YASKAWA

YASKAWA AC Drive J1000

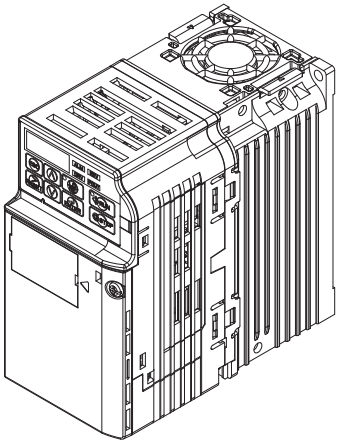
Compact V/f Control Drive

Installation & Start-Up Manual

Type: CIMR-JA ☐, CIMR-JB☐
CIMR-JT ☐

Models: 200 V Class, Three-Phase Input: 0.1 to 5.5 kW
200 V Class, Single-Phase Input: 0.1 to 2.2 kW
400 V Class, Three-Phase Input: 0.2 to 5.5 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.



Receiving 1

Mechanical Installation 2

Electrical Installation 3

Start-Up Programming & Operation 4

Troubleshooting 5

Periodic Inspection & Maintenance 6

Peripheral Devices & Options 7

Specifications A

Parameter List B

Standards Compliance C

MANUAL NO. TOEP C710606 25C

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Table of Contents

i. PREFACE & GENERAL SAFETY 11

i.1 Preface 12

Applicable Documentation 12
Symbols.....12
Terms and Abbreviations.....13

i.2 General Safety 14

Supplemental Safety Information.....14
Safety Messages 15
Drive Label Warnings 18
Warranty Information 18
Quick Reference.....20

1. RECEIVING 21

1.1 Section Safety.....22

1.2 Model Number and Nameplate Check.....23

Nameplate.....23

1.3 Component Names 26

IP20/Open-Chassis 26
Front Views 28

2. MECHANICAL INSTALLATION 29

2.1 Section Safety 30
2.2 Mechanical Installation 33
Installation Environment 33
Installation Orientation and Spacing 34
Exterior and Mounting Dimensions 36

3. ELECTRICAL INSTALLATION 39
3.1 Section Safety 40
3.2 Standard Connection Diagram 43
3.3 Main Circuit Connection Diagram 46
Single-Phase 200 V Class (CIMR-J□BA0001 ~ 0010) 46
Three-Phase 200 V Class (CIMR-J□2A0001 ~ 0020); Three-Phase 400 V Class (CIMR-J□4A0001 ~ 0011) 46
3.4 Terminal Block Configuration 47
3.5 Protective Covers 48
IP20/Open-Chassis Cover Removal and Installation 48
3.6 Main Circuit Wiring 50
Main Circuit Terminal Functions 50
Wire Gauges and Tightening Torque 50
Main Circuit Terminal Power Supply and Motor Wiring 54
3.7 Control Circuit Wiring 57
Control Circuit Terminal Block Functions 58
Terminal Configuration 59
Wiring Procedure 61
3.8 I/O Connections 64
Sinking/Sourcing Mode Switch 64
3.9 Main Frequency Reference 67
DIP Switch S1 Analog Input Signal Selection 67
3.10 Braking Resistor 69
Installation 69
3.11 Interlocking with Connected Machinery 71
Drive Ready Signal 71
3.12 Wiring Checklist 72

4. START-UP PROGRAMMING & OPERATION 75

4.1 Section Safety 76

4.2 Using the Digital LED Operator 79

Keys, Displays, and LEDs 79
Digital Text Display 81
LED Screen Displays 81
LO/RE LED and RUN LED Indications 82
Menu Structure for Digital LED Operator 84

4.3 The Drive and Programming Modes 85

Navigating the Drive and Programming Modes 86
Changing Parameter Settings or Values 90
Verifying Parameter Changes: Verify Menu 90
Switching Between LOCAL and REMOTE 91
Parameters Available in the Setup Group 92

4.4 Start-up Flowchart 93

Flowchart: Basic Start-up 93

4.5 Basic Operation 94

Initialize Parameter Values: A1-03 94
Frequency Reference Source: b1-01 94
Run Command Input Selection: b1-02 96
Stopping Method Selection: b1-03 98
Acceleration/Deceleration: C1-01 to C1-04 99
Drive Duty and Carrier Frequency Selection: C6-01 and C6-02 101
Multi-Step Speed Operation (4-Step Speed) 103
E1: V/f Characteristics 107
Motor Parameters: E2-01 to E2-03 110
Digital Output: H2-01 111
Analog Outputs: H4-01 to H4-03 111
Motor Protection: L1-01 and L1-02 113
Notes on Controlling the Brake for the Hoist Application 116
Drive Status Monitors: U1-01 to U4-13 118

4.6 Powering Up the Drive 119

Powering Up the Drive and Operation Status Display 119
V/f Pattern Setting 120

4.7 No-Load Operation Test Run 121

No-Load Operation Test Run 121
4.8 Test Run with Load Connected 123
Test Run with the Load Connected 123
4.9 Verifying and Backing Up Parameter Settings 124
Parameter Access Level: A1-01 124
Password Settings: A1-04, A1-05 124
Copy Function (Optional) 124
4.10 Test Run Checklist 126

5. TROUBLESHOOTING 127
5.1 Section Safety 128
5.2 Motor Performance Fine Tuning 131
Parameters for Tuning the Drive 131
Motor Hunting and Oscillation Control Parameters 132
5.3 Drive Alarms, Faults, and Errors 133
Types of Alarms, Faults, and Errors 133
Alarm and Error Displays 134
5.4 Fault Detection 137
Fault Displays, Causes and Possible Solutions 137
5.5 Alarm Detection 147
Alarm Codes, Causes, and Possible Solutions 147
5.6 Operator Programming Errors 152
oPE Codes, Causes, and Possible Solutions 152
5.7 Diagnosing and Resetting Faults 154
Fault Occurs Simultaneously with Power Loss 154
If the Drive Still has Power After a Fault Occurs 154
Viewing Fault History Data After Fault 154
Fault Reset Methods 155
5.8 Troubleshooting without Fault Display 156
Cannot Change Parameter Settings 156
Motor Does Not Rotate Properly after Pressing RUN Button or after Entering External Run Command 157

6. PERIODIC INSPECTION & MAINTENANCE 167

6.1 Section Safety 168
6.2 Inspection 171
Recommended Daily Inspection 171
Recommended Periodic Inspection 173
6.3 Periodic Maintenance 175
Replacement Parts 175
6.4 Drive Cooling Fans 178
Number of Cooling Fans 178
Cooling Fan Replacement 179

7. PERIPHERAL DEVICES & OPTIONS 183
7.1 Section Safety 184
7.2 Drive Options and Peripheral Devices 186
7.3 Connecting Peripheral Devices 189
7.4 Installing Peripheral Devices 191
Installing a Molded Case Circuit Breaker (MCCB) and Earth Leakage Circuit Breaker (ELCB) 191
Installing a Leakage Breaker 192
Installing a Magnetic Contactor 192
Connecting an AC or DC Reactor 193
Connecting a Surge Absorber 194
Connecting a Noise Filter 194
Zero-Phase Reactor 197
Installing Fuses on the Input Side 198
Attachment for External Heatsink 199
Noise Filter Installation 199
Installing a Motor Thermal Overload (oL) Relay on the Drive Output 199
NEMA Type 1 Kit 201
7.5 Options 207
Interface Options 207
Other Options 207

A. SPECIFICATIONS 209
A.1 Heavy Duty and Normal Duty Ratings 210

A.2 Single/Three-Phase 200 V Class Drive 211
A.3 Three-Phase 400 V Class Drives 213
A.4 Drive Specifications 214
A.5 Drive Watt Loss Data 217
A.6 Drive Derating Data 219
Carrier Frequency Derating 219
Temperature Derating 219
Altitude Derating 220

B. PARAMETER LIST 221
B.1 Parameter Groups 222
B.2 Parameter Table 223
A: Initialization Parameters 223
b: Application 224
C: Tuning 225
d: References 228
E: Motor Parameters 230
H Parameters: Multi-Function Terminals 231
L: Protection Function 237
n: Advanced Performance Set-Up 241
o: Operator Related Parameters 241
U: Monitors 243
B.3 China Localized Drive Default Values 246
B.4 Defaults by Drive Model and Duty Rating ND/HD 247

C. STANDARDS COMPLIANCE 251
C.1 Section Safety 252
C.2 European Standards 255
CE Low Voltage Directive Compliance 255
EMC Guidelines Compliance 256
C.3 UL Standards 261
UL Standards Compliance 261
Drive Motor Overload Protection 269
C.4 Precautions for Korean Radio Waves Act 271

C.5 한국 전파법에 관한 주의사항 272

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i

Preface & General Safety

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

i.1 PREFACE.....12

i.2 GENERAL SAFETY.....14

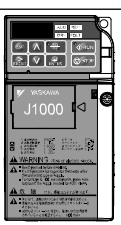
i.1 Preface

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

This manual is designed to ensure correct and suitable application of Variable J1000-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 J1000 series drives:

	J1000 Series Compact V/f Control Drive Installation and Start-Up Manual
	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. Refer to the J1000 Technical Manual for complete descriptions of drive features and functions.
	J1000 Series Compact V/f Control Drive Technical Manual
	This manual describes installation, wiring, operation procedures, functions, troubleshooting, maintenance, and inspections to perform before operation.

◆ Symbols

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



Indicates a term or definition used in this manual.

◆ Terms and Abbreviations

- **Drive**: Yaskawa J1000 Series Drive
- **r/min**: Revolutions per Minute
- **SI-485/J**: RS-422/RS-485 Interface for MEMOBUS/Modbus Communication
- **V/f**: V/f Control

i.2 General Safety

◆ Supplemental Safety Information

General Precautions
• The diagrams in this manual may be indicated without covers or safety shields to show details. 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. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are OFF and measure the DC bus voltage level to confirm safe level.

⚠ 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.

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.

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

Improper equipment sequencing could result in damage to the drive.

Do not perform a withstand voltage test on any part of the drive.

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

Do not operate damaged equipment.

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

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

Install adequate branch circuit short circuit protection per applicable codes.

Failure to comply could result in damage to the drive.

The drive is suitable for circuits capable of delivering not more than 31,000 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 i.1*** in the position shown in ***Figure i.2***.

WARNING Risk of electric shock.

- Read manual before installing.
- Wait 1 minute for capacitor discharge after disconnecting power supply.
- To conform to CE requirements, make sure to ground the supply neutral for 400V class.

Figure i.1 Warning Information

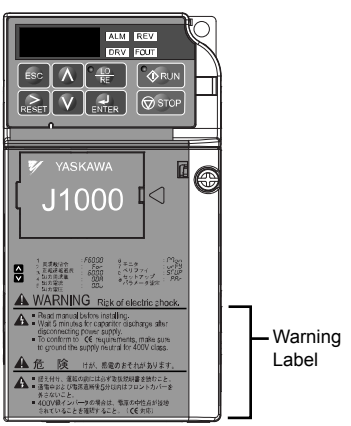


Figure i.2 Warning Information Position

◆ 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.

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

The drive 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.

◆ Quick Reference

Run a Motor of One-Frame Larger Capacity
When using this drive for variable torque loads such as fans and pumps, a motor one frame size larger can be used.

Know the Details of Safety Measures
The functions listed below affect the safe operation of the drive. Ensure that the settings fit the application requirements prior to operation.
Safe operations. Run by power on. Parameter setting b1-17.
LED operator stop key priority selection. Parameter o2-02.
Enter press required after changing the keypad frequency reference. Parameter o2-05.
Operation interlock when program mode is selected. Parameter b1-08.

Standards Compliance	
Refer to European Standards on page 255, *Refer to UL Standards on page 261*, and *Refer to Precautions for Korean Radio Waves Act on page 271*.	CE c UL us LISTED KC

1

Receiving

This chapter describes the proper inspections to perform after receiving the drive and illustrates the different enclosure types and components.

1.1 SECTION SAFETY.....22

1.2 MODEL NUMBER AND NAMEPLATE CHECK 23

1.3 COMPONENT NAMES.....26

1.1 Section Safety

⚠ CAUTION

Do not carry the drive by the front cover.

Failure to comply may cause the main body of the drive to fall, resulting in minor or moderate injury.

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.

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

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

1.2 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

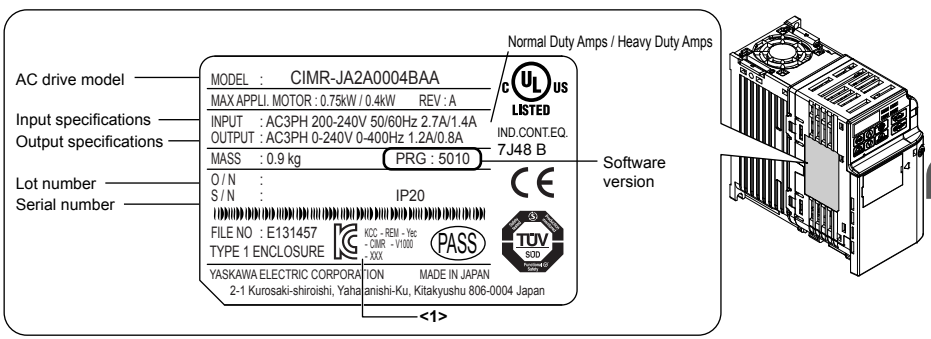
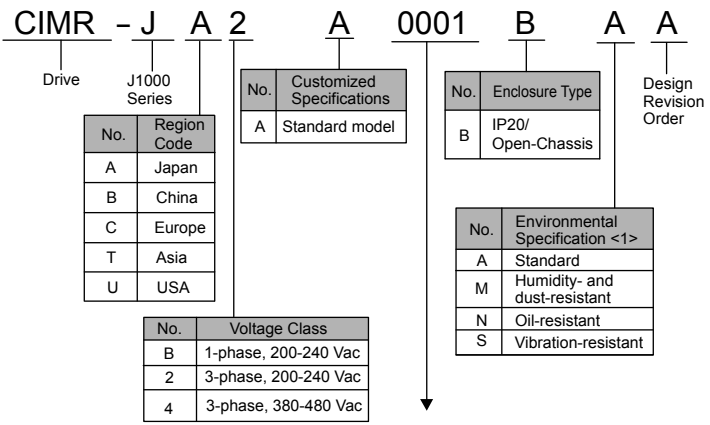


Figure 1.1 Nameplate Information

<1> Drive models CIMR-JT□□□□□□ bearing the KC mark conform to the Korean Radio Waves Act and are designated for use in Asia (Region code: T).

KC 마크가 부착되어 있는 제품은 한국 전파법에 적합한 아시아향 기종 (형식: CIMR-JT□□□□□□)입니다.



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

■ Single-Phase 200 V

Normal Duty		
No.	**Max. Motor Capacity kW**	**Rated Output Current A**
0001	0.2	1.2
0002	0.4	1.9
0003	0.75	3.3
0006	1.1	6.0
0010	2.2	9.6

Heavy Duty		
No.	**Max. Motor Capacity kW**	**Rated Output Current A**
0001	0.1	0.8
0002	0.2	1.6
0003	0.4	3.0
0006	0.75	5.0
0010	1.5	8.0

■ Three-Phase 200 V

Normal Duty		
No.	Max Motor Capacity kW	Rated Output Current A
0001	0.2	1.2
0002	0.4	1.9
0004	0.75	3.5
0006	1.1	6.0
0008 <1>	1.5	8.0
0010	2.2	9.6
0012	3.0	12.0
0018 <1>	3.7	17.5
0020	5.5	19.6

Heavy Duty		
No.	Max Motor Capacity kW	Rated Output Current A
0001	0.1	0.8
0002	0.2	1.6
0004	0.4	3.0
0006	0.75	5.0
0008 <1>	1.1	6.9
0010	1.5	8.0
0012	2.2	11.0
0018 <1>	3.0	14.0
0020	3.7	17.5

<1> Available for Japan localized drives only: CIMR-JA□A.

■ Three-Phase 400 V

Normal Duty		
No.	Max. Motor Capacity kW	Rated Output Current A
0001	0.4	1.2
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

Heavy Duty		
No.	Max. Motor Capacity kW	Rated Output Current A
0001	0.2	1.2
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

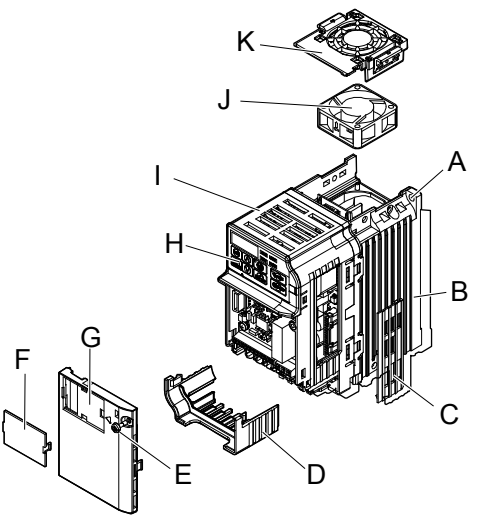
1.3 Component Names

This section illustrates drive components in the IP20/Open-Chassis models.

Refer to NEMA Type 1 Kit on page 201 for information on using the NEMA Type 1 Kit option to create a NEMA Type 1 rating.

◆ IP20/Open-Chassis

■ Single-Phase AC200 V CIMR-J□BA0001B ~ 0003B Three-Phase AC200 V CIMR-J□2A0001B ~ 0006B

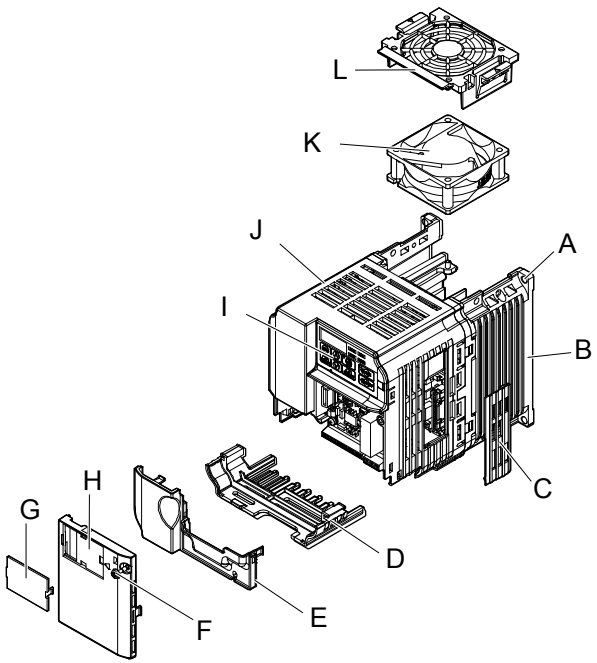


A – Mounting hole
B – Heatsink
C – Cable cover
D – Terminal cover
E – Front cover screw
F – Option connector cover
G – Front cover
H – LED operator *Refer to Using the Digital LED Operator on page 79*
I – Case
J – Cooling fan *<1>*
K – Fan cover *<1>*

Figure 1.2 Exploded View of IP20/Open-Chassis Type Components Three-Phase AC200 V CIMR-J□2A0006B

<1> The drives CIMR-J□BA0001B ~ 0003B and CIMR-J□2A0001B ~ 0004B do not have a cooling fan or a cooling fan cover.

■ Single-Phase AC200 V CIMR-J□BA0006B ~ 0010B
Three-Phase AC200 V CIMR-J□2A0008B ~ 0020B
Three-Phase AC400 V CIMR-J□4A0001B ~ 0011B

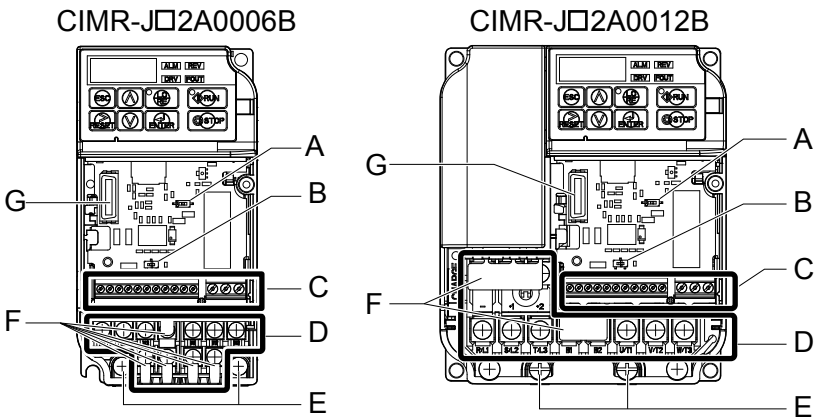


A – Mounting hole
B – Heatsink
C – Cable cover
D – Terminal cover
E – Bottom cover
F – Front cover screw
G – Option connector cover
H – Front cover
I – LED operator *Refer to Using the Digital LED Operator on page 79*
J – Case
K – Cooling fan *<1>*
L – Fan cover *<1>*

Figure 1.3 Exploded view of IP20/Open-Chassis Type Components
Three-Phase AC200 V CIMR-J□2A0012B

<1> The drives CIMR-J□BA0006B and CIMR-J□4A0001B ~ 0004B do not have a cooling fan or a cooling fan cover.

◆ Front Views



A – DIP switch S1 *Refer to DIP Switch S1 Analog Input Signal Selection on page 67*
B – DIP switch S3 *Refer to Sinking/Sourcing Mode Switch on page 64*
C – Control circuit terminal *Refer to Control Circuit Wiring on page 57*
D – Main circuit terminal *Refer to Wiring the Main Circuit Terminal on page 56*
E – Ground terminal
F – Terminal cover
G – Option unit connector *Refer to Options on page 207*

Figure 1.4 Front Views of Drives

2

Mechanical Installation

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

2.1 SECTION SAFETY.....30
2.2 MECHANICAL INSTALLATION.....33

2.1 Section Safety

⚠ WARNING

Fire Hazard

Provide sufficient cooling with a fan or air conditioning unit when installing the drive inside an enclosed panel or cabinet.

Failure to comply could result in overheating and fire.

The airflow over an IP20/Open-Chassis drive should be less than 50 °C, while an IP20/ NEMA Type 1 drive using the NEMA Type 1 Kit option should have an airflow cooler than 40 °C.

⚠ 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 (ESD) procedures when handling the drive.

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

It may be difficult to perform maintenance on the cooling fans of drives installed in a vertical row inside an enclosure.

Ensure adequate spacing at the top of the drive to perform cooling fan replacement when required.

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

Reduce the motor torque in the low-speed range whenever using a standard blower cooled motor. If 100% torque is required continuously at low speed, consider using a special drive or vector motor. Select a motor that is compatible with the required load torque and operating speed range.

Do not operate motors above the maximum rated RPM.

Failure to comply may lead to bearing or other mechanical motor failures.

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

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

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

NOTICE

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

Failure to comply could lead to motor winding failure.

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

Install vibration-proof rubber on the motor base or use the frequency jump function to skip a frequency resonating the machine.

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

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

The rated input current of submersible motors is higher than the rated input current of standard motors.

Select an appropriate drive according to its rated output current. When the distance between the motor and drive is long, use a cable thick enough to connect the motor to the drive to prevent motor torque reduction.

When using an explosion-proof motor, it must be subject to an explosion-proof test in conjunction with the drive.

This is also applicable when an existing explosion-proof motor is to be operated with the drive. Since the drive itself is not explosion-proof, always install it in a safe place.

Do not use a drive for a single-phase motor.

Replace the motor with a three-phase motor.

If an oil-lubricated gearbox or speed reducer is used in the power transmission mechanism, oil lubrication will be affected when the motor operates only in the low speed range.

The power transmission mechanism will make noise and experience problems with service life and durability if the motor is operated at a speed higher than the rated speed.

2.2 Mechanical Installation

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

◆ Installation Environment

To help prolong the optimum performance life of the drive, install the drive in the proper environment. The table below provides a description of the appropriate environment for the drive.

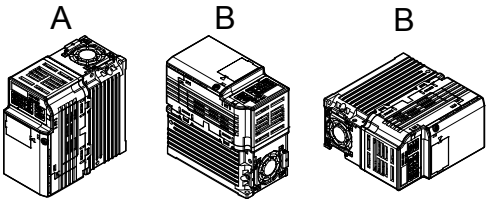
Table 2.1 Installation Environment

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	-10 °C to +50 °C (IP20/Open-Chassis) Drive reliability improves in environments without wide temperature fluctuations. When using an enclosure panel, install a cooling fan or air conditioner in the area to ensure that the air temperature inside the enclosure does not exceed the specified levels. Do not allow ice to develop on the drive.
Humidity	95% RH or less and free of condensation
Storage Temperature	-20 °C to +60 °C
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	Up to 1000 meters without derating; up to 3000 meters with output current, ambient temperature, and voltage derating.
Vibration	10 to 20 Hz at 9.8 m/s^2 20 to 55 Hz at 5.9 m/s^2
Orientation	Install the drive vertically to maintain maximum cooling effects.

NOTICE: *Prevent foreign matter such as metal shavings or wire clippings from falling into the drive during installation and project construction. Failure to comply could result in damage to the drive. Place a temporary cover over the top of the drive during installation. Remove the temporary cover before 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 2.1* to maintain proper cooling.

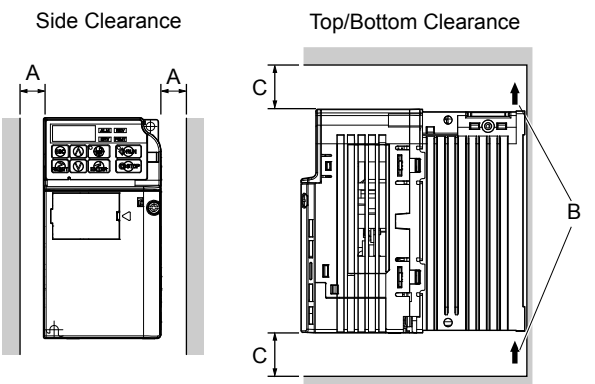


A – Correct **B – Incorrect**

Figure 2.1 Correct Installation Orientation

■ Single Drive Installation

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



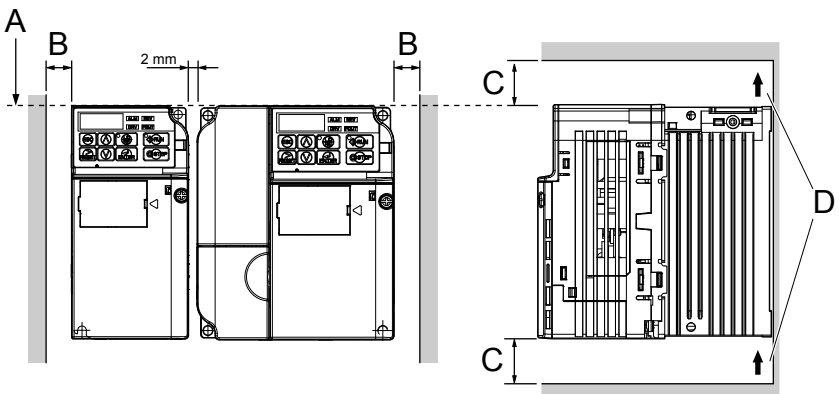
A – 30 mm minimum **C – 100 mm minimum**
B – Airflow direction

Figure 2.2 Correct Installation Spacing

Note: The space required on the left and right sides of the drive are the same for IP20/Open-Chassis drives and IP20/NEMA Type 1 drives using the NEMA Type 1 Kit option.

■ Multiple Drive Installation

When installing multiple drives into the same enclosure panel, mount the drives according to ***Figure 2.2***. When mounting drives with a minimum side-by-side clearance of 2 mm according to ***Figure 2.3***, derating must be considered and parameter L8-35 must be set. ***Refer to Parameter List on page 221***.



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

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

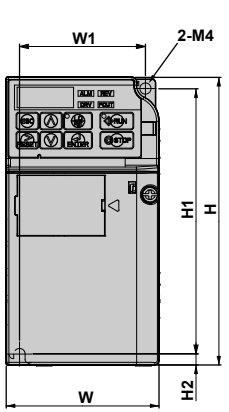
Note: When installing drives of different heights in the same enclosure panel, the tops of the drives should line up. Leave space between the top and bottom of stacked drives for cooling fan replacement if required. Using this method, it is possible to replace the cooling fans later.

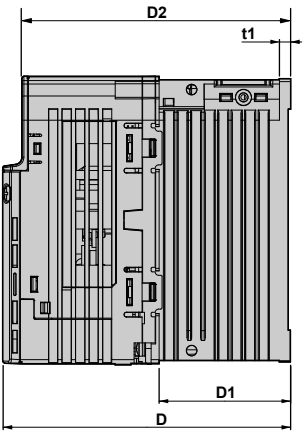
◆ Exterior and Mounting Dimensions

Refer to NEMA Type 1 Kit on page 201 for exterior and mounting dimensions for drives using the NEMA Type 1 Kit option.

■ IP20/Open-Chassis Drives

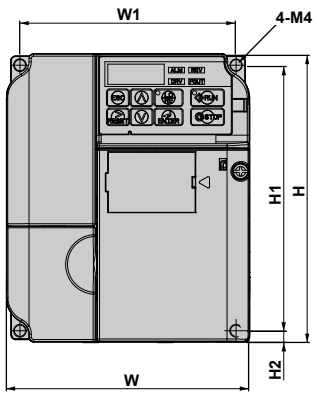
Table 2.2 IP20/Open-Chassis (without an EMC filter)

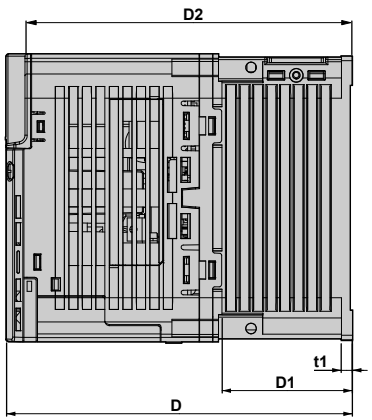




Voltage Class	Drive Model CIMR-J□	Dimensions (mm)									
		W	H	D	W1	H1	H2	D1	D2	t1	Wt. (kg)
Single-Phase 200 V Class	BA0001B	68	128	76	56	118	5	6.5	67.5	3	0.6
	BA0002B	68	128	76	56	118	5	6.5	67.5	3	0.6
	BA0003B	68	128	118	56	118	5	38.5	109.5	5	1.0
Three-Phase 200 V Class	2A0001B	68	128	76	56	118	5	6.5	67.5	3	0.6
	2A0002B	68	128	76	56	118	5	6.5	67.5	3	0.6
	2A0004B	68	128	108	56	118	5	38.5	99.5	5	0.9
	2A0006B	68	128	128	56	118	5	58.5	119.5	5	1.1

Table 2.3 IP20/Open-Chassis (without an EMC filter)





Voltage Class	Drive Model CIMR-J□	Dimensions (mm)									
		W	H	D	W1	H1	H2	D1	D2	t1	Wt. (kg)
Single-Phase 200 V Class	BA0006B	108	128	137.5	96	118	5	58	129	5	1.7
	BA0010B	108	128	154	96	118	5	58	145.5	5	1.8
Three-Phase 200 V Class	2A0008B	108	128	129	96	118	5	58	120.5	5	1.7
	2A0010B	108	128	129	96	118	5	58	120.5	5	1.7
	2A0012B	108	128	137.5	96	118	5	58	129	5	1.7
	2A0018B	140	128	143	128	118	5	65	134.5	5	2.4
	2A0020B	140	128	143	128	118	5	65	134.5	5	2.4
Three-Phase 400 V Class	4A0001B	108	128	81	96	118	5	10	72.5	5	1.0
	4A0002B	108	128	99	96	118	5	28	90.5	5	1.2
	4A0004B	108	128	137.5	96	118	5	58	129	5	1.7
	4A0005B	108	128	154	96	118	5	58	145.5	5	1.7
	4A0007B	108	128	154	96	118	5	58	145.5	5	1.7
	4A0009B	108	128	154	96	118	5	58	145.5	5	1.7
	4A0011B	140	128	143	128	118	5	65	134.5	5	2.4

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3

Electrical Installation

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

3.1 SECTION SAFETY.....40
3.2 STANDARD CONNECTION DIAGRAM.....43
3.3 MAIN CIRCUIT CONNECTION DIAGRAM.....46
3.4 TERMINAL BLOCK CONFIGURATION.....47
3.5 PROTECTIVE COVERS.....48
3.6 MAIN CIRCUIT WIRING.....50
3.7 CONTROL CIRCUIT WIRING.....57
3.8 I/O CONNECTIONS.....64
3.9 MAIN FREQUENCY REFERENCE.....67
3.10 BRAKING RESISTOR.....69
3.11 INTERLOCKING WITH CONNECTED MACHINERY.....71
3.12 WIRING CHECKLIST.....72

3.1 Section Safety

DANGER

Electrical Shock Hazard

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

Failure to comply will result in death or serious injury.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

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

Always ground the motor-side grounding terminal.

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

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

Failure to comply could result in death or serious injury.

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

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

Failure to comply could result in death or serious injury.

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

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

⚠ WARNING

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are off and measure the DC bus voltage level to confirm safe level.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

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

Do not use improper combustible materials.

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

Attach the drive to metal or other noncombustible material.

Do not use an improper voltage source.

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

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

NOTICE

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

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

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

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

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

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

Failure to comply could result in damage to the drive.

Do not modify the drive circuitry.

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

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

3.2 Standard Connection Diagram

Connect the drive and peripheral devices as shown in ***Figure 3.***. It is possible to 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 75*** for instructions on operating the drive.

NOTICE: *Inadequate branch short circuit protection 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 31,000 RMS symmetrical amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400 V Class).*

NOTICE: *When 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.*

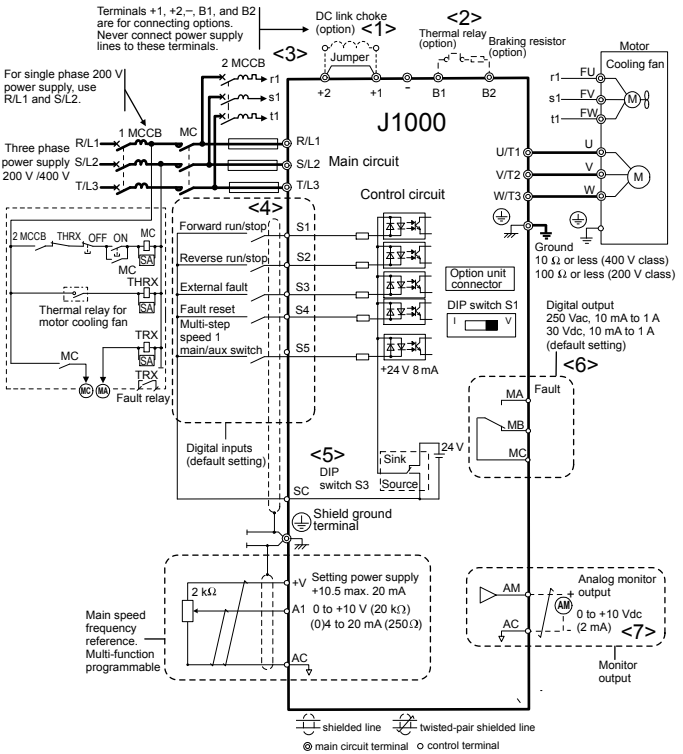


Figure 3.1 Drive Standard Connection Diagram (200 V Class Example)

<1> Remove the jumper when installing an optional DC reactor.

<2> The MC on the input side of the main circuit should open when the thermal relay is triggered.

<3> Self-cooled motors do not require separate cooling fan motor wiring.

<4> Connected using sequence input signal (S1 to S5) from NPN transistor; Default: sink mode (0 V com).

<5> Use only a +24 V internal power supply in sinking mode; the source mode requires an external power supply. ***Refer to I/O Connections on page 64***.

<6> Minimum load: 5 Vdc, 10 mA (reference value).

<7> 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.

WARNING! *Sudden Movement Hazard. Do not close the wiring for the control circuit unless the multifunction input terminal parameter is properly set (S5 for 3-Wire; H1-05 = "0"). 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.*

Figure 3.2 illustrates an example of a 3-Wire sequence.

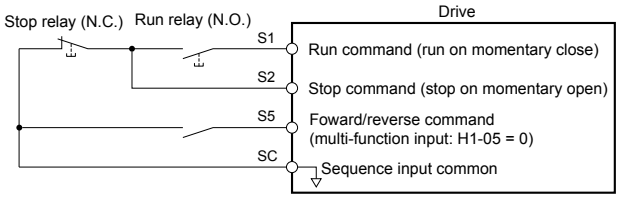


Figure 3.2 3-Wire Sequence

3.3 Main Circuit Connection Diagram

Refer to diagrams in this section for the Main Circuit wiring connections. Connections may vary based on drive capacity. The main circuit DC power supply powers the control circuit.

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

◆ Single-Phase 200 V Class (CIMR-J□BA0001 ~ 0010)

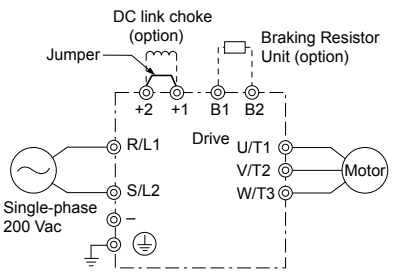


Figure 3.3 Connecting Single-Phase Main Circuit Terminals

NOTICE: *Do not connect T/L3 terminal when using single-phase power supply input. Incorrect wiring may damage the drive.*

◆ Three-Phase 200 V Class (CIMR-J□2A0001 ~ 0020); Three-Phase 400 V Class (CIMR-J□4A0001 ~ 0011)

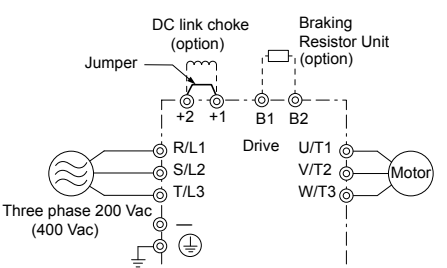


Figure 3.4 Connecting Three-Phase Main Circuit Terminals

3.4 Terminal Block Configuration

The figures in this section provide illustrations of the main circuit terminal block configurations of the different drive sizes.

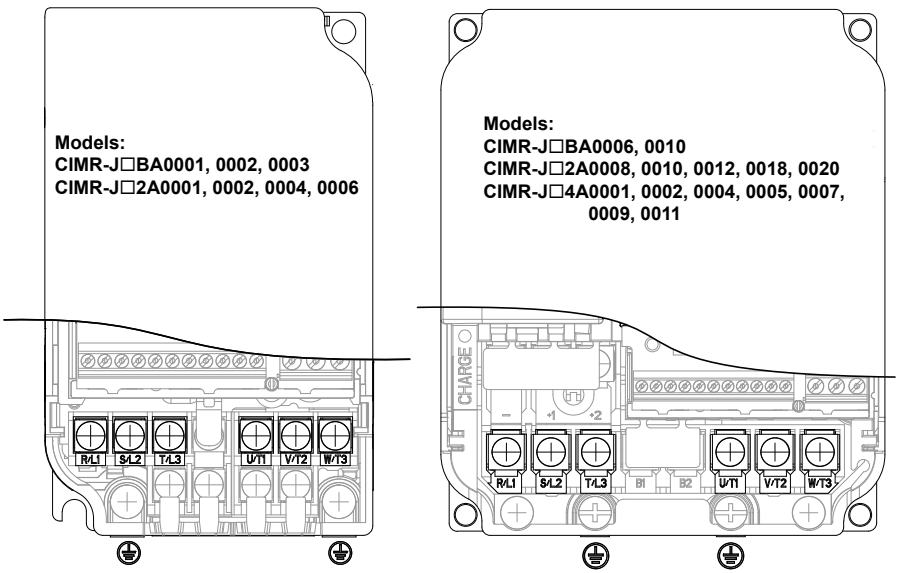


Figure 3.5 Main Circuit Terminal Block Configurations

3.5 Protective Covers

Follow the procedure below to remove the protective covers before wiring the drive and to reattach the covers after wiring is complete.

◆ IP20/Open-Chassis Cover Removal and Installation

■ Removing the Protective Covers

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

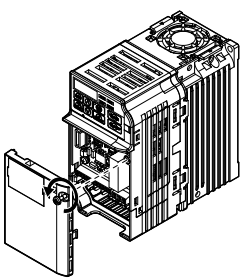


Figure 3.6 Remove the Front Cover on an IP20/Open-Chassis Drive

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

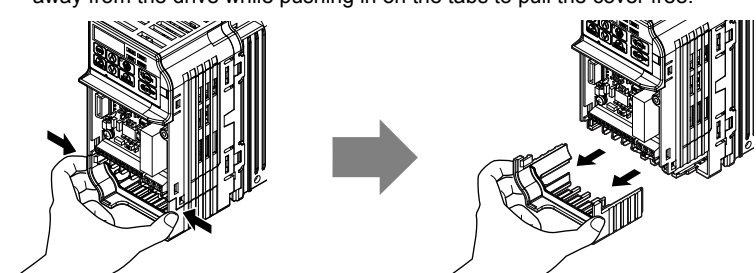


Figure 3.7 Remove the Terminal Cover on an IP20/Open-Chassis Drive

■ Reattaching the Protective Covers

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

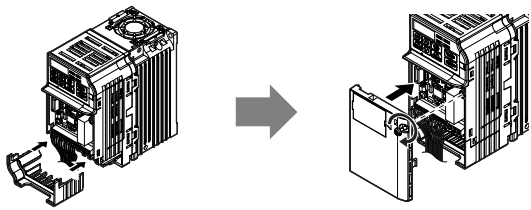


Figure 3.8 Reattach the Protective Covers on an IP20/Open-Chassis Drive

3.6 Main Circuit Wiring

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

◆ Main Circuit Terminal Functions

Table 3.1 Main Circuit Terminal Functions

Terminal	Type	Function	Reference
R/L1	Main circuit power supply input	Connects line power to the drive. Drives with single-phase 200 V input power use terminals R/L1 and S/L2 only (T/L3 must not be used).	–
S/L2			
T/L3			
U/T1	Drive output	Connects to the motor.	*54*
V/T2			
W/T3			
B1	Braking resistor	Available for connecting a braking resistor or the braking resistor unit option.	–
B2			
+1	DC reactor connection	These terminals are shorted at shipment. Remove the shorting bar between +1 and +2 when connecting a DC reactor to this terminal.	–
+2			
+1	DC power supply input	For connecting a DC power supply.	–
–			
⏚ (2 terminals)	Ground	Grounding Terminal	*55*

◆ Wire Gauges and Tightening Torque

Select the appropriate wires and crimp terminals from *Table 3.2* through *Table 3.4*.

Note:
1. Wire gauge recommendations based on drive continuous current ratings using 75 °C 600 Vac vinyl-sheathed wire assuming ambient temperature within 30 °C and wiring distance less than 100 m.
2. Terminals +1, +2, –, B1 and B2 are for connecting optional devices such as a 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) = $\sqrt{3}$ x wire resistance (Ω/km) x wire length (m) x current (A) x 10^{-3}
- Refer to instruction manual TOBP C720600 00 for braking unit or braking resistor unit wire gauges.

- *Refer to UL Standards Compliance on page 261* for information on UL compliance.

■ Single-Phase 200 V Class

Table 3.2 Wire Gauge and Torque Specifications

Model CIMR-J□BA	Terminal	For Japan and Asia <1>		For United States <2>		For Europe and China <3>		Screw Size	Tightening Torque N•m (lb.in.)
		Recomm. Gauge mm²	Wire Range mm²	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Recomm. Gauge mm²	Wire Range mm²		
0001 0002 0003	R/L1, S/L2, T/L3	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5	M3.5	0.8 to 1.0 (7.1 to 8.9)
	U/T1, V/T2, W/T3	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5		
	–, +1, +2	2	0.75 to 2	–	18 to 14	–	0.75 to 2.5		
	B1, B2	2	0.75 to 2	–	18 to 14	–	0.75 to 2.5		
	⏚	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5		
0006	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		
0010	R/L1, S/L2, T/L3	3.5	2 to 5.5	10	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	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		

<1> Gauges listed here are for use in Japan and Asia.

<2> Gauges listed here are for use in the United States.

<3> Gauges listed here are for use in Europe and China.

■ Three-Phase 200 V Class

Table 3.3 Wire Gauge and Torque Specifications

Model CIMR-J□2A	Terminal	For Japan and Asia <1>		For United States <2>		For Europe and China <3>		Screw Size	Tightening Torque N•m (lb.in.)
		Recomm. Gauge mm²	Wire Range mm²	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Recomm. Gauge mm²	Wire Range mm²		
0001 0002 0004 0006	R/L1, S/L2, T/L3	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5	M3.5	0.8 to 1.0 (7.1 to 8.9)
	U/T1, V/T2, W/T3	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5		
	–, +1, +2	2	0.75 to 2	–	18 to 14	–	0.75 to 2.5		
	B1, B2	2	0.75 to 2	–	18 to 14	–	0.75 to 2.5		
	⏚	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5		
0008 0010	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		
0012	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		
	⏚	2	2 to 5.5	10	14 to 10	2.5	2.5 to 6		
0018	R/L1, S/L2, T/L3	3.5	2 to 5.5	10	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	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		

Model CIMR-J□2A	Terminal	For Japan and Asia <1>		For United States <2>		For Europe and China <3>		Screw Size	Tightening Torque N•m (lb.in.)
		Recomm. Gauge mm²	Wire Range mm²	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Recomm. Gauge mm²	Wire Range mm²		
0020	R/L1, S/L2, T/L3	5.5	2 to 5.5	10	14 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	2 to 5.5	10	14 to 10	2.5	2.5 to 6		
	–, +1, +2	5.5	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	4	2.5 to 6		

<1> Gauges listed here are for use in Japan and Asia.

