YASKAWA

LA500

AC Micro Drive

Technical Manual

Type CIPR-LA50Cxxxxxxxx

Models 200 V Class, Three-Phase Input: 4.0 to 18.5 kW
400 V Class, Three-Phase Input: 4.0 to 22 kW

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Preface and General Precautions

This chapter gives information about important safety precautions for the use of this product. Failure to obey these precautions can cause serious injury or death, or damage to the product or related devices and systems. Yaskawa must not be held responsible for any injury or equipment damage as a result of the failure to observe these precautions and instructions.

i.1 Using the Product Safely

These instructions contain the information necessary to use the product correctly. Read and understand the safety information and precautions before you start to use the product.

◆ Explanation of Signal Words

Read and understand this manual before you install, operate, or do maintenance on the drive. Install the drive as specified by this manual and local codes.

The symbols in this section identify safety messages in this manual. If you do not obey these safety messages, the hazards can cause serious injury, death, or damage to the products and related equipment and systems. These identifier words categorize and emphasize important safety precautions in these instructions.

⚠DANGER

This signal word identifies a hazard that will cause serious injury or death if you do not prevent it.

⚠WARNING

This signal word identifies a hazard that can cause death or serious injuries if you do not prevent it.

⚠CAUTION

This signal word identifies a hazard that can cause minor or moderate injuries if you do not prevent it.

NOTICE

This signal word identifies a property damage message that is not related to personal injury.

◆ Section Safety

- Some figures in the instructions include options and drives without covers or safety shields to more clearly show the inside of the drive. Replace covers and shields before operation. Use options and drives only as specified by the instructions.
- The figures in this manual are examples only. All figures do not apply to all products included in this manual.
- The manufacturer can change the products, specifications, and content of the instructions without notice to make the product and/or the instructions better.
- If you damage or lose these instructions, contact a representative or the nearest sales office of the manufacturer. You can find the contact information on the rear cover of the manual, and tell them the document number to order new copies. You can also download the manual from the manufacturer’s website.

⚠DANGER

Do not ignore the safety messages in this manual.

If you ignore the safety messages in this manual, it will cause serious injury or death. The manufacturer is not responsible for injuries or damage to equipment.

Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠WARNING

Crush Hazard

Test the system to make sure that the drive operates safely after you wire the drive and set parameters.

If you do not test the system, it can cause damage to equipment or serious injury or death.

Sudden Movement Hazard

Before you do a test run, make sure that the setting values for virtual input and output function parameters are correct. Virtual input and output functions can have different default settings and operation than wired input and output functions.

Incorrect function settings can cause serious injury or death.

Remove all personnel and objects from the area around the drive, motor, and machine and attach covers, couplings, shaft keys, and machine loads before you energize the drive.

If personnel are too close or if there are missing parts, it can cause serious injury or death.

Examine the I/O signals and internal sequence with the engineer who made the DriveWorksEZ program before you operate the drive.

If you do not know how the drive will operate, it can cause serious injury or death. When you use DriveWorksEZ to make custom programming, the drive I/O terminal functions change from factory settings and the drive will not operate as written in this manual.

Electrical Shock Hazard

Do not modify the drive body or drive circuitry.

Modifications to drive body and circuitry can cause serious injury or death, will cause damage to the drive, and will void the warranty. Yaskawa is not responsible for modifications of the product made by the user.

Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive.

If personnel are not approved, it can cause serious injury or death.

Do not remove covers or touch circuit boards while the drive is energized.

If you touch the internal components of an energized drive, it can cause serious injury or death.

After the drive blows a fuse or trips an RCM/RCD, do not immediately energize the drive or operate peripheral devices. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. If you do not know the cause of the problem, contact Yaskawa before you energize the drive or peripheral devices.

If you do not fix the problem before you operate the drive or peripheral devices, it can cause serious injury or death.

Damage to Equipment

Do not apply incorrect voltage to the main circuit of the drive. Operate the drive in the specified range of the input voltage on the drive nameplate.

Voltages that are higher than the permitted nameplate tolerance can cause damage to the drive.

Fire Hazard

Install sufficient branch circuit short circuit protection as specified by applicable codes and this manual. The drive is suited for circuits that supply not more than 31,000 RMS symmetrical amperes, 240 Vac maximum (200 V Class), 480 Vac maximum (400 V Class).

Incorrect branch circuit short circuit protection can cause serious injury or death.

⚠CAUTION

Crush Hazard

Tighten terminal cover screws and hold the case safely when you move the drive.

If the drive or covers fall, it can cause moderate injury.

NOTICE

Use an inverter-duty motor or vector-duty motor with reinforced insulation and windings applicable for use with an AC drive.

If the motor does not have the correct insulation, it can cause a short circuit or ground fault from insulation deterioration.

Damage to Equipment

When you touch the drive and circuit boards, make sure that you observe correct electrostatic discharge (ESD) procedures.

If you do not follow procedures, it can cause ESD damage to the drive circuitry.

Do not do a withstand voltage test or use a megohmmeter or megger insulation tester on the drive.

These tests can cause damage to the drive.

Do not operate a drive or connected equipment that has damaged or missing parts.

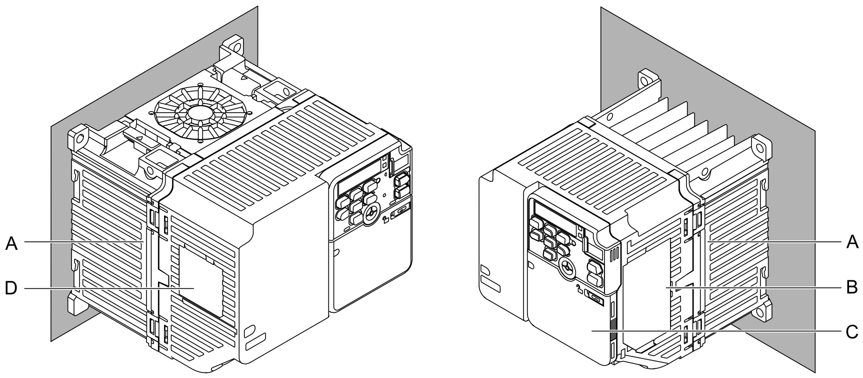
You can cause damage to the drive and connected equipment.

Do not use steam or other disinfectants to fumigate wood for packaging the drive. Use alternative methods, for example heat treatment, before you package the components.

Gas from wood packaging fumigated with halogen disinfectants, for example fluorine, chlorine, bromine, iodine or DOP gas (phthalic acid ester), can cause damage to the drive.

◆ Warning Label Content and Location

The drive warning label is in the location shown in Figure i.1. Use the drive as specified by this information. Replace unreadable or missing labels.



A - Warning label "Hot surface"
B - Nameplate
C - Warning label "Risk of electric shock"
D - Warning label "Application"

Figure i.1 Warning Label Content and Location

The labels show the following content:

Figure i.2 Warning Label "Hot surface"

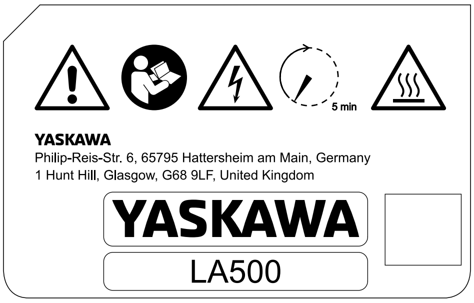
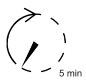


Figure i.3 Warning Label "Risk of electric shock"

The following table shows the explanation of the icons used on the front cover of the drive.

Icon	Explanation
	Refer to the instructions manual for details on warnings and other safety related information.
	
	Electric Shock Hazard. Disconnect the device from main power supply and wait 5 minutes before you touch the drive or parts of it.
	**⚠DANGER** **Electrical Shock Hazard** **Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.** If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.
	Hot surfaces. Risk of burn. **⚠CAUTION** **Burn Hazard** **Do not touch a hot drive heatsink. De-energize the drive, wait for a minimum of 15 minutes, then make sure that the heatsink is cool before you replace the cooling fans.** If you touch a hot drive heatsink, it can burn you.

WARNING Suitable for use on a circuit capable of delivering not more than □□kA RMS symmetrical amperes, □□□V maximum. Internal motor overload protection provided. For field wiring, use 75°C rated wire. See manual for details.

AVERTISSEMENT

Convenient aux circuits non susceptibles de délivrer plus de □□kA ampères symétriques eff., maximum □□□V. Protection interne contre les surcharges du moteur. En cas de branchements sur site, utiliser câble pour température nominale de 75°C. Voir le manuel pour de détails.

Figure i.4 Warning Label "Application"

i.2 Legal Information

◆ Exclusion of Liability

- This product is not designed and manufactured for use in life-support machines or systems.
- Contact a Yaskawa representative or your Yaskawa sales representative if you are considering the application of this product for special purposes, such as machines or systems used for passenger cars, medicine, airplanes and aerospace, nuclear power, electric power, or undersea relaying.

⚠WARNING

Injury to Personnel

When you use this product in applications where its failure could cause the loss of human life, a serious accident, or physical injury, you must install applicable safety devices.

If you do not correctly install safety devices, it can cause serious injury or death.

◆ About Registered Trademarks

- All company names and product names in this document are trademarks or registered trademarks of the respective companies.

i.3 Glossary

Phrase	Definition
CLV	Closed Loop Vector Control
Drive	YASKAWA AC Drive LA500
EDM	External Device Monitor
HD	Heavy Duty
MFAO	Multi-Function Analog Output
MFDI	Multi-Function Digital Input
MFDO	Multi-Function Digital Output
OLV	Open Loop Vector Control
SIL	Safety Integrity Level
V/f	V/f Control

1

Receiving

This chapter gives information about the different drive models and features, and how to examine the drive when you receive it.

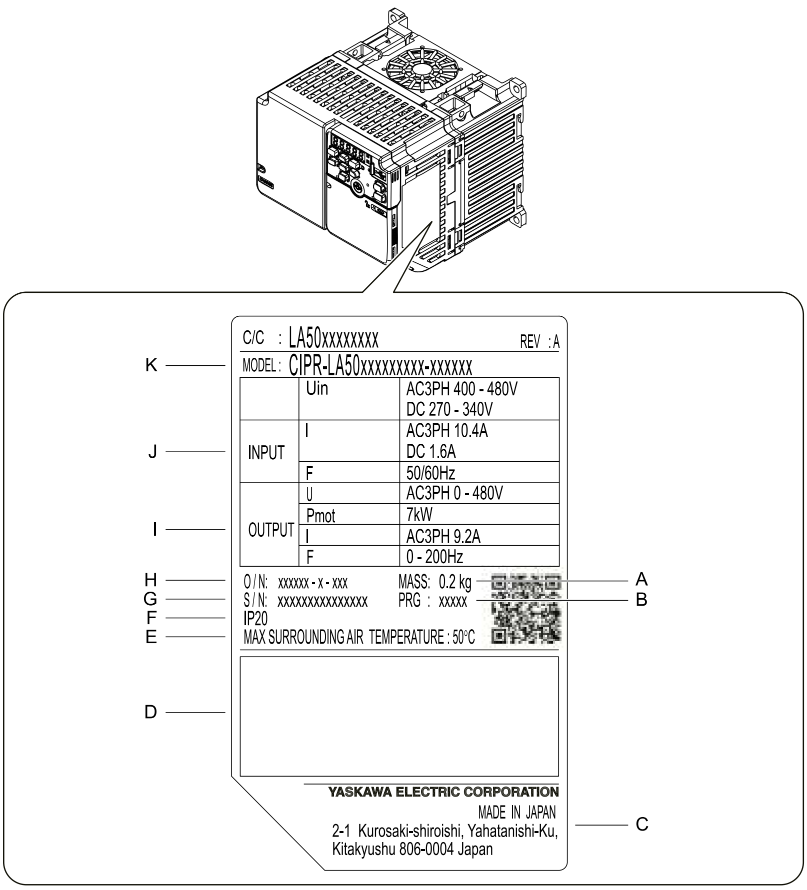
1.1 Model Number and Nameplate Check

◆ When Receiving the Drive

Please examine these items after you receive the drive:

- Examine the drive for damage. Immediately contact the shipping company if the drive is damaged. The Yaskawa warranty does not cover damage from shipping.
- Examine the drive model number to make sure that you received the correct model. Examine the model number in the “MODEL” section of the drive nameplate to make sure that you received the correct model.
- If you received the incorrect product or a product with a defect, contact Yaskawa or your nearest sales representative.

◆ Nameplate



A - Weight
B - Drive software version
C - The address of the head office of Yaskawa Electric Corporation
D - Accreditation standards
E - Ambient temperature setting
F - Enclosure protection design
G - Product number
H - Serial number
I - Output specifications
J - Input specifications
K - Drive model

Figure 1.1 Nameplate Information Example

◆ Model Number

Use the information in Figure 1.2 and Table 1.1 to read the drive model numbers.

CIPR	-	LA50	C	4	009	E	B	A	A	-	C	A	A	A	S	A
1		2	3	4	5	6	7	8	9		10	11	12	13	14	15

Figure 1.2 Drive Model

Table 1.1 Model Number Details

No.	Description
1	Drive
2	Product series
3	Region code • C: Europe
4	Input power supply voltage • 2: Three-Phase AC 200 V Class • 4: Three-Phase AC 400 V Class
5	Rated Output Current
6	EMC noise filter • A: No internal EMC filter • E: Built-in EMC Filter
7	Enclosure protection design • B: IP20/UL Open Type • F: IP20/UL Type 1
8	Environmental specification
9	Design revision order
10	Control circuit board
11	Option
12	A: Standard
13	A: Standard
14	Keypad
15	Special applications

◆ Rated Output Current

The following tables give the rated output current values.

Note:
- Rated output current values are applicable for drives that operate at standard specifications.
- Derate the output current in applications that:
  – Increase the carrier frequency
  – Have high ambient temperature
  – Install drives side-by-side

Table 1.2 Three-Phase AC 200 V Class

Model	Heavy Duty Rating (HD) [C6-01 = 0] (Default)	
	Maximum Applicable Motor Output kW (HP)	Rated Output Current A
2018	4.0 (5)	17.6
2025	5.5 (7.5)	25.0
2033	7.5 (10)	33.0
2047	11.0 (15)	47.0
2060	15.0 (20)	60.0
2075	18.5 (25)	75.0

Table 1.3 Three-Phase AC 400 V Class

Model	Heavy Duty Rating (HD) [C6-01 = 0] (Default)	
	Maximum Applicable Motor Output kW (HP)	Rated Output Current A
4009	4.0 (5)	9.2
4015	5.5 (10)	14.8

Model	Heavy Duty Rating (HD) [C6-01 = 0] (Default)	
	Maximum Applicable Motor Output kW (HP)	Rated Output Current A
4018	7.5 (10)	18.0
4024	11.0 (15)	24.0
4031	15.0 (20)	31.0
4039	18.5 (25)	39.0
4045	22.0 (30)	45.0

1.2 Features and Advantages of Control Methods

This drive has different control methods from which you can select for different applications.

◆ V/f Control Method

Table 1.4 Features and Advantages of V/f Control

Control Method Selection	Open Loop V/f Control (V/f)	Notes
Controlled Motor	Induction Motor	-
Parameter Settings	A1-02 = 0	-
Basic Control	V/f	-
Maximum Output Frequency	120 Hz	-
Speed Control Range	1:40	This is the range of variable control. When you connect and operate motors in this mode, think about the increase in motor temperature.
Starting Torque	150% / 3 Hz	This is the motor torque that the drive can supply at low speed during start-up and the related output frequency (rotation speed). You must think about drive capacity when a large quantity of torque is necessary at low speed.
Auto-Tuning *1	Rotational and Line-to-Line Resistance (usually not necessary)	Automatically tunes electrical motor parameters.
DC Injection at Start and Stop/Position Lock	Yes (DC injection braking at start and stop)	Builds up motor torque during stop in order to prevent movement of the elevator when the brake is released at start and applied at stop.
Slip Compensation	No	Adjusts the leveling speed reference in order to improve the stopping accuracy.
Short Floor	Yes	Optimizes the stopping time at rides where the nominal speed is not reached.

*1 When you can decouple the motor and machine for a test run, use Rotational Auto-Tuning. You must make adjustments to the control in the range where there is no vibration in the machine after Rotational Auto-Tuning.

◆ Open Loop Vector Control Method

Table 1.5 Features and Advantages of OLV Control

Control Method Selection	Open Loop Vector (OLV)	Notes
Controlled Motor	Induction Motor	-
Parameter Settings	A1-02 = 2 (Default)	-
Basic Control	Open Loop Current Vector Control	-
Maximum Output Frequency	120 Hz	-
Speed Control Range	1:100	This is the range of variable control. When you connect and operate motors in this mode, think about the increase in motor temperature.
Starting Torque	150% / 1 Hz *1	This is the motor torque that the drive can supply at low speed during start-up and the related output frequency (rotation speed). You must think about drive capacity when a large quantity of torque is necessary at low speed.
Auto-Tuning *2	Rotational, Stationary, and Line-to-Line Resistance	Automatically tunes electrical motor parameters.
DC Injection at Start and Stop/Position Lock	Yes (DC injection braking at start and stop)	Builds up motor torque during stop in order to prevent movement of the elevator when the brake is released at start and applied at stop.
Slip Compensation	Yes	Adjusts the leveling speed reference in order to improve the stopping accuracy.
Short Floor	Yes	Optimizes the stopping time at rides where the nominal speed is not reached.

*1 Select the drive capacity accordingly.
*2 When you can decouple the motor and machine for a test run, use Rotational Auto-Tuning. You must make adjustments to the control in the range where there is no vibration in the machine after Rotational Auto-Tuning.

◆ Closed Loop Vector Control Method

Table 1.6 Features and Advantages of CLV Control

Control Method Selection	Closed Loop Vector (CLV)	Notes
Controlled Motor	**Induction Motor**	**-**
Parameter Settings	A1-02 = 3	-
Basic Control	Closed Loop Current Vector Control	-
Main Applications	Very high-performance control with motor encoders Example: High-precision speed control, torque limits	-
PG Option Card	Necessary (JOHB-PGX3-AE)	-
Maximum Output Frequency	120 Hz	-
Speed Control Range	1:1500	This is the range of variable control. When you connect and operate motors in this mode, think about the increase in motor temperature.
Starting Torque	200% / 0 min^{-1} *1	This is the motor torque that the drive can supply at low speed during start-up and the related output frequency (rotation speed). When a large quantity of torque is necessary at low speed, you must think about drive capacity and motor capacity.
Auto-Tuning *2	Rotational and Stationary	Automatically tunes electrical motor parameters.
DC Injection at Start and Stop/Position Lock	Yes (Position Lock)	Builds up motor torque during stop in order to prevent movement of the elevator when the brake is released at start and applied at stop.
Anti Roll Back	Yes	Prevents roll back at start without any external load signal.
Slip Compensation	Yes	Adjusts the leveling speed reference in order to improve the stopping accuracy.
Short Floor	Yes	Optimizes the stopping time at rides where the nominal speed is not reached.

*1 Select the drive capacity and motor capacity correctly for the application.

*2 When you can decouple (remove rope from traction sheave) the motor and machine for a test run, use Rotational Auto-Tuning. You must make adjustments to the control in the range where there is no vibration in the machine after Rotational Auto-Tuning.

2

Mechanical Installation

This chapter gives information about the correct environment and clearances to install the drive.

2.1 Section Safety

⚠WARNING

Electrical Shock Hazard

Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive.

If personnel are not approved, it can cause serious injury or death.

Do not modify the drive body or drive circuitry.

Modifications to drive body and circuitry can cause serious injury or death, will cause damage to the drive, and will void the warranty. Yaskawa is not responsible for modifications of the product made by the user.

Fire Hazard

Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material.

Flammable and combustible materials can start a fire and cause serious injury or death.

When you install the drive in an enclosure, use a cooling fan or cooler to decrease the temperature around the drive. Make sure that the intake air temperature to the drive is 50 °C (122 °F) or less for IP20/UL Open Type drives, and 40 °C (104 °F) or less for IP20/UL Type 1 drives.

If the air temperature is too hot, the drive can become too hot and cause a fire and serious injury or death.

⚠CAUTION

Crush Hazard

Tighten terminal cover screws and hold the case safely when you move the drive.

If the drive or covers fall, it can cause moderate injury.

NOTICE

Do not let unwanted objects, for example metal shavings or wire clippings, fall into the drive during drive installation. Put a temporary cover over the drive during installation. Remove the temporary cover before start-up.

Unwanted objects inside of the drive can cause damage to the drive.

Damage to Equipment

When you touch the drive and circuit boards, make sure that you observe correct electrostatic discharge (ESD) procedures.

If you do not follow procedures, it can cause ESD damage to the drive circuitry.

Install vibration-proof rubber on the base of the motor or use the frequency jump function in the drive to prevent specific frequencies that vibrate the motor.

Motor or system resonant vibration can occur in fixed speed machines that are converted to variable speed. Too much vibration can cause damage to equipment.

You can use the drive with an explosion-proof motor, but the drive is not explosion-proof. Install the drive only in the environment shown on the nameplate.

If you install the drive in a dangerous environment, it can cause damage to the drive.

Do not lift the drive with the covers removed.

If the drive does not have covers, you can easily cause damage to the internal parts of the drive.

2.2 Installation Environment

The installation environment is important for the lifespan of the product and to make sure that the drive performance is correct. Make sure that the installation environment agrees with these specifications.

Environment	Conditions
Area of Use	Indoors
Power Supply	Overvoltage Category III (IEC60664)
Ambient Temperature Setting	IP20/UL Open Type: -10 °C to +50 °C (14 °F to 122 °F) IP20/UL Type 1: -10 °C to +40 °C (14 °F to 104 °F) • When you install the drive in an enclosure, use a cooling fan or air conditioner to keep the internal air temperature in the permitted range. • Do not let the drive freeze.
Humidity	95%RH or less Do not let condensation form on the drive.
Storage Temperature	-20 °C to +70 °C (-4 °F to +158 °F) (short-term temperature during transportation)
Surrounding Area	Pollution degree 2 or less (IEC 60664-1) Install the drive in an area without: • Oil mist, corrosive or flammable gas, or dust • Metal powder, oil, water, or other unwanted materials • Radioactive or flammable materials. • Harmful gas or fluids • Salt • Direct sunlight Keep wood and other flammable materials away from the drive.
Altitude	1000 m (3281 ft) Maximum **Note:** Derate the output current by 1% for each 100 m (328 ft) to install the drive in altitudes between 1000 m to 4000 m (3281 ft to 13123 ft). It is not necessary to derate the rated voltage in these conditions: • Installing the drive at 2000 m (6562 ft) or lower • Installing the drive between 2000 m to 4000 m (6562 ft to 13123 ft) and grounding the neutral point on the power supply. Contact Yaskawa or your nearest sales representative when not grounding the neutral point.
Vibration	• 10 Hz to 20 Hz: 1 G (9.8 m/s², 32.15 ft/s²) • 20 Hz to 55 Hz: 0.6 G (5.9 m/s², 19.36 ft/s²)
Installation Orientation	Install the drive vertically or horizontally for sufficient airflow to cool the drive. Refer to the drive Technical Manual for more information.

NOTICE

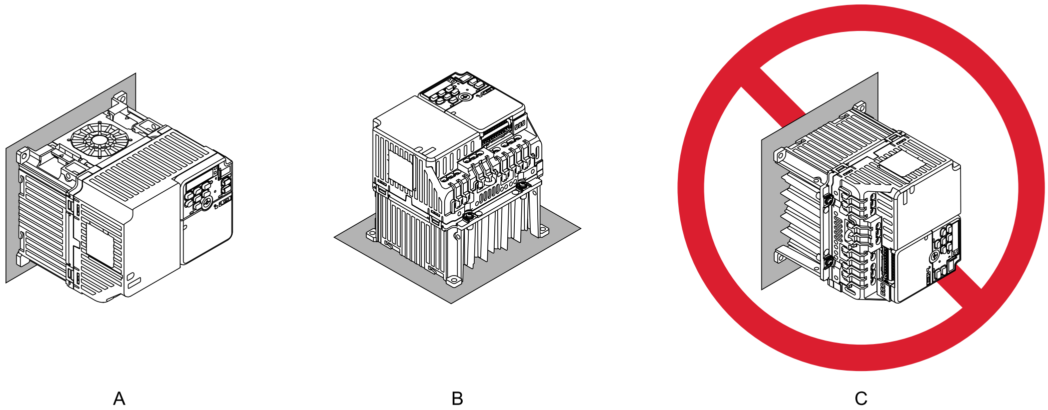
Do not put drive peripheral devices, transformers, or other electronics near the drive. Shield the drive from electrical interference if components must be near the drive.
Components near the drive can cause incorrect drive operation from electrical interference.

NOTICE

Do not let unwanted objects, for example metal shavings or wire clippings, fall into the drive during drive installation. Put a temporary cover over the drive during installation. Remove the temporary cover before start-up.
Unwanted objects inside of the drive can cause damage to the drive.

2.3 Installation Position and Clearances

Install the drive as shown in Figure 2.1 for sufficient airflow to cool the drive.

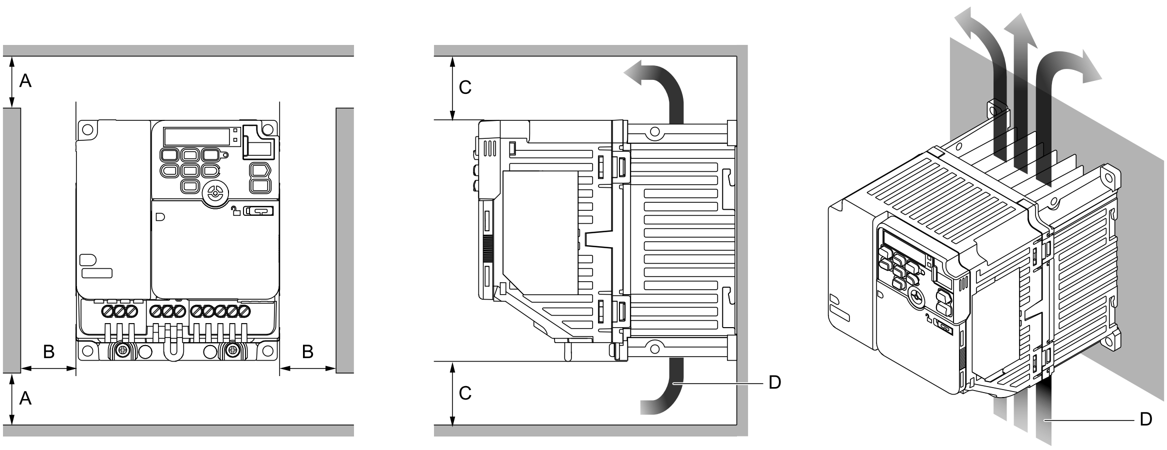


A - Vertical installation
B - Horizontal installation
C - Rotated installation

Figure 2.1 Installation Orientation

◆ Install Single Drive

Use the clearances specified in Figure 2.2 to install the drive. Make sure that there is sufficient space for wiring and airflow.

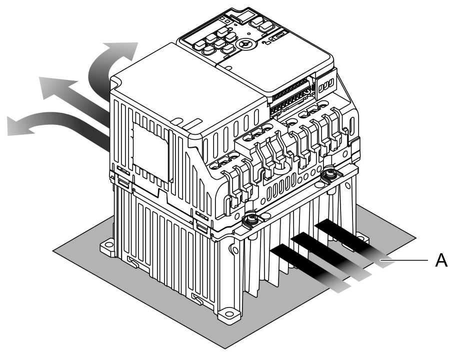


A - 50 mm (2 in) minimum
B - 30 mm (1.18 in) minimum on each side
C - 100 mm (3.94 in) minimum above and below
D - Airflow direction

Figure 2.2 Installation Clearances for One Drive

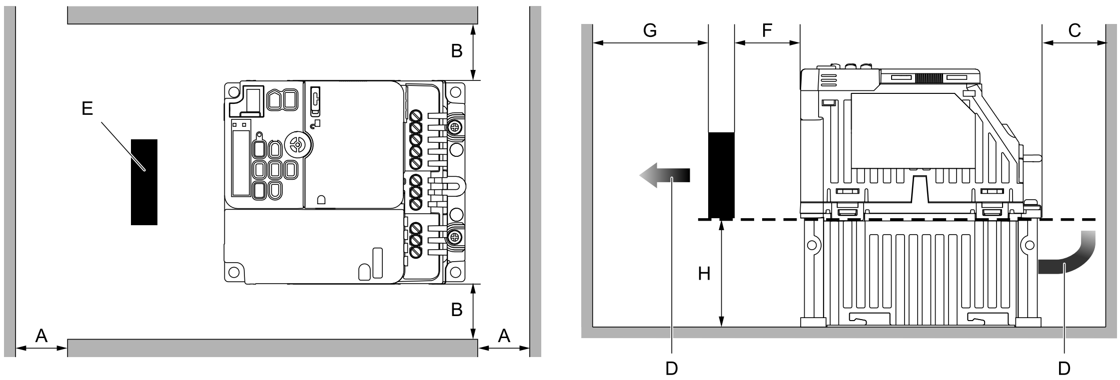
◆ Install the Drive Horizontally

When you install drives horizontally, set *L8-12 = 40 [Ambient Temperature Setting = 40 °C]* and *L8-35 = 1 [Installation Method Selection = Side-by-Side Mounting]*. Use the clearances specified in Figure 2.4 and Figure 2.5 to install the drive. Make sure that there is sufficient space for wiring and airflow. To install the drive model 4009 horizontally, install an external cooling fan. Refer to Table 2.1 for more information about the external cooling fan.



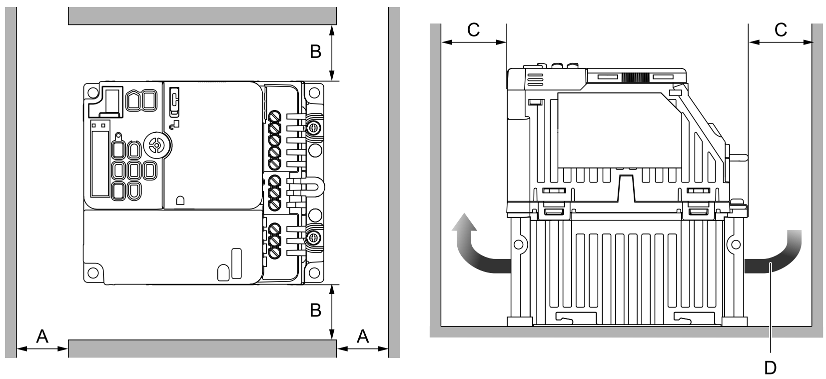
A - Airflow direction

Figure 2.3 Airflow Direction of Horizontal installation



A - 50 mm (2 in) minimum
B - 30 mm (1.18 in) minimum on each side
C - 100 mm (3.94 in) minimum below
D - Airflow direction
E - External cooling fan
F - 30 mm (1.18 in) between the drive and the external cooling fan
G - 120 mm (4.72 in) minimum between the external cooling fan and the enclosure panel
H - Heatsink height

Figure 2.4 Installation Clearances for Horizontal Installation: 2018, and 4009



A - 50 mm (2 in) minimum
B - 30 mm (1.18 in) minimum on each side
C - 100 mm (3.94 in) minimum above and below
D - Airflow direction

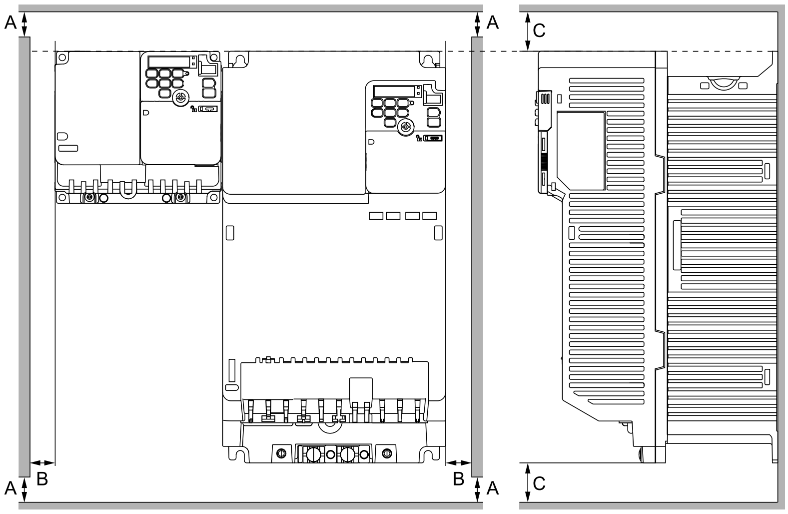
Figure 2.5 Installation Clearances for Horizontal Installation: 2025 - 2075, and 4015 - 4045

Table 2.1 Specifications of External Cooling Fan for Horizontal (Floor) Installation

Model	Airflow (m³/min)	Static Pressure (Pa)
2018 4009	1.11 minimum	244 minimum
2025 - 2075 4015 - 4045	External cooling fan is not necessary	

◆ Install Drives Side-by-Side

When you install drives side-by-side, set *L8-35 = 1 [Installation Method Selection = Side-by-Side Mounting]*. Refer to *Derating Depending on Ambient Temperature on page 240* and set derating depending on ambient temperature.



A - 50 mm (1.97 in) minimum
B - 30 mm (1.18 in) minimum on each side
C - 100 mm (3.94 in) minimum above and below

Figure 2.6 Installation Clearances for More than One Drive (Side-by-Side)

Note:
Align the tops of drives that have different dimensions to help when you replace cooling fans.

2.4 Moving the Drive

When you move and install this product, make sure that you obey local laws and regulations.

⚠ CAUTION Crush Hazard
Do not hold the drive by the keypad or front cover. Tighten the screws correctly when you move the drive.
If the drive or covers fall, it can cause moderate injury.

2.5 Drive Models and Drive Watt Loss

◆ Drive Watt Loss (without Built-in EMC Filter)

■ Three-Phase 200 V Class

Table 2.2 Drive Watt Loss (HD, Fc = 2 kHz)

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
2018A	17.6	2	36	83	119
2025A	25.0	2	45	163	208
2033A	33.0	2	55	200	255
2047A	47.0	2	77	269	346
2060A	60.0	2	108	411	519
2075A	75.0	2	132	439	571

Table 2.3 Drive Watt Loss (HD, Fc = 8 kHz [Default Setting])

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
2018A	17.6	8	40	108	148
2025A	25.0	8	49	187	236
2033A	33.0	8	60	232	292
2047A	47.0	8	85	318	403
2060A	60.0	8	119	473	592
2075A	75.0	8	148	525	673

■ Three-Phase 400 V Class

Table 2.4 Drive Watt Loss (HD, Fc = 2 kHz)

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
4009A	9.2	2	27	60	87
4015A	14.8	2	48	126	174
4018A	18	2	53	152	205
4024A	24	2	68	191	259
4031A	31	2	81	256	337
4039A	39	2	109	338	447
4045A	45	2	114	328	442

Table 2.5 Drive Watt Loss (HD, Fc = 8 kHz [Default Setting])

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
4009A	9.2	8	32	85	117
4015A	14.8	8	55	166	221
4018A	18	8	61	200	261
4024A	24	8	79	255	334
4031A	31	8	95	338	433
4039A	39	8	127	442	569
4045A	45	8	135	446	581

◆ Drive Watt Loss (with Built-in EMC Filter)

■ Three-Phase 200 V Class

Table 2.6 Drive Watt Loss (HD, Fc = 2 kHz)

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
2018E	17.6	2	37	83	120
2025E	25.0	2	46	163	209
2033E	33.0	2	56	200	256
2047E	47.0	2	78	269	347
2060E	60.0	2	109	411	520
2075E	75.0	2	133	439	572

Table 2.7 Drive Watt Loss (HD, Fc = 8 kHz [Default Setting])

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
2018E	21	8	41	108	149
2025E	30	8	50	187	237
2033E	42	8	61	232	293
2047E	56	8	86	318	404
2060E	70	8	120	473	593
2075E	82	8	149	525	674

■ Three-Phase 400 V Class

Table 2.8 Drive Watt Loss (HD, Fc = 2 kHz)

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
4009E	9.2	2	29	60	89
4015E	14.8	2	52	126	178
4018E	18	2	57	152	209
4024E	24	2	73	191	264
4031E	31	2	89	256	345
4039E	39	2	119	338	457
4045E	45	2	128	328	456

Table 2.9 Drive Watt Loss (HD, Fc = 8 kHz [Default Setting])

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
4009E	9.2	8	34	85	119
4015E	14.8	8	59	166	225
4018E	18	8	65	200	265
4024E	24	8	84	255	339
4031E	31	8	103	338	441
4039E	39	8	137	442	579
4045E	45	8	149	446	595

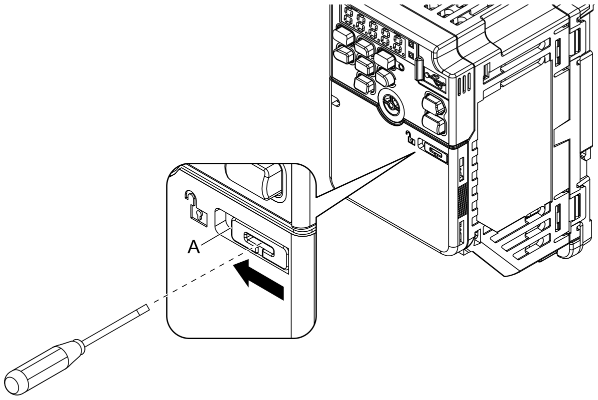
2.6 Remove and Reattach the Covers

DANGER **Electrical Shock Hazard**

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.
If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

◆ Removing the Front Cover

1. Unlock the front cover of the drive.
   Use a slotted screwdriver with a tip width of 2.5 mm (0.1 in) or less and a thickness of 0.4 mm (0.02 in) or less.



A - Front cover lock

Figure 2.7 Unlocking

2. Pull down, then pull away from the drive to remove the front cover.

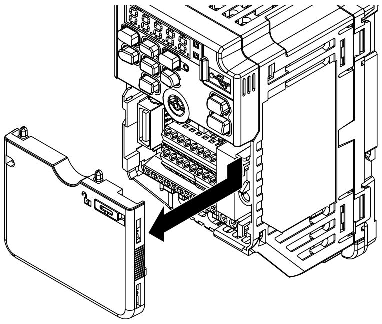


Figure 2.8 Remove the Front Cover

◆ Reattaching the Front Cover

1. Reverse the steps to reattach the cover.

Note:
Make sure that you do not pinch wires or signal lines between the front cover and the drive before you reattach the cover.

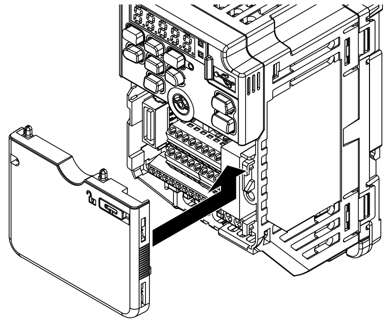
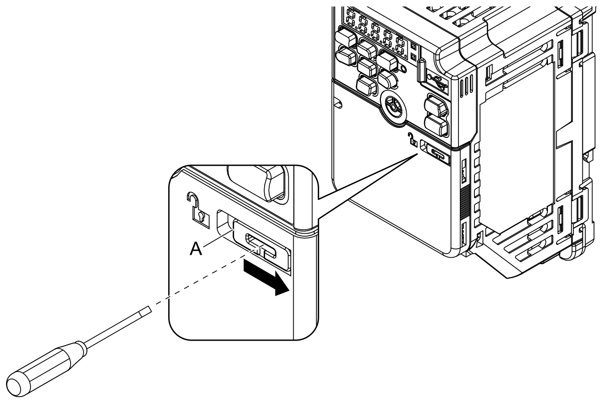


Figure 2.9 Reattach the Front Cover

2. Lock the front cover of the drive.
   Use a slotted screwdriver with a tip width of 2.5 mm (0.1 in) or less and a thickness of 0.4 mm (0.02 in) or less.



A - Front cover lock

Figure 2.10 Locking the Front Cover

2.7 Remove and Reattach the Keypad

◆ Removing the Keypad

1. Remove the front cover.
2. Push on the tab on the right side of the keypad, then pull the keypad forward to remove it from the drive.

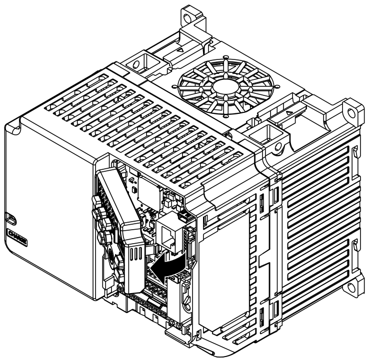


Figure 2.11 Remove the Keypad

◆ Reattaching the Keypad

1. Push in the keypad from the front until the hooks click into place.

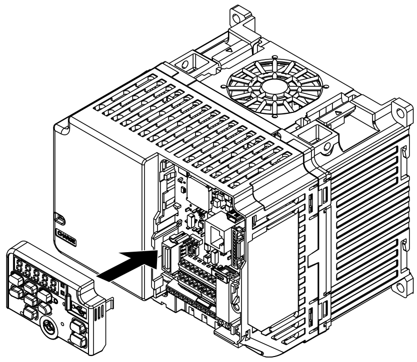


Figure 2.12 Reattach the Keypad

2. Attach the front cover.

2.8 Install the Keypad in a Control Panel or Another Device

◆ Operate the Keypad from a Remote Location

You can remove the keypad from the drive and connect it to a remote control extension cable 3 m (9.8 ft) long to make operation easier when you cannot access the drive. It is not necessary to open or close the panel door to operate a drive that is in a control panel. To order optional accessories, contact Yaskawa or your nearest sales representative.

Name	Option Model	Intended Use
Keypad Remote Cable	WV001: 1 m (3.3 ft) WV003: 3 m (9.8 ft)	To connect the keypad and drive. This option is an RJ-45, 8-pin straight-through UTP CAT5e cable.
Installation Support Set A	900-192-933-001	To attach the keypad to the control panel. This option uses screws.
Installation Support Set B	900-192-933-002	To attach the keypad to the control panel. This option uses nut clamps. Use this option when weld studs are located in the control panel.

3

Electrical Installation

This chapter gives how to wire the control circuit terminals, motor, and power supply of the drive.

3.1 Section Safety

⚠DANGER

Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠WARNING

Electrical Shock Hazard

Do not operate the drive when covers are missing. Replace covers and shields before you operate the drive. Use the drive only as specified by the instructions.

Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. If covers or safety shields are missing from the drive, it can cause serious injury or death.

Ground the neutral point on the power supply of drive models built-in EMC filter to comply with the EMC Directive before you turn on the EMC filter or if there is high resistance grounding.

If you turn ON the EMC filter, but you do not ground the neutral point, it can cause serious injury or death.

Make sure that the protective ground wire complies with technical standards and local safety regulations. The EN 61800-5-1:2007 standard specifies that you must wire the power supply to automatically de-energize when the protective ground wire disconnects. If you turn on the internal EMC filter, the leakage current of the drive will be more than 3.5 mA. Use the closed-loop crimp terminal to connect a protective ground wire that has a minimum cross-sectional area of 10 mm^2 (copper wire).

If you do not obey the standards and regulations, it can cause serious injury or death.

When there is a DC component in the protective earthing conductor, the drive can cause a residual current. When a residual current operated protective or monitoring device prevents direct or indirect contact, always use a type B Residual Current Monitor/Residual Current Device (RCM/RCD) as specified by IEC/EN 60755.

If you do not use the correct RCM/RCD, it can cause serious injury or death.

Do not wear loose clothing or jewelry when you do work on the drive. Tighten loose clothing and remove all metal objects, for example watches or rings.

Loose clothing can catch on the drive and jewelry can conduct electricity and cause serious injury or death.

Do not remove covers or touch circuit boards while the drive is energized.

If you touch the internal components of an energized drive, it can cause serious injury or death.

Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive.

If personnel are not approved, it can cause serious injury or death.

Do not modify the drive body or drive circuitry.

Modifications to drive body and circuitry can cause serious injury or death, will cause damage to the drive, and will void the warranty. Yaskawa is not responsible for modifications of the product made by the user.

Fire Hazard

Tighten all terminal screws to the correct tightening torque.

Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.

Tighten screws at an angle in the specified range shown in this manual.

If you tighten the screws at an angle not in the specified range, you can have loose connections that can cause damage to the terminal block or start a fire and cause serious injury or death.

⚠WARNING

Damage to Equipment

Do not apply incorrect voltage to the main circuit of the drive. Operate the drive in the specified range of the input voltage on the drive nameplate.

Voltages that are higher than the permitted nameplate tolerance can cause damage to the drive.

Fire Hazard

When you install a dynamic braking option, wire the components as specified by the wiring diagrams.

Incorrect wiring can cause damage to braking components or serious injury or death.

NOTICE

Do not let unwanted objects, for example metal shavings or wire clippings, fall into the drive during drive installation. Put a temporary cover over the drive during installation. Remove the temporary cover before start-up.

Unwanted objects inside of the drive can cause damage to the drive.

Damage to Equipment

When you touch the drive and circuit boards, make sure that you observe correct electrostatic discharge (ESD) procedures.

If you do not follow procedures, it can cause ESD damage to the drive circuitry.

Select a motor that is compatible with the load torque and speed range. When 100% continuous torque is necessary at low speed, use an inverter-duty motor or vector-duty motor. When you use a standard fan-cooled motor, decrease the motor torque in the low-speed range.

If you operate a standard fan-cooled motor at low speed and high torque, it will decrease the cooling effects and can cause heat damage.

Obey the speed range specification of the motor as specified by the manufacturer. When you must operate the motor outside of its specifications, contact the motor manufacturer.

If you continuously operate oil-lubricated motors outside of the manufacturer specifications, it can cause damage to the motor bearings.

When the input voltage is 440 V or higher or the wiring distance is longer than 100 m (328 ft), make sure that the motor insulation voltage is sufficient or use an inverter-duty motor or vector-duty motor with reinforced insulation.

Motor winding and insulation failure can occur.

Before you connect a dynamic braking option to the drive, make sure that qualified personnel read and obey the Braking Unit and Braking Resistor Unit Installation Manual (TOBPC72060001).

If you do not read and obey the manual or if personnel are not qualified, it can cause damage to the drive and braking circuit.

Make sure that all connections are correct after you install the drive and connect peripheral devices.

Incorrect connections can cause damage to the drive.

Note:
- Torque characteristics are different than when you operate the motor directly from line power. Make sure that you understand the load torque characteristics for the application.
- The rated input current of submersible motors is higher than the rated input current of standard motors. Carefully select the correct drive capacity. When the distance between the motor and drive is long, use a wire that can connect the motor to the drive without a reduction in motor torque.
- Do not use unshielded wire for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive. Unshielded wire can cause electrical interference and unsatisfactory system performance.

3.2 Standard Connection Diagram

◆ Safety

⚠ DANGER **Electrical Shock Hazard**
Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.
If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠ WARNING **Electrical Shock Hazard**
De-energize the drive and wait 5 minutes minimum until the Charge LED turns off. Remove the front cover and terminal cover to do work on wiring, circuit boards, and other parts. Use terminals for their correct function only.
Incorrect wiring, incorrect ground connections, and incorrect repair of protective covers can cause death or serious injury.

⚠ WARNING **Electrical Shock Hazard**
Correctly ground the drive before you turn on the EMC filter switch.
If you touch electrical equipment that is not grounded, it can cause serious injury or death.

⚠ WARNING **Electrical Shock Hazard**
Use the terminals for the drive only for their intended purpose. Refer to the technical manual for more information about the I/O terminals.
Wiring and grounding incorrectly or modifying the cover may damage the equipment or cause injury.

⚠ WARNING **Sudden Movement Hazard**
Correctly wire the start/stop and safety circuits before you energize the drive.
If you momentarily close a digital input terminal, it can start a drive that is programmed for 3-Wire control and cause serious injury or death from moving equipment.

⚠ WARNING **Sudden Movement Hazard**
Set the MFDI parameters before you close control circuit switches.
Incorrect Run/Stop circuit sequence settings can cause serious injury or death from moving equipment.

⚠ WARNING **Fire Hazard**
Install sufficient branch circuit short circuit protection as specified by applicable codes and this manual. The drive is suitable for circuits that supply not more than 31,000 RMS symmetrical amperes, 240 Vac maximum (200 V Class), 480 Vac maximum (400 V Class).
Incorrect branch circuit short circuit protection can cause serious injury or death.

NOTICE **Damage to Equipment**
Do not connect the AC control circuit ground to the drive enclosure.
Failure to obey can cause incorrect control circuit operation.

NOTICE **Damage to Equipment**
When the input voltage is 440 V or higher or the wiring distance is longer than 100 m (328 ft), make sure that the motor insulation voltage is sufficient or use an inverter-duty motor or vector-duty motor with reinforced insulation.
Motor winding and insulation failure can occur.

◆ Drive Connection Diagram

Wire the drive as specified by Figure 3.1.

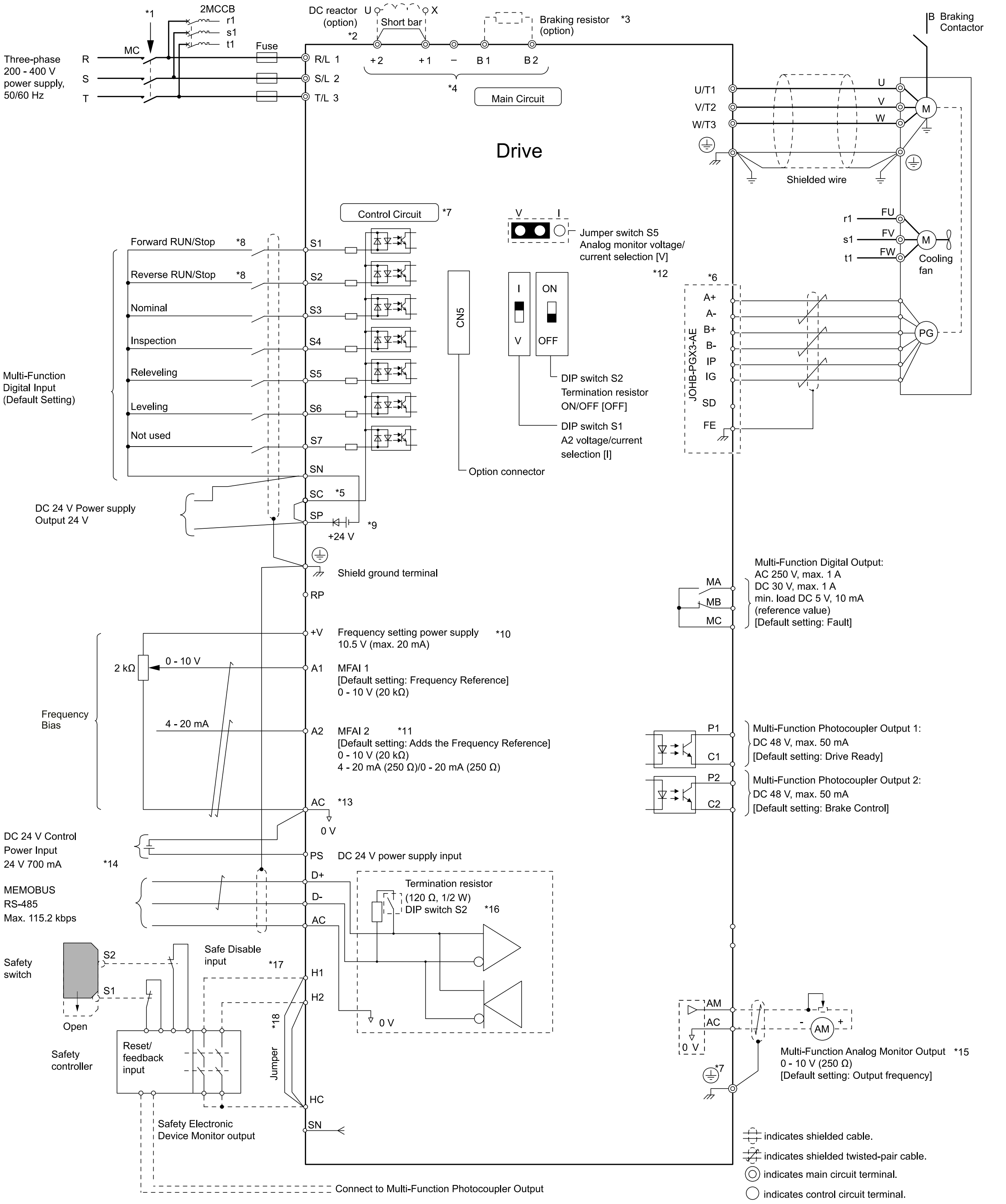


Figure 3.1 Standard Drive Connection Diagram

*1 Set the wiring sequence to use a fault relay output to de-energize the drive. When you set *L5-02 = 1 [Fault Output during Auto Reset = Fault output is set]*, the drive outputs a fault signal during Automatic Fault Reset and de-energizes. Be careful when you use a cutoff sequence. The default setting is *L5-02 = 0 [No fault output]*.

*2 When you install a DC reactor, you must remove the jumper between terminals +1 and +2. Ground the DC reactor (option) on the back of the mounting base. Remove all paint from the mounting surface of the control panel.

*3 When you use a regenerative converter, regenerative unit, braking resistor, or braking resistor unit, set *L8-55 = 0 [Internal DB TransistorProtection = Disabled]*. If *L8-55 = 1 [RF Enabled/BOL Enabled]*, the drive will detect rF [Braking Resistor Fault].

*4 Connect peripheral options to terminals -, +1, +2, B1, and B2.

WARNING **Fire Hazard**

Only connect factory-recommended devices or circuits to drive terminals B1, B2, -, +1, and +2. Do not connect an AC power supply lines to these terminals.
Incorrect wiring can cause damage to the drive and serious injury or death from fire.

*5 Set a wiring sequence to de-energize the drive with the fault relay output.
*6 Encoder circuit wiring (wiring to PG-X3AE option) is not necessary for applications that do not use motor speed feedback.
*7 Connect a 24 V power supply to terminals PS-AC to operate the control circuit while the main circuit power supply is OFF.

WARNING **Electrical Shock Hazard**

When you connect the shield wire of the control circuit wiring to the protective ground terminal, do not connect the protective ground wire.
If you connect the shield wire and the protective ground wire to the protective grounding terminal, it may not comply with the technical standards and local safety regulations and can cause serious injury or death.

*8 Set up the wiring to rotate the motor forward (FWD) when an elevator car moves upward, and to rotate the motor reverse (REV) when an elevator car moves downward in all control methods.
*9 To set the MFDI power supply (Sinking/Sourcing Mode or internal/external power supply), install or remove a jumper between terminals SC-SP or SC-SN depending on the application.

NOTICE **Damage to Equipment**

Do not close the circuit between terminals SP-SN.
If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.

- Sinking Mode, Internal power supply: Install the jumper to close the circuit between terminals SC-SP.

  NOTICE **Damage to Equipment**

  Do not close the circuit between terminals SC-SN.
  If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.

- Sourcing Mode, Internal power supply: Install the jumper to close the circuit between terminals SC-SN.

  NOTICE **Damage to Equipment**

  Do not close the circuit between terminals SC-SP.
  If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.

- External power supply: Remove the jumper from the MFDI terminals. It is not necessary to close the circuit between terminals SC-SP and terminals SC-SN.

*10 The maximum output current capacity for terminal +V on the control circuit is 20 mA.

NOTICE **Damage to Equipment**

Do not install a jumper between terminals +V and AC.
A closed circuit between these terminals will cause damage to the drive.

*11 DIP switch S1 sets terminal A2 for voltage or current input. The default setting for S1 is voltage input (“V” side).
*12 Set Jumper S5 for voltage or current signals for Analog Monitor Output.
*13 Do not ground the control circuit terminals AC or connect them to the drive chassis.

NOTICE

Do not ground the AC control circuit terminals and only connect the AC terminals as specified by the product instructions.
If you connect the AC terminals incorrectly, it can cause damage to the drive.

*14 Connect the positive lead from an external 24 Vdc power supply to terminal PS and the negative lead to terminal AC.

NOTICE

Connect terminals PS and AC correctly for the 24 V power supply.
If you connect the wires to the incorrect terminals, it will cause damage to the drive.

*15 Use multi-function analog monitor outputs with analog frequency meters, ammeters, voltmeters, and wattmeters. Do not use monitor outputs with feedback-type signal devices.
*16 Set DIP switch S2 to "ON" to enable the termination resistor in the last drive in a MEMOBUS/Modbus network.
*17 Use only Sourcing Mode for Safe Disable input.
*18 Disconnect the wire jumpers between H1 and HC and H2 and HC to use the Safe Disable input.

3.3 Main Circuit Wiring

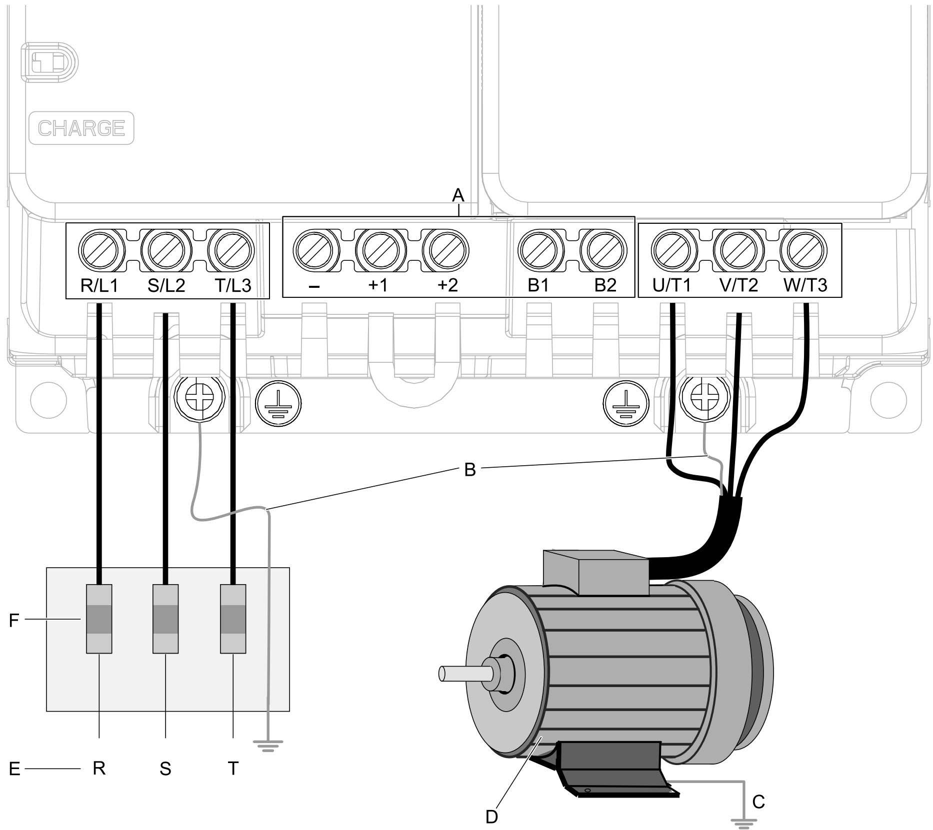
This section gives information about the functions, specifications, and procedures necessary to safely and correctly wire the main circuit in the drive.

NOTICE Damage to Equipment
Do not energize and de-energize the drive more frequently than one time each 30 minutes. If you frequently energize and de-energize the drive, it can cause drive failure.

Note:
Soldered wire connections can become loose over time and cause unsatisfactory drive performance.

◆ Motor and Main Circuit Connections

WARNING Electrical Shock Hazard
Do not connect terminals R/L1, S/L2, T/L3, L/L1, N/L2, U/T1, V/T2, W/T3, -, +1, +2, B1, or B2 to the ground terminal.
If you connect these terminals to earth ground, it can cause damage to the drive or serious injury or death.



Note:
The locations of terminals are different for different drive models.

