YASKAWA

YASKAWA AC Drive A1000

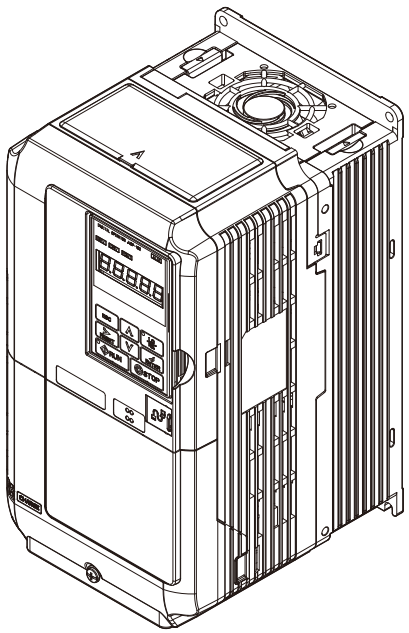
High Performance Vector Control Drive

Quick Start Guide

Type: CIMR-AA ☐ , CIMR-AT ☐

Models: 200 V Class: 0.4 to 55 kW
400 V Class: 0.4 to 90 kW

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



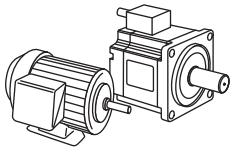
MANUAL NO. TOEP C710616 21A

This Page Intentionally Blank

◆ Quick Reference

Easily Set Parameters for Specific Applications	
Preset parameter defaults are available for setting up applications. *Refer to Application Selection on page 51*.	

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 59*.

Drive a Synchronous PM Motor	
A1000 can operate synchronous PM motors. *Refer to Subchart A-3: Operation with Permanent Magnet Motors on page 50*.	

Perform Auto-Tuning
Automatic tuning sets motor parameters. *Refer to Auto-Tuning on page 77*.

Maintenance Check Using Drive Monitors
Use drive monitors to check the if fans, capacitors, and other components may require maintenance. *Refer to Performance Life Monitors Maintenance Monitors on page 101*.

Fault Display and Troubleshooting
Refer to Drive Alarms, Faults, and Errors on page 84.

Standards Compliance	
Refer to European Standards on page 144 and *Refer to UL Standards on page 148*.	CE c UL us LISTED

Table of Contents

i Preface & General Safety

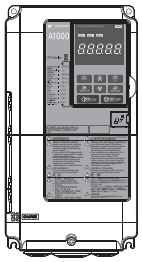
◆ Preface

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, EXPRESSED 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 Variable 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 Technical Manual This manual describes installation, wiring, operation procedures, functions, troubleshooting, maintenance, and inspections to perform before operation. A1000 Series AC Drive Quick Start Guide Read this manual first. This guide is packaged together with the product. It contains basic information required to install and wire the drive. This guide provides basic programming and simple setup and adjustment.

◆ General Safety

■ Supplemental Safety Information

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

⚠ WARNING

Read and understand this manual before installing, operating or servicing this drive. The drive must be installed according to this manual and local codes.

The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or possibly even 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! *will 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! *will 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: *will also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

■ Safety Messages

⚠ DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

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

Electrical Shock Hazard

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

Failure to comply will result in death or serious injury.

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

⚠ WARNING

Sudden Movement Hazard

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.

⚠ WARNING

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.

Maintenance, inspection, and replacement of parts 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.

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.

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 on any part of the drive.

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

Do not operate damaged equipment.

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

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

Install adequate branch circuit short circuit protection per applicable codes.

Failure to comply could result in damage to the drive.

The drive is suitable for circuits capable of delivering not more than 100,000 RMS symmetrical Amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400 V Class).

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.

■ Drive Label Warnings

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

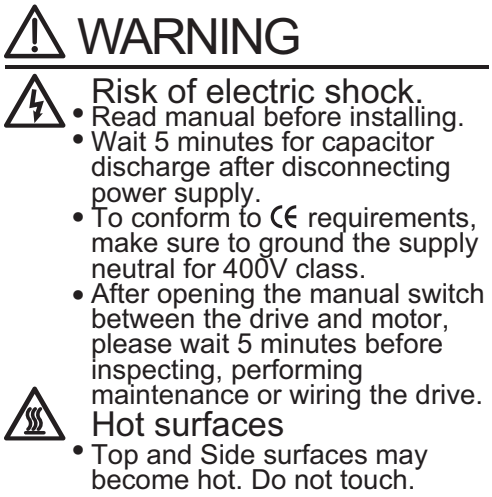


Figure 1 Warning Information

Figure 2 Warning Information Position

■ Warranty Information

Warranty Period

This drive is warranted for 12 months from the date of delivery to the customer or 18 months from the date of shipment from the Yaskawa factory, whichever comes first.

Scope of Warranty

Inspections

Customers are responsible for periodic inspections of the drive. Upon request, a Yaskawa representative will inspect the drive for a fee. If the Yaskawa representative finds the drive to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, this inspection fee will be waived and the problem remedied free of charge.

Repairs

If a Yaskawa product is found to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, Yaskawa will provide a replacement, repair the defective product, and provide shipping to and from the site free of charge.

However, if the Yaskawa Authorized Service Center determines that the problem with the drive is not due to defective workmanship or materials, the customer will be responsible for the cost of any necessary repairs. Some problems that are outside the scope of this warranty are:

Problems due to improper maintenance or handling, carelessness, or other reasons where the customer is determined to be responsible.

Problems due to additions or modifications made to a Yaskawa product without Yaskawa's understanding.

Problems due to the use of a Yaskawa product under conditions that do not meet the recommended specifications.

Problems caused by natural disaster or fire.

After the free warranty period elapses.

Replenishment or replacement of consumables or expendables.

Defective products due to packaging or fumigation.

Malfunction or problems caused by program that has been made by customers using DriveWorksEZ.

Other problems not due to defects in Yaskawa workmanship or materials.

Warranty service is only applicable within Japan. However, after-sales service is available for customers outside of Japan for a reasonable fee.

Contact your local Yaskawa representative for more information.

Exceptions

Any inconvenience to the customer or damage to non-Yaskawa products due to Yaskawa's defective products whether within or outside of the warranty period are NOT covered by warranty.

Restrictions

A1000 was not designed or manufactured for use in devices or systems that may directly affect or threaten human lives or health.

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

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

◆ Model Number and Nameplate Check

Please perform the following tasks after receiving the drive:

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

■ Nameplate

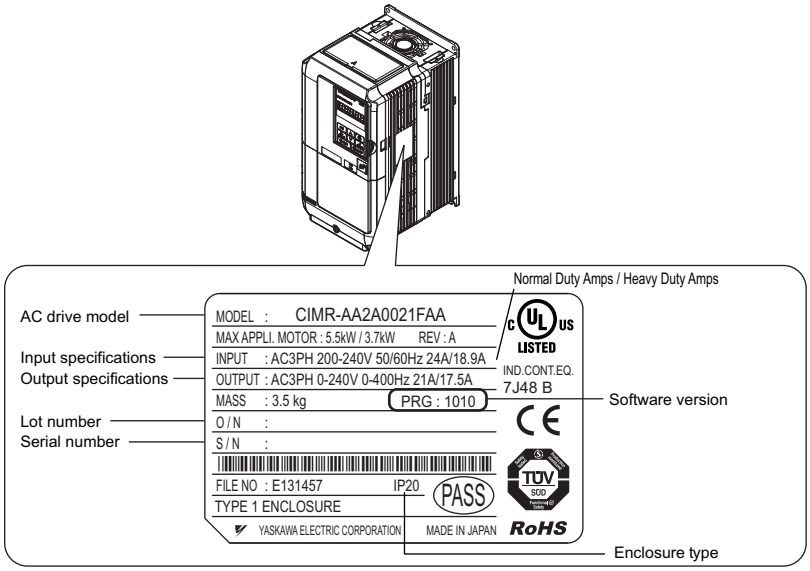
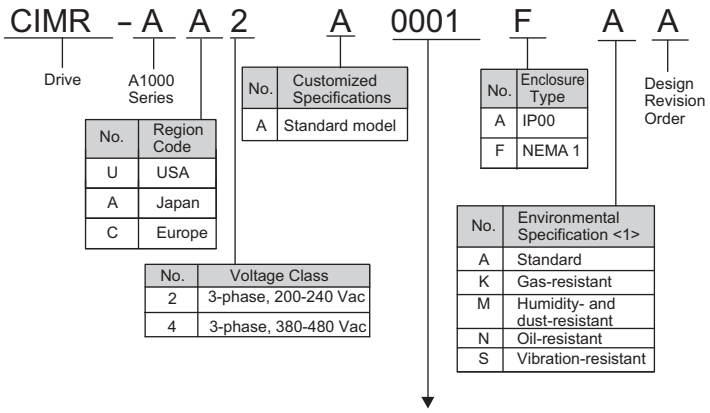


Figure 3 Nameplate Information



Three-Phase 200 V

Normal Duty		
No.	Max. Motor Capacity kW	Rated Output Current A
0004	0.75	3.5
0006	1.1	6.0
0008	1.5	8.0
0010	2.2	9.6
0012	3.0	12
0018	3.7	17.5
0021	5.5	21
0030	7.5	30
0040	11	40
0056	15	56
0069	18.5	69
0081	22	81
0110	30	110
0138	37	138
0169	45	169
0211	55	211

Heavy Duty		
No.	Max. Motor Capacity kW	Rated Output Current A
0004	0.4	3.2
0006	0.75	5
0008	1.1	6.9
0010	1.5	8
0012	2.2	11
0018	3.0	14.0
0021	3.7	17.5
0030	5.5	25
0040	7.5	33
0056	11	47
0069	15	60
0081	18.5	75
0110	22	85
0138	30	115
0169	37	145
0211	45	180

Three-Phase 400 V

Normal Duty		
No.	Max. Motor Capacity kW	Rated Output Current A
0002	0.75	2.1
0004	1.5	4.1
0005	2.2	5.4
0007	3.0	6.9
0009	3.7	8.8
0011	5.5	11.1
0018	7.5	17.5
0023	11	23
0031	15	31
0038	18.5	38
0044	22	44
0058	30	58
0072	37	72
0088	45	88
0103	55	103
0139	75	139
0165	90	165

Heavy Duty		
No.	Max. Motor Capacity kW	Rated Output Current A
0002	0.4	1.8
0004	0.75	3.4
0005	1.5	4.8
0007	2.2	5.5
0009	3.0	7.2
0011	3.7	9.2
0018	5.5	14.8
0023	7.5	18
0031	11	24
0038	15	31
0044	18.5	39
0058	22	45
0072	30	60
0088	37	75
0103	45	91
0139	55	112
0165	75	150

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

2 Mechanical Installation

◆ Mechanical Installation

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

■ Installation Environment

To help prolong the optimum performance life of the drive, install the drive in an environmental matching the specifications below.

Table 1 Installation Environment

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	-10 °C to +40 °C (IP20/NEMA Type 1) -10 °C to +50 °C (IP00/Open-Chassis) Drive reliability improves in environments without wide temperature fluctuations. When using the drive in an enclosure panel, install a cooling fan or air conditioner in the area to ensure that the air temperature inside the enclosure does not exceed the specified levels. Do not allow ice to develop on the drive.
Humidity	95% RH or less and free of condensation
Storage Temperature	-20 to +60 °C
Surrounding Area	• Install the drive in an area free from: • oil mist and dust • metal shavings, oil, water or other foreign materials • radioactive materials • combustible materials (e.g., wood) • harmful gases and liquids • excessive vibration • chlorides • direct sunlight
Altitude	1000 m or lower
Vibration	10 to 20 Hz at 9.8 m/s^2 20 to 55 Hz at 5.9 m/s^2 (up to 200 V 45 kW or 400 V 75 kW) or 2.0 m/s2 (200 V 55 kW or 400 V 90 kW and above)
Orientation	Install the drive vertically to maintain maximum cooling effects.

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

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

■ Installation Orientation and Spacing

Install the drive upright as illustrated in ***Figure 4*** to maintain proper cooling.

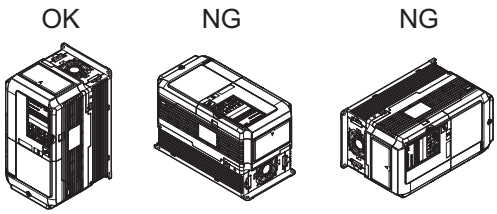
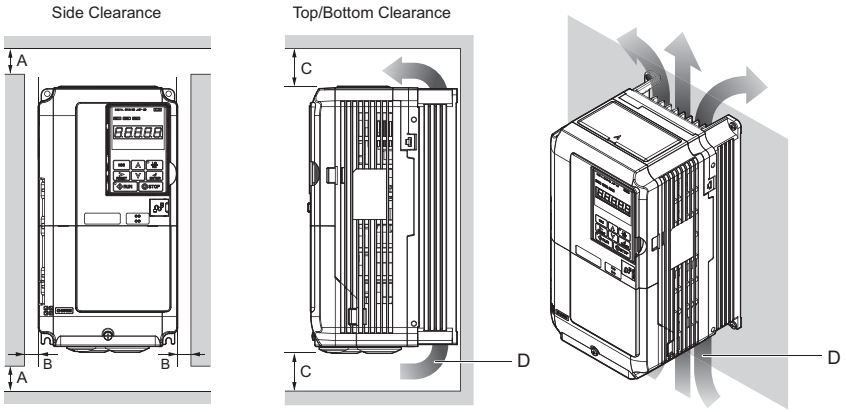


Figure 4 Correct Installation Orientation

Single Drive Installation

Figure 5 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.



A – 50 mm minimum **C – 120 mm minimum**
B – 30 mm minimum **D – Airflow direction**

Figure 5 Correct Installation Spacing

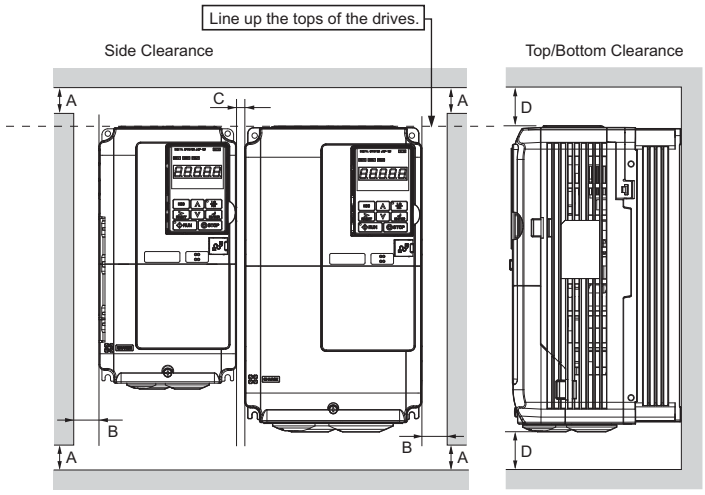
Note: IP20/NEMA Type 1 and IP00/Open-Chassis models require the same amount of space above and below the drive for installation.

Multiple Drive Installation (Side-by-Side Installation)

Models CIMR-A☐2A0004 through 0081 and 4A0002 through 0044 can take advantage of Side-by-Side installation.

When installing multiple drives into the same enclosure panel, mount the drives according to *Figure 5*.

When mounting drives with the minimum clearance of 2 mm according to *Figure 6*, derating must be considered and parameter L8-35 must be set to 1. *Refer to Parameter List on page 107*



A – 50 mm minimum **C – 2 mm minimum**
B – 30 mm minimum **D – 120 mm minimum**

Figure 6 Space Between Drives (Side-by-Side Mounting)

Note: When installing drives of different heights in the same enclosure panel, the tops of the drives should line up. Leave space between the top and bottom of stacked drives for easy cooling fan replacement if required.

When drives with IP20/NEMA Type 1 enclosures are mounted side by side, the protective covers of all drives must be removed as shown in ***Figure 7***. ***Refer to Protective Cover on page 26*** to remove and reattach the protective cover.

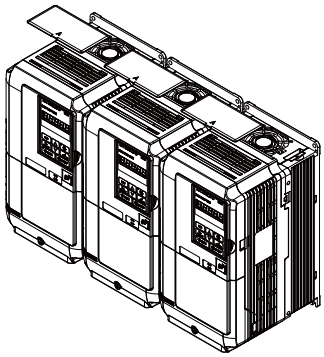


Figure 7 IP20/NEMA 1 Side-by-Side Mounting in Enclosure

IP20/NEMA Type 1 Drives

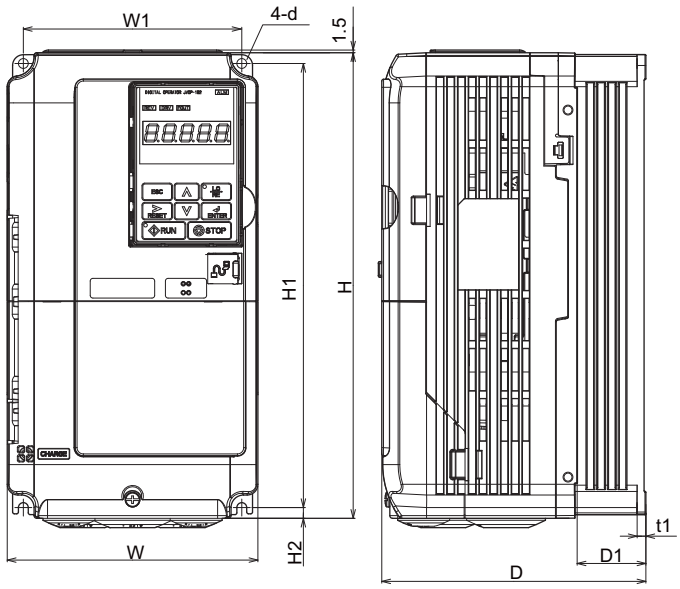


Figure 1

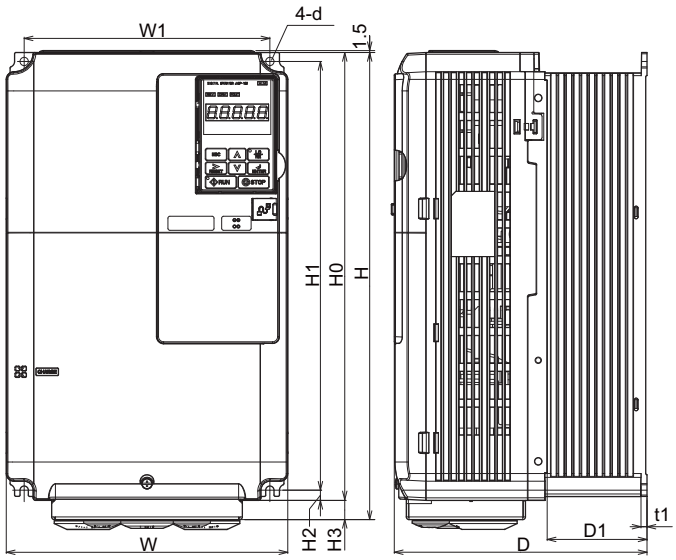


Figure 2

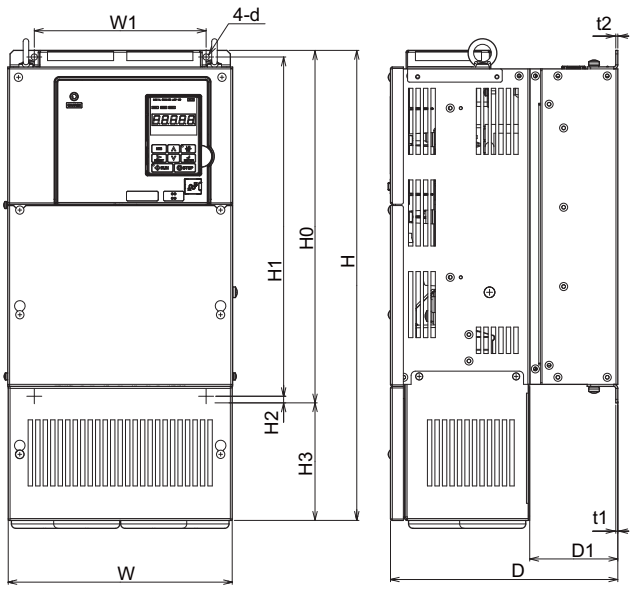


Figure 3

Table 2 Dimensions for IP20/NEMA Type 1: 200 V Class

Drive Model CIMR-A□2A	Dimensions (mm)													
	Figure	W	H	D	W1	H0	H1	H2	H3	D1	t1	t2	d	Weight (kg)
0004	1 <1>	140	260	147	122	–	248	6	–	38	5	–	M5	3.1
0006		140	260	147	122	–	248	6	–	38	5	–	M5	3.1
0008		140	260	147	122	–	248	6	–	38	5	–	M5	3.2
0010		140	260	147	122	–	248	6	–	38	5	–	M5	3.2
0012		140	260	147	122	–	248	6	–	38	5	–	M5	3.2
0018		140	260	164	122	–	248	6	–	55	5	–	M5	3.5
0021		140	260	164	122	–	248	6	–	55	5	–	M5	3.5
0030		140	260	167	122	–	248	6	–	55	5	–	M5	4.0
0040		140	260	167	122	–	248	6	–	55	5	–	M5	4.0
0056		180	300	187	160	–	284	8	–	75	5	–	M5	5.6
0069		220	350	197	192	–	335	8	–	78	5	–	M6	8.7
0081	2 <1>	220	365	197	192	350	335	8	15	78	5	–	M6	9.7
0110	3 <2>	254	534	258	195	400	385	7.5	134	100	2.3	2.3	M6	23
0138		279	614	258	220	450	435	7.5	164	100	2.3	2.3	M6	28
0169		329	730	283	260	550	535	7.5	180	110	2.3	2.3	M6	41
0211		329	730	283	260	550	535	7.5	180	110	2.3	2.3	M6	42

<1> Removing the top cover from a IP20/NEMA Type 1 drive voids NEMA Type 1 protection but still keeps IP20 conformity.
<2> Special order required. Contact your Yaskawa sales representative.

Table 3 Dimensions for IP20/NEMA Type 1: 400 V Class

Drive Model CIMR-A□4A	Dimensions (mm)													
	Figure	W	H	D	W1	H0	H1	H2	H3	D1	t1	t2	d	Weight (kg)
0002	1 <1>	140	260	147	122	–	248	6	–	38	5	–	M5	3.2
0004		140	260	147	122	–	248	6	–	38	5	–	M5	3.2
0005		140	260	147	122	–	248	6	–	38	5	–	M5	3.2
0007		140	260	164	122	–	248	6	–	55	5	–	M5	3.4
0009		140	260	164	122	–	248	6	–	55	5	–	M5	3.5
0011		140	260	164	122	–	248	6	–	55	5	–	M5	3.5
0018		140	260	167	122	–	248	6	–	55	5	–	M5	3.9
0023		140	260	167	122	–	248	6	–	55	5	–	M5	3.9
0031		180	300	167	160	–	284	8	–	55	5	–	M5	5.4
0038		180	300	187	160	–	284	8	–	75	5	–	M5	5.7
0044		220	350	197	192	–	335	8	–	78	5	–	M6	8.3
0058	3 <2>	254	465	258	195	400	385	7.5	65	100	2.3	2.3	M6	23
0072		279	515	258	220	450	435	7.5	65	100	2.3	2.3	M6	27
0088		329	630	258	260	510	495	7.5	120	105	2.3	3.2	M6	39
0103		329	630	258	260	510	495	7.5	120	105	2.3	3.2	M6	39
0139		329	730	283	260	550	535	7.5	180	110	2.3	2.3	M6	45
0165		329	730	283	260	550	535	7.5	180	110	2.3	2.3	M6	46

<1> Removing the top cover from a IP20/NEMA Type 1 drive voids NEMA Type 1 protection but still keeps IP20 conformity.
<2> Special order required. Contact your Yaskawa sales representative.

IP00/Open-Chassis Drives

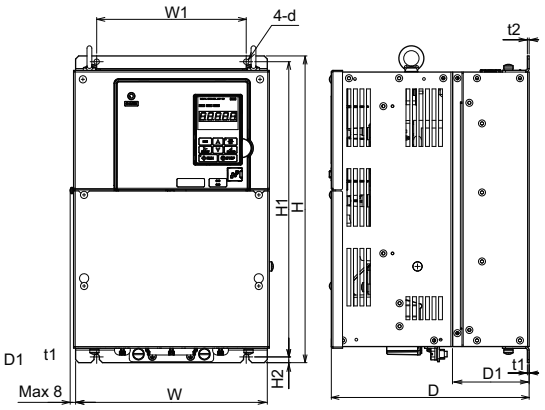


Figure 1

Table 4 Dimensions for IP00/Open-Chassis: 200 V Class

Drive Model CIMR-A□2A	Dimensions (mm)											
	Figure	W	H	D	W1	H1	H2	D1	t1	t2	d	Weight (kg)
0110	1	250	400	258	195	385	7.5	100	2.3	2.3	M6	21
0138		275	450	258	220	435	7.5	100	2.3	2.3	M6	25
0169		325	550	283	260	535	7.5	110	2.3	2.3	M6	37
0211		325	550	283	260	535	7.5	110	2.3	2.3	M6	38

Table 5 Dimensions for IP00/Open-Chassis: 400 V Class

Drive Model CIMR-A□4A	Dimensions (mm)											
	Figure	W	H	D	W1	H1	H2	D1	t1	t2	d	Weight (kg)
0058	1	250	400	258	195	385	7.5	100	2.3	2.3	M6	21
0072		275	450	258	220	435	7.5	100	2.3	2.3	M6	25
0088		325	510	258	260	495	7.5	105	2.3	3.2	M6	36
0103		325	510	258	260	495	7.5	105	2.3	3.2	M6	36
0139		325	550	283	260	535	7.5	110	2.3	2.3	M6	41
0165		325	550	283	260	535	7.5	110	2.3	2.3	M6	42

3 Electrical Installation

◆ Standard Connection Diagram

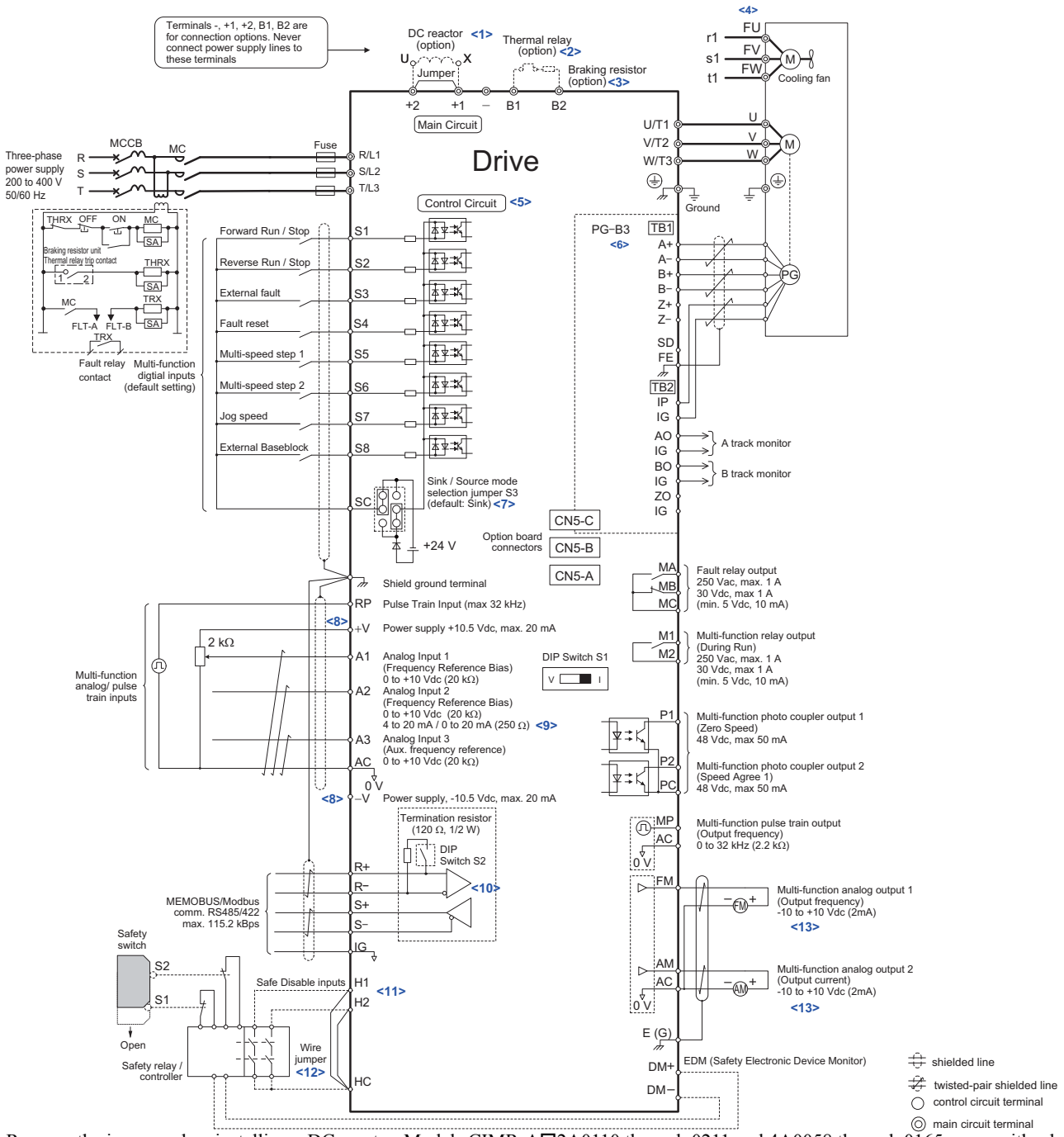
Connect the drive and peripheral devices as shown in ***Figure 10***. It is possible to set and run the drive via the digital operator without connecting digital I/O wiring. This section does not discuss drive operation; ***Refer to Start-Up Programming & Operation on page 42*** for instructions on operating 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 18,000 RMS symmetrical amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400 V Class).*

NOTICE: *When the input voltage is 440 V or higher or the wiring distance is greater than 100 meters, 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: *The minimum load for the multi-function relay output MA-MB-MC is 10 mA. If a circuit requires less than 10 mA (reference value), connect it to a photocoupler output (P1, P2, PC). Improper application of peripheral devices could result in damage to the photocoupler output of the drive.*



<1> Remove the jumper when installing a DC reactor. Models CIMR-A□2A0110 through 0211 and 4A0058 through 0165 come with a built-in DC reactor.
<2> When installing a braking resistor option, a thermal relay sequence should also be set up to shut off power to the drive in case overheat occurs.
<3> The drive's protection function for the internal braking transistor needs to be disabled (L8-55 = 0) if using a regen unit such as a regen converter or some type of braking option unit (and therefore not the internal braking transistor). If left enabled, a braking resistor fault (rF) may result.
Make sure Stall Prevention is disabled (L3-04 = 0) whenever using a regenerative converter, a regenerative unit, a braking resistor or the Braking Resistor Unit. If left enabled, the drive may not stop within the specified deceleration time.
<4> Self-cooling motors do not require wiring that would be necessary with motors using a cooling fan.
<5> Supplying power to the control circuit separately from the main circuit requires 24 V power supply (option).
<6> For control modes that do not use a motor speed feedback signal, PG option card wiring is not necessary.
<7> This figure shows an example of a sequence input to S1 through S8 using a non-powered relay or an NPN transistor. Use jumper S3 to select sink or source, and an internal or external power supply.
<8> The maximum output current capacity for the +V and -V terminals on the control circuit is 20 mA. Never short terminals +V, -V, and AC, as this can cause erroneous operation or damage the drive.
<9> Set DIP switch S1 to select between a voltage or current input signal to terminal A2. The default setting is for current input.
<10> Enable the termination resistor in the last drive in a MEMOBUS network by setting DIP switch S2 to the ON position.
<11> The sink/source setting for the Safe Disable input is the same as with the sequence input. Jumper S3 has the drive set for an external power supply. When not using the Safe Disable input feature, remove the jumper shorting the input and connect an external power supply. Refer to ***Figure 39*** for instructions.
<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 of signal.

Figure 8 Drive Standard Connection Diagram (example: CIMR-A□2A0040)

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! *When 3-Wire sequence is used, set the drive to 3-Wire sequence before wiring the control terminals and ensure parameter b1-17 is set to 0 (drive does not accept a run command at power up (default). If the drive is wired for 3-Wire sequence but set up for 2-Wire sequence (default) and if parameter b1-17 is set to 1 (drive accepts a Run command at power up), the motor will rotate in reverse direction at power up of the drive and may cause injury.*

WARNING! *When the application preset function is executed (or A1-06 is set to any value other than 0) the drive I/O terminal functions change. This may cause unexpected operation and potential damage to equipment or injury.*

◆ Main Circuit Connection Diagram

Refer to diagrams in this section when wiring the drive's main circuit. 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.*

■ Three-Phase 200 V Class (CIMR-A□2A0004 to 0081)
Three-Phase 400 V Class (CIMR-A□4A0002 to 0044)

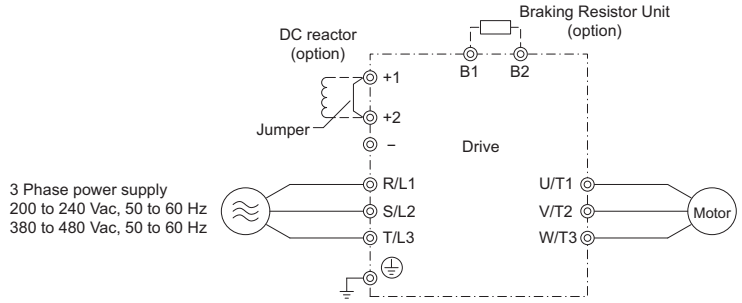


Figure 9 Connecting Main Circuit Terminals

■ Three-Phase 200 V Class (CIMR-A□2A0110, 0138)
Three-Phase 400 V Class (CIMR-A□4A0058, 0072)

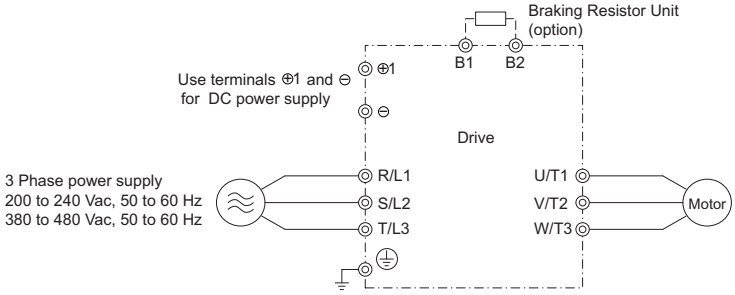


Figure 10 Connecting Main Circuit Terminals

■ Three-Phase 200 V Class (CIMR-A□2A0169, 0211)
Three-Phase 400 V Class (CIMR-A□4A0088 to 0165)

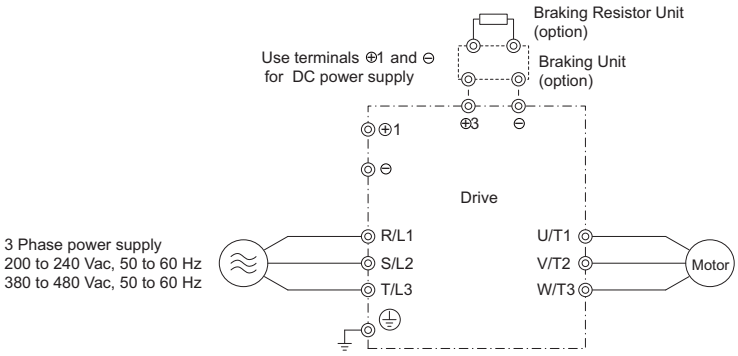


Figure 11 Connecting Main Circuit Terminals

◆ Terminal Cover

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

■ CIMR-A□2A0004 to 0081, 4A0002 to 0044 (IP20/NEMA Type 1)

Removing the Terminal Cover

1. Loosen the terminal cover screw.

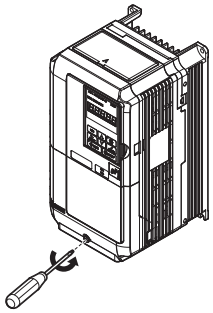


Figure 12 Removing the Terminal Cover on an IP20/NEMA Type 1 Drive

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

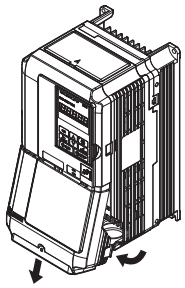


Figure 13 Removing the Terminal Cover on an IP20/NEMA Type 1 Drive

Reattaching the Terminal Cover

Power lines and signal wiring should pass through the opening provided. *Refer to Wiring the Main Circuit Terminal on page 31* and *Wiring the Control Circuit Terminal on page 35* for details on wiring.

After all wiring to the drive and other devices is complete, reattach the terminal cover.

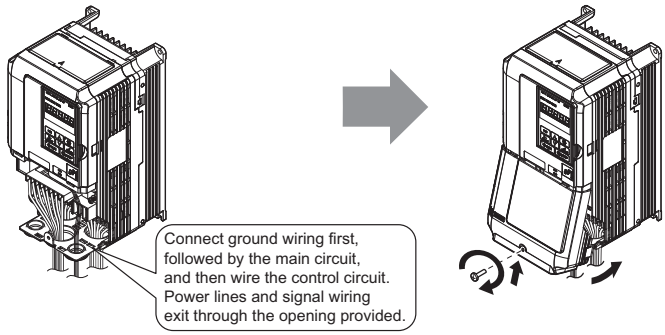


Figure 14 Reattaching the Terminal Cover on an IP20/NEMA Type 1 Drive

■ CIMR-A□2A0110 to 0211, 4A0058 to 0165 (IP00/Open-Chassis)

Removing the Terminal Cover

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

Note: 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.

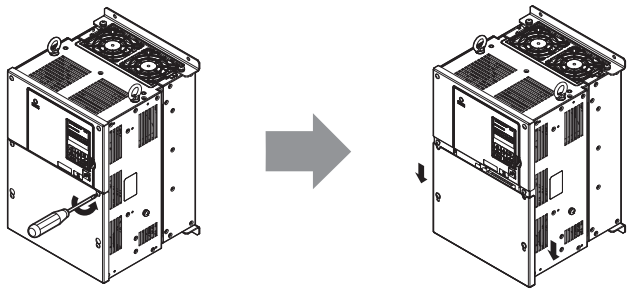


Figure 15 Removing the Terminal Cover on an IP00/Open-Chassis Drive

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

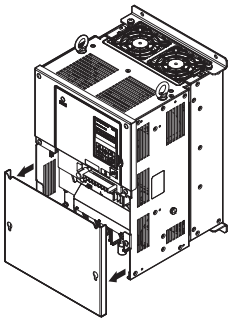


Figure 16 Removing the Terminal Cover on an IP00/Open-Chassis Drive

Reattaching the Terminal Cover

Once wiring to the terminal board and other devices is complete, double check all connections and finally reattach the terminal cover. *Refer to Wiring the Main Circuit Terminal on page 31* and *Wiring the Control Circuit Terminal on page 35* for details on wiring.

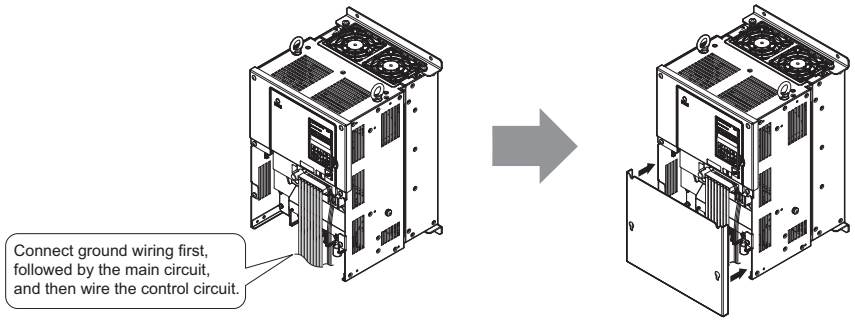


Figure 17 Reattaching the Terminal Cover on an IP00/Open-Chassis Drive

◆ Digital Operator and Front Cover

The digital operator can be detached from the drive for remote operation, or when the front cover has to be opened to install an option card.

Be sure the digital operator has been removed prior to opening the front cover or reattaching it. Leaving the digital operator plugged into the drive when removing the front cover can result in erroneous operation caused by a poor connection. Before reattaching the operator make sure the front cover has been firmly fastened back into place.

■ Removing/Reattaching the Digital Operator

Removing the Digital Operator

While pinching inwards on the tab located on the right side of the digital operator, pull forward and remove the operator from the drive.

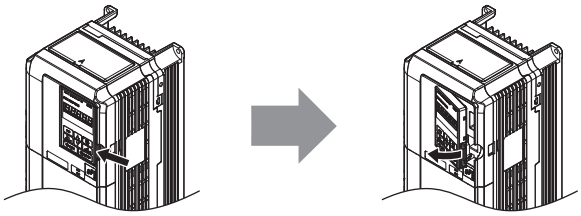


Figure 18 Removing the Digital Operator

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.

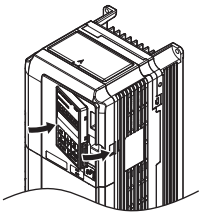


Figure 19 Reattaching the Digital Operator

■ Removing/Reattaching the Front Cover

Removing the Front Cover

After removing the terminal cover and the digital operator, loosen the screw that affixes the front cover (model CIMR-A□2A0081 does not use a screw to affix the front cover). Pinch inwards on tabs found on each side of the front cover, then pull forward to remove it from the drive.

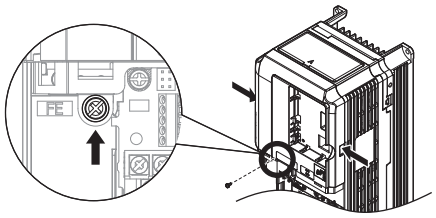


Figure 20 Remove the Front Cover

Reattaching the Front Cover

Reverse the instructions given above to reattach the front cover. Pinch inwards on the tabs found on each side of the front cover while guiding it back into the drive. Make sure it clicks firmly into place.

◆ Protective Cover

Drive models CIMR-A□2A0004 to 0081 and 4A0002 to 0058 are designed with NEMA Type 1 specifications, and have a protective cover on the top. Removing this top cover voids the NEMA Type 1 conformance but still keeps a protection degree in accordance with IP20.

■ Removing the Protective Cover

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

Note: Removing the top cover from a IP20/NEMA Type 1 drive voids the NEMA Type 1 protection but still keeps IP20 conformity.

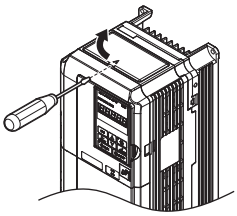


Figure 21 Removing the Protective Cover

■ Reattaching the Protective Cover

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

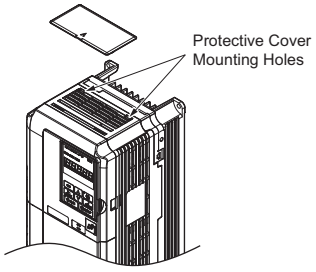


Figure 22 Reattaching the Protective Cover

◆ 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 lifetime of the DC bus charge circuit and the DC bus capacitors, and can cause premature drive failures. For the full performance life, refrain from switching the drive on and off more than once every 30 minutes.*

■ Main Circuit Terminal Functions

Table 6 Main Circuit Terminal Functions

<table>
<tr><th colspan="2" rowspan="2">Terminal</th><th colspan="3">Type</th><th rowspan="3">Function</th><th rowspan="3">Page</th></tr>
<tr><th rowspan="2">200 V Class
400 V Class</th><th rowspan="2">Model CIMR-A□</th><th>2A0004 to 2A0081</th><th>2A0110 to 2A0138</th><th>2A0169 to 2A0211</th></tr>
<tr><th>4A0002 to 4A0044</th><th>4A0058 to 4A0072</th><th>4A0088 to 4A0165</th></tr>
<tr><td colspan="2">R/L1</td><td colspan="3" rowspan="3">Main circuit power supply input</td><td rowspan="3">Connects line power to the drive</td><td rowspan="3">21</td></tr>
<tr><td colspan="2">S/L2</td></tr>
<tr><td colspan="2">T/L3</td></tr>
<tr><td colspan="2">U/T1</td><td colspan="3" rowspan="3">Drive output</td><td rowspan="3">Connects to the motor</td><td rowspan="3">21</td></tr>
<tr><td colspan="2">V/T2</td></tr>
<tr><td colspan="2">W/T3</td></tr>
<tr><td colspan="2">B1</td><td colspan="2" rowspan="2">Braking resistor</td><td rowspan="2">not available</td><td rowspan="2">Available for connecting a braking resistor or a braking resistor unit option</td><td rowspan="2">–</td></tr>
<tr><td colspan="2">B2</td></tr>
<tr><td colspan="2">+2</td><td rowspan="3">• DC reactor connection (+1, +2) (remove the shorting bar between +1 and +2)
• DC power supply input (+1, –)</td><td colspan="2">not available</td><td rowspan="3">For connection
• of the drive to a DC power supply (terminals +1 and – are not EU or UL approved)
• of braking options
• connection of a DC reactor</td><td rowspan="3">–</td></tr>
<tr><td colspan="2">+1</td><td rowspan="2">• DC power supply input (+1, –)</td><td rowspan="2">• DC power supply input (+1, –)
• Braking transistor connection (+3, –)</td></tr>
<tr><td colspan="2">–</td></tr>
<tr><td colspan="2">+3</td><td colspan="2">not available</td><td rowspan="2">Grounding terminal</td><td rowspan="2">31</td></tr>
<tr><td colspan="2">⏚</td><td colspan="3">For 200 V class: 100 Ω or less
For 400 V class: 10 Ω or less</td></tr>
</table>

■ Wire Gauges and Tightening Torque

Select the appropriate wires and crimp terminals from *Table 7* through *Table 9*.

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 devices such as a DC reactor or braking resistor. Do not connect other non-specified devices to these terminals.

- Consider the amount of voltage drop when selecting wire gauges. Increase the wire gauge when the voltage drop is greater than 2% of motor rated voltage. Ensure the wire gauge is suitable for the terminal block. Use the following formula to calculate the amount of voltage drop:
  Line drop voltage (V) = $\sqrt{3} \times$ wire resistance (Ω/km) × wire length (m) × current (A) × 10^{-3}
- Use terminal +1 and the negative terminal when connecting a braking resistor, regenerative converter, or a regen unit.
- Refer to instruction manual TOBPC72060000 for braking unit or braking resistor unit wire gauges.
- *Refer to UL Standards Compliance on page 148* for information on UL compliance.

Three-Phase 200 V Class

Table 7 Wire Gauge and Torque Specifications (Three-Phase 200 V Class)

Model CIMR-A☐	Terminal	For Asia <1>		For U.S.A <2>		For Europe <3>		Screw Size	Tightening Torque N·m (lb.in.)
		Recommended Gauge mm^2	Applicable Gauge mm^2	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil	Recommended Gauge mm^2	Applicable Gauge mm^2		
2A0004 2A0006 2A0008 2A0010	R/L1, S/L2, T/L3	2	2 to 5.5	14	14 to 10	2.5	2.5 to 6	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2	2 to 5.5	14	14 to 10	2.5	2.5 to 6		
	–, +1, +2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	B1, B2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	⏚	2	2 to 5.5	10	14 to 10	2.5	2.5 to 6		
2A0012	R/L1, S/L2, T/L3	2	2 to 5.5	12	14 to 10	2.5	2.5 to 6	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2	2 to 5.5	14	14 to 10	2.5	2.5 to 6		
	–, +1, +2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	B1, B2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	⏚	3.5	2 to 5.5	10	14 to 10	2.5	2.5 to 6		
2A0018	R/L1, S/L2, T/L3	3.5	2 to 5.5	10	12 to 10	2.5	2.5 to 6	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	3.5	2 to 5.5	10	14 to 10	2.5	2.5 to 6		
	–, +1, +2	3.5	2 to 5.5	–	14 to 10	–	2.5 to 6		
	B1, B2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	⏚	3.5	2 to 5.5	10	14 to 10	2.5	2.5 to 6		
2A0021	R/L1, S/L2, T/L3	5.5	3.5 to 5.5	10	12 to 10	4	2.5 to 6	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	3.5	3.5 to 5.5	10	12 to 10	2.5	2.5 to 6		
	–, +1, +2	5.5	3.5 to 5.5	–	12 to 10	–	4 to 6		
	B1, B2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	⏚	3.5	3.5 to 5.5	10	12 to 10	4	4 to 6		
2A0030	R/L1, S/L2, T/L3	14	5.5 to 14	8	10 to 6	6	4 to 16	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	8	5.5 to 14	8	10 to 6	6	4 to 16		
	–, +1, +2	14	5.5 to 14	–	10 to 6	–	6 to 16		
	B1, B2	3.5	2 to 5.5	–	14 to 10	–	4 to 6		
	⏚	5.5	5.5 to 8	8	10 to 8	6	6 to 10	M5	2 to 2.5 (17.7 to 22.1)
2A0040	R/L1, S/L2, T/L3	14	14	6	8 to 6	10	6 to 16	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	8 to 14	8	8 to 6	10	6 to 16		
	–, +1, +2	14	14	–	6	–	16		
	B1, B2	5.5	3.5 to 5.5	–	12 to 10	–	4 to 6		
	⏚	5.5	5.5 to 8	8	10 to 8	10	6 to 10	M5	2 to 2.5 (17.7 to 22.1)
2A0056	R/L1, S/L2, T/L3	22	14 to 22	4	6 to 4	16	16 to 25	M6	4 to 6 (35.4 to 53.1)
	U/T1, V/T2, W/T3	14	14 to 22	4	6 to 4	16	16 to 25		
	–, +1, +2	22	14 to 22	–	6 to 4	–	16 to 25		
	B1, B2	14	5.5 to 14	–	10 to 6	–	6 to 10	M5	2 to 2.5 (17.7 to 22.1)
	⏚	8	8 to 14	6	8 to 6	16	10 to 16	M6	4 to 6 (35.4 to 53.1)
2A0069	R/L1, S/L2, T/L3	30	22 to 30	3	4 to 3	25	16 to 25	M8	9 to11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	22	14 to 30	3	4 to 3	16	16 to 25		
	–, +1, +2	30	22 to 30	–	4 to 3	–	25		
	B1, B2	14	8 to 14	–	8 to 6	–	10 to 16	M5	2 to 2.5 (17.7 to 22.1)
	⏚	8	8 to 22	6	6 to 4	16	16 to 25	M6	4 to 6 (35.4 to 53.1)
2A0081	R/L1, S/L2, T/L3	38	30 to 38	2	3 to 2	35	25 to 35	M8	9 to11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	30	22 to 38	2	3 to 2	25	25 to 35		
	–, +1, +2	38	30 to 38	–	3 to 2	–	25 to 35		
	B1, B2	14	14	–	6	–	16	M5	2 to 2.5 (17.7 to 22.1)
	⏚	14	14 to 22	6	6 to 4	16	16 to 25	M6	4 to 6 (35.4 to 53.1)
2A0110	R/L1, S/L2, T/L3	38	30 to 50	1/0	3 to 1/0	35	25 to 50	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	38	30 to 50	1/0	3 to 1/0	35	25 to 50		
	–, +1	60	38 to 60	–	2 to 1/0	–	35 to 50		
	B1, B2	22	14 to 50	–	6 to 1/0	–	16 to 50		
	⏚	14	14 to 38	6	6 to 4	16	16 to 25		

Model CIMR-A□	Terminal	For Asia <1>		For U.S.A <2>		For Europe <3>		Screw Size	Tightening Torque N·m (lb.in.)
		Recommended Gauge mm²	Applicable Gauge mm²	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil	Recommended Gauge mm²	Applicable Gauge mm²		
2A0138	R/L1, S/L2, T/L3	60	50 to 80	2/0	1 to 3/0	50	35 to 70	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	60	50 to 80	2/0	1 to 3/0	50	35 to 70		
	–, +1	80	60 to 80	–	1/0 to 3/0	–	50 to 70		
	B1, B2	30	22 to 80	–	4 to 3/0	–	25 to 70		
	⏚	22	22 to 38	4	4	25	25	M8	9 to 11 (79.7 to 97.4)
2A0169	R/L1, S/L2, T/L3	80	60 to 100	4/0	2/0 to 4/0	70	50 to 95	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	80	60 to 100	4/0	3/0 to 4/0	70	50 to 95		
	–, +1	50 × 2P	50 to 100	–	1 to 4/0	–	35 to 95		
	+3	60	50 to 100	–	1/0 to 4/0	–	50 to 95		
	⏚	22	22 to 60	4	4 to 2	35	25 to 35	M8	9 to 11 (79.7 to 97.4)
2A0211	R/L1, S/L2, T/L3	100	80 to 100	1/0 × 2P	1/0 to 4/0	95	70 to 95	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	50 × 2P	50 to 100	1/0 × 2P	1/0 to 4/0	95	70 to 95		
	–, +1	50 × 2P	50 to 100	–	1 to 4/0	–	35 to 95		
	+3	80	60 to 100	–	1/0 to 4/0	–	50 to 95		
	⏚	22	22 to 60	4	4 to 1/0	50	25 to 50	M8	9 to 11 (79.7 to 97.4)

<1> Gauges listed here are for use in Japan.
<2> Gauges listed here are for use in the United States.
<3> Gauges listed here are for use in Europe.