<2> Gauges listed here are for use in the United States.

<3> Gauges listed here are for use in Europe and China.

■ Three-Phase 400 V Class

Table 3.4 Wire Gauge and Torque Specifications

Model CIMR-J□4A	Terminal	For Japan and Asia <1>		For United States <2>		For Europe and China <3>		Screw Size	Tightening Torque N•m (lb.in.)
		Recomm. Gauge mm²	Wire Range mm²	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Recomm. Gauge mm²	Wire Range mm²		
0001 0002 0004	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	14	14 to 10	2.5	2.5 to 6		
0005 0007 0009	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		

Model CIMR-J□4A	Terminal	For Japan and Asia <1>		For United States <2>		For Europe and China <3>		Screw Size	Tightening Torque N•m (lb.in.)
		Recomm. Gauge mm²	Wire Range mm²	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Recomm. Gauge mm²	Wire Range mm²		
0011	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		
	⏚	2	2 to 5.5	10	14 to 10	2.5	2.5 to 6		

<1> Gauges listed here are for use in Japan and Asia.

<2> Gauges listed here are for use in the United States.

<3> Gauges listed here are for use in Europe and China.

◆ Main Circuit Terminal Power Supply 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. Improper application of noise filters could result in damage to the drive.*

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

When the cable length between the drive and the motor is too long (especially at low frequency output), note that the cable voltage drop may cause reduced motor torque. 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 the following table. If the motor wiring distance exceeds 100 m because of the system configuration, reduce the ground currents.

Refer to ***Table 3.5*** to set the carrier frequency to an appropriate level.

Table 3.5 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, calculate the cable length as the total distance of wiring to all connected motors when running multiple motors from a single drive.

■ Ground Wiring

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

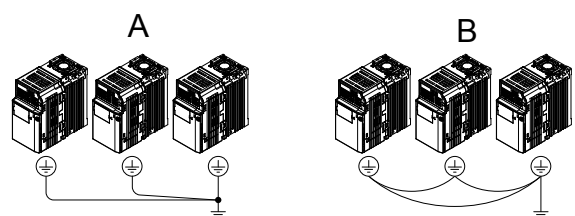
WARNING! *Electrical Shock Hazard. Always use a ground wire that complies with technical standards on electrical equipment and minimize the length of the ground wire. Improper equipment grounding may cause dangerous electrical potentials on equipment chassis, which could result in death or serious injury.*

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



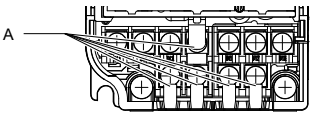
A – Correct **B – Incorrect**

Figure 3.9 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.*

Note: A cover placed over the DC Bus and braking circuit terminals prior to shipment helps prevent miswiring. Cut away covers as needed for terminals with a needle-nose pliers.



A – Protective Cover to Prevent Miswiring

Main Circuit Connection Diagram

Refer to section ***3.3 Main Circuit Connection Diagram*** on page ***46*** for drive main power circuit connections.

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

3.7 Control Circuit Wiring

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

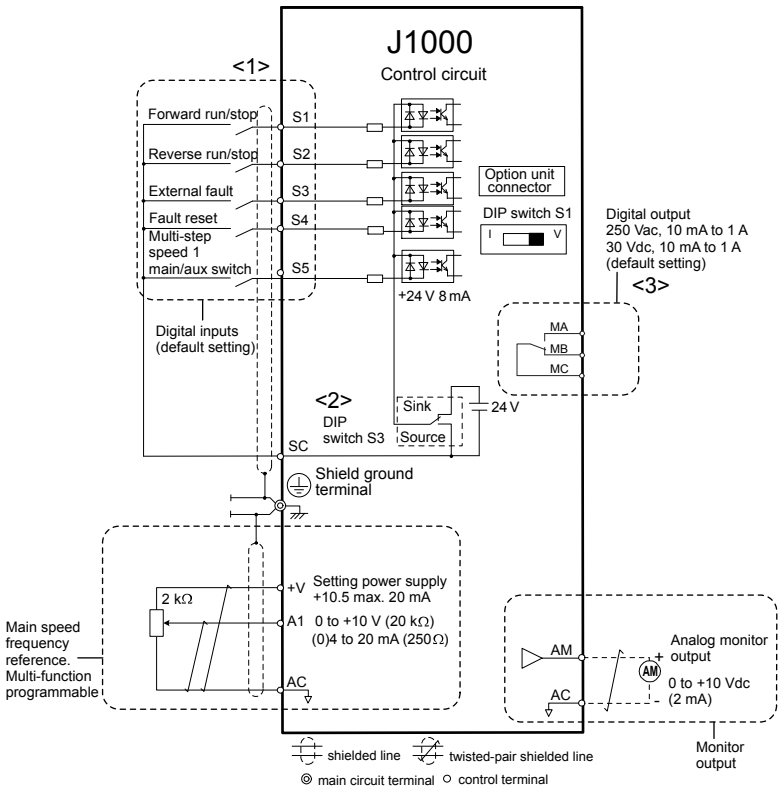


Figure 3.10 Control Circuit Connection Diagram

<1> Connected using sequence input signal (S1 to S5) from NPN transistor; Default: sink mode (0 V com)

<2> Use only the +24 V internal power supply in sinking mode; the source mode requires an external power supply. ***Refer to I/O Connections on page 64***.

<3> Minimum load: 5 Vdc, 10 mA (reference value).

◆ Control Circuit Terminal Block Functions

Drive parameters determine which functions apply to the multi-function digital inputs (S1 to S5), multi-function digital outputs (MA, MB, MC), and multi-function analog output (AM). The default is called out next to each terminal in ***Figure 3.10***.

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

NOTICE: *Do not switch an input contactor more often than once every 30 minutes. Improper equipment sequencing could shorten useful life of the drive electrolytic capacitors and circuit relays. Normally the drive I/O should be used to stop and start the motor.*

■ Input Terminals

Table 3.6 Control Circuit Input Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Multi-Function Digital Inputs	S1	Multi-function input 1 (Closed: Forward run, Open: Stop)	24 Vdc, 8 mA **Note:** Drive preset to sinking mode. When using source mode, set DIP switch S3 to allow for a 24 Vdc (±10%) external power supply. ***Refer to Sinking/ Sourcing Mode Switch on page 64***.
	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)	
	SC	Multi-function input common (Control common)	Sequence common
Main Frequency Reference Input	A1	Frequency reference	Input voltage or input current (Selected by DIP switch S1 and H3-01) 0 to +10 Vdc (20 kΩ), Resolution: 1/1000 4 to 20 mA (250 Ω) or 0 to 20 mA (250 Ω), Resolution: 1/500
	+V	Analog input power supply	+10.5 Vdc (max allowable current 20 mA)
	AC	Frequency reference common	0 Vdc

■ Output Terminals

Table 3.7 Control Circuit Output Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Multi-Function Digital Output	MA	N.O. output (fault)	Digital output 30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA (reference value)
	MB	N.C. output (fault)	
	MC	Digital output common	
Monitor Output	AM	Analog monitor output	0 to 10 Vdc (2 mA or less) Resolution: 1/256
	AC	Monitor common	0 V

◆ Terminal Configuration

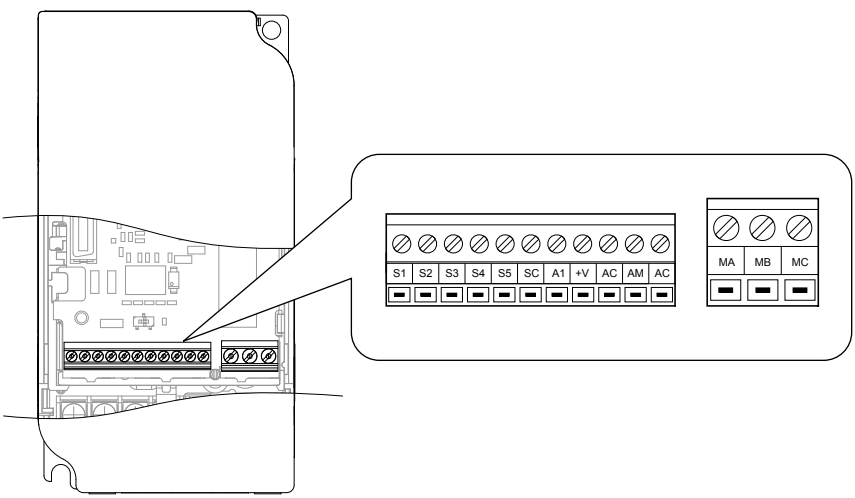


Figure 3.11 Control Circuit Terminal

■ Wire Size and Torque Specifications

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

Table 3.8 Wire Size and Torque Specifications (Same for All Models)

Terminal	Screw Size	Tightening Torque N•m	Bare Wire Terminal		Ferrule-Type Terminal		
			Applicable wire size mm² (AWG)	Recomm. mm² (AWG)	Applicable wire size mm² (AWG)	Recomm. mm² (AWG)	Wire Type
MA, MB, MC	M3	0.5 to 0.6	Stranded: 0.25 to 1.5 (24 to 16) Single: 0.25 to 1.5 (24 to 16)	0.75 (18)	0.25 to 1.0 (24 to 17)	0.5 (20)	Shielded line, etc.
S1-S5, SC, +V, A1, AC, AM	M2	0.22 to 0.25	Stranded: 0.25 to 1.0 (24 to 18) 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 Terminations

Crimp a ferrule to signal wiring to improve wiring simplicity and reliability. Use CRIMPFOX ZA-3, a crimping tool manufactured by PHOENIX CONTACT.

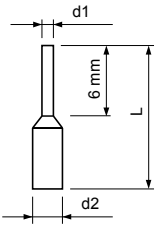


Figure 3.12 Ferrule Dimensions

Table 3.9 Ferrule Terminal Types and Sizes

Size mm² (AWG)	Type	L (mm)	d1 (mm)	d2 (mm)	Manufacturer
0.25 (24)	AI 0.25-6YE	10.5	0.8	2.0	PHOENIX CONTACT
0.34 (22)	AI 0.34-6TQ	10.5	0.8	2.0	
0.5 (20)	AI 0.5-6WH	12	1.1	2.5	
0.75 (18)	AI 0.75-6GY	12	1.3	2.8	
1.0	AI 1-6RD	12	1.5	3.0	

◆ Wiring Procedure

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.*

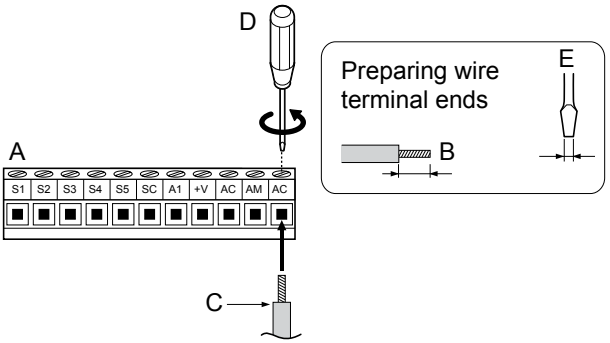
NOTICE: *Connect the shield of shielded cable to the appropriate ground terminal. Improper equipment grounding could result in drive or equipment malfunction or nuisance trips.*

Wire the control terminals using ***Figure 3.13*** as a guide. Prepare the ends of the control circuit wiring as shown in ***Figure 3.14***. ***Refer to Wire Size and Torque Specifications on page 60***.

NOTICE: *Do not tighten screws beyond the specified tightening torque. Failure to comply may damage the terminal.*

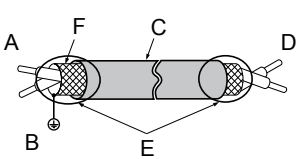
NOTICE: *Use shielded twisted-pair cables as indicated to prevent operating faults. Improper wiring practices could result in drive or equipment malfunction due to electrical interference.*

Connect control wires as shown in the following figure:



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

Figure 3.13 Terminal Board Wiring Guide

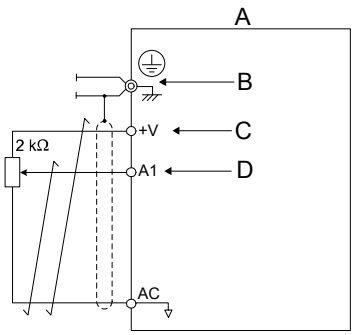


A – Drive side
B – Connect shield to ground terminal of drive.
C – Insulation
D – Control device side
E – Shield sheath (Insulate with tape)
F – Shield

Figure 3.14 Preparing the Ends of Shielded Cables

When setting the frequency by analog reference from an external potentiometer, use shielded twisted-pair wires and ground the shield of twisted-pair wires to the ground terminal of the drive.

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.*



A – Drive
B – Ground terminal (shield connection)
C – (+V) Frequency setting power source +10.5 Vdc maximum 20 mA
D – (A1) Main speed frequency reference 0 to +10 Vdc (20 kΩ) or 4 to 20 mA (250 Ω)/ 0 to 20 mA (250 Ω)

Figure 3.15 Wiring the Frequency Reference to the Control Circuit Terminals (External Reference)

3.8 I/O Connections

◆ Sinking/Sourcing Mode Switch

Set the DIP switch S3 on the front of the drive to switch the digital input terminal logic between sinking mode and sourcing mode; the drive is preset to sinking mode.

Table 3.10 Sinking/Sourcing Mode Setting

Set Value	Details
SINK	Sinking Mode (0 V common): default setting
SOURCE	Sourcing Mode (+24 V common)

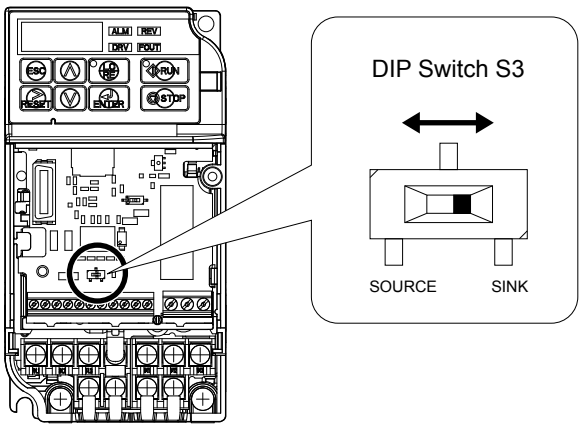


Figure 3.16 DIP Switch S3

■ Transistor Input Signal Using 0 V Common/Sink Mode

When controlling the digital inputs by NPN transistors (0 V common/sinking mode), set the DIP switch S3 to SINK and use the internal 24 V power supply.

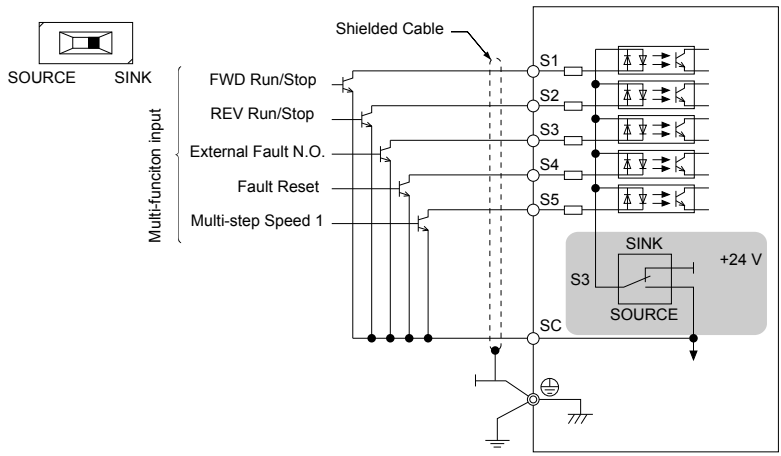


Figure 3.17 Sinking Mode: Sequence from NPN Transistor (0 V Common)

■ Transistor Input Signal Using +24 V Common/Source Mode

When controlling digital inputs by PNP transistors (+24 V common/sourcing mode), set the DIP switch S3 to SOURCE and use an external 24 V power supply.

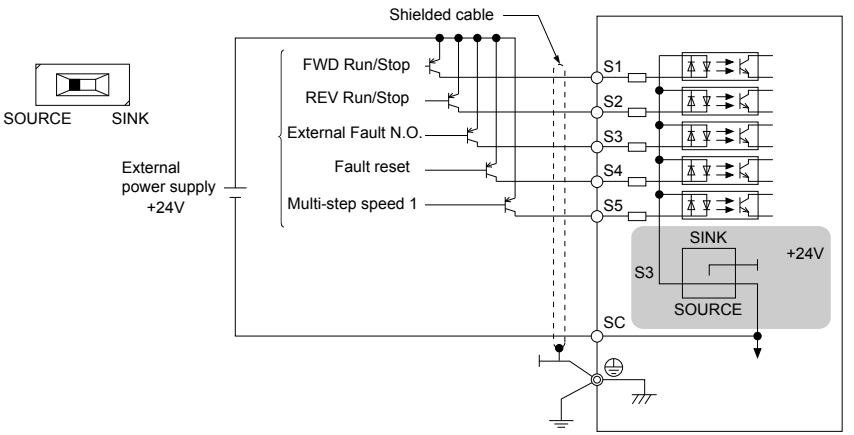


Figure 3.18 Source Mode: Sequence from PNP Transistor (+24 V Common)

3.9 Main Frequency Reference

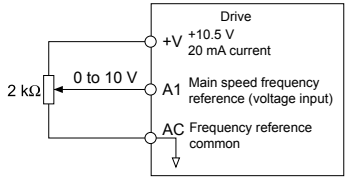
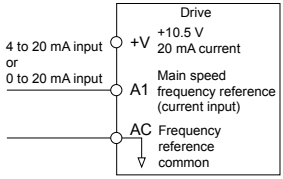
◆ DIP Switch S1 Analog Input Signal Selection

The main frequency reference can either be a voltage or current signal input at terminal A1.

When using input A1 as a voltage input, set DIP switch S1 to “V” (right position, default setting) and program parameter H3-01 to “0” (0 to +10 Vdc with lower limit) or “1” (0 to +10 Vdc without lower limit).

To use current input at terminal A1, set the DIP switch S1 to "I" and set parameter H3-01 = “2” or “3” (4-20 mA or 0-20 mA).

Table 3.11 Frequency Reference Configurations

Voltage Input	Current Input
	

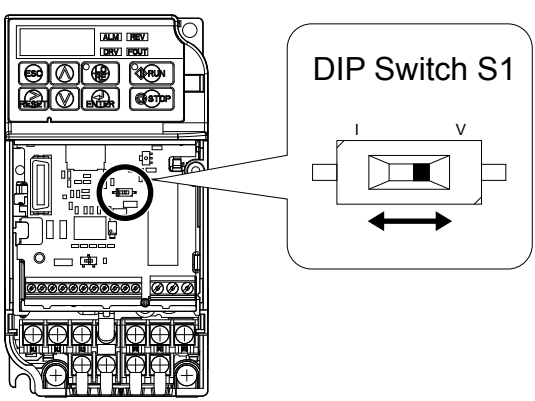


Figure 3.19 DIP Switch S1

Table 3.12 DIP Switch S1 Settings

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

Table 3.13 Parameter H3-01 Details

No.	Parameter Name	Description	Setting Range	Default Setting	MEMOBUS Register
H3-01	Frequency ref. (voltage/current) terminal A1 signal level selection	Selects the signal level for terminal A1. 0: 0 to +10 V, unipolar input (negative frequency reference values are zeroed) 1: 0 to +10 V, bipolar input (negative frequency reference changes the direction) 2: 4 to 20 mA 3: 0 to 20 mA	0 to 3	0	410

3.10 Braking Resistor

Dynamic braking (DB) helps bring the motor to a smooth and rapid stop when working with high inertia loads. Regeneration occurs as the drive lowers the motor frequency with high inertia. When the regeneration flows back into the DC bus capacitors, an overvoltage situation occurs. A braking resistor prevents these overvoltage faults.

NOTICE: *Do not allow unqualified personnel to use the product. Failure to comply could result in damage to the drive or braking circuit. Carefully review the braking resistor instruction manual when connecting a braking option to the drive.*

Note: The braking circuit must be sized properly in order to dissipate the power required to decelerate the load in the desired time. Ensure that the braking circuit can dissipate the energy for the set deceleration time prior to running the drive.

NOTICE: *Use a thermal overload relay or over-temperature contact to interrupt input power to the drive if the braking resistor overheats. In the event of a possible thermal overload, the relay triggers the input contactor and prevents the braking resistor from burning up.*

◆ Installation

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

NOTICE: *Connect braking resistors to the drive as shown in the I/O wiring examples. Improperly wiring braking circuits could result in damage to the drive or equipment.*

■ Installation Procedure

1. Disconnect all electrical power to the drive and wait at least one minute before servicing the drive and any connected components.
2. Remove drive front cover.
3. Use a voltmeter to verify that voltage is disconnected from incoming power terminals and that the DC bus no longer holds a charge.

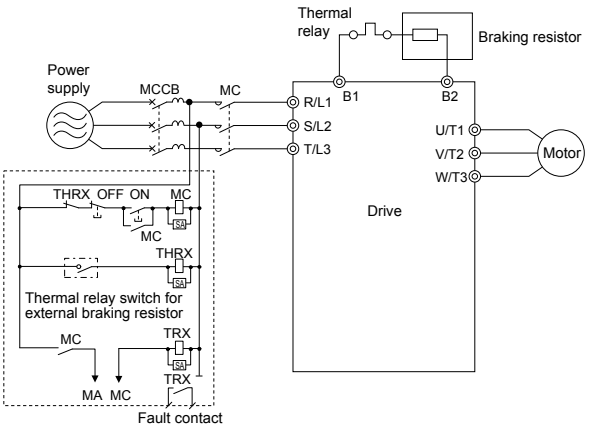


Figure 3.20 Connecting a Braking Resistor

4. Follow manufacturer instructions to connect the resistor unit to the drive using proper wire gauge according to local electrical codes.

Power leads for the remote mount resistors generate high levels of electrical noise; group these signal leads separately.

5. Mount the resistor unit on a noncombustible surface. Maintain minimum side and top clearances according to resistor manufacturer instructions.

WARNING! *Fire Hazard. Do not use improper combustible materials. Failure to comply could result in death or serious injury by fire. Attach the drive or braking resistors to metal or other noncombustible material.*

6. Reinstall drive covers and resistor covers, if provided.

7. Set parameter L3-04 = “0” to disable stall prevention during deceleration.
Set parameter L8-01 to “1” to enable overheat protection when using a heatsink-mounted braking resistor option.
Set L8-01 = “0” for other braking resistor types.

Table 3.14 Braking Resistor Settings

Parameter	Settings
L8-01: Internal Dynamic Braking Resistor Protection Selection	0: Disabled. The drive will not provide overheat protection. Supply separate means of overheat protection. 1: Enabled. Braking Resistor is protected from overheat.
L3-04: Stall Prevention During Decel	0: Stall prevention disabled.

8. Operate the system and verify the required deceleration rate is obtained during dynamic braking or stopping.

3.11 Interlocking with Connected Machinery

For safety reasons, applications that may be affected by the operation status of the drive should be set up so that operation can only occur when the drive is ready to operate. A "Drive ready" and "Fault" signal should be assigned to the multi-function outputs to guarantee interlock with application.

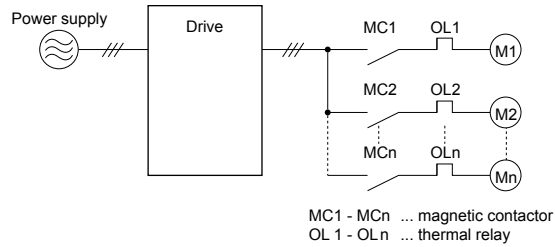
◆ Drive Ready Signal

When the “Drive ready” signal has been set to one of the multi-function contact outputs, that output will close whenever the drive is ready to accept a Run command or is already running. Under the following conditions the Drive ready signal will switch off and remain off, even if a Run command is entered:

- when the power supply is shut off
- during a fault
- when there is problem with the control power supply
- when a parameter setting error makes the drive unable to run even if a Run command has been entered
- when a fault such as overvoltage or undervoltage is triggered as soon as the Run command is entered
- when the drive is in the Programming mode and will not accept a Run command even when entered.

3.12 Wiring Checklist

☑	No.	Item	Page
		Drive, peripherals, option cards	
☐	1	Check drive model number to ensure receipt of correct model.	*23*
☐	2	Check for correct braking resistors, DC reactors, noise filters, and other peripheral devices.	*69*
		Installation area and physical setup	
☐	3	Ensure area surrounding the drive complies with specifications.	*33*
		Power supply voltage, output voltage	
☐	4	The voltage from the power supply should fall within the input voltage specification range of the drive.	
☐	5	The voltage rating for the motor should match the drive output specifications.	*23*
		Main circuit wiring	
☐	6	Confirm proper branch circuit protection exists per National and Local codes.	*43*
☐	7	Properly wire the power supply to drive terminals R/L1, S/L2 and T/L3.	*46*
☐	8	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.	*54*
☐	9	Use 600 Vac vinyl-sheathed wire for the power supply and motor lines.	*50*
☐	10	Use the correct wire gauges for the main circuit. Refer to *Table 3.2* through *Table 3.4*.	*50*
		• 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}	*50*
		• If the cable between the drive and motor exceeds 50 m, adjust the carrier frequency (C6-02) accordingly.	*55*
☐	11	Properly ground the drive. Review page *55*.	*55*
☐	12	Tightly fasten all terminal screws (control circuit terminals, grounding terminals). Refer to *Table 3.2* through *Table 3.4*..	*50*

☑	No.	Item	Page
☐	13	Set up overload protection circuits when running multiple motors from a single drive.  **Note:** Close MC1 through MCn before operating the drive.	-
☐	14	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.	*69*
☐	15	Verify phase advancing capacitors are NOT installed on the output side of the drive.	-
		Control circuit wiring	
☐	16	Use twisted-pair cables for all drive control circuit wiring.	*57*
☐	17	Ground the shields of shielded wiring to the GND ⏚ terminal.	*61*
☐	18	If using a 3-Wire sequence, properly set parameters for multi-function contact input terminals S1 through S5, and properly wire control circuits.	*45*
☐	19	Check for any other wiring mistakes. Only use a multimeter to check wiring.	-
☐	20	Properly fasten the control circuit terminal screws in the drive. Refer to *Table 3.2* through *Table 3.4*.	*50*
☐	21	Pick up all wire clippings.	-
☐	22	Ensure that no frayed wires on the terminal block are touching other terminals or connections.	-
☐	23	Properly separate control circuit wiring and main circuit wiring.	-
☐	24	Analog signal line wiring should not exceed 50 m.	-

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4

Start-Up Programming & Operation

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

4.1 SECTION SAFETY.....76
4.2 USING THE DIGITAL LED OPERATOR.....79
4.3 THE DRIVE AND PROGRAMMING MODES.....85
4.4 START-UP FLOWCHART.....93
4.5 BASIC OPERATION.....94
4.6 POWERING UP THE DRIVE.....119
4.7 NO-LOAD OPERATION TEST RUN.....121
4.8 TEST RUN WITH LOAD CONNECTED.....123
4.9 VERIFYING AND BACKING UP PARAMETER SETTINGS.....124
4.10 TEST RUN CHECKLIST.....126

4.1 Section Safety

DANGER

Electrical Shock Hazard

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

Failure to comply will result in death or serious injury.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

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

Always ground the motor-side grounding terminal.

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

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are off and measure the DC bus voltage level to confirm safe level.

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

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

⚠ WARNING

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

Failure to comply could result in death or serious injury.

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

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

Failure to comply could result in death or serious injury.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

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

Do not use an improper voltage source.

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

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

Do not use improper combustible materials.

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

Attach the drive to metal or other noncombustible material.

NOTICE

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

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

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

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

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

Do not allow unqualified personnel to use the product.

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

Carefully review instruction manual TOBPC72060000 when connecting a braking option to the drive.

Do not modify the drive circuitry.

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

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

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

Failure to comply could result in damage to the drive.

4.2 Using the Digital LED Operator

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

◆ Keys, Displays, and LEDs

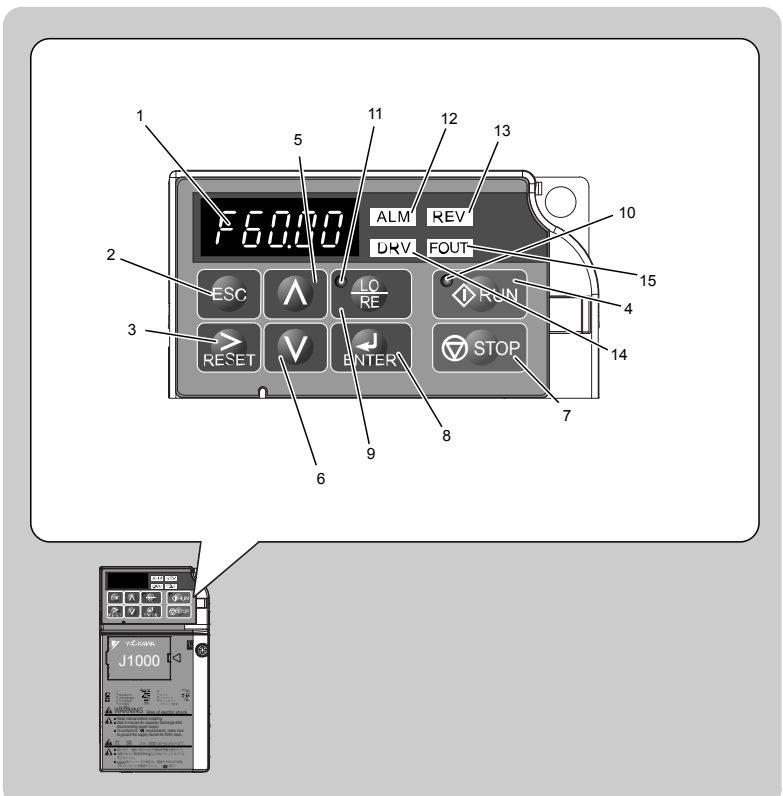


Table 4.1 Keys and Displays on the LED Operator

No.	Display	Name	Function
1		Data Display Area	Displays the frequency reference, parameter number, etc.
2		ESC Key	Returns to the previous menu.
3		RESET Key	Moves the cursor to the right. Resets the drive to clear a fault situation.
4		RUN Key	Starts the drive.
5		Up Arrow Key	Scrolls up to select parameter numbers, setting values, etc.
6		Down Arrow Key	Scrolls down to select parameter numbers, setting values, etc.
7		STOP Key	Stops the drive. **Note:** Stop priority circuit. 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. Set parameter o2-06 to 0 to disable the STOP key priority.
8		ENTER Key	Selects all modes, parameters, settings, etc. Selects a menu item to move from one display screen to the next.
9		LO/RE Selection Key	Switches drive control between the operator (LOCAL) and the control circuit terminals (REMOTE). **Note:** LOCAL/REMOTE key effective during stop in drive mode.
10		RUN Light	Lit while the drive is operating the motor.
11		LO/RE Light	Lit while the operator (LOCAL) is selected to run the drive.
12		ALM LED Light	*Refer to LED Screen Displays on page 81*.
13		REV LED Light	
14		DRV LED Light	
15		FOUT LED Light	

◆ Digital Text Display

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

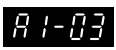
Lit	Flashing
	

Table 4.2 Digital Text Display

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

<1> Displayed in two digits.

◆ LED Screen Displays

Display	Lit	Flashing	Off
ALM	When the drive detects an alarm or error	• When an alarm occurs • oPE detected	Normal state (no fault or alarm)
REV	Motor is rotating in reverse	—	Motor is rotating forward
DRV	Drive Mode	—	Programming Mode
FOUT	Displays output frequency (Hz)	—	—

Display	Lit	Flashing	Off
As illustrated in this manual			

◆ LO/RE LED and RUN LED Indications

LED	Lit	Flashing	Flashing Quickly <1>	Off
	When a Run command is selected from the LED operator (LOCAL)	–	–	Run command is selected from device other than LED operator (REMOTE)
	During Run	• During deceleration to stop • When a Run command is input and frequency reference is 0	• During deceleration at a fast-stop. • During stop by interlock operation.	During stop
As shown				

<1> Refer to ***Figure 4.1*** for the difference between “flashing” and “flashing quickly”.

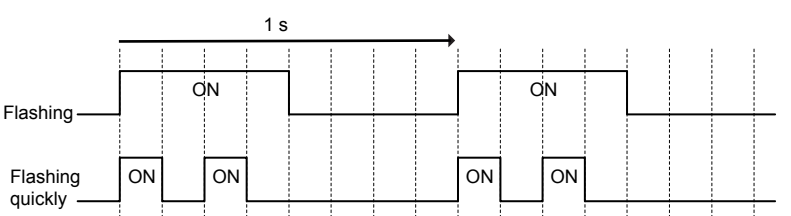


Figure 4.1 RUN LED Status and Meaning

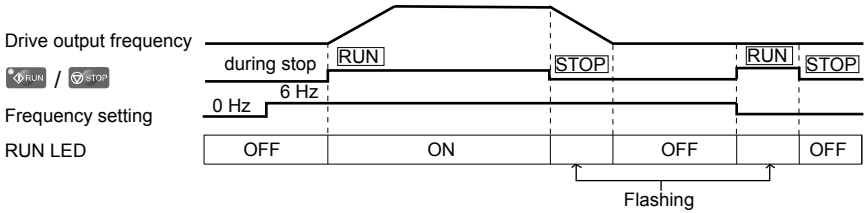


Figure 4.2 RUN LED and Drive Operation

◆ Menu Structure for Digital LED Operator

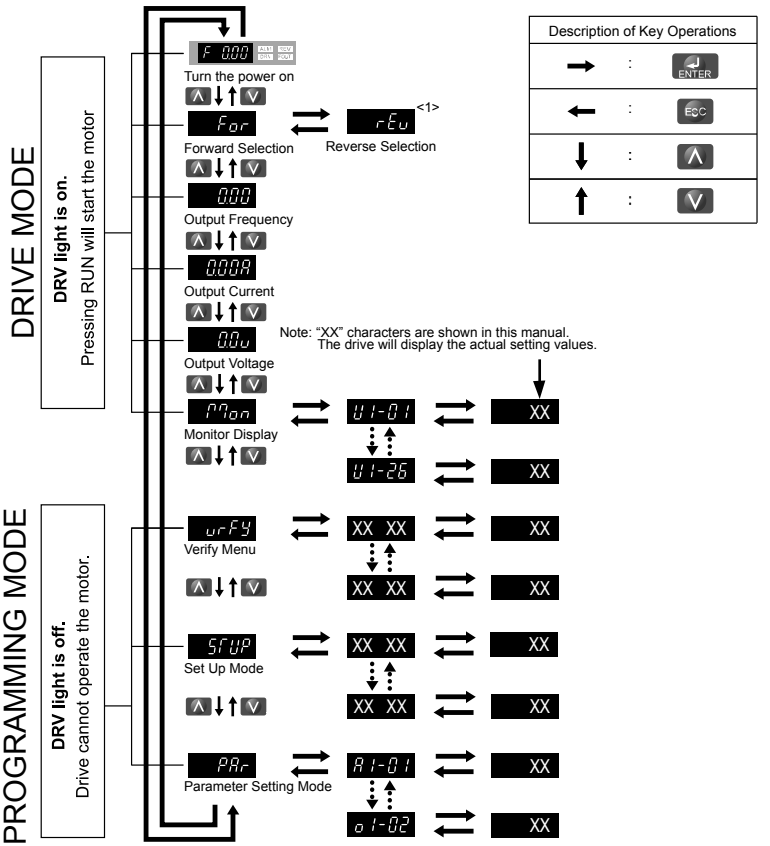


Figure 4.3 Digital LED Operator Screen Structure

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

4.3 The Drive and Programming Modes

The drive functions are divided into two main groups accessible via the Digital LED Operator:

Drive Mode: The Drive mode allows motor operation and parameter monitoring. Parameter settings cannot be changed when accessing functions in the Drive Mode *(Table 4.3)*.

Programming Mode: The Programming Mode allows access to setup/adjust, verify parameters. The drive prohibits changes in motor operation such as start/stop when the Digital LED Operator is accessing a function in the Programming Mode.

Table 4.3 illustrates the different functions visible as the "Up arrow" is scrolled immediately after powering up the drive.

Note: When b1-08 (Run Command Selection while in Programming Mode) is set to 1 (enabled), the drive can run even if the mode is switched to the programming mode. When setting b1-08 to 0 (disabled), the mode cannot be switched to the programming mode while the drive is running.

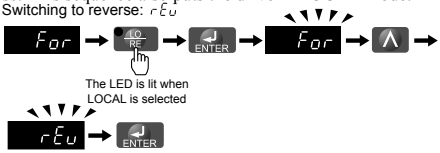
Table 4.3 Summary of Modes

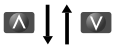
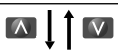
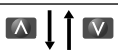
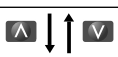
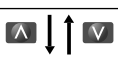
Mode Group	Description	Key Press	LED Digital Operator Display <1>
Drive Mode Functions (Motor operation and monitoring)	Frequency Reference Display (Initial power-up state)		
	Forward/Reverse		
	Output Frequency Display		
	Output Current Display		
	Output Voltage Reference		
	Monitor Display		
Programming Mode Functions (Changing parameters)	Verify Function		
	Setup Group Parameters		
	All Parameters		

<1> The enlarged illustration of the LED indicates that the LED is on.

◆ Navigating the Drive and Programming Modes

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

Power Up	Frequency Reference  Default Setting	This display screen allows the user to monitor and set the frequency reference while the drive is running. *Refer to The Drive and Programming Modes on page 85*. **Note:** The user can select items to display when the drive is first powered up by setting parameter o1-02.
Drive Mode	∧ ∨	
	Forward/Reverse  	For: Motor rotates forward.
		rEv: Motor rotates in reverse.
		Note: For applications that should not run in reverse (fans, pumps, etc.), set parameter b1-04 = "1" to prohibit the motor from rotating in reverse. This sequence also puts the drive in LOCAL mode. Switching to reverse: rEv 
Drive Mode	∧ ∨	
	Output Frequency Display  	Monitors the frequency output by the drive.
	∧ ∨	
	Output Current Display  	Monitors the output current of the drive.
	∧ ∨	

Drive Mode	Output Voltage Reference 	Monitors the output voltage of the drive.
		
	Monitor Display 	Monitor parameters (U parameters) are displayed.
Programming Mode		
	Verify Function 	Lists all parameters that have been edited or changed from default settings. ➡ *Refer to Verifying Parameter Changes: Verify Menu on page 90*.
		
	Setup 	A select list of parameters necessary to get the drive operational quickly. ➡ *Refer to The Setup Group within the Programming Mode on page 88*.
		
	Parameter Setting 	Allows the user to access and edit all parameter settings. ➡ *Refer to Parameter List on page 221*.
		
Drive Mode	Frequency Reference 	Returns to the frequency reference display screen.

■ Drive Mode Details

The following actions are possible in the Drive Mode:

- Run and stop the drive.
- Monitor the operation status of the drive (frequency reference, output frequency, output current, output voltage, etc.).
- View information on an alarm.

Note: Select "Drive Mode" when running. The mode can be switched to any mode (program mode, etc.) other than drive mode while the drive is stopped. However, the drive cannot be operated in other modes. Return the mode to "Drive Mode" after completing periodic inspection.

Figure 4.4 illustrates changing the default frequency reference of F 0.00 (0 Hz) to F 6.00 (6 Hz) while in Drive Mode. This example assumes the drive is set to LOCAL.

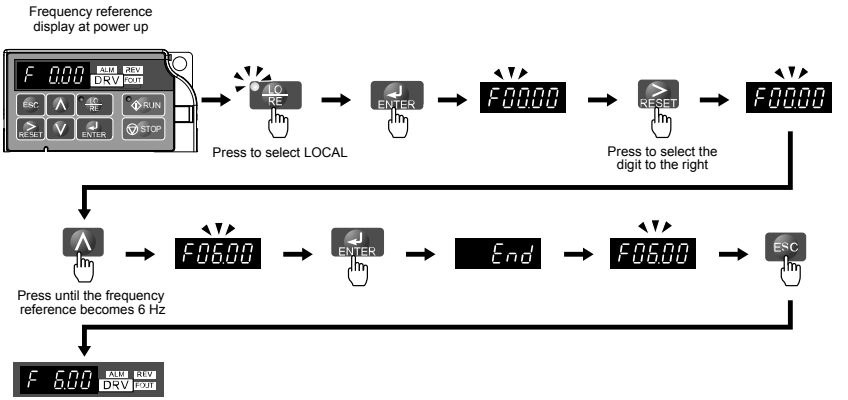


Figure 4.4 Setting the Frequency Reference while in Drive Mode

Note: The drive will not accept a frequency reference set value unless the ENTER key is pressed after the frequency reference is entered. This feature prevents accidental setting of the frequency reference. By setting o2-05 (Frequency Reference Setting Method Selection) to 1 (Enabled), the drive will accept the frequency reference while it is being adjusted on the digital operator.

■ Programming Mode Details

The following actions are possible in the programming mode:

- **Verify Function:** Verify parameter setting changes from original default values.
- **Setup Group:** Access a list of commonly used parameters to simplify setup.
- **Parameter Setting Mode:** Access and edit all parameter settings.

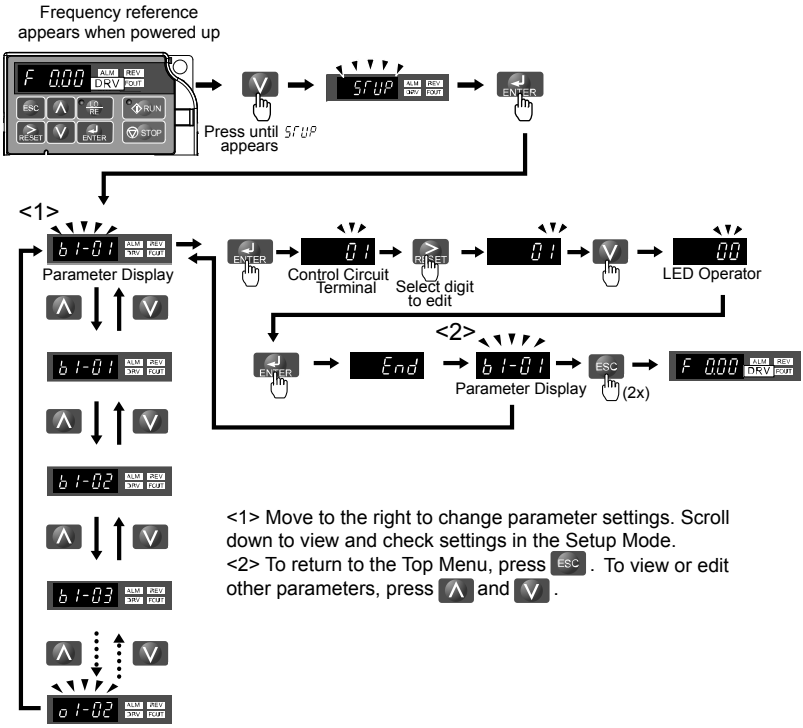
The Setup Group within the Programming Mode

In Setup Group, the user can access the minimum group of parameters required to operate the application.

Note: Setup Group parameters are listed in *Table 4.4*.

Figure 4.5 illustrates the keys to press to enter the Setup Group.

In this example, the source of the frequency reference is changed from the control circuit terminals to the LED Operator (i.e., b1-01 is changed from 1 to 0).



<1> Move to the right to change parameter settings. Scroll down to view and check settings in the Setup Mode.
<2> To return to the Top Menu, press ESC. To view or edit other parameters, press ∧ and ∨.

Figure 4.5 Setup Group Example

◆ Changing Parameter Settings or Values

This example explains changing C1-01 (Acceleration 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.	→	F 0.00 DRV
2.	Press the ∧ key until the Setup Mode Screen appears.	→	SETUP
3.	Press the ENTER key to view the parameter setting display.	→	b1-01
4.	Scroll through parameters by pressing the ∧ key until C1-01 appears.	→	C1-01
5.	Press ENTER to view the current setting value (10.0). (Number farthest to the left flashes)	→	0010.0
6.	Press RESET until the desired number is selected. ("1" flashes)	→	0010.0
7.	Press the ∧ key and enter 0020.0.	→	0020.0
8.	Press ENTER and the drive will confirm the change.	→	End
9.	The display automatically returns to the screen shown in Step 4.	→	C1-01
10.	Press the ESC key until back at the initial display.	→	F 0.00 DRV

◆ Verifying Parameter Changes: Verify Menu

The Verify Menu lists edited parameters from the Programming Mode. The Verify Menu helps determine which settings have been changed, and is particularly useful when replacing a drive. If no settings have been changed the Verify Menu will read none. The Verify menu also allows users to access and re-edit edited parameters.

Note: The Verify Menu will not display parameters from the A1 group even if those parameters have been changed from default settings.

The following example is a continuation of the steps beginning on page ***90***. Here, parameter C1-01 is accessed using the Verify Menu and is changed again to 20.0 s.

To check the list of edited parameters:

	Step		Display/Result
1.	Turn on the power to the drive. The initial display appears.	→	F 0.00 DRV
2.	Press ∧ until the display shows the "Verify" representation.	→	vrFy
3.	Press ENTER to enter the list of parameters that have been edited from their original default settings. Scroll through the list by pressing the ∧ key.	→	b1-01
4.	Press the ∧ key until C1-01 appears.	→	C1-01
5.	Press the ENTER key to access the setting value. (number farthest to the left flashes)	→	0020.0

◆ Switching Between LOCAL and REMOTE

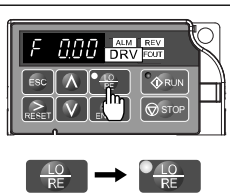
Entering the run command using the LED operator is referred to as LOCAL, while entering the run command from an external device via the control circuit terminals or network option is referred to as REMOTE.