- **A - DC bus terminal**
- **B - Connect to the drive ground terminal.**
- **C - Ground the motor case.**
- **D - Three-Phase Motor**
- **E - Use terminals R/L1, S/L2, and T/L3 for three-phase power supply input. Use terminals L/L1 and N/L2 for single-phase power supply input.**
- **F - Input Protection (Fuses or Circuit Breakers)**

Figure 3.2 Wiring the Main Circuit and Motor

◆ Configuration of Main Circuit Terminal Block

■ Drive Models 2018, 4009

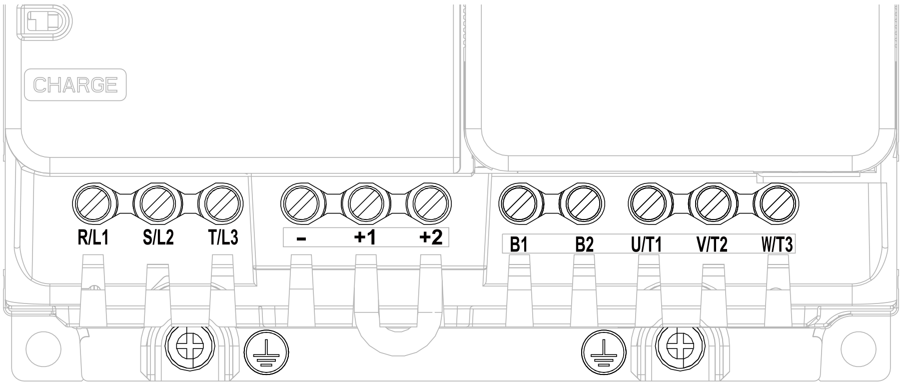


Figure 3.3 Configuration of Main Circuit Terminal Block (Three-Phase, Without a Built-in EMC Filter)

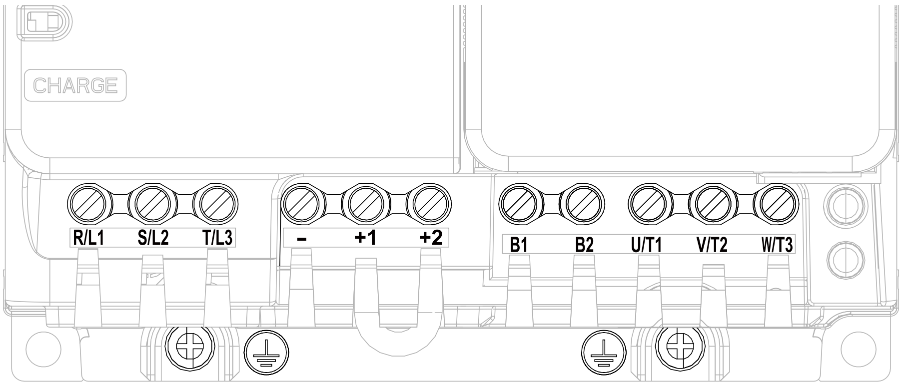


Figure 3.4 Configuration of Main Circuit Terminal Block (Three-Phase, With a Built-in EMC Filter)

■ Drive Models 2025, 2033, 4015, 4018

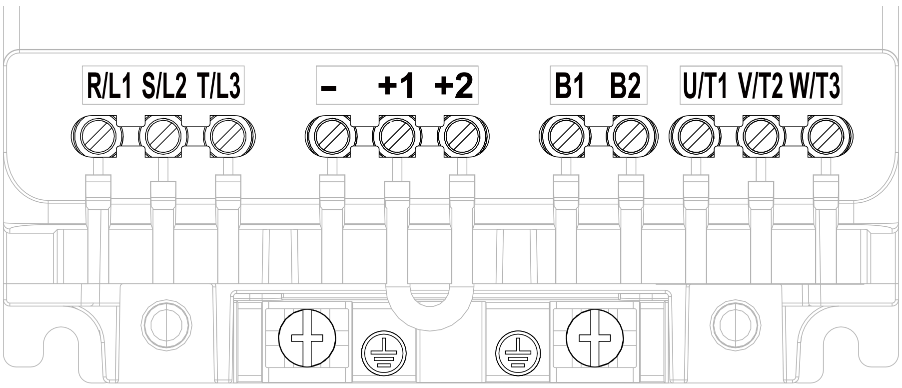


Figure 3.5 Configuration of Main Circuit Terminal Block (Three-Phase, Without a Built-in EMC Filter)

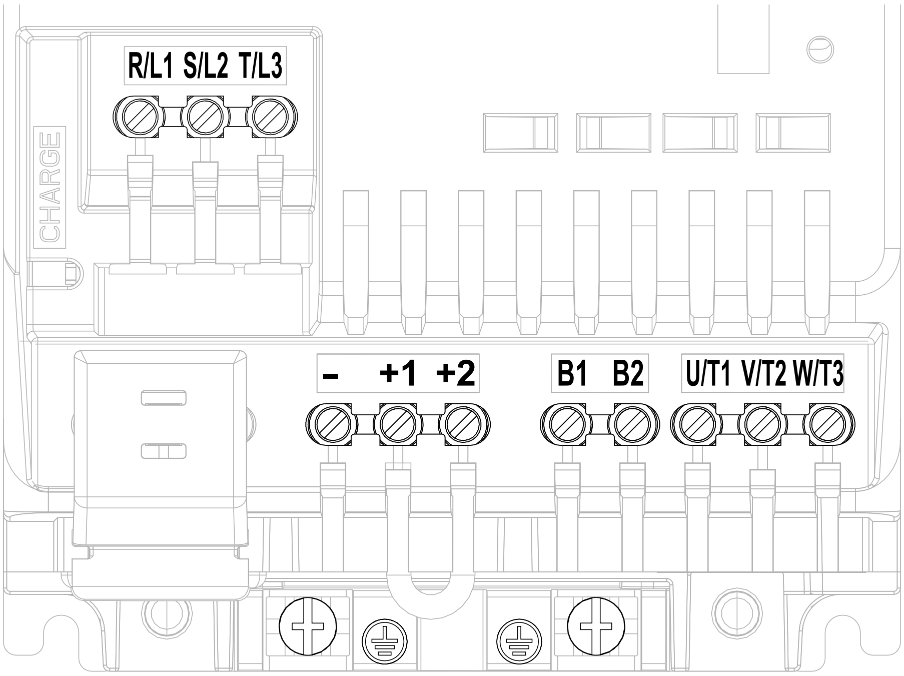


Figure 3.6 Configuration of Main Circuit Terminal Block (Three-Phase, With a Built-in EMC Filter)

■ Drive Models 2047, 4024, 4031

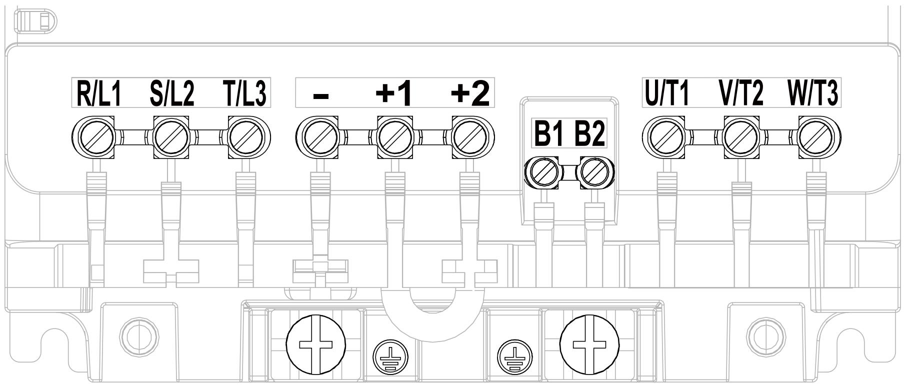


Figure 3.7 Configuration of Main Circuit Terminal Block (Three-Phase, Without a Built-in EMC Filter)

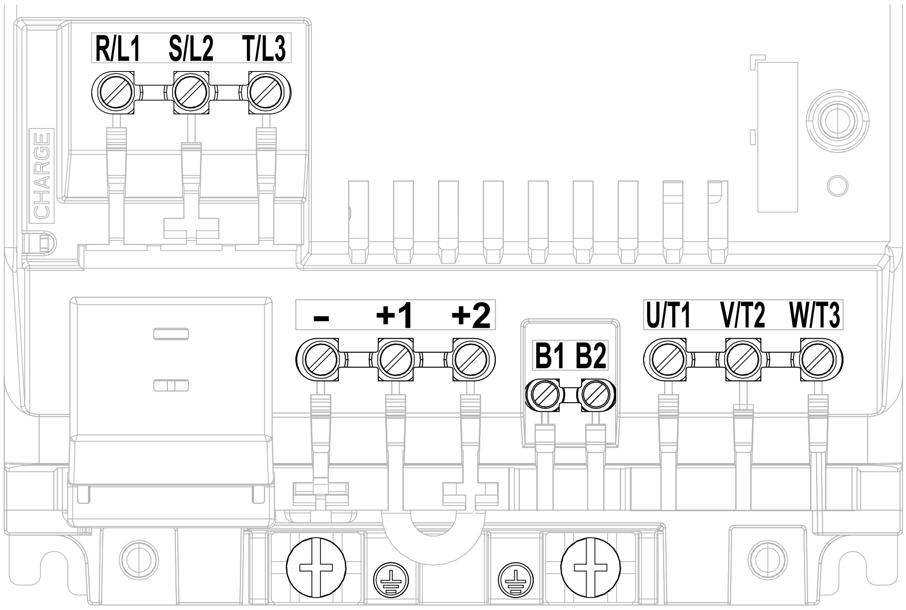


Figure 3.8 Configuration of Main Circuit Terminal Block (Three-Phase, With a Built-in EMC Filter)

■ Drive Models 2060, 2075

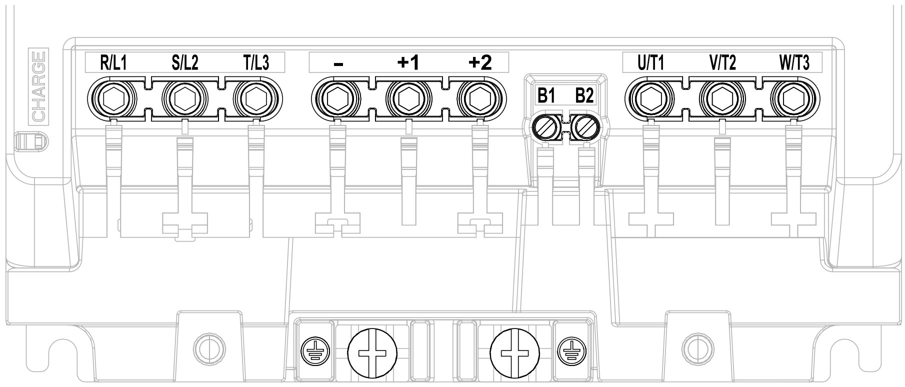


Figure 3.9 Configuration of Main Circuit Terminal Block (Three-Phase, Without a Built-in EMC Filter)

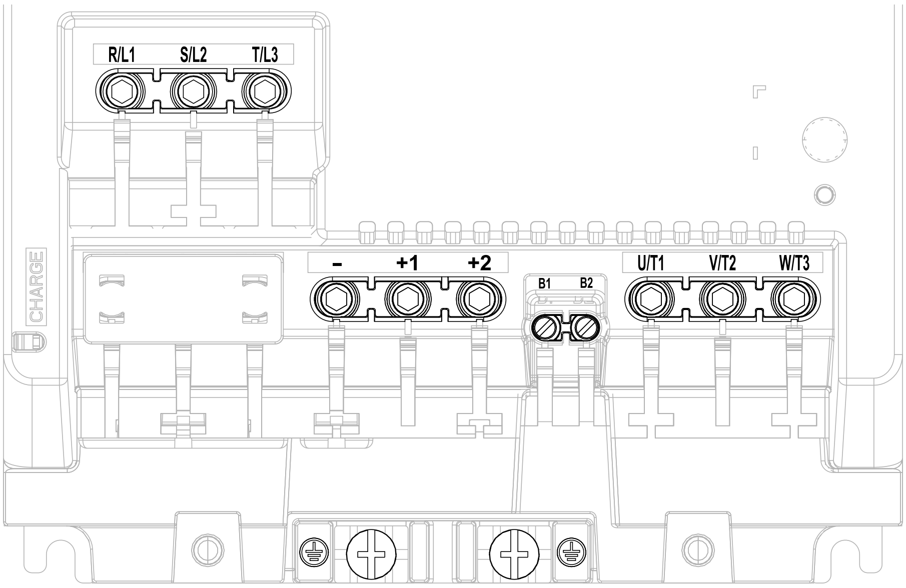


Figure 3.10 Configuration of Main Circuit Terminal Block (Three-Phase, With a Built-in EMC Filter)

■ Drive Models 4039, 4045

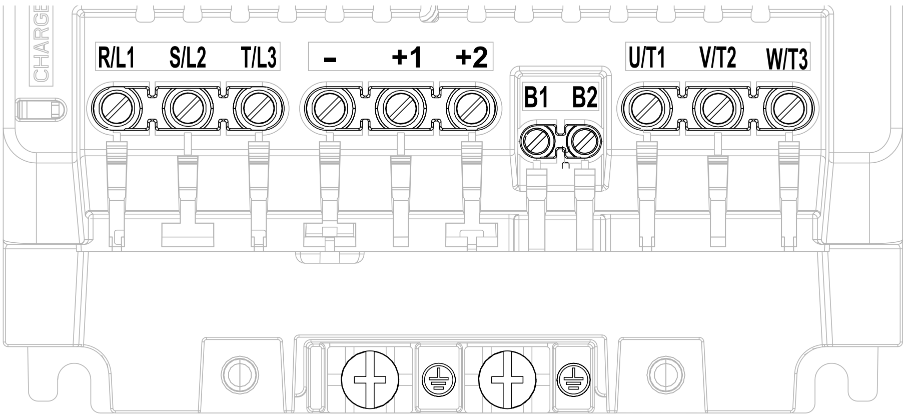


Figure 3.11 Configuration of Main Circuit Terminal Block (Three-Phase, Without a Built-in EMC Filter)

Electrical Installation

3

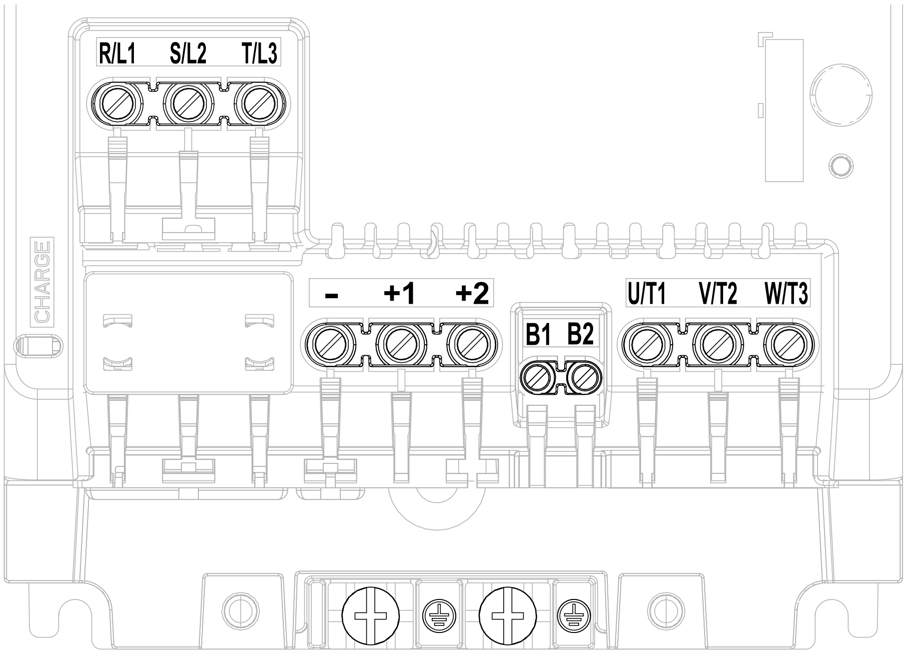


Figure 3.12 Configuration of Main Circuit Terminal Block (Three-Phase, With a Built-in EMC Filter)

◆ Main Circuit Terminal Functions

Table 3.1 Main Circuit Terminal Functions

Terminal	Name	Function
Model	4009 - 4045	
R/L1	Main circuit power supply input	To connect a commercial power supply.
S/L2		
T/L3		
L/L1	-	
N/L2		
U/T1	Drive output	To connect a motor.
V/T2		
W/T3		
+1	DC reactor connection	Remove the jumper between terminals +1 and +2 to connect a DC reactor.
+2		
B1	Braking resistor connection	To connect a braking resistor or braking resistor unit.
B2		
⏚	Ground Wiring	To ground the drive. • 400 V: C class grounding (ground to 10 Ω or less)

◆ Wire Selection

Select the correct wires for main circuit wiring.

Refer to *Main Circuit Wire Gauges and Tightening Torques on page 120* for wire gauges and tightening torques as specified by European standards, and for wiring precautions.

◆ Main Circuit Terminal and Motor Wiring

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

⚠ WARNING **Fire Hazard**

Do not connect main power supply wiring to drive motor terminals U/T1, V/T2, and W/T3. Connect main power supply wiring to main circuit input terminals R/L1, S/L2, and T/L3.
Incorrect wiring can cause serious injury or death from fire.

⚠ WARNING **Sudden Movement Hazard**

Make sure that you align the phase order for the drive and motor when you connect the motor to drive output terminals U/T1, V/T2, and W/T3.
If the phase order is incorrect, it can cause the motor to run in reverse. If the motor accidentally runs in reverse, it can cause serious injury or death.

NOTICE

Do not connect phase-advancing capacitors, LC/RC noise filters, or leakage breakers (RCM/RCD) to the motor circuit.
If you connect these devices to the output circuits, it can cause damage to the drive and connected equipment.

■ Cable Length Between Drive and Motor

When the wiring between the drive and the motor is too long, voltage drop along the motor cable can decrease motor torque, usually at low frequency output. If you connect motors in parallel with long motor cable, this is also a problem. Drive output current increases when the leakage current from the cable increases. An increase in leakage current can cause overcurrent and decrease the precision of the current detection.

Use the values in Table 3.2 to adjust the drive carrier frequency. For systems that have 100 m (328 ft) or longer motor wiring, if you use metal conduits or isolated cables for each phase, it will increase stray capacitance.

Table 3.2 Carrier Frequency against Cable Length Between Drive and Motor

Wiring Distance Between the Drive and Motor	50 m (164 ft) Maximum	100 m (328 ft) Maximum	More than 100 m (328 ft)
Carrier Frequency	15 kHz or less	5 kHz or less	2 kHz or less

Note:
- To set the carrier frequency in a drive that is operating more than one motor, calculate the cable length as the total distance of wiring to all connected motors.
- If the length of the wire between the drive and an induction motor is longer than 100 m (328 ft), set *A1-02 = 0 [V/f]*.

■ Ground Wiring

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

⚠ WARNING **Electrical Shock Hazard**

Make sure that the protective ground wire complies with technical standards and local safety regulations. The EN 61800-5-1:2007 standard specifies that you must wire the power supply to automatically de-energize when the protective ground wire disconnects. If you turn on the internal EMC filter, the leakage current of the drive will be more than 3.5 mA. Use the closed-loop crimp terminal to connect a protective ground wire that has a minimum cross-sectional area of 10 mm² (copper wire).
If you do not obey the standards and regulations, it can cause serious injury or death.

⚠ WARNING **Electrical Shock Hazard**

Ground the neutral point on the power supply of drive models 4xxxE to comply with the EMC Directive before you turn on the EMC filter or if there is high resistance grounding.
If you turn ON the EMC filter, but you do not ground the neutral point, it can cause serious injury or death.

⚠ WARNING **Electrical Shock Hazard**

Use a ground wire that complies with technical standards on electrical equipment and use the minimum length of ground wire.
Incorrect equipment grounding can cause serious injury or death from dangerous electrical potentials on the equipment chassis.

⚠ WARNING **Electrical Shock Hazard**

Correctly ground the ground terminals. Obey federal and local electrical wiring codes for correct grounding methods. The maximum grounding resistance is
- **200 V class: ground to 100 Ω or less**
- **400 V class: ground to 10 Ω or less**

If you touch electrical equipment that is not grounded, it can cause serious injury or death.

Note:
- Only use the drive grounding wire to ground the drive. Do not share the ground wire with other devices such as welding machines or large-current electrical equipment. Incorrect equipment grounding can cause drive or equipment malfunction from electrical interference.
- To connect more than one drive to the same grounding circuit, follow the instructions in the instruction manual. Incorrect equipment grounding can cause drive or equipment malfunction from electrical interference.

When you connect more than one drive, refer to Figure 3.13. Do not loop the grounding wire.

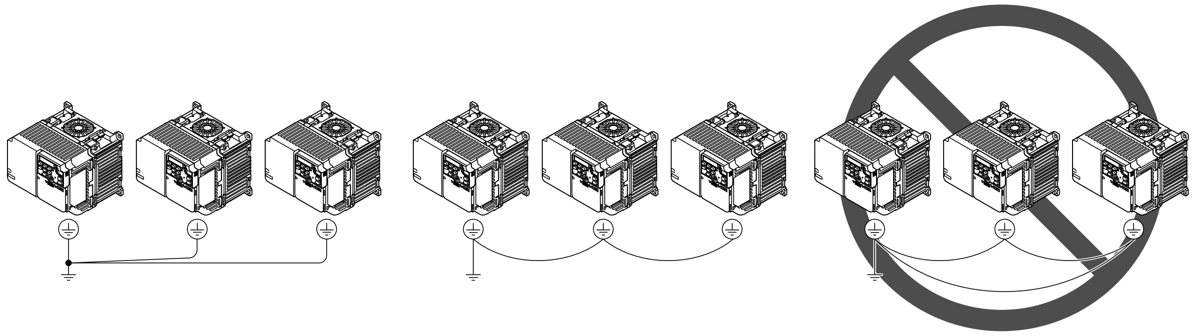


Figure 3.13 Wiring More than One Drive

■ Wiring the Main Circuit Terminal Block

⚠ WARNING **Electrical Shock Hazard**

Before you wire the main circuit terminals, make sure that MCCB and MC are OFF.
If you touch electrical equipment when MCCB and MC are ON, it can cause serious injury or death.

■ Main Circuit Configuration

The figures in this section show the different schematics of the drive main circuit. The connections change when the drive capacity changes. The DC power supply for the main circuit also supplies power to the control circuit.

Note:
Drive models 2018A to 2075A do not have a built-in EMC filter.

⚠ WARNING **Fire Hazard**

Do not connect a braking resistor to terminals +1 or -. Use terminals B1 and B2 for the braking resistor connections.
If you connect a braking resistor to the incorrect terminals, it can cause damage to the drive and braking circuit and serious injury or death.

NOTICE

Do not use the negative DC bus terminal “-” as a ground terminal. This terminal is at high DC voltage potential.
Incorrect wiring connections can cause damage to the drive.

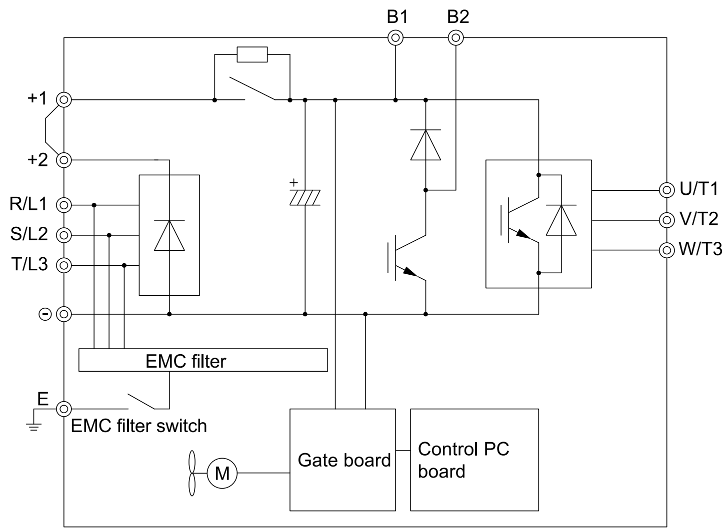


Figure 3.14 Drive Main Circuit Configuration for Models 2018 - 2075, 4009 - 4045

3.4 Main Circuit Terminal Block Wiring Procedure

⚠ DANGER Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.
If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

◆ Wire to the Main Circuit Terminal Block

Wire the unit to the main circuit terminal block correctly as specified by the instructions in the manual.

Read the following notes and instructions before wiring the terminal block.

■ Notes on Wiring the Main Circuit Terminal Block

- Use UL-Listed, vinyl-coated insulated copper wires for operation with a continuous maximum permitted temperature of 75 °C at 600 V.
- Remove all unwanted objects that are near the terminal block connections.
- Remove the insulation from the connection wires to the wire stripping lengths shown in the manual.
- Do not use bent or crushed wires. Remove the damaged end of the wire before you use it. Incorrect connections can cause death or serious injury from fire.
- Do not solder stranded wire. Soldered wire connections can become loose over time and cause unsatisfactory drive performance.
- If you use stranded wire, make sure that all of the wire strands are in the connection. Also, do not twist the stranded wire too much. Incorrect connections can cause death or serious injury from fire.
- Put the wire all the way into the terminal block. Remove the insulation from the wire to the recommended wire stripping length to fit the wire with insulation in the plastic housing.
- Use a torque driver, torque ratchet, or torque wrench for the screws. A slotted driver or a hex tool will be necessary to wire the screw clamp terminal. Use applicable tools as specified by the recommended conditions in the product manual.
- If you use power tools to tighten the terminal screws, use a low speed setting (300 to 400 r/min). Failure to obey can cause damage to the terminal screws.
- Wire gauges on existing drive models to be replaced may not match wire gauge ranges on new drives. Refer to the drive manuals for correct wire sizes.
- Do not tighten the terminal screws at an angle of 5 degrees or more. Failure to obey can cause damage to the terminal screws.
  If you damage a terminal screw, contact Yaskawa or your nearest sales representative.

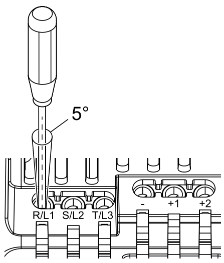


Figure 3.15 Permitted Angle

- Put the bit all the way into the hex socket to tighten the hex socket cap screw.
- When you tighten slotted screws, hold the straight-edge screwdriver perpendicularly to the screw. Make sure that you align the end of the straight-edge screwdriver with the screw groove.

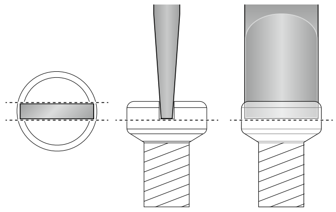
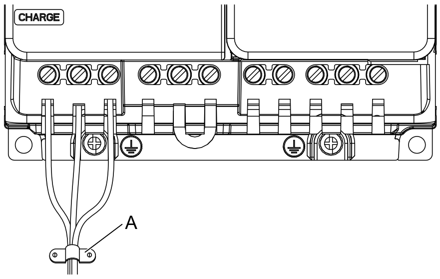


Figure 3.16 Tightening Slotted Screws

- After you connect the wires to the terminal block, lightly pull on the wires to make sure that they do not come out of the terminals.
- Do not let strain on the wiring cause damage. Use a strain relief near the wiring to release the tension. Refer to Figure 3.17 for an example.



A - Cable clamp

Figure 3.17 Strain Relief Example

Table 3.3 Recommended Wiring Tools

Screw Size	Screw Shape	Wire Gauge	Adapter	Bit Manufacturer, Model	Torque Driver Model (Tightening Torque)	Torque Wrench (Tightening Torque)
M3		-	Bit	PHOENIX CONTACT SF-BIT-SL 0,5X3,0-70	TSD-M 1,2NM (0.3 - 1.2 N·m (2.7 - 10.6 in·lb))	-
M4		-	Bit	PHOENIX CONTACT SF-BIT-SL 1,0X4,0-70	TSD-M 3NM (1.2 - 3.0 N·m (10.6 - 26.6 in·lb))	-
M5 *1		≤ 25 mm² (AWG 10)	Bit	PHOENIX CONTACT SF-BIT-SL 1,2X6,5-70	TSD-M 3NM (1.2 - 3.0 N·m (10.6 - 26.6 in·lb))	-
		≥ 30 mm² (AWG 8)			-	4.1 - 4.5 N·m (36.3 - 39.8 in·lb) *2
M6	(WAF: 5 mm)	-	Bit	PHOENIX CONTACT SF-BIT-HEX 5-50	-	5 - 9 N·m (44.3 - 79.7 in·lb) *2

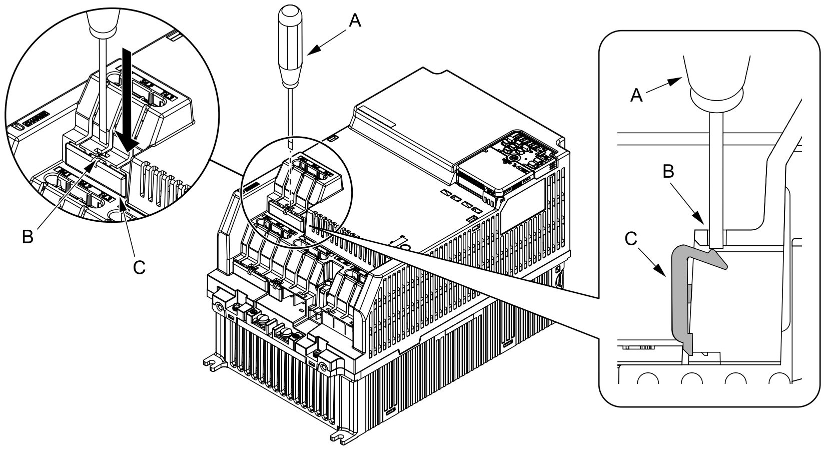
*1 Select the correct tools for the wire gauge.
*2 Use 6.35 mm (0.25 in) bit socket holder.

■ Removing the IP20 Terminal Protective Cover

These drives have IP20 terminal protective covers. Remove the covers for the application.

Model	Terminal R/L1, S/L2, T/L3	Terminal -
2033 4024, 4031	-	x
2047, 2060, 2075 4039, 4045	x	x

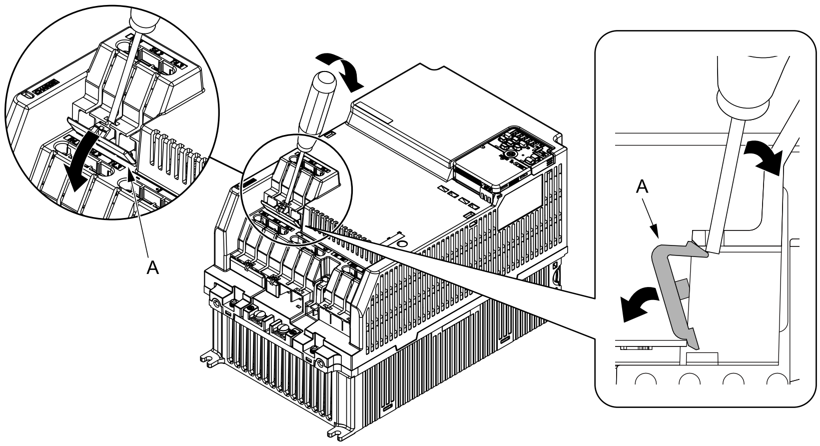
1. Put a slotted screwdriver blade into the slit to push the hook of the IP20 terminal protective cover.



A - Slotted screwdriver
B - Slit
C - IP20 terminal protective cover

Figure 3.18 Put the Screwdriver Blade into the Slit

2. Push up the screwdriver to release the IP20 terminal protective cover.



A - IP20 terminal protective cover

Figure 3.19 Release IP20 terminal protective cover

3. Remove IP20 terminal protective cover.

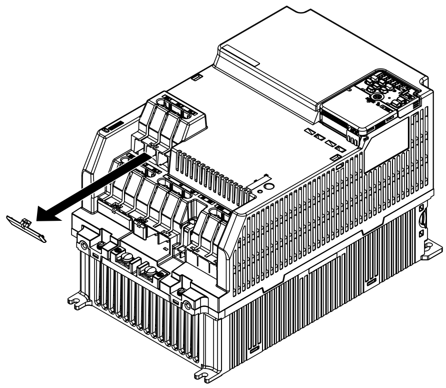


Figure 3.20 Remove IP20 Terminal Protective Cover

■ Wiring the Main Circuit Terminal Block

When terminals R/L1, S/L2, T/L3, and terminal - have IP20 terminal protective covers, remove the cover on the terminal where you will wire.

1. Put wires with prepared ends into the main circuit terminal block.
   Look through the opening in the drive case to make sure that you correctly installed the wires into the terminal block.

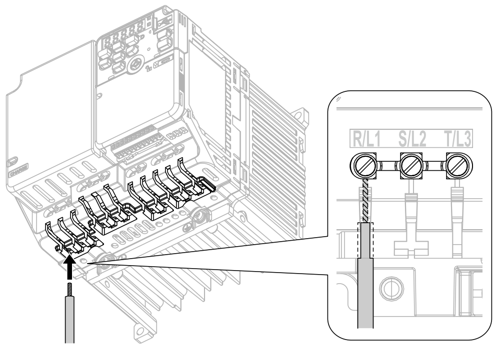


Figure 3.21 Install the Electrical Wire

Note:
There is a jumper between terminals +1 and +2. Remove the jumper, then wire to terminals +1 and +2.

2. Tighten the screws to the specified torque.

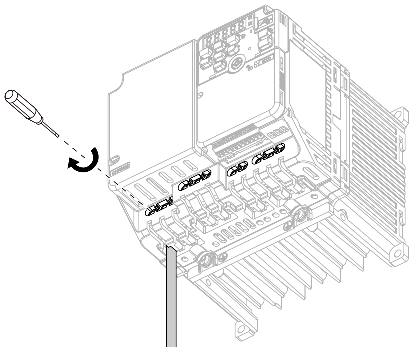


Figure 3.22 Tighten Terminal Block Screws

3.5 Control Circuit Wiring

This section gives information about how to correctly wire the control circuit.

◆ Control Circuit Connection Diagram

Wire the drive control circuit as shown in Figure 3.23.

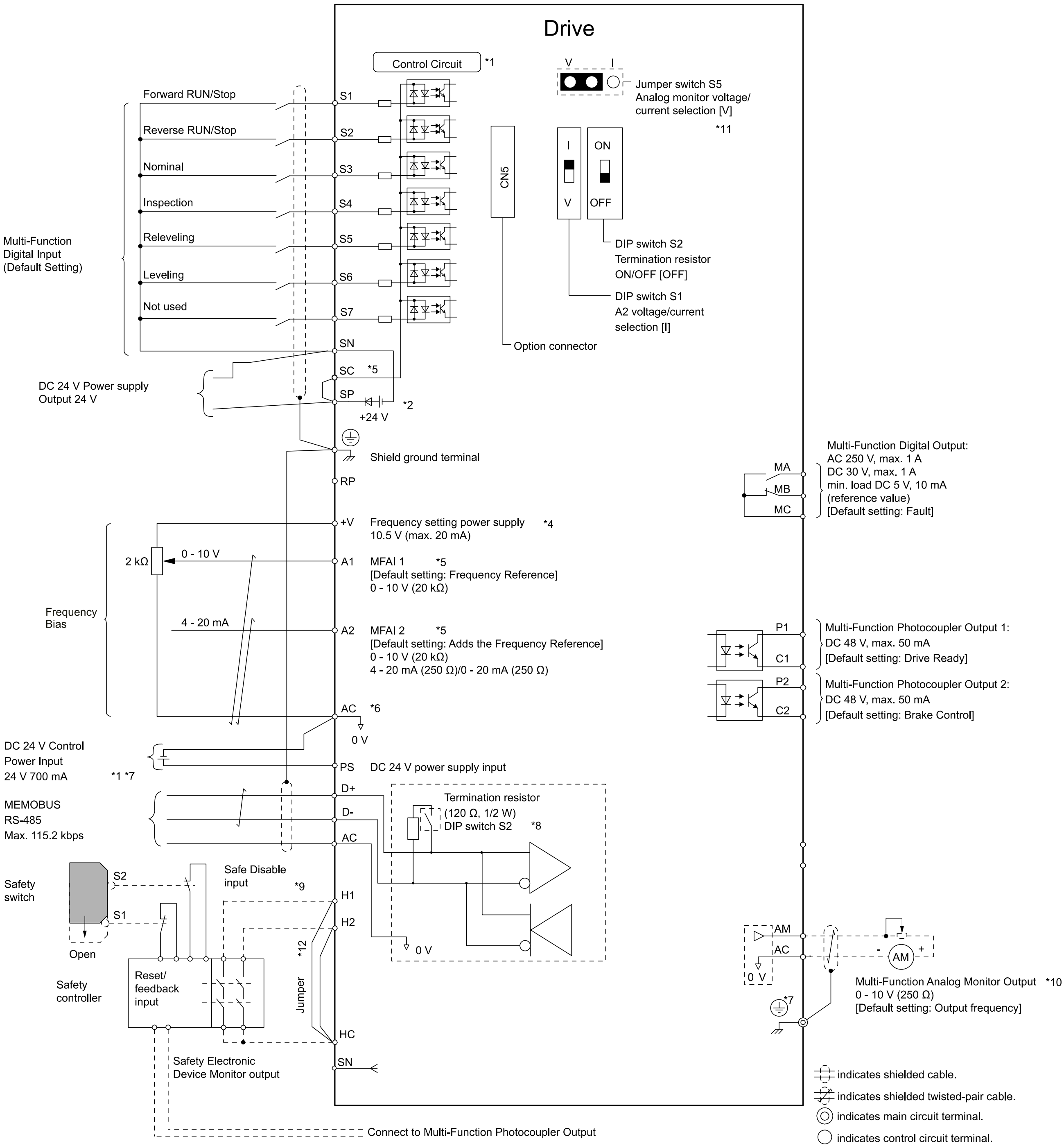


Figure 3.23 Control Circuit Connection Diagram

*1 Connect a 24 V power supply to terminals PS-AC to operate the control circuit while the main circuit power supply is OFF.

*2 To set the MFDI power supply (Sinking/Sourcing Mode or internal/external power supply), install or remove a jumper between terminals SC-SP or SC-SN depending on the application.

NOTICE **Damage to Equipment**
Do not close the circuit between terminals SP-SN.
If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.

- Sinking Mode, Internal power supply: Install the jumper to close the circuit between terminals SC-SP.

NOTICE **Damage to Equipment**
Do not close the circuit between terminals SC-SN.
If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.

- Sourcing Mode, Internal power supply: Install the jumper to close the circuit between terminals SC-SN.

NOTICE **Damage to Equipment**
Do not close the circuit between terminals SC-SP.
If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.

- External power supply: Remove the jumper from the MFDI terminals. It is not necessary to close the circuit between terminals SC-SP and terminals SC-SN.

*3

⚠ WARNING **Electrical Shock Hazard**
When you connect the shield wire of the control circuit wiring to the protective ground terminal, do not connect the protective ground wire.
If you connect the shield wire and the protective ground wire to the protective grounding terminal, it may not comply with the technical standards and local safety regulations and can cause serious injury or death.

*4 The maximum output current capacity for terminal +V on the control circuit is 20 mA.

NOTICE **Damage to Equipment**
Do not install a jumper between terminals +V and AC.
A closed circuit between these terminals will cause damage to the drive.

*5 DIP switch S1 sets terminal A2 for voltage or current input. The default setting for S1 is current input ("I" side).
*6 Do not ground the control circuit terminals AC or connect them to the drive chassis.

NOTICE
Do not ground the AC control circuit terminals and only connect the AC terminals as specified by the product instructions.
If you connect the AC terminals incorrectly, it can cause damage to the drive.

*7 Do not connect terminals PS and AC inversely. Failure to obey will cause damage to the drive.
*8 Set DIP switch S2 to the ON position to enable the termination resistor in the last drive when you use MEMOBUS/Modbus communications.
*9 To use the internal power supply with the Safe Disable input, use sourcing mode.
*10 Use multi-function analog monitor outputs with analog frequency meters, ammeters, voltmeters, and wattmeters. Do not use monitor outputs with feedback-type signal devices.
*11 Jumper S5 sets terminal AM for voltage or current output. The default setting for S5 is voltage output ("V" side).
*12 Disconnect the wire jumpers between H1 and HC and H2 and HC to use the Safe Disable input.

◆ Control Circuit Terminal Block Functions

Hx-xx parameters set functions for the multi-function input and output terminals.

⚠ WARNING **Sudden Movement Hazard**
Correctly wire and test all control circuits to make sure that the control circuits operate correctly. If you use a drive that has incorrect control circuit wiring or operation, it can cause death or serious injury.

NOTICE **Damage to Equipment**
Do not energize and de-energize the drive more frequently than one time each 30 minutes.
If you frequently energize and de-energize the drive, it can cause drive failure.

■ Input Terminals

Refer to Table 3.4 for a list of input terminals and functions.

Table 3.4 Multi-function Input Terminals

Type	Terminal	Name (Default)	Function (Signal Level)
Digital Inputs	S1	Up Command (Closed: Up, Open: Stop)	• Photocoupler • 24 V, 6 mA **Note:** Install the wire jumpers between terminals SC-SP and SC-SN to set the MFDI power supply (sinking/sourcing mode or internal/external power supply). • Sinking Mode: Install a jumper between terminals SC and SP. **NOTICE** **Damage to Equipment** **Do not close the circuit between terminals SP-SN.** **If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.**
	S2	Down Command (Closed: Down, Open: Stop)	
	S3	Multi-function input 1 (Nominal Speed)	
	S4	Multi-function input 2 (Inspection Operation)	
	S5	Multi-function input 3 (Releveling Speed)	
	S6	Multi-function input 4 (Leveling Speed)	
	S7	(Not used)	
	SC	MFDI selection common	MFDI power supply, 24 V (maximum 150 mA) **Note:** When you use the option card JOHB-PGX3-AE, the maximum output current is 90 mA. **NOTICE** **Damage to Equipment** **Do not close the circuit between terminals SC-SN.** **If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.**
Safe Disable Input	H1	Safe Disable input 1	• 24 V, 6 mA • ON: Normal operation • OFF: Coasting motor • Internal impedance 4.7 kΩ • OFF Minimum OFF time of 3 ms.
	H2	Safe Disable input 2	
	HC	Safe Disable function common	Safe Disable function common **NOTICE** **Do not close the circuit between terminals HC and SN.** **A closed circuit between these terminals will cause damage to the drive.**
Master Frequency Reference	RP	Reserved	-
	+V	Power supply for frequency setting	10.5 V (allowable current 20 mA maximum)
	A1	MFAI1 (not used)	Voltage input • 0 V to 10 V/100% (input impedance: 20 kΩ)
	A2	MFAI2 (not used)	Voltage input or current input Use DIP switch S1 and *H3-09 [Terminal A2 Signal Level Select]* to select the input. • 0 V to 10 V/100% (input impedance: 20 kΩ) • 4 mA to 20 mA/100%, 0 mA to 20 mA/100% (input impedance: 250 Ω)
	AC	Frequency reference common	0 V

■ Output Terminals

Refer to Table 3.5 and Table 3.6 for a list of Output terminals and functions.

Table 3.5 Control Circuit Output Terminals

Type	Terminal	Name (Default)	Function (Signal Level)
Digital Outputs	MA	N.O. output (Fault)	• Relay output • 30 Vdc, 10 mA to 1 A • 250 Vac, 10 mA to 1 A • Minimum load: 5 V, 10 mA (Reference value)
	MB	N.C. output (Fault)	
	MC	Digital output common	
Multi-function Photocoupler Outputs	P1	• P1-PC Multi-function photocoupler output 1 (Drive Ready) • P2-PC Multi-function photocoupler output 2 (Brake Control)	• Photocoupler output • 48 V, 2 mA to 50 mA
	P2		
	PC		

Table 3.6 Control Circuit Monitor Output Terminals

Type	Terminal	Name (Default)	Function (Signal Level)
Monitor Output	MP	Pulse train output (Output frequency)	32 kHz (maximum)
	AM	Analog monitor output (Output speed)	0 V to 10 V/0% to 100%
	AC	Monitor common	0 V

■ External Power Supply Input Terminals

Refer to Table 3.7 for a list of the functions of the external power supply input terminals.

Table 3.7 External Power Supply Input Terminals

Type	Terminal	Name (Default)	Function
External Power Supply Input Terminals	PS	External 24 V power supply input	Supplies backup power to the drive control circuit, keypad, and option board. 21.6 VDC to 26.4 VDC, 700 mA
	AC	External 24 V power supply ground	0 V

When you use an external 24 V power supply, the drive detects an alarm as shown in Table 3.8 if you set *o2-23 [External 24V Powerloss Detection]* and *o2-26 [Alarm Display at Ext. 24V Power]* for the main circuit power supply. Set the alarm display as necessary.

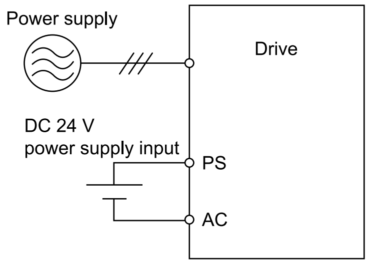


Table 3.8 Power Supply and Alarm Display

Main Circuit Power Supply	External 24 V Power Supply	o2-23 [External 24V Powerloss Detection]	o2-26 [Alarm Display at Ext. 24V Power]	Alarm Display
ON	ON	-	-	-
ON	OFF	0 [Disabled]	-	-
		1 [Enabled]	-	*L24v [Loss of External Power 24 Supply]*
OFF	ON	-	0 [Disabled]	"Ready" LED light flashes quickly
		-	1 [Enabled]	*EP24v [External Power 24V Supply]*

■ Operation When Using External 24 V Power Supply

To operate the drive, de-energize the main circuit power supply and connect an external 24 V power supply to terminals PS-AC.

Function	Operation	Solution
Keypad	The keypad operates the same as when the main circuit power supply is ON. The drive will not detect *oPr [Keypad Connection Fault]*.	-
Data Log	The data log function operates the same as when the main circuit power supply is ON. The operation is different for different drive software versions. *1	-
Communications by Communication Option or MEMOBUS/Modbus Communication Terminals	Communication operates the same as when the main circuit power supply is ON.	-
MFAI	MFAI operates the same as when the main circuit power supply is ON.	-
MFAO	MFAO operates the same as when the main circuit power supply is ON.	-

Function	Operation	Solution
MFDI	MFDI does not operate when the main circuit power supply of the drive is OFF.	Connect the external 24 V power supply to MFDI selection common terminal (SC). *2
MFDO Multi-Function Photocoupler Output Fault Relay Output Terminal	MFDO operates the same as when the main circuit power supply is ON.	-

*1 When you use an external 24 V power supply, the operation of the data log function is different for different drive software versions. On drives with software versions PRG: 01015 and later, you can continue the data log function.

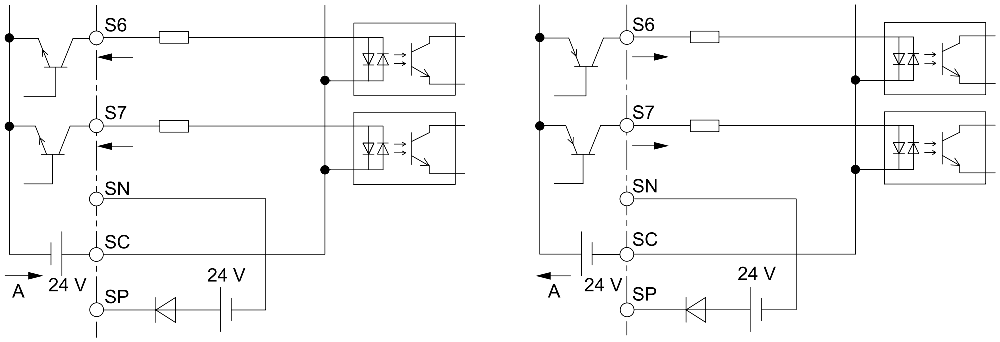
Note:

The “PRG” column on the nameplate on the right side of the drive identifies the software version. You can also use *U1-25 [SoftwareNumber FLASH]* to identify the software version.

*2 When you use MFDI and a Digital Input option (DI-A3), wire the terminals as shown in *Wiring MFDI Terminals on page 62*.

■ Wiring MFDI Terminals

If you de-energize the main circuit power supply, the MFDI terminals will not operate, even when you connect an external 24 V power supply to terminals PS-AC. When you set N.O. functions to *H1-xx [MFDI Function Select]*, MFDI terminals always de-activate. When you set N.C. functions, MFDI terminals always activate. Connect the external 24 V power supply to the MFDI selection common terminal (SC). Refer to Figure 3.24 for more information.



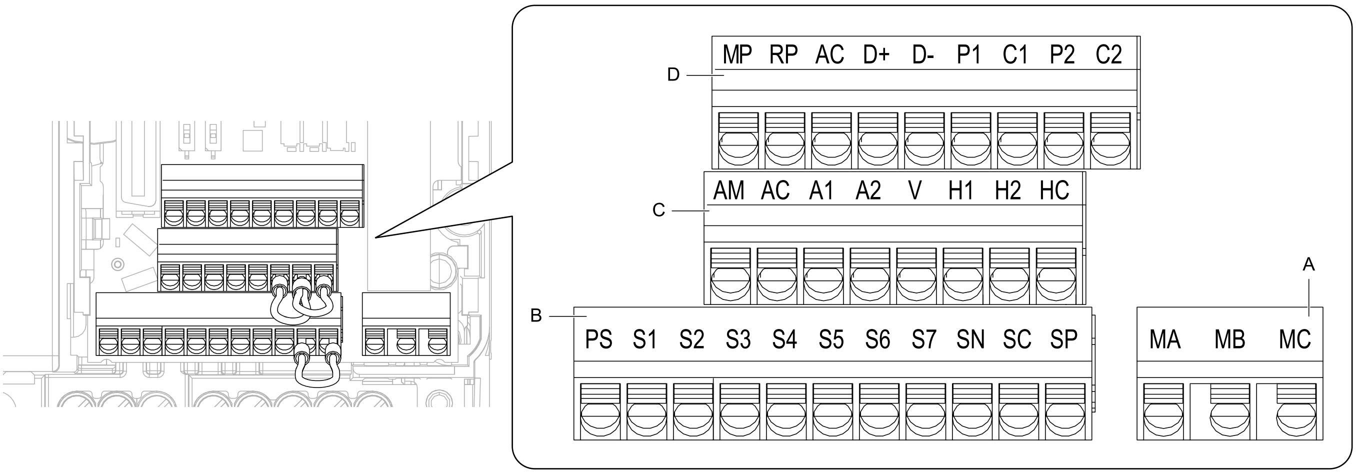
A - External power supply

Figure 3.24 Wiring MFDI Terminals

◆ Control Circuit Terminals

■ Terminal Configuration

The control circuit terminals are in the positions shown in Figure 3.25.



A - Terminal block (TB2)
B - Terminal block (TB1-1)
C - Terminal block (TB1-2)
D - Terminal block (TB1-3)

Figure 3.25 Control Circuit Terminal Arrangement

■ Wire Gauges and Tightening Torques

Use the tables in this section to select the correct wires. Use shielded wire to wire the control circuit terminal block. Use crimp ferrules on the wire ends to make the wiring procedure easier and more reliable.

Table 3.9 Control Circuit Wire Gauges and Tightening Torques

Terminal Block	Terminal	Bare Wire		Crimp Ferrule	
		Recomm. Gauge mm² (AWG)	Applicable Gauge mm² (AWG)	Recomm. Gauge mm² (AWG)	Applicable Gauge mm² (AWG)
TB1-1	PS, S1 - S7, SN, SC, SP	0.75 (18)	• Stranded wire 0.25 - 1.0 (24 - 17) • Solid wire 0.25 - 1.5 (24 - 16)	0.5 (20)	0.25 - 0.5 (24 - 20)
TB1-2	AM, AC, A1, A2, +V, H1, H2, HC				
TB1-3	MP, RP, AC, D+, D-, P1, C1, P2, C2				
TB2	MA, MB, MC				

■ Crimp Ferrules

Attach an insulated sleeve when you use crimp ferrules. Refer to Table 3.10 for the recommended external dimensions and model numbers of crimp ferrules.

Use the PHOENIX CONTACT CRIMPFOX 6.

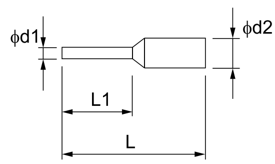


Figure 3.26 External Dimensions of Crimp Ferrules

Table 3.10 Crimp Ferrule Models and Sizes

Wire Gauge mm² (AWG)	Model	L (mm)	L1 (mm)	φd1 (mm)	φd2 (mm)
0.25 (24)	AI 0.25-6 YE AI 0.25-6 BU	10.5	6.0	0.8	2.0
0.34 (22)	AI 0.34-6 TQ	10.5	6.0	0.8	2.0
0.5 (20)	AI 0.5-6 WH AI 0.5-6 OG	12.0	6.0	1.1	2.5
0.75 (18)	AI 0.75-6 GY AI 0.75-6 WH	12.0	6.0	1.3	2.8
1.0 (17)	AI 1-6 RD AI 1-6 YE	12.0	6.0	1.5	3.0

◆ Wiring the Control Circuit Terminal

⚠ WARNING Electrical Shock Hazard

Do not remove covers or touch circuit boards while the drive is energized.
If you touch the internal components of an energized drive, it can cause serious injury or death.

NOTICE

Do not let wire shields touch other signal lines or equipment. Insulate the wire shields with electrical tape or shrink tubing.
If you do not insulate the wire shields, it can cause a short circuit and damage the drive.

Note:
- Use a Class 2 power supply to connect external power to the control terminals. If the power supply for peripheral devices is incorrect, it can cause a decrease in drive performance.
- Connect the shield of shielded cable to the applicable ground terminal. Incorrect equipment grounding can cause drive or equipment malfunction from electrical interference.
- Isolate wiring for contact output terminals MA, MB, MC, P1, C1, P2, and C2 from other control circuit wiring. Incorrect wiring procedures can cause the drive and connected equipment to malfunction and cause the drive to trip.
- Isolate control circuit wiring from main circuit wiring (terminals R/L1, S/L2, T/L3, L/L1, N/L2, B1, B2, U/T1, V/T2, W/T3, -, +1, +2) and other high-power wiring. If control circuit wiring is adjacent to main circuit wiring, it can cause incorrect operation of the drive and equipment from electrical interference.

Wire the grounding terminal and main circuit terminals, then wire the control circuit terminals.

1. Remove the front cover from the drive.

   You must remove the keypad to move Jumper S5.

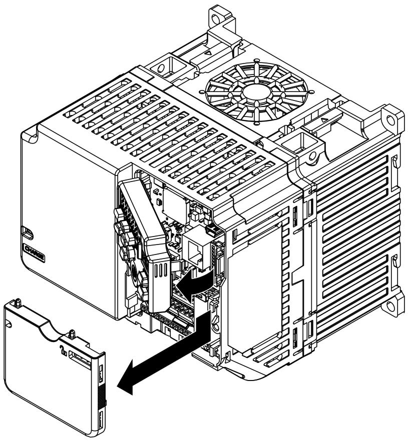


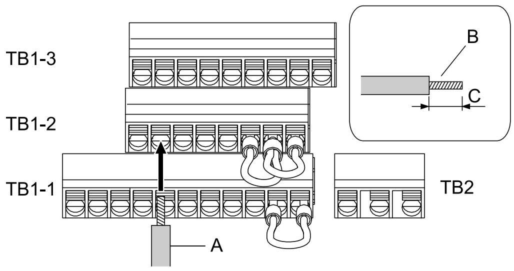
Figure 3.27 Remove the Front Cover

2. Refer to the figure and wire the control circuit.

   Use a slotted screwdriver with a blade width of 2.5 mm (0.1 in) or less and thickness of 0.4 mm (0.01 in) or less.

⚠ WARNING **Fire Hazard**
Tighten all terminal screws to the correct tightening torque.
Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.

Note:
- Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive. Incorrect equipment grounding can cause drive or equipment malfunction from electrical interference.
- Do not use control circuit wiring that is longer than 50 m (164 ft) to supply the analog frequency reference from a remote source. If the control circuit wiring is too long, it can cause unsatisfactory system performance.



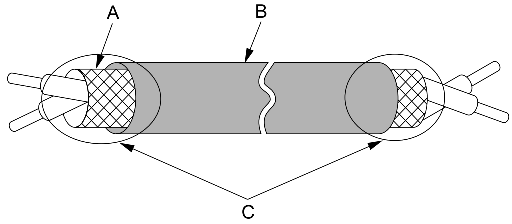
A - Wire with a crimp ferrule attached, or unsoldered wire with the core wires lightly twisted.

B - Pull back the shielding and lightly twist the end with your fingers to make sure that the ends do not fray.

C - When you do not use crimp ferrules, remove approximately 5.5 mm (0.21 in) of the covering at the end of the wire.

Figure 3.28 Wiring Procedure for the Control Circuit

Note:
- It is easier to wire TB1-1 first, then TB1-2, then TB1-3.
- Do not solder the core wire. Soldered wiring connections can become loose and cause the drive to malfunction.
- Refer to Figure 3.29 for information to prepare terminal ends of the shielded wire.
- Prepare the wire ends of shielded twisted-pair wires as shown in Figure 3.29 to use an analog reference from an external frequency setting potentiometer to set the frequency. Connect the shield to the ground terminal ⏚ of the drive.



A - Connect the shield to the ground terminal of the drive.
B - Sheath
C - Insulate with electrical tape or shrink tubing.

Figure 3.29 Prepare the Ends of Shielded Wire

3. Install the front cover.
   If you moved Jumper S5, attach the keypad before you attach the front cover.
   If you did not move Jumper S5, attach the front cover.
   Make sure that you do not pinch wires or signal lines between the front cover and the drive before you reattach the cover.

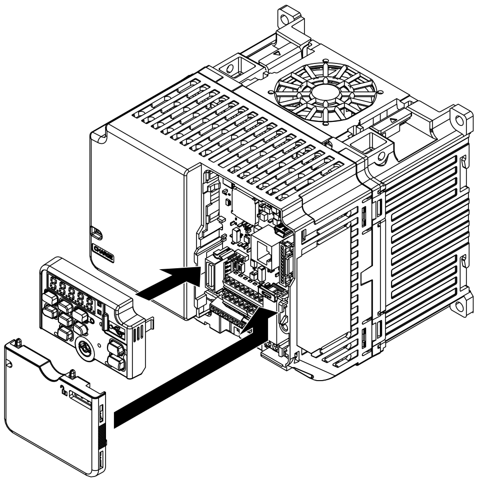


Figure 3.30 Install the Front Cover

◆ Switches and Jumpers on the Terminal Board

The terminal board has switches to adapt the drive I/Os to the external control signals as shown in Figure 3.31. Set the switches to select the functions for each terminal.

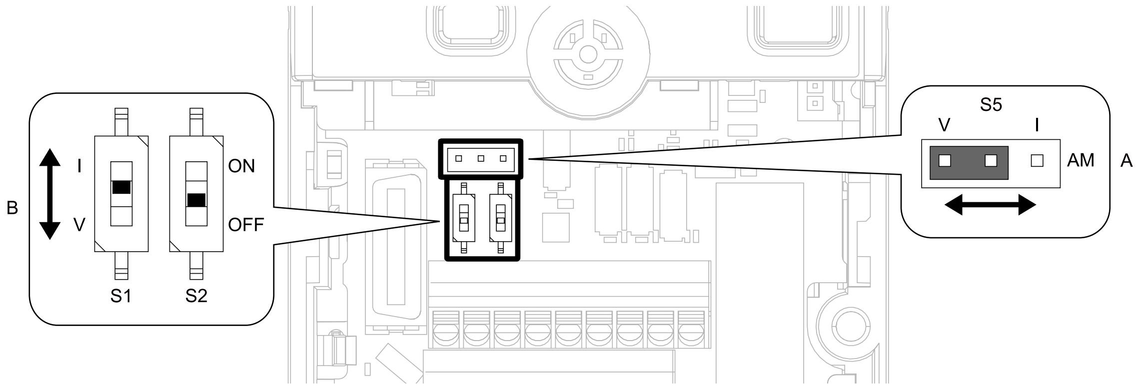


Figure 3.31 Locations of Switches

Table 3.11 I/O Terminals and Switches Functions

Position	Switch	Terminal	Function	Default
A	Jumper switch S5	AM	Sets the output method for terminal AM (voltage or current).	V (voltage output)
B	DIP switch S1	A2	Sets the input method for terminal A2 (voltage or current).	I (current input)
	DIP switch S2	-	Enables and disables the MEMOBUS/Modbus communications termination resistor.	OFF

3.6 Control I/O Connections

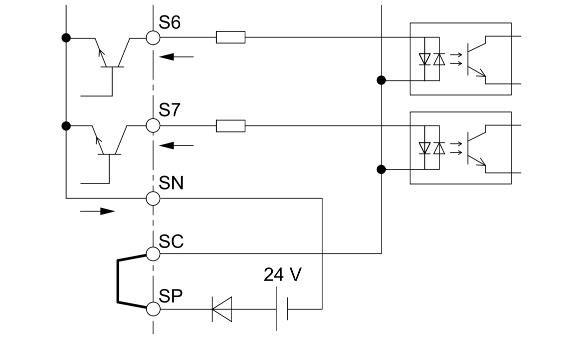
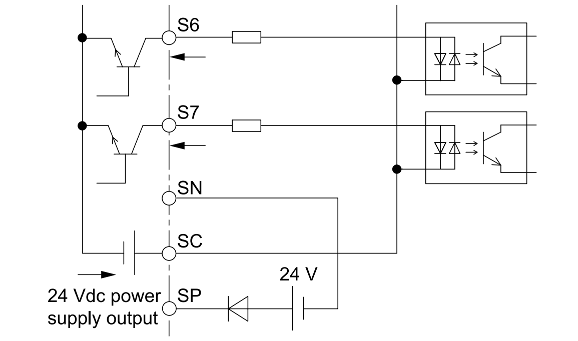
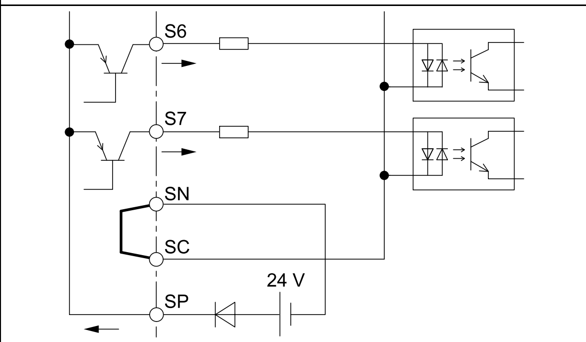
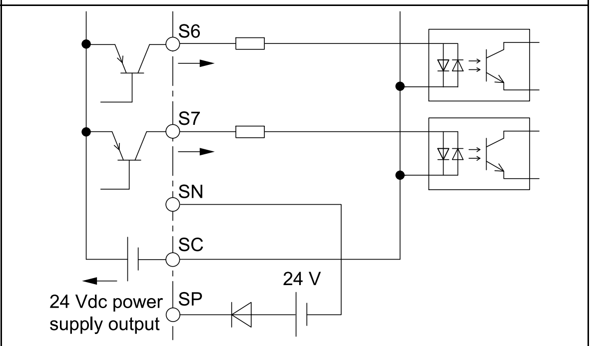
This section gives information about the settings for the listed control circuit I/O signals.

- MFDI (terminals S1 to S7)
- MFAI (terminal A2)
- MFAO (terminal AM)
- MEMOBUS/Modbus communications (terminals D+, D-, AC)

◆ Set Sinking Mode/Sourcing Mode

Close the circuit between terminals SC-SP and SC-SN to set the sinking mode/sourcing mode and the internal/ external power supply for the MFDI terminals. The default setting for the drive is internal power supply sinking mode.

NOTICE **Damage to Equipment**
Do not close the circuit between terminals SP-SN.
If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.

Mode	Internal Power Supply (Terminal SN-SP)	External 24 V power supply
Sinking Mode (NPN)		
Sourcing Mode (PNP)		

◆ Set the Input Signal for the MFAI Terminal A2

Use terminal A2 to input a voltage or a current signal. Set the signal type as shown in Table 3.12.

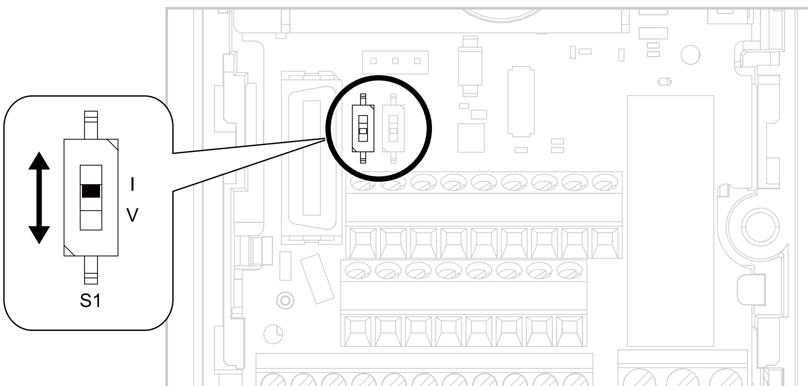


Figure 3.32 Location of DIP Switch S1

Table 3.12 MFAI Terminal A2 Signal Settings

Terminal	Input Signal	DIP Switch Settings		Parameter	
		Switch	Setting	No.	Signal Level
A2	Current input	S1	I (Default)	H3-09	2: 4 mA to 20 mA/0% to 100% (input impedance: 250 Ω) 3: 0 mA to 20 mA/0% to 100% (input impedance: 250 Ω)
	Voltage input		V		0: 0 V to 10 V/0% to 100% (with zero limit) (input impedance: 20 kΩ) 1: 0 V to 10 V/0% to 100% (without zero limit) (input impedance: 20 kΩ)

Note:

Use tweezers or a jig with a tip width of approximately 0.8 mm (0.03 in) to set DIP switches.

◆ Set the Output Signal for the MFAO Terminal AM

Set the signal type for terminal AM to voltage or current output. Use jumper S5 and *H4-07 [Terminal AM Signal Level Select]* to set the signal type.