Three-Phase 400 V Class

Table 8 Wire Gauge and Torque Specifications (Three-Phase 400 V Class)

Model CIMR-A□	Terminal	For Asia <1>		For U.S.A <2>		For Europe <3>		Screw Size	Tightening Torque N·m (lb.in.)
		Recommended Gauge mm²	Applicable Gauge mm²	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil	Recommended Gauge mm²	Applicable Gauge mm²		
4A0002 4A0004	R/L1, S/L2, T/L3	2	2 to 5.5	14	14 to 10	2.5	2.5 to 6	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2	2 to 5.5	14	14 to 10	2.5	2.5 to 6		
	–, +1, +2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	B1, B2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	⏚	2	2 to 5.5	12	14 to 12	2.5	2.5 to 4		
4A0005 4A0007 4A0009	R/L1, S/L2, T/L3	2	2 to 5.5	14	14 to 10	2.5	2.5 to 6	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2	2 to 5.5	14	14 to 10	2.5	2.5 to 6		
	–, +1, +2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	B1, B2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	⏚	3.5	2 to 5.5	10	14 to 10	2.5	2.5 to 6		
4A0011	R/L1, S/L2, T/L3	2	2 to 5.5	12	14 to 10	2.5	2.5 to 6	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2	2 to 5.5	14	14 to 10	2.5	2.5 to 6		
	–, +1, +2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	B1, B2	2	2 to 5.5	–	14 to 10	–	2.5 to 6		
	⏚	3.5	2 to 5.5	10	14 to 10	2.5	2.5 to 6		
4A0018	R/L1, S/L2, T/L3	3.5	2 to 14	10	12 to 6	2.5	2.5 to 16	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	3.5	2 to 14	10	12 to 6	2.5	2.5 to 16		
	–, +1, +2	3.5	2 to 14	–	12 to 6	–	4 to 16		
	B1, B2	2	2 to 5.5	–	12 to 10	–	4 to 6		
	⏚	3.5	2 to 5.5	10	14 to 10	2.5	2.5 to 6	M5	2 to 2.5 (17.7 to 22.1)
4A0023	R/L1, S/L2, T/L3	5.5	3.5 to 14	10	10 to 6	4	2.5 to 16	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	5.5	3.5 to 14	10	10 to 6	4	2.5 to 16		
	–, +1, +2	5.5	3.5 to 14	–	12 to 6	–	4 to 16		
	B1, B2	2	2 to 5.5	–	12 to 10	–	4 to 6		
	⏚	3.5	3.5 to 5.5	10	12 to 10	4	4 to 6	M5	2 to 2.5 (17.7 to 22.1)
4A0031	R/L1, S/L2, T/L3	14	5.5 to 14	8	8 to 6	6	6 to 16	M5	2 to 2.5 (17.7 to 22.1)
	U/T1, V/T2, W/T3	8	5.5 to 8	8	10 to 6	6	6 to 16		
	–, +1, +2	14	5.5 to 14	–	10 to 6	–	6 to 16		
	B1, B2	3.5	2 to 8	–	10 to 8	–	6 to 10	M5	2 to 2.5 (17.7 to 22.1)
	⏚	5.5	5.5 to 8	8	10 to 8	6	6 to 10	M6	4 to 6 (35.4 to 53.1)

Model CIMR-A□	Terminal	For Asia <1>		For U.S.A <2>		For Europe <3>		Screw Size	Tightening Torque N·m (lb.in.)
		Recommended Gauge mm²	Applicable Gauge mm²	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil	Recommended Gauge mm²	Applicable Gauge mm²		
4A0038	R/L1, S/L2, T/L3	14	14	6	8 to 6	10	10 to 16	M5	2 to 2.5 (17.7 to 22.1)
	U/T1, V/T2, W/T3	14	8 to 14	8	8 to 6	6	6 to 16		
	–, +1, +2	14	14	–	6	–	6 to 16		
	B1, B2	5.5	3.5 to 8	–	10 to 8	–	6 to 10	M5	2 to 2.5 (17.7 to 22.1)
	⏚	8	5.5 to 14	6	10 to 6	10	6 to 16	M6	4 to 6 (35.4 to 53.1)
4A0044	R/L1, S/L2, T/L3	14	14 to 22	6	6 to 4	16	16 to 25	M6	4 to 6 (35.4 to 53.1)
	U/T1, V/T2, W/T3	14	14 to 22	6	6 to 4	16	16 to 25		
	–, +1, +2	14	14 to 22	–	6 to 4	–	16 to 25		
	B1, B2	8	5.5 to 8	–	10 to 8	–	6 to 10	M5	2 to 2.5 (17.7 to 22.1)
	⏚	8	8 to 14	6	8 to 6	16	10 to 16	M6	4 to 6 (35.4 to 53.1)
4A0058	R/L1, S/L2, T/L3	14	14 to 50	4	6 to 1/0	16	10 to 50	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	14	14 to 50	4	6 to 1/0	16	10 to 50		
	–, +1	22	14 to 50	–	6 to 1/0	–	16 to 50		
	B1, B2	14	8 to 50	–	8 to 1/0	–	10 to 50		
	⏚	8	8 to 14	6	8 to 6	16	10 to 16		
4A0072	R/L1, S/L2, T/L3	22	14 to 50	3	4 to 1/0	16	16 to 50	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	22	14 to 50	3	4 to 1/0	25	16 to 50		
	–, +1	30	22 to 50	–	4 to 1/0	–	25 to 50		
	B1, B2	14	14 to 50	–	6 to 1/0	–	16 to 50		
	⏚	14	14 to 22	6	6 to 4	16	16 to 25		
4A0088	R/L1, S/L2, T/L3	30	22 to 60	2	3 to 3/0	25	16 to 70	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	30	22 to 60	2	3 to 3/0	25	25 to 70		
	–, +1	38	30 to 60	–	3 to 2/0	–	25 to 70		
	+3	22	14 to 60	–	6 to 3/0	–	16 to 70		
	⏚	22	14 to 22	4	6 to 4	16	16 to 25		
4A0103	R/L1, S/L2, T/L3	38	30 to 60	1/0	2 to 3/0	35	25 to 70	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	38	30 to 60	1	2 to 3/0	35	25 to 70		
	–, +1	60	30 to 60	–	3 to 2/0	–	25 to 70		
	+3	30	22 to 60	–	4 to 3/0	–	25 to 70		
	⏚	22	14 to 22	4	6 to 4	16	16 to 25		
4A0139	R/L1, S/L2, T/L3	60	38 to 100	3/0	1/0 to 4/0	50	35 to 95	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	60	50 to 100	2/0	1/0 to 4/0	50	35 to 95		
	–, +1	100	60 to 100	–	1/0 to 4/0	–	50 to 95		
	+3	50	30 to 100	–	3 to 4/0	–	25 to 95		
	⏚	22	22	4	4	25	25		
4A0165	R/L1, S/L2, T/L3	80	60 to 100	4/0	3/0 to 4/0	70	50 to 95	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	80	80 to 100	4/0	3/0 to 4/0	70	70 to 95		
	–,+1	50 Å~ 2P	50 to 100	–	1 to 4/0	–	35 to 95		
	+3	60	50 to 100	–	1/0 to 4/0	–	50 to 95		
	⏚	22	22 to 30	4	4 to 2	35	25 to 35		

<1> Gauges listed here are for use in Japan.
<2> Gauges listed here are for use in the United States.
<3> Gauges listed here are for use in Europe.

■ Main Circuit Terminal and Motor Wiring

This section outlines the various steps, precautions, and checkpoints for wiring the main circuit terminals and motor 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: *Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits. Failure to comply could result in damage to the drive, phase-advancing capacitors, LC/RC noise filters or ground fault circuit interrupters.*

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

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 9***. 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 60***.

Table 9 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: When setting carrier frequency in a drive running multiple motors, calculate the cable length as the total distance of wiring to all motors that are connected.

Ground Wiring

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

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

WARNING! *Electrical Shock Hazard. Be sure to ground the drive ground terminal. (200 V Class: Ground to 100 Ω or less, 400 V Class: Ground to 10 Ω or less). Improper equipment grounding 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 26*** when using multiple drives. Do not loop the ground wire.

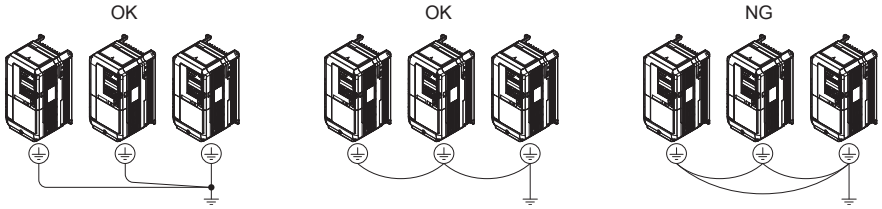


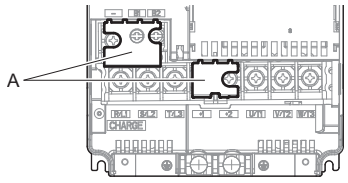
Figure 23 Multiple Drive Wiring

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 CIMR-A☐2A0004 through 0081 and 4A0002 through 0044 have a cover placed over the DC bus and braking circuit terminals prior to shipment to help prevent miswiring. Cut away covers as needed for terminals using wire cutters.



A – Protective Cover

Figure 24 Protecting Cover to Prevent Miswiring (CIMR-A☐2A0056)

Main Circuit Connection Diagram

Refer to Main Circuit Connection Diagram on page 22 when wiring terminals on the drive's main power circuit.

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.*

◆ 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, M2), multi-function photocoupler outputs (P1, P2), 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 12***.

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! *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 51****. Failure to comply may result in death or serious injury.*

Input Terminals

Table 10 lists the input terminals on the drive. Text in parenthesis indicates the default setting for each multi-function input.

Table 10 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 Set the S3 jumper to select between sinking, sourcing mode, and the power supply. Refer to ***Sinking/Sourcing Mode Switch for Digital Inputs on page 37***.	***124***
	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 (External baseblock)		
	SC	Multi-function input common	Multi-function input common	
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 for multi-function input terminals in ***Sinking/Sourcing Mode Switch for Digital Inputs on page 37***. <1>	***151***
	H2	Safe Disable input 2		
	HC	Safe Disable function common	Safe disable function common	
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	***129*** ***150***
	+V	Power supply for analog inputs	10.5 Vdc (max allowable current 20 mA)	***150***
	-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)	***53***
	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	***39*** ***53***
	A3	Multi-function analog input 3 (auxiliary frequency reference)	-10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ)	***53***
	AC	Frequency reference common	0 V	***53***
	E (G)	Ground for shielded lines and option cards	–	–

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

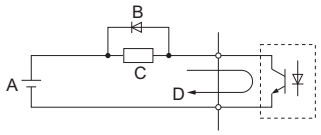
Output Terminals

Table 11 lists the output terminals on the drive. Text in parenthesis indicates the default setting for each multi-function output.

Table 11 Control Circuit Output Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting	Page
Fault Relay	MA	N.O.	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA	126
	MB	N.C. output		
	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	
	M2			
Multi-Function Photocoupler Output	P1	Photocoupler output 1 (Zero speed)	48 Vdc, 2 to 50 mA <2>	
	P2	Photocoupler output 2 (Speed agree 1)		
	PC	Photocoupler output common		
Monitor Output	MP	Pulse train output (Output frequency)	32 kHz (max)	129
	FM	Analog monitor output 1 (Output frequency)	-10 to +10 Vdc or 0 to +10 Vdc	128
	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	151
	DM-	Safety monitor output common		

<1> Refrain from assigning functions to terminals M1 and M2 that involve frequent switching, as doing so may shorten relay performance life. Switching life is estimated at 200,000 times (assumes 1 A, resistive load).
<2> Connect a flywheel diode as shown in the *Figure 28* when driving a reactive load such as a relay coil. Make sure the diode rating is greater than the circuit voltage.



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

Figure 25 Connecting a Suppression Diode

Serial Communication Terminals

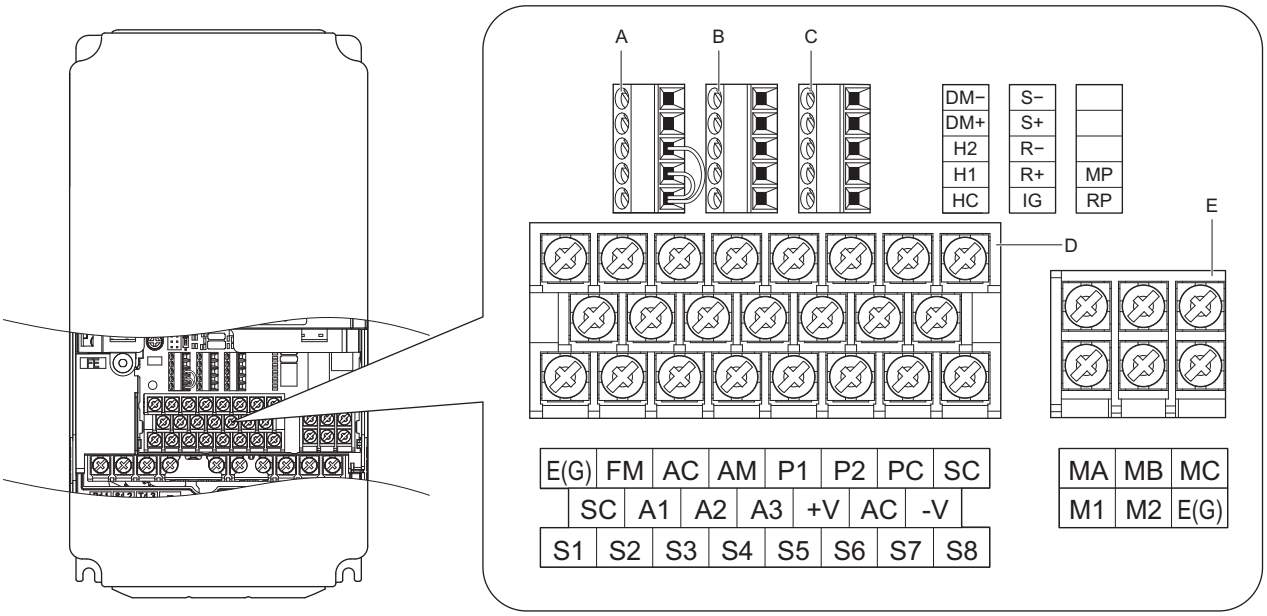
Table 12 Control Circuit Terminals: Serial Communications

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

<1> Enable the termination resistor in the last drive in a MEMOBUS network by setting DIP switch S2 to the ON position. For more information on the termination resistor, see *Control I/O Connections on page 37*.

■ Terminal Configuration

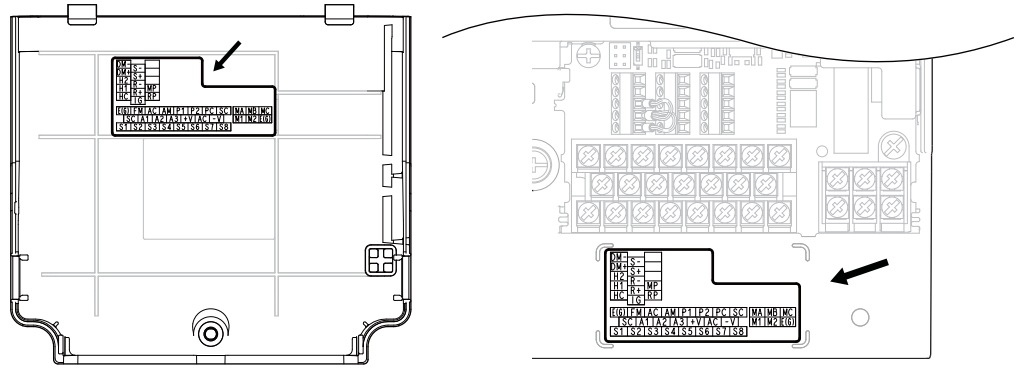
Control circuit terminals should be wired as shown in ***Figure 29***.



A – Terminal Block (TB 6)
B – Terminal Block (TB 5)
C – Terminal Block (TB 4)
D – Terminal Block (TB 1)
E – Terminal Block (TB 2)
F –

Figure 26 Control Circuit Terminal Arrangement (CIMR-AA□□□□□□□□□□)

Terminal board arrangement appears below. The exact location of the labeling may vary by model.



Inside of the Terminal Cover
(CIMR-A□2A0004 to 2A0081, 4A0002 to 4A0044)

Under the Terminal Board
(CIMR-A□2A0110 to 2A0211, 4A0072 to 4A0165)

Figure 27 Control Circuit Terminal Arrangement

Wire Size and Torque Specifications

Select appropriate wire type and gauges from *Table 13*. For simpler and more reliable wiring, use crimp ferrules on the wire ends. Refer to *Table 14* for ferrule terminal types and sizes.

Table 13 Wire Gauges and Torque Specifications

Terminal Block	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Bare Wire Terminal		Ferrule-Type Terminal		
				Applicable wire size mm² (AWG)	Recomm. mm² (AWG)	Applicable wire size mm² (AWG)	Recomm. mm² (AWG)	Wire Type
TB1, TB2	FM, AC, AM, P1, P2, PC, SC, A1, A2, A3, +V, -V, S1-S8, MA, MB, MC, M1, M2	M3.5	0.8 to 1.0 (7.1 to 8.6)	0.5 to 2 (20 to 14)	0.75 (18)	–	–	Shielded line, etc.
	E (G)	M3.5	0.8 to 1.0 (7.1 to 8.6)	0.5 to 2 (20 to 14)	1.25 (12)			
TB4, TB5, TB6	HC, H1, H2, DM+, DM-, IG, R+, R-, S+, S-, RP, MP	M2	0.22 to 0.25 (1.9 to 2.2)	Standard 0.25 to 1.0 (24 to 17) Single 0.25 to 1.5 (24 to 16)	0.75 (18)	0.25 to 0.5 (24 to 20)	0.5 (20)	

Ferrule-Type Wire Terminals

Prepare wire ends with insulated sleeves before connecting to the drive. See *Table 14* for dimensions. Yaskawa recommends CRIMPFOX ZA-3, a crimping tool manufactured by PHOENIX CONTACT.

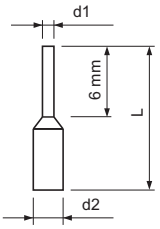


Figure 28 Ferrule Dimensions

Table 14 Ferrule Terminal Types and Sizes

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

■ Wiring the Control Circuit Terminal

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

WARNING! *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 and MC 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 (UL standard) when connecting to the control terminals. Improper application of peripheral devices could result in drive performance degradation due to improper power supply.*

NOTICE: *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.*

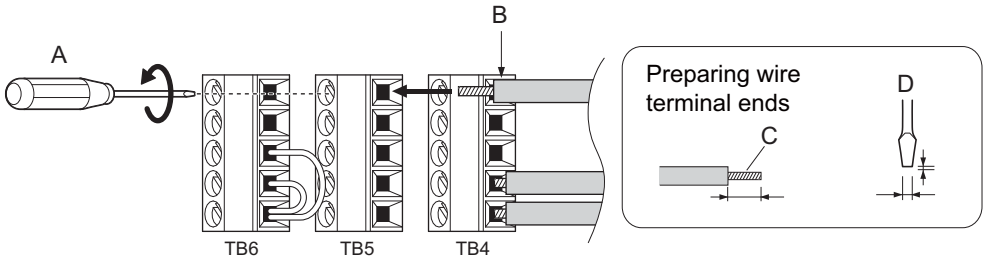
NOTICE: *Connect the shield of shielded cable to the appropriate ground terminal. Improper equipment grounding could result in drive or equipment malfunction or nuisance trips.*

Wire the control circuit only after terminals have been properly grounded and main circuit wiring is complete. Refer to *Figure 32* for details. Prepare the ends of the control circuit wiring as shown in *Figure 34*. *Refer to Wire Size and Torque Specifications on page 35*.

NOTICE: *Do not tighten screws beyond the specified tightening torque. Failure to comply may result in erroneous operation, damage 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.*

Connect control wires as shown in the following figure:



A – Loosen screw to insert wire. Wire in the following order: TB4, TB5, TB6

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 29 Terminal Board Wiring Guide

Use the space above TB2 to wire TB4 through TB6 as illustrated in ***Figure 33***.

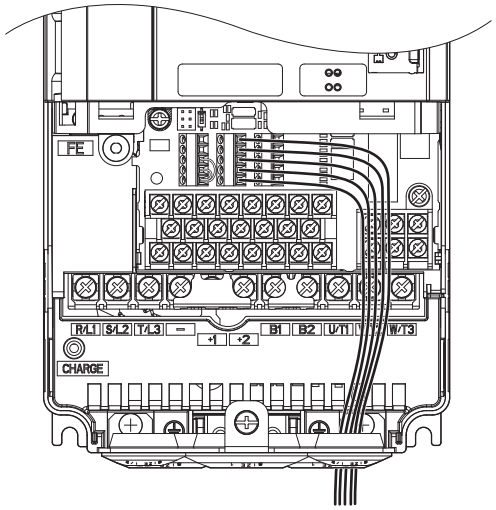
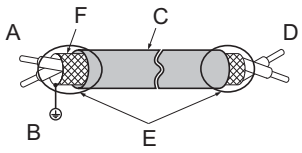


Figure 30 Terminal Board Wiring

When setting the frequency by analog reference from an external potentiometer, use shielded twisted-pair wires (treating wire ends as shown in ***Figure 34***) and connect the shield to the ground terminal of the drive.



A – Drive side

B – Connect shield to ground terminal of drive.

C – Insulation

D – Control device side

E – Shield sheath (insulate with tape)

F – Shield

Figure 31 Preparing the Ends of Shielded Cables

NOTICE: *The analog signal lines 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.*

◆ Control I/O Connections

■ Sinking/Sourcing Mode Switch for Digital Inputs

Set jumper S3 to select between sinking/sourcing mode, and internal or external power supply. Signal levels are the same for terminals S1 through S8 and the safety inputs. The drive is preset to sinking mode.

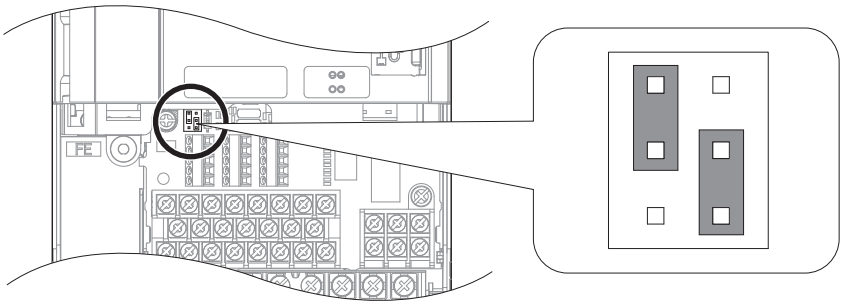


Figure 32 Jumper S3

Sink Mode (0 V Common), Internal Power Supply

When controlling the digital inputs by NPN transistors (0 V common/sinking mode) or contacts using the drive internal power supply, position the jumper S3 for sinking as shown in ***Figure 36***.

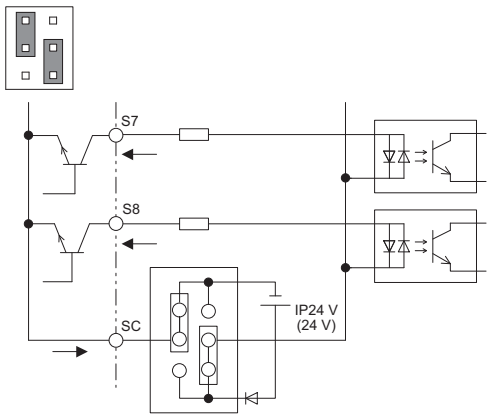


Figure 33 Sinking Mode (0 V Common), Internal Power Supply

Source Mode (+24 V Common), Internal Power Supply

When controlling digital inputs by PNP transistors (+24 V common/sourcing mode) or contact inputs using the drive internal power supply, set jumper S3 for sourcing as shown in ***Figure 37***.

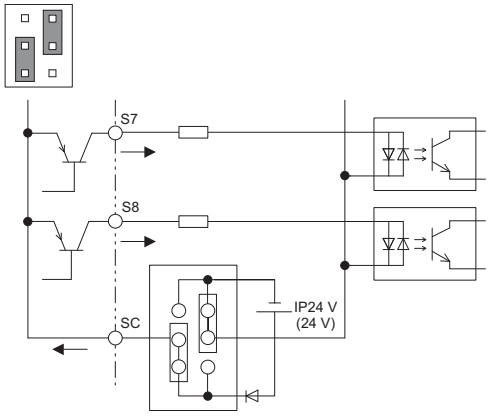
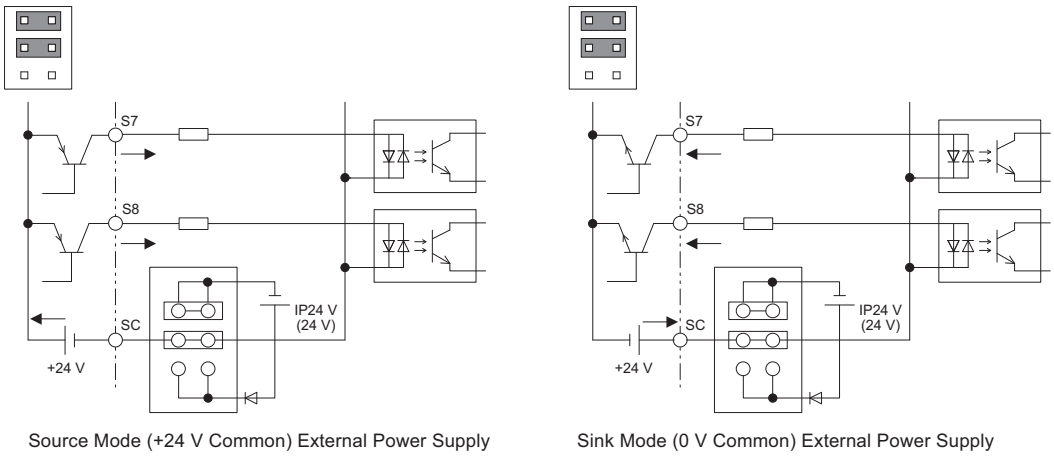


Figure 34 Source Mode (+24 V Common), Internal Power Supply

Sink/Source Mode, External Power Supply

When using an external voltage source for controlling the digital inputs, set jumper S3 as shown in ***Figure 38***. Here, the inputs can be used for either sinking or sourcing.



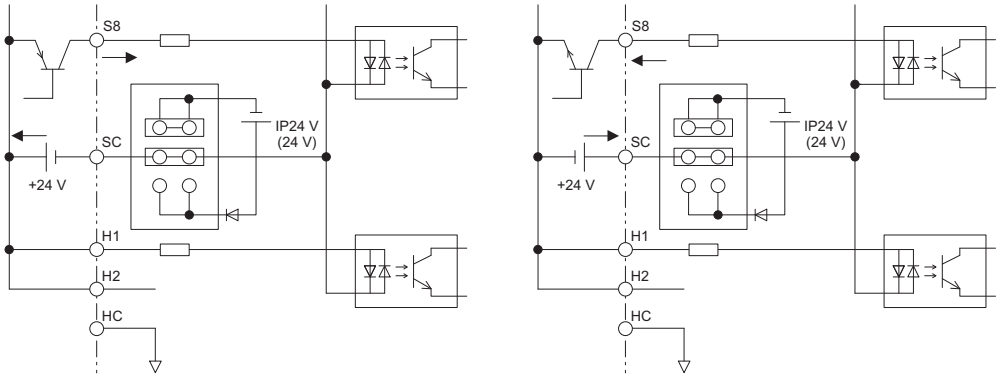
Source Mode (+24 V Common) External Power Supply

Sink Mode (0 V Common) External Power Supply

Figure 35 Sink/Source Mode, External Power Supply

Power Supply Inputs Instead of the Safe Disable Feature

Refer to ***Figure 39*** to wire the input terminals for an external power supply instead of the Safe Disable feature.



Source Mode

Sink Mode

Figure 36 Power Supply Inputs Instead of the Safe Disable Feature

■ Using the Pulse Train Output

The pulse train output terminal MP can either supply power but can also be used with external power supply. Peripheral devices should be connected in accordance with the specifications listed below. Failure to do so can 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: $R_L = V_{MP} \cdot 2 / (12 - V_{MP})$

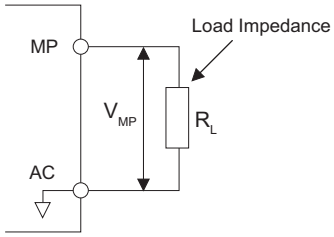


Figure 37 Pulse Output Connection Using Internal Voltage Supply

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

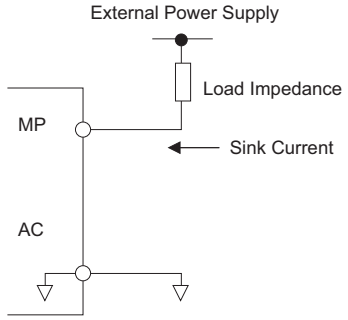


Figure 38 Pulse Output Connection Using External Voltage Supply

◆ Terminal A2 Analog Input Signal Selection

Terminal A2 can be used to input either a voltage or a current signal.

When using input A2 as a voltage input, set DIP switch S1 to “V” (left position) and set parameter H3-09 to 0 (0 to 10 Vdc) or to 1 (-10 to 10 Vdc).

To use current input at terminal A2, set the DIP switch S1 to “I” (default setting) and H3-09 = 2 or 3 (4 to 20 mA or 0 to 20 mA).

To set the DIP switch on the terminal board, use an appropriate sized tool with a tip of approximately 8 mm in width.

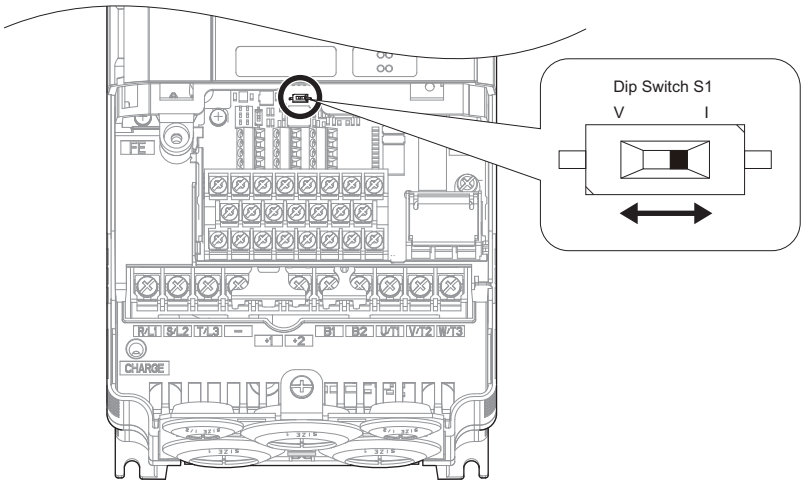


Figure 39 DIP Switch S1

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 15 DIP Switch S1 Settings

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

Table 16 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

◆ Connect to a PC

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

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

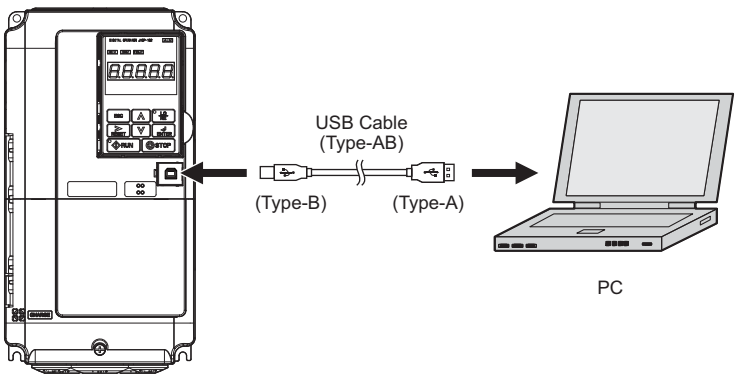
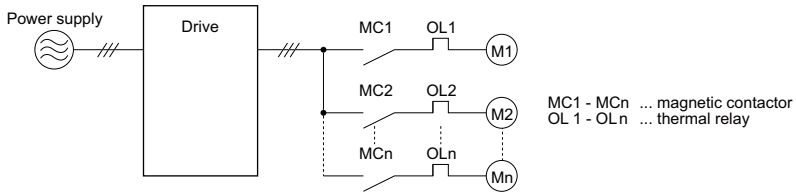


Figure 40 Connecting to a PC (USB)

◆ Wiring Checklist

☑	No.	Item	Page
		Drive, peripherals, option cards	
☐	1	Check drive model number to ensure receipt of correct model.	*12*
☐	2	Make sure you have the correct braking resistors, DC reactors, 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.	*14*
		Power supply voltage, output voltage	
☐	5	The voltage from the power supply should be within the input voltage specification range of the drive.	*62*
☐	6	The voltage rating for the motor should match the drive output specifications.	*12* *137*
☐	7	Verify that the drive is properly sized to run the motor.	*12* *137*
		Main circuit wiring	
☐	8	Confirm proper branch circuit protection as specified by national and local codes.	*20*
☐	9	Properly wire the power supply to drive terminals R/L1, S/L2, and T/L3.	*22*
☐	10	Properly wire the drive and motor together. The motor lines and drive output terminals R/T1, V/T2, and W/T3 should match in order to produce the desired phase order. If the phase order is incorrect, the drive will rotate in the opposite direction.	*30*
☐	11	Use 600 Vac vinyl-sheathed wire for the power supply and motor lines.	*27*
☐	12	Use the correct wire gauges for the main circuit. *Refer to Wire Gauges and Tightening Torque on page 27*. • When using comparatively long motor cable, calculate the amount of voltage drop. Motor rated voltage (V) x 0.02 ≥ 3 x voltage resistance (Ω/km) x cable length (m) x motor rated current (A) x 10^{-3} • If the cable between the drive and motor exceeds 50 m, adjust the carrier frequency set to C6-02 accordingly.	*27* *27* *31*
☐	13	Properly ground the drive. Review page *31*.	*31*
☐	14	Tightly fasten all terminal screws (control circuit terminals, grounding terminals). *Refer to Wire Gauges and Tightening Torque on page 27*.	*27*
☐	15	Set up overload protection circuits when running multiple motors from a single drive.  **Note:** Close MC1 through MCn before operating the drive.	–
☐	16	If using a braking resistor or dynamic braking resistor unit, install a magnetic contactor. Properly install the resistor, and ensure that overload protection shuts off the power supply.	–
☐	17	Verify phase advancing capacitors, input noise filters, or ground fault circuit interrupters are NOT installed on the output side of the drive.	–
		Control circuit wiring	
☐	18	Use twisted-pair line for all drive control circuit wiring.	*35*
☐	19	Ground the shields of shielded wiring to the GND ⏚ terminal.	*35*
☐	20	If using a 3-wire sequence, properly set parameters for multi-function contact input terminals S1 through S8, and properly wire control circuits.	–
☐	21	Properly wire any option cards.	*35*
☐	22	Check for any other wiring mistakes. Only use a multimeter to check wiring.	–
☐	23	Properly fasten the control circuit terminal screws in the drive. *Refer to Wire Gauges and Tightening Torque on page 27*.	*27*
☐	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.	–

4 Start-Up Programming & Operation

◆ Using the Digital Operator

Use the digital operator to enter run and stop commands, display data, edit parameters, as well as display fault and alarm information.

■ Keys and Displays

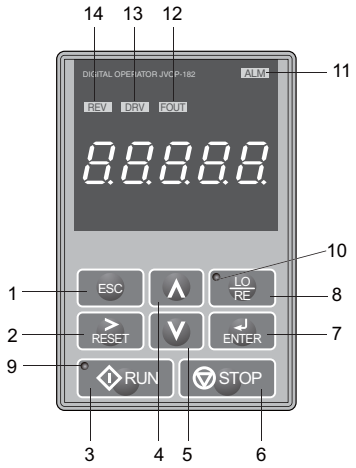


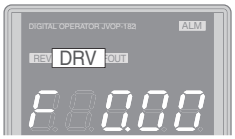
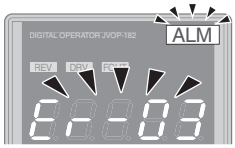
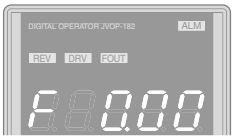
Figure 41 Keys and Displays on the Digital Operator

No.	Display	Name	Function
1	ESC	ESC Key	• Returns to the previous menu. • Moves the cursor to the left when selecting a parameter number. • When pressed and held, returns to the frequency reference display from any display screen or menu item.
2	RESET	RESET Key	• Moves the cursor to the right. • Resets the drive to clear a fault situation.
3	RUN	RUN Key	Starts the drive.
4	∧	Up Arrow Key	• Scrolls up the display screen. • Scrolls up to select parameter numbers, setting values, etc.
5	∨	Down Arrow Key	• Scrolls down the display screen. • Scrolls down to select parameter numbers, setting values, etc.
6	STOP	STOP Key <1>	Stops the operation.
7	ENTER	ENTER Key	• Selects all modes, parameters, settings, etc. • Selects a menu item to move from one display screen to the next.
8	LO RE	LO/RE Selection Key <2>	Switches drive control between the operator (LOCAL) and an external source (REMOTE) for the Run command and frequency reference.
9	RUN	RUN Light	Lit while the drive is operating the motor. Refer to page *43* for details.
10	LO RE	LO/RE Light	Lit while the operator is selected to run the drive (LOCAL mode). Refer to page *43* for details.
11	ALM	ALM LED Light	*Refer to LED Screen Displays on page 43*.
12	FOUT	FOUT LED Light	
13	DRV	DRV LED Light	
14	REV	REV LED Light	

<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 o2-06 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.

■ LED Screen Displays

Table 17 LED Screen Displays

Display	Lit	Flashing	Off
ALM	The drive has detected an alarm or error	• When an alarm occurs • oPE detected • When a fault or error occurs during Auto-Tuning	Normal state (no fault or alarm)
REV	Motor is rotating in reverse	—	Motor is rotating forward
DRV	• The drive is in the Drive Mode • During Auto-Tuning	When DriveWorksEZ is used <1>	• The drive is in the Programming Mode • The drive will not accept a Run command
FOUT	When the display shows the output frequency	—	When a display other than the output frequency monitor is shown.
As illustrated in this manual			

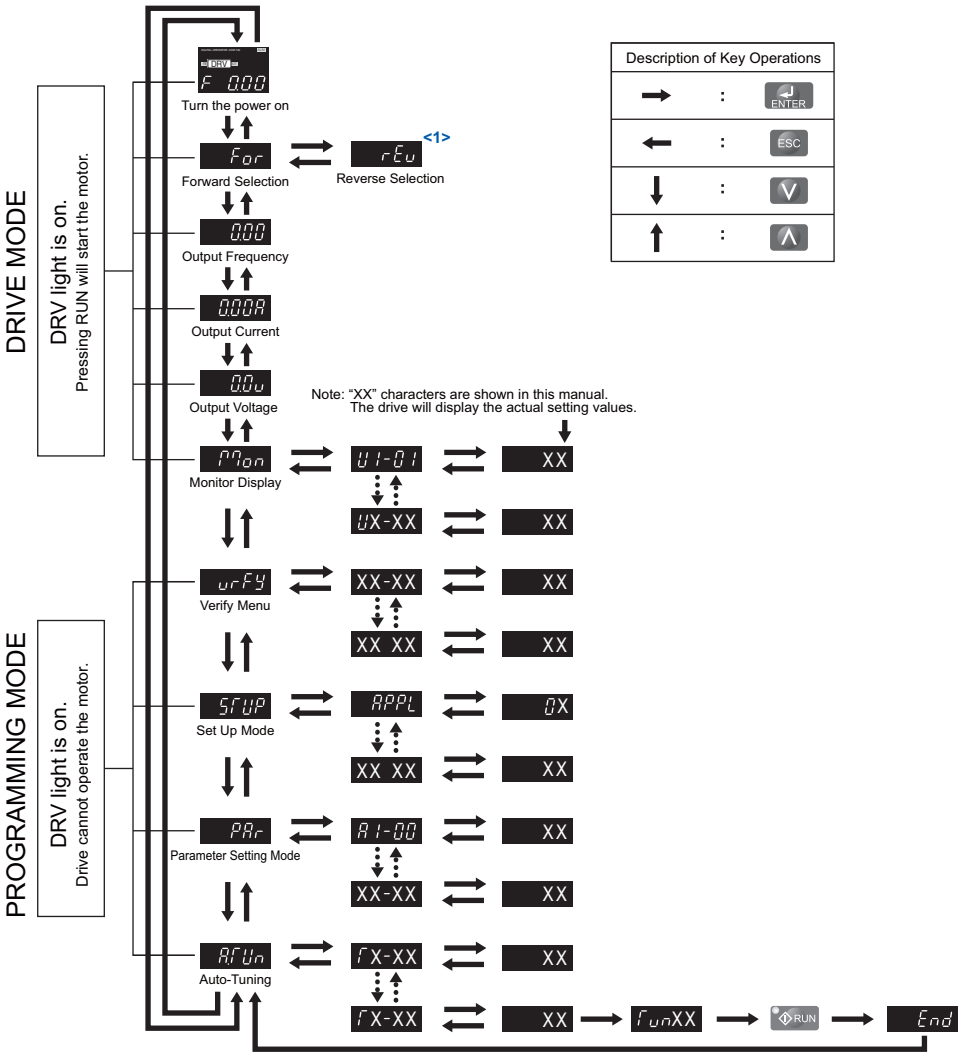
<1> Refer to the DriveWorksEZ instruction manual for further information.

■ LO/RE LED and RUN LED Indications

Table 18 LO/RE LED and RUN LED Indications

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

■ Menu Structure for Digital Operator



<1> Reverse can only be selected when the drive is set for LOCAL.

Figure 42 Digital Operator Menu and Screen Structure

◆ The Drive and Programming Modes

The drive has a Programming Mode to program the drive for operation, and a Drive Mode used to actually run the motor.

Drive Mode: In the Drive Mode, the user can start the motor and observe operation status with the monitors that are available. Parameter settings cannot be edited or changed when in the Drive Mode.

Programming Mode: The Programming Mode allows access to edit, adjust, and verify parameters, as well as perform Auto-Tuning. Unless set to allow a Run command, the drive will not accept a Run command when the digital operator is in the 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.	→	
2.	Press the ∧ or ∨ key until the Parameter Setting Mode screen appears.	→	
3.	Press the ENTER key to enter the parameter menu tree.	→	
4.	Press ∧ or ∨ key to select the C parameter group.	→	
5.	Press ENTER two times.		
6.	Press ∧ or ∨ key to select the parameter C1-02.	→	
7.	Press ENTER to view the current setting value (10.0 s). Left digit flashes.	→	
8.	Press RESET until the desired number is selected. “1” flashes.	→	
9.	Press the ∧ key and enter 0020.0.	→	
10.	Press ENTER and the drive will confirm the change.	→	
11.	The display automatically returns to the screen shown in Step 4.	→	
12.	Press the ESC key until back at the initial display.	→	

■ Setup Group Parameters

Table 19 lists parameters available by default in the Setup Group. When an Application Preset has been selected in parameter A1-06 or the ***APPL*** display of the Setup Group, the parameters selected for the Setup Group will change automatically. Refer to *Application Selection on page 51*.

If the desired parameter is not listed in the Setup Group, go to the Programming Mode.

Table 19 Setup Group Parameters

Parameter	Name
A1-02	Control Method Selection
b1-01	Frequency Reference Selection 1
b1-02	Run Command Selection 1
b1-03	Stop Method Selection
C1-01	Acceleration Time 1
C1-02	Deceleration Time 1
C6-01	Duty Selection
C6-02	Carrier Frequency Selection
d1-01	Frequency Reference 1
d1-02	Frequency Reference 2
d1-03	Frequency Reference 3
d1-04	Frequency Reference 4
d1-17	Jog Frequency Reference

Parameter	Name
E1-01	Input Voltage Reference
E1-03	V/f Pattern Selection
E1-04	Maximum Output Frequency
E1-05	Maximum Voltage
E1-06	Base Frequency
E1-09	Minimum Output Frequency
E1-13	Base Voltage
E2-01	Motor Rated Current
E2-04	Number of Motor Poles
E2-11	Motor Rate Capacity
H4-02	Terminal AM Gain Setting
L1-01	Motor Protection Function Selection
L3-04	Stall Prevention Selection during Deceleration

Note: Parameter availability depends on the control mode set in A1-02 that is used to run the drive and motor. Consequently, some of the parameters listed above may not be accessible in certain control modes.

■ Switching Between LOCAL and REMOTE

When the drive is set to accept the Run command from the digital operator RUN key, this is referred to as LOCAL mode. When the drive is set to accept the Run command from an external device (via the input terminals, serial communications, etc.) this is referred to as REMOTE mode.

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.*

The operation can be switched between LOCAL and REMOTE either by using the LO/RE key on the digital operator or 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 LO/RE

The user can also switch between LOCAL and REMOTE modes using one of the digital input terminals S1 through S8 (set the corresponding parameter H1-☐☐ to "1").

When setting the multi-function input terminals,

Note: **1.** *Refer to Parameter List on page 107* for a list of digital input selections.
2. Setting H1-☐☐ to 1 disables the LO/RE key on the digital operator.

◆ Start-Up Flowcharts

The flowcharts in this section summarize basic steps required to start the drive. Use the flowcharts to determine the most appropriate start-up method for a given application. The charts are intended as a quick reference to help familiarize the user with start-up procedures.

Flowchart	Subchart	Objective	Page
A	–	Basic startup procedure and motor tuning	*47*
–	A-1	Simple motor setup using V/f mode	*48*
	A-2	High-performance operation using Open Loop Vector (OLV) or Closed Loop Vector (CLV) motor control	*49*
	A-3	Setting up the drive to run a permanent magnet (PM) motor	*50*

Note: To set up the drive using one of the Application Presets, refer to *Application Selection on page 51*.

■ Flowchart A: Basic Start-up and Motor Tuning

Flowchart A in ***Figure 48*** describes a basic start-up sequence. This sequence varies slightly depending on the application. Use drive default parameter settings in simple applications that do not require high precision.