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 and electrical connections prior to switching between LOCAL mode and REMOTE mode.*

There are two ways to switch between LOCAL and REMOTE.

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

■ Using the LO/RE Key on the LED Operator

	Step		Display/Result
1.	Turn on the power to the drive. The initial display appears.	→	F 0.00 DRV
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 S5 to Switch between LO/RE

Switch between LOCAL and REMOTE using one of the digital input terminals S1 through S5 (set the corresponding parameter H1-01 through H1-05 to "1").

Follow the example below to set the digital input terminals.

Note:
1. For a list of digital input selections, *Refer to Parameter List on page 221*.
2. Setting a multi-function input terminal to a value of 1 disables the LO/RE key on the LED operator.

◆ Parameters Available in the Setup Group

■ Setup Mode (STUP)

Parameters used for this drive are classified into A to U. To simplify the drive setup, frequently used parameters are selected and input into Setup Mode.

1. To set a parameter, the Setup Mode must be displayed first. Press the Up/Down key until STUP is displayed.
2. Select the parameter and change the setting. *Table 4.4* lists parameters available in the Setup group. If the desired parameter cannot be set in the Setup mode, use the Parameter Setting mode.

Table 4.4 Setup Group Parameters

Parameter	Name
b1-01	Frequency Reference Selection
b1-02	Run Command Selection
b1-03	Stop Method Selection
C1-01	Acceleration Time 1
C1-02	Deceleration Time 1
C6-01	Drive 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

Parameter	Name
d1-17	Jog Frequency Reference
E1-01	Input Voltage Reference
E1-04	Maximum Output Frequency
E1-05	Maximum Voltage
E1-06	Base Frequency
E1-09	Minimum Output Frequency
E2-01	Motor Rated Current
H4-02	Terminal AM Gain Setting
L1-01	Motor Protection Function Selection
L3-04	Stall Prevention Selection during Deceleration

4.4 Start-up Flowchart

This section summarizes the basic steps required to start the drive. The flowchart is intended as a quick reference to help familiarize the user with start-up procedures.

◆ Flowchart: Basic Start-up

Figure 4.6 describes basic start-up sequence for the drive and motor system. This sequence varies slightly depending on application. Use drive default parameter settings in simple applications that do not require high precision.

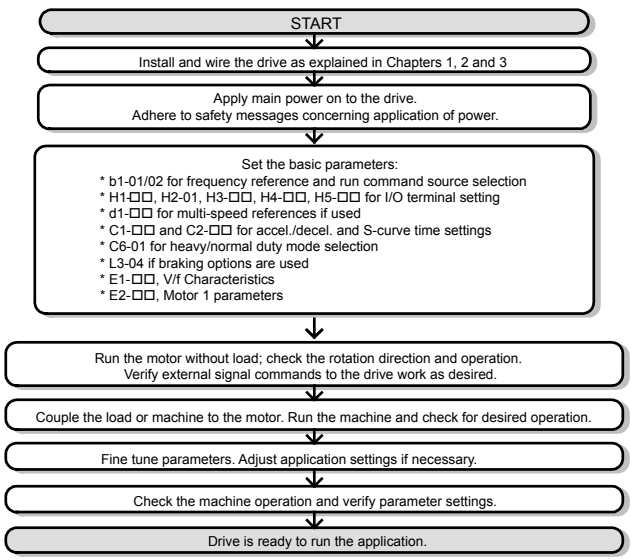


Figure 4.6 Basic Start-Up

4.5 Basic Operation

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 Parameter List on page 221* as required for a complete listing of drive parameters.

◆ Initialize Parameter Values: A1-03

Parameter A1-03 (Initialize Parameters) resets all parameters to the original default values.

Note: Record all the changed settings before initializing parameters.

■ Different Methods of Drive initialization

2220: 2-Wire Initialization

Returns all parameters to factory default values for 2-wire control. A 2-Wire sequence assigns functions to input terminals S1 and S2.

3330: 3-Wire Initialization

Returns all parameters to factory default values for 3-wire control. A 3-Wire sequence assigns functions to input terminals S1, S2, and S5.

◆ Frequency Reference Source: b1-01

This section explains how to assign the frequency reference. Parameters b1-01 and b1-02 can be used to select the source of the run command and the frequency reference independently (e.g., set the reference from the operator and set the run command from the terminals).

■ Frequency Reference from the LED Operator: b1-01 = 0

When b1-01 = 0 the frequency reference will be provided by the LED operator. *Refer to The Drive and Programming Modes on page 85* for information on how to set the frequency reference.

■ Frequency Reference from the Analog Input Terminal: b1-01 = 1

When b1-01 = 1, analog input A1 provides the frequency reference.

Note: Set H3-01 (Terminal A1 Function Selection) to “0” to configure Terminal A1 for the main analog frequency reference.

Voltage Input

When entering the frequency reference with a voltage signal, set parameter H3-01 to “0” for 0 to 10 Vdc with lower reference limit. Set H3-01 to “1” if 0 to 10 Vdc input without lower limit is required. Set DIP Switch S1 for voltage input (position “V”).

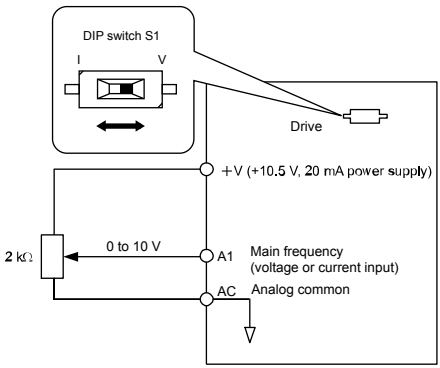


Figure 4.7 Voltage Input for the Frequency Reference

Current Input

When entering the frequency reference using an analog input signal, set parameter H3-01 to "2" if 4 to 20 mA input is used. When using 0 to 20 mA input, set H3-01 to "3". Set DIP Switch S1 for current input (position "I").

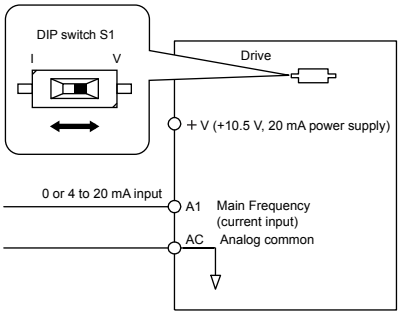


Figure 4.8 Current Input for the Frequency Reference

◆ Run Command Input Selection: b1-02

This section explains how to assign the run command input.

Parameters b1-01 and b1-02 can be used to select the source of the run command and the frequency reference independently, e.g. set the reference from the operator and set the run command from the terminals.

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

■ Run the Drive at 6 Hz using the LED Operator: b1-02 = 0

To assign the run command to the operator panel, set parameter b1-02 to “0”. This will set up the drive to acknowledge the run command through the LED operator. Initialize the run command using the Run and Stop keys. Upon power up, the drive uses parameter b1-02 to determine the run command location.

The following procedure indicates how to start and stop the drive through the LED operator after parameter b1-02 has been set to 0.

Note:
When b1-02 (Run Command Selection) is not set to 0 (operator), press LO/RE to set LOCAL.

Step			Display/Result
1.	Turn on the power to the drive. The initial display appears.	➡	F 0.00 DRV
2.	Set the frequency reference to F6.00 (6 Hz). **Note:** *Refer to Drive Mode Details on page 87* for instructions on how to set the frequency reference.	➡	F 6.00
3.	Press the RUN key to start the motor.		
4.	The motor should accelerate up to 6 Hz while the RUN light is on.	➡	
5.	Press the STOP key to stop the motor. The RUN light will flash until the motor comes to a complete stop.	➡	

■ Run the Drive using Digital Input Terminals: b1-02 = 1

This setting uses the digital input terminals to enter the run command. The factory setting is a 2-Wire sequence.

Using a 2-Wire Sequence

Digital Input Terminals	ON	OFF
S1	Forward Run	Stop
S2	Reverse Run	Stop

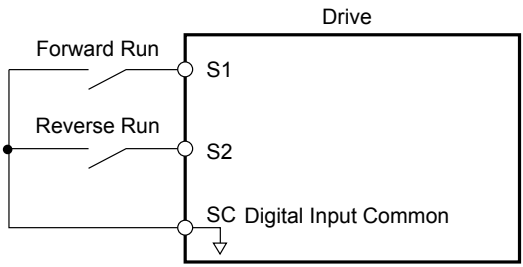


Figure 4.9 Example Wiring Diagram for 2-Wire Sequence

Using a 3-Wire Sequence

When H1-05 (Multi-Function Digital Input Terminal S5 Function Selection) = 0, the functions of terminals S1 and S2 are set to 3-Wire sequence, and the multi-function input terminal becomes forward/reverse run command terminal.

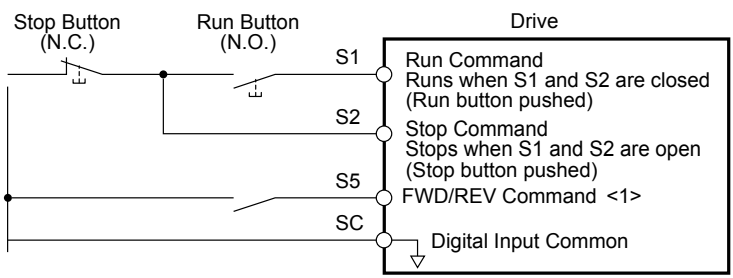


Figure 4.10 Example Wiring Diagram for 3-Wire Sequence Using Terminal S5

<1> When terminal S5 is open, the motor rotates forward. When closed, the motor rotates in reverse.

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.*

Note: *Refer to Parameter List on page 221* for a list of digital input functions. After performing a 3-Wire initialization (A1-03 = "3"), the drive will automatically assign the forward/reverse command to terminal S5.

Note: Run by Turning on/off the Power Supply. For safety reasons, the drive is initially set up not to accept a run command at power up (b1-17 = "0"). If a run command is issued at power up, the RUN indicator LED will flash quickly. To change this and have the run command issued by the drive, change parameter b1-17 to 1.

◆ Stopping Method Selection: b1-03

When a Stop command is issued, the drive stops the motor using one of two possible methods.

■ Ramp to Stop: b1-03 = 0

When b1-03 = 0, the motor will decelerate to a stop when a stop command is entered. The deceleration time is set by C1-02 (Deceleration Time 1). *Refer to Acceleration/Deceleration: C1-01 to C1-04 on page 99*.

When the output frequency falls below E1-09 (Minimum Output Frequency) during deceleration, the DC Injection braking current (b2-02) will be activated for the specified DC Injection time at stop (b2-04).

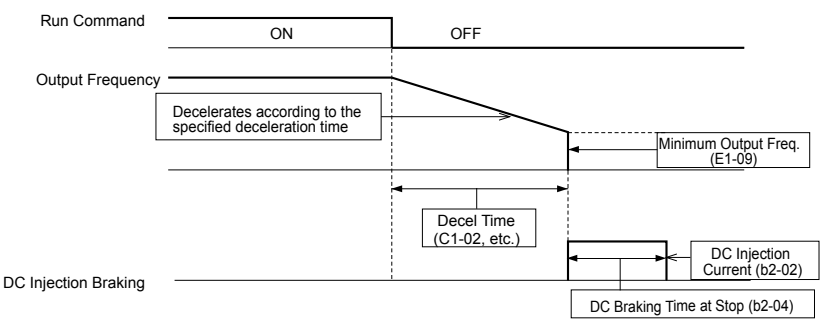


Figure 4.11 Ramp to Stop

■ Coast to Stop: b1-03 = 1

When the run command is removed, the drive will shut off its output and the motor will coast (uncontrolled deceleration). The motor will coast to a stop at the rate determined by the load inertia.

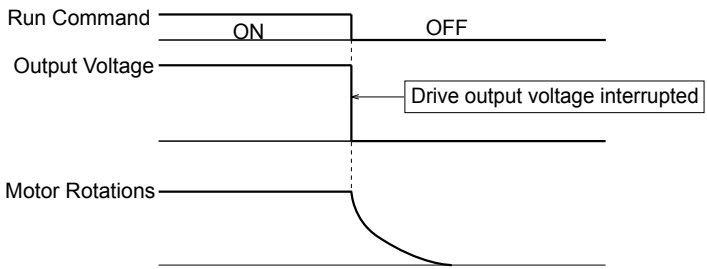


Figure 4.12 Coast to Stop

Note:
1. After entering a stop command, the drive will not accept another run command until the time set passes.
2. Do not enter another run command until the motor comes to a complete stop. If a run command must be entered before the motor has fully stopped, use DC Injection to slow the motor or catch the motor before restarting.

◆ Acceleration/Deceleration: C1-01 to C1-04

C1-01 (Acceleration Time 1) sets the time to accelerate from 0 to the maximum output frequency (E1-04). C1-02 (Deceleration Time 1) sets the time to decelerate from maximum output frequency to 0.

No.	Parameter Name	Description	Setting Range	Default
C1-01 <1>	Acceleration Time 1	Sets the time to accelerate from 0 to 100% (maximum output frequency).	0.0 to 6000.0	10.0 s
C1-02 <1>	Deceleration Time 1	Sets the time to decelerate from 100% (maximum output frequency) to 0%.		

<1> The parameter can be changed during run.

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

■ Switching Accel/Decel Times with Digital Input Terminals

Two acceleration / deceleration times can be selected using one of the digital input terminals S1 through S5.

Program one of the parameters H1-01 through H1-05 to “07” (Accel/Decel Time). Opening or closing the digital input changes the accel/decel times as shown below:

Accel/Decel Time H1-□□ = 7	Acceleration Time	Deceleration Time
Open (not selected)	C1-01	C1-02
Closed	C1-03	C1-04

■ Using S-Curve Characteristics during Acceleration/Deceleration

Use S-curve characteristics to smooth acceleration and deceleration and to minimize abrupt shock to the load.

Note: Setting S-curve characteristics will lengthen accel/decel times as follows:
Accel Time = Selected Accel Time + (C2-01 + C2-02)/2
Decel Time = Selected Decel Time + (C2-03 + C2-04)/2

Setting Example

Figure 4.13 illustrates S-curve characteristics switching between forward and reverse.

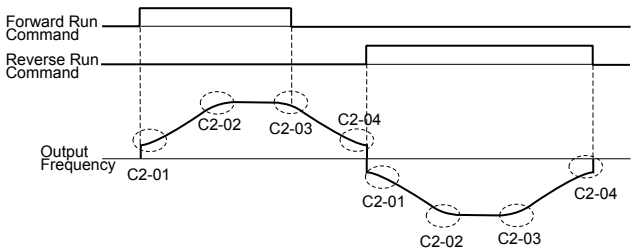


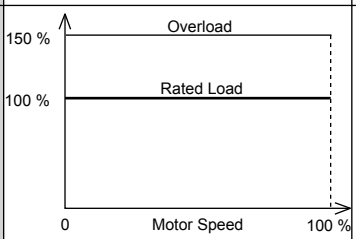
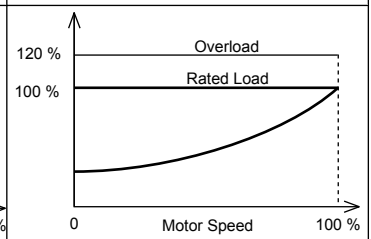
Figure 4.13 S-Curve Characteristics

◆ Drive Duty and Carrier Frequency Selection: C6-01 and C6-02

■ Drive Duty Selection: C6-01

The drive has two different duty modes from which to select based on the load characteristics. The drive rated current, overload capacity, and carrier frequency will change depending upon the duty mode selection. Use parameter C6-01 (Duty Cycle) to select Heavy Duty (HD) or Normal Duty (ND) for the application. The default setting is ND. *Refer to Specifications on page 209* for details about the rated current.

HD and ND Mode Selections

Mode	HD Rating	ND Rating
C6-01	0	1
Characteristics		
Application	Use HD Rating is designed applications requiring a high overload tolerance with constant load torque, like conveyors.	Use ND Rating for applications in which the torque requirements drop along with the speed. Examples include fans or pumps where a high overload tolerance is not required.
Overload capability (oL2)	100% continuous, 150% of drive rated current for 60 s	100% continuous, 120% of drive rated current for 60 s
C6-02	2.0 to 15.0 kHz (default depends on drive capacity)	
L3-02 Stall Prevention during Acceleration	150%	120%
L3-06 Stall Prevention during Run	150%	120%

Note:
1. By selecting HD/ND, motor parameter E2 is changed to the value for the maximum applicable motor.
2. Swing PWM uses 2.0 kHz carrier frequency as a base. The application of special PWM patterns keeps the audible noise of the motor low.

■ Carrier Frequency Selection: C6-02

Fixed Carrier Frequencies

The carrier frequency can be set using parameter C6-02 as shown in table below.

Parameter	Name	Description	Setting Range	Default
C6-02	Carrier frequency	1 : 2.0 kHz 2 : 5.0 kHz 3 : 8.0 kHz 4 : 10.0 kHz 5 : 12.5 kHz 6 : 15.0 kHz 7: Swing PWM F : User defined (C6-03 to C6-05)	1 to F	Depends on drive size

Note: Settings 7 through A for parameter C6-02 use a Swing PWM equivalent to a 2 kHz audible noise. This function turns the motor noise into a less obtrusive white noise.

Note: The upper limit for the carrier frequency is determined by drive capacity.

Precautions when setting parameter C6-02:

Symptom	Possible Solution
Speed and torque are unstable at low speeds.	Lower the carrier frequency.
Noise from the drive is affecting peripheral devices.	
Excessive leakage current from the drive.	
Wiring between the drive and motor is too long. <1>	
Motor acoustic noise is too loud.	Increase the carrier frequency or use Swing PWM.

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

Wiring Distance	Up to 50 m	Up to 100 m	Greater than 100 m
C6-02 (Carrier Frequency Selection)	1 to F (15 kHz)	1 to 2 (5 kHz), 7	1 (2 kHz), 7

Carrier Frequency Setting Error (oPE11)

A carrier frequency setup error (oPE11) will occur when carrier frequency gain (C6-05) is greater than 6 and C6-03 < C6-04.

Note: *Refer to Troubleshooting without Fault Display on page 156* for information on operator errors (oPE).

■ Carrier Frequency and Drive Overload Current Level

The tables below show the drive output current depending on the carrier frequency settings. The 2 kHz value is equal to the Normal Duty (C6-01 = 1) rated current, the 8/10 kHz value is equal to the Heavy Duty rated current. The carrier frequency determines the output current linearly. Use the data below to calculate output current values for carrier frequencies not listed in the tables.

Note: In Heavy Duty mode the maximum rated output current is equal to the 8/10 kHz value, even if the carrier frequency is reduced.

Table 4.5 Drives with Heavy Duty Default Carrier Frequency of 10 kHz

200 V Single Phase Units				200 V Three Phase Units			
Model J□	Rated Current [A]			Model J□	Rated Current [A]		
	2 kHz	10 kHz	15 kHz		2 kHz	10 kHz	15 kHz
BA0001	1.2	0.8	0.6	2A0001	1.2	0.8	0.6
BA0002	1.9	1.6	1.3	2A0002	1.9	1.6	1.3
BA0003	3.5	3.0	2.4	2A0004	3.5	3.0	2.4
BA0006	6.0	5.0	4.0	2A0006	6.0	5.0	4.0

Table 4.6 Drives with Heavy Duty Default Carrier Frequency of 8 kHz

200 V Single Phase Units				200 V Three Phase Units				400 V Three Phase Units			
Model J□	Rated Current [A]			Model J□	Rated Current [A]			Model J□	Rated Current [A]		
	2 kHz	8 kHz	15 kHz		2 kHz	8 kHz	15 kHz		2 kHz	8 kHz	15 kHz
BA0010	9.6	8.0	6.4	2A0008	8.0	6.9	5.5	4A0001	1.2	1.2	0.7
—	—	—	—	2A0010	9.6	8.0	6.4	4A0002	2.1	1.8	1.1
—	—	—	—	2A0012	12.0	11.0	8.8	4A0004	4.1	3.4	2.0
—	—	—	—	2A0018	17.5	14.0	11.2	4A0005	5.4	4.8	2.9
—	—	—	—	2A0020	19.6	17.5	14.0	4A0007	6.9	5.5	3.3
—	—	—	—	—	—	—	—	4A0009	8.8	7.2	4.3
—	—	—	—	—	—	—	—	4A0011	11.1	9.2	5.5

◆ Multi-Step Speed Operation (4-Step Speed)

Select up to 9 preset references (including Jog reference) using two multi-function inputs S4 and S5. Two multi-step references can be selected using two multi-function inputs as illustrated in ***Figure 4.14***.

■ Multi-Step Speed Operation Parameters

No.	Name	Description
d1-01	Frequency Reference 1	Frequency reference. o1-03 determines the units, with Hz as the default.
d1-02	Frequency Reference 2	Frequency reference when multi-function input “Multi-Step Speed Reference 1" (H1-□□ = 3) is on. Setting unit: set by o1-03.
d1-03	Frequency Reference 3	Frequency reference when multi-function input “Multi-Step Speed Reference 2” (H1-□□ = 4) is on. Setting unit: set by o1-03.
d1-04	Frequency Reference 4	Frequency reference when multi-function input “Multi-Step Speed Reference 1, 2" (H1-□□ = 3 and 4) are both on. Setting unit: set by o1-03.

■ Digital Input

Terminal	Parameter	Setting	Contents
S4	H1-04	4	Multi-Step Speed Reference 2
S5	H1-05	3	Multi-Step Speed Reference 1

■ Wiring Example

Set up external switches SW1 and SW2.

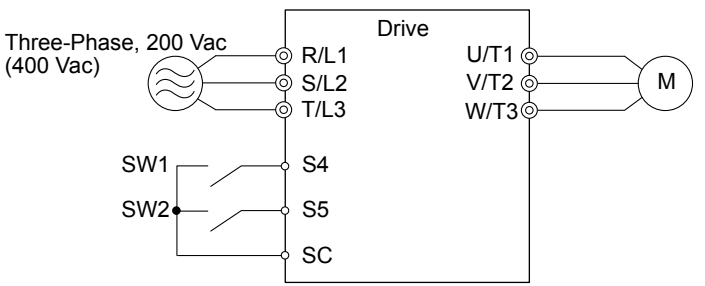


Figure 4.14 Control Terminals for 4 Multi-Step Speeds

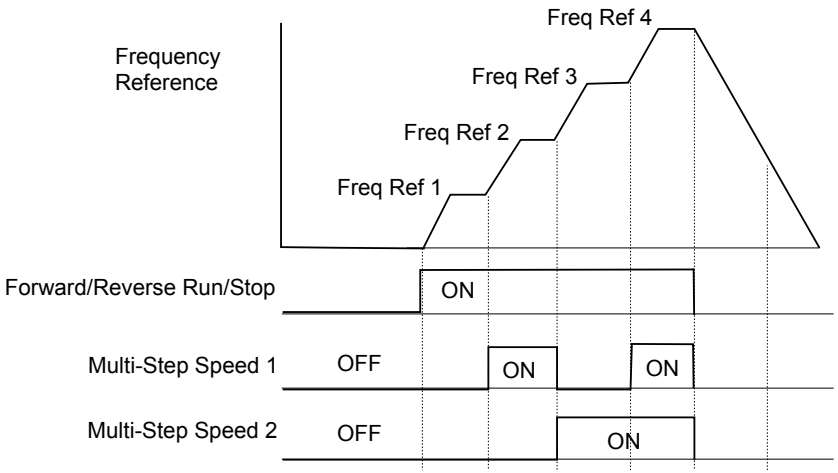
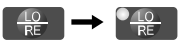


Figure 4.15 4-Step Speed Time Chart

■ Setting Procedure

Step			Display/Result
1.	Turn on the power to the drive. The initial display appears.	→	F 0.00 DRV
2.	Set the frequencies listed below to the specified parameters: 1. d1-01 = 5 Hz: Step 1 <1> 2. d1-02 = 20 Hz: Step 2 3. d1-03 = 50 Hz: Step 3 4. d1-04 = 60 Hz: Step 4		
3.	Press the ESC key until the initial display appears.		F 0.00 DRV
4.	DRV turns on.	→	F 0.00 DRV

Step			Display/Result
5.	Press LO/RE to select LOCAL. The LO/RE light will turn on.	→	 
6.	Press RUN to run the motor at 5 Hz. The RUN light will turn on.	→	  Off On
7.	With SW1 closed, the drive runs the motor at Multi-Step Speed 2 (20 Hz).	→	
8.	With SW1 open and SW2 closed, the drive runs the motor at Multi-Step 3 (50 Hz).	→	
9.	With both SW1 and SW2 closed, the drive runs the motor at Multi-Step 4 (60 Hz).	→	
10.	Press STOP to stop the drive. The RUN light will flash until the motor comes to a complete stop.	→	  Flashing Off

<1> When the frequency reference is assigned to the LED operator (b1-01=0), the first step in a multi-step speed sequence comes from d1-01.

Note: When a run command is input from the control circuit terminal, the frequency reference value is selected as follows:
When b1-01 = 0 and the run command is given, the drive uses the frequency set to d1-01.
When b1-01 = 1 and the run command is given, the drive uses the frequency reference value input to analog control terminal A1.

◆ E1: V/f Characteristics

■ 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 of the drive to function properly. Failure to comply could 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 over-/undervoltage detection level and the operation levels of the braking transistor.

Voltage	Setting Value of E1-01	(Approximate Values)		
		ov Detection Level	BTR Operation Level	Uv Detection Level
200 V Class	All settings	410 V	394 V	190 V (single-phase = 160 V)
400 V Class	Setting ≥ 400 V	820 V	788 V	380 V
	Setting < 400 V	740 V	708 V	350 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

The drive utilizes a set V/f pattern to determine the appropriate output voltage level for each relative to the frequency reference.

V/f Pattern Setup for V/f Control

1. Set the input voltage for the drive. Refer to E1-01: Input Voltage Setting on page *230*.
2. Set the V/f pattern. Refer to V/f Pattern Settings E1-04 to E1-10 on page *230*.

■ V/f Pattern Setting Examples

This section provides examples of how to set a V/f pattern using E1-04 to E1-10.

Table 4.7 V/f Pattern Examples

Example	Specification	Characteristic	Application
A	50 Hz	Constant torque	For general purpose applications. Torque remains constant regardless of changes to speed.
B	60 Hz (default setting)		
C	60 Hz (with 50 Hz base)		
D	72 Hz (with 60 Hz base)		
E	50 Hz, Heavy Duty 2	Derated torque	For fans, pumps, and other applications that require torque derating relative to the load.
F	50 Hz, Heavy Duty 1		
G	50 Hz, Heavy Duty 1		
H	50 Hz, Heavy Duty 2		
I	50 Hz, mid starting torque	High starting torque	Select high starting torque when: • Wiring between the drive an motor exceeds 150 m • A large amount of starting torque is required • An AC reactor is installed
J	50 Hz, high starting torque		
K	60 Hz, mid starting torque		
L	60 Hz, high starting torque		
M	90 Hz (with 60 Hz base)	Constant output	When operating at greater than 60 Hz the output voltage will be constant.
N	120 Hz (with 60 Hz base)		
O	180 Hz (with 60 Hz base)		

The following tables show details on V/f patterns.

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

V/f Pattern Examples

Table 4.8 Constant Torque Characteristics, Examples A to D

Example A	50 Hz	Example B	60 Hz (default)	Example C	60 Hz	Example D	72 Hz

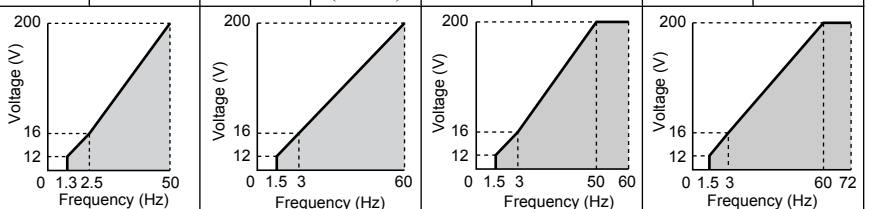


Table 4.9 Derated Torque Characteristics, Examples E to H

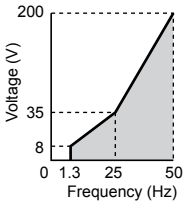
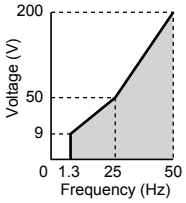
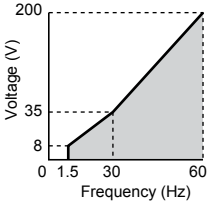
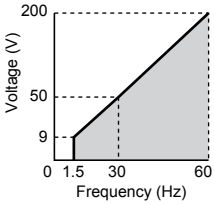
Example E	50 Hz	Example F	50 Hz	Example G	60 Hz	Example H	60 Hz
							

Table 4.10 High Starting Torque, Examples I to L

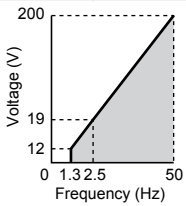
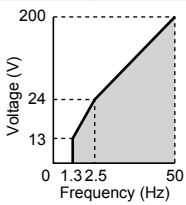
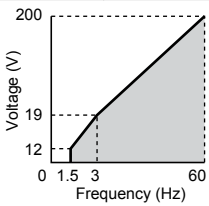
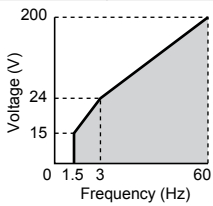
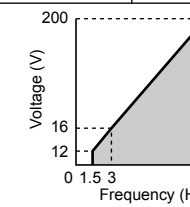
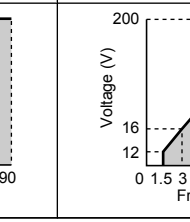
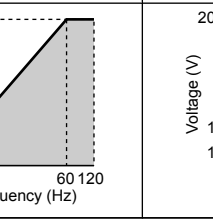
Example I	50 Hz	Example J	50 Hz	Example K	60 Hz	Example L	60 Hz
							

Table 4.11 Rated Output Operation, Examples M to O

Example M	90 Hz	Example N	120 Hz	Example O	180 Hz
					

■ V/f Pattern Settings E1-04 to E1-10

Set up the V/f pattern as shown in ***Figure 4.16***.

No.	Parameter Name	Setting Range	Default
E1-04	Maximum Output Frequency	40.0 to 400.0 Hz	60 Hz <2>
E1-05	Maximum Voltage	0.0 to 255.0 V <1>	200 V

No.	Parameter Name	Setting Range	Default
E1-06	Base Frequency	0.0 to 400.0 Hz	60 Hz <2>
E1-07	Middle Output Frequency	0.0 to 400.0 Hz	3.0 Hz <2>
E1-08	Middle Output Frequency Voltage	0.0 to 255.0 V <1>	16.0 V
E1-09	Minimum Output Frequency	0.0 to 400.0 Hz	1.5 Hz <2>
E1-10	Minimum Output Frequency Voltage	0.0 to 255.0 V <1>	12.0 V

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

<2> The default value is for the following localized drives: Japan (Model code: CIMR-JA☐A) and Asia (Model code: CIMR-JT☐A) *Refer to China Localized Drive Default Values on page 246* for the default values of China localized (Model code: CIMR-JB☐A) drives.

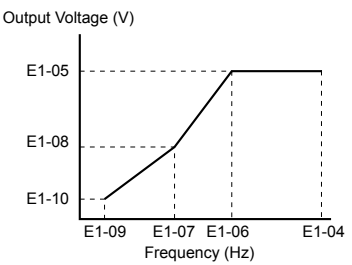


Figure 4.16 V/f Pattern

Note:
1. The following condition must be true when setting up the V/f pattern: E1-09 ≤ E1-07 ≤ E1-06 ≤ E1-04
2. To make the V/f pattern a straight line set E1-09 = E1-07. In this case the E1-08 setting is disregarded.
3. E1-03 is unaffected when the drive is initialized using parameter A1-03, but the settings for E1-04 through E1-10 are returned to their default values.

◆ Motor Parameters: E2-01 to E2-03

■ Setting Motor Parameters

The following table provides instructions on how to set motor parameters. Refer to the motor data sheet for the correct motor data.

No.	Parameter Name	Setting Method
E2-01	Motor Rated Current	Sets the motor nameplate full load current in amperes (A).
E2-02	Motor Rated Slip	Calculate and set the motor rated slip based on the rated speed described on the motor nameplate. Motor rated slip = Motor rated frequency [Hz] - Rated speed [r/min] x No. of motor poles / 120.
E2-03	Motor No-Load Current	Set motor no-load current at rated voltage and rated frequency. Contact the motor manufacturer to get the no-load current. This information is not usually written on the motor nameplate. The default no-load current is for a Yaskawa 4-pole motor.
E2-05	Motor Line-to-Line Resistance	Sets the phase-to-phase motor resistance in ohms.

◆ Digital Output: H2-01

Parameter H2-01 assigns functions to digital output terminals MA, MB, and MC. Set this parameter as required by the application. Default value is listed below.

NOTICE: *Do not assign a function that repeats ON/OFF frequently to terminals MA and MB. Failure to comply will reduce the relay contact lifetime. The expected number of relay contact switching times is normally 200,000 times (current 1 A, resistance load).*

No.	Parameter Name	Default
H2-01	Terminal MA, MB and MC Function Selection (relay)	E: Fault

Note: The setting range for H2-01 is 0 to 13D. *Refer to Parameter List on page 221* for more information.

Multi-Function Contact Outputs
250 Vac, 10 mA - 1 A
30 Vdc, 10 mA - 1 A
(standard default setting)

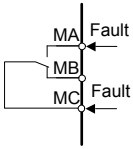


Figure 4.17 Digital Output Connection Diagram

◆ Analog Outputs: H4-01 to H4-03

Group U parameters can be used to observe the drive status (operating conditions) through the LED operator. Analog outputs corresponding to these monitors can be obtained on analog output terminal AM when programmed with parameter group H4. Some Group U monitors are not available as analog outputs.

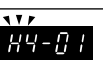
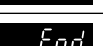
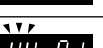
No.	Parameter Name	Description
H4-01	Terminal AM Monitor Selection	Select the data to output through multi-function analog output terminal AM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter “103” for U1-03. When using this terminal as a through terminal or when not using it at all, set “000” or “031”.
H4-02 <1>	Terminal AM Output Gain	Sets the voltage level gain of terminal AM. The bias to be added ranges from 0 to +/- 10% when 10 V is assumed to be 100%.
H4-03 <1>	Terminal AM Bias Setting	Sets the voltage level bias for terminal AM. The bias added is 0 to ±10% with a maximum voltage output of 10 V as 100%.

<1> The parameter can be changed during run.

■ Changing Analog Output Settings

The following example illustrates how to program analog output terminal AM to generate a signal proportional to drive output current (monitor U1-03).

Using H4-01 to Display Monitor Contents

Step			Display/Result
1.	Turn on the power to the drive. The initial display appears.	→	
2.	Press V until the Parameter setting menu is displayed.	→	
3.	Press ENTER to enter the Parameter setting menu.	→	
4.	Press RESET and ∧ to select H4-01.	→	
5.	Press ENTER to display the value currently set to H4-01.	→	
6.	Press RESET and ∧ to set the output current (103).	→	
7.	Save the setting by pressing ENTER.	→	
8.	The display automatically returns to the parameter setting menu.	→	
9.	Press the ESC key until back at the Top Screen.	→	

Adjusting the Analog Output Terminal Voltage with H4-02 and H4-03

Note: This example continues from Step 3 in the previous example.

Step			Display/Result
1.	Select H4-02 or H4-03 by pressing the RESET and ∧ keys.	→	H4-02
2.	Press the ENTER key while the drive is stopped and the following voltage is output for adjustment: Output voltage = (10 V x Output Gain (H4-02) + Output Bias (H4-03). Using this output, adjust output gain (H4-02) and output bias (H4-03).	→	0 100.0

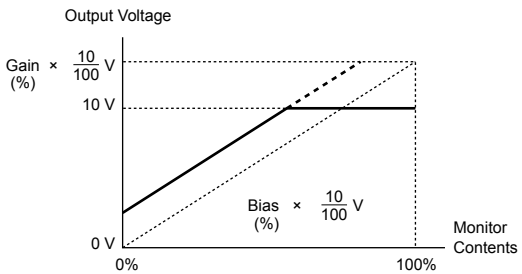


Figure 4.18 Analog Output Gain/Bias Setting

◆ Motor Protection: L1-01 and L1-02

This section explains how to set motor overload protection.

■ Electronic Thermal Motor Protection

The drive has built-in electronic thermal overload protection to detect overload conditions. This protection meets standards set by UL and cUL for motor thermal overload protection. The protective feature is activated when the output current rises above the motor rated current for a specified time. This speed sensitive protective feature interrupts the motor current to protect the motor wiring and windings in the event of overload, eliminating the need for an external overload device. When multiple motors are used with a single drive, separate overload devices are required to properly protect the individual motor branches.

Related Parameters

No.	Parameter Name	Description	Setting Range	Default Setting
E2-01	Motor Rated Current	Sets the motor nameplate full load current in amperes (A). This set value becomes the reference value for motor protection, torque limit, and torque control.	10 to 200% of drive rated current	Determined by o2-04 and C6-01
L1-01	Motor Overload Protection Selection	Enables or disables motor thermal overload protection (oL1) 0: Disabled 1: Protection for general purpose motor 2: Protection for inverter motor	0 to 2 Use L1-13 (Continuous Electrothermal Operation Selection) to select whether electronic thermal value is “held” or “not held” when the power supply is turned off. When connecting several motors to one drive, set “0” (disabled) and install a thermal relay on each motor.	1
L1-02	Motor Overload Protection Time	Sets the electronic thermal overload protection detection time in the motor overload protection (oL1) function. This setting rarely needs to be changed and should be set in accordance with the overload tolerance of the motor.	0.1 to 5.0	1.0 min

Note: Executing C6-01 (Duty Cycle) changes motor parameters E2 including motor rated current to the values of the maximum applicable motor.

Setting Procedure

1. Set E2-01 (Motor Rated Current) to the motor rated current.

Values set for the current become the base current for electronic thermal overload protection.

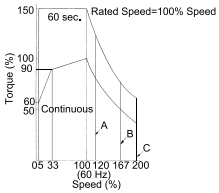
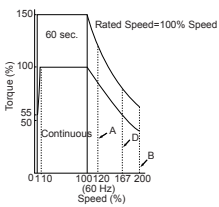
2. Set the proper motor protection level to L1-01.

The ability of the cooling fan to keep an induction motor cool varies by the speed control range. Protection characteristics of the electronic thermal overload protection should be set accordingly. Refer to ***Table 4.12*** for motor types and overload tolerances.

NOTICE: *When connecting multiple motors to one drive, disable the electronic overload protection of the drive (L1-01 = 0) and protect each motor with its own motor thermal overload. Failure to comply could result in improper drive operation.*

NOTICE: *Inadequate motor protection could result in damage to the motor. Configure a motor thermal overload to disconnect main power to the drive when tripped. When using a thermal relay, disable the motor protection function (L1-01 = “0”).*

Table 4.12 Motor Type and Overload Tolerances

L1-01 Setting	Motor Type	Overload Tolerance	Cooling Ability	Overload Characteristics
1	General-Purpose Motor (Standard Self-Cooled)		Motor designed to operate from line power. Motor cooling is most effective when running at rated nameplate base frequency (check the motor specifications).	Operating continuously at less than line power frequency can trigger motor overload protection (oL1). A fault is then output and the motor will coast to stop.
2	Drive Dedicated Motor (Constant Torque, 1:10)		Motor is designed to effectively cool itself at speeds as low as 6 Hz.	Continuous operation with 100% load from 6 Hz to 50/60 Hz.

Notes on Motor Protection

- Motor protection meeting UL and cUL standards is achieved with the motor overload protection time (L1-02) set to factory default setting. Normally, L1-02 (Motor Overload Protection Time) does not require setting. If the motor overload tolerance is clear, set the overload protection time at hot start according to the motor. To detect overload earlier, decrease the setting.

Figure 4.19 illustrates motor protection operation time characteristics.

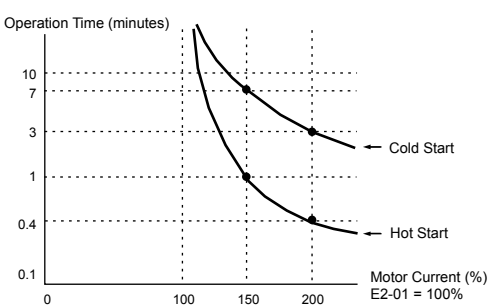


Figure 4.19 Motor Protection Operation

- Disable motor protection (L1-01 = 1) when running multiple motors from the same drive. Attach a thermal relay for each motor to provide overload protection.
- Use L1-13 (Continuous Electrothermal Operation Selection) to select whether the electrothermal value is “held” or “not held” when power supply is turned off. Default setting is 1 (Enabled).
- In the case of a general purpose (standard) motor, the cooling capability is reduced at a low speed. Motor overload protection (oL1) may occur in frequencies lower than motor rated current. Use an exclusive-use or inverter-duty motor to operate the drive at rated current at low frequency.

◆ Notes on Controlling the Brake for the Hoist Application

- The frequency detection function is used for controlling the brake.

  When an external Baseblock command is present while a Run command is active, the frequency reference will be kept as long as the Run command is active. To avoid improper brake operation make sure that frequency detection is set so that the brake does not open during Baseblock (L4-07 = “0”, default).

Brake Open/Close		Brake Activation Level	
Function	**Parameter**	**Signal**	**Parameter**
Frequency Detection Conditions	L4-07 = 0	Frequency Detection Level	L4-01 = 2.0 to 3.0 Hz <1>
Frequency Detection 2	H2-01 = 5	Frequency Detection Width	2.0 Hz (fixed)

<1> If the load slips during stop, make it greater than E1-09 or 2.0 Hz until the load no longer slips.

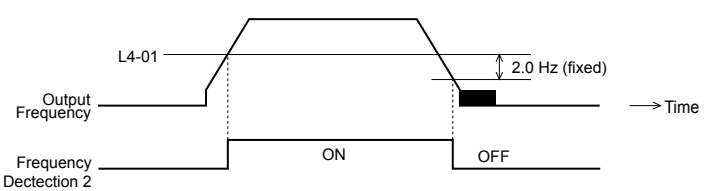


Figure 4.20 Frequency Detection 2

- The braking sequence should be designed as follows:

  A normally open signal (N.O.) should be used to control the brake so that it is released when terminal MA-MC closes.

  An external circuit should be added to ensure the brake is fully applied in case of a fault or emergency condition.

An additional external circuit should also be added to ensure the brake releases properly when an Up/Down Command is entered.

- When changing the speed using an analog signal, make sure that the source of the frequency reference is assigned to the control circuit terminals (b1-01 = 1).
- A sequence to open and close the holding brake appears in the diagram below.

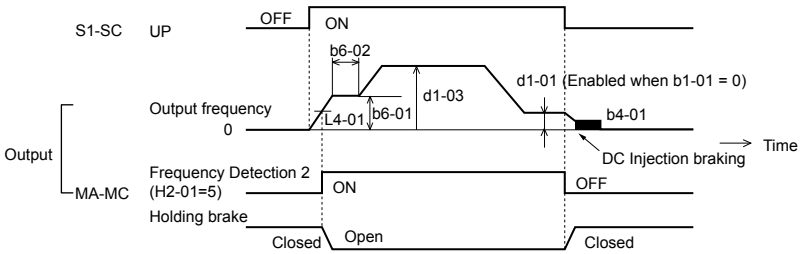


Figure 4.21 Holding Brake Time Chart

◆ Drive Status Monitors: U1-01 to U4-13

Parameter group U displays various data regarding the operating status of the drive.

The following example demonstrates viewing output voltage reference (U1-06).

Step			Display/Result
1.	Turn on the power to the drive. The initial display appears.	➡	
2.	Press  until "Monitor Display" appears.	➡	
3.	Press  to enter the Parameter Setting Screen.	➡	
4.	Press  until U1-06 appears.	➡	
5.	Press  to display the voltage reference. The Output Voltage Reference appears.	➡	

Refer to Parameter List on page 221 for more details about Drive Status Monitors.

Table 4.13 Drive Status Monitors

No.	Parameter Name	Page
U1-01	Frequency Reference	*243*
U1-02	Output Frequency	*243*
U1-03	Output Current	*243*
U1-06	Output Voltage Reference	*243*
U1-07	DC Bus Voltage	*243*
U1-10	Input Terminal Status	*244*
U1-11	Output Terminal Status	*244*
U1-13	Terminal A1 Input Voltage	*244*
U1-19	MEMOBUS/Modbus Error Code	*244*
U1-25	Software Number (ROM)	*244*

No.	Parameter Name	Page
U1-26	Software Number (Flash)	*244*
U2-01	Current Fault	*244*
U2-02	Previous Fault	*244*
U4-01	Accumulated Operation Time	*245*
U4-04	Cooling Fan Maintenance	*245*
U4-05	Capacitor Maintenance	*245*
U4-07	IGBT Maintenance	*245*
U4-08	Heatsink Temperature	*245*
U4-09	LED Check	*245*
U4-13	Peak Hold Current	*245*

4.6 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: single-phase 200 to 240 Vac 50/60 Hz 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). (for single-phase 200 V class models, wire only R/L1 and S/L2)
	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	Uncouple the motor from the load.

