-Axis current when output voltage is limited. There is normally no need to change this parameter from the default value. 0: Output Voltage Limit Priority 1: q-Axis Current Priority Note: This parameter is not available in models 4A0930 and 4A1200.	Default: 0 Range.: 0, 1	–

<1> Default setting is determined by parameter A1-02, Control Method Selection.

<2> Default setting is determined by parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.

<3> Default setting is determined by parameters o2-04, Drive Model Selection, and C6-01, Drive Duty Selection.

<4> Parameter value changes automatically if E2-11 is manually changed or changed by Auto-Tuning.

<5> Available in drive software versions PRG: 1015 and later.

<6> The maximum value is 2.00 in drive software versions PRG: 1018 and earlier.

◆ b9: Zero Servo

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b9-01 (01DA)	Zero Servo Gain	Zero Servo Gain	Sets the position loop gain for the Zero Servo function.	Default: 5 Min.: 0 Max.: 100	–
b9-02 (01DB)	Zero Servo Completion Width	Zero Servo Count	Sets the range to trigger an output terminal set for "Zero Servo Complete" during Zero Servo operation.	Default: 10 Min.: 0 Max.: 16383	–

Parameter List

B

B.3 C: Tuning
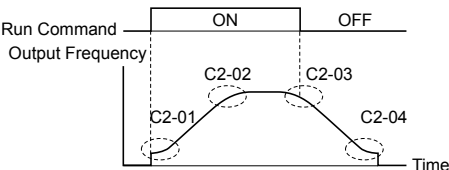
C parameters are used to adjust the acceleration and deceleration times, S-curves, torque compensation, and carrier frequency selections.

◆ C1: Acceleration and Deceleration Times

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C1-01 (0200) ◇RUN	Acceleration Time 1	Accel Time 1	Sets the time to accelerate from 0 to maximum frequency.	Default: 10.0 s Min.: 0.0 Max.: 6000.0 *<1>*	*143*
C1-02 (0201) ◇RUN	Deceleration Time 1	Decel Time 1	Sets the time to decelerate from maximum frequency to 0.		*143*
C1-03 (0202) ◇RUN	Acceleration Time 2	Accel Time 2	Sets the time to accelerate from 0 to maximum frequency.	Default: 10.0 s Min.: 0.0 Max.: 6000.0 *<1>*	*143*
C1-04 (0203) ◇RUN	Deceleration Time 2	Decel Time 2	Sets the time to decelerate from maximum frequency to 0.		*143*
C1-05 (0204) ◇RUN	Acceleration Time 3 (Motor 2 Accel Time 1)	Accel Time 3	Sets the time to accelerate from 0 to maximum frequency.	Default: 10.0 s Min.: 0.0 Max.: 6000.0 *<1>*	*143*
C1-06 (0205) ◇RUN	Deceleration Time 3 (Motor 2 Decel Time 1)	Decel Time 3	Sets the time to decelerate from maximum frequency to 0.		*143*
C1-07 (0206) ◇RUN	Acceleration Time 4 (Motor 2 Accel Time 2)	Accel Time 4	Sets the time to accelerate from 0 to maximum frequency.	Default: 10.0 s Min.: 0.0 Max.: 6000.0 *<1>*	*143*
C1-08 (0207) ◇RUN	Deceleration Time 4 (Motor 2 Decel Time 2)	Decel Time 4	Sets the time to decelerate from maximum frequency to 0.		*143*
C1-09 (0208) ◇RUN	Fast Stop Time	Fast Stop Time	Sets the time for the Fast Stop function.	Default: 10.0 s Min.: 0.0 Max.: 6000.0 *<1>*	–
C1-10 (0209)	Accel/Decel Time Setting Units	Acc/Dec Units 0: 0.01 Seconds 1: 0.1 Seconds	0: 0.01 s (0.00 to 600.00 s) 1: 0.1 s (0.0 to 6000.0 s)	Default: 1 Range: 0, 1	–
C1-11 (020A)	Accel/Decel Time Switching Frequency	Acc/Dec SW Freq	Sets the frequency to switch between accel/decel time settings	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	–

<1> Setting range value is determined by parameter C1-10, Accel/Decel Time Setting Units. When C1-10 = 0 (units of 0.01 seconds), the setting range becomes 0.00 to 600.00 seconds.

◆ C2: S-Curve Characteristics

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C2-01 (020B)	S-Curve Characteristic at Accel Start	SCrv Acc @ Start	The S-curve can be controlled at the four points shown below. 	Default: 0.20 s *<1>* Min.: 0.00 Max.: 10.00	–
C2-02 (020C)	S-Curve Characteristic at Accel End	SCrv Acc @ End		Default: 0.20 s Min.: 0.00 Max.: 10.00	–
C2-03 (020D)	S-Curve Characteristic at Decel Start	SCrv Dec @ Start		Default: 0.20 s Min.: 0.00 Max.: 10.00	–
C2-04 (020E)	S-Curve Characteristic at Decel End	SCrv Dec @ End		Default: 0.00 s Min.: 0.00 Max.: 10.00	–

<1> Default setting is determined by parameter A1-02, Control Method Selection.

◆ C3: Slip Compensation

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C3-01 (020F) ◇RUN	Slip Compensation Gain	Slip Comp Gain	Sets the gain for the motor slip compensation function used for motor 1.	Default: *<1>* Min.: 0.0 Max.: 2.5	–
C3-02 (0210) ◇RUN	Slip Compensation Primary Delay Time	Slip Comp Time	Adjusts the slip compensation function delay time used for motor 1.	Default: *<1>* Min.: 0 ms Max.: 10000 ms	–
C3-03 (0211)	Slip Compensation Limit	Slip Comp Limit	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	–
C3-04 (0212)	Slip Compensation Selection during Regeneration	Slip Comp Regen	0: Disabled. 1: Enabled above 6 Hz. 2: Enabled whenever slip compensation is possible.	Default: 0 Range: 0 to 2	–
C3-05 (0213)	Output Voltage Limit Operation Selection	Output V Lim Sel	0: Disabled. 1: Enabled. Automatically decreases motor flux when output voltage saturation is reached. **Note:** The available control modes for parameter C3-05 vary by drive model: Models 2A0004 to 2A0415, 4A0002 to 4A0675, and 5A0003 to 5A0242: Available when A1-02 = 2, 3. Models 4A0930 and 4A1200: Available when A1-02 = 2, 3, 6, 7.	Default: 0 Range: 0, 1	–
C3-16 (0261)	Output Voltage Limit Operation Start Level (Percentage Modulation)	Output V Lim Sta	Sets the output voltage limit operation start level (percentage modulation) when C3-05 is enabled. **Note:** This parameter is only available in models 4A0930 and 4A1200.	Default: 85.0% Min.: 70.0 Max.: 90.0	–
C3-17 (0262)	Maximum Output Voltage Limit Level (Percentage Modulation)	Output V Lim Max	Sets the output voltage limit operation determined by C3-18 (percentage modulation) when C3-05 is enabled. **Note:** This parameter is only available in models 4A0930 and 4A1200.	Default: 90.0% Min.: 85.0 Max.: 100.0	–
C3-18 (0263)	Output Voltage Limit Level	Output V Lim lev	Sets the maximum percentage of output voltage reduction when C3-05 is enabled. **Note:** This parameter is only available in models 4A0930 and 4A1200.	Default: 90.0% Min.: 30.0 Max.: 100.0	–
C3-21 (033E) ◇RUN	Motor 2 Slip Compensation Gain	SlpCmp Gain Mtr2	Sets the slip compensation gain used for motor 2.	Default: *<2>* Min.: 0.0 Max.: 2.5	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C3-22 (0241) ◇RUN	Motor 2 Slip Compensation Primary Delay Time	Slip Comp Time 2	Sets the slip compensation delay time used for motor 2.	Default: [2] Min.: 0 ms Max.: 10000 ms	–
C3-23 (0242)	Motor 2 Slip Compensation Limit	Silp Comp Limit2	Sets the upper limit for the slip compensation function for motor 2. Set as a percentage of the motor rated slip (E4-02).	Default: 200% Min.: 0 Max.: 250	–
C3-24 (0243)	Motor 2 Slip Compensation Selection During Regeneration	RegenSlpComp2 0: Disabled 1: Above 6 Hz 2: Lowst possbl spd	0: Disabled. 1: Enabled above 6 Hz. 2: Enabled whenever slip compensation is possible.	Default: 0 Range: 0 to 2	–

<1> Default setting is determined by parameter A1-02, Control Method Selection.

<2> Default setting is determined by parameter E3-01, Motor 2 Control Mode Selection.

◆ C4: Torque Compensation

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C4-01 (0215) ◇RUN	Torque Compensation Gain	Torq Comp Gain	Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque. Used for motor 1.	Default: [1] Min.: 0.00 Max.: 2.50	–
C4-02 (0216) ◇RUN	Torque Compensation Primary Delay Time 1	Torq Comp Time	Sets the torque compensation filter time.	Default: [2] Min.: 0 ms Max.: 60000 ms	–
C4-03 (0217)	Torque Compensation at Forward Start	F TorqCmp@start	Sets torque compensation at forward start as a percentage of motor torque.	Default: 0.0% Min.: 0.0 Max.: 200.0	–
C4-04 (0218)	Torque Compensation at Reverse Start	R TorqCmp@start	Sets torque compensation at reverse start as a percentage of motor torque.	Default: 0.0% Min.: -200.0 Max.: 0.0	–
C4-05 (0219)	Torque Compensation Time Constant	TorqCmp Delay T	Sets the time constant for torque compensation at forward start and reverse start (C4-03 and C4-04).	Default: 10 ms Min.: 0 Max.: 200	–
C4-06 (021A)	Torque Compensation Primary Delay Time 2	Start Torq Time	Sets the torque compensation time 2.	Default: 150 ms Min.: 0 Max.: 10000	–
C4-07 (0341) ◇RUN	Motor 2 Torque Compensation Gain	TrqCmp Gain Mtr2	Sets the torque compensation gain used for motor 2.	Default: 1.00 Min.: 0.00 Max.: 2.50	–

<1> Default setting is determined by parameter A1-02, Control Method Selection.

<2> Default setting is determined by parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.

◆ C5: Automatic Speed Regulator (ASR)

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C5-01 (021B) ◇RUN	ASR Proportional Gain 1	ASR P Gain 1	Sets the proportional gain of the speed control loop (ASR).	Default: [1] Min.: 0.00 Max.: 300.00 [2]	–
C5-02 (021C) ◇RUN	ASR Integral Time 1	ASR I Time 1	Sets the integral time of the speed control loop (ASR).	Default: [1] Min.: 0.000 s Max.: 10.000 s	–
C5-03 (021D) ◇RUN	ASR Proportional Gain 2	ASR P Gain 2	Sets the speed control gain 2 of the speed control loop (ASR).	Default: [1] Min.: 0.00 Max.: 300.00 [2]	–
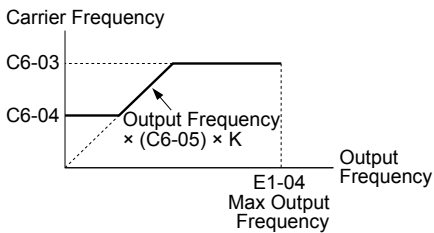
No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C5-04 (021E) ◇RUN	ASR Integral Time 2	ASR I Time 2	Sets the integral time 2 of the speed control loop (ASR).	Default: [1] Min.: 0.000 s Max.: 10.000 s	–
C5-05 (021F)	ASR Limit	ASR Limit	Sets the upper limit for the speed control loop (ASR) as a percentage of the maximum output frequency (E1-04).	Default: 5.0% Min.: 0.0 Max.: 20.0	–
C5-06 (0220)	ASR Primary Delay Time Constant	ASR Delay Time	Sets the filter time constant for the time from the speed loop to the torque command output.	Default: [1] Min.: 0.000 s Max.: 0.500 s	–
C5-07 (0221)	ASR Gain Switching Frequency	ASR Gain Switch	Sets the frequency for switching between proportional gain 1, 2 and integral time 1, 2.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	–
C5-08 (0222)	ASR Integral Limit	ASR I Limit	Sets the ASR integral upper limit as a percentage of rated load torque.	Default: 400% Min.: 0 Max.: 400	–
C5-12 (0386)	Integral Operation during Accel/Decel	Acc/Dec I Sel	0: Disabled. Integral functions are enabled only during constant speed. 1: Enabled. Integral functions are always enabled, during accel/decel and during constant speed.	Default: 0 Range: 0, 1	–
C5-17 (0276)	Motor Inertia	Motor Inertia	Sets the motor inertia. This value is automatically set during ASR or Inertia Auto-Tuning.	Default: [3] [4] Min.: 0.0001 kgm^2 Max.: 600.00 kgm^2	–
C5-18 (0277)	Load Inertia Ratio	Load Inertia	Sets the ratio between the motor and load inertia. This value is automatically set during ASR or Inertia Auto-Tuning.	Default: 1.0 Min.: 0.0 Max.: 6000.0	–
C5-21 (0356) ◇RUN	Motor 2 ASR Proportional Gain 1	ASR P Gain1 Mtr2	Sets the proportional gain of the speed control loop (ASR) for motor 2.	Default: [5] Min.: 0.00 Max.: 300.00 [2]	–
C5-22 (0357) ◇RUN	Motor 2 ASR Integral Time 1	ASR I Time1 Mtr2	Sets the integral time of the speed control loop (ASR) for motor 2.	Default: [5] Min.: 0.000 s Max.: 10.000 s	–
C5-23 (0358) ◇RUN	Motor 2 ASR Proportional Gain 2	ASR P Gain2 Mtr2	Sets the speed control gain 2 of the speed control loop (ASR) for motor 2.	Default: [5] Min.: 0.00 Max.: 300.00 [2]	–
C5-24 (0359) ◇RUN	Motor 2 ASR Integral Time 2	ASR I Time2 Mtr2	Sets the integral time 2 of the speed control loop (ASR) for motor 2.	Default: [5] Min.: 0.000 s Max.: 10.000 s	–
C5-25 (035A)	Motor 2 ASR Limit	ASR Limit Mtr2	Sets the upper limit for the speed control loop (ASR) for motor 2 as a percentage of the maximum output frequency (E3-04).	Default: 5.0% Min.: 0.0 Max.: 20.0	–
C5-26 (035B)	Motor 2 ASR Primary Delay Time Constant	ASR Dly Time 2	Sets the filter time constant for the time from the speed loop to the torque command output used for motor 2.	Default: [5] Min.: 0.000 s Max.: 0.500 s	–
C5-27 (035C)	Motor 2 ASR Gain Switching Frequency	ASRGainSwitch2	Sets the frequency for motor 2 used to switch between proportional gain 1 and 2, and between the integral time 1 and 2.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	–
C5-28 (035D)	Motor 2 ASR Integral Limit	ASR I limit 2	Sets the ASR integral upper limit for motor 2 as a percentage of rated load torque.	Default: 400% Min.: 0 Max.: 400	–
C5-32 (0361)	Integral Operation during Accel/Decel for Motor 2	Acc/Dec I Sel 2 0: Disabled 1: Enabled	0: Disabled. Integral functions for motor 2 are enabled only during constant speed. 1: Enabled. Integral functions are always enabled for motor 2, during accel/decel and during constant speed.	Default: 0 Range: 0, 1	–
C5-37 (0278)	Motor 2 Inertia	Motor Inertia 2	Sets the inertia of motor 2 alone without the load. This value is automatically set during ASR or Inertia Auto-Tuning.	Default: [3] [4] Min.: 0.0001 kgm^2 Max.: 600.00 kgm^2	–

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C5-38 (0279)	Motor 2 Load Inertia Ratio	Load Inertia 2	Sets the ratio between the motor 2 and machine inertia. This value is automatically set during ASR or Inertia Auto-Tuning.	Default: 1.0 Min.: 0.0 Max.: 6000.0	–
C5-39 (030D)	ASR Primary Delay Time Constant 2	ASR Delay Time 2	Sets the filter time constant in seconds for the time from the speed loop to the torque reference output when the Power KEB Ride-Thru is enabled (L2-29 = 1). **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0.000 s Min.: 0.000 Max.: 0.500	–

<1> Default setting is determined by parameter A1-02, Control Method Selection.

<2> The setting range is 1.00 to 300.00 in CLV and AOLV/PM control modes.

<3> Default setting is dependent on parameter E5-01, Motor Code Selection.

<4> Default setting is dependent on parameters C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.

<5> Default setting is determined by parameter E3-01, Motor 2 Control Mode Selection.

◆ C6: Carrier Frequency

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C6-01 (0223)	Drive Duty Selection	Heavy/NormalDuty 0: Heavy Duty 1: Normal Duty	0: Heavy Duty (HD) Overload capability: 150% of drive rated Heavy Duty current for 60 s Default Carrier Frequency: 2 kHz 1: Normal Duty (ND) Overload capability: 120% of drive rated Normal Duty current for 60 s Default Carrier Frequency: 2 kHz Swing PWM	Default: 1 Range: 0, 1	*144*
C6-02 (0224)	Carrier Frequency Selection	CarrierFreq Sel 1: Fc=2.0 kHz 2: Fc=5.0 kHz 3: Fc=8.0 kHz 4: Fc=10.0 kHz 5: Fc=12.5 kHz 6: Fc=15.0 kHz 7: Swing PWM1 8: Swing PWM2 9: Swing PWM3 A: Swing PWM4 F: Program	1: 2.0 kHz 2: 5.0 kHz (4.0 kHz) 3: 8.0 kHz (6.0 kHz) 4: 10.0 kHz (8.0 kHz) 5: 12.5 kHz (10.0 kHz) 6: 15.0 kHz (12.0 kHz) 7: Swing PWM1 (Audible sound 1) 8: Swing PWM2 (Audible sound 2) 9: Swing PWM3 (Audible sound 3) A: Swing PWM4 (Audible sound 4) B to E: No setting possible F: User-defined (determined by C6-03 through C6-05) **Note:** 1. The available settings are 1, 2, and F for models 4A0930 and 4A1200. 2. The value in parenthesis indicates the carrier frequency for AOLV/PM.	Default: *<1>* Range: 1 to 9; A, F	*145*
C6-03 (0225)	Carrier Frequency Upper Limit	CarrierFreq Max	**Note:** C6-04 and C6-05 are available only in V/f and V/f w/PG control modes. Determines the upper and lower limits for the carrier frequency. In OLV, C6-03 determines the upper limit of the carrier frequency.	Default: *<2>* Min.: 1.0 kHz Max.: 15.0 kHz	–
C6-04 (0226)	Carrier Frequency Lower Limit	CarrierFreq Min		Default: *<2>* Min.: 1.0 kHz Max.: 15.0 kHz	–
C6-05 (0227)	Carrier Frequency Proportional Gain	CarrierFreq Gain	Carrier Frequency C6-03 ⎯⎯⎯ C6-04 ⎯⎯ Output Frequency × (C6-05) × K E1-04 Max Output Frequency — Output Frequency **Note:** The setting range is 1.0 to 5.0 kHz for models 4A0515 to 4A1200.	Default: *<2>* Min.: 0 Max.: 99	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C6-09 (022B)	Carrier Frequency during Rotational Auto-Tuning	Carrier in tune 0: Fc = 5kHz 1: Fc = C6-03	0: Carrier Frequency = 5 kHz. In PM control modes, this value is 2 kHz. 1: Setting value for C6-03. In PM control modes, this value is the carrier frequency set in C6-02. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0 Range: 0, 1	–

<1> Default setting value is determined by parameters A1-02, Control Method Selection, C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.

<2> Default setting value is determined by parameter C6-02, Carrier Frequency Selection.

Parameter List

B

B.4   d: References

Reference parameters set the various frequency reference values during operation.

◆ d1: Frequency Reference

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
d1-01 (0280) ◇RUN	Frequency Reference 1	Reference 1	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-02 (0281) ◇RUN	Frequency Reference 2	Reference 2	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-03 (0282) ◇RUN	Frequency Reference 3	Reference 3	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-04 (0283) ◇RUN	Frequency Reference 4	Reference 4	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-05 (0284) ◇RUN	Frequency Reference 5	Reference 5	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-06 (0285) ◇RUN	Frequency Reference 6	Reference 6	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-07 (0286) ◇RUN	Frequency Reference 7	Reference 7	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-08 (0287) ◇RUN	Frequency Reference 8	Reference 8	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-09 (0288) ◇RUN	Frequency Reference 9	Reference 9	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-10 (028B) ◇RUN	Frequency Reference 10	Reference 10	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
d1-11 (028C) ◇RUN	Frequency Reference 11	Reference 11	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-12 (028D) ◇RUN	Frequency Reference 12	Reference 12	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-13 (028E) ◇RUN	Frequency Reference 13	Reference 13	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-14 (028F) ◇RUN	Frequency Reference 14	Reference 14	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-15 (0290) ◇RUN	Frequency Reference 15	Reference 15	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-16 (0291) ◇RUN	Frequency Reference 16	Reference 16	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. **Note:** The value set to o1-03 is changed to 1 and the unit is changed to percentage automatically when A1-02 is set to 6 or 7.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*
d1-17 (0292) ◇RUN	Jog Frequency Reference	Jog Reference	Sets the Jog frequency reference. Setting units are determined by parameter o1-03. **Note:** Setting A1-02 to 6 or 7 will automatically change o1-03 to 1 and unit to %.	Default: 6.00 Hz Min.: 0.00 Max.: 400.00 [1] [2]	*145*

[1] Range upper limit is determined by parameters d2-01, Frequency Reference Upper Limit, and E1-04, Maximum Output Frequency.

[2] The value of o1-03 is changed to 1 and the unit is also changed to a percentage (%) when the control mode is set to CLV/PM or AOLV/PM.

◆ d2: Frequency Upper/Lower Limits

No. (Addr. Hex.)	Name	LCD Display	Description	Setting	Page
d2-01 (0289)	Frequency Reference Upper Limit	Ref Upper Limit	Sets the frequency reference upper limit as a percentage of the maximum output frequency.	Default: 100.0% Min.: 0.0 Max.: 110.0	–
d2-02 (028A)	Frequency Reference Lower Limit	Ref Lower Limit	Sets the frequency reference lower limit as a percentage of the maximum output frequency.	Default: 0.0% Min.: 0.0 Max.: 110.0	–
d2-03 (0293)	Master Speed Reference Lower Limit	Ref1 Lower Limit	Sets the lower limit for frequency references from analog inputs as a percentage of the maximum output frequency.	Default: 0.0% Min.: 0.0 Max.: 110.0	–

Parameter List

B

◆ d3: Jump Frequency

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
d3-01 (0294)	Jump Frequency 1	Jump Freq 1	Eliminates problems with resonant vibration of the motor/machine by avoiding continuous operation in predefined frequency ranges. The drive accelerates and decelerates the motor through the prohibited frequency ranges. Setting 0.0 disables this function. Parameters must be set so that d3-01 ≥ d3-02 ≥ d3-03.	Default: [1] [2] Min.: 0.0 [2] Max.: 400.0 [2]	–
d3-02 (0295)	Jump Frequency 2	Jump Freq 2	Eliminates problems with resonant vibration of the motor/machine by avoiding continuous operation in predefined frequency ranges. The drive accelerates and decelerates the motor through the prohibited frequency ranges. Setting 0.0 disables this function. Parameters must be set so that d3-01 ≥ d3-02 ≥ d3-03.	Default: [1] [2] Min.: 0.0 [2] Max.: 400.0 [2]	–
d3-03 (0296)	Jump Frequency 3	Jump Freq 3	Eliminates problems with resonant vibration of the motor/machine by avoiding continuous operation in predefined frequency ranges. The drive accelerates and decelerates the motor through the prohibited frequency ranges. Setting 0.0 disables this function. Parameters must be set so that d3-01 ≥ d3-02 ≥ d3-03.	Default: [1] [2] Min.: 0.0 [2] Max.: 400.0 [2]	–
d3-04 (0297)	Jump Frequency Width	Jump Bandwidth	Sets the dead-band width around each selected prohibited frequency reference point.	Default: [1] [3] Min.: 0.0 [3] Max.: 20.0 [3]	–

[1] Default setting is determined by parameter A1-02, Control Mode Setting.

[2] Default setting is 0.0% and setting range is 0.0 to 100.0% in AOLV/PM or CLV/PM.

[3] Default setting is 1.0% and setting range is 0.0 to 40.0% in AOLV/PM and CLV/PM.

◆ d4: Frequency Reference Hold and Up/Down 2 Function

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
d4-01 (0298)	Frequency Reference Hold Function Selection	Fref Hold Sel 0: Disabled 1: Enabled	0: Disabled. Drive starts from zero when the power is switched on. 1: Enabled. At power up, the drive starts the motor at the Hold frequency that was saved.	Default: 0 Range: 0, 1	–
d4-03 (02AA) ⏻RUN	Frequency Reference Bias Step (Up/Down 2)	Up/Dn 2 Step Lvl	Sets the bias added to the frequency reference when the Up 2 and Down 2 digital inputs are enabled (H1-□□ = 75, 76).	Default: 0.00 Hz Min.: 0.00 Max.: 99.99	–
d4-04 (02AB) ⏻RUN	Frequency Reference Bias Accel/Decel (Up/Down 2)	Up/Dn 2 Ramp Sel 0: Sel Acc/Dec Time 1: Acc/Dec Time 4	0: Use selected accel/decel time. 1: Use accel/decel time 4 (C1-07 and C1-08).	Default: 0 Range: 0, 1	–
d4-05 (02AC) ⏻RUN	Frequency Reference Bias Operation Mode Selection (Up/Down 2)	Up/Dn 2 Bias Sel 0: Hold Bias Value 1: Reset Bias Value	0: Bias value is held if no input Up 2 or Down 2 is active. 1: When the Up 2 reference and Down 2 reference are both on or both off, the applied bias becomes 0. The specified accel/decel times are used for acceleration or deceleration.	Default: 0 Range: 0, 1	–
d4-06 (02AD)	Frequency Reference Bias (Up/Down 2)	Up/Dn 2 Bias Lvl	The Up/Down 2 bias value is saved in d4-06 when the frequency reference is not input by the digital operator. Set as a percentage of the maximum output frequency.	Default: 0.0% Min.: -99.9 Max.: 100.0	–
d4-07 (02AE) ⏻RUN	Analog Frequency Reference Fluctuation Limit (Up/Down 2)	Up/Dn 2 FluctLim	Limits how much the frequency reference is allowed to change while an input terminal set for Up 2 or Down 2 is enabled. If the frequency reference changes for more than the set value, then the bias value is held and the drive accelerates or decelerates to the frequency reference. Set as a percentage of the maximum output frequency.	Default: 1.0% Min.: 0.1 Max.: 100.0	–
d4-08 (02AF) ⏻RUN	Frequency Reference Bias Upper Limit (Up/Down 2)	Up/Dn 2 UpperLim	Sets the upper limit for the bias and the value that can be saved in d4-06. Set as a percentage of the maximum output frequency.	Default: 100.0% Min.: 0.0 Max.: 100.0	–
d4-09 (02B0) ⏻RUN	Frequency Reference Bias Lower Limit (Up/Down 2)	Up/Dn 2 LowerLim	Sets the lower limit for the bias and the value that can be saved in d4-06. Set as a percentage of the maximum output frequency.	Default: 0.0% Min.: -99.9 Max.: 0.0	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
d4-10 (02B6)	Up/Down Frequency Reference Limit Selection	Up/Dn LowLim Sel 0: D2-02 or Analog 1: D2-02 Only	0: The lower limit is determined by d2-02 or an analog input. 1: The lower limit is determined by d2-02.	Default: 0 Range: 0, 1	–

◆ d5: Torque Control

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
d5-01 (029A)	Torque Control Selection	Torq Control Sel 0: Speed Control 1: Torque Control	0: Speed Control 1: Torque Control Set to 0 when using a digital input to switch between Speed and Torque Control (H1-□□ = 71).	Default: 0 Range: 0, 1	–
d5-02 (029B)	Torque Reference Delay Time	Tq Ref Dly Time	Sets a delay time for the torque reference signal. Used to suppress effects by noisy or fluctuating torque reference signals.	Default: 0 ms Min.: 0 Max.: 1000	–
d5-03 (029C)	Speed Limit Selection	Speed Limit Sel 1: Fref Limit 2: Speed Limit Sel	1: Limit set by the frequency reference in b1-01. 2: Limit set by d5-04.	Default: 1 Range: 1, 2	–
d5-04 (029D)	Speed Limit	Speed Limit Val	Sets the speed limit during Torque Control as a percentage of the maximum output frequency. Enabled when d5-03 = 2. A negative setting sets a limit in the opposite direction of the Run command.	Default: 0% Min.: -120 Max.: 120	–
d5-05 (029E)	Speed Limit Bias	Speed Limit Bias	Sets the speed limit bias as a percentage of the maximum output frequency. The bias is applied to the specified speed limit and can adjust the margin for the speed limit.	Default: 10% Min.: 0 Max.: 120	–
d5-06 (029F)	Speed/Torque Control Switchover Time	Spd/Trq Sw Timer	Sets the delay time for switching between Speed and Torque Control using an input terminal (H1-□□ = 71). Reference values are held during this switch delay time.	Default: 0 ms Min.: 0 Max.: 1000	–
d5-08 (02B5)	Unidirectional Speed Limit Bias	UnidirSpdLimBias 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 1 Range: 0, 1	–

◆ d6: Field Weakening and Field Forcing

No. (Addr Hex.)	Name	LCD Display	Description	Values	Page
d6-01 (02A0)	Field Weakening Level	Field-Weak Lvl	Sets the drive output voltage for the Field Weakening function as a percentage of the maximum output voltage. Enabled when a multi-function input is set for Field Weakening (H1-□□ = 63).	Default: 80% Min.: 0 Max.: 100	–
d6-02 (02A1)	Field Weakening Frequency Limit	Fiel-Weak Freq	Sets the lower limit of the frequency range where Field Weakening control is valid. The Field Weakening command is valid only at frequencies above this setting and only when the output frequency matches the frequency reference (speed agree).	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	–
d6-03 (02A2)	Field Forcing Selection	Field Force Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 0 Range: 0, 1	–
d6-06 (02A5)	Field Forcing Limit	FieldForce Limit	Sets the upper limit of the excitation current command during magnetic field forcing. A setting of 100% is equal to motor no-load current. Disabled only during DC Injection Braking.	Default: 400% Min.: 100 Max.: 400	–

Parameter List

B

◆ d7: Offset Frequency

No. (Addr. Hex)	Name	LCD Display	Description	Setting	Page
d7-01 (02B2) ◇RUN	Offset Frequency 1	Offset Freq 1	Added to the frequency reference when the digital input "Frequency offset 1" (H1-□□ = 44) is switched on. A setting of 100% is equal to the drive maximum output current.	Default: 0.0% Min.: -100.0 Max.: 100.0	–
d7-02 (02B3) ◇RUN	Offset Frequency 2	Offset Freq 2	Added to the frequency reference when the digital input "Frequency offset 2" (H1-□□ = 45) is switched on. A setting of 100% is equal to the drive maximum output current.	Default: 0.0% Min.: -100.0 Max.: 100.0	–
d7-03 (02B4) ◇RUN	Offset Frequency 3	Offset Freq 3	Added to the frequency reference when the digital input "Frequency offset 3" (H1-□□ = 46) is switched on. A setting of 100% is equal to the drive maximum output current.	Default: 0.0% Min.: -100.0 Max.: 100.0	–

B.5   E: Motor Parameters

◆ E1: V/f Pattern for Motor 1

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
E1-01 (0300)	Input Voltage Setting	Input Voltage	This parameter must be set to the power supply voltage. **WARNING!** *Electrical Shock Hazard. Drive input voltage (not motor voltage) must be set in E1-01 for the protective features of the drive to function properly. Failure to do so may result in equipment damage and/or death or personal injury.*	Default: 230 V [1] Min.: 155 Max.: 255 [1]	*147*
E1-03 (0302)	V/f Pattern Selection	V/F Selection 0: 50 Hz 1: 60 Hz Saturation 2: 50 Hz Saturation 3: 72 Hz 4: 50 Hz VT1 5: 50 Hz VT2 6: 60 Hz VT1 7: 60 Hz VT2 8: 50 Hz HST1 9: 50 Hz HST2 A: 60 Hz HST1 B: 60 Hz HST2 C: 90 Hz D: 120 Hz E: 180 Hz F: Custom V/F	0: 50 Hz, Constant torque 1 1: 60 Hz, Constant torque 2 2: 60 Hz, Constant torque 3 (50 Hz base) 3: 72 Hz, Constant torque 4 (60 Hz base) 4: 50 Hz, Variable torque 1 5: 50 Hz, Variable torque 2 6: 60 Hz, Variable torque 1 7: 60 Hz, Variable torque 2 8: 50 Hz, High starting torque 1 9: 50 Hz, High starting torque 2 A: 60 Hz, High starting torque 3 B: 60 Hz, High starting torque 4 C: 90 Hz (60 Hz base) D: 120 Hz (60 Hz base) E: 180 Hz (60 Hz base) F: Custom V/f, E1-04 through E1-13 settings define the V/f pattern **Note:** Setting F is only available in vector control modes.	Default: F [2] Range: 0 to 9; A to F	*148*

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
E1-04 (0303)	Maximum Output Frequency	Max Frequency	Parameters E1-04 and E1-06 to E1-13 can only be changed when E1-03 is set to F. To set linear V/f characteristics, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Ensure that the five frequencies are set according to the following rules to prevent triggering an oPE10 fault: E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04 Setting E1-11 to 0 disables both E1-11 and E1-12 and the above conditions do not apply.	Default: [3] [4] Min.: 40.0 Max.: 400.0 [5]	151
E1-05 (0304)	Maximum Voltage	Max Voltage		Default: [3] [4] Min.: 0.0 V Max.: 255.0 V [1]	151
E1-06 (0305)	Base Frequency	Base Frequency		Default: [3] [4] Min.: 0.0 Max.: E1-04 [5]	151
E1-07 (0306)	Middle Output Frequency	Mid Frequency A	Output Voltage (V) E1-05 E1-12 E1-13 E1-08 E1-10 E1-09 E1-07 E1-06 E1-11 E1-04 Frequency (Hz) **Note:** Some parameters may not be available depending on the control mode. • E1-07, E1-08, and E1-10 are available only in the following control modes: V/f Control, V/f with PG, Open Loop Vector. • E1-11, E1-12, and E1-13 are available only in the following control modes: V/f Control, V/f with PG, Open Loop Vector, Closed Loop Vector.	Default: [3] Min.: 0.0 Max.: E1-04	151
E1-08 (0307)	Middle Output Frequency Voltage	Mid Voltage A		Default: [3] Min.: 0.0 V Max.: 255.0 V [1]	151
E1-09 (0308)	Minimum Output Frequency	Min Frequency		Default: [3] [4] Min.: 0.0 Max.: E1-04 [5]	151
E1-10 (0309)	Minimum Output Frequency Voltage	Min Voltage		Default: [3] Min.: 0.0 V Max.: 255.0 V [1]	151
E1-11 (030A) [7]	Middle Output Frequency 2	Mid Frequency B		Default: 0.0 Hz Min.: 0.0 Max.: E1-04	151
E1-12 (030B) [7]	Middle Output Frequency Voltage 2	Mid Voltage B		Default: 0.0 V Min.: 0.0 Max.: 255.0 V [1]	151
E1-13 (030C) [6]	Base Voltage	Base Voltage		Default: 0.0 V [6] Min.: 0.0 Max.: 255.0 V [1]	151

<1> Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives.