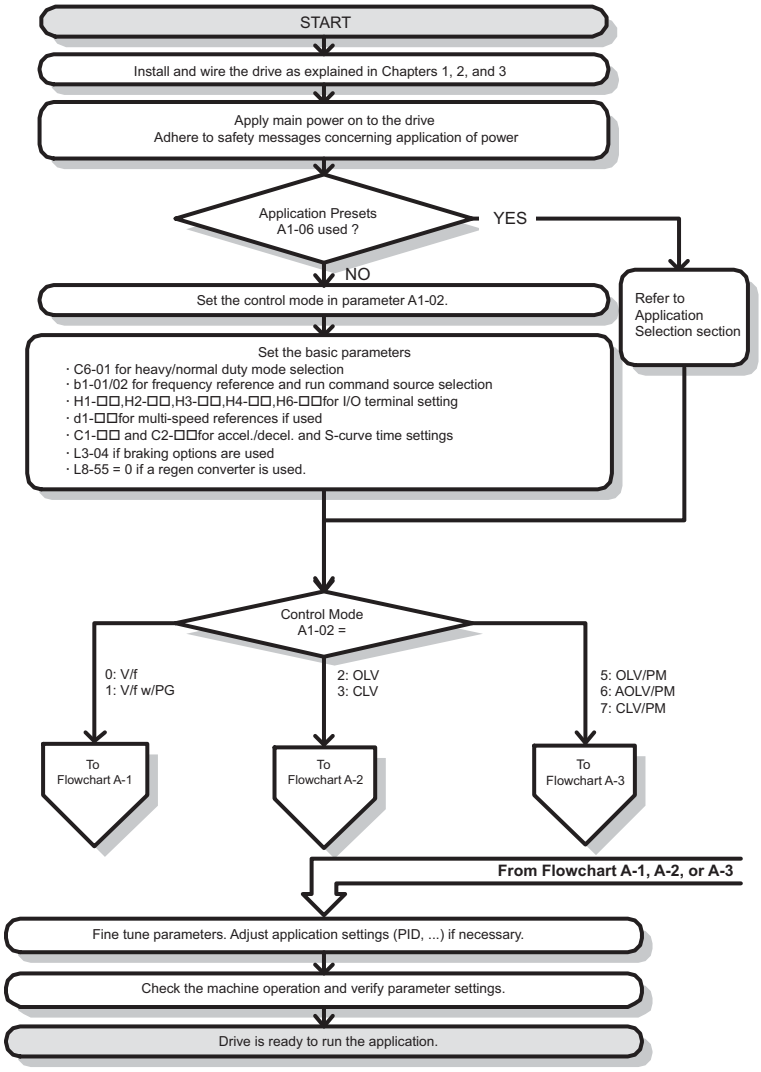


Figure 43 Basic Start-up

Note: When the motor cable length has changed for more than 50 m after Auto-Tuning has been performed (e.g., after the drive has been set up and then later installed in a different location), execute Stationary Auto-Tuning for resistance between motor lines once the drive is installed in its final installation location.

Note: Auto-Tuning should be performed 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 49*** 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.

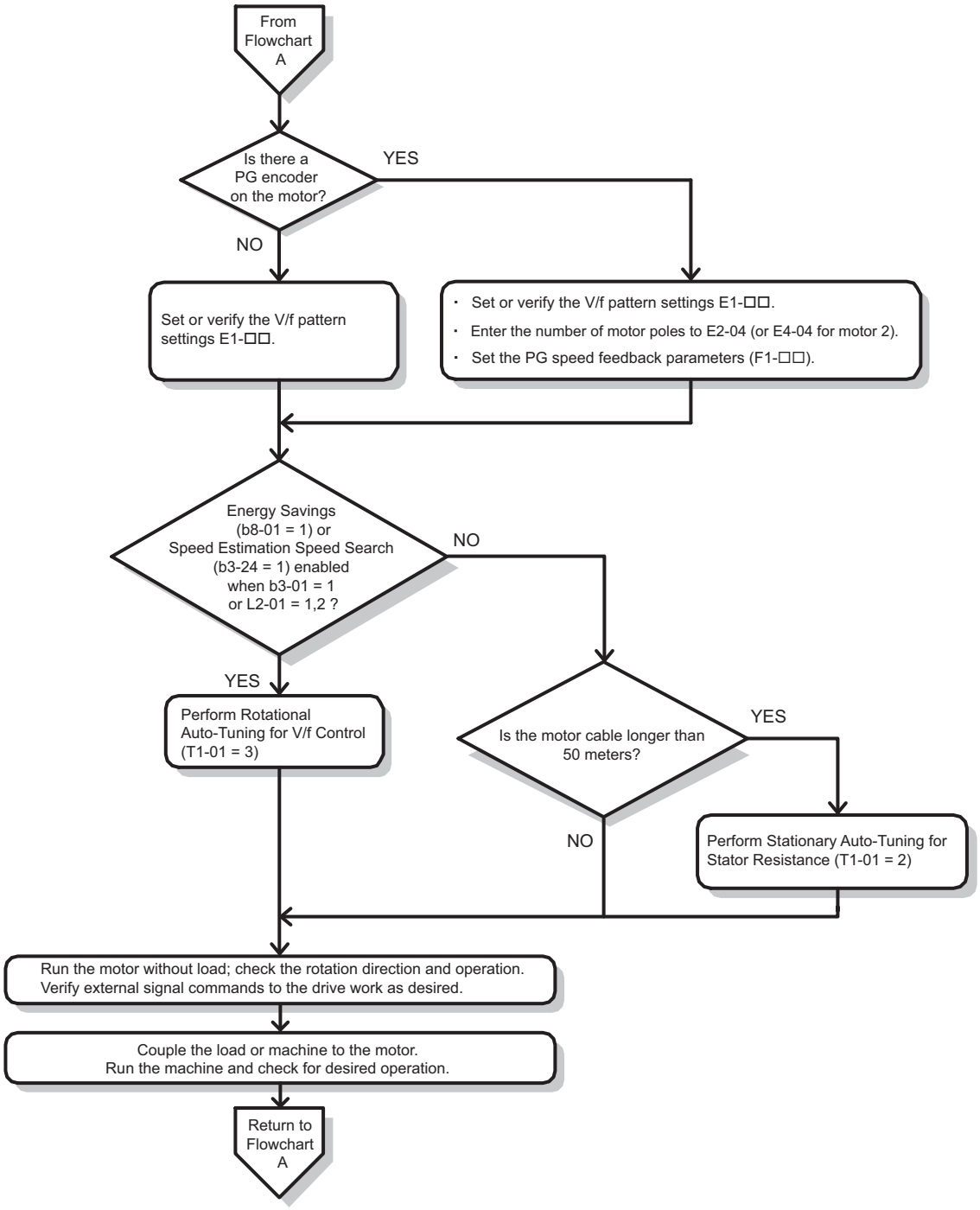
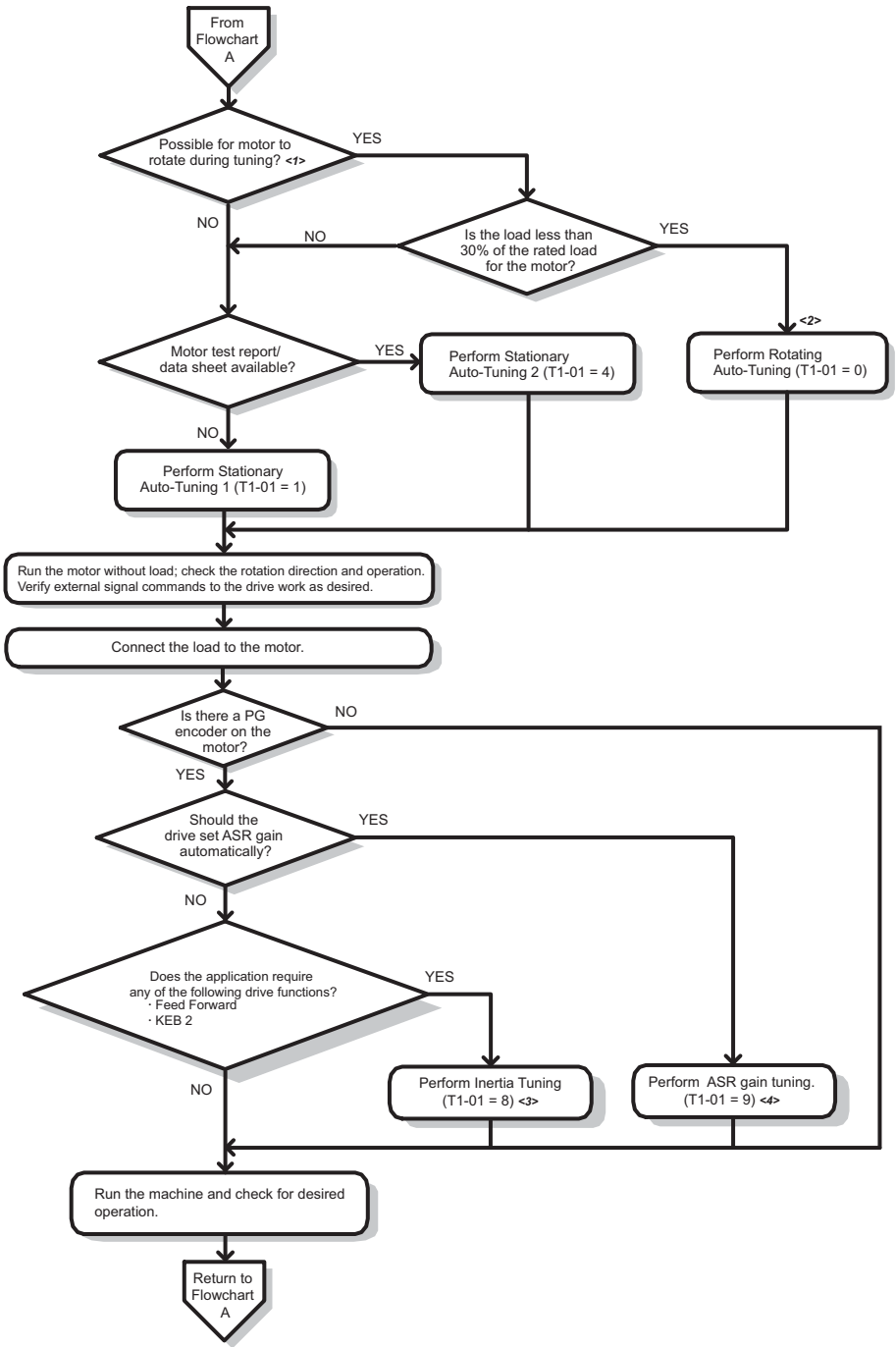


Figure 44 Simple Motor Setup with Energy Savings or Speed Search

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

Flowchart A2 in ***Figure 50*** describes the setup procedure for high-performance with Open Loop Vector Control or Closed Loop Vector Control. 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.



<1> The load must be decoupled 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 will probably 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.

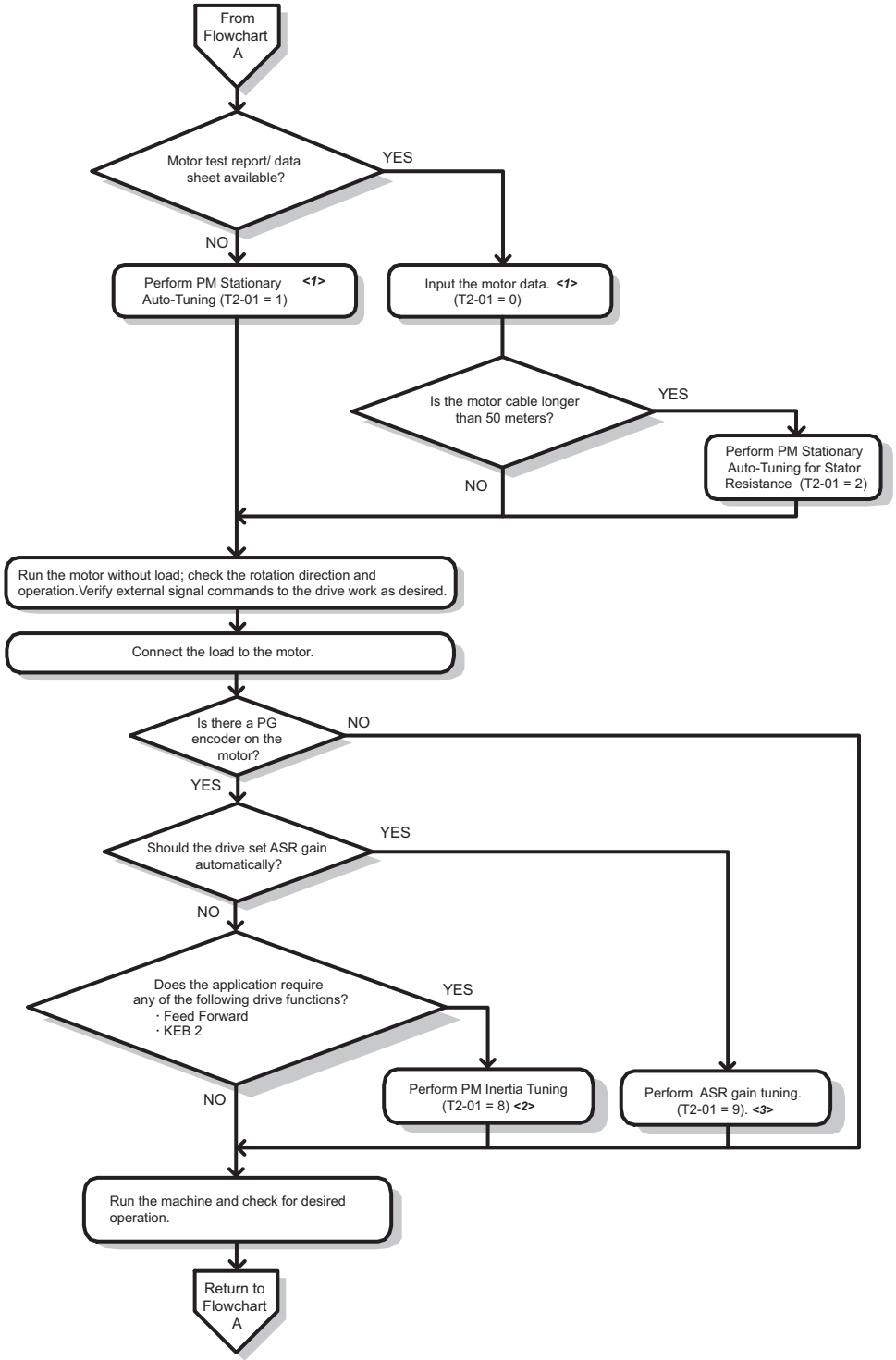
Figure 45 Flowchart A2: High Performance Operation Using OLV or CLV

■ Subchart A-3: Operation with Permanent Magnet Motors

Flowchart A3 in ***Figure 52*** describes the set-up 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: 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.

Note: The Z pulse must be realigned if the PG encoder is replaced. Set T2-01 to 3 to recalibrate the drive for the new encoder.



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

<3> ASR Gain Tuning automatically performs Inertia Tuning and sets parameters related to Feed Forward and the KEB Ride-Thru function.

Figure 46 Operation with Permanent Magnet Motors

◆ 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	Ensure the power supply voltage is correct: 200 V class: 3-phase 200 to 240 Vac 50/60 Hz 400 V class: 3-phase 380 to 480 Vac 50/60 Hz
	Properly wire the power supply input terminals (R/L1, S/L2, T/L3).
	Check for 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.

Status Display

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

No.	Name	Description
Normal Operation		The data display area displays the frequency reference. DRV is lit.
Fault	 External fault (example)	Data displayed varies by the type of fault. *Refer to Fault Displays, Causes, and Possible Solutions on page 84* for more information and possible solution. ALM and DRV are lit.

◆ 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 certain parameters to values appropriate for the application that was selected. 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, and provide quicker access to by eliminating the need to scroll through multiple menus.

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

Note: An Application Preset can only be selected if all drive parameters are on 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.

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

No.	Parameter Name	Setting Range	Default
A1-06	Application Presets	0: Disabled 1: Water supply pump 2: Conveyor 3: Exhaust fan 4: HVAC 5: Compressor 6: Hoist 7: Crane	0

◆ Basic Drive Setup Adjustments

This section explains the basic settings required for initial drive operation. Checking these basic parameter settings during start-up will help to ensure a successful drive start-up.

If more information is required for parameters not listed in this section, Refer to *Refer to Parameter List on page 107* as required for a complete listing of drive parameters.

■ A1-02: Control Method Selection

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

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

V/f Control is for simple speed control and multiple motor applications with low demands to dynamic response or speed accuracy. This control mode should be 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

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

Setting 2: Open Loop Vector Control

For general, variable-speed applications with a speed control range of 1:120 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

For general, variable-speed applications that requiring precise speed control down to zero speed, fast torque response, or precise torque control. A speed feedback signal from the motor is required. 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 variable torque applications and take advantage of the energy saving capabilities of a PM motor. Using this mode, the drive can control an SPM or IPM motor with a speed range of 1:20.

Setting 6: Advanced Open Loop Vector Control for PM

This control mode can be used to operate an IPM motor for constant torque applications. Using High Frequency Injection, a speed control range as high as 1:100 is possible.

Setting 7: Closed Loop Vector Control for PM

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

■ A1-03: Initialize Parameters

Resets parameters back to the original default values. After initialization, the setting for A1-03 automatically returns to 0.

No.	Parameter Name	Setting Range	Default
A1-03	Initialize Parameters	0, 1110, 2220, 3330, 5550	0

Setting 1110: User Initialize

Drive parameters are reset to values selected by the user as User Settings. User Settings are stored when parameter o2-03 is set to "1: Set defaults".

Note: A "user-initialization" resets all parameters to a user-defined set of default values that were previously saved to the drive. To clear the user-defined default values, set parameter o2-03 to 2.

Setting 2220: 2-Wire Initialization

Resets all parameters back to their original default settings with digital inputs S1 and S2 configured as Forward run and Reverse run, respectively.

Setting 3330: 3-Wire Initialization

The drive parameters are returned to factory default values with digital inputs S1, S2, and S5 configured as Run, Stop, and Forward/Reverse respectively. Also refer to digital input functions, *Setting 0: 3-Wire Sequence on page 67*.

Setting 5550: oPE04 Reset

If parameters on a certain drive have been edited and then a different terminal block is installed with different settings saved in its built-in memory, an oPE04 error will appear on the display. To use the parameter settings saved to the terminal block memory, set A1-02 to 5550.

Notes on Parameter Initialization

The parameters shown in *Table 20* 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 20 Parameters not Changed by Drive Initialization

No.	Parameter Name
A1-00	Language Selection
A1-02	Control Method Selection
C6-01	Duty Selection
E1-03	V/f Pattern Selection
E5-01	Motor Code Selection (for PM motors)
F6-08	Comm. Parameter Reset
L8-35	Installation Selection
o2-04	Drive/kVA Selection

■ b1-01: Frequency Reference Selection 1

Use parameter b1-01 to select 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.
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

Using this setting, the frequency reference can be input by:

- switching between the multi-speed references in the d1-☐☐ parameters.
- entering the frequency reference on the operator keypad.

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 21* for the input used.

Table 21 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 Vd	H3-01 = 0	H3-02 = 0 (Master Speed Reference)	H3-03	H3-04	-
	-10 to +10 Vdc	H3-01 = 1				
A2	0 to 10 Vd	H3-09 = 0	H3-10 = 0 (Master Speed Reference)	H3-11	H3-12	Make sure to set DIP switch S1 on the terminal board to “V” for voltage input.
	-10 to +10 Vdc	H3-09 = 1				
A3	0 to 10 Vd	H3-05 = 0	H3-06 = 0 (Master Speed Reference)	H3-07	H3-08	-
	-10 to +10 Vdc	H3-05 = 1				

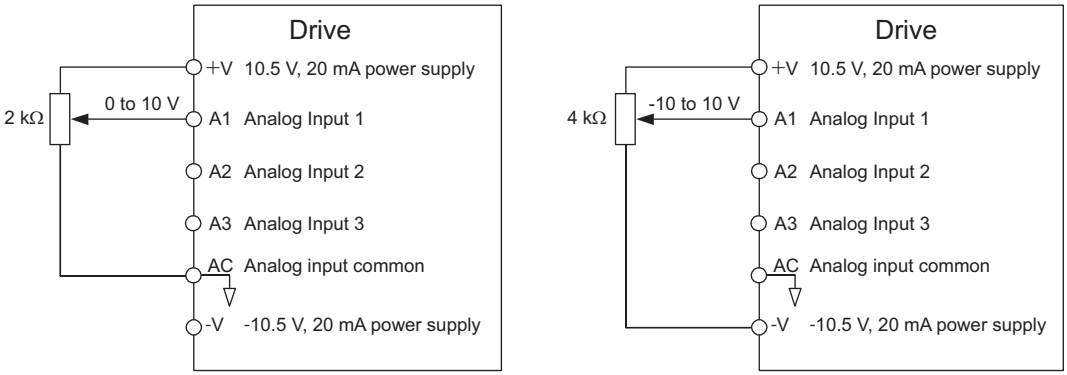


Figure 47 Setting the Frequency Reference as a Voltage Signal at Terminal A1

Use the wiring example shown in *Figure 54* 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 22* to set terminal A2 for current input.

Table 22 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				

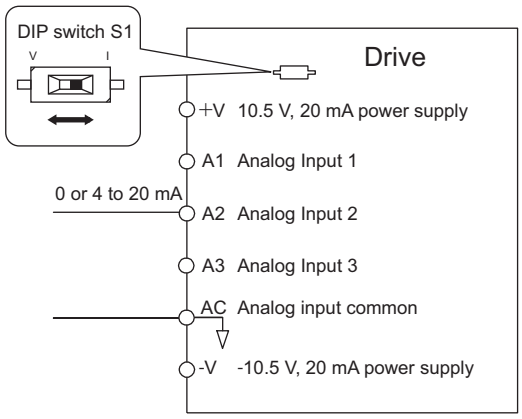


Figure 48 Setting the Frequency Reference as a Current Signal to Terminal A2

DIP switch S1 must first be set for current input.

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 61* for details on using this function.

Setting 2: MEMOBUS/Modbus Communications

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

Setting 3: Option card

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

Note: If the frequency reference source is set for an option PCB (b1-01 = 3), but an option board is not installed, an OPE05 Operator Programming Error will be displayed on the digital operator and the drive will not run.

Setting 4: Pulse Train Input

If b1-01 is set to 4, the frequency reference must be provided by a pulse train signal to terminal RP. Follow the directions below to make sure the pulse signal is working properly.

Verifying Pulse Train is Working Properly

- Make sure that b1-04 is set to 4 and H6-01 is set to 0.
- Set the pulse input scaling 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 if the correct frequency reference is displayed.

■ b1-02: Run Command Selection 1

Parameter b1-02 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

When the b1-02 = 0, the LO/RE light will switch on and the RUN key will enter a Run command to start the drive.

Setting 1: Control Circuit Terminal

This setting requires that the Run and Stop commands are entered from the digital input terminals. The following sequences can be used:

- 2-wire sequence 1:
  Two inputs (FWD/Stop-REV/Stop). Initializing the drive by setting A1-01 = 2220, presets the terminals S1 and S2 to these functions. This is the default setting of the drive.
- 2-wire sequence 2:
  Two inputs (Start/Stop-FWD/REV).
- 3-wire sequence:
  Three inputs (Start-Stop-FWD/REV). Initialize the drive by setting A1-01 = 3330 presets the terminals S1, S2, and S5 to these functions. Also refer to *Setting 0: 3-Wire Sequence on page 67*.

Setting 2: MEMOBUS/Modbus Communications

To issue a Run command via serial communications, set b1-02 to 2 and connect the RS-485/422 serial communication cable to control terminals R+, R-, S+, and S- on the removable terminal block.

Setting 3: Option Card

To issue the Run command via the communication option board, set b1-02 to 3 and plug a communication option board into the CN5-A port on the control PCB. Refer to the manual supplied with the option board 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 operator programming error will be displayed on the digital operator and the drive will not run.

■ b1-03: Stopping Method Selection

Select 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	0

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 57*** for details.

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.

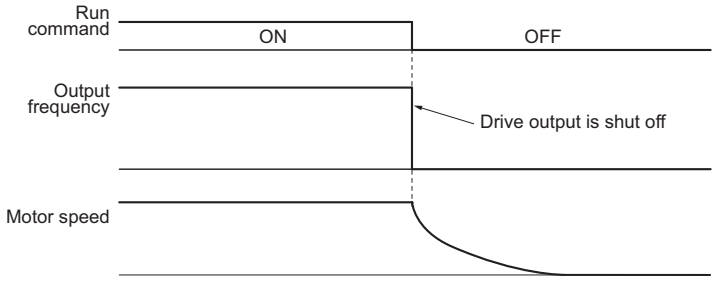


Figure 49 Coast to Stop

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. To start the motor back up before it has stopped completely, use DC Injection at start (refer to *Refer to b2-03 on page 108*) or Speed Search (refer to *Refer to b3: Speed Search on page 109*).

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). Once the minimum baseblock time has expired, the drive will brake the motor by injecting DC current into the motor windings. The stopping time is significantly faster than when compared with simply coasting to stop. The level of current used for DC Injection Braking is set by parameter b2-02 (default = 50%).

Note: This function is not available in the control modes for PM motors (A1-02 = 5, 6, 7).

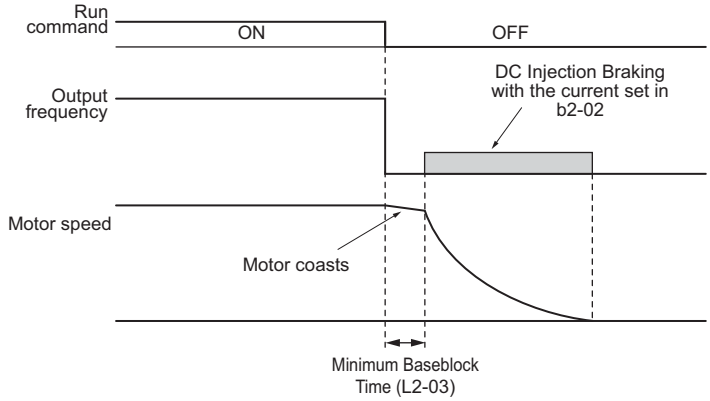


Figure 50 DC Injection Braking to Stop

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

$$\text{DC Injection brake time} = \frac{(\text{b2-04}) \times 10 \times \text{Output frequency}}{\text{Max. output frequency (E1-04)}}$$

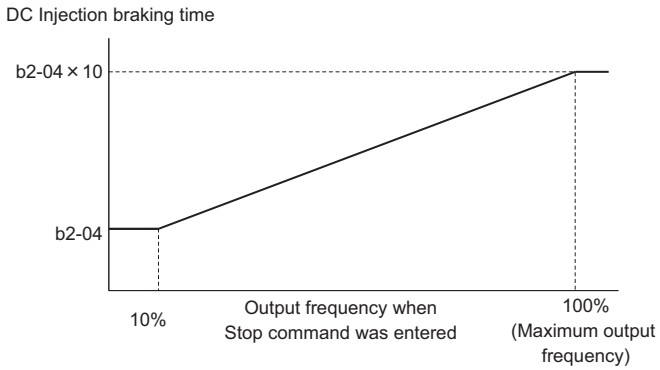


Figure 51 DC Injection Braking Time Depending on Output Frequency

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. If a Run command is input before the time t (value of C1-02) has expired, the drive will not start. A Run command activated during time t must be cycled after t has expired in order to start the drive.

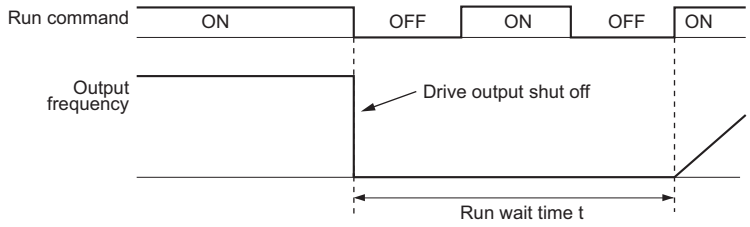


Figure 52 Coast to Stop with Timer

The wait time t is determined by the output frequency when the Run command is removed and by the active deceleration time.

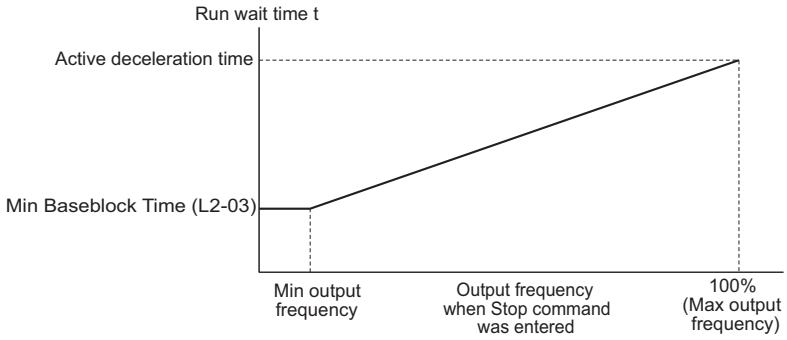


Figure 53 Run Wait Time Depending on Output Frequency

■ b2-01: DC Injection Braking Start Frequency

Parameter b2-01 is 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. Once the output frequency falls below the setting of b2-01, DC Injection Braking is enabled for the time set in parameter b2-04.

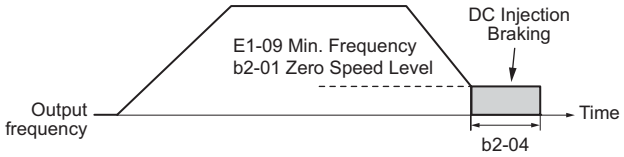


Figure 54 DC Injection Braking at Stop for V/f, V/f w/PG and OLV

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

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. Once 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.

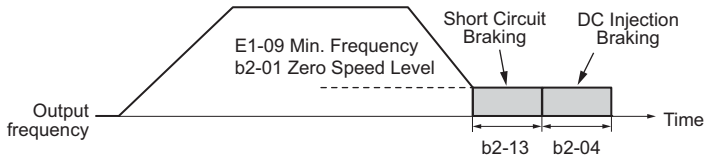


Figure 55 Short-Circuit Braking at Stop in OLV/PM and AOLV/PM

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

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. Once the output frequency falls below the setting of b2-01, Zero Speed Control is enabled for the time set in parameter b2-04 if b1-05 = 0.

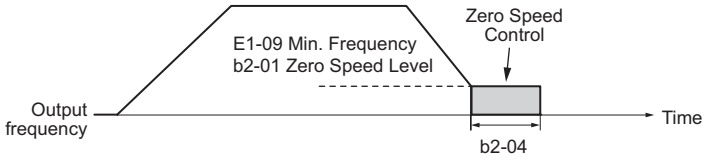


Figure 56 Zero Speed Control at Stop in CLV and CLV/PM

Note: If b2-01 is set to lower than the minimum frequency (E1-09), 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 or not.

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

Setting 0: Disabled

When the Run command is entered, the drive starts operating at the minimum output frequency. 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

Speed Search is performed whenever the Run command is entered. The drive begins running the motor once 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. They can be selected by digital inputs, by the motor selection, or can be 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	0.0 to 6000.0 s <1>	10.0 s
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)		
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 Accel 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. The accel/decel times 2, 3, and 4 can be activated by digital inputs (H1-□□ = 7 and 1A) as explained in *Table 23*.

Table 23 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 64 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).

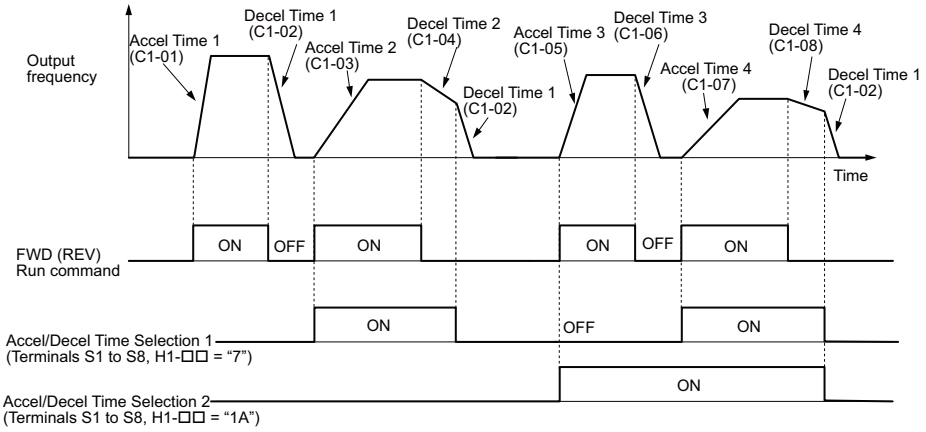


Figure 57 Timing Diagram of Accel/Decel Time Change

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 time 1 and 2 for motor 1, while C1-05 to C1-08 become accel/decel time 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 24***.

Note: The digital input setting "Accel/Decel time 2 selection" (H1-☐☐ = 1A) cannot be used together with motor 1/2 switching. Trying to do so triggers an oPE03 error, indicating a contradictory multifunction input settings.

Table 24 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 in parameter C1-11. When it falls below this level, the accel/decel times are switched back. ***Figure 65*** 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 this time only and not switch from accel/decel time 4 to the selected one.

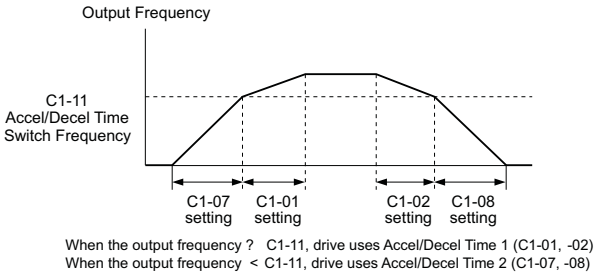


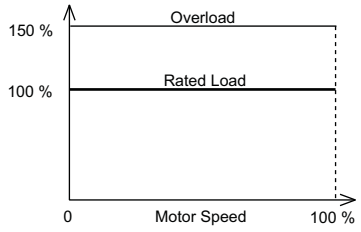
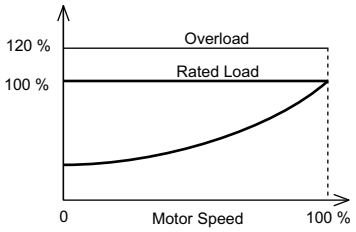
Figure 58 Accel/Decel Time Switching Frequency

■ C6-01: Drive Duty Mode Selection

The drive has two different "duty modes" to select from 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. The default setting is ND. *Refer to* ***Three-Phase 200 V Class Drives on page 104***, ***Three-Phase 400 V Class Drives on page 105***

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

Table 25 Differences between Heavy and Normal Duty

Characteristics	Heavy Duty Rating (HD)	Normal Duty Rating (ND)
C6-01	0	1
Performance		
Application	Use Heavy Duty Rating for applications requiring a high overload tolerance with constant load torque. Such applications include extruders and conveyors.	Use Normal Duty Rating for applications in which the torque requirements drop along with the speed. Examples include fans and pumps where a high overload tolerance is not required.
Over load 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: By changing the Duty Mode selection, the maximum size motor the drive can run changes, and the E2-☐☐ parameters are automatically set to appropriate values (E4-☐☐ for motor 2). Parameters settings determined by motor capacity are recalculated automatically when the Duty Mode selection is changed. This includes b8-04, L2-03, n5-02, L3-24, C5-17, and C5-37.

■ C6-02: Carrier Frequency Selection

Parameter C6-02 sets the switching frequency of the drive's output transistors. Changes to the switching frequency helps lower audible noise and also reduces leakage current.

Note: Increasing the carrier frequency above the default value automatically lowers the drive's current rating.

No.	Parameter Name	Setting Range	Default
C6-02	Carrier Frequency Selection	1 to F	Determined by A1-02, o2-04. Reset when C6-01 is changed.

Note: The default setting for the carrier frequency differs based on the type of motor and the Duty Mode selection. The default is 2 kHz when the drive is set for Heavy Duty performance, and defaulted to "Swing PWM1" when set for Normal Duty performance. When using a PM motor, the default carrier frequency is 5.0 Hz.

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 the table below.
<2> In Normal Duty, the carrier frequency default is for Swing PWM (C6-02 = 7), the same as setting 2 kHz. Increasing the carrier frequency is fine when the drive is set for Normal Duty, but remember that the drive rated current falls when the carrier frequency is increased.

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)

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

Up to 17 preset frequency references (including the Jog reference) can be programmed in the drive. The drive lets the user switch between these frequency references during run by using 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 must be selected by a separate digital input and overrides all other frequency references.

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).

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:

- The first frequency reference (Multi-Speed 1) comes from the source specified in b1-01. When using an analog input terminal to supply the frequency reference, the frequency reference source must be assigned to the control terminals (b1-01 = 1).
- When an analog input is set to "Auxiliary frequency 1" (H3-02, H2-06, or H2-10 = 2), then the value set to this input will be used as the Multi-Step Speed 2 instead of the value set to parameter d1-02. If no analog inputs are set for "Auxiliary frequency 1", then d1-02 becomes the reference for Multi-Step Speed 2.
- When the an analog input is set to "Auxiliary frequency 2" (H3-02, H2-06, or H2-10 = 3), then the value set to this input will be used as the Multi-Step Speed 3 instead of the value set to parameter d1-03. If no analog inputs are set for "Auxiliary frequency 2", then d1-03 becomes the reference for Multi-Step Speed 3.

The different speed references can be selected as shown in ***Table 26***. ***Figure 66*** illustrates the multi-step speed selection.

Table 26 Multi-Step Speed Reference and Terminal Switch Combinations

Reference	Multi-Step Speed H1-□□=3	Multi-Step Speed 2 H1-□□=4	Multi-Step Speed 3 H1-□□=5	Multi-Step Speed 4 H1-□□=32	Jog Reference 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 whatever frequency reference is being used.

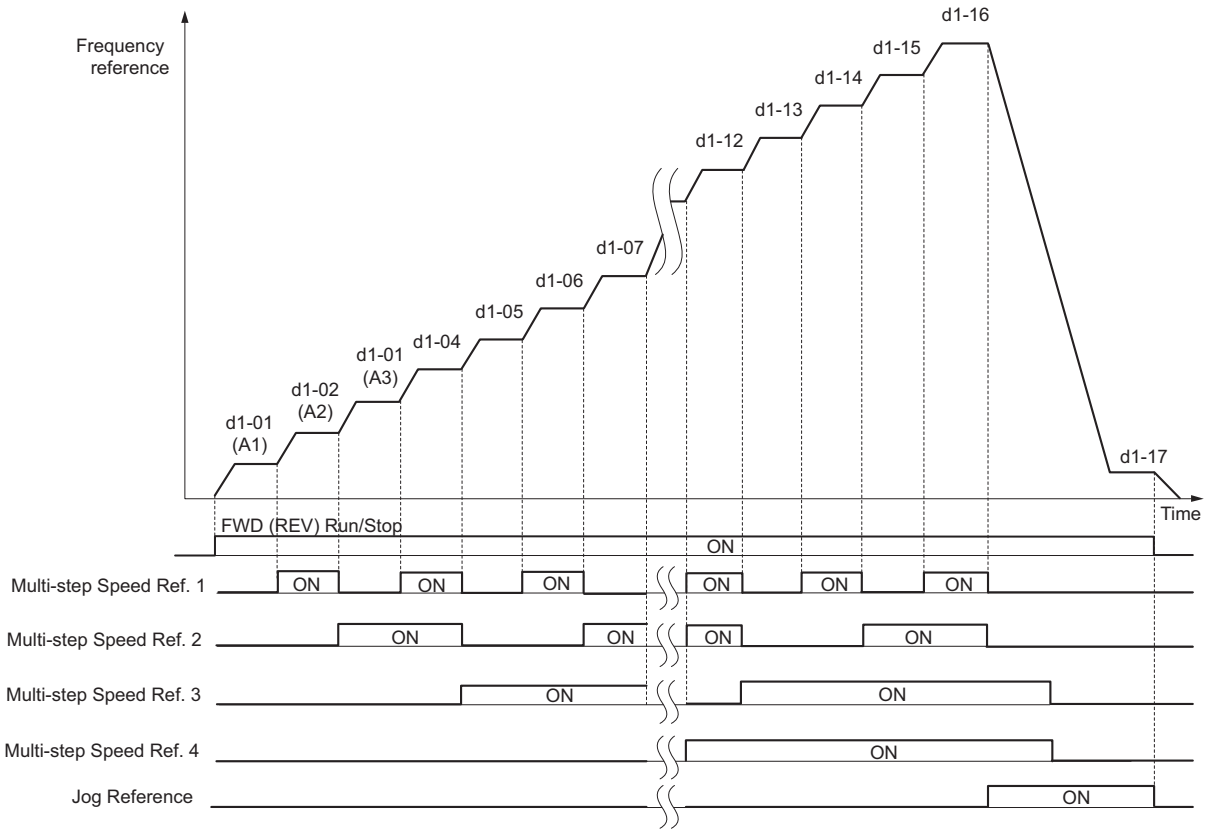


Figure 59 Preset Reference Timing Diagram

■ E1-01: Input Voltage Setting

Set the input voltage parameter to the nominal voltage of the AC power supply. This parameter adjusts the levels of some protective features of the drive (overvoltage, Stall Prevention, etc.).

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 <1>	Input Voltage Setting	155 to 255 V	200 V

<1> The setting range and default value shown here are for 200 V class drives. Double this for 400 V class units.

E1-01 Related Values

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

Voltage	Setting Value of E1-01	(Approximate Values)				
		ov Detection Level	BTR Operation Level	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	240 V	370 V
400 V Class	setting ≥ 400 V	820 V	788 V	380 V	480 V	740 V
	setting < 400 V	820 V	788 V	350 V	440 V	740 V

Note: The braking transistor operation levels are valid for the drive internal braking transistor. If an external CDBR braking chopper is used, refer to the instruction manual of that unit.

■ V/f Pattern Settings (E1-03)

The drive uses the V/f pattern that has been set to adjust the output voltage relative to the frequency reference. There are 15 different preset V/f patterns (setting 0 to E) to select from, 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). The custom V/f pattern requires the user to create the pattern using parameters E1-04 through E1-10.

■ E1-03: V/f Pattern Selection

The user can select the V/f pattern for the drive and motor from 15 predefined patterns, or create a custom V/f pattern.

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

<1> Parameter setting value is not reset to the default value during drive initialization (A1-03).
<2> In OLV, only setting F is available.

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

Choose the V/f pattern that best meets the application demands from the table below. 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. Parameter E1-03 is not reset when the drive is initialized.

Table 27 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 (default setting)		
2	60 Hz (with 50 Hz base)		
3	72 Hz (with 60 Hz base)		
4	50 Hz, Heavy Duty 2	Derated torque	For fans, pumps, and other applications that require torque derating relative to the load.
5	50 Hz, Heavy Duty 1		
6	50 Hz, Heavy Duty 1		
7	50 Hz, Heavy Duty 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)		

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

The following graphs are for 200 V class drives. Double the values when using a 400 V class drive.

Predefined V/f Patterns for models CIMR-A□2A0004 to 0021 and CIMR-A□4A0002 to 0011

Table 28 Constant Torque Characteristics, Settings 0 to 3

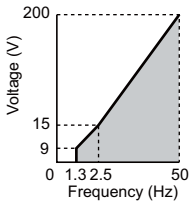
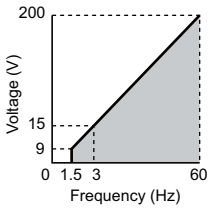
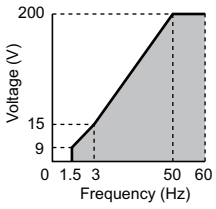
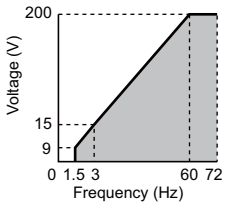
Setting = 0	50 Hz	Setting = 1	60 Hz (default)	Setting = 2	60 Hz	Setting = 3	72 Hz
							

Table 29 Derated Torque Characteristics, Settings 4 to 7

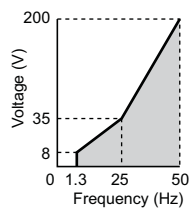
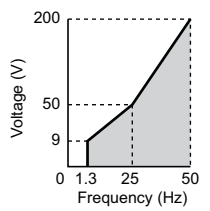
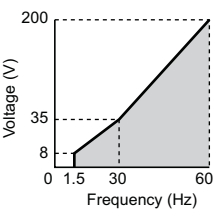
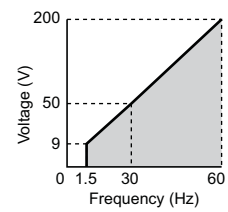
Setting = 4	50 Hz	Setting = 5	50 Hz	Setting = 6	60 Hz	Setting = 7	60 Hz
							

Table 30 High Starting Torque, Settings 8 to B

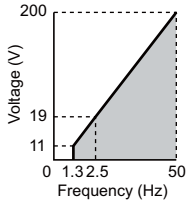
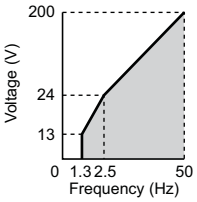
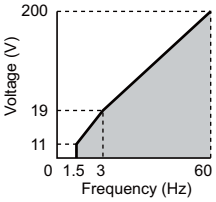
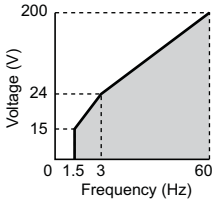
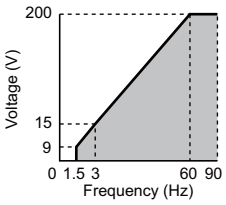
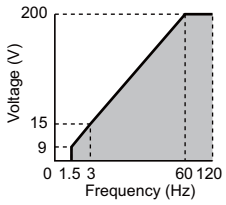
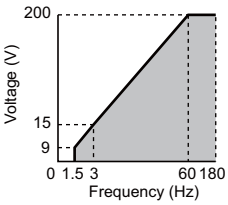
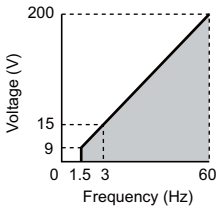
Setting = 8	50 Hz	Setting = 9	50 Hz	Setting = A	60 Hz	Setting = B	60 Hz
							

Table 31 Rated Output Operation, Settings C to F

Setting = C	90 Hz	Setting = D	120 Hz	Setting = E	180 Hz	Setting = F	60 Hz
							

Predefined V/f Patterns for Models CIMR-A□2A0030 to 0211 and CIMR-A□4A0018 to 0103

The following graphs are for 200 V class drives. Double values when using a 400 V class drive.

Table 32 Rated Torque Characteristics, Settings 0 to 3

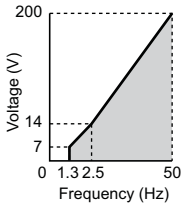
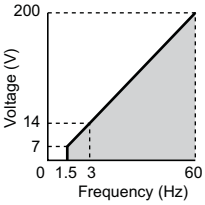
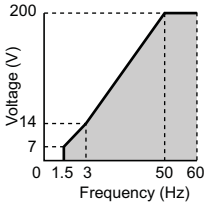
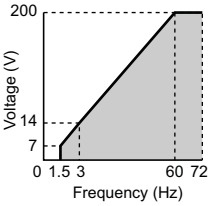
Setting = 0	50 Hz	Setting = 1	60 Hz	Setting = 2	60 Hz	Setting = 3	72 Hz
							

Table 33 Derated Torque Characteristics, Settings 4 to 7

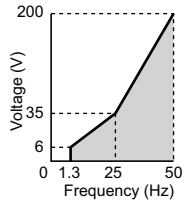
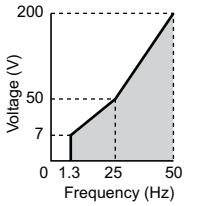
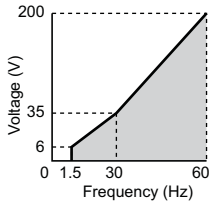
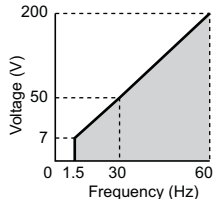
Setting = 4	50 Hz	Setting = 5	50 Hz	Setting = 6	60 Hz	Setting = 7	60 Hz
							

Table 34 High Starting Torque, Settings 8 to B

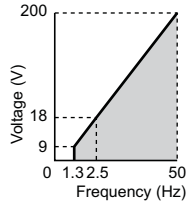
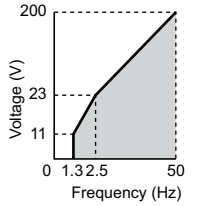
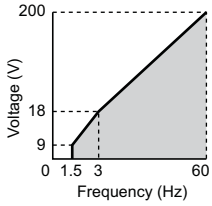
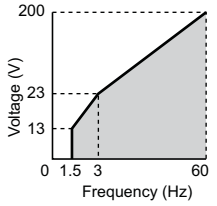
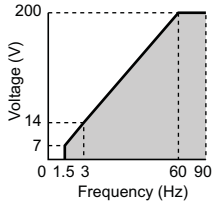
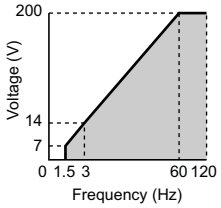
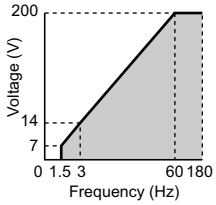
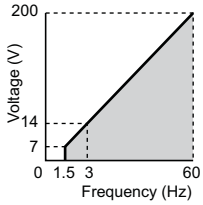
Setting = 8	50 Hz	Setting = 9	50 Hz	Setting = A	60 Hz	Setting = B	60 Hz
							

Table 35 Constant Output, Settings C to F

Setting = C	90 Hz	Setting = D	120 Hz	Setting = E	180 Hz	Setting = F	60 Hz
							

Predefined V/f Patterns for Models CIMR-A□2A0250 to 0312 and CIMR-A□4A0139 to 0165

The following graphs are for 200 V class drives. Double values when using a 400 V class drive.