■ Status Display

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

No.	Name	Description
Normal Operation		The data display area displays the frequency reference. DRV is lit.
Fault	 Main circuit low voltage (ex)	Data displayed varies by the type of fault. *Refer to Fault Displays, Causes and Possible Solutions on page 137* for more information and possible solution. ALM and DRV are lit.

◆ V/f Pattern Setting

Setting the V/f pattern according to the application. for details on setting the V/f pattern.

■ Notes when Setting the V/f Pattern

Set the maximum output frequency to match the motor characteristics.

If the V/f pattern voltage is increased motor torque may also increase. However, if the V/f voltage is set too high these problems may occur:

- Excessive motor current.
- Motor overheat or vibration.

4.7 No-Load Operation Test Run

◆ No-Load Operation Test Run

This section explains how to operate the drive with the motor uncoupled 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

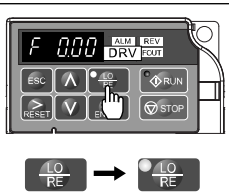
Check the following items during operation:

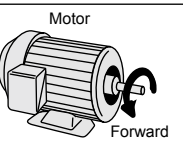
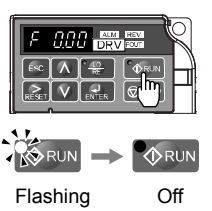
- The motor should rotate smoothly (i.e., no abnormal noise or oscillation).
- The motor should accelerate and decelerate smoothly.

■ 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 LED will turn on.	→	

Step			Display/Result
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 no faults or alarms occur.	➡	
5.	If there is no error in step 4, press ∧ to increase the frequency reference. Increase the frequency in 10 Hz increments verifying smooth operation results at all speeds. For each frequency, monitor the drive output current (U1-03) through the LED operator to confirm the current is 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.	➡	

4.8 Test Run with Load Connected

◆ Test Run with the Load Connected

After performing a no-load test run connect the load 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 machinery.
- 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.

- Check monitor parameter U1-03 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 occurs with hunting, oscillation, or other control-related issues.

4.9 Verifying and Backing Up Parameter Settings

Check changes to parameter settings using the Verify function. *Refer to Verifying Parameter Changes: Verify Menu on page 90*.

Save the verified parameter settings. Change the access level or set a password to the drive to prevent accidental modification of parameter settings.

◆ Parameter Access Level: A1-01

Setting the Access Level for "Operation only" (A1-01 = 0) allows the user to access parameters A1-☐☐ and U☐-☐☐ only. Other parameters are not displayed.

No.	Parameter Name	Description	Setting Range	Default
A1-01	Access Level Selection	Selects which parameters are accessible via the digital operator. 0: Operation only (A1-01 and A1-04 can be set and monitored. U parameters can be monitored) 2: Advanced Access Level (All parameters can be set and monitored)	0, 2	2

◆ Password Settings: A1-04, A1-05

The user can set a password to the drive to restrict access. The password is selected via parameter A1-05. The selected password must be entered in parameter A1-04 to unlock parameter access (i.e., parameter setting A1-04 must match the value programmed into A1-05). The following parameters cannot be viewed or edited until the value programmed into A1-04 correctly matches the value as programmed in parameter A1-05: A1-01 and A1-03.

Note: Parameter A1-05 is hidden from view. To display A1-05, access parameter A1-04 and simultaneously depress the STOP key and the ∧ key.

◆ Copy Function (Optional)

Parameter settings can be copied to another drive to simplify parameter restoration or multiple drive setup. The RS-232C Interface Unit (Removable Type) (SI-232/JC) is required to use the following options with J1000 drives:

■ USB/Copy Unit (JVOP-181)

The copy unit is an external option connected to the drive to copy parameter settings to another drive. It includes a USB adapter to connect the drive to a PC.

■ LED Operator (JVOP-182)

The LED operator operates the drive and supports copying, importing, and verifying parameter settings.

Note: Use of the LED operator requires that the drive is running drive software version PRG: 1010 or later.

■ Drive Wizard Plus

Drive Wizard Plus is a PC software tool for parameter management, monitoring, and diagnosis. Drive Wizard Plus can load, store, and copy drive parameter settings. For details, refer to Help in the Drive Wizard Plus software.

The installation files can be obtained at no charge from:

Japan: http://www.e-mechatronics.com

Other areas: Contact a Yaskawa representative.

4.10 Test Run Checklist

Review the checklist before performing a test run. Check each item that applies.

☑	No.	Checklist	Page
☐	1	Thoroughly read the manual before performing a test run.	—
☐	2	Turn the power on.	*119*
☐	3	Set the voltage for the power supply to E1-01.	*107*

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
☐	4	The DRV should illuminate after giving a run command.	—
☐	5	To give a run command and frequency reference from the LED Digital Operator, press LO/RE to set to LOCAL. The LO/RE key lights while LOCAL is displayed.	*91*
☐	6	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).	*119*
☐	7	Select the correct duty rating (C6-01) for the application.	—
☐	8	Set the correct values for the motor rated current (E2-01) and the motor protection selection (L1-01) to ensure motor thermal protection.	—
☐	9	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.	*91*
☐	10	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).	*91*
☐	11	Set the proper voltage to terminal A1. (0 to 10 V).	*94*
☐	12	When current input is used, switch the drive built-in DIP switch S1 from the V-side (OFF) to I-side (ON).	—
☐	13	Set the minimum and maximum frequency references to the desired values. 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) 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) until the frequency reference value reaches the desired minimum value.	—

5

Troubleshooting

This chapter provides descriptions of the drive faults, alarms, errors, related displays, and possible solutions. This chapter can also serve as a reference guide for tuning the drive during a trial run.

5.1 SECTION SAFETY.....128
5.2 MOTOR PERFORMANCE FINE TUNING.....131
5.3 DRIVE ALARMS, FAULTS, AND ERRORS.....133
5.4 FAULT DETECTION..... 137
5.5 ALARM DETECTION.....147
5.6 OPERATOR PROGRAMMING ERRORS..... 152
5.7 DIAGNOSING AND RESETTING FAULTS.....154
5.8 TROUBLESHOOTING WITHOUT FAULT DISPLAY.....156

5.1 Section Safety

DANGER

Electrical Shock Hazard

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

Failure to comply will result in death or serious injury.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

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

Always ground the motor-side grounding terminal.

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

Do not touch terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the drive input power is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are off and measure the DC bus voltage level to confirm safe level.

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

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

⚠ WARNING

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

Failure to comply could result in death or serious injury.

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

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

Failure to comply could result in death or serious injury.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

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

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 drive input power before applying power.

Do not use improper combustible materials.

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

Attach the drive to metal or other noncombustible material.

NOTICE

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

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

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

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

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

Do not allow unqualified personnel to use the product.

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

Carefully review instruction manual TOBPC72060000 when connecting a braking option to the drive.

Do not modify the drive circuitry.

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

Yaskawa is not responsible for modification of the product made by the user.

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

Failure to comply could result in damage to the drive.

5.2 Motor Performance Fine Tuning

This section offers helpful information for counteracting oscillation, hunting, or other faults that occur while performing a trial run.

Note: This section describes parameters that are commonly edited. Consult Yaskawa for more information on detailed settings and fine-tuning the drive.

◆ Parameters for Tuning the Drive

Table 5.1 Parameters for Tuning the Drive

Problem	Parameter	Corrective Action	Default Value	Suggested Setting
• Motor hunting and oscillation at speeds between 10 and 40 Hz	Hunting Prevention Gain (n1-02)	• If insufficient motor torque relative to the size of the load causes hunting, reduce the setting. • When motor hunting and oscillation occur with a light load, increase the setting. • Lower this setting if hunting occurs when using a motor with a relatively low inductance, such as a high-frequency motor or a motor with a larger frame size.	1.00	0.00 to 2.00
• Motor noise • Motor hunting and oscillation at speeds up to 40 Hz	Carrier Frequency Selection (C6-02)	• If the motor noise is too loud, increase the carrier frequency. • When motor hunting and oscillation occur at speeds up to 40 Hz, lower the carrier frequency. • The default setting for the carrier frequency depends on the drive capacity (o2-04) and the Drive Duty Selection (C6-01).	7 (Swing PWM)	1 to 7
• Poor motor torque at speeds below 10 Hz • Motor hunting and oscillation	Torque Compensation Gain (C4-01)	• If motor torque is insufficient at speeds below 10 Hz, increase the setting. • If motor hunting and oscillation with a relatively light load, decrease the setting.	1.00	0.50 to 1.50
• Poor motor torque at low speeds • Motor instability at motor start	Mid Output Voltage A (E1-08) Minimum Output Voltage (E1-10)	• If torque is insufficient at speeds below 10 Hz, increase the setting. • If motor instability occurs at motor start, decrease the setting. **Note:** The recommended setting value is for 200 V class drives. Double this value when using a 400 V class drive.	E1-08: 16.0 V E1-10: 12.0 V	Initial value ±5 V
• Poor speed precision	Slip Compensation Gain (C3-01)	• After setting the motor-rated current (E2-01), motor-rated slip (E2-02) and motor no-load current (E2-03), adjust the slip compensation gain (C3-01).	-	0.5 to 1.5

Note: Use slip compensation to improve speed precision. First make sure that the proper values have been set for the motor rated current to E2-01, motor rated slip (E2-02), and motor no-load current (E2-03). Next, adjust the slip compensation gain set to C3-01 so that it is between 0.5 to 1.5.

◆ Motor Hunting and Oscillation Control Parameters

The following parameters indirectly affect motor hunting and oscillation.

Table 5.2 Parameters that Affect Control Performance in Applications

Name (Parameter No.)	Application
Accel/Decel Time (C1-01 through C1-09)	Adjusting accel and decel times will affect the torque presented to the motor during acceleration or deceleration.
S-Curve Characteristics (C2-01 through C2-04)	Prevents shock at the beginning and end of acceleration and deceleration.
Jump Frequency (d3-01 through d3-04)	Skips over the resonant frequencies of connected machinery.
Analog Filter Time Constant (H3-13)	Prevents fluctuation in the analog input signal due to noise.
Stall Prevention (L3-01 through L3-06)	• Prevents motor speed loss and overvoltage. Used when the load is too heavy and also during sudden acceleration/deceleration. • Adjustment is not normally required because Stall Prevention is enabled as a default. Disable Stall Prevention during deceleration (L3-04 = “0”) when using a braking resistor.

5.3 Drive Alarms, Faults, and Errors

◆ Types of Alarms, Faults, and Errors

Check the LED operator for information about possible faults if the drive or motor fails to operate. *Refer to Using the Digital LED Operator on page 79*.

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 5.3 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 5.3 Types of Alarms, Faults, and Errors

Type	Drive Responses to Alarms, Faults, and Errors
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. • Depending on the setting, the drive and motor may stop via different methods than listed. • If a digital output is programmed for fault output (H2-01 = E), it will close if a fault occurs. When the drive detects a fault, it will remain inoperable until that fault has been reset. *Refer to Fault Reset Methods on page 155*.
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 motor does not stop. • The multi-function contact output closes if set to be tripped by a minor fault (H2-01 = 10), but not by an alarm. • The digital operator displays text indicating a specific alarm and ALM indicator LED flashes. Remove the cause of an alarm or minor fault to automatically reset.

Type	Drive Responses to Alarms, Faults, and Errors
Operation Errors	When parameter settings conflict with one another or do not match hardware settings (such as with an option unit), it results in an operation error. When the drive detects an operation error: • The digital operator displays text that indicates the specific error. • The multi-function contact output does not operate. When the drive detects an operation error, it will not operate the motor until the error has been reset. Correct the settings that caused the operation error to reset.

◆ Alarm and Error Displays

■ Faults

When the drive detects a fault, the ALM indicator LEDs remain lit without flashing. If the LEDs flash, the drive has detected a minor fault or alarm. ***Refer to Minor Faults and Alarms on page 135*** for more information. Conditions such as overvoltage or external faults can trip both faults and minor faults, therefore it is important to note whether the LEDs remain lit or if the LEDs flash.

Table 5.4 Fault Displays

LED Operator Display		Name	Pg.
CE	CE	MEMOBUS/Modbus Communication Error	*137*
CoF	CoF	Current Offset Fault	*137*
CPF00 or CPF01 <1>	CPF00 or CPF01	CPF11 – RAM Fault	*137*
		CPF12 – FLASH Memory Fault	*137*
		CPF14 – Control Circuit Fault	*137*
		CPF17 – Timing Fault	*137*
		CPF18 – Control Circuit Fault	*137*
CPF02	CPF02	A/D Conversion Error	*138*
CPF06	CPF06	Drive specification mismatch during Terminal Board or Control Board replacement	*138*
CPF08	CPF08	EEPROM Serial Communications Fault	*138*

LED Operator Display		Name	Pg.
CPF20 or CPF21 <2>	CPF20 or CPF21	RAM Fault	*138*
		FLASH Memory Fault	*138*
		Watchdog Circuit Exception	*138*
		Clock Fault	*138*
CPF22	CPF22	A/D Conversion Error	*139*
CPF23	CPF23	PWM Feedback Data Fault	*139*
CPF24	CPF24	Drive Capacity Signal Fault	*139*
EF0	EF0	Option Unit External Fault	*139*
EF1 to EF5	EF1 to EF5	External Fault (input terminal S1 to S5)	*139*
Err	Err	EEPROM Write Error	*140*
LF	LF	Output Phase Loss	*140*
oC	oC	Overcurrent	*140*
oFA01	oFA01	Option Disconnected	*141*
oH1	oH1	Heatsink Overheat	*142*
oL1	oL1	Motor Overload	*142*

LED Operator Display		Name	Pg.
oL2	oL2	Drive Overload	143
oL3	oL3	Overtorque Detection 1	143
oPr	oPr	Operator Connection Fault	144
ov	ov	Overvoltage	150
PF	PF	Input Phase Loss	145

LED Operator Display		Name	Pg.
rH	rH	Dynamic Braking Resistor	145
Uv1 <3>	Uv1	Undervoltage	146
Uv3	Uv3	Soft Charge Circuit Fault	146

<1> Displayed as CPF00 when occurring at drive power up. When one of the faults occurs after successfully starting the drive, the display will show CPF01.

<2> Displayed as CPF20 when occurring at drive power up. When one of the faults occurs after successfully starting the drive, the display will show CPF21.

<3> Uv1 fault is not saved to the fault history

■ Minor Faults and Alarms

When a minor fault or alarm occurs, the ALM LED flashes and the text display shows an alarm code. A fault has occurred if the text remains lit and does not flash. *Refer to Alarm Detection on page 147*. An overvoltage situation, for example, can trigger both faults and minor faults. It is therefore important to note whether the LEDs remain lit or if the LEDs flash.

Table 5.5 Minor Fault and Alarm Displays

LED Operator Display		Name	Minor Fault Output (H2-01 = 10)	Pg.
bb	bb	Drive Baseblock	No output	147
CALL	CALL	Serial Communication Transmission Error	YES	147
CE	CE	MEMOBUS/Modbus Communication Error	YES	147
CrST	CrST	Cannot Reset	YES	148
EF	EF	Run Command Input Error	YES	148
EF1 to EF5	EF1 to EF5	External Fault (input terminal S1 to S5)	YES	148
oH	oH	Heatsink Overheat	YES	149
oL3	oL3	Overtorque 1	YES	150
ov	ov	Overvoltage	YES	150
PASS	PASS	MEMOBUS/Modbus Test Mode Complete	No output	150
SE	SE	MEMOBUS/Modbus Test Mode Fault	YES	150

LED Operator Display		Name	Minor Fault Output (H2-01 = 10)	Pg.
Uv	Uv	Undervoltage	YES	*151*

■ Operation Errors

Table 5.6 Operation Error Displays

LED Operator Display		Name	Pg.
oPE01	oPE01	Drive Unit Setting Error	*152*
oPE02	oPE02	Parameter Setting Range Error	*152*
oPE03	oPE03	Multi-Function Input Setting Error	*152*

LED Operator Display		Name	Pg.
oPE05	oPE05	Run Command Selection Error	*153*
oPE10	oPE10	V/f Data Setting Error	*153*
oPE11	oPE11	Carrier Frequency Setting Error	*153*

5.4 Fault Detection

◆ Fault Displays, Causes and Possible Solutions

Table 5.7 Detailed Fault Displays, Causes and Possible Solutions

LED Operator Display		Fault Name
CE	CE	MEMOBUS/Modbus Communication Error No data was received for longer than 2 seconds.
Cause		**Possible Solution**
Faulty communications wiring, or a short circuit exists.		• Check for faulty wiring. • Correct the wiring. • Check for loose wiring and short circuits. Repair as needed.
A communications data error occurred due to noise.		• Check the various options available to minimize the effects of noise. • Counteract noise in control circuit, main circuit, and ground wiring. • Use Yaskawa-recommended cables, or another type of 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 wiring for communications devices from drive input power lines. Install a noise filter to the input side of the drive input power.
LED Operator Display		**Fault Name**
CoF	CoF	Current Offset Fault The current sensor is damaged or there was residual current in the motor (e.g., during sudden acceleration or when coasting) when the drive attempted to start the motor.
Cause		**Possible Solution**
Due to residual induction current in the motor when the drive attempted to start the motor, the drive tried to adjust the current offset value beyond the allowable range.		Create a motor restart sequence that allows enough time for residual induction voltage to dissipate.
LED Operator Display		**Fault Name**
CPF00 or CPF01	CPF00 or CPF01	CPF11 – RAM Fault CPF12 – Problem with the ROM (FLASH memory) CPF14 – CPU error (CPU operates incorrectly due to noise, etc.) CPF17 – A timing error occurred during an internal process CPF18 – CPU error (CPU operates incorrectly due to noise, etc.)
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.

LED Operator Display		Fault Name
CPF02	CPF02	A/D Conversion Error
		An A/D conversion error occurred.
Cause		**Possible Solution**
Control circuit is damaged.		Cycle power to the drive. If the problem continues, replace the drive.
Control circuit terminals have shorted out (+V, AC).		• Check for wiring errors along the control circuit terminals. • Correct the wiring.
		Check the resistance of the speed potentiometer and related wiring.
Control terminal input current has exceeded allowable levels.		• Check the input current. • Reduce the current input to control circuit terminal (+V) to 20 mA.
LED Operator Display		**Fault Name**
CPF06	CPF06	EEPROM Data Error
		There is an error in the data saved to EEPROM.
Cause		**Possible Solution**
Control circuit is damaged.		Cycle power to the drive. If the problem continues, replace the drive.
The power supply was switched off when parameters were written (e.g., using an option unit).		• Cycle power to the drive and check operation again. • Initialize the drive using A1-03. • If the problem continues, replace the drive.
The power supply was switched off within 5 seconds after changing the frequency reference when o2-05 is set to 1.		Set up the external operation to allow at least 5 seconds pass before the power supply is shut off and after changing the frequency reference while o2-05 is set to 1.
LED Operator Display		**Fault Name**
CPF08	CPF08	EEPROM Communication Fault
		EEPROM communications are not functioning properly.
Cause		**Possible Solution**
Control circuit is damaged.		Cycle power to the drive. If the problem persists, replace the drive.
LED Operator Display		**Fault Name**
CPF20 or CPF21	CPF20 or CPF21	One of the following faults occurred: RAM fault, FLASH memory error, watchdog circuit exception, clock error
		• RAM fault. • FLASH memory error (ROM error). • Watchdog circuit exception (self-diagnostic error). • Clock error.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.

LED Operator Display		Fault Name
CPF22	CPF22	A/D Conversion Fault
		A/D conversion error.
Cause		**Possible Solution**
Control circuit is damaged.		• Cycle power to the drive. *Refer to Diagnosing and Resetting Faults on page 154*. • If the problem continues, replace the drive.
LED Operator Display		**Fault Name**
CPF23	CPF23	PWM Feedback Fault
		PWM feedback error.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF24	CPF24	Drive Capacity Signal Fault
		Entered a capacity that does not exist. (Checked when the drive is powered up.)
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
EF0	EF0	MEMOBUS/Modbus Communication External Fault
		An external fault condition is present.
Cause		**Possible Solution**
An external fault was received from the PLC with other than H5-04 = 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.
LED 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.
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 unused terminals set for H1-□□ = 20 to 2F (External Fault). • Change the terminal settings.
LED Operator Display	**Fault Name**
Err	EEPROM Write Error
	Data does not match the EEPROM being written to.
Cause	**Possible Solution**
-	• Press the ENTER button. • Correct the parameter settings. • Cycle power to the drive. *Refer to Diagnosing and Resetting Faults on page 154*.
LED Operator Display	**Fault Name**
LF	Output Phase Loss
	Phase loss on the output side of the drive.
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 60*.
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 the drive.
A single-phase motor is being used.	The drive being used cannot operate a single phase motor.
LED 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) • 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. • 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.	• Program the Speed Search command input through one of the multi-function contact input terminals (H1-□□ = “61” or “62”).
The motor cable is too long	Use a larger drive.
LED Operator Display	**Fault Name**
oFA01	Option Unit Fault
	Replace the option unit.
Cause	**Possible Solution**

The option unit is not properly connected to the drive.	Turn the power off and reconnect the option unit.

LED Operator Display		Fault Name
oH1	oH1	Overheat 1 (Heatsink Overheat) The temperature of the heatsink exceeded the overheat pre-alarm level.
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.
Current flowing to control circuit terminal +V exceeded the tolerance level.		• Check the current level of the terminal. • Set the current to the control circuit terminal to be 20 mA or less.

LED Operator Display		Fault Name
oL1	oL1	Motor Overload The electrothermal sensor tripped overload protection.
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 C1-04).
• Drive overloaded at low speeds. • Overload may occur at low speeds when using a general-purpose motor, even if operating within the rated current limitation.		• Reduce the load. • Increase the speed. • If the drive is supposed to operate at low speeds, either increase the motor capacity or use a motor specifically designed to operate with the drive.
Although a special type of motor is being used, the motor protection selection is set for a general-purpose motor (L1-01 = 1).		Set L1-01 = “2”.
Voltage is too high for the V/f characteristics.		• Adjust the user set V/f patterns (E1-04 through E1-10). Parameters E1-08 and E1-10 may need to be reduced. • If E1-08 and E1-10 are set too high, there may be very little load tolerance at low speed.
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 motor base frequency for the drive input power is set too low.		• 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 value set to L1-01 (Motor Protection Function). • 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 thereby 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.
Output current fluctuation due to input phase loss	Check the power supply for phase loss.
LED Operator Display	**Fault Name**
oL2	Drive Overload
oL2	The thermal sensor of the drive triggered overload protection.
Cause	**Possible Solution**
Load is too heavy.	Reduce the load.
Cycle times are too short during acceleration and deceleration.	Increase the settings for the acceleration and deceleration times (C1-01 through C1-04).
Voltage is too high for the V/f characteristics.	• 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.
Output current fluctuation due to input phase loss	Check the power supply for phase loss.
LED Operator Display	**Fault Name**
oL3	Overtorque Detection 1
oL3	The current has exceeded the value set for torque detection (L6-02) for longer than the allowable time (L6-03).
Cause	**Possible Solution**
Parameter settings are not appropriate for the type of load.	Check the settings of parameters L6-02 and L6-03.
There is a fault on the machine side (e.g., the machine is locked up).	Check the status of the load. Remove the cause of the fault.

LED Operator Display		Fault Name
oPr	oPr	External Digital Operator Connection Fault
		The external operator has been disconnected from the drive. **Note:** An oPr fault will occur when both of the following conditions are true: • Output is interrupted when the operator is disconnected (o2-06 = 1) • The run command is assigned to the operator (b1-02 = 0 and LOCAL has been selected)
Cause		**Possible Solution**
External operator is not properly connected to the drive.		• Check the connection between the operator and the drive • Replace the cable if damaged • Turn off the drive input power and disconnect the operator. Next reconnect the operator and turn the drive input power back on.
LED Operator Display		**Fault Name**
ov	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 flows from the motor into the drive.		• Increase the deceleration time (C1-02, -04). • 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.
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 thyristor convertor and phase advancing capacitor using same drive main 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.
Excessive regeneration when overshoot occurs after acceleration.		• Lengthen the S-curve at acceleration end.
Drive input power voltage is too high.		• Check the voltage. • Lower drive input power voltage within the limits listed in the specifications.
The dynamic braking transistor is damaged.		Replace the drive.
The braking transistor is wired incorrectly.		• Check braking transistor wiring for errors. • Properly rewire the braking resistor device.
Drive fails to operate properly due to noise interference.		• Review the list of possible solutions provided for controlling noise. • Review the section on handling noise interference and check the control circuit lines, main circuit lines and ground wiring.

Motor hunting occurs.	• Adjust the parameters that control hunting. • Set the hunting prevention gain (n1-02).
LED 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 specified in this manual to fasten the terminals. *Refer to Wire Gauges and Tightening Torque on page 50*
There is excessive fluctuation in the drive input power voltage.	• Check the voltage from the drive input power. • Review the possible solutions for stabilizing the drive input power. • Disable Input Phase Loss Detection (L8-05 = “0”). PF is detected if DC bus ripple is too high. If it is disabled, there is no fault but the ripple is still too high, thereby the capacitors are stressed more and lose lifetime.
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 drive if U4-05 is greater than 90%.
	• Check for anything wrong with the drive input power. • If nothing is wrong with the drive input power, try the following solutions if the alarm continues: • Disable Input Phase Loss Protection selection (L8-05 = “0”). PF is detected if DC bus ripple is too high. If it is disabled, there is no fault but the ripple is still too high, thereby the capacitors are stressed more and lose lifetime. • Replace the drive.
LED Operator Display	**Fault Name**
rH	Braking Resistor Overheat
	Braking resistor protection was triggered. Fault detection is enabled when L8-01 = 1 (disabled as a default). **Note:** The magnitude of the braking load trips the braking resistor overheat alarm, NOT the surface temperature. Using the braking resistor more frequently than its rating trips the alarm even when the braking resistor surface is not very hot.
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. • Increase the acceleration and deceleration times (C1-01 through C1-04). • 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. Then try reducing the braking load and checking the braking resistor settings and improve braking capacity.

The proper braking resistor has not been installed.	• Check the specifications and conditions for the braking resistor device. • Select the optimal braking resistor.
LED Operator Display	**Fault Name**
Uv1	DC Bus Undervoltage
	One of the following conditions occurred while the drive was in operation: • Voltage in the DC bus fell below the undervoltage detection level. • For 200 V class: approximately 190 V (160 V for single phase drives) • 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 the DC bus voltage is below the Uv detection level for a certain time while L2-01 = 1.
Cause	**Possible Solution**
Input power phase loss.	• The main circuit drive input power is wired incorrectly. • Correct the wiring.
One of the drive input power wiring terminals is loose.	• Ensure there are no loose terminals. • Apply the tightening torque specified in this manual to fasten the terminals. *Refer to Wire Gauges and Tightening Torque on page 50*
There is a problem with the voltage from the drive input power.	• Check the voltage. • Correct the voltage to within range listed in drive input power specifications.
The power has been interrupted.	Correct the drive input power.
Drive internal circuitry has become worn.	• Check the maintenance time for the capacitors (U4-05). • Replace the drive if U4-05 exceeds 90%.
The drive input power transformer is not large enough and voltage drops after switching on power.	Check the capacity of the drive input power transformer.
Air inside the drive is too hot.	Check the drive internal temperature.
Problem with the CHARGE indicator.	Replace the drive.
LED Operator Display	**Fault Name**
Uv3	Undervoltage 3 (Inrush Prevention Circuit Fault)
	The inrush prevention circuit has failed.
Cause	**Possible Solution**
The contactor on the inrush prevention circuit is damaged.	• Cycle power to the drive. Check if the fault reoccurs. • Replace the drive if the fault continues to occur. • Check monitor U4-06 for the performance life of the inrush prevention circuit. • Replace the drive if U4-06 exceeds 90%.

5.5 Alarm Detection

Alarms are drive protection functions that do not operate the fault contact. The drive will return to original status when the cause of the alarm has been removed.

During an alarm condition, the Digital Operator display flashes and an alarm output is generated at the multi-function output (H2-01), if programmed.

Investigate the cause of the alarm and refer to ***Table 5.8*** for the appropriate action.

◆ Alarm Codes, Causes, and Possible Solutions

Table 5.8 Alarm Codes, Causes, and Possible Solutions

LED Operator Display		Minor Fault Name	
bb	bb	Baseblock	
		Drive output interrupted as indicated by an external baseblock signal.	
Cause		**Possible Solutions**	**Minor Fault (H2-01 = 10)**
External baseblock signal entered via multi-function input terminal (S1 to S5).		Check external sequence and baseblock signal input timing.	No output
LED Operator Display		**Minor Fault Name**	
CALL	CALL	Serial Communication Transmission Error	
		Communication has not yet been established.	
Cause		**Possible Solutions**	**Minor Fault (H2-01 = 10)**
Communications wiring is faulty, there is a short circuit, or something is not connected properly.		• Check for wiring errors. • Correct the wiring. • Remove and ground shorts and reconnect loose wires.	YES
Programming error on the master side.		Check communications at start-up and correct programming errors.	YES
Communications circuitry is damaged.		• Perform a self-diagnostics check. • Replace the drive if the fault continues to occurs.	YES
Terminal resistance setting is incorrect.		The terminal slave drive must have the internal terminal resistance switch set correctly. Place DIP switch S2 to the ON position.	YES
LED Operator Display		**Minor Fault Name**	
CE	CE	MEMOBUS/Modbus Communication Error	
		Control data was not received correctly for two seconds.	
Cause		**Possible Solutions**	**Minor Fault (H2-01 = 10)**

A data error occurred due to noise.	• Check options available to minimize the effects of noise. • Counteract noise in the control circuit wiring, main circuit lines and ground wiring. • Reduce noise on the controller side. • Use surge absorbers on magnetic contactors or other equipment causing the disturbance. • Use cables recommended by Yaskawa or another type of shielded line. The shield should be grounded on the controller side or on the drive input power side. • Separate all wiring for communications devices from drive input power lines. Install a noise filter to the input side of the drive input power.	YES
Communication protocol is incompatible.	• Check the H5 parameter settings as well as the protocol setting in the controller. • Ensure settings are compatible.	YES
The communication cycle is longer than 2 seconds.	• Check the PLC. • Change the software settings in the PLC.	YES
Incompatible PLC software settings or there is a hardware problem.	• Check the PLC. • Remove the cause of the error on the controller side.	YES
Communications cable is disconnected or damaged.	• Check the connector for a signal through the cable. • Replace the communications cable.	YES

LED Operator Display		**Minor Fault Name**
CrST	CrST	Cannot Reset

Cause	**Possible Solutions**	**Minor Fault Output (H2-01 = 10)**
Fault reset was being executed when a run command was entered.	• Ensure that a run command cannot be entered from the external terminals or option unit during fault reset. • Turn off the run command.	YES

LED Operator Display		**Minor Fault Name**
EF	EF	Forward/Reverse Run Command Input Error
		Both forward run and reverse run closed simultaneously for over 0.5 s.

Cause	**Possible Solutions**	**Minor Fault Output (H2-01 = 10)**
Sequence error	Check the forward and reverse command sequence and correct the problem. **Note:** When minor fault EF detected, motor ramps to stop.	YES

LED Operator Display		**Minor 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.

Cause	Possible Solutions	Minor Fault Output (H2-01 = 10)
An external device has tripped an alarm function.	Remove the cause of the external fault and reset the multi-function input value.	YES
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.	YES
Multi-function contact inputs are set incorrectly.	• Check if the unused terminals have been set for H1-□□ = 20 to 2F (External Fault). • Change the terminal settings.	YES

LED Operator Display		Minor Fault Name
oH	oH	Heatsink Overheat
		The temperature of the heatsink exceeded the overheat pre-alarm level.

Cause	Possible Solutions	Minor Fault Output (H2-01 = 10)
Surrounding temperature is too high	• Check the surrounding temperature. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool surrounding area. • Remove anything near drive that may cause extra heat.	YES
Internal cooling fan has stopped.	• Replace the cooling fan. ***Refer to Cooling Fan Replacement on page 179***. • After replacing the drive, reset the cooling fan maintenance parameter to (o4-03 = "0").	YES
Airflow around the drive is restricted.	• Provide proper installation space around the drive as indicated in the manual. ***Refer to Correct Installation Orientation on page 34***. • Allow for the specified space and ensure that there is sufficient circulation around the control panel.	YES
	• Check for dust or foreign materials clogging cooling fan. • Clear debris caught in the fan that restricts air circulation.	YES

LED Operator Display		Minor Fault Name	
oL3	oL3	Overtorque 1	
		Drive output current was greater than L6-02 for longer than the time set in L6-03.	
Cause		**Possible Solutions**	**Minor Fault Output (H2-01 = 10)**
Inappropriate parameter settings.		Check parameters L6-02 and L6-03.	YES
There is a fault on the machine side (e.g., the machine is locked up).		• Check the status of the machine. • Remove the cause of the fault.	YES
LED Operator Display		**Minor Fault Name**	
ov	ov	DC Bus Overvoltage	
		The DC bus voltage exceeded the trip point. For 200 V class: approximately 410 V For 400 V class: approximately 820 V (740 V when E1-01 < 400)	
Cause		**Possible Solutions**	**Minor Fault Output (H2-01 = 10)**
Surge voltage present in the drive input power.		• Install a DC reactor or an AC reactor. • Voltage surge can result from a thyristor convertor and a phase advancing capacitor operating on the same drive input power system.	YES
• The motor is short-circuited. • Ground current has over-charged the main circuit capacitors via the drive input power.		• Check the motor power cable, relay terminals and motor terminal box for short circuits. • Correct grounding shorts and turn the power back on.	YES
Noise interference causes the drive to operate incorrectly.		• Review possible solutions for handling noise interference. • Review section on handling noise interference and check control circuit lines, main circuit lines and ground wiring. • If the magnetic contactor is identified as a source of noise, install a surge protector to the MC coil.	YES
		Set number of fault restarts (L5-01) to a value other than 0.	YES
LED Operator Display		**Minor Fault Name**	
PASS	PASS	MEMOBUS/Modbus Communication Test Mode Complete	
Cause		**Possible Solutions**	**Minor Fault Output (H2-01 = 10)**
MEMOBUS/Modbus test has finished normally.		This verifies that the test was successful.	No output
LED Operator Display		**Minor Fault Name**	
SE	SE	MEMOBUS/Modbus Communication Test Mode Error	

Cause	Possible Solutions	Minor Fault Output (H2-01 = 10)
A digital input programmed to 67H (MEMOBUS/Modbus test) was closed while the drive was running.	Stop the drive and run the test again.	No output
LED Operator Display	**Minor Fault Name**	
Uv	Undervoltage	
	One of the following conditions occurred while the drive was in operation: • DC bus voltage dropped below the under voltage detection level. • Contactor to suppress inrush current in the drive was open. • Low voltage in the control drive input power. This alarm outputs only if L2-01 is not 0 and DC bus voltage is below the detection level.	
Cause	**Possible Solutions**	**Minor Fault Output (H2-01 = 10)**
Phase loss in the drive input power.	Check for wiring errors in the main circuit drive input power. Correct the wiring.	YES
Loose wiring in the drive input power terminals.	• Ensure the terminals have been properly tightened. • Apply the tightening torque specified in this manual to fasten the terminals. *Refer to Wire Gauges and Tightening Torque on page 50*	YES
There is a problem with the drive input power voltage.	• Check the voltage. • Lower the voltage of the drive input power so that it is within the limits listed in the specifications.	YES
Drive internal circuitry is worn.	• Check the maintenance time for the capacitors (U4-05). • Replace the drive if U4-05 exceeds 90%.	YES
The drive input power transformer is not large enough and voltage drops when the power is switched on.	• Check for a tripped alarm when the magnetic contactor, line breaker and leakage breaker are turned on. • Check the capacity of the drive input power transformer.	YES
Air inside the drive is too hot.	• Check the temperature inside the drive.	YES
The CHARGE indicator light is broken or disconnected.	• Replace the drive.	YES

5.6 Operator Programming Errors

An Operator Programming Error (oPE) occurs when an inappropriate parameter is set or an individual parameter setting is inappropriate.

The drive will not operate until the parameter is set correctly; however, no alarm or fault outputs will occur. If an oPE occurs, investigate the cause and *Refer to oPE Codes, Causes, and Possible Solutions on page 152* for the appropriate action.

◆ oPE Codes, Causes, and Possible Solutions

Table 5.9 oPE Codes, Causes, and Possible Solutions

LED Operator Display		Error Name
oPE01	oPE01	Drive Capacity Setting Fault
		Drive capacity and the value set to o2-04 do not match.
Cause		**Possible Solutions**
The drive capacity setting (o2-04) and the actual capacity of the drive are not the same.		Correct the value set to o2-04.
LED Operator Display		**Error Name**
oPE02	oPE02	Parameter Range Setting Error
Cause		**Possible Solutions**
Parameters were set outside the possible setting range.		Set parameters to the proper values.
Note: Other errors are given precedence over oPE02 when multiple errors occur at the same time.		
LED Operator Display		**Error Name**
oPE03	oPE03	Multi-Function Input Selection Error
		A contradictory setting is assigned to multi-function contact inputs H1-01 to H1-05.
Cause		**Possible Solutions**
• The same function is assigned to two multi-function inputs. • Excludes “Not used” and “External Fault.”		• Ensure all multi-function inputs are assigned to different functions. • Re-enter the multi-function settings to ensure this does not occur.
The Up command was set but the Down command was not, or vice versa (settings 10 vs. 11).		Correctly set functions that need to be enabled in combination with other functions.
Run command for a 2-Wire sequence was set, but forward/reverse command for a 2-Wire sequence was not.		Correctly set functions that need to be enabled in combination with other functions.

The following two functions are set at the same time: • Up/Down Command (10 vs. 11) • Hold Accel/Decel Stop (A)	• Check if contradictory settings have been assigned to the multi-function input terminals at the same time. • Correct setting errors.
One of the following settings is set at the multi-function input terminals: • External Search Command 1 and External Search Command 2 (61 vs. 62) • Fast-Stop N.O. and Fast-Stop N.C. (15 vs. 17)	
LED Operator Display	**Error Name**
oPE05	Run Command/Frequency Reference Source Selection Error
Cause	**Possible Solutions**
Frequency reference is assigned to an option unit (b1-01 = 2 or 3) that is not connected to the drive.	Reconnect the option unit to the drive.
The Run command is assigned to serial communication (b1-02 = 2) but no communication option is connected to the drive.	
LED Operator Display	**Error Name**
oPE10	V/f Data Setting Error The following setting errors have occurred where: E1-04 is greater than or equal to E1-06 is greater than or equal to E1-07 is greater than or equal to E1-09.
Cause	**Possible Solutions**
—	Correct the settings for E1-04, -06, -07 and -09.
LED Operator Display	**Error Name**
oPE11	Carrier Frequency Setting Error Correct the setting for the carrier frequency.
Cause	**Possible Solutions**
The following simultaneous contradictory settings: C6-05 is greater than 6 and C6-04 is greater than C6-03 (carrier frequency lower limit is greater than the upper limit). If C6-05 is less than or equal to 6, the drive operates at C6-03.	Correct the parameter settings.
Upper and lower limits between C6-02 and C6-05 contradict each other.	

5.7 Diagnosing and Resetting Faults

When a fault occurs and the drive stops, follow the instructions below to remove whatever conditions triggered the fault, then restart the drive.

◆ Fault Occurs Simultaneously with Power Loss

WARNING! *Electrical Shock Hazard. Ensure there are no short circuits between the main circuit terminals (R/L1, S/L2, and T/L3) or between the ground and main circuit terminals before restarting the drive. Failure to comply may result in serious injury or death and will cause damage to equipment.*

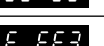
1. Turn on the drive input power.
2. Remove the cause of the fault and reset.

Note:
1. To find out what faults were triggered, Check U2-02 (Fault History) to determine the faults that have been triggered.
2. If the fault continues to be displayed after cycling power, remove the cause of the fault and reset.

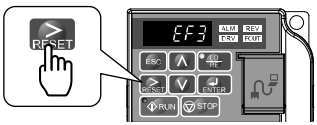
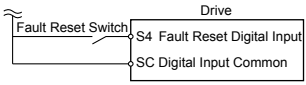
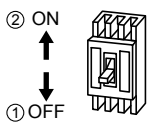
◆ If the Drive Still has Power After a Fault Occurs

1. Look at the LED operator for information on the fault that occurred.
2. ***Refer to Fault Displays, Causes and Possible Solutions on page 137***.
3. Reset the fault. ***Refer to Fault Reset Methods on page 155***.

◆ Viewing Fault History Data After Fault

	Step		Display/Result
1.	Turn on the drive input power. The first screen displays.	→	
2.	Press ∧ until the monitor screen is displayed.	→	
3.	Press ENTER to display the parameter setting screen.	→	
4.	Press ∧ and > until U2-02 (Fault History) is displayed.	→	
5.	Press ENTER to view previous fault (here, EF3).	→	

◆ Fault Reset Methods

After the Fault Occurs	Procedure	
Fix the cause of the fault, restart the drive, and reset the fault	Press RESET on the digital operator.	
Fix the cause of the fault and reset via Fault Reset Digital Input S4.	Close then open the fault signal digital input via terminal S4. S4 is set fault reset as default (H1-04 = 12)	
If the above methods do not reset the fault, turn off the drive main power supply. Reapply power after LED operator display is out.		

5.8 Troubleshooting without Fault Display

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

◆ Cannot Change Parameter Settings

Cause	Possible Solutions
The drive is running the motor (i.e., the Run command is present).	• Stop the drive and switch over to the Programming Mode. • Most parameters cannot be edited during run.
The Access Level is set to restrict access to parameter settings.	• Set the Access Level to allow parameters to be edited (A1-01 = 2).
The operator is not in the Parameter Setup Mode (the LED screen will display "PAr").	• See what mode the LED parameter is current set for. • Parameters cannot be edited when in the Setup Mode ("STUP"). Switch modes so that "PAr" appears on the screen.
The wrong password was entered.	• If the password entered to A1-04 does not match the password saved to A1-05, then drive settings cannot be changed. • Reset the password. If you cannot remember the password: • Display parameter A1-04. Press the STOP button while pressing  at the same time. Parameter A1-05 will appear. • Set a new password to parameter A1-05.
Undervoltage was detected.	• Check the drive input power voltage by looking at the DC bus voltage (U1-07). • Check all main circuit wiring.

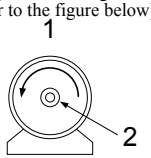
◆ Motor Does Not Rotate Properly after Pressing RUN Button or after Entering External Run Command

■ Motor Does Not Rotate

Cause	Possible Solutions
The drive is not in the Drive Mode.	• Check if the DRV light on the LED operator is lit. • Enter the Drive Mode to begin operating the motor. *Refer to The Drive and Programming Modes on page 85*.
The  button was pushed.	Stop the drive and check if the correct frequency reference source is selected. If the operator keypad shall be the source, the LO/RE button LED must be on, if the source is REMOTE, it must be off. Take the following step to solve the problem: • Push the  button.
A Fast-Stop was executed and has not yet been reset.	Reset the Fast-Stop command.
Settings are incorrect for the source that provides the run command.	Check parameter b1-02 (Run Command Selection). Set b1-02 so that it corresponds with the correct run command source. 0: LED operator 1: Control circuit terminal (default setting) 2: MEMOBUS/Modbus communications
There is faulty wiring in the control circuit terminals.	• Check the wiring for the control terminal. • Correct wiring mistakes. • Check the input terminal status monitor (U1-10).
The drive has been set to accept the frequency reference from the incorrect source.	Check parameter b1-01 (Frequency Reference Selection 1). Set b1-01 to the correct source of the frequency reference. 0: LED operator 1: Control circuit terminal (default setting) 2: MEMOBUS/Modbus communications 3: Potentiometer (option)
The terminal set to accept the main speed reference is set to the incorrect voltage and/or current.	Check DIP switch S1. Next assign the correct input level to terminal A1 (H3-01). *Refer to DIP Switch S1 Analog Input Signal Selection on page 67*.
Selection for the sink/source mode is incorrect.	Check DIP switch S3. *Refer to Sinking/Sourcing Mode Switch on page 64*.
Frequency reference is too low.	• Check the frequency reference monitor (U1-01). • Increase the frequency by changing the maximum output frequency (E1-09).
Multi-function analog input is set up to accept gain for the frequency reference, but no voltage (current) has been provided.	• Check the multi-function analog input settings. • Check if H3-02 has been set to the proper values. • Check if the analog input value has been set properly.

Cause	Possible Solutions
The STOP button was pressed when the drive was started from a REMOTE source.	• When the STOP button is pressed, the drive will decelerate to stop. • Switch off the run command and then re-enter a run command. • The STOP button is disabled when o2-02 is set to 0.
Motor is not producing enough torque.	• Ensure the selected V/f pattern corresponds with the characteristics of the motor being used. • Increase both the minimum and mid output frequency voltages (E1-08, E1-10).
	Increase the frequency reference so that it is higher than the minimum frequency reference (E1-09).
	Increase the torque compensation gain (C4-01).
The drive is set for both 2-Wire and 3-Wire sequence at the same time.	• The drive is set for a 3-Wire sequence when one of the parameters H1-03 through H1-05 is set to 0. • If the drive is supposed to be set up for a 2-Wire sequence, then ensure parameters H1-03 through H1-05 are not set to 0. • If the drive is supposed to be set up for a 3-Wire sequence, then H1-□□ must be set to 0.