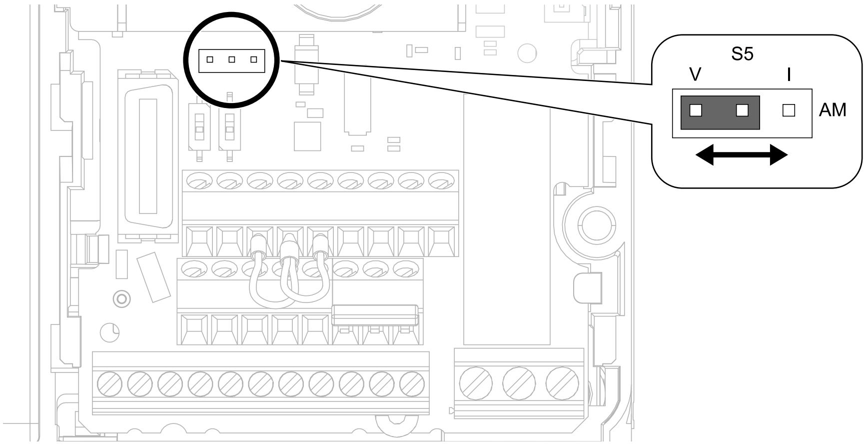
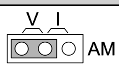
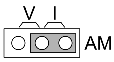


Figure 3.33 Location of Jumper Switch S5

Terminal	Types of Output Signals	Jumper S5	Parameter	
			No.	Signal Level
AM	Voltage output (Default)	 V I AM	H4-07	0: 0 V to 10 V
	Current output	 V I AM		2: 4 mA to 20 mA

◆ Switch ON Termination Resistor for MEMOBUS/Modbus Communications

When the drive is the last slave in a MEMOBUS/Modbus communications, set DIP switch S2 to the ON position. This drive has a built-in termination resistor for the RS-485 interface.

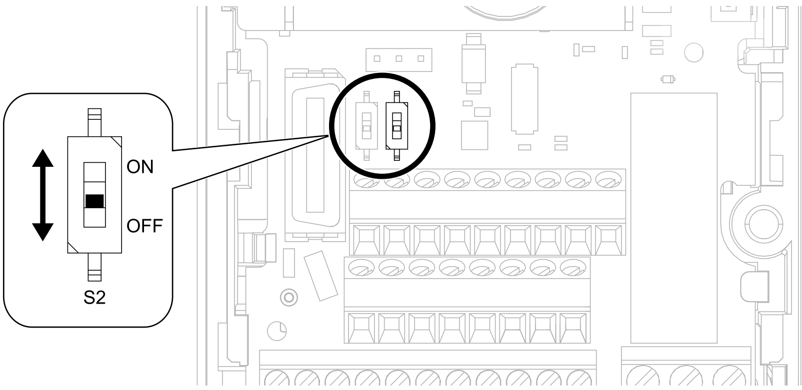


Figure 3.34 Location of DIP Switch S2

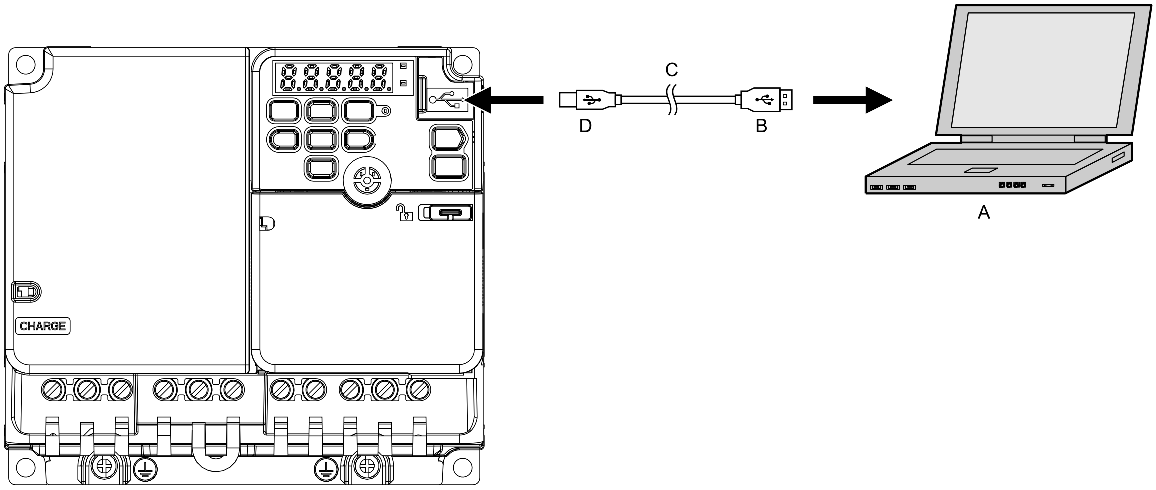
Table 3.13 MEMOBUS/Modbus Communications Termination Resistor Setting

DIP switch S2	Description
ON	The built-in termination resistor is ON.
OFF (Default)	The built-in termination resistor is OFF.

3.7 Connect the Drive to a PC

The drive has a mini-B type USB port.

You can use a USB cable (USB 2.0, type: A - mini-B) to connect the drive to a type-A USB port on a PC. After you connect the drive to the PC, you can use Yaskawa DriveWizard software to monitor drive performance and manage parameter settings.



A - PC
B - Type-A connector
C - USB 2.0, type A - mini-B cable
D - Mini-B type connector

Figure 3.35 Connect to a PC (USB)

Yaskawa recommends that you use a USB cable with connectors connected with shielded wires.

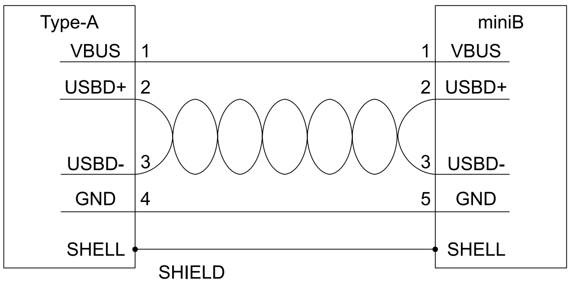


Figure 3.36 Recommended USB Cable

3.8 Braking Resistor Installation

A braking resistor or braking resistor unit (dynamic braking option) helps stop the motor quickly and smoothly when there is high load inertia. If you try to decelerate a motor in less time than usual for a coast to stop, the motor will rotate faster than the synchronous speed that aligns with the set frequency. This will cause the motor to become an induction generator. The inertia energy of the motor and regenerate to the drive and charge the drive DC bus capacitor and increase the voltage. If the voltage is more than the overvoltage level, an *ov [Overvoltage]* will occur. To prevent these overvoltage faults, a dynamic braking option is necessary.

NOTICE **Damage to Equipment**
Before you connect a dynamic braking option to the drive, make sure that qualified personnel read and obey the Braking Unit and Braking Resistor Unit Installation Manual (TOBPC72060001). If you do not read and obey the manual or if personnel are not qualified, it can cause damage to the drive and braking circuit.

Note:
Select the correct braking circuit size to dissipate the power that is necessary to decelerate the load in the correct time. Before you run the drive, make sure that the braking circuit can dissipate the energy for the set deceleration time.

⚠ WARNING **Fire Hazard**
Do not connect a braking resistor to terminals +1 or -. Use terminals B1 and B2 for the braking resistor connections.
If you connect a braking resistor to the incorrect terminals, it can cause damage to the drive and braking circuit and serious injury or death.

NOTICE
Connect braking resistors to the drive as shown in the connection diagram examples.
If you wire the braking circuits incorrectly, it can cause damage to the drive or equipment.

To use a braking resistor, connect a thermal overload relay between the drive and the braking resistor, and set a circuit to de-energize the drive at the trip contacts of the thermal overload relay.

◆ Install a Braking Resistor

Connect the braking resistor to a drive as shown in Figure 3.37.

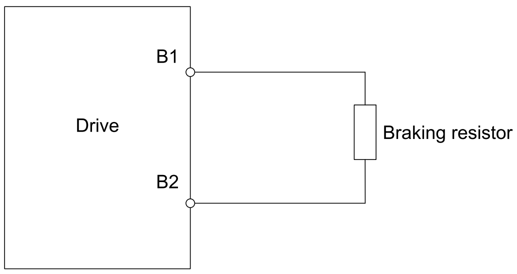


Figure 3.37 Install a Braking Resistor

◆ Dynamic Braking Option Overload Protection

To prevent overheating the dynamic braking option, set a sequence to de-energize the drive at the trip contacts of the thermal overload relay.

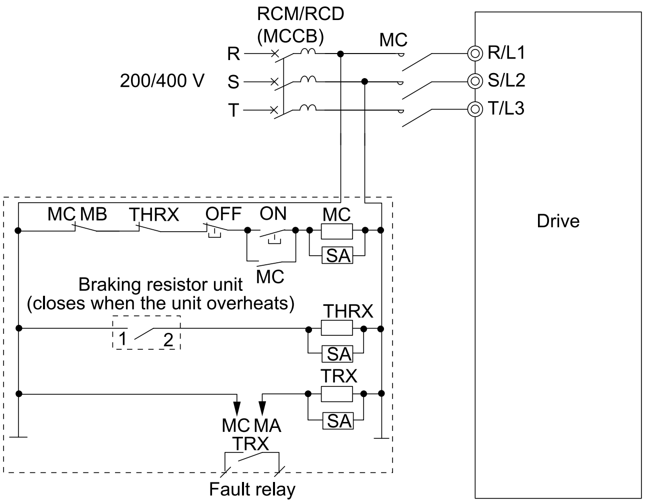


Figure 3.38 Power Supply Interrupt for Overheat Protection Example

⚠ WARNING Fire Hazard

When you use a braking unit, use a thermal relay on the braking resistors and set a fault contact output for the braking resistor unit to disconnect drive main power through an input contactor. Incorrect braking circuit protection can cause the resistors to become too hot and cause serious injury or death.

3.9 Drive Wiring Protection

◆ Installing a Residual Current Monitoring/Detection (RCM/RCD)

When the drive output switches at high speeds, it causes high frequency leakage current. To prevent electrical shock and fires caused by ground fault protection that is not sufficient, install an RCM/RCD.

Use a high frequency RCM/RCD at the power input side of the drive and make sure that each drive has a minimum cumulative sensitivity amperage of 30 mA. The specialized breaker detects only the leakage current from frequency bands that are dangerous to humans.

If a device does not have protection against high frequencies, high frequency leakage currents can cause the device to malfunction. If you have a malfunction on a device that is not protected, decrease the carrier frequency of the drive, switch to a better breaker, or use an RCM/RCD with a minimum cumulative sensitivity amperage of 200 mA for each drive.

These conditions can have an effect on leakage current:

- Drive capacity
- Carrier frequency
- Wiring distance and types of motor cables
- EMI/RFI filter

To prevent damage and injury to personnel and drives, use a high-frequency RCM/RCD that is rated for AC and DC power supplies.

Note:

Yaskawa recommends these RCMs/RCDs, which are designed to operate with high frequencies:
- Mitsubishi Electric Corporation, NV series
- Schneider Electric, NS series

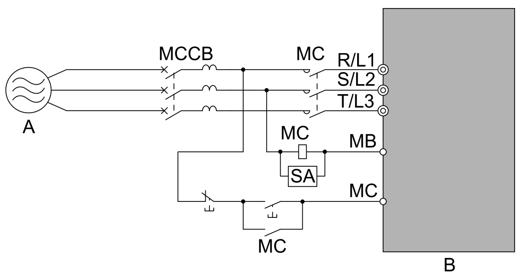
You can use a molded-case circuit breaker (MCCB) as a replacement for an RCM/RCD that is upstream in the power supply system.

◆ Installing a Molded-Case Circuit Breaker (MCCB) or Residual Current Monitor/ Device (RCM/RCD)

Install a molded-case circuit breaker (MCCB) or a residual current monitor/device (RCM/RCD) for line protection between the power supply and main circuit power supply input terminals R/L1, S/L2, and T/L3. The MCCB or RCM/RCD gives overload protection and also prevent damage to the main circuit and the devices that are wired to the main circuit.

Use the information in this section to select the correct MCCB or RCM/RCD and to safely connect the device.

- The capacity of the MCCB or GFCI must be 1.5 to 2 times the rated output current of the drive. Use an MCCB or RCM/RCD as an alternative to overheat protection (150% for one minute at the rated output current) to prevent drive faults.
- When you connect more than one drive or the drive and other device to an MCCB or RCM/RCD, refer to Figure 3.39, use a magnetic contactor (MC), and set a sequence that de-energizes the drive when it outputs errors.



A - Power supply **B - Drive**

Figure 3.39 Connect an MCCB

⚠ WARNING Electrical Shock Hazard

Use an MCCB, RCM/RCD, or Magnetic Contactor (MC) to de-energize the drive before you wire the main circuit terminal.

If the main circuit terminal is energized during wiring, it will cause serious injury or death.

3.10 Dynamic Braking Option, Motor Protection

◆ Install an Electromagnetic Contactor (MC) at the Input Side of the Drive

You can use an MC as an alternative to a molded case circuit breaker (MCCB) when:

- The protective functions of the drive have been triggered
- An emergency stop occurred, and the sequence de-energizes the drive.

If an MC on the input side of the drive (primary side) stops the drive, regenerative braking will not operate, and the drive will coast to stop.

NOTICE

When you connect electromagnetic switches or magnetic contactors to the output motor circuits, make sure that you sequence them correctly.
If the output motor circuit sequence is incorrect, it can cause damage to the drive.

NOTICE **Damage to Equipment**

Do not energize and de-energize the drive more frequently than one time each 30 minutes.
If you frequently energize and de-energize the drive, it can cause drive failure.

Note:

- When machinery must not restart after recovery from a momentary power loss that occurred during run, install an MC at the input side of the drive and set a sequence that does not automatically set the Run command to ON after recovery of power.
- When it is necessary to stop momentary power loss, for example to maintain a circuit that has momentary power loss, use a delayed-release MC.
- Use an MC (magnetic contactor) to make sure that you can fully remove power to the drive when necessary. Wire the MC to open when a fault output terminal is triggered.

■ Protect the Braking Resistor/Braking Resistor Unit

Use an MC on the input side (primary side) to prevent damage to the braking resistor/braking resistor unit.

⚠ WARNING **Fire Hazard**

When you use a braking unit, use a thermal relay on the braking resistors and set a fault contact output for the braking resistor unit to disconnect drive main power through an input contactor. Incorrect braking circuit protection can cause the resistors to become too hot and cause serious injury or death.

◆ Installing a Thermal Overload Relay on the Drive Output

A thermal overload relay disconnects the power line to the motor during a motor overload condition to prevent damage to the motor.

Install a thermal overload relay between the drive and motor in these conditions:

- When you operate more than one motor with one drive
- When you operate the motor directly from the power line with a power line bypass

When you operate one motor with one drive, it is not necessary to install a thermal overload relay. The drive has electronic motor overload protection in the drive software.

Note:

- When you install a thermal overload relay, set parameter *L1-01 = 0 [Motor Overload (oL1) Protection = Disabled]*.
- Set up a sequence that will trip an external fault (coast to stop) for the contacts of the thermal overload relay.

■ General Precautions When Using Thermal Overload Relays

When you use a motor thermal overload relay on the drive output to prevent nuisance trips and overheating of the motor at low speeds, be sure to think about these application precautions:

- Operation of a low speed motor
- When you operate more than one motor with one drive
- Length of the motor cables
- Nuisance tripping because of high drive carrier frequency

■ Operation of a Low Speed Motor

Usually, you use thermal overload relays on general-purpose motors (standard motors). When a drive drives a general-purpose motor, the motor current is approximately 5% to 10% more than with a commercial power supply. When a motor with a shaft-driven fan operates at low speeds, the cooling capacity decreases. This can cause the motor to overheat when the load current is in the motor rated value. Enable the electronic thermal protection in the drive when possible to prevent this problem.

The electronic thermal overload function uses the relation between the speed and heat characteristics in the variable speed control range to simulate the cooling ability of general-purpose motors and forced-vented motors to prevent damage to the motor.

■ Length of the Motor Cables

If you use long motor cables with a high carrier frequency, the increased leakage current can cause nuisance tripping of the thermal relay. To prevent this, decrease the carrier frequency or increase the tripping level of the thermal overload relay.

■ Nuisance Tripping Because of High Drive Carrier Frequency

High carrier frequency PWM drives make current waveforms that can increase the temperature in overload relays. It may be necessary to increase the trip level setting when encountering nuisance triggering of the relay.

⚠ WARNING **Fire Hazard**

Before you increase the detection level of the thermal relay, make sure that a secondary problem is not the cause of the overload. Make sure that you know the local codes for electrical wiring, then adjust the electrothermal settings.

Incorrect thermal relay adjustment and incorrect wiring can cause serious injury or death.

3.11 Improve the Power Factor

◆ Connect an AC Reactor or a DC Reactor

■ Overview

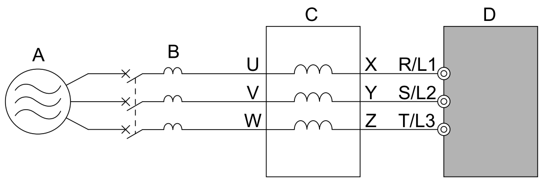
AC reactors and DC reactors decrease surges in current and improve the power factor on the input side of the drive.

Connect an AC reactor or a DC reactor to the input side (primary side) in the these conditions:

- To decrease harmonic current or improve the power factor of the power supply
- When there is switching of phase advancing capacitor
- With a large capacity power supply transformer (600 kVA or more).

Note:
- You can use an AC reactor and DC reactor together.
- When you connect a thyristor converter (for example, a DC drive) to the same power supply system, use an AC reactor.
- The main circuit terminal block for the drive and the terminal blocks for the AC and DC reactors come in different shapes. Correctly prepare the ends of the wiring.
- Ground the AC and DC reactors (option) on the back of the mounting base. Remove all paint from the mounting surface of the control panel.

■ Connect an AC Reactor

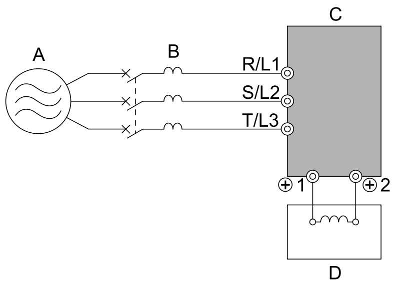


A - Power Supply
B - MCCB
C - AC reactor
D - Drive

Figure 3.40 AC Reactor Connection Example

■ Connect a DC Reactor

When you install a DC reactor, remove the jumper between terminals +1 and +2. If you will not use a DC reactor, do not remove the jumper. Refer to Figure 3.41 for an example of how to wire the DC reactor.



A - Power Supply
B - MCCB
C - Drive
D - DC reactor

Figure 3.41 DC Reactor Connection Example

3.12 Prevent Switching Surge

◆ Connect a Surge Protective Device

A surge protective device decreases the surge voltage generated when you switch an inductive load near the drive. Inductive loads include:

- Magnetic contactors
- Electromagnetic relays
- Magnetic valves
- Solenoids
- Magnetic brakes.

Always use a surge protective device or diode with inductive loads.

Note:

Do not connect a surge protective device to the drive output side.

3.13 Decrease Noise

Note:

The main circuit terminal block for the drive and the terminal blocks for the AC and DC reactors come in different shapes. Correctly prepare the ends of the wiring.

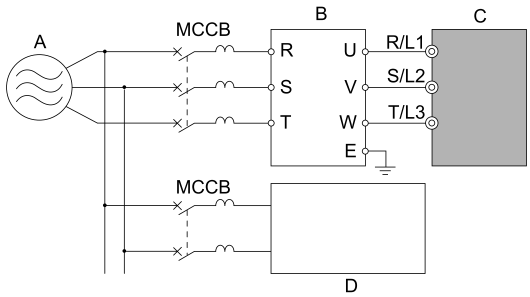
◆ Connect a Noise Filter to the Input Side (Primary Side)

High-speed switching makes noise in the drive output. This noise flows from the drive to the power supply, and can have an effect on other equipment.

Drive models LA50CxxxxExx have built-in input noise filters. When you use these drives, make sure that the filter specifications align with the application and applicable regulations. Refer to *European Standards on page 118* for more information.

When you use a drive without built-in noise filter, install a noise filter to the input side of the drive to decrease the quantity of noise that flows to the power supply. A noise filter will also stop noise from entering the drive from the power supply. Contact Yaskawa for more information.

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



A - Power supply
B - Input side (primary side) noise filter
C - Drive
D - Other controller

Figure 3.42 Example of Connecting the Noise Filter on the Input Side (Primary Side)

3.14 Wiring Checklist

Wire the drive, examine these items, then do a test run.

◆ Power Supply Voltage

Checked	No.	Item to Check
	1	The power supply voltage must be in the input voltage specification range of the drive.

◆ Main Circuit Wiring

Checked	No.	Item to Check
	1	• Put the power supply through a molded-case circuit breaker (MCCB) before it gets to the drive input. • Connect an applicable MCCB.
	2	Correctly wire the power supply to drive terminals R/L1, S/L2, and T/L3, or L/L1 and N/L2.
	3	Correctly wire the drive and motor together. The motor lines and drive output terminals U/T1, V/T2, and W/T3 must align to make the correct phase order. **Note:** If the phase order is incorrect, the drive will rotate in the opposite direction.
	4	Use 600 V heat resistant indoor PVC wire for the power supply and motor lines. **Note:** Wire gauge recommendations assume use of 600 V class 2 heat-resistant indoor PVC wire.
	5	Use the correct wire gauges for the main circuit. **Note:** When the wiring distance between the drive and the motor is long, use this formula for the voltage drop in the wire: Motor rated voltage (V) × 0.02 ≥ √3 × wire resistance (Ω/km) × wiring distance (m) × motor rated current (A) × 10^{-3}
	6	Correctly ground the drive.
	7	Tighten the main circuit and grounding terminal screws of the drive to a correct tightening torque.
	8	When you use a braking resistor or a braking resistor unit, install an electromagnetic contactor (MC). Correctly install the resistor and make sure that overload protection uses the MC to shut off the power supply.
	9	Make sure you did not install phase advancing capacitors, input noise filters, or ELCBs, GFCIs, RCM/RCDs on the output side of the drive.

◆ Control Circuit Wiring

Checked	No.	Item to Check
	1	Use twisted-pair cables for all drive control circuit wiring.
	2	Ground the shields of shielded wiring to terminal E (G).
	3	Wire Up/Down inputs S1 and S2.
	4	Correctly install any options.
	5	Examine the drive for other wiring errors. Only use a multimeter to check wiring.
	6	Tighten the control circuit terminal screws of the drive to a correct tightening torque.
	7	Pick up all wire clippings.
	8	Make sure that none of the wires on the terminal block touch other terminals or connections.
	9	Make sure that you isolate the control circuit wiring from main circuit wiring in the control panel or in a duct.
	10	Make sure that control circuit wiring is not longer than 50 m (164 ft).
	11	Make sure that Safe Disable input wiring is not longer than 30 m (98 ft).

4

Startup Procedure and Test Run

4.1 Section Safety

⚠DANGER

Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠WARNING

Electrical Shock Hazard

Do not operate the drive when covers are missing. Replace covers and shields before you operate the drive. Use the drive only as specified by the instructions.

Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. If covers or safety shields are missing from the drive, it can cause serious injury or death.

Do not remove covers or touch circuit boards while the drive is energized.

If you touch the internal components of an energized drive, it can cause serious injury or death.

Sudden Movement Hazard

When you use a mechanical holding brake with the drive, you must close the brake if an input terminal triggers the Baseblock command to stop drive output.

If you enter the baseblock command, the motor will suddenly coast and the load will slip, which can cause serious injury or death.

You must install external safety circuitry. The drive does not have protection against accidental load drops. Install electrical and/or mechanical safety circuit mechanisms that are isolated from the drive circuitry.

If you do not use external safety circuitry, the drive could drop the load and cause serious injury or death.

4.2 Keypad Overview

◆ Keypad Components and Functions

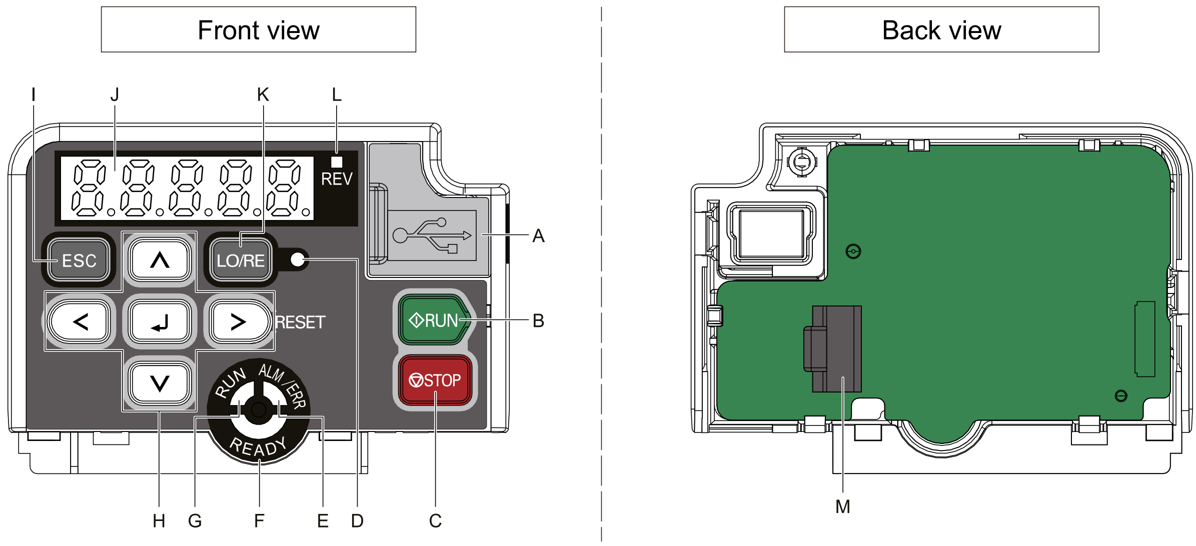


Figure 4.1 Keypad

Table 4.1 Keypad Components and Functions

Symbol	Name	Function
A	USB Terminal Pass-through	Pass-through point to connect a USB cable to the drive.
B	RUN Key	Starts the drive in LOCAL Mode. Starts the operation in Auto-Tuning Mode. **Note:** Before you use the keypad to operate the motor, set *o2-01 = 1 [LO/RE Key Function Selection = Enabled]*, then push LO/RE on the keypad to set the drive to LOCAL Mode.
C	STOP Key	Stops drive operation. **Note:** Uses a stop-priority circuit. Set *o2-02 = 1 [STOP Key Function Selection = Enabled]*, then push STOP to stop the motor. This will also apply when a Run command (REMOTE Mode) is active at an external Run command source. To disable STOP priority, set *o2-02 = 0 [STOP Key Function Selection = Disabled]*.
D	LO/RE LED	Illuminated: The keypad controls the Run command (LOCAL Mode). OFF: The control circuit terminal or serial transmission device controls the Run command (REMOTE Mode). **Note:** • LOCAL: Use the keypad to operate the drive. Use the keypad to enter Run/Stop commands and the frequency reference command. • REMOTE: Use the control circuit terminal or serial transmission to operate the drive. Use the Run command source selected in *b1-02*. • Set *o2-01 = 1* and *o2-02 = 1* to use LO/RE and STOP.
E	ALM/ERR LED	Illuminated: The drive detects a fault. OFF: There are no drive faults or alarms. Flashing: • An alarm • Operation Errors • An Auto-Tuning error **Note:** The LED will illuminate to identify a fault if the drive detects a fault and an alarm at the same time.
F	READY LED	Illuminated: The drive is operating or is ready for operation. OFF: • The drive detects a fault. • There is no fault and the drive received a Run command, but the drive cannot run. For example, in Programming Mode. Flashing: The drive is in *STo [Safe Torque OFF]* condition. Flashing quickly: The voltage of the main circuit power supply is not in drive nameplate specifications, and the external 24 V power supply provides the only power to the drive.

Symbol	Name	Function
G	RUN LED	Illuminated: The drive is in normal operation. OFF: The drive is stopped. Flashing: • The drive is decelerating to stop. • The drive received a Run command, but the frequency reference is 0 Hz. Flashing quickly: • When the drive is in LOCAL Mode, the drive received a Run command from the MFDI terminals and is switched to REMOTE Mode. • The drive received a Run command from the MFDI terminals when the drive is not in Drive Mode. • The drive received a Fast Stop command. • The safety function shut off the drive output. • The user pushed STOP on the keypad while the drive is operating in REMOTE Mode.
H	Left Arrow Key	Moves the cursor to the left.
	Up Arrow Key/Down Arrow Key	• Moves to a different screen. • Selects parameter numbers and increments or decrements setting values.
	Right Arrow Key (RESET)	• Moves the cursor to the right. • Resets the drive to clear a fault.
	ENTER Key	• Enters parameter values and settings. • Selects each mode, parameter, and set value.
I	ESC Key	• Goes back to the previous screen. • Push and hold to go back to the frequency reference screen (the initial screen).
J	LED Display	Shows parameters, errors, and other data.
K	LO/RE Selection Key	Switches drive control for the Run command and frequency reference between the keypad (LOCAL) and an external source (REMOTE). **Note:** • The LOCAL/REMOTE Selection Key continuously stays enabled after the drive stops in Drive Mode. If the application must not switch from REMOTE to LOCAL because it will have a negative effect on system performance, set *o2-01 = 0 [LO/RE Key Function Selection = Disabled]* to disable LO/RE. Set *o2-01 = 1 [Enabled]* to enable LO/RE again. • The drive will not switch between LOCAL and REMOTE when it is receiving a Run command from an external source.
L	REV LED	Illuminated: The drive received a Reverse run command.
N	RJ-45 Connector	Connects to the drive. Use an RJ-45 8-pin straight through UTP CAT5e extension cable to install the keypad in a different location than the drive.

◆ Indicator flashing statuses

Refer to Figure 4.2 for the difference between “flashing” and “flashing quickly”.

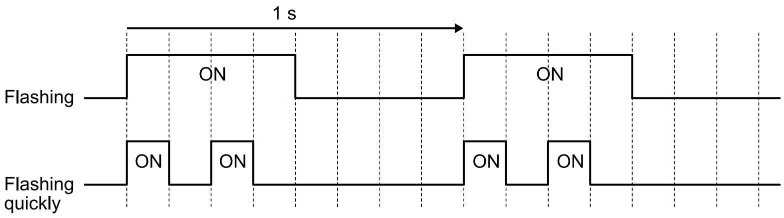


Figure 4.2 About indicator flashing statuses

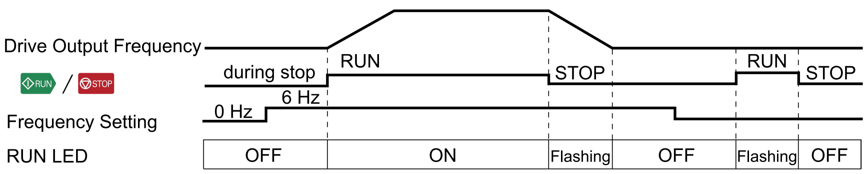


Figure 4.3 Relation between RUN indicator and Drive Operation

◆ Keypad Mode and Menu Displays

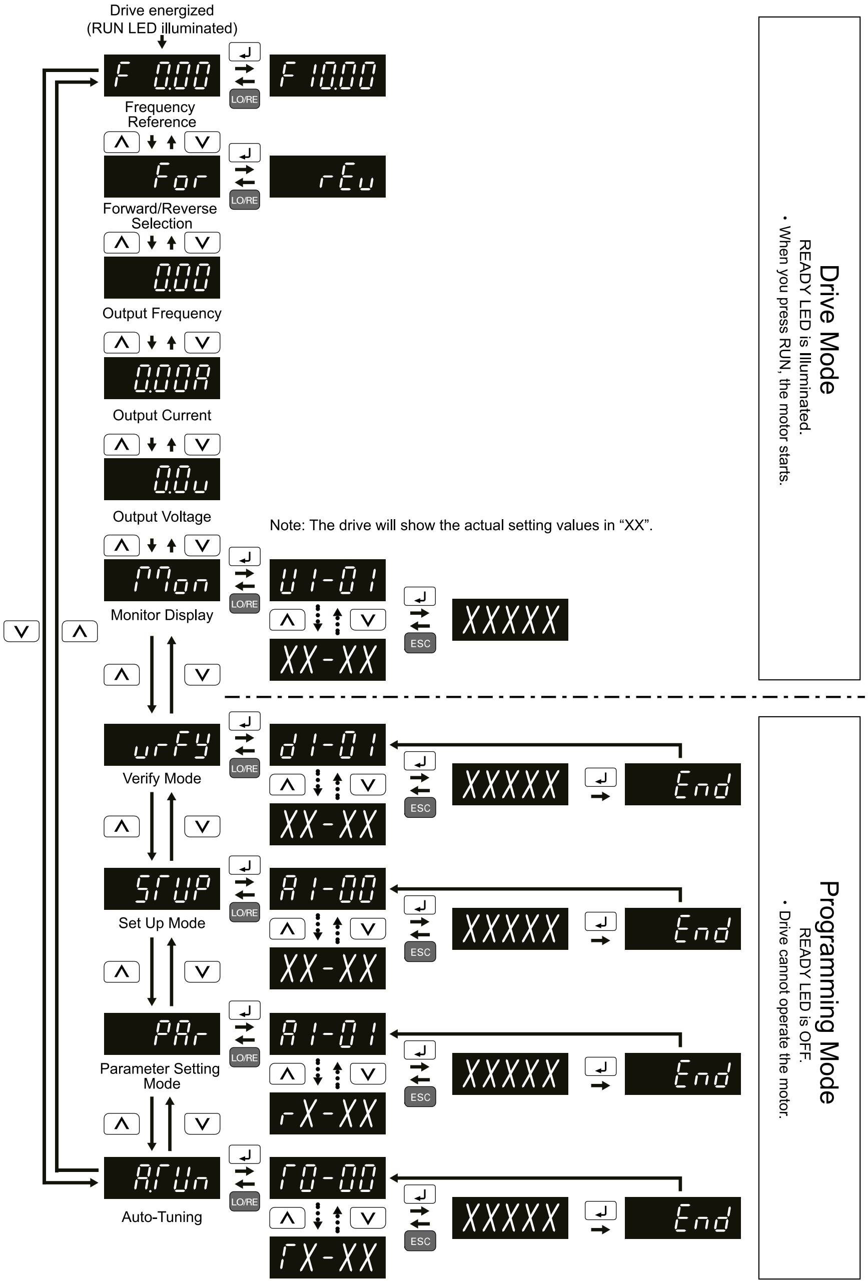


Figure 4.4 Keypad Functions and Display Levels

4.3 Set up the Drive with User-Parameter Menu

Drive parameters are in letter groups from A to U. Setup Mode  contains only the most frequently used parameters to help you set up the drive more easily.

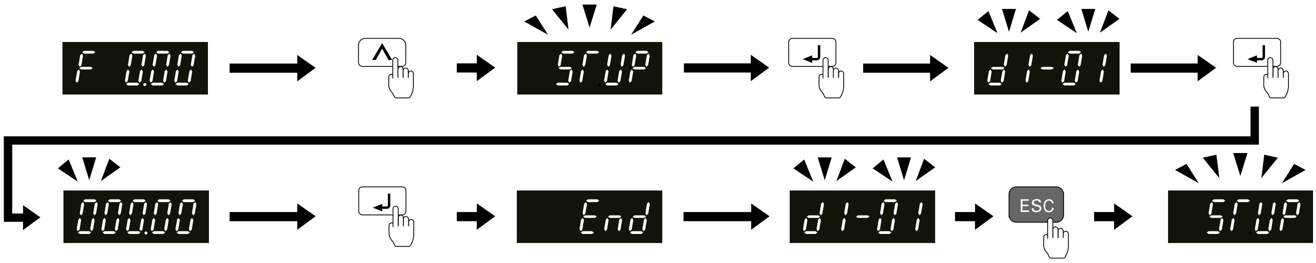


Figure 4.5 Parameters in General-Purpose Setup Mode

Table 4.2 shows the parameters available in Setup Mode. To access parameters not shown in the Setup Mode, use the  menu.

Table 4.2 Parameters in General-Purpose Setup Mode

User Parameter	Parameter	Name
A2-01	A1-00	Language Selection
A2-02	A1-02	Control Method Selection
A2-03	d1-18	Speed Reference Selection Mode
A2-04	d1-19	Nominal Speed
A2-05	d1-23	Releveling Speed
A2-06	d1-24	Inspection Operation
A2-07	d1-25	Rescue Operation Speed
A2-08	d1-26	Leveling Speed
A2-09	d1-01	Speed Reference 1
A2-10	d1-02	Speed Reference 2
A2-11	d1-03	Speed Reference 3
A2-12	d1-04	Speed Reference 4
A2-13	d1-05	Speed Reference 5
A2-14	d1-06	Speed Reference 6
A2-15	d1-07	Speed Reference 7
A2-16	d1-08	Speed Reference 8
A2-17	d1-28	Nominal/Leveling Spd Detection
A2-18	d1-29	Inspection Speed Detection
A2-19	C1-01	Acceleration Time 1
A2-20	C1-02	Deceleration Time 1
A2-21	C2-01	S-Curve @ Start of Acceleration
A2-22	C2-02	S-Curve @ End of Acceleration
A2-23	C2-03	S-Curve @ Start of Deceleration
A2-24	C2-04	S-Curve @ End of Deceleration
A2-25	C2-05	Jerk @ Levelig
A2-26	E2-03	Motor No-Load Current
A2-27	S1-02	DC-Injection @ Start
A2-28	S1-03	DC-Injection @ Stop
A2-29	S1-06	Brake Open Delay
A2-30	S1-07	Brake Close Delay

User Parameter	Parameter	Name
A2-31		User Parameter Selection
A2-32		
A2-33		

4.4 Drive Mode and Programming Mode

The keypad display of this drive has two modes: Drive Mode and Programming Mode.

- Drive Mode
  Use this mode to operate the drive. These operations are available:
  – Monitor operation statuses (for example, output frequency, output current, and output voltage)
  – Set the parameters that you can change while the drive is operating (for example, d1-01 to d1-17). Refer to *Parameter Details on page 301* for more information.
- Programming Mode
  Use this mode to set parameters. These operations are available:
  – Examine and set the parameters that are not at default settings (Verify Mode)
  – See and set the basic parameters necessary for the drive operation (Setup Mode)
  – See and set all parameters (Parameter Setting Mode)
  – Automatically set motor parameters (Auto-Tuning Mode)

Table 4.3 gives information about the functions you can access when you push ∧ / ∨.

Note:

Set *b1-08 [Run Command Select in PRG Mode]* to accept or reject the Run command from an external source when in Programming Mode. Refer to *b1-08: Up/Down Command Select in PRG Mode on page 308* for more information.

Table 4.3 Overview of the Modes

Mode	LED Display	Description	Description	Ref.
Drive Mode (Operation of the motor and monitoring of operation status)	F 0.00	Frequency reference display	You can set and monitor frequency references.	-
	MOn	Monitor display	The keypad shows *Ux-xx [Monitor]*.	-
	0.0u	Output voltage display	You can monitor the output voltage reference. Set *o1-01 [User Monitor Selection]* to change the item shown on this screen.	389
	0.00A	Output current display	You can monitor the output current.	-
	0.00	Output frequency display	You can monitor the frequency output from the drive.	-
	For	Forward/reverse selection	For: Motor rotates in forward direction rEu: Motor rotates in reverse direction **Note:** For applications where the motor must not rotate in reverse direction (for example, for fans and pumps), you can use *b1-04 [Reverse Operation Selection]* to prevent reverse rotation. How to set reverse operation rEu For → ↲ → For → ∧ → rEu → ↲	-
Programming Mode (Parameter Settings)	AtUn	Auto-Tuning Mode	The drive automatically calculates and sets the motor parameters.	95
	PAr	Parameter Setting Mode	You can see and set all parameters.	90
	STUP	Setup Mode	You can see and set the basic parameters necessary for drive operation.	89
	urFy	Verify Menu	You can examine and set the parameters that are not at default settings.	90

◆ Drive Mode

These operations are available in Drive Mode:

- Operate and stop the drive
- Show the drive status monitors (for example, frequency reference, output frequency, output current, and output voltage)
- Show the alarm content

- Show the alarm history

Note:

To operate the drive, select Drive Mode. You can switch to other modes when the drive stops, but the drive must be in Drive Mode to start operation.

These steps show how to set the frequency reference source to LOCAL (keypad) and change the frequency reference from 0 Hz to 6 Hz.

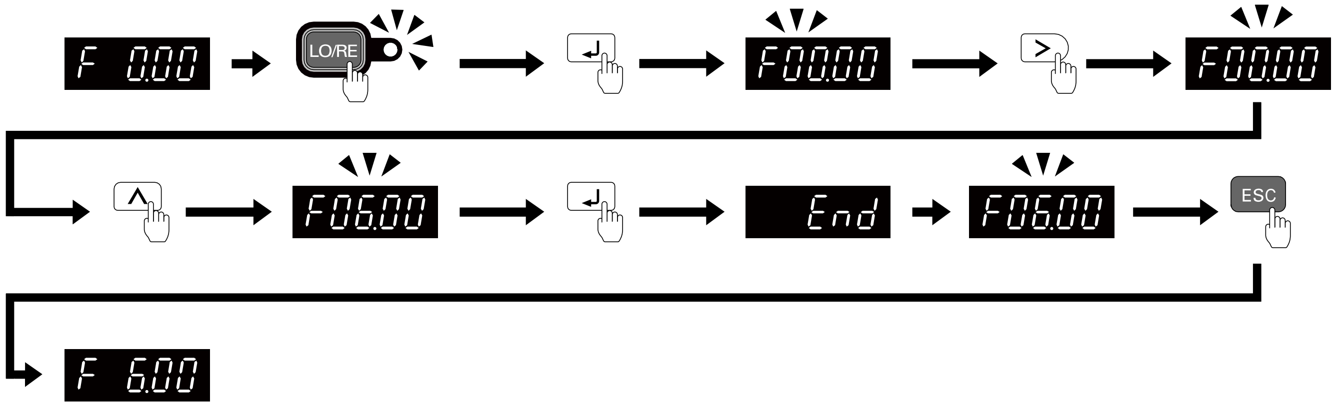


Figure 4.6 Frequency Reference Setting in Drive Mode

Note:

To prevent an incorrect setting, after you enter the frequency reference, you must push the ENTER key to change the frequency reference. Set *o2-05 = 1 [Home Mode Freq Ref Entry Mode = Immediate / MOP-style]* to change the frequency reference value without pushing the ENTER key.

◆ Programming Mode

In Programming Mode, you can set parameters or do Auto-Tuning. This mode has 4 sub-modes for different programming requirements:

- Verify Menu: Use this mode to examine and set the parameters that are not at default settings.
- Setup Mode: Use this mode to see and set the minimum parameters necessary for drive operation. Refer to *Verify and Set the Changed Parameters (Verify Menu) on page 90* for more information.
- Parameter Setting Mode: Use this mode to see and set all parameters.
- Auto-Tuning Mode: Use this mode to automatically set the motor parameters necessary for each control method.

■ Setup Mode

In Setup Mode, you can see and set the minimum parameters necessary for drive operation. Refer to Figure 4.7 for an example.

Note:

- Refer to *Set up the Drive with User-Parameter Menu on page 86* for more information about Setup mode parameters.
- Push and hold ESC to go back to the frequency reference screen from any screen.
- To change another parameter in Setup Mode, push ∧ or ∨.

Change *A1-00 [Language Selection]* from *6 [Portuguese]* to *0 [English]*.

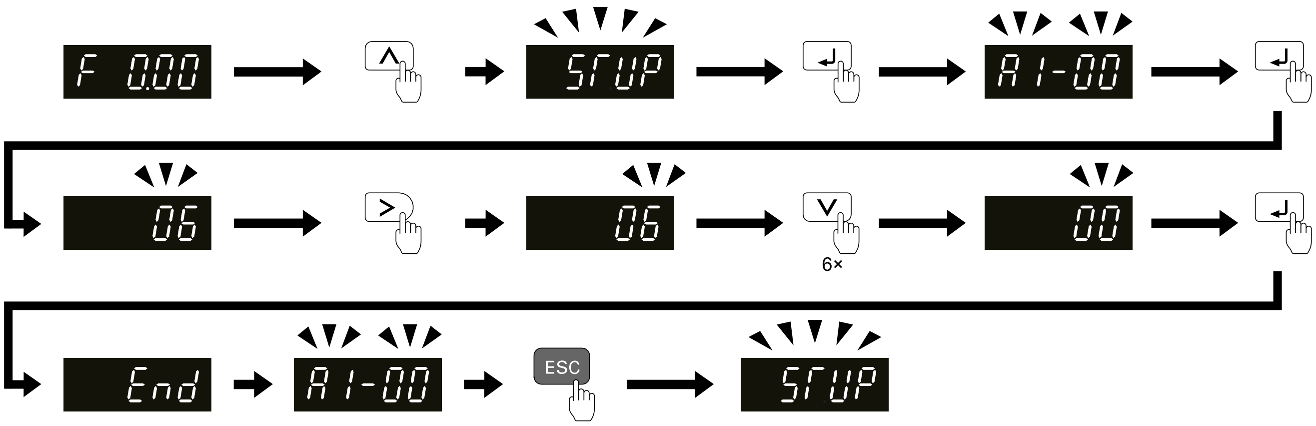


Figure 4.7 Key Operation Examples in Setup Mode

◆ Change Parameter Settings

Push and hold ESC to return to the frequency reference screen from any screen.
Use these steps to change *C1-01 [Acceleration Time 1]* from 1.0 s (default) to 2.0 s.

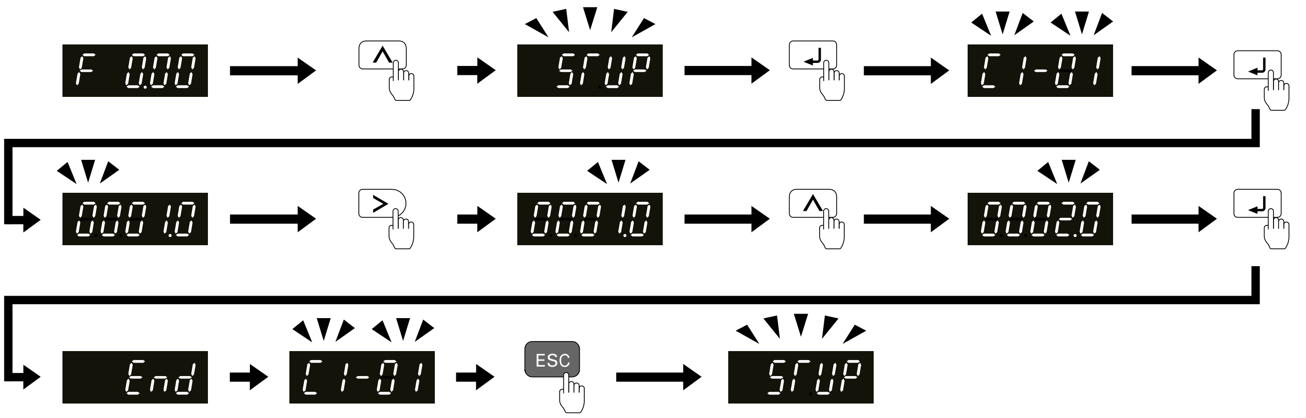


Figure 4.8 Key Operation Examples for Parameter Settings

◆ Verify and Set the Changed Parameters (Verify Menu)

Push and hold ESC to return to the frequency reference screen from any screen.
Use Verify mode to view all parameters that are not at default settings. This is very useful when you replace a drive. When there are no changes to parameter settings, the display shows nonE. This lets you quickly access and re-edit changed parameters. Figure 4.9 shows the procedure.

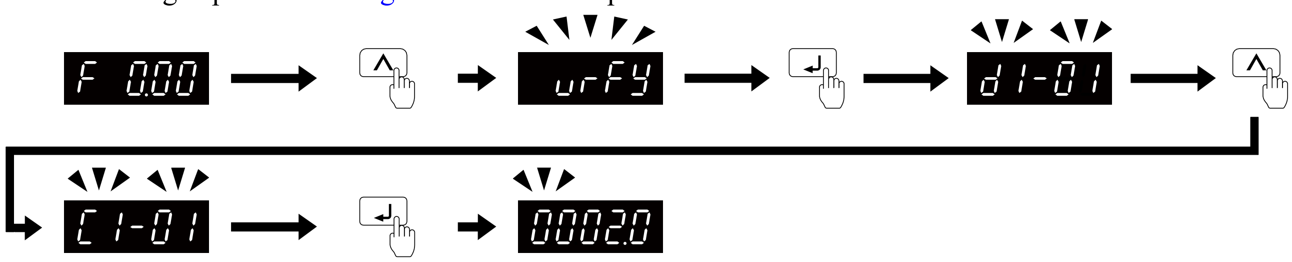


Figure 4.9 Verify and Set the Changed Parameters

◆ How to Switch between LOCAL and REMOTE

LOCAL mode lets you use the keypad to input Run commands. REMOTE mode lets you use other sources than the keypad to input Run commands.

⚠ WARNING Sudden Movement Hazard

If you change the control source when *b1-07 = 1 [LOCAL/REMOTE Run Selection = Accept Existing RUN Command]*, the drive can start suddenly. Before you change the control source, remove all personnel from the area around the drive, motor, and load.
Sudden starts can cause serious injury or death.

You can use LO/RE or MFDI functions (LOCAL/REMOTE Selection) to switch between LOCAL and REMOTE.

Note:
- LO/RE illuminates while the drive is in LOCAL Mode.
- While you are entering a Run command, you cannot switch between LOCAL and REMOTE.

■ Use the LO/RE Selection Key on the Keypad to Switch between LOCAL and REMOTE

Each time you push LO/RE, the mode switches between LOCAL and REMOTE. The LED illuminates in LOCAL Mode.

Figure 4.10 Use the LO/RE Selection Key to Switch between LOCAL and REMOTE

■ Use MFDI Terminals (S3 to S7) to Switch between LOCAL and REMOTE

When you set *H1-xx = 1 [MFDI Function Selection = LOCAL/REMOTE Selection]*, you can activate/deactivate the terminal to switch between LOCAL and REMOTE. Set *H1-xx = 1* to disable the LO/RE key on the keypad. For information about the MFDI functions, refer to the list in *H1: Digital Inputs on page 334*.

4.5 Start-up Procedures

This section gives the basic steps necessary to start up the drive using only the most basic settings.
Use the flowcharts in this section to find the most applicable start-up method for your application.

◆ Flowchart A: Connect and Run the Motor with Minimal Setting Changes

Figure 4.11 shows a basic start-up sequence to connect and run a motor with a minimum of setting changes. Settings can change when the application changes.

Use the drive default parameter settings for basic applications where high precision is not necessary.

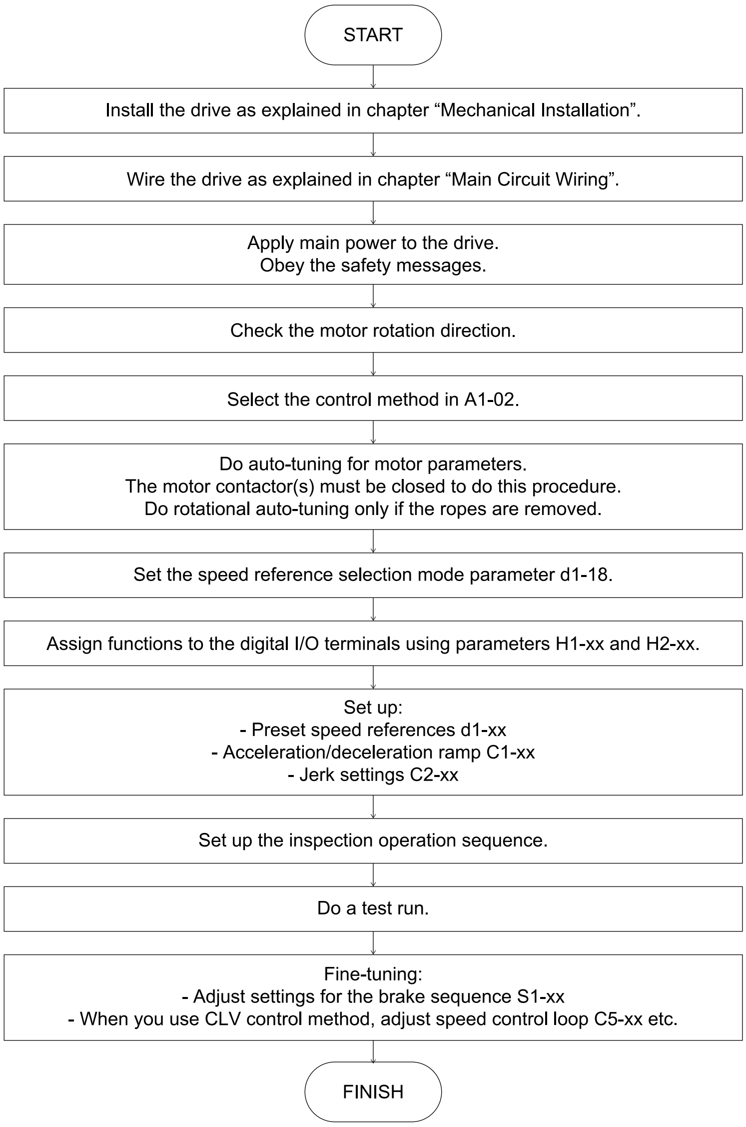


Figure 4.11 Basic Steps before Startup

◆ Power On

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

⚠ WARNING Fire Hazard

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

⚠ WARNING Fire Hazard

Tighten all terminal screws to the specified tightening torque. Avoid loose electrical connections.
Failure to comply can result in death or serious injury from fire.

⚠ WARNING **Fire Hazard**
Connect AC power supply lines to main circuit terminals R/L1, S/L2, and T/L3 (or R/L1 and S/L2 for single-phase power).
Do not connect the AC power supply line to the output motor terminals of the drive.
Failure to comply can result in death or serious injury from fire.

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

⚠ WARNING **Sudden Movement Hazard**
Clear personnel, secure equipment and check sequence and safety circuitry before starting the drive.
Secure covers, couplings, shaft keys, and machine loads.
Ensure start/stop and safety circuits are wired properly and in the correct state.
Failure to comply can result in death or serious injury from moving equipment.

⚠ WARNING **Sudden Movement Hazard**
Always check the operation of any emergency circuits after they are wired. Emergency circuits are required to provide safe and quick shutdown of the drive.
Do not operate the drive with untested emergency circuits.
Failure to comply can result in death or serious injury.

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

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

After applying power, the drive mode display should appear and no fault or alarm should be displayed. In the event of a drive fault or error code, refer to *Troubleshooting on page 171*.

◆ Control Method Selection

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

Machine Type	Control Method	A1-02 Setting
Induction Motor	V/f Control	0
	Open Loop Vector (OLV) Control	2
	Closed Loop Vector (CLV) Control	3

◆ Motor Rotation Direction Setup

Depending on the system configuration of the elevator, it can be necessary to change the motor direction to make the elevator travel up when the drive receives an Up command.

When the drive receives an Up command, it puts out voltage in U-V-W phase sequence.

- Examine the motor rotation with this phase sequence (for most motors, clockwise when looking from the shaft side).
- If a U-V-W sequence to the motor drives the elevator in the Up direction, set *b1-14 = 0 [Phase Order Selection = Standard]*.
- If a U-V-W sequence to the motor drives the elevator in the Down direction, set *b1-14 = 1 [Switch Phase Order]*.

Note:

Always do the motor rotation direction setup before you set the encoder rotation direction.

If these problems occur in the test run, use the Rotation Direction Trouble Shoot function to help solve them:

- There is current flow, but no motor rotation.
- The drive detects a *dv3 [Inversion Detection]*, *dv4 [Inversion Prevention Detection]*, *oL2 [Drive Overload]*, or *PGo [Encoder (PG) Feedback Loss]* fault.
- The motor rotates in a different direction than expected.

◆ Flowchart B: Auto-Tuning for Induction Motors

Figure 4.12 shows Auto-Tuning for induction motors operating with V/f Control or Open Loop Vector Control. Settings can change when the application changes.

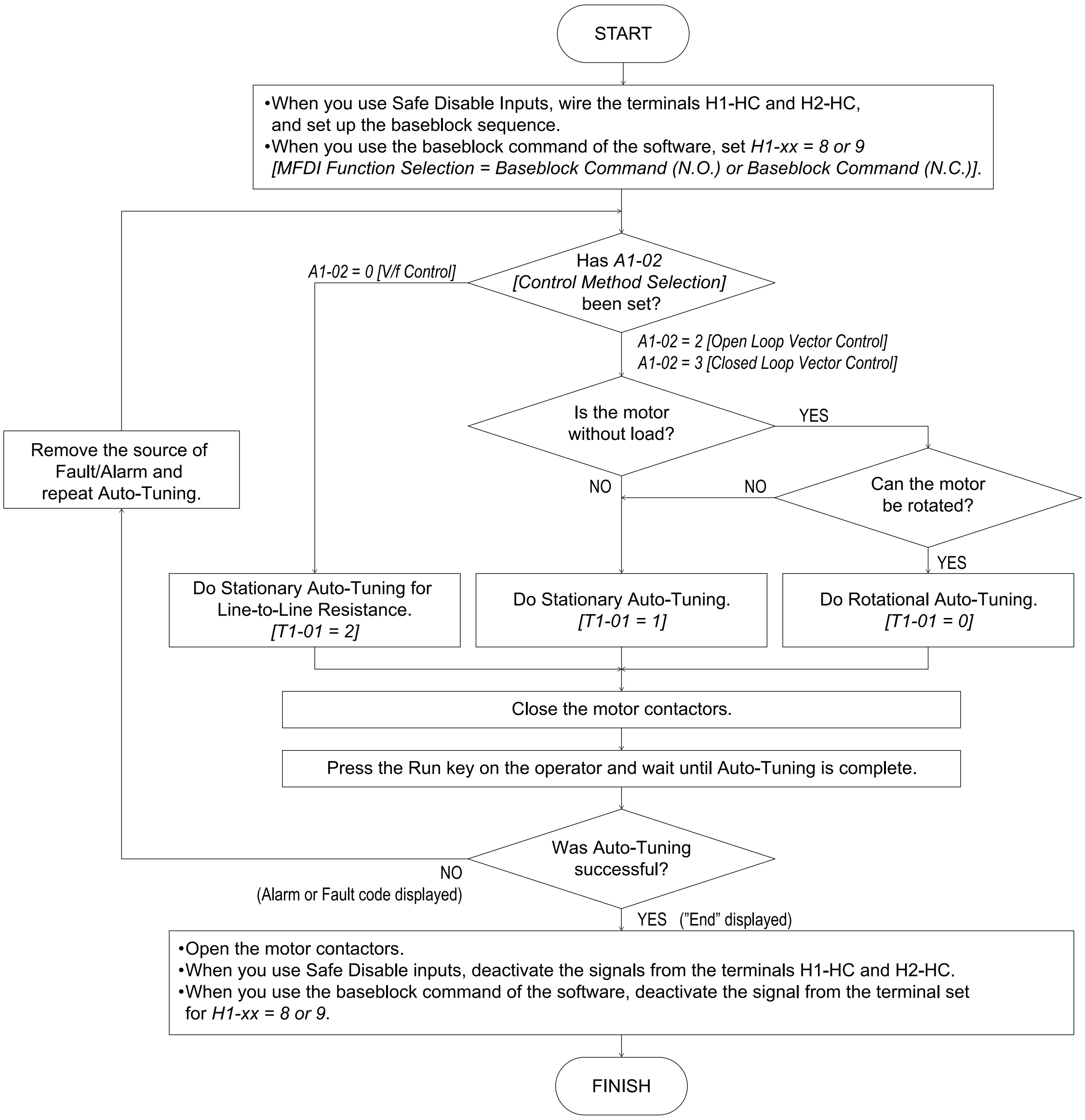


Figure 4.12 Auto-Tuning for Induction Motors

4.6 Auto-Tuning

⚠ WARNING Sudden Movement Hazard

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

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

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

◆ Types of Auto-Tuning

The type of Auto-Tuning used differs based on the control mode and other operating conditions. Refer to the tables below to select the type of Auto-Tuning that bests suits the application. For directions for performing Auto-Tuning, refer to *Start-up Procedures on page 92* with Figure 4.11.

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

Table 4.4 Status of Input/Output Terminals during Auto-Tuning

Auto-Tuning Type	Parameter	Requirements and Benefits	Control Method		
			V/f *A1-02 = 0*	OLV *A1-02 = 2*	CLV *A1-02 = 3*
Rotational Auto-Tuning	T1-01 = 0	• Rotational Auto-Tuning gives the most accurate results, and is recommended if possible. • Motor must run freely, i.e. ropes have to be removed.	No	Yes	Yes
Stationary Auto-Tuning 1	T1-01 = 1	• A motor test report listing motor data is not available. • Automatically calculates motor parameters needed for vector control. • Use if ropes cannot be removed. Note that the accuracy is lower than with Rotational Auto-Tuning.	No	Yes	Yes
Stationary Line-Line Resistance	T1-01 = 2	• Used when the motor cable exceeds 50 m. • Used in V/f control if drive and motor capacities differ. • Perform when the ropes cannot be removed from the installation for rotational auto-tuning.	Yes	Yes	Yes

The following table lists the data that must be entered for Auto-Tuning. Make sure this data is available before starting Auto-Tuning. The necessary information is usually listed on the motor nameplate or in the motor test report provided by the motor manufacturer.

Table 4.5 Status of Input/Output Terminals during Auto-Tuning

Input Value	Input Parameter	Unit	Tuning Type		
			Rotational Auto-Tuning *T1-01 = 0*	Stationary Auto-Tuning 1 *T1-01 = 1*	Stationary Line-Line Resistance *T1-01 = 2*
Motor Rated Power	T1-02	kW	Yes	Yes	Yes
Motor Rated Voltage	T1-03	Vac	Yes	Yes	No
Motor Rated Current	T1-04	A	Yes	Yes	Yes
Motor Rated Frequency	T1-05	Hz	Yes	Yes	No
Number of Motor Poles	T1-06	-	Yes	Yes	No
Motor Rated Speed	T1-07	r/min	Yes	Yes	No

The number of motor poles *[T1-06]* is usually not found on the motor nameplate, but it can be calculated by: $p = (120 \times f) / n_s$. Where **f** is the motor rated frequency and $\mathbf{n_s}$ is the motor synchronous speed.

Startup Procedure and Test Run

4

◆ Before Auto-Tuning the Drive

⚠ WARNING Sudden Movement Hazard
When performing Rotational Auto-Tuning for motor data or PG encoder offset, always uncouple the motor from the mechanical system (remove ropes from traction sheave).
Failure to comply can cause death or serious injury to personnel, and damage to the equipment.

⚠ WARNING Electrical Shock Hazard
Do not touch the motor during Auto-Tuning. Lethal voltages may be present on the motor case.
Failure to comply can cause death or serious injury.

⚠ WARNING Electrical Shock Hazard
Do not touch the motor until Auto-Tuning is completed. When doing Stationary Auto-Tuning, the motor does not rotate, however, power is applied.
Failure to comply can result in death or serious injury.

⚠ WARNING Sudden Movement Hazard
The holding brake must remain engaged for the entire Stationary Auto-Tuning sequence. Ensure a brake release digital output signal cannot be issued by the drive.
Failure to comply can result in death or serious injury.