<2> Parameter setting value is not reset to the default value when the drive is initialized.

<3> Default setting is determined by parameters A1-02, Control Method Selection, C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.

<4> Default setting is determined by parameter E5-01, Motor Code Selection.

<5> In OLV/PM, setting range varies according to the motor code entered to E5-01. The setting range is 0.0 to 400.0 Hz when E5-01 is set to FFFF.

<6> When E1-13, Base Voltage, is set to 0.0, output voltage is controlled with E1-05, Maximum Voltage, = E1-13. When Auto-Tuning is performed, E1-05 and E1-13 are automatically set to the same value.

<7> Parameter ignored when E1-11 (Motor 1 Mid Output Frequency 2) and E1-12 (Motor 1 Mid Output Frequency Voltage 2) are set to 0.0.

◆ E2: Motor 1 Parameters

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
E2-01 (030E)	Motor Rated Current	Motor Rated FLA	Sets the motor nameplate full load current in amps. Automatically set during Auto-Tuning.	Default: [1] Min.: 10% of drive rated current Max.: 200% of drive rated current [2]	*151*
E2-02 (030F)	Motor Rated Slip	Motor Rated Slip	Sets the motor rated slip. Automatically set during Auto-Tuning.	Default: [1] Min.: 0.00 Hz Max.: 20.00 Hz	–
E2-03 (0310)	Motor No-Load Current	No-Load Current	Sets the no-load current for the motor. Automatically set during Auto-Tuning.	Default: [1] Min.: 0 A Max.: E2-01 [2]	–
E2-04 (0311)	Number of Motor Poles	Number of Poles	Sets the number of motor poles. Automatically set during Auto-Tuning.	Default: 4 Min.: 2 Max.: 48	–
E2-05 (0312)	Motor Line-to-Line Resistance	Term Resistance	Sets the phase-to-phase motor resistance. Automatically set during Auto-Tuning. **Note:** The units are expressed in mΩ in models 4A0930 and 4A1200.	Default: [1] Min.: 0.000 Ω Max.: 65.000 Ω	–
E2-06 (0313)	Motor Leakage Inductance	Leak Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage. Automatically set during Auto-Tuning.	Default: [1] Min.: 0.0% Max.: 40.0%	–
E2-07 (0314)	Motor Iron-Core Saturation Coefficient 1	Saturation Comp1	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	–
E2-08 (0315)	Motor Iron-Core Saturation Coefficient 2	Saturation Comp2	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	–
E2-09 (0316)	Motor Mechanical Loss	Mechanical Loss	Sets the motor mechanical loss as a percentage of motor rated power (kW).	Default: 0.0% Min.: 0.0 Max.: 10.0	–
E2-10 (0317)	Motor Iron Loss for Torque Compensation	Motor Iron Loss	Sets the motor iron loss.	Default: [1] Min.: 0 W Max.: 65535 W	–
E2-11 (0318)	Motor Rated Power	Mtr Rated Power	Sets the motor rated power in kilowatts (1 HP = 0.746 kW). Automatically set during Auto-Tuning.	Default: [1] Min.: 0.00 kW Max.: 650.00 kW	–

[1] Default setting is dependent on parameters C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.

[2] Display is in the following units:
2A0004 to 2A0040, 4A0002 to 4A0023, and 5A0007 to 5A0017: 0.01 A units.
2A0056 to 2A0415, 4A0031 to 4A0675, and 5A0022 to 5A0242: 0.1 A units.
4A0930 and 4A1200: 1 A units.

◆ E3: V/f Pattern for Motor 2

These parameters are hidden when a PM motor control mode has been selected for motor 1 (A1-02 = 5, 6, 7).

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
E3-01 (0319)	Motor 2 Control Mode Selection	Mot 1 Contr Meth 0: V/f Control 1: V/f with PG 2: Open Loop Vector 3: Closed Loop Vect	0: V/f Control 1: V/f Control with PG 2: Open Loop Vector Control 3: Closed Loop Vector Control	Default: 0 Range: 0 to 3	–
E3-04 (031A)	Motor 2 Maximum Output Frequency	Max Frequency	To set linear V/f characteristics, set the same values for E3-07 and E3-09. In this case, the setting for E3-08 will be disregarded. Ensure that the five frequencies are set according to the following rules to prevent triggering an oPE10 fault: E3-09 ≤ E3-07 < E3-06 ≤ E3-11 ≤ E3-04 Setting E3-11 to 0 disables both E3-11 and E3-12 and the above conditions do not apply.	Default: [1] Min.: 40.0 Max.: 400.0	–
E3-05 (031B)	Motor 2 Maximum Voltage	Max Voltage		Default: [1] [4] Min.: 0.0 V Max.: 255.0 V [2]	–
E3-06 (031C)	Motor 2 Base Frequency	Base Frequency		Default: [1] Min.: 0.0 Max.: E3-04	–
E3-07 (031D)	Motor 2 Mid Output Frequency	Mid Frequency A		Default: [1] Min: 0.0 Max: E3-04	–
E3-08 (031E)	Motor 2 Mid Output Frequency Voltage	Mid Voltage B		Default: [1] Min: 0.0 V Max: 255.0 V [2]	–
E3-09 (031F)	Motor 2 Minimum Output Frequency	Min Frequency		Default: [1] Min.: 0.0 Max.: E3-04	–
E3-10 (0320)	Motor 2 Minimum Output Frequency Voltage	Min Voltage	Note: E3-07 and E3-08 are only available in the following control modes: V/f, V/f w/PG and OLV.	Default: [1] Min: 0.0 V Max: 255.0 V [2]	–
E3-11 (0345) [3]	Motor 2 Mid Output Frequency 2	Mid Frequency B		Default: 0.0 Hz Min.: 0.0 Max.: E3-04	–
E3-12 (0346) [3]	Motor 2 Mid Output Frequency Voltage 2	Mid Voltage B		Default: 0.0 V Min.: 0.0 Max.: 255.0 [2]	–
E3-13 (0347) [4]	Motor 2 Base Voltage	Base Voltage		Default: 0.0 V [4] Min.: 0.0 Max.: 255.0 [2]	–

The description cell also contains a graph:

Output Voltage (V)
E3-05
E3-12
E3-13
E3-08
E3-10

E3-09   E3-07 E3-06 E3-11 E3-04
Frequency (Hz)

<1> Default setting is determined by parameter E3-01, Motor 2 Control Mode Selection. The value shown here is for V/f Control (0).

<2> Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives.

<3> Ignored when E3-11, Motor 2 Mid Output Frequency 2, and E3-12, Motor 2 Mid Output Frequency Voltage 2, are set to 0.

<4> When E3-13, Motor 2 Base Voltage, is set to 0.0, output voltage is controlled with E3-05, Motor 2 Maximum Voltage, = E3-13. When Auto-Tuning is performed, E3-05 and E3-13 are automatically set to the same value.

◆ E4: Motor 2 Parameters

These parameters are hidden when a PM motor control mode has been selected for motor 1 (A1-02 = 5, 6, 7).

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
E4-01 (0321)	Motor 2 Rated Current	Motor Rated FLA	Sets the full load current for motor 2. Automatically set during Auto-Tuning.	Default: [1] Min.: 10% of drive rated current Max.: 200% of drive rated current [2]	–
E4-02 (0322)	Motor 2 Rated Slip	Motor Rated Slip	Sets the rated slip for motor 2. Automatically set during Auto-Tuning.	Default: [1] Min.: 0.00 Hz Max.: 20.00 Hz	–
E4-03 (0323)	Motor 2 Rated No-Load Current	No-Load Current	Sets the no-load current for motor 2. Automatically set during Auto-Tuning.	Default: [1] Min.: 0 A Max.: E4-01 [2]	–
E4-04 (0324)	Motor 2 Motor Poles	Number of Poles	Sets the number of poles of motor 2. Automatically set during Auto-Tuning.	Default: 4 Min.: 2 Max.: 48	–
E4-05 (0325)	Motor 2 Line-to-Line Resistance	Term Resistance	Sets the phase-to-phase resistance for motor 2. Automatically set during Auto-Tuning. **Note:** The units are expressed in mΩ in models 4A0930 and 4A1200.	Default: [1] Min.: 0.000 Ω Max.: 65.000 Ω	–
E4-06 (0326)	Motor 2 Leakage Inductance	Leak Inductance	Sets the voltage drop for motor 2 due to motor leakage inductance as a percentage of rated voltage. Automatically set during Auto-Tuning.	Default: [1] Min: 0.0% Max: 40.0%	–
E4-07 (0343)	Motor 2 Motor Iron-Core Saturation Coefficient 1	Saturation Comp1	Set to the motor iron saturation coefficient at 50% of magnetic flux for motor 2. Automatically set during Auto-Tuning.	Default: 0.50 Min.: 0.00 Max.: 0.50	–
E4-08 (0344)	Motor 2 Motor Iron-Core Saturation Coefficient 2	Saturation Comp2	Set to the motor iron saturation coefficient at 75% of magnetic flux for motor 2. This value is automatically set during Auto-Tuning.	Default: 0.75 Min.: E4-07 Max.: 0.75	–
E4-09 (033F)	Motor 2 Mechanical Loss	Mechanical Loss	Sets the motor mechanical loss for motor 2 as a percentage of motor rated power (kW). There is normally no need to change this parameter from the default value.	Default: 0.0% Min.: 0.0 Max.: 10.0	–
E4-10 (0340)	Motor 2 Iron Loss	Motor Iron Loss	Sets the motor iron loss.	Default: [1] Min.: 0 W Max.: 65535 W	–
E4-11 (0327)	Motor 2 Rated Power	Mtr Rated Power	Sets the motor rated capacity in kW. Automatically set during Auto-Tuning.	Default: [1] Min.: 0.00 kW Max.: 650.00 kW	–

<1> Default setting is determined by parameters C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.

<2> Display is in the following units:
   2A0004 to 2A0040, 4A0002 to 4A0023, and 5A0007 to 5A0017: 0.01 A units.
   2A0056 to 2A0415, 4A0031 to 4A0675, and 5A0022 to 5A0242: 0.1 A units.
   4A0930 and 4A1200: 1 A units.

◆ E5: PM Motor Settings

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
E5-01 (0329) *<1>*	Motor Code Selection (for PM Motors)	PM Mtr Code Sel	Enter the Yaskawa motor code for the PM motor being used. Various motor parameters are automatically set based on the value of this parameter. Settings that were changed manually will be overwritten by the defaults of the selected motor code. **Note:** 1. Set to FFFF when using a non-Yaskawa PM motor or a special motor. 2. If an alarm or hunting occurs despite using a motor code, enter the value indicated on the nameplate. *Refer to Auto-Tuning for Permanent Magnet Motors on page 165* for details.	Default: *<2>* Min.: 0000 Max.: FFFF *<3>*	–
E5-02 (032A) *<1>*	Motor Rated Power (for PM Motors)	PM Mtr Capacity	Sets the rated capacity of the motor.	Default: *<4>* Min.: 0.10 kW Max.: 650.00 kW	–
E5-03 (032B) *<1>*	Motor Rated Current (for PM Motors)	PM Mtr Rated FLA	Sets the motor rated current.	Default: *<4>* Min: 10% of drive rated current Max: 200% of drive rated current *<5>*	–
E5-04 (032C) *<1>*	Number of Motor Poles (for PM Motors)	PM Motor Poles	Sets the number of motor poles.	Default: *<4>* Min.: 2 Max.: 48	–
E5-05 (032D) *<1>*	Motor Stator Resistance (for PM Motors)	PM Mtr Arm Ohms	Set the resistance for each motor phase.	Default: *<4>* Min.: 0.000 Ω Max.: 65.000 Ω	–
E5-06 (032E) *<1>*	Motor d-Axis Inductance (for PM Motors)	PM Mtr d Induct	Sets the d-Axis inductance for the PM motor.	Default: *<4>* Min.: 0.00 mH Max.: 300.00 mH	–
E5-07 (032F) *<1>*	Motor q-Axis Inductance (for PM Motors)	PM Mtr q Induct	Sets the q-Axis inductance for the PM motor.	Default: *<4>* Min.: 0.00 mH Max.: 600.00 mH	–
E5-09 (0331) *<1>*	Motor Induction Voltage Constant 1 (for PM Motors)	PM Mtr Ind V 1	Sets the induced phase peak voltage in units of 0.1 mV/(rad/s) [electrical angle]. Set this parameter when using a Yaskawa SSR1-Series PM motor with derated torque, or a Yaskawa SST4-Series motor with constant torque. Set E5-24 to 0 when setting this parameter.	Default: *<4>* Min.: 0.0 mV/(rad/s) Max.: 2000.0 mV/(rad/s)	–
E5-11 (0333)	Encoder Z Pulse Offset (for PM Motors)	Enc Z-Pulse Offs	Sets the offset between the rotor magnetic axis and the Z Pulse of an incremental encoder during Z Pulse offset tuning.	Default: 0.0 deg Min.: -180 Max.: 180	–
E5-24 (0353) *<1>*	Motor Induction Voltage Constant 2 (for PM Motors)	PM Mtr Ind V 2	Sets the induced phase-to-phase rms voltage in units of 0.1 mV/(r/min) [mechanical angle]. Set this parameter when using a Yaskawa SMRA-Series SPM motor.	Default: *<4>* Min.: 0.0 mV/(r/min) Max.: 6500.0 mV/(r/min)	–
E5-25 (035E)	Polarity Switch for Initial Polarity Estimation Timeout (for PM Motors)	RotPolarityInvrs 0: Disabled 1: Enabled	Switches polarity for initial polarity estimation. 0: Disabled 1: Enabled There is normally no need to change this parameter from the default value. If "Sd = 1" is listed on the nameplate or in a test report for a Yaskawa motor, this parameter should be set to 1. **Note:** Available control mode varies by drive model: 2A0004 to 2A0415 and 4A0002 to 4A0675: Available when A1-02 = 6, 7 4A0930 and 4A1200: Available when A1-02 = 5, 6, or 7.	Default: 0 Range: 0, 1	–

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

<2> Default setting is determined by parameters A1-02, Control Method Selection, o2-04, Drive Model Selection, and C6-01, Drive Duty Selection.

<3> Selections may vary depending on the motor code entered to E5-01.

<4> Default setting is determined by parameter E5-01, Motor Code Selection.

<5> Display is in the following units:
2A0004 to 2A0040, 4A0002 to 4A0023, and 5A0007 to 5A0017: 0.01 A units.
2A0056 to 2A0415, 4A0031 to 4A0675, and 5A0022 to 5A0242: 0.1 A units.
4A0930 and 4A1200: 1 A units.

Parameter List

B

B.6 F: Option Settings

F parameters program the drive for PG feedback from the motor and to function with option cards.

◆ F1: PG Speed Control Card (PG-B3, PG-X3, PG-RT3, PG-F3)

Parameters F1-01, F1-05, F1-06, F1-12, F1-13, and F1-18 through F1-21 include "PG 1" in the parameter name and are used to set up a PG option card plugged into option port CN5-C of the drive.

Parameters F1-31 through F1-37 include "PG 2" in the parameter name and are used to set up a PG option card plugged into option port CN5-B of the drive.

Other parameters in the F1 group are used to set operation for PG options plugged into port CN5-C and CN5-B.

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F1-01 (0380)	PG 1 Pulses Per Revolution	PG1 Pulses/Rev	Sets the number of PG (pulse generator or encoder) pulses. Sets the number of pulses per motor revolution. **Note:** Setting range is 0 to 15000 ppr when A1-02 = 7 (CLV/PM control mode).	Default: 1024 ppr Min.: 1 Max.: 60000	–
F1-02 (0381)	Operation Selection at PG Open Circuit (PGo)	PG Fdbk Loss Sel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only 4: Not Detect	0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm only. 4: No alarm display **Note:** Depending on motor speed and load conditions, an error such as ov or oC may occur.	Default: 1 Range: 0 to 4	–
F1-03 (0382)	Operation Selection at Overspeed (oS)	PG Overspeed Sel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm only. **Note:** In AOLV/PM, the motor will coast to a stop (F1-03 = 1). The setting for F1-03 cannot be changed to 0, 2, or 3.	Default: 1 Range: 0 to 3	–
F1-04 (0383)	Operation Selection at Deviation	PG Deviation Sel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm only.	Default: 3 Range: 0 to 3	–
F1-05 (0384)	PG 1 Rotation Selection	PG1 Rotation Sel 0: Fwd = C.C.W 1: Fwd = C.W.	0: Pulse A leads 1: Pulse B leads	Default: [1] Range: 0, 1	–
F1-06 (0385)	PG 1 Division Rate for PG Pulse Monitor	PG1 Output Ratio	Sets the division ratio for the pulse monitor used of the PG option card installed to port CN5-C. When setting for a three-digit number "xyz", the division ratio becomes = $[(1 + x) / yz]$. If only using the A pulse for one-track input, the input ratio will be 1:1 regardless of F1-06 setting. **Note:** Values 033 to 101 are not available.	Default: 001 Min.: 001 Max.: 132	–
F1-08 (0387)	Overspeed Detection Level	PG Overspd Level	Sets the overspeed detection level as a percentage of the maximum output frequency.	Default: 115% Min.: 0 Max.: 120	–
F1-09 (0388)	Overspeed Detection Delay Time	PG Overspd Time	Sets the time in seconds for an overspeed situation to trigger a fault (oS).	Default: [1] Min.: 0.0 s Max.: 2.0 s	–
F1-10 (0389)	Excessive Speed Deviation Detection Level	PG Deviate Level	Sets the speed deviation detection level as a percentage of the maximum output frequency.	Default: 10% Min.: 0 Max.: 50	–
F1-11 (038A)	Excessive Speed Deviation Detection Delay Time	PG Deviate Time	Sets the time in seconds for a speed deviation situation to trigger a fault (dEv).	Default: 0.5 s Min.: 0.0 Max.: 10.0	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F1-12 (038B)	PG 1 Gear Teeth 1	PG1 Gear Teeth1	Sets the gear ratio between the motor shaft and the encoder (PG). A gear ratio of 1 will be used if F1-12 or F1-13 are set to 0.	Default: 0 Min.: 0 Max.: 1000	–
F1-13 (038C)	PG 1 Gear Teeth 2	PG1 Gear Teeth2	Sets the gear ratio between the motor shaft and the encoder (PG). A gear ratio of 1 will be used if F1-12 or F1-13 are set to 0.	Default: 0 Min.: 0 Max.: 1000	–
F1-14 (038D)	PG Open-Circuit Detection Time	PGO Detect Time	Sets the time required to trigger a PG Open fault (PGo).	Default: 2.0 s Min.: 0.0 Max.: 10.0	–
F1-18 (03AD)	dv3 Detection Selection	DV3 Det Sel	0: Disabled n: Number of dv3 occurrences that must be detected to trigger a dv3 fault.	Default: 10 Min.: 0 Max.: 10	–
F1-19 (03AE)	dv4 Detection Selection	DV4 Det Sel	0: Disabled n: Number of pulses that the A and B pulse are reversed that triggers dv4 detection.	Default: 128 Min.: 0 Max.: 5000	–
F1-20 (03B4)	PG Option Card Disconnect Detection 1	PGCardDisconDet1 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 1 Range: 0, 1	–
F1-21 (03BC)	PG 1 Signal Selection	PG1 Signal Sel 1 0: A Phase Det 1: A,B Phase Det	0: A pulse detection 1: AB pulse detection	Default: 0 Range: 0, 1	–
F1-30 (03AA)	PG Card Option Port for Motor 2 Selection	Mtr2 PG Port Sel 0: Port CN5-C 1: Port CN5-B	0: CN5-C 1: CN5-B	Default: 1 Range: 0, 1	–
F1-31 (03B0)	PG 2 Pulses Per Revolution	PG2 Pulses/Rev	Sets the number of pulses for a PG option card connected to port CN5-B.	Default: 1024 ppr Min.: 1 Max.: 60000	–
F1-32 (03B1)	PG 2 Rotation Selection	PG2 Rotation Sel 0: Fwd = C.C.W 1: Fwd = C.W.	0: Pulse A leads 1: Pulse B leads	Default: 0 Range: 0, 1	–
F1-33 (03B2)	PG 2 Gear Teeth 1	PG2 Gear Teeth1	Sets the gear ratio between the motor shaft and the encoder (PG). A gear ratio of 1 will be used if F1-33 or F1-34 are set to 0.	Default: 0 Min.: 0 Max.: 1000	–
F1-34 (03B3)	PG 2 Gear Teeth 2	PG2 Gear Teeth2	Sets the gear ratio between the motor shaft and the encoder (PG). A gear ratio of 1 will be used if F1-33 or F1-34 are set to 0.	Default: 0 Min.: 0 Max.: 1000	–
F1-35 (03BE)	PG 2 Division Rate for Pulse Monitor	PG2 Output Ratio	Sets the division ratio for the pulse monitor used of the PG option card 2 installed to port CN5-B. When setting for a three-digit number "xyz", the division ratio becomes = $[(1 + x) / yz]$. **Note:** Values 033 to 101 are not available.	Default: 001 Min.: 001 Max.: 132	–
F1-36 (03B5)	PG Option Card Disconnect Detection 2	PGCardDisconDet1 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 1 Range: 0, 1	–
F1-37 (03BD)	PG 2 Signal Selection	PG2 Signal Sel 0: A Phase Det 1: A,B Phase Det	0: A pulse detection 1: AB pulse detection	Default: 0 Range: 0, 1	–
F1-50 (03D2) [2]	Encoder Selection	Encoder Select 0: EnDat Sin/Cos 1: EnDat SerialOnly 2: Hiperface	Selects the encoder connected the PG-F3 option. 0: EnDat 2.1/01, 2.2/01 Serial Communication + Sin/Cos 1: EnDat 2.2/22 Serial Communication 2: Hiperface **Note:** 1. Parameter is not available in models 4A0930 and 4A1200. 2. The use of EnDat2.2/22 encoders requires a PG-F3 option with software version 0102 or later. To identify the PG-F3 software version refer to the PG-F3 label in the field designated "C/N" (S + four digit number).	Default: 0 Range: 0 to 2	–
F1-51 (03D3) [2]	PGoH Detection Level	PGOH Det Level	Sets the level for detecting PG Hardware Fault (PGoH). Available when F1-20 = 1 **Note:** Parameter is not available in models 4A0930 and 4A1200.	Default: 80% Min.: 1 Max.: 100	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F1-52 (03D4) <2>	Communication Speed of Serial Encoder Selection	Ser Enc Comm Spd 0: 1M/9600bps 1: 500k/19200bps 2: 1M/38400bps 3: 1M/38400bps	Selects the communication speed between the PG-F3 option and serial encoder. 0: 1M bps/9600 bps (EnDat 2.2/22 / Hiperface) 1: 500k bps/19200 bps (EnDat 2.2/22 / Hiperface) 2: 1M bps/38400 bps (EnDat 2.2/22 / Hiperface) 3: 1M bps/38400 bps (EnDat 2.2/22 / Hiperface) **Note:** Parameter is not available in models 4A0930 and 4A1200.	Default: 0 Range: 0 to 3	–

<1> Default setting is determined by parameter A1-02, Control Method Selection.

<2> Available in drive software versions PRG: 1018 and later.

◆ F2: Analog Input Card Settings (AI-A3)

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F2-01 (038F)	Analog Input Option Card Operation Selection	AI Function Sel 0: 3ch Individual 1: 3ch Addition	0: Option card input terminals V1, V2, and V3 replace drive input terminals A1, A2, and A3. 1: Input signals to terminals V1, V2, and V3 are added together to create the frequency reference.	Default: 0 Range: 0, 1	–
F2-02 (0368) ⟨⟩RUN	Analog Input Option Card Gain	AI Input Gain	Sets the gain for the input signal to the analog card.	Default: 100.0% Min.: -999.9 Max.: 999.9	–
F2-03 (0369) ⟨⟩RUN	Analog Input Option Card Bias	AI Input Bias	Sets the bias for the input signal to the analog card.	Default: 0.0% Min.: -999.9 Max.: 999.9	–

◆ F3: Digital Input Card Settings (DI-A3)

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F3-01 (0390)	Digital Input Option Card Input Selection	DI Function Sel 0: BCD 1% 1: BCD 0.1% 2: BCD 0.01% 3: BCD 1 Hz 4: BCD 0.1 Hz 5: BCD 0.01 Hz 6: BCD(5DG) 0.01 Hz 7: Binary	0: BCD, 1% units 1: BCD, 0.1% units 2: BCD, 0.01% units 3: BCD, 1 Hz units 4: BCD, 0.1 Hz units 5: BCD, 0.01 Hz units 6: BCD customized setting (5-digit), 0.02 Hz units 7: Binary input The unit and the setting range are determined by F3-03. F3-03 = 0: 255/100% (-255 to +255) F3-03 = 1: 40961/100% (-4095 to +4095) F3-03 = 2: 30000/100% (-33000 to +33000) When the digital operator units are set to be displayed in Hz or user-set units (o1-03 = 2 or 3), the units for F3-01 are determined by parameter o1-03.	Default: 0 Range: 0 to 7	–
F3-03 (03B9)	Digital Input Option DI-A3 Data Length Selection	Data length Sel 0: 8bit 1: 12bit 2: 16bit	0: 8 bit 1: 12 bit 2: 16 bit	Default: 2 Range: 0 to 2	–

◆ F4: Analog Monitor Card Settings (AO-A3)

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F4-01 (0391)	Terminal V1 Monitor Selection	AO Ch1 Select	Sets the monitor signal for output from terminal V1. Set this parameter to the last three digits of the desired U□-□□ monitor. Some U parameters are available only in certain control modes.	Default: 102 Range: 000 to 999 *<1>*	–
F4-02 (0392) RUN	Terminal V1 Monitor Gain	AO Ch1 Gain	Sets the gain for voltage output via terminal V1.	Default: 100.0% Min.: -999.9 Max.: 999.9	–
F4-03 (0393)	Terminal V2 Monitor Selection	AO Ch2 Select	Sets the monitor signal for output from terminal V2. Set this parameter to the last three digits of the desired U□-□□ monitor. Some U parameters are available only in certain control modes.	Default: 103 Range: 000 to 999 *<1>*	–
F4-04 (0394) RUN	Terminal V2 Monitor Gain	AO Ch2 Gain	Sets the gain for voltage output via terminal V2.	Default: 50.0% Min.: -999.9 Max.: 999.9	–
F4-05 (0395) RUN	Terminal V1 Monitor Bias	AO Ch1 Bias	Sets the amount of bias added to the voltage output via terminal V1.	Default: 0.0% Min.: -999.9 Max.: 999.9	–
F4-06 (0396) RUN	Terminal V2 Monitor Bias	AO Ch2 Bias	Sets the amount of bias added to the voltage output via terminal V2.	Default: 0.0% Min.: -999.9 Max.: 999.9	–
F4-07 (0397)	Terminal V1 Signal Level	AO Opt Level Ch1 0: 0-10 VDC 1: -10 +10 VDC	0: 0 to 10 V 1: -10 to 10 V	Default: 0 Range: 0, 1	–
F4-08 (0398)	Terminal V2 Signal Level	AO Opt Level Ch2 0: 0-10 VDC 1: -10 +10 VDC	0: 0 to 10 V 1: -10 to 10 V	Default: 0 Range: 0, 1	–

<1> Set to 000 or 031 when using the terminal in the through mode. This setting can adjust the V1 and V2 terminal output from PLC via MEMOBUS/Modbus communications or communications option.

◆ F5: Digital Output Card Settings (DO-A3)

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F5-01 (0399)	Terminal P1-PC Output Selection	DO Ch1 Select	Sets the function for contact output terminals M1-M2, M3-M4, and photocoupler output terminals P1 through P6.	Default: 2 Range: 0 to 192	–
F5-02 (039A)	Terminal P2-PC Output Selection	DO Ch2 Select		Default: 4 Range: 0 to 192	–
F5-03 (039B)	Terminal P3-PC Output Selection	DO Ch3 Select		Default: 6 Range: 0 to 192	–
F5-04 (039C)	Terminal P4-PC Output Selection	DO Ch4 Select		Default: 37 Range: 0 to 192	–
F5-05 (039D)	Terminal P5-PC Output Selection	DO Ch5 Select		Default: F Range: 0 to 192	–
F5-06 (039E)	Terminal P6-PC Output Selection	DO Ch6 Select		Default: F Range: 0 to 192	–
F5-07 (039F)	Terminal M1-M2 Output Selection	DO Ch7 Select		Default: 0 Range: 0 to 192	–
F5-08 (03A0)	Terminal M3-M4 Output Selection	DO Ch8 Select		Default: 1 Range: 0 to 192	–
F5-09 (03A1)	DO-A3 Output Mode Selection	DO Function Sel	0: Output terminals are each assigned separate output functions. 1: Binary code output. 2: Use output terminal functions selected by parameters F5-01 through F5-08.	Default: 0 Range: 0 to 2	–

Parameter List

B

◆ F6: Communication Option Card Settings (SI-B3, SI-C3, SI-ES3, SI-ET3, SI-N3, SI-P3, SI-S3, SI-T3, SI-W3)

Parameters F6-01 through F6-03, F6-06 through F6-08, F6-14, and F7-16 are used for CC-Link, CANopen, DeviceNet, EtherCAT, PROFINET, BACnet, LonWorks, PROFIBUS-DP, MECHATROLINK-II, and MECHATROLINK-III options. Other parameters in the F6 group are used for communication-protocol-specific settings. For more details on a specific option card, refer to the instruction manual for the option.

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F6-01 (03A2)	Communications Error Operation Selection	Comm Bus Flt Sel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only 4: Alarm(d1-04) 5: Alm – Ramp Stop	0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm only. 4: Alarm and Run at d1-04 5: Alarm and Ramp to stop (automatic recovery) **Note:** Take proper safety measures, such as installing an emergency stop switch, when setting F6-01 to 3 or 4.	Default: 1 Range: 0 to 5	–
F6-02 (03A3)	External Fault from Comm. Option Detection Selection	EF0 Detection 0: Always Detected 1: Only During Run	0: Always detected. 1: Detection during run only.	Default: 0 Range: 0, 1	–
F6-03 (03A4)	External Fault from Comm. Option Operation Selection	EF0 Fault Action 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm only.	Default: 1 Range: 0 to 3	–
F6-04 (03A5)	bUS Error Detection Time	BUS Err Det Time	Sets the delay time for error detection if a bus error occurs.	Default: 2.0 s Min.: 0.0 Max.: 5.0	–
F6-06 (03A7)	Torque Reference/ Torque Limit Selection from Comm. Option	Torq Ref/Lmt Sel 0: Disabled 1: Enabled	0: Disabled. Torque reference/limit from option board disabled. 1: Enabled. Torque reference/limit from option board enabled.	Default: 0 Range: 0, 1	–
F6-07 (03A8)	Multi-Step Speed Enable/Disable Selection when NefRef/ ComRef is Selected	Fref PrioritySel 0: Net/Com REF 1: MultiStep Speed	0: Multi-step reference disabled (same as F7) 1: Multi-step reference enabled (same as V7)	Default: 0 Range: 0, 1	–
F6-08 (036A) *[1]*	Reset Communication Parameters	Com Prm Init Sel 0: Init Com Prms 1: No Init Com Prms	0: Communication-related parameters (F6-□□/F7-□□) are not reset when the drive is initialized using A1-03. 1: Reset all communication-related parameters (F6-□□/F7-□□) when the drive is initialized using A1-03.	Default: 0 Range: 0, 1	–
F6-10 (03B6)	CC-Link Node Address	CC-Link Node Add	Sets the node address if a CC-Link option is installed.	Default: 0 Min.: 0 Max.: 64	–
F6-11 (03B7)	CC-Link Communication Speed	CC-Link Baud 0: 156 kbps 1: 625 kbps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps	0: 156 Kbps 1: 625 Kbps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps	Default: 0 Range: 0 to 4	–
F6-14 (03BB)	bUS Error Auto Reset	Bus Err Auto Rst 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 0 Range: 0, 1	–
F6-20 (036B)	MECHATROLINK Station Address	Station Address	Sets the station address when the MECHATROLINK option has been installed.	Default: 21 Min.: 20 *[2]* Max.: 3F *[2]*	–
F6-21 (036C)	MECHATROLINK Frame Size	Frame length	0: 32-byte *[3]* 1: 17-byte *[3]*	Default: 0 Range: 0, 1	–
F6-22 (036D)	MECHATROLINK Link Speed	Link Speed 0: 10MHz 1: 4MHz	0: 10 Mbps 1: 4 Mbps	Default: 0 Range: 0, 1	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F6-23 (036E)	MECHATROLINK Monitor Selection (E)	Mon E register	Sets the MECHATROLINK monitor (E).	Default: 0 Min.: 0 Max.: FFFF	–
F6-24 (036F)	MECHATROLINK Monitor Selection (F)	Mon F register	Sets the MECHATROLINK monitor (F).	Default: 0 Min.: 0 Max.: FFFF	–
F6-25 (03C9)	Operation Selection at MECHATROLINK Watchdog Timer Error (E5)	SI-T WDTErr Sel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0: Ramp to stop. Decelerate using the deceleration time in C1-02. 1: Coast to stop 2: Fast stop. Decelerate using the deceleration time in C1-09. 3: Alarm only	Default: 1 Range: 0 to 3	–
F6-26 (03CA)	MECHATROLINK bUS Errors Detected	Num of SI-T BUS	Sets the number of option communication errors (bUS).	Default: 2 Min.: 2 Max.: 10	–
F6-30 (03CB)	PROFIBUS-DP Node Address	PB Node Address	Sets the node address.	Default: 0 Min.: 0 Max.: 125	–
F6-31 (03CC)	PROFIBUS-DP Clear Mode Selection	PB Clear Select 0: Reset to Zero 1: Hold Prev Value	0: Resets drive operation with a Clear mode command. 1: Maintains the previous operation state when Clear mode command is given.	Default: 0 Range: 0, 1	–
F6-32 (03CD)	PROFIBUS-DP Data Format Selection	PB Map Select 0: PPO Type 1: Conventional 2: PPO (bit0) 3: PPO (Enter) 4: Conv (Enter) 5: PPO (bit0,Enter)	0: PPO Type 1: Conventional 2: PPO (w/bit 0) 3: PPO Type (Auto Enter) 4: Conventional (Auto Enter) 5: PPO (w/bit0, Auto Enter)	Default: 0 Range: 0 to 5	–
F6-35 (03D0)	CANopen Node ID Selection	CO Node Address	Sets the node address.	Default: 0 Min.: 0 Max.: 126	–
F6-36 (03D1)	CANopen Communication Speed	CO Baud Rate 0: Auto Detect 1: 10 kbps 2: 20 kbps 3: 50 kbps 4: 125 kbps 5: 250 kbps 6: 500 kbps 7: 800 kbps 8: 1Mbps	0: Auto-detection 1: 10 kbps 2: 20 kbps 3: 50 kbps 4: 125 kbps 5: 250 kbps 6: 500 kbps 7: 800 kbps 8: 1 Mbps	Default: 6 Range: 0 to 8	–
F6-40 (03D5)	CompoNet Node Address	CN Node Adress	Reserved.	–	–
F6-41 (03D6)	CompoNet Communication Speed	CN Baud Rate	Reserved.	–	–
F6-45 (02FB)	BACnet Node Address	BAC Node Address	Sets BACnet physical node address.	Default: 1 Min.: 0 Max.: 127	–
F6-46 (02FC)	BACnet Baud Rate	BAC Baud Rate 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19.2 kbps 5: 38.4 kbps 6: 57.6 kbps 7: 76.8 kbps 8: 115.2 kbps	0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 76800 8: 115200	Default: 3 Range: 0 to 8	–
F6-47 (02FD)	Rx to Tx Wait Time	Rx to Tx Wait T	Sets the wait time between receiving and sending for BACnet.	Default: 5 ms Min.: 5 Max.: 65	–
F6-48 (02FE)	BACnet Device Object Identifier 0	BAC Dev Obj Id 0	Sets the least significant word for BACnet.	Default: 0 Min.: 0 Max.: FFFF	–

Parameter List

B

B.6 F: Option Settings

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F6-49 (02FF)	BACnet Device Object Identifier 1	BAC Dev Obj Id 1	Sets the most significant word for BACnet.	Default: 0 Min.: 0 Max.: 3F	–
F6-50 (03C1)	DeviceNet MAC Address	DN MAC Address	Selects the drive MAC address.	Default: 64 Min.: 0 Max.: 64	–
F6-51 (03C2)	DeviceNet Communication Speed	DN Baud Rate 0: 125 kbps 1: 250 kbps 2: 500 kbps 3: Set from Network 4: Auto Detect	0: 125 kbps 1: 250 kbps 2: 500 kbps 3: Adjustable from network 4: Detect automatically	Default: 4 Range: 0 to 4	–
F6-52 (03C3)	DeviceNet PCA Setting	PCA Selection	Sets the format of the data set from the DeviceNet master to the drive.	Default: 21 Min.: 0 Max.: 255	–
F6-53 (03C4)	DeviceNet PPA Setting	PPA Selection	Sets the format of the data set from the drive to the DeviceNet master.	Default: 71 Min.: 0 Max.: 255	–
F6-54 (03C5)	DeviceNet Idle Mode Fault Detection	DN Idle Flt Det 0: Stop 1: Ignore 2: Vendor Specific 3: Run Fwd 4: Run Rev	0: Enabled 1: Disabled, no fault detection 2: Vendor Specific 3: Forward 4: Reverse	Default: 0 Range: 0 to 4	–
F6-55 (03C6)	DeviceNet Baud Rate Monitor	DN BAUD RATE MEM 0: 125 kbps 1: 250 kbps 2: 500 kbps	Verifies the baud rate running on the network. 0: 125 kbps 1: 250 kbps 2: 500 kbps	Default: 0 Range: 0 to 2	–
F6-56 (03D7)	DeviceNet Speed Scaling	Speed Scale	Sets the scaling factor for the speed monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	–
F6-57 (03D8)	DeviceNet Current Scaling	Current Scale	Sets the scaling factor for the output current monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	–
F6-58 (03D9)	DeviceNet Torque Scaling	Torque Scale	Sets the scaling factor for the torque monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	–
F6-59 (03DA)	DeviceNet Power Scaling	Power Scale	Sets the scaling factor for the power monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	–
F6-60 (03DB)	DeviceNet Voltage Scaling	Voltage Scale	Sets the scaling factor for the voltage monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	–
F6-61 (03DC)	DeviceNet Time Scaling	Time Scale	Sets the scaling factor for the time monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	–
F6-62 (03DD)	DeviceNet Heartbeat Interval	DN Heart Beat	Sets the heartbeat interval for DeviceNet communications.	Default: 0 Min.: 0 Max.: 10	–
F6-63 (03DE)	DeviceNet Network MAC ID	DN MAC ID MEM	Saves and monitors settings 0 to 63 of F6-50 (DeviceNet MAC Address).	Default: 63 Min.: 0 Max.: 63	–
F6-64 to F6-71 (03DF to 03C8)	Reserved	–	Reserved for Dynamic I/O Assembly Parameters.	–	–
F6-72 (081B)	PowerLink Node Address	PowerLink NodeID	Reserved.	–	–

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

<2> Values shown are for the MECHATROLINK-II option (SI-T3). Values for MECHATROLINK-III option (SI-ET3) are: Min: 03, Max.: EF

<3> Values shown are for the MECHATROLINK-II option (SI-T3). Values for MECHATROLINK-III option (SI-ET3) are: 0: 64-byte, 1: 32-byte

◆ F7: Communication Option Card Settings (SI-EM3, SI-EN3, SI-EP3)

F7 parameters are used for EtherNet/IP, Modbus TCP/IP, and PROFINET options. Other parameters in the F7 group are used for communication-protocol-specific settings. For more details on a specific option card, refer to the instruction manual for the option.