■ Motor Rotates in the Opposite Direction from the Run Command

Cause	Possible Solutions
Phase wiring between the drive and motor is incorrect.	• Check the motor wiring. • Switch two motor cables (U, V, and W) to reverse motor direction. • Connect drive output terminals U/T1, V/T2 and W/T3 in the right order to the corresponding motor terminals U, V, and W. • Change the setting of parameter b1-14.
The forward direction for the motor is setup incorrectly.	Typically, forward is designated as being counterclockwise when looking from the motor shaft (refer to the figure below).  **1. Forward Rotating Motor (looking down the motor shaft)** **2. Motor Shaft**

Note: Check the motor specifications for the forward and reverse directions. The motor specifications will vary depending on the manufacturer of the motor.

■ Motor is Too Hot

Cause	Possible Solutions
The load is too heavy.	If the load is too heavy for the motor, the motor will overheat as it exceeds its rated torque value for an extended period of time. Keep in mind that the motor also has a short-term overload rating in addition to the possible solutions provided below: • Reduce the load. • Increase the acceleration and deceleration times. • Check the values set for the motor protection (L1-01, L1-02) as well as the motor rated current (E2-01). • Increase motor capacity.
The air around the motor is too hot.	• Check the ambient temperature. • Cool the area until it is within the specified temperature range.
Insufficient voltage insulation between motor phases.	When the motor is connected to terminals U/T1, V/T2, and W/T3, voltage surges occur between the motor coils and drive switching. Normally, surges can reach up to three times the drive input power supply voltage (600 V for 200 V class, and 1200 V for 400 V class). • Use a motor with voltage tolerance higher than the max voltage surge. • Use a motor designed to work specifically with a drive when using a 400 V class unit. • Install an AC reactor on the output side of the drive.
The motor fan has stopped or is clogged.	Check the motor fan.

■ oPE02 Error Occurs when Lowering the Motor Rated Current Setting

Cause	Possible Solutions
The motor rated current and the motor no-load current settings in the drive are incorrect.	The user is trying to set the motor rated current in E2-01 to a value lower than the no-load current set in E2-03. • Make sure that value set in E2-01 is higher than E2-03. Setting E2-01 < E2-03 will trigger an oPE02 error. • If it is necessary to set E2-01 lower than E2-03, first lower the value set to E2-03, then change the setting in E2-01 as needed.

■ Motor Stalls During Acceleration or With Large Loads

Cause	Possible Solutions
Load is too heavy.	Take the following steps to resolve the problem: • Reduce the load. • Increase the acceleration time. • Increase motor capacity. • Although the drive has a Stall Prevention function and a Torque Compensation Limit function, accelerating too quickly or trying to drive an excessively large load can exceed the capabilities of the motor.

■ Motor Will Not Accelerate or the Acceleration Time is Too Long

Cause	Possible Solutions
Frequency reference is too low.	• Check the maximum output frequency (E1-04). • Increase E1-04 if it is set too low.
	Check U1-01 for proper frequency reference.
	Check if a frequency reference signal switch has been set to one of the multi-function input terminals.
	Check for low gain level set to terminal A1 (H3-03).
Load is too heavy.	• Reduce the load so that the output current remains within the motor-rated current. • In extruder and mixer applications, the load will sometimes increase as the temperature drops.
	Check if the mechanical brake is fully releasing as it should.
Acceleration time has been set too long.	Check if the acceleration time parameters have been set too long (C1-01, -03).
Motor characteristics and drive parameter settings are incompatible with one another in V/f Control.	• Set the correct V/f pattern so that it matches the characteristics of the motor being used. • Check the motor data and adjust V/f pattern settings.
Incorrect frequency reference setting.	• Check the multi-function analog input settings. • Ensure the analog input value is set to the right value (U1-13).
The Stall Prevention level during acceleration and deceleration set too low.	• Check the Stall Prevention level during acceleration (L3-02). • If L3-02 is set too low, acceleration will take a fair amount of time. • Increase L3-02.
The Stall Prevention level during run has been set too low.	• Check the Stall Prevention level during run (L3-06). • If L3-06 is set too low, speed will drop as the drive outputs torque. • Increase the setting value.

■ Drive Frequency Reference Differs from the Controller Frequency Reference Command

Cause	Possible Solutions
The analog input frequency gain and bias are set to incorrect values.	Check the frequency reference terminal input gain level assigned to terminal A1 (parameter H3-03).

■ Poor Speed Control Accuracy

Cause	Possible Solutions
Slip compensation function disabled or set up incorrectly.	Adjust the slip compensation gain (C3-01).

■ Deceleration Takes Longer Than Expected when Using a Braking Resistor

Cause	Possible Solutions
L3-04 is set incorrectly.	• Check the Stall Prevention Level during deceleration (L3-04). • If a braking resistor option has been installed, disable Stall Prevention during deceleration (L3-04 = "0").
The deceleration time is set too long.	Set deceleration to more appropriate time (C1-02 and C1-04).
Insufficient motor torque.	• Assuming parameter settings are normal and that no overvoltage occurs when there is insufficient torque, it is likely that the demand on the motor has exceeded the motor capacity. • Use a larger motor.
Load exceeded the internal torque limit determined by the drive rated current.	Switch to a larger capacity drive.

■ Motor Hunting Occurs When Operating With a Light Load

Cause	Possible Solutions
Carrier frequency is too high.	Lower the carrier frequency setting C6-02.
Large V/f setting value at low speeds triggers overexcitation.	• Use parameters E1-04 through E1-10 to set the V/f pattern in relation to the load characteristics.
The maximum output frequency and the base frequency reference are not set properly in relationship to each other.	Set the proper values for the maximum output frequency and base frequency (E1-04, E1-06).
Hunting Prevention is set up incorrectly.	Adjust the hunting prevention gain (n1-02).

■ Noise From Drive or Output Lines When the Drive is Powered On

Cause	Possible Solutions
Relay switching in the drive generates excessive noise.	• Lower the carrier frequency (C6-02). • Install a noise filter on the input side of drive input power. • Install a noise filter on the output side of the drive. • Place the wiring inside a metal conduit to shield it from switching noise. • Ground the drive and motor properly. • Separate the main circuit wiring and the control lines.

■ Ground Fault Circuit Interrupter (GFCI) Trips During Run

Cause	Possible Solutions
Excessive leakage current trips MCCB.	• Increase the GFCI sensitivity or use GFCI with a higher threshold. • Lower the carrier frequency (C6-02). • Reduce the length of the cable used between the drive and the motor. • Install a noise filter or reactor on the output side of the drive.

■ Connected Machinery Vibrates When Motor Rotates

Excessive Motor Oscillation and Erratic Rotation

Cause	Possible Solutions
Poor balance between motor phases.	Check drive input power voltage to ensure that it provides stable power.

Unexpected Noise from Connected Machinery

Cause	Possible Solutions
The carrier frequency is at the resonant frequency of the connected machinery.	Adjust the carrier frequency using parameters C6-02 through C6-05.
The drive output frequency is the same as the resonant frequency of the connected machinery.	• Adjust the parameters used for the Jump Frequency function (d3-01 through d3-04) to skip the problem-causing bandwidth. • Place the motor on a rubber pad to reduce vibration.

Note: The drive may have trouble assessing the status of the load due to white noise generated when using Swing PWM (C6-02 = 7).

■ Oscillation or Hunting

Cause	Possible Solutions
Insufficient tuning.	Adjust Hunting prevention Gain Setting (n1-02).
The frequency reference is assigned to an external source and the signal is noisy.	• Ensure that noise is not affecting the signal lines. • Separate main circuit wiring and control circuit wiring. • Use twisted-pair cables or shielded wiring for the control circuit. • Increase the analog input time filter constant (H3-13).
The cable between the drive and motor is too long.	• Reduce the length of the cable.

■ Motor Rotates After the Drive Output is Shut Off

Cause	Possible Solutions
Low DC Injection Braking and the drive cannot decelerate properly.	• Adjust the DC Injection braking settings. • Increase the value of b2-02 (DC Injection Braking Current). • Increase the b2-04 (DC Injection Braking Time at Stop).

■ ov or Speed Loss Occurs When Starting into a Rotating Load

Cause	Possible Solutions
The load is already rotating when the drive is trying to start it.	• Stop the motor using DC Injection braking. Restart the motor. • Increase the value of b2-03 (DC Injection Braking Time at start). • Set a multi-function input terminal for external Speed Search command (H1-□□=“61” or “62” during restart).

■ Output Frequency is not as High as Frequency Reference

Cause	Possible Solutions
Frequency reference is set within the range of the Jump Frequency.	• Adjust the parameters used for the Jump Frequency function (d3-01, d3-02). • Enabling the Jump Frequency prevents the drive from outputting the frequencies specified in the Jump Frequency range.
Upper limit for the frequency reference has been exceeded.	• Set the maximum output frequency and the upper limit for the frequency reference to more appropriate values (E1-04, d2-01). • The following calculation yields the upper value for the output frequency = E1-04 x d2-01 / 100
Large load triggered Stall Prevention function during acceleration.	• Reduce the load. • Adjust the Stall Prevention level during acceleration (L3-02).

■ Buzzing Sound from Motor at 2 kHz

Cause	Possible Solutions
Exceeded 110% of the rated output current of the drive while operating at low speeds.	• If the output current rises too high at low speeds, the carrier frequency automatically reduces and causes a whining or buzzing sound. • If the sound is coming from the motor, disable carrier frequency derating (L8-38 = “0”). • Disabling the automatic carrier frequency derating increases the chances of an overload fault (oL2). Switch to a larger capacity motor if oL2 faults occur too frequently.

■ Motor Does Not Operate When the RUN Button on the Digital Operator is Pressed

Cause	Possible Solutions
The LOCAL/REMOTE mode is not selected properly.	Press the LOCAL/REMOTE button to switch. The LO/RE LED should be on for LOCAL mode.
The drive is not in drive mode.	A run command will not be issued. Exit to the drive mode and cycle the run command.
The frequency reference is too low.	• If the frequency reference is set below the frequency set in E1-09 (Minimum Output Frequency), the drive will not operate. • Raise the frequency reference to at least the minimum output frequency.

■ Motor Does Not Operate When an External Run Command is Input

Cause	Possible Solutions
The LOCAL/REMOTE mode is not selected properly.	Press the LOCAL/REMOTE button to switch. The LO/RE LED should be off for REMOTE mode.
The drive is not in Drive Mode.	A run command will not be issued. Exit to the Drive mode and cycle the run command.

Cause	Possible Solutions
The frequency reference is too low.	• If the frequency reference is set below the frequency set in E1-09 (Minimum Output Frequency), the drive will not operate. • Raise the frequency reference to at least the minimum output frequency.

■ Motor Stops During Acceleration or When a Load is Connected

Cause	Possible Solution
• The load is too heavy. • The limit of motor response may be reached during rapid acceleration. This may be a result of improper stall prevention or automatic torque boost function adjustment.	Increase the acceleration time (C1-01) or reduce the motor load. Also, consider increasing the motor size and/or drive size.

■ Motor Rotates in One Direction Only

Cause	Possible Solutions
"Reverse run prohibited" is selected. If b1-04 (Reverse Prohibit Operation) is set to 1 (reverse run prohibited), the drive will not accept a reverse run command.	Set b1-04 = “0” to allow reverse run operation.
The drive prohibits reverse rotation.	• Check parameter b1-04. • Set the drive to allow the motor to rotate in reverse (b1-04 = “0”).
A Reverse run signal has not been entered, although 3-Wire sequence is selected.	• Make sure that one of the input terminals S3 to S5 used for the 3-Wire sequence has been set for reverse.

■ Peripheral Devices Affected by Drive Operation

Cause	Possible Solutions
Radio frequency interference may be generated by drive output PWM waveform.	• Change the Carrier Frequency Selection (C6-02) to lower the carrier frequency. This will help to reduce the amount of transistor switching noise. • Install an Input Noise Filter at the input power terminals. • Install an Output Noise Filter at the motor terminals. • Use conduit. Metal can shield electrical noise. • Ground the drive and motor. • Separate main circuit wiring from control wiring.

■ Ground Fault Interrupter Activates When Drive is Running

Cause	Possible Solutions
The output of the drive is a series of high frequency pulses (PWM), so there is a certain amount of leakage current. This may cause the ground fault interrupter to operate and cut off the drive input power.	• Change to a ground fault interrupter with a higher leakage current detection level (such as, a sensitivity current of 200 mA or greater per Unit, with an operating time of 0.1 s or more), or one that incorporates high-frequency corrective actions. • Change the Carrier Frequency Selection (C6-02) to lower the carrier frequency. **Note:** Leakage current increases in proportion to cable length.

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6

Periodic Inspection & Maintenance

This chapter describes the periodic inspection and maintenance of the drive to ensure that it receives the proper care to maintain overall performance.

6.1 SECTION SAFETY.....168
6.2 INSPECTION.....171
6.3 PERIODIC MAINTENANCE.....175
6.4 DRIVE COOLING FANS.....178

6.1 Section Safety

DANGER

Electrical Shock Hazard

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

Failure to comply will result in death or serious injury.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

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

Always ground the motor-side grounding terminal.

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

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

Failure to comply could result in death or serious injury.

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

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

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

Failure to comply could result in death or serious injury.

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

⚠ WARNING

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are off and measure the DC bus voltage level to confirm safe level.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

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

Do not use an improper voltage source.

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

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

Do not use improper combustible materials.

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

Attach the drive to metal or other noncombustible material.

NOTICE

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

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

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

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

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

Do not allow unqualified personnel to use the product.

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

Carefully review instruction manual TOBPC72060000 when connecting a braking option to the drive.

Do not modify the drive circuitry.

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

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

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

Failure to comply could result in damage to the drive.

6.2 Inspection

Power electronics have limited life and may exhibit changed characteristics or performance deterioration after years of use under normal conditions. To help avoid such problems, it is important to perform preventive maintenance and periodic inspection on the drive.

Drives contain a variety of power electronics such as power transistors, semiconductors, capacitors, resistors, fans, and relays. The electronics in the drive serve a critical role in maintaining proper motor control.

Follow the inspection lists provided in this chapter as a part of a regular maintenance program.

Note: The drive will require more frequent inspection if it is placed in harsh environments, such as:

- High ambient temperatures
- Frequent starting and stopping
- Fluctuations in the AC supply or load
- Excessive vibrations or shock loading
- Dust, metal dust, salt, sulfuric acid, chlorine atmospheres
- Poor storage conditions.

Perform the first equipment inspection 3 months after installation.

◆ Recommended Daily Inspection

Table 6.1 outlines the recommended daily inspection for Yaskawa drives. Check the following items on a daily basis to avoid premature deterioration in performance or product failure. Copy this checklist and mark the "Checked" column after each inspection.

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. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are OFF and measure the DC bus voltage level to confirm safe level.*

Table 6.1 General Recommended Daily Inspection Checklist

Inspection Category	Inspection Points	Corrective Action	Checked
Motor	• Inspect for abnormal oscillation or noise coming from the motor.	• Check the load coupling. • Measure motor vibration. • Tighten all loose components.	
Cooling	• Inspect for abnormal heat generated from the drive or motor and visible discoloration.	• Check for excessive load. • Loose connections • Check for dirty heatsink or motor. • Ambient temperature	

6.2 Inspection

Inspection Category	Inspection Points	Corrective Action	Checked
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 the Installation section of this manual.	• 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 6.2 outlines the recommended periodic inspections for Yaskawa drive installations. Periodic inspections should generally be checked every 3-6 months; however, the drive may require more frequent inspection due to poor environments or 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 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. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are OFF and measure the DC bus voltage level to confirm safe level.*

Table 6.2 Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Main Circuit Periodic Inspection			
General	• Inspect equipment for discoloration from overheating or deterioration. • Inspect for damaged or deformed parts.	• Replace damaged components as required. • The drive has few serviceable parts and may require complete drive replacement.	
	• Inspect for dirt, foreign particles, or dust collection on components.	• Inspect enclosure door seal if present. Replace components if cleaning is not possible. • Use dry air to clear away foreign matter. Use a pressure of: 39.2 x 10^4 to 58.8 x 10^4 Pa (4 - 6 kg •cm^2).	
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.	

Inspection Area	Inspection Points	Corrective Action	Checked
Control Circuit Periodic Inspection			
General	• Inspect terminals for stripped, damaged or loose connections. • Check for tightness.	• 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.	
LED Periodic Inspection			
LEDs	• Make sure the LED lights correctly. • 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 LED or keypad. • Clean the LED.	
Cooling System Periodic Inspection			
Cooling Fan	• Check for abnormal oscillation or unusual noise. • Check for damaged or missing fan blades.	• Replace as required. • ***Refer to Drive Cooling Fans on page 178*** for information on cleaning or replacing the cooling fan.	
Heatsink	• Inspect for dust or other foreign material collected on the surface.	• Use dry air to clear away foreign matter. • Use a pressure of 39.2 x 10^4 to 58.8 x 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.	
Motor Periodic Inspection			
Operation Check	• Check for increased vibration or abnormal noise.	• Stop the motor and contact qualified maintenance personnel as required.	

Note: Periodic inspections should be performed every one or two years. The drive, however, may require more frequent inspection due to poor environments or rigorous use.

6.3 Periodic Maintenance

The drive has various "maintenance monitors." 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 the following maintenance periods.

- Cooling Fan
- Electrolytic Capacitors (Main Circuit)
- Inrush Prevention Circuit
- IGBT

◆ Replacement Parts

Table 6.3 contains the estimated performance life of components that require replacement during the life of the drive. Only use Yaskawa replacement parts for the appropriate drive model and revision.

Table 6.3 Estimated Performance Life

Component	Estimated Performance Life
Cooling Fan	2 ~ 3 years
Electrolytic Capacitors (Main Circuit)	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 30 °C
• Load factor: 80% maximum
• Operation time: 12 hours a day

■ Performance Life 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 LED 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 173 for more details.

Table 6.4 Performance Life Monitors Used for Component Replacement

Parameter	Component	Contents
U4-04	Cooling Fan	Displays the accumulated cooling fan operation time as a percentage of the specified maintenance period (displayed in percent %).
U4-05	Main Circuit (DC bus) Electrolytic Capacitors	Displays the accumulated time the capacitors are used as a percentage of the specified maintenance period.
U4-06	Inrush (pre-charge) relay	Displays the number of times the drive is powered up as a percentage of the performance life of the inrush circuit.
U4-07	IGBT	Displays the percentage of the maintenance period reached by the IGBTs.

■ Alarm Outputs for Maintenance Monitors

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

When one of multi-function digital output terminals has been assigned the maintenance monitor function (H2-☐☐ = 2F), the terminal will close when the cooling fan, DC bus capacitors, or DC bus pre-charge relay reach 90% of the expected performance life, or when the IGBTs have reached 50% of their expected performance life. Additionally the digital operator will display an alarm like shown in *Table 6.5* to indicate the specific components that may need maintenance.

Table 6.5 Maintenance Alarms

Digital Operator Alarm Display		Function	Corrective Action
LT-1 <1>	LT-1	The cooling fans have reached 90% of their designated life time.	Replace the cooling fan.
LT-2 <1>	LT-2	The DC bus capacitors have reached 90% of their designated life time.	Contact a Yaskawa representative or the nearest Yaskawa sales office on possible drive replacement.
LT-3 <1>	LT-3	The DC bus charge circuit has reached 90% of its designated life time.	Contact a Yaskawa representative or the nearest Yaskawa sales office on possible drive replacement.
LT-4 <1>	LT-4	The IGBTs have reached 50% of their designated life time.	Check the load, carrier frequency, and output frequency.
trPC <2>	TrPC	The IGBTs have reached 90% of their designated life time.	Contact a Yaskawa representative or the nearest Yaskawa sales office on possible drive replacement.

<1> This alarm message will be output only if the Maintenance Monitor function is assigned to one of the digital outputs (H2-☐☐ = 2F). The alarm will also trigger a digital output that is programmed for alarm indication (H2-☐☐ = 10).

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

■ Related Drive Parameters

Use parameters o4-03, o4-05, o4-07, and o4-09 to reset a Maintenance Monitor to zero after replacing a specific component. *Refer to Parameter List on page 221* for details on parameter settings.

NOTICE: *If these parameters are not reset after the corresponding parts have been replaced, the Maintenance Monitor function will continue to count down the performance life from the value that was reached with the old part. If the Maintenance Monitor is not reset, the drive will not have the correct value of the performance life for the new component.*

6.4 Drive Cooling Fans

NOTICE: *Follow cooling fan replacement instructions. The cooling fan cannot operate properly when installed incorrectly and could seriously damage the drive. To ensure maximum useful product life, replace all cooling fans when performing maintenance.*

Contact your Yaskawa representative or supplier to order replacement cooling fans as required.

◆ Number of Cooling Fans

Model CIMR-J□	Cooling Fans
Single-Phase 200 V Class	
BA0001	–
BA0002	–
BA0003	–
BA0006	–
BA0010	1
Three-Phase 200 V Class	
2A0001	–
2A0002	–
2A0004	–
2A0006	1
2A0008	1
2A0010	1
2A0012	1
2A0018	1
2A0020	1
Three-Phase 400 V Class	
4A0001	–
4A0002	–
4A0004	–
4A0005	1
4A0007	1
4A0009	1
4A0011	1

◆ Cooling Fan Replacement

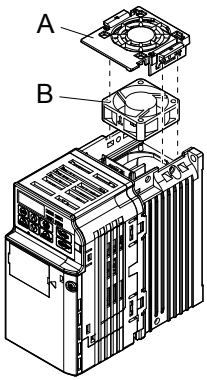
The cooling fan is installed on the top of the drive. The cooling fan can easily be replaced without tools or removal of the drive or enclosure parts.

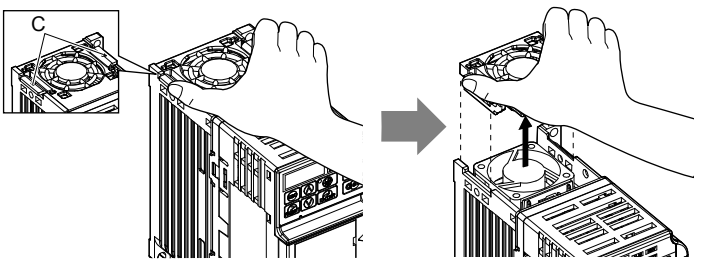
WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The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

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

■ Removing the Cooling Fan

1. Depress the right and left sides of the fan cover tabs and pull upward. Remove the fan cover from the top of the drive. The following figure illustrates a drive with a single cooling fan.





A – Fan cover
B – Cooling fan
C – Tab

Figure 6.1 Remove the Cooling Fan Cover

2. Remove the fan cable carefully, disconnect the pluggable connector and remove the fan.

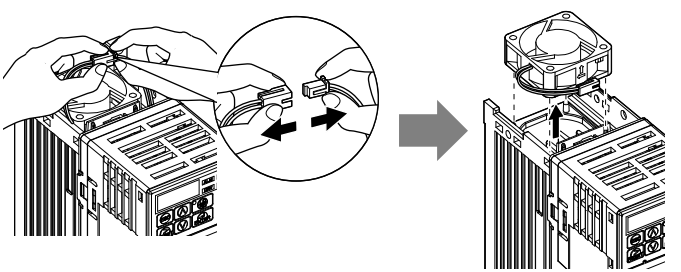
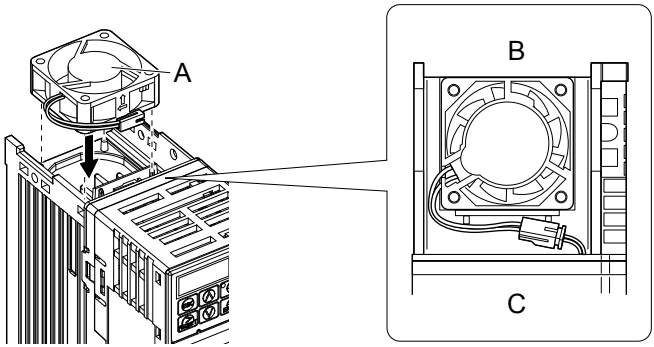


Figure 6.2 Disconnect and Remove the Fan

■ Installing the Cooling Fan

NOTICE: *Prevent Equipment Damage. Follow cooling fan replacement instructions. Improper cooling fan replacement could result in damage to equipment. When installing the replacement cooling fan into the drive, make sure the fan is facing upwards. To ensure maximum useful product life, replace all cooling fans when performing maintenance.*

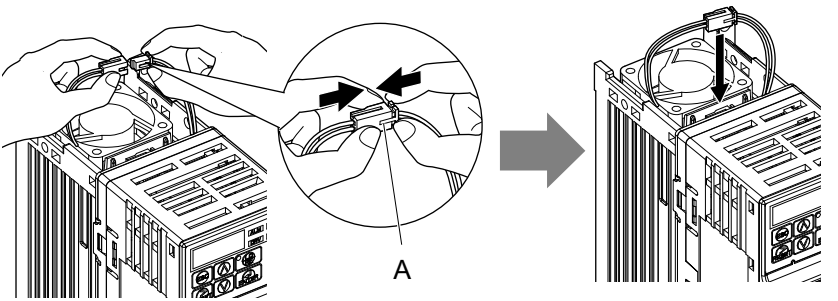
1. Install the replacement cooling fan into the drive, ensuring the alignment pins line up, as shown in the figure below:



A – Label facing up
B – Back
C – Front

Figure 6.3 Cooling Fan Orientation

2. Ensure the connectors are properly connected and place the cable back into the recess of the drive.



A – Push the connectors together so no space remains between them.

Figure 6.4 Connectors

Note: Ensure that the left and right tabs are locked back into place.

3. Align the left and right cover tabs to install the fan cover back on the top of the drive.

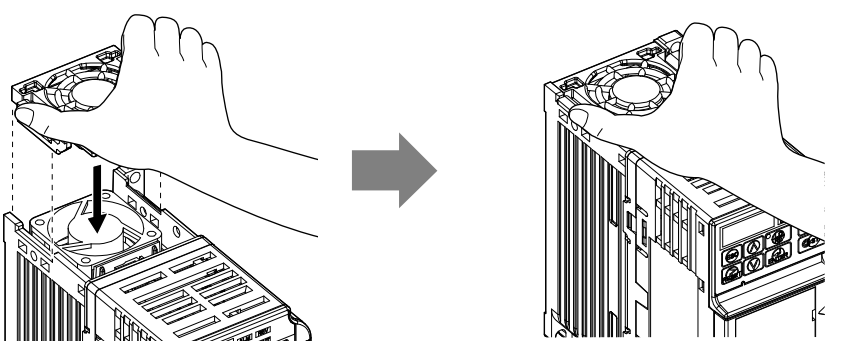


Figure 6.5 Installation

7

Peripheral Devices & Options

This chapter explains the installation of available peripheral devices and options for the drive.

7.1 SECTION SAFETY.....184
7.2 DRIVE OPTIONS AND PERIPHERAL DEVICES.....186
7.3 CONNECTING PERIPHERAL DEVICES.....189
7.4 INSTALLING PERIPHERAL DEVICES.....191
7.5 OPTIONS.....207

7.1 Section Safety

DANGER

Electrical Shock Hazard

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

Failure to comply will result in death or serious injury.

Disconnect all power to the drive, wait at least one minute after all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing to prevent electric shock. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

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

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

Failure to comply could result in death or serious injury.

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are off and measure the DC bus voltage level to confirm safe level.

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

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

⚠ WARNING

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

Failure to comply could result in death or serious injury.

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

Always ground the motor-side grounding terminal.

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

Do not change wiring or remove option unit while power is running through the drive.

Failure to comply could result in death or serious injury.

Disconnect all power to the drive and check for unsafe voltages before servicing.

Tighten all terminal screws to the specified tightening torque.

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

NOTICE

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

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

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

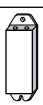
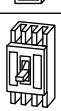
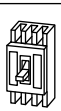
Improper equipment sequencing could result in damage to the drive.

7.2 Drive Options and Peripheral Devices

The following table of peripheral devices lists the names of the various devices/options available for Yaskawa drives. Contact Yaskawa or your Yaskawa agent to order these peripheral devices.

- **Peripheral Device Selection**: Refer to Yaskawa catalog for selection and part numbers.
- **Peripheral Device Installation**: Refer to option manual for option installation instructions.

Table 7.1 Available Peripheral Devices

Option		Model Number	Description
Power Options			
	DC Reactor	UZDA Series	DC reactor to improve power factor
	AC Reactor	UZBA Series	AC reactor to improve power factor
	Braking Resistor <1>	ERF-150WJ Series	3% ED, 150 W braking resistor
	Braking Resistor Unit	LKEB Series	Braking resistor
	Molded Case Circuit Breaker	NF Series	Circuit breaker for short circuit or overload protection **Note:** Yaskawa recommends installing an MCCB to the power supply side to protect drive wiring and to prevent other damage in the event of component failure. Install an MCCB if permitted by the power system.
	Earth Leakage Circuit Breaker (ELCB)	NV, EG, or SG Series	Provides protection against potentially harmful leakage currents **Note:** Yaskawa recommends installing an ELCB to the power supply side to protect drive wiring and to prevent other damage in the event of component failure. An MCCB can also be used if permitted by the power system.
	Magnetic Contactor (Input)	SC Series	Prevents potential damage to the braking resistor and other internal circuitry by ensuring that power to drive is completely shut off when necessary. Install an MCCB when using a braking resistor to prevent the braking resistor from overheating. Wire the MC so that it opens when a fault output terminal is triggered to protect internal components from sudden high levels of input current.

Option		Model Number	Description
	Surge Absorber	200 V class: DCR2-□A 400 V class: RFN3AL-504KD	Suppresses surge voltage caused by switching magnetic contactors
	Zero Phase Reactor	F6045GB	Reduces electromagnetic noise
	Input Noise Filter	LNFB, LNFD Series	Reduces electromagnetic noise flowing back from the drive into power supply
	Output Noise Filter	LF-310 Series	Reduces electromagnetic noise generated by the drive output
—	Isolator	DGP□□□	Isolates the drive control I/Os for improved noise resistance
Reference Setting / Monitor Options			
—	Frequency Meter / Ammeter	DCF-6A	External meter for displaying the output frequency or current using an analog signal from the drive
—	Frequency Meter Scaling Resistor (20 kΩ)	RV30YN20S20kΩ	External potentiometer for adjusting the frequency meter scaling
—	Voltmeter	SCF-12NH	External meter for displaying the output voltage using an analog signal from the drive
—	Frequency Reference Setting Potentiometer (2 kΩ)	RV30YN20S2kΩ	External potentiometer for setting the frequency reference by an analog input
—	Frequency Reference Potentiometer Knob	CM-3S	Knob for frequency reference potentiometer
—	Meter Plate	NPJT41561-1	Plate with scale for frequency reference setting potentiometer
Interface Options			
—	Remote LED Operator	JVOP-182	Remote operator with LED display and copy function; Cable length max. 3 m
—	USB/Copy Unit	JVOP-181	Allows the user to copy and verify parameter settings between drives. Can also be used as adapter to connect the drive to a PC USB port **Note:** SI-232/JC option is required
—	RS-232C Serial Communication Interface	SI-232/JC	RS-232/C communications interface to either connect the drive to a PC, to the optional copy unit, or to the external LED operator JVOP-182.
—	Remote Operator Interface	SI-232/J	RS-232/C communications interface for use with either the external LED operator JVOP-182, the optional copy unit, or for connecting to a PC.

7.2 Drive Options and Peripheral Devices

Option		Model Number	Description
—	Potentiometer Option	AI-V3/J	Potentiometer option for setting the frequency reference directly at the drive
—	PC Serial Cable	WV103	Cable to connect the drive to a serial port of a PC (3m)
—	External Operator Cable	WV001 / WV003	Extension cable (1 m or 3 m) to connect an external operator to the drive
Mechanical Options			
—	Heatsink External Mounting Attachment	EZZ020568□	Installation kit for mounting the drive with the heatsink outside of the panel (side-by-side mounting possible)
—	DIN Rail Attachment	EZZ08122□	Installation kit for mounting the drive on a DIN rail
—	NEMA Type 1 Kit	EZZ020564□	Parts to make the drive conform to NEMA Type 1 enclosure
Others			
—	Drive Wizard Plus	—	PC tool for drive setup and parameter management The installation files can be obtained at no charge from: Japan: http://www.e-mechatronics.com Other areas: Contact a Yaskawa representative.
Communication Options			
—	RS-422/RS-485 Serial Communications Interface	SI-485/J	Interface for RS-422/RS-485 communications using the MEMOBUS/Modbus RTU protocol

<1> Contact Yaskawa or your nearest Yaskawa representative for more information.

7.3 Connecting Peripheral Devices

Figure 7.1 illustrates connections between the drive, motor, and various peripheral devices. Refer to peripheral device option manual for detailed installation instructions.

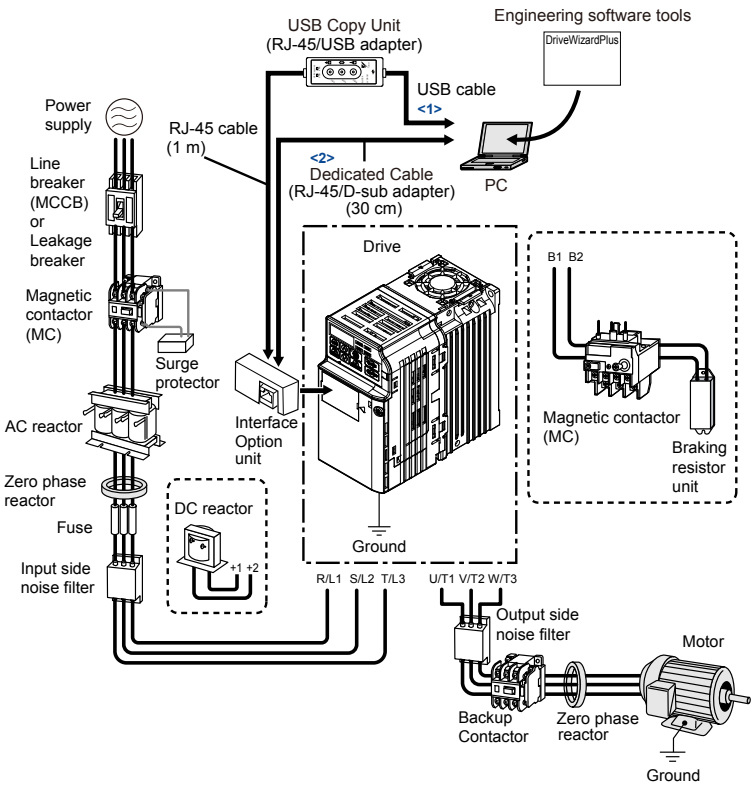


Figure 7.1 Connecting Peripheral Devices

<1> **NOTICE:** *Do not connect the LAN port on a PC and the comm. port of the RS-232C Interface Option Unit (SI-232/J and SI-232/JC). Failure to comply may damage the option unit and the PC. Use the USB Copy Unit with an RJ-45 cable and USB cable as shown in* ***Figure 7.1*** *to connect the drive to a PC.*

<2> The Interface Option Unit can be directly connected to a PC with a D-sub 9-pin connector. Use a cable designed for PC use (Yaskawa part number WV103).

Note: If the drive is set to trigger an output terminal when performing a fault restart (L5-02 = 1), the power supply will be shut off during fault restart as the drive outputs a fault signal. Keep this in mind when designing a wiring sequence to interrupt the power to the drive. The default setting for the drive is to not trigger an output terminal that indicates a fault restart is being performed (L5-02 = 0).

7.4 Installing Peripheral Devices

This section describes the proper steps and precautions to take when installing or connecting various peripheral devices to the drive.

Refer to peripheral device manual for detailed installation instructions.

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.*

◆ Installing a Molded Case Circuit Breaker (MCCB) and Earth Leakage Circuit Breaker (ELCB)

Install an MCCB or ELCB for line protection between the power supply and the main circuit power supply input terminals R/L1, S/L2 and T/L3. This protects the main circuit and devices wired to the main circuit while also providing overload protection.

Consider the following when selecting and installing an MCCB or ELCB:

- The rated current of the MCCB or ELCB should be 1.5 to 2 times the rated output current of the drive. Use an MCCB or ELCB with operation characteristics that do not trip the MCCB or ELCB faster than the drive overload protection (shuts off the drive after 1 minute of operation at 150% of the drive rated current).
- If several drives are connected to one MCCB or an ELCB that is shared with other equipment, use a sequence that shuts the power OFF when errors are output by using magnetic contactor (MC) as shown in the following figure.

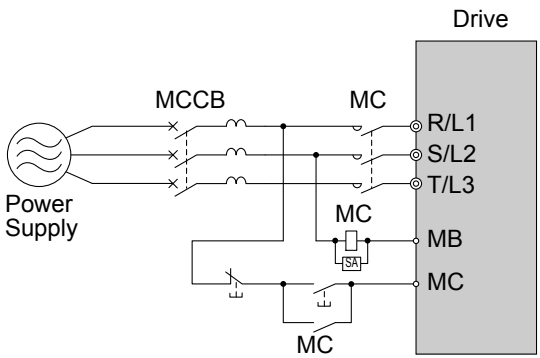


Figure 7.2 Connecting an MCCB

WARNING! *Electrical Shock Hazard. Disconnect the MCCB (or ELCB) and MC before wiring terminals. Failure to comply may result in serious injury or death.*

◆ Installing a Leakage Breaker

Drive outputs generate high-frequency leakage current as a result of high-speed switching. Install an Earth Leakage Circuit Breaker (ELCB) on the input side of the drive to switch off potentially harmful leakage current. Because each drive generates about 100 mA of leakage current across a 1 m cable and another 5 mA for each additional meter, each drive should have a leakage breaker with a sensitivity amperage of at least 30 mA per drive to eliminate harmonic leakage current and suppress any potentially harmful frequencies.

Refer to the Yaskawa catalog for ELCB selection. Leakage current can cause unprotected components to operate incorrectly. If this is a problem, lower the carrier frequency, replace the components in question with parts protected against harmonic current, or increase the sensitivity amperage of the leakage breaker to at least 200 mA per drive.

Factors in determining leakage current:

- Size of the AC drive
- AC drive carrier frequency
- Motor cable type and length
- EMI/RFI filter

To safely protect the drive system, select a breaker that senses AC and DC currents and high frequency currents.

◆ Installing a Magnetic Contactor

■ Disconnecting the Power Supply

The drive should be shut off in the case of a fault in external equipment such as braking resistors through use of a Magnetic Contactor (MC).

NOTICE: *Do not connect electromagnetic switches or MCs to the output motor circuits without proper sequencing. Improper sequencing of output motor circuits may cause damage to the drive.*

NOTICE: *Install an MC on the input side of the drive when the drive should not automatically restart after power loss. To get the full performance life out of the electrolytic capacitors and circuit relays, refrain from switching the MC more than once every 30 minutes. Frequent use can damage the drive. Use the drive to stop and start the motor.*

Note:

1. Install an MC to the drive output to prevent the drive from restarting automatically when the power is restored after momentary power loss.
2. Set up a delay for the MC so that it does not open prematurely for the drive to continue operating through momentary power loss.

■ Protecting the Braking Resistor or Braking Resistor Unit

Use an MC on the input side of the drive to protect a braking resistor or braking resistor unit from overheat or fire.

WARNING! *Fire Hazard. When using a braking unit, use a thermal relay on the braking resistors and configure a fault contact output for the braking resistor unit to disconnect drive main power via an input contactor. Inadequate braking circuit protection could result in death or serious injury by fire from overheating resistors.*

◆ Connecting an AC or DC Reactor

AC and DC reactors suppress surges in current and improve the power factor on the input side of the drive.

Use a DC reactor or AC reactor or both:

- To suppress harmonic current or improve the power factor of the power supply.
- When using a phase advancing capacitor switch.
- With a large capacity power supply transformer (over 600 kVA).

Note: Use an AC or DC reactor when also connecting a thyristor converter (such as a DC drive) to the same power supply system, regardless of the conditions of the power supply.

■ Connecting an AC Reactor

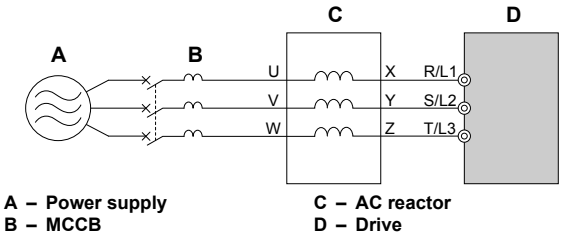
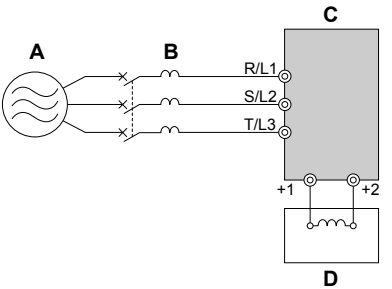


Figure 7.3 Connecting an AC Reactor

■ Connecting a DC Reactor

Ensure the jumper between terminals +1 and +2 (terminals are jumpered for shipment) is removed when connecting a DC reactor. The jumper must be installed if no DC reactor is used. *Refer to Connecting a DC Reactor on page 194* for an example of DC reactor wiring.



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

Figure 7.4 Connecting a DC Reactor

◆ Connecting a Surge Absorber

A surge absorber suppresses surge voltage generated from switching an inductive load near the drive. Inductive loads include magnetic contactors, relays, valves, solenoids and brakes. Always use a surge absorber or diode when operating with an inductive load.

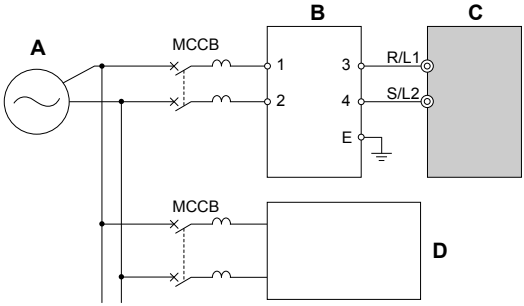
Note: Never connect a surge absorber to the drive output.

◆ Connecting a Noise Filter

■ Input-Side Noise Filter

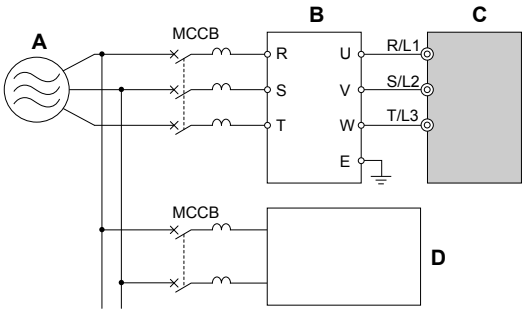
Drive outputs generate noise as a result of high-speed switching. This noise flows from inside the drive back toward the power supply, possibly affecting other equipment. Installing a noise filter to the input side of the drive can reduce the amount of noise flowing back into the power supply. This also prevents noise from entering the drive from the power supply.

- Use a noise filter specifically designed for AC drives.
- Install the noise filter as close as possible to the drive.



A – Power supply
B – Input-side noise filter (Model: LNFB-□□)
C – Drive
D – Other control device

Figure 7.5 Input-Side Noise Filter (Single-Phase 200 V)



A – Power supply
B – Input-side noise filter (Model: LNFD-□□)
C – Drive
D – Other control device

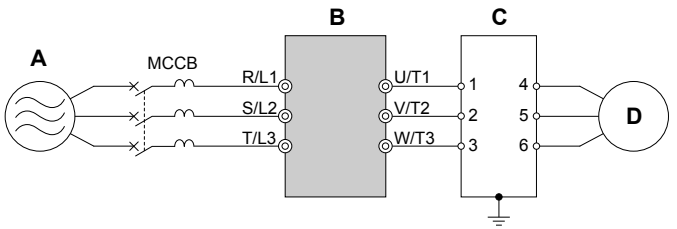
Figure 7.6 Input-Side Noise Filter (Three-Phase 200/400 V)

Refer to EMC Filter Installation on page 256 for details about EMC filter selection and installation in order to make the drive compliant with European standards EN61800-3 and the EMC guidelines.

■ Output-Side Noise Filter

A noise filter on the output side of the drive reduces inductive noise and radiated noise. ***Figure 7.7*** illustrates an example of output-side noise filter wiring.

NOTICE: *Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits. Improper application of noise filters could result in damage to the drive.*



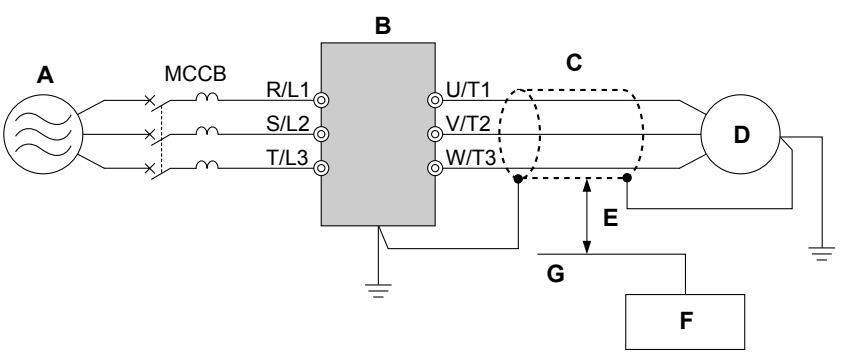
A – Power supply
B – Drive
C – Output-side noise filter
D – Motor

Figure 7.7 Output-Side Noise Filter

- **Radiated Noise:** Electromagnetic waves radiated from the drive and cables create noise throughout the radio bandwidth that can affect devices.
- **Induced Noise:** Noise generated by electromagnetic induction can affect the signal line and may cause the controller to malfunction.

Preventing Induced Noise

Use a noise filter on the output side or use shielded cables. Lay the cables at least 30 cm away from the signal line to prevent induced noise.