Table 36 Rated Torque Characteristics, Settings 0 to 3

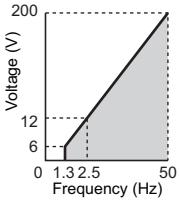
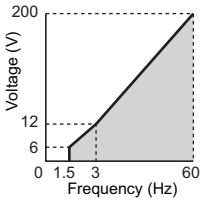
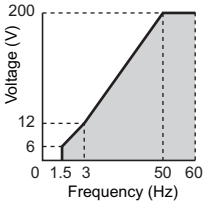
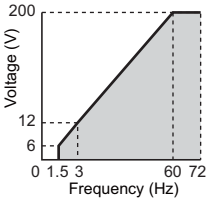
Setting = 0	50 Hz	Setting = 1	60 Hz	Setting = 2	60 Hz	Setting = 3	72 Hz
							

Table 37 Derated Torque Characteristics, Settings 4 to 7

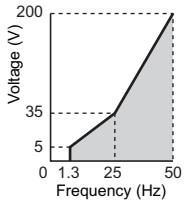
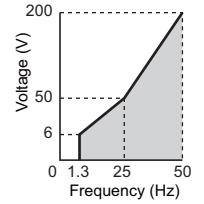
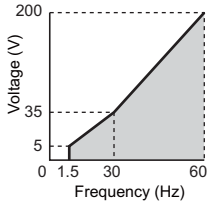
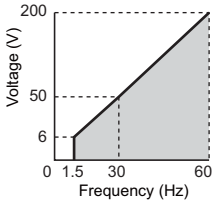
Setting = 4	50 Hz	Setting = 5	50 Hz	Setting = 6	60 Hz	Setting = 7	60 Hz
							

Table 38 High Starting Torque, Settings 8 to B

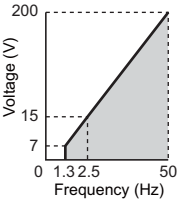
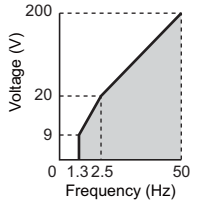
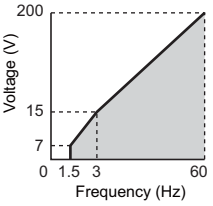
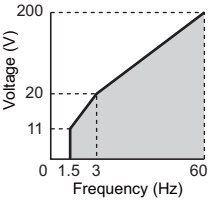
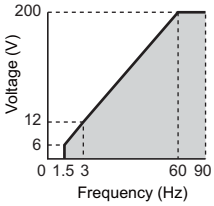
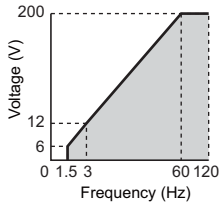
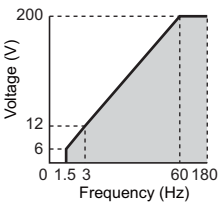
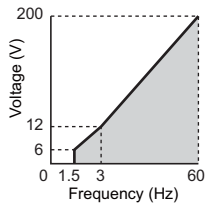
Setting = 8	50 Hz	Setting = 9	50 Hz	Setting = A	60 Hz	Setting = B	60 Hz
							

Table 39 Constant Output, Settings C to F

Setting = C	90 Hz	Setting = D	120 Hz	Setting = E	180 Hz	Setting = F	60 Hz
							

Setting a Custom V/f Pattern (Setting F: Default)

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

When initialized, the default values for parameters E1-04 to E1-13 will be equal to V/f pattern 1 of the predefined patterns.

■ V/f Pattern Settings E1-04 to E1-13

If E1-03 is set to a preset V/f pattern (i.e., set to any value besides F), then the user can refer to parameters E1-04 through E1-13 to monitor the V/f pattern. To create a new V/f pattern, set E1-03 to F. Refer to ***Figure 67*** for an example custom V/f pattern.

Note: Certain E1-□□ parameters might not be visible depending on the selected control mode.

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

<1> Default setting is determined by the control mode.
<2> When using PM motors, the default setting is determined by the motor code set to E5-01.
<3> Values shown here are for 200 V class drives. Double values when using a 400 V class unit.
<4> The drive changes these settings when Auto-Tuning is performed (Rotational Auto-Tuning, Stationary Auto-Tuning 1, 2).
<5> Parameter ignored when E1-11 and E1-12 are set to 0.0.

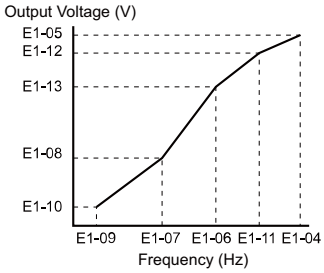


Figure 60 V/f Pattern

Note:
1. The following condition must be true when setting up the V/f pattern: E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04
2. To make the V/f pattern a straight line below E1-06, set E1-09 = E1-07. In this case the E1-08 setting is disregarded.
3. E1-03 is unaffected when the parameters are initialized using parameter A1-03, but the settings for E1-04 through E1-13 are returned to their default values.
4. Parameters E1-11, E1-12, and E1-13 should only be used to fine-tune the V/f pattern in the constant output range. These parameters rarely need to be changed.

■ E2-01: Motor Rated Current

Set E2-01 to the full load amps (FLA) stamped on the motor nameplate. This value is used for motor protection and to calculate torque limits. If Auto-Tuning completes successfully, the value entered to T1-04 will automatically be saved to E2-01.

No.	Parameter Name	Setting Range	Default
E2-01	Motor Rated Current	10% to 200% of the drive rated current.	Determined by C6-01 and o2-04

Note:
1. The resolution of E2-01 depends on the rated output power of the drive. If a drive is set up for 11 kW rated output power (ND or HD rating), then the value will have two decimal places. It will have one decimal place if a drive is set up for 11 kW and higher.
2. If the motor rated current in E2-01 is set lower than the motor no-load current in E2-03, than a parameter setting error will occur (oPE02). E2-03 must be set 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 their settings are listed below in ***Table 40***.

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)

No.	Parameter Name	Setting Range	Default
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.

Table 40 Multi-Function Digital Input Terminal Settings

Setting	Function	Setting	Function
0	3-wire sequence	32	Multi-step speed reference 4
1	Local/remote selection	34	PID soft starter cancel
2	External reference 1/2 selection	35	PID input level selection
3	Multi-Step Speed Reference 1	40	Forward run command (2-wire sequence)
4	Multi-Step Speed Reference 2	41	Reverse run command (2-wire sequence)
5	Multi-Step Speed Reference 3	42	Run command (2-wire sequence 2)
6	Jog reference selection	43	FWD/REV command (2-wire sequence 2)
7	Accel/decel time selection 1	44	Offset frequency 1
8	Baseblock command (N.O.)	45	Offset frequency 2
9	Baseblock Command (N.C.)	46	Offset frequency 3
A	Accel/decel ramp hold	60	DC Injection Braking command
B	Drive overheat alarm (OH2)	61	External Speed Search command 1
C	Analog terminal input selection	62	External Speed Search command 2
D	PG encoder disable	63	Field Weakening
E	ASR integral reset	65	KEB Ride-Thru 1 (N.C.)
F	Through mode	66	KEB Ride-Thru 1 (N.O.)
10	Up command	67	Communications test mode
11	Down command	68	High Slip Braking
12	Forward jog	6A	Drive enabled
13	Reverse jog	71	Speed/Torque Control switch
14	Fault reset	72	Zero Servo
15	Fast Stop (N.O.)	75	Up 2 command
16	Motor 2 selection	76	Down 2 command
17	Fast Stop (N.C.)	77	ASR gain switch
18	Timer function input	78	External torque reference polarity inversion
19	PID disable	7A	KEB Ride-Thru 2 (N.C.)
1A	Accel/decel time selection 2	7B	KEB Ride-Thru 2 (N.O.)
1B	Program lockout	7C	Short Circuit Braking (N.O.)
1E	Reference sample hold	7D	Short Circuit Braking (N.C.)
20 to 2F	External fault	7E	Forward/reverse detection (V/f control with simple PG)
30	PID integral reset	90 to 97	DriveWorksEZ Digital input 1 to 8
31	PID integral hold	9F	DriveWorksEZ disabled

Setting 0: 3-Wire Sequence

When one of the digital inputs is programmed for 3-wire control, that input becomes a forward/reverse directional input, S1 becomes the Run command input, and S2 becomes the Stop command input.

The drive will start the motor when the input S1 set for the Run command is closed for longer than 2 ms. The drive will stop the operation when the Stop input S2 is released for a brief moment. Whenever the input programmed for 3 wire sequence is open, the drive will be set for forward direction. If the input is closed, the drive is set for reverse direction.

Note: When 3-wire sequence is selected, the Run and Stop commands must be input via S1 and S2.

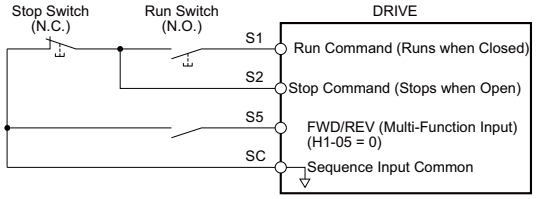


Figure 61 3-Wire Sequence Wiring Diagram

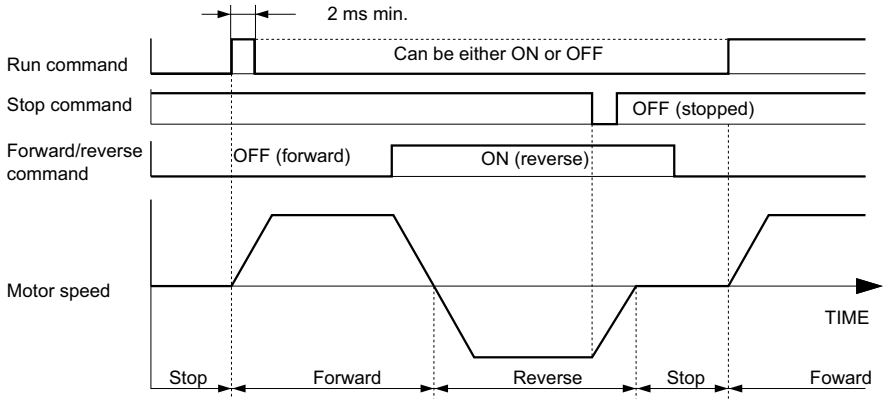


Figure 62 3-Wire Sequence

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 have the Run command issued automatically as soon as the drive is powered up.

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.*

WARNING! *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, P1-PC, and P2-PC Function Selection

The drive has three multi-function output terminals. ***Table 41*** lists the functions available for theses terminals using H2-01, H2-02, and H2-03.

No.	Parameter Name	Setting Range	Default
H2-01	Terminal M1-M2 Function Selection (relay)	0 to 192	0: During run
H2-02	Terminal P1-PC Function Selection (open-collector)	0 to 192	1: Zero Speed
H2-03	Terminal P2-PC Function Selection (open-collector)	0 to 192	2: Speed agree 1

Table 41 Multi-Function Digital Output Terminal Settings

Setting	Function	Setting	Function
0	During run	1D	During regeneration
1	Zero Speed	1E	Restart enabled
2	Speed agree 1	1F	Motor overload alarm (oL1)
3	User-set speed agree 1	20	Drive overheat pre-alarm (oH)
4	Frequency detection 1	22	Mechanical Weakening detection
5	Frequency detection 2	2F	Maintenance period
6	Drive ready	30	During torque limit
7	DC bus undervoltage	31	During speed limit
8	During baseblock (N.O.)	32	During speed limit in Torque Control
9	Frequency reference source	33	Zero Servo complete
A	Run command source	37	During frequency output
B	Torque detection 1 (N.O.)	38	Drive enabled
C	Frequency reference loss	39	Watt hour pulse output
D	Braking resistor fault	3C	LOCAL/REMOTE Status
E	Fault	3D	During Speed Search
F	Through mode	3E	PID feedback low
10	Minor fault	3F	PID feedback high
11	Fault reset command active	4A	During KEB operation
12	Timer output	4B	During Short Circuit Braking
13	Speed agree 2	4C	During Fast Stop
14	User-set speed agree 2	4D	oH pre-alarm time limit
15	Frequency detection 3	4E	Braking transistor fault (rr)
16	Frequency detection 4	4F	Braking resistor overheat (rH)
17	Torque detection 1 (N.C.)	60	Internal cooling fan alarm
18	Torque detection 2 (N.O.)	61	Rotor Position Detection Completed
19	Torque detection 2 (N.C.)	90	DriveWorksEZ digital output 1
1A	During reverse	91	DriveWorksEZ digital output 2

Setting	Function	Setting	Function
1B	During baseblock (N.C.)	92	DriveWorksEZ digital output 3
1C	Motor 2 selection	100 to 192	Functions 0 to 92 with inverse output

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

Closes whenever 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 does not match the frequency reference while the drive is running.
Closed	Output frequency or motor speed is within the range of frequency reference ±L4-02.

Note: Detection works in both directions, forward and reverse.

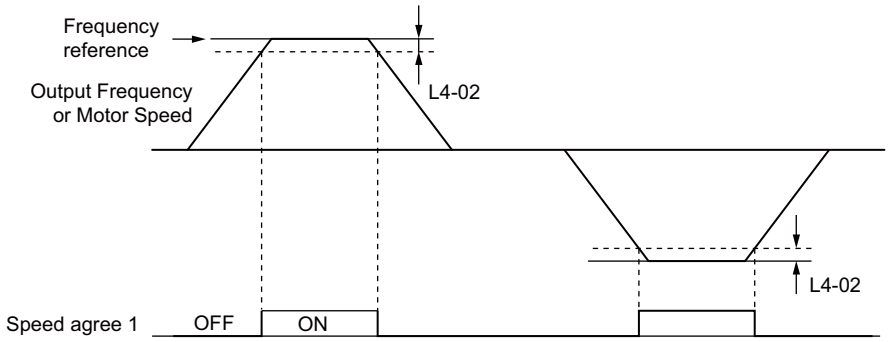


Figure 63 Speed Agree 1 Time Chart

Setting 3: User-set speed agree 1 (f_{ref}/f_{set} Agree 1)

Closes whenever 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 both forward and reverse. The value of L4-01 is used as the detection level for both directions.

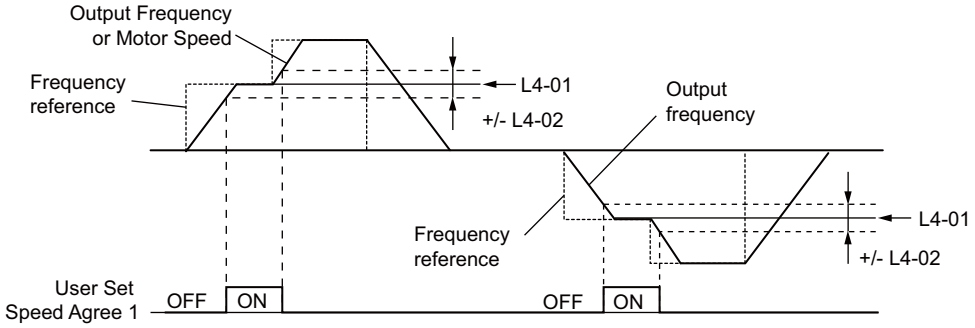


Figure 64 User Set Speed Agree 1 Time Chart

■ 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 simply 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 A3.

No.	Name	Setting Range	Default
H3-02	Terminal A1 Function Selection	0 to 31	0

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

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

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

Both can be used to adjust the characteristics of the analog input signal to terminal A1.

No.	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):
  An input 10 Vdc will be equivalent to a 200% frequency reference and 5 Vdc will be 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.

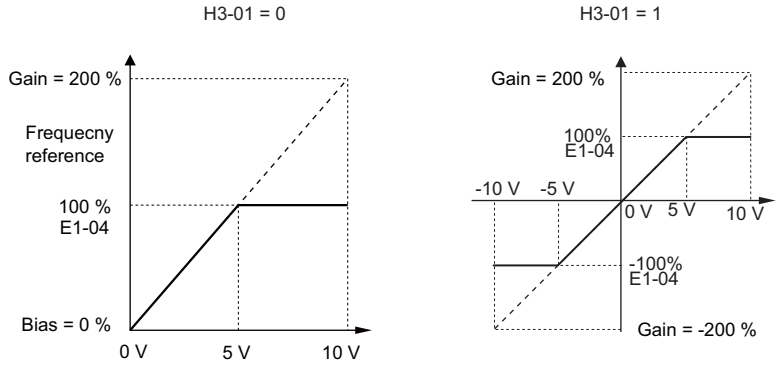


Figure 65 Frequency Reference Setting by Analog Input with Increased Gain

- 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.

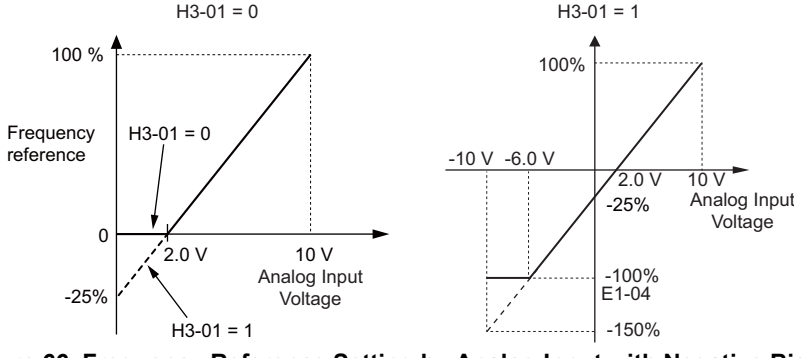


Figure 66 Frequency Reference Setting by Analog Input with Negative Bias

■ H3-05: Terminal A3 Signal Level Selection

Determines the function assigned to analog input terminal A3.

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 69*.

Setting 1: –10 V 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 69*.

■ 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 31	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. Be sure to also 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 69*

Setting 1: –10 to 10 Vdc

The input level is –10 to 10 Vdc. *Refer to Setting 1: –10 to 10 Vdc on page 69*.

Setting 2: 4 to 20 mA Current Input

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 Current Input

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 31	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.

Both can be used 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 139* for a list of all monitors. The “Analog Output Level” column indicates if a monitor can be used for analog output.

Example: Enter “103” for U1-03.

No.	Name	Setting Range	Default
H4-01	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 this setting, terminal functions as well as FM and AM output levels can be set by a PLC via a communication option or MEMOBUS/Modbus (through mode).

■ H4-02, H4-03: Multi-Function Analog Output Terminal FM Gain and Bias H4-05, H4-06: Multi-Function Analog Output Terminal AM Gain and Bias

Parameter H4-02 and H4-05 set the terminal FM and AM output signal level equal to 100% of the monitor (gain). Parameter H4-03 and H4-06 set the bias added to the monitor output for terminals FM and AM. Both are set as a percentage, where 100% equals 10 Vdc analog output. The output voltage of both terminals is limited to 10 Vdc.

The output signal range can be selected between 0 to +10 Vdc or -10 to +10 Vdc using parameter H4-07 and H4-08. *Figure 74* 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

When viewing a gain setting parameter (H4-02 or H4-05) on the digital operator, the analog output will supply a voltage signal equal to 100% of the monitor value (including changes made from bias and gain settings). When viewing a bias setting parameter (H4-03 or H4-06), the analog output voltage will supply a signal equal to 0% monitor value (including changes made from bias and gain settings).

Example 1: To have an output signal of 5 V at terminal FM when the monitored value is at 100%, set H4-02 to 50%.

Example 2: To have an output signal of 10 V at terminal FM when the monitored value is at 76.7%, set H4-02 to 150%.

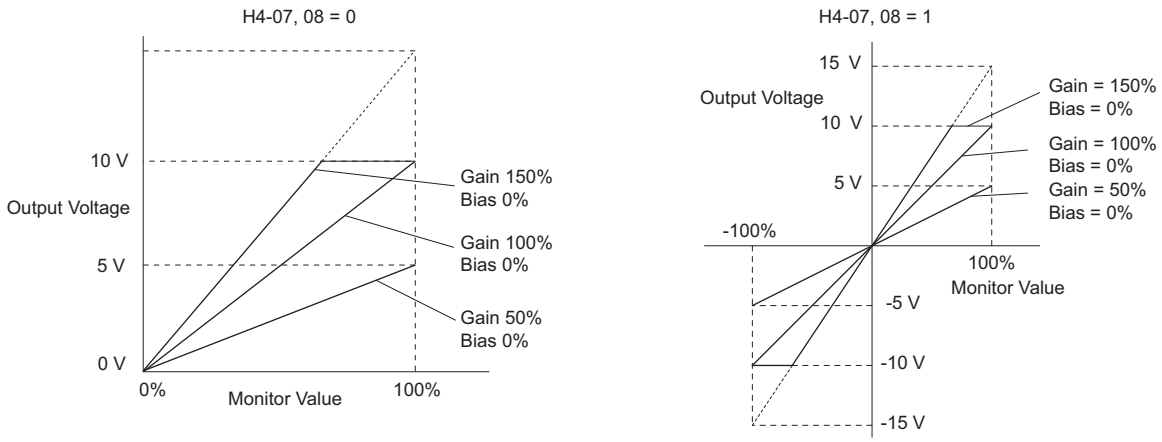


Figure 67 Analog Output Gain and Bias Setting Example 1 and 2

Example 3: To have an output signal of 3 V at terminal FM when the monitored value is at 0%, set H4-03 to 30%.

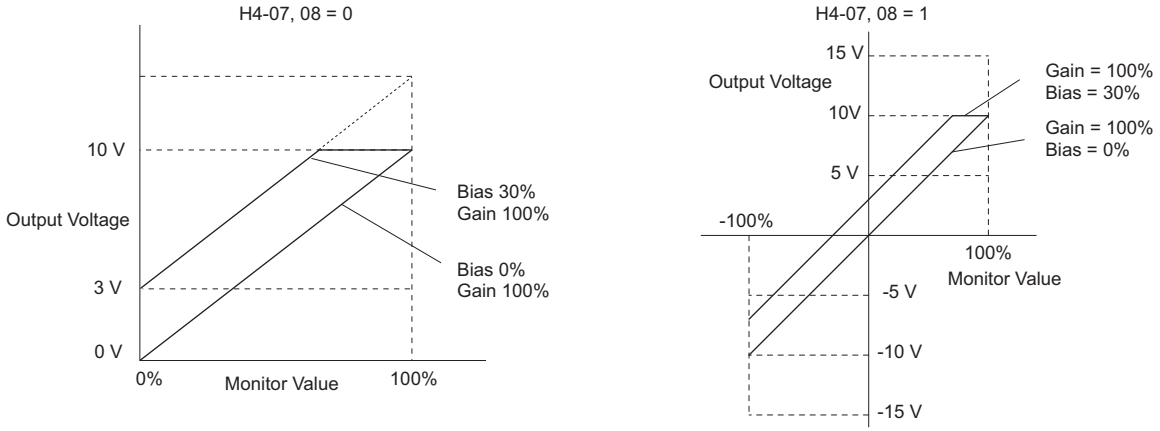


Figure 68 Analog Output Gain and Bias Setting Example 3

■ 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.

No.	Name	Setting Range	Default
H4-07	Multi-Function Analog Output Terminal FM Signal Level Selection	0, 1	0
H4-08	Multi-Function Analog Output Terminal AM Signal Level Selection	0, 1	0

Setting: 0 to 10 V
Setting: -10 V to 10 V

■ 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.

No.	Name	Setting Range	Default
L3-01	Stall Prevention Selection during Acceleration	0 to 2 <1>	1

<1> Setting 2 is not available for PM OLV.

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, thus tripping 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:
  When the output current value exceeds 85% of the level set in parameter L3-02 for a time longer than L3-27, the acceleration rate is reduced. The acceleration is stopped when the current exceeds L3-02. Acceleration continues when the current falls below L3-02 for a time longer than the L3-27 setting.
  The Stall Prevention level is automatically reduced in the constant power range. *Refer to L3-03: Stall Prevention Limit during Acceleration on page 75*.

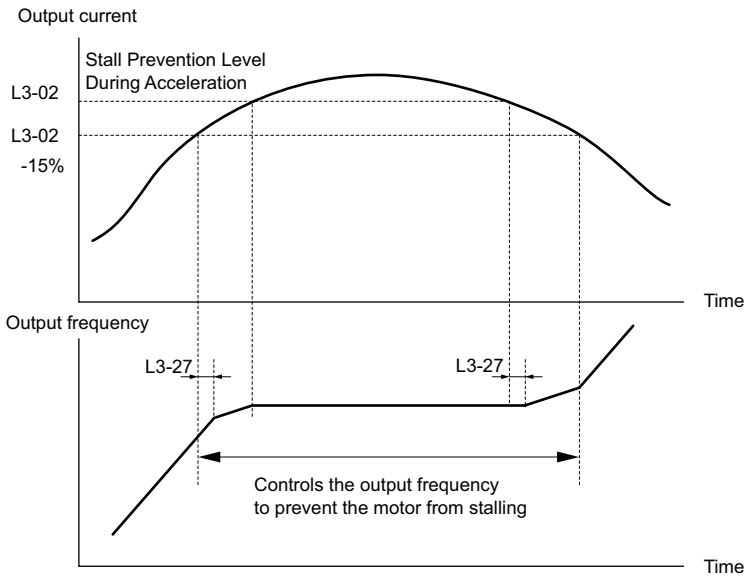


Figure 69 Stall Prevention During Acceleration for Induction Motors

- Open Loop Vector Control for PM:
  Acceleration is stopped when the output current reaches the level set in parameter L3-02. Once the time set in parameter L3-27 passes, the drive decelerates using the deceleration time set in L3-22. When the current falls below 85% of L3-02, deceleration is stopped. The drive will attempt to reaccelerate again after the time set in L3-27.

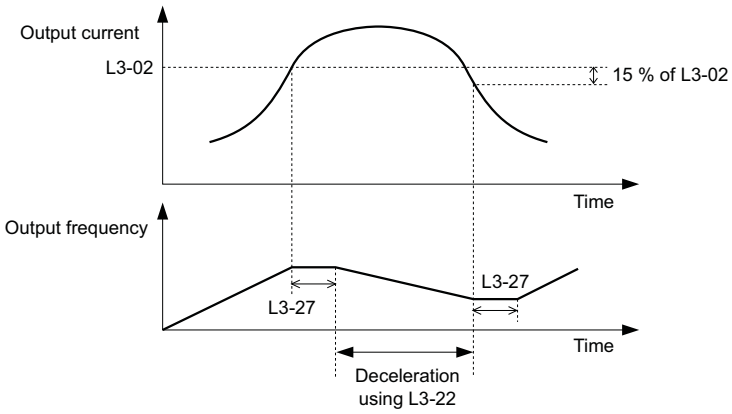


Figure 70 Stall Prevention During Acceleration for Permanent Magnet Motors

Setting 2: Intelligent Stall Prevention

When L3-02 = 2, the drive will disregard the selected acceleration time and try to accelerate in the minimum time. The acceleration rate is adjusted so that the current does not exceed the value set in 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).

- If stalling occurs with L3-02 set to its default value when using a motor that is relatively small compared to the drive, try lowering L3-02.
- When operating the motor in the constant power range, also set parameter L3-03.

■ 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%

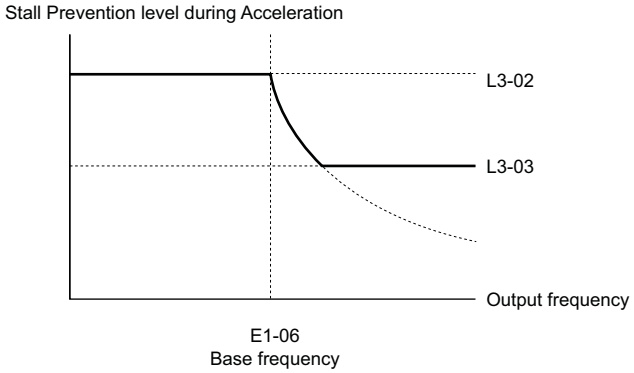


Figure 71 Stall Prevention Level and Limit During Acceleration

■ L3-04: Stall Prevention Selection during Deceleration

Stall Prevention during deceleration can control the deceleration based on the DC bus voltage and prevent 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 0: Disabled

When this setting is used, the drive decelerates according to the set deceleration time. With high inertia loads or rapid deceleration, an overvoltage (ov) fault may occur. In this case use braking options or switch to another L3-04 selection.

Setting 1: General-purpose Stall Prevention

With this setting the drive tries to decelerate within the set deceleration time. When the DC bus voltage exceeds the Stall Prevention level, the drive pauses deceleration. Deceleration continues as soon as 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

Note: **1.** This setting should not be used in combination with a Dynamic Braking Resistor or other 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 braking option.

Figure 79 illustrates the function of Stall Prevention during deceleration.

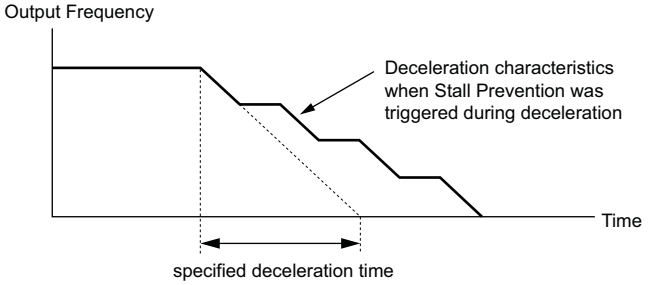


Figure 72 Stall Prevention During Deceleration

Setting 2: Intelligent Stall Prevention

With this setting, the drive adjusts the deceleration rate so that the DC bus voltage is kept at the level set in parameter L3-17. This way the shortest possible deceleration time is achieved while the motor is protected from stalling. The deceleration time that has been selected is disregarded, but the achievable deceleration time cannot be smaller than 1/10 of the set deceleration time.

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: As the deceleration time is not constant, Intelligent Stall Prevention should not be used in applications where stopping accuracy is a concern. Use braking options instead.

Setting 3: Stall Prevention with braking option

Enables the Stall Prevention function while using a braking resistor. Overvoltage problems in the DC bus can occur if Stall Prevention during deceleration is disabled (L3-04) in OLV and a braking option is installed. Set L3-04 to 3 to remedy this situation.

Setting 4: Overexcitation Deceleration 1

Overexcitation Deceleration 1 (increasing the motor flux) is faster than deceleration with no Stall Prevention (L3-04 = 0).

Setting 5: Overexcitation Deceleration 2

Overexcitation Deceleration 2 slows down the motor while trying to maintain the DC bus voltage at the level set in parameter L3-17. By doing this, the achievable deceleration time can even be shorter than with Overexcitation Deceleration 1.

■ L3-05: Stall Prevention Selection during Run

Stall Prevention during run can prevent a motor from stalling by automatically reducing the speed when a transient overload occurs while the motor is running at constant speed.

This parameter determines how Stall Prevention works during run.

No.	Name	Setting Range	Default
L3-05	Stall Prevention Selection During Run	0 to 2	1

Note: **1.** This function is available in V/f, V/f w/PG, and OLV/PM.
2. When output frequency is 6 Hz or less, Stall Prevention during run is disabled regardless of the setting in L3-05 and L3-06.

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, then the drive will decelerate at decel time 1 (C1-02). Once the current level drops below the value of L3-06 minus 2% for 100 ms, the drive accelerates back to the 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).

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 operation mode.

No.	Name	Setting Range	Default
L7-01	Forward Torque Limit	0 to 300%	200%
L7-02	Reverse Torque Limit	0 to 300%	200%
L7-03	Forward Regenerative Torque Limit	0 to 300%	200%
L7-04	Reverse Regenerative Torque Limit	0 to 300%	200%

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 lower value in L7-01 through L7-04, or analog input torque limit.

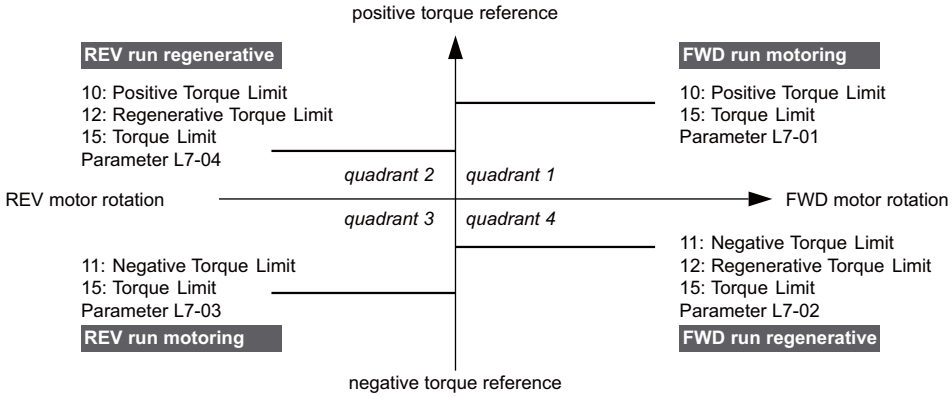


Figure 73 Torque Limit Parameters and Analog Input Settings

◆ 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. Directions on how to execute Auto-Tuning are listed in *Start-Up Flowcharts on page 46*.

Note: The drive will only show Auto-Tuning parameters that are valid for the control mode that has been set to A1-03. 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 Closed Loop Vector 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. In Closed Loop Vector, some F1-☐☐ parameters for speed feedback detection are also set up.

Table 42 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 can not be decoupled but the motor load is below 30%. • Rotational Auto-Tuning gives the most accurate results, and is therefore highly recommended if possible.	N/A	N/A	YES	YES
Stationary Auto-Tuning 1	T1-01 = 1	• Motor and load can not 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.	N/A	N/A	YES	YES
Stationary Auto-Tuning 2	T1-01 = 4	• Motor and load can not be decoupled and the load is higher than 30%. • A motor test report is available. Once the no-load current and the rated slip have been entered, the drive calculates and sets all other motor-related parameters.	N/A	N/A	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 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

Type	Setting	Application Conditions and Benefits	Control Mode			
			V/f	V/f w/PG	OLV	CLV
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	N/A	N/A

Table 43 lists the data that must be entered for Auto-Tuning. Make sure this data is available before starting Auto-Tuning. The information needed is usually listed on the motor nameplate or in the motor test report provided by the motor manufacturer. Also refer to page *48* and *49* for details on Auto-Tuning process and selections.

Table 43 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
Motor rated power	T1-02	kW	YES	YES	YES	YES	YES
Motor rated voltage	T1-03	Vac	YES	YES	N/A	YES	YES
Motor rated current	T1-04	A	YES	YES	YES	YES	YES
Motor rated frequency	T1-05	Hz	YES	YES	N/A	YES	YES
Number of motor poles	T1-06	-	YES	YES	N/A	YES	YES
Motor rated Speed	T1-07	r/min	YES	YES	N/A	YES	YES
PG Number of pulses per revolution	T1-08	-	YES <1>	YES <1>	N/A	N/A	YES <1>
Motor no-load current	T1-09	A	N/A	YES	N/A	N/A	YES
Motor rated Slip	T1-10	Hz	N/A	N/A	N/A	N/A	YES
Motor iron loss	T1-11	W	N/A	N/A	N/A	YES	N/A

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

Auto-Tuning for Permanent Magnet Motors

Automatically sets the V/f pattern and motor parameters E1-□□ and E5-□□ when a PM motor is used. In Closed Loop Vector Control, the Auto-Tuning process will also set some F1-□□ parameters for speed feedback detection.

Table 44 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 test report or motor data like listed in *Table 45* are available.	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 has changed after earlier 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 or very low load.	N/A	N/A	YES

Table 45 lists the data that must be entered for Auto-Tuning. Make sure the data is available before starting Auto-Tuning. The information needed is usually listed on the motor nameplate or in the motor test report provided by the motor manufacturer. Also refer to page *50* for details on the tuning mode selection and the tuning process.

Table 45 Auto-Tuning Input Data

Input Value	Input Parameter	Unit	Tuning Type (T2-01)						
			0 Parameter Calculation			1 Stationary		2 Phase Resistance	3 Z-Pulse Offset
Control Mode	A1-02	-	5, 6, 7	5	6, 7	5	6, 7	5, 6, 7	7
Motor Code	T2-01	-	FFFFh	FFFFh	FFFFh	-	-	-	-
Motor Type	T2-03	-	N/A	N/A	N/A	YES	YES	N/A	N/A
Motor rated power	T2-04	kW	N/A	YES	YES	YES	YES	N/A	N/A
Motor rated voltage	T2-05	Vac	N/A	YES	YES	YES	YES	N/A	N/A
Motor rated current	T2-06	A	N/A	YES	YES	YES	YES	YES	N/A
Motor rated frequency	T2-07	Hz	N/A	YES	N/A	YES	N/A	N/A	N/A
Number of motor poles	T2-08	-	N/A	YES	YES	YES	YES	N/A	N/A
Motor rated Speed	T2-09	r/min	N/A	N/A	YES	N/A	YES	N/A	N/A
Stator 1 Phase resistance	T2-10	Ω	YES	YES	YES	N/A	N/A	N/A	N/A
d-axis inductance	T2-11	mH	YES	YES	YES	N/A	N/A	N/A	N/A
q-axis inductance	T2-12	mH	YES	YES	YES	N/A	N/A	N/A	N/A
Voltage constant <1>	T2-13	mVs/rad (el.)	YES	YES	YES	N/A	N/A	N/A	N/A

Input Value	Input Parameter	Unit	Tuning Type (T2-01)						
			0 Parameter Calculation			1 Stationary		2 Phase Resistance	3 Z-Pulse Offset
Control Mode	A1-02	-	5, 6, 7	5	6, 7	5	6, 7	5, 6, 7	7
Motor Code	T2-01	-	FFFFh	FFFFh	FFFFh	-	-	-	-
Voltage constant <1>	T2-14	mVmin (mech.)	YES	YES	YES	N/A	N/A	N/A	N/A
Tuning pull-in current	T2-15	A	N/A	N/A	N/A	YES	YES	N/A	N/A
PG Number of pulses per revolution	T2-16	-	YES <2>	N/A	YES <2>	N/A	YES <2>	N/A	N/A
Z Pulse Offset	T2-17	deg (mech.)	YES <2>	N/A	YES <2>	N/A	YES <2>	N/A	N/A

<1> Only parameter T2-13 or T2-14 has to be input. Select one and leave the other empty.
<2> Input data is needed for CLV/PM only.

Inertia Tuning and Speed Control Loop Auto-Tuning

Inertia Tuning can be performed when the drive is using Closed Loop Vector 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, but also optimizes speed control loop settings.

Table 46 Inertia and Speed Control Loop Tuning

Type	Setting		Application Conditions and Benefits	Control Mode	
	IM Motor	PM Motor		CLV	CLV/PM
Inertia Tuning	T1-01 = 8	T2-01 = 8	Lets the motor rotate at a certain speed and applies a test signal. The response to the test signals are analyzed, and adjustments are made to parameters controlling the Feed Forward and KEB Ride-Thru functions (KEB 2, L2-29 = 1).	YES	YES
ASR Gain Auto-Tuning	T1-01 = 9	T2-01 = 9	Performs the same operation as Inertia Tuning, but also adjusts the ASR gain according to the response to the test signal.	YES	YES

Table 47 explains that data that must be entered in order to perform the Inertia Tuning and ASR Gain Auto-Tuning. Refer to *Auto-Tuning for Permanent Magnet Motors on page 78* for details.

Table 47 Auto-Tuning Input Data

Input Value	Input Parameter	Unit	Tuning Type (T1-01 or T2-01)	
			8 Inertia Tuning	9 ASR Gain Tuning
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	N/A	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.

A – During Auto-Tuning **B – Auto-Tuning Aborted**

Figure 74 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.	→	
2.	Press the ∧ or ∨ key until the Auto-Tuning display appears.	→	

Step			Display/Result
3.	Press ENTER to begin setting parameters.	→	T1-01
4.	Press ENTER to display the value for T1-01. <1>	→	00
5.	Save the setting by pressing ENTER.	→	End
6.	The display automatically returns to the display shown in Step 3.	→	T1-01

<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.	→	T1-02
2.	Press ENTER to view the default setting.	→	000.75
3.	Press RESET to select the digit to edit.	→	000.75
4.	Press ∧ and enter the motor power nameplate data in kW.	→	000.40
5.	Press ENTER to save the setting.	→	End
6.	The display automatically returns to the display in Step 1.	→	T1-02
7.	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	→	T1-03 ⋮ T1-07

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 7 in "Enter Data from the Motor Nameplate".

Step			Display/Result
1.	After entering the data listed on the motor nameplate, press ∧ to confirm.	→	RUn 10
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.	→	DRV RUn 10
3.	Auto-Tuning finishes in approximately one to two minutes.	→	End

◆ 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

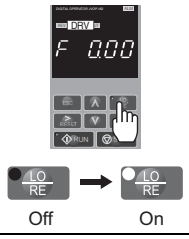
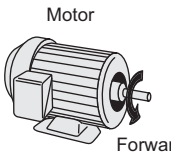
Check the following items during operation:

- 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 the LO/RE key to select LOCAL. The LO/RE light will turn on.	→	
3.	Press RUN to give the drive a Run command. RUN will light and the motor will rotate at 6 Hz.	→	
4.	Ensure the motor is rotating in the correct direction and that no faults or alarms occur.	→	
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.		
6.	The drive should operate normally. Press STOP to stop the motor. RUN flashes until the motor comes to a complete stop.	→	

◆ 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.

Notes on Connected Machinery

- Clear the area around the motor.
- The motor should come to a complete stop without problems.
- Connect the load and machinery to the motor.
- Fasten all installation screws properly. Check that the motor and connected machinery are held in place.
- Confirm that the Fast Stop circuit or mechanical safety measures operate correctly.
- Be ready to press the STOP button in case of emergency.

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.

- Watch monitor parameter U1-03 during operation to ensure there is no overcurrent.
- If the application permits running the load in the reverse direction, try changing motor direction and the frequency reference while watching for abnormal motor oscillation or vibration.
- Correct any problems that occur with hunting, oscillation, or other control-related issues.

◆ 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.	*51*
☐	3	Set the voltage for the power supply to E1-01.	*62*
☐	4	Select the correct duty rating (C6-01) for the application.	–

Check the items that correspond to the control mode being used.

WARNING! *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. Example: If using a motor with a rated frequency of 60.0 Hz, set E1-03 to “1”.	–
☐	6	Perform Rotational Auto-Tuning for V/f Control if using Energy Saving functions.	*77*
V/f Control with PG (A1-02 = 1)			
☐	7	Setup 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	Perform Auto-Tuning as described.	*77*
Closed Loop Vector Control (A1-02 = 3)			
☐	10	Set the proportional gain for ASR speed control to C5-01 and the integral time to C5-02. Perform ASR Tuning if possible.	–
Open Loop Vector Control for PM (A1-02 = 5)			
☐	11	Perform Auto-Tuning as described.	*77*
Advanced Open Loop Vector Control for PM (A1-02 = 6)			
☐	12	Perform Auto-Tuning as described.	*77*

☑	No.	Checklist	Page
☐	13	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)			
☐	14	Perform Auto-Tuning as described.	*77*
☐	15	Set the proportional gain for ASR speed control to C5-01 and the integral time to C5-02. Perform ASR Tuning if possible.	–
☐	16	Set the Z pulse offset to or enter the Z manually to parameter E5-11.	–

Proceed to the following checklist after checking items 4 through 15.

☑	No.	Checklist	Page
☐	17	The DRV should light after giving a Run command.	–
☐	18	To give a Run command and frequency reference from the digital operator, press LO RE to set to LOCAL. The LO/RE key will light.	*46*
☐	20	If the motor rotates in the opposite direction during the test run, switch two of the drive output terminals (U/T1, V/T2, W/T3) or change parameter b1-14.	*51*
☐	21	Set the correct values for the motor rated current (E2-01, E4-01, E5-03) and motor protection (L1-01) to ensure motor thermal protection.	–
☐	22	If the Run command and frequency reference are provided via the control circuit terminals, set the drive for REMOTE and be sure the LO/RE light is out.	*46*
☐	23	If the control circuit terminals should supply the frequency reference, select the correct voltage input signal level (0 to 10 V) or the correct current input signal level (4 to 20 mA or 0 to 20 mA).	*53*
☐	24	Set the proper voltage to terminal A1 and A3 (-10 to +10 V).	*53*
☐	25	When current input is used, switch the drive's built-in DIP switch S1 from the V-side to I-side. Set the level for current signal used to H2-09 (set "2" for 4 to 20 mA, or "3" for 0 to 20 mA).	*53*
☐	26	Set the proper current to terminal A2. (-10 to +10 V, 4 to 20 mA or 0 to 20 mA).	*53*
☐	27	If the frequency reference is supplied via one of the analog inputs, make sure the analog input 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 input A1, H3-11 for input A2, H3-07 for analog input 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 input A1, H3-12 for input A2, H3-08 for analog input A3) until the frequency reference value reaches the desired minimum value.	–

5 Troubleshooting

◆ 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 42*.

If problems occur that are not covered in this manual, contact the nearest Yaskawa representative with the following information:

- Drive model
- Software version
- Date of purchase
- Description of the problem

Table 48 contains descriptions of the various types of alarms, faults, and errors that may occur while operating the drive.

Contact Yaskawa in the event of drive failure.

Table 48 Types of Alarms, Faults, and Errors

Type	Drive Response
Faults	When the drive detects a fault: • The digital operator displays text that indicates 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 how the drive should stop when the fault occurs. • Fault output terminals MA-MC will close, and MB-MC will open. The drive will remain inoperable until that fault has been cleared. *Refer to Fault Reset Methods on page 98*.
Minor Faults and Alarms	When the drive detects an alarm or a minor fault: • The digital operator displays text that indicates the specific alarm or minor fault, and the ALM indicator LED flashes. • The drive generally continues running the motor, although some alarms allow the user to select a stopping method when the alarm occurs. • One of the multi-function contact outputs closes if set to be tripped by a minor fault (H2- □□ = 10), but not by an alarm. • The digital operator displays text indicating a specific alarm and ALM indicator LED flashes. To reset the a minor fault or alarm, remove whatever is causing the problem.
Operation Errors	When parameter settings conflict with one another or do not match hardware settings (such as with an option card), it results in an operation error. When the drive detects an operation error: • The digital operator displays text that indicates 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	These are the types of errors that can occur when using the optional 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 operator will clear the fault. Find out what is causing the problem (such as model incompatibility) and try again.

◆ Fault Detection

■ Fault Displays, Causes, and Possible Solutions

Faults are detected for drive protection, and cause the drive to stop. When a fault occurs, the fault output terminal MA-MB-MC is triggered. Faults have to be cleared manually after removing the cause to start running the drive again.

Table 49 Detailed Fault Displays, Causes, and Possible Solutions

Digital Operator Display		Fault Name
boL	boL	Braking Transistor Overload Fault The braking transistor has reached its overload level.
bUS	bUS	Option Communication Error • After establishing initial communication, the connection was lost. • Only detected when the run command frequency reference is assigned to an option card.
Cause		**Possible Solution**
No signal received from the PLC.		• Check for faulty wiring. • Correct the wiring. • Check for disconnected cables and short circuits. Repair as needed.
Faulty communications wiring or a short circuit exists.		

A communications data error occurred due to noise.	• Check the various options available to minimize the effects of noise. • Take steps to 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 suppressors if necessary. • Use only recommended cables or other shielded line. Ground the shield on the controller side or on the drive input power side. • Separate all communication wiring from drive power lines. Install an EMC noise filter to the drive power supply input.
The option card is damaged.	Replace the option card if there are no problems with the wiring and the error continues to occur.
The option card is not properly connected to the drive.	• The connector pins on the option card are not properly lined up with the connector pins on the drive. • Reinstall the option card.
Digital Operator Display	**Fault Name**
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 a short circuit exists.	• Check for faulty wiring. • Correct the wiring. • Check for disconnected cables and short circuits. Repair as needed.
Communication data error occurred due to noise.	• Check the various options available to minimize the effects of noise. • Take steps to counteract noise in the control circuit, main circuit, and ground wiring. • Use only recommended cables or other shielded line. Ground the shield on the controller side or on the drive input power side. • Ensure that other equipment such as switches or relays do not cause noise and use surge 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	Control Fault
	A torque limit was reached continuously for three seconds or longer while ramping to stop in Open Loop Vector Control.
CPF00 or CPF01	Control Circuit Error
CPF02	A/D Conversion Error
	An A/D conversion error or control circuit error occurred.
CPF03	Control Board Connection Error
	Connection error between the control board and the drive
CPF06	EEPROM Memory Data Error
	There is an error in the data saved to EEPROM.
Cause	**Possible Solution**
There is an error in EEPROM control circuit.	• Turn the power off and check the connection between the control board and the drive. • If the problem continues, replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
The power supply was switched off when parameters were being saved to the drive.	Reinitialize the drive (A1-03).
Digital Operator Display	**Fault Name**
CPF07	Terminal Board Connection Error
CPF08	
CPF20 or CPF21	Control Circuit Error
CPF22	Powerboard Failure
CPF23	Control Board Connection Error
	Connection error between the control board and the drive
CPF24	Drive Unit Signal Fault
	The drive capacity cannot be detected correctly (drive capacity is checked when the drive is powered up).
CPF26 to CPF34	Control Circuit Error
	CPU error
Cause	**Possible Solution**
Hardware is damaged.	Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display	**Fault Name**
dEv	Speed Deviation (for Control Mode with 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.
dv1	Z Pulse Fault
	The motor turned one full rotation without the Z pulse being detected.
dv2	Z Pulse Noise Fault Detection
	The Z pulse is out of phase by more than 5 degrees for the number of times specified in parameter F1-17.
dv3	Inversion Detection
	The torque reference and acceleration are in opposite directions from one another (one is in reverse and the other is forward) while at the same time the speed reference and actual motor speed differ by over 30% for the number of pulses set to F1-18.
dv4	Inversion Prevention Detection
	Pulses indicate that the motor is rotating in the opposite direction of the speed reference. Set the number of pulses to trigger inverse detection to F1-19. **Note:** Disable inverse detection in applications where the motor may rotate in the opposite direction of the speed reference. Setting F1-19 to 0 disables this feature.

dWAL	dWAL	DriveWorksEZ Fault
dWFL	dWFL	
EF0	EF0	Option Card External Fault
		An external fault condition is present.
Cause		**Possible Solution**
An external fault was received from the PLC with other than F6-03 = 3 “alarm only” (the drive continued to run after external fault).		• Remove the cause of the external fault. • Remove the external fault input from the PLC.
Problem with the PLC program.		Check the PLC program and correct problems.
Digital Operator Display		**Fault Name**
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
Cause		**Possible Solution**
An external device has tripped an alarm function.		Remove the cause of the external fault and reset the fault.
Wiring is incorrect.		• Ensure the signal lines have been connected properly to the terminals assigned for external fault detection (H1-□□ = 20 to 2F). • Reconnect the signal line.
Incorrect setting of multi-function contact inputs.		• Check if the any unused terminals are set for H1-□□ = 20 to 2F (External Fault). • Change the terminal settings.
Digital Operator Display		**Fault Name**
Err	Err	EEPROM Write Error
		Data cannot be written to the EEPROM.
FbH	FbH	Excessive PID Feedback
		PID feedback input is greater than the level set b5-36 for longer than the time set to b5-37. To enable fault detection, set b5-12 = 2 or 5.
FbL	FbL	PID Feedback Loss
		This fault occurs when PID feedback loss detection is programmed to trigger a fault (b5-12 = 2) and the PID feedback level is below the detection level set to b5-13 for longer than the time set to b5-14.
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 in models 5.5 kW or larger.
Cause		**Possible Solution**
Motor insulation is damaged.		• Check the insulation resistance of the motor. • Replace the motor.
A damaged motor cable is creating a short circuit.		• Check the motor cable. • Remove the short circuit and turn the power back on.
		• Check the resistance between the cable and the ground terminal ⏚. • Replace the cable.
The leakage current at the drive output is too high.		• Reduce the carrier frequency. • Reduce the amount of stray capacitance.
The drive started to run during a current offset fault or while coasting to a stop.		• The value set exceeds the allowable setting range while the drive automatically adjusts the current offset (this happens only when attempting to restart a PM motor that is coasting to stop). • Enable Speed Search at start (b3-01 = 1). • Perform Speed Search 1 or 2 (H1-□□ = 61 or 62) via one of the external terminals. **Note:** Speed Search 1 and 2 are the same when using PM OLV.
Hardware problem.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Fault Name**
LF	LF	Output Phase Loss
		• Phase loss on the output side of the drive. • Phase Loss Detection is enabled when L8-07 is set to 1 or 2.
Cause		**Possible Solution**
The output cable is disconnected.		• Check for wiring errors and ensure the output cable is connected properly. • Correct the wiring.
The motor winding is damaged.		• Check the resistance between motor lines. • Replace the motor if the winding is damaged.