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F7-01 (03E5) [1]	IP Address 1	IP Address 1	Sets the most significant octet of network static IP address.	Default: 192 Range: 0 to 255	–
F7-02 (03E6) [1]	IP Address 2	IP Address 2	Sets the second most significant octet of network static IP address.	Default: 168 Range: 0 to 255	–
F7-03 (03E7) [1]	IP Address 3	IP Address 3	Sets the third most significant octet of network static IP address.	Default: 1 Range: 0 to 255	–
F7-04 (03E8) [1]	IP Address 4	IP Address 4	Sets the fourth most significant octet of network static IP address.	Default: 20 Range: 0 to 255	–
F7-05 (03E9)	Subnet Mask 1	Subnet Mask 1	Sets the most significant octet of network static Subnet Mask.	Default: 255 Range: 0 to 255	–
F7-06 (03EA)	Subnet Mask 2	Subnet Mask 2	Sets the second most significant octet of network static Subnet Mask.	Default: 255 Range: 0 to 255	–
F7-07 (03EB)	Subnet Mask 3	Subnet Mask 3	Sets the third most significant octet of network static Subnet Mask.	Default: 255 Range: 0 to 255	–
F7-08 (03EC)	Subnet Mask 4	Subnet Mask 4	Sets the fourth most significant octet of network static Subnet Mask.	Default: 0 Range: 0 to 255	–
F7-09 (03ED)	Gateway Address 1	Gateway IP Add 1	Sets the most significant octet of network Gateway address.	Default: 192 Range: 0 to 255	–
F7-10 (03EE)	Gateway Address 2	Gateway IP Add 2	Sets the second most significant octet of network Gateway address.	Default: 168 Range: 0 to 255	–
F7-11 (03EF)	Gateway Address 3	Gateway IP Add 3	Sets the third most significant octet of network Gateway address.	Default: 1 Range: 0 to 255	–
F7-12 (03F0)	Gateway Address 4	Gateway IP Add 4	Sets the fourth most significant octet of network Gateway address.	Default: 1 Range: 0 to 255	–
F7-13 (03F1)	Address Mode at Startup	IP Add Mode Sel 0: User Defined 1: BOOTP 2: DHCP	Select the option address setting method 0: Static [2] 1: BOOTP 2: DHCP	Default: 2 Range: 0 to 2	–
F7-14 (03F2)	Duplex Mode Selection	Duplex Select 0: Half/Half 1: Auto/Auto 2: Full/Full 3: Half/Auto 4: Half/Full 5: Auto/Half 6: Auto/Full 7: Full/Half 8: Full/Auto	Selects duplex mode setting. 0: Half duplex forced 1: Auto-negotiate duplex mode and communication speed 2: Full duplex forced 3: Half duplex forced (port 1)/Auto-negotiate duplex mode and communication speed (port 2) 4: Half duplex forced (port 1)/Full duplex forced (port 2) 5: Auto-negotiate duplex mode and communication speed (port 1)/Half duplex forced (port 2) 6: Auto-negotiate duplex mode and communication speed (port 1)/Full duplex forced (port 2) 7: Full duplex forced (port 1)/Half duplex forced (port 2) 8: Full duplex forced (port 1)/Auto-negotiate duplex mode and communication speed (port 2)	Default: 1 Range: 0 to 8	–
F7-15 (03F3)	Communication Speed Selection	Baud Rate 10: 10/10 Mbps 100: 100/100 Mbps 101: 10/100 Mbps 102: 100/10 Mbps	Sets the communication speed 10: 10 Mbps 100: 100 Mbps 101: 10 Mbps (port 1)/100 Mbps (port 2) 102: 100 Mbps (port 1)/10 Mbps (port 2)	Default: 10 Range: 10 to 102	–
F7-16 (03F4)	Communication Loss Time Out	CommLoss Tout	Sets the time out value for communication loss detection in tenths of a second. A value of 0 disables the connection time out. Example: An entered value of 100 represents 10.0 seconds.	Default: 0.0 s Min.: 0.0 Max.: 30.0	–

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F7-17 (03F5)	EtherNet/IP Speed Scaling Factor	EN Speed Scale	Sets the scaling factor for the speed monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-18 (03F6)	EtherNet/IP Current Scaling Factor	EN Current Scale	Sets the scaling factor for the output current monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-19 (03F7)	EtherNet/IP Torque Scaling Factor	EN Torque Scale	Sets the scaling factor for the torque monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-20 (03F8)	EtherNet/IP Power Scaling Factor	EN Power Scale	Sets the scaling factor for the power monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-21 (03F9)	EtherNet/IP Voltage Scaling Factor	EN Voltage Scale	Sets the scaling factor for the voltage monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-22 (03FA)	EtherNet/IP Time Scaling	EN Time Scale	Sets the scaling factor for the time monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-23 to F7-27 (03FB to 03FF) F7-28 to F7-32 (0370 to 0374)	Dynamic Output Assembly Parameters	–	Parameters used in Output Assembly 116. Each parameter contains a MEMOBUS/Modbus address. The value received for Output Assembly 116 will be written to this corresponding MEMOBUS/Modbus address. A MEMOBUS/Modbus address value of 0 means that the value received for Output Assembly 116 will not be written to any MEMOBUS/Modbus register.	Default: 0	–
F7-33 to F7-42 (0375 to 037E)	Dynamic Input Assembly Parameters	–	Parameters used in Input Assembly 166. Each parameter contains a MEMOBUS/Modbus address. The value sent for Input Assembly 166 will be read from this corresponding MEMOBUS/Modbus address. A MEMOBUS/Modbus address value of 0 means that the value sent for Input Assembly 166 is not defined by the user, therefore the option default register value will be returned.	Default: 0	–
F7-60 (0780)	PZD1 Write	PZD1 Write	Sets MEMOBUS/Modbus address for PZD1 Write (PPO Write). Values 0 to 2 enable the PZD1 Write as STW.	Default: 0 Min.: 0 Max.: FFFF	–
F7-61 (0781)	PZD2 Write	PZD2 Write	Sets MEMOBUS/Modbus address for PZD2 Write (PPO Write). Values 0 to 2 enable the PZD2 Write as HSW.	Default: 0 Min.: 0 Max.: FFFF	–
F7-62 (0782)	PZD3 Write	PZD3 Write	Sets MEMOBUS/Modbus address for PZD3 Write (PPO Write). Values 0 to 2 disable the PZD3 Write.	Default: 0 Min.: 0 Max.: FFFF	–
F7-63 (0783)	PZD4 Write	PZD4 Write	Sets MEMOBUS/Modbus address for PZD4 Write (PPO Write). Values 0 to 2 disable the PZD4 Write.	Default: 0 Min.: 0 Max.: FFFF	–
F7-64 (0784)	PZD5 Write	PZD5 Write	Sets MEMOBUS/Modbus address for PZD5 Write (PPO Write). Values 0 to 2 disable the PZD5 Write.	Default: 0 Min.: 0 Max.: FFFF	–
F7-65 (0785)	PZD6 Write	PZD6 Write	Sets MEMOBUS/Modbus address for PZD6 Write (PPO Write). Values 0 to 2 disable the PZD6 Write.	Default: 0 Min.: 0 Max.: FFFF	–
F7-66 (0786)	PZD7 Write	PZD7 Write	Sets MEMOBUS/Modbus address for PZD7 Write (PPO Write). Values 0 to 2 disable the PZD7 Write.	Default: 0 Min.: 0 Max.: FFFF	–
F7-67 (0787)	PZD8 Write	PZD8 Write	Sets MEMOBUS/Modbus address for PZD8 Write (PPO Write). Values 0 to 2 disable the PZD8 Write.	Default: 0 Min.: 0 Max.: FFFF	–
F7-68 (0788)	PZD9 Write	PZD9 Write	Sets MEMOBUS/Modbus address for PZD9 Write (PPO Write). Values 0 to 2 disable the PZD9 Write.	Default: 0 Min.: 0 Max.: FFFF	–
F7-69 (0789)	PZD10 Write	PZD10 Write	Sets MEMOBUS/Modbus address for PZD10 Write (PPO Write). Values 0 to 2 disable the PZD10 Write.	Default: 0 Min.: 0 Max.: FFFF	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F7-70 (078A)	PZD1 Read	PZD1 Read	Sets MEMOBUS/Modbus address for PZD1 Read (PPO Read). Values 0 to 2 enable the PZD1 Read as ZSW.	Default: 0 Min.: 0 Max.: FFFF	–
F7-71 (078B)	PZD2 Read	PZD2 Read	Sets MEMOBUS/Modbus address for PZD2 Read (PPO Read). Values 0 to 2 enable the PZD2 Read as HIW.	Default: 0 Min.: 0 Max.: FFFF	–
F7-72 (078C)	PZD3 Read	PZD3 Read	Sets MEMOBUS/Modbus address for PZD3 Read (PPO Read). Values 0 to 2 disable the PZD3 Read.	Default: 0 Min.: 0 Max.: FFFF	–
F7-73 (078D)	PZD4 Read	PZD4 Read	Sets MEMOBUS/Modbus address for PZD4 Read (PPO Read). Values 0 to 2 disable the PZD4 Read.	Default: 0 Min.: 0 Max.: FFFF	–
F7-74 (078E)	PZD5 Read	PZD5 Read	Sets MEMOBUS/Modbus address for PZD5 Read (PPO Read). Values 0 to 2 disable the PZD5 Read.	Default: 0 Min.: 0 Max.: FFFF	–
F7-75 (078F)	PZD6 Read	PZD6 Read	Sets MEMOBUS/Modbus address for PZD6 Read (PPO Read). Values 0 to 2 disable the PZD6 Read.	Default: 0 Min.: 0 Max.: FFFF	–
F7-76 (0790)	PZD7 Read	PZD7 Read	Sets MEMOBUS/Modbus address for PZD7 Read (PPO Read). Values 0 to 2 disable the PZD7 Read.	Default: 0 Min.: 0 Max.: FFFF	–
F7-77 (0791)	PZD8 Read	PZD8 Read	Sets MEMOBUS/Modbus address for PZD8 Read (PPO Read). Values 0 to 2 disable the PZD8 Read.	Default: 0 Min.: 0 Max.: FFFF	–
F7-78 (0792)	PZD9 Read	PZD9 Read	Sets MEMOBUS/Modbus address for PZD9 Read (PPO Read). Values 0 to 2 disable the PZD9 Read.	Default: 0 Min.: 0 Max.: FFFF	–
F7-79 (0793)	PZD10 Read	PZD10 Read	Sets MEMOBUS/Modbus address for PZD10 Read (PPO Read). Values 0 to 2 disable the PZD10 Read.	Default: 0 Min.: 0 Max.: FFFF	–

<1> Cycle power for setting changes to take effect.

<2> If F7-13 is set to 0, then all IP Addresses (as defined with parameters F7-01 to F7-04) must be unique.

Parameter List

B

B.7   H Parameters: Multi-Function Terminals

H parameters assign functions to the multi-function input and output terminals.

◆ H1: Multi-Function Digital Inputs

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H1-01 (0438)	Multi-Function Digital Input Terminal S1 Function Selection	Term S1 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *288* to *291* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 40 (F) *<1>* Min.: 1 Max.: 9F	*152*
H1-02 (0439)	Multi-Function Digital Input Terminal S2 Function Selection	Term S2 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *288* to *291* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 41 (F) *<1>* Min.: 1 Max.: 9F	*152*
H1-03 (0400)	Multi-Function Digital Input Terminal S3 Function Selection	Term S3 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *288* to *291* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 24 Min.: 0 Max.: 9F	*152*
H1-04 (0401)	Multi-Function Digital Input Terminal S4 Function Selection	Term S4 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *288* to *291* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 14 Min.: 0 Max.: 9F	*152*
H1-05 (0402)	Multi-Function Digital Input Terminal S5 Function Selection	Term S5 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *288* to *291* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 3 (0) *<1>* Min.: 0 Max.: 9F	*152*
H1-06 (0403)	Multi-Function Digital Input Terminal S6 Function Selection	Term S6 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *288* to *291* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 4 (3) *<1>* Min.: 0 Max.: 9F	*152*
H1-07 (0404)	Multi-Function Digital Input Terminal S7 Function Selection	Term S7 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *288* to *291* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 6 (4) *<1>* Min.: 0 Max.: 9F	*152*
H1-08 (0405)	Multi-Function Digital Input Terminal S8 Function Selection	Term S8 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *288* to *291* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 8 Min.: 0 Max.: 9F	*152*

<1>   Value in parenthesis is the default setting when a 3-Wire initialization is performed (A1-03 = 3330).

H1 Multi-Function Digital Input Selections				
H1-□□ Setting	**Function**	**LCD Display**	**Description**	**Page**
0	3-Wire sequence	3-Wire Control	Closed: Reverse rotation (only if the drive is set up for 3-Wire sequence) Terminals S1 and S2 are automatically set up for the Run command and Stop command.	*153*
1	LOCAL/REMOTE selection	Local/Remote Sel	Open: REMOTE (parameter settings determine the source of the frequency Reference 1 or 2 (b1-01, b1-02 or b1-15, b1-16) Closed: LOCAL, Frequency reference and Run command are input from the digital operator.	–
2	External reference 1/2 selection	Ext Ref Sel	Open: Run command and frequency reference source 1 (determined by b1-01 and b1-02) Closed: Run command and frequency reference source 2 (determined by b1-15 and b1-16)	–
3	Multi-Step Speed Reference 1	Multi-Step Ref 1	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 frequency references set in d1-01 through d1-08.	–
4	Multi-Step Speed Reference 2	Multi-Step Ref 2	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 frequency references set in d1-01 through d1-08.	–
5	Multi-Step Speed Reference 3	Multi-Step Ref 3	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 frequency references set in d1-01 through d1-08.	–
6	Jog reference selection	Jog Freq Ref	Closed: Jog frequency reference (d1-17) selected. Jog has priority over all other reference sources.	–

H1 Multi-Function Digital Input Selections				
H1-□□ Setting	Function	LCD Display	Description	Page
7	Accel/decel time selection 1	Multi-Acc/Dec 1	Used to switch between accel/decel time 1 (set in C1-01, C1-02) and accel/decel time 2 (set in C1-03, C1-04).	–
8	Baseblock command (N.O.)	Ext BaseBlk N.O.	Closed: No drive output	–
9	Baseblock command (N.C.)	Ext BaseBlk N.C.	Open: No drive output	–
A	Accel/decel ramp hold	Acc/Dec RampHold	Open: Accel/decel is not held Closed: The drive pauses during acceleration or deceleration and maintains the output frequency.	–
B	Drive overheat alarm (oH2)	OH2 Alarm Signal	Closed: Closes when an oH2 alarm occurs	–
C	Analog terminal input selection	Term A2 Enable	Open: Function assigned by H3-14 is disabled. Closed: Function assigned by H3-14 is enabled.	–
D	PG encoder disable	PG Fdbk Disable	Open: Speed feedback for V/f Control with PG is enabled. Closed: Speed feedback disabled.	–
E	ASR integral reset	ASR Intgrl Reset	Open: PI control Closed: Integral reset	–
F	Through mode	Term Not Used	Select this setting when the terminal is not used or when using the terminal in the pass-through mode. The terminal does not trigger a drive function, but can be used as digital input for the controller to which the drive is connected.	–
10	Up command	Up Command 1	The drive accelerates when the Up command terminal closes, and decelerates when the Down command closes. When both terminals are closed or both are open, the drive holds the frequency reference. The Up and Down commands must always be used in conjunction with one another.	–
11	Down command	Down Command 1	The drive accelerates when the Up command terminal closes, and decelerates when the Down command closes. When both terminals are closed or both are open, the drive holds the frequency reference. The Up and Down commands must always be used in conjunction with one another.	–
12	Forward Jog	Forward Jog	Closed: Runs forward at the Jog frequency d1-17.	–
13	Reverse Jog	Reverse Jog	Closed: Runs reverse at the Jog frequency d1-17.	–
14	Fault reset	Fault Reset	Closed: Resets faults if the cause is cleared and the Run command is removed.	–
15	Fast Stop (N.O.)	Fast-Stop N.O.	Closed: Decelerates at the Fast Stop time set to C1-09.	–
16	Motor 2 selection	Motor 2 Select	Open: Motor 1 (E1-□□, E2-□□) Closed: Motor 2 (E3-□□, E4-□□)	–
17	Fast Stop (N.C.)	Fast-Stop N.C.	Open: Decelerates to stop at the Fast Stop time set to C1-09.	–
18	Timer function input	Timer function	Triggers the timer set up by parameters b4-01 and b4-02. Must be set in conjunction with the timer function output (H2-□□ = 12).	–
19	PID disable	PID Disable	Open: PID control enabled Closed: PID control disabled	–
1A	Accel/decel time selection 2	Multi-Acc/Dec 2	Used in conjunction with an input terminal set for "Accel/decel time selection 1" (H1-□□ = 7), and allows the drive to switch between accel/decel times 3 and 4.	–
1B	Program lockout	Program Lockout	Open: Parameters cannot be edited. Closed: Parameters can be edited and saved.	–
1E	Reference sample hold	Ref Sample Hold	Closed: Samples the analog frequency reference and operates the drive at that speed.	–

Parameter List

B

H1-□□ Setting	Function	LCD Display	Description	Page
H1 Multi-Function Digital Input Selections				
20 to 2F	External fault	20: NO/Always Det, Ramp to Stop 21: NC/Always Det, Ramp to Stop 22: NO/During RUN, Ramp to Stop 23: NC/During RUN, ramp to stop 24: NO/ Always Det, Coast to Stop 25: NC/Always Det, Coast to Stop 26: NO/During RUN, Coast to Stop 27: NC/During RUN, Coast to Stop 28: NO/Always Det, Fast-Stop 29: NC/Always Det, Fast-Stop 2A: NO/During RUN, Fast-Stop 2B: NC/During RUN, Fast- Stop 2C: NO/Always Det, Alarm Only 2D: NC/Always Det, Alarm Only 2E: NO/ During RUN, Alarm Only 2F: NC/During RUN, Alarm Only	20: N.O., Always detected, ramp to stop 21: N.C., Always detected, ramp to stop 22: N.O., During run, ramp to stop 23: N.C., During run, ramp to stop 24: N.O., Always detected, coast to stop 25: N.C., Always detected, coast to stop 26: N.O., During run, coast to stop 27: N.C., During run, coast to stop 28: N.O., Always detected, Fast Stop 29: N.C., Always detected, Fast Stop 2A: N.O., During run, Fast Stop 2B: N.C., During run, Fast Stop 2C: N.O., Always detected, alarm only (continue running) 2D: N.C., Always detected, alarm only (continue running) 2E: N.O., During run, alarm only (continue running) 2F: N.C., During run, alarm only (continue running)	–
30	PID integral reset	PID Intgrl Reset	Closed: Resets the PID control integral value.	–
31	PID integral hold	PID Intgrl Hold	Open: Performs integral operation. Closed: Maintains the current PID control integral value.	–
32	Multi-Step Speed Reference 4	Multi-Step Ref 4	Used in combination with input terminals set to Multi-Step Speed Reference 1, 2, and 3. Use parameters d1-09 to d1-16 to set reference values.	–
34	PID soft starter cancel	PID SFS Cancel	Open: PID soft starter is enabled. Closed: Disables the PID soft starter b5-17.	–
35	PID input level selection	PID Input Invert	Closed: Inverts the PID input signal.	–
40	Forward run command (2-Wire sequence)	FwdRun 2Wire Seq	Open: Stop Closed: Forward run **Note:** Cannot be set together with settings 42 or 43.	–
41	Reverse run command (2-Wire sequence)	RevRun 2WireSeq	Open: Stop Closed: Reverse run **Note:** Cannot be set together with settings 42 or 43.	–
42	Run command (2-Wire sequence 2)	Run/Stp 2WireSeq	Open: Stop Closed: Run **Note:** Cannot be set together with settings 40 or 41.	–
43	FWD/REV command (2-Wire sequence 2)	FWD/REV 2WireSeq	Open: Forward Closed: Reverse **Note:** Determines motor direction, but does not issue a Run command. Cannot be set together with settings 40 or 41.	–
44	Offset frequency 1	Offset Freq 1	Closed: Adds d7-01 to the frequency reference.	–
45	Offset frequency 2	Offset Freq 2	Closed: Adds d7-02 to the frequency reference.	–
46	Offset frequency 3	Offset Freq 3	Closed: Adds d7-03 to the frequency reference.	–
47	Node setup	CanOpenNID Setup	Closed: Node setup for SI-S3 enabled.	–
60	DC Injection Braking command	DCInj Activate	Closed: Triggers DC Injection Braking.	–
61	External Speed Search command 1	Speed Search 1	Closed: Activates Current Detection Speed Search from the maximum output frequency (E1-04).	–

H1-□□ Setting	Function	LCD Display	Description	Page
		H1 Multi-Function Digital Input Selections		
62	External Speed Search command 2	Speed Search 2	Closed: Activates Current Detection Speed Search from the frequency reference.	–
63	Field weakening	Field Weak	Closed: The drive performs Field Weakening control as set for d6-01 and d6-02.	–
65	KEB Ride-Thru 1 (N.C.)	KEB Ridethru NC	Open: KEB Ride-Thru 1 enabled.	–
66	KEB Ride-Thru 1 (N.O.)	KEB Ridethru NO	Closed: KEB Ride-Thru 1 enabled.	–
67	Communications test mode	Comm Test Mode	Tests the MEMOBUS/Modbus RS-422/RS-485 interface. Displays "PASS" if the test completes successfully.	–
68	High Slip Braking (HSB)	HighSlipBraking	Closed: Activates High Slip Braking to stop the drive during a Run command.	–
6A	Drive enable	Drive Enable	Open: Drive disabled. If this input is opened during run, the drive will stop as specified by b1-03. Closed: Ready for operation.	–
71	Speed/Torque control Sswitch	Spd/Trq Ctl Chng	Open: Speed Control Closed: Torque Control	–
72	Zero servo	Zero Servo Cmd	Closed: Zero Servo enabled	–
75	Up 2 command	Up Command 2	Used to control the bias added to the frequency reference by the Up/Down 2 function. The Up 2 and Down 2 commands must always be used in conjunction with one another.	–
76	Down 2 command	Down Command 2	Used to control the bias added to the frequency reference by the Up/Down 2 function. The Up 2 and Down 2 commands must always be used in conjunction with one another.	–
77	ASR gain switch	ASR Gain Switch	Open: ASR proportional gain 1 (C5-01) Closed: ASR proportional gain 2 (C5-03)	–
78	External torque reference polarity inversion	Tref Sign Change	Open: Forward torque reference. Closed: Reverse polarity.	–
7A	KEB Ride-Thru 2 (N.C.)	KEB Ridethru2NC	Open: KEB Ride-Thru 2 enabled. Drive disregards L2-29 and performs Single Drive KEB Ride-Thru 2.	–
7B	KEB Ride-Thru 2 (N.O.)	KEB Ridethru2NO	Closed: KEB Ride-Thru 2 enabled. Drive disregards L2-29 and performs Single Drive KEB Ride-Thru 2.	–
7C	Short circuit braking (N.O.)	SC Brake (NO)	Closed: Short Circuit Braking enabled	–
7D	Short circuit braking (N.C.)	SC Brake (NC)	Open: Short Circuit Braking enabled	–
7E	Forward/reverse detection	PG Rotate Rev	Open: Forward motor operation detected Closed: Reverse motor operation detected	–
7F	PID Bi-Directional Enable	PID BiDir Enable	Reserved.	–
90 to 97	DriveWorksEZ digital inputs 1 to 8	–	Reserved for DWEZ input functions	–
9F	DriveWorksEZ disable	DWEZ Disable	Open: DWEZ enabled Closed: DWEZ disabled	–

◆ H2: Multi-Function Digital Outputs

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H2-01 (040B)	Terminal M1-M2 function selection (relay)	M1-M2 Func Sel	Refer to H2 Multi-Function Digital Output Settings on pages *292* to *294* for descriptions of setting values.	Default: 0 Range: 0 to 192	*153*
H2-02 (040C)	Terminal M3-M4 function selection (relay)	M3/M4 Func Sel		Default: 1 Range: 0 to 192	*153*
H2-03 (040D)	Terminal M5-M6 function selection (relay)	M5/M6 Func Sel		Default: 2 Range: 0 to 192	*153*

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H2-06 (0437)	Watt Hour Output Unit Selection	Pwr Mon Unit Sel	Sets the output units for the watt hours when Watt Hour Pulse Output is selected as the digital output (H2-01, H2-02, or H2-03 = 39). Outputs a 200 ms pulse signal when the watt hour counter increases by the units selected. 0: 0.1 kWh units 1: 1 kWh units 2: 10 kWh units 3: 100 kWh units 4: 1000 kWh units	Default: 0 Range: 0 to 4	–
H2-07 (0B3A) *<1>*	MEMOBUS Register 1 Address Select	MFDO Regs1 Addr	Sets the addresses of the MEMOBUS/Modbus registers from which data will be sent to contact outputs 62 and 162. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 1 Range: 1 to 1FFF	–
H2-08 (0B3B) *<1>*	MEMOBUS Register 1 Bit Select	MFDO Regs1 Bit	Sets the bits for the MEMOBUS/Modbus registers from which data will be sent to contact outputs 62 and 162. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0 Range: 0 to FFFF	–
H2-09 (0B3C) *<1>*	MEMOBUS Register 2 Address Select	MFDO Regs2 Addr	Sets the addresses of the MEMOBUS/Modbus registers from which data will be sent to contact outputs 63 and 163. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 1 Range: 1 to 1FFF	–
H2-10 (0B3D) *<1>*	MEMOBUS Register 2 Bit Select	MFDO Regs2 Bit	Sets the bits for the MEMOBUS/Modbus registers from which data will be sent to contact outputs 63 and 163. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0 Range: 0 to FFFF	–

<1> Available in drive software versions PRG: 1019 and later.

H2 Multi-Function Digital Output Settings				
H2-□□ Setting	Function	LCD Display	Description	Page
0	During run	During RUN 1	Closed: A Run command is active or voltage is output.	–
1	Zero speed	Zero Speed	Open: Output speed is greater than or equal to the value of E1-09 (Minimum Output Frequency) or b2-01 (DC Injection Braking Start Frequency). Closed: Output frequency is less than the value of E1-09 (Minimum Output Frequency) or b2-01 (DC Injection Braking Start Frequency).	–
2	Speed agree 1	Fref/Fout Agree1	Closed: Output frequency equals the speed reference (plus or minus the hysteresis set to L4-02).	*154*
3	User-set speed agree 1	Fref/Set Agree 1	Closed: Output frequency and speed reference equal L4-01 (plus or minus the hysteresis set to L4-02).	*155*
4	Frequency detection 1	Freq Detect 1	Closed: Output frequency is less than or equal to the value in L4-01 with hysteresis determined by L4-02.	–
5	Frequency detection 2	Freq Detect 2	Closed: Output frequency is greater than or equal to the value in L4-01 with hysteresis determined by L4-02.	–
6	Drive ready	Drive Ready	Closed: Power up is complete and the drive is ready to accept a Run command.	–
7	DC bus undervoltage	DC Bus Undervolt	Closed: DC bus voltage is below the Uv trip level set in L2-05.	–
8	During baseblock (N.O.)	BaseBlk 1	Closed: Drive has entered the baseblock state (no output voltage).	–
9	Frequency reference source	Ref Source	Open: External Reference 1 or 2 supplies the frequency reference (set in b1-01 or b1-15). Closed: Digital operator supplies the frequency reference.	–
A	Run command source	Run Cmd Source	Open: External Reference 1 or 2 supplies the Run command (set in b1-02 or b1-16). Closed: Digital operator supplies the Run command.	–
B	Torque detection 1 (N.O.)	Trq Det 1 N.O.	Closed: An overtorque or undertorque situation has been detected.	–
C	Frequency reference loss	Loss of Ref	Closed: Analog frequency reference has been lost. Frequency reference loss is detected when the frequency reference drops below 10% of the reference within 400 ms.	–

H2 Multi-Function Digital Output Settings				
H2-□□ Setting	**Function**	**LCD Display**	**Description**	**Page**
D	Braking resistor fault	DB Overheat	Closed: Braking resistor or transistor is overheated or faulted out. **Note:** This setting is not available in models 4A0930 and 4A1200.	–
E	Fault	Fault	Closed: Fault occurred (this excludes CPF00 and CPF01).	–
F	Through mode	Not Used	Select this setting when the terminal is not used or when using the terminal in the pass-through mode.	–
10	Minor fault	Minor Fault	Closed: An alarm has been triggered, or the IGBTs have reached 90% of their expected life span.	–
11	Fault reset command active	Reset Cmd Active	Closed: The drive has received a reset command from the multi-function input terminals or from a serial network, or the RESET key on the digital operator has been pressed.	–
12	Timer output	Timer Output	Closed: Timer output.	–
13	Speed agree 2	Fref/Fout Agree2	Closed: When drive output frequency equals the frequency reference ±L4-04. **Note:** This setting is not available in models 4A0930 and 4A1200.	–
14	User-set speed agree 2	Fref/Set Agree 2	Closed: When the drive output frequency is equal to the value in L4-03 ±L4-04.	–
15	Frequency detection 3	Freq Detect 3	Closed: When the drive output frequency is less than or equal to the value in L4-03 ±L4-04.	–
16	Frequency detection 4	Freq Detect 4	Closed: When the output frequency is greater than or equal to the value in L4-03 ±L4-04.	–
17	Torque detection 1 (N.C.)	Trq Det 1 N.C.	Open: Overtorque or undertorque has been detected.	–
18	Torque detection 2 (N.O.)	Trq Det 2 N.O.	Closed: Overtorque or undertorque has been detected.	
19	Torque detection 2 (N.C.)	Trq Det 2 N.C.	Open: Overtorque or undertorque has been detected.	–
1A	During reverse	Reverse Dir	Closed: Drive is running in the reverse direction.	–
1B	During baseblock (N.C.)	BaseBlk 2	Open: Drive has entered the baseblock state (no output voltage).	–
1C	Motor 2 selection	Motor 2 Selected	Closed: Motor 2 is selected by a digital input (H1-□□ = 16)	–
1D	During regeneration	Regenerating	Closed: Motor is regenerating energy into the drive.	–
1E	Restart enabled	Dur Flt Restart	Closed: An automatic restart is performed	–
1F	Motor overload alarm (oL1)	Overload (OL1)	Closed: oL1 is at 90% of its trip point or greater. An oH3 situation also triggers this alarm.	–
20	Drive overheat pre-alarm (oH)	OH Prealarm	Closed: Heatsink temperature exceeds the parameter L8-02 value.	–
22	Mechanical weakening detection	MechFatigue(OL5)	Closed: Mechanical weakening detected.	–
2F	Maintenance period	Maintenance	Closed: Cooling fan, electrolytic capacitors, IGBTs, or the soft charge bypass relay may require maintenance.	–
30	During torque limit	Torque Limit	Closed: When the torque limit has been reached.	–
31	During speed limit	Speed Limit	Closed: Speed limit has been reached.	–
32	During speed limit in Torque Control	Spd Lim @ T Cont	Closed: Speed limit has been reached while using Torque Control.	–
33	Zero Servo complete	Zero Servo End	Closed: Zero Servo operation has finished.	–
37	During frequency output	During RUN 2	Open: No frequency output from drive if stopped with baseblock, DC injection braking during initial excitation, or short-circuit braking. Closed: Drive is outputting a frequency.	–
38	Drive enabled	Drive Enable	Closed: Multi-function input set for "Drive enable" is closed (H1-□□ = 6A)	–
39	Watt hour pulse output	Watt-hour Pulse	Output units are determined by H2-06. Outputs a pulse every 200 ms to indicate the kWh count.	–
3C	LOCAL/REMOTE status	Local	Open: REMOTE Closed: LOCAL	–
3D	During speed search	During SpdSrch	Closed: Speed Search is being executed.	–
3E	PID feedback low	PID Feedback Low	Closed: PID feedback level is too low.	–

Parameter List

B

H2 Multi-Function Digital Output Settings				
H2-□□ Setting	**Function**	**LCD Display**	**Description**	**Page**
3F	PID feedback high	PID FeedbackHigh	Closed: The PID feedback level is too high.	–
4A	During KEB Ride-Thru	During KEB	Closed: KEB Ride-Thru is being performed.	–
4B	During short circuit braking	During SC Brake	Closed: Short Circuit Braking is active.	–
4C	During fast stop	During Fast Stop	Closed: A Fast Stop command has been entered from the operator or input terminals.	–
4D	oH Pre-alarm time limit	OH Pre-Alarm	Closed: oH pre-alarm time limit has passed.	–
4E	Braking transistor fault (rr)	Brk Trans Fault	Closed: The built-in dynamic braking transistor failed. **Note:** This setting is not available in models 2A0169 to 2A0415 and 4A0088 to 4A1200.	–
4F	Braking resistor overheat (oH)	BrkResistOvHeat	Closed: The dynamic braking resistor has overheated. **Note:** This setting is not available in models 2A0169 to 2A0415 and 4A0088 to 4A1200.	–
60	Internal cooling fan alarm	Fan Alrm Det	Closed: Internal cooling fan alarm	–
61	Rotor position detection complete	RotPosDetCmpIt	Closed: Drive has successfully detected the rotor position of the PM motor.	–
62 [1]	MEMOBUS Register 1 (Selected with H2-07 and H2-08)	Memobus Regs1	The contact output is closed when any of the bits specified by H2-08 for the MEMOBUS/Modbus register address set in H2-07 turn on. **Note:** This setting is not available in models 4A0930 and 4A1200.	–
63 [1]	MEMOBUS Register 2 (Selected with H2-09 and H2-10)	Memobus Regs2	The contact output is closed when any of the bits specified by H2-10 for the MEMOBUS/Modbus register address set in H2-09 turn on. **Note:** This setting is not available in models 4A0930 and 4A1200.	–
90 to 92	DriveWorksEZ digital outputs 1 to 3	–	Reserved for DWEZ digital output functions.	–
100 to 192	Function 0 to 92 with inverse output	!Function	Inverts the output switching of the multi-function output functions. Set the last two digits of 1□□ to reverse the output signal of that specific function.	–

<1> Available in drive software versions PRG: 1019 and later.