⚠ WARNING Sudden Movement Hazard
Do not release the mechanical brake during Stationary Auto-Tuning.
Ensure that the mechanical brake release circuit is not controlled by the drive multi-function digital outputs exclusively.
Failure to comply can result in death or serious injury.

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

Improved performance is possible when using a motor with a base voltage that is 40 V (20 V for 200 V class models) lower than the input supply voltage. This is particularly important when operating the motor above 90% of base speed, where high torque precision is required.

⚠ WARNING Sudden Movement Hazard
Stay clear of the motor during rotational auto-tuning. During automatic starting of equipment, the machine may start moving suddenly.
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.
Failure to comply can result in death or serious injury.

The following table describes digital input and output terminal operation while Auto-Tuning is executed.

Table 4.6 Status of Input/Output Terminals during Auto-Tuning

Auto-Tuning Type	Digital Input	Digital Output
Rotational Auto-Tuning *[T1-01 = 0]*	Digital input functions are disabled.	Functions the same as during normal operation.
Stationary Auto-Tuning 1 *[T1-01 = 1]*	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning.
Stationary Line-Line Resistance *[T1-01 = 2]*	Digital input functions are disabled.	Maintains the status at the start of Auto-Tuning.

◆ Auto-Tuning Interruption and Fault Codes

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

◆ Auto-Tuning Operation Example

The following example demonstrates Rotational Auto-Tuning when using *OLV [A1-02 = 2]*.

1. Turn on the power to the drive.
   The initial display appears.
2. Press [∧] or [∨] until the Auto-Tuning display appears.
3. Press [↵] to start setting parameters.
4. Press [↵] to display the value for T1-01.
5. Press [>] to select the digit to be modified.
6. Press [∨] to select Rotational Auto-Tuning.
7. Press [↵] to save the setting.
   The display returns to the display shown in step 3.
8. Press [∧] to access the motor output power parameter T1-02.
9. Press [↵] to view the default setting.
10. Press [>] to select the correct digit and [∧]/[∨] to change the digit value, enter the motor power nameplate data in kW.
11. Press [↵] to save the settings.
    The display returns to the display in step 1.
12. Repeat steps 1 to 4 to set the remaining motor parameters.
    - *T1-03 [Motor Rated Voltage]*
    - *T1-04 [Motor Rated Current]*
    - *T1-05 [Motor Base Frequency]*
    - *T1-06 [Number of Motor Poles]*
    - *T1-07 [Motor Base Speed]*
13. Press [∧] to confirm the motor data.
14. Press [◇RUN] to start Auto-Tuning.
    The drive begins by injecting current into the motor for about 1 min, and then starts to rotate the motor. Auto-Tuning finishes in approximately one to two minutes if no errors occur.

◆ Input Data for Motor Auto-Tuning: T1

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

Note:
- Cycling drive power after setting the *T1* parameters will reset these parameters to default values.
- For motors operating in the field weakening range, first perform the Auto-Tuning with the base data. After Auto-Tuning is complete, change *E1-04 [Maximum Output Frequency]* to the desired value.

For more information refer to *T: Auto-Tuning on page 416*.

4.7 Setup Procedure for Elevator Applications

◆ Up and Down Commands And Speed Reference Selection

⚠ WARNING Sudden Movement Hazard
Remove the Up/Down Command before you reset faults or alarms.
If the drive has an active Up/Down command when you reset a fault or alarm, the elevator can start suddenly and cause serious injury or death.

⚠ WARNING Sudden Movement Hazard
Verify the maximum drive output frequency before you apply an Up/Down command.
The drive can run the motor at high speeds. If the maximum drive output frequency is incorrect, it can cause serious injury or death.

⚠ WARNING Sudden Movement Hazard
Make sure that *b1-03 = 0 [Stopping Method Selection = Ramp to Stop]* before you apply an Up/Down command.
If *b1-03 ≠ 0* when you apply an Up/Down command, it can cause serious injury or death from elevator free-fall when you remove the Up/Down command.

■ Speed Reference Selection

Parameter *b1-01 [Speed Reference Selection 1]* sets the speed reference source.

b1-01 Settings	Reference Source	Speed Reference Input
0 (default)	Keypad	The drive uses the keypad to enter the speed reference.
1	Analog input	The drive uses MFAI terminals A1 or A2 to input an analog speed reference with a voltage or current input signal.
2	Serial communication *1	The drive uses the serial communication port RS-485 to enter the speed reference.

*1 When *d1-18 = 1 [High speed has priority]*, the speed reference entered from MFDI terminals will have priority over other speed references.

■ Up/Down Command Source Selection

Parameter *b1-02 [Up/Down Command Selection 1]* sets the Up/Down command source.

b1-02 Settings	Up/Down Command Source	Up/Down Command Input
0	Keypad	The drive uses the keypad to enter the Up/Down command.
1 (default)	Digital input	The drive uses the control circuit terminals to enter the Up/Down command. Select the input method for the Up/Down command with an *H1-xx* parameter.
2	Serial communication	The drive uses the serial communication port RS-485 to enter the speed reference.

■ Travel Start

To start the elevator in the Up or Down direction, make sure that you do these items:

- Select a speed reference greater than zero.
- Close the Safe Disable signals at terminals H1 and H2 (drive output enabled).
- If a multi-function digital input is programmed for Baseblock (H1-xx = 8 or 9), set this input so the drive is not in a baseblock condition.
- Set an Up or Down Signal at the source specified in *b1-02 [Up/Down Command Selection 1]*.
- If a multifunction input is programmed for output contactor feedback (H1-xx = 56), then make sure the output contactor is closed.

■ Travel Stop

The drive stops when:

- You clear the Up or Down command.
- You set *d1-18 = 1 [Speed Reference Selection Mode = High speed has priority]* and clear the Up/Down or *Leveling Speed* signal (*H1-xx = 53*).
- You set *d1-18 = 0 [Use Multi-Speed references d1-01 to d1-08]* and clear all speed inputs.

- The drive detects a fault. There are different stopping methods for different faults and parameter settings.
- The Safe Disable inputs are opened or a Baseblock signal is input. When one of these occurs, the brake is applied immediately and the drive output shuts off.

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

Set *b1-01 = 0 [Speed Reference Selection 1 = Keypad]* to enable the speed selection using the drive digital inputs. Use *d1-18 [Speed Reference Selection Mode]* to determine different travel speeds selected by the digital inputs.

Setting of d1-18	Speed Selection
0 (default)	Multi-speed inputs 1, Speed references are set in d1-01 to d1-08.
1	Separate speed inputs, Speed references are set in d1-19 to d1-24 and d1-26, Higher speed has priority.

■ Multi-Speed Inputs 1 (d1-18 = 0)

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

Setting of d1-18	Speed Selection	Set Value	
S5	H1-05	3	Multi-Speed Reference 1
S6	H1-06	4	Multi-Speed Reference 2
S7	H1-07	5	Multi-Speed Reference 3

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

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

Digital Inputs			Selected Speed
Multi-Speed Reference 1	Multi-Speed Reference 2	Multi-Speed Reference 3	d1-18 = 0
0 (Off)	0 (Off)	0 (Off)	*d1-01 [Speed Reference 1]*
1 (On)	0 (Off)	0 (Off)	*d1-02 [Speed Reference 2]*
0 (Off)	1 (On)	0 (Off)	*d1-03 [Speed Reference 3]* Terminal A1, A2, input value when *H3-xx = 3 [MFAI Function Selection = Auxiliary Frequency Reference 2]*
1 (On)	1 (On)	0 (Off)	*d1-04 [Speed Reference 4]*
0 (Off)	0 (Off)	1 (On)	*d1-05 [Speed Reference 5]*
1 (On)	0 (Off)	1 (On)	*d1-06 [Speed Reference 6]*
0 (Off)	1 (On)	1 (On)	*d1-07 [Speed Reference 7]*
1 (On)	1 (On)	1 (On)	*d1-08 [Speed Reference 8]*

Setting d1-18 = 0 :

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

■ Separate Speed Inputs (d1-18 = 1)

Six different speed settings (defined in the parameters d1-19 to d1-24 and d1-26) can be set and selected using four digital inputs. When *d1-18 = 1*, multi-function digital inputs are preset as shown below:

Setting of d1-18	Speed Selection	Set Value	Details
S3	H1-03	50	*d1-19 [Nominal speed]*
S4	H1-04	54	*d1-24 [Inspection speed]*
S5	H1-05	51	*d1-20 [Intermediate speed]*
S6	H1-06	53	*d1-26 [Leveling speed]*

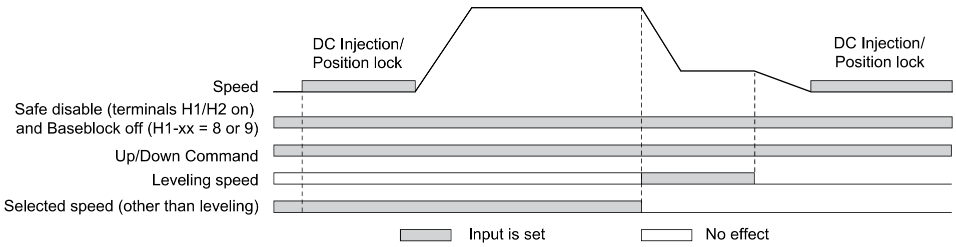
Different speed settings can be selected depending on the assignment of the speed selection digital inputs *H1-xx [Digital Inputs]* as shown in the table below. Parameters d1-19 through d1-26 are displayed only when *d1-18 = 1*.

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

0 = Off, *1* = On, *A* = no influence, *N/A* = Not available

Higher Speed has Priority and the Leveling Speed Input is Assigned (d1-18 = 1 and H1-xx = 53) (default) :

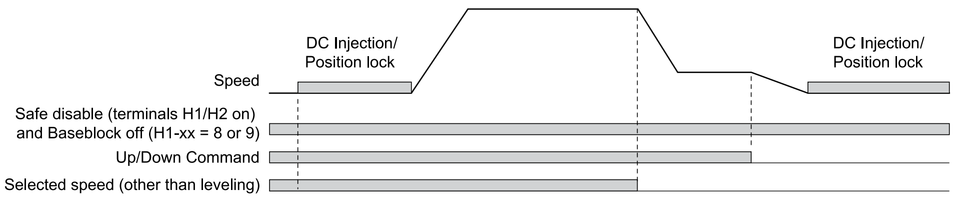
The higher speed has priority over the leveling speed. The leveling signal is disregarded as long as any other speed selection input is active. The drive decelerates to the leveling speed (d1-26) when the selected speed reference signal is removed.



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

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

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



◆ Multi-Function Terminal Setup

■ Multi-Function Digital Inputs (Terminals S3 to S7)

The H1 parameters assign functions to digital input terminals S3 to S7. Refer to *H1: Digital Inputs on page 334*.

■ Multi-Function Digital Outputs

The H2 parameters assign functions to digital output terminals. Refer to *H2: Digital Outputs on page 340*.

■ Multi-Function Analog Inputs

The H3 parameters assign functions to analog input terminals. Refer to *H3: Analog Inputs on page 352*.

■ Multi-Function Analog Output

The H4 parameters assign a function to analog output terminal AM. Select the function for this terminals by entering the last three digits of the desired U monitor. Refer to *H4: Analog Outputs on page 356* and *U: Monitors on page 289*.

◆ Accel/Decel Ramp and Jerk Settings

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

The figure below explains how accel/decel ride and jerk settings can be used to adjust the ride profile.

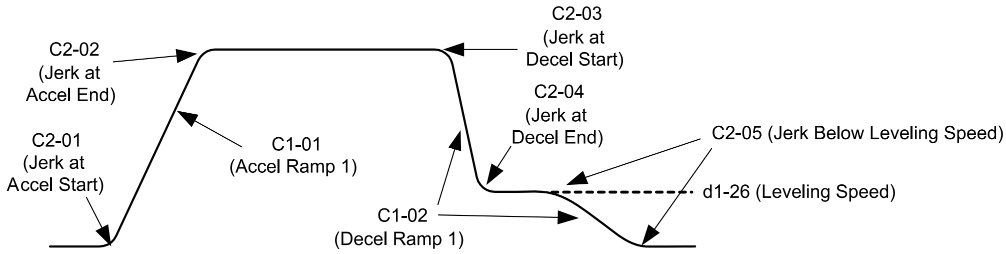


Figure 4.13 Accel/Decel Ramp and Jerk Function

Units used to set the acceleration and deceleration ramp as well as the Jerk function change with the setting of parameter.

◆ Inspection Operation

■ Start Condition in Inspection Operation

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

- Parameter d1-18 is set to 0 and the selected speed is higher than d1-28 but lower than d1-29.
- Parameter d1-18 is set to 1 and a digital input programmed for Inspection Operation Speed *[H1-xx = 54]* is enabled.

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

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

■ Stop Condition in Inspection Operation

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

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

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

■ Inspection Operation Timing Chart

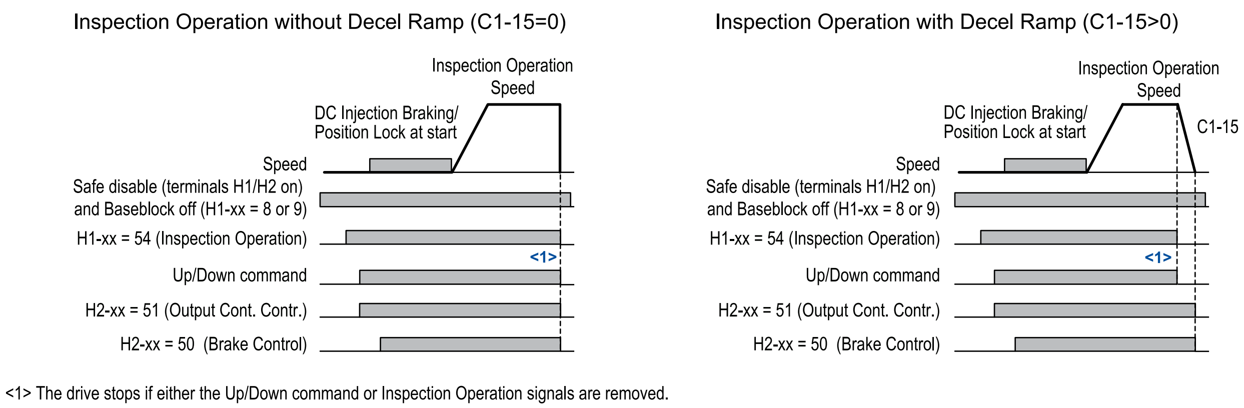


Figure 4.14 Inspection Operation Sequence

◆ Brake Sequence

⚠ WARNING Sudden Movement Hazard

Be sure to set an acceptable deceleration time in parameter *C1-09 [EmergencyStop Ramp]* when using the fast-stop feature. Rapid deceleration may cause the drive to fault on an overvoltage condition and lead to an uncontrolled motor state.
Failure to comply can result in death or serious injury

⚠ WARNING Sudden Movement Hazard

Always turn OFF the Up/Down command before you change *b1-01 [Speed Reference Selection 1]*, *d1-18 [Speed Reference Selection Mode]*, or *H1-xx [MFDI Function Selection]*.
If the Up/Down command is ON when you change these parameter settings, the motor can unexpectedly start to run and cause serious injury or death.

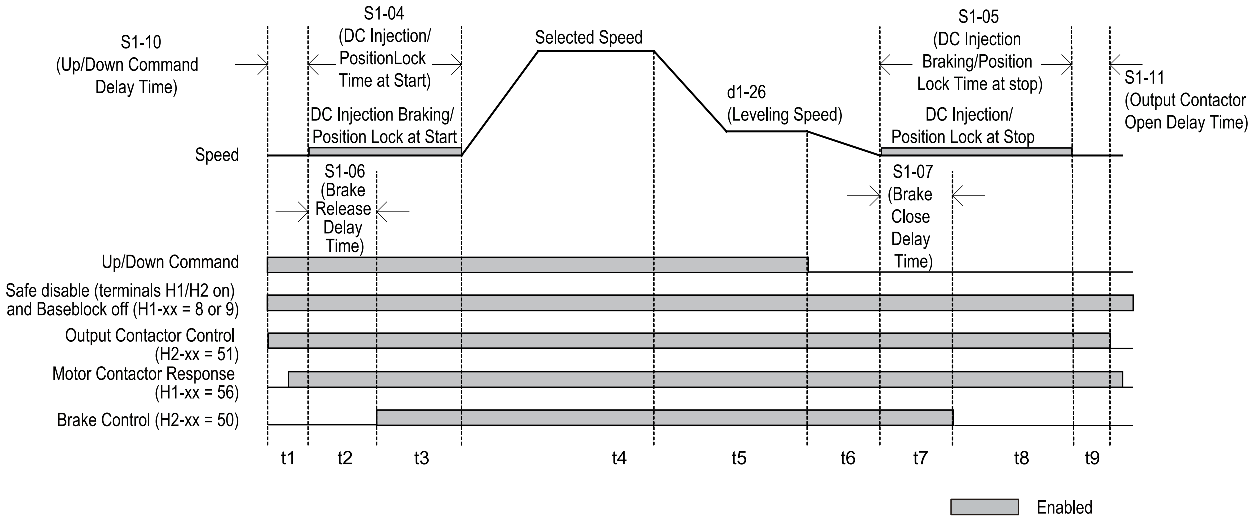


Figure 4.15 Brake Sequence Timing Diagram

Table 4.7 Timing Zones for Brake Sequence Timing Diagram

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

Timing Zone	Description
t8	The drive continues DC Injection or Position Lock until the time S1-05 has passed. When S1-05 has passed the drive output is shut off.
t9	After the delay for the magnetic contactor set in S1-11 has passed, the drive resets the output terminal set for “Output Contactor Control” *[H2-xx = 51]*. The Safe Disable Inputs can be cleared and Baseblock can be enabled.

◆ Rescue Operation

■ Overview

In the event of a power outage, Rescue Operation allows the elevator to travel to the nearest floor by switching to a backup battery or UPS (Uninterruptable Power Supply) for power.

An input terminal set for Rescue Operation (H1-xx = 55) can be used to initiate Rescue Operation. During Rescue Operation, the drive uses the speed reference set in d1-25 to travel to the nearest floor.

NOTICE Equipment Hazard
Do not use the Rescue Operation feature for extended periods.
Failure to comply can result in drive heat sink overtemperature alarms (oH).

NOTICE Equipment Hazard
When changing parameters while the drive is supplied from the rescue operation power supply, wait at least 5 s after entering parameters before switching off the power supply. Instantly switching off the power can cause parameter settings corruption that can only be resolved by initializing the drive.
Failure to comply can cause erroneous drive performance.

■ Drive Power Supply for Rescue Operation

There are various methods of supplying power to the drive for rescue operation. Independent of the chosen method, the voltage in the DC bus of the drive and the voltage supplied to the drive control circuit must meet the specifications provided in the following table.

The DC bus voltage can either be supplied by a battery connected to the DC bus terminals of the drive or by a UPS connected to drive terminals L1 and L2. The control circuit voltage is supplied directly from the drive’s DC bus.

When using a single-phase AC power supply for rescue operation such as a single-phase UPS, the ripple in the DC bus voltage will be higher than with a three-phase or battery supply. Make sure that the DC bus voltage never falls below the minimum value listed in the following table.

Table 4.8 Power Supply Ratings for Rescue Operation

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

■ Parameter Setup

Adjust drive parameters as described below when using Rescue Operation.

- Set parameter S4-01 to select if light load direction search should be automatically performed when Rescue Operation is started and to configure the light load search function.

■ Wiring Examples

Switching the main power supply to a battery or UPS requires magnetic contactors that must be controlled by an external controller. Wiring methods and the sequence used for the magnetic contactors depend on the application. This instruction manual describes the following configurations:

- A single-phase, 230 V UPS is used as backup power supply for a 200 V or 400 V class drive.
- Two separate batteries for the main power and control power supplies. Main power battery voltage is below 250 Vdc for 200 V class drives or 500 Vdc for 400 V class drives.
- Two separate batteries. One is used for the main power supply, a second battery supplies the controller via an optional 24 V Backup Power Supply Unit.
- A single battery with minimum 250 Vdc for 200 V class drives or 500 Vdc for 400 V class drives is used for the main and control power supply.

Select the configuration that matches your application. Follow the corresponding instructions for wiring and drive settings. For configurations not covered in the list above, contact your Yaskawa representative or our sales office directly for consultation.

⚠ WARNING **Electrical Shock Hazard**

Make sure that the drive and all devices connected to the drive have been shut off prior to performing and type of maintenance or wiring.
After shutting off the power, wait for at least the amount of time specified on the drive before touching any components or perform wiring. The internal capacitor remains charged even after the power supply is turned off.
Do not connect or disconnect wiring while the power is on.
Never remove or install option cards or attempt to replace the cooling fan while the drive is switched on.
Failure to comply can result in death or serious injury

NOTICE

Be sure to thoroughly read the instructions for wiring and magnetic contactor sequence described in this section before setting up the drive for Rescue Operation.
Failure to follow these instructions can damage the drive.

NOTICE **Equipment Hazard**

Do not use the Rescue Operation feature for extended periods.
Failure to comply can result in drive heat sink overtemperature alarms (oH).

■ Using a Single-Phase 230 Vac UPS (Uninterruptable Power Supply)

Follow the instructions when using a single-phase 230 V UPS for Rescue Operation. A 230 V UPS can be used for both 200 V and 400 V class drives.

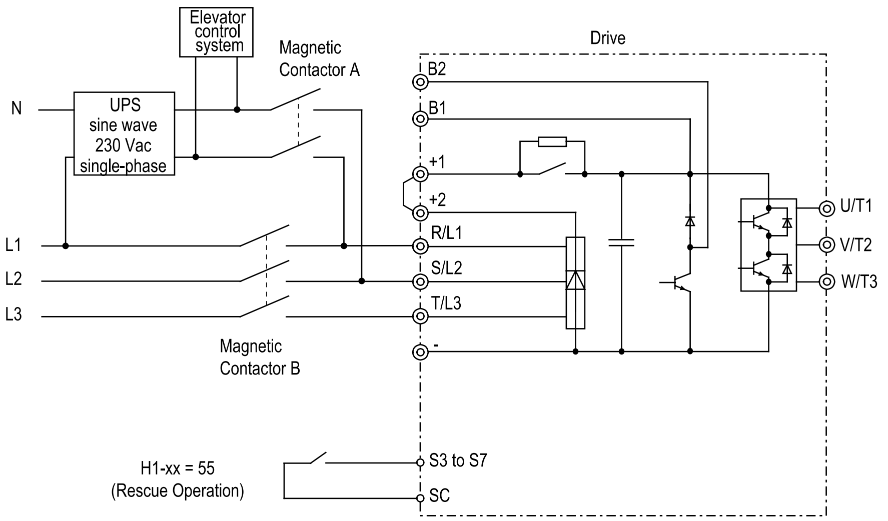


Figure 4.16 Wiring Diagram when Using a UPS

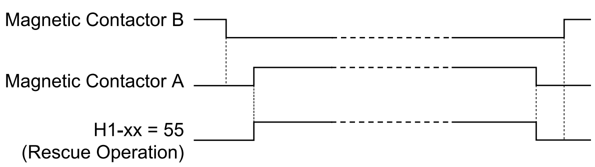


Figure 4.17 Magnetic Contactor Sequence

Starting Rescue Operation :

1. Open contactor B.
2. Set the input terminal programmed for Rescue Operation *[H1-xx = 55]*.
3. Close contactor A.
4. Set the Up/Down command.

Ending Rescue Operation :

1. After the car has stopped, open contactor A.
2. Clear the input terminal set for Rescue Operation *[H1-xx = 55]*.
3. Close contactor B to return to operation with normal power supply.

The drive may fault on a control power supply fault (Uv2) if the UPS can’t provide enough voltage, or if the Light Load Direction Search is not set properly.

■ Using a Single Battery with Minimum 230 Vdc

Follow the instructions when using one battery to supply both, main circuit and controller. The battery voltage must be at least 230 Vdc for 400 V class drives, battery voltage of 250 Vdc is recommended.

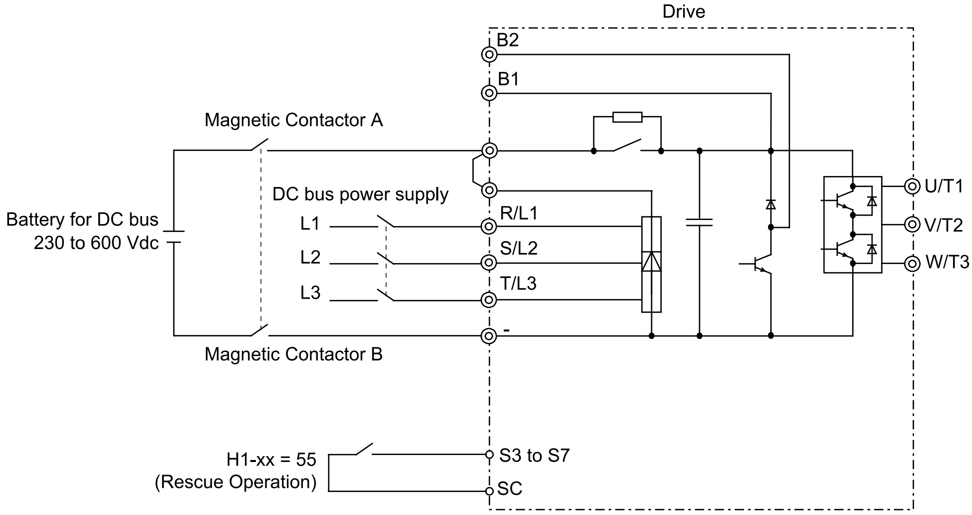


Figure 4.18 Wiring Diagram when Using a UPS

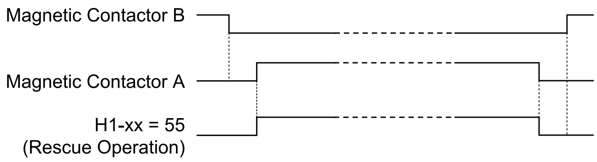


Figure 4.19 Magnetic Contactor Sequence

Starting Rescue Operation :

1. Open contactor B.
2. Set the input terminal programmed for Rescue Operation *[H1-xx = 55]*.
3. Close contactor A.
4. Set the Up/Down command.

Ending Rescue Operation :

1. After the car has stopped, open contactor A.
2. Clear the input terminal set for Rescue Operation *[H1-xx = 55]*.
3. Close contactor B to return to operation with normal power supply.

4.8 Items to Check before Starting Up the Drive

◆ Check before You Energize the Drive

Check the items in Table 4.9 before you energize the drive.

Table 4.9 Items to Check before You Energize the Drive

Items to Check	Description
Input Power Supply Voltage	The voltage of the input power supply must be: Three-phase 200 V class: three-phase 200 Vac to 240 Vac 50/60 Hz, 270 Vdc to 340 Vdc Three-phase 400 V class: three-phase 380 Vac to 480 Vac 50/60 Hz, 513 Vdc to 679 Vdc
	Correctly wire power supply input terminals R/L1, S/L2, and T/L3, or L and N.
	Correctly ground the drive and motor.
Connection between Drive Output Terminals and Motor Terminals	Make sure that you connected drive output terminals U/T1, V/T2, and W/T3 in the correct sequence to align with motor terminals U, V, and W and tighten the screws to a correct tightening torque.
Control Circuit Terminal Wiring	Make sure that you connected the drive control circuit terminals in the correct sequence to align with devices and switches and tighten the screws to a correct tightening torque.
Control Circuit Terminal Status	Turn OFF the inputs from all devices and switches connected to the drive control circuit terminals.
Connection between Machinery and Motor	Disengage all couplings and belts that connect the motor and machinery.

◆ Check after You Energize the Drive

Check the items in Table 4.10 after you energize the drive. The keypad display is different depending on drive status.

Table 4.10 Display Status after You Energize the Drive

Status	Display	Description
During Usual Operation	F 0.00	The LED display shows the frequency reference.
When the Drive Detects a Fault	EF3	The display is different for different faults. Refer to "Troubleshooting" to remove the cause of the fault. The ALM/ERR LED will illuminate.

4.9 Keypad Operation

◆ Show the Monitor

Push and hold ESC to return to the frequency reference screen from any screen.

Use these steps to access Mon menu and check drive operation status.

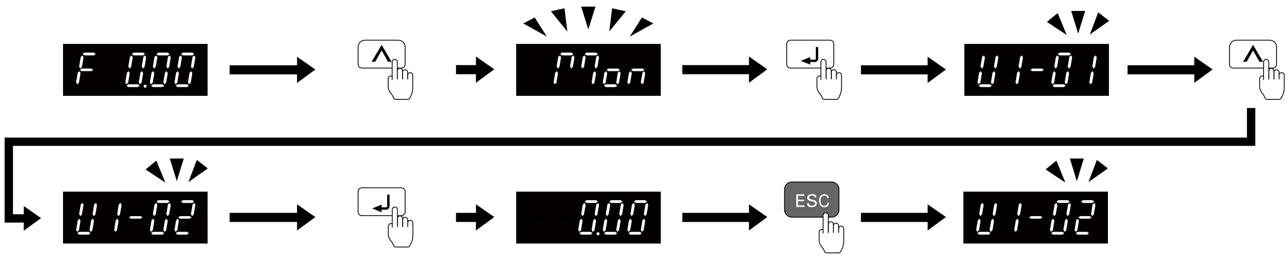


Figure 4.20 How to Monitor the Parameter Setting Values

◆ Check Modified Parameters

Push and hold ESC to return to the frequency reference screen from any screen.
Use Verify mode to view all parameters that are not at default settings. This is very useful when you replace a drive. This lets you quickly access and re-edit changed parameters.

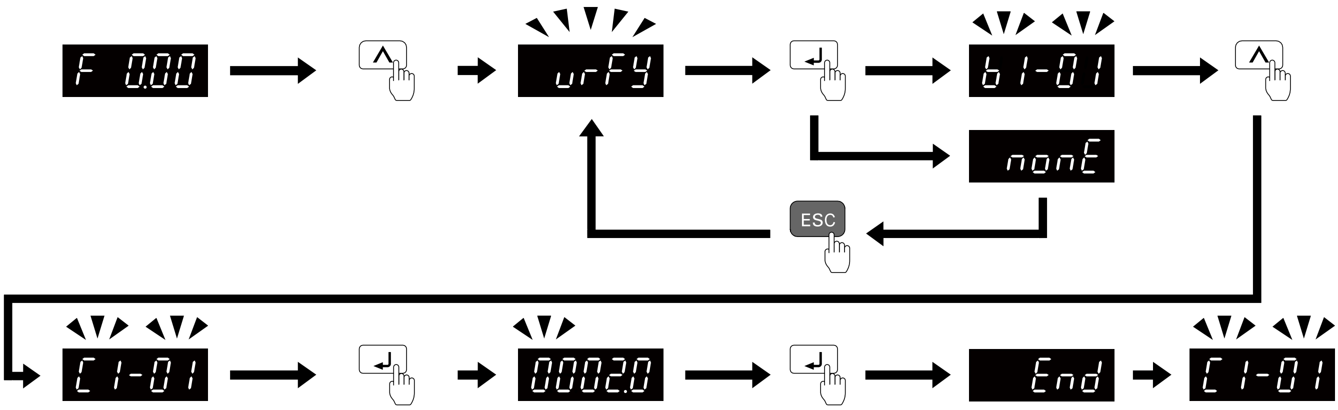


Figure 4.21 How to Examine the Changed Parameters

◆ Set and View Quick Setup Parameters

Push and hold ESC to return to the frequency reference screen from any screen.
The setup mode shows the parameters set in *A2-01 to A2-32 [User Parameter 1 to User Parameter 32]*. This lets you quickly access and change these parameters.

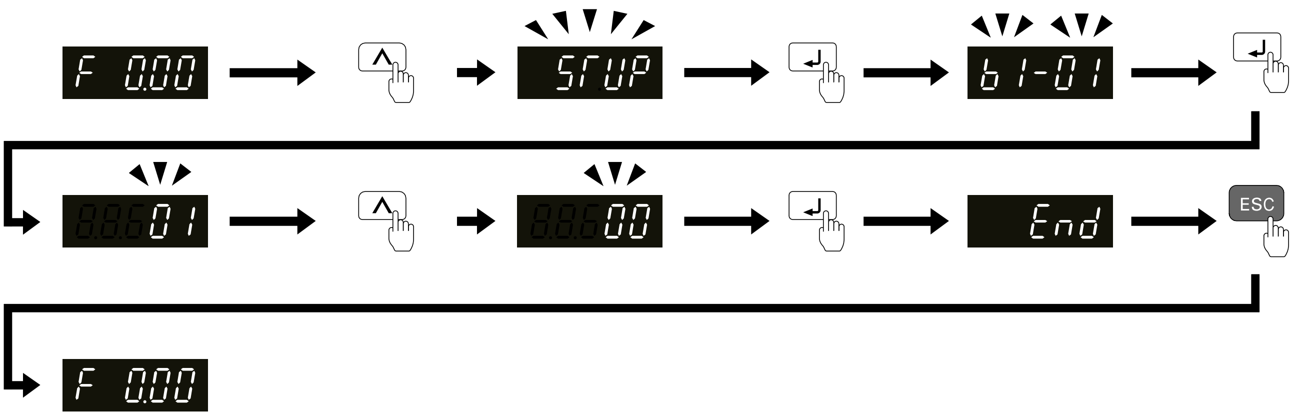


Figure 4.22 Set and View Quick Setup Parameters

Continue to change the parameters or press and hold ESC to go back to the frequency reference screen.

◆ Change Parameter Settings

Push and hold ESC to return to the frequency reference screen from any screen.

This example shows how to change *C1-01 [Acceleration Time 1]*. Set the parameter to the necessary value.

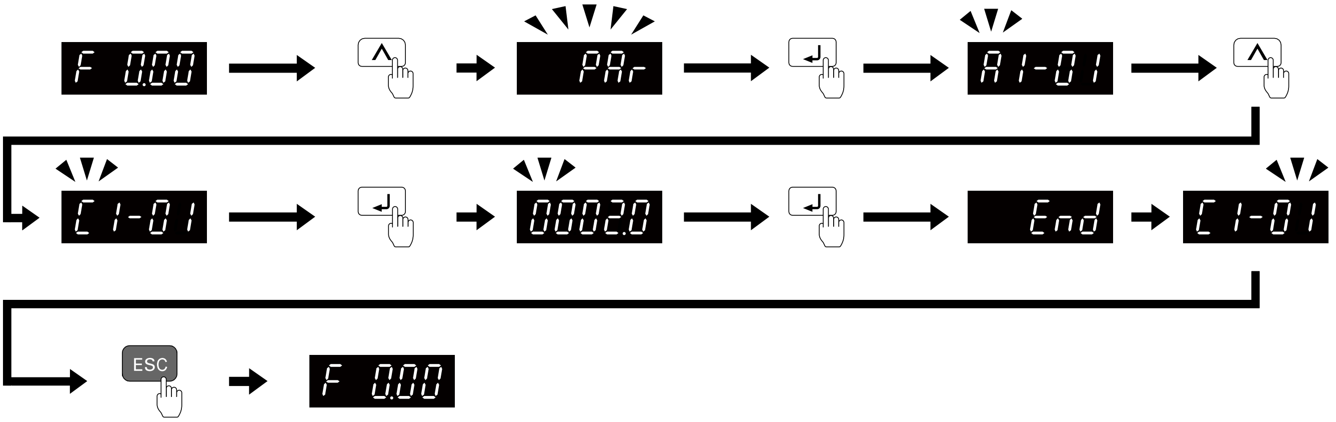


Figure 4.23 How to Change the Parameter Setting

Continue to change parameters or push and hold ESC to go back to the frequency reference screen.

◆ Save a Backup of Parameters

Push and hold ESC to return to the frequency reference screen from any screen.

Use these steps to save a backup of the drive parameters to the keypad.

Making backups of the parameter settings can save time when setting parameters after replacing a drive. If you set up more than one drive, you can copy the parameter settings from a drive that completed a test run to the other drives.

Note:

- Make sure that you stop the motor before you back up parameters.
- The drive does not accept Run commands while it is making a backup.
- Set *o3-02 = 0 [Copy Allowed Selection = Disabled]* to protect the parameters saved in the keypad.

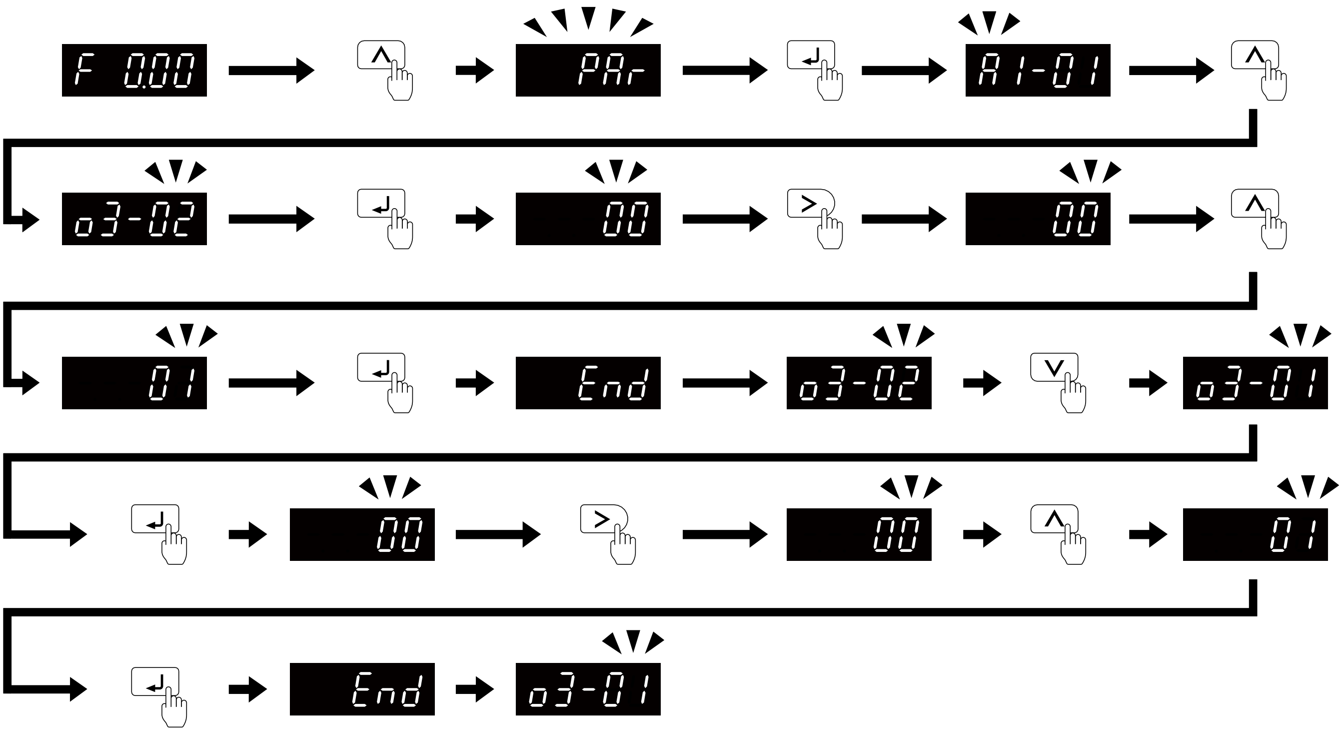


Figure 4.24 How to Save Backed-up Parameters

Push and hold ESC to go back to the frequency reference screen.

◆ Write Backed-up Parameters to the Drive

Push and hold ESC to return to the frequency reference screen from any screen.

Use these steps to write the parameters backed up in the keypad into a different drive.

Note:

- Make sure that you stop the drive before you restore the backed-up parameters.
- The drive does not accept Run commands while it is restoring parameters.

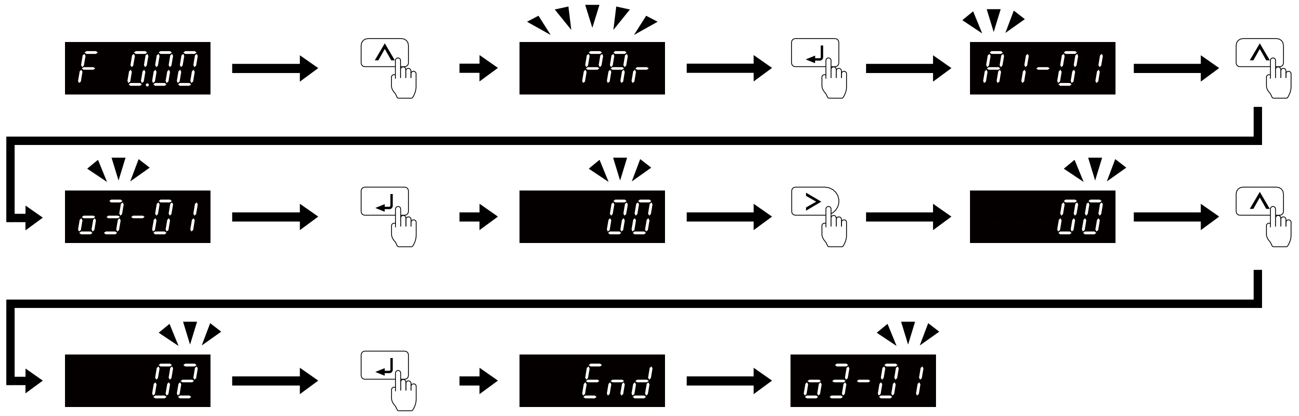


Figure 4.25 Writing backed up parameters

Push and hold ESC to go back to the frequency reference screen.

◆ Verify Keypad Parameters and Drive Parameters

Push and hold ESC to return to the frequency reference screen from any screen.

This procedure verifies that the parameter setting values that were backed up in the keypad agree with the parameter setting values in the drive.

Note:

- Make sure that you stop the drive before you examine parameters.
- The drive does not accept Run commands while it is restoring parameters.

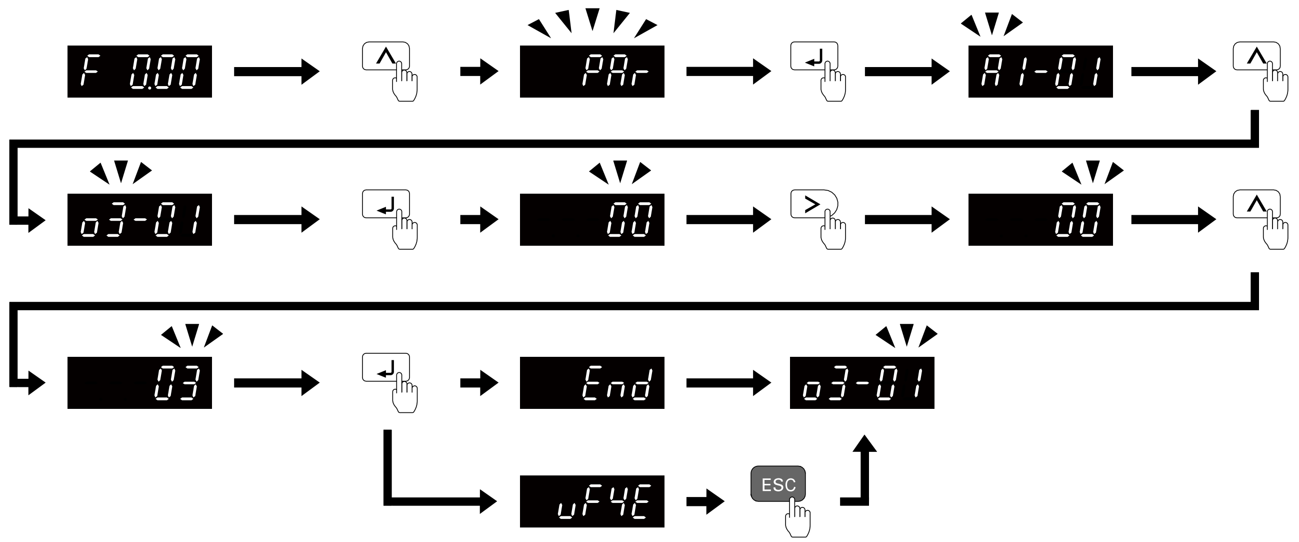


Figure 4.26 Verify Keypad Parameters and Drive Parameters

Push and hold ESC to go back to the frequency reference screen.

◆ Delete Parameters Backed Up to the Keypad

Push and hold ESC to return to the frequency reference screen from any screen.

Use these steps to erase the parameters backed up in the keypad.

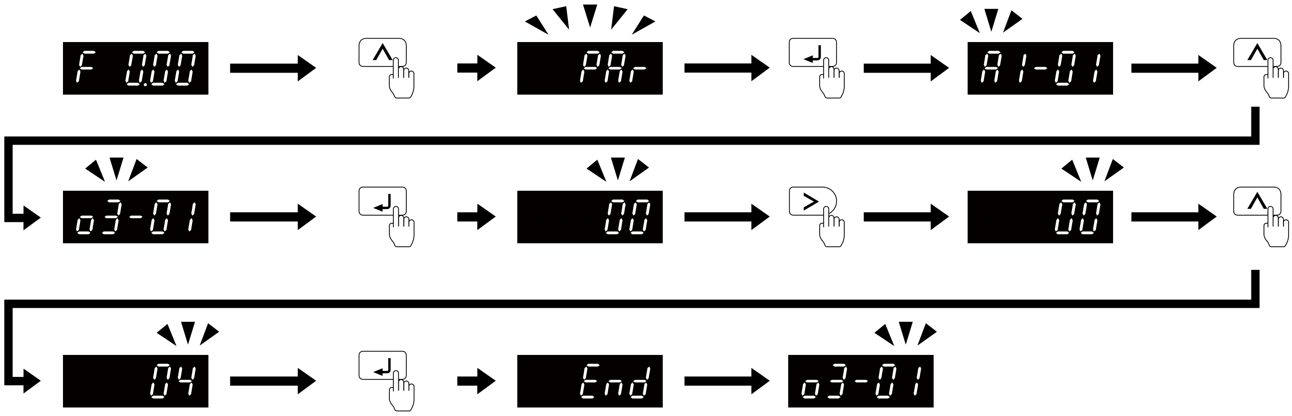


Figure 4.27 How to Erase the Backed-up Parameters

Push and hold ESC to go back to the frequency reference screen.

4.10 Fine Tuning during Test Runs (Adjust the Control Function)

The following table describes the most common problems related to ride comfort and proposes countermeasures to those problems. Before taking any action, make sure the startup procedures have been performed as previously described.

Problem	Control Method and Possible Cause		Corrective Action
Rollback at start	V/f, OLV	Insufficient torque when the brake is released.	• Increase *S1-02 [DC Injection Current at Start]*. • Increase *E1-10 [Minimum Output Voltage]* and *E1-08 [Mid Point A Voltage]*. Make sure that the starting and leveling current does not rise too high.
		The slip or torque compensation function acts too slowly.	Set the time for *S1-04 [DC Inj/Pos Lock Time at Start]* as short as possible, and make sure that brake releases completely before the motor starts to turn.
	OLV	The slip or torque compensation function acts too slowly.	• Decrease *C4-02 [Torque Compensation Delay Time]*. • Decrease *C3-02 [Slip Compensation Delay Time]*.
	CLV	The speed control is not responding fast enough when the brake is released.	Adjust the speed control loop parameters used during Position Lock. Increase *C5-19 [ASR P Gain during Position Lock]* and decrease *C5-20 [ASR I Time during Position Lock]*.
		The Position Lock control loop does not respond fast enough.	• Adjust the speed control loop parameters used during Position Lock. Increase *C5-19* and decrease *C5-20*. • Increase *S3-02 [Position Lock Gain 2 at Start]* gradually until rollback disappears.
	All	Motor torque is not fully established when the brake is released.	Increase the times set in *S1-06 [Brake Release Delay Time]* and *S1-04*.
		Motor contactor closes too late.	Make sure that the contactors are closed before the Up/Down command is issued.
Shock at start	All	Motor starts turning when the brake is not completely released or runs against the brake.	Increase the time set in *S1-04*.
		Acceleration rate is changing too quickly.	Decrease the Jerk at Start of Acceleration. Decrease *C2-01 [Jerk @ Start of Accel]* if set in m/s², increase *C2-01* if set in s.
		Rollback occurs during brake release.	Refer to "Rollback at start".
Shock at stop	All	Brake is applied too early, causing the motor to run against the brake.	Increase *S1-07 [Brake Close Delay Time]*. If necessary, also increase *S1-05 [DC Inj/Pos Lock Time at Stop]*.
		Motor contactor is released before the brake is fully applied.	Check the motor contactor sequence.
	CLV	Rollback occurs before the brake applies at stop.	• Make sure that *C5-13 [ASR Proportional Gain 3]* and *C5-14 [ASR Integral Time 3]* are adjusted correctly. • Increase *S3-03 [Position Lock Gain at Stop]* gradually until no rollback occurs. If vibration occurs, decrease *S3-03*.
Jerk occurs due to overshoot when the motor reaches top speed.	OLV	Too fast torque or slip compensation.	• Increase *C4-02*. • Increase *C3-02*.
	CLV	Speed control loop setting is too soft or too hard.	• Adjust the values set in *C5-01 [ASR Proportional Gain 1]* and *C5-02 [ASR Integral Time 1]*. • Adjust *n5-xx [Feed Forward Control]* parameters if speed control loop settings cannot solve the problem.
		Incorrect motor data.	• For induction motors: Readjust the motor data in *E2-xx [Motor Parameters]*, especially the values set in *E2-02 [Motor Rated Slip]* and *E2-03 [Motor No-Load Current]*, or do Auto-Tuning again. • For PM motors: Readjust the motor data in *E5-xx [PM Motor Settings]* or do Auto-Tuning again.
		Inertia compensation function is not set up correctly.	When *n5-01 = 1 [Feed Forward Control Selection = Enabled]*, make sure that the values set in *n5-02 [Motor Inertia Acceleration Ramp]* and *n5-03 [Feed Forward Control Gain]* are correct.
	All	The acceleration rate changes too quickly when reaching the selected speed.	Decrease the Jerk at the End of Acceleration. Decrease *C2-02 [Jerk @ End of Accel]* if set in m/s², increase *C2-02* if set in s.

Problem	Control Method and Possible Cause		Corrective Action
Motor stops shortly (undershoot) when the leveling speed is reached.	V/f, OLV	Not enough torque at low speed.	Increase *E1-10* and *E1-08*. Make sure that the starting and leveling current does not rise too high.
	OLV, CLV	Motor data incorrect.	Readjust the motor data in *E2-xx* parameters, especially the values set in *E2-02* and *E2-03*, or do Auto-Tuning again.
		Too much slip compensation.	
	CLV	Speed control loop responds too slow.	Increase the Speed Control Gain and decrease the Speed Control Integral Time used for Low Speed at Stop. Refer to Speed Loop Adjustments (CLV and CLV/PM).
		The inertia compensation function is not set up correctly.	When *n5-01 = 1*, make sure that the values set in *n5-02* and *n5-03* are correct.
	All	The deceleration rate changes too quickly when reaching leveling speed.	Decrease the Jerk at the End of Deceleration. Decrease *C2-04 [Jerk @ End of Decel]* if set in m/s², increase *C2-04* if set in s.
Motor speed overshoot at acceleration end and undershoot when reaching leveling speed occurs. Problem cannot be resolved by adjusting the speed loop.	CLV	Inertia is high.	Use the Feed Forward Control Function. Set *n5-01 = 1* and then adjust *n5-02* and *n5-03* as described in Inertia Compensation (CLV and CLV/ PM).
Motor or machine vibrates at high speed or top speed.	OLV	Torque compensation responds too quickly.	Increase *C4-02 [Torque Compensation Delay Time]*.
	CLV	Speed control loop adjusted too hard.	Decrease *C5-01*, then increase *C5-02*.
Motor or machine vibrates in the low or medium speed range.	V/f, OLV	Output voltage is too high.	Decrease *E1-10* and *E1-08*.
	OLV	Torque compensation is responding too quickly.	Increase *C4-02*.
	OLV CLV	The value for the motor slip is set incorrectly.	Check the Motor Slip value in *E2-02*. Increase or decrease it in steps of 0.2 Hz.
	CLV	Speed control loop adjusted with too much gain.	• Decrease *C5-01* and then increase *C5-02* if the problem occurs at speed higher than *C5-07 [ASR Gain Switchover Speed]*. • Decrease *C5-03 [ASR Proportional Gain 2]* and then increase *C5-04 [ASR Integral Time 2]* if the problem occurs at speed lower than *C5-07*. • Decrease *C5-13* and then increase *C5-14* if the problem occurs at speed lower than *C5-07* but only during deceleration.
Motor or machine vibrates in During Position Lock.	CLV	The Position Lock control loop does not respond fast enough.	• If vibration occurs at During Position Lock at start, first decrease *S3-02*. • Decrease *S3-03* if vibration occurs During Position Lock at stop. • When you use the absolute encoder, if the problem continues after you adjusted these parameters, adjust the value set in *F1-48 [Detect Speed Filter]* in 1-unit increments.
		The speed control is not responding quickly enough when the brake is released.	Decrease *C5-19* and then increase *C5-20*.
Vibrations with the frequency equal to the motor speed occur.	CLV	Encoder vibrates.	Check the encoder mounting and the alignment of encoder and motor shaft.
	All	Mechanical problems.	Check bearings and gearbox.
		Rotational parts (motor armature, handwheel, brake disk/ drum) are not properly balanced.	Properly balance rotating parts.
Oscillations when using an analog speed reference.	All	The analog reference value is not stable or the signal is noisy.	• Check the analog signal line connection. Use shielded twisted pair cables. • Apply a filter to the analog input signal by setting parameter *H3-13 [Analog Input FilterTime Constant]*.
Top speed is different in motoring and regenerative mode.	OLV	Slip Compensation during Regenerative operation is switched off.	Make sure that *C3-04 [Slip Compensation at Regen]* is set correctly and set *C3-05 = 0 [Output Voltage Limit Selection = Disabled]*.
Speed reference and motor speed do not match when using an analog reference signal.	All	The drives analog input is not set according to the signal level of the controller speed reference output signal.	Check the gain and bias settings for the analog input that is used to set the speed reference. • For input A1, check *H3-03 [Terminal A1 Gain Setting]* and *H3-04 [Terminal A1 Bias Setting]* • For input A2, check *H3-11 [Terminal A2 Gain Setting]* and *H3-12 [Terminal A2 Bias Setting]*. • For input A3, check *H3-07 [Terminal A3 Gain Setting]* and *H3-08 [Terminal A3 Bias Setting]*.

Problem	Control Method and Possible Cause		Corrective Action
Acceleration is longer than set to C1-xx parameters.	All	The load is too high.	• Check if the acceleration rate set is not too high (acceleration time is too short). • Make sure that the 50% ED current of the drive is enough to fulfill the application requirements. • Make sure that the load is not seized, car guide lubrication is ok, etc.
	V/f, OLV	The load is too high and the current/torque exceeds the stall prevention level.	Check if the Stall Prevention Level at Acceleration in *L3-02* is not set too small.
	OLV, CLV	The load is too high and the torque exceeds the drives torque limits.	Check if *L7-xx [Torque Limit]* parameters are not set too low.
Motor speed does not match the speed reference at constant speed.	All	The load is too high.	Make sure that the 50% ED current of the drive is enough to fulfill the application requirements.
	V/f	The load is too high and the current/torque exceeds the stall prevention level.	Check if the Stall Prevention Level During Run in *L3-06 [Stall Prevent Level during Run]* is not set too low.
	OLV, CLV	The load is too high and the torque exceeds the torque limits.	Check if *L7-xx* parameters are not set too low.
High frequency acoustic noise from the motor.	All	The carrier frequency is too low.	Increase *C6-03 [Carrier Frequency]*. If the carrier frequency is set higher than the default setting, a current derating must be considered.

5

Standards Compliance

This chapter gives information about how to make the machines and devices that use this product comply with European standards and UL standards.

5.1 Section Safety

⚠DANGER

Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠WARNING

Electrical Shock Hazard

Do not operate the drive when covers are missing. Replace covers and shields before you operate the drive. Use the drive only as specified by the instructions.

Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. If covers or safety shields are missing from the drive, it can cause serious injury or death.

Always ground the motor-side grounding terminal.

If you do not ground the equipment correctly, it can cause serious injury or death if you touch the motor case.

Do not remove covers or touch circuit boards while the drive is energized.

If you touch the internal components of an energized drive, it can cause serious injury or death.

Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive.

If personnel are not approved, it can cause serious injury or death.

Do not wear loose clothing or jewelry when you do work on the drive. Tighten loose clothing and remove all metal objects, for example watches or rings.

Loose clothing can catch on the drive and jewelry can conduct electricity and cause serious injury or death.

Do not modify the drive body or drive circuitry.

Modifications to drive body and circuitry can cause serious injury or death, will cause damage to the drive, and will void the warranty. Yaskawa is not responsible for modifications of the product made by the user.

Fire Hazard

Tighten all terminal screws to the correct tightening torque.

Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.

Tighten screws at an angle in the specified range shown in this manual.

If you tighten the screws at an angle not in the specified range, you can have loose connections that can cause damage to the terminal block or start a fire and cause serious injury or death.

Damage to Equipment

Do not apply incorrect voltage to the main circuit of the drive. Operate the drive in the specified range of the input voltage on the drive nameplate.

Voltages that are higher than the permitted nameplate tolerance can cause damage to the drive.

Fire Hazard

Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material.

Flammable and combustible materials can start a fire and cause serious injury or death.

⚠WARNING

Crush Hazard

Wear eye protection when you do work on the drive.

If you do not use correct safety equipment, it can cause serious injury or death.

Electrical Shock Hazard

After the drive blows a fuse or trips an RCM/RCD, do not immediately energize the drive or operate peripheral devices. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. If you do not know the cause of the problem, contact Yaskawa before you energize the drive or peripheral devices.

If you do not fix the problem before you operate the drive or peripheral devices, it can cause serious injury or death.

NOTICE

Damage to Equipment

When you touch the drive and circuit boards, make sure that you observe correct electrostatic discharge (ESD) procedures.

If you do not follow procedures, it can cause ESD damage to the drive circuitry.

Do not break the electrical connection between the drive and the motor when the drive is outputting voltage.

Incorrect equipment sequencing can cause damage to the drive.

Before you connect a dynamic braking option to the drive, make sure that qualified personnel read and obey the Braking Unit and Braking Resistor Unit Installation Manual (TOBPC72060001).

If you do not read and obey the manual or if personnel are not qualified, it can cause damage to the drive and braking circuit.

Make sure that all connections are correct after you install the drive and connect peripheral devices.

Incorrect connections can cause damage to the drive.

Note:

Do not use unshielded cable for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive. Unshielded wire can cause electrical interference and unsatisfactory system performance.

5.2 European Standards

Figure 5.1 CE Mark

The CE Mark identifies that the product meets environmental and safety standards in the European Union. Products manufactured, sold, or imported in the European Union must display the CE Mark.

European Union standards include standards for electrical appliances (Low Voltage Directive), standards for electrical noise (EMC Directive), and standards for machinery (Machinery Directive).

This product displays the CE Mark in accordance with the Low Voltage Directive, the EMC Directive, and the Machinery Directive.

Table 5.1 Harmonized Standards

European Directive	Harmonized Standard
CE Low Voltage Directive Compliance 2014/35/EU	EN 61800-5-1
EMC Directive 2014/30/EU	EN 61800-3
Machinery Directive 2006/42/EC	• EN ISO 13849-1:2015 (PL e (Cat. 3)) • EN 61800-5-2 (SIL3)
Restriction of the use of certain hazardous substances (RoHS) 2011/65/EU	EN IEC 63000

The customer must display the CE Mark on the final device containing this product. Customers must verify that the final device complies with EU standards.

Table 5.2 Other Applicable Standards

European Directive	Applicable Standards
EU ErP Directive 2009/125/EC	The drive meets the requirements for IE2 efficiency according to the European regulation 2019/1781. The losses and the efficiency class were determined in accordance with EN 61800-9-2

◆ CE Low Voltage Directive Compliance

It has been confirmed that this product complies with the CE Low Voltage Directive by conducting a test according to EN 61800-5-1.

The following conditions must be satisfied for machines and devices incorporating this product to comply with the CE Low Voltage Directive.

■ Area of Use

Install this product in a location with Overvoltage Category III and pollution degree 2 or less as specified in IEC/CE 60664.

■ Guarding Against Debris

When you install IP20/UL Open type drives, use an enclosure that does not let unwanted material enter the drive from above or below.

■ Wiring Diagram

Refer to Figure 5.2 for an example of a drive that is wired to comply with the CE Low Voltage Directive.

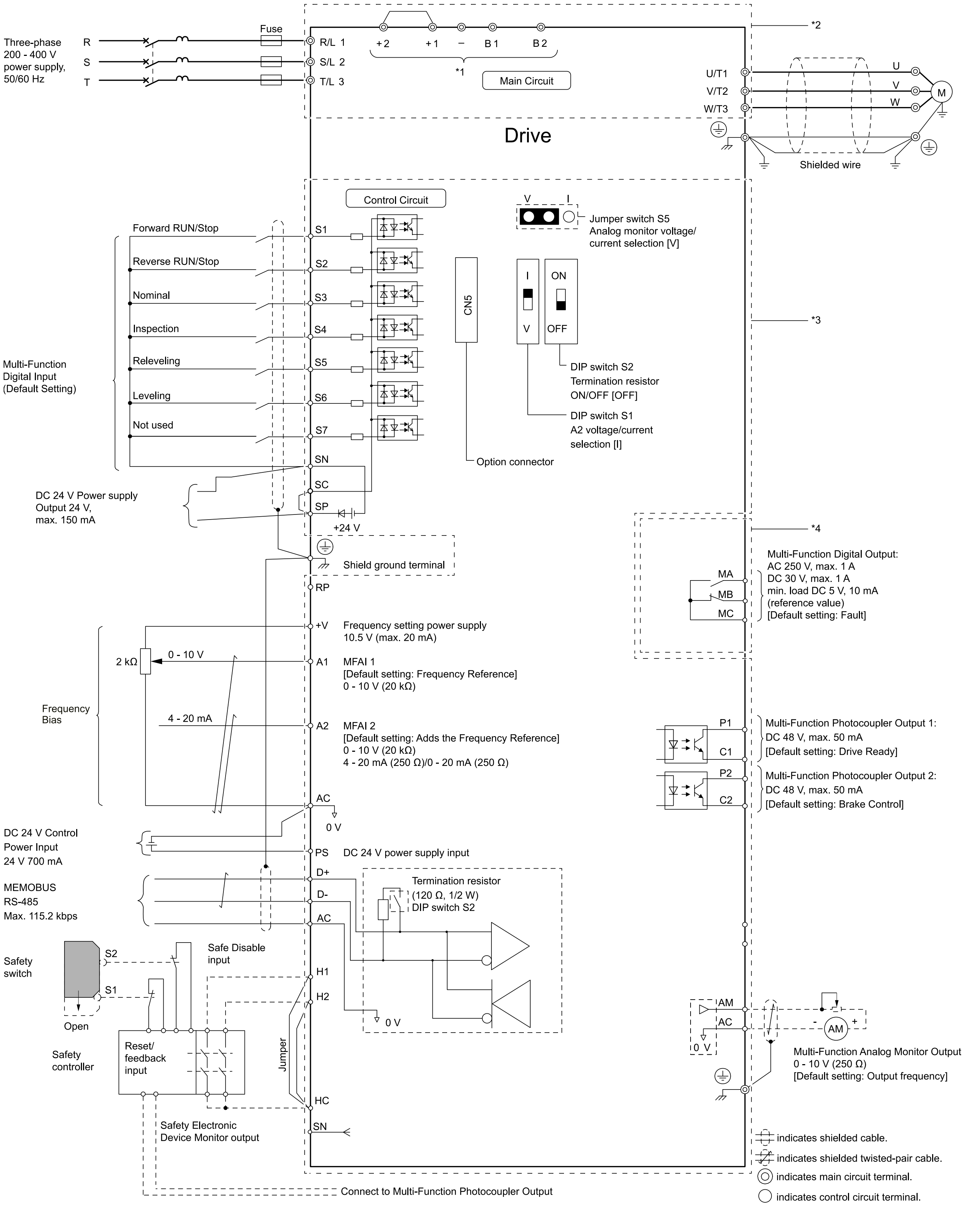


Figure 5.2 Wiring Diagram for CE Low Voltage Directive Compliance

*1 Connect peripheral options to terminals -, +1, +2, B1, and B2.