The output terminal is loose.	Apply the tightening torque specified in this manual to fasten the terminals. *Refer to Wire Size and Torque Specifications on page 35*.
The rated current of the motor being used is less than 5% of the drive rated current.	Check the drive and motor capacities.
An output transistor is damaged.	Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
A single-phase motor is being used.	The drive cannot operate a single phase motor.
Digital Operator Display	**Fault Name**
LF2	Output current imbalance
	One or more of the phases in the output current is lost.
Cause	**Possible Solution**
Phase loss has occurred on the output side of the drive.	• Check for faulty wiring or poor connections on the output side of the drive. • Correct the wiring.
Terminal wires on the output side of the drive are loose.	Apply the tightening torque specified in this manual to fasten the terminals. *Refer to Wire Size and Torque Specifications on page 35*.
The output circuit is damaged.	Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Motor impedance or motor phases are uneven.	• Measure the line-to-line resistance for each motor phase. Ensure all values are the same. • Replace the motor.
Digital Operator Display	**Fault Name**
oC	Overcurrent
	Drive sensors have detected an output current greater than the specified overcurrent level.
Cause	**Possible Solution**
The motor has been damaged due to overheating or the motor insulation is damaged.	• Check the insulation resistance. • Replace the motor.
One of the motor cables has shorted out or there is a grounding problem.	• Check the motor cables. • Remove the short circuit and power the drive back up.
	• Check the resistance between the motor cables and the ground terminal ⏚. • Replace damaged cables.
The load is too heavy.	• Measure the current flowing into the motor. • Replace the drive with a larger capacity unit if the current value exceeds the rated current of the drive. • 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 the right amount of torque cannot be set, make the following changes: • Increase the acceleration time (C1-01, -03, -05, -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 that the MC is not tripped while the drive is outputting current.
V/f setting is not operating as expected.	• Check the ratios between the voltage and frequency. • Set parameter E1-04 through E1-10 appropriately (E3-04 through E3-10 for motor 2). • Lower the voltage if it is too high relative to the frequency.
Excessive torque compensation.	• Check the amount of torque compensation. • Reduce the torque compensation gain (C4-01) until there is no speed loss and less current.
Drive fails to operate properly due to noise interference.	• Review the possible solutions provided for handling noise interference. • Review the section on handling noise interference and check the control circuit lines, main circuit lines, and ground wiring.
Overexcitation gain is set too high.	• Check if fault occurs simultaneously to overexcitation function operation. • Consider motor flux saturation and reduce the value of n3-13 (Overexcitation Deceleration Gain).
Run command applied while motor was coasting.	• Enable Speed Search at start (b3-01 = 1). • 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 PM Open Loop Vector (Yaskawa motors only) or the motor data are wrong.	• Enter the correct motor code to E5-01. • If a non-Yaskawa PM motor is used, enter "FFFF" to E5-01. Set the correct motor data to the E5-□□ parameters or perform Auto-Tuning.
The motor control method and motor do not match.	• Check which motor control method the drive is set to (A1-02). • For IM motors, set A1-02 = "0", "1", "2", or "3". • For PM motors, set A1-02 = "5", "6" or "7".
The drives rated output current is too small.	Use a larger drive.
Digital Operator Display	**Fault Name**
oFA00	Option Card Connection Error at Option Port CN5-A
	Option compatibility error
oFA01	Option Card Fault at Option Port CN5-A
	Option not properly connected
oFA03 to oFA06	Option card error occurred at option port CN5-A
oFA10, oFA11	
oFA12 to oFA17	
oFA30 to oFA43	
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 already connected
oFb03 to oFb11	oFb03 to oFb11	Option card error occurred at Option Port CN5-B
oFb12 to oFb17	oFb12 to oFb17	
oFb30 to oFb43	oFb30 to oFb43	
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 already connected
oFC03 to oFC11	oFC03 to oFC11	Option card error occurred at option port CN5-C
oFC12 to oFC17	oFC12 to oFC17	
oFC30 to oFC43	oFC30 to oFC43	
oH	oH	Heatsink Overheat
		The temperature of the heatsink exceeded the overheat pre-alarm level set to L8-02. Default value for L8-02 is determined by drive capacity (o2-04).
Cause		**Possible Solution**
Surrounding temperature is too high.		• Check the temperature surrounding the drive. Verify temperature is within drive specifications. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool the surrounding area. • Remove anything near the drive that might be producing excessive heat.
Load is too heavy.		• Measure the output current. • Decrease the load. • Lower the carrier frequency (C6-02).
Internal cooling fan is stopped.		• Replace the cooling fan. • After replacing the drive, reset the cooling fan maintenance parameter (o4-03 = 0).
Digital Operator Display		**Fault Name**
oH1	oH1	Overheat 1 (Heatsink Overheat)
		The temperature of the heatsink exceeded the drive overheat level. The overheat level is determined by drive capacity (o2-04).
Cause		**Possible Solution**
Surrounding temperature is too high.		• Check the temperature surrounding the drive. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool the surrounding area. • Remove anything near the drive that might be producing excessive heat.
Load is too heavy.		• Measure the output current. • Lower the carrier frequency (C6-02). • Reduce the load.
Internal cooling fan is stopped.		• Replace the cooling fan. • After replacing the drive, reset the cooling fan maintenance parameter (o4-03 = 0).
Digital Operator Display		**Fault Name**
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 multi-function analog input H3-02, H3-06, or H3-10 be set 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 that multi-function analog input H3-02, H3-06, or H3-10 = “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). This will mainly involve reducing E1-08 and E1-10. Be careful not to lower E1-08 and E1-10 too much because this reduces load tolerance at low speeds.
		• Check the motor rated current. • Enter the motor rated current as indicated on the motor nameplate (E2-01). • Ensure the motor cooling system is operating normally. • Repair or replace the motor cooling system.
Digital Operator Display		**Fault Name**
oL1	oL1	Motor Overload
		The electronic motor overload protection tripped.
Cause		**Possible Solution**
Load is too heavy.		Reduce the load.
Cycle times are too short during acceleration and deceleration.		Increase the acceleration and deceleration times (C1-01 through C1-08).
A general purpose motor is driven below the rated speed with too high load.		• Reduce the load. • Increase the speed. • If the motor is supposed to operate at low speeds, either increase the motor capacity or use a motor specifically designed to operate in the desired speed range.

The output voltage is too high.	Adjust the user-set V/f patterns (E1-04 through E1-10). Parameters E1-08 and E1-10 may need to be reduced. Be careful not to lower E1-08 and E1-10 too much because this reduces load tolerance at low speeds.
The wrong motor rated current is set to E2-01.	• Check the motor-rated current. • Enter the value written on the motor nameplate to parameter E2-01.
The maximum output frequency is set incorrectly.	• Check the rated frequency indicated on the motor nameplate. • Enter the rated frequency to E1-06 (Base Frequency).
Multiple motors are running off the same drive.	Disable the motor protection function (L1-01 = 0) and install a thermal relay to each motor.
The electrical thermal protection characteristics and motor overload characteristics do not match.	• Check the motor characteristics. • Correct the type of motor protection that has been selected (L1-01). • Install an external thermal relay.
The electrical thermal relay is operating at the wrong level.	• Check the current rating listed on the motor nameplate. • Check the value set for the motor rated current (E2-01).
Motor overheated by overexcitation operation.	• Overexcitation increases the motor losses and the motor temperature. If applied too long, motor damage can occur. 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.
Speed Search related parameters 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, enable Speed Estimation Speed Search (b3-24 = 1).
Output current fluctuation due to input phase loss	Check the power supply for phase loss.
Digital Operator Display	**Fault Name**
oL2	Drive Overload
	The thermal sensor of the drive triggered overload protection.
Cause	**Possible Solution**
Load is too heavy.	Reduce the load.
Acceleration or deceleration times are too short.	Increase the settings for the acceleration and deceleration times (C1-01 through C1-08).
The output voltage is too high.	• Adjust the preset V/f pattern (E1-04 through E1-10). This will mainly involve reducing E1-08 and E1-10. • Be careful not to lower E1-08 and E1-10 excessively because this reduces load tolerance at low speeds.
Drive capacity is too small.	Replace the drive with a larger model.
Overload occurred when operating at low speeds.	• Reduce the load when operating at low speeds. • Replace the drive with a model that is one frame size larger. • Lower the carrier frequency (C6-02).
Excessive torque compensation.	Reduce the torque compensation gain (C4-01) until there is no speed loss but less current.
Speed Search related parameters are set incorrectly.	• Check the settings for all Speed Search related parameters. • Adjust the current used during Speed Search and the Speed Search deceleration time (b3-03 and b3-02 respectively). • After Auto-Tuning the drive, enable the Speed Estimation Speed Search (b3-24 = 1).
Output current fluctuation due to input phase loss	Check the power supply for phase loss.
Digital Operator Display	**Fault Name**
oL3	Overtorque Detection 1
	The current has exceeded the value set for torque detection (L6-02) for longer than the allowable time (L6-03).
oL4	Overtorque Detection 2
	The current has exceeded the value set for Overtorque Detection 2 (L6-05) for longer than the allowable time (L6-06).
oL5	Mechanical Weakening Detection 1
	Overtorque occurred, matching the conditions specified in L6-08.
oL7	High Slip Braking oL
	The output frequency stayed constant for longer than the time set in n3-04 during High Slip Braking.
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).
oS	Overspeed (for Control Mode with PG)
	The motor speed feedback exceeded the F1-08 setting.
ov	Overvoltage
	Voltage in the DC bus has exceeded the overvoltage detection level. • For 200 V class: approximately 410 V • For 400 V class: approximately 820 V (740 V when E1-01 is less than 400)
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 braking resistor or a dynamic braking resistor unit. • Enable stall prevention during deceleration (L3-04 = 1). 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 braking option, or lengthen decel time.
Surge voltage entering from the drive input power.	Install a DC reactor. **Note:** Voltage surge can result from a thyristor convertor and phase advancing capacitor using the same input power supply.
Ground fault in the output circuit causing the DC bus capacitor to overcharge.	• Check the motor wiring for ground faults. • Correct grounding shorts and turn the power back on.

Improper Setting of Speed Search related parameters. (Includes 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 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 enable Speed Estimation Speed Search (b3-24 = 1).
Drive input power voltage is too high.	• Check the voltage. • Lower drive input power voltage within the limits listed in the specifications.
The braking transistor is wired incorrectly.	• Check braking transistor wiring for errors. • Properly rewire the braking resistor device.
PG cable is disconnected.	Reconnect the cable.
PG cable wiring is wrong.	Correct the wiring.
Noise interference along the PG encoder wiring.	Separate the wiring from the source of the noise (often the output lines from the drive).
Drive fails to operate properly due to noise interference.	• Review the list of possible solutions provided for controlling noise. • Review the section on handling noise interference and check the control circuit lines, main circuit lines, and ground wiring.
Load inertia has been 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	Input Phase Loss
	Drive input power has an open phase or has a large imbalance of voltage between phases. Detected when L8-05 = 1 (enabled).
Cause	**Possible Solution**
There is phase loss in the drive input power.	• Check for wiring errors in the main circuit drive input power. • Correct the wiring.
There is loose wiring in the drive input power terminals.	• Ensure the terminals are tightened properly. • Apply the tightening torque as specified in this manual. *Refer to Wire Gauges and Tightening Torque on page 27*
There is excessive fluctuation in the drive input power voltage.	• Check the voltage from the drive input power. • Review the possible solutions for stabilizing the drive input power.
There is poor balance between voltage phases.	• Stabilize drive input power or disable phase loss detection.
The main circuit capacitors are worn.	• Check the maintenance time for the capacitors (U4-05). • Replace the capacitor if U4-05 is greater than 90%. For instructions on replacing the capacitor, contact Yaskawa or your nearest sales representative.
	Check for anything 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 your nearest sales representative.
Digital Operator Display	**Fault Name**
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	PG Hardware Fault (detected when using a PG-X3 option card)
	PG cable is not connected properly.
rF	Braking Resistor Fault
	The resistance of the braking resistor being used is too low.
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 (C1-02, C1-04, C1-06, C1-08, C1-09). • Replace the braking option with a larger device that can handle the power that is discharged.
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 it is rated for trips the alarm even when the braking resistor surface is not very hot.	
Digital Operator Display	**Fault Name**
rr	Dynamic Braking Transistor
	The built-in dynamic braking transistor failed.
Cause	**Possible Solution**
The braking transistor is damaged.	• Cycle power to the drive and check if the fault reoccurs. • Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
The control circuit is damaged.	
Digital Operator Display	**Fault Name**
SEr	Too Many Speed Search Restarts
	The number of Speed Search restarts exceeded the number set to b3-19.
STo	Motor Pull Out or Step Out Detection
	Motor pull out or step out has occurred. Motor has exceeded its pull-out torque.
SvE	Zero Servo Fault
	Position deviation during zero servo.

UL3	UL3	Undertorque Detection 1
		The current has fallen below the minimum value set for torque detection (L6-02) for longer than the allowable time (L6-03).
Cause		**Possible Solution**
Parameter settings are not appropriate for the load.		Check the settings of parameters L6-02 and L6-03.
There is a fault on the machine side.		Check the load for any problems.
Digital Operator Display		**Fault Name**
UL4	UL4	Undertorque Detection 2
		The current has fallen below the minimum value set for torque detection (L6-05) for longer than the allowable time (L6-06).
UL5	UL5	Mechanical Weakening Detection 2
		The operation conditions matched the conditions set to L6-08.
Uv1	Uv1	DC Bus Undervoltage
		One of the following conditions occurred while the drive was stopped: • Voltage in the DC bus fell below the undervoltage detection level (L2-05) • For 200 V class: approximately 190 V • For 400 V class: approximately 380 V (350 V when E1-01 is less than 400) The fault is output only if L2-01 = 0 or L2-01 = 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 Wire Gauges and Tightening Torque on page 27*
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 your nearest sales representative.
The relay or contactor on the soft-charge bypass circuit is damaged.		• Cycle power to the drive and see if the fault reoccurs. • If the problem continues, replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative. • Check monitor U4-06 for the performance life of the soft-charge bypass. • Replace either the control board or the entire drive if U4-06 exceeds 90%. For instructions on replacing the control board, contact Yaskawa or your nearest sales 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**
L2-02 was changed from its default value in a drive that is 7.5 kW or smaller 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.
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 your nearest sales representative.
Digital Operator Display		**Fault Name**
Uv3	Uv3	Undervoltage 3 (Soft-Charge Bypass Circuit Fault)
		The soft-charge bypass circuit has failed.
voF	voF	Output Voltage Detection Fault
		Problem detected with the voltage on the output side of the drive.

◆ Alarm Detection

■ Alarm Codes, Causes, and Possible Solutions

Alarms are drive protection functions that do not necessarily cause the drive to stop. Once the cause of an alarm is removed, the drive will return to the same status 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 50 Alarm Codes, Causes, and Possible Solutions

Digital Operator Display		Minor Fault Name
AEr	AEr	Communication Option Station Number Setting Error (CC-Link, CANopen)
		Option card node address is outside the acceptable setting range.
bb	bb	Baseblock
		Drive output interrupted as indicated by an external baseblock signal.
boL	boL	Braking Transistor Overload Fault
		The braking transistor in the drive has been overloaded.
bUS	bUS	Option Communication Error
		• After initial communication was established, the connection was lost. • Assign a Run command frequency reference to the option card.
CALL	CALL	Serial Communication Transmission Error
		Communication has not yet been established.
CE	CE	MEMOBUS/Modbus Communication Error
		Control data was not received correctly for two seconds.
CrST	CrST	Cannot Reset
dEv	dEv	Speed Deviation (when using a PG option card)
		The deviation between the speed reference and speed feedback is greater than the setting in F1-10 for longer than the time in F1-11.
dnE	dnE	Drive Disabled
EF	EF	Forward/Reverse Run Command Input Error
		Both forward run and reverse run closed simultaneously for over 0.5 s.
EF0	EF0	Option Card External Fault
		An external fault condition is present.
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.
FbH	FbH	Excessive PID Feedback
		The PID feedback input is higher than the level set in b5-36 for longer than the time set in b5-37, and b5-12 is set to 1 or 4.
FbL	FbL	PID Feedback Loss
		The PID feedback input is lower than the level set in b5-13 for longer than the time set in b5-14, and b5-12 is set to 1 or 4.
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 one is closed.
HCA	HCA	Current Alarm
		Drive current exceeded overcurrent warning level (150% of the rated current).
LT-1	LT-1	Cooling Fan Maintenance Time
		The cooling fan has reached its expected maintenance period and may need to be replaced. **Note:** An alarm output (H2-□□ = 10) will only be triggered if H2-□□ = 2F.
LT-2	LT-2	Capacitor Maintenance Time
		The main circuit and control circuit capacitors are nearing the end of their expected performance life. **Note:** An alarm output (H2-□□ = 10) will only be triggered if H2-□□ = 2F.
LT-3	LT-3	Soft Charge Bypass Relay Maintenance Time
		The DC bus soft charge relay is nearing the end of its expected performance life. **Note:** An alarm output (H2-□□ = 10) will only be triggered if H2-□□ = 2F.
LT-4	LT-4	IGBT Maintenance Time (50%)
		IGBTs have reached 50% of their expected performance life. **Note:** An alarm output (H2-□□ = 10) will only be triggered if H2-□□ = 2F.
oH	oH	Heatsink Overheat
		The temperature of the heatsink exceeded the overheat pre-alarm level set to L8-02 (90-100°C). Default value for L8-02 is determined by drive capacity (o2-04).

Digital Operator Display		Minor Fault Name
oH2	oH2	Drive Overheat Warning
		"Drive 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).
oL3	oL3	Overtorque 1
		Drive output current (or torque in OLV, CLV, AOLV/PM, CLV/PM) was greater than L6-02 for longer than the time set in 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 in L6-06.
oL5	oL5	Mechanical Weakening Detection 1
		Overtorque occurred, matching the conditions specified in L6-08.
oS	oS	Overspeed (for Control Mode with PG)
		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: approximately 410 V For 400 V class: approximately 820 V (740 V when E1-01 < 400)
PASS	PASS	MEMOBUS/Modbus Comm. Test Mode Complete
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.
PGoH	PGoH	PG Hardware Fault (detected when using a PG-X3 option card)
		PG cable has become disconnected.
rUn	rUn	Motor Switch during Run
		A command to switch motors was entered during run.
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).
TrPC	TrPC	IGBT Maintenance Time (90%)
		IGBTs have reached 90% of their expected performance life.
UL3	UL3	Undertorque Detection 1
		Drive output current (or torque in OLV, CLV, AOLV/PM, CLV/PM) less than L6-02 for longer than L6-03 time.
UL4	UL4	Undertorque Detection 2
		Drive output current (or torque in OLV, CLV, AOLV/PM, CLV/PM) less than L6-05 for longer than L6-06 time.
Uv	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.
voF	voF	Output Voltage Detection Fault
		There is a problem with the output voltage.

◆ Operator Programming Errors

■ oPE Codes, Causes, and Possible Solutions

An Operator Programming Error (oPE) occurs when a contradictory parameter is set or an individual parameter is set to an inappropriate value.

The drive will not operate until the parameter or parameters causing the problem are set correctly. An oPE, however, does not trigger an alarm or fault output. If an oPE occurs, investigate the cause and ***Refer to oPE Codes, Causes, and Possible Solutions on page 93*** for the appropriate action. When an oPE appears on the operator display, press the ENTER button to view U1-18 and see the parameter that is causing the oPE error (U1-18).

Table 51 oPE Codes, Causes, and Possible Solutions

Digital Operator Display		Error Name
oPE01	oPE01	Drive Capacity Setting Fault
		Drive capacity and the value set to o2-04 do not match.
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.

Digital Operator Display		Error Name
oPE07	oPE07	Multi-Function Analog Input Selection Error
		A contradictory setting is assigned to multi-function analog inputs H3-02, H3-06, or H3-10 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
		The following setting errors have occurred where: • E1-04 is greater than or equal to E1-06, E1-06 is greater than or equal to E1-07, E1-07 is greater than or equal to E1-09, or E1-09 is greater than or equal to E1-11. • E3-04 is greater than or equal to E3-06, E3-06 is greater than or equal to E3-07, E3-07 is greater than or equal to E3-09, or E3-09 is greater than or equal to E3-11.
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
		Parameters settings that are not allowed in combination with Torque Control have been set.

◆ Auto-Tuning Fault Detection

Auto-Tuning faults are shown below. When the following faults are detected, the fault is displayed on the digital operator and the motor coasts to a stop. Auto-Tuning faults do not trigger an multi-function terminal set for fault or alarm output.

An End□ error indicates that although Auto-Tuning has completely successful, there is some discrepancy in the calculations the drive made. If an End□ error occurs, check for what might be causing the error using the table below, and perform Auto-Tuning again once the problem has been taken care of. If there appears to be no problem despite the End□ error being displayed, go ahead and start the application.

■ Auto-Tuning Codes, Causes, and Possible Solutions

Table 52 Auto-Tuning Codes, Causes, and Possible Solutions

Digital Operator Display		Error Name
End1	End1	Excessive V/f Setting (detected only during Rotational Auto-Tuning, and displayed after Auto-Tuning is complete)
Cause		**Possible Solutions**
The torque reference exceeded 20% during Auto-Tuning.		• Before Auto-Tuning the drive, verify the information written on the motor nameplate and enter that data to T1-03 through T1-05. • Enter proper information to parameters T1-03 to T1-05 and repeat Auto-Tuning. • If possible, disconnect the motor from the load and perform Auto-Tuning. If the load cannot be uncoupled, simply use the Auto-Tuning results as they are.
The results from Auto-Tuning the no-load current exceeded 80%.		
Digital Operator Display		**Error Name**
End2	End2	Motor Iron-Core Saturation Coefficient (detected only during Rotational Auto-Tuning and displayed after Auto-Tuning is complete)
Cause		**Possible Solutions**
Motor data entered during Auto-Tuning was incorrect.		• Make sure the data entered to the T1 parameters match the information written on the motor nameplate. • Restart Auto-Tuning and enter the correct information.
Results from Auto-Tuning are outside the parameter setting range, assigning the iron-core saturation coefficient (E2-07, E2-08) a temporary value.		• Check and correct faulty motor wiring. • 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 nameplate was not entered into T1-04.		• Check the setting of parameter T1-04. • Check the motor data and repeat Auto-Tuning.
Digital Operator Display		**Error Name**
End4	End4	Adjusted Slip Calculation Error
Cause		**Possible Solutions**
The slip that was calculated is outside the allowable range.		• Make sure the data entered for Auto-Tuning is correct. • Execute Rotational Auto-Tuning instead. If not possible, try Stationary Auto-Tuning 2.
Digital Operator Display		**Error Name**
End5	End5	Resistance Tuning Error
Cause		**Possible Solutions**
The resistance value that was calculated is outside the allowable range.		• Double check the data that was entered for the Auto-Tuning process. • Check the motor and motor cable connection for faults.
Digital Operator Display		**Error Name**
End6	End6	Leakage Inductance Alarm

Cause	Possible Solutions
The leakage inductance value that was calculated is outside the allowable range.	Double check the data that was entered for the Auto-Tuning process.
Digital Operator Display	**Error Name**
End7	No-Load Current Alarm
Cause	**Possible Solutions**
The entered no-load current value was outside the allowable range.	Check and correct faulty motor wiring.
Auto-Tuning results were less than 5% of the motor rated current.	Double check the data that was entered for the Auto-Tuning process.
Digital Operator Display	**Error Name**
Er-01	Motor Data Error
Cause	**Possible Solutions**
Motor data or data entered during Auto-Tuning was incorrect.	• Check that the motor data entered to T1 parameters matches motor nameplate input before Auto-Tuning. • Start Auto-Tuning over again and enter the correct information.
Motor output power and motor-rated current settings (T1-02 and T1-04) do not match.	• Check the drive and motor capacities. • Correct the settings of parameters T1-02 and T1-04.
Motor rated current and detected no-load current are not consistent with another.	• Check the motor rated current and no-load current. • Correct the settings of parameters T1-04 and E2-03.
Base frequency and motor rated speed (T1-05 and T1-07) do not match.	• Set T1-05 and T1-07 to the correct value. • Check if the correct pole number was entered to T1-06.
Digital Operator Display	**Error Name**
Er-02	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.
Digital Operator Display	**Error Name**
Er-03	STOP Button Input
Cause	**Possible Solutions**
Auto-Tuning canceled by pressing STOP button.	Auto-Tuning did not complete properly and will have to be performed again.
Digital Operator Display	**Error Name**
Er-04	Line-to-Line Resistance Error
Cause	**Possible Solutions**
Motor data entered during Auto-Tuning was incorrect.	• Make sure the data entered to the T1 parameters match the information written on the motor nameplate. • Restart Auto-Tuning and enter the correct information.
Results from Auto-Tuning are outside the parameter setting range or the tuning process took too long.	Check and correct faulty motor wiring.
Motor cable or cable connection faulty.	
Digital Operator Display	**Error Name**
Er-05	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 during Rotational Auto-tuning was too high.	• Disconnect the motor from machine and restart Auto-Tuning. If motor and load cannot be uncoupled make sure the load is lower than 30%. • If a mechanical brake is installed, make sure it is fully lifted during tuning.
Digital Operator Display	**Error Name**
Er-08	Rated Slip Error
Cause	**Possible Solutions**
Motor data entered during Auto-Tuning was incorrect.	• Make sure the data entered to the T1 parameters match the information written on the motor nameplate. • Restart Auto-Tuning and enter the correct information.
Drive-calculated values outside parameter setting range or the tuning process took too long.	• Check and correct faulty motor wiring. • Perform Rotational Auto-Tuning.
The load during rotational Auto-tuning was too high.	• Disconnect the motor from machine and restart Auto-Tuning. If motor and load cannot be uncoupled make sure the load is lower than 30%. • If a mechanical brake is installed, make sure it is fully lifted during tuning.
Digital Operator Display	**Error Name**
Er-09	Acceleration Error
Cause	**Possible Solutions**
The motor did not accelerate for the specified acceleration time.	• Increase the acceleration time (C1-01). • Check if it is possible to disconnect the machine from the motor.
Torque limit when motoring is too low (L7-01 and L7-02).	• Check the settings of parameters L7-01 and L7-02. • Increase the setting.
The load during Rotational Auto-Tuning was too high.	• Disconnect the motor from machine and restart Auto-Tuning. If motor and load cannot be uncoupled make sure the load is lower than 30%. • If a mechanical brake is installed, make sure it is fully lifted during tuning.

Digital Operator Display		Error Name
Er - 10	Er-10	Motor Direction Error
Cause		**Possible Solutions**
The encoder signal lines are not properly connected to the drive.		Check and correct wiring to the PG encoder.
Motor and PG direction are opposite.		Check the motor speed monitor U1-05 while turning the motor manually in forward direction. If the sign displayed is negative, change the setting of parameter F1-05.
The load pulled the motor in the opposite direction of the speed reference and the torque exceeded 100%.		Uncouple the motor from the load and repeat Auto-Tuning.
Digital Operator Display		**Error Name**
Er - 11	Er-11	Motor Speed Fault
Cause		**Possible Solutions**
Torque reference is too high.		• Increase the acceleration time (C1-01). • Disconnect the machine from the motor, if possible.
Digital Operator Display		**Error Name**
Er - 12	Er-12	Current Detection Error
Cause		**Possible Solutions**
One of the motor phases is missing: (U/T1, V/T2, W/T3).		Check motor wiring and correct any problems.
Current exceeded the current rating of the drive.		• Check the motor wiring for a short between motor lines. • If a magnetic contactor is used between motors, make sure it is closed. • Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
The current is too low.		
Attempted Auto-Tuning without motor connected to the drive.		Connect the motor and perform Auto-Tuning.
Current detection signal error.		Replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
Digital Operator Display		**Error Name**
Er - 13	Er-13	Leakage Inductance Error
Cause		**Possible Solutions**
Drive was unable to complete tuning for leakage inductance within 300 seconds.		• Check all wiring and correct any mistakes. • Double check the motor rated current value that was entered to T1-04 for Auto-Tuning. • Check the motor rated current value written on the motor nameplate and enter the correct value.
Digital Operator Display		**Error Name**
Er - 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 (but keep them within reasonable limits). • First try reducing the test signal amplitude in T3-01 and repeat the tuning. If necessary, then try reducing the test signal frequency (T3-02) and repeat the tuning.
Digital Operator Display		**Error Name**
Er - 16	Er-16	Inertia Detection Error
Cause		**Possible Solutions**
The inertia identified by the drive was abnormally small or abnormally large during Inertia Tuning.		• First try reducing the test signal amplitude in T3-01 and repeat the tuning. If necessary, then try reducing the test signal frequency (T3-02) and repeat the 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 execute Inertia Tuning.
Digital Operator Display		**Error Name**
Er - 18	Er-18	Induction Voltage Error
Cause		**Possible Solutions**
The induced voltage constant attempted to set a value outside the allowable setting range.		Double check the data that was entered to the T2-□□ parameters, and perform Auto-Tuning again.
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 outside the allowable range.		Double check the data that was entered to the T2-□□ parameters, and perform Auto-Tuning again.
Digital Operator Display		**Error Name**

Er-20	Er-20	Stator Resistance Error
Cause		**Possible Solutions**
Stator resistance tuning attempted to set a value to E5-06 that is outside the allowable setting range.		Double check the data that was entered to the T2-□□ parameters, and perform Auto-Tuning again.
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 has stopped completely. Repeat Auto-Tuning.
Either the motor or the PG encoder on the motor is not properly wired.		Check the wiring for the motor and the PG encoder. Repeat 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. Repeat Auto-Tuning.
PG encoder is damaged.		Check the signal output from the PG encoder attached to the motor. Replace the PG if damaged.

◆ 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 53 lists the corrective action that can be taken when an error occurs.

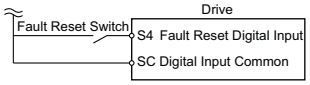
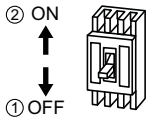
Note: **1.** Whenever using the copy function, the drive should be fully stopped.
2. The drive will not accept a Run command while the Copy function is being executed.
3. Parameters can only be saved to a drive when the voltage class, capacity, control mode, and software version match.

Table 53 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.	
Resetting via Fault Reset Digital Input S4	Close then open the fault signal digital input via terminal S4. S4 is set for “Fault Reset” as default (H1-04 = 14).	
If the above methods do not reset the fault, turn off the drive main power supply. Reapply power after the digital operator display is out.		

Note: If the Run command is present, the drive will disregard any attempts to reset the fault. The Run command must first be removed before a fault situation can be cleared.

6 Periodic Inspection & Maintenance

◆ 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 54 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 54 General Recommended Daily Inspection Checklist

Inspection Category	Inspection Points	Corrective Action	Checked
Motor	• Inspect for abnormal oscillation or noise coming from the motor.	• Check the load coupling. • Measure motor vibration. • Tighten all loose components.	
Cooling	• Inspect for abnormal heat generated from the drive or motor and visible discoloration.	• Check for excessive load. • Loose connections • Check for dirty heatsink or motor. • Ambient temperature	
Cooling Fan	• Inspect drive cooling fan operation.	• Check for clogged or dirty fan. • Check fan operation drive parameter.	
Environment	• Verify the drive environment complies with the specifications listed in *Installation Environment on page 14*.	• 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 excessive load. • Check the motor parameter settings of the drive.	
Power Supply Voltage	• Check main power supply and control voltages.	• Correct the voltage or power supply to within nameplate specifications. • Verify all main circuit phases.	

■ Recommended Periodic Inspection

Table 55 outlines the recommended periodic inspections for Yaskawa drive installations. Although periodic inspections should generally be performed once a year; the drive may require more frequent inspection in harsh environments or with rigorous use. Operating and environmental conditions, along with experience in each application, will determine the actual inspection frequency for each installation. Periodic inspection will help to avoid premature deterioration in performance or product failure. Copy this checklist and mark the "Checked" column after each inspection.

Periodic Inspection

WARNING! *Electrical Shock Hazard. Do not inspect, connect, or disconnect any wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

Table 55 Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Main Circuit Periodic Inspection			
General	• Inspect equipment for discoloration from overheating or deterioration. • Inspect for damaged or deformed parts.	• Replace damaged components as required. • The drive has few serviceable parts and may require complete drive replacement.	
	• Inspect for dirt, foreign particles, or dust collection on components.	• Inspect enclosure door seal if used. • Use dry air to clear away foreign matter. Use a pressure of 39.2×10^4 to 58.8×10^4 Pa (4 - 6 kg·cm^2). • 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 over or under voltage conditions. • Replace damaged removable relays contactors or circuit board.	
Braking Resistors	• Inspect for discoloration of heat stress on or around resistors.	• Minor discoloration may be acceptable. • If discoloration exists check for loose connections.	
Electrolytic Capacitor	• Inspect for leaking, discoloration, or cracks. • Check if the cap has come off, for any swelling, or if the sides have burst open.	• The drive has few serviceable parts and may require complete drive replacement.	
Diode, IGBT (Power Transistor)	• Inspect for dust or other foreign material collected on the surface.	• Use dry air to clear away foreign matter. Use a pressure of 39.2×10^4 to 58.8×10^4 Pa (4 - 6 kg·cm^2).	
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 can't be used, replace the board. • Do not use any solvents to clean the board. • Use dry air to clear away foreign matter. Use a pressure of 39.2×10^4 to 58.8×10^4 Pa (4 - 6 kg·cm^2). • The drive has few serviceable parts and may require complete drive replacement.	
Cooling System Periodic Inspection			
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.	• Use dry air to clear away foreign matter. Use a pressure of 39.2×10^4 to 58.8×10^4 Pa (4 - 6 kg·cm^2).	
Air Duct	• Inspect air intake and exhaust openings. They must be free from obstruction and properly installed.	• Visually inspect the area. • Clear obstructions and clean air duct as required.	
Display Periodic Inspection			
Digital Operator	• Make sure data appears on the operator properly. • Inspect for dust or other foreign material that may have collected on surrounding components.	• Contact your Yaskawa representative if there is any trouble with the display or keypad. • Clean the digital operator.	

◆ 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
- Electrolytic Capacitors
- Inrush Prevention Circuit
- IGBTs

For replacement parts, contact the distributor where the drive was purchased or contact Yaskawa directly.

■ Replacement Parts

Table 56 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 56 Estimated Performance Life

Component	Estimated Performance Life
Cooling Fan	10 years
Electrolytic Capacitors	10 years <1>

<1> The drive has few serviceable parts and may require complete drive replacement.

NOTICE: *Estimated performance life based on specific usage conditions. These conditions are provided for the purpose of replacing parts to maintain performance. Some parts may require more frequent replacement due to poor environments or rigorous use. Usage conditions for estimated performance life:*
• Ambient temperature: Yearly average of 40°C (open-chassis)
• Load factor: 80% maximum
• Operation time: 24 hours a day

Performance Life Monitors Maintenance Monitors

The drive calculates the maintenance period for components that may require replacement during the life of the drive. A percentage of the maintenance period is displayed on the digital operator by viewing the appropriate monitor parameter.

When the maintenance period reaches 100%, there is increased risk that the drive may malfunction. Yaskawa recommends checking the maintenance period regularly to ensure maximum performance life.

Refer to Recommended Periodic Inspection on page 100 for more details.

Table 57 Performance Life Monitors Used for Component Replacement

Parameter	Component	Contents
U4-03	Cooling Fan	Displays the accumulated operation time of the cooling fan, from 0 to 99999 hours. This value is automatically reset to 0 once it reaches 99999.
U4-04		Displays the accumulated cooling fan operation time as a percentage of the specified maintenance period.
U4-05	DC Bus Capacitors	Displays the accumulated time the capacitors are used as a percentage of the specified maintenance period.
U4-06	Inrush (pre-charge) Relay	Displays the number of times the drive is powered up as a percentage of the performance life of the inrush circuit.
U4-07	IGBT	Displays the percentage of the maintenance period reached by the IGBTs.

Alarm Outputs for Maintenance Monitors

An output can be set up to inform the user when a specific components has neared its expected performance life.

When one of multi-function digital output terminals has been assigned the maintenance monitor function (H2-☐☐ = 2F), the terminal will close when the cooling fan, DC bus capacitors, or DC bus pre-charge relay reach 90% of the expected performance life, or the IGBTs have reached 50% of their expect performance life. Additionally the digital operator will display an alarm like shown in *Table 58* to indicate the specific components that may need maintenance.

Table 58 Maintenance Alarms

Alarm Display	Function	Corrective Action
LT-1 <1>	The cooling fans have reached 90% of their designated life time.	Replace the cooling fan.
LT-2 <1>	The DC bus capacitors have reached 90% of their designated life time.	Replace the drive.
LT-3 <1>	The DC bus charge circuit has reached 90% of its designated life time.	Replace the drive.
LT-4 <1>	The IGBT's have reached 50% of their designated life time.	Check the load, carrier frequency, and output frequency.
rrPL <2>	The IGBT's have reached 90% of their designated life time.	Replace the drive.

<1> This alarm message will be output only if the Maintenance Monitor function is assigned to one of the digital outputs (H2-☐☐ = 2F). The alarm will also trigger a digital output that is programmed for alarm indication (H2-☐☐ = 10).
<2> This alarm message will always be output, even if the Maintenance Monitor function is not assigned to any of the digital outputs (H2-☐☐ = 2F). The alarm will also trigger a digital output that is programmed for alarm indication (H2-☐☐ = 10).

Related Drive Parameters

Parameters o4-03, o4-05, o4-07, and o4-09 can be used to reset a Maintenance Monitor back to zero after a specific component has been replaced. *Refer to Parameter List on page 107* 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.*

■ Replacing the Drive

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

WARNING! *Electrical Shock Hazard. Do not allow unqualified personnel to perform work on the drive. Failure to comply could result in serious injury. Installation, maintenance, inspection and servicing must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.*

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

The following procedure explains how to replace a drive. This section provides instructions for drive replacement only. To install option boards or other types of options, then refer to the specific manuals for those options.

NOTICE: *When transferring a braking transistor, braking resistor, or other type of option from a damaged drive to a new replacement drive, make sure they are working properly before reconnecting them to the new drive. Replace broken options to prevent immediate break down of the replacement drive.*

1. Remove the terminal cover.

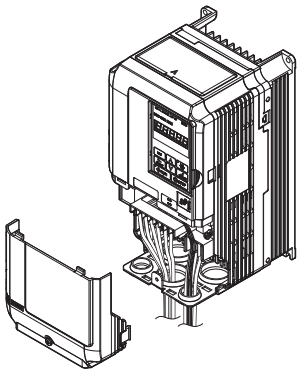


Figure 75 Drive Replacement: Removing the Terminal Cover

2. Loosen the screws holding the terminal board in place. Take out the screw securing the bottom cover and remove the bottom cover from the drive.

Note: Drives set up for compliance with IP00 do not have a bottom cover.

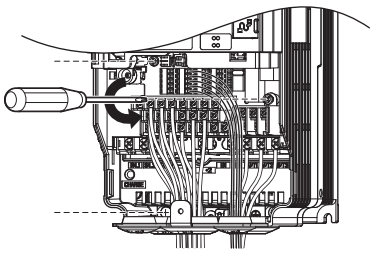


Figure 76 Drive Replacement: Removing the Terminal Board

3. Slide the terminal board as illustrated by the arrows, and remove it from the drive along with the bottom cover.

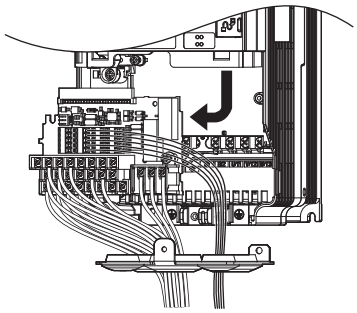


Figure 77 Drive Replacement: Remove the Terminal Board

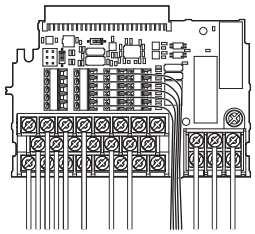


Figure 78 Drive Replacement:
Removable Terminal Board Disconnected from the Drive

4. Disconnect all option cards and options. Make sure they are intact before reusing them.
5. Replace the drive and wire the main circuit.

Installing the Drive

1. Once the main circuit has been wired, connect the terminal block to the drive as shown in ***Figure 86***. Use the installation screw to fasten the terminal block into place.

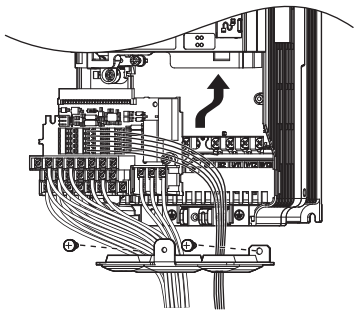


Figure 79 Drive Replacement: Installing the Terminal Board

2. Reconnect all options to the new drive in the same way they were installed in the old drive. Connect option boards to the same option ports in the new drive that were used in the old drive.
3. Put the terminal cover back into its original place.
4. When the power to the drive is first switched on, all parameter settings are transferred from the terminal board into the drive memory. Should an oPE04 error occur, load the parameter settings that have been saved on the terminal board onto the new drive by setting parameter A1-03 to 5550. Reset timers used for the Maintenance Monitor function by setting parameters o4-01 through o4-12 back to 0, and parameter o4-13 to 1.

A Specifications

◆ 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 Selecting the Appropriate Load Rating on page 104 for the differences between HD and ND.

Table 59 Selecting the Appropriate Load Rating

Setting Parameter C6-01	Rated Output Current	Overload Tolerance	Default Carrier Frequency
0: Heavy Duty (default)	HD Rating varies by model <1>	150% rated output current for 60 s	2 kHz
1: Normal Duty	ND Rating varies by model <1>	120% rated output current for 60 s varies by model	2 kHz, Swing PWM

<1> Refer to *Three-Phase 200 V Class Drives on page 104* and *Three-Phase 400 V Class Drives on page 105* 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 HD (C6-01 = 0).

◆ Three-Phase 200 V Class Drives

Table 60 Power Ratings (Three-Phase 200 V Class)

Item			Specification														
CIMR-A□2A			0004	0006	0008	0010	0012	0018	0021	0030	0040	0056	0069	0081	0110	0138	0169	0211
Maximum Applicable Motor Capacity (kW) <1>		HD Rating	0.4	0.75	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45
		ND Rating	0.7	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Input	Input Current (A) <2>	HD Rating	2.9	5.8	7	7.5	11	15.6	18.9	28	37	52	68	80	82	111	136	164
		ND Rating	3.9	7.3	8.8	10.8	13.9	18.5	24	37	52	68	80	96	111	136	164	200
	Rated Voltage Rated Frequency		Three-phase 200 to 240 V 50/60 Hz															
	Allowable Voltage Fluctuation		-15 to 10%															
	Allowable Frequency Fluctuation		±5%															
	Input Power (kVA)	HD Rating	1.3	2.2	3.1	4.1	5.8	7.8	9.5	14	18	27	36	44	37	51	62	75
		ND Rating	2.2	3.1	4.1	5.8	7.8	9.5	14	18	27	36	44	52	51	62	75	91
Output	Rated Output Capacity (kVA) <3>	HD Rating	1.2	1.9	2.6	3	4.2	5.3	6.7	9.5	12.6	17.9	23	29	32	44	55	69
		ND Rating	1.3	2.3	3	3.7	4.6	6.7	8	11.4	15.2	21	26	31	42	53	64	80
	Rated Output Current (A)	HD Rating	3.2 <5>	5 <5>	6.9 <5>	8 <5>	11 <5>	14 <5>	17.5 <5>	25 <5>	33 <5>	47 <5>	60 <5>	75 <5>	85 <5>	115 <5>	145 <6>	180 <6>
		ND Rating <4>	3.5	6	8	9.6	12	17.5	21	30	40	56	69	81	110	138	169	211
	Overload Tolerance		HD Rating: 150% of rated output current for 1 minute (Derating may be required for applications that start and stop frequently) ND Rating: 120% of rated output current for 1 minute															
	Carrier Frequency		User adjustable between 2 and 15 kHz														User adjustable between 2 and 10 kHz	
	Maximum Output Voltage (V)		Three-phase 200 to 240 V (proportional to input voltage)															
	Maxmum Output Frequency (Hz)		400 Hz (user-set)															

<1> The motor capacity (kW) refers to a Yaskawa 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor rated current.
<2> Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.
<3> Rated motor capacity is calculated with a rated output voltage of 220 V.
<4> Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.
<5> Carrier frequency is set to 8 kHz. Current derating is required in order to raise the carrier frequency.
<6> Carrier frequency is set to 5 kHz. Current derating is required in order to raise the carrier frequency.

◆ Three-Phase 400 V Class Drives

Table 61 Power Ratings (Three-Phase 400 V Class)

Item			Specification															
CIMR-A□4A			0002	0004	0005	0007	0009	0011	0018	0023	0031	0038	0044	0058	0072	0088	0103	0139	0165
Maximum Applicable Motor Capacity (kW) <1>		HD Rating	0.4	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
		ND Rating	0.75	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
Input	Input Current (A) <2>	HD Rating	1.8	3.2	4.4	6	8.2	10.4	15	20	29	39	44	43	58	71	86	105	142
		ND Rating	2.1	4.3	5.9	8.1	9.4	14	20	24	38	44	52	58	71	86	105	142	170
	Rated Voltage Rated Frequency		Three-phase: 380 to 480 V 50/60 Hz																
	Allowable Voltage Fluctuation		-15 to 10%																
	Allowable Frequency Fluctuation		±5%																
	Input Power (kVA)	HD Rating	1.4	2.3	4.3	6.1	8.1	10.0	14.6	19.2	28.4	37.5	46.6	39.3	53.0	64.9	78.6	96.0	129.9
		ND Rating	2.3	4.3	6.1	8.1	10.0	14.5	19.4	28.4	37.5	46.6	54.9	53.0	64.9	78.6	96.0	129.9	155.5
Output	Rated Output Capacity (kVA) <3>	HD Rating	1.4	2.6	3.7	4.2	5.5	7	11.3	13.7	18.3	24	30	34	48	57	69	85	114
		ND Rating <4>	1.6	3.1	4.1	5.3	6.7	8.5	13.3	17.5	24	29	34	44	55	67	78	106	126
	Rated Output Current (A)	HD Rating	1.8 <5>	3.4 <5>	4.8 <5>	5.5 <5>	7.2 <5>	9.2 <5>	14.8 <5>	18 <5>	24 <5>	31 <5>	39 <5>	45 <5>	60 <5>	75 <5>	91 <5>	112 <6>	150 <6>
		ND Rating <4>	2.1	4.1	5.4	6.9	8.8	11.1	17.5	23	31	38	44	58	72	88	103	139	165
	Overload Tolerance		HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently) ND Rating: 120% of rated output current for 60 s																
	Carrier Frequency		User adjustable between 2 and 15 kHz															User adjustable between 2 and 10 kHz	
	Maximum Output Voltage (V)		Three-phase: 380 to 480 V (proportional to input voltage)																
	Maximum Output Frequency (Hz)		400 Hz (user-adjustable)																

<1> The motor capacity (kW) refers to a Yaskawa 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor rated current.
<2> Assumes operation at the rated output current. Input current rating varies depending on the power supply transformer, input reactor, wiring conditions, and power supply impedance.
<3> Rated motor capacity is calculated with a rated output voltage of 440 V.
<4> Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.
<5> Carrier frequency is set to 8 kHz. Current derating is required in order to raise the carrier frequency.
<6> Carrier frequency is set to 5 kHz. Current derating is required in order to raise the carrier frequency.