◆ H3: Multi-Function Analog Inputs

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H3-01 (0410)	Terminal A1 Signal Level Selection	Term A1 Level 0: 0-10V, (LowLim=0) 1: 0-10V, (BipolRef)	0: 0 to 10 V 1: -10 to 10 V	Default: 0 Range: 0, 1	*155*
H3-02 (0434)	Terminal A1 Function Selection	Term A1 FuncSel	Sets the function of terminal A1.	Default: 0 Range: 0 to 32	*155*
H3-03 (0411) RUN	Terminal A1 Gain Setting	Terminal A1 Gain	Sets the level of the input value selected in H3-02 when 10 V is input at terminal A1.	Default: 100.0% Min.: -999.9 Max.: 999.9	*156*
H3-04 (0412) RUN	Terminal A1 Bias Setting	Terminal A1 Bias	Sets the level of the input value selected in H3-02 when 0 V is input at terminal A1.	Default: 0.0% Min.: -999.9 Max.: 999.9	*156*
H3-05 (0413)	Terminal A3 Signal Level Selection	Term A3 Signal 0: 0-10V (LowLim=0) 1: 0-10V, (BipolRef)	0: 0 to 10 V 1: -10 to 10 V	Default: 0 Range: 0, 1	*156*
H3-06 (0414)	Terminal A3 Function Selection	Terminal A3 Sel	Sets the function of terminal A3.	Default: 2 Range: 0 to 32	*156*
H3-07 (0415) RUN	Terminal A3 Gain Setting	Terminal A3 Gain	Sets the level of the input value selected in H3-06 when 10 V is input at terminal A3.	Default: 100.0% Min.: -999.9 Max.: 999.9	*157*

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H3-08 (0416) ◇RUN	Terminal A3 Bias Setting	Terminal A3 Bias	Sets the level of the input value selected in H3-06 when 0 V is input at terminal A3.	Default: 0.0% Min.: -999.9 Max.: 999.9	*157*
H3-09 (0417)	Terminal A2 Signal Level Selection	Term A2 Level	0: 0 to 10 V 1: -10 to 10 V 2: 4 to 20 mA 3: 0 to 20 mA **Note:** Use DIP switch S1 to set input terminal A2 for a current or a voltage input signal.	Default: 2 Range: 0 to 3	*157*
H3-10 (0418)	Terminal A2 Function Selection	Term A2 FuncSel	Sets the function of terminal A2.	Default: 0 Range: 0 to 32	*157*
H3-11 (0419) ◇RUN	Terminal A2 Gain Setting	Terminal A2 Gain	Sets the level of the input value selected in H3-10 when 10 V (20 mA) is input at terminal A2.	Default: 100.0% Min.: -999.9 Max.: 999.9	*157*
H3-12 (041A) ◇RUN	Terminal A2 Bias Setting	Terminal A2 Bias	Sets the level of the input value selected in H3-10 when 0 V (0 or 4 mA) is input at terminal A2.	Default: 0.0% Min.: -999.9 Max.: 999.9	*157*
H3-13 (041B)	Analog Input Filter Time Constant	A1/A2 Filter T	Sets a primary delay filter time constant for terminals A1, A2, and A3. Used for noise filtering.	Default: 0.03 s Min.: 0.00 Max.: 2.00	–
H3-14 (041C)	Analog Input Terminal Enable Selection	A1/A2/A3 Sel 1: A1 Available 2: A2 Available 3: A1/A2 Available 4: A3 Available 5: A1/A3 Available 6: A2/A3 Available 7: All Available	Determines which analog input terminals will be enabled or disabled when a digital input programmed for "Analog input enable" (H1-□□ = C) is activated. The terminals not set as the target are not influenced by input signals. 1: Terminal A1 only 2: Terminal A2 only 3: Terminals A1 and A2 only 4: Terminal A3 only 5: Terminals A1 and A3 6: Terminals A2 and A3 7: All terminals enabled	Default: 7 Range: 1 to 7	–
H3-16 (02F0)	Terminal A1 Offset	TerminalA1Offset	Adds an offset when the analog signal to terminal A1 is at 0 V.	Default: 0 Min.: -500 Max.: 500	–
H3-17 (02F1)	Terminal A2 Offset	TerminalA2Offset	Adds an offset when the analog signal to terminal A2 is at 0 V.	Default: 0 Min.: -500 Max.: 500	–
H3-18 (02F2)	Terminal A3 Offset	TerminalA3Offset	Adds an offset when the analog signal to terminal A3 is at 0 V.	Default: 0 Min.: -500 Max.: 500	–

H3 Multi-Function Analog Input Settings				
H3-□□ Setting	Function	LCD Display	Description When Output Is 100%	Page
0	Frequency bias	Freq Ref Bias	10 V = E1-04 (maximum output frequency)	–
1	Frequency gain	Freq Ref Gain	0 to 10 V signal allows a setting of 0 to 100%. -10 to 0 V signal allows a setting of -100 to 0%.	–
2	Auxiliary frequency reference 1	Aux Reference1	10 V = E1-04 (maximum output frequency)	–
3	Auxiliary frequency reference 2	Aux Reference2	10 V = E1-04 (maximum output frequency)	–
4	Output voltage bias	Voltage Bias	10 V = E1-05 (motor rated voltage)	–
5	Accel/decel time gain	Acc/DecTime Gain	10 V = 100%	–
6	DC Injection Braking current	DC Brake Current	10 V = Drive rated current	–
7	Overtorque/ undertorque detection level	Torque Det Level	10 V = Drive rated current (V/f, V/f w PG) 10 V = Motor rated torque (OLV, CLV, OLV/PM, AOLV/PM, CLV/PM)	–
8	Stall Prevention level during run	Stall Prev Level	10 V = Drive rated current	–

Parameter List

B

H3-□□ Setting	Function	LCD Display	Description When Output Is 100%	Page
		H3 Multi-Function Analog Input Settings		
9	Output frequency lower limit level	Ref Lower Limit	10 V = E1-04 (maximum output frequency)	–
B	PID feedback	PID Feedback1	10 V = 100%	–
C	PID setpoint	PID Set Point	10 V = 100%	–
D	Frequency bias	Freq Ref Bias 2	10 V = E1-04 (maximum output frequency)	–
E	Motor temperature (PTC input)	Motor PTC	10 V = 100%	–
F	Through mode	Not Used	Select this setting when the terminal is not used or when using the terminal in the pass-through mode.	–
10	Forward torque limit	Fwd Torque Limit	10 V = Motor rated torque	–
11	Reverse torque limit	Rev Torque Limit	10 V = Motor rated torque	–
12	Regenerative torque limit	Regen Torq Limit	10 V = Motor rated torque	–
13	Torque Limit Using Torque Reference/ Speed Control	Torque Reference	10 V = Motor rated torque	–
14	Torque compensation	Torque Comp	10 V = Motor rated torque	–
15	General torque limit	Torque Limit	10 V = Motor rated torque	–
16	Differential PID feedback	PID Feedback 2	10 V = 100%	–
17	Motor Thermistor (NTC)	Moter temp (NTC)	10 V = -9 °C 0 V = +234 °C Note: This setting is only available in models 4A0930 and 4A1200.	–
1F	Through mode	Not Used	Select this setting when the terminal is not used or when using the terminal in the pass-through mode.	–
30 to 32	DriveWorksEZ analog input 1 to 3	–	Output is determined by the function selected using DWEZ.	–

◆ H4: Analog Outputs

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H4-01 (041D)	Multi-Function Analog Output Terminal FM Monitor Selection	Term FM FuncSel	Selects the data to be output through multi-function analog output terminal FM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter "103" for U1-03.	Default: 102 Range: 000 to 999	*157*
H4-02 (041E) ⟨RUN⟩	Multi-Function Analog Output Terminal FM Gain	Terminal FM Gain	Sets the signal level at terminal FM that is equal to 100% of the selected monitor value.	Default: 100.0% Min.: -999.9 Max.: 999.9	*158*
H4-03 (041F) ⟨RUN⟩	Multi-Function Analog Output Terminal FM Bias	Terminal FM Bias	Sets the signal level at terminal FM that is equal to 0% of the selected monitor value.	Default: 0.0% Min.: -999.9 Max.: 999.9	*158*
H4-04 (0420)	Multi-Function Analog Output Terminal AM Monitor Selection	Terminal AM Sel	Selects the data to be output through multi-function analog output terminal AM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter "103" for U1-03.	Default: 103 Range: 000 to 999	*157*
H4-05 (0421) ⟨RUN⟩	Multi-Function Analog Output Terminal AM Gain	Terminal AM Gain	Sets the signal level at terminal AM that is equal to 100% of the selected monitor value.	Default: 50.0% Min.: -999.9 Max.: 999.9	*158*
H4-06 (0422) ⟨RUN⟩	Multi-Function Analog Output Terminal AM Bias	Terminal AM Bias	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	*158*

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H4-07 (0423)	Multi-Function Analog Output Terminal FM Signal Level Selection	Term FM Lvl Sel 0: 0-10 VDC 1: -10 +10 VDC 2: 4-20 mA	0: 0 to 10 V 1: -10 to 10 V 2: 4 to 20 mA	Default: 0 Range: 0 to 2	*159*
H4-08 (0424)	Multi-Function Analog Output Terminal AM Signal Level Selection	Term AM Lvl Sel 0: 0-10 VDC 1: -10 +10 VDC 2: 4-20 mA	0: 0 to 10 V 1: -10 to 10 V 2: 4 to 20 mA	Default: 0 Range: 0 to 2	*159*

◆ H5: MEMOBUS/Modbus Serial Communication

Note: Restart the drive to enable MEMOBUS/Modbus communication settings.

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H5-01 (0425) <1>	Drive Node Address	Serial Comm Adr	Selects drive station node number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect.	Default: 1F (Hex) Min.: 0 Max.: FF	–
H5-02 (0426)	Communication Speed Selection	Serial Baud Rate 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19.2 kbps 5: 38.4 kbps 6: 57.6 kbps 7: 76.8 kbps 8: 115.2 kbps	0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps **Note:** Cycle power for the setting to take effect.	Default: 3 Range: 0 to 8	–
H5-03 (0427)	Communication Parity Selection	Serial Com Sel 0: No Parity 1: Even Parity 2: Odd Parity	0: No parity 1: Even parity 2: Odd parity **Note:** Cycle power for the setting to take effect.	Default: 0 Range: 0 to 2	–
H5-04 (0428)	Stopping Method after Communication Error (CE)	Serial Fault Sel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0: Ramp to stop 1: Coast to stop 2: Fast Stop 3: Alarm only	Default: 3 Range: 0 to 3	–
H5-05 (0429)	Communication Fault Detection Selection	Serial Flt Dtct 0: Disabled 1: Enabled	0: Disabled 1: Enabled. If communication is lost for more than two seconds, a CE fault will occur.	Default: 1 Range: 0, 1	–
H5-06 (042A)	Drive Transmit Wait Time	Transmit WaitTIM	Set the wait time between receiving and sending data. **Note:** Cycle power for the setting to take effect.	Default: 5 ms Min.: 5 Max.: 65	–
H5-07 (042B)	RTS Control Selection	RTS Control Sel 0: Disabled 1: Enabled	0: Disabled. RTS is always on. 1: Enabled. RTS turns on only when sending. **Note:** Cycle power for the setting to take effect.	Default: 1 Range: 0, 1	–
H5-09 (0435)	CE Detection Time	CE Detect Time	Sets the time required to detect a communications error. Adjustment may be needed when networking several drives.	Default: 2.0 s Min.: 0.0 Max.: 10.0	–
H5-10 (0436)	Unit Selection for MEMOBUS/Modbus Register 0025H	CommReg 25h Unit 0: 0.1 V 1: 1 V	0: 0.1 V units 1: 1 V units	Default: 0 Range: 0, 1	–
H5-11 (043C)	Communications ENTER Function Selection	Enter CommandSel 0: Enter Required 1: No EnterRequired	0: Drive requires an Enter command before accepting any changes to parameter settings. 1: Parameter changes are activated immediately without the Enter command (same as V7).	Default: 0 Range: 0, 1	–
H5-12 (043D)	Run Command Method Selection	Run CommandSel 0: FWD Run &REV Run 1: Run & FWD/REV	0: FWD/Stop, REV/Stop 1: Run/Stop, FWD/REV	Default: 0 Range: 0, 1	–

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H5-17 (11A1) <2>	Operation Selection when Unable to Write into EEPROM	Busy Enter Sel 0: No ROM Enter 1: RAM Enter	Selects operation when an attempt is made to write data into EEPROM via MEMOBUS/Modbus communications and writing into EEPROM is not possible. There is normally no need to change this parameter from the default value 0: Cannot write into EEPROM 1: Write in RAM only	Default: 0 Range: 0, 1	–
H5-18 (11A2) <3>	Filter Time Constant for Motor Speed Monitoring	MtrSpd Monitor T	Sets the filter time constant for monitoring the motor speed from MEMOBUS/Modbus communications and communication options. Applicable MEMOBUS/Modbus registers are: 3EH, 3FH, 44H, ACH, and ADH **Note:** Parameter is not available in models 4A0930 and 4A1200.	Default: 0 ms Min.: 0 Max.: 100	–

<1> If this parameter is set to 0, the drive will be unable to respond to MEMOBUS/Modbus commands.

<2> Available in drive software versions PRG: 1018 and later.

<3> Available in drive software versions PRG: 1019 and later.

◆ H6: Pulse Train Input/Output

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H6-01 (042C)	Pulse Train Input Terminal RP Function Selection	Term RP Func Sel 0: Frequency Ref 1: PID Feedback 2: PID Set Point 3: PG Feedback	0: Frequency reference 1: PID feedback value 2: PID setpoint value 3: V/f Control with Simple PG feedback (possible only when using motor 1 in V/f Control)	Default: 0 Range: 0 to 3	–
H6-02 (042D) ⚙RUN	Pulse Train Input Scaling	Term RP Scaling	Sets the terminal RP input signal frequency that is equal to 100% of the value selected in H6-01.	Default: 1440 Hz Min.: 100 Max.: 32000	–
H6-03 (042E) ⚙RUN	Pulse Train Input Gain	Terminal RP Gain	Sets the level of the value selected in H6-01 when a frequency with the value set in H6-02 is input.	Default: 100.0% Min.: 0.0 Max.: 1000.0	–
H6-04 (042F) ⚙RUN	Pulse Train Input Bias	Terminal RP Bias	Sets the level of the value selected in H6-01 when 0 Hz is input.	Default: 0.0% Min.: -100.0 Max.: 100.0	–
H6-05 (0430) ⚙RUN	Pulse Train Input Filter Time	Term RP Flt Time	Sets the pulse train input filter time constant.	Default: 0.10 s Min.: 0.00 Max.: 2.00	–
H6-06 (0431) ⚙RUN	Pulse Train Monitor Selection	Term MP Func Sel	Select the pulse train monitor output function (value of the □-□□ part of U□-□□). For example, enter "501" for U5-01.	Default: 102 Range: 000 to 809	–
H6-07 (0432) ⚙RUN	Pulse Train Monitor Scaling	Term RP Scaling	Sets the terminal MP output signal frequency when the monitor value is 100%. For example, to have the pulse train monitor output equal the output frequency, set H6-06 to 102 and H6-07 to 0.	Default: 1440 Hz Min.: 0 Max.: 32000	–
H6-08 (043F)	Pulse Train Input Minimum Frequency	MP Lower Limit	Sets the minimum frequency for the pulse train input to be detected. Enabled when H6-01 = 0, 1, or 2.	Default: 0.5 Hz Min.: 0.1 Max.: 1000.0	–

B.8   L: Protection Function

L parameters provide protection to the drive and motor, including control during momentary power loss, stall prevention, frequency detection, fault restarts, overtorque and undertorque detection, and other types of hardware protection.

◆ L1: Motor Protection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L1-01 (0480)	Motor Overload Protection Selection	Mtr OL Charact 0: OL1 Disabled 1: VT Motor 2: CT Motor 3: Vector Motor 4: PM Motor 5: Constant Torque 6: 50Hz VT Motor	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 4: PM motor with variable torque 5: PM motor with constant torque control 6: General purpose motor (50 Hz) The drive may not be able to provide protection when using multiple motors, even if overload is enabled in L1-01. Set L1-01 to 0 and install separate thermal relays to each motor.	Default: [1] Range: 0 to 6	–
L1-02 (0481)	Motor Overload Protection Time	MOL Time Const	Sets the motor thermal overload protection (oL1) time.	Default: 1.0 min Min.: 0.1 Max.: 5.0	–
L1-03 (0482)	Motor Overheat Alarm Operation Selection (PTC input)	Mtr OH Alarm Sel 0 : Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm only	Sets operation when the motor temperature analog input (H3-02, H3-10, or H3-06 = E) exceeds the oH3 alarm level. 0: Ramp to stop 1: Coast to stop 2: Fast Stop (decelerate to stop using the deceleration time in C1-09) 3: Alarm only ("oH3" will flash)	Default: 3 Range: 0 to 3	–
L1-04 (0483)	Motor Overheat Fault Operation Selection (PTC input)	Mtr OH Fault Sel 0 : Ramp to Stop 1: Coast to Stop 2: Fast-Stop	Sets stopping method when the motor temperature analog input (H3-02, H3-10, or H3-06 = E) exceeds the oH4 fault level. 0: Ramp to stop 1: Coast to stop 2: Fast Stop (decelerate to stop using the deceleration time in C1-09)	Default: 1 Range: 0 to 2	–
L1-05 (0484)	Motor Temperature Input Filter Time (PTC input)	Mtr Temp Filter	Adjusts the filter for the motor temperature analog input (H3-02, H3-10, or H3-06 = E).	Default: 0.20 s Min.: 0.00 Max.: 10.00	–
L1-08 (1103) [2]	oL1 Current Level	OL1 current lvl1	Sets the reference current for motor thermal overload detection for motor 1 in amperes. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0.0 A Min.: 10% of drive rated current Max.: 150% of drive rated current [3]	–
L1-09 (1104) [2]	oL1 Current Level for Motor 2	OL1 current lvl2	Sets the reference current for motor thermal overload detection for motor 2 in amperes. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0.0 A Min.: 10% of drive rated current Max.: 150% of drive rated current [3]	–
L1-13 (046D)	Continuous Electrothermal Operation Selection	Mtr OL Mem Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 1 Range: 0, 1	–
L1-15 (0440)	Motor 1 Thermistor Selection (NTC)	M1 OH5 Fault Sel	0: Disabled 1: Enabled **Note:** This parameter is only available in models 4A0930 and 4A1200.	Default: 0 Range: 0, 1	–
L1-16 (0441)	Motor 1 Overheat Temperature	M1 OH5 level	Sets the temperature for motor 1 that triggers an overheat fault (oH5). **Note:** This parameter is only available in models 4A0930 and 4A1200.	Default: 120 °C Min.: 50 Max.: 200	–

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L1-17 (0442)	Motor 2 Thermistor Selection (NTC)	M2 OH5 Fault Sel	0: Disabled 1: Enabled **Note:** This parameter is only available in models 4A0930 and 4A1200.	Default: 0 Range: 0, 1	–
L1-18 (0443)	Motor 2 Overheat Temperature	M2 OH5 level	Sets the temperature for motor 1 that triggers an overheat fault (oH5). **Note:** This parameter is only available in models 4A0930 and 4A1200.	Default: 120 °C Min.: 50 Max.: 200	–
L1-19 (0444)	Operation at Thermistor Disconnect (THo) (NTC)	Tho Stop sel	Determines drive response when a thermistor disconnect fault (THo) occurs. 0: Ramp to stop 1: Coast to stop 2: Fast Stop (decelerate to stop using the deceleration time set to C1-09) 3: Alarm only ("THo" will flash) **Note:** This parameter is only available in models 4A0930 and 4A1200.	Default: 3 Range: 0 to 3	–
L1-20 (0445)	Operation at Motor Overheat (oH5)	OH5 Stop sel	Determines drive response when a motor overheat fault (oH5) occurs. 0: Ramp to stop 1: Coast to stop 2: Fast Stop (decelerate to stop using the deceleration time set to C1-09) 3: Alarm only ("oH5" will flash) **Note:** This parameter is only available in models 4A0930 and 4A1200.	Default: 1 Range: 0 to 3	–

<1> Default setting is determined by parameter A1-02, Control Method Selection.

<2> Available in drive software versions PRG: 1019 and later.

<3> Display is in the following units:
    2A0004 to 2A0040, 4A0002 to 4A0023, and 5A0007 to 5A0017: 0.01 A units.
    2A0056 to 2A0415, 4A0031 to 4A0675, and 5A0022 to 5A0242: 0.1 A units.

◆ L2: Momentary Power Loss Ride-Thru

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L2-01 (0485)	Momentary Power Loss Operation Selection	PwrL Selection 0: Disabled 1: Enbl with Timer 2: Enbl whl CPU act 3: KEB Mode 4: KEB Stop Mode 5: KEB Decel to Stp	0: Disabled. Drive trips on Uv1 fault when power is lost. 1: Recover within the time set in L2-02. Uv1 will be detected if power loss is longer than L2-02. 2: Recover as long as CPU has power. Uv1 is not detected. 3: KEB deceleration for the time set to L2-02. 4: KEB deceleration as long as CPU has power. 5: KEB deceleration to stop.	Default: 0 Range: 0 to 5	–
L2-02 (0486)	Momentary Power Loss Ride-Thru Time	PwrL Ridethru t	Sets the Power Loss Ride-Thru time. Enabled only when L2-01 = 1 or 3.	Default: *<1>* Min.: 0.0 s Max.: 25.5 s	–
L2-03 (0487)	Momentary Power Loss Minimum Baseblock Time	PwrL Baseblock t	Sets the minimum wait time for residual motor voltage decay before the drive output reenergizes after performing Power Loss Ride-Thru. Increasing the time set to L2-03 may help if overcurrent or overvoltage occur during Speed Search or during DC Injection Braking.	Default: *<1>* Min.: 0.1 s Max.: 5.0 s	–
L2-04 (0488)	Momentary Power Loss Voltage Recovery Ramp Time	PwrL V/F Ramp t	Sets the time for the output voltage to return to the preset V/f pattern during Speed Search.	Default: *<1>* Min.: 0.0 s Max.: 5.0 s	–
L2-05 (0489)	Undervoltage Detection Level (Uv1)	PUV Det Level	Sets the DC bus undervoltage trip level.	Default: 190 Vdc *<2> <3>* Min.: 150 Vdc Max.: 210 Vdc *<3>*	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L2-06 (048A)	KEB Deceleration Time	KEB Decel Time	Sets the time required to decelerate from the speed when KEB was activated to zero speed.	Default: 0.00 s Min.: 0.00 Max.: 6000.0 [4]	–
L2-07 (048B)	KEB Acceleration Time	KEB Accel Time	Sets the time to accelerate to the frequency reference when momentary power loss is over. If set to 0.0, the active acceleration time (C1-01, C1-03, C1-05, or C1-07) is used.	Default: 0.00 s Min.: 0.00 Max.: 6000.0 [4]	–
L2-08 (048C)	Frequency Gain at KEB Start	KEB Freq Red	Sets the percentage of output frequency reduction at the beginning of deceleration when the KEB Ride-Thru function is started. Reduction = (slip frequency before KEB) × (L2-08/100) × 2	Default: 100% Min.: 0 Max.: 300	–
L2-10 (048E)	KEB Detection Time (Minimum KEB Time)	KEB Detect Time	Sets the time to perform KEB Ride-Thru.	Default: 50 ms Min.: 0 Max.: 2000	–
L2-11 (0461)	DC Bus Voltage Setpoint during KEB	KEB DC Bus Level	Sets the desired value of the DC bus voltage during KEB Ride-Thru.	Default: [2] Min.: 150 Vdc Max.: 400 Vdc [5]	–
L2-29 (0475)	KEB Method Selection	KEB Mode Sel 0: Single Mode KEB1 1: Single Mode KEB2 2: System Mode KEB1 3: System Mode KEB2	0: Single Drive KEB Ride-Thru 1 1: Single Drive KEB Ride-Thru 2 2: System KEB Ride-Thru 1 3: System KEB Ride-Thru 2	Default: 0 Range: 0 to 3	–

<1> Default setting is determined by parameters C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.

<2> Default setting is determined by parameter E1-01, Input voltage Setting.

<3> Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives.

<4> Setting range value is dependent on parameter C1-10, Accel/Decel Time Setting Units. When C1-10 = 0 (units of 0.01 seconds), the setting range becomes 0.00 to 600.00 seconds.

<5> Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives, but set the value below 1040 Vdc (overvoltage protection level).

◆ L3: Stall Prevention

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L3-01 (048F)	Stall Prevention Selection during Acceleration	StallP Accel Sel 0: Disabled 1: General Purpose 2: Intelligent	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. **Note:** Setting 2 is not available when using OLV/PM.	Default: 1 Range: 0 to 2	*159*
L3-02 (0490)	Stall Prevention Level during Acceleration	StallP Accel Lvl	Used when L3-01 = 1 or 2. 100% is equal to the drive rated current.	Default: [1] Min.: 0% Max.: 150% [1]	*160*
L3-03 (0491)	Stall Prevention Limit during Acceleration	StallPAcc LowLim	Sets Stall Prevention lower limit during acceleration when operating in the constant power range. Set as a percentage of drive rated current.	Default: 50% Min.: 0 Max.: 100	*161*

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L3-04 (0492)	Stall Prevention Selection during Deceleration	StallP Decel Sel 0: Disabled 1: General Purpose 2: Intelligent 3: StallP +Resistor 4: High Flux Brake 5: High Flux Brake2	0: Disabled. Deceleration at the active deceleration rate. An ov fault may occur. 1: General purpose. Deceleration is paused when the DC bus voltage exceeds the Stall Prevention level. 2: Intelligent. Decelerate as fast as possible while avoiding ov faults. 3: Stall Prevention with braking resistor. Stall Prevention during deceleration is enabled in coordination with dynamic braking. 4: Overexcitation Deceleration. Decelerates while increasing the motor flux. 5: Overexcitation Deceleration 2. Adjust the deceleration rate according to the DC voltage. **Note:** Setting 3 is not available in models 4A0930 and 4A1200.	Default: 1 Range: 0 to 5 [2]	*161*
L3-05 (0493)	Stall Prevention Selection during Run	StallP Run Sel 0: Disabled 1: Decel Time 1 2: Decel Time 2	0: Disabled. Drive runs at a set frequency. A heavy load may cause stalling. 1: Decel time 1. Uses the deceleration time set to C1-02 while Stall Prevention is performed. 2: Decel time 2. Uses the deceleration time set to C1-04 while Stall Prevention is performed.	Default: 1 Range: 0 to 2	*162*
L3-06 (0494)	Stall Prevention Level during Run	StallP Run Level	Enabled when L3-05 is set to 1 or 2. 100% is equal to the drive rated current.	Default: [1] Min.: 30% Max.: 150% [1]	*163*
L3-11 (04C7)	Overvoltage Suppression Function Selection	OV Inhibit Sel 0: Disabled 1: Enabled	Enables or disables the ov suppression function, which allows the drive to change the output frequency as the load changes to prevent an ov fault. 0: Disabled 1: Enabled	Default: 0 Range: 0, 1	–
L3-17 (0462)	Target DC Bus Voltage for Overvoltage Suppression and Stall Prevention	DC Bus Reg Level	Sets the desired value for the DC bus voltage during overvoltage suppression and Stall Prevention during deceleration.	Default: 375 Vdc [3] [8] Min.: 150 Max.: 400 [8]	–
L3-20 (0465)	DC Bus Voltage Adjustment Gain	DC Bus P Gain	Sets the proportional gain for KEB Ride-Thru, Stall Prevention, and overvoltage suppression.	Default: [4] Min.: 0.00 Max.: 5.00	–
L3-21 (0466)	Accel/Decel Rate Calculation Gain	Acc/Dec P Gain	Sets the proportional gain used to calculate the deceleration rate during KEB Ride-Thru, ov suppression function, and Stall Prevention during deceleration (L3-04 = 2).	Default: 1.00 Min.: 0.10 Max.: 10.00	–
L3-22 (04F9)	Deceleration Time at Stall Prevention during Acceleration	PM Acc Stall P T	Sets the deceleration time used for Stall Prevention during acceleration in OLV/PM.	Default: 0.0 s Min.: 0.0 Max.: 6000.0	–
L3-23 (04FD)	Automatic Reduction Selection for Stall Prevention during Run	CHP Stall P Sel 0: Lv1 set in L3-06 1: Autom. Reduction	0: Sets the Stall Prevention level set in L3-04 that is used throughout the entire frequency range. 1: Automatic Stall Prevention level reduction in the constant output range. The lower limit value is 40% of L3-06.	Default: 0 Range: 0, 1	–
L3-24 (046E)	Motor Acceleration Time for Inertia Calculations	Mtr Accel Time	Sets the time needed to accelerate the uncoupled motor at rated torque from stop to the maximum frequency.	Default: [5] [6] [7] Min: 0.001 s Max: 10.000 s	–
L3-25 (046F)	Load Inertia Ratio	Load Inertia Rat	Sets the ratio between the motor and machine inertia.	Default: 1.0 Min.: 1.0 Max.: 1000.0	–
L3-26 (0455)	Additional DC Bus Capacitors	ExtDC busCapSize	When DC bus capacitors have been added externally, be sure to add those values to the internal capacitor table for proper DC bus calculations.	Default: 0 μF Min: 0 Max: 65000	–
L3-27 (0456)	Stall Prevention Detection Time	Stl Prev DetTime	Sets the time the current must exceed the Stall Prevention level to activate Stall Prevention.	Default: 50 ms Min.: 0 Max.: 5000	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L3-34 (016F)	Torque Limit Delay Time	TRQ Dly Filter T	Sets the filter time constant in seconds for the torque limit value to return to set value when the Power KEB Ride-Thru is enabled (L2-29 = 1). If oscillation occurs during Power KEB Ride-Thru, gradually increase this setting in increments of 0.010 s. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: [9] Min.: 0.000 Max.: 1.000	–
L3-35 (0747) [10]	Speed Agree Width at Intelligent Stall Prevention during Deceleration	IntDecSpdAgrWdth	Sets the width of the speed agree when L3-04 = 2 (Intelligent Stall Prevention during deceleration) in units of 0.01 Hz. There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0.00 Hz Min.: 0.00 Max.: 1.00	–

<1> The default setting and upper limit are determined by C6-01, Drive Duty Selection, and L8-38, Frequency Reduction Selection.

<2> The setting range is 0 to 2 in OLV/PM control mode. The setting range is 0 and 1 in CLV or AOLV/PM control modes.

<3> Default setting is determined by parameter E1-01, Input voltage Setting.

<4> Default setting is determined by parameter A1-02, Control Method Selection.

<5> Parameter value changes automatically if E2-11 is manually changed or changed by Auto-Tuning.

<6> Default setting is determined by parameters C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.

<7> Default setting is determined by parameter E5-01, Motor Code Selection.

<8> Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives, but set the value below 1040 Vdc (overvoltage protection level).

<9> Default setting is determined by parameter A1-02, Control Method Selection.
When A1-02 = 6 (AOLV/PM), default is 0.2
When A1-02 = 7 (CLV/PM), default is 0.02.

<10> Available in drive software versions PRG: 1018 and later.