⚠ WARNING Fire Hazard

Only connect factory-recommended devices or circuits to drive terminals B1, B2, -, +1, and +2. Do not connect an AC power supply lines to these terminals.
Incorrect wiring can cause damage to the drive and serious injury or death from fire.

When you use a regenerative converter, regenerative unit, braking resistor, or braking resistor unit, set *L3-04 = 0 [Stall Prevention during Decel = Disabled]*. If *L3-04 = 1 [General Purpose]*, the drive could possibly not stop in the specified deceleration time.

*2 To protect the circuit, the main circuit is separated from the surface case that can touch the main circuit.
*3 The control circuit is a Safety Extra-Low Voltage circuit. Use reinforced insulation to separate this circuit from other circuits. Make sure that you connect the Safety Extra-Low Voltage as specified.
*4 Reinforced insulation separates the output terminals from other circuits. You can also connect circuits that are not Safety Extra-Low Voltage circuits when the drive output is 250 Vac 1 A maximum or 30 Vdc 1 A maximum.

■ Main Circuit Wire Gauges and Tightening Torques

⚠ WARNING Electrical Shock Hazard

Make sure that the protective ground wire complies with technical standards and local safety regulations. The EN 61800-5-1: 2007 standard specifies that users must wire the power supply to automatically turn off when the protective ground wire disconnects. If you turn on the internal EMC filter, the leakage current of the drive will be more than 3.5 mA. You can also connect a protective ground wire that has a minimum cross-sectional area of 10 mm ^{2} (copper wire).
If you do not obey the standards and regulations, it can cause serious injury or death.

⚠ WARNING Electrical Shock Hazard

Only connect factory-recommended devices or circuits to drive terminals B1, B2, -, +1, and +2. Do not connect AC power to these terminals.
Incorrect wiring can cause damage to the drive and serious injury or death from fire.

Note:
- The recommended wire gauges are based on drive continuous current ratings with 75 °C (167 °F) 600 V class 2 heat-resistant indoor PVC wire. Assume these conditions:
  –Ambient temperature: 40 °C (104 °F) maximum
  –Wiring distance: 100 m (3281 ft) maximum
  –Normal Duty rated current value
- Refer to the instruction manual for each device for recommended wire gauges to connect peripheral devices or options to terminals +1, +2, -, B1, and B2. Contact Yaskawa or your nearest sales representative if the recommended wire gauges for the peripheral devices or options are out of the range of the applicable gauges for the drive.

Wire Selection Precautions

Think about line voltage drop before selecting wire gauges. Select wire gauges that drop the voltage by 2% or less of the rated voltage. Increase the wire gauge and the cable length when the risk of voltage drops increases. Calculate line voltage drop with this formula:

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

Precautions during Wiring

- Refer to “Yaskawa AC Drive Option Braking Unit, Braking Resistor Unit Instruction Manual (TOBPC72060001)” for information about wire gauges and tightening torques to connect braking resistor units.
- Use terminals +1 and - to connect a regenerative converter or regenerative unit.

⚠ WARNING Fire Hazard

Do not connect a braking resistor to terminals +1 or -. Use terminals B1 and B2 for the braking resistor connections.
If you connect a braking resistor to the incorrect terminals, it can cause damage to the drive and braking circuit and serious injury or death.

Screw Shape

These tables use icons in Table 5.3 to show the shapes of the screw heads.

Table 5.3 Icons to Identify Screw Shapes

Icon	Screw Shape
⊕	+/-
⊖	Slotted (-)
⑤	Hex socket cap (WAF: 5 mm)

Three-Phase 200 V Class

Table 5.4 Wire Gauges and Tightening Torques for CE Compliance

Model	Terminal	Recomm. Gauge mm^2	Applicable Gauge mm^2	Wire Stripping Length *1 mm	Terminal Screw Size	Terminal Screw Shape	Tightening Torque N·m (in·lb)
2018	R/L1, S/L2, T/L3	4	2.5 - 6	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	6	4 - 10	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	B1, B2	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	6 *2	2.5 - 6 *2	-	M4	⊕	1.2 - 1.5 (10.6 - 13.3)
2025	R/L1, S/L2, T/L3	6	4 - 10	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	6	4 - 10	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	10	2.5 - 16	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	B1, B2	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	6	6 - 16	-	M5	⊕	2.0 - 2.5 (17.7 - 22.1)
2033	R/L1, S/L2, T/L3	10	2.5 - 16	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	10	2.5 - 16	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	16	4 - 25	18	M5	⊖	2.3 - 2.5 (19.8 - 22)
	B1, B2	4	2.5 - 6	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	6 - 16	-	M5	⊕	2.0 - 2.5 (17.7 - 22.1)
2047	R/L1, S/L2, T/L3	16	4 - 25	18	M5	⊖	2.3 - 2.5 (19.8 - 22)
	U/T1, V/T2, W/T3	16	4 - 25	18	M5	⊖	2.3 - 2.5 (19.8 - 22)
	-, +1, +2	25	6 - 35	18	M5	⊖	• ≤ 25 mm^2 2.3 - 2.5 (19.8 - 22) • 35 mm^2 ≤ 4.1 - 4.5 (36 - 40)
	B1, B2	10	4 - 16	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	10 - 25	-	M6	⊕	5.4 - 6.0 (47.8 - 53.1)
2060	R/L1, S/L2, T/L3	25	6 - 35	20	M6	5	5 - 5.5 (45 - 49)
	U/T1, V/T2, W/T3	16	6 - 25	20	M6	5	5 - 5.5 (45 - 49)
	-, +1, +2	35	10 - 50	20	M6	5	5 - 5.5 (45 - 49)
	B1, B2	10	4 - 16	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	16	10 - 25	-	M6	⊕	5.4 - 6.0 (47.8 - 53.1)

Model	Terminal	Recomm. Gauge mm^2	Applicable Gauge mm^2	Wire Stripping Length *1 mm	Terminal Screw Size	Terminal Screw Shape	Tightening Torque N·m (in·lb)
2075	R/L1, S/L2, T/L3	35	10 - 50	20	M6	❺	5 - 5.5 (45 - 49)
	U/T1, V/T2, W/T3	25	10 - 35	20	M6	❺	5 - 5.5 (45 - 49)
	-, +1, +2	50	16 - 70	20	M6	❺	5 - 5.5 (45 - 49)
	B1, B2	16	4 - 16	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	16	10 - 25	-	M6	⊕	5.4 - 6.0 (47.8 - 53.1)

*1 Remove insulation from the ends of wires to expose the length of wire shown.
*2 If you turn on the internal EMC filter, the leakage current of the drive will be more than 3.5 mA. Use the closed-loop crimp terminals to connect a protective ground wire that has a minimum cross-sectional area of 10 mm^2 (copper wire).

Three-Phase 400 V Class

Table 5.5 Wire Gauges and Tightening Torques for CE Compliance

Model	Terminal	Recomm. Gauge mm^2	Applicable Gauge mm^2	Wire Stripping Length *1 mm	Terminal Screw Size	Terminal Screw Shape	Tightening Torque N·m (in·lb)
4009	R/L1, S/L2, T/L3	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	B1, B2	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	4 *2	2.5 - 6 *2	-	M4	⊕	1.2 - 1.5 (10.6 - 13.3)
4015	R/L1, S/L2, T/L3	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	4	2.5 - 6	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	B1, B2	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	4 *2	2.5 - 16	-	M5	⊕	2.0 - 2.5 (17.7 - 22.1)
4018	R/L1, S/L2, T/L3	4	2.5 - 6	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	4	2.5 - 6	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	4	4 - 6	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	B1, B2	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	4 *2	4 - 16	-	M5	⊕	2.0 - 2.5 (17.7 - 22.1)

Model	Terminal	Recomm. Gauge mm²	Applicable Gauge mm²	Wire Stripping Length *1 mm	Terminal Screw		Tightening Torque N·m (in·lb)
					Size	Shape	
4024	R/L1, S/L2, T/L3	6	4 - 10	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	6	4 - 10	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	10	2.5 - 16	18	M5	⊖	2.3 - 2.5 (19.8 - 22)
	B1, B2	2.5	2.5 - 4	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	6 *2	6 - 16 *2	-	M6	⊕	5.4 - 6.0 (47.8 - 53.1)
4031	R/L1, S/L2, T/L3	10	4 - 16	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	6	2.5 - 10	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	16	4 - 25	18	M5	⊖	2.3 - 2.5 (19.8 - 22)
	B1, B2	4	2.5 - 6	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	6 - 16	-	M6	⊕	5.4 - 6.0 (47.8 - 53.1)
4039	R/L1, S/L2, T/L3	16	4 - 25	18	M5	⊖	2.3 - 2.5 (19.8 - 22)
	U/T1, V/T2, W/T3	10	4 - 16	18	M5	⊖	2.3 - 2.5 (19.8 - 22)
	-, +1, +2	16	6 - 25	18	M5	⊖	2.3 - 2.5 (19.8 - 22)
	B1, B2	6	4 - 10	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	6 - 16	-	M6	⊕	5.4 - 6.0 (47.8 - 53.1)
4045	R/L1, S/L2, T/L3	25	6 - 35	18	M5	⊖	• ≤ 25 mm² 2.3 - 2.5 (19.8 - 22) • 35 mm² ≤ 4.1 - 4.5 (36 - 40)
	U/T1, V/T2, W/T3	16	4 - 25	18	M5	⊖	2.3 - 2.5 (19.8 - 22)
	-, +1, +2	25	6 - 35	18	M5	⊖	• ≤ 25 mm² 2.3 - 2.5 (19.8 - 22) • 35 mm² ≤ 4.1 - 4.5 (36 - 40)
	B1, B2	10	2.5 - 16	10	M4	⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	6 - 16	-	M6	⊕	5.4 - 6.0 (47.8 - 53.1)

*1 Remove insulation from the ends of wires to expose the length of wire shown.
*2 If you turn on the internal EMC filter, the leakage current of the drive will be more than 3.5 mA. Use the closed-loop crimp terminals to connect a protective ground wire that has a minimum cross-sectional area of 10 mm² (copper wire).

■ Connect a Fuse to the Input Side (Primary Side)

The drive circuit protection must comply with EN 61800-5-1 for protection against a short circuit in the internal circuitry. Connect semiconductor fuses on the input side for branch circuit protection.

⚠ WARNING **Electrical Shock Hazard**

After the drive blows a fuse or trips an RCM/RCD, do not immediately energize the drive or operate peripheral devices. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. If you do not know the cause of the problem, contact Yaskawa before you energize the drive or peripheral devices.
If you do not fix the problem before you operate the drive or peripheral devices, it can cause serious injury or death.

Three-Phase 200 V Class

Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
2018	FWH-90B
2025	FWH-100B
2033	FWH-150B
2047	FWH-200B
2060	FWH-200B
2075	FWH-225A

Three-Phase 400 V Class

Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
4009	FWH-90B
4015	FWH-80B
4018	FWH-100B
4024	FWH-125B
4031	FWH-175B
4039	FWH-200B
4045	FWH-200B

■ CE Standards Compliance for DC Power Supply Input

To comply with CE Standards, install a fuse for the DC power supply input.

Figure 5.3 shows a wiring example for a DC power supply that has two drives connected in parallel.

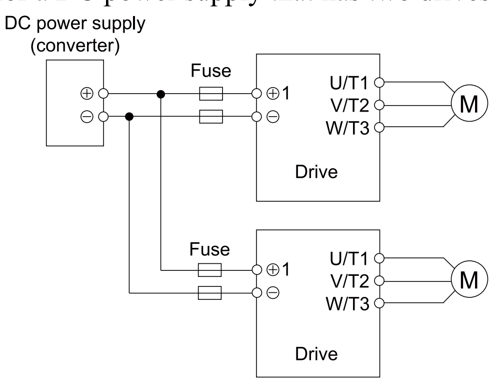


Figure 5.3 Wiring Example for DC Power Supply Input

⚠ WARNING **Electrical Shock Hazard**

Do not ground the main circuit bus.
Incorrect wiring can cause serious injury or death.

Note:
- Install a fuse for each drive when operating more than one drive. If one fuse blows, replace all fuses.
- Install the external filter (system) to comply with the EMC Directive.

Three-Phase 200 V Class

Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann	Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
2018	FWH-90B	2047	FWH-200B
2025	FWH-100B	2060	FWH-200B
2033	FWH-150B	2075	FWH-225A

Three-Phase 400 V Class

Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann	Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
4009	FWH-90B	4031	FWH-175B
4015	FWH-80B	4039	FWH-200B
4018	FWH-100B	4045	FWH-200B
4024	FWH-125B		

◆ EMC Directive

Use drives with built-in EMC filters or install external EMC filters to the drive input side to comply with the EMC Directive.

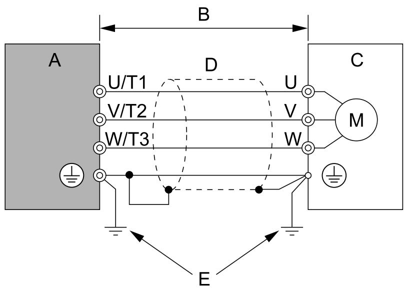
Drives with built-in EMC filters (models 2xxxE, 4xxxE) were tested in accordance with European standard EN 61800-3, and comply with the EMC Directive.

■ Install a Drive to Conform to the EMC Directive

Installation Procedure

Install drive models 2xxxE, and 4xxxE with this procedure to comply with the EMC Directive when the drive is a single unit or installed in a larger device.

1. Install the drive on a grounded metal plate.
2. Wire the drive and motor.
3. Ground the wire shielding on the drive side and motor side.



A - Drive
B - Wiring length *1
C - Motor
D - Metal conduit
E - Grounding wire

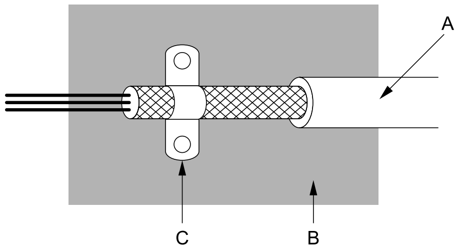
Figure 5.4 Wiring the Drive and Motor

*1 The maximum wiring length between the drive and motor is:
- 2xxxE, 4xxxE: 20 m (65.6 ft)

Note:
- Use a braided shield cable for the drive and motor wiring or put the wires through a metal conduit.
- Keep the cable between the drive and motor and the grounding wire as short as possible.

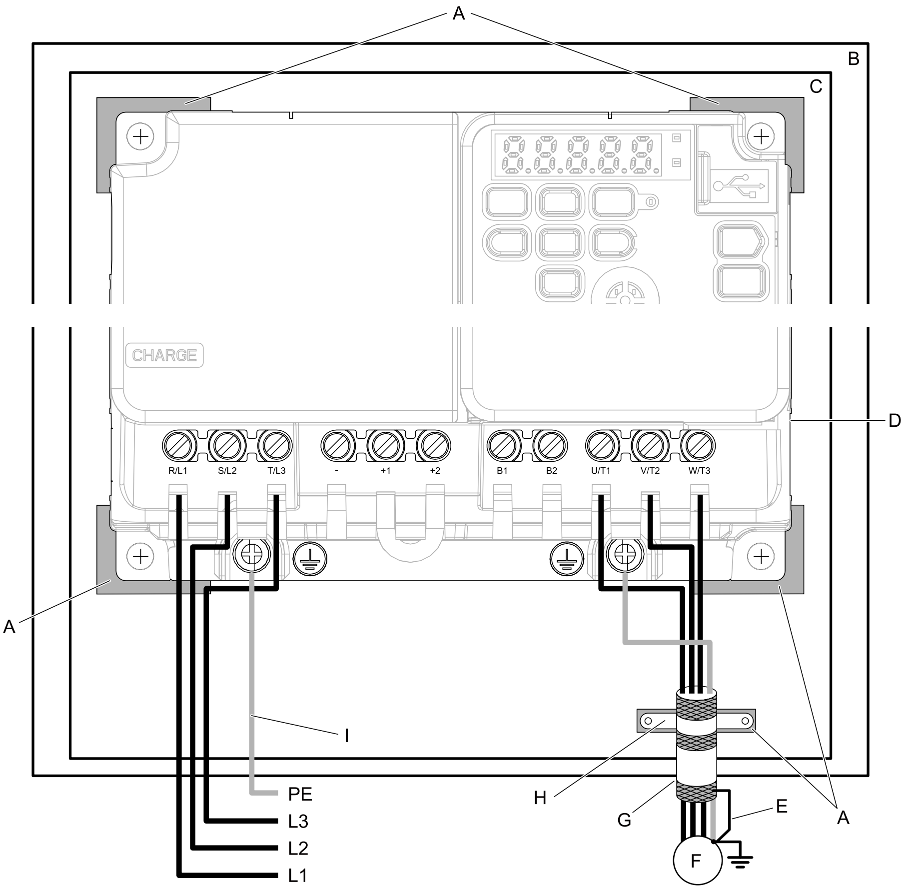
4. Use a cable clamp to ground the motor cable to the metal plate.

Note:
Make sure that the protective ground wire complies with technical specifications or local safety standards.



A - Braided shield cable
B - Metal plate
C - Cable clamp (conductive)

Figure 5.5 Ground the Shield



A - Grounding surface (Remove any paint or sealant.)
B - Enclosure panel
C - Metal plate
D - Drive
E - Shielded wire
F - Motor
G - Motor cable
H - Cable clamp
I - Grounding wire

Figure 5.6 Install a Drive with a Built-in EMC Filter

Ground Wiring

⚠ WARNING Electrical Shock Hazard
Do not remove covers or touch circuit boards while the drive is energized.
If you touch the internal components of an energized drive, it can cause serious injury or death.

⚠ WARNING Electrical Shock Hazard
Ground the neutral point on the power supply of drive models BxxxE, 2xxxE, and 4xxxE to comply with the EMC Directive before you turn on the EMC filter or if there is high resistance grounding.
If you turn ON the EMC filter, but you do not ground the neutral point, it can cause serious injury or death.

Enable the Internal EMC Filter

On drive models 2xxxE, and 4xxxE, move the screw or screws to turn ON and OFF (enable and disable) the EMC filter.

Make sure that the symmetric grounding network is applied, and install the screw or screws in the ON position to enable the built-in EMC filter in compliance with the EMC Directive. The EMC filter switch screw or screws are installed in the OFF position by default.

⚠ WARNING Electrical Shock Hazard

Disconnect all power to the drive, wait for the time specified on the warning label, and check the drive for dangerous voltages before you remove covers or touch EMC filter screws.
If you touch the screws when there are dangerous voltages, it will cause serious injury or death.

⚠ WARNING Electrical Shock Hazard

Do not remove covers or touch circuit boards while the drive is energized.
If you touch the internal components of an energized drive, it can cause serious injury or death.

⚠ WARNING Electrical Shock Hazard

Ground the neutral point on the power supply of drive models BxxxE, 2xxxE, and 4xxxE to comply with the EMC Directive before you turn on the EMC filter or if there is high resistance grounding.
If you turn ON the EMC filter, but you do not ground the neutral point, it can cause serious injury or death.

⚠ WARNING Electrical Shock Hazard

Connect the ground cable correctly.
If you touch electrical equipment that is not grounded, it can cause serious injury or death.

NOTICE

To disable the internal EMC filter, move the screws from ON to OFF and then tighten to the specified torque.
If you fully remove the screws or tighten the screws to an incorrect torque, it can cause drive failure.

NOTICE

Move the EMC switch screw or screws to the OFF position for networks that are not symmetrically grounded.
If the screws are not in the correct position, it can cause damage to the drive.

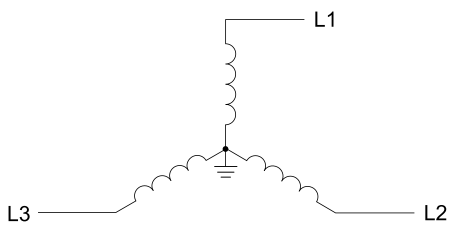


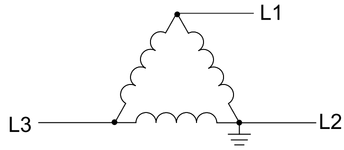
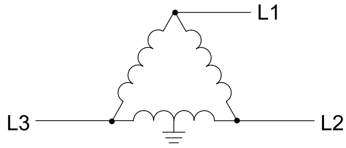
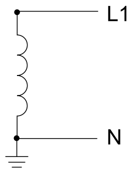
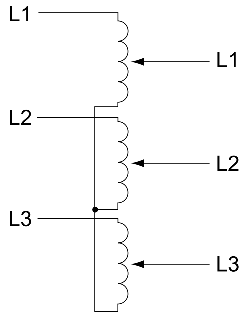
Figure 5.7 Symmetric Grounding

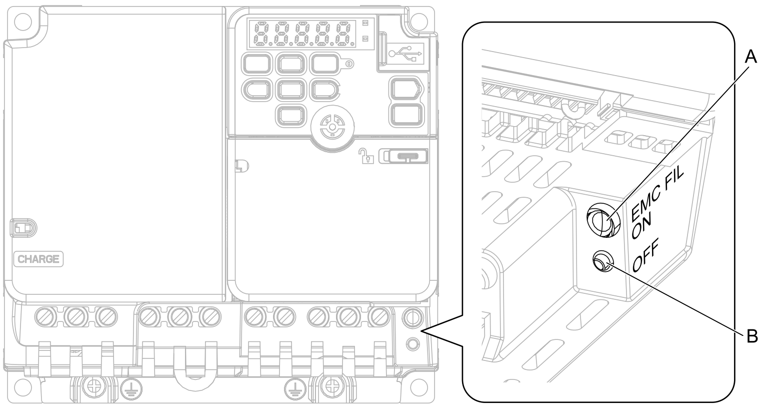
NOTICE Damage to Equipment

When you use the drive with a non-grounding, high-resistance grounding, or asymmetric-grounding network, put the EMC Filter screw or screws in the OFF position to disable the built-in EMC filter.
If you do not disable the built-in EMC filter, it will cause damage to the drive.

Table 5.6 shows asymmetric grounding networks.

Table 5.6 Asymmetric Grounding

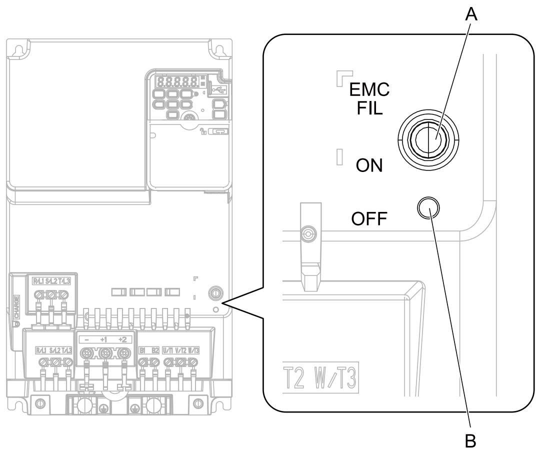
Type of Grounding	Diagram
Grounded at the corner of the delta connection	
Grounded at the middle of the side	
Single-phase, grounded at the end point	
Three-phase variable transformer without solidly grounded neutral	



A - SW (ON) **B - SW (OFF)**

Screw Size
M3 × 20

Figure 5.8 EMC Filter Switch Location for Models 2018E, 4009E



A - **SW (ON)**
B - **SW (OFF)**

Screw Size
M4 × 20

Figure 5.9 EMC Filter Switch Location for Models 2025E - 2075E, 4015E - 4045E

If you lose an EMC filter switch screw, use the correct replacement screw and install the new screw with the correct tightening torque.

NOTICE

Only use the screws specified in this manual.
If you use screws that are not approved, it can cause damage to the drive.

■ Installing the External EMC Noise Filter

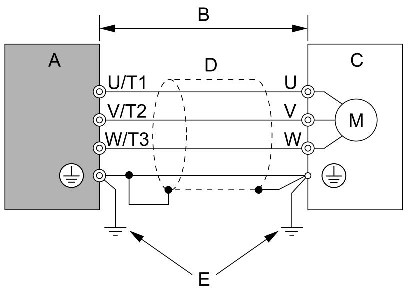
Installation Procedure

Drive models 2xxxA, and 4xxxA must align with the conditions in this section to comply with EN 61800-3.

Connect an EMC noise filter that complies with European standards as specified by Yaskawa to the input side (primary side). Refer to Table 5.7 and Table 5.8 to select the correct EMC noise filter.

Use this procedure to install an EMC noise filter to make equipment and devices added to the drive comply with the EMC Directive.

1. Install the drive and EMC noise filter on the same grounded metal plate.
2. Wire the drive and motor.
3. Ground the wire shielding on the drive side and motor side.



A - **Drive**
B - **10 m (32.8 ft) maximum**
C - **Motor**
D - **Metal conduit**
E - **Grounding wire**

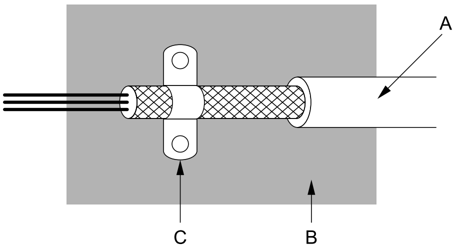
Figure 5.10 Wiring the Drive and Motor

Note:
- Use a braided shield cable for the drive and motor wiring or put the wires through a metal conduit.
- Keep the wire as short as possible. The maximum wiring length between the drive and motor is:
  –2xxxA, 4xxxA: 10 m (32.8 ft)
- Keep the grounding wire as short as possible.

4. Use a cable clamp to ground the motor cable to the metal plate.

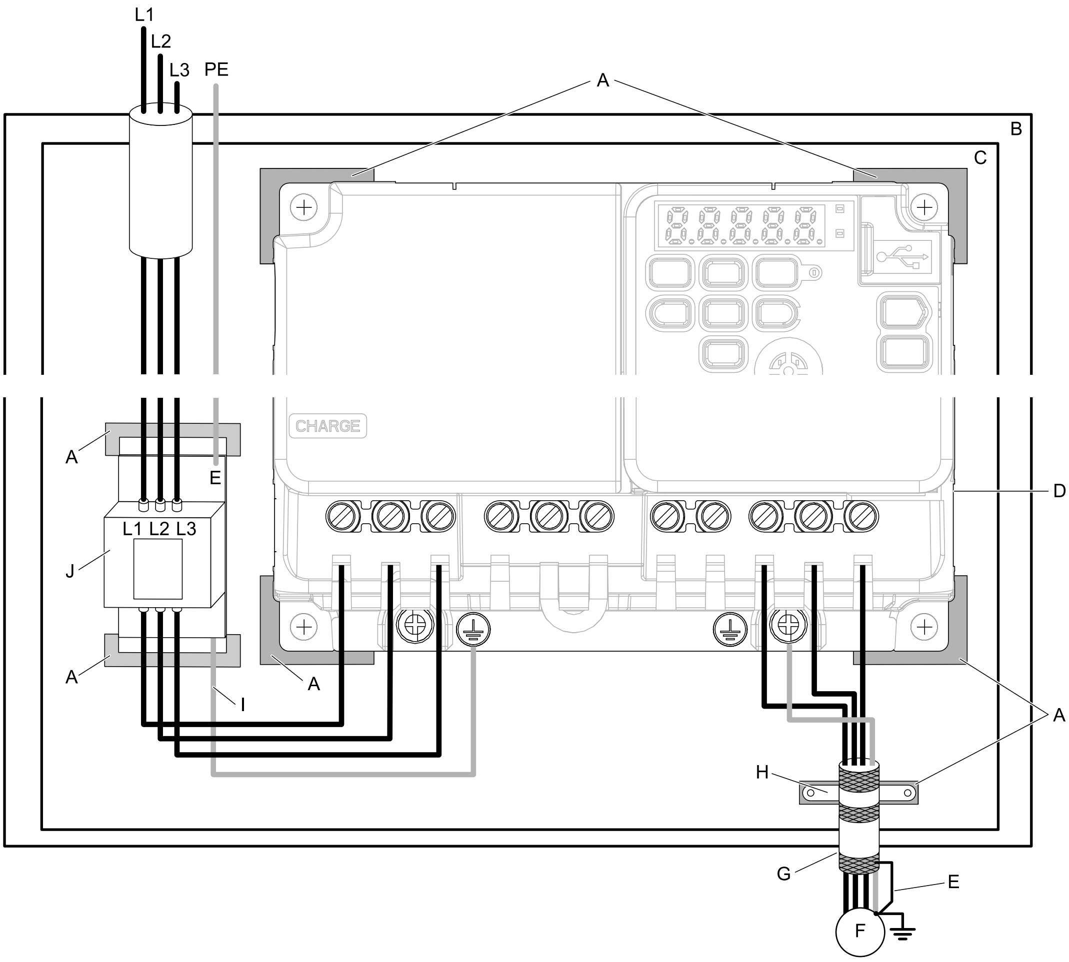
Standards Compliance
5

Note:
Make sure that the protective ground wire complies with technical specifications or local safety standards.



A - Braided shield cable
B - Metal plate
C - Cable clamp (conductive)

Figure 5.11 Ground the Shield



A - Grounding surface (Remove any paint or sealant.)
B - Enclosure panel
C - Metal plate
D - Drive
E - Ground the shield.
F - Motor
G - Motor cable (Braided shield cable: 10 m (32.8 ft) maximum)
H - Cable clamp
I - Grounding wire
J - EMC noise filter

Figure 5.12 EMC Noise Filter and Drive Installation Procedure

5. Connect the DC reactor to decrease harmonic distortion.

Ground Wiring

⚠ WARNING **Electrical Shock Hazard**
Do not remove covers or touch circuit boards while the drive is energized.
If you touch the internal components of an energized drive, it can cause serious injury or death.

External EMC Noise Filter Selection

Table 5.7 External EMC Noise Filter (2xxxA)

Drive model	EMC Noise Filter Model	Quantity	Manufacturer
2018	FS23637-24-07	1	Schaffner
2025	FS23637-52-07 *1	1	Schaffner
2033	FS23637-52-07 *1	1	Schaffner
2047	FS23637-68-07 *1	1	Schaffner
2060	FS23637-80-07 *1	1	Schaffner
2075	FB-40105A	1	Block

*1 When you install an external EMC noise filter, change the terminals or use the junction terminal.

Table 5.8 External EMC Noise Filter (4xxxA)

Drive model	EMC Noise Filter Model	Quantity	Manufacturer
4009	FS23639-15-07	1	Schaffner
4015	FS23639-30-07 *1	1	Schaffner
4018	FS23639-30-07 *1	1	Schaffner
4024	FS23639-50-07 *1	1	Schaffner
4031	FS23639-50-07 *1	1	Schaffner
4039	FB-40060A	1	Block
4045	FB-40060A	1	Block

*1 When you install an external EMC noise filter, change the terminals or use the junction terminal.

5.3 United Kingdom Conformity Assessed Marking

Figure 5.13 UKCA Mark

Information about Manufacturer
YASKAWA ELECTRIC CORPORATION (Manufacturer) 2-1 Kurosaki-shiroishi, Yahatanishi-Ku, Kitakyushu 806-0004 Japan http://www.yaskawa.co.jp
YASKAWA EUROPE GmbH (EU Contact) Philipp-Reis-Str. 6, 65795 Hattersheim am Main, Germany http://www.yaskawa.eu.com/
YASKAWA ELECTRIC (UK) LTD (UK Contact) 1 Hunt Hill, Glasgow G68 9LF, United Kingdom https://www.yaskawa.co.uk/

The UKCA Mark identifies that the product meets environmental and safety standards in the United Kingdom (Statutory Instruments).

Products manufactured, sold, or imported in Great Britain (England, Wales, and Scotland) must display the UKCA Mark.

United Kingdom standards include the Supply of Machinery (Safety) Regulations (Machinery) for machine manufacturers, the Electrical Equipment (Safety) Regulations (Low voltage) for electronics manufacturers, and the Electromagnetic Compatibility Regulations (EMC) for controlling noise.

This product displays the UKCA Mark in accordance with the Machinery Directive, the Low Voltage Directive, and the EMC Directive.

Table 5.9 Designated Standards

Statutory Instruments	Designated Standards
Supply of Machinery (Safety) Regulations S.I. 2008 No. 1597	EN ISO 13849-1:2015 (PL e (Cat.3)) IEC/EN IEC 62061 (Maximum SIL3) *1 EN 61800-5-2 (SIL3) *1
Electrical Equipment (Safety) Regulations S.I. 2016 No. 1101	EN 61800-5-1 *1
Electromagnetic Compatibility Regulations S.I. 2016 No. 1091	EN 61800-3 *1
Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations S.I. 2012 No. 3032	EN IEC 63000 *1

*1 Refer to “UK Declaration of Conformity” for the year of the Designated Standards.

The customer must display the UKCA Mark on the final device containing this product. Customers must verify that the final device complies with UK standards.

Table 5.10 Other Applicable Standards

Statutory Instruments	Applicable Standards
Ecodesign for Energy-Related Products and Energy Information Regulations S.I. 2021 No. 745	The drive meets the requirements for IE2 efficiency according to the S.I. 2021 No. 745. The losses and the efficiency were determined in accordance with the requirements of IEC 61800-9-2.

◆ General Instructions for UK Import

This product is an industrial product intended for incorporation and use in industrial equipment by professionals only.

This product is designed to be built into equipment and machines in which they are incorporated. To comply with UK legislations, it may be necessary to implement additional precautions to the equipment and machine. Instructions for compliance to UK legislations are same as the instruction of EU legislation. Refer to the precautions described in the EU legislation.

The latest manuals and other useful information are published on our website.

5.4 Safe Disable Input

◆ Overview

This section gives precautions to support the Safe Disable input. Contact Yaskawa for more information.

The safety function complies with the standards shown in Table 5.11.

Table 5.11 Applied Unified Standards

Function	Unified Standards
Functional Safety	EN/IEC 61508 (SIL3) EN/IEC 61800-5-2 (SIL3)
Machine Safety	EN ISO 13849-1:2015 (PL e (Cat. 3))
EMC	EN/IEC 61000-6-7 EN/IEC 61326-3-1
LVD	EN 61800-5-1

Note:

SIL = Safety Integrity Level.

Table 5.12 Applied Standards

Function	Applied Standards
RoHS	EN/IEC 63000
EU ErP Directive	2009/125/EC

This product meets the requirements for IE2 efficiency according to the European regulation 2019/1781.

The losses and the efficiency class were determined in accordance with EN 61800-9-2.

◆ Safe Disable Specifications

The Safe Disable input provides the stop function that complies with “Safe Torque Off” as specified by EN/IEC 61800-5-2. The Safe Disable input meets the requirements of EN ISO 13849-1:2015 (PL e (Cat. 3)) and EN/IEC 61508. It also has a safety status monitor to detect safety circuit errors.

When you install the drive as a component in a system, you must make sure that the system complies with the applicable safety standards.

Refer to Table 5.13 for safety function specifications.

Table 5.13 Safe Disable Specifications

Item		Description
Input/Output		• Input: 2 Safe Disable input (H1, H2) Signal ON level: 18 Vdc to 28 Vdc Signal OFF level: -4 Vdc to +4 Vdc • Output: 1 MFDO safety monitor output for external device monitor (EDM)
Response time from when the input opens to when the drive output stops		3 ms or less
Response time from when the H1 and H2 terminal inputs open to when the EDM signal operates		30 ms or less
Failure probability	Less frequent operation request mode	PFD = $1.38E^{-5}$
	Frequent operation request mode or continuous mode	PFH = $3.35E^{-9}$
Performance level		The Safe Disable input complies with the performance level requirements of EN ISO 13849-1.
HFT (hardware fault tolerance)		N = 1
Type of subsystem		Type B
$MTTF_D$		High
DCavg		Medium
Mission time		10 years

Note:
EDM = External Device Monitoring
PFD = Probability of Failure on Demand
PFH = Probability of Dangerous Failure per Hour

◆ Precautions and Notes

⚠ DANGER Sudden Movement Hazard
When you use the Safe Disable function in the safety system of a machine, do a full risk assessment for the system to make sure that all parts of the system comply with applicable safety standards.
Incorrect application of the Safe Disable function can cause serious injury or death.

⚠ DANGER Sudden Movement Hazard
If the output circuit of the drive is damaged and the Safe Disable function turns OFF the drive output to a permanent magnet (PM) motor, the motor can rotate 180 electrical degrees. Prevent damage to equipment and injury to personnel during this condition.
Sudden motor movement can cause serious injury or death. It is possible for current to flow through the motor winding in these conditions.

⚠ DANGER Electrical Shock Hazard
You cannot depend on the Safe Disable function to prevent electrical shock. Disconnect all power to the drive and wait for the time specified on the warning label before you remove covers. Check the drive for dangerous voltages before servicing or repair work.
If you do work on the drive when it is energized and there is no cover over the electronic circuits, it can cause serious injury or death.

⚠ WARNING Sudden Movement Hazard
Although the Safe Disable function is in operation, gravity or other external forces in the vertical axis can move the motor.
Incorrect application of the Safe Disable function can cause serious injury or death.

⚠ WARNING Sudden Movement Hazard
Do not use the drive output signals to control external holding brakes or dynamic brakes for functional safety. Use a system that conforms to the functional safety requirements.
Incorrect application of the Safe Disable function can cause serious injury or death. Systems that use drive output signals (including EDM) for safety are not safe because drive output signals are not safety components.

⚠ WARNING Sudden Movement Hazard
Connect the Safe Disable inputs to the devices as specified by the safety requirements.
If you connect the Safe Disable inputs incorrectly, it can cause serious injury or death.

⚠ WARNING Sudden Movement Hazard
To use the Safe Disable inputs, remove the jumpers between terminals H1-HC and H2-HC.
If the Safe Disable circuit does not work correctly, it can cause serious injury or death.

⚠ WARNING Sudden Movement Hazard
When you clear the Safe Disable input, make sure that the Safe Disable Monitor output operates correctly as the specification for Safe Disable function.
If the Safe Disable circuit does not operate correctly, it can cause serious injury or death.

⚠ WARNING Sudden Movement Hazard
Regularly examine the Safe Disable input and all other safety features.
A system that does not operate correctly can cause serious injury or death.

⚠ WARNING **Sudden Movement Hazard**

Only let approved personnel who know about the drive, instruction manual, and safety standards wire, examine, and maintain the Safe Disable input.
If personnel are not approved, it can cause serious injury or death.

⚠ WARNING **Sudden Movement Hazard**

Only use the Safe Disable Monitor (multi-function output terminal set to the EDM function) to monitor the Safe Disable status or to find a malfunction in the Safe Disable inputs. The monitor output is not a safety output.
If you use the Safe Disable Monitor incorrectly, it can cause death or serious injury.

Note:
- When you use a drive with a built in safety function, you must replace it 10 years after first use.
- A maximum of 3 ms will elapse from when terminals H1 or H2 shut off until the drive switches to the "Safe Torque Off" status. Set the OFF status for terminals H1 and H2 to hold for at least 3 ms. The drive may not be able to switch to the "Safe Torque Off" status if terminals H1 and H2 are only open for less than 3 ms.

◆ Safe Disable Circuit

The Safe Disable circuit has two isolated channels (terminals H1 and H2) that stop the output transistors. The input can use the internal power supply of the drive.

Set the EDM function to one of the MFDO terminals *[H2-xx = 21 or 121]* to monitor the status of the Safe Disable function. This is the "Safe Disable monitor output function".

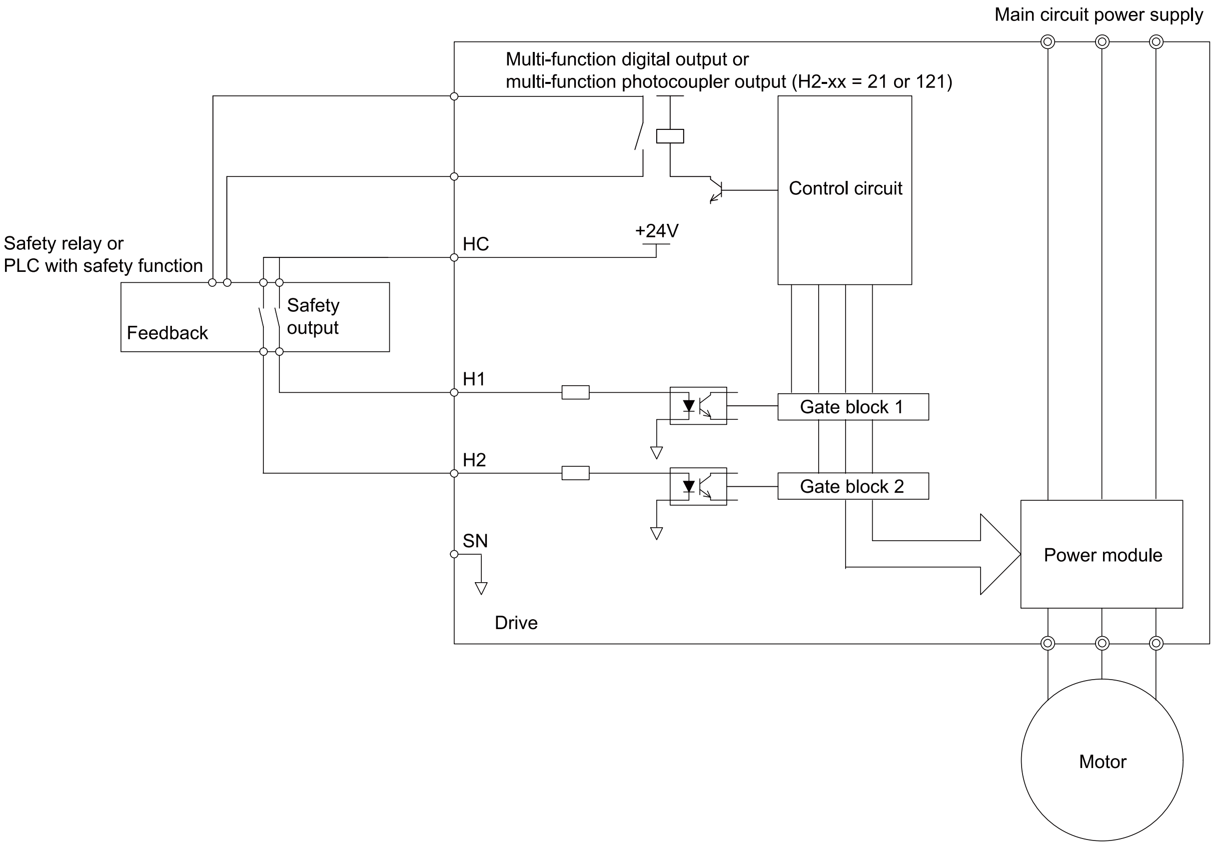


Figure 5.14 Safe Disable Function Wiring Example

◆ Connect Safe Disable Input Contacts to Multiple Drives

■ To Use the Drive Internal Power Supply

Figure 5.15 shows an example of how to connect Safe Disable contacts.

From the terminals HC-SN of drive 1, supply the power for the Safe Disable function for the applicable drives. These conditions limit the number of units to connect:

- Internal power supply capacity

- Number of MFDIs used
- Supply current to the external sensors

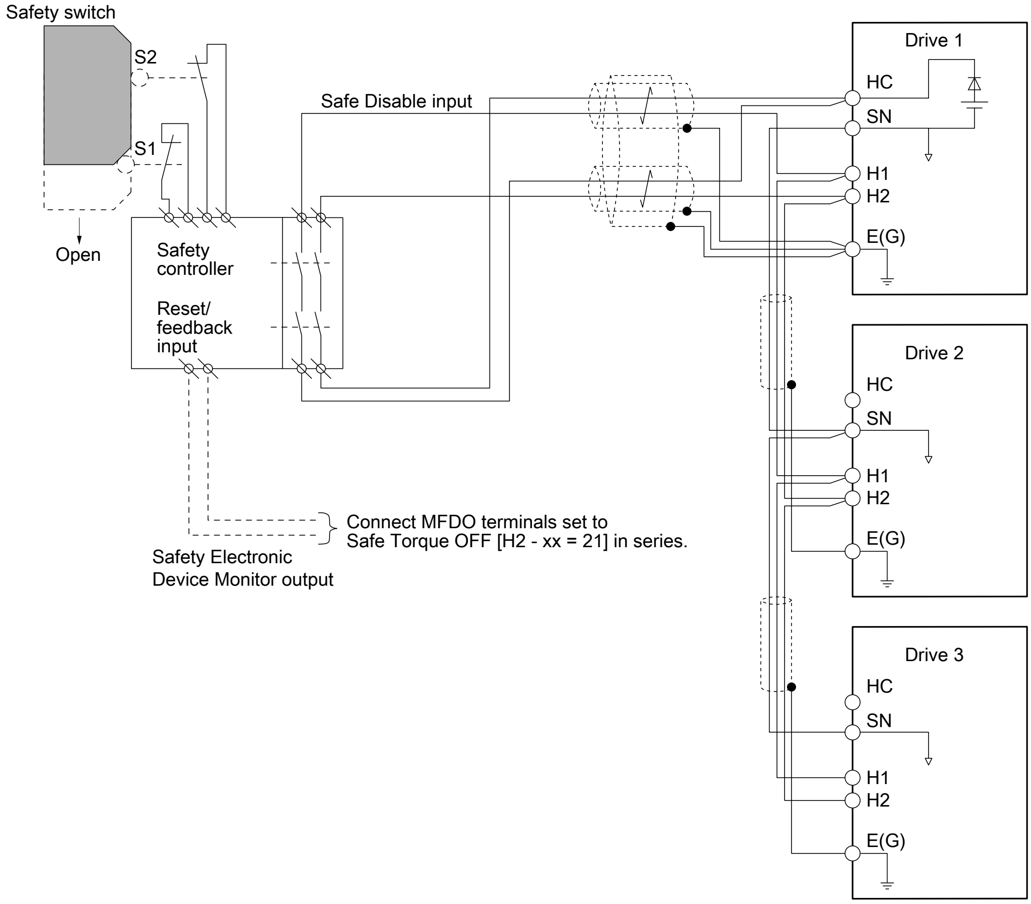


Figure 5.15 Connection Example to Use the Internal Power Supply

■ To Use 24 V External Power Supply

Figure 5.16 shows an example of how to connect Safe Disable contacts. These conditions limit the number of units to connect:

- External power supply capacity
- Number of MFDIs used
- Supply current to the external sensors

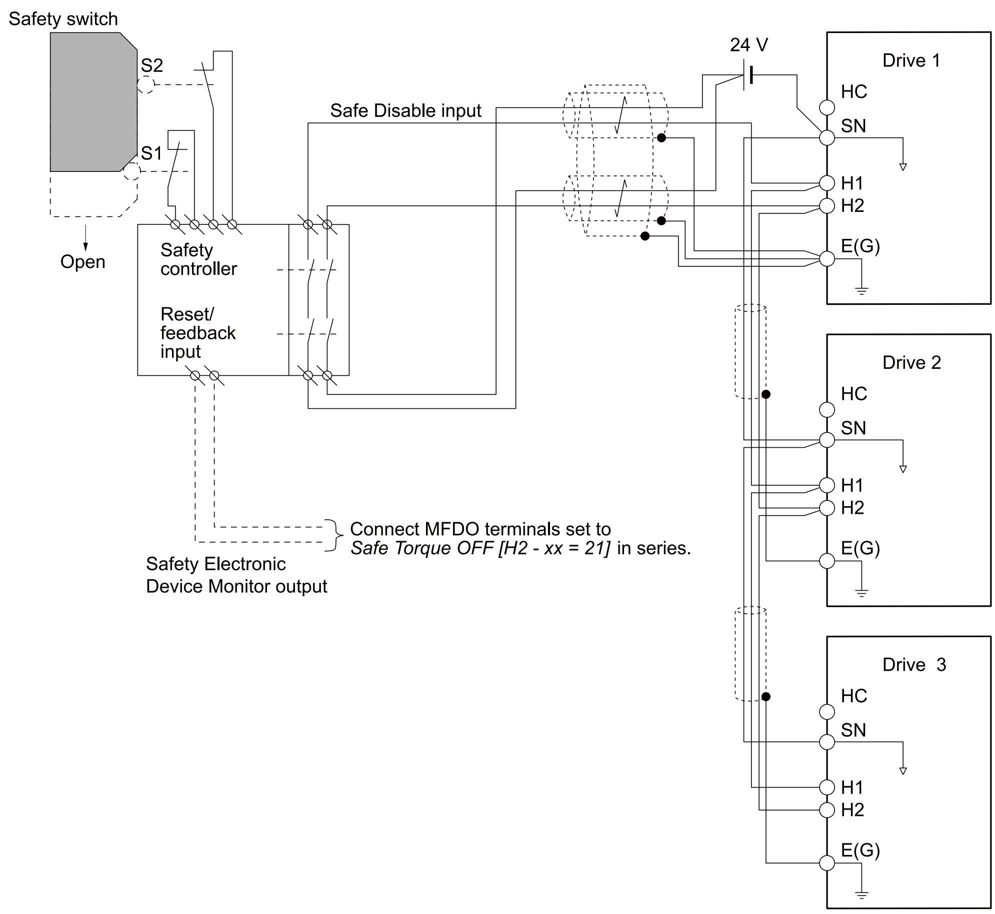


Figure 5.16 Connection Example to Use 24 V External Power Supply

■ Number of Possible Drives to Connect

Power Supply	Digital Inputs	24 V Output	Number of Drives
Internal power supply (Drive 1)	Yes (7-channel input)	Yes *1	1
		No	13
	No	Yes *1	4
		No	17
External power supply	-		Different for different external power supply capacities *2

*1 This is when you use a maximum of 150 mA.
*2 24 V, 12 mA is necessary for each drive.

Use this formula to calculate the number of units to connect:

$$n = (Io_{max} - I_{MFDI} \times n_{MFDI} - I_{sensor}) / I_{safety}$$

- n: Number of units to connect
- Io_{max}: Maximum current that the power supply can supply (234 mA for the internal power supply)
- I_{MFDI}: Current consumed per MFDI (6 mA)
- n_{MFDI}: Maximum number of MFDIs that can be activated at the same time (maximum of 7-channel)
- I_{sensor}: Current externally supplied for sensor power supply (maximum of 150 mA)
- I_{safety}: Current consumed by Safe Disable terminals H1 and H2 (12 mA)

Note:

Round the values to the first decimal place.

◆ Enabling and Disabling the Drive Output (“Safe Torque Off”)

Refer to Figure 5.17 for an example of drive operation when the drive changes from “Safe Torque Off” status to usual operation.

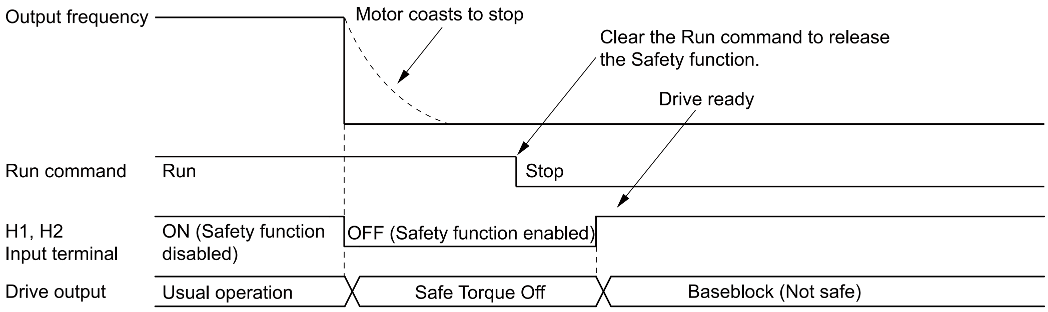


Figure 5.17 Safe Disable Operation

■ Switching from Usual Operation to "Safe Torque Off"

Turn OFF (open) safety input terminal H1 or H2 to enable the Safe Disable function. When the Safe Disable function is enabled while the motor is operating, the drive output and motor torque turn off and the motor always coasts to stop. The *b1-03 [Stopping Method Selection]* setting does not have an effect on the stopping method.

The "Safe Torque Off" status is only possible with the Safe Disable function. Clear the Run command to stop the drive. Turning off drive output (a baseblock condition) ≠ "Safe Torque Off".

Note:

- When it is necessary to ramp to stop the motor, do not turn off terminals H1 and H2 until the motor fully stops. This will prevent the motor from coasting to stop during usual operation.
- A maximum of 3 ms will elapse from when terminals H1 or H2 shut off until the drive switches to the "Safe Torque Off" status. Set the OFF status for terminals H1 and H2 to hold for at least 3 ms. The drive may not be able to switch to the "Safe Torque Off" status if terminals H1 and H2 are only open for less than 3 ms.

■ Going from "Safe Torque Off" to Usual Operation

The safety input will only release when there is no Run command.

- During Stop
  When the Safe Disable function is triggered during stop, close the circuit between terminals H1-HC and H2-HC to disable "Safe Torque Off". Enter the Run command after the drive stops correctly.
- During Run
  If you trigger the Safe Disable function during run, clear the Run command, then close the circuit between terminals H1-HC and H2-HC to disable "Safe Torque Off". Enter the Stop command, then enter the Run command when terminals H1 and H2 are activated.

◆ Safe Disable Monitor Output Function and Keypad Display

Refer to Table 5.14 for information about the relation between the input channel status, Safety monitor output status, and drive output status.

Table 5.14 Safe Disable Input and External Device Monitor (EDM) Terminal Status

Input Channel Status		Safety Monitor Output Status		Drive Output Status	Keypad Display	READY LED
Input 1 (H1-HC)	Input 2 (H2-HC)	MFDO Terminal (H2-xx = 21)	MFDO Terminal (H2-xx = 121)			
ON (Close the circuit)	ON (Close the circuit)	OFF	ON	Baseblock (Drive ready)	Normally displayed	READY: Illuminated
OFF (Open)	ON (Close the circuit)	OFF	ON	Safety status (STo)	SToF (Flashing)	ALM/ERR: Flashing
ON (Close the circuit)	OFF (Open)	OFF	ON	Safety status (STo)	SToF (Flashing)	ALM/ERR: Flashing
OFF (Open)	OFF (Open)	ON	OFF	Safety status (STo)	STo (Flashing)	READY: Flashing

■ Safety Function Status Monitor

The drive Safety monitor output sends a feedback signal about the status of the Safety function. The Safety monitor output is one of the possible settings available for the MFDO terminals. If there is damage to the Safe Disable circuit, a controller (PLC or safety relay) must read this signal as an input signal to hold the "Safe Torque Off" status. This will help verify the condition of the safety circuit. Refer to the manual for the safety device for more information about the Safety function.

It is possible to switch polarity of the Safety monitor output signal with the MFDO function settings. Refer to Table 5.14 for setting instructions.

■ Keypad Display

If the two input channels are OFF (Open), the keypad will flash *STo [Safe Torque OFF]*.

If there is damage to the Safe disable circuit or the drive, the keypad will flash *SToF [Safe Torque OFF Hardware]* when one input channel is OFF (Open), and the other is ON (Short circuit). When you use the Safe disable circuit correctly, the keypad will not show *SToF*.

If there is damage to the drive, the keypad will show *SCF [Safety Circuit Fault]* when the drive detects a fault in the Safe disable circuit. Refer to the chapter on Troubleshooting for more information.

◆ Validating the Safe Disable Function

After you replace parts or do maintenance on the drive, complete all necessary wiring to start the drive, then follow these steps to test the Safe Disable input. Keep a record of the test results.

1. When the two input channels are OFF (Open), make sure that the keypad flashes *STo [Safe Torque OFF]*, and make sure that the motor is not running.
2. Monitor the ON/OFF status of the input channels and make sure that MFDO set to the EDM function operates as shown in Table 5.14.
   If one or more of the these items are true, the ON/OFF status of the MFDO may not display correctly on the keypad.
   - Incorrect parameter settings.
   - A problem with an external device.
   - The external wiring has a short circuit or is disconnected.
   - There is damage to the device.

   Find the cause and repair the problem to correctly display the status.
3. Make sure that the EDM signal operates during usual operation as shown in Table 5.14.

5.5 EN81-20 Compliant Circuit with one Motor Contactor

You can use the safe disable circuit to install the drives in an elevator system using only one motor contactor instead of two. In such a system, follow these guidelines to comply with EN81-20:

- Design the circuit so that the inputs H1 and H2 are opened and the drive output shuts off when the safety chain is interrupted.
- Program a drive digital output as *Safe Disable feedback [H2-xx = 58]*. Implement this feedback signal in the contactor supervision circuit of the controller that prevents a restart in case of a fault in the Safe Disable circuit or the motor contactor.
- Select and install all contactors and wiring in compliance with EN81-20.
- Use the safe disable inputs H1 and H2 to enable/disable the drive. Set the input logic to Source Mode.

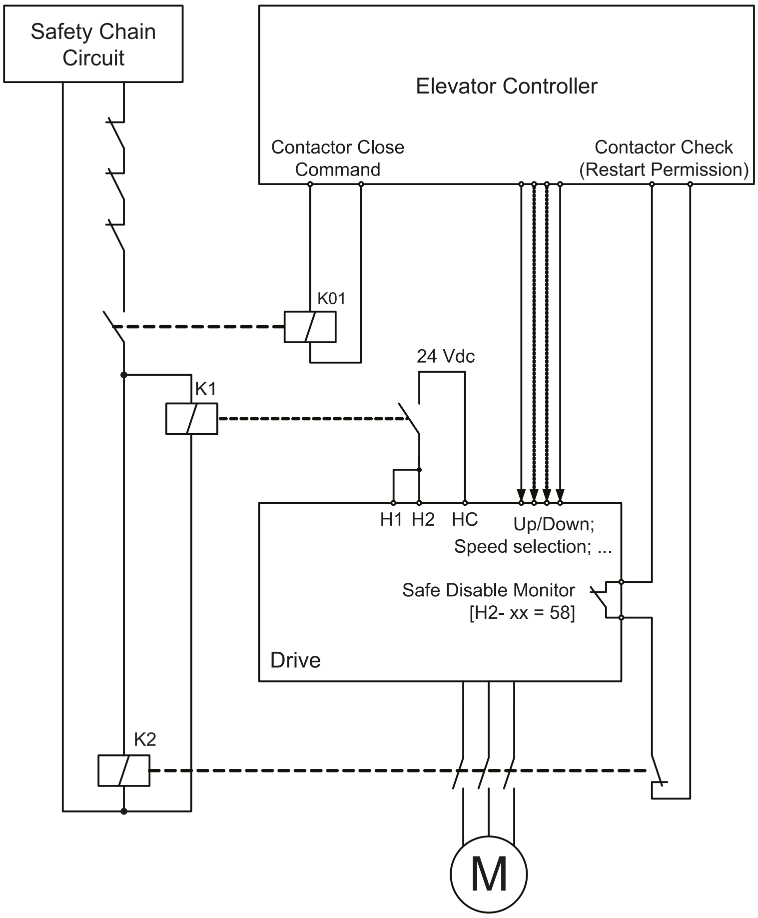


Figure 5.18 Wiring Example

Note:
- The drive output will immediately shut off when either of the inputs H1 or H2 is opened. In this case the brake should apply immediately in order to prevent uncontrolled movement of the elevator.
- Terminals H1 or H2 must be closed prior to setting the Up/Down command.

5.6 EN81-20 Compliant Circuit with no Motor Contactor

You can use the safe disable circuit to install the drives in an elevator system using no motor contactor. In such a system, follow these guidelines to comply with EN81-20:

- Design the circuit so that the inputs H1 and H2 are opened and the drive output shuts off when the safety chain is interrupted.
- Use the safe disable inputs H1 and H2 to enable/disable the drive. Set the input logic to Source Mode.

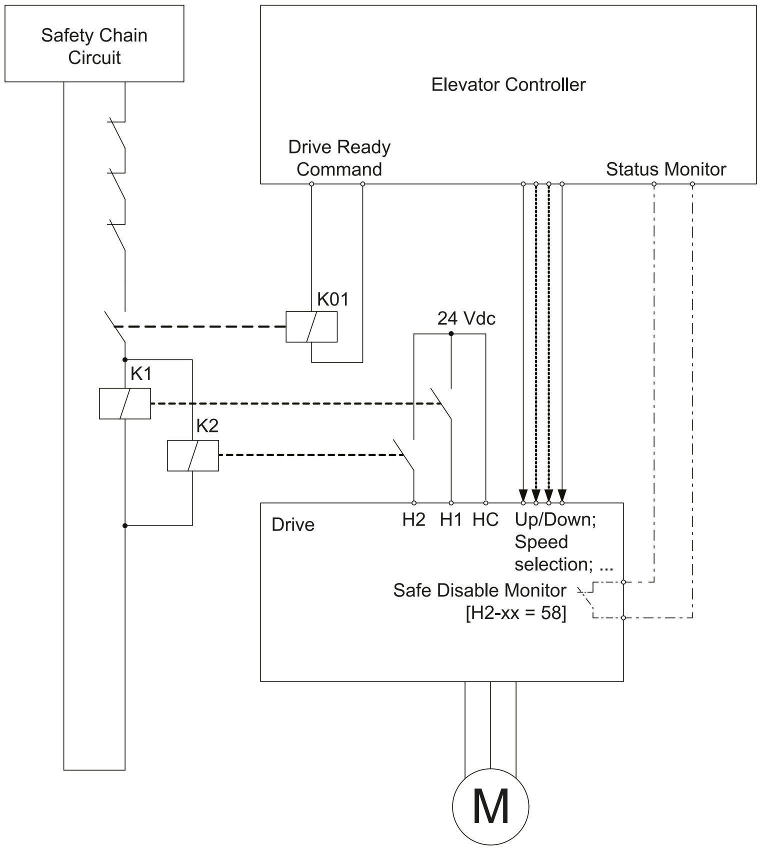


Figure 5.19 Wiring Example

Note:
- The drive output will immediately shut off when either of the inputs H1 or H2 is opened. In this case the brake should apply immediately in order to prevent uncontrolled movement of the elevator.
- Terminals H1 or H2 must be closed prior to setting the Up/Down command.
- A drive digital output must be programmed as *Safe Disable feedback [H2-xx = 58]*. This feedback signal can be implemented in the contactor supervision circuit of the controller that monitors a fault in the Safe Disable circuit.