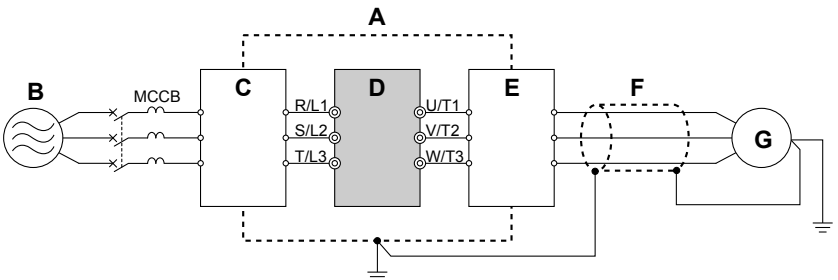
A – Power supply
B – Drive
C – Shielded motor cable
D – Motor
E – Separate at least 30 cm
F – Controller
G – Signal line

Figure 7.8 Preventing Induced Noise

Reducing Radiated/Radio Frequency Noise

The drive, input lines, and output lines generate radio frequency noise. Use noise filters on input and output sides and install the drive in a metal enclosure panel to reduce radio frequency noise.

Note: The cable running between the drive and motor should be as short as possible.

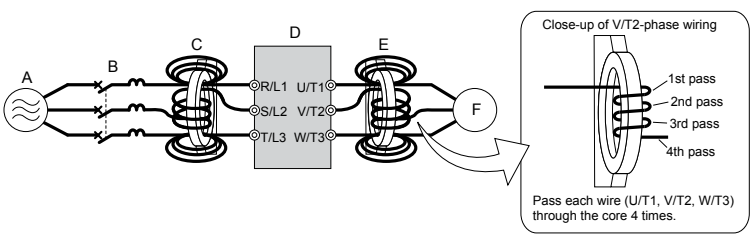


A – Metal enclosure
B – Power supply
C – Noise filter
D – Drive
E – Noise filter
F – Shielded motor cable
G – Motor

Figure 7.9 Reducing Radio Frequency Noise

◆ Zero-Phase Reactor

A zero-phase reactor can be used to reduce the noise on the input and output sides of the drive.



A – Power supply
B – MCCB
C – Zero-phase reactor on input side
D – Drive
E – Zero-phase reactor on output side
F – Motor

Figure 7.10 Zero-Phase Reactor

◆ Installing Fuses on the Input Side

Always install input fuses to the input side of the as a protective measure against damage caused by a short circuit.

Refer to *Table 7.2* for input fuse selection.

Table 7.2 Input Fuses

Model CIMR-J□	Class L Fuse Type Manufacturer: Fuji Electric	
	Model	Fuse Ampere Rating
Single-Phase 200 V Class		
BA0001	CR6L-20/UL	20
BA0002	CR6L-30/UL	30
BA0003	CR6L-50/UL	50
BA0006	CR6L-75/UL	75
BA0010	CR6L-100/UL	100
Three-Phase 200 V Class		
2A0001	CR6L-20/UL	20
2A0002	CR6L-20/UL	20
2A0004	CR6L-20/UL	20
2A0006	CR6L-30/UL	30
2A0008	CR6L-50/UL	50
2A0010	CR6L-50/UL	50
2A0012	CR6L-50/UL	50
2A0018	CR6L-75/UL	75
2A0020	CR6L-75/UL	75
Three-Phase 400 V Class		
4A0001	CR6L-20/UL	20
4A0002	CR6L-20/UL	20
4A0004	CR6L-50/UL	50
4A0005	CR6L-50/UL	50
4A0007	CR6L-50/UL	50
4A0009	CR6L-50/UL	50
4A0011	CR6L-50/UL	50

◆ Attachment for External Heatsink

An external attachment can be used to project the heatsink outside of an enclosure to ensure that there is sufficient air circulation around the heatsink. This installation method still requires a certain amount of airflow over the drive case. *Refer to Output Current Derating Due to Ambient Temperature on page 219* if derating is required. Contact a Yaskawa sales representative for more information.

◆ Noise Filter Installation

This drive has undergone testing in conformance with IEC61800-5-1: 2007 and is in compliance with low voltage directives. *Refer to EMC Guidelines Compliance on page 256* for information on selecting a noise filter.

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

Motor thermal overload relays protect the motor by disconnecting power lines to the motor due to a motor overload condition.

Install a motor thermal overload relay between the drive and motor:

- When operating multiple motors on a single AC drive.
- When using a power line bypass to operate the motor directly from the power line.

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

Note: Disable the motor protection function (L1-0 1 = “0”) when using an external motor thermal overload relay. The relay should shut off main power on the input side of the main circuit when triggered.

■ General Precautions when Using Thermal Overload Relays

The following application precautions should be considered when using motor thermal overload relays on the output of AC drives in order to prevent nuisance trips or overheat of the motor at low speeds:

- Low speed motor operation
- Use of multiple motors on a single AC drive
- Motor cable length
- Nuisance tripping resulting from high AC drive carrier frequency

Low Speed Operation and Motor Thermal oL Relays

Generally, thermal relays are applied on general-purpose motors. When general-purpose motors are driven by AC drives, the motor current is approximately 5 ~ 10% greater than if driven by the commercial power supply. In addition, the cooling capacity of a motor with a

shaft-driven fan decreases when operating at low speeds. Even if the load current is within the motor rated value, motor overheating may occur. A thermal relay cannot effectively protect the motor due to the reduction of cooling at low speeds. For this reason, apply the UL recognized electronic thermal overload protection function built into the drive whenever possible.

UL recognized electronic thermal overload function of the drive: Speed-dependent heat characteristics are simulated using data from standard motors and force-ventilated motors. The motor is protected from overload using this function.

Using One Drive with Multiple Motors

Turn off the electronic thermal overload function. Please refer to the appropriate product instruction manual to determine which parameter disables this function.

The UL recognized electronic thermal overload function of the drive cannot be applied when using multiple motors on one drive.

Long Motor Cables

When long motor cables and high carrier frequency are used, nuisance tripping of the thermal relay may occur due to increased leakage current. Therefore, reduce the carrier frequency or increase the tripping level of the thermal overload relay.

Nuisance Tripping Resulting from High AC Drive Carrier Frequency

Current waveforms generated by high carrier frequency PWM drives tend to create additional temperature rise in overload relays. Therefore, it may be necessary to increase the trip level setting when encountering nuisance triggering of the relay.

WARNING! *Fire Hazard. Confirm an actual motor overload condition is not present prior to increasing the thermal oL trip setting. Check local electrical codes before making adjustments to motor thermal overload settings.*

◆ NEMA Type 1 Kit

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

The optional NEMA Type 1 kit can be installed to raise the enclosure protection level of an IP20/Open-Chassis drive to NEMA Type 1. Drives with a NEMA Type 1 kit cannot be installed using side-by-side mounting unless the top cover is removed. The drive does not retain NEMA Type 1 integrity with the top cover removed. ***Refer to Installation Orientation and Spacing on page 34*** for installation instructions.

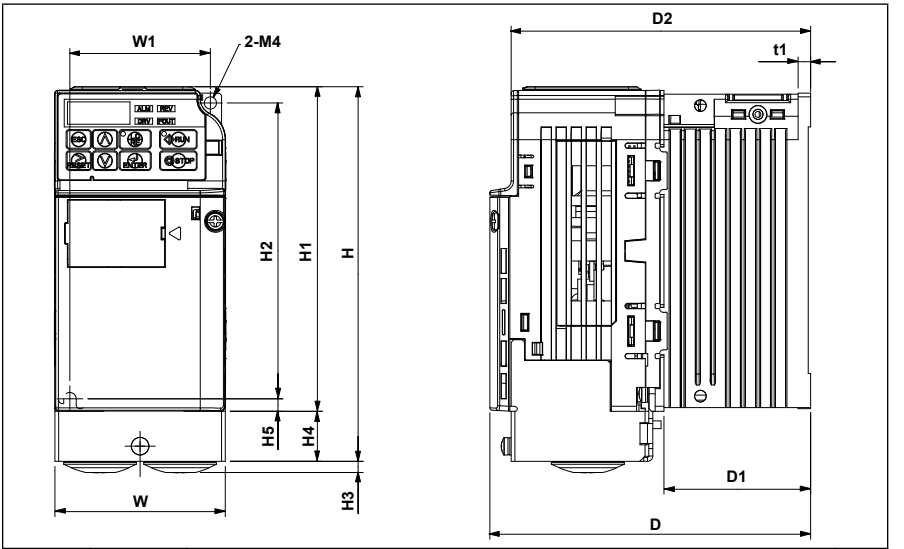
■ Installation Environment

Table 7.3 Installation Environment

Environment	Conditions
Ambient Temperature	-10 °C to +40 °C (NEMA Type 1/wall-mounted enclosure) Drive reliability improves in environments without wide temperature fluctuations. When using 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.
Refer to Installation Environment on page 33 for all other installation environment specifications.	

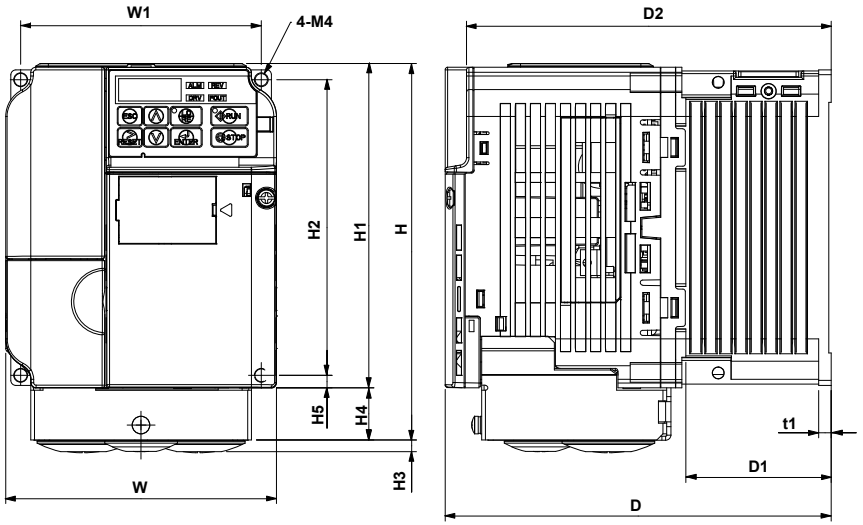
■ Exterior and Mounting Dimensions for NEMA Type 1 Kit

Table 7.4 IP20/Open-Chassis Design Fitted with the NEMA Type 1 Kit

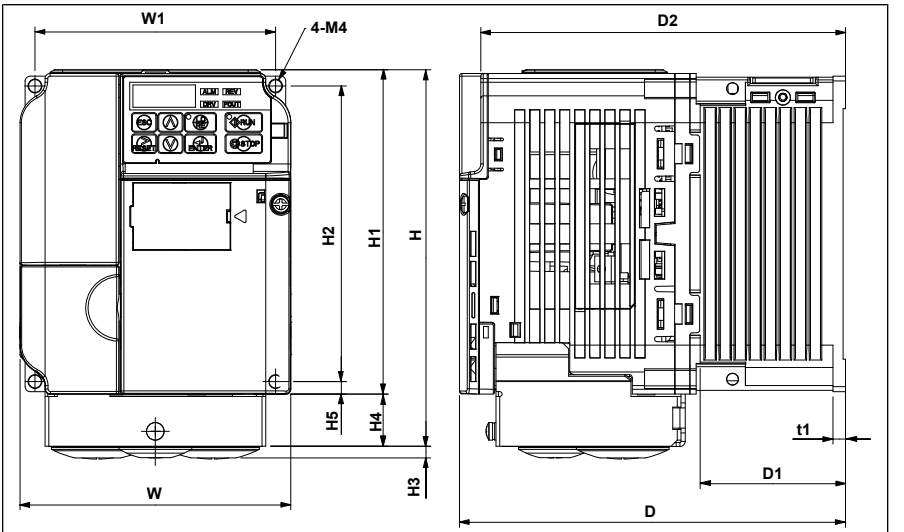


Drive Model CIMR-J□	NEMA Type 1 Kit Model EZZ	Dimensions (mm)													Wt. (kg)
		W	H	D	W1	H1	H2	H3	H4	H5	H6	D1	D2	t1	
Single-Phase 200 V Class															
BA0001B	020564A	68	148	76	56	128	118	5	20	5	1.5	6.5	67.5	3	0.8
BA0002B	020564A	68	148	76	56	128	118	5	20	5	1.5	6.5	67.5	3	0.8
BA0003B	020564B	68	148	118	56	128	118	5	20	5	1.5	38.5	109.5	5	1.2
Three-Phase 200 V Class															
2A0001B	020564A	68	148	76	56	128	118	5	20	5	1.5	6.5	67.5	3	0.8
2A0002B	020564A	68	148	76	56	128	118	5	20	5	1.5	6.5	67.5	3	0.8
2A0004B	020564A	68	148	108	56	128	118	5	20	5	1.5	38.5	99.5	5	1.1
2A0006B	020564A	68	148	128	56	128	118	5	20	5	1.5	58.5	119.5	5	1.3

Table 7.5 IP20/Open-Chassis Design Fitted with the NEMA Type 1 Kit



Drive Model CIMR-J□	NEMA Type 1 Kit Model EZZ	Dimensions (mm)													Wt. (kg)
		W	H	D	W1	H1	H2	H3	H4	H5	H6	D1	D2	t1	
Single-Phase 200 V Class															
BA0006B	020564C	108	149	137.5	96	128	118	5	21	5	1.5	58	129	5	1.9
BA0010B	020564D	108	149	154	96	128	118	5	21	5	1.5	58	145.5	5	2.0
Three-Phase 200 V Class															
2A0008B	020564G	108	149	129	96	128	118	5	21	5	1.5	58	120.5	5	1.9
2A0010B	020564G	108	149	129	96	128	118	5	21	5	1.5	58	120.5	5	1.9
2A0012B	020564C	108	149	137.5	96	128	118	5	21	5	1.5	58	129	5	1.9
2A0018B	020564H	140	149	143	128	128	118	5	21	5	5	65	134.5	5	2.6
2A0020B	020564H	140	149	143	128	128	118	5	21	5	5	65	134.5	5	2.6
Three-Phase 400 V Class															
4A0001B	020564G	108	149	81	96	128	118	5	21	5	1.5	10	72.5	5	1.2
4A0002B	020564G	108	149	99	96	128	118	5	21	5	1.5	28	90.5	5	1.4
4A0004B	020564C	108	149	137.5	96	128	118	5	21	5	1.5	58	129	5	1.9
4A0005B	020564J	108	149	154	96	128	118	5	21	5	1.5	58	145.5	5	1.9
4A0007B	020564J	108	149	154	96	128	118	5	21	5	1.5	58	145.5	5	1.9



Drive Model CIMR-J□	NEMA Type 1 Kit Model EZZ	Dimensions (mm)													Wt. (kg)
		W	H	D	W1	H1	H2	H3	H4	H5	H6	D1	D2	t1	
4A0009B	020564J	108	149	154	96	128	118	5	21	5	1.5	58	145..5	5	1.9
4A0011B	020564H	140	149	143	128	128	118	5	21	5	5	65	134.5	5	2.6

■ Removing the Protective Covers on a NEMA Type 1 Design (Using the NEMA Type 1 Kit Option for the NEMA Type 1 Rating)

1. Loosen the screw on the front cover to remove the front cover.

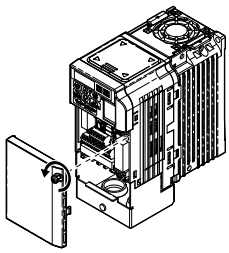


Figure 7.11 Remove the Front Cover

2. Loosen the screw on the terminal cover (***Figure 7.12***, **B**) to remove the terminal cover and expose the conduit bracket (***Figure 7.12***, **A**).

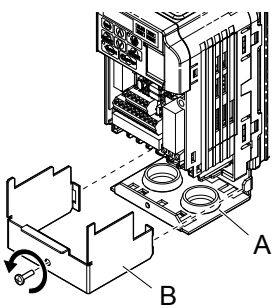


Figure 7.12 Remove the Terminal Cover

3. Loosen two screws attaching the conduit bracket **(*Figure 7.13*, *A*)** to remove.

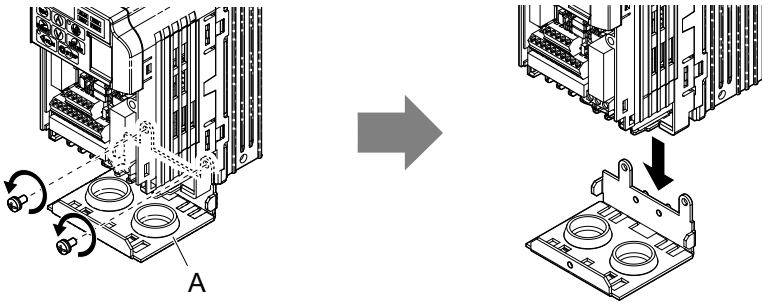
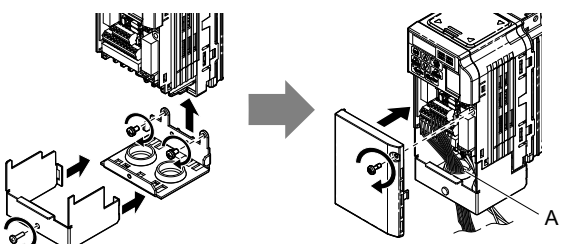


Figure 7.13 Remove the Conduit Bracket

■ Reattaching the Protective Covers

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



A – Pass power wiring and control signal wiring through different exit holes at the bottom of the drive.

Figure 7.14 Reattach the Protective Covers and Conduit Bracket

7.5 Options

Table 7.6 and *Table 7.7* give detailed information about the available options that allow Yaskawa drives to connect to communication networks. A host controller can control and monitor the drive, read and change parameters by using a communication option. Contact Yaskawa or your Yaskawa agent to order options.

- **Option Selection**: Refer to Yaskawa catalog for more details on option card selection and part numbers.
- **Option Installation**: Refer to option unit manual for option unit installation instructions.

◆ Interface Options

Table 7.6 Interface Option Units

Option	Model	Function
RS-232C Interface	SI-232/J	Allows the user to connect an extension cable for remote operation and for use with Drive Wizard Plus.
RS-232C Interface (Removable)	SI-232/JC	Allows the user to take advantage of the USB Copy Unit option and the Remote LED Operator option.
RS-422/RS-485 Interface for MEMOBUS/Modbus Communication	SI-485/J	Allows the drive to connect to a network using MEMOBUS/ Modbus RTU protocol. Option includes a communication cable connector.
Potentiometer	AI-V3/J	Allows for easier speed control.

◆ Other Options

Table 7.7 Other Options

Option	Model	Function
Remote LED Operator	JVOP-182	Allows for remote operation when using the optional LED operator. This option is used in combination with the LED extension cable and the RS-232C interface. Option includes a Copy function for saving drive settings.
USB Copy Unit	JVOP-181	Saves and transfers parameter settings and connects to a PC for operation with Drive Wizard Plus. This option is used in combination with the RS-232C interface.

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Appendix: A

Specifications

A.1 HEAVY DUTY AND NORMAL DUTY RATINGS 210
A.2 SINGLE/THREE-PHASE 200 V CLASS DRIVE 211
A.3 THREE-PHASE 400 V CLASS DRIVES..... 213
A.4 DRIVE SPECIFICATIONS..... 214
A.5 DRIVE WATT LOSS DATA.....217
A.6 DRIVE DERATING DATA.....219

A.1 Heavy Duty and Normal Duty Ratings

The capacity of the drive is based on two types of load characteristics: Heavy Duty (HD) and Normal Duty (ND).

Refer to Selecting the Appropriate Load Rating on page 210 for the differences between HD and ND. Specifications for capacity ratings are listed on the following pages.

Table A.1 Selecting the Appropriate Load Rating

Setting Parameter C6-01	Rated Output Current	Overload Tolerance	Default Carrier Frequency
0: Heavy Duty	HD Rating varies by model *<1>*	150% rated output current for 60 s	8/10 kHz varies by model
1: Normal Duty (default)	ND Rating varies by model *<1>*	120% rated output current for 60 s varies by model	2 kHz, Swing PWM

<1> The following pages list information on rating changes based on drive model.



- **HD and ND**: HD refers to applications requiring constant torque output, while ND refers to applications with variable torque needs. The drive allows the user to select HD or ND torque depending on the application. Fans, pumps, and blowers should use ND (C6-01 = 1), and other applications generally use HD (C6-01 = 0).
- **Swing PWM**: Swing PWM equivalent to a 2 kHz audible noise. This function turns the motor noise into a less obtrusive white noise.

Note: Differences between HD ratings and ND ratings for the drive include rated input and output current, overload capacity, carrier frequency, and current limit. The default setting is for ND (C6-01 = 1).

A.2 Single/Three-Phase 200 V Class Drive

Table A.2 Power Ratings

Item				Specification								
Three-Phase: CIMR-J□2A				0001	0002	0004	0006	0008 <1>	0010	0012	0018 <1>	0020
Single-Phase: CIMR-J□BA <2>				0001	0002	0003	0006	-	0010	-	-	-
Maximum Motor Size Allowed (kW) <3>			ND Rating	0.2	0.4	0.75	1.1	1.5	2.2	3.0	3.7	5.5
			HD Rating	0.1	0.2	0.4	0.75	1.1	1.5	2.2	3.0	3.7
Input	Input Current (A) <4>	Three-Phase	ND Rating	1.1	1.9	3.9	7.3	8.8	10.8	13.9	18.5	24.0
			HD Rating	0.7	1.5	2.9	5.8	7.0	7.5	11.0	15.6	18.9
		Single-Phase	ND Rating	2.0	3.6	7.3	13.8	–	20.2	–	–	–
			HD Rating	1.4	2.8	5.5	11.0	–	14.1	–	–	–
Output	Rated Output Capacity (kVA) <5>		ND Rating	0.5	0.7	1.3	2.3	3.0	3.7	4.6	6.7	7.5
			HD Rating	0.3	0.6	1.1	1.9	2.6	3.0	4.2	5.3	6.7
	Output Current (A)		ND Rating <6>	1.2	1.9	3.5 (3.3)	6.0	8.0	9.6	12.0	17.5	19.6
			HD Rating	0.8 <7>	1.6 <7>	3.0 <7>	5.0 <7>	6.9 <8>	8.0 <8>	11.0 <8>	14.0 <8>	17.5 <8>
	Overload Tolerance			ND Rating: 120% of rated output current for 1 minute HD Rating: 150% of rated output current for 1 minute (Derating may be required for applications that start and stop frequently)								
	Carrier Frequency			2 kHz (user-set, 2 to 15 kHz)								
	Max Output Voltage (V)			Three-phase 200 to 240 V (proportional to input voltage)								
	Max Output Frequency (Hz)			400 Hz (user-adjustable)								
Power Supply	Rated Voltage Rated Frequency			Three-phase power: Three-phase 200 to 240 V 50/60 Hz Single-phase power: 200 to 240 V 50/60 Hz								
	Allowable Voltage Fluctuation			-15 to 10%								
	Allowable Frequency Fluctuation			±5%								
Harmonic Corrective Actions	DC Reactor			Optional								

<1> Available for Japan localized drives only: CIMR-JA□.

<2> Drives with a single-phase power supply input will output three-phase power and cannot run a single-phase motor.

<3> 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.

<4> Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.

<5> Rated motor capacity is calculated with a rated output voltage of 220 V.

<6> Carrier frequency is set to 2 kHz (Swing PWM). Current derating is required in order to raise the carrier frequency.

<7> Carrier frequency is set to 10 kHz. Current derating is required in order to raise the carrier frequency.

<8> Carrier frequency is set to 8 kHz. Current derating is required in order to raise the carrier frequency.

Note: Differences between Heavy Duty (HD) ratings and Normal Duty (ND) ratings for the drive include rated input and output current, overload capacity, carrier frequency and current limit. Set parameter C6-01 to "0" for HD or "1" for ND (default).

A.3 Three-Phase 400 V Class Drives

Table A.3 Power Ratings

Item			Specification						
CIMR-J□4A			0001	0002	0004	0005	0007	0009	0011
Maximum Applicable Motor Capacity (kW) <1>		ND Rating	0.37	0.75	1.5	2.2	3.0	4.0	5.5
		HD Rating	0.37	0.55	1.1	1.5	2.2	3.0	3.7
Input	Input Current (A) <2>	ND Rating	1.2	2.1	4.3	5.9	8.1	9.4	14.0
		HD Rating	1.2	1.8	3.2	4.4	6.0	8.2	10.4
Output	Output Current (kVA) <3>	ND Rating <4>	0.9	1.6	3.1	4.1	5.3	6.7	8.5
		HD Rating <5>	0.9	1.4	2.6	3.7	4.2	5.5	7.0
	Output Current (A)	ND Rating <4>	1.2	2.1	4.1	5.4	6.9	8.8	11.1
		HD Rating <5>	1.2	1.8	3.4	4.8	5.5	7.2	9.2
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)						
	Carrier Frequency		2 kHz (user-adjustable from 2 to 15 kHz)						
	Maximum Output Voltage (V)		Three-phase: 380 to 480 V (proportional to input voltage)						
	Maximum Output Frequency (Hz)		400 Hz (user-adjustable)						
Power Supply	Rated Voltage Rated Frequency		Three-phase: 380 to 480 V 50/60 Hz						
	Allowable Voltage Fluctuation		-15 to 10%						
	Allowable Frequency Fluctuation		±5%						
Harmonic Corrective Actions		DC Reactor	Optional						

<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> 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 (Swing PWM). 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.

Note: Differences between Heavy Duty (HD) ratings and Normal Duty (ND) ratings for the drive include rated input and output current, overload capacity, carrier frequency and current limit. Set parameter C6-01 to "0" for HD or "1" for ND (default).

A.4 Drive Specifications

Note: For optimum performance life of the drive, install the drive in an environment that meets the environmental conditions.

Item		Specification
Control Characteristics	Control Method	V/f Control
	Frequency Control Range	0.01 to 400 Hz
	Frequency Accuracy	Digital input: within ±0.01% of the max output frequency (-10 to +50 °C) Analog input: within ±0.5% of the max output frequency (25 °C ±10 °C)
	Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/1000 of maximum output frequency
	Output Frequency Calculation Resolution	$1/2^{20}$ x Maximum output frequency (E1–04)
	Frequency Setting Signal	Main frequency reference: 0 to +10 Vdc (20 kΩ), 4 to 20 mA (250 Ω), 0 to 20 mA (250 Ω)
	Starting Torque	150%/3 Hz
	Speed Control Range	1: 20~40
	Accel/Decel Time	0.00 to 6000.0 s (allows four separate settings for accel and decel)
	Braking Torque	Instantaneous Average Decel Torque <1> : 0.1/0.2 kW: over 150%, 0.4/0.75 kW: over 100%, 1.5 kW: over 50%, 2.2 kW and above: over 20% Continuous Regen Torque: 20%, 125% with a Braking Resistor Unit <2> : (10% ED) 10 s with an internal braking resistor.
	V/f Characteristics	User-set, programmable.
	Functions	• Momentary Power Loss Ride-Thru • Speed Search • Multi-Step Speed (9 steps max) • Accel/Decel Time Switch • S-Curve Accel/Decel • 2-Wire/3-Wire Sequence • Cooling Fan ON/OFF • Slip Compensation • Torque Compensation • Jump Frequencies (reference dead band) • Frequency Reference Upper/Lower Limit • DC Injection Braking (start and stop) • Overexcitation Braking • Fault Reset

Item		Specification
Protection Functions	Motor Protection	Motor overheat protection via output current sensor
	Overcurrent Protection	Drives stops when output exceeds 200% of the rated current (Heavy Duty)
	Overload Protection	A stop command will be entered after operating at 150% for 60 s (Heavy Duty) <3>
	Overvoltage Specification	200 V class: Stops when DC bus voltage exceeds approximately 410 V 400 V class: Stops when DC bus voltage exceeds approximately 820 V
	Low Voltage Protection	Drive stops when DC bus voltage falls below the levels indicated: 190 V (3-phase 200 V), 160 V (single-phase 200 V), 380 V (3-phase 400 V), 350 V (3-phase 380 V)
	Momentary Power Loss Ride-Thru	Stops after 15 ms
	Heatsink Overheat Protection	Protected by thermistor
	Braking Resistor Overheat Protection	Overheat input signal for braking resistor (Optional ERF-type, 3% ED)
	Stall Prevention	During acceleration and during run: Separate settings for each type of stall prevention determine the current level at which stall prevention is triggered. During deceleration: Select, enable/disable.
	Cooling Fan Failure Protection	Circuit protection (“fan-lock” sensor)
	Ground Fault Protection	Electronic circuit protection <4>
	DC Bus Charge LED	Remains lit until DC bus voltage falls below 50 V

Item		Specification
Environment	Storage/Installation Area	Indoors
	Ambient Temperature	-10 to +40 °C (IP20/NEMA Type 1) <5> -10 to +50 °C (IP20/Open-Chassis)
	Humidity	95% RH or less with no condensation
	Storage Temperature	-20 to +60 °C allowed for short-term transport of the product
	Altitude	Up to 1000 meters without derating; up to 3000 meters with output current and voltage derating.
	Shock, Impact	10 to 20 Hz: 9.8 m/s^2 20 to 55 Hz: 5.9 m/s^2
	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 • harmful gases and liquids • excessive vibration • chlorides • direct sunlight
	Orientation	Install the drive vertically to maintain maximum cooling effects
Standards		• UL508C • EN61800-3, EN61800-5-1
Protective Enclosure		IP20/Open-Chassis IP20/NEMA Type 1 <5>
Cooling Method		CIMR-J☐BA0001 to 0006: self-cooled CIMR-J☐BA0010: cooling fan CIMR-J☐2A0001 to 0004: self-cooled CIMR-J☐2A0006 to 0020: cooling fan CIMR-J☐4A0001 to 0004: self-cooled CIMR-J☐4A0005 to 0011: cooling fan

<1> 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.

<2> Ensure that Stall Prevention Selection during Deceleration is disabled (L3-04 = 0) or set to 3 when using a braking resistor or the Braking Resistor Unit. The default setting for the stall prevention function will interfere with the braking resistor.

<3> Overload protection may be triggered when operating with 150% of the rated output current if the output frequency is less than 6 Hz.

<4> Ground protection cannot be provided under the following circumstances when a ground fault is likely in the motor windings during run: Low ground resistance for the motor cable and terminal block; low ground resistance for the motor cable and terminal block; or the drive is powered up from a ground short.

<5> All models have an IP20/Open-Chassis enclosure as standard. Use the NEMA Type 1 Kit option to convert drives to an IP20/NEMA Type 1 enclosure rating.

A.5 Drive Watt Loss Data

Table A.4 Watt Loss 200 V Class Single-Phase Models

Model Number CIMR-J□	Heavy Duty (Carrier Frequency 8/10 kHz) <1>				Normal Duty (Swing PWM equal 2 kHz)			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
BA0001	0.8	4.3	7.4	11.7	1.2	5.0	8.5	13.5
BA0002	1.6	7.9	8.9	16.7	1.9	7.6	9.7	17.3
BA0003	3.0	16.1	11.5	27.7	3.3	14.6	14.4	29.1
BA0006	5.0	33.7	16.8	50.5	6.0	30.1	19.4	49.5
BA0010	8.0	54.8	25.9	80.7	9.6	51.7	29.8	81.4

<1> 10 kHz for BA0001 to BA0006

Table A.5 Watt Loss 200 V Class Three-Phase Models

Model Number CIMR-J□	Heavy Duty (Carrier Frequency 8/10 kHz) <1>				Normal Duty (Swing PWM equal 2 kHz)			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
2A0001	0.8	4.3	7.3	11.6	1.2	5.0	8.0	13.0
2A0002	1.6	7.9	8.8	16.7	1.9	7.6	9.5	17.1
2A0004	3.0	16.2	11.5	27.7	3.5	15.8	13.6	29.4
2A0006	5.0	27.4	15.9	43.3	6.0	27.5	17.2	44.7
2A0008	7.0	48.7	22.2	70.9	8.0	44.6	24.0	68.6
2A0010	8.0	54.8	23.8	78.6	9.6	51.7	25.8	77.5
2A0012	11.0	70.7	29.9	100.6	12.0	61.3	30.4	91.7
2A0018	14.0	92.6	38.8	131.4	18.0	89.8	44.1	133.8
2A0020	17.5	110.5	43.3	153.8	19.6	98.7	46.3	145.0

<1> 10 kHz for 2A0001 to2A0006

Table A.6 Watt Loss 400 V Class Three-Phase Models

Model Number CIMR-J□	Heavy Duty (Carrier Frequency 8 kHz)				Normal Duty (Swing PWM equal 2 kHz)			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
4A0001	1.2	19.2	11.5	30.7	1.2	10.0	9.6	19.6
4A0002	1.8	28.9	14.8	43.7	2.1	18.5	13.9	32.4

A.5 Drive Watt Loss Data

Model Number CIMR-J□	Heavy Duty (Carrier Frequency 8 kHz)				Normal Duty (Swing PWM equal 2 kHz)			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
4A0004	3.4	42.3	17.9	60.2	4.1	30.5	16.8	47.3
4A0005	4.8	70.7	26.2	96.9	5.4	44.5	21.8	66.3
4A0007	5.5	81.0	30.7	111.7	6.9	58.5	28.4	86.9
4A0009	7.2	84.6	32.9	117.5	8.8	63.7	31.4	95.1
4A0011	9.2	107.2	41.5	148.7	11.1	81.7	46.0	127.7

A.6 Drive Derating Data

The drive can be operated at above rated temperature, altitude and default carrier frequency by derating the drive capacity.

◆ Carrier Frequency Derating

Derate drive capacity using ***Figure A.1*** as the carrier frequency of the drive increases above the factory setting.

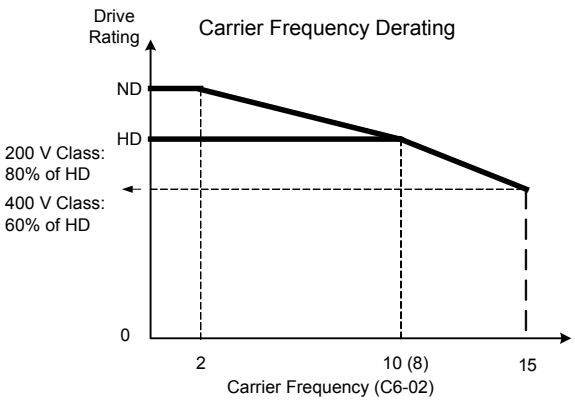


Figure A.1 Carrier Frequency Derating

◆ Temperature Derating

As the ambient temperature for the drive is increased above the drive specification the drive should be derated. Additionally parameter L8-35 Installation Method Selection on page ***219*** should be set according to enclosure type and mounting method as illustrated in ***Figure A.2***.

■ Output Current Derating Due to Ambient Temperature

Set L8-12 and L8-35 according to the installation conditions when the ambient temperature is above the drive specification or if drives are side-by-side mounted in a cabinet. The output current is derated as shown in ***Figure A.2***.

No.	Name	Description	Range	Def.
L8-12	Ambient Temperature Setting	Adjust the drive overload (oL2) protection level when the drive is installed in an environment that exceeds its ambient temperature rating.	-10 to 50	30 °C
L8-35	Installation Method Selection	0: IP20/IP00 Drive 1: Side-by-Side Mounting 2: NEMA Type 1 Drive <1> 3: Finless Drive or External Heatsink Installation	0 to 3	0

<1> This selection assumes that the drive is fitted with the NEMA Type 1 Kit option.

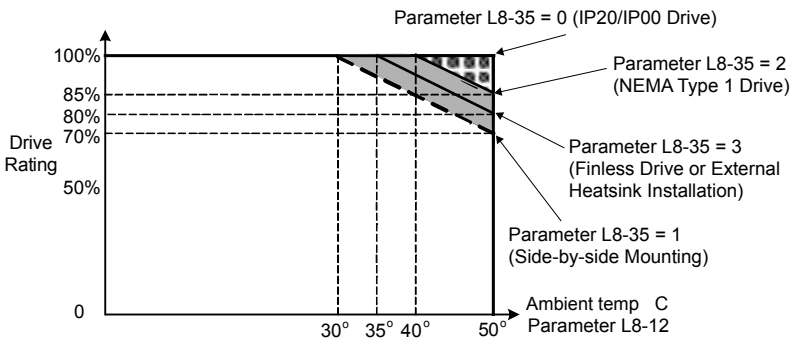


Figure A.2 Ambient Temperature and Installation Method Derating

◆ Altitude Derating

The drive standard ratings are valid for an installation altitude up to 1000 m. If the altitude exceeds 1000 m, both the drive input voltage and the rated output current must be derated for 1% per 100 m. The maximum altitude is 3000 m.

Appendix: B

Parameter List

This appendix contains a full listing of all parameters and settings available in the drive.

B.1 PARAMETER GROUPS.....222
B.2 PARAMETER TABLE.....223
B.3 CHINA LOCALIZED DRIVE DEFAULT VALUES.....246
B.4 DEFAULTS BY DRIVE MODEL AND DUTY RATING ND/HD.....247

B.1 Parameter Groups

Table B.1 Parameter Groups

Parameter Group	Name	Page
A1	Initialization	223
b1	Operation Mode Selection	224
b2	DC Injection Braking	224
C1	Acceleration/Deceleration Time	225
C2	S-Curve Accel/Decel	225
C3	Motor Slip Compensation	226
C4	Motor Torque Compensation	226
C6	Carrier Frequency	226
d1	Frequency Reference	228
d2	Reference Limits	228
d3	Jump Frequencies	228
d4	Frequency Reference Hold	229
E1	V/f Pattern	230
E2	Motor Setup	230
H1	Digital Inputs	231
H2	Digital Outputs	233
H3	Analog Inputs	234
H4	Analog Outputs	235
H5	Serial Communications Setup	235
L1	Motor Overload	237
L2	Power Loss Ride-Thru	237
L3	Stall Prevention	237
L4	Reference Detection	238
L5	Fault Restart	239
L6	Overtorque Detection	239
L8	Hardware Protection	239
n1	Hunting Prevention	241
n3	Overexcitation Braking	241
o1	Monitor Display Selection	241
o2	Operator Keypad Functions	241
o3	Copy Function	242
o4	Maintenance Functions	242
U1	Status Monitor	243
U2	Fault History	245
U4	Maintenance Monitor	245

B.2 Parameter Table

An “O” in the “Mode” column indicates that the parameter is available in the Advanced menu.

An “S” in the “Mode” column indicates that the parameter is available in the Startup menu.

◆ A: Initialization Parameters

The A parameter group creates the operating environment for the drive. This includes the parameter Access Level, and Password.

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
A1: Initialization Parameters Use A1 parameters to configure the basic environment for drive operation.							
A1-01 <1>	Access Level Selection	Selects which parameters are accessible via the digital operator. 0: Operation only 2: Advanced Access Level	0, 2	2	O	101	*124*
A1-03	Initialize Parameters	Resets all parameters to factory default settings. (Initializes the drive then returns A1-03 to 0) 0: No Initialize 2220: 2-Wire Initialization 3330: 3-Wire Initialization	0 to 3330	0	O	103	*94*
			E1-03, L8-35, o2-04, o2-09, and all U2 monitors are not reset when performing initialization.				
A1-04	Password 1	When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 and A1-03 cannot be changed.	0 to 9999	0	O	104	*124*
A1-05	Password 2		0 to 9999	0	O	105	*124*
			This parameter is hidden from view. To access A1-05, first display A1-04. Then press the STOP key while holding down the up arrow key. Parameter A1-05 will appear.				

<1> Parameter can be changed during run.

◆ b: Application

Application parameters configure the Run Command Source, DC Injection Braking, and other application-related settings.

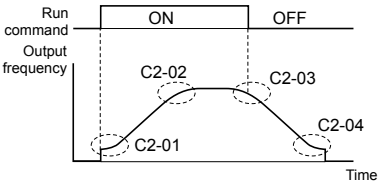
No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
b1: Operation Mode Selection Use b1 parameters to configure the operation mode.							
b1-01	Frequency Reference Selection	Selects the frequency reference input source. 0: Operator - Digital preset speed d1-01 to d1-08 1: Terminals - Analog input terminal A1 2: MEMOBUS/Modbus communications (option) 3: Potentiometer (option)	0 to 3	1	S	180	*94*
b1-02	Run Command Selection	Selects the run command input source. 0: Operator - RUN and STOP keys on the digital operator 1: Digital input terminals 2: MEMOBUS/Modbus communications (option)	0 to 2	1	S	181	*96*
b1-03	Stopping Method Selection	Selects the stopping method when the run command is removed. 0: Ramp to Stop 1: Coast to Stop	0, 1	0	S	182	*98*
b1-04	Reverse Operation Selection	Permits or prohibits reverse operation. 0: Reverse enabled. 1: Reverse disabled.	0, 1	0	O	183	–
b1-07	LOCAL/ REMOTE Run Selection	Determines the operation when the Run command source is switched from LOCAL to REMOTE or between REMOTE and MEMOBUS/Modbus communication. 0: External Run command has to be cycled at the new source to be activated. 1: External Run command at new source is accepted immediately.	0, 1	0	O	186	–
b1-08	Run Command Selection while in Programming Mode	0: Run command accepted only in the operation menu. 1: Run command accepted in all menus. 2: Prohibit entering Programming Mode during Run	0 to 2	0	O	187	–
b1-14	Phase Order Selection	Sets the phase order for drive output terminals U/T1, V/T2 and W/T3. 0 : Standard 1 : Switch phase order	0, 1	0	O	1C3	–
b1-17	Run Command at Power Up	Determines the operation when a Run command is active at power up of the drive. 0: Run command not issued, needs to be cycled 1: Run command issued, motor operation start	0, 1	0	O	1C6	–
b2: DC Injection Braking Use b2 parameters to configure DC Injection Braking operation							

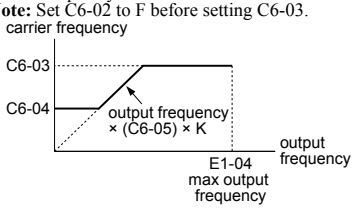
No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
b2-02	DC Injection Braking Current	Sets the DC Injection Braking current as a percentage of the drive rated current.	0 to 75	50%	O	18A	–
b2-03	DC Injection Braking Time/ DC Excitation Time at Start	Sets DC Injection Braking time at start. Disabled when set to 0.00 seconds.	0.00 to 10.00	0.00 s	O	18B	–
b2-04	DC Injection Braking Time at Stop	Sets DC Injection Braking time at stop. When b1-03 = 0, this parameter sets the amount of DC Injection time applied to the motor at the end of the decel ramp. Disabled when set to 0.00.	0.00 to 10.00	0.50 s	O	18C	–

◆ C: Tuning

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

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
C1: Acceleration and Deceleration Times Use C1 parameters to configure motor acceleration and deceleration.							
C1-01 <1>	Acceleration Time 1	Sets the time to accelerate from 0 to maximum frequency.	0.0 to 6000.0	10.0 s	S	200	99
C1-02 <1>	Deceleration Time 1	Sets the time to decelerate from maximum frequency to 0.			S	201	99
C1-03 <1>	Acceleration Time 2	Sets the time to accelerate from 0 to maximum frequency when Accel/Decel times 2 are selected by a digital input.			O	202	99
C1-04 <1>	Deceleration Time 2	Sets the time to decelerate from maximum frequency to 0 when Accel/Decel times 2 are selected by a digital input.			O	203	99
C1-09	Fast-Stop Time	Sets the time to decelerate from maximum frequency to 0 for the multi-function input fast-stop function. **Note:** This parameter is also used by selecting "Fast-Stop" as a Stop Method when a fault is detected.			O	208	–
C2: S-Curve Characteristics Use C2 parameters to configure S-curve operation.							

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
C2-01	S-Curve Characteristic at Accel Start	The S-curve can be controlled in the four points shown below.  S-curve is used to further soften the starting and stopping ramp. The longer the S-curve time, the softer the starting and stopping ramp.	0.00 to 10.00	0.20 s	O	20B	–
C2-02	S-Curve Characteristic at Accel End		0.00 to 10.00	0.20 s	O	20C	–
C2-03	S-Curve Characteristic at Decel Start		0.00 to 10.00	0.20 s	O	20D	–
C2-04	S-Curve Characteristic at Decel End		0.00 to 10.00	0.00 s	O	20E	–
C3: Slip Compensation Use C3 parameters to configure the slip compensation function.							
C3-01 *<1>*	Slip Compensation Gain	Sets the slip compensation gain. Decides for what amount the output frequency is boosted in order to compensate the slip. **Note:** Adjustment is not normally required.	0.0 to 2.5	0.0	O	20F	–
C3-02	Slip Compensation Primary Delay Time	Adjusts the slip compensation function delay time. Decrease the setting when the slip compensation response is too slow, increase it when the speed is not stable.	0 to 10000	2000 ms	O	210	–
C4: Torque Compensation Use C4 parameters to configure Torque Compensation function.							
C4-01 *<1>*	Torque Compensation Gain	Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque. Increase this setting when using a long motor cable or when the motor is significantly smaller than the drive capacity. Decrease this setting when motor oscillation occurs. Set the value so that the current at low speed does not exceeds the drive rated current.	0.00 to 2.50	1.00	O	215	–
C6: Carrier Frequency Use C6 parameters to configure the carrier frequency drive settings.							
C6-01	Drive Duty Selection	Selects the load rating for the drive. 0: Heavy Duty (HD) for constant torque applications. 1: Normal Duty (ND) for variable torque applications. This setting affects the Rated output current and overload tolerance of the drive.	0, 1	1	S	223	*101*

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
C6-02	Carrier Frequency Selection	Selects the carrier frequency 1 : 2.0 kHz 2 : 5.0 kHz 3 : 8.0 kHz 4 : 10.0 kHz 5 : 12.5 kHz 6 : 15.0 kHz 7 : Swing PWM 8 to E : No setting possible F: User defined (determined by C6-03 through C6-05)	1 to F	<2>	S	224	101
C6-03	Carrier Frequency Upper Limit	C6-03 and C6-04 set upper and lower limits for the carrier frequency. **Note:** Set C6-02 to F before setting C6-03.	1.0 to 15.0	<3>	O	225	–
C6-04	Carrier Frequency Lower Limit	 The coefficient K depends on C6-03: C6-03 ≥ 10.0 kHz: K = 3 10.0 kHz > C6-03 ≥ 5.0 kHz: K = 2 5.0 kHz > C6-03: K = 1 When C6-05 ≤ 6, C6-04 is disabled (makes the carrier frequency C6-03 value).	1.0 to 15.0	<3>	O	226	–
C6-05	Carrier Frequency Proportional Gain	Sets the relationship of output frequency to carrier frequency when C6-02 = F.	00 to 99	<3>	O	227	–

<1> Parameter can be changed during run.