◆ L4: Speed Detection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L4-01 (0499)	Speed Agree Detection Level	Spd Agree Level	L4-01 sets the frequency detection level for digital output functions H2-□□ = 2, 3, 4, 5.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	–
L4-02 (049A)	Speed Agree Detection Width	Spd Agree Width	L4-02 sets the hysteresis or allowable margin for speed detection.	Default: [1] Min.: 0.0 Max.: 20.0	–
L4-03 (049B)	Speed Agree Detection Level (+/-)	Spd Agree Lvl+-	L4-03 sets the frequency detection level for digital output functions H2-□□ = 13, 14, 15, 16.	Default: 0.0 Hz Min.: -400.0 Max.: 400.0	–
L4-04 (049C)	Speed Agree Detection Width (+/-)	Spd Agree Wdth+-	L4-04 sets the hysteresis or allowable margin for speed detection.	Default: [1] Min.: 0.0 Max.: 20.0	–
L4-05 (049D)	Frequency Reference Loss Detection Selection	Ref Loss Sel 0: Stop 1: Run@L4-06PrevRef	0: Operate following the frequency reference. 1: Continue operation with reduced frequency reference.	Default: 0 Range: 0, 1	–
L4-06 (04C2)	Frequency Reference at Reference Loss	Fref at Floss	Sets the percentage of the frequency reference that the drive should run with when the frequency reference is lost.	Default: 80.0% Min.: 0.0 Max.: 100.0	–
L4-07 (0470)	Speed Agree Detection Selection	Freq Detect Sel 0: No Detection @BB 1: Always Detected	0: No detection during baseblock. 1: Detection always enabled.	Default: 0 Range: 0, 1	–

<1> Default setting is determined by parameter A1-02, Control Method Selection.

Parameter List

B

◆ L5: Fault Restart

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L5-01 (049E)	Number of Auto Restart Attempts	Num of Restarts	Sets the number of times the drive may attempt to restart after the following faults occur: GF, LF, oC, oH1, ov, PF, rH, rr, oL1, oL2, oL3, oL4, STo, Uv1.	Default: 0 Min.: 0 Max.: 10	–
L5-02 (049F)	Auto Restart Fault Output Operation Selection	Restart Sel 0: Flt Outp Disabld 1: Flt Outp Enabled	0: Fault output not active. 1: Fault output active during restart attempt.	Default: 0 Range: 0, 1	–
L5-04 (046C)	Fault Reset Interval Time	Flt Reset Wait T	Sets the amount of time to wait between performing fault restarts.	Default: 10.0 s Min.: 0.5 Max.: 600.0	–
L5-05 (0467)	Fault Reset Operation Selection	Fault Reset Sel 0: Continuous 1: Use L5-04 Time	0: Continuously attempt to restart while incrementing restart counter only at a successful restart (same as F7 and G7). 1: Attempt to restart with the interval time set in L5-04 and increment the restart counter with each attempt (same as V7).	Default: 0 Range: 0, 1	–

◆ L6: Torque Detection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L6-01 (04A1)	Torque Detection Selection 1	Torq Det 1 Sel 0: Disabled 1: OL Alm at SpdAgr 2: OL Alm dur RUN 3: OL Flt at SpdAgr 4: OL Flt dur RUN 5: UL Alm at SpdAgr 6: UL Alm dur RUN 7: UL Flt at SpdAgr 8: UL Flt dur RUN	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 a UL3 fault 8: UL3 detection always active during run, output shuts down on a UL3 fault	Default: 0 Range: 0 to 8	–
L6-02 (04A2)	Torque Detection Level 1	Torq Det 1 Lvl	Sets the overtorque and undertorque detection level.	Default: 150% Min.: 0 Max.: 300	–
L6-03 (04A3)	Torque Detection Time 1	Torq Det 1 Time	Sets the time an overtorque or undertorque condition must exist to trigger torque detection 1.	Default: 0.1 s Min.: 0.0 Max.: 10.0	–
L6-04 (04A4)	Torque Detection Selection 2	Torq Det 2 Sel 0: Disabled 1: OL Alm at SpdAgr 2: OL Alm dur RUN 3: OL Flt at SpdAgr 4: OL Flt dur RUN 5: UL Alm at SpdAgr 6: UL Alm dur RUN 7: UL Flt at SpdAgr 8: UL Flt dur RUN	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 a UL4 fault 8: UL4 detection always active during run, output shuts down on a UL4 fault	Default: 0 Range: 0 to 8	–
L6-05 (04A5)	Torque Detection Level 2	Torq Det 2 Lvl	Sets the overtorque and undertorque detection level.	Default: 150% Min.: 0 Max.: 300	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L6-06 (04A6)	Torque Detection Time 2	Torq Det 2 Time	Sets the time an overtorque or undertorque condition must exist to trigger torque detection 2.	Default: 0.1 s Min.: 0.0 Max.: 10.0	–
L6-08 (0468)	Mechanical Weakening Detection Operation	Mech Fatigue Sel 0: Disabled 1: Alm Spd>L6-09 2: Alm [Spd]>L6-09 3: Flt Spd>L6-09 4: Flt [Spd]>L6-09 5: Alm Spd<L6-09 6: Alm [Spd]<L6-09 7: Flt Spd<L6-09 8: Flt [Spd]<L6-09	This function can detect an overtorque or undertorque in a certain speed range as a result of machine fatigue. It is triggered by a specified operation time and uses the oL3/UL3 detection settings (L6-01, L6-02, and L6-03). 0: Mechanical Weakening Detection disabled. 1: Continue running (alarm only). Detected when the speed (signed) is greater than L6-09. 2: Continue running (alarm only). Detected when the speed (not signed) is greater than L6-09. 3: Interrupt drive output (fault). Detected when the speed (signed) is greater than L6-09. 4: Interrupt drive output (fault). Detected when the speed (not signed) is greater than L6-09. 5: Continue running (alarm only). Detected when the speed (signed) is less than L6-09. 6: Continue running (alarm only). Detected when the speed (not signed) is less than L6-09. 7: Interrupt drive output (fault). Detected when the speed (signed) is less than L6-09. 8: Interrupt drive output (fault). Detected when the speed (not signed) is less than L6-09.	Default: 0 Range: 0 to 8	–
L6-09 (0469)	Mechanical Weakening Detection Speed Level	MechFat Det Spd	Sets the speed that triggers Mechanical Weakening Detection. When L6-08 is set for an unsigned value, the absolute value is used if the setting is negative.	Default: 110.0% Min.: -110.0 Max.: 110.0	–
L6-10 (046A)	Mechanical Weakening Detection Time	MechFat Det Time	Sets the time mechanical weakening has to be detected before an alarm or fault is triggered.	Default: 0.1 s Min.: 0.0 Max.: 10.0	–
L6-11 (046B)	Mechanical Weakening Detection Start Time	MechFat Det Hour	Sets the operation time (U4-01) required before Mechanical Weakening Detection is active.	Default: 0 h Min.: 0 Max.: 65535	–

◆ L7: Torque Limit

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L7-01 (04A7)	Forward Torque Limit	Torq Limit Fwd	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	*163*
L7-02 (04A8)	Reverse Torque Limit	Torq Limit Rev		Default: 200% Min.: 0 Max.: 300	*163*
L7-03 (04A9)	Forward Regenerative Torque Limit	Torq Lmt Fwd Rgn		Default: 200% Min.: 0 Max.: 300	*163*
L7-04 (04AA)	Reverse Regenerative Torque Limit	Torq Lmt Rev Rgn		Default: 200% Min.: 0 Max.: 300	*163*
L7-06 (04AC)	Torque Limit Integral Time Constant	Trq Lim I Time	Sets the integral time constant for the torque limit.	Default: 200 ms Min: 5 Max: 10000	–
L7-07 (04C9)	Torque Limit Control Method Selection during Accel/Decel	Trq Lim d AccDec P-ctrl @ Acc/Dec I-ctrl @ Acc/Dec	0: Proportional control (changes to integral control at constant speed). Use this setting when acceleration to the desired speed should take precedence over the torque limit. 1: Integral control. Set L7-07 to 1 if the torque limit should take precedence.	Default: 0 Range: 0, 1	–
L7-16 (044D) *<1>*	Torque Limit Process at Start	TLim DlyTime Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 1 Range: 0, 1	–

<1> Available in drive software versions PRG: 1018 and later.

Parameter List

B

◆ L8: Drive Protection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L8-01 (04AD)	Internal Dynamic Braking Resistor Protection Selection (ERF type)	DB Resistor Prot 0: Not Provided 1: Provided	0: Resistor overheat protection disabled 1: Resistor overheat protection enabled **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0 Range: 0, 1	–
L8-02 (04AE)	Overheat Alarm Level	OH Pre-Alarm Lvl	An overheat alarm occurs when heatsink temperature exceeds the L8-02 level.	Default: [1] Min.: 50 °C Max.: 150 °C	–
L8-03 (04AF)	Overheat Pre-Alarm Operation Selection	OH Pre-Alarm Sel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only 4: Run@L8-19 Rate	0: Ramp to stop. A fault is triggered. 1: Coast to stop. A fault is triggered. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. A fault is triggered. 3: Continue operation. An alarm is triggered. 4: Continue operation at reduced speed as set in L8-19.	Default: 3 Range: 0 to 4	–
L8-05 (04B1)	Input Phase Loss Protection Selection	Inp Ph Loss Det 0: Disabled 1: Enabled	Selects the detection of input current phase loss, power supply voltage imbalance, or main circuit electrolytic capacitor deterioration. 0: Disabled 1: Enabled	Default: 1 Range: 0, 1	–
L8-07 (04B3)	Output Phase Loss Protection Selection	Outp Ph Loss Det 0: Disabled 1: 1PH Loss Det 2: 2/3PH Loss Det	0: Disabled 1: Enabled (triggered by a single phase loss) 2: Enabled (triggered when two phases are lost)	Default: 1 Range: 0 to 2	–
L8-09 (04B5)	Output Ground Fault Detection Selection	Grnd Flt Det Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: [1] Range: 0, 1	–
L8-10 (04B6)	Heatsink Cooling Fan Operation Selection	Fan On/Off Sel 0: Dur Run (OffDly) 1: Always On	0: Run with timer (Fan operates only during run and for L8-11 seconds after stop.) 1: Run always (Cooling fan operates whenever the drive is powered up.)	Default: 0 Range: 0, 1	–
L8-11 (04B7)	Heatsink Cooling Fan Off Delay Time	Fan Delay Time	Sets a delay time to shut off the cooling fan after the Run command is removed when L8-10 = 0.	Default: 60 s Min.: 0 Max.: 300	–
L8-12 (04B8)	Ambient Temperature Setting	Ambient Temp	Enter the ambient temperature. This value adjusts the oL2 detection level.	Default: 40 °C Min.: -10 Max.: 50	–
L8-15 (04BB)	oL2 Characteristics Selection at Low Speeds	OL2 Sel @ L-Spd 0: Disabled 1: Enabled	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 Range: 0, 1	–
L8-18 (04BE)	Software Current Limit Selection	Soft CLA Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 0 Range: 0, 1	–
L8-19 (04BF)	Frequency Reduction Rate during Overheat Pre-Alarm	Fc Red dur OHAlm	Specifies the frequency reference reduction gain at overheat pre-alarm when L8-03 = 4.	Default: 0.8 Min.: 0.1 Max.: 0.9	–
L8-27 (04DD)	Overcurrent Detection Gain	OC Level	Sets the gain for overcurrent detection as a percentage of the motor rated current. Overcurrent is detected using the lower value between the overcurrent level of the drive or the value set to L8-27.	Default: 300.0% Min.: 0.0 Max.: 400.0	–
L8-29 (04DF)	Current Unbalance Detection (LF2)	LF2 Flt Det Sel 0: Disabled 1: Current&Voltage 2: Current Det Type 3: Voltage Det Type	For models 2A0004 to 2A0415, 4A0002 to 4A0675, and 5A0003 to 5A0242: 0: Disabled 1: Enabled (current and voltage detection) 2: Enabled (current detection) 3: Enabled (voltage detection) For models 4A0930 and 4A1200: 0: Disabled 1: Enabled (current detection)	Default: 1 Range: 0 to 3 Range: 0, 1	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L8-32 (04E2)	Cooling Fan Failure Selection	MC/FAN PS FltSel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only 4: Run@L8-19 Rate	Determines drive response when a fault occurs with the internal cooling fan. 0: Ramp to stop 1: Coast to stop 2: Fast stop (Decel to stop using the decel time set in C1-09) 3: Alarm only ("FAn" will flash) 4: Continue operation at reduced speed as set in L8-19.	Default: 1 Range: 0 to 4	–
L8-35 (04EC)	Installation Method Selection	Installation Sel 0: IP00/OpenChassis 1: Side-by-Side 2: IP20/Nema Type 1 3: Finless/Fin Ext	0: IP00/Open-Chassis enclosure 1: Side-by-Side mounting 2: IP20/NEMA 1, UL Type 1 enclosure 3: Finless model drive or external heatsink installation	Default: [2] Range: 0 to 3	–
L8-38 (04EF)	Carrier Frequency Reduction	Fc Reduct dur OL 0: Disabled 1: Active below 6Hz 2: Active @ any Spd	0: Disabled 1: Enabled below 6 Hz 2: Enabled for the entire speed range	Default: [3] Range: 0 to 2	–
L8-40 (04F1)	Carrier Frequency Reduction Off Delay Time	Fc Reduct Time	Sets the time that the drive continues running with reduced carrier frequency after the carrier reduction condition is gone. Setting 0.00 s disables the carrier frequency reduction time.	Default: [4] Min.: 0.00 s Max.: 2.00 s	–
L8-41 (04F2)	High Current Alarm Selection	High Cur Alm Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled. An alarm is triggered at output currents above 150% of drive rated current.	Default: 0 Range: 0, 1	–
L8-55 (045F)	Internal Braking Transistor Protection	DB Tr protection 0: Disable 1: Enable	0: Disabled. Disable when using a regen converter or optional braking unit. 1: Protection enabled. Note: This parameter is not available in models 4A0930 and 4A1200.	Default: 1 Range: 0, 1	–
L8-78 (02CC)	Power Unit Output Phase Loss Protection	LF3 Det Sel 0: Disabled 1: Enabled	Enables motor protection in the event of output phase loss. 0: Disabled 1: Enabled Note: This parameter is only available in models 4A0930 and 4A1200.	Default: 1 Range: 0, 1	–
L8-93 (073C)	LSo Detection Time at Low Speed	LSO Det Time	Sets the amount of time until baseblock is executed after detecting pull-out at low speed.	Default: 1.0 s Min.: 0.0 Max.: 10.0	–
L8-94 (073D)	LSo Detection Level at Low Speed	LSO Det Level	Determines the detection level of pull-out at low speed.	Default: 3% Min.: 0 Max.: 10	–
L8-95 (073F)	Average LSo Frequency at Low Speed	Num of LSO Avg	Sets the average number of times pull-out can occur at low speed.	Default: 10 times Min.: 1 Max.: 50	–

<1> Default setting is determined by parameters C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.

<2> Default setting is determined by parameter o2-04, Drive Model Selection.

<3> Default setting is determined by parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.

<4> Default setting is determined by parameter A1-02, Control Method Selection.

◆ L9: Drive Protection 2

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L9-03 (0819) [1]	Carrier Frequency Reduction Level Selection	Fc ReductLvl Sel 0: Disabled 1: Enabled	Selects the level to start frequency reduction or to clear the current frequency level for automatic carrier frequency reduction. There is normally no need to change this parameter from the default value. 0: Reduces the carrier frequency based on the drive rated current that is not derated. 1: Reduces the carrier frequency based on the drive rated current that is derated by the carrier frequency and the temperature selected for C6-02. Note: This parameter is not available in models 4A0930 and 4A1200.	Default: 0 Range: 0, 1	–

<1> Available in drive software versions PRG: 1018 and later.

Parameter List

B

B.9 n: Special Adjustment

The n parameters adjust more advanced performance characteristics such as Hunting Prevention, speed feedback detection, High Slip Braking, and Online Tuning for motor line-to-line resistance.

◆ n1: Hunting Prevention

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n1-01 (0580)	Hunting Prevention Selection	Hunt Prev Select 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 1 Range: 0, 1	–
n1-02 (0581)	Hunting Prevention Gain Setting	Hunt Prev Gain	If the motor vibrates while lightly loaded, increase the gain by 0.1 until vibration ceases. If the motor stalls, decrease the gain by 0.1 until the stalling ceases.	Default: 1.00 Min.: 0.00 Max.: 2.50	–
n1-03 (0582)	Hunting Prevention Time Constant	Hunt Prev Time	Sets the time constant used for Hunting Prevention.	Default: [1] Min.: 0 ms Max.: 500 ms	–
n1-05 (0530)	Hunting Prevention Gain while in Reverse	Hprev Gain @Rev	Sets the gain used for Hunting Prevention. If set to 0, the gain set to n1-02 is used for operation in reverse.	Default: 0.00 Min.: 0.00 Max.: 2.50	–

<1> Default setting is determined by parameter o2-04, Drive Model Selection.

◆ n2: Speed Feedback Detection Control (AFR) Tuning

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n2-01 (0584)	Speed Feedback Detection Control (AFR) Gain	AFR Gain	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	–
n2-02 (0585)	Speed Feedback Detection Control (AFR) Time Constant 1	AFR Time	Sets the time constant used for speed feedback detection control (AFR).	Default: 50 ms Min.: 0 Max.: 2000	–
n2-03 (0586)	Speed Feedback Detection Control (AFR) Time Constant 2	AFR Time 2	Sets the AFR time constant to be used during Speed Search and during regen.	Default: 750 ms Min.: 0 Max.: 2000	–

◆ n3: High Slip Braking (HSB) and Overexcitation Braking

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n3-01 (0588)	High-Slip Braking Deceleration Frequency Width	HSB DecStepWidth	Sets the output frequency reduction step width for when the drive stops the motor using HSB. Set as a percentage of the maximum output frequency. Increase this setting if overvoltage occurs during HSB.	Default: 5% Min.: 1 Max.: 20	–
n3-02 (0589)	High-Slip Braking Current Limit	HSB Current Lim	Sets the current limit during HSB as a percentage of the motor rated current.	Default: [1] Min.: 100% Max.: [1]	–
n3-03 (058A)	High-Slip Braking Dwell Time at Stop	HSB DwelTim@Stp	Sets the time the drive will run with minimum frequency (E1-09) at the end of deceleration. If this time is set too low, the machine inertia can cause the motor to rotate slightly after HSB.	Default: 1.0 s Min.: 0.0 Max.: 10.0	–
n3-04 (058B)	High-Slip Braking Overload Time	HSB OL Time	Sets the time required for an HSB overload fault (oL7) to occur when the drive output frequency does not change during an HSB stop. This parameter does not typically require adjustment.	Default: 40 s Min.: 30 Max.: 1200	–
n3-13 (0531)	Overexcitation Deceleration Gain	Hflux Brake Gain	Sets the gain applied to the V/f pattern during Overexcitation Deceleration (L3-04 = 4).	Default: 1.10 Min.: 1.00 Max.: 1.40	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n3-14 (0532)	High Frequency Injection during Overexcitation Deceleration	HarmInj@HiFlxBrk 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 0 Range: 0, 1	–
n3-21 (0579)	High-Slip Suppression Current Level	Hflux I Supp Lvl	Sets output current level at which the drive will start reducing the overexcitation gain in order to prevent a too high motor slip during Overexcitation Deceleration. Set as a percentage of the drive rated current.	Default: 100% Min.: 0 Max.: 150	–
n3-23 (057B)	Overexcitation Operation Selection	Hflux Brake Sel 0: Enabled-Both Dir 1: Enabled-Fwd only 2: Enabled-Rev only	0: Enabled in both directions 1: Enabled only when rotating forward 2: Enabled only when in reverse	Default: 0 Range: 0 to 2	–

<1> The upper limit of the setting range and default setting are determined by parameters C6-01, Drive Duty Selection, and L8-38, Frequency Reduction Selection.

◆ n5: Feed Forward Control

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n5-01 (05B0)	Feed Forward Control Selection	Feedfoward Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 0 Range: 0, 1	–
n5-02 (05B1)	Motor Acceleration Time	Motor Accel Time	Sets the time required to accelerate the motor at the rated torque from stop to rated speed.	Default: *<1> <2>* Min.: 0.001 s Max.: 10.000 s	–
n5-03 (05B2)	Feed Forward Control Gain	Feedfoward Gain	Sets the ratio between motor and load inertia. Lower this setting if overshoot occurs at the end of acceleration.	Default: 1.00 Min.: 0.00 Max.: 100.00	–

<1> Default setting is determined by parameter E5-01, Motor Code Selection.

<2> Default setting is determined by parameters C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.

◆ n6: Online Tuning

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n6-01 (0570)	Online Tuning Selection	Online Tune Sel	0: Disabled 1: Line-to-line resistance tuning 2: Voltage correction. Setting not possible when Energy Saving is enabled (b8-01).	Default: 0 Range: 0 to 2	–
n6-05 (05C7)	Online Tuning Gain	R1 Comp Gain	Decrease this setting for motors with a relatively large rotor time constant.	Default: 1.0 Min.: 0.1 Max.: 50.0	–

◆ n8: PM Motor Control Tuning

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n8-01 (0540)	Initial Rotor Position Estimation Current	InitRotPosDetCur	Sets the current used for initial rotor position estimation as a percentage of the motor rated current (E5-03). If the motor nameplate lists an "Si" value, that value should be entered here.	Default: 50% Min.: 0 Max.: 100	–
n8-02 (0541)	Pole Attraction Current	Pull-In Current	Sets the current during initial polar attraction as a percentage of the motor rated current. **Note:** This parameter is not available in models 4A0930 and 4A1200 for CLV/PM.	Default: 80% Min.: 0 Max.: 150	–

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n8-03 (0542)	Current Startup Time	CurrentRampTime	Sets the current startup time to detect the rotor pole when tuning the phase-Z pulse position. Set this parameter to a large value if the motor vibrates when tuning the phase-Z pulse position. There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 1.5 Min.: 1.5 Max.: 5.0	–
n8-04 (0543)	Pole Attraction Time	Pull-In Time	Sets the pole attraction time to detect the rotor pole when tuning the phase-Z pulse position. Set this parameter to a large value if the motor vibrates when tuning the phase-Z pulse position. There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 1.5 Min.: 1.5 Max.: 5.0	–
n8-11 (054A) *<1>*	Induction Voltage Estimation Gain 2	InducedVEstGain2	Sets the gain for estimating the speed. There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: *<2>* Min.: 0.0 Max.: 1000.0	–
n8-14 (054D) *<1>*	Polarity Compensation Gain 3	PoleComp Gain 3	Sets the gain for estimating the speed. There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 1.000 Min.: 0.000 Max.: 10.000	–
n8-15 (054E) *<1>*	Polarity Compensation Gain 4	PoleComp Gain 4	Sets the gain for estimating the speed. There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0.500 Min.: 0.000 Max.: 10.000	–
n8-21 (0554) *<1>*	Motor Ke Gain	Back EMF Gain	Sets the gain for estimating the speed. There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 0.90 Min.: 0.80 Max.: 1.00	–
n8-35 (0562)	Initial Rotor Position Detection Selection	Init Pole EstSel 0: Pull-In Method 1: Harm Inj Method 2: Pulse Method	0: Pull-in 1: High frequency injection 2: Pulse injection	Default: 1 Range: 0 to 2	–
n8-36 (0563) *<1>*	High Frequency Injection Level	PM Harm Inj Freq	Sets the frequency in Hz for the superimposed signal used for superimposed harmonics. Enabled when n8-57 = 1. There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 500 Hz Min.: 200 Max.: 1000	–
n8-37 (0564) *<1>*	High Frequency Injection Amplitude	PM Harm Inj Amp	Sets the amplitude for High Frequency Injection as a percentage of the voltage when the voltage class base is 100% (200 V Class is 200 V, 400 V Class is 400 V, and 600 V Class is 575 V). Adjust this value when there is too much or too little current as a result of the settings assigned to motor parameters. Enabled when n8-57 = 1. There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 20.0% Min.: 0.0 Max.: 50.0	–
n8-39 (0566) *<1>*	Low Pass Filter Cutoff Frequency for High Frequency Injection	PM Harm LPF Freq	Sets the cutoff frequency of a low pass filter for high frequency injection. Enabled when n8-57 = 1. There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 50 Hz Min.: 0 Max.: 1000	–
n8-45 (0538)	Speed Feedback Detection Control Gain (for PM Motors)	PM Spd Fdbk Gain	Increase this setting if hunting occurs. Decrease to lower the response.	Default: 0.80 Min.: 0.00 Max.: 10.00	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n8-47 (053A)	Pull-In Current Compensation Time Constant (for PM Motors)	PM Pull-in I Tc	Sets the time constant to make the pull-in current reference and actual current value agree. Decrease the value if the motor begins to oscillate, and increase the value if it takes too long for the current reference to equal the output current.	Default: 5.0 s Min.: 0.0 Max.: 100.0	–
n8-48 (053B)	Pull-In Current (for PM Motors)	PM No-load Curr	Defines the d-Axis current reference during no-load operation at a constant speed. Set as a percentage of the motor rated current. Increase this setting if hunting occurs while running at constant speed.	Default: 30% Min.: 20 Max.: 200	–
n8-49 (053C)	d-Axis Current for High Efficiency Control (for PM Motors)	EnergySav ID Lvl	Sets the d-Axis current reference when running a high load at constant speed. Set as a percentage of the motor rated current.	Default: [3] Min.: -200.0% Max.: 0.0%	–
n8-51 (053E)	Acceleration/ Deceleration Pull-In Current (for PM Motors)	PM Pull-in I@Acc	Sets the d-Axis current reference during acceleration/ deceleration as a percentage of the motor rated current. Set to a high value when more starting torque is needed.	Default: 50% Min.: 0 Max.: 200	–
n8-54 (056D)	Voltage Error Compensation Time Constant	PM V Error CompT	Adjusts the value when hunting occurs at low speed. If hunting occurs with sudden load changes, increase n8-54 in increments of 0.1. Reduce this setting if oscillation occurs at start. Increase this setting if vibration occurs at start.	Default: 1.00 s Min.: 0.00 Max.: 10.00	–
n8-55 (056E)	Load Inertia	PMLoad wk2 Ratio 0: Less than 1:10 1: 1:10 to 1:30 2: 1:30 to 1:50 3: More than 1:50	Sets the ratio between motor and machine inertia. 0: Below 1:10 1: Between 1:10 and 1:30 2: Between 1:30 and 1:50 3: Beyond 1:50	Default: 0 Min.: 0 Max.: 3	–
n8-57 (0574)	High Frequency Injection	PM Harm Inj Sel 0: Disabled 1: Enabled	0: Disabled. Disable when using an SPM motor. 1: Enabled. Use this setting to enhance the speed control range when using an IPM motor.	Default: 0 Range: 0, 1	–
n8-62 (057D)	Output Voltage Limit (for PM Motors)	PM Vout Limit	Prevents output voltage saturation. Should be set just below the voltage provided by the input power supply.	Default: 200.0 V [4] Min.: 0.0 Max.: 230.0 [4]	–
n8-65 (065C)	Speed Feedback Detection Control Gain during ov Suppression	SFdbk G @OV Supp	Sets the gain used for internal speed feedback detection during ov suppression.	Default: 1.50 Min.: 0.00 Max.: 10.00	–
n8-69 (065D)	Speed Calculation Gain	SpdSrch Gain	Sets the proportional gain for PLL control of an extended observer. There is normally no need to change this parameter from the default value.	Default: 1.00 Min.: 0.00 Max.: 20.00	–
n8-72 (0655) [1]	Speed Estimation Method Selection	Spd Est method 0: Conventional 1: A1000 method	Sets the method to be used for estimating the speed. 0: Conventional method 1: A1000 method There is normally no need to change this parameter from the default value. **Note:** This parameter is not available in models 4A0930 and 4A1200.	Default: 1 Range: 0, 1	–
n8-84 (02D3)	Initial Polarity Estimation Timeout Current	Polarity Det Curr	Sets the current to determine polarity for the initial polarity calculation as a percentage of the motor rated current. 100% = Motor rated current **Note:** If an "Si" value is listed on a Yaskawa motor nameplate, set n8-84 to "Si" value x 2.	Default: 100% Min.: 0 Max.: 150	–

<1> Available in drive software versions PRG: 1018 and later.

<2> Default setting is determined by parameter n8-72, Speed Estimation Method Selection.
When n8-72 = 0, default is 50.0
When n8-72 = 1, default is 150.0.

<3> Default setting is determined by parameter E5-01, Motor Code Selection.

<4> Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives.

Parameter List

B

B.10 o: Operator-Related Settings

The o parameters set up the digital operator displays.

◆ o1: Digital Operator Display Selection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o1-01 (0500) ⬦RUN	Drive Mode Unit Monitor Selection	User Monitor Sel	Switches the display after the power has been turned on. When using an LED operator, pressing the up arrow key will display the following data: frequency reference → rotational direction → output frequency → output current → output voltage → U1-☐☐. **Note:** Enter the "1-☐☐" portion of "U1-☐☐" to view the monitor. Certain monitors are not available in all control modes.	Default: 106 (Monitor U1-06) Range: 104 to 813	–
o1-02 (0501) ⬦RUN	User Monitor Selection after Power Up	Power-On Monitor 1: Frequency Ref 2: FWD/REV 3: Output Freq 4: Output Current 5: User Monitor	Selects the information displayed on the digital operator when the power is turned on. 1: Frequency reference (U1-01) 2: Direction 3: Output frequency (U1-02) 4: Output current (U1-03) 5: User-selected monitor (set by o1-01)	Default: 1 Range: 1 to 5	–
o1-03 (0502)	Digital Operator Display Selection	Display Unit Sel 0: 0.01 Hz 1: 0.01 % 2: r/min 3: User Units	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] Range: 0 to 3	–
o1-04 (0503)	V/f Pattern Display Unit	V/f Ptrn Unit 0: Hertz 1: RPM	0: Hz 1: r/min	Default: [1] Range: 0, 1	–
o1-05 (0504) ⬦RUN [2]	LCD Contrast Control	LCD Contrast	Sets the contrast of the LCD operator.	Default: 3 Min.: 0 Max.: 5	–
o1-10 (0520)	User-Set Display Units Maximum Value	UserDisp Scaling	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: [3] Range: 1 to 60000	–
o1-11 (0521)	User-Set Display Units Decimal Display	UserDisp Dec Sel		Default: [3] Range: 0 to 3	–

[1] Default setting is determined by parameter A1-02, Control Method Selection.

[2] Available in drive software versions PRG: 1019 and later.

[3] Default setting is determined by parameter o1-03, Digital Operator Display Selection.

◆ o2: Digital Operator Keypad Functions

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o2-01 (0505)	LO/RE Key Function Selection	LO/RE Key 0: Disabled 1: Enabled	0: Disabled 1: Enabled. LO/RE key switches between LOCAL and REMOTE operation.	Default: 1 Range: 0, 1	–
o2-02 (0506)	STOP Key Function Selection	Oper STOP Key 0: Disabled 1: Enabled	0: Disabled. STOP key is disabled in REMOTE operation. 1: Enabled. STOP key is always enabled.	Default: 1 Range: 0, 1	–
o2-03 (0507)	User Parameter Default Value	User Default Sel 0: No Change 1: Save User Init 2: Clear User Init	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 Range: 0 to 2	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o2-04 (0508)	Drive Model Selection	Inverter Model #	Enter the drive model. Setting required only if installing a new control board.	Default: Determined by drive capacity	–
o2-05 (0509)	Frequency Reference Setting Method Selection	Oper Ref Method 0: Disabled 1: Enabled	0: ENTER key must be pressed to enter a frequency reference. 1: ENTER key is not required. The frequency reference can be adjusted using the up and down arrow keys only.	Default: 0 Range: 0, 1	–
o2-06 (050A)	Operation Selection when Digital Operator is Disconnected	Oper Discon Det 0: Disabled 1: Enabled	0: The drive continues operating if the digital operator is disconnected. 1: An oPr fault is triggered and the motor coasts to stop.	Default: 1 Range: 0, 1	–
o2-07 (0527)	Motor Direction at Power Up when Using Operator	For/RevSel@PwrUp 0: Forward 1: Reverse	0: Forward 1: Reverse This parameter requires assigning drive operation to the digital operator.	Default: 0 Range: 0, 1	–
o2-09 (050D)	–	–	Factory use.	–	–
o2-19 (061F) *<1>*	Selection of Parameter Write during Uv	ParameterSet Sel 0: Disabled 1: Enabled	Selects whether parameter settings can be changed during a DC bus undervoltage condition. To be used with 24 V Power Supply option (PS-A10L, PS-A10H) revision B or later. 0: Disabled 1: Enabled **Note:** Enabling this function may trigger a CPF06 fault when used with a 24 V Power Supply option revision earlier than B, as the parameter changes might not occur correctly.	Default: 0 Range: 0, 1	–

<1> Available in drive software versions PRG: 1019 and later.