6

Network Communications

6.1 MEMOBUS/Modbus Communications

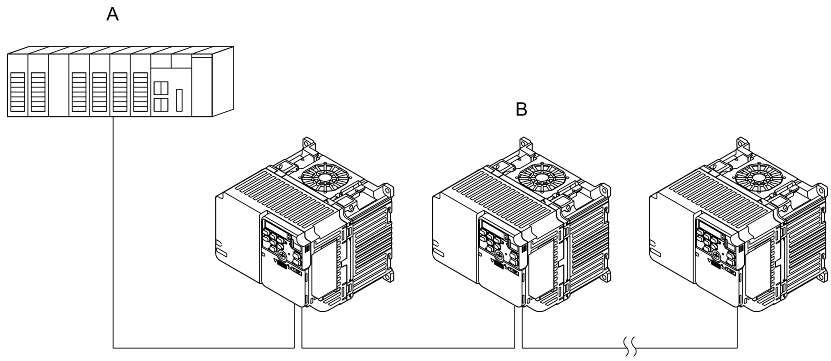
This section gives detailed information about the parameters, error codes and communication procedures for MEMOBUS/Modbus communications.

◆ Configure Master/Slave

You can use the MEMOBUS/Modbus protocol for serial communication with programmable controllers (PLC).

The MEMOBUS/Modbus communication uses one master (PLC) and a maximum of 31 slave drives. Serial communications usually starts with a signal from the master to the slave drives.

A slave drive that receives a command from the master does the specified function and then sends a response back to the master. You must set the address number for each slave drive before you start signal communications to make sure that the master uses the correct address numbers.



A - Master (PLC) **B - Slave (drive)**

Figure 6.1 PLC and Drive Connection Example

◆ Communication Specifications

Table 6.1 lists the specifications for the MEMOBUS/Modbus communications.

Table 6.1 MEMOBUS/Modbus Specifications

Item	Specification
Interface	RS-485
Synchronization method	Asynchronous (start-stop synchronization)
Communication parameter	Communications speed:1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 76.8, 115.2 kbps
	Data length: 8 bit (fixed)
	Parity: even, odd, none
	Stop bit 1 bit (fixed)
Communication protocol	MEMOBUS/Modbus standard (RTU mode only)
Number of possible units to connect	Maximum: 31 units

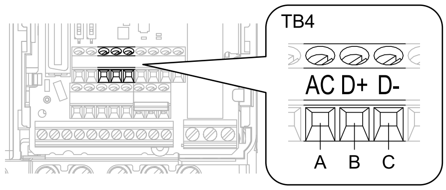
◆ Communication with the PLC

This section gives information about the settings for the termination resistor and how to connect to MEMOBUS/Modbus communications. MEMOBUS/Modbus communications uses an RS-485 interface (2-wire connection).

■ Connect Communications Cable

Use this procedure to start communication between the PLC and drive.

1. De-energize the drive then connect the communications cable to the PLC and the drive. The drive uses terminal TB4 for MEMOBUS/Modbus communications.



A - Terminal AC: Common ground

B - Terminal D+: Communication input/output (+)

C - Terminal D-: Communication input/output (-)

Figure 6.2 Communications Cable Connection Terminal (TB4)

Note:

Isolate the communications wiring from the main circuit wiring and other high-power wiring Use shielded wires for the communications wiring and connect cable sheaths to the ground terminal of the drive. Incorrect wiring procedures could cause drive malfunction because of electrical interference.

2. Install the termination resistor on the network termination slave drive. Set DIP switch S2 to the ON position to enable the termination resistor on the drive.
3. Energize the drive.
4. Use the drive keypad to set the necessary communications parameters *H5-01 to H5-12*.
   - *H5-01 [Drive Node Address]*
   - *H5-02 [Communication Speed Selection]*
   - *H5-03 [Communication Parity Selection]*
   - *H5-04 [Communication Error Stop Method]*
   - *H5-05 [Comm Fault Detection Selection]*
   - *H5-06 [Drive Transmit Wait Time]*
   - *H5-09 [CE Detection Time]*
   - *H5-10 [Modbus Register 0025H Unit Sel]*
   - *H5-11 [Comm ENTER Command Mode]*
   - *H5-12 [Run Command Method Selection]*
5. De-energize the drive and wait for the keypad display to turn off.
6. Energize the drive.

The drive is prepared to start communication with the PLC.

■ Set the Termination Resistor

You must enable the termination resistor on the slave terminal of the drive to use MEMOBUS/Modbus communications. Use DIP switch S2 on the terminal block to enable and disable the built-in termination resistor. Refer to Figure 6.3 for an example of how to set DIP switch S2. Use the tip of a tweezers or a jig with a tip width of 0.8 mm (0.03 in) to set the DIP switch. When you install the drive at the end of the communication line, set DIP switch S2 to ON. Set DIP switch S2 to OFF on all other drives.

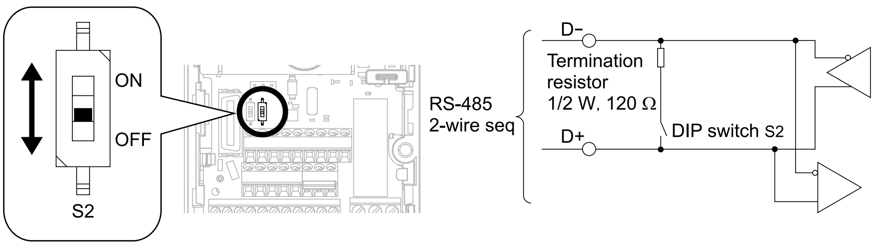


Figure 6.3 MEMOBUS/Modbus Communication Terminal and DIP Switch S2

■ Wiring Diagram for More than One Drive

Figure 6.4 shows the correct wiring when you use more than one drive with MEMOBUS/Modbus communications.

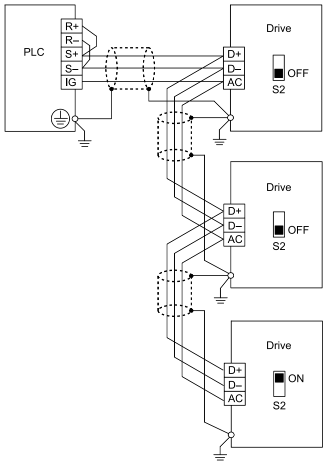


Figure 6.4 Wiring Diagram for More than One Drive

Note:

1. Set DIP switch S2 to the ON position on the last drive of the MEMOBUS/Modbus communication network to enable the termination resistor.
2. For long cable runs or multi-floor installations, connect the shield to ground at only one device on the network (at the PLC, if possible) to prevent ground loops. When you remove the shield from the ground terminal, it can increase the communication quality in some drive installation locations.

◆ MEMOBUS/Modbus Drive Operations

Drive parameters will apply to the settings when the drive is running during MEMOBUS/Modbus communications. This section gives information about the available functions and their related parameters.

■ Executable Functions

A PLC can do these operations with MEMOBUS/Modbus communications. Parameter settings (except *H5-xx*) do not have an effect on the availability of these operations.

- Monitor the drive status and operate the drive
- Set and view parameters
- Fault Reset
- Multi-function input settings
  The input command from MEMOBUS/Modbus communications and MFDI terminals (S1 to S7) are linked by a logical OR operation.

■ Drive Control

Select the external command that sets the frequency references and motor run/stop with MEMOBUS/Modbus communications. Use the information in Table 6.2 to set the parameters as specified by the application.

Table 6.2 Necessary Parameter Settings for Drive Control from MEMOBUS/Modbus

LOCAL Control Selected	No.	Name	Setting Value
External reference 1	b1-01	Frequency Reference Selection 1	*2 [Memobus/Modbus Communications]*
	b1-02	Run Command Selection 1	*2 [Memobus/Modbus Communications]*

For more information about operation mode selection, refer to *b1-01 [Frequency Reference Selection 1]* and *b1-02 [Run Command Selection 1]*. Refer to *H1-xx = 2 [MFDI Function Select = External Reference 1/2 Selection]* for more information about external commands.

◆ Communications Timing

To prevent overrun of the slave side, the master cannot send a message to the same drive for a selected length of time.

To prevent overrun of the master side, the slave cannot send a response message to the master for a selected length of time.

This section gives information about message timing.

■ Command Message from Master to Slave

To prevent data loss and overrun, after the master receives a message from the slave, the master cannot send the same type of command message to the same slave for a selected length of time. The minimum wait time is different for each type of message. Refer to Table 6.3 to find the minimum wait times.

Table 6.3 Minimum Wait Time to Send a Message

Command Type	Example	Minimum Wait Time
1	• Operation commands (Run command, stop command) • I/O settings • Reading the motor and parameter setting values	5 ms *1
2	Writing a parameter	50 ms *1
3	Writing of modified data with the Enter command	3 to 5 s *1

*1 When the drive receives a message in the minimum wait time, it does command type 1 and sends a response message. If the drive receives command type 2 or command type 3 messages in the minimum wait time, it will trigger a communications error or the drive will ignore the command.

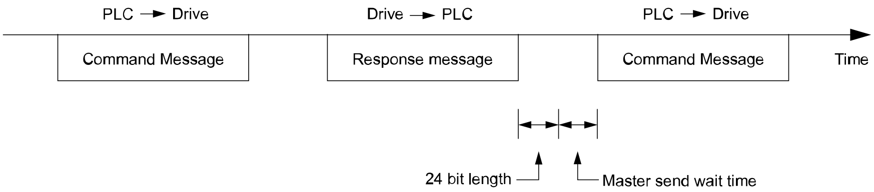


Figure 6.5 Minimum Wait Time to Send a Message

You must set the timer in the master to measure the length of time for the slave to respond to the master. If you set the timer, but the slave does not send a response message in a specified length of time, the master will send the message again.

■ Response Message from Slave

The slave receives the command message from the master then processes the data it received. The slave then waits for the time set in *H5-06 [Drive Transmit Wait Time]* then sends a response message to the master. If overrun occurs on the master, increase the wait time set in *H5-06*.

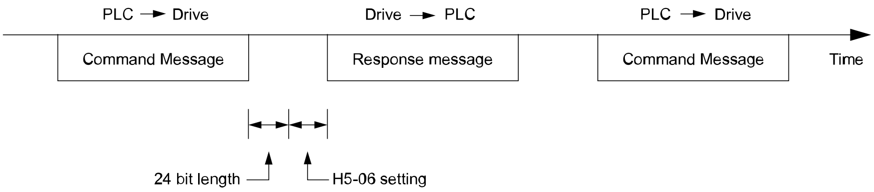


Figure 6.6 Response Wait Time

◆ Message Format

■ Communication Message Description

In MEMOBUS/Modbus communications, the master sends commands to the slave, then the slave responds. The master and slave send their messages in the configuration in Figure 6.7. The length of the data changes when the description of the command (function) changes.

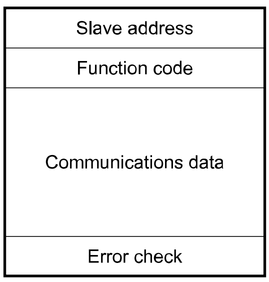


Figure 6.7 Message Format

■ Slave Address

Set the slave address of the drive to 00 to FF (Hex.).

When the slave address is 00 (Hex), the master sends the command and all slaves receive the command, and the slave will not send a response message to the master.

■ Function Code

There are five function codes that set commands. Table 6.4 shows the different codes.

Table 6.4 Function Codes

Function Code (Hex.)	Subfunction Code (Hex.)	Function	Command Message		Response Message	
			Minimum Data Length (byte)	Maximum Data Length (byte)	Minimum Data Length (byte)	Maximum Data Length (byte)
03	-	Read Multiple Holding Registers	8	8	7	37
08	-	Loopback Test	8	8	8	8
10	-	Writing to Multiple Holding Registers	11	41	8	8
5A	-	Writing to Multiple Holding Registers / Reading the Register Indicated	11	41	17	17
67	010D	Reading the Contents of Non-Consecutive Holding Registers	10	248	10	248
	010E	Writing to Non-Consecutive Holding Registers	14	250	8	8

■ Communications Data

Communications data is a series of data that uses the combination of the communications register number and the data for these registers. The data length changes when the description of the command changes. For a loopback test, it switches to test code.

The communications register for the drive has a 2-byte length. Data that is written to the register for the drive is usually 2 bytes. Register data that is read from the drive is also 2 bytes.

■ Error Check

Error check uses the CRC-16 method to detect transmission errors. Use the procedure in this section to calculate CRC-16.

Command Data :

When the drive receives data, it will make sure that there are no errors in the data. The drive uses the procedure below to calculate CRC-16, then the drive compares that data with the CRC-16 value in the message. If the CRC-16 values do not agree, the drive will not execute a command message.

When you calculate CRC-16 in MEMOBUS/Modbus communications, make sure that you set the start value as FFFF (Hex.). All 16 bits must be 1.

Use this procedure to calculate CRC-16:

1. Make sure that the start value is FFFF (Hex.).
2. Calculate the FFFF (Hex.) start value and the XOR of the slave address (exclusive OR).
3. Move the step 2 results one column to the right. Do this shift until the carry bit is 1.
4. When the carry bit is 1, calculate XOR via the result from the above step 3 and A001 (Hex.).
5. Do steps 3 and 4 until the 8th shift to the right.
6. Use the result of step 5 to calculate the XOR and the data of the following messages (function code, register address, data). Do steps 3 to 5 until the last data, then calculate.
7. The result of the last right shift or the value of the last XOR calculation is the result for CRC-16.

Table 6.5 lists examples of the CRC-16 calculation of slave address 02 (Hex.) and function code 03 (Hex.). The calculated results of CRC-16 for this section is D140 (Hex.).

Note:

The calculation example only gives information about some error checks with CRC-16. The drive will do the same error checks for the next data.

Table 6.5 CRC-16 Calculation Example

Description	Calculation	Overflow	Description	Calculation	Overflow
Initial value (FFFF (Hex.))	1111 1111 1111 1111	-	Function code 03 (Hex.)	0000 0011	-
Address 02 (Hex.)	0000 0010	-	XOR w result	1000 0001 0011 1101	-
XOR w initial value	1111 1111 1111 1101		Shift 1	0100 0000 1001 1110	1
Shift 1	0111 1111 1111 1110	1	XOR w A001 (Hex.)	1010 0000 0000 0001	-
XOR w A001 (Hex.)	1010 0000 0000 0001	-	XOR result	1110 0000 1001 1111	-
XOR result	1101 1111 1111 1111	-	Shift 2	0111 0000 0100 1111	1
Shift 2	0110 1111 1111 1111	1	XOR w A001 (Hex.)	1010 0000 0000 0001	-
XOR w A001 (Hex.)	1010 0000 0000 0001	-	XOR result	1101 0000 0100 1110	-
XOR result	1100 1111 1111 1110	-	Shift 3	0110 1000 0010 0111	0
Shift 3	0110 0111 1111 1111	0	Shift 4	0011 0100 0001 0011	1
Shift 4	0011 0011 1111 1111	1	XOR w A001 (Hex.)	1010 0000 0000 0001	-
XOR w A001 (Hex.)	1010 0000 0000 0001	-	XOR result	1001 0100 0001 0010	-
XOR result	1001 0011 1111 1110	-	Shift 5	0100 1010 0000 1001	0
Shift 5	0100 1001 1111 1111	0	Shift 6	0010 0101 0000 0100	1
Shift 6	0010 0100 1111 1111	1	XOR w A001 (Hex.)	1010 0000 0000 0001	-
XOR w A001 (Hex.)	1010 0000 0000 0001	-	XOR result	1000 0101 0000 0101	-
XOR result	1000 0100 1111 1110	-	Shift 7	0100 0010 1000 0010	1
Shift 7	0100 0010 0111 1111	0	XOR w A001 (Hex.)	1010 0000 0000 0001	-
Shift 8	0010 0001 0011 1111	1	XOR result	1110 0010 1000 0011	-
XOR w A001 (Hex.)	1010 0000 0000 0001	-	Shift 8	0111 0001 0100 0001	1
XOR result	1000 0001 0011 1110	-	XOR w A001 (Hex.)	1010 0000 0000 0001	-
Perform operations with next data (function code)			XOR result	1101 0001 0100 0000	-
			CRC-16	1101 0001 0100 0000	-
				D 1 4 0 (Lower) (Upper)	-
			Continue from here with next data.		

Response Data :

The drive does the CRC-16 calculation for the response message and makes sure that the data does not have errors. Make sure that the calculated value is the same value as the CRC-16 in the response message.

◆ Examples of Messages for Commands/Responses

The items in this section are examples of messages for commands/responses.

■ Read Multiple Holding Registers

Uses function code 03 (Hex.) to read the contents of a maximum of 16 holding registers.

Table 6.6 shows example messages when the drive reads status signal from the drive of slave 2, the error contents, fault contents, and frequency references.

Table 6.6 Message Example When Reading the Contents of Holding Register

Byte	Command Message		Response Message (Normal)		Response Message (Fault)	
		Setting Data (Hex.)		Setting Data (Hex.)		Setting Data (Hex.)
0	Slave address	02	Slave address	02	Slave address	02
1	Function code	03	Function code	03	Function code	83

Byte	Command Message			Response Message (Normal)			Response Message (Fault)		
			Setting Data (Hex.)			Setting Data (Hex.)			Setting Data (Hex.)
2	Starting No.	Upper	00	Data Qty		08	Error code		03
3		Lower	20	First storage register	Upper	00	CRC-16	Upper	F1
4	Data Qty	Upper	00		Lower	65		Lower	31
5		Lower	04	Next storage register	Upper	00	-		
6	CRC-16	Upper	45		Lower	00	-		
7		Lower	F0	Next storage register	Upper	00	-		
8	-				Lower	00	-		
9	-			Next storage register	Upper	01	-		
10	-				Lower	F4	-		
11	-			CRC-16	Upper	AF	-		
12	-				Lower	82	-		

■ Loopback Test

The loopback test uses function code 08 (Hex.) and returns the command message as a response message. This test checks communication between the master and slave. The test code and data can use desired values.

Table 6.7 shows examples of messages given out when the loopback test is done with the drive of slave 1.

Table 6.7 Message Examples from the Loopback Test

Byte	Command Message			Response Message (Normal)		
			Setting Data (Hex.)			Setting Data (Hex.)
0	Slave address		01	Slave address		01
1	Function code		08	Function code		08
2	Test code	Upper	00	Test code	Upper	00
3		Lower	00		Lower	00
4	Data	Upper	A5	Data	Upper	A5
5		Lower	37		Lower	37
6	CRC-16	Upper	DA	CRC-16	Upper	DA
7		Lower	8D		Lower	8D

■ Writing to Multiple Holding Registers

You can write the data that you set to the number of holding registers set in function code 10 (hex). You must configure the number of the holding registers and each 8 higher bits and 8 lower bits in order in the command message for the write data. You can write to a maximum of 16 holding registers.

Table 6.8 shows example messages when you use the PLC to set Forward run in the drive of slave 1 with a 60.00 Hz frequency reference.

Table 6.8 Message Example When Writing to Multiple Holding Registers

Byte	Command Message			Response Message (When Normal)			Response Message (When There is a Fault)		
			Setting Data (Hex.)			Setting Data (Hex.)			Setting Data (Hex.)
0	Slave address		01	Slave address		01	Slave address		01
1	Function code		10	Function code		10	Function code		90
2	Starting No.	Upper	00	Starting No.	Upper	00	Error code		02
3		Lower	01		Lower	01	CRC-16	Upper	CD
4	Data Quantity	Upper	00	Data Quantity	Upper	00		Lower	C1
5		Lower	02		Lower	02	-		

Byte	Command Message			Response Message (When Normal)			Response Message (When There is a Fault)	
			Setting Data (Hex.)			Setting Data (Hex.)		Setting Data (Hex.)
6	Byte No.		04	CRC-16	Upper	10	-	
7	First data	Upper	00		Lower	08	-	
8		Lower	01	-			-	
9	Next data	Upper	17	-			-	
10		Lower	70	-			-	
11	CRC-16	Upper	6D	-			-	
12		Lower	B7	-			-	

Note:

The number of bytes set in the command message set the data quantity × 2 during the command message. The response message uses the same formula.

■ Writing to More than One Holding Register/Reading the Indicated Register

The drive uses function code 5A (Hex.) to write to more than one register, then it reads the contents of four holding registers at the same time.

The function for writing to more than one register is the same as the function for function code 10 (Hex.). You can write to a maximum of 16 holding registers.

The four holding registers to be read from are specified in *H5-25 to H5-28 [Function 5A Register x Selection]*.

Table 6.9 shows example messages when you write to more than one holding register or when you read more than one command register. Table 6.9 uses this register data for the examples:

- The drive for slave 1 is set for Forward run with a frequency reference of 60.00 Hz.
- The setting in *H5-25* to *H5-28* and the data in the specified holding registers are as follows.
  – *H5-25* = 0044H: *U1-05 [Motor Speed]* = 60.00 Hz (6000 = 1770H)
  – *H5-26* = 0045H: *U1-06 [Output Voltage Ref]* = 200.0 V (2000 = 07D0H)
  – *H5-27* = 0042H: *U1-03 [Output Current]* = 50% of drive rated current (100% = 8192, 50% = 4096 = 1000H)
  – *H5-28* = 0049H: *U1-10 [Input Terminal Status]* = 00H

When you rewrite the parameter value with the write command through the *H5-11 [Comm ENTER Command Mode]* setting, you must use the Enter command to save and enable the contents of the changes. Refer to **Missing reference ID** and *Enter Command on page 153* for more information.

Table 6.9 Message Example When Writing to More than One Holding Register/Reading the Indicated Register

Byte	Command Message			Response Message (When Normal)			Response Message (When There is a Fault)		
			Setting Data (Hex.)			Setting Data (Hex.)			Setting Data (Hex.)
0	Slave address		01	Slave address		01	Slave address		01
1	Function code		5A	Function code		5A	Function code		DA
2	Starting No.	Upper	00	Register status		0F	Register status		0F
3		Lower	01	Data in holding register 1 selected with *H5-25*	Upper	17	Data in holding register 1 selected with *H5-25*	Upper	17
4	Data Quantity	Upper	00		Lower	70		Lower	70
5		Lower	02	Data in holding register 2 selected with *H5-26*	Upper	07	Data in holding register 2 selected with *H5-26*	Upper	07
6	Byte No.		04		Lower	D0		Lower	D0
7	First data	Upper	00	Data in holding register 3 selected with *H5-27*	Upper	10	Data in holding register 3 selected with *H5-27*	Upper	10
8		Lower	01		Lower	00		Lower	00
9	Next data	Upper	17	Data in holding register 4 selected with *H5-28*	Upper	00	Data in holding register 4 selected with *H5-28*	Upper	00
10		Lower	70		Lower	00		Lower	00
11	CRC-16	Upper	4F	Starting No.	Upper	00	Error code		02
12		Lower	43		Lower	01	CRC-16	Upper	E9
13	-			Data Quantity	Upper	00		Lower	6C
14	-				Lower	02	-		

Byte	Command Message		Response Message (When Normal)			Response Message (When There is a Fault)	
		Setting Data (Hex.)			Setting Data (Hex.)		Setting Data (Hex.)
15	-		CRC-16	Upper	AC	-	
16	-			Lower	D0	-	

Note:

The number of bytes set in the command message set the data quantity × 2 during the command message.

Register status	
bit 0	Data in register 1 selected with *H5-25* 1: Successfully read the register 0: Register read error
bit 1	Data in register 2 selected with *H5-26* 1: Successfully read the register 0: Register read error
bit 2	Data in register 3 selected with *H5-27* 1: Successfully read the register 0: Register read error
bit 3	Data in register 4 selected with *H5-28* 1: Successfully read the register 0: Register read error
bit 4	Not used
bit 5	Not used
bit 6	Not used
bit 7	Not used

■ Reading the Contents of Non-Consecutive Holding Registers

The drive uses function code 67 (Hex.) and subfunction code 010D (Hex.) to read data with a maximum of 120 holding registers.

You must give the holding register number from which to read separately.

Table 6.10 shows example messages when you read the frequency reference and torque limit from the drive for slave 1. Table 6.10 uses this register data for the examples.

- 0024H: *U1-01 [Frequency Reference]* = 60.00 Hz (6000 = 1770H)
- 0028H: *U1-09 [Torque Reference]* = 100.0% (1000 = 03E8H)

Table 6.10 Message Example When Reading the Contents of Non-Consecutive Holding Registers

Byte	Command Message			Response Message (When Normal)			Response Message (When There is a Fault)		
			Setting Data (Hex.)			Setting Data (Hex.)			Setting Data (Hex.)
0	Slave address		01	Slave address		01	Slave address		01
1	Function code		67	Function code		67	Function code		E7
2	Subfunction Code	Upper	01	Subfunction Code	Upper	01	Error code		02
3		Lower	0D		Lower	0D	CRC-16	Upper	EA
4	Data Quantity	Upper	00	Byte No.	Upper	00		Lower	31
5		Lower	02		Lower	04	-		
6	Holding register 1 No.	Upper	00	Holding register 1 data	Upper	17	-		
7		Lower	24		Lower	70	-		
8	Holding register 2 No.	Upper	00	Holding register 2 data	Upper	03	-		
9		Lower	28		Lower	E8	-		
10	CRC-16	Upper	8B	CRC-16	Upper	47	-		
11		Lower	29		Lower	ED	-		

Note:

The number of bytes set in the command message set the data quantity × 2 during the command message.

■ Writing to Non-Consecutive Holding Registers

The drive uses function code 67 (Hex.) and subfunction code 010E (Hex.) to write data with a maximum of 60 holding registers.

You must give the holding register number from which to write separately.

Table 6.11 shows example messages when you write the frequency reference and torque limit from the drive for slave 1. Table 6.11 uses these specified holding registers data for the examples.

- 0002H: Frequency Reference = 60.00 Hz (6000 = 1770H)
- 0004H: Torque Limit = 150.0% (1500 = 05DCH)

Table 6.11 Message Example When Writing to Non-Consecutive Holding Registers

Byte	Command Message		Setting Data (Hex.)	Response Message (When Normal)		Setting Data (Hex.)	Response Message (When There is a Fault)		Setting Data (Hex.)
0	Slave address		01	Slave address		01	Slave address		01
1	Function code		67	Function code		67	Function code		E7
2	Subfunction Code	Upper	01	Subfunction Code	Upper	01	Error code		02
3		Lower	0E		Lower	0E	CRC-16	Upper	EA
4	Data Quantity	Upper	00	Data Quantity	Upper	00		Lower	31
5		Lower	02		Lower	02	-		
6	Byte No.	Upper	00	CRC-16	Upper	D5	-		
7		Lower	04		Lower	FC	-		
8	Holding register 1 No.	Upper	00	-			-		
9		Lower	02	-			-		
10	Holding register 1 data	Upper	17	-			-		
11		Lower	70	-			-		
12	Holding register 2 No.	Upper	00	-			-		
13		Lower	04	-			-		
14	Holding register 2 data	Upper	05	-			-		
15		Lower	DC	-			-		
16	CRC-16	Upper	55	-			-		
17		Lower	59	-			-		

Note:

The number of bytes set in the command message set the data quantity × 2 during the command message.

◆ Enter Command

When you use MEMOBUS/Modbus communications to write parameters from the PLC to the drive, *H5-11 [Comm ENTER Command Mode]* lets you use the Enter command to enable these parameters. This section gives information about the Enter command.

■ Types of Enter Commands

The drive supports the two Enter commands shown in Table 6.12.

Write 0 to register number 0900 or 0910 (Hex.) to enable the Enter command. You can only write to these registers. If you read to these registers, it will cause an error.

Table 6.12 Types of Enter Commands

Register No. (Hex.)	Description
0900	When you write parameter data to the EEPROM, you will enable the data on the RAM at the same time. This process saves the parameter changes even if you de-energize the drive.
0910	This updates the data on the RAM, but does not write data to the EEPROM. If you de-energize the drive, you will lose the parameter changes.

Note:
- You can write the EEPROM to the drive a maximum of 100,000 times. Do not frequently execute the Enter command (0900 (Hex.)) that is written to EEPROM.
- The Enter command register is write-only. If this register is read, it will cause a Register Number Error (02 (Hex.)).
- When the command data or broadcast message is transmitted to the drive, the Enter command is not necessary.

■ Functions of the Enter Command when Replacing a Previous Generation Drive

When you replace a previous generation Yaskawa drive with this product, you must set the Enter command function for this product the same as the previous product. The Enter command function is different for Yaskawa G7, F7-series, and V7-series drives.

Use *H5-11* to set the Enter command function:

- When replacing G7 and F7 series drives, set *H5-11 = 0 [ENTER Command Required]*.
- When replacing V7 series drives, set *H5-11 = 1 [ENTER Command Not Required]*.
- When replacing 1000-series drives, set *H5-11* to the same value as the drive you replaced.

Table 6.13 Enter Command Function Differences

H5-11 Settings	H5-11 = 0	H5-11 = 1
The drive you replaced	G7, F7	V7
Time when the parameter settings are enabled	When the drive receives the Enter command from the master	When you change the parameter settings
Upper and lower limit check	Checks the upper and lower limits and considers the related parameter settings.	Checks the upper and lower limit of the changed parameter only.
Default setting of related parameters	Will not change related parameter settings. You must change the parameters manually.	Automatically changes the default settings for the related parameters.
Fault detection when you set more than one parameter	Accepts and responds as usual to correct setting data if the data contains parameter setting errors. The drive discards the disabled setting data, but will not return an error message.	If there is a setting error in a parameter, the drive responds with a fault. The drive discards the data that was sent.

◆ Self-Diagnostics

The drive can use Self-Diagnositcs to find the operation of the serial communications interface circuit. Self-Diagnostics connects the transmission terminal to the reception terminal on the control circuit. It then transmits the data sent by the drive and makes sure that the drive can communicate correctly.

Use this procedure to do Self-Diagnostics:

1. Energize the drive.
2. Set *H1-06 = 67 [Terminal S6 Function Select = Communications test mode]*.
3. De-energize the drive.
4. Connect a jumper between control circuit terminals S6 and SN.

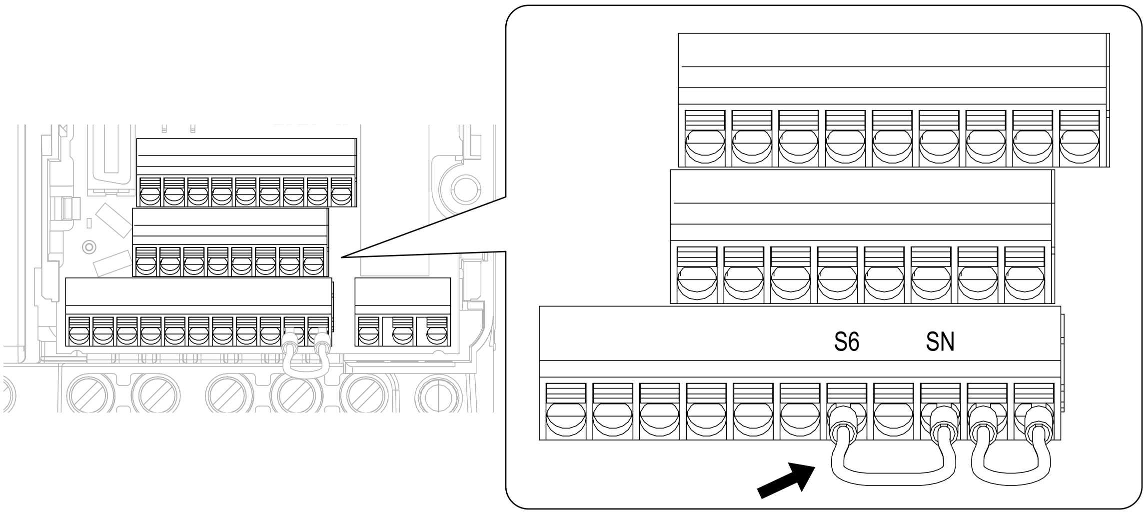


Figure 6.8 Self-Diagnostics Jumper Terminals

5. Energize the drive.
6. When normal, the keypad will show *PASS [MEMOBUS/Modbus Communications Test Mode Normal]*. When there is an error, the keypad will show *CE [MEMOBUS/Modbus Communications Error]*.

7. De-energize the drive.
8. Disconnect the wire jumper between terminals S6 and SN. Set terminal S6 to its initial function.

Self-Diagnostics is complete and the drive returns to its usual function.

◆ Communications Data Table

The communication data types are command data, monitor data, and broadcast message. *Command Data on page 155*, *Monitor Data on page 157*, and *Broadcast Messages on page 167* show the communications data.

Refer to the Parameter List for parameter communications registers.

■ Command Data

You can read and write command data.

Note:

Set the reserved bit to 0. Do not write the data in the reserved register or the monitor register.

Table 6.14 MEMOBUS/Modbus Communications Command Data

Register No. (Hex.)	Description	
0000	Reserved	
0001	Run command, multi-function input command	
	bit 0	When *H5-12 = 0*, Forward run/stop 1: Forward run, 0: Stop When *H5-12 = 1*, run/stop 1: Run, 0: Stop
	bit 1	When *H5-12 = 0*, Reverse run/stop 1: Reverse run, 0: Stop When *H5-12 = 1*, Forward/Reverse run 1: Reverse, 0: Forward run
	bit 2	External fault 1: EF0 [Option Card External Fault]
	bit 3	Fault Reset 1: Reset command
	bit 4	Multi-function input 1 When the multi-function input command is *H1-01 = 40 [Forward Run Command (2-Wire Seq)]*, bit 4 is “ComRef.” **Note:** When you switch the bit ON as ComRef, the frequency reference source changes to MEMOBUS/Modbus communications. When you connect a communication option to the drive, the frequency reference source gives priority to the communications option.
	bit 5	Multi-function input 2 When the multi-function input command is *H1-02 = 41 [Reverse Run Command (2-Wire Seq)]*, bit 5 is “ComCtrl.” **Note:** When you switch the bit ON as ComCtrl, the Run Command source changes to MEMOBUS/Modbus communications. When you connect a communication option to the drive, the Run Command source gives priority to the communications option.
	bit 6	Multi-function input 3
	bit 7	Multi-function input 4
	bit 8	Multi-function input 5
	bit 9	Multi-function input 6
	bit A	Multi-function input 7
	bit B - F	Reserved
0002	Frequency Reference	*o1-03 [Frequency Display Unit Selection]* (unsigned) sets the units.
0003	Output voltage gain	Units: 0.1% Setting range: 20 (2.0%) to 2000 (200.0%), the default value at energize: 1000 (100.0%)
0004	Torque limit (0.1% signed)	
0005	Torque compensation (0.1% signed)	
0006	Reserved	
0007	Setting for the multi-function analog monitor output terminal AM (10 V/4000 (Hex.))	
0008	Reserved	

Register No. (Hex.)	Description	
0009	MFDO setting	
	bit 0	MFDO (terminal MA/MB-MC) 1: ON, 0: OFF
	bit 1	Multi-function photocoupler output 1 (terminal P1-C1) 1: ON, 0: OFF
	bit 2	Multi-function photocoupler output 2 (terminal P2-C2) 1: ON, 0: OFF
	bit 3 - F	Reserved
000A - 000E	Reserved	
000F	Command selection setting	
	bit 0 - 1	Reserved
	bit 2	Torque Limit Input 1: Enables setting values from MEMOBUS/Modbus
	bit 3	Torque Compensation Input 1: Enables setting values from MEMOBUS/Modbus
	bit 4 - B	Reserved
	bit C	Terminal S5 input of broadcast message 1: Enabled, 0: Disabled
	bit D	Terminal S6 input of broadcast message 1: Enabled, 0: Disabled
	bit E	Terminal S7 input of broadcast message 1: Enabled, 0: Disabled
	bit F	Reserved
0010 - 001F	Reserved	
15C0	bit 0	Extended multi-function input command 1
	bit 1	Extended multi-function input command 2
	bit 2	Extended multi-function input command 3
	bit 3 - F	Reserved
3004	Time Setting Setting range: 0000 to 2359 (decimal), the default value at energize: 0000 Set the hour and the minute in HHMM format. • HH: 00 to 23 (decimal) • MM: 00 to 59 (decimal)	
3005	Year and Day Setting Setting range: 1600 to 9906 (decimal), the default value at energize: 1600 Set the year and the day of the week in YYDW format. • YY: the last two digits of the year from 16 to 99 (decimal) • DW: the day of the week – Sunday: 00 – Monday: 01 – Tuesday: 02 – Wednesday: 03 – Thursday: 04 – Friday: 05 – Saturday: 06	
3006	Date Setting Setting range: 101 to 1231 (decimal), the default value at energize: 101 Set the month and the date in MMDD format. • MM: 01 to 12 (decimal) • DD: 01 to 31 (decimal)	
3007	Set the Date Information Setting range: 0 to 8 (decimal), the default value at energize: 8 Set the values specified in 3004H to 3006H as the date and time. • Command Data: 1 • Response Data: 0 (normal), 8 (fault)	

■ Monitor Data

You can only read monitor data.

Table 6.15 Monitor Data for MEMOBUS/Modbus Communication

Register No. (Hex.)	Description	
0020	Drive Status 1	
	bit 0	During Run 1: During run, 0: During stop
	bit 1	During Reverse 1: During reverse, 0: Forward run
	bit 2	Drive ready 1: Ready, 0: Not ready
	bit 3	Fault 1: Fault
	bit 4	Data Setting Error 1: oPExx error
	bit 5	MFDO (terminal MA/MB-MC) 1: ON, 0: OFF
	bit 6	Multi-function photocoupler output 1 (terminal P1-C1) 1: ON, 0: OFF
	bit 7	Multi-function photocoupler output 2 (terminal P2-C2) 1: ON, 0: OFF
	bit 8 - B	Reserved
	bit C	SToF [Safe Torque OFF Hardware] 1: One of Safe Disable input 1 (terminal H1-HC) and Safe Disable input 2 (terminal H2-HC) is OFF (open) and the other is ON (closed)
	bit D	STo [Safe Torque OFF] 1: Both Safe Disable input 1 (terminal H1-HC) and Safe Disable input 2 (terminal H2-HC) are OFF (open)
	bit E	ComRef status 1: Enabled
	bit F	ComCtrl status 1: Enabled
0021	Fault Description 1	
	bit 0	oC [Overcurrent], GF [Ground Fault]
	bit 1	ov [Overvoltage]
	bit 2	oL2 [Drive Overload]
	bit 3	oH1 [Heatsink Overheat]
	bit 4	rH [Braking Resistor Overheat], rr [Dynamic Braking Transistor Fault]
	bit 5 - 6	Reserved
	bit 7	EF0 [Option Card External Fault], EF1 to EF7 [External Fault]
	bit 8	CPFxx [Hardware Fault] **Note:** Includes *oFx*.
	bit 9	oL1 [Motor Overload], oL3, oL4 [Overtorque Detection 1/2], UL3, UL4 [Undertorque Detection 1/2]
	bit A	PGo [Encoder (PG) Feedback Loss], oS [Overspeed], dEv [Speed Deviation]
	bit B	During Uv [Undervoltage] detection
	bit C	Uv1 [DC Bus Undervoltage], Uv2 [Control Power Undervoltage], Uv3 [Soft Charge Answerback Fault]
	bit D	LF [Output Phase Loss], PF [Input Phase Loss]
	bit E	CE [Modbus Communication Error], bUS [Option Communication Error]
	bit F	Reserved

Register No. (Hex.)	Description	
0022	Fault Contents	
	bit 0	1: During data writing, during motor switching
	bit 1	Reserved
	bit 2	Reserved
	bit 3	1: Upper/Lower Limit Fault
	bit 4	1: Data Integrity Fault
	bit 5	1: During EEPROM writing
	bit 6	0: EEPROM writing 1: Change data only on the RAM **Note:** Enabled when *H5-17 = 1 [ENTER Command Response @CPU BUSY = Write to RAM Only]*.
	bit 7 - F	Reserved
0023	U1-01 [Frequency Reference] **Note:** *o1-03 [Frequency Display Unit Selection]* sets the units.	
0024	U1-02 [Output Frequency] **Note:** *o1-03 [Frequency Display Unit Selection]* sets the units.	
0025	U1-06 [Output Voltage Ref] (units: 0.1 V) **Note:** Use *H5-10 [Modbus Register 0025H Unit Sel]* to change the setting unit.	
0026	U1-03 [Output Current] (units: 0.1 A)	
0027	U1-08 [Output Power]	
0028	U1-09 [Torque Reference]	
0029	Fault Description 2	
	bit 0	Reserved
	bit 1	GF [Ground Fault]
	bit 2	PF [Input Phase Loss]
	bit 3	LF [Output Phase Loss]
	bit 4	rH [Braking Resistor Overheat]
	bit 5	Reserved
	bit 6	oH4 [Motor Overheat Fault (PTC Input)]
	bit 7 - F	Reserved
002A	Minor Fault Description 1	
	bit 0 - 1	Reserved
	bit 2	EF [FWD/REV Run Command Input Error]
	bit 3	bb [Baseblock]
	bit 4	oL3 [Overtorque 1]
	bit 5	oH [Heatsink Overheat]
	bit 6	ov [Overvoltage]
	bit 7	Uv [Undervoltage]
	bit 8	Reserved
	bit 9	CE [Modbus Communication Error]
	bit A	bUS [Option Communication Error]
	bit B	UL3/UL4 [Undertorque Detection 1/2]
	bit C	oH3 [Motor Overheat (PTC Input)]
	bit D - E	Reserved
	bit F	CALL [Serial Comm Transmission Error]

Register No. (Hex.)	Description	
002B	U1-10 [Input Terminal Status]	
	bit 0	1: Control circuit terminal S1 ON
	bit 1	1: Control circuit terminal S2 ON
	bit 2	1: Control circuit terminal S3 ON
	bit 3	1: Control circuit terminal S4 ON
	bit 4	1: Control circuit terminal S5 ON
	bit 5	1: Control circuit terminal S6 ON
	bit 6	1: Control circuit terminal S7 ON
	bit 7 - F	Reserved
002C	Drive Status 2	
	bit 0	During Run 1: During Run
	bit 1	During zero speed 1: During zero speed
	bit 2	Speed agreement 1: During agreement
	bit 3	User-defined speed agreement 1: During agreement
	bit 4	Frequency Detection 1 1: Output frequency ≤ L4-01
	bit 5	Frequency Detection 2 1: Output frequency ≥ L4-01
	bit 6	Drive ready 1: Run ready
	bit 7	During low voltage detection 1: During detection
	bit 8	During Baseblock 1: Drive output during baseblock
	bit 9	Frequency reference mode 1: No communication option, 0: Communication option
	bit A	Run command mode 1: No communication option, 0: Communication option
	bit B	During overtorque/undertorque 1, 2 detection
	bit C	Frequency reference loss 1: Loss
	bit D	Executing Auto-Restart 1: Restart Enabled
	bit E	Fault 1: Fault generated
	bit F	MEMOBUS/Modbus communications timeout 1: At Timeout
002D	U1-11 [Output Terminal Status]	
	bit 0	MFDO (terminal MA/MB-MC) 1: ON, 0: OFF
	bit 1	Multi-function photocoupler output 1 (terminal P1-C1) 1: ON, 0: OFF
	bit 2	Multi-function photocoupler output 2 (terminal P2-C2) 1: ON, 0: OFF
	bit 3 - F	Reserved
002E - 0030	Reserved	
0031	U1-07 [DC Bus Voltage] (unit: 1 V)	
0032	U1-09 [Torque Reference] (unit: 1%)	
0033	Reserved	

Register No. (Hex.)	Description	
0034	Product Code 1 (2-character ASCII code), GA500 = “0A”	
0035	Product Code 2 (2-character ASCII code), GA500 = “50”	
0036 - 003C	Reserved	
003D	Communications error description **Note:** The drive saves the description of the communications error until you reset the fault.	
	bit 0	CRC Error
	bit 1	Data Length Error
	bit 2	Reserved
	bit 3	Parity Error
	bit 4	Overrun Error
	bit 5	Framing Error
	bit 6	Timeout
	bit 7 - F	Reserved
003E	Output frequency	Units: min^{-1} or r/min **Note:** Set *E2-04 [Motor Pole Count]*.
003F		0.01% units
0040 - 004A	Used with *U1-xx [Operation Status Monitors]*. Refer to *U Monitor* for more information.	
004B	U1-12 [Drive Status]	
	bit 0	1: During Run
	bit 1	1: During zero speed
	bit 2	1: During reverse
	bit 3	1: During reset signal input
	bit 4	1: During speed agreement
	bit 5	1: Drive operation ready
	bit 6	1: Minor Fault
	bit 7	1: Fault
	bit 8	1: oPExx [Operation Error] generation
	bit 9	1: Recovery from momentary power loss, 0: Power recovery
	bit A - B	Reserved
	bit E	ComRef status/ NetRef status
	bit F	ComCtrl status/ NetCtrl status
004C - 007E	Use with *U1-xx, U4-xx, U6-xx [Monitors]*. Refer to *U Monitor* for more information.	
007F	Minor fault code (Refer to “Minor fault description” for more information about the minor fault codes.)	
0080 - 0097	Use with *U2-xx, U3-xx [Monitors]*. Refer to “U Monitor” for more information, and refer to “Fault Trace/Fault History Descriptions” for more information about register values.	
0098 - 0099	U4-01 [Cumulative Ope Time] Example: When *U4-01 [Cumulative Ope Time = 12345]*, 0098 (Hex.) = 1234 and 0099 (Hex.) = 5.	
009A - 009B	U4-03 [Cooling Fan Ope Time] Example: When *U4-03 [Cooling Fan Ope Time = 12345]*, 009A (Hex.) = 1234 and 009B (Hex.) = 5.	
009C - 00AA	Reserved	
00AB	Drive rated current **Note:** The unit of display is different for different models. 2018 - 2033, and 4009 - 4018: 0.01 A 2047 - 2075, 4024 - 4045: 0.1 A	
00AC	U1-05 [Motor Speed]	Units: min^{-1} or r/min **Note:** Set *E2-04 [Motor Pole Count]*.
00AD		Units: 0.01%

Register No. (Hex.)	Description	
00AE, 00AF	Reserved	
00B0	Option codes connected to CN5	The drive stores option codes in the register. E.g.: SI-S3 = 5353 (Hex.)
00B1 - 00B4	Reserved	
00B5	U1-16 [SFS Output Frequency]	Units: min^{-1} or r/min **Note:** Set *E2-04 [Motor Pole Count]*.
00B6		Units: 0.01%
00B7	Frequency reference monitor	Units: min^{-1} or r/min **Note:** Set *E2-04 [Motor Pole Count]*.
00B8		Units: 0.01%
00B9 - 00BE	Reserved	
00BF	Operation error number *xx* of *oPExx* is displayed.	
00C0	Fault Description 3	
	bit 0	Reserved
	bit 1	Uv1 [DC Bus Undervoltage]
	bit 2	Uv2 [Control Power Undervoltage]
	bit 3	Uv3 [Soft Charge Answerback Fault]
	bit 4	SC [Short Circuit/IGBT Failure]
	bit 5	GF [Ground Fault]
	bit 6	oC [Overcurrent]
	bit 7	ov [Overvoltage]
	bit 8	oH [Heatsink Overheat]
	bit 9	oH1 [Heatsink Overheat]
	bit A	oL1 [Motor Overload]
	bit B	oL2 [Drive Overload]
	bit C	oL3 [Overtorque Detection 1]
	bit D	oL4 [Overtorque Detection 2]
	bit E	rr [Dynamic Braking Transistor Fault]
	bit F	rH [Braking Resistor Overheat]
00C1	Fault Description 4	
	bit 0	EF3 [External Fault (Terminal S3)]
	bit 1	EF4 [External Fault (Terminal S4)]
	bit 2	EF5 [External Fault (Terminal S5)]
	bit 3	EF6 [External Fault (Terminal S6)]
	bit 4	EF7 [External Fault (Terminal S7)]
	bit 5 - 6	Reserved
	bit 7	oS [Overspeed]
	bit 8	dEv [Speed Deviation]
	bit 9	PGo [Encoder (PG) Feedback Loss]
	bit A	PF [Input Phase Loss]
	bit B	LF [Output Phase Loss]
	bit C	oH3 [Motor Overheat (PTC Input)]
	bit D	Reserved
	bit E	Err [EEPROM Write Error]
	bit F	oH4 [Motor Overheat Fault (PTC Input)]

Register No. (Hex.)	Description	
00C2	Fault Description 5	
	bit 0	CE [Modbus Communication Error]
	bit 1	bUS [Option Communication Error]
	bit 2 - 3	Reserved
	bit 4	CF [Control Fault]
	bit 5	Reserved
	bit 6	EF0 [Option Card External Fault]
	bit 7	Reserved
	bit 8	UL3 [Undertorque Detection 1]
	bit 9	UL4 [Undertorque Detection 2]
	bit A - E	Reserved
	bit F	Hardware Fault (includes *oFx* fault)
00C3	Fault Description 6	
	bit 0 - 4	Reserved
	bit 5	LF2 [Output Current Imbalance]
	bit 6 - F	Reserved
00C4	Fault Description 7	
	bit 0	Reserved
	bit 1	EF1 [External Fault (Terminal S1)]
	bit 2	EF2 [External Fault (Terminal S2)]
	bit 3	oL5 [Mechanical Weakening Detection 1]
	bit 4	UL5 [Mechanical Weakening Detection 2]
	bit 5	CoF [Current Offset Fault]
	bit 6 - 7	Reserved
	bit 8	dWFL [DriveWorksEZ Fault]
	bit 9	dWF1 [EEPROM Memory DWEZ Data Error]
	bit A	dWF2 [DriveWorksEZ Fault 2]
	bit B	dWF3 [DriveWorksEZ Fault 3]
	bit C	Reserved
	bit D	rF [Braking Resistor Fault]
	bit E	boL [BrakingTransistor Overload Fault]
	bit F	Reserved
00C5	Fault Description 8	
	bit 0	Reserved
	bit 1	nSE [Node Setup Error]
	bit 2 - F	Reserved
00C6 - 00C7	Reserved	

Register No. (Hex.)	Description	
00C8	Minor Fault Description 2	
	bit 0	Uv [Undervoltage]
	bit 1	ov [Overvoltage]
	bit 2	oH [Heatsink Overheat]
	bit 3	Reserved
	bit 4	oL3 [Overtorque 1]
	bit 5	oL4 [Overtorque 2]
	bit 6	EF [FWD/REV Run Command Input Error]
	bit 7	bb [Baseblock]
	bit 8	EF3 [External Fault (Terminal S3)]
	bit 9	EF4 [External Fault (Terminal S4)]
	bit A	EF5 [External Fault (Terminal S5)]
	bit B	EF6 [External Fault (Terminal S6)]
	bit C	EF7 [External Fault (Terminal S7)]
	bit D - E	Reserved
	bit F	oS [Overspeed]
00C9	Minor Fault Description 3	
	bit 0	dEv [Speed Deviation]
	bit 1	PGo [Encoder (PG) Feedback Loss]
	bit 2	Reserved
	bit 3	CE [Modbus Communication Error]
	bit 4	bUS [Option Communication Error]
	bit 5	CALL [Serial Comm Transmission Error]
	bit 6	oL1 [Motor Overload]
	bit 7	oL2 [Drive Overload]
	bit 8	Reserved
	bit 9	EF0 [Option Card External Fault]
	bit A - B	Reserved
	bit C	CALL [Serial Comm Transmission Error]
	bit D	UL3 [Undertorque Detection 1]
	bit E	UL4 [Undertorque Detection 2]
	bit F	SE [Modbus Test Mode Error]
00CA	Minor Fault Description 4	
	bit 0	Reserved
	bit 1	oH3 [Motor Overheat (PTC Input)]
	bit 2 - 8	Reserved
	bit 9	dnE [Drive Disabled]
	bit A - F	Reserved

Register No. (Hex.)	Description	
00CB	Minor Fault Description 5	
	bit 0	Reserved
	bit 1	AEr [Station Address Setting Error]
	bit 2	Reserved
	bit 3	HCA [High Current Alarm]
	bit 4	LT-1 [Cooling Fan Maintenance Time]
	bit 5	LT-2 [Capacitor Maintenance Time]
	bit 6 - 7	Reserved
	bit 8	EF1 [External Fault (Terminal S1)]
	bit 9	EF2 [External Fault (Terminal S2)]
	bit A	SToF [Safe Torque OFF Hardware]
	bit B	Reserved
	bit C	oL5 [Mechanical Weakening Detection 1]
	bit D	UL5 [Mechanical Weakening Detection 2]
	bit E - F	Reserved
00CC	Minor Fault Description 6	
	bit 0	Reserved
	bit 1	TrPC [IGBT Maintenance Time (90%)]
	bit 2	LT-3 [SoftChargeBypassRelay MainteTime]
	bit 3	LT-4 [IGBT Maintenance Time (50%)]
	bit 4	boL [Braking Transistor Overload]
	bit 5 - 7	Reserved
	bit 8	dWAL [DriveWorksEZ Alarm]
	bit 9	dWA2 [DriveWorksEZ Alarm 2]
	bit A	dWA3 [DriveWorksEZ Alarm 3]
	bit B - F	Reserved
00CD - 00CF	Reserved	
00D0	CPF Contents 1	
	bit 0 - 1	Reserved
	bit 2	CPF02 [Control Circuit Error]
	bit 3	CPF03 [Control Circuit Error]
	bit 4 - 5	Reserved
	bit 6	CPF06 [Control Circuit Error]
	bit 7	Reserved
	bit 8	CPF08 [Control Circuit Error]
	bit 9 - A	Reserved
	bit B	CPF11 [Control Circuit Error]
	bit C	CPF12 [Control Circuit Error]
	bit D	CPF13 [Control Circuit Error]
	bit E	CPF14 [Control Circuit Error]
	bit F	Reserved

Register No. (Hex.)	Description	
00D1	CPF Contents 2	
	bit 0	CPF16 [Control Circuit Error]
	bit 1	CPF17 [Control Circuit Error]
	bit 2	CPF18 [Control Circuit Error]
	bit 3	CPF19 [Control Circuit Error]
	bit 4	CPF20 [Control Circuit Error]
	bit 5	CPF21 [Control Circuit Error]
	bit 6	CPF22 [Control Circuit Error]
	bit 7	CPF23 [Control Circuit Error]
	bit 8	CPF24 [Control Circuit Error]
	bit 9 - F	Reserved
00D2	CPF Contents 3	
	bit 0- 5	Reserved
	bit 6	CPF38 [Control Circuit Error]
	bit 7 - F	Reserved
00D3 - 00D7	Reserved	
00D8	oFA0x Description (CN5-A)	
	bit 0	oFA00 [Option Not Compatible with Port]
	bit 1	oFA01 [Option Fault/Connection Error]
	bit 2 - 4	Reserved
	bit 5	oFA05 [Option A/D Error]
	bit 6	oFA06 [Option Communication Error]
	bit 7 - F	Reserved
00D9	oFA1x Description (CN5-A)	
	bit 0	oFA10 [Option RAM Error]
	bit 1	oFA11 [Option Ope Mode Error]
	bit 2	oFA12 [Drive Receive CRC Error]
	bit 3	oFA13 [Drive Receive Frame Error]
	bit 4	oFA14 [Drive Receive Abort Error]
	bit 5	oFA15 [Option Receive CRC Error]
	bit 6	oFA16 [Option Receive Frame Error]
	bit 7	oFA17 [Option Receive Abort Error]
	bit 8 - F	Reserved
00DA	Reserved	

Register No. (Hex.)	Description	
00DB	oFA3x Description (CN5-A)	
	bit 0	oFA30 [COM ID Error]
	bit 1	oFA31 [Type Code Error]
	bit 2	oFA32 [SUM Check Error]
	bit 3	oFA33 [Option Receive Time Over]
	bit 4	oFA34 [Memobus Time Over]
	bit 5	oFA35 [Drive Receive Time Over 1]
	bit 6	oFA36 [CI Check Error]
	bit 7	oFA37 [Drive Receive Time Over 2]
	bit 8	oFA38 [Control Reference Error]
	bit 9	oFA39 [Drive Receive Time Over 3]
	bit A	oFA40 [CtrlResSel 1Err]
	bit B	oFA41 [Drive Receive Time Over 4]
	bit C	oFA42 [CtrlResSel 2Err]
	bit D	oFA43 [Drive Receive Time Over 5]
	bit E - F	Reserved
00DC - 00E4	Reserved	
00E5	Minor Fault Description 9	
	bit 0	EP24v [External Power 24V Supply]
	bit 1 - 3	Reserved
	bit 4	bAT [Keypad Battery Low Voltage]
	bit 5	Reserved
	bit 6	CP1 [Comparator 1 Limit Fault]
	bit 7	CP2 [Comparator 2 Limit Fault]
	bit 8	TiM [Keypad Time Not Set]
	bit 9	bCE [Bluetooth Communication Error]
	bit A - F	Reserved
00E6 - 00E9	Reserved	
00EA	Fault Description 11	
	bit 0	TiM [Keypad Time Not Set]
	bit 1	bAT [Keypad Battery Low Voltage]
	bit 2- D	Reserved
	bit E	SCF [Safety Circuit Fault]
	bit F	Reserved
00EB - 00ED	Reserved	
00EE	Fault Description 12	
	bit 0 - 2	Reserved
	bit 3	CP1 [Comparator 1 Limit Fault]
	bit 4	CP2 [Comparator 2 Limit Fault]
	bit 5	bCE [Bluetooth Communication Fault]
	bit 6 - F	Reserved
00EF - 00FA	Reserved	
00FB	Output current **Note:** The unit of display is different for different models. 2018 - 2033, and 4009 - 4018: 0.01 A 2047 - 2075, 4024 - 4045: 0.1 A	

■ Broadcast Messages

Broadcast messages are available as read-only.
The undefined bit signal in the broadcast operation signal uses the local data signal.

Table 6.16 Broadcast Messages for MEMOBUS/Modbus Communication

Register No. (Hex.)	Description	
0001	Operation signal	
	bit 0	Run command 1: Run, 0: Stop
	bit 1	Reverse run command 1: Reverse, 0: Forward run
	bit 2 - 3	Reserved
	bit 4	External fault 1: EF0 [Option Card External Fault]
	bit 5	Fault Reset 1: Reset command
	bit 6 - B	Reserved
	bit C	MFDI terminal S5 input
	bit D	MFDI terminal S6 input
	bit E	MFDI terminal S7 input
	bit F	Reserved
0002	Frequency reference	30000/100%

■ Fault Trace/Fault History Contents

Table 6.17 shows the fault codes that the commands from monitors *[U2-xx, U3-xx]* read.

Table 6.17 Fault Trace/Fault History Contents

Fault Code (Hex.)	Name	Fault Code (Hex.)	Name
0002	Uv1 [DC Bus Undervoltage]	001A	PGo [Encoder (PG) Feedback Loss]
0003	Uv2 [Control Power Undervoltage]	001B	PF [Input Phase Loss]
0004	Uv3 [Soft Charge Answerback Fault]	001C	LF [Output Phase Loss]
0005	SC [Short Circuit/IGBT Failure]	001D	oH3 [Motor Overheat (PTC Input)]
0006	GF [Ground Fault]	001F	Err [EEPROM Write Error]
0007	oC [Overcurrent]	0020	oH4 [Motor Overheat Fault (PTC Input)]
0008	ov [Overvoltage]	0021	CE [Modbus Communication Error]
0009	oH [Heatsink Overheat]	0022	bUS [Option Communication Error]
000A	oH1 [Heatsink Overheat]	0025	CF [Control Fault]
000B	oL1 [Motor Overload]	0027	EF0 [Option Card External Fault]
000C	oL2 [Drive Overload]	0028	Reserved
000D	oL3 [Overtorque Detection 1]	0029	UL3 [Undertorque Detection 1]
000E	oL4 [Overtorque Detection 2]	002A	UL4 [Undertorque Detection 2]
000F	rr [Dynamic Braking Transistor Fault]	002B	oL7 [High Slip Braking Overload]
0010	rH [Braking Resistor Overheat]	0030	Includes oFx Fault [Hardware Fault]
0011	EF3 [External Fault (Terminal S3)]	0036	LF2 [Output Current Imbalance]
0012	EF4 [External Fault (Terminal S4)]	0037	STPo [Motor Step-Out Detected]
0013	EF5 [External Fault (Terminal S5)]	003B	SEr [Speed Search Retries Exceeded]
0014	EF6 [External Fault (Terminal S6)]	0041	Reserved
0015	EF7 [External Fault (Terminal S7)]	0042	EF1 [External Fault (Terminal S1)]
0018	oS [Overspeed]	0043	EF2 [External Fault (Terminal S2)]
0019	dEv [Speed Deviation]	0044	oL5 [Mechanical Weakening Detection 1]

Fault Code (Hex.)	Name	Fault Code (Hex.)	Name
0045	UL5 [Mechanical Weakening Detection 2]	0107	oFA06 [Option Communication Error]
0046	CoF [Current Offset Fault]	0111	oFA10 [Option RAM Error]
0049	dWFL [DriveWorksEZ Fault]	0112	oFA11 [Option Ope Mode Error]
004A	dWF1 [EEPROM Memory DWEZ Data Error]	0113	oFA12 [Drive Receive CRC Error]
004B	dWF2 [DriveWorksEZ Fault 2]	0114	oFA13 [Drive Receive Frame Error]
004C	dWF3 [DriveWorksEZ Fault 3]	0115	oFA14 [Drive Receive Abort Error]
004E	rF [Braking Resistor Fault]	0116	oFA15 [Option Receive CRC Error]
004F	boL [BrakingTransistor Overload Fault]	0117	oFA16 [Option Receive Frame Error]
0051	Reserved	0118	oFA17 [Option Receive Abort Error]
0052	nSE [Node Setup Error]	0131	oFA30 [COM ID Error]
005B	Reserved	0132	oFA31 [Type Code Error]
0083	CPF02 [Control Circuit Error]	0133	oFA32 [SUM Check Error]
0084	CPF03 [Control Circuit Error]	0134	oFA33 [Option Receive Time Over]
0087	CPF06 [Control Circuit Error]	0135	oFA34 [Memobus Time Over]
0089	CPF08 [Control Circuit Error]	0136	oFA35 [Drive Receive Time Over 1]
008C	CPF11 [Control Circuit Error]	0137	oFA36 [CI Check Error]
008D	CPF12 [Control Circuit Error]	0138	oFA37 [Drive Receive Time Over 2]
008E	CPF13 [Control Circuit Error]	0139	oFA38 [Control Reference Error]
008F	CPF14 [Control Circuit Error]	013A	oFA39 [Drive Receive Time Over 3]
0091	CPF16 [Control Circuit Error]	013B	oFA40 [CtrlResSel 1Err]
0092	CPF17 [Control Circuit Error]	013C	oFA41 [Drive Receive Time Over 4]
0093	CPF18 [Control Circuit Error]	013D	oFA42 [CtrlResSel 2Err]
0094	CPF19 [Control Circuit Error]	013E	oFA43 [Drive Receive Time Over 5]
0095	CPF20 [Control Circuit Error]	0401	TiM [Keypad Time Not Set]
0096	CPF21 [Control Circuit Error]	0402	bAT [Keypad Battery Low Voltage]
0097	CPF22 [Control Circuit Error]	040F	SCF [Safety Circuit Fault]
0098	CPF23 [Control Circuit Error]	0414	CP1 [Comparator 1 Limit Fault]
0099	CPF24 [Control Circuit Error]	0415	CP2 [Comparator 2 Limit Fault]
00A7	CPF38 [Control Circuit Error]	0416	bCE [Bluetooth Communication Fault]
0101	oFA00 [Option Not Compatible with Port]	041A	dCE1 [Communication Error1]
0102	oFA01 [Option Fault/Connection Error]	041B	dCE2 [Communication Error2]
0106	oFA05 [Option A/D Error]	045F	oC2 [Overcurrent2]

■ Minor Fault/Alarm Contents

Table 6.18 shows the minor fault/alarm codes that communications register (007F (Hex.)) reads.