<2> Default setting value is dependent on parameter o2-04, Drive Model Selection and C6-01, Drive Duty Selection.

<3> 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.

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
d1: Frequency Reference Use d1 parameters to configure the drive frequency reference.							
d1-01 <1>	Frequency Reference 1	Frequency reference. ***Refer to Frequency Reference Source: b1-01 on page 94*** for instructions to use d1-01 as the main frequency reference.	0.00 to 400.00 Hz <2>	0.00 Hz	S	280	***103***
d1-02 <1>	Frequency Reference 2	Frequency reference when digital input "Multi-Step Speed Reference 1" (H1-□□ = 3) is on.		0.00 Hz	S	281	***103***
d1-03 <1>	Frequency Reference 3	Frequency reference when digital input "Multi-Step Speed Reference 2" (H1-□□ = 4) is on.		0.00 Hz	S	282	***103***
d1-04 <1>	Frequency Reference 4	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 2" (H1-□□ = 3 and 4) are on.		0.00 Hz	S	283	***103***
d1-05 <1>	Frequency Reference 5	Frequency reference when digital input "Multi-Step Speed Reference 3" (H1-□□ = 5) is on.		0.00 Hz	O	284	–
d1-06 <1>	Frequency Reference 6	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 3 " (H1-□□ = 3 and 5) are on.		0.00 Hz	O	285	–
d1-07 <1>	Frequency Reference 7	Frequency reference when digital inputs "Multi-Step Speed Reference 2, 3" (H1-□□ = 4 and 5) are on.		0.00 Hz	O	286	–
d1-08 <1>	Frequency Reference 8	Frequency reference when multi-function input "Multi-Step speed reference 1, 2, 3" (H1-□□ = 3, 4, 5) are on.		0.00 Hz	O	287	–
d1-17 <1>	Jog Frequency Reference	Frequency reference when digital inputs "Jog Frequency Reference", "Forward Jog" or "Reverse Jog." are on.		6.00 Hz	S	292	–
d2: Frequency Upper and Lower Limits Use d2 parameters to configure the frequency reference limits.							
d2-01	Frequency Reference Upper Limit	Sets the frequency reference upper limit as a percentage of maximum output frequency (E1-04). Output speed is limited to this value even if the frequency reference is higher. This limit applies to all frequency reference sources.	0.0 to 110.0	100.0%	O	289	–
d2-02	Frequency Reference Lower Limit	Sets the frequency reference lower limit as a percentage of maximum output frequency (E1-04). Output speed is limited to this value even if the frequency reference is lower. This limit applies to all frequency reference sources.	0.0 to 110.0	0.0%	O	28A	–
d3: Jump Frequency Use d3 parameters to configure the drive Jump Frequency settings.							

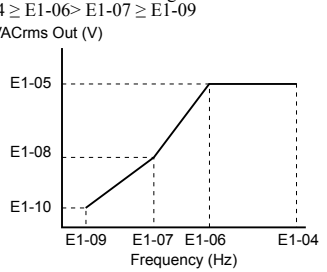
No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
d3-01	Jump Frequency 1	d3-01 to d3-04 allow programming of three prohibited frequency reference points for eliminating problems with resonant vibration of the motor/ machine. This feature does not eliminate the selected frequency values, but accelerates and decelerates the motor through the prohibited bandwidth. The parameters must be according to the rule d3-01 ≥ d3-02 .	0.0 to 400.0	0.0 Hz	O	294	–
d3-02	Jump Frequency 2			0.0 Hz	O	295	–
d3-04	Jump Frequency Width	This parameter sets the dead-band width around each selected prohibited frequency reference point. The bandwidth becomes the designated Jump frequency, plus or minus d3-04.	0.0 to 20.0	1.0 Hz	O	297	–
d4: Frequency Reference Hold Use d4 parameters to configure the drive frequency reference hold function.							
d4-01	Frequency Reference Hold Function Selection	Determines if the frequency reference or frequency reference bias is saved when the Run command is removed or the power goes off. 0: Disabled 1: Enabled This parameter is effective when the multi-function inputs “Accel/Decel Ramp Hold” or “Up/Down” commands are selected (H1-□□ = A or 10/11).	0, 1	0	O	298	–

<1> Parameter can be changed during run.

<2> Range upper limit is dependent on parameters E1-04, Maximum Output Frequency, and d2-01, Frequency Reference Upper Limit.

◆ E: Motor Parameters

E parameters set V/f characteristics and motor-related data.

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
E1: V/f Pattern Characteristics Use E1 parameters to set V/f characteristics for the motor.							
E1-01 <1>	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.*	155 to 255	200	S	300	*107*
E1-03	V/f Pattern Selection	F: Custom V/f. E1-04 through E1-10 settings define the V/f pattern.	F	F	O	302	—
E1-04	Maximum Output Frequency	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: E1-04 ≥ E1-06> E1-07 ≥ E1-09  	40.0 to 400.0	60 Hz <4>	S	303	*107*
E1-05 <1>	Maximum Output Voltage		0.0 to 255.0	200 V	S	304	*107*
E1-06	Base Frequency		0.0 to E1-04	60 Hz <4>	O	305	*107*
E1-07	Middle Output Frequency		0.0 to E1-04	3.0 Hz <4>	O	306	*107*
E1-08 <1>	Middle Output Frequency Voltage		0.0 to 255.0	16.0 V	O	307	*107*
E1-09	Minimum Output Frequency		0.0 to E1-04	1.5 Hz <4>	S	308	*107*
E1-10 <1>	Minimum Output Frequency Voltage		0.0 to 255.0	12.0 V	O	309	*107*
E2: Motor Parameters Use E2 parameters to set motor-related data.							
E2-01	Motor Rated Current	Sets the motor nameplate full load current in amperes. **Note:** Set E2-03 (Motor No-Load Current) before making changes to E2-01. Setting E2-01 < E2-03 will trigger an oPE02 error.	10 to 200% of drive rated current	<2>	S	30E	*110*

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
E2-02	Motor Rated Slip	Sets the motor rated slip in Hertz.	0.00 to 20.00	<2>	O	30F	110
E2-03	Motor No-Load Current	Sets the magnetizing current of the motor in amperes. **Note:** Set E2-03 (Motor No-Load Current) before making changes to E2-01. Setting E2-01 < E2-03 will trigger an oPE02 error.	0 to less than E2-01	<2>	O	310	110
E2-05	Motor Line-to-Line Resistance	Sets the phase-to-phase motor resistance in ohms.	0.000 to 65.000 <3>	<2>	O	312	–

<1> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

<2> Default setting value is dependent on parameter o2-04, Drive Model Selection and C6-01, Drive Duty Selection.

<3> Setting range becomes 0.00 to 130.00 for drives 0.2 kW and smaller.

<4> The default value is for the following localized drives: Japan (Model code: CIMR-JA☐A) and Asia (Model code: CIMR-JT☐A) .*Refer to China Localized Drive Default Values on page 246* for the default values of China localized (Model code: CIMR-JB☐A) drives.

◆ H Parameters: Multi-Function Terminals

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

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
H1: Multi-Function Digital Input H1 parameters to assign functions to the multi-function digital input terminals. Unused terminals should be set to "F".							
H1-01	Multi-Function Digital Input Terminal S1 Function Selection	Assigns a function to the multi-function digital inputs. Refer to H1 Multi-Function Digital Input Selections on page *232* for a description of setting values.	1 to 67	40	O	438	–
H1-02	Multi-Function Digital Input Terminal S2 Function Selection			41	O	439	–
H1-03	Multi-Function Digital Input Terminal S3 Function Selection		0 to 67	24	O	400	–
H1-04	Multi-Function Digital Input Terminal S4 Function Selection			14	O	401	–
H1-05	Multi-Function Digital Input Terminal S5 Function Selection			3 (0) <1>	O	402	–

<1> Parenthetical value is the default when parameter A1-03 = 3330 3-Wire Initialization.

H1 Multi-Function Digital Input Selections			
H1-□□ Setting	Function	Description	Page
0	3-Wire Sequence	Closed: Reverse rotation (only if the drive is set up for 3-Wire sequence)	–
1	LOCAL/REMOTE Selection	Open: REMOTE, Run and frequency reference source set in b1-01/02 Closed: LOCAL, LED operator is run and reference source	–
2	Serial Communication Reference Selection	Open: REMOTE, Run and frequency reference source set in b1-01/02 Closed: MEMOBUS/Modbus Communication	–
3	Multi-Step Speed Reference 1	Used to select Multi-Step Speeds set in d1-01 to d1-08	–
4	Multi-Step Speed Reference 2		–
5	Multi-Step Speed Reference 3		–
6	Jog Reference Selection	Open: Selected speed reference Closed: Jog Frequency reference (d1-17). Jog has priority over all other reference sources.	–
7	Accel/Decel Time 1	Used to switch between Accel/Decel Time 1 and 2	–
8	Baseblock Command (N.O.)	Open: Normal operation Closed: No drive output	–
9	Baseblock Command (N.C.)	Open: No drive output Closed: Normal operation	–
A	Accel/Decel Ramp Hold	Closed: The drive pauses during acceleration or deceleration and maintains the output frequency.	–
F	Not used	Select this setting when not using the terminal or when using the terminal in a pass-through mode.	–
10	Up Command	Open: Maintains the current frequency reference Closed: Increases or decreases the current frequency reference. Ensure that the increase and decrease commands are set in conjunction with one another.	–
11	Down Command		–
14	Fault Reset	Closed: Resets faults if the cause is cleared and the Run command is removed.	–
15	Fast-Stop (N.O.)	Closed: Decelerates at the Fast-Stop time C1-09. To restart the Fast-Stop input must be released and Run must be cycled.	–
17	Fast-stop (N.C.)	Open: Decelerates according to C1-09 (Fast-stop Time)	–

H1 Multi-Function Digital Input Selections			
H1-□□ Setting	**Function**	**Description**	**Page**
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)	–
40	Forward Run Command (2-Wire sequence)	Open: Stop Closed: Forward run	–
41	Reverse Run Command (2-Wire sequence)	Open: Stop Closed: Reverse run	–
61	External Search Command 1	Closed: Activates Current Detection Speed Search from the max. output frequency (E1-04)	–
62	External Search Command 2	Closed: Activates Current Detection Speed Search from the frequency reference	–
67	Communications Test Mode	Tests the MEMOBUS/Modbus RS-422/485 interface.	–

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
H2: Multi-Function Digital Output MA-MB-MC Use H2 parameters to assign functions to the multi-function digital output MA-MB-MC.							
H2-01	Terminal MA, MB and MC Function Selection (relay)	Refer to H2 Multi-Function Digital Output Settings on page *233* for a description of setting values.	0 to 13D	E	O	40B	*111*

H2 Multi-Function Digital Output Settings			
H2-01 Setting	**Function**	**Description**	**Page**
0	During Run	Closed: A Run command is active or voltage is output	–
1	Zero Speed	Closed: Output frequency is 0	–
2	Speed Agree 1	Closed: Output frequency equals the speed reference (plus or minus 2 Hz hysteresis)	–
4	Frequency Detection 1	Closed: Output frequency is less than or equal to the value in L4-01 with 2 Hz hysteresis	–

H2 Multi-Function Digital Output Settings			
H2-01 Setting	**Function**	**Description**	**Page**
5	Frequency Detection 2	Closed: Output frequency is greater than the value in L4-01 with 2 Hz hysteresis	–
6	Drive Ready	Closed: Drive Ready. The drive is powered up, not in a fault state, and in the Drive mode	–
7	DC Bus Undervoltage	Closed: DC bus voltage is below the Uv trip level	–
8	During Baseblock (N.O.)	Closed: There is no output voltage	–
B	Torque Detection 1 (N.O.)	Closed: Output current/torque exceeds the torque value set in parameter L6-02 for longer than the time set in parameter L6-03	–
E	Fault	Closed: Fault occurred (other than CPF00 and CPF01)	–
F	Not used	Set this value when the terminal is not used, or when using the terminal in the pass-through mode	–
10	Minor Fault	Closed: An alarm is triggered	–
17	Torque Detection 1 (N.C.)	Open: When the output current exceeds the value set in parameter L6-02 for more time than is set in parameter L6-03	–
1A	Reverse Direction	Closed: Drive is running in the reverse direction	–
1E	Restart Enabled	Closed: An automatic restart is performed	–
3C	LOCAL/REMOTE Status	Closed: LOCAL Open: REMOTE	–
3D	Speed Search	Closed: Speed search is being executed	–
100 to 102; 104 to 108; 10B, 10E, 110, 117, 11A, 11E, 13C, 13D	H2 Parameter Functions Reversed Output Switching of 0 to 13D	Reverse 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 Examples: Setting “108” reverses the output of “During baseblock”, which is setting value 08 Setting “13C” reverses the output of “LOCAL/REMOTE Status”, which is setting “3C”	–

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
H3: Analog Input A1 Use H3 parameters to set the analog input terminal A1.							
H3-01	Terminal A1 Signal Level Selection	Sets the input level for terminal A1. 0: 0 to +10 V (lower limit) 1: 0 to +10 V (no lower limit) 2: 4 to 20 mA 3: 0 to 20 mA	0 to 3	0	O	410	–
H3-03 <*1*>	Terminal A1 Gain Setting	Sets the level of the input value when 10 V (20 mA) is input at terminal A1.	-999.9 to 999.9	100.0%	O	411	–
H3-04 <*1*>	Terminal A1 Bias Setting	Sets the level of the input value when 0 V (0 or 4 mA) is input at terminal A1.	-999.9 to 999.9	0.0 %	O	412	–

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
H3-13	Analog Input Filter Time Constant	Sets the primary delay filter time constant for terminal A1 or potentiometer (optional). Used for noise filtering.	0.00 to 2.00	0.03 s	O	41B	–

<1> Parameter can be changed during run.

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
H4: Multi-Function Analog Output AM Use H4 parameters to configure the multi-function analog output terminal AM.							
H4-01	Multi-Function Analog Output Terminal AM	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. When using this terminal in through mode or when not using it at all, set "000" or "031".	000 to 999	102	O	41D	*111*
H4-02 *<1>*	Multi-Function Analog Output Terminal AM Gain	Sets terminal AM output level when selected monitor is at 100%. Maximum output voltage is 10 V.	-999.9 to 999.9	100.0 %	S	41E	*111*
H4-03 *<1>*	Multi-Function Analog Output Terminal AM Bias	Sets terminal AM output level when selected monitor is at 0%.	-999.9 to 999.9	0.0%	O	41F	*111*
H5: MEMOBUS/Modbus Communications Use H5 Parameters to connect the drive to a MEMOBUS/Modbus network (communication option required).							
H5-01 *<2>*	Drive Slave Address	Selects drive slave number (address) for MEMOBUS/Modbus communication. Cycle power for the setting to take effect.	0 to FF	1F	O	425	–
H5-02	Comm. Speed Selection	Selects the baud rate for MEMOBUS/Modbus communication. Cycle power for the setting to take effect. 0 : 1200 bps 1 : 2400 bps 2 : 4800 bps 3 : 9600 bps 4 : 19200 bps 5 : 38400 bps	0 to 5	3	O	426	–
H5-03	Comm. Parity Selection	Selects the communication parity for MEMOBUS/Modbus communication. Cycle power for the setting to take effect. 0: No parity 1: Even parity 2: Odd parity	0 to 2	0	O	427	–

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
H5-04	Stopping Method After Comm. Error	Selects the stopping method when a communication time-out fault (CE) is detected. 0: Ramp to stop 1: Coast to stop 2: Fast-stop 3: Alarm only	0 to 3	3	O	428	–
H5-05	Comm. Fault Detection Selection	Enables or disables the communications timeout fault (CE). 0: Disabled - A communication loss will not cause a communication fault. 1: Enabled - If communication is lost for more than 2 seconds, a CE fault will occur.	0, 1	1	O	429	–
H5-06	Drive Transmit Wait Time	Set the wait time between receiving and sending data.	10 to 65	10 ms	O	42A	–
H5-07	RTS Control Selection	Selects "request to send" (RTS) control: 0: Disabled - RTS is always on. 1: Enabled - RTS turns on only when sending.	0, 1	1	O	42B	–
H5-12	Run Command Method Selection	0: FWD/STOP, REV/STOP Method 1: RUN/STOP, FWD/REV Method	0, 1	0	O	43D	–
H5-13	MEMOBUS Freq. Reference and Freq. Monitor Unit	0: 0.1 Hz/1 1: o1-03 based 2: 100%/30000 3: 0.1%/1	0 to 3	0	O	43E	–

<1> Parameter can be changed during run.

<2> If this parameter is set to 0, the drive will be unable to respond to MEMOBUS/Modbus commands.

Note: Cycle power to the drive to enable MEMOBUS/Modbus settings.

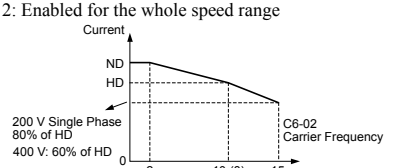
◆ L: Protection Function

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

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
L1: Motor Protection Functions Use L1 parameters to configure motor protective functions.							
L1-01	Motor Overload Protection Selection	Sets the motor thermal overload protection (oL1) based on the cooling capacity of the motor. 0: Disabled 1: General Purpose Motor (Standard Fan-Cooled) 2: Drive Dedicated Motor with a Speed Range of 1:10 **NOTICE:** When multiple motors are used the drive may not be able to provide protection, even if it is enabled in L1-01. Set L1-01 to "0" and ensure each motor has a thermal relay installed.	0 to 2	1	S	480	*113*
L1-02	Motor Overload Protection Time	Sets the motor thermal overload protection (oL1) time. A larger L1-02 time will increase the time for an oL1 fault to occur. This parameter does not typically require adjustment. Should be set in accordance with the overload tolerance of the motor.	0.1 to 5.0	1.0 min	O	481	*113*
L1-13	Continuous Electrothermal Operation Selection	Determines whether or not to hold the electrothermal value when the power supply is interrupted. 0: Disabled 1: Enabled	0, 1	1	O	46D	–
L2: Momentary Power Loss Use L2 parameters to configure drive functions for momentary power loss conditions.							
L2-01	Momentary Power Loss Operation Selection	Enables and disables the momentary power loss function. 0: Disabled - Drive trips on (Uv1) fault when power is lost. 1: Power Loss Ride-Thru Time - Drive will restart if power returns within the Power Loss Ride-Thru Time. 2: CPU Power Active - Drive will restart if power returns as long as the CPU is working.	0 to 2	0	O	485	–
L3: Stall Prevention Function Use L3 parameters to configure the Stall Prevention function.							

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
L3-01	Stall Prevention Selection during Acceleration	Selects the Stall Prevention method used to prevent excessive current during acceleration. 0: Disabled - Motor accelerates at active acceleration rate. The motor may stall if load is too heavy or accel time is too short. 1: General Purpose - When output current exceeds L3-02 level, acceleration stops. Acceleration will continue when the output current level falls below the L3-02 level.	0, 1 <1>	1	O	48F	–
L3-02	Stall Prevention Level during Acceleration	Used when L3-01 = 1. 100% is equal to the drive rated current. Decrease the set value if stalling or excessive current occurs with default setting.	0 to 150	<2>	O	490	–
L3-04	Stall Prevention Selection during Deceleration	When using a braking resistor, use setting "0". 0: Disabled - The drive decelerates at the active deceleration rate. If the load is too large or the deceleration time is too short, an ov fault may occur. 1: General Purpose - The drive decelerates at the active deceleration rate, but if the main circuit DC bus voltage reaches the Stall Prevention level, deceleration will stop. Deceleration will continue once the DC bus level drops below the Stall Prevention level. 4: Overexcitation Deceleration - Decelerates with the flux level determined by n3-13 (Overexcitation Gain).	0, 1, 4	1	S	492	–
L3-05	Stall Prevention Selection during Run	Selects the Stall Prevention method to use to prevent drive faults during run. 0: Disabled - Drive runs a set frequency. A heavy load may cause the drive to trip on an oC or oL fault. 1: Decel Time 1 - The drive will decelerate at Decel Time 1 (C1-02) if the output current exceeds the level set by L3-06. Once the current level drops below the L3-06 level, the drive will accelerate back to its frequency reference at the active acceleration rate. 2: Decel Time 2 - Same as setting 1 except the drive decelerates at Decel Time 2 (C1-04). When output frequency is 6 Hz or less, Stall Prevention during run is disabled regardless of the setting in L3-05.	0 to 2	1	O	493	–
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. Decrease the set value if stalling or excessive current occurs with the default settings. Upper level is determined by C6-01 and L8-38.	30 to 150	<2>	O	494	–
L4: Frequency Detection Use L4 parameters to configure frequency detection operation.							
L4-01	Speed Agreement Detection Level	These parameters configure the multi-function output (H2- 01 = 2, 4, 5) settings "Speed Agree 1", "Frequency Detection 1," and "Frequency detection 2".	0.0 to 400.0	0.0 Hz	O	499	–

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
L4-07	Speed Agreement Detection Selection	0: No detection during baseblock. 1: Detection always enabled.	0, 1	0	O	470	–
L5: Fault Reset Use L5 parameters to configure Automatic Restart after fault.							
L5-01	Number of Auto Restart Attempts	Sets the counter for the number of times the drive attempts to restart when one of the following faults occurs: oC, ov, PF, rH, oL1, oL2, oL3, Uv1. When the drive operates without fault for 10 minutes, the counter will be reset.	0 to 10	0	O	49E	–
L6: Overtorque Detection Use L6 parameters to configure overtorque detection.							
L6-01	Torque Detection Selection 1	Selects the overtorque operation. Overtorque is determined by the settings in parameters L6-02 and L6-03. The multi-function output settings (H2- 01= B and 17) are also active if programmed. 0: Disabled 1: oL3 at Speed Agree - Alarm (overtorque detection only active during Speed Agree and operation continues after detection). 2: oL3 at RUN - Alarm (overtorque detection is always active and operation continues after detection). 3: oL3 at Speed Agree - Fault (overtorque detection only active during Speed Agree and drive output will shut down on an oL3 fault). 4: oL3 at RUN - Fault (overtorque detection is always active and drive output will shut down on an oL3 fault).	0 to 4	0	O	4A1	–
L6-02	Torque Detection Level 1	Sets the overtorque detection level. 100% is equal to the motor rated current.	0 to 300	150 %	O	4A2	–
L6-03	Torque Detection Time 1	Sets the length of time an overtorque condition must exist before Torque Detection is triggered.	0.0 to 10.0	0.1 s	O	4A3	–
L8: Hardware Protection Use L8 parameters to configure hardware protection functions.							
L8-01	Internal Dynamic Braking Resistor Protection Selection (ERF type)	Selects the Braking resistor when using a 3% duty cycle heatsink mounted braking resistor. This parameter does not enable or disable the braking transistor of the drive. 0: Resistor overheat protection disabled 1: Resistor overheat protection enabled	0, 1	0	O	4AD	–

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
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 **Note:** This parameter is disabled in 200 V single-phase drives.	0, 1	<4>	O	4B1	–
L8-10	Heatsink Cooling Fan Operation Selection	Controls the heatsink cooling fan operation. 0: Fan On-Run Mode - Fan will operate only when the drive is running and for 60 seconds after stop. 1: Fan always on - Cooling fan operates whenever the drive is powered up.	0, 1	0	O	4B6	–
L8-12	Ambient Temperature Setting	Used to input the ambient temperature. This value adjusts the drive oL2 detection level.	-10 to 50	30 °C	O	4B8	–
L8-18	Soft CLA Selection	Selects the software current limit function. Typically no adjustment is required. 0: Disabled 1: Enabled	0, 1	1	O	4BE	–
L8-35 <3>	Installation Method Selection	Selects the installation type: 0: IP20/IP00 Drive 1: Side-by-Side Mounting 2: NEMA Type 1 Drive 3: Finless Drive or External Heatsink Installation	0 to 3	<4>	O	4EC	–
L8-38	Carrier Frequency Reduction	Provides protection to the IGBTs by reducing the carrier frequency at low speeds. 0: Disabled 1: Enabled below 6 Hz 2: Enabled for the whole speed range 	0 to 2	1	O	4EF	–

<1> When enabled, the drive stops accelerating when it exceeds the value of L3-02, Stall Prevention Level. The drive decelerates after 100 ms and begins accelerating again after restoring the current level.

<2> Default setting value is 120% when C6-01 is set to 1 (ND) and 150% when C6-01 is set to 0 (HD).

<3> This parameter is not reset to the default value when the drive is reinitialized using A1-03.

<4> Regional default settings:
Setting 0: Japan (Model code: CIMR-JA☐A) and Asia (Model code: CIMR-JT☐A)
Setting 1: China: (Model code: CIMR-JB☐A)

◆ n: Advanced Performance Set-Up

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

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
n1: Hunting Prevention Use n1 parameters to configure hunting prevention operation.							
n1-02	Hunting Prevention Gain Setting	Sets the gain for the Hunting Prevention Function. 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.	0.00 to 2.50	1.00	O	581	–
n3: Overexcitation Braking Use n3 parameters to configure the overexcitation braking function.							
n3-13	Overexcitation Deceleration Gain	Applies a gain to the V/f pattern during deceleration (L3-04 = 4). Returns to normal values after ramp to stop or at re-acceleration. To increase the braking power of overexcitation, increase the gain by 1.25 to 1.30.	1.00 to 1.40	1.10	O	531	–

◆ o: Operator Related Parameters

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

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
o1: Display Settings Use o1 parameters to configure the digital operator display.							
o1-02 <1>	User Monitor Selection After Power Up	Selects the monitor to display upon power-up. 1: Frequency Reference (U1-01) 2: Forward/Reverse 3: Output Frequency (U1-02) 4: Output Current (U1-03)	1 to 4	1	O	501	–
o1-03	Digital Operator Display Selection	Sets the units to display the frequency reference and output frequency. 0: 0.01 Hz 1: 0.01% (100% = E1-04)	0, 1	0	O	502	–
o2: Operator Keypad Functions Use o2 parameters to configure LED digital operator key functions.							
o2-02	STOP Key Function Selection	Determines if the STOP key on the digital operator will stop the drive when operating from the external terminals or via serial communication. 0: Disabled 1: Enabled	0, 1	1	O	506	–

No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
o2-04	Drive Model Selection	Sets the drive model. This parameter only needs to be set when installing a new control board. Do not change for other reason.	0 to FF	dep. on drive spec.	O	508	–
o2-05	Frequency Reference Setting Method Selection	Selects if the ENTER key must be pressed when inputting the frequency reference by the operator keypad. 0: Data/Enter key must be pressed to enter a frequency reference. 1: Data/Enter key is not required. The frequency reference is adjusted by the UP and DOWN keys. **Note:** When o2-05 is set to 1, the power supply to the drive must remain on for at least 5 seconds after making changes to the frequency reference.	0, 1	0	O	509	–
o2-06	Operation Selection when Digital Operator is Disconnected	Sets drive action when the digital operator is removed in LOCAL mode or with b1-02 = 0 (valid for optional remote operator only). 0: The drive will continue operation 1: The drive will trigger a fault (oPr) and the motor will coast to stop	0, 1	0	O	50A	–
o2-09	–	Factory use.	–	–	–	–	–
o3: Copy Function Use o3 parameters to Read, Copy and Verify the parameter settings to and from the drive.							
o3-01	Copy Function Selection	Selects the copy function operation. 0: No action 1: READ - All parameters are read from the drive and stored in the LED operator. 2: COPY - All parameters are copied from the LED operator to the drive. 3: VERIFY - Parameter settings in the drive are compared to those in the LED operator. **Note:** When using the copy function, the drive model number (o2-04) and the software number (U1-26) must match or an error will occur.	0 to 3	0	O	515	–
o3-02	Copy Allowed Selection	Locks the READ operation to prevent accidental overwriting of the data stored in the LED operator. 0: READ operation prohibited 1: READ operation allowed	0, 1	0	O	516	–
o4: Maintenance Period Use o4 parameters to perform maintenance.							
o4-01	Accumulated Operation Time Setting	Sets the value for the cumulative operation time of the drive in units of 10 h.	0 to 9999	0	O	50B	–
o4-02	Accumulated Operation Time Selection	Determines, how the cumulative operation time (U4-01) is counted. 0: Logs power-on time 1: Logs operation time when the drive output is active (output operation time).	0, 1	0	O	50C	–

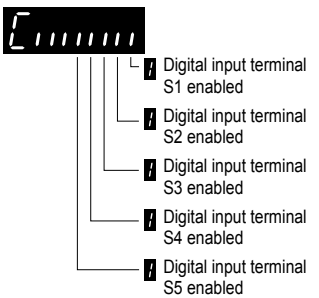
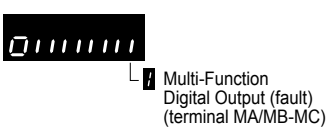
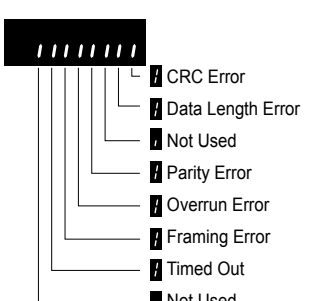
No.	Name	Description	Range	Def.	Mode	Addr. Hex	Pg.
o4-03	Cooling Fan Operation Time Setting	Sets the value of the fan operation time in units of 10 h.	0 to 9999	0	O	50E	–
o4-05	Capacitor Maintenance Setting	Sets the value of the capacitor maintenance time monitor U4-05.	0 to 150	0%	O	51D	–
o4-07	Soft Charge Bypass Relay Maintenance Setting	Sets the value of the Soft Charge Bypass Relay Maintenance monitor U4-06.	0 to 150	0%	O	523	–
o4-09	IGBT Maintenance Setting	Sets the value of the IGBT Maintenance monitor U4-07.	0 to 150	0%	O	525	–
o4-11	U2 Initialize Selection	0: U2-□□ and U3-□□ monitor data are not reset when the drive is initialized using A1-03. 1: U2-□□ and U3-□□ monitor data are reset when the drive is initialized using A1-03.	0, 1	0	O	510	–

<1> Parameter can be changed during run.

◆ U: Monitors

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

No.	Name	Description	Analog Output Level	Unit	Mode	Addr. Hex
U1: Operation Status Monitors Use U1 monitors to display the operation status of the drive.						
U1-01	Frequency Reference	Monitors the frequency reference	10 V: Max frequency	0.01 Hz	O	40
U1-02	Output Frequency	Displays the output frequency. Display units are determined by o1-03.	10 V: Max frequency	0.01 Hz	O	41
U1-03	Output Current	Displays the output current.	10 V: Drive rated current	0.01 A <1>	O	42
U1-06	Output Voltage Reference	Displays the output voltage.	10 V: 200 Vrms (400 Vrms)	0.1 V	O	45
U1-07	DC Bus Voltage	Displays the DC bus voltage.	10 V: 400 V (800 V)	1 V	O	46

No.	Name	Description	Analog Output Level	Unit	Mode	Addr. Hex
U1-10	Input Terminal Status	Displays the input terminal status.  	No output signal available	–	O	49
U1-11	Output Terminal Status	Displays the output terminal status.  	No output signal available	–	O	4A
U1-13	Terminal Input Level	Displays analog input A1 level: 100% when input is 10 V or 20 mA.	10 V/20 mA: 100%	0.1%	O	4E
U1-19	MEMOBUS/ Modbus Error Code	Displays the contents of a MEMOBUS/Modbus error.  	No output signal available	–	O	66
U1-25	Software No. (ROM)	ROM ID	No signal output avail.	–	O	4D
U1-26	Software No. (Flash)	Flash ID	No signal output avail.	–	O	5B

No.	Name	Description	Analog Output Level	Unit	Mode	Addr. Hex
U2: Fault History Use U2 monitors to view fault history data.						
U2-01	Current Fault	Display of the current fault.	No signal output avail.	–	O	80
U2-02	Previous Fault	Display of the previous fault. o4-11 resets the values for U2-02	No signal output avail.	–	O	81
U4: Maintenance Monitors Use U4 monitors to display drive maintenance information.						
U4-01	Accumulated 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 avail.	1 h	O	4C
U4-04	Cooling Fan Maintenance	Displays main cooling fan usage time as a percentage of the expected performance life. Parameter o4-03 can be used to reset this monitor.	No signal output avail.	1%	O	7E
U4-05 <2>	Capacitor Maintenance	Displays main circuit capacitor usage time as a percentage of the expected performance life. Parameter o4-05 can be used to reset this monitor.	No signal output avail.	1%	O	7C
U4-06 <2>	Soft Charge Bypass Relay Maintenance	Displays the soft charge bypass relay maintenance time as a percentage of the estimated product life. Parameter o4-07 can be used to reset this monitor.	No signal output avail.	1%	O	7D6
U4-07 <2>	IGBT Maintenance	Displays IGBT usage time as a percentage of expected performance life. Parameter o4-09 can be used to reset this monitor.	No signal output avail.	1%	O	7D7
U4-08	Heatsink Temperature	Displays the heatsink temperature.	10 V: 100 °C	1 °C	O	68
U4-09	LED Check	Lights all segments of the LED to verify that the display is working properly.	No signal output avail.	–	O	3C
U4-13	Peak Hold Current	Displays the peak hold current during run.	No signal output avail.	0.01 A <1>	O	7CF

<1> U1-03 and U4-13 display monitor contents in amp units. When reading the value of these monitors via MEMOBUS/Modbus, a value of 8192 is equal to 100% of the drive rated output current.

<2> When this value reaches 100%, the maintenance period has been reached for the component in question and the drive is at risk of faulting out due to component failure. Periodically check the maintenance monitors to avoid this situation.

B.3 China Localized Drive Default Values

Table B.2 Default Values of the China Localized Drive: CIMR-JB□□

Parameter	Description	Default
E1-04	Maximum Output Frequency	50.0 Hz
E1-06	Base Frequency	50.0 Hz
E1-07	Middle Output Frequency	2.5 Hz
E1-09	Minimum Output Frequency	1.3 Hz

B.4 Defaults by Drive Model and Duty Rating ND/HD

Table B.3 Single-Phase, 200 V Class Drives Default Settings by Drive Capacity and ND/HD Settings

No.	Description	Unit	Default Settings					
–	Model CIMR-J□	–	BA0001		BA0002		BA0003	
o2-04	Drive Model Selection	Hex	30		31		32	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND
			0	1	0	1	0	1
–	Motor rated power	kW	0.1	0.18	0.25	0.37	0.55	0.75
C6-02	Carrier frequency	–	4	7	4	7	4	7
E2-01	Motor rated current	A	0.60	1.10	1.10	1.90	1.90	3.30
E2-02	Motor rated slip	Hz	2.50	2.60	2.60	2.90	2.90	2.50
E2-03	Motor no-load current	A	0.40	0.80	0.80	1.20	1.20	1.80
E2-05	Motor line-to-line resistance	Ω	35.98	20.56	20.56	9.84	9.842	5.156
–	Momentary power loss ride-through time	s	0.1	0.1	0.1	0.1	0.1	0.1
–	Mom. power loss Baseblock time	s	0.2	0.2	0.2	0.2	0.2	0.3

No.	Description	Unit	Default Settings			
–	Model CIMR-J□	–	BA0006		BA0010	
o2-04	Drive Model Selection	Hex	33		34	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND
			0	1	0	1
C6-02	Carrier frequency	–	4	7	3	7
E2-01	Motor rated current	A	3.30	6.20	6.20	8.50
E2-02	Motor rated slip	Hz	2.50	2.60	2.60	2.90
E2-03	Motor no-load current	A	1.80	2.80	2.80	3.00
E2-05	Motor line-to-line resistance	Ω	5.156	1.997	1.997	1.601
–	Momentary power loss ride-through time	s	0.2	0.2	0.3	0.3
–	Momentary power loss Baseblock time	s	0.3	0.4	0.4	0.5

Table B.4 Three-Phase, 200 V Class Drives Default Settings by Drive Capacity and ND/HD settings

No.	Description	Unit	Default Settings									
–	Model CIMR-J□	–	2A0001		2A0002		2A0004		2A0006		2A0008	
o2-04	Drive Model Selection	–	96 (60H)		97 (61H)		98 (62H)		99 (63H)		100 (64H)	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND	HD	ND	HD	ND
			0	1	0	1	0	1	0	1	0	1
–	Motor rated power	kW	0.1	0.18	0.25	0.37	0.55	0.75	1.1	1.1	1.1	1.5
C6-02	Carrier frequency	–	4	7	4	7	4	7	4	7	3	7
E2-01	Motor rated current	A	0.60	1.10	1.10	1.90	1.90	3.30	3.30	4.90	4.90	6.20
E2-02	Motor rated slip	Hz	2.50	2.60	2.60	2.90	2.90	2.50	2.50	2.60	2.60	2.60
E2-03	Motor no-load current	A	0.40	0.80	0.80	1.20	1.20	1.80	1.80	2.30	2.30	2.80
E2-05	Motor line-to-line resistance	Ω	35.98	20.56	20.56	9.84	9.842	5.156	5.156	3.577	3.577	1.997
L2-02	Momentary power loss ride-through time	s	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3
L2-03	Momentary power loss Baseblock time	s	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4

No.	Description	Unit	Default Settings							
–	Model CIMR-J□	–	2A0010		2A0012		2A0018		2A0020	
o2-04	Drive Model Selection	–	101 (65H)		102 (66H)		103 (67H)		104 (68H)	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND	HD	ND
			0	1	0	1	0	1	0	1
–	Motor rated power	kW	1.5	2.2	2.2	3.0	3.0	3.7	4.0	5.5
C6-02	Carrier frequency	–	3	7	3	7	3	7	3	7
E2-01	Motor rated current	A	6.20	8.50	8.50	11.40	11.40	14.00	14.00	19.60
E2-02	Motor rated slip	Hz	2.60	2.90	2.90	2.70	2.70	2.73	2.73	1.50
E2-03	Motor no-load current	A	2.80	3.00	3.00	3.70	3.70	4.50	4.50	5.10
E2-05	Motor line-to-line resistance	Ω	1.997	1.601	1.601	1.034	1.034	0.771	0.771	0.399
L2-02	Momentary power loss ride-through time	s	0.3	0.3	0.5	0.5	1	1	1	1
L2-03	Momentary power loss Baseblock time	s	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.7

Table B.5 Three-Phase 400 V Class Drives Default Settings by Drive Capacity and ND/HD Setting

No.	Description	Unit	Default Settings							
–	Model CIMR-J□	–	4A0001		4A0002		4A0004		4A0005	
o2-04	Drive Model Selection	Hex	91		92		93		94	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND	HD	ND
			0	1	0	1	0	1	0	1
–	Motor rated power	kW	0.37	0.37	0.55	0.75	1.1	1.5	1.5	2.2
C6-02	Carrier frequency	–	3	7	3	7	3	7	3	7
E2-01	Motor rated current	A	0.60	1.00	1.00	1.60	1.60	3.10	3.10	4.20
E2-02	Motor rated slip	Hz	2.50	2.90	2.90	2.60	2.60	2.50	2.50	3.00
E2-03	Motor no-load current	A	0.40	0.60	0.60	0.80	0.80	1.40	1.40	1.50
E2-05	Motor line-to-line resistance	Ω	83.94	38.20	38.198	22.459	22.459	10.1	10.1	6.495
–	Momentary power loss ride-through time	s	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3
–	Momentary power loss Baseblock time	s	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5

No.	Description	Unit	Default Setting					
–	Model CIMR-J□	–	4A0007		4A0009		4A0011	
o2-04	Drive Model Selection	–	95		96		97	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND
			0	1	0	1	0	1
–	Motor rated power	kW	2.2	3.0	3.0	4.0	4.0	5.5
C6-02	Carrier frequency	–	3	7	3	7	3	7
E2-01	Motor rated current	A	4.20	5.70	5.70	7.00	7.00	9.80
E2-02	Motor rated slip	Hz	3.00	2.70	2.70	2.70	2.70	1.50
E2-03	Motor no-load current	A	1.50	1.90	1.90	2.30	2.30	2.60
E2-05	Motor line-to-line resistance	Ω	6.495	4.360	4.360	3.333	3.333	1.595
–	Momentary power loss ride-through time	s	0.5	0.5	0.5	0.5	0.5	0.5
–	Momentary power loss Baseblock time	s	0.5	0.5	0.5	0.6	0.6	0.7

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Appendix: C

Standards Compliance

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

C.1 SECTION SAFETY.....252
C.2 EUROPEAN STANDARDS.....255
C.3 UL STANDARDS.....261
C.4 PRECAUTIONS FOR KOREAN RADIO WAVES ACT.....271
C.5 한국 전파법에 관한 주의사항.....272

C.1 Section Safety

DANGER

Electrical Shock Hazard

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

Failure to comply will result in death or serious injury.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

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

Always ground the motor-side grounding terminal.

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

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are off and measure the DC bus voltage level to confirm safe level.

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

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

⚠ WARNING

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

Failure to comply could result in death or serious injury.

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

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

Failure to comply could result in death or serious injury.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

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

Do not use an improper voltage source.

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

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

Do not use improper combustible materials.

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

Attach the drive to metal or other noncombustible material.

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

Failure to comply could result in fire and damage to the drive or injury to personnel. The device is suitable for use on a circuit capable of delivering not more than 31,000 RMS symmetrical amperes, 240 Vac maximum (200 V class) and 480 Vac maximum (400 V class) when protected by branch circuit protection devices specified in this manual.

NOTICE

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

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

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

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

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

Do not allow unqualified personnel to use the product.

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

Carefully review instruction manual TOBPC72060000 when connecting a braking option to the drive.

Do not modify the drive circuitry.

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

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

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

Failure to comply could result in damage to the drive.

C.2 European Standards



Figure C.1 CE Mark

The CE mark indicates compliance with European safety and environmental regulations and 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.

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

◆ CE Low Voltage Directive Compliance

This drive has been tested according to IEC61800-5-1:2007, and it fully complies with the Low Voltage Directive.

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

■ Area of Use

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

■ Installing Fuses on the Input Side

Always install input fuses that comply with UL standards to prevent the drive from short circuits. *Refer to Factory Recommended Drive Branch Circuit Protection on page 267* for the appropriate fuse based on the maximum input of the drive. *Refer to Heavy Duty and Normal Duty Ratings on page 210* for information on drive input and output currents.

■ 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 dealer or Yaskawa for instructions.

◆ EMC Guidelines Compliance

This drive is tested according to IEC61800-3:2004 and it complies with the EMC guidelines.

■ EMC Filter Installation

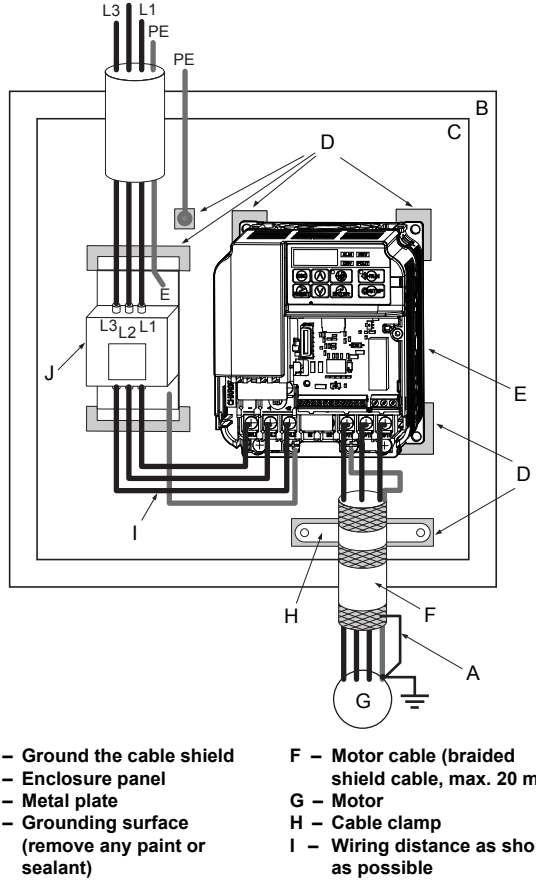
The following conditions must be met to ensure continued compliance with guidelines. *Refer to EMC Filters on page 259* for EMC filter selection.

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.
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.