◆ 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	-10 to 10 V, 0 to 10 V, 0 to 20 mA, 4 to 20 mA, Pulse Train Input
	Starting Torque <1>	V/f, V/f w/PG: 150% at 3 Hz OLV: 200% at 0.3 Hz CLV, AOLV/PM, CLV/PM: 200% at 0 r/min OLV/PM: 100% at 5% speed
	Speed Control Range <1>	V/f, V/f w/PG: 1:40 OLV: 1:200 CLV, CLV/PM: 1:1500 OLV/PM: 1:20 AOLV/PM: 1:100
	Speed Control Accuracy <1>	OLV: ±0.2% (25°C ±10°C)
	Speed Response <1>	OLV, OLV/PM, AOLV/PM: 10 Hz CLV, CLV/PM: 50 Hz
	Torque Limit	Parameters setting allow separate limits in four quadrants (available in OLV, CLV, AOLV/PM, CLV/PM)
	Accel/Decel Time	0.0 to 6000.0 s (4 selectable combinations of independent acceleration and deceleration settings)

Item		Specification
Control Characteristics	Braking Torque	Approx. 20% (approx. 125% when using braking resistor) <3> ① Short-time decel torque <2>: 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 <4> (over excitation braking/High Slip Braking: approx. 40%) ② Continuous regenerative torque: approx. 20% <4> (approx. 125% with dynamic braking resistor option <3>: 10% ED, 10s)
	Braking Transistor	Drives of 200/400 V 30 kW or less 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 Comm. (RS-422/485 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...
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 <5>
	Overvoltage Protection	200 V class: Stops when DC bus voltage exceeds approx. 410 V 400 V class: Stops when DC bus voltage exceeds approx. 820 V
	Undervoltage Protection	200 V class: Stops when DC bus voltage falls below approx. 190 V 400 V class: Stops when DC bus voltage falls below approx. 380 V
	Momentary Power Loss Ride-Thru	Immediately stop after 15 ms or longer power loss <6>. Continuous operation during power loss than 2 s (standard) <7>
	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 <8>
	DC Bus Charge LED	Remains lit until DC bus voltage falls below 50 V.
Environment	Area of Use	Indoors
	Ambient Temperature	-10 to 40°C (NEMA Type 1), -10 to 50°C (open-chassis), up to 60°C with output current derating <8>
	Humidity	95 RH% or less (no condensation)
	Storage Temperature	-20 to 60°C (short-term temperature during transportation)
	Altitude	Up to 1000 meters without derating, up to 3000m with output current and voltage derating
	Vibration / Shock	10 to 20 Hz: 9.8 m/s^2 20 to 55 Hz: 5.9 m/s^2 (up to 200 V 45 kW or 400 V 75 kW) 2.0 m/s^2 (200 V 55 kW or 400 V 90 kW and above)
Safety Standard		Two Safe Disable inputs and 1 EDM output according to EN61800-5-1, EN954-1 Cat. 3, IEC/EN61508 SIL2, Insulation coordination: class 1 **Note:** Time from input open to drive output stop is less than 1 ms
Protection Design		IP00 open-chassis, IP20 (NEMA Type 1) enclosure <9>

<1> The accuracy of these values depends on motor characteristics, ambient conditions, and drive settings. Specifications may vary with different motors and with changing motor temperature. Contact Yaskawa for consultation.
<2> 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.
<3> Ensure that Stall Prevention is disabled 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.
<4> Overload protection may be triggered when operating with 150% of the rated output current if the output frequency is less than 6 Hz.
<5> May be shorter due to load conditions and motor speed.
<6> A separate Momentary Power Loss Ride-Thru Unit is required for the drives CIMR-A☐2A0040 through 2A0040 and A☐4A0002 through 4A0023 if the application needs to continue running during a momentary power loss up to 2 seconds.
<7> 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.
<8> Model CIMR-A☐2A0040 has a maximum ambient temperature of 40 degrees when set for Normal Duty.
<9> Removing the top cover from a IP20/NEMA Type 1 drive voids the NEMA Type 1 protection but still keeps IP20 conformity.

B Parameter List

◆ Parameter Table

■ A: Initialization Parameters

The A parameter group creates the operating environment for the drive. This includes the parameter Access Level, Motor Control Method, Password, User Parameters and more.

RUN : Indicates that the parameter setting can be changed while the drive is operating the motor.

Motor 2: Refers the second motor when the drive is operating two motors (use input terminals to switch between motors).

A1: Initialization Parameters

No.	Name	Description	Setting
A1-00 RUN <25>	Language Selection	0: English 1: Japanese 2: German 3: French 4: Italian 5: Spanish 6: Portuguese 7: Chinese	Default: 0 Min: 0 Max: 7
A1-01 RUN <16>	Access Level Selection	0: View and set A1-01 and A1-04. U□-□□ parameters can also be viewed. 1: User Parameters (access to a set of parameters selected by the user, A2-01 to A2-32) 2: Advanced Access (access to view and set all parameters)	Default: 2 Min: 0 Max: 2
A1-02 <25>	Control Method Selection	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 Min: 0 Max: 7
A1-03	Initialize Parameters	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 Min: 0 Max: 5550
A1-04	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, and A2-01 through A2-33 cannot be changed.	Default: 0000 Min: 0000 Max: 9999
A1-05	Password Setting		
A1-06	Application Preset	0: General-purpose 1: Water supply pump 2: Conveyor 3: Exhaust fan 4: HVAC fan 5: Air compressor 6: Elevator 7: Hoist	Default: 0 Min: 0 Max: 7
A1-07	DriveWorksEZ Function Selection	0: Disabled 1: Enabled 2: Multi-function input (enabled when H1-□□ = 9F)	Default: 0 Min: 0 Max: 2

<16> Default setting value is dependent on the Application Preset selected with parameter A1-06.
<25> Parameter setting value is not reset to the default value when the drive is initialized.

A2: User Parameters

No.	Name	Description	Setting
A2-01 to A2-32	User Parameters 1 to 32	Parameters that were recently edited are listed here. The user can also select parameters to appear here for quick access.	Default: – <16> Min: b1-01 Max: o2-08
A2-33	User Parameter Automatic Selection	0: Parameters A2-01 through A2-32 are reserved for the user to create a list of User Parameters. 1: Save history of recently viewed parameters. Recently edited parameters will be saved to A2-17 through A2-32 for quick access.	Default: 1 <4> Min: 0 Max: 1

<4> Default setting value is dependent on parameter A1-06. This setting value is 0 when A1-06 = 0, and 1 when A1-06 does not equal 0.
<16> Default setting value is determined by the Application Preset selected with parameter A1-06.

■ 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.	Name	Description	Setting
b1-01	Frequency Reference Selection 1	0: Digital operator 1: Analog input terminals 2: MEMOBUS/Modbus communications 3: Option PCB 4: Pulse input (terminal RP)	Default: 1 Min: 0 Max: 4
b1-02	Run Command Selection 1	0: Digital operator 1: Digital input terminals 2: MEMOBUS/Modbus communications 3: Option PCB	Default: 1 Min: 0 Max: 3
b1-03	Stopping Method Selection	0: Ramp to stop 1: Coast to stop 2: DC Injection Braking to stop 3: Coast with timer	Default: 0 Min: 0 Max: 3 *<87>*
b1-04	Reverse Operation Selection	0: Reverse enabled. 1: Reverse disabled.	Default: 0 Min: 0 Max: 1
b1-05	Action Selection below Minimum Output Frequency	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 Min: 0 Max: 3
b1-06	Digital Input Reading	0: Input status is read once and processed immediately (for quick response) 1: Input is read twice and processed only if the status is the same in both readings (robust against noisy signals)	Default: 1 Min: 0 Max: 1
b1-07	LOCAL/REMOTE Run Selection	0: An external Run command has to be cycled at the new source to be activated. 1: An external Run command at new source is accepted immediately.	Default: 0 Min: 0 Max: 1
b1-08	Run Command Selection while in Programming Mode	0: Run command not accepted while in the Programming Mode. 1: Run command accepted while in the Programming Mode. 2: Prohibit entering Programming Mode during run.	Default: 0 Min: 0 Max: 2
b1-14	Phase Order Selection	0: Standard 1: Switch phase order (reverses the direction of the motor)	Default: 0 Min: 0 Max: 1
b1-15	Frequency Reference Selection 2	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 Min: 0 Max: 4
b1-16	Run Command Selection 2	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 Min: 0 Max: 3
b1-17	Run Command at Power Up	0: Disregarded. A new Run command needs to be issued after power up. 1: Allowed. Motor will start immediately after power up if a Run command is already enabled.	Default: 0 Min: 0 Max: 1

<87> The setting range is 0 to 1 in CLV.

b2: DC Injection Braking and Short Circuit Braking

No.	Name	Description	Setting
b2-01	DC Injection Braking Start Frequency	Sets the frequency at which DC Injection Braking starts when “Ramp to stop” (b1-03 = 0) is selected.	Default: *<77>* Min: 0.0 Hz Max: 10.0 Hz
b2-02	DC Injection Braking Current	Sets the DC Injection Braking current as a percentage of the drive rated current.	Default: 50% Min: 0% Max: 100%
b2-03	DC Injection Braking Time at Start	Sets DC Injection Braking (Zero Speed Control when in CLV/PM) time at start. Disabled when set to 0.00 seconds.	Default: 0.00 s Min: 0.00 s Max: 10.00 s
b2-04	DC Injection Braking Time at Stop	Sets DC Injection Braking time at stop.	Default: *<77>* Min: 0.00 s Max: 10.00 s
b2-08	Magnetic Flux Compensation Value	Sets the magnetic flux compensation as a percentage of the no-load current value (E2-03).	Default: 0% Min: 0% Max: 1000%
b2-12	Short Circuit Brake Time at Start	Sets the time for Short Circuit Braking operation at start. *<32>*	Default: 0.00 s Min: 0.00 s Max: 25.50 s
b2-13	Short Circuit Brake Time at Stop	Sets the Short Circuit Braking operation time at stop. *<32>*	Default: 0.50 s Min: 0.00 s Max: 25.50 s

No.	Name	Description	Setting
b2-18	Short Circuit Braking Current	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%

<32> A coasting motor may require a braking resistor circuit to bring the motor to a stop in the required time.
<77> Default setting is determined by the control mode (A1-02).

b3: Speed Search

No.	Name	Description	Setting
b3-01	Speed Search Selection at Start	0: Disabled 1: Enabled	Default: <77> Min: 0 Max: 1
b3-02	Speed Search Deactivation Current	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: <77> Min: 0% Max: 200%
b3-03	Speed Search Deceleration Time	Sets output frequency reduction time during Speed Search.	Default: 2.0 s Min: 0.1 s Max: 10.0 s
b3-04	V/f Gain during Speed Search	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.	Default: <1> Min: 10% Max: 100%
b3-05	Speed Search Delay Time	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 s Max: 100.0 s
b3-06	Output Current 1 during Speed Search	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: <1> Min: 0.0 Max: 2.0
b3-10	Speed Search Detection Compensation Gain	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
b3-14	Bi-Directional Speed Search Selection	0: Disabled (uses the direction of the frequency reference) 1: Enabled (drive detects which way the motor is rotating)	Default: <77> Min: 0 Max: 1
b3-17	Speed Search Restart Current Level	Sets the Speed Search restart current level as a percentage of the drive rated current.	Default: 150% Min: 0% Max: 200%
b3-18	Speed Search Restart Detection Time	Sets the time to detect Speed Search restart.	Default: 0.10 s Min: 0.00 s Max: 1.00 s
b3-19	Number of Speed Search Restarts	Sets the number of times the drive can attempt to restart when performing Speed Search.	Default: 3 Min: 0 Max: 10
b3-24	Speed Search Method Selection	0: Current Detection 1: Speed Estimation	Default: 0 Min: 0 Max: 1
b3-25	Speed Search Wait Time	Sets the time the must wait between each Speed Search restart attempt.	Default: 0.5 s Min: 0.0 s Max: 30.0 s

<1> Default setting value varies by the drive model (o2-04).
<77> Default setting is determined by the control mode (A1-02).

b4: Timer Function

No.	Name	Description	Setting
b4-01	Timer Function On-Delay Time	Used to set the on-delay and off-delay times for a digital timer output (H2-□□=12). The output is triggered by a digital input programmed to H1-□□=18)	Default: 0.0 s Min: 0.0 s Max: 3000.0 s
b4-02	Timer Function Off-Delay Time		Default: 0.0 s Min: 0.0 s Max: 3000.0 s

b5: PID Control

No.	Name	Description	Setting
b5-01	PID Function Setting	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)	Default: 0 Min: 0 Max: 4
b5-02 RUN	Proportional Gain Setting (P)	Sets the proportional gain of the PID controller.	Default: 1.00 Min: 0.00 Max: 25.00
b5-03 RUN	Integral Time Setting (I)	Sets the integral time for the PID controller.	Default: 1.0 s Min: 0.0 s Max: 360.0 s
b5-04 RUN	Integral Limit Setting	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%

No.	Name	Description	Setting
b5-05 RUN	Derivative Time (D)	Sets D control derivative time.	Default: 0.00 s Min: 0.00 s Max: 10.00 s
b5-06 RUN	PID Output 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 RUN	PID Offset Adjustment	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 RUN	PID Primary Delay Time Constant	Sets a low pass filter time constant on the output of the PID controller.	Default: 0.00 s Min: 0.00 s Max: 10.00 s
b5-09	PID Output Level Selection	0: Normal output (direct acting) 1: Reverse output (reverse acting)	Default: 0 Min: 0 Max: 1
b5-10	PID Output Gain Setting	Sets the gain applied to the PID output.	Default: 1.00 Min: 0.00 Max: 25.00
b5-11	PID Output Reverse Selection	0: Negative PID output triggers zero limit. 1: Rotation direction reverses with negative PID output. When using setting 1, make sure reverse operation is permitted by parameter b1-04.	Default: 0 Min: 0 Max: 1
b5-12	PID Feedback Loss Detection Selection	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 Min: 0 Max: 5
b5-13	PID Feedback Low Detection Level	Sets the PID feedback loss detection level as a percentage of the maximum output frequency.	Default: 0% Min: 0% Max: 100%
b5-14	PID Feedback Low Detection Time	Sets a delay time for PID feedback loss.	Default: 1.0 s Min: 0.0 s Max: 25.5 s
b5-15	PID Sleep Function Start Level	Sets the frequency level that triggers the sleep function.	Default: 0.0 Hz Min: 0.0 Hz Max: 400.0 Hz
b5-16	PID Sleep Delay Time	Sets a delay time before the sleep function is triggered.	Default: 0.0 s Min: 0.0 s Max: 25.5 s
b5-17	PID Accel/Decel Time	Sets the acceleration and deceleration time to PID setpoint.	Default: 0.0 s Min: 0.0 s Max: 6000.0 s
b5-18	PID Setpoint Selection	0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1
b5-19	PID Setpoint Value	Sets the PID target value when b5-18 = 1. Set as a percentage of the maximum output frequency.	Default: 0.00% Min: 0.00% Max: 100.00%
b5-20	PID Setpoint Scaling	0: 0.01Hz units 1: 0.01% units (100% = max output frequency) 2: r/min (number of motor poles must entered) 3: User-set (set scaling to b5-38 and b5-39)	Default: 1 Min: 0 Max: 3
b5-34 RUN	PID Output Lower Limit	Sets the minimum output possible from the PID controller as a percentage of the maximum output frequency.	Default: 0.00% Min: -100.0% Max: 100.0%
b5-35 RUN	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% Max: 1000.0%
b5-36	PID Feedback High Detection Level	Sets the PID feedback high detection level as a percentage of the maximum output frequency.	Default: 100% Min: 0% Max: 100%
b5-37	PID Feedback High Detection Time	Sets the PID feedback high level detection delay time.	Default: 1.0 s Min: 0.0 s Max: 25.5 s
b5-38	PID Setpoint User Display	Sets the display value of U5-01 and U5-04 when the maximum frequency is output.	Default: <5> Min: 1 Max: 60000
b5-39	PID Setpoint Display Digits	0: No decimal places 1: One decimal places 2: Two decimal places 3: Three decimal places	Default: <5> Min: 0 Max: 3
b5-40	Frequency Reference Monitor Content during 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 Min: 0 Max: 1

<5> Default setting is dependent on PID setpoint scaling (b5-20).

b6: Dwell Function

No.	Name	Description	Setting
b6-01	Dwell Reference at Start	Parameters b6-01 and b6-02 set the frequency to hold and the time to maintain that frequency at start. 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 Hz Max: 400.0 Hz
b6-02	Dwell Time at Start		Default: 0.0 s Min: 0.0 s Max: 10.0 s
b6-03	Dwell Frequency at Stop		Default: 0.0 Hz Min: 0.0 Hz Max: 400.0 Hz
b6-04	Dwell Time at Stop		Default: 0.0 s Min: 0.0 s Max: 10.0 s

b7: Droop Control

No.	Name	Description	Setting
b7-01 RUN	Droop Control Gain	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 RUN	Droop Control Delay Time.	Used to adjust the responsiveness of Droop Control.	Default: 0.05 s Min: 0.03 s Max: 2.00 s

b8: Energy Saving

No.	Name	Description	Setting
b8-01	Energy Saving Control Selection	0: Disabled 1: Enabled	Default: *<77>* Min: 0 Max: 1
b8-02 RUN	Energy Saving Gain	Sets the gain used for Energy Saving.	Default: *<77>* Min: 0.0 Max: 10.0
b8-03 RUN	Energy Saving Control Filter Time Constant	Sets a time constant for Energy Saving.	Default: *<69>* Min: 0.00 s Max: 10.00 s
b8-04	Energy Saving Coefficient Value	Determines the level of maximum motor efficiency. Setting range is 0.0 to 2000.0 for drives 3.7 kW and smaller.	Default: *<1>* *<51>* Min: 0.00 Max: 655.00
b8-05	Power Detection Filter Time	Sets a time constant filter for output power detection.	Default: 20 ms Min: 0 ms Max: 2000 ms
b8-06	Search Operation Voltage Limit	Sets the limit for the voltage search operation as a percentage of the motor rated voltage.	Default: 0% Min: 0% Max: 100%

<1> Default setting value varies by the drive model (o2-04).
<51> Parameter value changes automatically if E2-11 is manually changed or changed by Auto-Tuning.
<69> Default setting is determined by the control mode (A1-02) and the drive model (o2-04).
<77> Default setting is determined by the control mode (A1-02).

b9: Zero Servo

No.	Name	Description	Setting
b9-01	Zero Servo Gain	Sets the position loop gain for the Zero Servo function.	Default: 5 Min: 0 Max: 100
b9-02	Zero Servo Completion Width	Sets the range to trigger an output terminal set for “Zero Servo Complete” during Zero Servo operation.	Default: 10 Min: 0 Max: 16383

■ C: Tuning

C parameters are used to adjust the acceleration and deceleration times, S-curves, slip compensation, torque compensation, and carrier frequency selections.

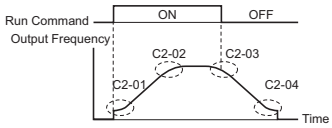
C1: Acceleration and Deceleration Times

No.	Name	Description	Setting
C1-01 RUN	Acceleration Time 1	Sets the time to accelerate from 0 to maximum frequency.	Default: 10.0 s Min: 0.0 s Max: 6000.0 s *<6>*
C1-02 RUN	Deceleration Time 1	Sets the time to decelerate from maximum frequency to 0.	

No.	Name	Description	Setting
C1-03 RUN	Acceleration Time 2	Sets the time to accelerate from 0 to maximum frequency.	Default: 10.0 s Min: 0.0 s Max: 6000.0 s <6>
C1-04 RUN	Deceleration Time 2	Sets the time to decelerate from maximum frequency to 0.	
C1-05 RUN	Acceleration Time 3 (Motor 2 Accel Time 1)	Sets the time to accelerate from 0 to maximum frequency.	Default: 10.0 s Min: 0.0 s Max: 6000.0 s <6>
C1-06 RUN	Deceleration Time 3 (Motor 2 Decel Time 1)	Sets the time to decelerate from maximum frequency to 0.	
C1-07 RUN	Acceleration Time 4 (Motor 2 Accel Time 2)	Sets the time to accelerate from 0 to maximum frequency.	
C1-08 RUN	Deceleration Time 4 (Motor 2 Decel Time 2)	Sets the time to decelerate from maximum frequency to 0.	
C1-09	Fast Stop Time	Sets the time for the Fast Stop function.	Default: 10.0 s Min: 0.0 s Max: 6000.0 s <6>
C1-10	Accel/Decel Time Setting Units	0: 0.01 s (0.00 to 600.00 s) 1: 0.1 s (0.0 to 6000.0 s)	Default: 1 Min: 0 Max: 1
C1-11	Accel/Decel Time Switching Frequency	Sets the frequency to switch between accel/decel time settings	Default: 0.0 Hz Min: 0.0 Hz Max: 400.0 Hz

<6> 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.

C2: S-Curve Characteristics

No.	Name	Description	Setting
C2-01	S-Curve Characteristic at Accel Start	The S-curve can be controlled at the four points shown below. 	Default: 0.20 s <77> Min: 0.00 s Max: 10.00 s
C2-02	S-Curve Characteristic at Accel End		Default: 0.20 s Min: 0.00 s Max: 10.00 s
C2-03	S-Curve Characteristic at Decel Start		Default: 0.20 s Min: 0.00 s Max: 10.00 s
C2-04	S-Curve Characteristic at Decel End		Default: 0.00 s Min: 0.00 s Max: 10.00 s

<77> Default setting is determined by the control mode (A1-02).

C3: Slip Compensation

No.	Name	Description	Setting
C3-01 RUN	Slip Compensation Gain	Sets the gain for the motor slip compensation function used for motor 1.	Default: <77> Min: 0.0 Max: 2.5
C3-02 RUN	Slip Compensation Primary Delay Time	Adjusts the slip compensation function delay time used for motor 1.	Default: <77> Min: 0 ms Max: 10000 ms
C3-03	Slip Compensation 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	Slip Compensation Selection during Regeneration	0: Disabled. 1: Enabled above 6 Hz. 2: Enabled whenever slip compensation is possible.	Default: 0 Min: 0 Max: 2
C3-05	Output Voltage Limit Operation Selection	0: Disabled. 1: Enabled. Automatically decreases motor flux when output voltage saturation is reached.	Default: 0 Min: 0 Max: 1
C3-21 RUN	Motor 2 Slip Compensation Gain	Sets the slip compensation gain used for motor 2.	Default: <67> Min: 0.0 Max: 2.5
C3-22 RUN	Motor 2 Slip Compensation Primary Delay Time	Sets the slip compensation delay time used for motor 2.	Default: <77> Min: 0 ms Max: 10000 ms
C3-23	Motor 2 Slip Compensation Limit	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	Motor 2 Slip Compensation Selection During Regeneration	0: Disabled. 1: Enabled above 6 Hz. 2: Enabled whenever slip compensation is possible.	Default: 0 Min: 0 Max: 2

<67> Default setting is determined by the control mode for motor 2 (E3-01).

<77> Default setting is determined by the control mode (A1-02).

C4: Torque Compensation

No.	Name	Description	Setting
C4-01 RUN	Torque Compensation Gain	Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque. Used for motor 1.	Default: <77> Min: 0.00 Max: 2.50
C4-02 RUN	Torque Compensation Primary Delay Time	Sets the torque compensation filter time.	Default: <67> Min: 0 ms Max: 60000 ms
C4-03	Torque Compensation at Forward Start	Sets torque compensation at forward start as a percentage of motor torque.	Default: 0.0% Min: 0.0% Max: 200.0%
C4-04	Torque Compensation at Reverse Start	Sets torque compensation at reverse start as a percentage of motor torque.	Default: 0.0% Min: -200.0% Max: 0.0%
C4-05	Torque Compensation Time Constant	Sets the time constant for torque compensation at forward start and reverse start (C4-03 and C4-04).	Default: 10 ms Min: 0 ms Max: 200 ms
C4-06	Torque Compensation Primary Delay Time 2	Sets the torque compensation time 2.	Default: 150 ms Min: 0 ms Max: 10000 ms
C4-07 RUN	Motor 2 Torque Compensation Gain	Sets the torque compensation gain used for motor 2.	Default: 1.00 Min: 0.00 Max: 2.50

<67> Default setting is determined by the control mode for motor 2 (E3-01).
<77> Default setting is determined by the control mode (A1-02).

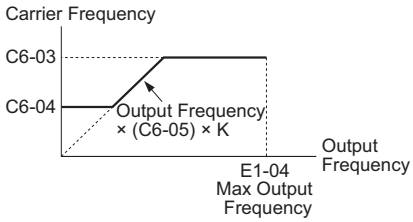
C5: Automatic Speed Regulator (ASR)

No.	Name	Description	Setting
C5-01 RUN	ASR Proportional Gain 1	Sets the proportional gain of the speed control loop (ASR).	Default: <77> Min: 0.00 Max: 300.00 <71>
C5-02 RUN	ASR Integral Time 1	Sets the integral time of the speed control loop (ASR).	Default: <77> Min: 0.000 s Max: 10.000 s
C5-03 RUN	ASR Proportional Gain 2	Sets the speed control gain 2 of the speed control loop (ASR).	Default: <77> Min: 0.00 Max: 300.00 <71>
C5-04 RUN	ASR Integral Time 2	Sets the integral time 2 of the speed control loop (ASR).	Default: <77> Min: 0.000 s Max: 10.000 s
C5-05	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	ASR Primary Delay Time Constant	Sets the filter time constant for the time from the speed loop to the torque command output.	Default: <77> Min: 0.000 s Max: 0.500 s
C5-07	ASR Gain Switching Frequency	Sets the frequency for switching between proportional gain 1, 2 and integral time 1, 2.	Default: 0.0 Hz Min: 0.0 Hz Max: 400.0 Hz
C5-08	ASR Integral Limit	Sets the ASR integral upper limit as a percentage of maximum output frequency (E1-04).	Default: 400% Min: 0% Max: 400%
C5-12	Integral Operation during Accel/ Decel	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 Min: 0 Max: 1
C5-17	Motor Inertia	Sets the motor inertia. This value is automatically set during ASR or Inertia Auto-Tuning.	Default: <10> <57> Min: 0.0001 kgm^2 Max: 600.00 kgm^2
C5-18	Load Inertia Ratio	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 RUN	Motor 2 ASR Proportional Gain 1	Sets the proportional gain of the speed control loop (ASR) for motor 2.	Default: <67> Min: 0.00 Max: 300.00 <71>
C5-22 RUN	Motor 2 ASR Integral Time 1	Sets the integral time of the speed control loop (ASR) for motor 2.	Default: <67> Min: 0.000 s Max: 10.000 s
C5-23 RUN	Motor 2 ASR Proportional Gain 2	Sets the speed control gain 2 of the speed control loop (ASR) for motor 2.	Default: <67> Min: 0.00 Max: 300.00 <71>
C5-24 RUN	Motor 2 ASR Integral Time 2	Sets the integral time 2 of the speed control loop (ASR) for motor 2.	Default: <67> Min: 0.000 s Max: 10.000 s
C5-25	Motor 2 ASR Limit	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%

No.	Name	Description	Setting
C5-26	Motor 2 ASR Primary Delay Time Constant	Sets the filter time constant for the time from the speed loop to the torque command output used for motor 2.	Default: 0.004 s Min: 0.000 s Max: 0.500 s
C5-27	Motor 2 ASR Gain Switching Frequency	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 Hz Max: 400.0 Hz
C5-28	Motor 2 ASR Integral Limit	Sets the ASR integral upper limit for motor 2 as a percentage of maximum output frequency (E3-04).	Default: 400% Min: 0% Max: 400%
C5-32	Integral Operation during Accel/ Decel for Motor 2	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 Min: 0 Max: 1
C5-37	Motor 2 Inertia	Sets the inertia of motor 2 alone without the load. This value is automatically set during ASR or Inertia Auto-Tuning.	Default: *<57>* Min: 0.0001 kgm^2 Max: 600.00 kgm^2
C5-38	Motor 2 Load Inertia Ratio	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

<10> Default setting value is dependent on the motor code set to E5-01.
<57> Default setting value is dependent on the drive model set to o2-04 and the Drive Duty set to C6-01.
<67> Default setting is determined by the control mode for motor 2 (E3-01).
<71> The setting range is 1.00 to 300.0 in CLV and AOLV/PM.
<77> Default setting is determined by the control mode (A1-02).

C6: Carrier Frequency

No.	Name	Description	Setting
C6-01	Drive Duty Selection	0: Heavy Duty (HD) for constant torque applications. 1: Normal Duty (ND) for variable torque applications.	Default: 0 Min: 0 Max: 1
C6-02	Carrier Frequency Selection	1: 2.0 kHz 2: 5.0 kHz 3: 8.0 kHz 4: 10.0 kHz 5: 12.5 kHz 6: 15.0 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)	Default: *<3>* Min: 1 Max: F
C6-03	Carrier Frequency Upper Limit	**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: *<8>* Min: 1.0 kHz Max: 15.0 kHz
C6-04	Carrier Frequency Lower Limit		Default: *<8>* Min: 1.0 kHz Max: 15.0 kHz
C6-05	Carrier Frequency Proportional Gain		Default: *<8>* Min: 0 Max: 99
C6-09	Carrier Frequency during Rotational Auto-Tuning	0: Carrier Frequency = 5 kHz 1: Setting value for C6-03	Default: 0 Min: 0 Max: 1

<3> Default setting value is dependent on the drive model (o2-04), the control mode (A1-02), and the Drive Duty (C6-01).
<8> Default setting value is dependent on parameter C6-02, Carrier Frequency Selection.

■ d: References

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

d1: Frequency Reference

No.	Name	Description	Setting
d1-01 RUN	Frequency Reference 1	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03.	Default: 0.00 Hz Min: 0.00 Hz Max: 400.00 Hz *<19> <72>*
d1-02 RUN	Frequency Reference 2		
d1-03 RUN	Frequency Reference 3		

No.	Name	Description	Setting
d1-04 RUN	Frequency Reference 4	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03.	Default: 0.00 Hz Min: 0.00 Hz Max: 400.00 Hz <19> <72>
d1-05 RUN	Frequency Reference 5		
d1-06 RUN	Frequency Reference 6		
d1-07 RUN	Frequency Reference 7		
d1-08 RUN	Frequency Reference 8		
d1-09 RUN	Frequency Reference 9		
d1-10 RUN	Frequency Reference 10		
d1-11 RUN	Frequency Reference 11		
d1-12 RUN	Frequency Reference 12		
d1-13 RUN	Frequency Reference 13		
d1-14 RUN	Frequency Reference 14		
d1-15 RUN	Frequency Reference 15		
d1-16 RUN	Frequency Reference 16		
d1-17 RUN	Jog Frequency Reference	Sets the Jog frequency reference. Setting units are determined by parameter o1-03.	Default: 6.00 Hz Min: 0.00 Hz Max: 400.00 Hz <19> <72>

<19> Range upper limit is determined by the maximum output frequency (E1-04) and the upper limit of the frequency reference (d2-01).
<72> The setting range is 0.0 to 66.0 in AOLV/PM.

d2: Frequency Upper/Lower Limits

No.	Name	Description	Setting
d2-01	Frequency Reference 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	Frequency Reference 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	Master Speed Reference 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%

d3: Jump Frequency

No.	Name	Description	Setting
d3-01	Jump Frequency 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: 0.0 Hz Min: 0.0 Hz Max: 400.0 Hz
d3-02	Jump Frequency 2		
d3-03	Jump Frequency 3		
d3-04	Jump Frequency Width	Sets the dead-band width around each selected prohibited frequency reference point.	Default: 1.0 Hz Min: 0.0 Hz Max: 20.0 Hz

d4: Frequency Reference Hold and Up/Down 2 Function

No.	Name	Description	Setting
d4-01	Frequency Reference Hold Function Selection	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 Min: 0 Max: 1

No.	Name	Description	Setting
d4-03 RUN	Frequency Reference Bias Step (Up/Down 2)	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 Hz Max: 99.99 Hz
d4-04 RUN	Frequency Reference Bias Accel/Decel (Up/Down 2)	0: Use selected accel/decel time. 1: Use accel/decel time 4 (C1-07 and C1-08).	Default: 0 Min: 0 Max: 1
d4-05 RUN	Frequency Reference Bias Operation Mode Selection (Up/Down 2)	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 Min: 0 Max: 1
d4-06	Frequency Reference Bias (Up/Down 2)	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 RUN	Analog Frequency Reference Fluctuation Limit (Up/Down 2)	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 RUN	Frequency Reference Bias Upper Limit (Up/Down 2)	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: 0.0% Min: 0.0% Max: 100.0%
d4-09 RUN	Frequency Reference Bias Lower Limit (Up/Down 2)	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%
d4-10	Up/Down Frequency Reference Limit Selection	0: The lower limit is determined by d2-02 or an analog input. 1: The lower limit is determined by d2-02.	Default: 0 Min: 0 Max: 1

d5: Torque Control

No.	Name	Description	Setting
d5-01	Torque Control Selection	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 Min: 0 Max: 1
d5-02	Torque Reference Delay 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 ms Max: 1000 ms
d5-03	Speed Limit Selection	1: Limit set by the frequency reference in b1-01. 2: Limit set by d5-04.	Default: 1 Min: 1 Max: 2
d5-04	Speed Limit	Sets the speed limit during Torque Control as a percentage of the maximum output frequency. Enabled when d5-03 = 2. A negative setting set a limit in the opposite direction of the Run command.	Default: 0% Min: -120% Max: 120%
d5-05	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	Speed/Torque Control Switchover Time	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 ms Max: 1000 ms
d5-08	Unidirectional Speed Limit Bias	0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1

d6: Field Weakening and Field Forcing

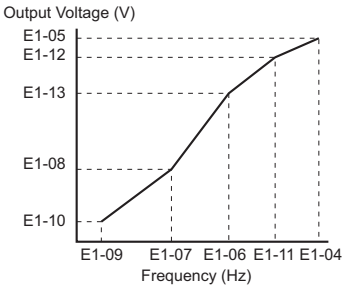
No.	Name	Description	Setting
d6-01	Field Weakening Level	Sets the drive output voltage for the Field Weakening function as a percentage of the maximum output voltage. Enabled when a multi-function input is set for Field Weakening (H1-□□ = 63).	Default: 80% Min: 0% Max: 100%
d6-02	Field Weakening Frequency Limit	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 Hz Max: 400.0 Hz
d6-03	Field Forcing Selection	0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1
d6-06	Field Forcing 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%

d7: Offset Frequency

No.	Name	Description	Setting
d7-01 RUN	Offset Frequency 1	Added to the frequency reference when the digital input “Frequency offset 1” (H1-□□ = 44) is switched on.	Default: 0.0% Min: -100.0% Max: 100.0%
d7-02 RUN	Offset Frequency 2	Added to the frequency reference when the digital input “Frequency offset 2” (H1-□□ = 45) is switched on.	Default: 0.0% Min: -100.0% Max: 100.0%
d7-03 RUN	Offset Frequency 3	Added to the frequency reference when the digital input “Frequency offset 3” (H1-□□ = 46) is switched on.	Default: 0.0% Min: -100.0% Max: 100%

■ E: Motor Parameters

E1: V/f Pattern for Motor 1

No.	Name	Description	Setting
E1-01	Input Voltage Setting	This parameter must be set to the power supply voltage. **WARNING!** Drive input voltage (not motor voltage) must be set in E1-01 for the protective features of the drive to function properly. Failure to do so may result in equipment damage and/or death or personal injury.	Default: 200 V *<24>* Min: 155 V Max: 255 V
E1-03	V/f Pattern Selection	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 3 7: 60 Hz, Variable torque 4 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	Default: F *<25>* Min: 0 Max: F
E1-04	Maximum Output Frequency	These parameters are only applicable 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 four frequencies are set according to these rules: E1-09 ≤ E1-07 < E1-06 ≤ E1−11 ≤ E1-04  **Note: Some parameters may not be available depending on the control mode.** • E1-07, E1-08 and E-10 are available only in the following control modes: V/f Control, V/f with PG, Open Loop Vector. • E1-11, E1-12 and E-13 are available only in the following control modes: V/f Control, V/f with PG, Open Loop Vector, Closed Loop Vector.	Default: *<2> <10>* Min: 40.0 Max: 400.0 *<82>*
E1-05	Maximum Voltage		Default: *<2> <24> <10>* Min: 0.00 V Max: 255.0 V
E1-06	Base Frequency		Default: *<2> <10>* Min: 0.0 Max: E1-04
E1-07	Middle Output Frequency		Default: *<2>* Min: 0.0 Max: E1-04
E1-08	Middle Output Frequency Voltage		Default: *<2> <24>* Min: 0.0 V Max: 255.0 V
E1-09	Minimum Output Frequency		Default: *<2> <10>* Min: 0.0 Max: E1-04 *<72> <82>*
E1-10	Minimum Output Frequency Voltage		Default: *<2> <24>* Min: 0.0 V Max: 255.0 V
E1-11 *<26>*	Middle Output Frequency 2		Default: 0.0 Hz Min: 0.0 Max: E1-04 *<72>*
E1-12 *<26>*	Middle Output Frequency Voltage 2		Default: 0.0 V Min: 0.0 V Max: 255.0 V *<24>*
E1-13	Base Voltage		Default: 0.0 V *<24> <79>* Min: 0.0 V Max: 255.0 V

<2> Default setting value is dependent on the control method (A1-02). The value shown is for V/f Control (A1-02 = 0).
<10> Default setting value is dependent on the motor code set to E5-01.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<25> Parameter setting value is not reset to the default value when the drive is initialized.
<26> 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.
<72> The setting range is 0.0 to 66.0 in AOLV/PM.
<79> When Auto-Tuning is performed, E1-13 and E1-05 will be set to the same value.
<82> Setting range varies according to the motor code entered to E5-01 when using OLV/PM.

E2: Motor 1 Parameters

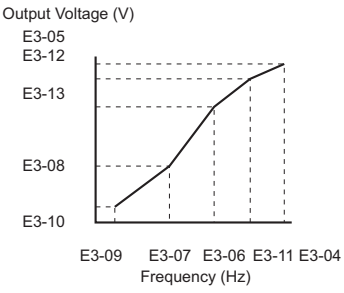
No.	Name	Description	Setting
E2-01	Motor Rated Current	Sets the motor nameplate full load current in Amps. Automatically set during Auto-Tuning.	Default: *<57>* Min: 10% of drive rated current Max: 200% of drive rated current *<27>*
E2-02	Motor Rated Slip	Sets the motor rated slip. Automatically set during Auto-Tuning.	Default: *<57>* Min: 0.00 Hz Max: 20.00 Hz
E2-03	Motor No-Load Current	Sets the no-load current for the motor. Automatically set during Auto-Tuning.	Default: *<57>* Min: 0 A Max: E2-01 *<27>*
E2-04	Number of Motor Poles	Sets the number of motor poles. Automatically set during Auto-Tuning.	Default: 4 Min: 2 Max: 48

No.	Name	Description	Setting
E2-05	Motor Line-to-Line Resistance	Sets the phase-to-phase motor resistance. Automatically set during Auto-Tuning.	Default: <57> Min: 0.000 Ω Max: 65.000 Ω
E2-06	Motor Leakage Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage. Automatically set during Auto-Tuning.	Default: <57> Min: 0.0% Max: 40.0%
E2-07	Motor Iron-Core Saturation Coefficient 1	Sets the motor iron saturation coefficient at 50% of magnetic flux. Automatically set during Auto-Tuning.	Default: 0.50 Min: E2-07 Max: 0.50
E2-08	Motor Iron-Core Saturation Coefficient 2	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	Motor 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	Motor Iron Loss for Torque Compensation	Sets the motor iron loss.	Default: <57> Min: 0 W Max: 65535 W
E2-11	Motor 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 <80>

<1> Default setting value is dependent on the drive model set to o2-04.
<27> Setting units are determined by the drive model set to o2-04. Less than 11 kW: two decimal points, 11 kW and above: one decimal point.
<57> Default setting value is dependent on the drive model (o2-04) and the Drive Duty (C6-01).
<80> The setting value has two decimal places for drives up to 300 kW, and one decimal place for larger drives.

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.	Name	Description	Setting
E3-01	Motor 2 Control Mode Selection	0: V/f Control 1: V/f Control with PG 2: Open Loop Vector Control 3: Closed Loop Vector Control	Default: 0 Min: 0 Max: 3
E3-04	Motor 2 Maximum Output Frequency	These parameters are only applicable when E1-03 is set to F. To set linear V/f characteristics, set the same values for E3-07 and E3-09. In this case, the setting for E3-08 will be disregarded. Ensure that the four frequencies are set according to these rules or an oPE10 fault will occur: E3-09 ≤ E3-07 < E3-06 ≤ E3–11 ≤ E3-04  **Note:** E3-07 and E3-08 are only available in the following control modes: V/f, V/f w/PG and OLV.	Default: <53> Min: 40.0 Max: 400.0
E3-05	Motor 2 Maximum Voltage		Default: <24> <53> Min: 0.0 V Max: 255.0 V
E3-06	Motor 2 Base Frequency		Default: <53> Min: 0.0 Max: E3-04
E3-07	Motor 2 Mid Output Frequency		Default: <53> Min: 0.0 Max: E3-04
E3-08	Motor 2 Mid Output Frequency Voltage		Default: <24> <53> Min: 0.0 V Max: 255.0 V
E3-09	Motor 2 Minimum Output Frequency		Default: <53> Min: 0.0 Max: E3-04
E3-10	Motor 2 Minimum Output Frequency Voltage		Default: <24> <53> Min: 0.0 V Max: 255.0 V
E3-11	Motor 2 Mid Output Frequency 2		Default: 0.0 <52> Min: 0.0 Max: E3-04 <72>
E3-12 <52>	Motor 2 Mid Output Frequency Voltage 2		Default: 0.0 V <24> Min: 0.0 V Max: 255.0 V
E3-13	Motor 2 Base Voltage		Default: 0.0 V <24> <79> Min: 0.0 V Max: 255.0 V

<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<52> Parameter ignored when E3-11 (Motor 2 Mid Output Frequency 2) and E3-12 (Motor 2 Mid Output Frequency Voltage 2) are set to 0.
<53> Default setting depends on the control mode for motor 2 set in parameter E3-01. The value shown here is for V/f Control.
<72> The setting range is 0.0 to 66.0 in AOLV/PM.
<79> When Auto-Tuning is performed, E1-13 and E1-05 will be 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.	Name	Description	Setting
E4-01	Motor 2 Rated Current	Sets the full load current for motor 2. Automatically set during Auto-Tuning.	Default: <57> Min: 10% of drive rated current Max: 200% of drive rated current <27>
E4-02	Motor 2 Rated Slip	Sets the rated slip for motor 2. Automatically set during Auto-Tuning.	Default: <57> Min: 0.00 Hz Max: 20.00 Hz <27>
E4-03	Motor 2 Rated No-Load Current	Sets the no-load current for motor 2. Automatically set during Auto-Tuning.	Default: <57> Min: 0 A Max: E4-01 <27>
E4-04	Motor 2 Motor Poles	Sets the number of poles of motor 2. Automatically set during Auto-Tuning.	Default: 4 Min: 2 Max: 48
E4-05	Motor 2 Line-to-Line Resistance	Sets the phase-to-phase resistance for motor 2. Automatically set during Auto-Tuning.	Default: <57> Min: 0.000 Ω Max: 65.000 Ω
E4-06	Motor 2 Leakage 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: <57> Min: 0.0% Max: 40.0%
E4-07	Motor 2 Motor Iron-Core Saturation Coefficient 1	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	Motor 2 Motor Iron-Core Saturation Coefficient 2	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	Motor 2 Mechanical Loss	Sets the motor mechanical loss for motor 2 as a percentage of motor rated power (kW).	Default: 0.0% Min: 0.0% Max: 10.0%
E4-10	Motor 2 Iron Loss	Sets the motor iron loss.	Default: <57> Min: 0 W Max: 65535 W
E4-11	Motor 2 Rated Power	Sets the motor rated capacity in kW. Automatically set during Auto-Tuning.	Default: <1> Min: 0.00 kW Max: 650.00 kW <80>

<1> Default setting value is determined by the drive model (o2-04).
<27> Setting units are determined by the drive model (o2-04). Less than 11 kW: two decimal points, 11 kW and above: one decimal point.
<57> Default setting value is dependent on the drive model (o2-04) and the Drive Duty (C6-01).
<80> The setting value has two decimal places for drives up to 300 kW, and one decimal place for larger drives.

E5: PM Motor Settings

No.	Name	Description	Setting
E5-01 <25>	Motor Code Selection	Enter the Yaskawa motor code for the PM motor being used. Various motor parameters are automatically set based on the value of this parameter. Setting that were changed manually will be overwritten by the defaults of the selected motor code. **Note:** Set to FFFF when using a non-Yaskawa PM motor.	Default: <38> <57> <77> Min: 0000 Max: FFFF <81>
E5-02 <25>	Motor Rated Power	Sets the rated capacity of the motor.	Default: <10> Min: 0.10 kW Max: 650.00 kW <80>
E5-03 <25>	Motor Rated Current	Sets the motor rated current.	Default: <10> Min: 10% of drive rated current Max: 200% of drive rated current <27>
E5-04 <25>	Number of Motor Poles	Sets the number of motor poles.	Default: <10> Min: 2 Max: 48
E5-05 <25>	Motor Stator Resistance	Set the resistance for each motor phase.	Default: <10> Min: 0.000 Ω Max: 65.000 Ω
E5-06 <25>	Motor d-Axis Inductance	Sets the d-axis inductance for the PM motor.	Default: <10> Min: 0.00 mH Max: 300.00 mH
E5-07 <25>	Motor q-Axis Inductance	Sets the q-axis inductance for the PM motor.	Default: <10> Min: 0.00 mH Max: 600.00 mH

No.	Name	Description	Setting
E5-09 <25>	Motor Induction Voltage Constant 1	Set 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. When setting this parameter, E5-24 should be set to 0.	Default: <10> Min: 0.0 mV/(rad/s) Max: 2000.0 mV/(rad/s)
E5-11	Encoder Z-pulse Offset	Sets the offset between the rotor magnetic axis and the Z pulse of an incremental encoder. Set during Z Pulse Offset Tuning.	Default: 0.0 deg Min: -180 deg Max: 180 deg
E5-24 <25>	Motor Induction Voltage Constant 2	Set 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. When setting this parameter, E5-24 should be set to 0.	Default: <10> Min: 0.0 mV/(r/min) Max: 2000.0 mV/(r/min)

<10> Default setting value is dependent on the motor code set to E5-01.
<25> Parameter setting value is not reset to the default value when the drive is initialized.
<27> Setting units are determined by the drive model (o2-04). Less than 11 kW: two decimal points, 11 kW and above: one decimal point.
<38> If using a Yaskawa SMRA Series SPM Motor, the default setting is 1800 r/min.
<57> Default setting value is determined by the drive model (o2-04) and the Drive Duty (C6-01).
<77> Default setting value is determined by the control mode (A1-02).
<80> The setting value has two decimal places for drives up to 300 kW, and one decimal place for larger drives.
<81> Selections may vary depending on the motor code entered to E5-01.

■ F: Options

F parameters are used to program the drive for PG feedback from the motor and to function with option cards.

F1: PG Speed Control Card (PG-B3 / PG-X3)

Parameters F1-01, F1-05, F1-06, F1-12, F1-13, and F1-18 through F1-21 are used to set up a PG option card plugged into option port CN5-C of the drive. They include “PG 1” in the parameter name.

Parameters F1-21 through F1-37 are used to set up a PG option card plugged into option port CN5-B of the drive. They include “PG 2” in the parameter name.

Other parameters in the F1 group are used to set operation for PG options plugged into port CN5-C and CN5-B.

No.	Name	Description	Setting
F1-01	PG 1 Pulses Per Revolution	Sets the number of PG (pulse generator or encoder) pulses. Sets the number of pulses per motor revolution.	Default: 600 ppr Min: 0 ppr Max: 60000 ppr
F1-02	Operation Selection at PG Open Circuit (PGo)	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 Min: 0 Max: 3
F1-03	Operation Selection at Overspeed (oS)	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 Min: 0 Max: 3
F1-04	Operation Selection at Deviation	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 Min: 0 Max: 3
F1-05	PG 1 Rotation Selection	0: Pulse A leads 1: Pulse B leads	Default: 0 Min: 0 Max: 1
F1-06	PG 1 Division Rate for PG Pulse Monitor	Sets the division ratio for the pulse monitor used of the PG option card installed to port CN5-C. By setting “xyz”, the division ratio becomes = [(1 + x) / yz]. If only using the A pulse for one track input, then the input ratio will be 1:1, regardless of what F1-06 is set to.	Default: 1 Min: 1 Max: 132
F1-08	Overspeed Detection Level	Sets the overspeed detection level as a percentage of the maximum output frequency.	Default: 115% Min: 0% Max: 120%
F1-09	Overspeed Detection Delay Time	Sets the time in seconds for an overspeed situation to trigger a fault (oS).	Default: <77> Min: 0.0 s Max: 2.0 s
F1-10	Excessive Speed Deviation Detection Level	Sets the speed deviation detection level as a percentage of the maximum output frequency.	Default: 10% Min: 0% Max: 50%
F1-11	Excessive Speed Deviation Detection Delay Time	Sets the time in seconds for a speed deviation situation to trigger a fault (dEv).	Default: 0.5 s Min: 0.0 s Max: 10.0 s
F1-12	PG 1 Gear Teeth 1	Sets the gear ratio between the motor shaft and the encoder (PG). A gear ratio of 1 will be used if either of these parameters is set to 0.	Default: 0 Min: 0 Max: 1000
F1-13	PG 1 Gear Teeth 2		Default: 0 Min: 0 Max: 1000

No.	Name	Description	Setting
F1-14	PG Open-Circuit Detection Time	Sets the time required to trigger a PG Open fault (PGo).	Default: 2.0 s Min: 0.0 s Max: 10.0 s
F1-18	dv3 Detection Selection	0: Disabled 1: Enabled	Default: 10 Min: 0 Max: 10
F1-19	dv4 Detection Selection	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	PG Option Card Disconnect Detection 1	0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1
F1-21	PG 1 Signal Selection	0: A pulse detection 1: AB pulse detection	Default: 0 Min: 0 Max: 1
F1-30	PG Card Option Port for Motor 2 Selection	Sets the port for the PG option card used by motor 2. 0: CN5-C 1: CN5-B	Default: 1 Min: 0 Max: 1
F1-31	PG 2 Pulses Per Revolution	Sets the number of pulses for a PG option card connected to port CN5-B.	Default: 600 ppr Min: 0 ppr Max: 60000 ppr
F1-32	PG 2 Rotation Selection	0: Pulse A leads 1: Pulse B leads	Default: 0 Min: 0 Max: 1
F1-33	PG 2 Gear Teeth 1	Sets the gear ratio between the motor shaft and the encoder (PG). A gear ratio of 1 will be used if either of these parameters is set to 0.	Default: 0 Min: 0 Max: 1000
F1-34	PG 2 Gear Teeth 2		Default: 0 Min: 0 Max: 1000
F1-35	PG 2 Division Rate for Pulse Monitor	Sets the division ratio for the pulse monitor used of the PG option card 2 installed to port CN5-B. By setting “xyz”, the division ratio becomes = [(1 + x) / yz].	Default: 1 Min: 1 Max: 132
F1-36	PG Option Card Disconnect Detection 2	0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1
F1-37	PG 2 Signal Selection	0: A pulse detection 1: AB pulse detection	Default: 0 Min: 0 Max: 1

<77> Default setting is determined by the control mode (A1-02).