Table 6.18 Minor Fault/Alarm Contents (007 (Hex.))

Minor Fault/ Alarm Code (Hex.)	Name	Minor Fault/ Alarm Code (Hex.)	Name
0001	Uv [Undervoltage]	000A	EF4 [External Fault (Terminal S4)]
0002	ov [Overvoltage]	000B	EF5 [External Fault (Terminal S5)]
0003	oH [Heatsink Overheat]	000C	EF6 [External Fault (Terminal S6)]
0005	oL3 [Overtorque 1]	000D	EF7 [External Fault (Terminal S7)]
0006	oL4 [Overtorque 2]	0010	oS [Overspeed]
0007	EF [FWD/REV Run Command Input Error]	0011	dEv [Speed Deviation]
0008	bb [Baseblock]	0012	PGo [Encoder (PG) Feedback Loss]
0009	EF3 [External Fault (Terminal S3)]	0014	CE [Modbus Communication Error]

Minor Fault/ Alarm Code (Hex.)	Name
0015	bUS [Option Communication Error]
0016	CALL [Serial Comm Transmission Error]
0017	oL1 [Motor Overloaded]
0018	oL2 [Drive Overloaded]
001A	EF0 [Option Card External Fault]
001B	rUn [Motor Switch during Run]
001D	CALL [Serial Comm Transmission Error]
001E	UL3 [Undertorque Detection 1]
001F	UL4 [Undertorque Detection 2]
0020	SE [Modbus Test Mode Error]
0021	L24v [Loss of External Power 24 Supply]
0022	oH3 [Motor Overheat (PTC Input)]
0027	Reserved
0028	Reserved
002A	dnE [Drive Disabled]
0032	AEr [Station Address Setting Error]
0033	Reserved
0034	HCA [High Current Alarm]
0035	LT-1 [Cooling Fan Maintenance Time]

Minor Fault/ Alarm Code (Hex.)	Name
0036	LT-2 [Capacitor Maintenance Time]
0039	EF1 [External Fault (Terminal S1)]
003A	EF2 [External Fault (Terminal S2)]
003B	SToF [Safe Torque OFF Hardware]
003D	oL5 [Mechanical Weakening Detection 1]
003E	UL5 [Mechanical Weakening Detection 2]
0042	TrPC [IGBT Maintenance Time (90%)]
0043	LT-3 [SoftChargeBypassRelay MainteTime]
0044	LT-4 [IGBT Maintenance Time (50%)]
0045	boL [Braking Transistor Overload]
0049	dWAL [DriveWorksEZ Alarm]
004A	dWA2 [DriveWorksEZ Alarm 2]
004B	dWA3 [DriveWorksEZ Alarm 3]
0081	EP24v [External Power 24V Supply]
0085	bAT [Keypad Battery Low Voltage]
0087	CP1 [Comparator 1 Limit Error]
0088	CP2 [Comparator 2 Limit Error]
0089	TiM [Keypad Time Not Set]
008A	bCE [Bluetooth Communication Error]

◆ Error Codes

■ MEMOBUS/Modbus Communications Error Code List

Table 6.19 lists the MEMOBUS/Modbus communications error codes.
When an error occurs, remove the cause of the error and restart communications.

Table 6.19 MEMOBUS/Modbus Communications Error Codes

Error Code (Hex.)	Name	Cause
01	Function Code Error	The PLC set a function code that was not 03, 08, or 10 (Hex.)
02	Register Number Error	• The register number that is trying to access is not registered. • A starting number that was not 0001 or 0002 (Hex.) was set when broadcasting.
03	Bit Count Error	• Read and write data quantities are more than the 1 to 16 range. (Command message data quantity is disabled.) • The data that was read from non-consecutive holding registers contained more than 120 bytes. • The data to be written to non-consecutive holding registers contained more than 60 bytes. • In the write mode, the number of bytes in the message is not the number of data × 2.
21	Data Setting Error	• Writing control data or parameters made the settings go out of the permitted setting range. • A parameter setting error occurred when writing a parameter.
22	Write Mode Error	• Tried to write a disabled parameter during run. • When there was a *CPF06 [Control Circuit Error]*, the master tried to write a parameter other than one of these: – *A1-00 [Language Selection]* – *A1-01 [Access Level Selection]* – *A1-02 [Control Method Selection]* – *A1-03 [Initialize Parameters]* – *A1-04 [Password]* – *A1-05 [Password Setting]* – *E1-03 [V/f Pattern Selection]* – *o2-04 [Drive Model (KVA) Selection]* • Writes the read-only data.
23	DC Bus Undervoltage Write Error	During *Uv [DC Bus Undervoltage]*, a *Uv* write disabled parameter was written.

Error Code (Hex.)	Name	Cause
24	Error Writing Data During Parameter Processing	Tried to write a parameter from the master during parameter processing on the drive side.
25	Writing into EEPROM Disabled	Writing into EEPROM write is disabled, but EEPROM write was executed from MEMOBUS/Modbus communications. When this error occurs, the keypad shows a message and the drive continues operation.

■ No Response from Slave

The slave ignores the command message from the master and will not send a response message in these conditions:

- When a communications error (overrun, framing, parity, CRC-16) is detected in the command message.
- When the slave address in the command message and the slave address for the drive side do not agree (Use *H5-01 [Drive Node Address]* to set the slave address of the drive)
- When the time interval between the data of which the message is composed is longer than 24 bits
- When the data length for the command message is not accurate

Note:
- If the keypad shows *CALL [Serial Comm Transmission Error]*, refer to “Troubleshooting” to remove the cause of the error, and try to do communications again. If the keypad does not show *CALL*, check *U1-19 [MEMOBUS/Modbus Error Code]* for the error and error type.
- If you execute the write function code when the slave address in the command message is 00 (Hex.), all of the slaves will execute the write command, but they will not send response messages to the master.

7

Troubleshooting

7.1 Section Safety

DANGER

Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

WARNING

Electrical Shock Hazard

Do not operate the drive when covers are missing. Replace covers and shields before you operate the drive. Use the drive only as specified by the instructions.

Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. If covers or safety shields are missing from the drive, it can cause serious injury or death.

Always ground the motor-side grounding terminal.

If you do not ground the equipment correctly, it can cause serious injury or death if you touch the motor case.

After the drive blows a fuse or trips an RCM/RCD, do not immediately energize the drive or operate peripheral devices. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. If you do not know the cause of the problem, contact Yaskawa before you energize the drive or peripheral devices.

If you do not fix the problem before you operate the drive or peripheral devices, it can cause serious injury or death.

Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive.

If personnel are not approved, it can cause serious injury or death.

Do not wear loose clothing or jewelry when you do work on the drive. Tighten loose clothing and remove all metal objects, for example watches or rings.

Loose clothing can catch on the drive and jewelry can conduct electricity and cause serious injury or death.

Do not remove covers or touch circuit boards while the drive is energized.

If you touch the internal components of an energized drive, it can cause serious injury or death.

Do not modify the drive body or drive circuitry.

Modifications to drive body and circuitry can cause serious injury or death, will cause damage to the drive, and will void the warranty. Yaskawa is not responsible for modifications of the product made by the user.

Fire Hazard

Tighten all terminal screws to the correct tightening torque.

Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.

Tighten screws at an angle in the specified range shown in this manual.

If you tighten the screws at an angle not in the specified range, you can have loose connections that can cause damage to the terminal block or start a fire and cause serious injury or death.

Damage to Equipment

Do not apply incorrect voltage to the main circuit of the drive. Operate the drive in the specified range of the input voltage on the drive nameplate.

Voltages that are higher than the permitted nameplate tolerance can cause damage to the drive.

⚠WARNING

Fire Hazard

Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material.

Flammable and combustible materials can start a fire and cause serious injury or death.

Crush Hazard

Wear eye protection when you do work on the drive.

If you do not use correct safety equipment, it can cause serious injury or death.

Use a crane or hoist to move large drives when necessary.

If you try to move a large drive without a crane or hoist, it can cause serious injury or death.

NOTICE

Damage to Equipment

When you touch the drive and circuit boards, make sure that you observe correct electrostatic discharge (ESD) procedures.

If you do not follow procedures, it can cause ESD damage to the drive circuitry.

Do not break the electrical connection between the drive and the motor when the drive is outputting voltage.

Incorrect equipment sequencing can cause damage to the drive.

Make sure that all connections are correct after you install the drive and connect peripheral devices.

Incorrect connections can cause damage to the drive.

Note:

Do not use unshielded wire for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive. Unshielded wire can cause electrical interference and unsatisfactory system performance.

7.2 Types of Faults, Minor Faults, Alarms, and Errors

If the drive or motor do not operate correctly, check the drive keypad for a code or message.

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

- Drive model
- Drive software version
- Date of purchase
- Description of the problem (for example failure conditions and modified parameters)

Table 7.1 contains descriptions of the different types of faults, minor faults, alarms, and errors that can occur during drive operation.

Contact Yaskawa if there is damage to the drive. Contact information is on the back cover of the manual.

Table 7.1 Types of Faults, Minor Faults, Alarms, and Errors

Type	Drive Response
Fault	When the drive detects a fault, it will cause these conditions: • The keypad shows the fault code, and ALM/ERR stays illuminated. • The drive shuts off output, and the motor coasts to a stop. Some faults let the user select a motor stopping method. • The terminal set to *H2-01 to H2-03 = E [MFDO Function Selection = Fault]* will activate. The drive will not operate until you clear the fault with a Fault Reset and the drive goes back to usual status.
Minor Faults/Alarms	When the drive detects a minor fault or an alarm, it will cause these conditions: • The keypad shows the alarm code, and ALM/ERR flashes. • The drive will continue to operate the motor. Some alarms let you select a motor stopping method. • If the drive detects a minor fault, the terminal set to *H2-01 to H2-03 = 10 [Alarm]* will activate If you do not set parameters *H2-01 to H2-03*, the drive will not trigger MFDO terminals if it detects a minor fault. • The drive will not output a minor fault signal if it detects an alarm. It is not necessary to do Fault Reset.
Operation Errors	An error occurs when parameter settings do not agree or a parameter combination is incorrect. The drive will not operate until you set the parameters correctly. When the drive detects an operation error, these conditions will result: • The keypad shows the error code. • Multi-function outputs do not output an alarm signal. Find the parameters that caused the error and correct the settings.
Auto-Tuning Error	An error occurs during Auto-Tuning. When the drive detects an operation error, it will cause these conditions: • The keypad shows the error code. • Multi-function outputs do not output an alarm signal. • The motor coasts to stop. Remove the cause of the error and do Auto-Tuning again.
Copy Function Error	An error occurs when you use the keypad for a backup, restore, or verify operation. When the drive detects a copy function error, it will cause these conditions: • The keypad shows the error code. • Multi-function outputs do not output an alarm signal. Push a key on the keypad to clear the error. Remove the cause of the error and try the backup, restore, or verify operation again.

7.3 List of Fault, Minor Fault, Alarm, and Error Codes

Table 7.2 shows the possible fault, minor fault, alarm, and error codes.

The display codes are in alphabetical order. Search the table for the code shown on the keypad, and identify its causes and possible solutions.

Note:

The number in parentheses adjacent to the code in the table identifies the fault code or minor fault code (hex. number) that was read during MEMOBUS/Modbus communications.

Example: bCE (008A)

Table 7.2 List of Fault, Minor Fault, Alarm, and Error Codes

Display (Hex.)	Name	ALM LED	Type	Ref.
bAT (0085)	Keypad Battery Low Voltage	Flashing	Alarm	191
bAT (0402)	Keypad Battery Low Voltage	Illuminated	Fault	179
bb (0008)	Baseblock	Flashing	Alarm	191
bCE (008A)	Bluetooth Communication Error	Flashing	Alarm	191
bCE (0416)	Bluetooth Communication Fault	Illuminated	Fault	179
boL (0045)	Braking Transistor Overload	Flashing	Alarm	191
boL (004F)	BrakingTransistor Overload Fault	Illuminated	Fault	179
bUS (0015)	Option Communication Error	Flashing	Alarm	191
bUS (0022)	Option Communication Error	Illuminated	Fault	179
bUSy	Busy	Flashing	Alarm	191
CALL	Serial Comm Transmission Error	Flashing	Alarm	192
CE	Modbus Communication Error	Flashing	Alarm	192
CE (0021)	Modbus Communication Error	Illuminated	Fault	179
CF (0025)	Control Fault	Illuminated	Fault	180
CoF (0046)	Current Offset Fault	Illuminated	Fault	180
CPEr	Control Mode Mismatch	-	Backup Function Runtime Error	204
CPF00	Control Circuit Error	Illuminated	Fault	180
CPF01	Control Circuit Error	Illuminated	Fault	180
CPF02, CPF03 (0083, 0084)	Control Circuit Error	Illuminated	Fault	180, 181
CPF06 (0087)	EEPROM Memory Data Error	Illuminated	Fault	181
CPF08 (0089)	Terminal Board Connection Error	Illuminated	Fault	181
CPF11 - CPF14 (008C - 008F)	Control Circuit Error	Illuminated	Fault	181 - 181
CPF16 - CPF24 (0091 - 0099)	Control Circuit Error	Illuminated	Fault	181 - 181
CPF25 (009A)	Terminal Board not Connected	Illuminated	Fault	181
CPF38 (00A7)	EEPROM Memory Data Error	Illuminated	Fault	182
CPyE	Error Writing Data	-	Backup Function Runtime Error	204
CrST	Remove RUN Command to Reset	Flashing	Not an alarm.	192
CSEr	Control Mode Mismatch	-	Backup Function Runtime Error	204
dCE1 (041A)	Communication Error 1	Illuminated	Fault	182
dCE2 (041B)	Communication Error 2	Illuminated	Fault	182
dEv (0011)	Speed Deviation	Flashing	Alarm	192
dEv (0019)	Speed Deviation	Illuminated	Fault	182
dFPS	Drive Model Mismatch	-	Backup Function Runtime Error	204
dv7 (005B)	Polarity Judge Timeout	Illuminated	Fault	182
EF (0007)	FWD/REV Run Command Input Error	Flashing	Alarm	192
EF0 (001A)	External Fault via Communication	Flashing	Alarm	182
EF0 (0027)	External Fault via Communication	Illuminated	Fault	182

Display (Hex.)	Name	ALM LED	Type	Ref.
EF1 (0039)	External Fault (Terminal S1)	Flashing	Alarm	193
EF1 (0042)	External Fault (Terminal S1)	Illuminated	Fault	182
EF2 (003A)	External Fault (Terminal S2)	Flashing	Alarm	193
EF2 (0043)	External Fault (Terminal S2)	Illuminated	Fault	182
EF3 (0009)	External Fault (Terminal S3)	Flashing	Alarm	193
EF3 (0011)	External Fault (Terminal S3)	Illuminated	Fault	183
EF4 (000A)	External Fault (Terminal S4)	Flashing	Alarm	193
EF4 (0012)	External Fault (Terminal S4)	Illuminated	Fault	183
EF5 (000B)	External Fault (Terminal S5)	Flashing	Alarm	193
EF5 (0013)	External Fault (Terminal S5)	Illuminated	Fault	183
EF6 (000C)	External Fault (Terminal S6)	Flashing	Alarm	193
EF6 (0014)	External Fault (Terminal S6)	Illuminated	Fault	183
EF7 (000D)	External Fault (Terminal S7)	Flashing	Alarm	194
EF7 (0015)	External Fault (Terminal S7)	Illuminated	Fault	183
End1	Excessive Rated Voltage Setting	Flashing	Auto-Tuning Error	201
End2	Iron Core Saturation Coefficient	Flashing	Auto-Tuning Error	201
End3	Rated Current Setting Alarm	Flashing	Auto-Tuning Error	201
End4	Adjusted Slip Calculation Error	Flashing	Auto-Tuning Error	201
End5	Resistance Tuning Error	Flashing	Auto-Tuning Error	201
End6	Leakage Inductance Alarm	Flashing	Auto-Tuning Error	201
End7	No-Load Current Alarm	Flashing	Auto-Tuning Error	201
EP24v (0081)	External Power 24V Supply	Flashing	Alarm	194
Er-01	Motor Data Error	Flashing	Auto-Tuning Error	201
Er-02	Drive in an Alarm State	Flashing	Auto-Tuning Error	202
Er-03	STOP Button was Pressed	Flashing	Auto-Tuning Error	202
Er-04	Resistance Tuning Error	Flashing	Auto-Tuning Error	202
Er-05	No-Load Current Alarm	Flashing	Auto-Tuning Error	202
Er-08	Rated Slip Error	Flashing	Auto-Tuning Error	202
Er-09	Acceleration Error	Flashing	Auto-Tuning Error	203
Er-11	Motor Speed Error	Flashing	Auto-Tuning Error	203
Er-12	Current Detection Error	Flashing	Auto-Tuning Error	203
Er-13	Leakage Inductance Alarm	Flashing	Auto-Tuning Error	203
Er-15	Torque Saturation Error	Flashing	Auto-Tuning Error	203
Err (001F)	EEPROM Write Error	Illuminated	Fault	183
FRL (0059)	Speed Reference Missing	Illuminated	Fault	184
GF (0006)	Ground Fault	Illuminated	Fault	184
HCA (0034)	High Current Alarm	Flashing	Alarm	194
iFEr	Communication Err	-	Backup Function Runtime Error	204
L24v (0021)	Loss of External Power 24 Supply	Flashing	Alarm	194
LF (001C)	Output Phase Loss	Illuminated	Fault	184
LF2 (0036)	Output Current Imbalance	Illuminated	Fault	184
LoG	Log Com Error	Flashing	Alarm	194
LT-1 (0035)	Cooling Fan Maintenance Time	Flashing	Alarm	194
LT-2 (0036)	Capacitor Maintenance Time	Flashing	Alarm	194
LT-3 (0043)	SoftChargeBypassRelay MainteTime	Flashing	Alarm	195
LT-4 (0044)	IGBT Maintenance Time (50%)	Flashing	Alarm	195

Display (Hex.)	Name	ALM LED	Type	Ref.
ndAT	Model,VolClass,Capacity Mismatch	-	Backup Function Runtime Error	204
oC (0007)	Overcurrent	Illuminated	Fault	184
oH (0003)	Heatsink Overheat	Flashing	Alarm	195
oH (0009)	Heatsink Overheat	Illuminated	Fault	185
oH1 (000A)	Heatsink Overheat	Illuminated	Fault	185
oH3 (0022)	Motor Overheat (PTC Input)	Flashing	Alarm	195
oL1 (000B)	Motor Overload	Illuminated	Fault	186
oL2 (000C)	Drive Overload	Illuminated	Fault	186
oL3 (0005)	Overtorque 1	Flashing	Alarm	195
oL3 (000D)	Overtorque Detection 1	Illuminated	Fault	187
oL4 (0006)	Overtorque 2	Flashing	Alarm	196
oL4 (000E)	Overtorque Detection 2	Illuminated	Fault	187
oPE01	Drive Capacity Setting Fault	Flashing	Parameter Setting Error	199
oPE02	Parameter Range Setting Error	Flashing	Parameter Setting Error	199
oPE03	Multi-Function Input Setting Err	Flashing	Parameter Setting Error	199
oPE06	Control Method Selection Error	Flashing	Parameter Setting Error	200
oPE07	Analog Input Selection Error	Flashing	Parameter Setting Error	200
oPE08	Parameter Selection Error	Flashing	Parameter Setting Error	200
oPE10	V/f Data Setting Error	Flashing	Parameter Setting Error	200
oPE14	RPM Setting Error	Flashing	Parameter Setting Error	200
oPr (001E)	Keypad Connection Fault	Illuminated	Fault	187
oS (0010)	Overspeed	Flashing	Alarm	196
ov (0002)	Overvoltage	Flashing	Alarm	196
ov (0008)	Overvoltage	Illuminated	Fault	187
ovEr	Too Many Parameters Changed	-	Not an alarm.	196
PASS	Modbus Communication Test	Flashing	Not an alarm.	196
PF (0047)	Input Phase Loss	Flashing	Alarm	196
PF (001B)	Input Phase Loss	Illuminated	Fault	188
PGo (0012)	Encoder (PG) Feedback Loss	Flashing	Alarm	197
rdEr	Error Reading Data	-	Backup Function Runtime Error	204
rF (004E)	Braking Resistor Fault	Illuminated	Fault	188
rH (0010)	Braking Resistor Overheat	Illuminated	Fault	188
rr (000F)	Dynamic Braking Transistor Fault	Illuminated	Fault	188
SC (0005)	Short Circuit/IGBT Failure	Illuminated	Fault	188
SCF (040F)	Safety Circuit Fault	Illuminated	Fault	189
SE (0020)	Modbus Test Mode Error	Flashing	Alarm	197
STo (003C)	Safe Torque OFF	Flashing	Alarm	197
SToF (003B)	Safe Torque OFF	Flashing	Alarm	197
TiM (0089)	Keypad Time Not Set	Flashing	Alarm	197
TiM (0401)	Keypad Time Not Set	Illuminated	Fault	189
TrPC (0042)	IGBT Maintenance Time (90%)	Flashing	Alarm	197
UL3 (001E)	Undertorque Detection 1	Flashing	Alarm	198
UL3 (0029)	Undertorque Detection 1	Illuminated	Fault	189
UL4 (001F)	Undertorque Detection 2	Flashing	Alarm	198
UL4 (002A)	Undertorque Detection 2	Illuminated	Fault	189
Uv (0001)	DC Bus Undervoltage	Flashing	Alarm	198

Display (Hex.)	Name	ALM LED	Type	Ref.
Uv1 (0002)	DC Bus Undervoltage	Illuminated	Fault	189
Uv2 (0003)	Control Power Undervoltage	Illuminated	Fault	189
Uv3 (0004)	Soft Charge Answerback Fault	Illuminated	Fault	190
vAEr	Voltage Class, Capacity Mismatch	-	Backup Function Runtime Error	204
vFyE	Parameters do not Match	-	Backup Function Runtime Error	204

7.4 Fault

This section gives information about some of the causes and possible solutions of faults. You must use the Fault Reset operation to remove the fault before you can operate the drive. Use the information in this table to remove the cause of the fault.

Code	Name	Causes	Possible Solutions
bAT	Keypad Battery Low Voltage	The keypad battery voltage is low.	Replace the keypad battery.

Note:
Use *o4-24 [bAT Detection Selection]* to enable/disable *bAT* detection.

Code	Name	Causes	Possible Solutions
bCE	Bluetooth Communication Fault	The smartphone or tablet with DriveWizard Mobile or DriveWizard installed is too far from the keypad.	Use the smartphone or tablet 10 m (32.8 ft) or nearer to the keypad. **Note:** *bCE* can occur when the smartphone or tablet is 10 m (32.8 ft) or nearer to the keypad depending on the specifications of the smartphone or tablet.
		Radio waves from a different device are causing interference with communications between the smartphone or tablet and keypad.	Make sure that no device around the keypad uses the same radio bandwidth (2400 MHz to 2480 MHz), and prevent radio interference.

Note:
- The drive detects this error when you use the Bluetooth LCD keypad to operate the drive from a smartphone or tablet.
- Do a Fault Reset to clear the fault.
- Set the stopping method for this fault in *o2-27 [bCE Detection Selection]*.

Code	Name	Causes	Possible Solutions
boL	BrakingTransistor Overload Fault	The duty cycle of the braking transistor is high (the regeneration power or repetition frequency is high).	• Install a regenerative converter. • Increase the deceleration time.
		You enabled the protective function for the braking transistor when you have a regenerative converter.	Set *L8-55 = 0 [Internal DB TransistorProtection Selection = Disable]*.
		The braking transistor in the drive is broken.	Replace the drive.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
bUS	Option Communication Error	The drive did not receive a signal from the controller.	Correct wiring errors.
		The communications cable wiring is incorrect.	
		There is a short-circuit in the communications cable or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The option is incorrectly installed to the drive.	Correctly install the option to the drive.
		The option is damaged.	If the fault continues and the wiring is correct, replace the option.

Note:
- The drive detects this error if the Run command or frequency reference is assigned to the option card.
- Do a Fault Reset to clear the fault.
- If the drive detects this error, the drive will operate the motor as specified by the stopping method set in *F6-01 [Communication Error Selection]*.

Code	Name	Causes	Possible Solutions
CE	Modbus Communication Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short circuit in the communications cable or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.

Code	Name	Causes	Possible Solutions
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.

Note:
- The drive detects this error if it does not correctly receive control data for the *CE* detection time set to *H5-09 [CE Detection Time]*.
- Do a Fault Reset to clear the fault.
- If the drive detects this error, the drive will operate the motor as specified by the stopping method set in *H5-04 [Communication Error Stop Method]*.

Code	Name	Causes	Possible Solutions
CF	Control Fault	Motor parameters are set incorrectly	Correctly set the motor parameters and do Auto-Tuning again.
		The torque limit setting is too low.	Adjust *L7-01 to L7-04 [Torque Limit]*.
		The load inertia is too large.	• Adjust *C1-02, C1-04, C1-06, and C1-08 [Deceleration Times]*. • Set the frequency reference to the minimum output frequency, and stop the Run command when the drive stops deceleration.
		The drive is trying to ramp to stop a machine that cannot do ramp to stop or on a machine for which deceleration is not necessary.	Correctly set *b1-03 [Stopping Method Selection]*.
		The motor and drive are connected incorrectly.	Correct wiring errors.
		Line-to-line Resistance Tuning is not done.	Do Stationary Auto-Tuning for Line-to-Line Resistance.
		The drive received a Run command while the motor was coasting.	• Examine the sequence and input the Run command after the motor fully stops. • Set *b3-01 = 1 [Speed Search at Start Selection = Enabled]*.

Note:
- The drive detects this error if the torque reference is more than the torque limit for 3 seconds or longer while the drive ramps to stop.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
CoF	Current Offset Fault	The drive starts operation while the induced voltage stays in the motor (during coasting to a stop or after fast deceleration).	• Make a sequence that does not restart operation when induced voltage stays in the motor. • Set *b3-01 = 1 [Speed Search at Start Selection = Enabled]*. • Use *Speed Search from Fmax or Fref [H1-xx = 61, 62]* to do a speed search through one of the external terminals. **Note:** When controlling the PM motor, External Speed Search commands 1 and 2 operate the same.
		A drive hardware problem occurred.	• Do a Fault Reset to clear the fault or de-energize the drive. • If the fault stays, replace the drive.

Code	Name	Causes	Possible Solutions
CPF00	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
- Do a Fault Reset to clear the fault.
- Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF01	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
- Do a Fault Reset to clear the fault.
- Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF02	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
- Do a Fault Reset to clear the fault.
- Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF03	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
• Do a Fault Reset to clear the fault.
• Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF06	Control Circuit Error (EEPROM memory Data Error)	The drive power supply was de-energized while a communication option entered a parameter Write command.	Set *A1-03 = 2220 [Initialize Parameters = 2-Wire Initialization]* and initialize the drive.
		An EEPROM peripheral circuit error occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about how to replace the control board, contact Yaskawa or your nearest sales representative.

Note:
• The drive detects this error if there is an error in the data written to the drive EEPROM.
• Do a Fault Reset to clear the fault.
• Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF08	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
• Do a Fault Reset to clear the fault.
• Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF11	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
• Do a Fault Reset to clear the fault.
• Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF14	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
• Do a Fault Reset to clear the fault.
• Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF16	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
• Do a Fault Reset to clear the fault.
• Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF24	Control Circuit Error (Drive Unit Signal Fault)	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
• Do a Fault Reset to clear the fault.
• Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF25	Terminal Board not Connected	The terminal board is not correctly connected to the drive.	1. De-energize the drive. 2. Correctly connect the terminal board to the drive. 3. Re-energize the drive.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
CPF38	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
• Do a Fault Reset to clear the fault.
• Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
dCE1	Communication Error1	A drive hardware problem occurred temporarily due to noise.	• Remove the cause of the noise. • If the fault stays, replace the control board or the drive.

Note:
• Do a Fault Reset to clear the fault.
• Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
dCE2	Communication Error2	A drive hardware problem occurred temporarily due to noise.	• Remove the cause of the noise. • If the fault stays, replace the control board or the drive.

Note:
• Do a Fault Reset to clear the fault.
• Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
dEv	Speed Deviation	The load is too heavy.	Decrease the load.
		Acceleration and deceleration ramps are set too short.	Increase the values set in *C1-01 to C1-08 [Acceleration/ Deceleration Ramps]*.
		The *dEv* detection level settings are incorrect.	Adjust *F1-10 [Speed Deviation Detection Level]* and *F1-11 [Speed Deviation Detect DelayTime]*.
		The load is locked up.	Examine the machine.
		The holding brake is stopping the motor.	Release the holding brake.

Note:
• The drive detects this error if the difference between the detected speed and the speed reference is more than the setting of *F1-10* for longer than *F1-11*.
• Do a Fault Reset to clear the fault.
• If the drive detects this error, the drive will operate the motor as specified by the stopping method set in *F1-04 [Speed Deviation Detection Select]*.

Code	Name	Causes	Possible Solutions
dv7	Polarity Judge Timeout	There is a disconnection in the motor coil winding.	Measure the motor line-to-line resistance and replace the motor if a coil is disconnected.
		The screws on the drive output terminals are loose.	Tighten the terminal screws to the correct tightening torque.

Note:
• The drive detects this error if it cannot detect polarity in a pre-set length of time.
• Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
EF0	Option Card External Fault	The communication option received an external fault from the controller.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input from the controller.
		A programming error occurred on the controller side.	Examine the operation of the controller program.

Note:
• The drive detects this fault if the alarm function on the external device side is operating.
• Do a Fault Reset to clear the fault.
• If the drive detects this fault, it will operate the motor as specified by the stop method set in *F6-03 [Comm External Fault (EF0) Select]*.

Code	Name	Causes	Possible Solutions
EF1	External Fault (Terminal S1)	MFDI terminal S1 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S1.
		External Fault [H1-01 = 20 to 2B] is set to MFDI terminal S1, but the terminal is not in use.	Correctly set the MFDI.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
EF2	External Fault (Terminal S2)	MFDI terminal S2 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S2.

Code	Name	Causes	Possible Solutions
		External Fault [H1-02 = 20 to 2B] is set to MFDI terminal S2, but the terminal is not in use.	Correctly set the MFDI.
Note: Do a Fault Reset to clear the fault.			

Code	Name	Causes	Possible Solutions
EF3	External Fault (Terminal S3)	MFDI terminal S3 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S3.
		External Fault [H1-03 = 20 to 2B] is set to MFDI terminal S3, but the terminal is not in use.	Correctly set the MFDI.
Note: Do a Fault Reset to clear the fault.			

Code	Name	Causes	Possible Solutions
EF4	External Fault (Terminal S4)	MFDI terminal S4 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S4.
		External Fault [H1-04 = 20 to 2B] is set to MFDI terminal S4, but the terminal is not in use.	Correctly set the MFDI.
Note: Do a Fault Reset to clear the fault.			

Code	Name	Causes	Possible Solutions
EF5	External Fault (Terminal S5)	MFDI terminal S5 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S5.
		External Fault [H1-05 = 20 to 2B] is set to MFDI terminal S5, but the terminal is not in use.	Correctly set the MFDI.
Note: Do a Fault Reset to clear the fault.			

Code	Name	Causes	Possible Solutions
EF6	External Fault (Terminal S6)	MFDI terminal S6 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S6.
		External Fault [H1-06 = 20 to 2B] is set to MFDI terminal S6, but the terminal is not in use.	Correctly set the MFDI.
Note: Do a Fault Reset to clear the fault.			

Code	Name	Causes	Possible Solutions
EF7	External Fault (Terminal S7)	MFDI terminal S7 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S7.
		External Fault [H1-07 = 20 to 2B] is set to MFDI terminal S7, but the terminal is not in use.	Correctly set the MFDI.
Note: Do a Fault Reset to clear the fault.			

Code	Name	Causes	Possible Solutions
Err	EEPROM Write Error	There was a problem with the EEPROM hardware.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. Contact Yaskawa or your nearest sales representative to replace the board.
		Electrical interference corrupted the data while it was writing to the EEPROM of the drive.	• Push ENTER Key. • Set the parameters again.
Note: Do a Fault Reset to clear the fault.			

Code	Name	Causes	Possible Solutions
FRL	Speed Reference Missing	The drive received an Up/Down command when *d1-18 = 1 [Speed Reference Selection Mode = High speed has priority]*, *H1-xx ≠ 53 [MFDI Function Selection ≠ Leveling Speed]*, and no speed is selected at start.	• Examine the settings for *d1-18* and *H1-03 to H1-07 [Terminal S3 to S7 Function Selection]* to make sure that the selected speed selection method aligns with the elevator controller sequence. • Make sure that the elevator controller is connected correctly. • Make sure the elevator controller selects the speed correctly.

Note:
• The drive detects this fault if you enter an Up/Down command when *d1-18 = 1*, *H1-xx ≠ 53*, and no speed is selected at start.
• Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
GF	Ground Fault	Overheating caused damage to the motor or the motor insulation is not satisfactory.	Measure the motor insulation resistance, and replace the motor if there is electrical conduction or unserviceable insulation.
		The motor main circuit cable is contacting ground to make a short circuit.	• Examine the motor main circuit cable for damage, and repair short circuits. • Measure the resistance between the motor main circuit cable and the ground terminal. If there is electrical conduction, replace the cable.
		An increase in the stray capacitance of the cable and the ground terminal caused an increase in the leakage current.	• If the wiring length of the cable is more than 100 m, decrease the carrier frequency. • Decrease the stray capacitance.
		There was a problem with the drive hardware.	Replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
• The drive detects this fault if a current short to ground was more than 50% of rated current on the output side of the drive.
• Do a Fault Reset to clear the fault.
• *L5-08 [Fault Reset Enable Select Grp2]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
LF	Output Phase Loss	The motor main circuit cable is disconnected.	Connect motor main circuit cable wiring. Correct wiring errors in the main circuit drive input power.
		There is a disconnection in the motor coil winding.	If a coil is disconnected, measure the motor Line-to-Line Resistance and replace the motor.
		The screws on the drive output terminals are loose.	Tighten the terminal screws to the correct tightening torque.
		The rated output current of the motor is less than 5% of the drive rated current.	Examine the drive capacity or the motor output to be applied.
		You are trying to use a single-phase motor.	The drive cannot operate a single-phase motor.
		The output transistor in the drive is damaged.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
• The drive detects this fault if phase loss occurs on the output side of the drive.
• Do a Fault Reset to clear the fault.
• Set *L8-07 [Output Phase Loss Protection Sel]* to enable and disable *LF* detection.

Code	Name	Causes	Possible Solutions
LF2	Output Current Imbalance	Phase loss occurred in the wiring on the output side of the drive.	Examine for wiring errors or disconnected wires on the output side of the drive, and repair problems.
		The output terminal screws of the drive are loose.	Tighten the terminal screws to the correct tightening torque.
		There is not balance between the three phases of the PM motor impedance.	• Measure the Line-to-Line Resistance for each motor phase and make sure that resistance is equal in the three phases, and that all wires are connected correctly. • Replace the motor.
		The drive output circuit is broken.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
• The drive detects this fault if there is not balance between the three phases of the output current from the PM motor.
• Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oC	Overcurrent	The load is too heavy.	• Measure the current flowing into the motor. • Replace the drive with a larger capacity model if the current value is more than the drive rated current. • Decrease the load or replace with a larger drive to prevent sudden changes in the current level.
		Overheating caused damage to the motor or the motor insulation is not satisfactory.	Measure the motor insulation resistance, and replace the motor if there is electrical conduction or unserviceable insulation.

Code	Name	Causes	Possible Solutions
		The motor main circuit cable is contacting ground to make a short circuit.	• Examine the motor main circuit cable for damage, and repair short circuits. • Measure the resistance between the motor main circuit cable and the ground terminal. If there is electrical conduction, replace the cable.
		A short circuit or ground fault on the drive output side caused damage to the output transistor of the drive.	• Make sure that there is not a short circuit in terminal B1 and terminals U/T1, V/T2, and W/T3. Make sure that there is not a short circuit in terminals - and terminals U/T1, V/T2, and W/T3. • If there is a short circuit, contact Yaskawa or your nearest sales representative.
		The acceleration time is too short.	• Calculate the torque necessary during acceleration related to the load inertia and the specified acceleration time. • Increase the values set in *C1-01, C1-03, C1-05, or C1-07 [Acceleration Times]* to get the necessary torque. • Increase the values set in *C2-01 to C2-05 [S-Curve Characteristics]* to get the necessary torque. • Replace the drive with a larger capacity model.
		The drive is trying to operate a specialized motor or a motor that is larger than the maximum applicable motor output of the drive.	• Examine the motor nameplate, the motor, and the drive to make sure that the drive rated current is larger than the motor rated current. • Replace the drive with a larger capacity model.
		A magnetic contactor was switched at the output.	Set the operation sequence to not turn ON or OFF the magnetic contactor while the drive is outputting voltage.
		The V/f pattern settings are incorrect.	• Examine the ratios between the V/f pattern frequency and voltage. Decrease the voltage if it is too high compared to the frequency. • Adjust *E1-04 to E1-10 [V/f Pattern Parameters]*.
		The torque compensation gain is too large.	Decrease the value set in *C4-01 [Torque Compensation Gain]* to make sure that the motor does not stall.
		Electrical interference caused a problem.	Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference.
		The control method is set incorrectly for the motor.	Set *A1-02 [Control Method Selection]* correctly.

Note:
• This fault occurs if the drive sensors detect a drive output current more than the specified overcurrent detection level.

Code	Name	Causes	Possible Solutions
oH	Heatsink Overheat	The ambient temperature is high and the heatsink temperature of the drive is more than the value set in *L8-02 [Overheat Alarm Level]*.	• Measure the ambient temperature. • Increase the airflow in the control panel. • Install a cooling device (cooling fan or air conditioner) to lower the ambient temperature. • Remove objects near the drive that are producing too much heat.
		The load is too heavy.	• Measure the output current. • Decrease the load.
		The internal cooling fan of the drive stopped.	1. Use the procedures in this manual to replace the cooling fan. 2. Set *o4-03 = 0 [Fan Operation Time Setting = 0 h]*.

Note:
• The drive detects this fault if the heatsink temperature of the drive is more than the value set in *L8-02*.
• Do a Fault Reset to clear the fault.
• If the drive detects this fault, it will operate the motor as specified by the Stopping Method set in *L8-03 [Overheat Pre-Alarm Selection]*.

Code	Name	Causes	Possible Solutions
oH1	Heatsink Overheat	The ambient temperature is high and the heatsink temperature of the drive is more than the *oH1* detection level.	• Measure the ambient temperature. • Increase the airflow in the control panel. • Install a cooling device (cooling fan or air conditioner) to lower the ambient temperature. • Remove objects near the drive that are producing too much heat.
		The load is too heavy.	• Measure the output current. • Decrease the load.

Note:
• The drive detects this fault if the heatsink temperature of the drive is more than the *oH1* detection level. *o2-04 [Drive Model (KVA) Selection]* determines the *oH1* detection level.
• Do a Fault Reset to clear the fault.
• *L5-08 [Fault Reset Enable Select Grp2]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
oL1	Motor Overload	The load is too large.	Decrease the load. **Note:** Reset *oL1* when *U4-16 [Motor oL1 Level]* < 100.
		The acceleration/deceleration times or cycle times are too short.	• Examine the acceleration/deceleration times and the motor start/stop frequencies (cycle times). • Increase the values set in *C1-01 to C1-08 [Acceleration/ Deceleration Times]*.
		Overload occurred while running at low speed.	• Decrease the load when running at low speed. • Increase the motor speed. • If the motor is run frequently at low speeds, replace the motor with a larger motor or use a drive-dedicated motor. **Note:** For general-purpose motors, overload can occur while running at low speed when operating at below the rated current.
		L1-01 [Motor Overload (oL1) Protection] is set incorrectly.	Set *L1-01* in as specified by the motor qualities for a drive-dedicated motor.
		The V/f pattern does not fit the motor qualities.	• Examine the ratios between the V/f pattern frequency and voltage. Decrease the voltage if it is too high compared to the frequency. • Adjust *E1-04 to E1-10 [V/f Pattern Parameters]*. Decrease the values set in *E1-08 [Mid Point A Voltage]* and *E1-10 [Minimum Output Voltage]*. **Note:** If the values set in *E1-08* and *E1-10* are too low, the overload tolerance will decrease at low speeds.
		E1-06 [Base Frequency] is set incorrectly.	Set *E1-06* to the rated frequency shown on the motor nameplate.
		One drive is operating more than one motor.	Set *L1-01 = 0 [Motor Overload (oL1) Protection = Disabled]*, connect thermal overload relay to each motor to prevent damage to the motor.
		The electronic thermal protector qualities and the motor overload properties do not match.	• Examine the motor qualities and set *L1-01 [Motor Overload (oL1) Protection]* correctly. • Connect a thermal overload relay to the motor.
		The electronic thermal protector is operating at an incorrect level.	Set *E2-01 [Motor Rated Current (FLA)]* correctly to the value specified by the motor nameplate.
		Phase loss in the input power supply is causing the output current to change.	Make sure that there is no phase loss, and repair problems.
		The motor main circuit cable is too long.	Replace the drive with a larger capacity model.

Note:
• The drive detects this fault if the electronic thermal protector of the drive started the motor overload protection.
• Do a Fault Reset to clear the fault.
• *L5-07 [Fault Reset Enable Select Grp1]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
oL2	Drive Overload	The load is too large.	Decrease the load.
		The acceleration/deceleration times or cycle times are too short.	• Examine the acceleration/deceleration times and the motor start/stop frequencies (cycle times). • Increase the values set in *C1-01 to C1-08 [Acceleration/ Deceleration Times]*.
		The V/f pattern does not fit the motor qualities.	• Examine the ratios between the V/f pattern frequency and voltage. Decrease the voltage if it is too high compared to the frequency. • Adjust *E1-04 to E1-10 [V/f Pattern Parameters]*. Decrease the values set in *E1-08 [Mid Point A Voltage]* and *E1-10 [Minimum Output Voltage]*. **Note:** If the values set in *E1-08* and *E1-10* are too low, the overload tolerance will decrease at low speeds.
		The drive capacity is too small.	Replace the drive with a larger capacity model.
		Overload occurred while running at low speed.	• Decrease the load when running at low speed. • Replace the drive with a larger capacity model.
		The torque compensation gain is too large.	Decrease the value set in *C4-01 [Torque Compensation Gain]* to make sure that the motor does not stall.
		Phase loss in the input power supply is causing the output current to change.	• Correct errors with the wiring for main circuit drive input power. • Make sure that there is no phase loss, and repair problems.

Note:
• The drive detects this fault if the electronic thermal protector of the drive started the drive overload protection.
• Do a Fault Reset to clear the fault.
• *L5-07 [Fault Reset Enable Select Grp1]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
oL3	Overtorque Detection 1	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-02 [Torque Detection Level 1]* and *L6-03 [Torque Detection Time 1]* settings.

Note:
- The drive detects this fault if the drive output current is more than the level set in *L6-02* for longer than *L6-03*.
- Do a Fault Reset to clear the fault.
- If the drive detects this fault, it will operate the motor as specified by the Stopping Method set in *L6-01 [Torque Detection Selection 1]*.
- *L5-07 [Fault Reset Enable Select Grp1]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
oL4	Overtorque Detection 2	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-05 [Torque Detection Level 2]* and *L6-06 [Torque Detection Time 2]* settings.

Note:
- The drive detects this fault if the drive output current is more than the level set in *L6-05* for longer than *L6-06*.
- Do a Fault Reset to clear the fault.
- If the drive detects this fault, it will operate the motor as specified by the Stopping Method set in *L6-04 [Torque Detection Selection 2]*.
- *L5-07 [Fault Reset Enable Select Grp1]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
oPr	Keypad Connection Fault	The keypad is not securely connected to the connector on the drive.	Examine the connection between the keypad and the drive.
		The connection cable between the drive and the keypad is disconnected.	• Remove the keypad and then reconnect it. • Replace the cable if damaged.

Note:
- The drive detects this fault if these conditions are correct:
  - *o2-06 = 1 [Keypad Disconnect Detection = Enabled]*.
  - *b1-02 = 0 [Run Command Selection 1 = Keypad]*, or the drive is operating in LOCAL Mode with the keypad.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
ov	Overvoltage	The deceleration time is too short and too much regenerative energy is flowing back into the drive.	• Increase the values set in *C1-02, C1-04, C1-06, or C1-08 [Deceleration Times]*. • Connect a dynamic braking option to the drive. • Perform Deceleration Rate Tuning.
		The acceleration time is too short.	• Make sure that sudden drive acceleration does not cause the fault. • Increase the values set in *C1-01, C1-03, C1-05, or C1-07 [Acceleration Times]*. • Increase the value set in *C2-02 [S-Curve Time @ End of Accel]*.
		The braking load is too large.	Connect a dynamic braking option to the drive.
		There are surge voltages in the input power supply	Connect a DC reactor to the drive. **Note:** If you turn the phase advancing capacitors ON and OFF and use thyristor converters in the same power supply system, there can be surge voltages that irregularly increase the input voltage.
		The drive output cable or motor is shorted to ground (the current short to ground is charging the main circuit capacitor of the drive through the power supply).	1. Examine the motor main circuit cable, terminals, and motor terminal box, and then remove ground faults. 2. Re-energize the drive.
		The power supply voltage is too high.	Decrease the power supply voltage to match the drive rated voltage.
		The braking resistor or braking resistor unit wiring is incorrect.	Correct wiring errors in the connection to the braking resistor or braking resistor unit.
		Electrical interference caused a drive malfunction.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary.
		The Short Circuit Braking function used in OLV/PM control method.	Connect a braking resistor to the drive.
		There is motor hunting.	Adjust *n2-02 [Automatic Freq Regulator Time 1]* and *n2-03 [Automatic Freq Regulator Time 2]*.

Note:
- The drive detects this error if the DC bus voltage is more than the *ov* detection level while the drive is running.
- The *ov* detection level is approximately 410 V with 200 V class drives. The detection level is approximately 820 V for 400 V class drives.
- Do a Fault Reset to clear the fault.
- *L5-08 [Fault Reset Enable Select Grp2]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
PF	Input Phase Loss	There is a phase loss in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		There is loose wiring in the drive input power terminals.	Tighten the terminal screws to the correct tightening torque.
		The drive input power voltage is changing too much.	• Examine the input power for problems. • Make the drive input power stable. • If the input power supply is good, examine the magnetic contactor on the main circuit side for problems.
		There is unsatisfactory balance between voltage phases.	• Examine the input power for problems. • Make the drive input power stable. • Set *L8-05 = 0 [Input Phase Loss Protection Sel = Disabled]*.
		The main circuit capacitors have become unserviceable.	• Examine the capacitor maintenance time in monitor *U4-05 [CapacitorMaintenance]*. If *U4-05* is more than 90%, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative. • If drive input power is correct and the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
- The drive detects this error if the DC bus voltage changes irregularly without regeneration.
- Do a Fault Reset to clear the fault.
- Use *L8-05* to enable and disable *PF* detection.

Code	Name	Causes	Possible Solutions
rF	Braking Resistor Fault	The resistance of the dynamic braking option connected to the drive is too low.	Use a dynamic braking option that fits the model and duty rating of the drive.
		A regenerative converter or regenerative unit is connected to the drive.	Set *L8-55 = 0 [Internal DB TransistorProtection = Disable]*.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
rH	Braking Resistor Overheat	The deceleration time is too short and excessive regenerative energy is flowing back into the drive.	• Check the load level, deceleration time, and speed. • Decrease the load. • Increase the values set in *C1-02, C1-04, C1-06, or C1-08 [Deceleration Times]*. • Use a dynamic braking option that lets you use more power.
		The duty cycle is too high.	Examine the duty cycle.
		The braking load is too heavy.	• Calculate the braking load and braking power again, and decrease the braking load. • Use a braking resistor that improves braking power.
		The braking resistor is not sufficient.	Use the braking resistor specifications to select a sufficient braking resistor.

Note:
- The drive detects this error if the braking resistor overheat protective function is active.
- The magnitude of the braking load causes the braking resistor overheat alarm, NOT the surface temperature. If the duty cycle is higher than the braking resistor rating, the drive will show the alarm.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
rr	Dynamic Braking Transistor Fault	The drive control circuit is damaged.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
		There is a malfunction in the internal braking transistor of the drive.	

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
SC	Short Circuit/IGBT Failure	Overheating caused damage to the motor or the motor insulation is not satisfactory.	Measure the motor insulation resistance, and replace the motor if there is electrical conduction or unserviceable insulation.
		The motor main circuit cable is contacting ground to make a short circuit.	• Examine the motor main circuit cable for damage, and repair short circuits. • Measure the resistance between the motor main circuit cable and the ground terminal. If there is electrical conduction, replace the cable.
		A short circuit or ground fault on the drive output side caused damage to the output transistor of the drive.	• Make sure that there is not a short circuit in terminal B1 and terminals U/T1, V/T2, and W/T3. Make sure that there is not a short circuit in terminals - and terminals U/T1, V/T2, and W/T3. • If there is a short circuit, contact Yaskawa or your nearest sales representative.

Note:
- The drive detects this error if there is a short circuit or ground fault on the drive output side, or an IGBT failure.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
SCF	Safety Circuit Fault	The safety circuit is broken.	Replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
TiM	Keypad Time Not Set	There is a battery in the keypad, but the date and time are not set.	Use the keypad to set the date and time.

Note:
- Do a Fault Reset to clear the fault.
- Parameter *o4-24 [bAT Detection Selection]* enables and disables *TiM* detection.

Code	Name	Causes	Possible Solutions
UL3	Undertorque Detection 1	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-02 [Torque Detection Level 1]* and *L6-03 [Torque Detection Time 1]* settings.

Note:
- The drive detects this error if the drive output current is less than the level set in *L6-02* for longer than *L6-03*.
- Do a Fault Reset to clear the fault.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *L6-01 [Torque Detection Selection 1]*.

Code	Name	Causes	Possible Solutions
UL4	Undertorque Detection 2	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-05 [Torque Detection Level 2]* and *L6-06 [Torque Detection Time 2]* settings.

Note:
- The drive detects this error if the drive output current is less than the level set in *L6-05* for longer than *L6-06*.
- Do a Fault Reset to clear the fault.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *L6-04 [Torque Detection Selection 2]*.

Code	Name	Causes	Possible Solutions
Uv1	DC Bus Undervoltage	There is a phase loss in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		There is loose wiring in the drive input power terminals.	Tighten the terminal screws to the correct tightening torque.
		The drive input power voltage is changing too much.	• Examine the input power for problems. • Make the drive input power stable. • If the input power supply is good, examine the magnetic contactor on the main circuit side for problems.
		There was a loss of power.	Use a better power supply.
		The main circuit capacitors have become unserviceable.	Examine the capacitor maintenance time in monitor *U4-05 [CapacitorMaintenance]*. If *U4-05* is more than 90%, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
		The relay or contactor on the soft-charge bypass relay is damaged.	*U4-06 [PreChargeRelayMainte]* shows the performance life of the soft-charge bypass relay. If *U4-06* is more than 90%, replace the board or the drive. For information about replacing the board, contact Yaskawa or your nearest sales representative.

Note:
- The drive detects this error if the DC bus voltage decreases below the level set in *L2-05 [Undervoltage Detection Lvl (Uv1)]* while the drive is running.
- The *Uv1* detection level is approximately 190 V for a 200 V class drives. The detection level is approximately 380 V for 400 V class drives. The detection level is approximately 350 V when *E1-01 [Input AC Supply Voltage]* < 400.
- Do a Fault Reset to clear the fault.
- Fault trace is not available for this fault.
- *L5-08 [Fault Reset Enable Select Grp2]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
Uv2	Control Power Undervoltage	The value set in *L2-02 [Power Loss Ride Through Time]* increased and the momentary power loss recovery unit is not connected to the drive.	Connect the momentary power loss recovery unit to the drive.
		There was a problem with the drive hardware.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
- The drive detects this error if the control power supply voltage decreases.
- Do a Fault Reset to clear the fault.
- Fault trace is not available for this fault.

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Code	Name	Causes	Possible Solutions
Uv3	Soft Charge Answerback Fault	There is damage to the relay or contactor on the soft-charge bypass relay.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. • Monitor *U4-06 [PreChargeRelayMainte]* shows the performance life of the soft-charge bypass relay. If *U4-06* is more than 90%, replace the board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
		Air inside the drive is too hot.	Decrease the ambient temperature of the drive.
Note: • Do a Fault Reset to clear the fault. • Fault trace is not available for these faults.			

7.5 Minor Faults/Alarms

This section gives information about the causes and possible solutions when a minor fault or alarm occurs. Use the information in this table to remove the cause of the minor fault or alarm.

Code	Name	Causes	Possible Solutions
bAT	Keypad Battery Low Voltage	The keypad battery voltage is low.	Replace the keypad battery.

Note:
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.
- *Parameter o4-24 [bAT Detection Selection]* enables and disables *bAT* detection.

Code	Name	Causes	Possible Solutions
bb	Baseblock	An external baseblock command was entered through MFDI terminal S1 to S7, and the drive output stopped as shown by an external baseblock command.	Examine the external sequence and timing of the baseblock command input.

Note:
The drive will not output a minor fault signal for this alarm.

Code	Name	Causes	Possible Solutions
bCE	Bluetooth Communication Error	The smartphone or tablet with DriveWizard Mobile installed is too far from the keypad.	Use the smartphone or tablet 10 m (32.8 ft) or nearer to the keypad. **Note:** *bCE* can occur when the smartphone or tablet is 10 m or nearer to the keypad depending on the specifications of the smartphone or tablet.
		Radio waves from a different device are causing interference with the communication between the smartphone or tablet and keypad.	Make sure that no device around the keypad uses the same radio bandwidth (2400 MHz to 2480 MHz), and prevent radio interference.

Note:
- The drive detects this error when you operate the drive with a smartphone or tablet with a Bluetooth LCD Keypad.
- If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will activate.
- Parameter *o2-27 [bCE Detection selection]* enables and disables *bCE* detection.

Code	Name	Causes	Possible Solutions
boL	Braking Transistor Overload	The duty cycle of the braking transistor is high (the regeneration power or repetition frequency is high).	• Install a regenerative converter. • Increase the deceleration time.
		You enabled the protective function for the braking transistor when you have a regenerative converter.	Set *L8-55 = 0 [Internal DB TransistorProtection Selection = Disable]*.
		The braking transistor in the drive is broken.	Replace the drive.

Note:
If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.

Code	Name	Causes	Possible Solutions
bUS	Option Communication Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short-circuit in the communications cable or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The option card is incorrectly installed to the drive.	Correctly install the option card to the drive.
		The option card is damaged.	If the alarm continues and the wiring is correct, replace the option card.

Note:
- The drive detects this error if the Up/Down command or speed reference is assigned to the option card.
- If the drive detects this error, the terminal set to *H2-01 to H2-05 = 10 [MFDO Function Selection = Alarm]* will activate.
- If the drive detects this error, it will operate the motor as specified by the stopping method set in *F6-01 [Communication Error Selection]*.

Code	Name	Causes	Possible Solutions
bUSy	Busy	You set the drive to use MEMOBUS/Modbus communications to change parameters, but you used the keypad to change parameters.	Use MEMOBUS/Modbus communications to enter the enter command, then use the keypad to change the parameter.
		You tried to change a parameter while the drive was changing setting.	Wait until the process is complete.

Code	Name	Causes	Possible Solutions
CALL	Serial Comm Transmission Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short circuit in the communications cable or the communications cable is not connected.	• Repair the short-circuited or disconnected portion of the cable. • Replace the defective communications cable.
		A programming error occurred on the controller side.	Examine communications at start-up and correct programming errors.
		There is damage to the communications circuitry.	• Do a self-diagnostics check. • If the problem continues, replace the control board or the drive. Contact Yaskawa or your nearest sales representative to replace the control board.
		The termination resistor setting for MEMOBUS/Modbus communications is incorrect.	On the last drive in a MEMOBUS/Modbus network, set DIP switch S2 to the ON position to enable the termination resistor.

Note:
• The drive detects this error if it does not correctly receive control data from the controller when energizing the drive.
• If the drive detects this error, the terminal assigned to *H2-01 to H2-05 = 10 [MFDO Function Selection = Alarm]* will activate.

Code	Name	Causes	Possible Solutions
CE	Modbus Communication Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short circuit in the communications cable or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The communication protocol is not compatible.	• Examine the values set in *H5-xx*. • Examine the settings on the controller side and correct the difference in communication conditions.
		The value set in *H5-09 [CE Detection Time]* is too small for the communications cycle.	• Change the controller software settings. • Increase the value set in *H5-09*.
		The controller software or hardware is causing a communication problem.	Examine the controller and remove the cause of the problem.

Note:
• The drive detects this error if it does not correctly receive control data for the *CE* detection time set to *H5-09*.
• If the drive detects this error, the terminal assigned to *H2-01 to H2-05 = 10 [MFDO Function Selection = Alarm]* will be ON.
• If the drive detects this error, it will operate the motor as specified by the stopping method set in *H5-04 [Communication Error Stop Method]*.

Code	Name	Causes	Possible Solutions
CrST	Cannot Reset	The drive received a fault reset command when a Run command was active.	Turn off the Run command then de-energize and re-energize the drive.

Code	Name	Causes	Possible Solutions
dEv	Speed Deviation	The load is too heavy	Decrease the load.
		Acceleration and deceleration ramps are set too fast.	Increase the values set in *C1-01 to C1-08 [Acceleration/Deceleration Ramps]*.
		The *dEv* detection level settings are incorrect.	Adjust *F1-10 [Speed Deviation Detection Level]* and *F1-11 [Speed Deviation Detect DelayTime]*.
		The load is locked up.	Examine the machine.
		The holding brake is stopping the motor.	Release the holding brake.

Note:
• The drive detects this error if the difference between the detected speed and the speed reference is more than the setting of *F1-10* for longer than *F1-11*.
• If the drive detects this error, the terminal assigned to *H2-01 to H2-05 = 10 [MFDO Function Selection = Alarm]* will be ON.
• If the drive detects this error, the drive will operate the motor as specified by the stopping method set in *F1-04 [Speed Deviation Detection Select]*.

Code	Name	Causes	Possible Solutions
EF	FWD/REV Run Command Input Error	A forward command and a reverse command were input at the same time for longer than 0.5 s.	Examine the forward and reverse command sequence and correct the problem.

Note:
• If the drive detects *EF*, the motor will ramp to stop.
• If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
EF0	External Fault via Communication	The communication option card received an external fault from the controller.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input from the controller.
		Programming error occurred on the controller side.	Examine the operation of the controller program.
Note: • The drive detects this error if the alarm function on the external device side is operating. • If the drive detects this error, the terminal assigned to *H2-01 to H2-05 = 10 [MFDO Function Selection = Alarm]* will be ON. • Set the stopping method for this fault in *F6-03 [Comm External Fault (EF0) Select]*.			
Code	**Name**	**Causes**	**Possible Solutions**
EF1	External Fault (Terminal S1)	MFDI terminal S1 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S1.
		External Fault [H1-01 = 2C to 2F] is set to MFDI terminal S1, but the terminal is not in use.	Correctly set the MFDI.
Note: If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will activate.			
Code	**Name**	**Causes**	**Possible Solutions**
EF2	External Fault (Terminal S2)	MFDI terminal S2 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S2.
		External Fault [H1-02 = 2C to 2F] is set to MFDI terminal S2, but the terminal is not in use.	Correctly set the MFDI.
Note: If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will activate.			
Code	**Name**	**Causes**	**Possible Solutions**
EF3	External Fault (Terminal S3)	MFDI terminal S3 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S3.
		External Fault [H1-03 = 2C to 2F] is set to MFDI terminal S3, but the terminal is not in use.	Correctly set the MFDI.
Note: If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will activate.			
Code	**Name**	**Causes**	**Possible Solutions**
EF4	External Fault (Terminal S4)	MFDI terminal S4 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S4.
		External Fault [H1-04 = 2C to 2F] is set to MFDI terminal S4, but the terminal is not in use.	Correctly set the MFDI.
Note: If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will activate.			
Code	**Name**	**Causes**	**Possible Solutions**
EF5	External Fault (Terminal S5)	MFDI terminal S5 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S5.
		External Fault [H1-05 = 2C to 2F] is set to MFDI terminal S5, but the terminal is not in use.	Correctly set the MFDI.
Note: If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will activate.			
Code	**Name**	**Causes**	**Possible Solutions**
EF6	External Fault (Terminal S6)	MFDI terminal S6 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S6.
		External Fault [H1-06 = 2C to 2F] is set to MFDI terminal S6, but the terminal is not in use.	Correctly set the MFDI.
Note: If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will activate.			

Code	Name	Causes	Possible Solutions
EF7	External Fault (Terminal S7)	MFDI terminal S7 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S7.
		External Fault [H1-07 = 2C to 2F] is set to MFDI terminal S7, but the terminal is not in use.	Correctly set the MFDI.

Note:
If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will activate.

Code	Name	Causes	Possible Solutions
EP24v	External Power 24V Supply	The voltage of the main circuit power supply decreased, and the 24 V power supply is supplying power to the drive.	• Examine the main circuit power supply. • Turn ON the main circuit power supply to run the drive.

Note:
- Set *o2-26 [Ext. Power 24V Supply Display]* to enable or disable *EP24v* detection.
- The drive will not output an alarm signal for this alarm.

Code	Name	Causes	Possible Solutions
HCA	High Current Alarm	The load is too heavy.	• Decrease the load for applications with repetitive starts and stops. • Replace the drive with a larger capacity model.
		The acceleration time is too short.	• Calculate the torque necessary during acceleration related to the load inertia and the specified acceleration time. • Increase the values set in *C1-01, C1-03, C1-05, or C1-07 [Acceleration Times]* until you get the necessary torque. • Increase the values set in *C2-01 to C2-05 [S-Curve Characteristics]* until you get the necessary torque. • Replace the drive with a larger capacity model.
		The drive is trying to operate a specialized motor or a motor that is larger than the maximum applicable motor output of the drive.	• Examine the motor nameplate, the motor, and the drive to make sure that the drive rated current is larger than the motor rated current. • Replace the drive with a larger capacity model.
		The current level temporarily increased because of speed search after a momentary power loss or while trying to Auto Restart.	If speed search or Auto Restart cause an increase in current, the drive can temporarily show this alarm. The time that the drive shows the alarm is short. No more steps are necessary to clear the alarm.

Note:
- The drive detects this error if the drive output current is more than the overcurrent alarm level (150% of the rated current).
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.

Code	Name	Causes	Possible Solutions
L24v	Loss of External Power 24 Supply	The voltage of the backup 24 V power supply has decreased. The main circuit power supply is operating correctly.	• Examine the external 24 V power supply for disconnected wires and wiring errors and repair the problems. • Examine the external 24 V power supply for problems.