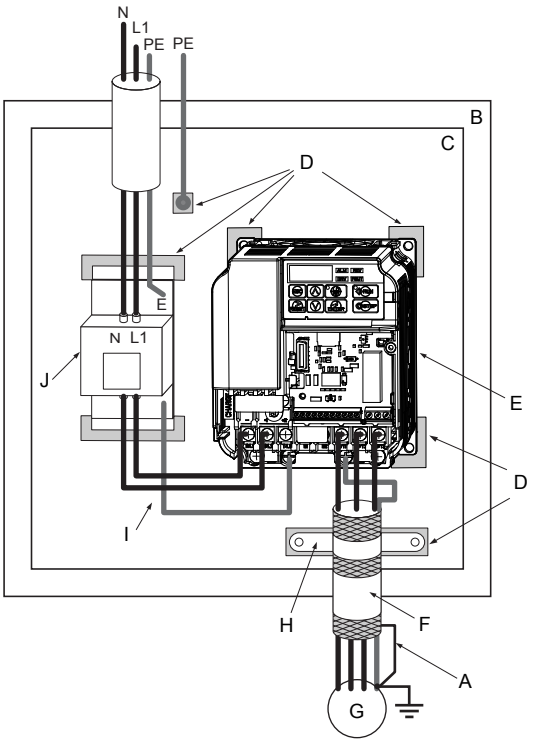
Three-Phase 200 V / 400 V Class



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. 20 m)
G – Motor
H – Cable clamp
I – Wiring distance as short as possible
J – EMC noise filter

Figure C.2 EMC Filter and Drive Installation for CE Compliance (Three-Phase 200 V / 400 V Class)

Single-Phase 200 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. 20 m)
G – Motor
H – Cable clamp
I – Wiring distance as short as possible
J – EMC noise filter

Figure C.3 EMC Filter and Drive Installation for CE Compliance (Single-Phase 200 V Class)

■ EMC Filters

The drive should be installed with the EMC filters listed below in order to comply with the EN 61800-3, category C1 requirements.

Table C.1 EN 61800-3 Category C1 Filters

Drive CIMR-J□	Filter Data (Manufacturer: Schaffner)						
	Type	Rated Current (A)	Weight (kg)	Dimensions [W x L x H] (mm)	Mounting Dimensions [Y x X] (mm)	Drive Mounting Screw A	Filter Mounting Screw
200 V Single-Phase Units							
BA0001	FS23638-10-07	10	0.44	71 x 169 x 45	51 x 156	M4	M5
BA0002	FS23638-10-07	10	0.44	71 x 169 x 45	51 x 156	M4	M5
BA0003	FS23638-10-07	10	0.44	71 x 169 x 45	51 x 156	M4	M5
BA0006	FS23638-20-07	20	0.75	111 x 169 x 50	91 x 156	M4	M5
BA0010	FS23638-20-07	20	0.75	111 x 169 x 50	91 x 156	M4	M5
200 V Three-Phase Units							
2A0001	FS23637-8-07	8	0.4	71 x 169 x 40	51 x 156	M4	M5
2A0002	FS23637-8-07	8	0.4	71 x 169 x 40	51 x 156	M4	M5
2A0004	FS23637-8-07	8	0.4	71 x 169 x 40	51 x 156	M4	M5
2A0006	FS23637-8-07	8	0.4	71 x 169 x 40	51 x 156	M4	M5
2A0008	FS23637-14-07	14	0.58	111 x 169 x 45	91 x 156	M4	M5
2A0010	FS23637-14-07	14	0.6	111 x 169 x 45	91 x 156	M4	M5
2A0012	FS23637-14-07	14	0.6	111 x 169 x 45	91 x 156	M4	M5
2A0018	FS23637-24-07	24	0.9	144 x 174 x 50	120 x 156	M4	M5
2A0020	FS23637-24-07	24	0.9	144 x 174 x 50	120 x 161	M4	M5
400 V Three-Phase Units							
4A0001	FS23639-5-07	5	0.5	111 x 169 x 45	91 x 156	M4	M5
4A0002	FS23639-5-07	5	0.5	111 x 169 x 45	91 x 156	M4	M5
4A0004	FS23639-5-07	5	0.5	111 x 169 x 45	91 x 156	M4	M5
4A0005	FS23639-10-07	10	0.7	111 x 169 x 45	91 x 156	M4	M5
4A0007	FS23639-10-07	10	0.7	111 x 169 x 45	91 x 156	M4	M5
4A0009	FS23639-10-07	10	0.7	111 x 169 x 45	91 x 156	M4	M5
4A0011	FS23639-15-07	15	0.9	144 x 174 x 50	120 x 161	M4	M5

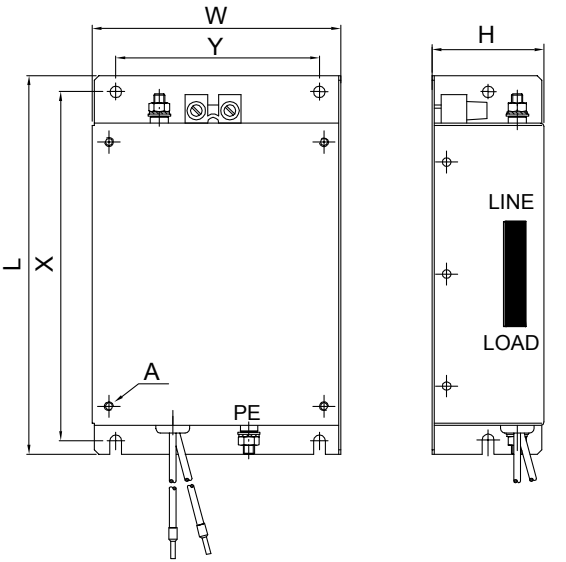


Figure C.4 EMC Filter Dimensions

■ DC Reactors for EN 61000-3-2 Compliance

Table C.2 DC Reactors for Harmonics Reduction

Drive Model CIMR-J□	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: Models not listed in the above table do not require a DC reactor for EMC compliance.

C.3 UL Standards

The UL/cUL mark applies to products in the United States and Canada indicates that UL has performed product testing and evaluation and determined that their stringent standards for product safety have been met. For a product to receive UL certification, all components inside that product must also receive UL certification.

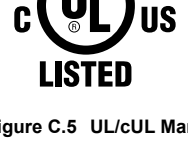


Figure C.5 UL/cUL Mark

◆ UL Standards Compliance

This drive is tested in accordance with UL standard UL508C, E131457 and complies with UL requirements. The following conditions 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).

■ Ambient Temperature

-10 to +40 °C (IP20/NEMA Type 1)

-10 to +50 °C (IP20/Open-Chassis)

■ Main Circuit Terminal Wiring

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

The wire gauges listed in *Table C.3*, *Table C.4*, and *Table C.5* are Yaskawa recommendations. Refer to local codes for proper wire gauge selections.

Table C.3 Wire Gauge and Torque Specifications

Model CIMR-J□BA	Terminal	For Japan and Asia <1>		For United States <2>		For Europe and China <3>		Screw Size	Tightening Torque N•m (lb.in.)
		Recomm. Gauge mm²	Wire Range mm²	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Recomm. Gauge mm²	Wire Range mm²		
0001 0002 0003	R/L1, S/L2, T/L3	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5	M3.5	0.8 to 1.0 (7.1 to 8.9)
	U/T1, V/T2, W/T3	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5		
	–, +1, +2	2	0.75 to 2	–	18 to 14	–	0.75 to 2.5		
	B1, B2	2	0.75 to 2	–	18 to 14	–	0.75 to 2.5		
	⏚	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5		
0006	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		
0010	R/L1, S/L2, T/L3	3.5	2 to 5.5	10	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	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		

<1> Gauges listed here are for use in Japan and Asia.

<2> Gauges listed here are for use in the United States.

<3> Gauges listed here are for use in Europe and China.

Table C.4 Wire Gauge and Torque Specifications

Model CIMR-J□2A	Terminal	For Japan and Asia <1>		For United States <2>		For Europe and China <3>		Screw Size	Tightening Torque N•m (lb.in.)
		Recomm. Gauge mm²	Wire Range mm²	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Recomm. Gauge mm²	Wire Range mm²		
0001 0002 0004 0006	R/L1, S/L2, T/L3	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5	M3.5	0.8 to 1.0 (7.1 to 8.9)
	U/T1, V/T2, W/T3	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5		
	–, +1, +2	2	0.75 to 2	–	18 to 14	–	0.75 to 2.5		
	B1, B2	2	0.75 to 2	–	18 to 14	–	0.75 to 2.5		
	⏚	2	0.75 to 2	14	18 to 14	2.5	0.75 to 2.5		
0008 0010	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		
0012	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		
	⏚	2	2 to 5.5	10	14 to 10	2.5	2.5 to 6		
0018	R/L1, S/L2, T/L3	3.5	2 to 5.5	10	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	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		

Model CIMR-J□2A	Terminal	For Japan and Asia <1>		For United States <2>		For Europe and China <3>		Screw Size	Tightening Torque N•m (lb.in.)
		Recomm. Gauge mm²	Wire Range mm²	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Recomm. Gauge mm²	Wire Range mm²		
0020	R/L1, S/L2, T/L3	5.5	2 to 5.5	10	14 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	2 to 5.5	10	14 to 10	2.5	2.5 to 6		
	–, +1, +2	5.5	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	4	2.5 to 6		

<1> Gauges listed here are for use in Japan and Asia.

<2> Gauges listed here are for use in the United States.

<3> Gauges listed here are for use in Europe and China.

Table C.5 Wire Gauge and Torque Specifications

Model CIMR-J□4A	Terminal	For Japan and Asia <1>		For United States <2>		For Europe and China <3>		Screw Size	Tightening Torque N•m (lb.in.)
		Recomm. Gauge mm²	Wire Range mm²	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Recomm. Gauge mm²	Wire Range mm²		
0001 0002 0004	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	14	14 to 10	2.5	2.5 to 6		
0005 0007 0009	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		

Model CIMR-J□4A	Terminal	For Japan and Asia <1>		For United States <2>		For Europe and China <3>		Screw Size	Tightening Torque N•m (lb.in.)
		Recomm. Gauge mm²	Wire Range mm²	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Recomm. Gauge mm²	Wire Range mm²		
0011	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		
	⏚	2	2 to 5.5	10	14 to 10	2.5	2.5 to 6		

<1> Gauges listed here are for use in Japan and Asia.

<2> Gauges listed here are for use in the United States.

<3> Gauges listed here are for use in Europe and China.

Note: Use crimp insulated terminals or insulated tubing for wiring these connections. Wires should have a continuous maximum allowable temperature of 75 °C 600 V UL approved vinyl sheathed insulation. Ambient temperature should not exceed 30 °C.

Yaskawa recommends crimp terminals made by JST and Tokyo DIP for the insulation cap. *Table C.6* matches drives models with crimp terminals and insulation caps. Orders can be placed with a Yaskawa representative or directly with the Yaskawa sales department.

Table C.6 Closed-Loop Crimp Terminal Size

Drive Model CIMR-J□	Wire Gauge AWG		Terminal Screws	Crimp Terminal Model No.	Tool		Insulation Cap Model No.	Code <2>
	R/L1, S/L2, T/L3	U/T1, V/T2, W/T3			Machine No.	Die Jaw		
200 V Class Single-Phase Drives								
BA0001 BA0002 BA0003	18		M3.5	R1.25-3.5	YA-4	AD-900	TP-003	100-066-217
	16							
	14 <1>			R2-3.5				100-066-218
BA0006	14 <1>		M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12			R5.5-4			TP-005	100-054-029
	10							
BA0010	14	14 <1>	M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12 <1>	12		R5.5-4			TP-005	100-054-029
	10	10						

Drive Model CIMR-J□	Wire Gauge AWG		Terminal Screws	Crimp Terminal Model No.	Tool		Insulation Cap Model No.	Code <2>
	R/L1, S/L2, T/L3	U/T1, V/T2, W/T3			Machine No.	Die Jaw		
200 V Class Three-Phase Drives								
2A0001 2A0002 2A0004 2A0006	18		M3.5	R1.25-3.5	YA-4	AD-900	TP-003	100-066-217
	16							
	14 <1>			R2-3.5				100-066-218
2A0008 2A0010	14 <1>		M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12			R5.5-4			TP-005	100-054-029
	10							
2A0012	14 <1>		M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12			R5.5-4			TP-005	100-054-029
	10							
2A0018	14		M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12 <1>			R5.5-4			TP-005	100-054-029
	10							
2A0020	14	14	M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12	12 <1>		R5.5-4			TP-005	100-054-029
	10 <1>	10						
400 V Class Single-Phase Drives								
4A0001 4A0002 4A0004	14 <1>		M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12			R5.5-4			TP-005	100-054-029
	10							
4A0005 4A0007 4A0009	14 <1>		M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12			R5.5-4			TP-005	100-054-029
	10							
4A0011	14 <1>		M4	R2-4	YA-4	AD-900	TP-003	100-054-028
	12			R5.5-4			TP-005	100-054-029
	10							

<1> Recommended wire gauge.

<2> All codes in the far right column of the table above refer to a set including three crimp terminals and three insulation caps. Input and output wiring must be prepared by the user. Two sets should be used for each terminal connection.

Example: Drive model BA0001 with 14 AWG for both input and output should use one set for input and one set for output. The user should therefore order a total of two sets of [100-066-218].

Note: Consider the amount of voltage drop when selecting wire gauges. Increase the wire gauge when the voltage drop is greater than 2% of motor rated voltage. Ensure the wire gauge is suitable for the terminal block. Use the following formula to calculate the amount of voltage drop:
Line drop voltage (V) = $\sqrt{3}$ × wire resistance (Ω/km) × wire length (m) × current (A) × 10^{-3}

■ Factory Recommended Branch Circuit Protection

Yaskawa recommends installing one of the following types of branch circuit protection to maintain compliance with UL508C. Semiconductor protective type fuses are preferred. Alternate branch circuit protection devices are also listed in ***Table C.7***.

Branch circuit protection shall be provided by any of the following:

- Non-time delay Class J, T, or CC fuses sized at 300% of the drive input rating
  Note: The following model/fuse combinations are excluded from the preceding statement: 2A0002/A6T6, 2A0004/A6T15, 4A0004/A6T15, 4A0005/A6T20, and 4A0007/A6T25.
- 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 C.7 Factory Recommended Drive Branch Circuit Protection

Drive Model CIMR-J□	Non-Time Delay Class T Fuse Type (Manufacturer: Ferraz) Rated Voltage: 600 Vac, 200 kAIR	Fuse Ampere Rating (A)	Fuse Type (Manufacturer: Bussmann) Rated Voltage: 500 Vac, 200 kAIR	Fuse Ampere Rating (A)
200 V Class Single-Phase Drives				
BA0001	A6T6	6	FWH-25A14F	25
BA0002	A6T10	10	FWH-25A14F	25
BA0003	A6T20	20	FWH-60B	60
BA0006	A6T40	40	FWH-80B	80
BA0010	A6T40	40	FWH-100B	100
200 V Class Three-Phase Drives				
2A0001	A6T3	3	FWH-25A14F	25
2A0002	A6T6	6	FWH-25A14F	25
2A0004	A6T15	15	FWH-25A14F	25
2A0006	A6T20	20	FWH-25A14F	25
2A0008 <1>	A6T25	25	FWH-70B	70
2A0010	A6T25	25	FWH-70B	70
2A0012	A6T25	25	FWH-70B	70
2A0018 <1>	A6T30	40	FWH-90B	90

Drive Model CIMR-J□	Non-Time Delay Class T Fuse Type (Manufacturer: Ferraz) Rated Voltage: 600 Vac, 200 kAIR	Fuse Ampere Rating (A)	Fuse Type (Manufacturer: Bussmann) Rated Voltage: 500 Vac, 200 kAIR	Fuse Ampere Rating (A)
2A0020	A6T40	40	FWH-90B	90
400 V Class Three-Phase Drives				
4A0001	A6T3	3	FWH-40B	40
4A0002	A6T6	6	FWH-40B	40
4A0004	A6T15	15	FWH-50B	50
4A0005	A6T20	20	FWH-70B	70
4A0007	A6T25	25	FWH-70B	70
4A0009	A6T25	25	FWH-90B	90
4A0011	A6T30	30	FWH-90B	90

<1> Available for Japan localized drives only (CIMR-□A□□).

■ Low Voltage Wiring for Control Circuit Terminals

Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national state or local codes for wiring. Use a class 2 (UL listed) power supply for the control circuit terminal.

Table C.8 Control Circuit Terminal Power Supply

Input / Output	Terminal Signal	Power Supply Specifications
Multi-function digital inputs	S1, S2, S3, S4, S5, SC	Use the internal power supply of the drive. Use class 2 for external power supply.
Main frequency reference	+V, A1, AC	Use the internal power supply of the drive. Use class 2 for external power supply.

■ 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 31,000 amps maximum at 240 V for 200 V class drives and 480 V for 400 V class drives.

- The MCCB and 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 31,000 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, standard induction motor protection enabled).

■ 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 overload relay for single motor operation.

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

Table C.9 Overload Protection Settings

Setting	Description
0	Disabled
1	General Purpose Motor (Standard Fan-Cooled) (default)
2	Drive Dedicated Motor with a Speed Range of 1:10

Disable the electronic overload protection (L1-01 = 0: Disabled) and wire each motor with its own motor thermal overload when connecting the drive to more than one motor for simultaneous operation.

Enable the motor overload protection (L1-01 = 1 or 2) when connecting the drive to a single motor unless there is another means of preventing motor thermal overload. The 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.

Setting L1-01 = 1 selects a motor with limited cooling capability below rated (base) speed when running at 100% load. The oL1 function derates the motor when it is running below base speed.

Setting L1-01 = 2 selects a motor capable of cooling itself over a 10:1 speed range when running at 100% load. The oL1 function derates the motor when it is running at 1/10 or less of its rated speed.

■ L1-02: Motor Overload Protection Time

Setting Range: 0.1 to 5.0 Minutes

Factory Default: 1.0 Minutes

The L1-02 parameter sets the allowed operation time before the oL1 fault occurs when the drive is running at 60 Hz and 150% of the full load amp rating (E2-01) of the motor. Adjusting the value of L1-02 can shift the set of oL1 curves up the Y-axis of the diagram below but will not change the shape of the curves.

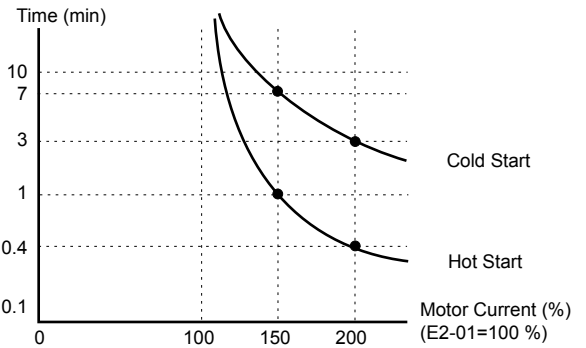


Figure C.6 Motor Overload Protection Time

C.4 Precautions for Korean Radio Waves Act

Drives labeled with the Korea Certification (KC) mark conform to the Korean Radio Waves Act. Adhere to these precautions if using the drive in Korea under the following conditions.

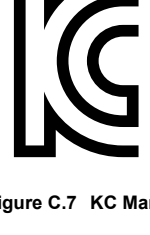


Figure C.7 KC Mark

Classification	Precautions
Class A equipment (Broadcast communications unit for commercial use)	Retailers or users should note that this device is registered to be electromagnetically compatible as a commercial device (class A) intended for use outside of the home.

C.5 한국 전파법에 관한 주의사항

KC 마크가 부착되어 있는 제품은 한국 전파법에 적합한 제품입니다. 한국에서 사용할 경우에는 아래 사항에 주의하여 주십시오.



Figure C.8 KC 마크

기종별	사용자 안내문
A 급 기기 (업무용 방송 통신기 자재)	이 기기는 업무용 (A 급) 전자파 적합 기기로서 판매자 또는, 사용자는 이 점을 주의하시기바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

Index

Numerics

2-Wire Initialization 94
2-Wire Sequence 97
3-Wire Initialization 94
3-Wire Sequence 97, 232
3-Wire Sequence Example 45

A

A/D Conversion Error..... 134, 138, 139
A1-01.....124, 223
A1-03..... 94, 98, 223
A1-04..... 124, 156, 223
A1-05..... 124, 156, 223
A1 Initialization Parameters 223
Accel/Decel 100
Accel/Decel Ramp Hold..... 232
Accel/Decel Time 132
Accel/Decel Time 1..... 232
Acceleration/Deceleration 98, 100
Acceleration Time 1 .....99, 225
Acceleration Time 2 225
Access Level Selection.....124, 223
Accumulated Operation Time.....118, 245
Accumulated Operation Time Selection 242
Accumulated Operation Time Setting 242
Alarm Outputs for Maintenance Monitors 176
Alarms and Errors 133
Allowable Frequency Fluctuation 211, 213
Allowable Voltage Fluctuation.....211, 213
Altitude Derating 220
Ambient Temperature Setting.....220, 240
Analog Filter Time Constant..... 132
Analog Input Filter Time Constant 235

B

b1-01 ..... 94, 106, 157, 224
b1-02 .....96, 97, 157, 224
b1-03 ..... 98, 99, 224
b1-04 .....164, 224
b1-07 224
b1-08 224
b1-14 224
b1-17 224
b1 Operation Mode Selection 224
b2-02 ..... 98, 162, 225
b2-03 .....162, 225
b2-04 ..... 98, 162, 225
b2 DC Injection Braking 224
Baseblock..... 147
Baseblock Command (N.C.)..... 232
Baseblock Command (N.O.)..... 232
Base Frequency.....142, 230
bb 135, 147
Braking Resistor..... 69
Braking Resistor, Installation 69
Braking Resistor Overheat..... 145
Buzzing Sound from Motor at 2 kHz 163

C

C1-01 ..... 90, 91, 98, 164
C1-01 through C1-08 145
C1-02 99
C1-09 ..... 99, 225
C1 Acceleration and Deceleration Times 225
C2-01 226
C2-01 through C2-04 ..... 132, 141
C2-02 226
C2-03 226
C2-04 226
C2 S-Curve Characteristics 225
C3-01 131
C3-02 226
C3 Slip Compensation 226
C4-01 ..... 131, 141, 143, 158
C4 Torque Compensation 226
C6-02 ..... 72, 131, 142, 143, 161, 162, 164, 165, 227
C6-03 227
C6-04 227
C6-05 ..... 162, 227
C6 Carrier Frequency 226
Cable Length Between Drive and Motor 54
CALL 135, 147
Cannot Change Parameter Settings 156
Cannot Reset 135, 148
Capacitor Maintenance 118, 245
Capacitor Maintenance Setting 243
Carrier Frequency Lower Limit 227
Carrier Frequency Proportional Gain 227
Carrier Frequency Reduction 240
Carrier Frequency Selection 131, 227
Carrier Frequency Setting Error 136, 153
Carrier Frequency Upper Limit 227
CE 134, 135, 137, 147
CE mark 255
clock error 138
Clock Fault 134
Coast to Stop 99
CoF 134, 137
Comm. Fault Detection Selection 236
Communication Parity Selection 235
Communication Speed Selection 235
Communications Test Mode 233
Connected Machinery Vibrates When Motor Rotates 162
Control Circuit Connection Diagram 57
Control Circuit Fault 134
Control Circuit Input Terminals 58
Control Circuit Output Terminals 59
Control Circuit Terminal Block Functions 58
Control Circuit Terminal Configuration 59
Cooling Fan Maintenance 118
Cooling Fan Maintenance Setting (Operation Time) 243
Cooling Fan Replacement 149
CPF02 138
CPF06 138
CPF08 138
CPF20 ..... 134, 138
CPF21 ..... 134, 138
CPF22 ..... 134, 139
CPF23 ..... 134, 139
CPF24 ..... 134, 139
CrST 135, 148
C Tuning 225
Current Fault 118, 245
Current Offset Fault 134, 137

D

d1-01 ..... 103, 106
d1-02 103
d1-03 103
d1-04 103
d1 Frequency Reference 228
d2-01 ..... 163, 228
d2-02 228
d2 Frequency Upper and Lower Limits 228
d3-01 ..... 162, 229
d3-01 through d3-04 132
d3-02 229
d3-04 ..... 162, 229
d3 Jump Frequency 228
d4-01 229
d4 Frequency Reference Hold 229
DC Bus Overvoltage 150
DC Bus Undervoltage 146, 234
DC Bus Voltage 118, 243
DC Injection Braking at start 162
DC Injection Braking at Stop 162

DC Injection Braking Current....162, 225
DC Injection Braking Time/DC Excitation Time at Start 225
Deceleration Time 1 ....99, 225
Deceleration Time 2 225
Digital Operator Display Selection 241
DIP Switch S1....67
Down Command 232
d References 228
Drive/kVA Selection....242
Drive Baseblock....135
Drive Capacity Setting Fault....152
Drive Capacity Signal Fault 134, 139
Drive Cooling Fans 174
Drive Dedicated Motor (Constant Torque, 1:10)....115
Drive Mode 85, 86, 87
Drive Overload....135, 143
Drive Ready....234
Drive Slave Address 235
Drive Status Monitors....118
Drive Transmit Wait Time....236
Drive Unit Setting Error....136
Drive Watt Loss Data 217
During Baseblock....234
During Run 233
Dynamic Braking Resistor....135

E

E1-01....230
E1-03....230
E1-04....153, 160, 161, 163, 230
E1-04 through E1-10....141, 142, 143
E1-06....142, 161, 230
E1-07....153, 230
E1-08....131, 142, 143, 158
E1-09....153, 157, 158, 163, 164, 230
E1-10....131, 142, 143, 158, 161
E1 V/f Pattern Characteristics....230
E2-01....114, 131, 142, 143, 230, 269
E2-02....111, 131, 231
E2-03....111, 131, 231
E2-05....111, 231
E2 Motor Parameters....230
EEPROM Data Error....138
EEPROM Write Error....134, 140
EF....135, 148
EF0....134, 139
EF1....139, 148
EF1 to EF5....135
EF2....139, 149
EF3....139, 149
EF4....139, 149
EF5....139, 149
Electrical Thermal Motor Protection 113
EMC Guidelines....255
Err....134, 140
Excessive Motor Oscillation and Erratic Rotation 162
External Digital Operator Connection Fault....144
External Fault 140, 149
External Fault (input terminal S1 to S5) 134, 135
External Fault (user selection possible) 233
External Search Command 1....233
External Search Command 2....233

Drive Motor Overload Protection....269
Drive Short-Circuit Rating....268
European Standards 20
Low Voltage Wiring 268
UL Standards 20

F

Fast-stop (N.C.) 232
Fast-Stop (N.O.)....232
Fast-stop Time 225
Fault....234
Fault Causes and Solutions 137
Fault Detection 137
Fault Displays 137
Fault History Example 154
Fault Reset....232
Fault Reset Example 133
Faults....133, 134
FLASH memory error....138
FLASH Memory Fault 134
Forward/Reverse Run Command Input Error....148
Forward Run Command (2-Wire sequence) 233
Fref/Fout Agree 1....233
Frequency (FOUT) Detection 1 233
Frequency (FOUT) Detection 2 234
Frequency Reference....118, 243
Frequency Reference 1....103, 228
Frequency Reference 2....103, 228

Frequency Reference 3 ..... 103, 228
Frequency Reference 4 ..... 103, 228
Frequency Reference 5 228
Frequency Reference 6 228
Frequency Reference 7 228
Frequency Reference 8 228
Frequency Reference Hold Function Selection 229
Frequency Reference Selection 224
Frequency Reference Selection 1 157
Frequency Reference Setting Method Selection 242
Frequency Reference Upper Limit 228
Frequency Reference Wiring 63

G

General-Purpose Motor (Standard Self-Cooled) 115
General Safety Information 14
Ground Fault Interrupter Activates When Drive is Running 165
Ground Wiring 55

H

H1-01 231
H1-02 231
H1-03 231
H1-04 231
H1-05 ..... 45, 231
H1 Multi-Function Digital Input 231
H1 Multi-Function Digital Input Selections 232
H2-01 ..... 111, 233
H2 Multi-Function Digital Outputs 233
H2 Multi-Function Digital Output Settings 233
H3-01 ..... 68, 157, 234
H3-01 Details 68
H3-13 ..... 132, 162
H3 Analog Input A1 234
H4-01 235
H4-03 235
H4 Multi-Function Analog Output AM 235
H5-01 235
H5-02 235
H5-03 235
H5-04 ..... 139, 236
H5-05 236
H5-06 236
H5-07 236
H5-12 236
H5-13 236
H5 MEMOBUS/Modbus Communications 235
Heatsink Cooling Fan Operation Selection 240
Heatsink Overheat 134, 135, 149
Heatsink Temperature 118
Heavy Duty Ratings 210
Hunting Prevention Gain 131
Hunting Prevention Gain Setting 241

I

I/O Connections 44
IGBT Maintenance 118, 245
IGBT Maintenance Setting 243
Initialize Parameters 94, 223
Initial Operation 93
Input Current (A) 211, 213
Input Phase Loss 135, 145
Input Phase Loss Protection Selection 240
Input Terminals 92
Input Terminal Status 118, 244
Input Voltage Setting 230
Inrush Prevention Circuit Fault 146
Inrush Prevention Relay Maintenance Setting 243
Inspection 171, 173
Installation Environment 33
Installation Orientation 34
Installation Spacing 34
Installing Multiple Drives 35
Internal Dynamic Braking Resistor Protection 70
Internal Dynamic Braking Resistor Protection Selection (ERF type) 239

J

Jog Frequency Reference 228
Jog Reference Selection 232
Jump Frequency 132
Jump Frequency 1 229
Jump Frequency 2 229
Jump Frequency Width 229

L

L1-01 ..... 114, 115, 116, 142, 143, 237, 269
L1-02 ..... 114, 237, 270
L1-13 237
L1 Motor Protection Functions 237
L2-01 237

L2 Momentary Power Loss 237
L3-01 238
L3-01 through L3-06 132
L3-02 ..... 160, 163, 238
L3-04 ..... 143, 144, 161, 238
L3-05 238
L3-06 ..... 160, 238
L3 Stall Prevention Function 237
L4-01 238
L4 Frequency Detection 238
L5-01 ..... 150, 239
L5 Fault Reset 239
L6-01 239
L6-02 ..... 143, 150, 239
L6-03 ..... 143, 150, 239
L6 Overtorque Detection 239
L8: Hardware Protection 239
L8-01 ..... 145, 239
L8-05 ..... 145, 240
L8-10 240
L8-12 ..... 220, 240
L8-18 240
L8-29 220
L8-38 ..... 163, 240
LED Check 118, 245
LED Operator 26, 80, 81, 96
LF 134, 140
LO/RE 82, 91, 121
LOCAL 91
Local/Remote Run Selection 224
Local/Remote Selection 232
Low Voltage Directive 255
L Protection Function 237

M

Magnetic Flux Compensation Capacity 225
Main Circuit Connection Diagram 46, 56
Main Circuit Terminal Functions 50
Main Circuit Terminal Power Supply 54
Main Circuit Terminals Connection 46
Main Circuit Terminal Wiring 28, 262
Main Frequency Reference 67
Main Frequency Reference Input 58
Maintenance Alarms 176
Master Speed Reference Lower Limit 228
Maximum Motor Size Allowed (kW) 211, 213
Maximum Output Frequency 230
Maximum Output Voltage 230
MEMOBUS/Modbus Communication Error ... 134, 135, 137, 147
MEMOBUS/Modbus Communications Test Mode Complete 150
MEMOBUS/Modbus Communications Test Mode Error 150
MEMOBUS/Modbus Error Code 244
Memobus/Modbus Error Code 118
MEMOBUS/Modbus Test Mode Complete 135
Middle Output Frequency 230
Middle Output Frequency Voltage 230
Mid Output Voltage A 131
Minimum Output Frequency 163, 164, 230
Minimum Output Frequency Voltage 230
Minimum Output Voltage 131
Minor Alarms 134
Minor Faults 133, 134
Modes 85
Momentary Power Loss Operation Selection 237
Monitor Output 59
Motor Does Not Operate When an External Run Command is Input 163
Motor Does Not Operate When the RUN Button on the Digital Operator is Pressed 163
Motor Does Not Rotate 157
Motor Hunting and Oscillation Control Parameters 132
Motor Hunting Occurs When Operating With a Light Load 161
Motor is Too Hot 159
Motor Line-to-Line Resistance 111, 231
Motor No-Load Current 111, 231
Motor Overload 134, 142
Motor Overload Protection Selection 114, 237, 269
Motor Overload Protection Time 114, 237, 270
Motor Parameters 110
Motor Protection Function 143
Motor protection operation time 115
Motor Rated Current 111, 114, 230, 269
Motor Rated Slip 111, 231
Motor Rotates After the Drive Output is Shut Off ... 162
Motor Rotates Faster Than the Frequency Reference 160
Motor Rotates in One Direction Only 164

Motor Stalls During Acceleration or With Large Loads 159
Motor Stops During Acceleration or When a Load is Connected 164
Motor Wiring 54
Multi-Function Analog 1 (Terminal AM Monitor Selection) 235
Multi-Function Analog Outputs 111
Multi-Function Contact Input 104
Multi-Function Contact Output 111
Multi-Function Digital Inputs 58
Multi-Function Digital Input Terminal S1 Function Selection 231
Multi-Function Digital Input Terminal S2 Function Selection 231
Multi-Function Digital Input Terminal S3 Function Selection 231
Multi-Function Digital Input Terminal S4 Function Selection 231
Multi-Function Digital Input Terminal S5 Function Selection 231
Multi-Function Digital Output 59
Multi-Function Input Selection Error 152
Multi-Function Input Setting Error 136
Multiple Drive Wiring 55
Multi-Step Speed Operation (4-Step Speed) 103
Multi-Step Speed Reference 232

N

n1-02 ..... 131, 145, 241
n1 Hunting Prevention 241
n3: Overexcitation Braking 241
n3-13 ..... 141, 143, 241
n Advanced Performance Set Up 241
Noise From the Drive or Output Lines When the Drive is Powered On 161
No-Load Operation 121
Normal Duty Ratings 210
Number of Auto Restart Attempts 239

O

o1 Display Settings 241
o2-02 ..... 158, 241
o2-04 ..... 152, 242
o2-05 242
o2 Multi-Function Selections 241
o4-01 242
o4-02 242
o4-03 ..... 149, 243
o4-05 243
o4-07 243
o4-09 243
o4-11 243
o4 Maintenance Period 242
oC 134, 140
oFA01 ..... 134, 141
oH 135, 149
oH1 ..... 134, 142
oL1 ..... 134, 142
oL2 ..... 135, 143, 163
oL3 ..... 135, 143, 150
o Operator Related Parameters 241
oPE 152
oPE01 ..... 136, 152
oPE02 ..... 136, 152
oPE03 ..... 136, 152
oPE05 ..... 136, 153
oPE10 ..... 136, 153
oPE11 ..... 136, 153
Open-Chassis IP20 ..... 36, 37
Operating with the Load Connected 123
Operation Errors 134, 136
Operator Connection Fault 135
Operator Programming Errors 152
oPr 135, 144
Option Disconnected 134
Option Unit External Fault 134, 139
Option Unit Fault 141
Oscillation or Hunting 162
Output Current 118, 243
Output Current (A) 211, 213
Output Frequency 118, 243
Output Frequency is not as High as Frequency Reference 163
Output Phase Loss 134, 140
Output Terminal Status 118, 244
Output Voltage Reference 118, 243
ov 135, 144, 150
Overcurrent 134, 140
Overexcitation Deceleration Gain 141, 241
Overheat 1 (Heatsink Overheat) 142
Overload Tolerance 211, 213
Overtorque 1 ..... 135, 150

Overtorque Detection 1 ..... 135, 143
Overvoltage 135, 144
ov Occurs When Starting a Fan or Motor Speed Loss Occurs 162

P

Parameter Range Setting Error 152
Parameter Setting Range Error 136
Parameter Settings 90
PASS 135, 150
Password 1 223
Password 2 223
Password Settings 124
Peak Hold Current 118, 245
Peripheral Devices Affected by Drive Operation 164
PF 135, 145
Phase Order Selection 224
Poor Speed Control Accuracy 160
Power Specifications 200 V Class Models 211
Power Specifications 400 V Class Models 213
Previous Fault 118, 245
Programming Mode 85, 87, 88
Protective Covers, Reattaching 206
Protective Covers, Removing 48, 205
PWM Feedback Data Fault 134
PWM Feedback Fault 139

R

RAM Fault 134, 138
Ramp to Stop 98
Rated Frequency 211, 213
Rated Output Capacity (kVA) 211
Rated Voltage 211, 213
REMOTE 91
Replacement Parts 219
Restart Enabled 234
Reverse Direction 234
Reverse Operation Selection 224
Reverse Run Command (2-Wire sequence) 233
rH 135, 145
RTS Control Selection 236
Run command 99
Run Command/Frequency Reference Source Selection Error 153
Run Command at Power Up 224
Run Command Input Error 135
Run Command Input Selection 96
Run Command Selection 157, 224
Run Command Selection during Program 224
Run Command Selection Error 136

S

S1 97
S2 97
Safety Hazard Definitions 14
Safety Information 14
S-Curve Characteristic at Accel End 226
S-Curve Characteristic at Accel Start 226
S-Curve Characteristic at Decel End 226
S-Curve Characteristic at Decel Start 226
S-Curve Characteristics 100, 132
SE 135, 150
Serial Communication Reference Selection 232
Serial Communication Transmission Error 135, 147
Setup Mode 87, 92
Shielded Twisted-Pair Cables 62
Side-by-Side Setup 35
Sinking/Sourcing Mode Switch 28
Slip Compensation Gain 226
Slip Compensation Primary Delay Time 226
Soft Charge Circuit Fault 135
Soft CLA Selection 240
Software No. (Flash) 244
Software No. (ROM) 244
Software Number (Flash) 118
Software Number (ROM) 118
Speed Agreement Detection Level 238
Speed Search 234
Stall Prevention 132
Stall Prevention During Deceleration 70, 143
Stall Prevention Level during Acceleration 238
Stall Prevention Level during Run 238
Stall Prevention Selection during Acceleration 238
Stall Prevention Selection during Deceleration 238
Stall Prevention Selection during Run 238
Standard Connection Diagram 43, 44
STOP Key Function Selection 241
Stopping Method 98
Stopping Method After Communication Error 236
Stopping Method Selection 224

T

Terminal A1 Bias Setting. 234
Terminal A1 Gain Setting 234
Terminal A1 Input Voltage 118
Terminal A1 Signal Level Selection 234
Terminal Block Configuration 47
Terminal Board Wiring Guide 62
Terminal M1 thru M2 Function Selection (relay) 111
Terminal MA, MB and MC Function Selection (relay) 111, 233
Test Run 122
Tightening Torque 50
Timing Fault 134
Torque Compensation Gain. 131, 226
Torque Detection 1 (N.O.). 234
Torque Detection 2 (N.O.). 234
Torque Detection Level 1 239
Torque Detection Selection 1 239
Torque Detection Time 1 239
Torque Specifications, Single Phase 200 V Class 51, 262
Torque Specifications, Three Phase 200 V Class . . . 52, 263
Torque Specifications, Three Phase 400 V Class . . . 53, 264
Transistor Input Signal 65, 66

U

U1-01. . . . . 118, 157, 160, 243
U1-02. . . . . 118, 243
U1-03. . . . . 118, 243
U1-06. . . . . 118, 243
U1-07. . . . . 118, 156, 243
U1-09. 157
U1-10. . . . . 118, 244
U1-11. . . . . 118, 244
U1-13. . . . . 118, 244
U1-19. . . . . 118, 244
U1-25. . . . . 118, 244
U1-26. . . . . 118, 244
U1 Operation Status Monitors 243
U2-01. . . . . 118, 245
U2-02. . . . . 118, 154, 245
U2 Fault History. 245
U2 Initial Value Selection 243
U4: Maintenance Monitors 245
U4-01. . . . . 118, 245
U4-04. . . . . 118, 245
U4-05. . . . . 118, 145, 146, 151, 245
U4-06. . . . . 146, 245
U4-07. . . . . 118, 245
U4-08. . . . . 118, 245
U4-09. . . . . 118, 245
U4-13. . . . . 118, 245
U Monitors. 243
Undervoltage 135, 136, 151
Undervoltage 3 146
Unexpected Noise from Connected Machinery 162
Up Command 232
User Monitor Selection After Power Up 241
Uv. 136, 151
Uv1 . . . . . 135, 146
Uv3 . . . . . 135, 146

V

V/f Data Setting Error. 136, 153
V/f Pattern Selection 230
Verify Menu 87

W

Watchdog Circuit Exception. 134, 138
Watt Loss 200 V Class Single Phase Models. 217
Watt Loss 200 V Class Three Phase Models 217
Watt Loss 400 V Class Three Phase Models 217
Wire Gauge, Single Phase 200 V Class 51, 262
Wire Gauge, Three Phase 200 V Class. 52, 263
Wire Gauge, Three Phase 400 V Class. 53, 264
Wire Gauges 50
Wiring Checklist 72
Wiring Procedure. 61

Z

Zero Speed. 233

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

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Compact V/f Control Drive
Installation & Start-Up Manual

DRIVE CENTER (INVERTER PLANT)
2-13-1, Nishimiyaichi, Yukuhashi, Fukuoka, 824-8511, Japan
Phone: 81-930-25-3844 Fax: 81-930-25-4369
http://www.yaskawa.co.jp

YASKAWA ELECTRIC CORPORATION
New Pier Takeshiba South Tower, 1-16-1, Kaigan, Minatoku, Tokyo, 105-6891, Japan
Phone: 81-3-5402-4502 Fax: 81-3-5402-4580
http://www.yaskawa.co.jp

YASKAWA AMERICA, INC.
2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone: (800) YASKAWA (927-5292) or 1-847-887-7000 Fax: 1-847-887-7310
http://www.yaskawa.com

YASKAWA ELÉTRICO DO BRASIL LTDA.
Avenda Fagundes Filho, 620 Bairro Saude, São Paulo, SP04304-000, Brasil
Phone: 55-11-3585-1100 Fax: 55-11-5581-8795
http://www.yaskawa.com.br

YASKAWA EUROPE GmbH
Hauptstrasse 185, 65760 Eschborn, Germany
Phone: 49-6196-569-300 Fax: 49-6196-569-398
http://www.yaskawa.eu.com

YASKAWA ELECTRIC UK LTD.
1 Hunt Hill Orchardton Woods, Cumbernauld, G68 9LF, United Kingdom
Phone: 44-1236-735000 Fax: 44-1236-458182
http://www.yaskawa.co.uk

YASKAWA ELECTRIC KOREA CORPORATION
9F, Kyobo Securities Bldg., 26-4, Yeouido-dong, Yeongdeungpo-gu, Seoul, 150-737, Korea
Phone: 82-2-784-7844 Fax: 82-2-784-8495
http://www.yaskawa.co.kr

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
151 Lorong Chuan, #04-01, New Tech Park, 556741, Singapore
Phone: 65-6282-3003 Fax: 65-6289-3003
http://www.yaskawa.com.sg

YASKAWA ELECTRIC (SHANGHAI) CO., LTD.
12F, Carlton Bld., No.21 HuangHe Road, HuangPu District, Shanghai 200003, China
Phone: 86-21-5385-2200 Fax: 86-21-5385-3299
http://www.yaskawa.com.cn

YASKAWA ELECTRIC (SHANGHAI) CO., LTD. BEIJING OFFICE
Room 1011, 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, 104, Taiwan
Phone: 886-2-2502-5003 Fax: 886-2-2505-1280

YASKAWA ELECTRIC INDIA PRIVATE LIMITED
#17/A Electronics City, Hosur Road Bangalore 560 100 (Karnataka), India
Phone: 91-80-4244-1900 Fax: 91-80-4244-1901
http://www.yaskawaindia.in

YASKAWA ELECTRIC CORPORATION

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice for ongoing product modifications and improvements.

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YASKAWA

YASKAWA AC Drive 1000 Series Supplemental Technical Manual Precautions for UL Standards Compliance

Introduction

This supplemental technical manual describes the precautions required for AC drive 1000 series to attain compliance with UL standards.
Read this manual together with the manuals that are delivered with the products.

■ Ambient Temperature

Be sure to observe the ambient temperature described on *Drive Specifications*.

A1000
-10 to +40°C (IP20/NEMA Type1 enclosure)
-10 to +50°C (IP00 enclosure)

V1000
-10 to +40°C (IP20/NEMA Type1 enclosure)
-10 to +50°C (IP20/IP00 Open-Chassis enclosure)
-10 to +50°C (Finless Type: IP20/IP00 enclosure)
-10 to +40°C (NEMA Type4X/IP66 enclosure)

J1000
-10 to +40°C (IP20/NEMA Type1 enclosure)
-10 to +50°C (IP20/IP00 Open-Chassis enclosure)
-10 to +50°C (Finless Type: IP20 enclosure)

T1000A
-10 to +50°C (IP20/IP00 enclosure)
-10 to +45°C (Finless Type: IP20/IP00 enclosure)

T1000V
-10 to +50°C (IP20/IP00 Open-Chassis enclosure)
-10 to +50°C (Finless Type: IP20/IP00 enclosure)

L1000A
-10 to 40°C (IP20/NEMA Type 1 enclosure and IP00 with top protective cover)
-10 to 50°C (IP00 enclosure)

YS1000
-10 to 50°C (IP00 enclosure)

For more information on temperature derating, refer to the manual for the drive used.

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■ Main Circuit Terminal Wiring

Yaskawa recommends using closed-loop crimp terminals on all drive models. UL/cUL approval requires the use of UL Listed closed-loop crimp terminals when wiring the drive main circuit terminals. Use only the tools recommended by the terminal manufacturer for crimping.
For more information on UL Listed closed-loop crimp terminals, refer to the manuals that are delivered with the products.

■ Low Voltage Wiring for Control Circuit Terminals

Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national state or local codes for wiring. If external power supply used, it shall be UL Listed Class 2 power source only or equivalent.