F2: Analog Input Card (AI-A3)

No.	Name	Description	Setting
F2-01	Analog Input Option Card Operation Selection	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 Min: 0 Max: 1
F2-02 RUN	Analog Input Option Card Gain	Sets the gain for the input signal to the analog card.	Default: 100.0% Min: -999.9% Max: 999.9%
F2-03 RUN	Analog Input Option Card 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 (DI-A3)

No.	Name	Description	Setting
F3-01	Digital Input Option Card Input Selection	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 When the digital operator units are set to be displayed in Hertz or user-set units (o1-03 = 2 or 3), the units for F3-01 are determined by parameter o1-03.	Default: 0 Min: 0 Max: 7
F3-03	Digital Input Option DI-A3 Data Length Selection	0: 8 bit 1: 12 bit 2: 16 bit	Default: 2 Min: 0 Max: 2

F4: Analog Monitor Card (AO-A3)

No.	Name	Description	Setting
F4-01	Terminal V1 Monitor Selection	Sets the monitor signal for output from terminal V1. Set this parameter to the last three digits of the desired U□-□□ monitor. Some U parameters are available only in certain control modes.	Default: 102 Min: 000 Max: 999

No.	Name	Description	Setting
F4-02 RUN	Terminal V1 Monitor Gain	Sets the gain for voltage output via terminal V1.	Default: 100.0% Min: -999.9% Max: 999.9%
F4-03	Terminal V2 Monitor Selection	Sets the monitor signal for output from terminal V2. Set this parameter to the last three digits of the desired U□-□□ monitor. Some U parameters are available only in certain control modes.	Default: 103 Min: 000 Max: 999
F4-04 RUN	Terminal V2 Monitor Gain	Sets the gain for voltage output via terminal V2.	Default: 50.0% Min: -999.9% Max: 999.9%
F4-05 RUN	Terminal V1 Monitor 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 RUN	Terminal V2 Monitor 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	Terminal V1 Signal Level	0: 0 to 10 V 1: -10 to 10 V	Default: 0 Min: 0 Max: 1
F4-08	Terminal V2 Signal Level		Default: 0 Min: 0 Max: 1

F5: Digital Output Card (DO-A3)

No.	Name	Description	Setting
F5-01	Terminal M1-M2 Output Selection	Sets the function for contact output terminals M1-M2, M3-M4, and photocoupler output terminals P1 through P6.	Default: 0 Min: 0 Max: 192
F5-02	Terminal M3-M4 Output Selection		Default: 1 Min: 0 Max: 192
F5-03	Terminal P1-PC Output Selection		Default: 2 Min: 0 Max: 192
F5-04	Terminal P2-PC Output Selection		Default: 4 Min: 0 Max: 192
F5-05	Terminal P3-PC Output Selection		Default: 6 Min: 0 Max: 192
F5-06	Terminal P4-PC Output Selection		Default: 37 Min: 0 Max: 192
F5-07	Terminal P5-PC Output Selection		Default: F Min: 0 Max: 192
F5-08	Terminal P6-PC Output Selection		Default: F Min: 0 Max: 192
F5-09	DO-A3 Output Mode Selection	0: Output terminals are each assigned separate output functions. 1: Binary code output 2: Use output terminal functions selected by parameters F5-01 through F5-08.	Default: 0 Min: 0 Max: 2

F6: Communication Option Card

F6-01 through F6-03 and F6-06 through F6-08 are common settings used for CC-Link, CANopen, DeviceNet, and PROFIBUS-DP option cards. Other parameters in the F6 group are used for communication protocol specific settings.

No.	Name	Description	Setting
F6-01	Communications Error Operation Selection	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 Min: 0 Max: 3
F6-02	External Fault from Comm. Option Detection Selection	0: Always detected 1: Detection during run only	Default: 0 Min: 0 Max: 1
F6-03	External Fault from Comm. Option Operation Selection	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 Min: 0 Max: 3
F6-04	bUS Error Detection Time	Set the delay time for error detection if a bus error occurs.	Default: 2.0 s Min: 0.0 s Max: 5.0 s
F6-06	Torque Reference/Torque Limit Selection from Comm. Option	0: Disabled.Torque reference/limit from option board disabled. 1: Enabled. Torque reference/limit from option board enabled.	Default: 0 Min: 0 Max: 1
F6-07	NetRef/ComRef Function Selection	0: Multi-step reference disabled (same as F7) 1: Multi-step reference enabled (same as V7)	Default: 0 Min: 0 Max: 1

No.	Name	Description	Setting
F6-08 <25>	Reset Communication Parameters	0: Communication-related parameters (F6-□□ and F7-□□) are not reset when the drive is initialized using A1-02. 1: Reset all communication-related parameters (F6-□□ and F7-□□) when the drive is initialized using A1-02.	Default: 0 Min: 0 Max: 1
F6-10	CC-Link Node Address	Sets the node address if a CC-Link option card is installed.	Default: 0 Min: 0 Max: 64
F6-11	CC-Link Communication Speed	0: 156 Kbps 1: 625 Kbps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps	Default: 0 Min: 0 Max: 4
F6-14	CC-Link bUS Error Auto Reset	0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1
F6-30	PROFIBUS-DP Node Address	Sets the node address.	Default: 0 Min: 0 Max: 125
F6-31	PROFIBUS-DP Clear Mode Selection	0: Resets drive operation with a Clear mode command. 1: Maintains the previous operation state when Clear mode command is given.	Default: 0 Min: 0 Max: 1
F6-32	PROFIBUS-DP Data Format Selection	0: PPO Type 1: Conventional	Default: 0 Min: 0 Max: 1
F6-35	CANopen Node ID Selection	Sets the node address.	Default: 0 Min: 0 Max: 126
F6-36	CANopen Communication Speed	0: Auto-detection 1: 10 kbps 2: 20 kbps 3: 50 kbps 4: 125 kbps 5: 250 kbps 6: 500 kbps 7: 800 kbps 8: 1 Mbps	Default: 6 Min: 0 Max: 8
F6-50	DeviceNet MAC Address	Selects the drives MAC address.	Default: 0 Min: 0 Max: 64
F6-51	DeviceNet Communication Speed	0: 125 kbps 1: 250 kbps 2: 500 kbps 3: Adjustable from network 4: Detect automatically	Default: 0 Min: 0 Max: 4
F6-52	DeviceNet PCA Setting	Sets the format of the data set from the DeviceNet master to the drive.	Default: 21 Min: 0 Max: 255
F6-53	DeviceNet PPA Setting	Sets the format of the data set from the drive to the DeviceNet master.	Default: 71 Min: 0 Max: 255
F6-54	DeviceNet Idle Mode Fault Detection	0: Enabled 1: Disabled, no fault detection	Default: 0 Min: 0 Max: 1
F6-55	DeviceNet Baud Rate Monitor	Used to verify the baud rate running on the network. 0: 125 kbps 1: 250 kbps 2: 500 kbps	Default: 0 Min: 0 Max: 2
F6-56	DeviceNet Speed Scaling	Sets the scaling factor for the speed monitor in DeviceNet.	Default: 0 Min: -15 Max: 15
F6-57	DeviceNet Current Scaling	Sets the scaling factor for the output current monitor in DeviceNet.	Default: 0 Min: -15 Max: 15
F6-58	DeviceNet Torque Scaling	Sets the scaling factor for the torque monitor in DeviceNet.	Default: 0 Min: -15 Max: 15
F6-59	DeviceNet Power Scaling	Sets the scaling factor for the power monitor in DeviceNet.	Default: 0 Min: -15 Max: 15
F6-60	DeviceNet Voltage Scaling	Sets the scaling factor for the voltage monitor in DeviceNet.	Default: 0 Min: -15 Max: 15
F6-61	DeviceNet Time Scaling	Sets the scaling factor for the time monitor in DeviceNet.	Default: 0 Min: -15 Max: 15
F6-62	DeviceNet Heartbeat Interval	Sets the heartbeat interval for DeviceNet communications.	Default: 0 Min: 0 Max: 10
F6-63	DeviceNet Network MAC ID	Used to verify the MAC ID the drive has been assigned.	Default: 0 Min: 0 Max: 63

No.	Name	Description	Setting
F6-64 to F6-71	Reserved	Reserved for Dynamic I/O Assembly Parameters.	–

<25> Parameter setting value is not reset to the default value when the drive is initialized.

■ H Parameters: Multi-Function Terminals

H parameters assign functions to the multi-function input and output terminals.

H1: Multi-Function Digital Inputs

No.	Name	Description	Setting
H1-01	Multi-Function Digital Input Terminal S1 Function Selection	Assigns a function to the multi-function digital inputs. Refer to page *124* to page *107* for a description of setting values. **Note:** Unused terminals should be set to F.	Default: 40 (F) *<18>* Min: 1 Max: 9F
H1-02	Multi-Function Digital Input Terminal S2 Function Selection		Default: 41 (F) *<18>* Min: 1 Max: 9F
H1-03	Multi-Function Digital Input Terminal S3 Function Selection		Default: 24 Min: 0 Max: 9F
H1-04	Multi-Function Digital Input Terminal S4 Function Selection		Default: 14 Min: 0 Max: 9F
H1-05	Multi-Function Digital Input Terminal S5 Function Selection		Default: 3(0) *<18>* Min: 0 Max: 9F
H1-06	Multi-Function Digital Input Terminal S6 Function Selection		Default: 4(3) *<18>* Min: 0 Max: 9F
H1-07	Multi-Function Digital Input Terminal S7 Function Selection		Default: 6(4) *<18>* Min: 0 Max: 9F
H1-08	Multi-Function Digital Input Terminal S8 Function Selection		Default: 8 Min: 0 Max: 9F

<18> 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	Description
0	3-wire sequence	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.
1	LOCAL/REMOTE selection	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, digital operator is run and reference source
2	External reference 1/2 selection	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	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	
5	Multi-Step Speed Reference 3	
6	Jog reference selection	Closed: Jog frequency reference (d1-17) selected. Jog has priority over all other reference sources.
7	Accel/decel time selection 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.)	Closed: No drive output
9	Baseblock command (N.C.)	Open: No drive output
A	Accel/decel ramp hold	Open: Accel/decel is not held Closed: The drive pauses during acceleration or deceleration and maintains the output frequency.
B	Drive overheat alarm (oH2)	Closed: Closes when an oH2 alarm occurs
C	Analog terminal input selection	Open: Function assigned by H3-14 is disabled. Closed: Function assigned by H3-14 is enabled.
D	PG encoder disable	Open: Speed feedback for V/f Control with PG is enabled. Closed: Speed feedback disabled.
E	ASR integral reset	Open: PI control Closed: Integral reset
F	Through mode	Select this setting when using the terminal in a pass-through mode. The terminal does not trigger a drive function but can be used as digital input for the controller the drive is connected to.
10	Up command	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	
12	Forward Jog	Closed: Runs forward at the Jog frequency d1-17.
13	Reverse Jog	Closed: Runs reverse at the Jog frequency d1-17.
14	Fault reset	Closed: Resets faults if the cause is cleared and the Run command is removed.

H1 Multi-Function Digital Input Selections		
H1-□□ Setting	**Function**	**Description**
15	Fast Stop (N.O.)	Closed: Decelerates at the Fast Stop time set to C1-09.
16	Motor 2 selection	Open: Motor 1 (E1-□□, E2-□□) Closed: Motor 2 (E3-□□, E4-□□)
17	Fast Stop (N.C.)	Open: Decelerates to stop at the Fast Stop time set to C1-09.
18	Timer function input	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	Open: PID control enabled Closed: PID control disabled
1A	Accel/decel time selection 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	Open: Parameters cannot be edited (except for U1-01 if the reference source is assigned to the digital operator). Closed: Parameters can be edited and saved.
1E	Reference sample hold	Closed: Samples the analog frequency reference and operates the drive at that speed.
20 to 2F	External fault	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	Closed: Resets the PID control integral value.
31	PID integral hold	Open: Performs integral operation. Closed: Maintains the current PID control integral value.
32	Multi-Step Speed Reference 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	Open: PID soft starter is enabled. Closed: Disables the PID soft starter b5-17.
35	PID input level selection	Closed: Inverts the PID input signal
40	Forward run command (2-wire sequence)	Open: Stop Closed: Forward run **Note:** Cannot be set together with settings 42 or 43.
41	Reverse run command (2-wire sequence)	Open: Stop Closed: Reverse run **Note:** Cannot be set together with settings 42 or 43.
42	Run command (2-wire sequence 2)	Open: Stop Closed: Run **Note:** Cannot be set together with settings 40 or 41.
43	FWD/REV command (2-wire sequence 2)	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	Closed: Adds d7-01 to the frequency reference.
45	Offset frequency 2	Closed: Adds d7-02 to the frequency reference.
46	Offset frequency 3	Closed: Adds d7-03 to the frequency reference.
60	DC Injection Braking command	Closed: Triggers DC Injection Braking.
61	External Speed Search command 1	Closed: Activates Current Detection Speed Search from the maximum output frequency (E1-04).
62	External Speed Search command 2	Closed: Activates Current Detection Speed Search from the frequency reference.
63	Field Weakening	Closed: The drive performs Field Weakening control as set for d6-01 and d6-02.
65	KEB Ride-Thru 1 (N.C.)	Open: KEB Ride-Thru 1 enabled
66	KEB Ride-Thru 1 (N.O.)	Closed: KEB Ride-Thru 1 enabled
67	Communications test mode	Tests the MEMOBUS/Modbus RS-485/422 interface. Displays "PASS" if the test completes successfully.
68	High Slip Braking	Closed: Activates High Slip Braking to stop the drive.
6A	Drive enable	Open: Drive disabled. If this input is opened during run, then the drive will stop as specified by b1-03. Closed: Ready for operation.
71	Speed/Torque Control Switch	Open: Speed Control Closed: Torque Control
72	Zero Servo	Closed: Zero Servo enabled
75	Up 2 command	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	

H1 Multi-Function Digital Input Selections		
H1-□□ Setting	Function	Description
77	ASR gain switch	Open: ASR proportional gain 1 (C5-01) Closed: ASR proportional gain 2 (C5-03)
78	External torque reference polarity inversion	Open: Forward torque reference Closed: Reverse polarity
7A	KEB Ride-Thru 2 (N.C.)	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.)	Closed: KEB Ride-Thru 2 enabled. Drive disregards L2-29 and performs Single Drive KEB Ride-Thru 2.
7C	Short Circuit Braking (N.O.)	Closed: Short Circuit Braking enabled
7D	Short Circuit Braking (N.C.)	Open: Short Circuit Braking enabled
7E	Forward/reverse detection (V/f Control with Simple PG feedback)	Direction of rotation detection (for V/f with Simple PG Feedback)
90 to 97	DWEZ digital inputs 1 to 8	Reserved for DWEZ input functions
9F	DriveWorksEZ disable	Open: DWEZ enabled Closed: DWEZ disabled

H2: Multi-Function Digital Outputs

No.	Name	Description	Setting
H2-01	Terminal M1-M2 function selection (relay)	Refer to H2 Multi-Function Digital Output Settings on page *107* for a description of setting values.	Default: 0 Min: 0 Max: 192
H2-02	Terminal P1-PC function selection (photocoupler)		Default: 1 Min: 0 Max: 192
H2-03	Terminal P2-PC function selection (photocoupler)		Default: 2 Min: 0 Max: 192
H2-06	Watt Hour Output Unit Selection	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 Min: 0 Max: 4

H2 Multi-Function Digital Output Settings		
H2-□□ Setting	Function	Description
0	During fun	Closed: A Run command is active or voltage is output.
1	Zero Speed	Open: Output frequency is above the minimum output frequency set in E1-09. Closed: Output frequency is below the minimum output frequency set in E1-09.
2	Speed agree 1	Closed: Output frequency equals the speed reference (plus or minus the hysteresis set to L4-02).
3	User-set speed agree 1	Closed: Output frequency and speed reference equal L4-01 (plus or minus the hysteresis set to L4-02).
4	Frequency detection 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	Closed: Output frequency is greater than or equal to the value in L4-01 with hysteresis determined by L4-02.
6	Drive ready	Closed: Power up is complete and the drive is ready to accept a Run command.
7	DC bus undervoltage	Closed: DC bus voltage is below the Uv trip level set in L2-05.
8	During baseblock (N.O.)	Closed: Drive has entered the baseblock state (no output voltage).
9	Frequency reference 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	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.)	Closed: An overtorque or undertorque situation has been detected.
C	Frequency reference loss	Closed: Analog frequency reference has been lost.
D	Braking resistor fault	Closed: Braking resistor or transistor is overheated or faulted out.
E	Fault	Closed: Fault occurred.
F	Through mode	Set this value when using the terminal in the pass-through mode.
10	Minor fault	Closed: An alarm has been triggered, or the IGBTs have reached 90% of their expected life span.
11	Fault reset command active	Closed: A command has been entered to clear a fault via the input terminals or from the serial network.
12	Timer output	Closed: Timer output.
13	Speed agree 2	Closed: When drive output frequency equals the frequency reference ±L4-04.
14	User-set speed agree 2	Closed: When the drive output frequency is equal to the value in L4-03 ±L4-04.
15	Frequency detection 3	Closed: When the drive output frequency is less than or equal to the value in L4-03 ±L4-04.
16	Frequency detection 4	Closed: When the output frequency is greater than or equal to the value in L4-03 ±L4-04.

H2 Multi-Function Digital Output Settings		
H2-□□ Setting	Function	Description
17	Torque detection 1 (N.C.)	Open: Overtorque or undertorque has been detected.
18	Torque detection 2 (N.O.)	Closed: Overtorque or undertorque has been detected.
19	Torque detection 2 (N.C.)	Open: Overtorque or undertorque has been detected.
1A	During reverse	Closed: Drive is running in the reverse direction.
1B	During baseblock (N.C.)	Open: Drive has entered the baseblock state (no output voltage).
1C	Motor 2 selection	Closed: Motor 2 is selected by a digital input (H1-□□ = 16)
1D	During regeneration	Closed: Motor is regenerating energy into the drive.
1E	Restart enabled	Closed: An automatic restart is performed
1F	Motor overload alarm (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)	Closed: Heatsink temperature exceeds the parameter L8-02 value.
22	Mechanical Weakening Detection	Closed: Mechanical weakening detected.
2F	Maintenance period	Closed: Cooling fan, electrolytic capacitors, IGBTs, or the soft charge bypass relay may require maintenance.
30	During torque limit	Closed: When the torque limit has been reached.
31	During speed limit	Closed: Speed limit has been reached.
32	During speed limit in Torque Control	Closed: Speed limit has been reached while using Torque Control.
33	Zero Servo complete	Closed: Zero Servo operation has finished.
37	During frequency output	Open: Either the drive has stopped or baseblock, DC Injection Braking, or Initial Excitation is being performed. Closed: Drive is running the motor (not in a baseblock state and DC Injection is not being performed).
38	Drive enabled	Closed: Multi-function input set for “Drive enable” is closed (H1-□□ = 6A)
39	Watt hour pulse output	Output units are determined by H2-06. Outputs a pulse every 200 ms to indicate the kWh count.
3C	LOCAL/REMOTE status	Open: REMOTE Closed: LOCAL
3D	During Speed Search	Closed: Speed Search is being executed.
3E	PID feedback low	Closed: PID feedback level is too low.
3F	PID feedback high	Closed: The PID feedback level is too high.
4A	During KEB Ride-Thru	Closed: KEB Ride-Thru is being performed.
4B	During Short-Circuit Braking	Closed: Short Circuit Braking is active.
4C	During Fast Stop	Closed: A Fast Stop command has been entered from the operator or input terminals.
4D	oH Pre-alarm time limit	Closed: oH pre-alarm time limit has passed.
4E	Braking transistor fault (rr)	Closed: The built-in dynamic braking transistor failed.
4F	Braking resistor overheat (oH)	Closed: The dynamic braking resistor has overheated.
60	Internal cooling fan alarm	Closed: Internal cooling fan alarm
61	Rotor position detection complete	Closed: Drive has successfully detected the rotor position of the PM motor.
90 to 92	DWEZ digital outputs 1 to 3	Reserved for DWEZ digital output functions.
100 to 192	Function 0 to 92 with inverse output	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.

H3: Multi-Function Analog Inputs

No.	Name	Description	Setting
H3-01	Terminal A1 Signal Level Selection	0: 0 to 10 V 1: –10 to 10 V	Default: 0 Min: 0 Max: 1
H3-02	Terminal A1 Function Selection	Sets the function of terminal A1.	Default: 0 Min: 0 Max: 31
H3-03 RUN	Terminal A1 Gain Setting	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%
H3-04 RUN	Terminal A1 Bias Setting	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%
H3-05	Terminal A3 Signal Level Selection	0: 0 to 10 V 1: –10 to 10 V	Default: 0 Min: 0 Max: 1
H3-06	Terminal A3 Function Selection	Sets the function of terminal A3.	Default: 2 Min: 0 Max: 31
H3-07 RUN	Terminal A3 Gain Setting	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%
H3-08 RUN	Terminal A3 Bias Setting	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%

No.	Name	Description	Setting
H3-09	Terminal A2 Signal Level Selection	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 Min: 0 Max: 3
H3-10	Terminal A2 Function Selection	Sets the function of terminal A2.	Default: 0 Min: 0 Max: 31
H3-11 RUN	Terminal A2 Gain Setting	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%
H3-12 RUN	Terminal A2 Bias Setting	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%
H3-13	Analog Input Filter Time Constant	Sets a primary delay filter time constant for terminals A1, A2, and A3. Used for noise filtering.	Default: 0.03 s Min: 0.00 s Max: 2.00 s
H3-14	Analog Input Terminal Enable Selection	Determines which of the analog input terminals will be enabled when a digital input programmed for "Analog input enable" (H1-□□ = C) is activated. 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 Min: 1 Max: 7

H3 Multi-Function Analog Input Settings		
H3-□□ Setting	Function	Description
0	Frequency bias	10 V = E1-04 (maximum output frequency)
1	Frequency 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 (used as a Multi-Step Speed 2)	10 V = E1-04 (maximum output frequency)
3	Auxiliary frequency reference 2 (3rd step analog)	10 V = E1-04 (maximum output frequency)
4	Output voltage bias	10 V = E1-05 (motor rated voltage)
5	Accel/decel time gain	10 V = 100%
6	DC Injection Braking current	10 V = Drive rated current
7	Overtorque/undertorque detection level	10 V = Drive rated current (V/f, V/fw/PG, OLV/PM) 10 V = Motor rated torque (OLV, CLV, AOLV/PM, CLV/PM)
8	Stall Prevention level during run	10 V = Drive rated current
9	Output frequency lower limit level	10 V = E1-04 (maximum output frequency)
B	PID feedback	10 V = 100%
C	PID setpoint	10 V = 100%
D	Frequency bias	10 V = E1-04 (maximum output frequency)
E	Motor temperature (PTC input)	10 V = 100%
F	Through mode	Set this value when using the terminal in the pass-through mode.
10	Forward torque limit	10 V = Motor rated torque
11	Reverse torque limit	10 V = Motor rated torque
12	Regenerative torque limit	10 V = Motor rated torque
13	Torque reference / Torque limit	10 V = Motor rated torque
14	Torque compensation	10 V = Motor rated torque
15	General torque limit	10 V = Motor rated torque
16	Differential PID feedback	10 V = 100%
1F	Through mode	Set this value when using the terminal in the pass-through mode.
30 to 32	DWEZ analog input 1 to 3	Output is determined by the function selected using DWEZ.

H4: Analog Outputs

No.	Name	Description	Setting
H4-01	Multi-Function Analog Output Terminal FM Monitor Selection	Selects the data to be output through multi-function analog output terminal FM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter "103" for U1-03.	Default: 102 Min: 000 Max: 999
H4-02 RUN	Multi-Function Analog Output 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%
H4-03 RUN	Multi-Function Analog Output Terminal FM Bias	Sets the bias value added to the terminal FM output signal.	Default: 0.0% Min: -999.9% Max: 999.9%

No.	Name	Description	Setting
H4-04	Multi-Function Analog Output Terminal AM Monitor Selection	Selects the data to be output through multi-function analog output terminal AM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter “103” for U1-03.	Default: 103 Min: 000 Max: 999
H4-05 RUN	Multi-Function Analog Output 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%
H4-06 RUN	Multi-Function Analog Output Terminal AM Bias	Sets the bias value added to the terminal AM output signal.	Default: 0.0% Min: -999.9% Max: 999.9%
H4-07	Multi-Function Analog Output Terminal FM Signal Level Selection	0: 0 to 10 V 1: –10 to 10 V	Default: 0 Min: 0 Max: 1
H4-08	Multi-Function Analog Output Terminal AM Signal Level Selection	0: 0 to 10 V 1: –10 to 10 V	Default: 0 Min: 0 Max: 1

H5: MEMOBUS/Modbus Serial Communication

No.	Name	Description	Setting
H5-01 <39>	Drive Node Address	Selects drive station node number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect.	Default: 1F Min: 0 Max: FFH
H5-02	Communication Speed Selection	0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps Cycle power for the setting to take effect.	Default: 3 Min: 0 Max: 8
H5-03	Communication Parity Selection	0: No parity 1: Even parity 2: Odd parity Cycle power for the setting to take effect.	Default: 0 Min: 0 Max: 2
H5-04	Stopping Method After Communication Error (CE)	0: Ramp to stop 1: Coast to stop 2: Fast Stop 3: Alarm only	Default: 0 Min: 0 Max: 3
H5-05	Communication Fault Detection Selection	0: Disabled 1: Enabled. If communication is lost for more than two seconds, a CE fault will occur.	Default: 0 Min: 0 Max: 1
H5-06	Drive Transmit Wait Time	Set the wait time between receiving and sending data.	Default: 5 ms Min: 5 ms Max: 65 ms
H5-07	RTS Control Selection	0: Disabled. RTS is always on. 1: Enabled. RTS turns on only when sending.	Default: 1 Min: 0 Max: 1
H5-09	CE Detection 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 s Max: 10.0 s
H5-10	Unit Selection for MEMOBUS/ Modbus Register 0025H	0: 0.1 V units 1: 1 V units	Default: 0 Min: 0 Max: 1
H5-11	Communications ENTER Function Selection	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: 1 Min: 0 Max: 1
H5-12	Run Command Method Selection	0: FWD/Stop, REV/Stop 1: Run/Stop, FWD/REV	Default: 0 Min: 0 Max: 1

<39> If this parameter is set to 0, the drive will be unable to respond to MEMOBUS/Modbus commands.

H6: Pulse Train Input/Output

No.	Name	Description	Setting
H6-01	Pulse Train Input Terminal RP Function Selection	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 Min: 0 Max: 3
H6-02 RUN	Pulse Train Input Scaling	Sets the terminal RP input signal frequency that is equal to 100% of the value selected in H6-01.	Default: 1440 Hz Min: 1000 Hz Max: 32000 Hz
H6-03 RUN	Pulse Train Input 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 RUN	Pulse Train Input 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%

No.	Name	Description	Setting
H6-05 RUN	Pulse Train Input Filter Time	Sets the pulse train input filter time constant.	Default: 0.10 s Min: 0.00 s Max: 2.00 s
H6-06 RUN	Pulse Train Monitor Selection	Select the pulse train monitor output function (value of the □-□□ part of U□-□□). Example: To select U5-01, set “501”.	Default: 102 Min: 000 Max: 502
H6-07 RUN	Pulse Train Monitor Scaling	Sets the terminal MP output signal frequency when the monitor value is 100%. To have the pulse train monitor output equal the output frequency, set H6-06 to 2 and H6-07 to 0.	Default: 1440 Hz Min: 0 Hz Max: 32000 Hz
H6-08	Pulse Train Input Minimum Frequency	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 Hz Max: 1000.0 Hz

■ L: Protection Function

L parameters provide protection to the drive and motor, such as: control during momentary power loss, Stall Prevention, frequency detection, fault restarts, overtorque detection, torque limits, and other types of hardware protection.

L1: Motor Protection

No.	Name	Description	Setting
L1-01	Motor Overload Protection Selection	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 The drive may not be able to provide protection when multiple motors are used, even if overload is enabled in L1-01. Set L1-01 to 0 and install separate thermal relay to each motor.	Default: *<77>* Min: 0 Max: 5
L1-02	Motor Overload Protection Time	Sets the motor thermal overload protection (oL1) time.	Default: 1.0 min Min: 0.1 min Max: 5.0 min
L1-03	Motor Overheat Alarm Operation Selection (PTC input)	Sets operation when the motor temperature analog input (H3-02, H3-06, or H3-10 = 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 Min: 0 Max: 3
L1-04	Motor Overheat Fault Operation Selection (PTC input)	Sets stopping method when the motor temperature analog input (H3-02, H3-06, or H3-10 = 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 Min: 0 Max: 2
L1-05	Motor Temperature Input Filter Time (PTC input)	Adjusts the filter for the motor temperature analog input (H3-02, H3-06, or H3-10 = E).	Default: 0.20 s Min: 0.00 s Max: 10.00 s
L1-13	Continuous Electrothermal Operation Selection	0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1

<77> Default setting is determined by the control mode (A1-02).

L2: Momentary Power Loss Ride-Thru

No.	Name	Description	Setting
L2-01	Momentary Power Loss Operation Selection	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 Min: 0 Max: 5
L2-02	Momentary Power Loss Ride-Thru Time	Sets the Power Loss Ride-Thru time. Enabled only when L2-01 = 1 or 3.	Default: *<57>* Min: 0.0 s Max: 25.5 s
L2-03	Momentary Power Loss Minimum Baseblock Time	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: *<57>* Min: 0.1 s Max: 5.0 s
L2-04	Momentary Power Loss Voltage Recovery Ramp Time	Sets the time for the output voltage to return to the preset V/f pattern during Speed Search.	Default: *<57>* Min: 0.0 s Max: 5.0 s
L2-05	Undervoltage Detection Level (Uv1)	Sets the DC bus undervoltage trip level.	Default: *<57> <77> <84>* Min: 150 Vdc Max: 210 Vdc *<24>*
L2-06	KEB Deceleration Time	Sets the time required to decelerate from the speed when KEB was activated to zero speed.	Default: 0.00 s Min: 0.00 s Max: 6000.0 s *<6>*
L2-07	KEB Acceleration 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 is used.	Default: 0.00 s Min: 0.00 s Max: 6000.0 s *<6>*

No.	Name	Description	Setting
L2-08	Frequency Gain at KEB Start	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 × 2	Default: 100% Min: 0% Max: 300%
L2-10	KEB Detection Time (Minimum KEB Time)	Sets the time to perform KEB Ride-Thru.	Default: 50 ms Min: 0 ms Max: 2000 ms
L2-11	DC Bus Voltage Setpoint during KEB	Sets the desired value of the DC bus voltage during KEB Ride-Thru.	Default: *<24> <84>* [E1-01] × 1.22 Min: 150 Vdc Max: 400 Vdc
L2-29	KEB Method Selection	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 Min: 0 Max: 3

<6> Setting range value is dependent on the units selected for the accel/decel time (C1-10). When C1-10 = 0 (units of 0.01 seconds), the setting range becomes 0.00 to 600.00 seconds.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<57> Default setting is determined by the drive model (o2-04) and duty selection (C6-01).
<77> Default setting is determined by the control mode (A1-02).
<78> The upper limit of the setting range is determined by the values set to C6-01 and L8-38.
<84> Reset to its default value when E1-01 is changed.

L3: Stall Prevention

No.	Name	Description	Setting
L3-01	Stall Prevention Selection during Acceleration	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 Min: 0 Max: 2
L3-02	Stall Prevention Level during Acceleration	Used when L3-01 = 1 or 2. 100% is equal to the drive rated current.	Default: *<78>* Min: 0% Max: 150%
L3-03	Stall Prevention Limit during Acceleration	Sets Stall Prevention lower limit during acceleration when operating in the constant power range. Set as a percentage of the drive's rated current.	Default: 50% Min: 0% Max: 100%
L3-04	Stall Prevention Selection during Deceleration	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 bus voltage.	Default: 1 Min: 0 Max: 5 *<68>*
L3-05	Stall Prevention Selection during Run	0: Disabled. Drive runs at a set frequency. A heavy load may cause speed loss. 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 Min: 0 Max: 2
L3-06	Stall Prevention Level during Run	Enabled when L3-05 is set to 1 or 2. 100% is equal to the drive rated current.	Default: *<78>* Min: 30% Max: 150%
L3-11	Overvoltage Suppression Function Selection	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 Min: 0 Max: 1
L3-17	Target DC Bus Voltage for Overvoltage Suppression and Stall Prevention	Sets the desired value for the DC bus voltage during overvoltage suppression and Stall Prevention during deceleration.	Default: 370 Vdc *<9> <24>* Min: 150 Vdc Max: 400 Vdc *<84>*
L3-20	DC Bus Voltage Adjustment Gain	Sets the proportional gain for KEB Ride-Thru, Stall Prevention, and overvoltage suppression.	Default: *<77>* Min: 0.00 Max: 5.00
L3-21	Accel/Decel Rate Calculation 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: *<77>* Min: 0.10 Max: 10.00
L3-22	Deceleration Time at Stall Prevention during Acceleration	Sets the deceleration time used for Stall Prevention during acceleration in OLV/PM.	Default: 0.0 s Min: 0.0 s Max: 6000 s
L3-23	Automatic Reduction Selection for Stall Prevention during Run	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 Min: 0 Max: 1
L3-24	Motor Acceleration Time for Inertia Calculations	Sets the time needed to accelerate the uncoupled motor at rated torque from stop to the maximum frequency.	Default: *<10> <51> <57>* Min: 0.001 s Max: 10.000 s
L3-25	Load Inertia Ratio	Sets the ratio between the motor and machine inertia.	Default: 1.0 Min: 1.0 Max: 1000.0
L3-26	Additional DC Bus Capacitors	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 µF Max: 65000 µF
L3-27	Stall Prevention Detection Time	Sets the time the current must exceed the Stall Prevention level to activate Stall Prevention.	Default: 50 ms Min: 0 ms Max: 5000 ms

<9> Default setting value is dependent on the setting for the input voltage (E1-01).
<10> Default setting value is dependent on the motor code set to parameter E5-01.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<51> Parameter value is changed if E2-11 is manually changed or changed by Auto-Tuning.
<57> Default setting is determined by the drive model (o2-04) and duty selection (C6-01).
<68> Setting range is dependent on the control mode (A1-02). When using CLV, OLV/PM, or AOLV/PM, the setting range is 0 to 2 seconds.
<77> Default setting is determined by the control mode (A1-02).
<78> The upper limit of the setting range is determined by the values set to C6-01 and L8-38.
<84> Reset to its default value when E1-01 is changed.

L4: Speed Detection

No.	Name	Description	Setting
L4-01	Speed Agreement Detection Level	L4-01 sets the frequency detection level for digital output functions H2-□□ = 2, 3, 4, 5. L4-02 sets the hysteresis or allowable margin for speed detection.	Default: 0.0 Hz Min: 0.0 Hz Max: 400.0 Hz
L4-02	Speed Agreement Detection Width		Default: 2.0 Hz Min: 0.0 Hz Max: 20.0 Hz
L4-03	Speed Agreement Detection Level (+/-)	L4-03 sets the frequency detection level for digital output functions H2-□□ = 2, 3, 4, 5. L4-04 sets the hysteresis or allowable margin for speed detection.	Default: 0.0 Hz Min: -400.0 Hz Max: 400.0 Hz
L4-04	Speed Agreement Detection Width (+/-)		Default: 2.0 Hz Min: 0.0 Hz Max: 20.0 Hz
L4-05	Frequency Reference Loss Detection Selection	0: Stop. Drive stops when the frequency reference is lost. 1: Run. Drive runs at a reduced speed when the frequency reference is lost.	Default: 0 Min: 0 Max: 1
L4-06	Frequency Reference at Reference Loss	Sets the percentage of the frequency reference that the drive should run with when the frequency reference is lost.	Default: 80% Min: 0.0% Max: 100.0%
L4-07	Speed Agreement Detection Selection	0: No detection during baseblock. 1: Detection always enabled.	Default: 0 Min: 0 Max: 1

L5: Fault Restart

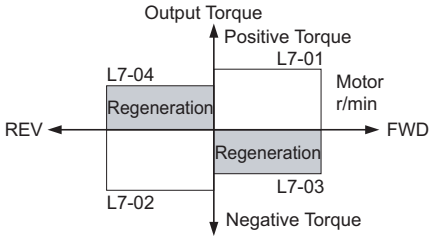
No.	Name	Description	Setting
L5-01	Number of Auto Restart Attempts	Sets the number of times the drive may attempt to restart after the following faults occur: GF, LF, oC, ov, PF, rH, rr, oL1, oL2, oL3, oL4, STo, Uv1.	Default: 0 Min: 0 Max: 10
L5-02	Auto Restart Fault Output Operation Selection	0: Fault output not active. 1: Fault output active during restart attempt.	Default: 0 Min: 0 Max: 1
L5-04	Fault Reset Interval Time	Sets the amount of time to wait between performing fault restarts.	Default: 10.0 s Min: 0.5 s Max: 600.0 s
L5-05	Fault Reset Operation Selection	0: Continuously attempt to restart while incrementing restart counter only at a successful restarts (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 V7).	Default: 0 Min: 0 Max: 1

L6: Torque Detection

No.	Name	Description	Setting
L6-01	Torque Detection Selection 1	0: Disabled 1: oL3 detection only active during speed agree, operation continues after detection 2: oL3 detection always active during run, operation continues after detection 3: oL3 detection only active during speed agree, output shuts down on an oL3 fault 4: oL3 detection always active during run, output shuts down on an oL3 fault 5: UL3 detection only active during speed agree, operation continues after detection 6: UL3 detection always active during run, operation continues after detection 7: UL3 detection only active during speed agree, output shuts down on an oL3 fault 8: UL3 detection always active during run, output shuts down on an oL3 fault	Default: 0 Min: 0 Max: 8
L6-02	Torque Detection Level 1	Sets the overtorque and undertorque detection level.	Default: 150% Min: 0% Max: 300%
L6-03	Torque Detection Time 1	Sets the time an overtorque or undertorque condition must exist to trigger torque detection 1.	Default: 0.1 s Min: 0.0 s Max: 10.0 s
L6-04	Torque Detection Selection 2	0: Disabled 1: oL4 detection only active during speed agree, operation continues after detection 2: oL4 detection always active during run, operation continues after detection 3: oL4 detection only active during speed agree, output shuts down on an oL4 fault 4: oL4 detection always active during run, output shuts down on an oL4 fault 5: UL4 detection only active during speed agree, operation continues after detection 6: UL4 detection always active during run, operation continues after detection 7: UL4 detection only active during speed agree, output shuts down on an oL4 fault 8: UL4 detection always active during run, output shuts down on an oL4 fault	Default: 0 Min: 0 Max: 8

No.	Name	Description	Setting
L6-05	Torque Detection Level 2	Sets the overtorque and undertorque detection level.	Default: 150% Min: 0% Max: 300%
L6-06	Torque Detection Time 2	Sets the time an overtorque or undertorque condition must exist to trigger torque detection 2.	Default: 0.1 s Min: 0.0 s Max: 10.0 s
L6-08	Mechanical Weakening Detection Operation	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 oL1 detection settings (L6-01 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 Min: 0 Max: 8
L6-09	Mechanical Weakening Detection Speed Level	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	Mechanical Weakening Detection Time	Sets the time mechanical weakening has to be detected before an alarm or fault is triggered.	Default: 0.1 s Min: 0.0 s Max: 10.0 s
L6-11	Mechanical Weakening Detection Start Time	Sets the operation time (U1-04) required before Mechanical Weakening Detection is active.	Default: 0 Min: 0 Max: 65535

L7: Torque Limit

No.	Name	Description	Setting
L7-01	Forward Torque Limit	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%
L7-02	Reverse Torque Limit		Default: 200% Min: 0% Max: 300%
L7-03	Forward Regenerative Torque Limit		Default: 200% Min: 0% Max: 300%
L7-04	Reverse Regenerative Torque Limit		Default: 200% Min: 0% Max: 300%
L7-06	Torque Limit Integral Time Constant	Sets the integral time constant for the torque limit.	Default: 200 ms Min: 5 ms Max: 10000 ms
L7-07	Torque Limit Control Method Selection during Accel/Decel	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 Min: 0 Max: 1

L8: Drive Protection

No.	Name	Description	Setting
L8-01	Internal Dynamic Braking Resistor Protection Selection (ERF type)	0: Resistor overheat protection disabled 1: Resistor overheat protection enabled	Default: <57> Min: 0 Max: 1
L8-02	Overheat Alarm Level	An overheat alarm will occur if the heatsink temperature exceeds the level set in L8-02.	Default: <57> Min: 50°C Max: 130°C
L8-03	Overheat Pre-Alarm Operation Selection	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 Min: 0 Max: 4
L8-05	Input Phase Loss Protection Selection	Selects the detection of input current phase loss, power supply voltage imbalance, or main circuit electrolytic capacitor deterioration. 0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1
L8-07	Output Phase Loss Protection Selection	0: Disabled 1: Enabled (triggered by a single phase loss) 2: Enabled (triggered when two phases are lost)	Default: 0 Min: 0 Max: 2
L8-09	Output Ground Fault Detection Selection	0: Disabled 1: Enabled	Default: <57> Min: 0 Max: 1
L8-10	Heatsink Cooling Fan Operation Selection	0: During run only. Fan operates only during run and for L8-11 seconds after stop. 1: Fan always on. Cooling fan operates whenever the drive is powered up.	Default: 0 Min: 0 Max: 1
L8-11	Heatsink Cooling Fan Off 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 s Max: 300 s

No.	Name	Description	Setting
L8-12	Ambient Temperature Setting	Enter the ambient temperature. This value adjusts the oL2 detection level.	Default: 40°C Min: -10°C Max: 50°C
L8-15	oL2 Characteristics Selection at Low Speeds	0: No oL2 level reduction below 6 Hz. 1: oL2 level is reduced linearly below 6 Hz. It is halved at 0 Hz.	Default: 1 Min: 0 Max: 1
L8-18	Software Current Limit Selection	0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1
L8-19	Frequency Reduction Rate during Overheat Pre-Alarm	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	Overcurrent Detection Gain	Sets the gain for overcurrent detection as a percentage of the motor rated current. Overcurrent is detected using the drive's overcurrent level or the value set to L8-27, whichever is lower.	Default: 300.0% Min: 0.0% Max: 300.0%
L8-29	Current Unbalance Detection (LF2)	0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1
L8-35	Installation Method Selection	0: IP00/Open-chassis drive 1: Side-by-Side mounting 2: NEMA Type 1 3: Finless model drive or external heatsink installation	Default: *<25> <57>* Min: 0 Max: 3
L8-38	Carrier Frequency Reduction Selection	0: Disabled 1: Enabled below 6 Hz 2: Enabled for the entire speed range	Default: *<69>* Min: 0 Max: 2
L8-40	Carrier Frequency Reduction Off Delay 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: 0.50 s Min: 0.00 s Max: 2.00 s
L8-41	High Current Alarm Selection	0: Disabled 1: Enabled. An alarm is triggered at output currents above 150% of the drives rated current.	Default: 0 Min: 0 Max: 1
L8-55	Internal Braking Transistor Protection	0: Disabled. L8-55 should be disabled when using a regen converter or an optional braking unit. 1: Protection enabled.	Default: 1 Min: 0 Max: 1

<25> Parameter setting value is not reset to the default value when the drive is initialized.
<57> Default setting is determined by the drive model (o2-04) and duty selection (C6-01).
<69> Default setting is determined by the control mode (A1-02) and the drive model (o2-04).

■ n: Advanced Performance Set-Up

The n parameters are used to 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.	Name	Description	Setting
n1-01	Hunting Prevention Selection	0: Disabled 1: Enabled	Default: 1 Min: 0 Max: 1
n1-02	Hunting Prevention Gain Setting	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	Hunting Prevention Time Constant	Sets the time constant used for Hunting Prevention.	Default: *<1>* Min: 0 ms Max: 500 ms
n1-05	Hunting Prevention Gain while in Reverse	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 value varies by the drive model (o2-04).

n2: Speed Feedback Detection Contol (AFR) Tuning

No.	Name	Description	Setting
n2-01	Speed Feedback Detection Control (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	Speed Feedback Detection Control (AFR) Time Constant 1	Sets the time constant used for speed feedback detection control (AFR).	Default: 50 ms Min: 0 ms Max: 2000 ms
n2-03	Speed Feedback Detection Control (AFR) Time Constant 2	Sets the AFR time constant to be used during Speed Search and during regen.	Default: 750 ms Min: 0 ms Max: 2000 ms

n3: High Slip Braking (HSB) and Overexcitation Braking

No.	Name	Description	Setting
n3-01	High-Slip Braking Deceleration Frequency Width	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	High-Slip Braking Current Limit	Sets the current limit during HSB as a percentage of the motor rated current.	Default: *<86>* Min: 100% Max: 200%
n3-03	High-Slip Braking Dwell Time at Stop	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 s Max: 10.0 s
n3-04	High-Slip Braking Overload 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 s Max: 1200 s
n3-13	Overexcitation Deceleration 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
n3-14	High Frequency Injection during Overexcitation Deceleration	0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1
n3-21	High-Slip Suppression Current Level	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	Overexcitation Operation Selection	0: Enabled in both directions 1: Enabled only when rotating forward 2: Enabled only when in reverse	Default: 0 Min: 0 Max: 2

<86> Default setting value is dependent on the Drive Duty (C6-01) and the carrier frequency reduction selection (L8-38).

n5: Feed Forward Control

No.	Name	Description	Setting
n5-01	Feed Forward Control Selection	0: Disabled 1: Enabled	Default: 0 Min: 0 Max: 1
n5-02	Motor Acceleration Time	Sets the time required to accelerate the motor at the rated torque from stop to rated speed.	Default: *<10> <57>* Min: 0.001 s Max: 10.000 s
n5-03	Feed Forward Control 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

<10> Default setting value is dependent on the motor code set to E5-01.
<57> Default setting value is dependent on the drive model set to o2-04 and the Drive Duty set to C6-01.

n6: Online Tuning

No.	Name	Description	Setting
n6-01	Online Tuning Selection	0: Disabled 1: Line-to-line resistance tuning 2: Voltage correction. Setting not possible when Energy Saving is enabled (b8-01).	Default: 2 Min: 0 Max: 2
n6-05	Online Tuning Gain	Decrease this setting for motors with a relatively large rotor time constant. If overload occurs, increase this setting slowly in increments of 0.10.	Default: 1.00 Min: 0.10 Max: 5.00

n8: PM Motor Control Tuning

No.	Name	Description	Setting
n8-01	Initial Rotor Position Estimation Current	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	Pole Attraction Current	Sets the current during initial polar attraction as a percentage of the motor rated current. Enter a high value when attempting to increase starting torque.	Default: 80% Min: 0% Max: 150%
n8-35	Initial Rotor Position Detection Selection	0: Pull-in 1: High frequency injection 2: Pulse injection	Default: 1 Min: 0 Max: 2
n8-45	Speed Feedback Detection Control Gain	Increase this setting if hunting occurs. Decrease to lower the response.	Default: 0.80 Min: 0.00 Max: 10.00
n8-47	Pull-In Current Compensation Time Constant	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 s Max: 100.0 s
n8-48	Pull-In Current	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	d-Axis Current for High Efficiency Control	Sets the d-axis current reference when running a high load at constant speed. Set as a percentage of the motor rated current.	Default: *<10>* Min: -200.0% Max: 0.0%

No.	Name	Description	Setting
n8-51	Acceleration/Deceleration Pull-In Current	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	Voltage Error Compensation Time Constant	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.	Default: 1.00 s Min: 0.00 s Max: 10.00 s
n8-55	Load Inertia	For large inertia loads or to increase the speed control response, increase this setting. Too high of a setting when driving a very light load or load with very low inertia can result in oscillation.	Default: 0 Min: 0 Max: 3
n8-57	High Frequency Injection	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 Min: 0 Max: 1
n8-62	Output Voltage Limit	Prevents output voltage saturation. Should be set just below the voltage provided by the input power supply.	Default: 200.0 V *<24>* Min: 0.0 V Max: 230.0 V
n8-65	Speed Feedback Detection Control Gain during ov Suppression	Sets the gain used for internal speed feedback detection during ov suppression	Default: 1.50 Min: 0.00 Max: 10.00

<10> Default setting value is dependent on the motor code set to E5-01.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

■ o: Operator Related Parameters

The o parameters are used to set up the digital operator displays.

o1: Digital Operator Display Selection

No.	Name	Description	Setting
o1-01 RUN	Drive Mode Unit Monitor Selection	Selects the content of the last monitor that is shown when scrolling through Drive Mode display. Enter the last three digits of the monitor parameter number to be displayed: U□-□□.	Default: 106 (Monitor U1-06) Min: 104 Max: 809
o1-02 RUN	User Monitor Selection after Power Up	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 Min: 1 Max: 5
o1-03	Digital Operator Display Selection	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: 0 Min: 0 Max: 3
o1-04	V/f Pattern Display Unit	0: Hz 1: r/min	Default: 0 Min: 0 Max: 1
o1-10	User-Set Display Units Maximum Value	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: *<11>* Min: 1 Max: 60000
o1-11	User-Set Display Units Decimal Display		Default: *<11>* Min: 0 Max: 3

<11> Default setting value is determined by the digital operator display selection (o1-03).

o2: Digital Operator Keypad Functions

No.	Name	Description	Setting
o2-01	LO/RE Key Function Selection	0: Disabled 1: Enabled. LO/RE key switches between LOCAL and REMOTE operation.	Default: 1 Min: 0 Max: 1
o2-02	STOP Key Function Selection	0: Disabled. STOP key is disabled in REMOTE operation. 1: Enabled. STOP key is always enabled.	Default: 1 Min: 0 Max: 1
o2-03	User Parameter Default Value	0: No change. 1: Set defaults. Saves parameter settings as default values for a User Initialization. 2: Clear all. Clears the default settings that have been saved for a User Initialization.	Default: 0 Min: 0 Max: 2
o2-04	Drive Model Selection	Enter the drive model. Setting required only if installing a new control board.	Default: Determined by drive capacity Min: – Max: –
o2-05	Frequency Reference Setting Method Selection	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 Min: 0 Max: 1
o2-06	Operation Selection when Digital Operator is Disconnected	0: The drive continues operating if the digital operator is disconnected. 1: A fault is triggered (oPr) and the motor coasts to stop.	Default: 0 Min: 0 Max: 1
o2-07	Motor Direction at Power Up when Using Operator	0: Forward 1: Reverse This parameter requires that drive operation be assigned to the digital operator.	Default: 0 Min: 0 Max: 1
o2-09	Reserved	–	–

o3: Copy Function

No.	Name	Description	Setting
o3-01	Copy Function Selection	0: No action 1: Read parameters from the drive, saving them onto the digital operator. 2: Copy parameters from the digital operator, writing them to the drive. 3: Verify parameter settings on the drive to check if they match the data saved on the operator.	Default: 0 Min: 0 Max: 3
o3-02	Copy Allowed Selection	0: Read operation prohibited 1: Read operation allowed	Default: 0 Min: 0 Max: 1

o4: Maintenance Monitor Settings

No.	Name	Description	Setting
o4-01	Cumulative Operation Time Setting	Sets the value for the cumulative operation time of the drive in units of 10 h.	Default: 0 H Min: 0 H Max: 9999 H
o4-02	Cumulative Operation Time Selection	0: Logs power-on time 1: Logs operation time when the drive output is active (output operation time).	Default: 0 Min: 0 Max: 1
o4-03	Cooling Fan Operation Time Setting	Sets the value of the fan operation time monitor U4-03 in units of 10 h.	Default: 0 H Min: 0 H Max: 9999 H
o4-05	Capacitor Maintenance Setting	Sets the value of the Maintenance Monitor for the capacitors. See U4-05 to check when the capacitors may need to be replaced.	Default: 0% Min: 0% Max: 150%
o4-07	DC Bus Pre-charge Relay Maintenance Setting	Sets the value of the Maintenance Monitor for the soft charge bypass relay. See U4-06 to check when the bypass relay may need to be replaced.	Default: 0% Min: 0% Max: 150%
o4-09	IGBT Maintenance Setting	Sets the value of the Maintenance Monitor for the IGBTs. See U4-07 to check when the IGBTs may need to be replaced.	Default: 0% Min: 0% Max: 150%
o4-11	U2, U3 Initialize Selection	0: U2-□□ and U3-□□ monitor data is not reset when the drive is initialized (A1-03). 1: U2-□□ and U3-□□ monitor data is reset when the drive is initialized (A1-03).	Default: 0 Min: 0 Max: 1
o4-12	kWh Monitor Initialization	0: U4-10 and U4-11 monitor data is not reset when the drive is initialized (A1-03). 1: U4-10 and U4-11 monitor data is reset when the drive is initialized (A1-03).	Default: 0 Min: 0 Max: 1
o4-13	Number of Run Commands Counter Initialization	0: Number of Run commands counter is not reset when the drive is initialized (A1-03). 1: Number of Run commands counter is reset when the drive is initialized (A1-03).	Default: 0 Min: 0 Max: 1

■ q: DWEZ Parameters

No.	Name	Description	Setting
q1-01 to q6-07	DWEZ Parameters	Reserved for DriveWorksEZ	Refer to Help in the DWEZ software.