◆ o3: Copy Function

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o3-01 (0515)	Copy Function Selection	COPY SELECT 0: COPY SELECT 1: INV→OP READ 2: OP→INV WRITE 3: OP←→INV VERIFY	0: Copy select 1: INV → OP READ (Read parameters from the drive, saving them onto the digital operator). 2: OP → INV WRITE (Copy parameters from the digital operator, writing them to the drive). 3: OP → INV VERIFY (Verify that parameter settings match the data saved on the operator). To read the drive parameter settings into the digital operator, set o3-02 to 1 (to allow reading).	Default: 0 Range: 0 to 3	–
o3-02 (0516)	Copy Allowed Selection	Read Allowable 0: Disabled 1: Enabled	Selects whether the read operation (o3-01 = 1) is enabled or disabled. 0: Read operation prohibited 1: Read operation allowed	Default: 0 Range: 0, 1	–

◆ o4: Maintenance Monitor Settings

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o4-01 (050B)	Cumulative Operation Time Setting	DrvElapsTimeCnt	Sets the value for the cumulative operation time of the drive in units of 10 h.	Default: 0 Min.: 0 Max.: 9999	–
o4-02 (050C)	Cumulative Operation Time Selection	ElapsTimeCntSet 0: Power-On Time 1: Running Time	0: Logs power-on time 1: Logs operation time when the drive output is active (output operation time).	Default: 0 Range: 0, 1	–
o4-03 (050E)	Cooling Fan Operation Time Setting	FanElapsTimeCn	Sets the value of the fan operation time monitor U4-03 in units of 10 h.	Default: 0 Min.: 0 Max.: 9999	–
o4-05 (051D)	Capacitor Maintenance Setting	BusCap Maint Set	Sets the point at which the cumulative timing for the main circuit capacitor maintenance starts. View monitor U4-05 to determine when the capacitors may require replacement.	Default: 0% Min.: 0 Max.: 150	–

Parameter List

B

B.10 o: Operator-Related Settings

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o4-07 (0523)	DC Bus Pre-Charge Relay Maintenance Setting	ChrgCircMaintSet	Sets the point at which the cumulative timing for the soft charge bypass relay maintenance starts. View monitor U4-06 to determine when the bypass relay may require replacement.	Default: 0% Min.: 0 Max.: 150	–
o4-09 (0525)	IGBT Maintenance Setting	IGBT Maint Set	Sets the point at which the cumulative timing for the IGBTs maintenance starts. View monitor U4-07 to determine when the IGBTs may require replacement.	Default: 0% Min.: 0 Max.: 150	–
o4-11 (0510)	U2, U3 Initialization	Fault Data Init 0: Disabled 1: Enabled	0: U2-□□ and U3-□□ monitor data is not reset when the drive is initialized using A1-03. 1: U2-□□ and U3-□□ monitor data is reset when the drive is initialized using A1-03. Parameter is automatically reset to 0.	Default: 0 Range: 0, 1	–
o4-12 (0512)	kWh Monitor Initialization	kWh Monitor Init 0: No Reset 1: Reset	0: U4-10 and U4-11 monitor data is not reset when the drive is initialized using A1-03. 1: U4-10 and U4-11 monitor data is reset when the drive is initialized using A1-03. Parameter is automatically reset to 0.	Default: 0 Range: 0, 1	–
o4-13 (0528)	Number of Run Commands Counter Initialization	Run Counter Init 0: No Reset 1: Reset	0: U4-02 monitor data is not reset when the drive is initialized using A1-03. 1: U4-02 monitor data is reset when the drive is initialized using A1-03. Parameter is automatically reset to 0.	Default: 0 Range: 0, 1	–

B.11 DriveWorksEZ Parameters

◆ q: DriveWorksEZ Parameters

No. (Addr. Hex)	Name	Description	Values	Page
q1-01 to q6-07 (1600 to 1746)	DriveWorksEZ Parameters	Reserved for DriveWorksEZ	Refer to Help in the DWEZ software.	–

◆ r: DriveWorksEZ Connection Parameters

No. (Addr. Hex)	Name	Description	Values	Page
r1-01 to r1-40 (1840 to 1867)	DriveWorksEZ Connection Parameters 1 to 20 (upper/lower)	DriveWorksEZ Connection Parameters 1 to 20 (upper/lower)	Default: 0 Min.: 0 Max.: FFFF	–

Parameter List

B

B.12 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. Hex)	Name	LCD Display	Description	Values	Page
T1-00 (0700)	Motor 1/Motor 2 Selection	Select Motor 1: 1st Motor 2: 2nd Motor	1: Motor 1 (sets E1-□□, E2-□□) 2: Motor 2 (sets E3-□□, E4-□□)	Default: 1 Range: 1, 2	–
T1-01 (0701) [1]	Auto-Tuning Mode Selection	Tuning Mode Sel 0: Standard Tuning 1: Tune-No Rotate1 2: Term Resistance 3: V/f Engy Sav Tun 4: Tune-No Rotate2 5: Tune-No Rotate3 8: Inertia Tuning 9: Tune ASR gain	0: Rotational Auto-Tuning 1: Stationary Auto-Tuning 1 2: Stationary Auto-Tuning for Line-to-Line Resistance 3: Rotational Auto-Tuning for V/f Control (necessary for Energy Savings and Speed Estimation Speed Search) 4: Stationary Auto-Tuning 2 5: Stationary Auto-Tuning 3 [2] 8: Inertia Tuning (perform Rotational Auto-Tuning prior to Inertia Tuning) 9: ASR Gain Tuning (perform Rotational Auto-Tuning prior to ASR Gain Auto-Tuning) Note: 1. Setting 5 is not available in models 4A0930 and 4A1200. 2. Settings 8 and 9 may not be available when gears are between the machine and the motor shaft.	Default: 0 [3] Range: 0 to 5; 8, 9	–
T1-02 (0702)	Motor Rated Power	Mtr Rated Power	Sets the motor rated power as specified on the motor nameplate. Note: Use the following formula to convert horsepower into kilowatts: 1HP = 0.746 kW.	Default: [4] Min.: 0.00 kW Max.: 650.00 kW	–
T1-03 (0703)	Motor Rated Voltage	Rated Voltage	Sets the motor rated voltage as specified on the motor nameplate.	Default: 200.0 V [5] Min: 0.0 Max: 255.0 [5]	–
T1-04 (0704)	Motor Rated Current	Rated Current	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	–
T1-05 (0705)	Motor Base Frequency	Rated Frequency	Sets the rated frequency of the motor as specified on the motor nameplate.	Default: 60.0 Hz Min.: 0.0 Max.: 400.0	–
T1-06 (0706)	Number of Motor Poles	Number of Poles	Sets the number of motor poles as specified on the motor nameplate.	Default: 4 Min.: 2 Max.: 48	–
T1-07 (0707)	Motor Base Speed	Rated Speed	Sets the rated speed of the motor as specified on the motor nameplate.	Default: 1750 r/min Min.: 0 Max.: 24000	–
T1-08 (0708)	PG Number of Pulses Per Revolution	PG Pulses/Rev	Sets the number of pulses per revolution for the PG being used (pulse generator or encoder).	Default: 1024 ppr Min.: 1 Max.: 60000	–
T1-09 (0709)	Motor No-Load Current (Stationary Auto-Tuning)	No-Load Current	Sets the no-load current for the motor. After setting the motor capacity to T1-02 and the motor rated current to T1-04, this parameter will automatically display the no-load current for a standard 4-pole Yaskawa motor. Enter the no-load current as indicated on the motor test report.	Default: – Min.: 0 A Max.: T1-04	–
T1-10 (070A)	Motor Rated Slip (Stationary Auto-Tuning)	Motor Rated Slip	Sets the motor rated slip. After setting the motor capacity to T1-02, this parameter will automatically display the motor slip for a standard 4-pole Yaskawa motor. Enter the motor slip as indicated on the motor test report.	Default: – Min.: 0.00 Hz Max.: 20.00 Hz	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
T1-11 (070B)	Motor Iron Loss	Mtr Iron Loss(W)	Sets the iron loss for determining the Energy Saving coefficient. The value is set to E2-10 (motor iron loss) set when the power is cycled. If T1-02 is changed, a default value appropriate for the motor capacity that was entered will appear.	Default: 14 W [6] Min.: 0 Max.: 65535	–

<1> The availability of certain Auto-Tuning methods is determined by the control mode selected for the drive.

<2> Available in drive software versions PRG: 1019 and later.

<3> Default setting is determined by parameter A1-02, Control Method Setting.

<4> Default setting is determined by parameter o2-04, Drive Model Selection.

<5> Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives.

<6> Default setting value differs depending on the motor code value and motor parameter settings.

◆ T2: PM Motor Auto-Tuning

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
T2-01 (0750)	PM Motor Auto-Tuning Mode Selection	PM Tuning Mode 0: Standard Tuning 1: Tune-No Rotate 2: Term Resistance 3: Z-Pulse Tuning 8: Inertia Tuning 9: Tune ASR gain 11: IndVoltConstTun 13: High Freq Tun 14: PM rotation tune	0: PM Motor Parameter Settings 1: PM Stationary Auto-Tuning 2: PM Stationary Auto-Tuning for Stator Resistance 3: Z Pulse Offset Tuning 8: Inertia Tuning 9: ASR Gain Auto-Tuning 11: Back EMF Constant Tuning [2] 13: High Frequency Injection Parameter Tuning [3] 14: PM Rotational Auto-Tuning [4] **Note:** 1. Settings 13 and 14 are not available in models 4A0930 and 4A1200. 2. Settings 8 and 9 may not be available when gears are between the machine and the motor shaft. 3. For special-purpose motors, Yaskawa recommends Back EMF Constant Tuning after performing Stationary Auto-Tuning. Back EMF Constant Tuning rotates the motor to measure the actual induction voltage constants, and allows for more accurate control than Stationary Auto-Tuning alone.	Default: 0 Range: 0 to 3; 8, 9, 11, 13, 14 [4]	–
T2-02 (0751)	PM Motor Code Selection	PM Mtr Code Sel	Enter the motor code when using a Yaskawa PM motor. After entering the motor code, the drive automatically sets parameters T2-03 through T2-09. Set T2-10 through T2-14 from the values on the motor nameplate or from the motor test report. When using a motor without a supported motor code or a non-Yaskawa motor, set FFFF and adjust the other T2 parameters according to the motor nameplate or the motor test report.	Default: [5] Min: 0000 Max: FFFF	–
T2-03 (0752)	PM Motor Type	PM Motor Type 0: IPM motor 1: SPM motor	0: IPM motor 1: SPM motor.	Default: 1 Range: 0, 1	–
T2-04 (0730)	PM Motor Rated Power	Mtr Rated Power	Sets the motor rated power. **Note:** Use the following formula to convert horsepower into kilowatts: 1HP = 0.746 kW.	Default: [6] Min.: 0.00 kW Max.: 650.00 kW	–
T2-05 (0732)	PM Motor Rated Voltage	Rated Voltage	Enter the motor rated voltage as indicated on the motor nameplate.	Default: 200.0 V [7] Min.: 0.0 Max.: 255.0 [7]	–

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
T2-06 (0733)	PM Motor Rated Current	Rated Current	Enter the motor rated current as indicated on the motor nameplate.	Default: [6] Min.: 10% of drive rated current Max.: 200% of drive rated current	–
T2-07 (0753)	PM Motor Base Frequency	Base Frequency	Enter the motor base frequency as indicated on the motor nameplate.	Default: 87.5 Hz Min.: 0.0 Max.: 400.0	–
T2-08 (0734)	Number of PM Motor Poles	Number of Poles	Enter the number of motor poles for the PM motor as indicated on the motor nameplate.	Default: 6 Min.: 2 Max.: 48	–
T2-09 (0731)	PM Motor Base Speed	Rated Speed	Enter the base speed for the PM motor as indicated on the motor nameplate.	Default: 1750 r/min Min.: 0 Max.: 24000	–
T2-10 (0754)	PM Motor Stator Resistance	Arm Resistance	Enter the rotor resistance for the PM motor as indicated on the motor nameplate.	Default: [8] Min.: 0.000 Ω Max.: 65.000 Ω	–
T2-11 (0735)	PM Motor d-Axis Inductance	d-Axis Induct	Enter the d-axis inductance for the PM motor as indicated on the motor nameplate.	Default: [8] Min.: 0.00 mH Max.: 600.00 mH	–
T2-12 (0736)	PM Motor q-Axis Inductance	q-Axis Induct	Enter the q-axis inductance for the PM motor as indicated on the motor nameplate.	Default: [8] Min.: 0.00 mH Max.: 600.00 mH	–
T2-13 (0755)	Induced Voltage Constant Unit Selection	Iduct Volt Unit 0: mV/RPM 1: mV/(rad/sec)	0: mV/(r/min). E5-09 will automatically be set to 0.0, and E5-24 will be used. 1: mV/(rad/sec). E5-24 will automatically be set to 0.0, and E5-09 will be used.	Default: 1 Range: 0, 1	–
T2-14 (0737)	PM Motor Induced Voltage Constant	Induct Volt Coef	Enter the induced voltage coefficient for the PM motor as indicated on the motor nameplate.	Default: [8] Min.: 0.0 Max.: 2000.0	–
T2-15 (0756)	Pull-In Current Level for PM Motor Tuning	Pull-In I Lvl	Sets the amount of pull-in current to use for Auto-Tuning as a percentage of the motor rated current. Increase this setting for high inertia loads.	Default: 30% Min.: 0 Max.: 120	–
T2-16 (0738)	PG Number of Pulses Per Revolution for PM Motor Tuning	PG Pulses/Rev	Sets the number of pulses per revolution for the PG being used (pulse generator or encoder).	Default: 1024 ppr Min.: 1 Max.: 15000	–
T2-17 (0757)	Encoder Z-Pulse Offset	Z-Pulse Offset	Sets the offset between encoder offset and the rotor magnetic axis.	Default: 0.0 deg Min.: -180.0 Max.: 180.0	–

<1> The availability of certain Auto-Tuning methods is determined by the control mode selected for the drive.

<2> Available in drive software versions PRG: 1015 and later.

<3> Available in drive software versions PRG: 1018 and later.

<4> Available in drive software versions PRG: 1019 and later.

<5> Default setting is determined by parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.

<6> Default setting is determined by parameter o2-04, Drive Model Selection.

<7> Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives.

<8> Default setting is determined by parameter T2-02, PM Motor Code Selection, and the drive capacity.

◆ T3: ASR and Inertia Tuning

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
T3-01 (0760)	Inertia Tuning Frequency Reference	Test Signal Freq	Sets the frequency of the test signal used during Inertia Tuning and ASR Gain Auto-Tuning. Reduce this value if the inertia is large or if a fault occurs.	Default: 3.0 Hz Min.: 0.1 Max.: 20.0	–
T3-02 (0761)	Inertia Tuning Reference Amplitude	Test Signal Ampl	Sets the amplitude of the test signal used during Inertia and ASR Gain Auto-Tuning. Reduce this value if the inertia is too large or if a fault occurs.	Default: 0.5 rad Min.: 0.1 Max.: 10.0	–
T3-03 (0762)	Motor Inertia	Motor Inertia	Sets the motor inertia. Default setting is the inertia of a Yaskawa motor.	Default: [2] [3] Min.: 0.0001 kgm^2 Max.: 600.00 kgm^2	–
T3-04 (0763) [1]	ASR Response Frequency	System Resp Freq	Sets the response frequency of the mechanical system connected to the motor. Oscillation may result if set too high.	Default: 10.0 Hz Min.: 0.1 Max.: 50.0	–

<1> Displayed only when performing Inertia Tuning or ASR Gain Auto-Tuning (T1-01 = 8 or T2-01 = 9).
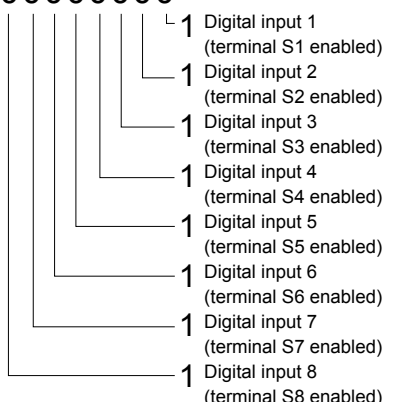
<2> Default setting is determined by parameter E5-01, Motor Code Selection.
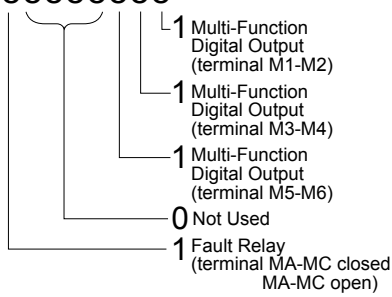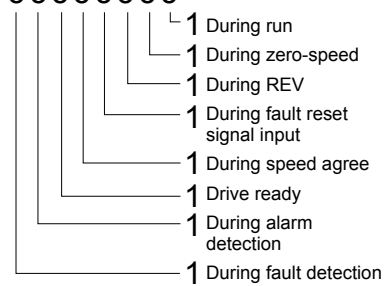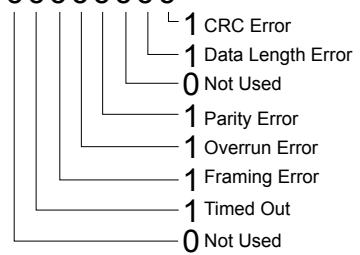
<3> Default setting is determined by parameters C6-01, Drive Duty Selection, and o2-04, Drive Model Selection.

B.13 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. Hex)	Name		Description	Analog Output Level	Unit
U1-01 (0040)	Frequency Reference	Frequency Ref	Monitors the frequency reference. Display units are determined by o1-03.	10 V: Max frequency (-10 to +10 V)	0.01 Hz
U1-02 (0041)	Output Frequency	Output Freq	Displays the output frequency. Display units are determined by o1-03.	10 V: Max frequency (-10 to +10 V)	0.01 Hz
U1-03 (0042)	Output Current	Output Current	Displays the output current. **Note:** The unit is expressed in 1 A for models 4A0930 and 4A1200.	10 V: Drive rated current	*<1> <2>*
U1-04 (0043)	Control Method	Control Method	0: V/f Control 1: V/f Control with PG 2: Open Loop Vector Control 3: Closed Loop Vector Control 5: Open Loop Vector Control for PM 6: Advanced Open Loop Vector Control for PM 7: Closed Loop Vector Control for PM	No signal output available	–
U1-05 (0044)	Motor Speed	Motor Speed	Displays the motor speed feedback. Display units are determined by o1-03.	10 V: Max frequency (-10 to +10 V)	0.01 Hz
U1-06 (0045)	Output Voltage Reference	Output Voltage	Displays the output voltage.	10 V: 200 Vrms *<3>*	0.1 Vac
U1-07 (0046)	DC Bus Voltage	DC Bus Voltage	Displays the DC bus voltage.	10 V: 400 V *<3>*	1 Vdc
U1-08 (0047)	Output Power	Output kWatts	Displays the output power (this value is calculated internally).	10 V: Drive capacity (motor capacity) kW (-10 to +10 V) *<4>*	*<4>*
U1-09 (0048)	Torque Reference	Torque Reference	Monitors the internal torque reference.	10 V: Motor rated torque (-10 to +10 V)	0.1%
U1-10 (0049)	Input Terminal Status	Input Term Sts	Displays the input terminal status. U1-10=00000000 1 Digital input 1 (terminal S1 enabled) 1 Digital input 2 (terminal S2 enabled) 1 Digital input 3 (terminal S3 enabled) 1 Digital input 4 (terminal S4 enabled) 1 Digital input 5 (terminal S5 enabled) 1 Digital input 6 (terminal S6 enabled) 1 Digital input 7 (terminal S7 enabled) 1 Digital input 8 (terminal S8 enabled)	No signal output available	–

No. (Addr. Hex)	Name		Description	Analog Output Level	Unit
U1-11 (004A)	Output Terminal Status	Output Term Sts	Displays the output terminal status. U1 - 11 = 00000000 — 1 Multi-Function Digital Output (terminal M1-M2) — 1 Multi-Function Digital Output (terminal M3-M4) — 1 Multi-Function Digital Output (terminal M5-M6) — 0 Not Used — 1 Fault Relay (terminal MA-MC closed MA-MC open)	No signal output available	–
U1-12 (004B)	Drive Status	Int Ctl Sts 1	Displays the drive operation status. U1 - 12 = 00000000 — 1 During run — 1 During zero-speed — 1 During REV — 1 During fault reset signal input — 1 During speed agree — 1 Drive ready — 1 During alarm detection — 1 During fault detection	No signal output available	–
U1-13 (004E)	Terminal A1 Input Level	Term A1 Level	Displays the signal level to analog input terminal A1.	10 V: 100% (-10 to +10 V)	0.1%
U1-14 (004F)	Terminal A2 Input Level	Term A2 Level	Displays the signal level to analog input terminal A2.	10 V: 100% (-10 to +10 V)	0.1%
U1-15 (0050)	Terminal A3 Input Level	Term A3 Level	Displays the signal level to analog input terminal A3.	10 V: 100% (-10 to +10 V)	0.1%
U1-16 (0053)	Output Frequency after Soft Starter	SFS Output	Displays output frequency with ramp time and S-curves. Units determined by o1-03.	10 V: Max frequency (-10 to +10 V)	0.01 Hz
U1-17 (0058)	DI-A3 Input Status	DI Opt Status	Displays the reference value input from the DI-A3 option card. Display will appear in hexadecimal as determined by the digital card input selection in F3-01. 3FFFF: Set (1 bit) + sign (1 bit) + 16 bit	No signal output available	–
U1-18 (0061)	oPE Fault Parameter	OPE Error Code	Displays the parameter number that caused the oPE02 or oPE08 operation error.	No signal output available	–
U1-19 (0066)	MEMOBUS/Modbus Error Code	Transmit Err	Displays the contents of a MEMOBUS/Modbus error. U1 - 19 = 00000000 — 1 CRC Error — 1 Data Length Error — 0 Not Used — 1 Parity Error — 1 Overrun Error — 1 Framing Error — 1 Timed Out — 0 Not Used	No signal output available	–
U1-21 (0077)	AI-A3 Terminal V1 Input Voltage Monitor	AI Opt Ch1 Level	Displays the input voltage to terminal V1 on analog input card AI-A3.	10 V: 100% (-10 to +10 V)	0.1%
U1-22 (072A)	AI-A3 Terminal V2 Input Voltage Monitor	AI Opt Ch2 Level	Displays the input voltage to terminal V2 on analog input card AI-A3.	10 V: 100% (-10 to +10 V)	0.1%
U1-23 (072B)	AI-A3 Terminal V3 Input Voltage Monitor	AI Opt Ch3 Level	Displays the input voltage to terminal V3 on analog input card AI-A3.	10 V: 100% (-10 to +10 V)	0.1%
U1-24 (007D)	Input Pulse Monitor	Term RP Inp Freq	Displays the frequency to pulse train input terminal RP.	Determined by H6-02	1 Hz

Parameter List

B

No. (Addr. Hex)	Name		Description	Analog Output Level	Unit
U1-25 (004D)	Software Number (Flash)	CPU 1 SW Number	FLASH ID	No signal output available	–
U1-26 (005B)	Software No. (ROM)	CPU 2 SW Number	ROM ID	No signal output available	–
U1-27 (07A8)	Message ID (OPR)	MessageID (OPR)	OPR ID	No signal output available	–
U1-28 (07A9)	Message ID (INV)	MessageID (INV)	INV ID	No signal output available	–
U1-29 (07AA)	Software No. (PWM)	CPU 3 SW Number	PWM ID Note: This monitor is only displayed in models 4A0930 and 4A1200.	No signal output available	–

<1> Display is in the following units:
    2A0004 to 2A0040, 4A0002 to 4A0023, and 5A0007 to 5A0017: 0.01 A units.
    2A0056 to 2A0415, 4A0031 to 4A0675, and 5A0022 to 5A0242: 0.1 A units.
    4A0930 and 4A1200: 1 A units.

<2> The values of U1-03, U2-05, and U4-13 are displayed on the digital operator in units of amperes. When those monitors are checked using MEMOBUS/Modbus communications, the monitor values in MEMOBUS/Modbus communications are displayed as: numeric value / 8192 × drive rated current (A) from the condition "192 (maximum value) = drive rated current (A)"

<3> Values shown are specific to 200 V class drives. Double the value for 400 V class drives. Multiply the value by 2.875 for 600 V class drives.

<4> In V/f and V/f w/PG control modes, 10 V = drive capacity (kW). In OLV, CLV, OLV/PM, AOLV/PM, and CLV/PM control modes, 10 V = motor rated power (E2-11) (kW).

◆ **U2: Fault Trace**

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U2-01 (0080)	Current Fault	Current Fault	Displays the current fault.	No signal output available	–
U2-02 (0081)	Previous Fault	Last Fault	Displays the previous fault.	No signal output available	–
U2-03 (0082)	Frequency Reference at Previous Fault	Frequency Ref	Displays the frequency reference at the previous fault.	No signal output available	0.01 Hz
U2-04 (0083)	Output Frequency at Previous Fault	Output Freq	Displays the output frequency at the previous fault.	No signal output available	0.01 Hz
U2-05 (0084)	Output Current at Previous Fault	Output Current	Displays the output current at the previous fault. Note: The unit is expressed in 1 A for models 4A0930 and 4A1200.	No signal output available	*<1> <2>*
U2-06 (0085)	Motor Speed at Previous Fault	Motor Speed	Displays the motor speed at the previous fault.	No signal output available	0.01 Hz
U2-07 (0086)	Output Voltage at Previous Fault	Output Voltage	Displays the output voltage at the previous fault.	No signal output available	0.1 Vac
U2-08 (0087)	DC Bus Voltage at Previous Fault	DC Bus Voltage	Displays the DC bus voltage at the previous fault.	No signal output available	1 Vdc
U2-09 (0088)	Output Power at Previous Fault	Output kWatts	Displays the output power at the previous fault.	No signal output available	0.1 kW
U2-10 (0089)	Torque Reference at Previous Fault	Torque Reference	Displays the torque reference at the previous fault.	No signal output available	0.1%
U2-11 (008A)	Input Terminal Status at Previous Fault	Input Term Sts	Displays the input terminal status at the previous fault. Displayed as in U1-10.	No signal output available	–
U2-12 (008B)	Output Terminal Status at Previous Fault	Output Term Sts	Displays the output status at the previous fault. Displayed as in U1-11.	No signal output available	–
U2-13 (008C)	Drive Operation Status at Previous Fault	Inverter Status	Displays the operation status of the drive at the previous fault. Displayed as in U1-12.	No signal output available	–
U2-14 (008D)	Cumulative Operation Time at Previous Fault	Elapsed time	Displays the cumulative operation time at the previous fault.	No signal output available	1 h

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U2-15 (07E0)	Run Speed after Soft Starter at Previous Fault	SFS Output	Displays the run speed after a soft start when a previous fault occurred. Displayed as in U1-16.	No signal output available	0.01 Hz
U2-16 (07E1)	Motor q-Axis Current at Previous Fault	Motor Iq Current	Displays the q-Axis current for the motor at the previous fault. Displayed as in U6-01.	No signal output available	0.1%
U2-17 (07E2)	Motor d-Axis Current at Previous Fault	Motor Id Current	Displays the d-Axis current for the motor at the previous fault. Displayed as in U6-02.	No signal output available	0.1%
U2-19 (07E4)	Rotor Deviation at Previous Fault	d-q Axis Dev Err	Displays the degree of rotor deviation when the most recent fault occurred. Displayed as in U6-10.	No signal output available	0.1 deg
U2-20 (008E)	Heatsink Temperature at Previous Fault	Actual Fin Temp	Displays the temperature of the heatsink when the most recent fault occurred. Displayed as in U4-08.	No signal output available	1 °C
U2-27 (07FA)	Motor Temperature at Previous Fault (NTC)	Moter temp (NTC)	Displays the temperature of the motor when the most recent fault occurred. Displayed as in U4-32. **Note:** This monitor is only displayed in models 4A0930 and 4A1200.	No signal output available	1 °C
U2-28 (07FC)	Malfunctioned Module	Fault Axis	Display the module where the previous fault occurred at a decimal number. **Note:** This monitor is only displayed in models 4A0930 and 4A1200.	No signal output available	–

<1> Display is in the following units:
2A0004 to 2A0040, 4A0002 to 4A0023, and 5A0007 to 5A0017: 0.01 A units.
2A0056 to 2A0415, 4A0031 to 4A0675, and 5A0022 to 5A0242: 0.1 A units.
4A0930 and 4A1200: 1 A units.

<2> The values of U1-03, U2-05, and U4-13 are displayed on the digital operator in units of amperes. When those monitors are checked using MEMOBUS/Modbus communications, the monitor values in MEMOBUS/Modbus communications are displayed as: numeric value / 8192 × drive rated current (A) from the condition "192 (maximum value) = drive rated current (A)"

◆ U3: Fault History

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U3-01 to U3-04 (0090 to 0093 (0800 to 0803))	1st to 4th Most Recent Fault	Fault Message ☐	Displays the first to the fourth most recent faults.	No signal output available	–
U3-05 to U3-10 (0804 to 0809)	5th to 10th Most Recent Fault	Fault Message ☐	Displays the fifth to the tenth most recent faults. After ten faults, 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 each time a fault occurs.	No signal output available	–
U3-11 to U3-14 (0094 to 0097 (080A to 080D))	Cumulative Operation Time at 1st to 4th Most Recent Fault	Elapsed Time ☐	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 (080E to 0813)	Cumulative Operation Time at 5th to 10th Most Recent Fault	Elapsed Time ☐	Displays the cumulative operation time when the fifth to the tenth most recent faults occurred.	No signal output available	1 h

Parameter List

B

◆ U4: Maintenance Monitors

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U4-01 (004C) <1>	Cumulative Operation Time	Drv Elapsed Time	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 Run 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 (0075)	Number of Run Commands	RUN Cmd Counter	Displays the number of times the Run command is entered. Reset the number of Run commands using parameter o4-13. This value will reset to 0 and start counting again after reaching 65535.	No signal output available	1 Time
U4-03 (0067) <2>	Cooling Fan Operation Time	Fan Elapsed TIme	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 (007E)	Cooling Fan Maintenance	Fan Life Mon	Displays main cooling fan usage time as a percentage of its expected performance life. Parameter o4-03 can be used to reset this monitor. Replace the fan when this monitor reaches 90%.	No signal output available	1%
U4-05 (007C)	Capacitor Maintenance	Cap Life Mon	Displays main circuit capacitor usage time as a percentage of their expected performance life. Parameter o4-05 can be used to reset this monitor. Replace the capacitor when this monitor reaches 90%.	No signal output available	1%
U4-06 (07D6)	Soft Charge Bypass Relay Maintenance	ChgCirc Life Mon	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. Replace the soft charge bypass relay when this monitor reaches 90%.	No signal output available	1%
U4-07 (07D7)	IGBT Maintenance	IGBT Life Mon	Displays IGBT usage time as a percentage of the expected performance life. Parameter o4-09 can be used to reset this monitor. Replace the IGBT when this monitor reaches 90%.	No signal output available	1%
U4-08 (0068)	Heatsink Temperature	Heatsink Temp	Displays the heatsink temperature.	10 V: 100 °C	1 °C
U4-09 (005E)	LED Check	LED Oper Check	Lights all segments of the LED to verify that the display is working properly.	No signal output available	–
U4-10 (005C)	kWh, Lower 4 Digits	kWh Lower 4 dig	Monitors the drive cumulative output power usage. The value is shown as a 9-digit number displayed across two monitors 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 (005D)	kWh, Upper 5 Digits	kWh Upper 5 dig		No signal output available	1 MWh
U4-13 (07CF)	Peak Hold Current	Current PeakHold	Displays the highest current value that occurred during run. **Note:** The unit is expressed in 1 A for models 4A0930 and 4A1200.	No signal output available	0.01 A <3> <4> <5>
U4-14 (07D0)	Peak Hold Output Frequency	Freq@ I PeakHold	Displays the output frequency when the current value shown in U4-13 occurred.	No signal output available	0.01 Hz
U4-16 (07D8)	Motor Overload Estimate (oL1)	Motor OL1 Level	Shows the value of the motor overload detection accumulator. 100% is equal to the oL1 detection level.	10 V: 100%	0.1%

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U4-18 (07DA)	Frequency Reference Source Selection	Reference Source	Displays the source for the frequency reference as XY-nn. **X: indicates which reference is used:** 1 = Reference 1 (b1-01) 2 = Reference 2 (b1-15) **Y-nn: indicates the reference source** 0-01 = Digital operator 1-00 = Analog 1-01 = Analog (terminal A1) 1-02 = Analog (terminal A2) 1-03 = Analog (terminal A3) 2-02 to 17 = Multi-step speed (d1-02 to 17) 3-01 = MEMOBUS/Modbus communications 4-01 = Communication option card 5-01 = Pulse input 7-01 = DWEZ 9-01 = Up/Down Command	No signal output available	–
U4-19 (07DB)	Frequency Reference from MEMOBUS/Modbus Comm.	MEMOBUS Freq Ref	Displays the frequency reference provided by MEMOBUS/Modbus (decimal).	No signal output available	0.01%
U4-20 (07DC)	Option Frequency Reference	Option Freq Ref	Displays the frequency reference input by an option card (decimal).	No signal output available	–
U4-21 (07DD)	Run Command Source Selection	Run Cmd Source	Displays the source for the Run command as XY-nn. **X: Indicates which Run source is used:** 1 = Reference 1 (b1-02) 2 = Reference 2 (b1-16) **Y: Input power supply data** 0 = Digital operator 1 = External terminals 3 = MEMOBUS/Modbus communications 4 = Communication option card 7 = DWEZ **nn: Run command limit status data** 00: No limit status. 01: Run command was left on when stopped in the PRG mode 02: Run 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 "Run command prohibited" time period to end 05: Fast Stop (digital input, digital operator) 06: b1-17 (Run command given at power-up) 07: During baseblock while coast to stop with timer 08: Frequency reference is below minimal reference during baseblock 09: Waiting for Enter command	No signal output available	–
U4-22 (07DE)	MEMOBUS/Modbus Communications Reference	MEMOBUS Ref Reg	Displays the drive control data set by MEMOBUS/Modbus communications register no. 0001H as a four-digit hexadecimal number.	No signal output available	–
U4-23 (07DF)	Communication Option Card Reference	Option Ref Reg	Displays drive control data set by an option card as a four-digit hexadecimal number.	No signal output available	–
U4-32 (07FB)	Motor Temperature (NTC)	Moter temp (NTC)	Displays the motor temperature (NTC). U4-32 will display "20 °C" when a multi-function analog input is not set for motor thermistor input (H1-□□ = 17H). **Note:** This monitor is only displayed in models 4A0930 and 4A1200.	200 °C	1 °C
U4-37 (1044)	oH Alarm Location Monitor	OH Alarm Axis	Displays the module where the oH alarm occurred as a binary number. **Note:** This monitor is only displayed in models 4A0930 and 4A1200.	No signal output available	–
U4-38 (1045)	FAn Alarm Location Monitor	FAN Alarm Axis	Displays the module where the FAn alarm occurred as a binary number. **Note:** This monitor is only displayed in models 4A0930 and 4A1200.	No signal output available	–

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U4-39 (1046)	voF Alarm Location Monitor	VOF Alarm Axis	Displays the module where the voF alarm occurred as a binary number. **Note:** This monitor is only displayed in models 4A0930 and 4A1200.	No signal output available	–

<1> The MEMOBUS/Modbus communications data is in 10 h units. If data in 1 h units are also required, refer to register number 0099H.

<2> The MEMOBUS/Modbus communications data is in 10 h units. If data in 1 h units are also required, refer to register number 009BH.

<3> Display is in the following units:
2A0004 to 2A0040, 4A0002 to 4A0023, and 5A0007 to 5A0017: 0.01 A units.
2A0056 to 2A0415, 4A0031 to 4A0675, and 5A0022 to 5A0242: 0.1 A units.
4A0930 and 4A1200: 1 A units.

<4> The values of U1-03, U2-05, and U4-13 are displayed on the digital operator in units of amperes. When those monitors are checked using MEMOBUS/Modbus communications, the monitor values in MEMOBUS/Modbus communications are displayed as: numeric value / 8192 × drive rated current (A) from the condition "192 (maximum value) = drive rated current (A)"

<5> When reading the value of this monitor via MEMOBUS/Modbus a value of 8192 is equal to 100% of the drive rated output current.

◆ U5: PID Monitors

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U5-01 (0057)	PID Feedback	PID Feedback 1	Displays the PID feedback value.	10 V: 100% (-10 to +10 V)	0.01%
U5-02 (0063)	PID Input	PID Input	Displays the amount of PID input (deviation between PID setpoint and feedback).	10 V: 100% (-10 to +10 V)	0.01%
U5-03 (0064)	PID Output	PID Output	Displays PID control output.	10 V: 100% (-10 to +10 V)	0.01%
U5-04 (0065)	PID Setpoint	PID Setpoint	Displays the PID setpoint.	10 V: 100% (-10 to +10 V)	0.01%
U5-05 (07D2)	PID Differential Feedback	PID Feedback 2	Displays the 2nd PID feedback value if differential feedback is used (H3-□□ = 16).	10 V: 100% (-10 to +10 V)	0.01%
U5-06 (07D3)	PID Adjusted Feedback	PID Diff Fdbk	Displays the difference of both feedback values if differential feedback is used (U5-01 - U5-05). If differential feedback is not used, then U5-01 and U5-06 will be the same.	10 V: 100% (-10 to +10 V)	0.01%
U5-21 (0872) *<1>*	Automatically Calculated Energy Saving Coefficient Ki Value	Ki Auto Cal Val	Displays the energy saving coefficient Ki value.	No signal output available	0.01
U5-22 (0873) *<1>*	Automatically Calculated Energy Saving Coefficient Kt Value	Kt Auto Cal Val	Displays the energy saving coefficient Kt value.	No signal output available	0.01

<1> Available in drive software versions PRG: 1015 and later.