■ r: DWEZ Connection Parameters

No.	Name	Description	Setting
r1-01 to r1-40	DWEZ Connection Parameters 1 to 20 (upper/lower)	DWEZ Connection Parameters 1 to 20 (upper/lower)	Default: 0 Min: 0 Max: FFFFH

■ T: Motor Tuning

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

T1: Induction Motor Auto-Tuning

No.	Name	Description	Setting
T1-00	Motor 1 / Motor 2 Selection	1: Motor 1 (sets E1-□□, E2-□□) 2: Motor 2 (sets E3-□□, E4-□□)	Default: 1 Min: 1 Max: 2
T1-01 <70>	Auto-Tuning Mode Selection	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 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)	Default: 0 Min: 0 Max: 4, 8, 9 <77>
T1-02	Motor Rated Power	Sets the motor rated power as specified on the motor nameplate. **Note:** Use the following formula to convert horsepower into kilowatts: kW = HP x 0.746.	Default: <1> Min: 0.00 kW Max: 650.00 kW
T1-03	Motor Rated Voltage	Sets the motor rated voltage as specified on the motor nameplate.	Default: 200.0 V <24> Min: 0.0 V Max: 255.0 V

No.	Name	Description	Setting
T1-04	Motor Rated Current	Sets the motor rated current as specified on the motor nameplate.	Default: <1> Min: 10% of drive rated current Max: 200% of drive rated current
T1-05	Motor Base Frequency	Sets the rated frequency of the motor as specified on the motor nameplate.	Default: 60.0 Hz Min: 0.0 Hz Max: 400.0 Hz
T1-06	Number of Motor Poles	Sets the number of motor poles as specified on the motor nameplate.	Default: 4 Min: 2 Max: 48
T1-07	Motor Base Speed	Sets the rated speed of the motor as specified on the motor nameplate.	Default: 1750 r/min Min: 0 r/min Max: 24000 r/min
T1-08	PG Number of Pulses Per Revolution	Set the number of pulses per revolution for the PG being used (pulse generator or encoder).	Default: 600 ppr Min: 0 ppr Max: 60000 ppr
T1-09	Motor No-Load Current (Stationary Auto-Tuning)	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	Motor Rated Slip (Stationary Auto-Tuning)	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
T1-11	Motor Iron Loss	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 <73> Min: 0 W Max: 65535 W

<1> Default setting value varies by the drive model (o2-04).
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<70> The availability of certain Auto-Tuning methods depends on the control mode selected for the drive.
<73> Default setting value differs depending on the motor code value and motor parameter settings.
<77> Default setting is determined by the control mode (A1-02).

T2: PM Motor Auto-Tuning

No.	Name	Description	Setting
T2-01	PM Motor Auto-Tuning Mode Selection	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 Prior to executing Inertia Tuning or ASR Gain Auto-Tuning, be sure to take the following steps: • perform Auto-Tuning for motor data (T2-01 = 0, 1, or 2) or set the motor code to E5-01. • verify all motor data entered to the drive with the motor nameplate or the motor test report.	Default: 0 Min: 0 Max: 3, 8, 9 <77>
T2-02	PM Motor Code Selection	Enter the motor code when using a Yaskawa PM motor. Once the motor code is entered, the drive automatically sets parameters T2-03 through T2-14. When using a motor that is not supported motor code or a non-Yaskawa motor, set FFFF here and then adjust the other T2 parameters according the motor nameplate or the motor test report.	Default: <69> Min: 0000 Max: FFFF
T2-03	PM Motor Type	0: IPM motor 1: SPM motor. Parameter T2-17 will not be displayed with this setting.	Default: 1 Min: 0 Max: 1
T2-04	PM Motor Rated Power	Sets the motor rated power. **Note:** Use the following formula to convert horsepower into kilowatts: kW = HP x 0.746.	Default: <1> Min: 0.00 kW Max: 650.00 kW
T2-05 <24>	PM Motor Rated Voltage	Enter the motor rated voltage as indicated on the motor nameplate.	Default: 200.0 V <24> Min: 0.0 V Max: 255.0 V
T2-06	PM Motor Rated Current	Enter the motor rated current as indicated on the motor nameplate.	Default: <1> Min: 10% of drive rated current Max: 200% of drive rated current
T2-07	PM Motor Base Frequency	Enter the motor base frequency as indicated on the motor nameplate.	Default: 87.5 Hz Min: 0.0 Hz Max: 400.0 Hz
T2-08	Number of PM Motor 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	PM Motor Base Speed	Enter the base speed for the PM motor as indicated on the motor nameplate.	Default: 1750 r/min Min: 0 r/min Max: 24000 r/min
T2-10	PM Motor Stator Resistance	Enter the rotor resistance for the PM motor as indicated on the motor nameplate.	Default: <24> Min: 0.000 Ω Max: 65.000 Ω
T2-11	PM Motor d-Axis Inductance	Enter the d-axis inductance for the PM motor as indicated on the motor nameplate.	Default: <74> Min: 0.00 mH Max: 600.00 mH
T2-12	PM Motor q-Axis Inductance	Enter the q-axis inductance for the PM motor as indicated on the motor nameplate.	Default: <74> Min: 0.00 mH Max: 600.00 mH

No.	Name	Description	Setting
T2-13	Induced Voltage Constant Unit Selection	0: mV/(r/min). E5-09 will automatically be set to 0.0, and E5-24 will be used. 1: mV/(rad/sec). E5-24 will automatically be set to 0.0, and E5-09 will be used	Default: 1 Min: 0 Max: 1
T2-14	PM Motor Induced Voltage Constant	Enter the induced voltage coefficient for the PM motor as indicated on the motor nameplate.	Default: <74> Min: 0.1 Max: 2000.0
T2-15	Pull-In Current Level for PM Motor Tuning	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	PG Number of Pulses Per Revolution for PM Motor Tuning	Sets the number of pulses per revolution for the PG being used (pulse generator or encoder).	Default: 1024 ppr Min: 0 ppr Max: 60000 ppr
T2-17	Encoder Z-Pulse Offset	Sets the offset between encoder offset and the rotor magnetic axis.	Default: 0.0 deg Min: -180.0 deg Max: 180.0 deg

<1> Default setting value varies by the drive model (o2-04).
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<69> Default setting is determined by the control mode (A1-02) and the drive model (o2-04).
<74> Default setting is determined by the drive capacity and the motor code selected in T2-02.
<77> Default setting is determined by the control mode (A1-02).

T3: ASR and Inertia Tuning

No.	Name	Description	Setting
T3-01 <75>	Test Signal Frequency	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 Hz Max: 20.0 Hz
T3-02 <75>	Test Signal Amplitude	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 rad Max: 10.0 rad
T3-03 <75>	Motor Inertia	Sets the motor inertia. Default setting is the inertia of a Yaskawa motor.	Default: <10> <57> Min: 0.0001 kgm^2 Max: 600.00 kgm^2
T3-04 <75>	System Response Frequency	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 Hz Max: 50.0 Hz

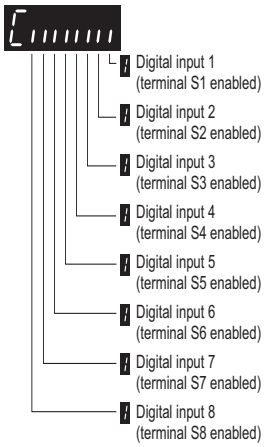
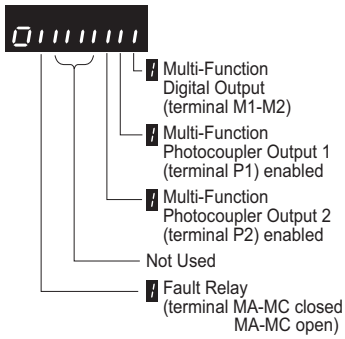
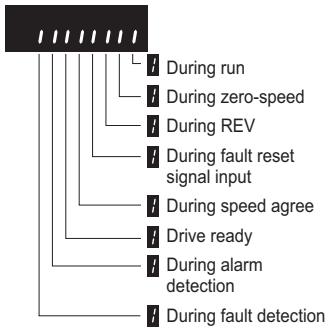
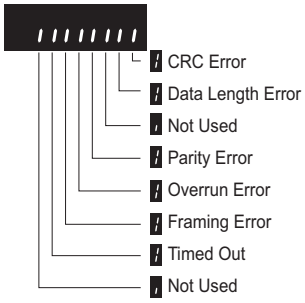
<10> Default setting value is dependent on the motor code set to E5-01.
<57> Default setting value is dependent on the drive model set to o2-04 and the Drive Duty set to C6-01.
<75> Displayed only when performing Inertia Tuning or ASR Gain Auto-Tuning (T1-01 = 8 or T2-01 = 9).

■ U: Monitors

Monitor parameters allow the user to view drive status, fault information, and other data concerning drive operation.

U1: Operation Status Monitors

No.	Name	Description	Analog Output Level	Unit
U1-01	Frequency Reference	Monitors the frequency reference. Display units are determined by o1-03.	10 V: Max frequency	0.01 Hz
U1-02	Output Frequency	Displays the output frequency. Display units are determined by o1-03.	10 V: Max frequency	0.01 Hz
U1-03	Output Current	Displays the output current.	10 V: Drive rated current	<27>
U1-04	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	Motor Speed	Displays the motor speed feedback. Display units are determined by o1-03.	10 V: Max Frequency	0.01 Hz
U1-06	Output Voltage Reference	Displays the output voltage.	10 V: 200 Vrms <24>	0.1 Vac
U1-07	DC Bus Voltage	Displays the DC bus voltage.	10 V: 400 V <24>	1 Vdc
U1-08	Output Power	Displays the output power (this value is calculated internally).	10 V: Drive rated power (kW)	<27>
U1-09	Torque Reference	Monitors the internal torque reference.	10 V: Motor rated torque	0.1%

No.	Name	Description	Analog Output Level	Unit
U1-10	Input Terminal Status	Displays the input terminal status. 	No signal output available	–
U1-11	Output Terminal Status	Displays the output terminal status. 	No signal output available	–
U1-12	Drive Status	Verifies the drive operation status. 	No signal output available	–
U1-13	Terminal A1 Input Level	Displays the signal level to analog input terminal A1.	10 V: 100%	0.1%
U1-14	Terminal A2 Input Level	Displays the signal level to analog input terminal A2.	10 V: 100%	0.1%
U1-15	Terminal A3 Input Level	Displays the signal level to analog input terminal A3.	10 V: 100%	0.1%
U1-16	Output Frequency after Soft Starter	Displays output frequency with ramp time and S-curves. Units determined by o1-03.	10 V: Max frequency	0.01 Hz
U1-17	DI-A3 Input 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	oPE Fault Parameter	Displays the parameter number that caused the oPE□□ or Err (EEPROM write error) error.	No signal output available	–
U1-19	MEMOBUS/Modbus Error Code	Displays the contents of a MEMOBUS/Modbus error. 	No signal output available	–
U1-21	AI-A3 Terminal V1 Input Voltage Monitor	Displays the input voltage to terminal V1 on analog input card AI-A3.	10 V: 100%	0.1%

No.	Name	Description	Analog Output Level	Unit
U1-22	AI-A3 Terminal V2 Input Voltage Monitor	Displays the input voltage to terminal V2 on analog input card AI-A3.	10 V: 100%	0.1%
U1-23	AI-A3 Terminal V3 Input Voltage Monitor	Displays the input voltage to terminal V3 on analog input card AI-A3.	10 V: 100%	0.1%
U1-24	Input Pulse Monitor	Displays the frequency to pulse train input terminal RP.	Determined by H6-02	1 Hz
U1-25	Software Number (Flash)	FLASH ID	No signal output available	–
U1-26	Software No. (ROM)	ROM ID	No signal output available	–

<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<27> Display is determined by the drive model (o2-04). Less than 11 kW: two decimal points, 11 kW and above: one decimal point.

U2: Fault Trace

No.	Name	Description	Analog Output Level	Unit
U2-01	Current Fault	Displays the current fault.	No signal output available	–
U2-02	Previous Fault	Displays the previous fault.	No signal output available	–
U2-03	Frequency Reference at Previous Fault	Displays the frequency reference at the previous fault.	No signal output available	0.01 Hz
U2-04	Output Frequency at Previous Fault	Displays the output frequency at the previous fault.	No signal output available	0.01 Hz
U2-05	Output Current at Previous Fault	Displays the output current at the previous fault.	No signal output available	<27>
U2-06	Motor Speed at Previous Fault	Displays the motor speed at the previous fault.	No signal output available	0.01 Hz
U2-07	Output Voltage at Previous Fault	Displays the output voltage at the previous fault.	No signal output available	0.1 Vac
U2-08	DC Bus Voltage at Previous Fault	Displays the DC bus voltage at the previous fault.	No signal output available	1 Vdc
U2-09	Output Power at Previous Fault	Displays the output power at the previous fault.	No signal output available	0.1 kW
U2-10	Torque Reference at Previous Fault	Displays the torque reference at the previous fault.	No signal output available	0.1%
U2-11	Input Terminal Status at Previous Fault	Displays the input terminal status at the previous fault. Displayed as in U1-10.	No signal output available	–
U2-12	Output Terminal Status at Previous Fault	Displays the output status at the previous fault. Displays the same status displayed in U1-11.	No signal output available	–
U2-13	Drive Operation Status at Previous Fault	Displays the operation status of the drive at the previous fault. Displays the same status displayed in U1-12.	No signal output available	–
U2-14	Cumulative Operation Time at Previous Fault	Displays the cumulative operation time at the previous fault.	No signal output available	1 h
U2-15	Soft Starter Speed Reference at Previous Fault	Displays the speed reference for the soft starter at the previous fault.	No signal output available	0.01 Hz
U2-16	Motor q-Axis Current at Previous Fault	Displays the q-axis current for the motor at the previous fault.	No signal output available	0.10%
U2-17	Motor d-Axis Current at Previous Fault	Displays the d-axis current for the motor at the previous fault.	No signal output available	0.10%
U2-19	Rotor Deviation at Previous Fault	Displays the degree of rotor deviation when the most recent fault occurred (same status will appear as shown in U6-10).	No signal output available	0.1 deg
U2-20	Heatsink Temperature at Previous Fault	Displays the temperature of the heatsink when the most recent fault occurred.	No signal output available	1°C

<27> Display is determined by the drive model (o2-04). Less than 11 kW: two decimal points, 11 kW and above: one decimal point.

U3: Fault History

No.	Name	Description	Analog Output Level	Unit
U3-01 to U3-04	First to 4th Most Recent Fault	Displays the first to the fourth most recent faults.	No signal output available	–
U3-05 to U3-10	5th to 10th Most Recent Fault	Displays the fifth to the tenth most recent faults.	No signal output available	–
U3-11 to U3-14	Cumulative Operation Time at 1st to 4th Most Recent Fault	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	Cumulative Operation Time at 5th to 10th Most Recent Fault	Displays the cumulative operation time when the fifth to the tenth most recent faults occurred.	No signal output available	1 h

U4: Maintenance Monitors

No.	Name	Description	Analog Output Level	Unit
U4-01	Cumulative Operation 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	Number of Run Commands	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	Cooling Fan Operation 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	Cooling Fan Maintenance	Displays main cooling fan usage time in as a percentage of its expected performance life. Parameter o4-03 can be used to reset this monitor.	No signal output available	1%
U4-05	Capacitor Maintenance	Displays main circuit capacitor usage time in as a percentage of their expected performance life. Parameter o4-05 can be used to reset this monitor.	No signal output available	1%
U4-06	Soft Charge Bypass Relay Maintenance	Displays the soft charge bypass relay maintenance time as a percentage of its estimated performance life. Parameter o4-07 can be used to reset this monitor.	No signal output available	1%
U4-07	IGBT Maintenance	Displays IGBT usage time as a percentage of the expected performance life. Parameter o4-09 can be used to reset this monitor.	No signal output available	1%
U4-08	Heatsink Temperature	Displays the heatsink temperature.	10 V: 100°C	1°C
U4-09	LED Check	Lights all segments of the LED to verify that the display is working properly.	No signal output available	–
U4-10	kWh, Lower 4 Digits	Monitors the drive output power. The value is shown as a 9 digit number displayed across two monitor parameters, U4-10 and U4-11. Example: 12345678.9 kWh is displayed as: U4-10: 678.9 kWh U4-11: 12345 MWh	No signal output available	1 kWh
U4-11	kWh, Upper 5 Digits		No signal output available	1 MWh
U4-13	Peak Hold Current	Displays the highest current value that occurred during run.	No signal output available	0.01 A
U4-14	Peak Hold Output Frequency	Displays the output frequency when the current value shown in U4-13 occurred.	No signal output available	0.01 Hz
U4-16	Motor Overload Estimate (oL1)	Shows the value of the motor overload detection accumulator. 100% is equal to the oL1 detection level.	10 V: 100%	0.1%
U4-18	Frequency Reference Source Selection	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 1-01 = 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	No signal output available	–
U4-19	Frequency Reference from MEMOBUS/Modbus Comm.	Displays the frequency reference provided by MEMOBUS/Modbus (decimal).	No signal output available	0.01%
U4-20	Option Frequency Reference	Displays the frequency reference input by an option card (decimal).	No signal output available	–
U4-21	Run Command Source Selection	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	MEMOBUS/Modbus Communications Reference	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	Communication Option Card Reference	Displays drive control data set by an option card as a four-digit hexadecimal number.	No signal output available	–

U5: PID Monitors

No.	Name	Description	Analog Output Level	Unit
U5-01	PID Feedback	Displays the PID feedback value.	10 V: 100%	0.01%
U5-02	PID Input	Displays the amount of PID input (deviation between PID setpoint and feedback).	10 V: 100%	0.01%
U5-03	PID Output	Displays PID control output.	10 V: 100%	0.01%
U5-04	PID Setpoint	Displays the PID setpoint.	10 V: 100%	0.01%
U5-05	PID Differential Feedback	Displays the 2nd PID feedback value if differential feedback is used (H3-□□ = 16).	10 V: 100%	0.01%
U5-06	PID Adjusted Feedback	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%	0.01%

U6: Operation Status Monitors

No.	Name	Description	Analog Output Level	Unit
U6-01	Motor Secondary Current (Iq)	Displays the value of the motor secondary current (Iq). Motor rated secondary current is 100%.	10 V: Motor secondary rated current	0.1%
U6-02	Motor Excitation Current (Id)	Displays the value calculated for the motor excitation current (Id). Motor rated secondary current is 100%.	10 V: Motor secondary rated current	0.1%
U6-03	ASR Input	Displays the input and output values when using ASR control.	10 V: Max frequency	0.01%
U6-04	ASR Output		10 V: Motor secondary rated current	
U6-05	Output Voltage Reference (Vq)	Output voltage reference (Vq) for the q-axis.	10 V: 200 Vrms <24>	0.1 Vac
U6-06	Output Voltage Reference (Vd)	Output voltage reference (Vd) for the d-axis.	10 V: 200 Vrms <24>	0.1 Vac
U6-07	q-Axis ACR Output	Displays the output value for current control relative to motor secondary current (q-axis).	10 V: 200 Vrms <24>	0.1%
U6-08	d-Axis ACR Output	Displays the output value for current control relative to motor secondary current (d-axis).	10 V: 200 Vrms <24>	0.1%
U6-09	Advance Phase Compensation (Δ θ)	Displays the degree of forward phase correction after calculating the deviation of Δθcmp.	10 V: 180 deg –10 V: –180 deg	0.1 deg
U6-10	Control Axis Deviation (Δθ)	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	0.1 deg
U6-13	Flux Position Detection (sensor)	Monitors the value of the flux position detection (sensor).	10 V: 180 deg –10 V: –180 deg	0.1 deg
U6-14	Flux Position Estimation (observer)	Monitors the value of the flux position estimation.	10 V: 180 deg –10 V: –180 deg	0.1 deg
U6-18	Speed Detection PG1 Counter	Monitors the number of pulses for speed detection (PG1).	10 V: 65536	1 pulse
U6-19	Speed Detection PG2 Counter	Monitors the number of pulses for speed detection (PG2).	10 V: 65536	1 pulse
U6-20	Frequency Reference Bias (Up/Down 2)	Displays the bias value used to adjust the frequency reference.	10 V: Max frequency	0.1%
U6-21	Offset Frequency	Displays the frequency added to the main frequency reference.	–	0.1%
U6-22	Zero Servo Pulse Movement	Displays how far the rotor has moved from its last position in PG pulses (multiplied by 4).	10 V: No. of pulses per revolution	1
U6-25	Feedback Control Output	Output monitor for the ASR speed loop.	10 V: Motor secondary rated current	0.01%
U6-26	Feed Forward Control Output	Output monitor for Feed Forward control.	10 V: Motor secondary rated current	0.01%

<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

U8: DriveWorksEZ Monitors

No.	Name	Description	Analog Output Level	Unit
U8-01 to U8-10	DriveWorksEZ Custom Monitor 1 to 10	DriveWorksEZ Custom Monitor 1 to 10	10 V: 100%	0.01%
U8-11 to U8-13	DWEZ Version Control Monitor 1 to 3	DWEZ Version Control Monitor 1 to 3	No signal output available	–

C Standards Compliance

◆ European Standards

Figure 80 CE Mark

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

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

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

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

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

■ CE Low Voltage Directive Compliance

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

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

Area of Use

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

Installing Fuses on the Input Side

Always install input fuses. Select fuses according to *Table 62*.

Table 62 Recommended Input Fuse Selection

Model CIMR-A☐	Fuse Type	
	Manufacturer: Bussmann	
	Model	Fuse Ampere Rating (A)
Three-Phase 200 V Class		
2A0004	FWH500V70	70
2A0006	FWH500V70	70
2A0008	FWH500V70	70
2A0010	FWH500V70	70
2A0012	FWH500V70	70
2A0018	FWH500V90	90
2A0021	FWH500V90	90
2A0030	FWH500V100	100
2A0040	FWH500V200	200
2A0056	FWH500V200	200
2A0069	FWH500V200	200
2A0081	FWH500V300	300
2A0110	FWH500V300	300
2A0138	FWH500V350	350
2A0169	FWH500V400	400
2A0211	FWH500V400	400
Three-Phase 400 V Class		
4A0002	FWH500V40	40
4A0004	FWH500V50	50
4A0005	FWH500V70	70
4A0007	FWH500V70	70

Model CIMR-A□	Fuse Type	
	Manufacturer: Bussmann	
	Model	Fuse Ampere Rating (A)
4A0009	FWH500V90	90
4A0011	FWH500V90	90
4A0018	FWH500V80	80
4A0023	FWH500V100	100
4A0031	FWH500V125	125
4A0038	FWH500V200	200
4A0044	FWH500V250	250
4A0058	FWH500V250	250
4A0072	FWH500V250	250
4A0088	FWH500V250	250
4A0103	FWH500V250	250
4A0139	FWH500V350	350
4A0165	FWH500V400	400

Guarding Against Harmful Materials

When installing IP00/Open-Chassis 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 EN61800-3: 2004, and complies with the EMC guidelines.

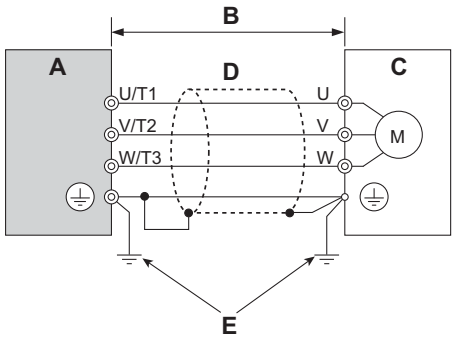
EMC Filter Installation

The following conditions must be met to ensure continued compliance with guidelines. *Refer to EMC Filters on page 147* 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.

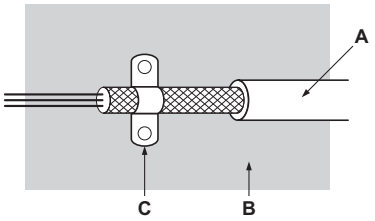
1. Install an EMC noise filter to the input side specified by Yaskawa for compliance with European standards.
2. Place the drive and EMC noise filter in the same enclosure.
3. Use braided shield cable for the drive and motor wiring, or run the wiring through a metal conduit.
4. Keep wiring as short as 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 81 Installation Method

5. Ground the largest possible surface area of the shield to the metal conduit when using braided shield cable. Yaskawa recommends using a cable clamp.

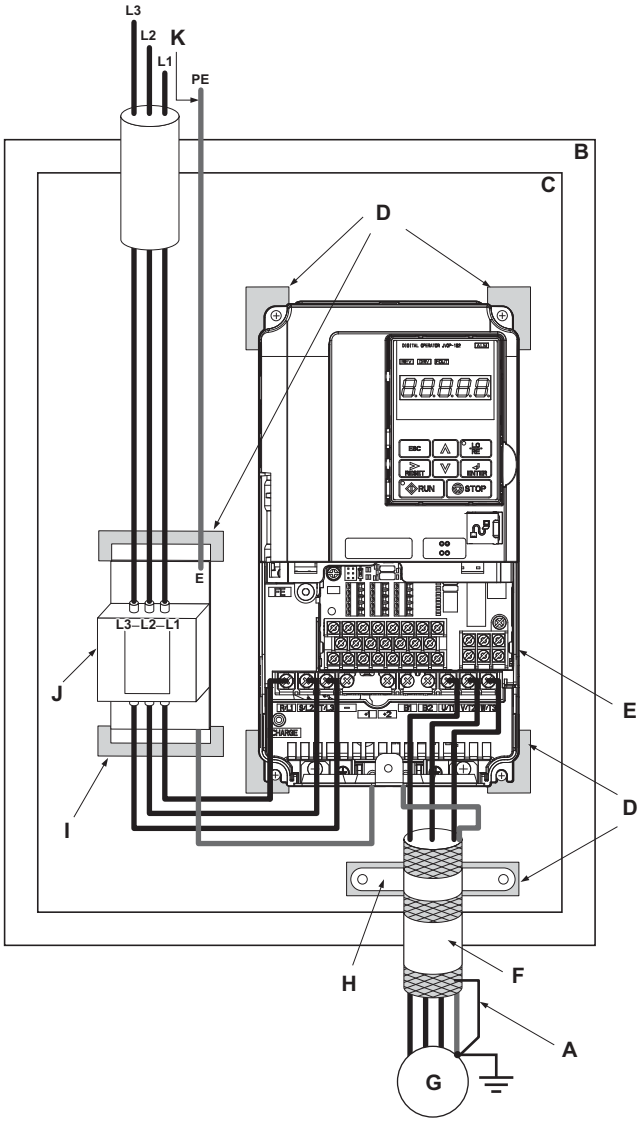


A – Braided shield cable
B – Metal panel
C – Cable clamp (conductive)

Figure 82 Ground Area

6. Connect a DC reactor to minimize harmonic distortion. See page *148*.

Three-Phase 200 V / 400 V Class



A – Ground the cable shield
B – Enclosure panel
C – Metal plate
D – Grounding surface (remove any paint or sealant)
E – Drive
F – Motor cable (braided shield cable, max. 10 m)
G – Motor
H – Cable clamp
I – Ground plate (scrape off any visible paint)
J – EMC noise filter
K – Make sure the ground wire is grounded

Figure 83 EMC Filter and Drive Installation for CE Compliance (Three-Phase 200 V / 400 V Class)

EMC Filters

The drive should be installed with the EMC filters listed below in order to comply with the EN61800-3, category C2 requirements.

Note: If the Safe Disable function of the drive is part of the safety concept of a machine or installation and used for a safe stop according to EN60204-1, stop category 0, use only filters manufactured by Schaffner as listed below.

Table 63 EN61800-3 C2 Filters

Model CIMR-A□	Filter Data (Manufacturer: Schaffner)				
	Type	Rated Current (A)	Weight (kg)	Dimensions [W x L x H] (mm)	Y x X
Three-Phase 200 V Class					
2A0004	FS5972-10-07	10	1.1	141 × 46 × 330	115 × 313
2A0006					
2A0008					
2A0010					
2A0012	FS5972-18-07	18	1.7	141 × 46 × 330	115 × 313
2A0018					
2A0021					
2A0030	FS5972-35-07	35	2.1	206 × 50 × 355	175 × 336
2A0040					
2A0056					
2A0069	FS5972-60-07	60	4	236 × 6 × 408	202 × 390
2A0081					
2A0110	FS5972-100-07	100	3.4	90 × 150 × 330	65 × 255
2A0138					
2A0169	FS5972-170-40	170	4.7	120 × 170 × 451	102 × 365
2A0211					
Three-Phase 400 V Class					
4A0002	FS5972-10-07	10	1.1	141 × 46 × 330	115 × 313
4A0004					
4A0005					
4A0007					
4A0009	FS5972-18-07	18	1.7	141 × 46 × 330	115 × 313
4A0011					
4A0018	FS5972-35-07	35	2.1	206 × 50 × 355	175 × 336
4A0023					
4A0031					
4A0038	FS5972-60-07	60	4	236 × 65 × 408	202 × 390
4A0044					
4A0058					
4A0072	FS5972-100-35	100	3.4	90 × 150 × 330	65 × 255
4A0088					
4A0103	FS5972-170-35	170	4.7	120 × 170 × 451	102 × 365
4A0139					
4A0165					

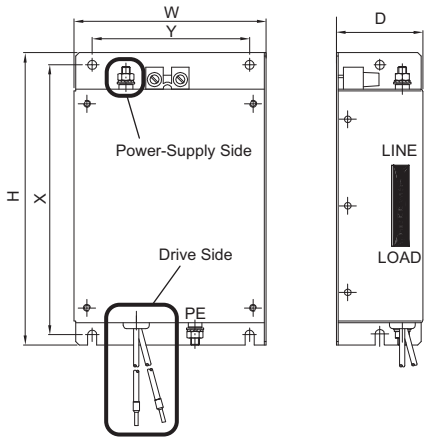


Figure 84 EMC Filter Dimensions

DC Reactors for EN 61000-3-2 Compliance

Table 64 DC Reactors for Harmonics Reduction

Drive Model CIMR-A□	DC Reactor	
	Model	Rating
200V Three-Phase Units		
2A0004	UZDA-B	5.4 A 8 mH
2A0006		
400 V Three-Phase Units		
4A0002	UZDA-B	3.2 A 28 mH
4A0004		

Note: Contact Yaskawa for information about DC reactors for other models.

◆ UL Standards

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 85 UL/cUL Mark

■ UL Standards Compliance

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 severity 2 (UL standard).

Main Circuit Terminal Wiring

Yaskawa recommends using UL-listed copper wires (rated at 75°C), and closed-loop connectors or CSA-certified ring connectors sized for the selected wire gauge to maintain proper clearances when wiring the drive. Use the correct crimp tool to install connectors per manufacturer recommendation. *Table 65* lists a suitable closed-loop connector manufactured by JST Corporation.

Table 65 Closed-Loop Crimp Terminal Size (JIS C 2805) (same for 200 V and 400 V)

Wire Gauge mm² (AWG)	Terminal Screws	Crimp Terminal Model Numbers	Tightening Torque N m (lb to in.)
0.75 (18)	M3.5	R1.25-3.5	0.8 to 1.0 (7.1 to 8.9)
	M4	R1.25-4	1.2 to 1.5 (10.6 to 13.3)
1.25 (16)	M3.5	R1.25-3.5	0.8 to 1.0 (7.1 to 8.9)
	M4	R1.25-4	1.2 to 1.5 (10.6 to 13.3)
2 (14)	M3.5	R2-3.5	0.8 to 1.0 (7.1 to 8.9)
	M4	R2-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R2-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R2-6	4.0 to 5.0 (35.4 to 44.3)
3.5/5.5 (12/10)	M4	R5.5-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R5.5-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R5.5-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R5.5-8	9.0 to 11.0 (79.7 to 97.4)
8 (8)	M4	8-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R8-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R8-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R8-8	9.0 to 11.0 (79.7 to 97.4)
14 (6)	M4	14-4 <1>	1.2 to 1.5 (10.6 to 13.3)
	M5	R14-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R14-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R14-8	9.0 to 11.0 (79.7 to 97.4)

Wire Gauge mm² (AWG)	Terminal Screws	Crimp Terminal Model Numbers	Tightening Torque N m (lb to in.)
22 (4)	M6	R22-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R22-8	9.0 to 11.0 (79.7 to 97.4)
30/38 (3/2)	M8	R38-8	9.0 to 11.0 (79.7 to 97.4)
50/60 (1/ 1/0)	M8	R60-8	9 to 11 (79.7 to 97.4)
	M10	R60-10	18 to 23 (159 to 204)
80 (2/0)	M10	80-10	18 to 23 (159 to 204)
100 (4/0)	M10	R100-10	18 to 23 (159 to 204)

<1> Use the specified crimp terminals (Model 14–NK4) when using CIMR-A□2A0030, A□2A0040, 4□4A0018, and A□4A0023 with 14 mm² (6 AWG).

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.

The installation manual specifies that branch circuit protection should be provided by any of the following:

- Non-time delay Class J, T, or CC fuses sized at 300% of the drive input rating
- Time delay Class J, T, or CC fuses sized at 175% of the drive input rating
- Time-delay Class RK5 fuses sized at 225% of the drive input rating

Table 66 Recommended Input Fuse Selection

Model CIMR-A□	Fuse Type	
	Manufacturer: Bussmann	
	Model	Fuse Ampere Rating (A)
Three-Phase 200 V Class		
2A0004	FWH500V70	70
2A0006	FWH500V70	70
2A0008	FWH500V70	70
2A0010	FWH500V70	70
2A0012	FWH500V70	70
2A0018	FWH500V90	90
2A0021	FWH500V90	90
2A0030	FWH500V100	100
2A0040	FWH500V200	200
2A0056	FWH500V200	200
2A0069	FWH500V200	200
2A0081	FWH500V300	300
2A0110	FWH500V300	300
2A0138	FWH500V350	350
2A0169	FWH500V400	400
2A0211	FWH500V400	400
Three-Phase 400 V Class		
4A0002	FWH500V40	40
4A0004	FWH500V50	50
4A0005	FWH500V70	70
4A0007	FWH500V70	70
4A0009	FWH500V90	90
4A0011	FWH500V90	90
4A0018	FWH500V80	80
4A0023	FWH500V100	100
4A0031	FWH500V125	125
4A0038	FWH500V200	200
4A0044	FWH500V250	250
4A0058	FWH500V250	250
4A0072	FWH500V250	250
4A0088	FWH500V250	250
4A0103	FWH500V250	250
4A0139	FWH500V350	350
4A0165	FWH500V400	400

Low Voltage Wiring for Control Circuit Terminals

Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national state or local codes for wiring. Use a class 2 (UL regulations) power supply for the control circuit terminal when not using the drives internal control power supply.

Table 67 Control Circuit Terminal Power Supply

Input / Output	Terminal Signal	Power Supply Specifications
Multi-function photocoupler output	P1, P2, PC	Requires class 2 power supply
Multi-function digital inputs	S1, S2, S3, S4, S5, S6, S7, S8, SC	Use the internal control power supply of the drive or an external class 2 power supply.
Multi-function analog inputs	A1, A2, A3, AC	
Pulse train input	RP, AC	
Pulse train output	MP, AC	

Drive Short-Circuit Rating

This drive has undergone the UL short-circuit test, which certifies that during a short circuit in the power supply, the current flow will not rise above 100,000 amps at 240 V for 200 V class drives and 480 V for 400 V class drives.

- The MCCB, breaker protection, and fuse ratings shall be equal to or greater than the short-circuit tolerance of the power supply being used.
- Suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes for 240 V in 200 V class drives (up to 480 V for 400 V class drives) motor overload protection.

■ Drive Motor Overload Protection

Set parameter E2-01 (motor rated current) to the appropriate value to enable motor overload protection. The internal motor overload protection is UL listed and in accordance with the NEC and CEC.

E2-01 Motor Rated Current

Setting Range: Model Dependent

Default Setting: Model Dependent

Parameter E2-01 (motor rated current) protects the motor if parameter L1-01 is not set to 0 (default is 1, enabling protection for standard induction motors).

If Auto-Tuning has been performed successfully, the motor data entered to T1-04 is automatically written into parameter E2-01. If Auto-Tuning has not been performed, manually enter the correct motor rated current to parameter E2-01.

L1-01 Motor Overload Protection Selection

The drive has an electronic overload protection function (oL1) based on time, output current, and output frequency, which protects the motor from overheating. The electronic thermal overload function is UL-recognized, so it does not require an external thermal relay for single motor operation.

This parameter selects the motor overload curve used according to the type of motor applied.

Table 68 Overload Protection Settings

Setting	Description	
0	Disabled	Disabled the drive's internal motor overload protection.
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 reduces 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 reduces 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.

When connecting the drive to more than one motor for simultaneous operation, disable the electronic overload protection (L1-01 = 0) and wire each motor with its own motor thermal overload relay.

Enable the motor overload protection (L1-01 = 1 to 5) when connecting the drive to a single motor, unless another motor overload preventing device is installed. The drive electronic thermal overload function causes an oL1 fault, which shuts off the output of the drive and prevents additional overheating of the motor. The motor temperature is continually calculated as long as the drive is powered up.

L1-02 Motor Overload Protection Time

Setting Range: 0.1 to 5.0 min

Factory Default: 1.0 min

Parameter L1-02 determines how long the motor is allowed to operate before the oL1 fault occurs when the drive is running at 60 Hz and at 150% of the full load amp rating (E2-01) of the motor. Adjusting the value of L1-02 can shift the set of oL1 curves up the y axis of the diagram below, but will not change the shape of the curves.

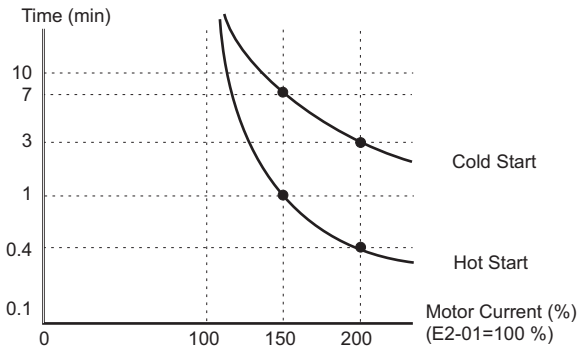


Figure 86 Motor Overload Protection Time

◆ Safe Disable Input Function

■ Precautions

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

DANGER! *When using a PM motor, even if the drive output is shut off by the Safe Disable function, a break down of two output transistors can cause current to flow through the motor winding, resulting in a rotor movement for a maximum angle of 180 degree (electrically). Make sure such a situation would have no effect on the safety of the application when using the Safe Disable function. This is not a concern with induction motors.*

DANGER! *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.*

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.

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.

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.

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.*

When utilizing the Safe Disable function, use only the EMC filters recommended in ***EMC Filter Installation on page 145***.

■ Using the Safe Disable Function

The Safe Disable inputs provide a stop function in compliance with Stop Category 0 as defined in the EN60204-1 (uncontrolled stop by power removal), and “Safe Torque Off” as defined in the IEC61800-5-2. Safe Disable inputs have been designed to meet the requirements of the EN954-1/ISO13849-1, Safety Category 3 and EN61508, SIL2.

A Safe Disable Status Monitor for error detection in the safety circuit is also provided.

Failure Probabilities of the Safety Disable Inputs

Table 69 Overview of the Failure Probabilities

Demand Rate	Failure Probability
Low	PFD = $5.16E^{-6}$
High/continuous	PFH = $1.2E^{-9}$

Performance Level of the Safety Disable Inputs

The Safety Disable Inputs satisfies all requirements of Performance Level d to ISO13849-1. (Note DC from EDM considered.)

Safe Disable Circuit

The Safe Disable circuit consists of two independent input channels that can block the output transistors. In addition, it provides a monitoring channel that indicates the status of those two input channels.

The input can either use the drive internal power supply or an external power supply. Both modes, Sink mode and Source mode are supported. The mode that is 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 Switch for Digital Inputs on page 37*.

The Safe Disable Monitor uses a single channel photocoupler output. *Refer to Control Circuit Input Terminals on page 32* for signal specifications when using this output.

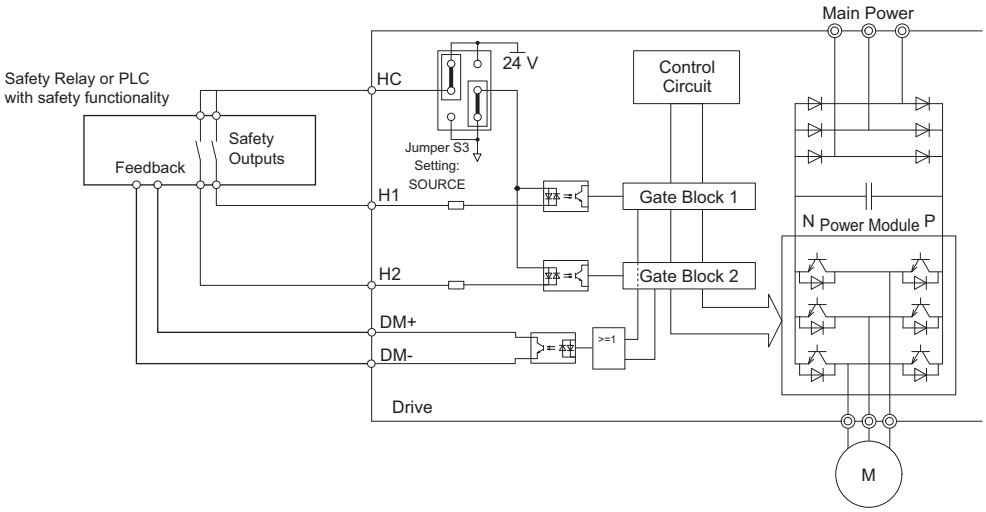


Figure 87 Safe Disable Function Wiring Example (Source Mode)

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

Figure 95 illustrates the Safe Disable input operation.

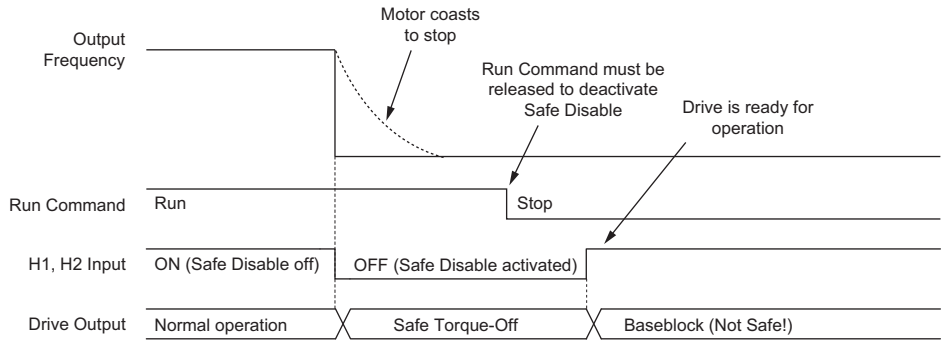


Figure 88 Safe Disable Operation

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.

When Safe Disable was activated during stop, normal operation can be resumed by simply turning on both Safe Disable inputs (i.e., by deactivating "Safe Torque Off").

When Safe Disable was activated during run, first the Run command has to be removed and then the Safe Disable inputs have to be turned on before the drive can be restarted.

Safe Disable Monitor Output Function and Digital Operator Display

Table 70 explains the drive output and Safe Disable monitor state depending on the Safe Disable inputs.

Table 70 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			
OFF	**OFF**	OFF	Safely disabled, "Safe Torque Off"	Hbb (flashes)
ON	**OFF**	ON	Safely disabled, "Safe Torque Off"	HbbF (flashes)
OFF	**ON**	ON	Safely disabled, "Safe Torque Off"	HbbF (flashes)
ON	**ON**	ON	Baseblock, ready for operation	Normal display

Safe Disable Status Monitor

With the Safe Disable monitor output (terminals DM+ and DM-), the drive provides a safety status feedback signal. This signal should be read by the device that controls the Safe Disable inputs (PLC or a safety relay) in order to prohibit leaving the "Safe Torque Off" status in case the safety circuit malfunctions. Refer to the instruction manual of the safety device for details on this function.

Digital Operator Display

When both Safe Disable inputs are open, "Hbb" will flash in the digital operator display.

Should only one of the Safe Disable channels be on while the other is off, "HbbF" will flash in the display to indicate that there is a problem in the safety circuit or in the drive. This display should not appear under normal conditions if the Safe Disable circuit is utilized properly. *Refer to Alarm Codes, Causes, and Possible Solutions on page 91* to resolve possible errors.

Revision History

The revision dates and the numbers of the revised manuals appear on the bottom of the back cover.

MANUAL NO. TOEP C710616 21A
Published in Japan September 2008 08-9
Date of publication
Date of original publication

Date of Publication	Revision Number	Section	Revised Content
September 2008	–	–	First Edition

YASKAWA AC Drive A1000

High Performance Vector Control Drive

Quick Start Guide

IRUMA BUSINESS CENTER (SOLUTION CENTER)
480, Kamifujisawa, Iruma, Saitama 358-8555, Japan
Phone 81-4-2962-5696 Fax 81-4-2962-6138

YASKAWA ELECTRIC AMERICA, INC.
2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone 1-847-887-7000 Fax 1-847-887-7370

YASKAWA ELÉTRICO DO BRASIL LTDA.
Avenida Fagundes Filho, 620 São Paulo-SP CEP 04304-000, Brazil
Phone 55-11-3585-1100 Fax 55-11-5581-8795

YASKAWA ELECTRIC EUROPE GmbH
Hauptstraβe 185, 65760 Eschborn, Germany
Phone 49-6196-569-300 Fax 49-6196-569-398

YASKAWA ELECTRIC UK LTD.
1 Hunt Hill Orchardton Woods Cumbernauld, G68 9LF, United Kingdom
Phone 44-1236-735000 Fax 44-1236-458182

YASKAWA ELECTRIC KOREA CORPORATION
7F, Doore Bldg. 24, Yeoido-dong, Youngdungpo-Ku, Seoul 150-877, Korea
Phone 82-2-784-7844 Fax 82-2-784-8495

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
151 Lorong Chuan, #04-01, New Tech Park 556741, Singapore
Phone 65-6282-3003 Fax 65-6289-3003

YASKAWA ELECTRIC (SHANGHAI) CO., LTD.
No.18 Xizang Zhong Road. Room 1702-1707, Harbour Ring Plaza Shanghai 200001, China
Phone 86-21-5385-2200 Fax 86-21-5385-3299

YASKAWA ELECTRIC (SHANGHAI) CO., LTD. BEIJING OFFICE
Room 1011A, Tower W3 Oriental Plaza, No.1 East Chang An Ave.,
Dong Cheng District, Beijing 100738, China
Phone 86-10-8518-4086 Fax 86-10-8518-4082

YASKAWA ELECTRIC TAIWAN CORPORATION
9F, 16, Nanking E. Rd., Sec. 3, Taipei, Taiwan
Phone 886-2-2502-5003 Fax 886-2-2505-1280

YASKAWA ELECTRIC CORPORATION

YASKAWA

MANUAL NO. TOEP C710616 21A

Published in Japan September 2008 08-9
08-5-3