◆ U6: Operation Status Monitors

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U6-01 (0051)	Motor Secondary Current (Iq)	Mot SEC Current	Displays the value of the motor secondary current (Iq). Motor rated secondary current is 100%.	10 V: Motor secondary rated current (-10 to +10 V)	0.1%
U6-02 (0052)	Motor Excitation Current (Id)	Mot EXC Current	Displays the value calculated for the motor excitation current (Id). Motor rated secondary current is 100%.	10 V: Motor secondary rated current (-10 to +10 V)	0.1%

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U6-03 (0054)	ASR Input	ASR Input	Displays the input and output values when using ASR control.	10 V: Max frequency (-10 to +10 V)	0.01%
U6-04 (0055)	ASR Output	ASR Output		10 V: Motor secondary rated current (-10 to +10 V)	
U6-05 (0059)	Output Voltage Reference (Vq)	Voltage Ref (Vq)	Output voltage reference (Vq) for the q-Axis.	10 V: 200 Vrms (-10 to +10 V) *<1>*	0.1 Vac
U6-06 (005A)	Output Voltage Reference (Vd)	Voltage Ref (Vd)	Output voltage reference (Vd) for the d-Axis.	10 V: 200 Vrms (-10 to +10 V) *<1>*	0.1 Vac
U6-07 (005F)	q-Axis ACR Output	ACR(q) Output	Displays the output value for current control relative to motor secondary current (q-Axis).	10 V: 200 Vrms (-10 to +10 V) *<1>*	0.1%
U6-08 (0060)	d-Axis ACR Output	ACR(d) Output	Displays the output value for current control relative to motor secondary current (d-Axis).	110 V: 200 Vrms (-10 to +10 V) *<1>*	0.1%
U6-09 (07C0)	Advance Phase Compensation (Δθ)	d-q Axis Comp	Displays the degree of forward phase correction after calculating the deviation of Δθcmp.	10 V: 180 deg -10 V: -180 deg (-10 to +10 V)	0.1 deg
U6-10 (07C1)	Control Axis Deviation (Δθ)	d-q Axis Devt	Displays the amount of deviation between the actual d-Axis / q-Axis and the γ-Axis / δ-Axis used for motor control.	10 V: 180 deg -10 V: -180 deg (-10 to +10 V)	0.1 deg
U6-13 (07CA)	Flux Position Detection (sensor)	FluxPosition Fb	Monitors the value of the flux position detection (sensor).	10 V: 180 deg -10 V: -180 deg (-10 to +10 V)	0.1 deg
U6-14 (07CB)	Flux Position Estimation (observer)	FluxPosition Est	Monitors the value of the flux position estimation.	10 V: 180 deg -10 V: -180 deg (-10 to +10 V)	0.1 deg
U6-18 (07CD)	Speed Detection PG1 Counter	PG1 CounterValue	Monitors the number of pulses for speed detection (PG1).	10 V: 65536	1 pulse
U6-19 (07E5)	Speed Detection PG2 Counter	PG2 CounterValue	Monitors the number of pulses for speed detection (PG2).	10 V: 65536	1 pulse
U6-20 (07D4)	Frequency Reference Bias (Up/Down 2)	Up/Dn 2 Bias Val	Displays the bias value used to adjust the frequency reference.	10 V: Max frequency	0.1%
U6-21 (07D5)	Offset Frequency	Offset Frequency	Displays the total value of the offset frequencies d7-01, d7-02 and d7-03 selected with digital inputs 44 to 46.	10 V: Max frequency	0.1%
U6-22 (0062)	Zero Servo Pulse Movement	Zero Servo Pulse	Displays how far the rotor has moved from its last position in PG pulses (multiplied by 4).	10 V: No. of pulses per revolution (-10 to +10 V)	1 pulse
U6-25 (006B)	Feedback Control Output	ASR Out w/o Fil	Output monitor for the ASR speed loop.	10 V: Motor secondary rated current (-10 to +10 V)	0.01%
U6-26 (006C)	Feed Forward Control Output	FF Cont Output	Output monitor for Feed Forward control.	10 V: Motor secondary rated current (-10 to +10 V)	0.01%
U6-57 (07C4)	Integrated Current Deviation during Judging Polarity	PoleDis IdDifVal	Displays the deviation from the integrated current when judging motor polarity. If this value is lower than 819, then increase the value set to n8-84. The value 8192 is equivalent to the motor rated current.	No signal output available	1
U6-80 to U6-83 (07B0 to 07B3) *<2>*	Online IP Address	–	IP Address currently available; U6-80 is the most significant octet.	0 to 255	–

Parameter List

B

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U6-84 to U6-87 (07B4 to 07B7) <2>	Online Subnet	–	Subnet currently available; U6-84 is the most significant octet.	0 to 255	–
U6-88 to U6-91 (07B8 to 07F1) <2>	Online Gateway	–	Gateway currently available; U6-88 is the most significant octet.	0 to 255	–
U6-92 (07F2) <2>	Online Speed	OPT LINK SPEED	Link Speed	10: 10 Mbps 100: 100 Mbps	–
U6-93 (07F3) <2>	Online Duplex	OPT DUPLEX	Duplex Setting	0: Half 1: Full	–
U6-98 (07F8) <2>	First Fault	OPT FIRST FAULT	First Option Fault	–	–
U6-99 (07F9) <2>	Current Fault	OPT STATUS	Current Option Fault	–	–

<1> Values shown are specific to 200 V class drives. Double the values for 400 V class drives. Multiply the values by 2.875 for 600 V class drives.

<2> Available in drive software versions PRG: 1018 and later.

Note: Fault histories are not kept when CPF00, CPF01, CPF06, CPF24, oFA00, oFb00, oFC00, Uv1, Uv2, or Uv3 occur.

◆ U8: DriveWorksEZ Monitors

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U8-01 to U8-10 (1950 to 1959)	DriveWorksEZ Custom Monitor 1 to 10	–	DriveWorksEZ Custom Monitor 1 to 10	10 V: 100%	0.01%
U8-11 to U8-13 (195A to 195C)	DriveWorksEZ Version Control Monitor 1 to 3	–	DriveWorksEZ Version Control Monitor 1 to 3	No signal output available	–
U8-14 to U8-26 (195D to 1969)	DriveWorksEZ Pro Monitors	–	DriveWorksEZ Pro Monitors. Refer to the DWEZ Pro Help file for details.	–	–

Appendix: C

Standards Compliance

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

C.1 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:** 2014/35/EU
• **EMC Guidelines:** 2014/30/EU

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 IEC/EN 61800-5-1:2007, 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 degree 2 and overvoltage category 3 in accordance with IEC/EN 60664.

■ Factory Recommended Branch Circuit Protection

Yaskawa recommends installing one of the following types of branch circuit protection to maintain compliance with UL508C. Semiconductor protective type fuses are preferred. Alternate branch circuit protection devices are also listed in *Table C.1*.

NOTICE: *If a fuse is blown or a Ground Fault Circuit Interrupter (GFCI) is tripped, check the wiring and the selection of peripheral devices to identify the cause. Contact Yaskawa before restarting the drive or the peripheral devices if the cause cannot be identified.*

Table C.1 Factory Recommended Drive Branch Circuit Protection

Drive Model	Fuse Type	
	Manufacturer: Bussmann	
	Model	**Fuse Ampere Rating (A)**
Three-Phase 200 V Class		
2A0004	FWH-70B	70
2A0006	FWH-70B	70
2A0008	FWH-70B	70
2A0010	FWH-70B	70
2A0012	FWH-70B	70
2A0018	FWH-90B	90
2A0021	FWH-90B	90
2A0030	FWH-100B	100
2A0040	FWH-200B	200
2A0056	FWH-200B	200
2A0069	FWH-200B	200
2A0081	FWH-300A	300
2A0110	FWH-300A	300
2A0138	FWH-350A	350

Drive Model	Fuse Type	
	Manufacturer: Bussmann	
	Model	**Fuse Ampere Rating (A)**
2A0169	FWH-400A	400
2A0211	FWH-400A	400
2A0250	FWH-600A	600
2A0312	FWH-700A	700
2A0360	FWH-800A	800
2A0415	FWH-1000A	1000
Three-Phase 400 V Class		
4A0002	FWH-40B	40
4A0004	FWH-50B	50
4A0005	FWH-70B	70
4A0007	FWH-70B	70
4A0009	FWH-90B	90
4A0011	FWH-90B	90
4A0018	FWH-80B	80
4A0023	FWH-100B	100
4A0031	FWH-125B	125
4A0038	FWH-200B	200
4A0044	FWH-250A	250
4A0058	FWH-250A	250
4A0072	FWH-250A	250
4A0088	FWH-250A	250
4A0103	FWH-250A	250
4A0139	FWH-350A	350
4A0165	FWH-400A	400
4A0208	FWH-500A	500
4A0250	FWH-600A	600
4A0296	FWH-700A	700
4A0362	FWH-800A	800
4A0414	FWH-800A	800
4A0515	FWH-1000A	1000
4A0675	FWH-1200A	1200
4A0930	FWH-1200A	1200
4A1200	FWH-1600A	1600
Three-Phase 600 V Class		
5A0003	FWP-50B	50
5A0004	FWP-50B	50
5A0006	FWP-60B	60
5A0009	FWP-60B	60
5A0011	FWP-70B	70
5A0017	FWP-100B	100
5A0022	FWP-100B	100
5A0027	FWP-125A	125
5A0032	FWP-125A	125
5A0041	FWP-175A	175
5A0052	FWP-175A	175
5A0062	FWP-250A	250
5A0077	FWP-250A	250
5A0099	FWP-250A	250

Standards Compliance

C

Drive Model	Fuse Type	
	Manufacturer: Bussmann	
	Model	**Fuse Ampere Rating (A)**
5A0125	FWP-350A	350
5A0145	FWP-350A	350
5A0192	FWP-600A	600
5A0242	FWP-600A	600

■ 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.

■ CE Standards Compliance for DC Power Supply Input

Install the fuses in the following tables to meet CE standards.
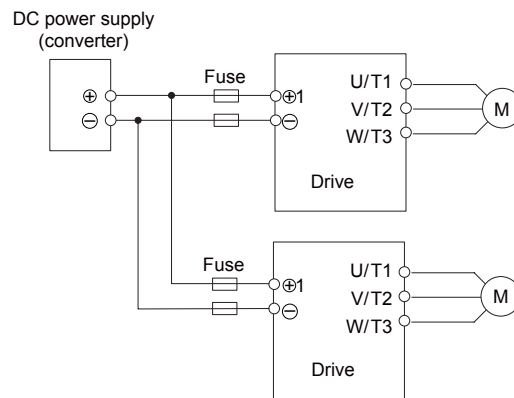
Figure C.2 Example of DC Power Supply Input (Two Drives Connected in Series)

Note: 1. When connecting multiple drives together, make sure that each drive has its own fuse. Replace all fuses when one fuse blows.
   3. The recommended fuses and fuse holders are made by Fuji Electric.

Table C.2 200 V Class Fuses and Fuse Holders

Drive Model	DC Power Supply Input				
	Fuse			Fuse Holder	
	Type	Rated Short Circuit Braking Current (kA)	Qty.	Type	Qty.
2A0004	CR2LS-30	100	2	CM-1A	1
2A0006					
2A0008					
2A0010	CR2LS-50				
2A0012					
2A0018	CR2LS-75				
2A0021	CR2LS-100				
2A0030	CR2L-125		2	CM-2A	1
2A0040	CR2L-150				
2A0056	CR2L-175				
2A0069	CR2L-225		2	*<1>*	
2A0081	CR2L-260				
2A0110	CR2L-300				
2A0138	CR2L-350				
2A0169	CR2L-400				
2A0211	CR2L-450				
2A0250	CR2L-600				
2A0312					
2A0360	CR2L-600	200			
2A0415	CS5F-1200				

<1> Manufacturer does not recommend a specific fuse holder for this fuse. Contact Yaskawa or your nearest sales representative for fuse dimensions.

Standards Compliance

C

Table C.3 400 V Class Fuses and Fuse Holders

Drive Model	DC Power Supply Input				
	Fuse			Fuse Holder	
	Type	Rated Short Circuit Braking Current (kA)	Qty.	Type	Qty.
4A0002	CR6L-20	100	2	CMS-4	2
4A0004	CR6L-30				
4A0005	CR6L-50				
4A0007					
4A0009					
4A0011					
4A0018	CR6L-75		2	CMS-5	2
4A0023					
4A0031	CR6L-100				
4A0038	CR6L-150				
4A0044					
4A0058	CR6L-200		2	<1>	
4A0072	CR6L-250				
4A0088					
4A0103	CR6L-300				
4A0139	CR6L-350				
4A0165	CR6L-400				
4A0208	CS5F-600	200			
4A0250					
4A0296					
4A0362	CS5F-800				
4A0414					
4A0515	CS5F-1200				
4A0675	CS5F-1500				
4A0930	CS5F-1200		4		
4A1200	CS5F-1500				

<1> Manufacturer does not recommend a specific fuse holder for this fuse. Contact Yaskawa or your nearest sales representative for fuse dimensions.

■ Guarding Against Harmful Materials

When installing IP00/Open Type enclosure drives, use an enclosure that prevents foreign material from entering the drive from above or below.

■ 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 EN 61800-3:2004+A1:2012.

■ EMC Filter Installation

The following conditions must be met to ensure continued compliance with guidelines. *Refer to EMC Filters on page 337* 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.
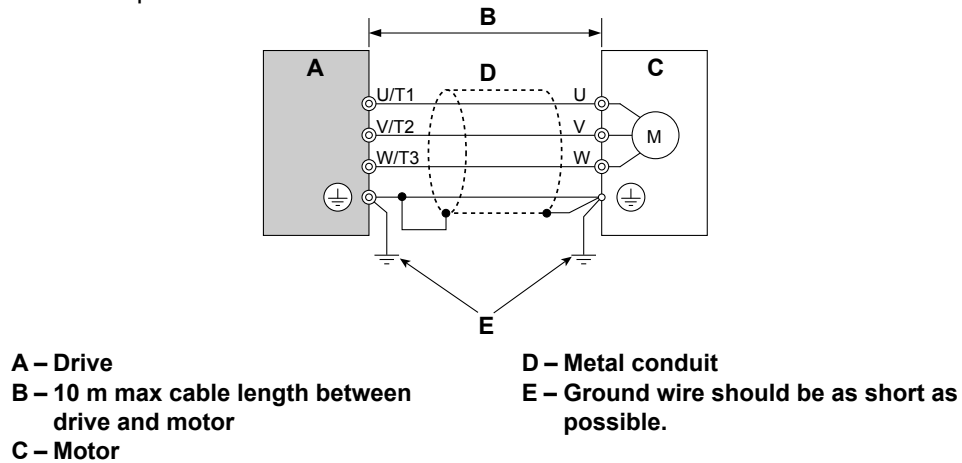
Figure C.3 Installation Method

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

WARNING! *Electrical Shock Hazard. Because the leakage current exceeds 3.5 mA in models 4A0414 to 4A1200, IEC/EN 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 mm^2 (Cu) or 16 mm^2 (Al) must be used. Failure to comply may result in death or serious injury.*

A – Braided shield cable
B – Metal panel
C – Cable clamp (conductive)
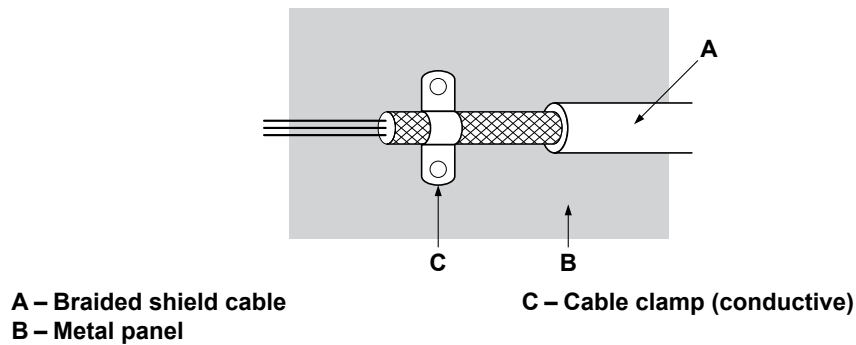
Figure C.4 Ground Area

6. Connect a DC link choke to minimize harmonic distortion.

Three-Phase 200 V / 400 V Class
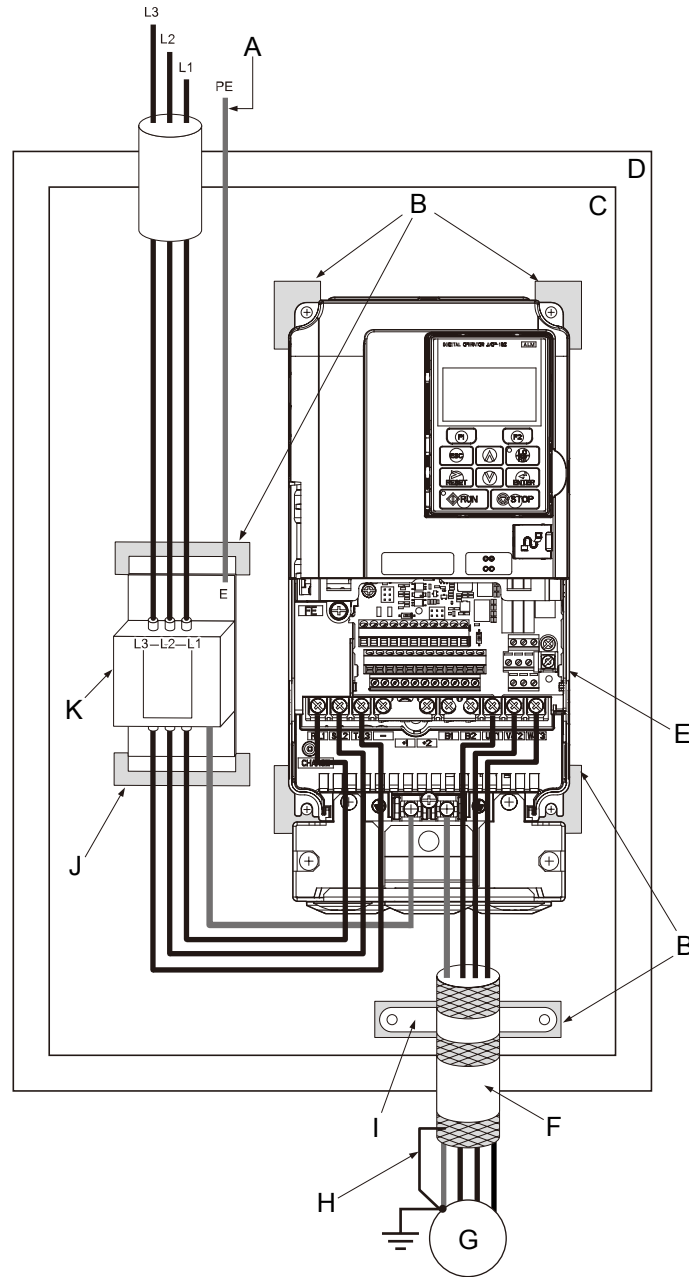
A – Make sure the ground wire is grounded
B – Grounding surface (remove any paint or sealant)
C – Metal plate
D – Enclosure panel
E – Drive
F – Motor cable (braided shield cable, max. 10 m)

G – Motor
H – Cable shield ground
I – Cable clamp
J – Ground plate (scrape off any visible paint)
K – EMC noise filter

Figure C.5 EMC Filter and Drive Installation for CE Compliance (Three-Phase 200 V / 400 V Class)

■ EMC Filters

Install the drive with the EMC filters listed in *Table C.4* to comply with the IEC/EN 61800-3 requirements.

Table C.4 IEC/EN 61800-3 Filters

Drive Model	Type Manufacturer: Schaffner	Rated Current (A)	Weight (lb)	Dimensions [W x D x H] (in)	Y x X (in)	Figure
Three-Phase 200 V Class						
2A0004	FS5972-10-07	10	2.6	5.6 × 1.8 × 13.0	4.5 × 12.3	1
2A0006						
2A0008						
2A0010	FS5972-18-07	18	2.9	5.6 × 1.8 × 13.0	4.5 × 12.3	
2A0012						
2A0018	FS5972-35-07	35	4.6	8.1 × 2.0 × 14.0	6.9 × 13.2	
2A0021						
2A0030						
2A0040	FS5972-60-07	60	8.8	9.3 × 2.6 × 16.1	8.1 × 15.4	
2A0056						
2A0069	FS5972-100-35	100	7.5	3.5 × 5.9 × 13.0	2.6 × 10.0	2
2A0081						
2A0110	FS5972-170-40	170	13.2	4.7 × 6.7 × 17.8	4.0 × 14.4	
2A0138						
2A0169	FS5972-250-37	250	25.8	5.1 × 9.5 × 24.0	3.5 × 19.6	
2A0211						
2A0250	FS5972-410-99	410	23.1	10.2 × 4.5 × 15.2	9.3 × 4.7	3
2A0312						
2A0360	FS5972-600-99	600	24.3	10.2 × 5.3 × 15.2	9.3 × 4.7	
2A0415						
Three-Phase 400 V Class						
4A0002	FS5972-10-07	10	2.7	5.6 × 1.8 × 13.0	4.5 × 12.3	1
4A0004						
4A0005						
4A0007						
4A0009	FS5972-18-07	18	2.9	5.6 × 1.8 × 13.0	4.5 × 12.3	
4A0011						
4A0018	FS5972-35-07	35	4.6	8.1 × 2.0 × 14.0	6.9 × 13.2	
4A0023						
4A0031						
4A0038	FS5972-60-07	60	8.8	9.3 × 2.6 × 16.1	8.0 × 15.4	
4A0044						
4A0058						
4A0072	FS5972-100-35	100	16.5	3.5 × 5.9 × 13.0	2.6 × 10.0	2
4A0088						
4A0103	FS5972-170-35	170	10.4	4.7 × 6.7 × 17.8	4.0 × 14.4	
4A0139						
4A0165						
4A0208	FS5972-250-37	250	25.8	5.1 × 9.5 × 24.0	3.5 × 19.6	

Standards Compliance

C

C.1 European Standards

Drive Model	Type Manufacturer: Schaffner	Rated Current (A)	Weight (lb)	Dimensions [W x D x H] (in)	Y x X (in)	Figure
4A0250	FS5972-410-99	410	23.1	10.2 × 4.5 × 15.2	9.3 × 4.7	3
4A0296						
4A0362						
4A0414	FS5972-600-99	600	24.3	10.2 × 5.3 × 15.2	9.3 × 4.7	
4A0515						
4A0675	FS5972-800-99	800	69.4	11.8 × 6.3 × 28.2	10.8 × 8.3	
4A0930	FS5972-600-99 [1]	600	24.3	10.2 × 5.3 × 15.2	9.3 × 4.7	
4A1200	FS5972-800-99 [1]	800	69.4	11.8 × 28.2 × 6.3	10.8 × 8.3	4

[1] Connect two of the same filters in parallel.
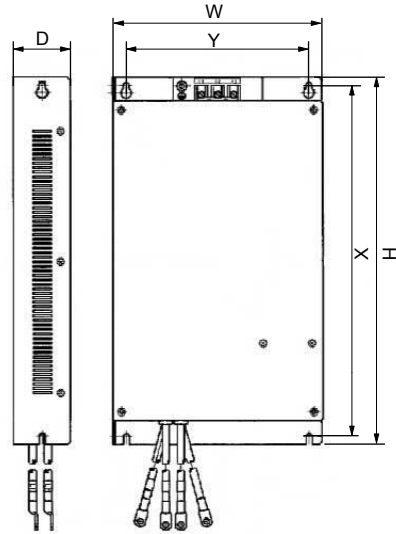
Figure 1
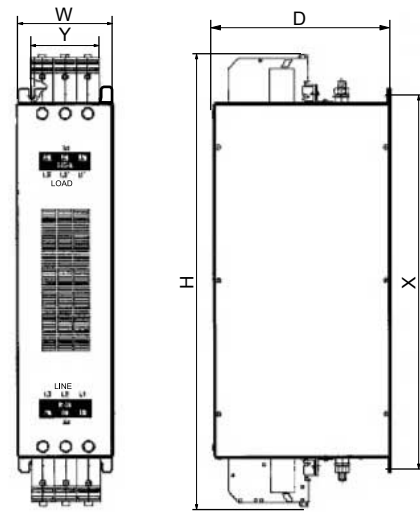
Figure 2
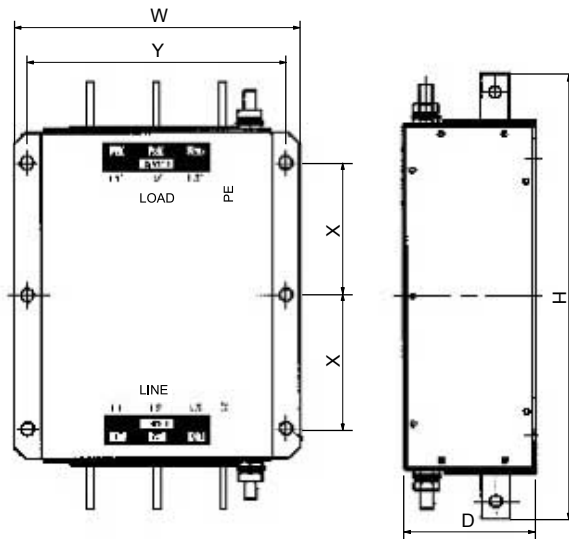
Figure 3

Figure C.6 EMC Filter Dimensions

■ DC Link Chokes for IEC/EN 61000-3-2 Compliance

Table C.5 DC Link Chokes for Harmonic Reduction

Drive Model	DC Link Chokes	
	Model	**Rating**
200 V Three-Phase Units		
2A0004	UZDA-B	5.4 A
2A0006		8 mH
400 V Three-Phase Units		
4A0002	UZDA-B	3.2 A
4A0004		28 mH

Note: DC link chokes are not required for other models to comply with EMC.

C.2 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.7 UL/cUL Mark

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

■ Installation Area

Do not install the drive to an area greater than pollution degree 2 (UL standard).

■ Ambient Temperature

IP00/Open Type Enclosure: -10 °C to +50 °C (14 °F to 122 °F)

IP20/UL Type 1 Enclosure: -10 to +40 °C (14 °F to 104 °F)

Finless Type: IP20/IP00 Enclosure: -10 to +45 °C (14 °F to 113 °F)

■ Main Circuit Terminal Wiring

Yaskawa recommends using closed-loop crimp terminals on all drive models. To maintain UL/cUL approval, UL Listed closed-loop crimp terminals are specifically required when wiring the drive main circuit terminals on models 2A0110 to 2A0415, 4A0058 to 4A0675, (4A1200 series-dependent), and 5A0041 to 5A0242. Use only the tools recommended by the terminal manufacturer for crimping. *Refer to Closed-Loop Crimp Terminal Recommendations on page 340* for closed-loop crimp terminal recommendations.

Closed-Loop Crimp Terminal Recommendations

To maintain UL/cUL approval, UL Listed closed-loop crimp terminals are specifically required when wiring the drive main circuit terminals on models 2A0110 to 2A0415, 4A0058 to 4A1200, and 5A0041 to 5A0242. Use only the tools recommended by the terminal manufacturer for crimping. Yaskawa recommends UL Listed crimp terminals made by JST and Tokyo DIP (or equivalent) for the insulation cap. *Table C.6* matches the wire gauges and terminal screw sizes with Yaskawa-recommended crimp terminals, tools, and insulation caps. Refer to the appropriate Wire Gauge and Torque Specifications table for the wire gauge and screw size for your drive model. Place orders with a Yaskawa representative or the Yaskawa sales department.

Wire gauge values shown in **bold italic** are the recommended values. Refer to local codes for proper selections.

Table C.6 Closed-Loop Crimp Terminal Size

Drive Model	Wire Gauge (AWG, kcmil)		Screw Size	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code [1]
	R/L1, S/L2, T/L3	U/T1, V/T2, W/T3			Machine No.	Die Jaw		
200 V Class								
2A0004 2A0006 2A0008 2A0010	*14*		M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12			R5.5-4			TP-005	100-054-029
	10							
2A0012	14	*14*	M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12	12		R5.5-4			TP-005	100-054-029
	10							

Drive Model	Wire Gauge (AWG, kcmil)		Screw Size	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code [1]
	R/L1, S/L2, T/L3	U/T1, V/T2, W/T3			Machine No.	Die Jaw		
2A0018	−	14	M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12		M4	R5.5-4			TP-005	100-054-029
	10							
2A0021	12		M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	10							
2A0030	10		M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4		AD-901	TP-008	100-054-031
	6			14-NK4		AD-902	TP-014	100-054-033
2A0040	8	*8*	M4	8-4	YA-4	AD-901	TP-008	100-054-031
	6	6		14-NK4		AD-902	TP-014	100-054-033
2A0056	6		M6	R14-6	YA-5	AD-952	TP-014	100-051-261
	4			R22-6		AD-953	TP-022	100-051-262
2A0069	4		M8	R22-8	YA-5	AD-953	TP-022	100-051-263
	3			R38-8		AD-954	TP-038	100-051-264
2A0081	3		M8	R38-8	YA-5	AD-954	TP-038	100-051-264
	2							
2A0110	3		M8	R38-8	YA-5	AD-954	TP-038	100-051-264
	2							
	1							
	1/0			R60-8	YA-5	AD-955	TP-060	100-051-265
2A0138	1		M10	R38-10	YF-1 YET-300-1	TD-321, TD-311	TP-060	100-061-114
	1/0			R60-10				100-051-266
	2/0			70-10		TD-323, TD-312	TP-080	100-054-036
2A0169	2/0	−	M10	70-10	YF-1 YET-300-1	TD-323, TD-312	TP-080	100-054-036
	3/0			80-10				100-051-267
	4/0			R100-10		TD-324, TD-312	TP-100	100-051-269
2A0211	*1/0 × 2P*		M10	R60-10	YF-1 YET-300-1	TD-321, TD-311	TP-060	100-051-266
	2/0 × 2P			70-10		TD-323, TD-312	TP-080	100-054-036
2A0250	*3/0 × 2P*		M12	80-L12	YF-1 YET-300-1	TD-323, TD-312	TP-080	100-051-558
	4/0 × 2P			100-L12		TD-324, TD-312	TP-100	100-051-560
	−	250 × 2P		150-L12			TP-150	100-051-562
	250	−		R150-12		TD-325, TD-313	TP-150	100-051-273
	300							
2A0312	3/0 × 2P	*3/0 × 2P*	M12	80-L12	YF-1 YET-300-1	TD-323, TD-312	TP-080	100-051-558
	4/0 × 2P	4/0 × 2P		100-L12		TD-324, TD-312	TP-100	100-051-560
	250 × 2P			150-L12		TD-325, TD-313	TP-150	100-051-562
	300 × 2P							

Standards Compliance

C

| Drive Model | Wire Gauge (AWG, kcmil) | | Screw Size | Crimp Terminal Model Number | Tool | | Insulation Cap Model No. | Code [1] |
	R/L1, S/L2, T/L3	U/T1, V/T2, W/T3			Machine No.	Die Jaw		
2A0360	4/0 × 2P	*4/0 × 2P*	M12	100-L12	YF-1 YET-300-1	TD-324, TD-312	TP-100	100-051-560
	250 × 2P	250 × 2P		150-L12		TD-325, TD-313	TP-150	100-051-562
	300 × 2P							
	350 × 2P			180-L12		TD-327, TD-314	TP-200	100-066-688
	400 × 2P			200-L12				100-051-564
	500 × 2P			325-12		TD-328, TD-315	TP-325	100-051-277
	600	600 × 2P						
2A0415	250 × 2P	–	M12	150-L12	YF-1 YET-300-1	TD-325, TD-313	TP-150	100-051-562
	300 × 2P	*300 × 2P*						
	350 × 2P	350 × 2P		180-L12		TD-327, TD-314	TP-200	100-066-688
	400 × 2P			200-L12				100-051-564
	500 × 2P			325-12		TD-328, TD-315	TP-325	100-051-277
	600 × 2P							
400 V Class								
4A0002 4A0004 4A0005 4A0007 4A0009	*14*		M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12			R5.5-4			TP-005	100-054-029
	10							
4A0011	14	*14*	M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12	12		R5.5-4			TP-005	100-054-029
	10							
4A0018	12		M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	10							
	8			8-4		AD-901	TP-008	100-054-031
	6			14-NK4		AD-902	TP-014	100-054-033
4A0023	**10**		M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	8			8-4		AD-901	TP-008	100-054-031
	6			14-NK4		AD-902	TP-014	100-054-033
4A0031	–	10	M5	R5.5-5	YA-4	AD-900	TP-005	100-054-030
	8			R8-5		AD-901	TP-008	100-054-032
	6			R14-5		AD-902	TP-014	100-054-034
4A0038	8	*8*	M5	R8-5	YA-4	AD-901	TP-008	100-054-032
	6	6		R14-5		AD-902	TP-014	100-054-034
4A0044	*6*		M6	R14-6	YA-5	AD-952	TP-014	100-051-261
	4			R22-6		AD-953	TP-022	100-051-262
4A0058	6		M8	R14-8	YA-5	AD-952	TP-014	100-054-035
	4			R22-8		AD-953	TP-022	100-051-263
4A0072	4		M8	R22-8	YA-5	AD-953	TP-022	100-051-263
	3			R38-8		AD-954	TP-038	100-051-264
4A0088	3		M8	R38-8	YA-5	AD-954	TP-038	100-051-264
	2							
	1							
	1/0			R60-8		AD-955	TP-060	100-051-265
4A0103	2		M8	R38-8	YA-5	AD-954	TP-038	100-051-264
	1	*1*						
	1/0	1/0		R60-8		AD-955	TP-060	100-051-265

Drive Model	Wire Gauge (AWG, kcmil) R/L1, S/L2, T/L3	Wire Gauge (AWG, kcmil) U/T1, V/T2, W/T3	Screw Size	Crimp Terminal Model Number	Tool Machine No.	Tool Die Jaw	Insulation Cap Model No.	Code [1]
4A0139	1/0		M10	R60-10	YF-1 YET-300-1	TD-321, TD-311	TP-060	100-051-266
	2/0	*2/0*		70-10		TD-323, TD-312	TP-080	100-054-036
	3/0	3/0		80-10				100-051-267
	4/0			R100-10		TD-324, TD-312	TP-100	100-051-269
4A0165	3/0		M10	80-10	YF-1 YET-300-1	TD-323, TD-312	TP-080	100-051-267
	4/0			R100-10		TD-324, TD-312	TP-100	100-051-269
4A0208	2 × 2P		M10	38-L10	YF-1 YET-150-1	TD-224, TD-212	TP-038	100-051-556
	1 × 2P							
	3/0 × 2P			80-L10		TD-227, TD-214	TP-080	100-051-557
	4/0			R100-10		TD-228, TD-214	TP-100	100-051-269
	250			R150-10		TD-229, TD-215	TP-150	100-051-272
	300							
4A0250	1 × 2P	–	M10	38-L10	YF-1 YET-150-1	TD-224, TD-212	TP-038	100-051-556
	3/0 × 2P			80-L10		TD-227, TD-214	TP-080	100-051-557
	4/0 × 2P			100-L10		TD-228, TD-214	TP-100	100-051-559
	250 × 2P			150-L10		TD-229, TD-215	TP-150	100-051-561
	300			R150-10			TP-150	100-051-272
	350			180-10	YF-1 YET-300-1	TD-327, TD-314	TP-200	100-066-687
	400			200-10				100-051-563
	500			325-10		TD-328, TD-315	TP-325	100-051-565
	600							
4A0296	3/0 × 2P		M12	80-L12	YF-1 YET-300-1	TD-323, TD-312	TP-080	100-051-558
	4/0 × 2P			100-L12		TD-324, TD-312	TP-100	100-051-560
	250 × 2P			150-L12		TD-325, TD-313	TP-150	100-051-562
	300 × 2P							
	–	350 × 2P		180-L12		TD-327, TD-314	TP-200	100-066-688
	350	–		180-12				100-066-689
	400			R200-12				100-051-275
	500			325-12		TD-328, TD-315	TP-325	100-051-277
	600							
4A0362	3/0 × 2P		M12	80-L12	YF-1 YET-300-1	TD-323, TD-312	TP-080	100-051-558
	4/0 × 2P			100-L12		TD-324, TD-312	TP-100	100-051-560
	250 × 2P			150-L12		TD-325, TD-313	TP-150	100-051-562
	300 × 2P							
	350 × 2P			180-L12		TD-327, TD-314	TP-200	100-066-688
	400 × 2P			200-L12				100-051-564
	500			325-12		TD-328, TD-315	TP-325	100-051-277
	600							

Standards Compliance

C

Drive Model	Wire Gauge (AWG, kcmil)		Screw Size	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code [1]
	R/L1, S/L2, T/L3	U/T1, V/T2, W/T3			Machine No.	Die Jaw		
4A0414	4/0 × 2P		M12	100-L12	YF-1 YET-300-1	TD-324, TD-312	TP-100	100-051-560
	250 × 2P			150-L12		TD-325, TD-313	TP-150	100-051-562
	300 × 2P							
4A0515	*3/0 × 4P*	3/0 × 4P	M12	80-L12	YF-1 YET-300-1	TD-323, TD-312	TP-080	100-051-558
	4/0 × 4P	*4/0 × 4P*		100-L12		TD-324, TD-312	TP-100	100-051-560
	250 × 4P			150-L12		TD-325, TD-313	TP-150	100-051-562
	300 × 2P							
4A0675	4/0 × 4P		M12	100-L12	YF-1 YET-300-1	TD-324, TD-312	TP-100	100-051-560
	250 × 4P			150-L12		TD-325, TD-313	TP-150	100-051-562
	300 × 4P							
4A0930	3/0 × 8P		M12	80-L12	YF-1 YET-300-1	TD-323, TD-312	TP-080	100-051-558
	4/0 × 8P			100-L12		TD-324, TD-312	TP-100	100-051-560
	250 × 8P			150-L12		TD-325, TD-313	TP-150	100-051-562
	300 × 8P							
4A1200	4/0 × 8P		M12	100-L12	YF-1 YET-300-1	TD-324, TD-312	TP-100	100-051-560
	250 × 8P			150-L12		TD-325, TD-313	TP-150	100-051-562
	300 × 8P							

<1> Codes refer to a set of three crimp terminals and three insulation caps. Prepare input and output wiring using two sets for each connection.
Example 1: Models with 300 kcmil for both input and output require one set for input terminals and one set for output terminals, so the user should order two sets of [100-051-272].
Example 2: Models with 4/0 AWG × 2P for both input and output require two sets for input terminals and two sets for output terminals, so the user should order four sets of [100-051-560].

Note: Use crimp insulated terminals or insulated shrink tubing for wiring connections. Wires should have a continuous maximum allowable temperature of 75 °C 600 Vac UL-approved vinyl-sheathed insulation.

Factory Recommended Branch Circuit Protection for UL Compliance

NOTICE: *If a fuse is blown or a Ground Fault Circuit Interrupter (GFCI) is tripped, check the wiring and the selection of the peripheral devices to identify the cause. Contact Yaskawa before restarting the drive or the peripheral devices if the cause cannot be identified.*

Yaskawa recommends installing one of the following types of branch circuit protection to maintain compliance with UL508C. Semiconductor protective type fuses are preferred. Alternate branch circuit protection devices are also listed in the tables below.

Table C.7 Factory Recommended Drive Branch Circuit Protection (Normal Duty)

Drive Model	Normal Duty					
	Nominal Output Power HP	AC Drive Input Amps	MCCB Rating Amps [1]	Time Delay Fuse Rating Amps [2]	Non-time Delay Fuse Rating Amps [3]	Bussmann Semi-conductor Fuse Rating (Fuse Ampere) [4]
200 V Class						
2A0004	0.75	3.9	15	6.25	10	FWH-70B (70)
2A0006	1 - 1.5	7.3	15	12	20	FWH-70B (70)
2A0008	2	8.8	15	15	25	FWH-70B (70)
2A0010	3	10.8	20	17.5	30	FWH-70B (70)
2A0012	3	13.9	25	20	40	FWH-70B (70)
2A0018	5	18.5	35	30	50	FWH-90B (90)
2A0021	7.5	24	45	40	70	FWH-90B (90)
2A0030	10	37	60	60	110	FWH-100B (100)

Drive Model	Normal Duty					
	Nominal Output Power HP	AC Drive Input Amps	MCCB Rating Amps [1]	Time Delay Fuse Rating Amps [2]	Non-time Delay Fuse Rating Amps [3]	Bussmann Semi-conductor Fuse Rating (Fuse Ampere) [4]
2A0040	15	52	100	90	150	FWH-200B (200)
2A0056	20	68	125	110	200	FWH-200B (200)
2A0069	25	80	150	125	225	FWH-200B (200)
2A0081	30	96	175	150	275	FWH-300A (300)
2A0110	40	111	200	175	300	FWH-300A (300)
2A0138	50	136	250	225	400	FWH-350A (350)
2A0169	60	164	300	250	450	FWH-400A (400)
2A0211	75	200	400	350	600	FWH-400A (400)
2A0250	100	271	500	450	800	FWH-600A (600)
2A0312	125	324	600	500	800	FWH-700A (700)
2A0360	150	394	700	600	1000 [5]	FWH-800A (800)
2A0415	175	471	900	800	1400 [5]	FWH-1000A (1000)
400 V Class						
4A0002	1	2.1	15	3.5	6	FWH-40B (40)
4A0004	2	4.3	15	7.5	12	FWH-50B (50)
4A0005	3	5.9	15	10	17.5	FWH-70B (70)
4A0007	3	8.1	15	12	20	FWH-70B (70)
4A0009	5	9.4	15	15	25	FWH-90B (90)
4A0011	7.5	14	25	20	40	FWH-90B (90)
4A0018	10	20	40	35	60	FWH-80B (80)
4A0023	15	24	45	40	70	FWH-100B (100)
4A0031	20	38	75	60	110	FWH-125B (125)
4A0038	25	44	75	75	125	FWH-200B (200)
4A0044	30	52	100	90	150	FWH-250A (250)
4A0058	40	58	100	100	150	FWH-250A (250)
4A0072	50	71	125	110	200	FWH-250A (250)
4A0088	60	86	150	150	250	FWH-250A (250)
4A0103	75	105	200	175	300	FWH-250A (250)
4A0139	100	142	250	225	400	FWH-350A (350)
4A0165	125	170	300	250	500	FWH-400A (400)
4A0208	150	207	400	350	600	FWH-500A (500)
4A0250	200	248	450	400	700	FWH-600A (600)
4A0296	250	300	600	500	800	FWH-700A (700)
4A0362	300	346	600	600	1000 [5]	FWH-800A (800)
4A0414	350	410	800	700	1200 [5]	FWH-800A (800)
4A0515	400 - 450	465	900	800	1350 [5]	FWH-1000A (1000)
4A0675	500 - 600	657	1200	1100 [5]	1800 [5]	FWH-1200A (1200)
4A0930	700 - 800	922	Not Applicable			FWH-1200A (1200)
4A1200	900 - 1000	1158				FWH-1600A (1600)
600 V Class						
5A0003	2	3.6	15	6.25	10	FWP-50B (50)
5A0004	3	5.1	15	8	15	FWP-50B (50)
5A0006	5	8.3	15	12	20	FWP-60B (60)
5A0009	7.5	12	20	20	35	FWP-60B (60)
5A0011	10	16	30	25	45	FWP-70B (70)
5A0017	15	23	40	40	60	FWP-100B (100)

Standards Compliance

C

Drive Model	Normal Duty					
	Nominal Output Power HP	AC Drive Input Amps	MCCB Rating Amps [1]	Time Delay Fuse Rating Amps [2]	Non-time Delay Fuse Rating Amps [3]	Bussmann Semiconductor Fuse Rating (Fuse Ampere) [4]
5A0022	20	31	60	50	90	FWP-100B (100)
5A0027	25	38	75	60	110	FWP-125A (125)
5A0032	30	45	75	75	125	FWP-125A (125)
5A0041	40	44	75	75	125	FWP-175A (175)
5A0052	50	54	100	90	150	FWP-175A (175)
5A0062	60	66	125	110	175	FWP-250A (250)
5A0077	75	80	150	125	225	FWP-250A (250)
5A0099	100	108	175	175	300	FWP-250A (250)
5A0125	125	129	225	225	350	FWP-350A (350)
5A0145	150	158	300	275	450	FWP-350A (350)
5A0192	200	228	400	350	600	FWP-600A (600)
5A0242	250	263	500	450	700	FWP-600A (600)

<1> Maximum MCCB Rating is 15 A, or 200 % of drive input current rating, whichever is larger. MCCB voltage rating must be 600 VAC or greater.

<2> Maximum Time Delay fuse is 175% of drive input current rating. This covers any Class CC, J or T class fuse.

<3> Maximum Non-time Delay fuse is 300% of drive input current rating. This covers any CC, J or T class fuse.

<4> When using semiconductor fuses, Bussman FWH and FWP are required for UL compliance. Select FWH for 200 V Class and 400 V Class models and FWP fuses for 600 V models.

<5> Class L fuse is also approved for this rating.

Table C.8 Factory Recommended Drive Branch Circuit Protection (Heavy Duty)

Drive Model	Heavy Duty					
	Nominal Output Power HP	AC Drive Input Amps	MCCB Rating Amps [1]	Time Delay Fuse Rating Amps [2]	Non-time Delay Fuse Rating Amps [3]	Bussmann Semiconductor Fuse Rating (Fuse Ampere) [4]
200 V Class						
2A0004	0.75	2.9	15	5	8	FWH-70B (70)
2A0006	1	5.8	15	10	15	FWH-70B (70)
2A0008	2	7	15	12	17.5	FWH-70B (70)
2A0010	2	7.5	15	12	20	FWH-70B (70)
2A0012	3	11	20	17.5	30	FWH-70B (70)
2A0018	3	15.6	25	25	40	FWH-90B (90)
2A0021	5	18.9	35	30	50	FWH-90B (90)
2A0030	7.5	28	50	40	75	FWH-100B (100)
2A0040	10	37	60	60	100	FWH-200B (200)
2A0056	15	52	100	90	150	FWH-200B (200)
2A0069	20	68	125	110	200	FWH-200B (200)
2A0081	25	80	150	125	225	FWH-300A (300)
2A0110	30	82	150	125	225	FWH-300A (300)
2A0138	40	111	200	175	250	FWH-350A (350)
2A0169	50	136	250	225	350	FWH-400A (400)
2A0211	60	164	300	250	450	FWH-400A (400)
2A0250	75	200	400	350	600	FWH-600A (600)
2A0312	100	271	500	450	800	FWH-700A (700)
2A0360	125	324	600	500	900 [4]	FWH-800A (800)
2A0415	150	394	700	600	1100 [4]	FWH-1000A (1000)
400 V Class						
4A0002	0.75	1.8	15	3	5	FWH-40B (40)

Drive Model	Heavy Duty					
	Nominal Output Power HP	AC Drive Input Amps	MCCB Rating Amps <1>	Time Delay Fuse Rating Amps <2>	Non-time Delay Fuse Rating Amps <3>	Bussmann Semi-conductor Fuse Rating (Fuse Ampere) <4>
4A0004	1 - 2	3.2	15	5	9	FWH-50B (50)
4A0005	3	4.4	15	7	12	FWH-70B (70)
4A0007	3	6	15	10	17.5	FWH-70B (70)
4A0009	5	8.2	15	12	20	FWH-90B (90)
4A0011	5	10.4	20	17.5	30	FWH-90B (90)
4A0018	7.5 - 10	15	30	25	40	FWH-80B (80)
4A0023	10	20	40	35	60	FWH-100B (100)
4A0031	15	29	50	50	80	FWH-125B (125)
4A0038	20	39	75	60	110	FWH-200B (200)
4A0044	25 - 30	47	75	75	125	FWH-250A (250)
4A0058	30	43	75	75	125	FWH-250A (250)
4A0072	40	58	100	100	150	FWH-250A (250)
4A0088	60	71	125	110	200	FWH-250A (250)
4A0103	60	86	150	150	250	FWH-250A (250)
4A0139	75	105	175	175	300	FWH-350A (350)
4A0165	100	142	225	225	400	FWH-400A (400)
4A0208	125 - 150	170	250	250	500	FWH-500A (500)
4A0250	150	207	350	350	600	FWH-600A (600)
4A0296	200	248	400	400	700	FWH-700A (700)
4A0362	250	300	500	500	800	FWH-800A (800)
4A0414	300	346	600	600	1000 <4>	FWH-800A (800)
4A0515	350	410	700	700	1200 <4>	FWH-1000A (1000)
4A0675	400 - 500	584	1000	1000 <4>	1600 <4>	FWH-1200A (1200)
4A0930	600 - 700	830	Not Applicable			FWH-1200A (1200)
4A1200	800 - 900	1031				FWH-1600A (1600)
600 V Class						
5A0003	1	1.9	15	3	5	FWP-50B (50)
5A0004	2	3.6	15	6.25	10	FWP-50B (50)
5A0006	3	5.1	15	8	15	FWP-60B (60)
5A0009	5	8.3	15	12	20	FWP-60B (60)
5A0011	7.5	12	20	20	35	FWP-70B (70)
5A0017	10	16	30	25	45	FWP-100B (100)
5A0022	15	23	40	40	60	FWP-100B (100)
5A0027	20	31	60	50	90	FWP-125A (125)
5A0032	25	38	75	60	100	FWP-125A (125)
5A0041	30	33	60	50	90	FWP-175A (175)
5A0052	40	44	75	75	125	FWP-175A (175)
5A0062	50	54	100	90	150	FWP-250A (250)
5A0077	60	66	125	110	175	FWP-250A (250)
5A0099	75	80	150	125	225	FWP-250A (250)
5A0125	100	108	175	175	300	FWP-350A (350)
5A0145	125	129	250	225	350	FWP-350A (350)
5A0192	150	158	300	250	400	FWP-600A (600)
5A0242	200	228	400	350	600	FWP-600A (600)

<1> Maximum MCCB Rating is 15 A, or 200 % of drive input current rating, whichever is larger. MCCB voltage rating must be 600 VAC or greater.

<2> Maximum Time Delay fuse is 175% of drive input current rating. This covers any Class CC, J or T class fuse.

<3> Maximum Non-time Delay fuse is 300% of drive input current rating. This covers any CC, J or T class fuse.

Standards Compliance

C

<4>   Class L fuse is also approved for this rating.

Wiring Fuses for Models 4A0930 and 4A1200

NOTICE: *If a fuse is blown or an Ground Fault Circuit Interrupter (GFCI) is tripped, check the wiring and the selection of peripheral devices to identify the cause. Contact Yaskawa before restarting the drive or the peripheral devices if the cause cannot be identified.*

Install a fuse on the input side to protect drive wiring and prevent other secondary damage. Wire the fuse so that leakage current in the upper controller power supply will trigger the fuse and shut off the power supply.

Select the appropriate fuse from *Table 3.2*.

Table C.9 Input Fuses for Models 4A0930 and 4A1200

Voltage Class	Model	Selection			Input Fuse (Example)			
		Input Voltage	Current	Pre-arc I²t (A²s)	Model	Manufacturer	Rating	Pre-arc I²t (A²s)
Three-Phase 400 V Class	4A0930	480 V	1500 A	140000 to 3100000	CS5F-1200	Fuji Electric	AC500 V, 1200 A	276000
	4A0930 with 12-pulse rectification				FWH-1200A	Bussman	AC500 V, 1200 A	–
					FWH-1000A	Bussman	AC500 V, 1000 A	–
	4A1200	480 V	1500 A	320000 to 3100000	CS5F-1500	Fuji Electric	AC500 V, 1500 A	351000
	4A1200 with 12-pulse rectification				FWH-1600A	Bussman	AC500 V, 1600 A	–
					FWH-1200A	Bussman	AC500 V, 1200 A	–

■ 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. The external power supply shall be a UL Listed Class 2 power supply source or equivalent only.

Table C.10 Control Circuit Terminal Power Supply

Input / Output	Terminal Signal	Power Supply Specifications
Open Collector Outputs	P1, P2, PC, DM+, DM-	Requires class 2 power supply
Digital inputs	S1 to S8, SC, HC, H1, H2	Use the internal LVLC power supply of the drive. Use class 2 for external power supply.
Analog inputs / outputs	+V, -V, A1, A2, A3, AC, AM, FM	Use the internal LVLC power supply of the drive. Use class 2 for external power supply.

■ Drive Short Circuit Rating

The drive is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, 240 Vac maximum (200 V Class), 480 Vac maximum (400 V Class), and 600 Vac maximum (600 V Class) when protected by Bussmann Type FWH or FWP fuses as specified in *Factory Recommended Branch Circuit Protection* on page *330*.

◆ CSA Standards Compliance

Figure C.8 CSA Mark

■ CSA for Industrial Control Equipment

The drive is CSA-certified as Industrial Control Equipment Class 3211.

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

◆ 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 protects the motor when parameter L1-01 is not set to 0. The default for L1-01 is 1, which enables protection for standard induction motors.

If Auto-Tuning has been performed successfully, the motor data entered to T1-04 is automatically written to 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 frequency that 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.11 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.
4	Permanent Magnet motor with variable torque	Selects protection characteristics for a variable torque PM motor. The motor overload detection level (oL1) is automatically reduced when running below the motor rated speed.
5	Permanent Magnet motor with constant torque	Selects protection characteristics for a constant torque PM motor. The motor overload detection level (oL1) is constant over the whole speed range.
6	Standard fan-cooled motor (50 Hz)	Selects protection characteristics for a standard self-cooled motor with limited cooling capabilities when running below the rated speed. The motor overload detection level (oL1) is automatically reduced when running below the motor rated speed.

When connecting the drive to more than one motor for simultaneous operation, disable the electronic overload protection (L1-01 = 0) and wire each motor with its own motor thermal overload relay.

Enable motor overload protection (L1-01 = 1 to 6) 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 a hot motor 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.
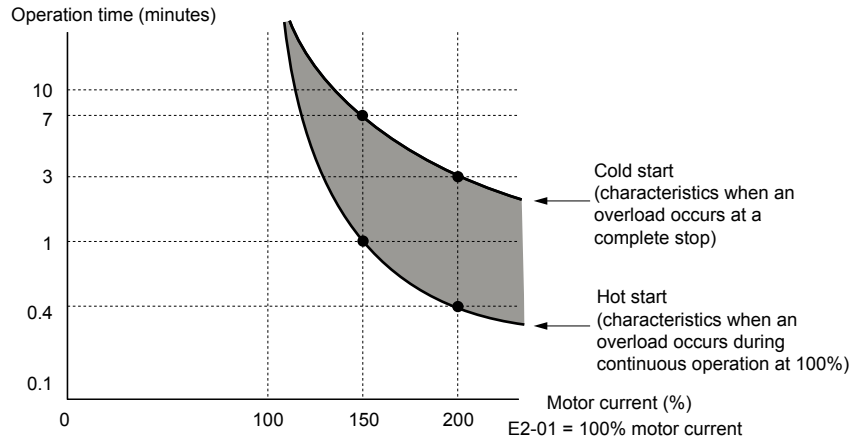
Standards Compliance

C

Figure C.9 Motor Overload Protection Time

◆ Precautionary Notes on External Heatsink (IP00/Open Type Enclosure)

When using an external heatsink, UL compliance requires covering exposed capacitors in the main circuit to prevent injury to surrounding personnel.

The portion of the external heatsink that projects out can be protected with the enclosure or with the appropriate capacitor cover after completing drive installation. Use *Table C.12* to match drive models with available capacitor covers. Order capacitor covers from a Yaskawa representative or directly from the Yaskawa sales department.

Table C.12 Capacitor Cover

Drive Model	Code Number	Figure
2A0110	100-061-273	*Figure C.10*
2A0138	100-061-274	
2A0169	100-061-275	
2A0211		
2A0250	100-061-277	
2A0312		
2A0360	100-061-278	
2A0415		
4A0058	100-061-273	
4A0072	100-061-274	
4A0088	100-061-276	
4A0103		
4A0139	100-061-275	
4A0165		
4A0208	100-061-277	
4A0250	100-061-278	
4A0296		
4A0362		
4A0414	100-061-279	
4A0515	100-061-280	
4A0675		
4A0930	100-061-281 [1]	*Figure C.11*
4A1200		

Drive Model	Code Number	Figure
5A0041	100-061-274	*Figure C.10*
5A0052		
5A0062	100-061-275	
5A0077		
5A0099		
5A0125	100-061-277	
5A0145		
5A0192	100-061-278	
5A0242		

<1>   Requires two sets.

Note: Model 4A1200 is UL compliant when the air entering the drive-installed panel or cabinet is 45 °C or cooler. For more information, contact your nearest Yaskawa representative or our sales office.

A – Drive (outside panel)   D – Installation screws
B – Drive (inside panel)   E – Capacitor cover
C – Opening to capacitors
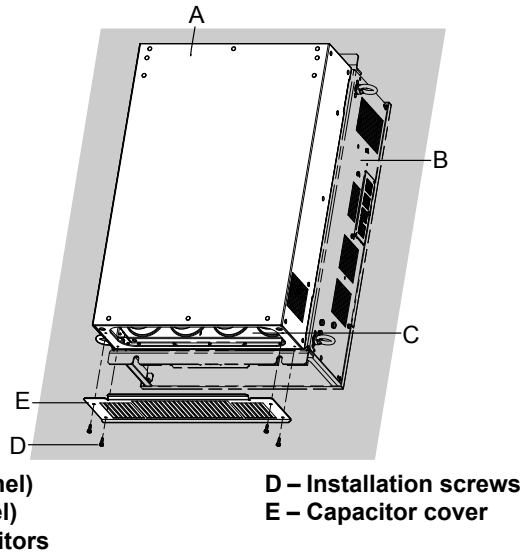
Figure C.10 Capacitor Cover

A – Drive (outside panel)   D – Installation screws
B – Opening to capacitors   E – Capacitor cover
C – Drive (inside panel)
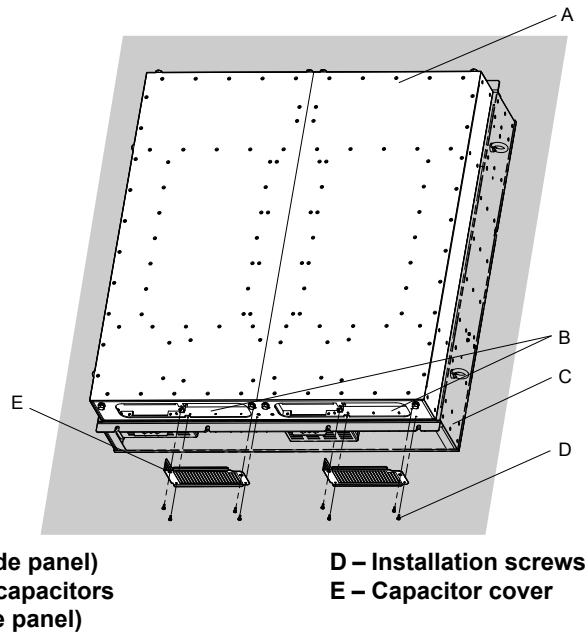
Figure C.11 Capacitor Cover (Models 4A0930, 4A1200)

Standards Compliance

C

C.3 Safe Disable Input Function

◆ Specifications

Inputs/Outputs		Two Safe Disable inputs and one EDM output according to ISO/EN 13849-1 Cat. 3 PLd, IEC/EN 61508 SIL2.
Operation Time		Time from input open to drive output stop is less than 1 ms.
Failure Probability	Demand Rate Low	PFD = 5.15E^{-5}
	Demand Rate High/ Continuous	PFH = 1.2E^{-9}
Performance Level		The Safe Disable inputs satisfy all requirements of Performance Level (PL) d according to ISO/EN 13849-1 (DC from EDM considered).

◆ Precautions

DANGER! *Sudden Movement Hazard. Improper use of the Safe Disable function can result in serious injury or even death. Make sure the whole system or machinery in which the Safe Disable function is used complies with safety requirements. When implementing the Safe Disable function into the safety system of a machine, perform a thorough risk assessment for the entire system to assure compliance with relevant safety norms.*

DANGER! *Sudden Movement Hazard. When using a PM motor, even if the drive output is shut off by the Safe Disable function, a breakdown of two output transistors can cause current to flow through the motor winding, resulting in a rotor movement for a maximum angle of 180 degrees (electrically). Make sure such a situation would have no effect on the safety of the application when using the Safe Disable function.*

DANGER! *Sudden Movement 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.*

WARNING! *Sudden Movement Hazard. When using the Safe Disable inputs, make sure to remove the wire links between terminals H1, H2, and HC that were installed prior to shipment. Failing to do so will keep the Safe Disable circuit from operating properly and can cause injury or even death.*

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 inputs H1 and H2 have opened, it takes up to 1 ms for drive output to shut off completely. The sequence set up to trigger terminals H1 and H2 should make sure that both terminals remain open for at least 1 ms in order to properly interrupt drive output.*

NOTICE: *The Safe Disable Monitor (output terminals DM+ and DM-) should not be used for any other purpose than to monitor the Safe Disable status or to discover a malfunction in the Safe Disable inputs. The monitor output is not considered a safe output.*

NOTICE: *When utilizing the Safe Disable function, an EMC filter must be used. Use only the EMC filters recommended in the drive Technical Manual.*

◆ Using the Safe Disable Function

The Safe Disable inputs provide a stop function in compliance with "Safe Torque Off" as defined in the IEC/EN 61800-5-2. Safe Disable inputs have been designed to meet the requirements of the ISO/EN 13849-1, Category 3 PLd, and IEC/EN 61508, SIL2. The PDS intended use shall be in the first environment (EM).

A Safe Disable Status Monitor for error detection in the safety circuit is also provided.

■ Safe Disable Circuit

The Safe Disable circuit consists of two independent input channels that can block the output transistors and provide a monitoring channel to indicate the status of those input channels.

The input can use the internal power supply of the drive or an external power supply and it will support Sink mode or Source mode. the mode selected for the digital input terminals S1 to S8 by switch S3 will also be used for the Safe Disable inputs. *Refer to Sinking/Sourcing Mode for Digital Inputs on page 110* for more information.

The Safe Disable Monitor uses a single channel photocoupler output. *Refer to Output Terminals on page 106* for signal specifications when using this output.
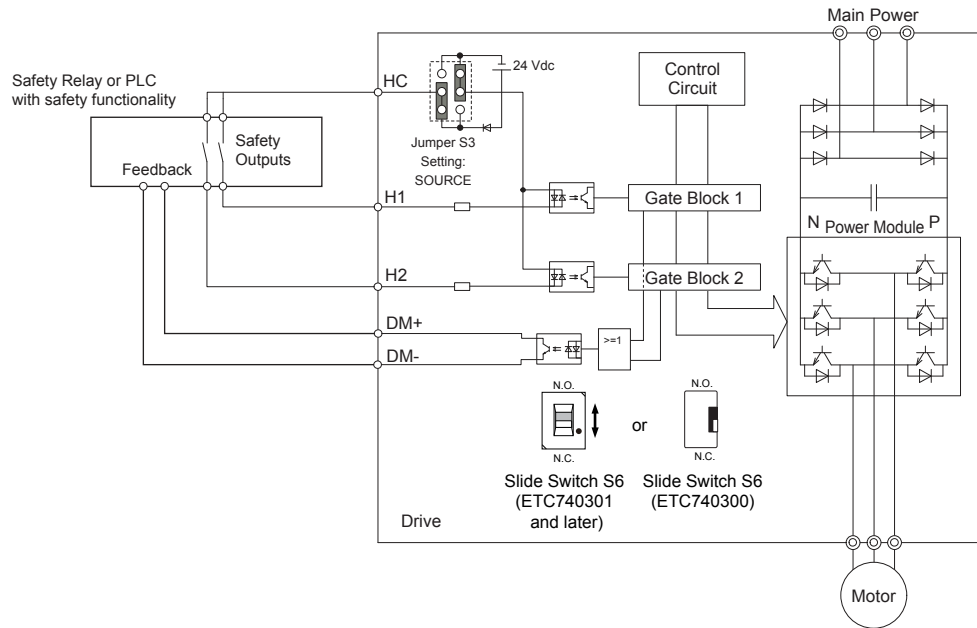
Figure C.12 Safe Disable Function Wiring Example (SINK Mode)

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

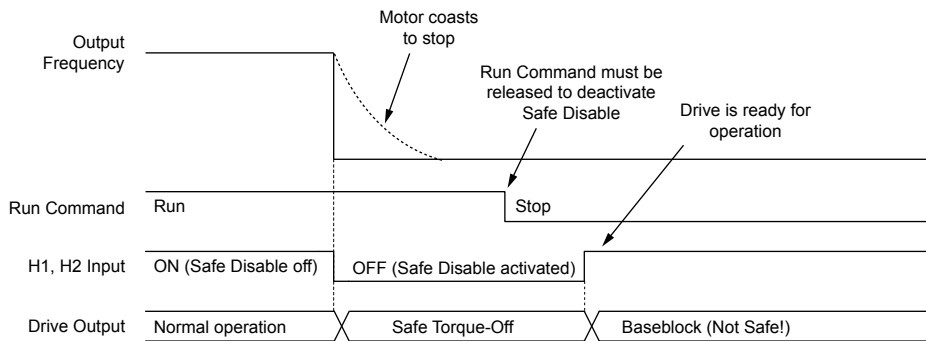*Figure C.13* illustrates the Safe Disable input operation.

Figure C.13 Safe Disable Operation

Entering the "Safe Torque Off" State

Whenever either one Safe Disable input or both inputs open, the motor torque is shut off by switching off the drive output. If the motor was running before the Safe Disable inputs opened, then the motor 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 Run 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 Disable function can only be deactivated when a Run command is not active.

If Safe Disable was activated during stop, turn on both Safe Disable inputs by deactivating "Safe Torque Off" to resume normal operation.

If Safe Disable was activated during run, remove the Run command then turn on the Safe Disable inputs before restarting the drive.

■ Safe Disable Monitor Output Function and Digital Operator Display

Table C.13 explains the drive output and Safe Disable monitor state depending on the Safe Disable inputs.

Standards Compliance

C

Table C.13 Safety Input and EDM Terminal Status

Safe Disable Input Status		Safe Disable Status Monitor, DM+ DM-		Drive Output Status	Digital Operator Display
Input 1, H1-HC	Input 2, H2-HC	S6 Switch = "N.C."	S6 Switch = "N.O."		
OFF	**OFF**	OFF	ON	Safely disabled, "Safe Torque Off"	Hbb (flashes)
ON	**OFF**	ON	OFF	Safely disabled, "Safe Torque Off"	HbbF (flashes)
OFF	**ON**	ON	OFF	Safely disabled, "Safe Torque Off"	HbbF (flashes)
ON	**ON**	ON	OFF	Baseblock, ready for operation	Normal display

Safe Disable Status Monitor

Slide Switch S6 controls the polarity of this signal. Refer to *Table C.13* for functionality.

With the Safe Disable monitor output (terminals DM+ and DM-), the drive provides a safety status feedback signal. This signal should be read by the device that controls the Safe Disable inputs (PLC or a safety relay) in order to prohibit leaving the "Safe Torque Off" status in case the safety circuit malfunctions. Refer to the instruction manual of the safety device for details on this function.

Digital Operator Display

When both Safe Disable inputs are open, "Hbb" will flash in the digital operator display.

If one Safe Disable channel is on while the other is off, "HbbF" will flash in the display to indicate that there is a problem in the safety circuit or in the drive. This display should not appear under normal conditions if the Safe Disable circuit is utilized properly. *Refer to Alarm Codes, Causes, and Possible Solutions on page 196* to resolve possible errors.

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Standards Compliance

C

Revision History

The revision dates and the numbers of the revised manuals appear on the bottom of the back cover.

MANUAL NO. TOEP C710616 41B <u><1></u>

└── Revision number

Published in Japan <u>July 2010</u>

└── Date of publication

Date of Publication	Revision Number	Section		Revised Content
August 2019	<6>	All	Revision	Updated the information to reflect the compliance of 600 V models with the safe disable input and European standards.
		Back Cover	Revision:	Address
April 2016	<5>	Front Cover	Revision:	Revision: Format
		All	Revision:	Reviewed and corrected entire documentation. Upgraded drive software version to PRG: 1021, PRG: 1022, PRG: 1023, and PRG: 1024
		Back Cover	Revision:	Format and address
October 2013	<4>	All	Revision:	Reviewed and corrected entire documentation. Upgraded drive software version to PRG: 1018, PRG: 1019, and PRG: 1020
		Chapter 2	Addition:	Addition: NEMA Type 1 and NEMA Type 12 External Heatsink Mounting data
		Back Cover	Revision:	Address
May 2012	<3>	Front Cover	Revision:	Format
		Chapter 8	Revision:	Factory Recommended Branch Circuit Protection data
		Appendix A	Addition:	Single-Phase Derating data
		Appendix D	Revision:	Factory Recommended Branch Circuit Protection data
		All	Revision:	Reviewed and corrected entire documentation. Upgraded drive software version to PRG: 1016 and PRG: 1017
		Back Cover	Revision:	Format and address
November 2010	<2>	All	Addition:	Larger drive capacities added along with corresponding data. Three-Phase 600 V Class: 5A0125 to 5A0242
			Revision:	Reviewed and corrected documentation.
July 2010	<1>	All	Addition:	Larger drive capacities added along with corresponding data. Three-Phase 400 V Class: 4A0930 and 4A1200 Three-Phase 600 V Class: 5A0041 to 5A0099
			Revision:	Reviewed and corrected entire documentation. Upgraded drive software version to PRG: 1015
April 2010	-	-	First Edition	This manual supports drive software versions VSA90504□ and VSA901014.

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YASKAWA AC Drive-A1000
High Performance Vector Control Drive
Quick Start Guide

YASKAWA

YASKAWA ELECTRIC CORPORATION

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice for ongoing product modifications and improvements.

TOEPC71061641