Note:
- Set *o2-23 [External 24V Powerloss Detection]* to enable or disable *L24v* detection.
- The drive will not output an alarm signal for this alarm.

Code	Name	Causes	Possible Solutions
LoG	Log Com Error	There is not a micro SD in the keypad.	Put a micro SD card in the keypad.
		• The drive is connected to USB. • The number of log communication files is more than 1000. • The micro SD card does not have available memory space. • The line number data in a log communication file was changed. • A communication error between the keypad and drive occurred during a log communication.	Set *o5-01 = 0 [Log Start/Stop Selection = OFF]*.

Note:
If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 6A [MFDO Function Select = Data Logger Error]* will be ON.

Code	Name	Causes	Possible Solutions
LT-1	Cooling Fan Maintenance Time	The cooling fan is at 90% of its expected performance life.	1. Use the procedures in this manual to replace the cooling fan. 2. Set *o4-03 = 0 [Fan Operation Time Setting = 0 h]* to reset the cooling fan operation time.

Note:
When the estimated performance life is expired, the terminal assigned to *H2-01 to H2-03 = 2F [MFDO Function Select = Maintenance Notification]* will be ON.

Code	Name	Causes	Possible Solutions
LT-2	Capacitor Maintenance Time	The capacitors for the main circuit and control circuit are at 90% of expected performance life.	Replace the board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
When the estimated performance life is expired, the terminal assigned to *H2-01 to H2-03 = 2F [MFDO Function Select = Maintenance Notification]* will be ON.

Code	Name	Causes	Possible Solutions
LT-3	SoftChargeBypassRelay MainteTime	The soft charge bypass relay is at 90% of its expected performance life.	Replace the board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
When the estimated performance life is expired, the terminal assigned to *H2-01 to H2-03 = 2F [MFDO Function Select = Maintenance Notification]* will be ON.

Code	Name	Causes	Possible Solutions
LT-4	IGBT Maintenance Time (50%)	The IGBT is at 50% of its expected performance life.	Check the load, carrier frequency, and output frequency.

Note:
When the estimated performance life is expired, the terminal assigned to *H2-01 to H2-03 = 2F [MFDO Function Select = Maintenance Notification]* will be ON.

Code	Name	Causes	Possible Solutions
oH	Heatsink Overheat	The ambient temperature is high and the heatsink temperature is more than the *L8-02 [Overheat Alarm Level]*.	• Measure the ambient temperature. • Increase the airflow around the drive. • Install a cooling device (cooling fan or air conditioner) to lower the ambient temperature. • Remove objects near the drive that are producing too much heat.
		There is not sufficient airflow around the drive.	• Give the drive the correct installation space as shown in the manual. • Make sure that there is sufficient circulation around the control panel. • Examine the drive for dust or other unwanted materials that could clog the cooling fan. • Remove unwanted materials that prevent air circulation.
		The internal cooling fan or fans have stopped.	1. Use the procedures in this manual to replace the cooling fan. 2. Set *o4-03 = 0 [Fan Operation Time Setting = 0 h]*.

Note:
- The drive detects this error if the heatsink temperature of the drive is more than *L8-02*.
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.
- If the drive detects this error, it will operate the motor as specified by the stopping method set in *L8-03 [Overheat Pre-Alarm Selection]*.

Code	Name	Causes	Possible Solutions
oH3	Motor Overheat (PTC Input)	The thermistor wiring that detects motor temperature is defective.	Correct wiring errors.
		A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault
		The motor has overheated.	• Check the load level, acceleration/deceleration ramp, and motor start/stop frequency (cycle time). • Decrease the load. • Increase the values set in *C1-01 to C1-08 [Acceleration/ Deceleration Ramps]*. • Set *E2-01 [Motor Rated Current (FLA)]* correctly to the value specified by the motor nameplate. • Make sure that the motor cooling system is operating correctly, and repair or replace it if it is damaged. • Adjust *E1-04 to E1-10 [V/f Pattern Parameters]*. For motor 2, adjust *E3-04 to E3-10*. Decrease the values set in *E1-08 [Mid Point A Voltage]* and *E1-10 [Minimum Output Voltage]*. **Note:** If the values set in *E1-08* and *E1-10* are too low, the overload tolerance will decrease at low speeds.

Note:
- When *H3-02, H3-10, or H3-06 = E [MFAI Function Selection = Motor Temperature (PTC Input)]*, the drive detects this fault if the motor overheat signal entered to an analog input terminal A1 or A2 is more than the alarm detection level.
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.
- If the drive detects this error, it will operate the motor as specified by the stopping method set in *L1-03 [Motor Thermistor oH Alarm Select]*.

Code	Name	Causes	Possible Solutions
oL3	Overtorque 1	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault
		The parameters are incorrect for the load.	Adjust *L6-02 [Torque Detection Level 1]* and *L6-03 [Torque Detection Time 1]*.

Note:
- The drive detects this fault if the drive output current is more than the level set in *L6-02* for longer than *L6-03*.
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.
- Set the conditions that trigger the minor fault using *L6-01 [Torque Detection Selection 1]*.

Code	Name	Causes	Possible Solutions
oL4	Overtorque 2	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault
		The parameters are incorrect for the load.	Adjust *L6-05 [Torque Detection Level 2]* and *L6-06 [Torque Detection Time 2]*.

Note:
- The drive detects this error if the drive output current is more than the level set in *L6-05* for longer than *L6-06*.
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.
- Set the conditions that trigger the minor fault using *L6-04 [Torque Detection Selection 2]*.

Code	Name	Causes	Possible Solutions
oS	Overspeed	There is overshoot.	Decrease *C5-01 [ASR Proportional Gain 1]* and increase *C5-02 [ASR Integral Time 1]*.
		The *oS* detection level is set incorrectly.	Adjust *F1-08 [Overspeed Detection Level]* and *F1-09 [Overspeed Detection Delay Time]*.

Note:
- The drive detects this error if the motor speed is more than the value set in *F1-08* for longer than *F1-09*.
- If the drive detects this error, the terminal set to *H2-01 to H2-05 = 10 [MFDO Function Selection = Alarm]* will activate.
- If the drive detects this error, it will operate the motor as specified by the stopping method set in *F1-03 [Overspeed Detection Selection]*.

Code	Name	Causes	Possible Solutions
ov	Overvoltage	There are surge voltages in the input power supply.	Connect a DC reactor to the drive. **Note:** If you turn the phase advancing capacitors ON and OFF and use thyristor converters in the same power supply system, there can be surge voltages that irregularly increase the input voltage.
		The drive output cable or motor is shorted to ground (the current short to ground is charging the main circuit capacitor of the drive through the power supply).	1. Examine the motor main circuit cable, terminals, and motor terminal box, and then remove ground faults. 2. Re-energize the drive.
		The power supply voltage is too high.	Decrease the power supply voltage to match the drive rated voltage.
		Electrical interference caused a drive malfunction.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Set *L5-01 ≠ 0 [Number of Auto-Restart Attempts ≠ 0 times]*.

Note:
- The drive detects this error if the DC bus voltage is more than the *ov* detection level when the Run command has not been input (while the drive is stopped).
- The *ov* detection level is approximately 410 V with 200 V class drives. The detection level is approximately 820 V for 400 V class drives.
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.

Code	Name	Causes	Possible Solutions
ovEr	Too Many Parameters Changed	You tried to change more than 150 parameters.	Make sure that parameters that do not have an effect on drive operation are at their default settings. **Note:** • You can change 150 parameters maximum. • If you change parameters that have dependencies, the drive can detect *ovEr* when the number of changed parameters is fewer than 150.

Code	Name	Causes	Possible Solutions
PASS	Modbus Communication Test	The MEMOBUS/Modbus communications test is complete.	The *PASS* display will turn off after communications test mode is cleared.

Code	Name	Causes	Possible Solutions
PF	Input Phase Loss	There is a phase loss in the drive input power.	Correct all wiring errors with the main circuit power supply.
		Loose wiring in the input power terminals.	Tighten the screws to the correct tightening torque.
		The drive input power voltage is changing too much.	• Examine the supply voltage for problems. • Make the drive input power stable.
		Unsatisfactory balance between voltage phases.	• Examine the supply voltage for problems. • Make the drive input power stable. • If the supply voltage is good, examine the magnetic contactor on the main circuit side for problems.

Code	Name	Causes	Possible Solutions
		The main circuit capacitors have become unserviceable.	• Examine the capacitor maintenance time in monitor *U4-05 [CapacitorMaintenance]*. • If *U4-05* is more than 90%, replace the capacitor. Contact Yaskawa or your nearest sales representative for more information.
			• Examine the supply voltage for problems. • Re-energize the drive. • If the alarm stays, replace the circuit board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
- The drive detects this error if the DC bus voltage changes irregularly without regeneration.
- If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will be ON.
- Use *L8-05 [Input Phase Loss Protection Sel]* to enable and disable *PF* detection.

Code	Name	Causes	Possible Solutions
PGo	Encoder (PG) Feedback Loss	The encoder cable is disconnected or wired incorrectly.	Examine for wiring errors or disconnected wires in the encoder cable, and repair problems.
		The encoder is not receiving power.	Examine the encoder power supply.
		The holding brake is stopping the motor.	Release the holding brake.

Note:
- The drive detects this error if it does not receive the speed detection pulse signal from the encoder in the detection time set in *F1-14 [Encoder Open-Circuit Detect Time]*.
- If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will be ON.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *F1-02 [PG Open Circuit Detection Select]*.

Code	Name	Causes	Possible Solutions
SE	Modbus Test Mode Error	MEMOBUS/Modbus communications self-diagnostics *[H1-xx = 67]* was done while the drive was running.	Stop the drive and do MEMOBUS/Modbus communications self-diagnostics.

Note:
If detected, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
STo	Safe Torque OFF	Safe Disable inputs H1-HC and H2-HC are open.	• Make sure that the Safe Disable signal is input from an external source to terminal H1-HC and H2-HC. • When the Safe Disable function is not in use, connect terminals H1-HC and H2-HC.
		There is internal damage to the two Safe Disable channels.	Replace the board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
- The drive will not output an alarm signal for this condition.
- If the drive detects this condition, the terminal set to *H2-01 to H2-03 = 21 [MFDO Function Selection = Safe Torque OFF]* will be ON.

Code	Name	Causes	Possible Solutions
SToF	Safe Torque OFF Failure	One of the two terminals H1-HC and H2-HC received the Safe Disable input signal.	• Make sure that the Safe Disable signal is input from an external source to terminals H1-HC or H2-HC. • When the Safe Disable function is not in use, connect terminals H1-HC and H2-HC.
		The Safe Disable input signal is wired incorrectly.	
		There is internal damage to one Safe Disable channel.	Replace the board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
If the drive detects this error, the terminal assigned to *H2-01 to H2-03 = 10 [MFDO Function Select = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
TiM	Keypad Time Not Set	There is a battery in the keypad, but the date and time are not set.	Set the date and time with the keypad.

Note:
- Parameter *o4-24 [bAT Detection Selection]* enables and disables *TiM* detection.
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.

Code	Name	Causes	Possible Solutions
TrPC	IGBT Maintenance Time (90%)	The IGBT is at 90% of its expected performance life.	Replace the IGBT or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.

Code	Name	Causes	Possible Solutions
UL3	Undertorque Detection 1	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault
		The parameters are incorrect for the load.	Adjust *L6-02 [Torque Detection Level 1]* and *L6-03 [Torque Detection Time 1]*.

Note:
- The drive detects this error if the drive output current is less than the level set in *L6-02* for longer than *L6-03*.
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.
- Set the conditions that trigger the minor fault using *L6-01 [Torque Detection Selection 1]*.

Code	Name	Causes	Possible Solutions
UL4	Undertorque Detection 2	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault
		The parameters are incorrect for the load.	Adjust *L6-05 [Torque Detection Level 2]* and *L6-06 [Torque Detection Time 2]*.

Note:
- The drive detects this error if the drive output current is less than the level set in *L6-05* for longer than *L6-06*.
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.
- Set the conditions that trigger the minor fault using *L6-04 [Torque Detection Selection 2]*.

Code	Name	Causes	Possible Solutions
Uv	DC Bus Undervoltage	The drive input power voltage is changing too much.	• Use a better power supply voltage to align with the drive rated voltage. • Make the drive input power stable. • If there is not a fault with the input power supply, examine the magnetic contactor on the main circuit side for faults.
		A phase loss occurred in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		There is loose wiring in the drive input power terminals.	Examine for loose screws and tighten them as specified by the tightening torque values in the manual.
		There was a loss of power.	Use a better power supply.
		The main circuit capacitors have deteriorated.	Examine the capacitor maintenance time in monitor *U4-05 [CapacitorMaintenance]*. If *U4-05* is more than 90%, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
		The drive input power transformer is too small and voltage drops when the power is switched on.	• Check for an alarm when a molded-case circuit breaker, Leakage Breaker (ELCB, GFCI, or RCM/RCD) (with overcurrent protective function), or magnetic contactor is ON. • Check the capacity of the drive power supply transformer.
		Air inside the drive is too hot.	Measure the ambient temperature of the drive.
		The Charge LED is broken.	Replace the board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Note:
- The drive detects this error if one of these conditions is correct when the Run command has not been input (while the drive is stopped).
  - The DC bus voltage < *L2-05 [Undervoltage Detection Lvl (Uv1)]*.
  - The Contactor that prevents inrush current in the drive was opened.
  - There is low voltage in the control drive input power.
- If the drive detects this error, the terminal set to *H2-01 to H2-03 = 10 [MFDO Function Selection = Alarm]* will activate.

7.6 Parameter Setting Errors

Parameter setting errors occur when multiple parameter settings do not agree, or when parameter setting values are not correct. Refer to the table in this section, examine the parameter setting that caused the error, and remove the cause of the error. You must first correct the parameter setting errors before you can operate the drive. The drive will not send notification signals for the faults and alarms when these parameter setting errors occur.

Code	Name	Causes	Possible Solutions
oPE01	Drive Capacity Setting Error	The value set in *o2-04 [Drive Model (KVA) Selection]* does not agree with the drive model.	Set *o2-04* to the correct value.
Code	**Name**	**Causes**	**Possible Solutions**
oPE02	Parameter Range Setting Error	Parameter settings are not in the applicable setting range.	1. Push to show *U1-18 [oPE Fault Parameter]*, and find parameters that are not in the applicable setting range. 2. Correct the parameter settings. **Note:** • If more than one error occurs at the same time, other *oPExx* errors have priority over *oPE02*.
		Set *E2-01 ≤ E2-03 [Motor Rated Current (FLA) ≤ Motor No-Load Current]*.	Make sure that *E2-01 > E2-03*. **Note:** If it is necessary to set *E2-01 < E2-03*, first lower the value set in *E2-03*, and then set *E2-01*.
Code	**Name**	**Causes**	**Possible Solutions**
oPE03	Multi-Function Input Setting Err	The settings for these parameters do not agree: • *H1-01 to H1-07 [Terminals S1 to S7 Function Selection]*	Correct the parameter settings.
		The settings for MFDIs overlap. **Note:** This does not include *H1-xx = 20 to 2F [MFDI Function Select = External Fault]* and *[Reserved]*.	Set the parameters correctly to prevent MFDI function overlap.
		You did not set these pairs of MFDI functions to Digital Inputs (*H1-xx*) at the same time.	Set the MFDI pairs.
		You set a minimum of two of these MFDI combinations to Digital Inputs (*H1-xx*) at the same time.	Remove the function settings that are not in use.
		Settings for N.C. and N.O. input *[H1-xx]* for these functions were selected at the same time: • Setting value *15 [Fast Stop (N.O.)]* • Setting value *17 [Fast Stop (N.C.)]*	Remove one of the function settings.
		These parameters are set at the same time: • *H1-xx ≠ 6A [Drive Enable]* • *H2-xx = 38 [Drive Enabled]*	Correct the parameter settings.
		These pairs of MFDI functions are not set to Digital Inputs (*H1-01 to H1-07 [Terminal S1 to S7 Function Selection]*): • Setting value *40 [Up Command]* • Setting value *41 [Down Command]*	
		One of these settings is set to two or more MFDIs (*H1-01 to H1-07*): • Setting value *40 [Up Command]* • Setting value *41 [Down Command]*	
		One of *H1-03 to H1-07 = 40* and *H1-01 ≠ F [Not Used]*	
		One of *H1-03 to H1-07 = 41* and *H1-02 ≠ F [Not Used]*	
		• *Multistep frequency reference [D1-18 = 0]* and *H1-xx = 50/150, 51/151, 52/152 or 53/153* are selected. • *Speed reference by digital input [D1-18 = 1]* and *Multi-Step Speed References [H1-xx = 3/103, 4/104 or 5/105]* are selected.	Check if contradictory settings have been assigned to the multi-function terminals at the same time. Correct setting errors.

Code	Name	Causes	Possible Solutions
oPE06	Control Method Selection Error	*A1-02 = 3 or 7 [Control Method Selection = CLV, CLV/PM]* is set, but there is no encoder option connected to the drive.	• Connect an encoder option to the drive. • Set *A1-02* correctly.
		You supplied external 24 V power to terminals PS-AC when: • There is an encoder option installed to the drive • The drive main circuit power supply is de-energized	1. De-energize the drive main circuit power supply and the external 24 V power supply to terminals PS-AC. 2. After the keypad display goes out, energize the drive main circuit power supply again. 3. Supply the external 24 V power to terminals PS-AC.
			When you use an encoder option, energize the drive main circuit power supply.

Code	Name	Causes	Possible Solutions
oPE07	Analog Input Selection Error	The settings for *H3-02, H3-06, and H3-10 [MFAI Function Selection]* overlap.	Set *H3-02, H3-06, and H3-10* correctly to prevent overlap. **Note:** It is possible to set these functions to multiple analog input terminals at the same time: • Setting value *0 [Speed Reference]* • Setting values *1F [Not Used]*

Code	Name	Causes	Possible Solutions
oPE08	Parameter Selection Error	You set a function that is not compatible with the control method set in *A1-02 [Control Method Selection]*.	1. Push to show *U1-18 [oPE Fault Parameter]*, and find parameters that are not in the applicable setting range. 2. Correct the parameter settings. **Note:** If more than one error occurs at the same time, other *oPExx* errors have priority over *oPE02*.
		When *A1-02 = 2 [Control Method Selection = OLV]*, you used these parameter settings: • *n2-02 > n2-03 [Automatic Freq Regulator Time 1 > Automatic Freq Regulator Time 2]* • *C4-02 [Torque Compensation Delay Time] >* 150	• Set *n2-02 < n2-03*. • Set *C4-02* < 150.
		When *d1-18 = 0 [Speed Reference Selection Mode = Multi-speed Mode1 (d1-01 to 08)]*, you used one of these MFDI functions: • *H1-xx = 50 [Nominal Speed]* • *H1-xx = 51 [Intermediate Speed]* • *H1-xx = 52 [Releveling Speed]* • *H1-xx = 53 [Leveling Speed]*	Correct the parameter settings.

Code	Name	Causes	Possible Solutions
oPE10	V/f Data Setting Error	The parameters that set the V/f pattern do not satisfy these conditions: • *E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04 [Minimum Output Frequency ≤ Mid Point A Frequency < Base Frequency ≤ Mid Point B Frequency ≤ Maximum Output Frequency]*	Set the parameters correctly to satisfy the conditions.

Code	Name	Causes	Possible Solutions
oPE14	RPM Setting Error	The values for *E2-04 [Motor Pole Count]* and *S2-01 [Motor Rated Speed]* do not match.	Set *S2-01* according to the motor pole count of your motor. • When *E1-06 = 50 Hz*: – 4 poles: 1001 ≤ *S2-01* ≤ 1500 – 6 poles: 751 ≤ *S2-01* ≤ 1000 – 8 poles: 601 ≤ *S2-01* ≤ 750 – 10 poles: 501 ≤ *S2-01* ≤ 600 – 12 poles: 429 ≤ *S2-01* ≤ 500 • When *E1-06 = 60 Hz*: – 4 poles: 1201 ≤ *S2-01* ≤ 1800 – 6 poles: 901 ≤ *S2-01* ≤ 1200 – 8 poles: 721 ≤ *S2-01* ≤ 900 – 10 poles: 601 ≤ *S2-01* ≤ 720 – 12 poles: 515 ≤ *S2-01* ≤ 600
		The value for *E1-06 [Base Frequency]* does not match the values for *E2-04 [Motor Pole Count]* and *S2-01 [Motor Rated Speed]*.	Make sure these conditions are met: *E1-06* ≥ (*S2-01* * *E2-04*) / 120

7.7 Auto-Tuning Errors

This table gives information about errors detected during Auto-Tuning. If the drive detects an Auto-Tuning error, the keypad will show the error and the motor will coast to stop. The drive will not send notification signals for faults and alarms when Auto-Tuning errors occur.

Two types of Auto-Tuning errors are: *Endx* and *Erx*. *Endx* identifies that Auto-Tuning has successfully completed with calculation errors. Find and repair the cause of the error and do Auto-Tuning again, or set the motor parameters manually. You can use the drive in the application if you cannot find the cause of the *Endx* error.

Erx identifies that Auto-Tuning was not successful. Find and repair the cause of the error and do Auto-Tuning again.

Code	Name	Causes	Possible Solutions
End1	Excessive Rated Voltage Setting	The torque reference was more than 20% during Auto-Tuning or the no-load current that was measured after Auto-Tuning is more than 80%.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data. • If you can uncouple the motor and load, remove the motor from the machine and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, use the results from Auto-Tuning.

Code	Name	Causes	Possible Solutions
End2	Iron Core Saturation Coefficient	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		Auto-Tuning results were not in the applicable parameter setting range, and *E2-07* or *E2-08 [Motor Saturation Coefficient 2]* have temporary values.	• Examine and repair damaged motor wiring. • If you can uncouple the motor and load, remove the motor from the machine and do Rotational Auto-Tuning again.

Code	Name	Causes	Possible Solutions
End3	Rated Current Setting Alarm	The rated current value is incorrect.	Do Auto-Tuning again and set the correct rated current shown on the motor nameplate.

Code	Name	Causes	Possible Solutions
End4	Adjusted Slip Calculation Error	The Auto-Tuning results were not in the applicable parameter setting range.	• Make sure the input motor nameplate data is correct. • Do Rotational Auto-Tuning again and correctly set the motor nameplate data. • If you cannot uncouple the motor and load, do Stationary Auto-Tuning 2.
		The motor rated slip that was measured after Stationary Auto-Tuning was 0.2 Hz or lower.	
		The motor rated slip that was measured after compensation with *E2-08 [Motor Saturation Coefficient 2]* is not in the applicable range.	
		The secondary resistor measurement results were not in the applicable range.	

Code	Name	Causes	Possible Solutions
End5	Resistance Tuning Error	The Auto-Tuning results of the Line-to-Line Resistance were not in the applicable range.	• Make sure that the input motor nameplate data is correct. • Examine and repair damaged motor wiring.

Code	Name	Causes	Possible Solutions
End6	Leakage Inductance Alarm	The Auto-Tuning results were not in the applicable parameter setting range.	Make sure that the input motor nameplate data is correct, and do Auto-Tuning again.
		A1-02 [Control Method Selection] setting is not applicable.	• Examine the value set in *A1-02*. • Make sure that the input motor nameplate data is correct, and do Auto-Tuning again.

Code	Name	Causes	Possible Solutions
End7	No-Load Current Alarm	The Auto-Tuning results of the motor no-load current value were not in the applicable range.	Examine and repair damaged motor wiring.
		Auto-Tuning results were less than 5% of the motor rated current.	Make sure that the input motor nameplate data is correct, and do Auto-Tuning again.

Code	Name	Causes	Possible Solutions
Er-01	Motor Data Error	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		The combination of the motor rated power and motor rated current do not match.	• Examine the combination of drive capacity and motor output. • Do Auto-Tuning again, and correctly set the motor rated power and motor rated current.

Code	Name	Causes	Possible Solutions
		The combination of the motor rated current that was entered during Auto-Tuning and *E2-03 [Motor No-Load Current]* do not match.	• Examine the motor rated current and the no-load current. • Set *E2-03* correctly. • Do Auto-Tuning again, and correctly set the motor rated current.
		The combination of the setting values of Motor Base Frequency and Motor Base Speed do not match.	Do Auto-Tuning again, and correctly set the Motor Base Frequency and Motor Base Speed.
Code	**Name**	**Causes**	**Possible Solutions**
Er-02	Drive in an Alarm State	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the motor nameplate data entered in Auto-Tuning is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		You did Auto-Tuning while the drive had a minor fault or alarm.	Clear the minor fault or alarm and do Auto-Tuning again.
		There is a defective motor cable or cable connection.	Examine and repair motor wiring.
		The load is too large.	• Decrease the load. • Examine the machine area to see if, for example, the motor shaft is locked.
		The drive detected a minor fault during Auto-Tuning.	1. Stop Auto-Tuning. 2. Examine the minor fault code and remove the cause of the problem. 3. Do Auto-Tuning again.
Code	**Name**	**Causes**	**Possible Solutions**
Er-03	STOP Button was Pressed	During Auto-Tuning, STOP was pushed.	Auto-Tuning did not complete correctly. Do Auto-Tuning again.
Code	**Name**	**Causes**	**Possible Solutions**
Er-04	Line-to-Line Resistance Error	The Auto-Tuning results were not in the applicable parameter setting range.	• Examine and repair motor wiring. • Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		Auto-Tuning did not complete in a pre-set length of time.	
		There is a defective motor cable or cable connection.	
		The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
Code	**Name**	**Causes**	**Possible Solutions**
Er-05	No-Load Current Error	The Auto-Tuning results were not in the applicable parameter setting range.	• Examine and repair motor wiring. • Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		Auto-Tuning did not complete in a pre-set length of time.	
		The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		Rotational Auto-Tuning was done with a load that was more than 30% of the rating connected to the motor.	• Disconnect the machine from the motor and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, make sure that the load is less than 30% of the motor rating. If a mechanical brake is installed in the motor, release the brake during Rotational Auto-Tuning.
Code	**Name**	**Causes**	**Possible Solutions**
Er-08	Rated Slip Error	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		Auto-Tuning did not complete in a pre-set length of time.	• Examine and repair the motor wiring. • If the motor and machine are connected during Rotational Auto-Tuning, decouple the motor from the machinery.
		The Auto-Tuning results were not in the applicable parameter setting range.	
		Rotational Auto-Tuning was done with a load that was more than 30% of the rating connected to the motor.	• Disconnect the machine from the motor and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, make sure that the load is less than 30% of the motor rating. If a mechanical brake is installed in the motor, release the brake during Rotational Auto-Tuning.

Code	Name	Causes	Possible Solutions
Er-09	Acceleration Error	The motor did not accelerate for the specified acceleration time.	1. Increase the value set in *C1-01 [Acceleration Time 1]*. 2. Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		The value of *L7-01 or L7-02 [Forward/Reverse Torque Limit]* is small.	Increase the value set in *L7-01 or L7-02*.
		Rotational Auto-Tuning was done with a load that was more than 30% of the rating connected to the motor.	• Disconnect the machine from the motor and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, make sure that the load is less than 30% of the motor rating. If a mechanical brake is installed in the motor, release the brake during Rotational Auto-Tuning.
Code	**Name**	**Causes**	**Possible Solutions**
Er-10	Motor Direction Error	There is defective drive and motor wiring.	Examine and repair motor wiring.
		There is defective drive and encoder wiring.	Examine and repair the wiring to the encoder.
		The direction of the motor and the setting of *F1-05 [PG 1 Rotation Selection]* are opposite.	Set *F1-05* correctly.
		The machine pulled the motor to rotate in the opposite direction.	Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		When the torque reference is 100% or higher, the sign of the speed reference was opposite of the detected speed.	
Code	**Name**	**Causes**	**Possible Solutions**
Er-11	Motor Speed Error	The torque reference during acceleration is too high (100%).	• Increase the value set in *C1-01 [Acceleration Time 1]*. • Disconnect the machine from the motor and do Rotational Auto-Tuning again.
Code	**Name**	**Causes**	**Possible Solutions**
Er-12	Current Detection Error	There is a phase loss in the drive input power. (U/T1, V/T2, W/T3)	Examine and repair motor wiring.
		The current exceeded the current rating of the drive.	• Check the motor wiring for any short circuits between the wires. • Check and turn ON any magnetic contactors used between motors. • Replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
		The output current is too low.	
		You tried Auto-Tuning without a motor connected to the drive.	Connect the motor and do Auto-Tuning.
		There was a current detection signal error.	Replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
Code	**Name**	**Causes**	**Possible Solutions**
Er-13	Leakage Inductance Alarm	The motor rated current value is incorrect.	Correctly set the rated current indicated on the motor nameplate and perform Auto-Tuning again.
		The drive could not complete tuning for leakage inductance in fewer than 300 seconds.	Examine and repair motor wiring.
Code	**Name**	**Causes**	**Possible Solutions**
Er-15	Torque Saturation Error	During Inertia Tuning, the output torque was more than the value set in *L7-01 to L7-04 [Torque Limit]*.	• Increase the value set in *L7-01 to L7-04 [Torque Limit]* as much as possible. • Decrease the values set for the frequency and amplitude of the test signals used when doing inertia tuning. First, decrease the test signal amplitude, and then do Inertia Tuning. If the error continues, decrease the test signal frequency and do Inertia Tuning again.

7.8 Backup Function Operating Mode Display and Errors

◆ Operating Mode Display

When you use the backup function from the LCD keypad, the keypad shows messages as specified by the current operation. These indicators do not show that there was an error.

Keypad Display	Name	Display	Status
Drive and Keypad mismatch. Should the parameters be restored?	Detection of inconsistency between the drive and keypad	Normally displayed	The drive detected the connection of a keypad from a different drive. Select [Yes] to copy parameters that were backed up in the keypad to the connected drive.
Restore from keypad	Restoring parameters	Flashing	The parameters stored in the keypad were restored to the drive.
End	Backup/restore/verify operation ended normally	Normally displayed	The parameter backup, restore, or verify operation ended normally.
Backup from Drive	Backing up parameters	Flashing	The parameters stored in the drive are being backed up to the keypad.
Verify Keypad & Drive	Verifying parameters	Flashing	The parameter settings stored in the keypad and the parameter settings in the drive match or are being compared.

◆ Backup Function Runtime Error

When there is an error, the keypad shows a code to identify the error.

The tables in this section show the error codes. Refer to these tables to remove the cause of the errors.

Note:

Push any key on the keypad to clear an error.

Code	Name	Causes	Possible Solutions
CPEr	Control Mode Mismatch	The keypad setting and drive setting for *A1-02 [Control Method Selection]* do not agree.	1. Set *A1-02* on the drive to the same value that is on the keypad. 2. Restore the parameters.
CPyE	Error Writing Data	Parameter restore did not end correctly.	Restore the parameters.
CSEr	Control Mode Mismatch	The keypad is broken.	Replace the keypad.
dFPS	Drive Model Mismatch	You tried to restore parameters to a different drive model than the one that you backed up.	1. Examine the drive model that you used to back up the parameters. 2. Restore the parameters.
iFEr	Keypad Communication Error	There was a communications error between the keypad and the drive.	Examine the connector or cable connection.
ndAT	Error Received Data	The parameter settings for model and specifications (power supply voltage and capacity) are different between the keypad and the drive.	1. Make sure that drive model and the value set in *o2-04 [Drive Model (KVA) Selection]* agree. 2. Restore the parameters.
		The parameters are not stored in the keypad.	1. Connect a keypad that has the correct parameters. 2. Restore the parameters.
rdEr	Error Reading Data	You tried to back up the data when *o3-02 = 0 [Copy Allowed Selection = Disabled]*.	Set *o3-02 = 1 [Enabled]* and back up again.
vAEr	Voltage Class, Capacity Mismatch	The power supply specifications or drive capacity parameter settings are different between the keypad and the drive.	1. Make sure that drive model and the value set in *o2-04 [Drive Model (KVA) Selection]* agree. 2. Restore the parameters.
vFyE	Parameters do not Match	The parameters that are backed up in the keypad and the parameters in the drive are not the same.	1. Restore or backup the parameter again. 2. Verify the parameters.

7.9 Diagnosing and Resetting Faults

When a fault occurs and the drive stops, do the procedures in this section to remove the cause of the fault, then re-energize the drive.

◆ Fault and Power Loss Occur at the Same Time

⚠ WARNING Crush Hazard
Wear eye protection when you do work on the drive.
If you do not use correct safety equipment, it can cause serious injury or death.

⚠ WARNING Electrical Shock Hazard
After the drive blows a fuse or trips an RCM/RCD, do not immediately energize the drive or operate peripheral devices. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. If you do not know the cause of the problem, contact Yaskawa before you energize the drive or peripheral devices.
If you do not fix the problem before you operate the drive or peripheral devices, it can cause serious injury or death.

1. Supply power to the control circuit from the external 24 V input.
2. Use monitor parameters *U2-xx [Fault Trace]* to show the fault code and data about the operating status of the drive immediately before the fault occurred.
3. Use the information in the Troubleshooting tables to remove the fault.

Note:

1. To find the faults that were triggered, check the fault history in *U2-02 [Previous Fault]*. To find information about drive status (such as frequency, current, and voltage) when the faults were triggered, check *U2-03 to U2-20*.
2. If the fault display stays after you re-energize the drive, remove the cause of the fault and reset.

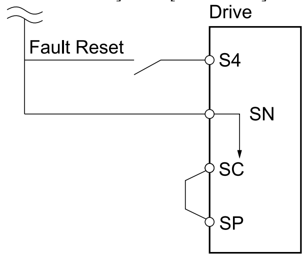
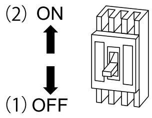
◆ Fault Occurs Without Power Loss

1. Examine the fault code shown on the keypad.
2. Use the information in the Troubleshooting tables to remove the fault.
3. Do a fault reset.

◆ Fault Reset Procedure

If a fault occurs, you must remove the cause of the fault and re-energize the drive. Table 7.3 lists the different methods to reset the drive after a fault.

Table 7.3 Fault Reset Methods

Methods	Description
Method 1	While the keypad is showing the fault or alarm code, push  on the keypad.
Method 2	Switch ON the MFDI terminal set to *H1-xx = 14 [MFDI Function Select = Fault Reset]*. **Note:** The default setting for *H1-04 [Terminal S4 Function Selection]* is *14 [Fault Reset]*. 
Method 3	1. De-energize the drive main circuit power supply. 2. Energize the drive again after the keypad display goes out. 

Note:

If the drive receives a Run command from a communication option or control circuit terminal, the drive will not reset the fault. Turn the Run command OFF to reset the fault. If you do a fault reset when the drive has a Run command, the keypad will show minor fault *CrST [Remove RUN Command to Reset]*.

7.10 Troubleshooting Without Fault Display

If the drive or motor operate incorrectly, but the keypad does not show a fault or error code, refer to the items this section.

- Motor hunting and oscillation
- Unsatisfactory motor torque
- Unsatisfactory speed precision
- Unsatisfactory motor torque and speed response
- Motor noise

◆ The Parameter Settings Will Not Change

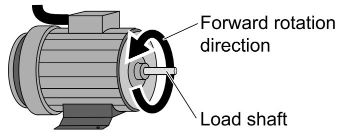
Causes	Possible Solutions
The drive is operating the motor (the drive is in Drive Mode).	Stop the drive and change to Programming Mode.
Parameter *A1-01 = 0 [Access Level Selection = Operation Only]*.	Set *A1-01 = 2 [Access Level Selection = Advanced Level]* or *A1-01 = 3 [Expert Level]*.
Parameter *H1-xx = 1B [MFDI Function Select = Programming Lockout]*.	Activate the terminals to which *H1-xx = 1B* is set, and then change the parameters.
You entered an incorrect password in *A1-04 [Password]*.	• Enter the correct password to *A1-04* again. • If you forgot the password, set the password again with *A1-04* and *A1-05 [Password Setting]*. **Note:** If you set the password, you cannot change these parameters until the password aligns: • *A1-01 [Access Level Selection]* • *A1-02 [Control Method Selection]* • *A1-03 [Initialize Parameters]* • *A2-01 to A2-32 [User Parameter 1 to User Parameter 32]*
The drive detected *Uv [Undervoltage]*.	• View *U1-07 [DC Bus Voltage]* to see the power supply voltage. • Examine the main circuit wiring.

◆ The Motor Does Not Rotate after You Enter a Run Command

Causes	Possible Solutions
The drive is not in Drive Mode.	1. Make sure that the READY LED on the keypad is ON. 2. If the READY LED is OFF, push and hold the ESC Key to go back to the frequency reference screen (the initial screen).
The drive stopped and you pushed LO/RE to transfer the Run command source to the keypad.	Do one of these two: • Push LO/RE. • Re-energize the drive. **Note:** When LO/RE must not change the Run command source, set *o2-01 = 0 [LO/RE Key Function Selection = Disabled]*.
Auto-Tuning completed.	Push and hold the ESC Key to go back to the frequency reference screen (the initial screen). **Note:** When Auto-Tuning completes, the drive changes to Programming Mode. The drive will not accept a Run command unless the drive is in Drive Mode.
The drive received a Fast Stop command.	Turn off the fast stop input signal.
The settings for the source that supplies the Run command are incorrect.	Set *b1-02 [Run Command Selection 1]* correctly.
The frequency reference source is not set correctly.	Set *b1-01 [Frequency Reference Selection 1]* correctly.
There is defective wiring in the control circuit terminals.	• Correctly wire the drive control circuit terminals. • View *U1-10 [Input Terminal Status]* for input terminal status.
The selection for the sinking/sourcing mode and the internal/external power supply is incorrect.	• For sinking mode, close the circuit between terminals SC-SP with a wire jumper. • For sourcing mode, close the circuit between terminals SC-SN with a wire jumper. • For external power supply, remove the wire jumper.
The frequency reference is too low.	• View *U1-01 [Freq Reference]*. • Increase the frequency reference to a value higher than *E1-09 [Minimum Output Frequency]*.
The MFAI setting is incorrect.	• Make sure that the functions set to the MFAI are correct. • View *U1-13 to U1-14 [Terminal A1, A2 Input Voltage]* to see if the analog input values set to terminals A1 and A2 are applicable.

Causes	Possible Solutions
The settings for the analog speed reference are incorrect.	Check the settings (signal level, function, bias, gain) for the analog input that supplies the speed reference.
You pushed STOP.	Turn the Run command OFF then ON from an external input. **Note:** When you push STOP during operation, the drive will ramp to stop. Set *o2-02 = 0 [STOP Key Function Selection = Disabled]* to disable the STOP function.

◆ The Motor Rotates in the Opposite Direction from the Up/Down Command

Causes	Possible Solutions
The phase wiring between the drive and motor is incorrect.	• Examine the wiring between the drive and motor. • Connect drive output terminals U/T1, V/T2, and W/T3 in the correct sequence to agree with motor terminals U, V, and W. • Switch two motor cables U, V, and W to reverse motor direction.
Drive control circuit terminals for the Up and Down commands are switched.	• Connect drive output terminals U/T1, V/T2, and W/T3 in the correct sequence to agree with motor terminals U, V, and W. • Switch two motor cables U, V, and W to reverse motor direction.  **Figure 7.1 Forward Rotating Motor** **Note:** • For Yaskawa motors, the forward direction is counterclockwise when looking from the motor shaft side. • Refer to the motor specifications, and make sure that the forward rotation direction is correct for the application. The forward rotation direction of motors can be different for different motor manufacturers and types.
The signal connections for forward run and reverse run on the drive control circuit terminals and control panel side are incorrect.	Correctly wire the control circuit.

◆ The Motor Is Too Hot

Causes	Possible Solutions
The load is too heavy.	• Decrease the load. • Increase the acceleration and deceleration times. • Examine the values set in *L1-01 [Motor Overload (oL1) Protection]*, *L1-02 [Motor Overload Protection Time]*, and *E2-01 [Motor Rated Current (FLA)]*. • Use a larger motor. **Note:** The motor also has a short-term overload rating. Examine this rating carefully before setting drive parameters.
The motor is running continuously at a very low speed.	• Change the run speed. • Use a drive-dedicated motor.
The drive is operating in a vector control method, but Auto-Tuning has not been done.	• Do Auto-Tuning. • Calculate motor parameter and set motor parameters. • Set *A1-02 = 0 [Control Method Selection = V/f Control]*.
The voltage insulation between motor phases is not sufficient.	• Use a motor with a voltage tolerance that is higher than the maximum voltage surge. • Use a drive-dedicated motor that is rated for use with AC drives for applications that use a motor on drives rated higher than 400 V class. • Install an AC reactor on the output side of the drive. **Note:** When the motor is connected to the drive output terminals U/T1, V/T2, and W/T3, surges occur between the drive switching and the motor coils. These surges can be three times the drive input power supply voltage (600 V for a 200 V class drive, 1200 V for a 400 V class drive).
The air around the motor is too hot.	• Measure the ambient temperature. • Decrease the temperature in the area until it is in the specified temperature range.
The motor fan stopped or is clogged.	• Clean the motor fan. • Make the drive environment better.

◆ The Correct Auto-Tuning Mode Is Not Available

Causes	Possible Solutions
The desired Auto-Tuning mode is not available for the selected control mode.	Change the motor control method with parameter *A1-02 [Control Method Selection]*.

◆ oPE02 Error Occurs When Decreasing the Motor Rated Current Setting

Causes	Possible Solutions
Motor rated current and the motor no-load current setting in the drive are incorrect.	• You are trying to set the motor rated current in *E2-01 [Motor Rated Current (FLA)]* to a value lower than the no-load current set in *E2-03 [Motor No-Load Current]*. • Make sure that value set in *E2-01* is higher than *E2-03*. • If it is necessary to set *E2-01* lower than *E2-03*, first decrease the value set to *E2-03*, then change the *E2-01* setting as necessary.

◆ The Motor Stalls during Acceleration or Accel/Decel Time Is Too Long

Causes	Possible Solutions
The drive and motor system are at the torque limit or current suppression will not let the drive accelerate.	• Decrease the load. • Use a larger motor. **Note:** Although the drive has a Stall Prevention function and a Torque Compensation Limit function, if you try to accelerate too fast or try to drive a load that is too large, it can be too much for the limits of the motor.
Torque limit is set incorrectly.	Set the torque limit correctly.
The acceleration time setting is too short.	Examine the values set in *C1-01, C1-03, C1-05, or C1-07 [Acceleration Time]* and set them to applicable values.
The load is too large.	• Increase the acceleration time. • Examine the mechanical brake and make sure that it is fully releasing. • Decrease the load to make sure that the output current stays less than the motor rated current. • Use a larger motor. **Note:** Although the drive has a Stall Prevention function and a Torque Compensation Limit function, if you try to accelerate too fast or try to drive a load that is too large, it can be too much for the limits of the motor.
The motor characteristics and drive parameter settings are not compatible.	• Set the correct V/f pattern to agree with the characteristics of the motor. • Examine the V/f pattern set in *E1-03 [V/f Pattern Selection]*. • Do Rotational Auto-Tuning.
The drive is operating in vector control mode, but you did not complete Auto-Tuning.	• Do Auto-Tuning. • Calculate motor data and reset motor parameters. • Set *A1-02 = 0 [Control Method Selection = V/f Control]*.
The Stall Prevention level during acceleration setting is too low.	Increase the value set in *L3-02 [Stall Prevent Level during Accel]*. **Note:** If the *L3-02* value is too low, the acceleration time can be unsatisfactorily long.
The Stall Prevention level during run setting is too low.	Increase the value set in *L3-06 [Stall Prevent Level during Run]*. **Note:** If the *L3-06* value is too low, speed will decrease before the drive outputs torque.
The drive is at the limit of the V/f motor control method.	• When the motor cable is longer than 50 m (164 ft), do Auto-Tuning for line-to-line resistance. • Set the V/f pattern to “High Starting Torque”. • Use a Vector Control method. **Note:** V/f control method does not supply high torque at low speeds.

◆ The Drive Speed Reference Is Different than the Controller Speed Reference Command

Causes	Possible Solutions
The analog input gain and bias for the speed reference input are set incorrectly.	Examine the gain and bias settings for the analog inputs that set the speed reference. • Terminal A1: *H3-03 [Terminal A1 Gain Setting]*, *H3-04 [Terminal A1 Bias Setting]* • Terminal A2: *H3-11 [Terminal A2 Gain Setting]*, *H3-12 [Terminal A2 Bias Setting]*
The drive is receiving frequency bias signals from analog input terminals A1 to A2 and the sum of all signals makes the speed reference.	• Examine parameters *H3-02, H3-10 [MFAI Function Selection]*. If two or more of these parameters are set to *0*, change the settings. • Use *U1-13 to U1-14 [Terminal A1, A2 Input Voltage]* to make sure that the analog input values set to terminals A1 and A2 are applicable.
The motor rotates faster than the speed reference at low speed.	Set *E1-09 [Minimum Output Frequency] > 0* . **Note:** • The recommended setting for *E1-09* is 0.5 Hz. • When speed reference < *E1-09*, the drive output will turn OFF.

◆ There Is Too Much Motor Oscillation and the Rotation Is Irregular

Causes	Possible Solutions
Unsatisfactory balance of motor phases.	• Make sure that the drive input power voltage supplies stable power. • Set *L8-05 = 0 [Input Phase Loss Protect Select = Disabled]*.
The motor is hunting.	Increase the value of *n2-01 [SpdFeedbackDetectCtr (AFR) Gain]* or *n2-02 [SpdFeedbackDetCtr (AFR)TimeConst1]*.

◆ Deceleration Takes Longer Than Expected When Dynamic Braking Is Enabled

Causes	Possible Solutions
The deceleration time setting is too long.	Set *C1-02, C1-04, C1-06, or C1-08 [Deceleration Times]* to applicable values.
The motor torque is not sufficient.	Use a larger motor. **Note:** If these items are correct, the demand on the motor is more than the motor capacity: • Parameter settings are correct. • The drive does not detect *ov [Overvoltage]*.
The drive and motor system reached the torque limit.	Examine the values set in *L7-01 to L7-04 [Torque Limit]* and increase them if necessary. **Note:** If the torque limit is enabled, deceleration time can increase because the drive cannot output more torque than the limit.
The load is more than the internal torque limit as specified by the drive rated current.	Replace the drive with a larger capacity model.

◆ The Elevator Car Rolls Back when You Apply or Release the Brake

Causes	Possible Solutions
The DC injection braking is not sufficient.	Increase the value set in *S1-03 [DC Injection Current at Stop]*.
The holding power of the Position Lock is insufficient.	• Increase the value set in *S3-02 [Position Lock Gain 2 at Start]*. • Increase the value set in *S3-03 [Position Lock Gain at Stop]*.

◆ There Is Audible Noise from the Drive or Motor Cables when You Energize the Drive

Causes	Possible Solutions
The relay switching in the drive is making too much noise.	• Use *C6-03 [Carrier Frequency Upper Limit]* to decrease the carrier frequency. • Connect a noise filter to the input side of the drive power supply. • Connect a noise filter to the output side of the drive. • Isolate the control circuit wiring from the main circuit wiring. • Use a metal cable gland to wire the drive. • Shield the periphery of the drive with metal. • Make sure that the drive and motor are grounded correctly. • Make sure that ground faults have not occurred in the wiring or motor.

◆ Residual Current Monitoring/Detection (RCM/RCD) Trips During Run

Causes	Possible Solutions
There is too much leakage current from the drive.	• Increase the RCM/RCD sensitivity or use RCM/RCD with a higher threshold. • Use *C6-03 [Carrier Frequency Upper Limit]* to decrease the carrier frequency. • Decrease the length of the cable used between the drive and the motor. • Install a noise filter or AC reactor on the output side of the drive. Set *C6-03 = 2 kHz* when connecting an AC reactor. • Disable the internal EMC filter.

◆ Motor Rotation Causes Unexpected Audible Noise from Connected Machinery

Causes	Possible Solutions
The carrier frequency and the resonant frequency of the connected machinery are the same.	Adjust *C6-03 [Carrier Frequency Upper Limit]*.

◆ Motor Rotation Causes Oscillation or Hunting

Causes	Possible Solutions
The speed reference is assigned to an external source, and there is electrical interference in the signal.	Make sure that electrical interference does not have an effect on the signal lines. • Isolate control circuit wiring from main circuit wiring. • Use twisted-pair cables or shielded wiring for the control circuit. • Increase the value of *H3-13 [Analog Input FilterTime Constant]*.
The cable between the drive and motor is too long.	• Do Auto-Tuning. • Make the wiring as short as possible.

◆ The Starting Torque Is Not Sufficient

Causes	Possible Solutions
Auto-Tuning has not been done in vector control method.	Do Auto-Tuning.
The control method was changed after doing Auto-Tuning.	Do Auto-Tuning again.
Stationary Auto-Tuning for Line-to-Line Resistance was done.	Do Rotational Auto-Tuning.

◆ The Output Frequency Is Lower Than the Frequency Reference

Causes	Possible Solutions
A large load triggered Stall Prevention function during acceleration.	• Decrease the load. • Adjust *L3-02 [Stall Prevent Level during Accel]*.
L3-01 = 3 [Stall Prevent Select duringAccel = ILim Mode] has been set.	1. Check whether the V/f pattern and motor parameter settings are appropriate, and set them correctly. 2. If this does not solve the problem, and it is not necessary to limit the current level of stall during acceleration, adjust *L3-02*. 3. If this does not solve the problem, set *L3-01 = 1 [Enabled]*.
The motor is rotating at this speed: *S1-02 [DC Injection/Zero SpeedThreshold]* ≤ Motor Speed < *E1-09 [Minimum Output Frequency]*	Set *E1-09 < S1-02*.

◆ The Motor Will Not Restart after a Loss of Power

Causes	Possible Solutions
The drive did not receive a Run command after applying power.	• Examine the sequence and wiring that enters the Run command. • Set up a relay to make sure that the Run command stays enabled during a loss of power.

8

Periodic Inspection and Maintenance

This chapter gives information about how to examine and maintain drives in use, how to replace cooling fans and other parts, and how to store drives.

8.1 Section Safety

⚠DANGER

Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

Disconnect all power to the drive and wait for the time specified on the warning label before you remove covers. Check the drive for dangerous voltages before servicing or repair work.

If you do work on the drive when it is energized and there is no cover over the electronic circuits, it will cause serious injury or death from electrical shock. The drive has internal capacitors that stay charged after you de-energize the drive.

⚠WARNING

Electrical Shock Hazard

The motor will run after you de-energize the drive. PM motors can generate induced voltage to the terminal of the motor after you de-energize the drive.

If you touch a motor that is moving or energized, it can cause serious injury or death.

Do not operate the drive when covers are missing. Replace covers and shields before you operate the drive. Use the drive only as specified by the instructions.

Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. If covers or safety shields are missing from the drive, it can cause serious injury or death.

Always ground the motor-side grounding terminal.

If you do not ground the equipment correctly, it can cause serious injury or death if you touch the motor case.

Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive.

If personnel are not approved, it can cause serious injury or death.

Do not wear loose clothing or jewelry when you do work on the drive. Tighten loose clothing and remove all metal objects, for example watches or rings.

Loose clothing can catch on the drive and jewelry can conduct electricity and cause serious injury or death.

Fire Hazard

Tighten all terminal screws to the correct tightening torque.

Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.

Damage to Equipment

Do not apply incorrect voltage to the main circuit of the drive. Operate the drive in the specified range of the input voltage on the drive nameplate.

Voltages that are higher than the permitted nameplate tolerance can cause damage to the drive.

Fire Hazard

Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material.

Flammable and combustible materials can start a fire and cause serious injury or death.

⚠WARNING

Electrical Shock Hazard

Do not modify the drive body or drive circuitry.

Modifications to drive body and circuitry can cause serious injury or death, will cause damage to the drive, and will void the warranty. Yaskawa is not responsible for modifications of the product made by the user.

Sudden Movement Hazard

Make sure that you align the phase order for the drive and motor when you connect the motor to drive output terminals U/T1, V/T2, and W/T3.

If the phase order is incorrect, it can cause the motor to run in reverse. If the motor accidentally runs in reverse, it can cause serious injury or death.

⚠CAUTION

Burn Hazard

Do not touch a hot drive heatsink. De-energize the drive, wait for a minimum of 15 minutes, then make sure that the heatsink is cool before you replace the cooling fans.

If you touch a hot drive heatsink, it can burn you.

NOTICE

Damage to Equipment

When you touch the drive and circuit boards, make sure that you observe correct electrostatic discharge (ESD) procedures.

If you do not follow procedures, it can cause ESD damage to the drive circuitry.

Use the instructions in this manual to replace the cooling fans. When you do maintenance on the fans, replace all the fans to increase product life.

If you install the fans incorrectly, it can cause damage to the drive.

Make sure that all connections are correct after you install the drive and connect peripheral devices.

Incorrect connections can cause damage to the drive.

Do not energize and de-energize the drive more frequently than one time each 30 minutes.

If you frequently energize and de-energize the drive, it can cause drive failure.

Do not operate a drive or connected equipment that has damaged or missing parts.

You can cause damage to the drive and connected equipment.

Note:

Do not use unshielded cable for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive. Unshielded wire can cause electrical interference and unsatisfactory system performance.

8.2 Inspection

Power electronics have limited life and can show changes in performance and deterioration of performance after years of use in usual conditions. To help prevent these problems, it is important to do preventive maintenance and regular inspection, and replace parts on the drive.

Drives contain different types of power electronics, for example power transistors, semiconductors, capacitors, resistors, fans, and relays. The electronics in the drive are necessary for correct motor control.

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

Note:

Examine the drive one time each year at a minimum.

The operating conditions, environmental conditions, and use conditions will have an effect on the examination frequency for connected equipment.

Examine the drive more frequently if you use the drive in bad conditions or in these conditions:
- High ambient temperatures
- Frequent starting and stopping
- Changes in the AC power supply or load
- Too much vibration or shock loading
- Dust, metal dust, salt, sulfuric acid, or chlorine atmospheres
- Unsatisfactory storage conditions.

◆ Recommended Daily Inspection

Examine the items in Table 8.1 each day to make sure that the components do not wear out or fail. Make a copy of this checklist and put a check mark in the “Checked” column after each inspection.

Table 8.1 Daily Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Motor	Examine for unusual oscillation or noise coming from the motor.	• Check the load coupling. • Measure motor vibration. • Tighten all loose components.	
Cooling System	Examine for unusual heat from the drive or motor and visible discoloration.	• Check for a load that is too heavy. • Tighten loose screws. • Check for a dirty heatsink or motor. • Measure the ambient temperature.	
	Examine the cooling fans.	• Check for a clogged or dirty fan. • Use the performance life monitor to check for correct fan operation.	
Surrounding Environment	Make sure that the installation environment is applicable.	Remove the source of contamination or correct unsatisfactory environment.	
Load	Make sure that the drive output current is not more than the motor or drive rating for an extended period of time.	• Check for a load that is too heavy. • Check the correct motor parameter settings.	
Power Supply Voltage	Examine main power supply and control voltages.	• Correct the voltage or power supply to agree with nameplate specifications. • Verify all main circuit phases.	

◆ Recommended Periodic Inspection

Examine the items in Table 8.2 to Table 8.6 one time each year at a minimum. The operating conditions, environmental conditions, and use conditions will have an effect on the examination frequency for connected equipment. You must use your experience with the application to select the correct inspection frequency for each drive installation. Periodic inspections will help to prevent performance deterioration and product failure. Make a copy of this checklist and put a check mark in the “Checked” column after each inspection.

⚠ DANGER Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

Table 8.2 Main Circuit Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
General	• Examine equipment for discoloration from too much heat or deterioration. • Examine for damaged parts.	• Replace damaged components as necessary. • The drive does not have many serviceable parts and it could be necessary to replace the drive.	
	Examine for dirt, unwanted particles, or dust on components.	• Examine enclosure door seal. • Use a vacuum cleaner to remove unwanted particles and dust without touching the components. • If you cannot remove unwanted particles and dust with a vacuum cleaner, replace the components.	
Conductors and Wiring	• Examine wiring and connections for discoloration or damage. Examine wiring and connections for discoloration from too much heat. • Examine wire insulation and shielding for discoloration and wear.	Repair or replace damaged wiring.	
Terminal Block	Examine terminals for stripped, damaged, or loose connections.	• Tighten loose screws. • Replace damaged screws.	
Electromagnetic Contactors and Relays	• Examine contactors and relays for too much noise during operation. • Examine coils for signs of too much heat, such as melted or broken insulation.	• Check coil voltage for overvoltage or undervoltage conditions. • Replace broken relays, contactors, or circuit boards that you can remove.	
Dynamic Braking Option	Examine the insulation for discoloration from too much heat.	If there is discoloration in the option, check to make sure that there is not damage to the wiring. A small quantity of discoloration is not a problem.	
Electrolytic Capacitor	• Examine for leaks, discoloration, or cracks. • Examine if the cap has come off, if there is swelling, or if there are leaks from broken sides.	The drive does not have many serviceable parts and it could be necessary to replace the drive.	
Diodes, IGBT (Power Transistor)	Examine for dust or other unwanted material collected on the surface.	Use a vacuum cleaner to remove unwanted particles and dust without touching the components.	

Table 8.3 Motor Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Operation Check	Check for increased vibration or unusual noise.	Stop the motor and contact approved maintenance personnel as necessary.	

Table 8.4 Control Circuit Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
General	• Examine terminals for stripped, damaged, or loose connections. • Make sure that all terminals have been correctly tightened.	• Tighten loose screws. • Replace damaged screws or terminals. • If terminals are integral to a circuit board, it could be necessary to replace the control board or the drive.	
Circuit Boards	• Check for odor, discoloration, or rust. • Make sure that all connections are correctly fastened. • Make sure that the surface of the circuit board does not have dust or oil mist.	• Tighten loose connections. • Use a vacuum cleaner to remove unwanted particles and dust without touching the components. • If you cannot remove unwanted particles and dust with a vacuum cleaner, replace the components. • Do not use solvents to clean the board. • The drive does not have many serviceable parts and it could be necessary to replace the drive.	

Table 8.5 Cooling System Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Cooling Fan	• Check for unusual oscillation or unusual noise. • Check for damaged or missing fan blades.	Clean or replace the fans as necessary.	
Heatsink	• Examine for dust or other unwanted material collected on the surface. • Examine for dirt.	Use a vacuum cleaner to remove unwanted particles and dust without touching the components.	
Air Duct	Examine air intake, exhaust openings and make sure that there are no unwanted materials on the surface.	Clear blockages and clean air duct as necessary.	

Table 8.6 Keypad Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
General	• Make sure that the keypad shows the data correctly. • Examine for dust or other unwanted material that collected on components in the area.	• If you have problems with the display or the keys, contact Yaskawa or your nearest sales representative. • Clean the keypad.	

8.3 Maintenance

The drive Maintenance Monitors keep track of component wear and tell the user when the end of the estimated performance life is approaching. The Maintenance Monitors prevent the need to shut down the full system for unexpected problems. Users can set alarm notifications for the maintenance periods for these drive components:

- Cooling fan
- Electrolytic capacitor
- Soft charge bypass relay
- IGBT

Contact Yaskawa or your nearest sales representative for more information about part replacement.

◆ Replaceable Parts

You can replace these parts of the drive:

- Cooling fan

If there is a failure in the main circuit, replace the drive.

If the drive is in the warranty period, contact Yaskawa or your nearest sales representative before you replace parts. Yaskawa reserves the right to replace or repair the drive as specified by the Yaskawa warranty policy.

⚠ DANGER Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.
If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

◆ Part Replacement Guidelines

Table 8.7 shows the standard replacement period for replacement parts. When you replace these parts, make sure that you use Yaskawa replacement parts for the applicable model and design revision number of your drive.

Table 8.7 Standard Replacement Period

Parts	Standard Replacement Period
Cooling fan	10 years
Electrolytic capacitor *1	10 years

*1 If there is damage to parts that you cannot repair or replace, replace the drive.

Note:

Performance life estimate is based on these use 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. Operating conditions for performance life estimate: Ambient temperature: Yearly average of 40 °C (IP20/UL Open Type), Load factor: 80%, Operating rate: 24 hours a day

◆ Monitors that Display the Lifespan of Drive Components

The drive keypad shows percentage values for the replacement parts to help you know when you must replace those components. Use the monitors in Table 8.8 to check replacement periods. When the monitor value is 100%, the component is at the end of its useful life and there is an increased risk of drive malfunction. Yaskawa recommends that you check the maintenance period regularly to make sure that you get the maximum performance life.

Table 8.8 Performance Life Monitors

Monitor No.	Parts	Description
U4-03	Cooling fan	Shows the total operation time of fans as 0 to 99999 hours. After this value is 99999, the drive automatically resets it to 0.
U4-04		Shows the total fan operation time as a percentage of the specified maintenance period.
U4-05	Electrolytic capacitor	Shows the total capacitor usage time as a percentage of the specified maintenance period.

Monitor No.	Parts	Description
U4-06	Soft charge bypass relay	Shows the number of times the drive is energized as a percentage of the performance life of the inrush circuit.
U4-07	IGBT	Shows the percentage of the maintenance period for the IGBTs.

◆ Alarm Outputs for Maintenance Monitors

You can use *H2-xx [MFDO Function Selection]* to send a message that tells you when a specified component is near the end of its performance life estimate. Set the applicable value to *H2-xx* as shown in Table 8.9 for your component.

When the specified component is near the end of its performance life estimate, the MFDO terminals set for *H2-xx = 2F [Maintenance Notification]* will turn ON, and the keypad will show an alarm that identifies the component to replace.

Table 8.9 Maintenance Period Alarms

Display	Alarm Name	Cause	Possible Solutions	MFDO (Setting Value in H2-xx)
LT-1	Cooling Fan Maintenance Time	The cooling fan is at 90% of its expected performance life.	Replace the cooling fan, then set *o4-03 = 0 [Fan Operation Time Setting = 0 h]* to reset the cooling fan operation time.	2F
LT-2	Capacitor Maintenance Time	The capacitors for the main circuit and control circuit are at 90% of expected performance life.	Replace the board or the drive. Contact Yaskawa or your nearest sales representative to replace the board.	2F
LT-3	SoftChargeBypassRelay MainteTime	The soft charge bypass relay is at 90% of its performance life estimate.	Replace the board or the drive. Contact Yaskawa or your nearest sales representative to replace the board.	2F
LT-4	IGBT Maintenance Time (50%)	The IGBT is at 50% of its expected performance life.	Check the load, carrier frequency, and output frequency.	2F
TrPC	IGBT Maintenance Time (90%)	The IGBT is at 90% of its expected performance life.	Replace the IGBT or the drive.	10

◆ Related Parameters

Replace the component, then set *o4-03, o4-05, o4-07, and o4-09 [Maintenance Setting] = 0* to reset the Maintenance Monitor. 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.

Note:

The maintenance period changes for different operating environments.

Table 8.10 Maintenance Setting Parameters

No.	Name	Function
o4-03	Fan Operation Time Setting	Sets the value from which to start the cumulative drive cooling fan operation time in 10-hour units. **Note:** When *o4-03 = 30* has been set, the drive will count the operation time for the cooling fan from 300 hours and *U4-03 [Cooling Fan Ope Time]* will show *300 h*.
o4-05	Capacitor Maintenance Setting	Sets the value from which to start the count for the main circuit capacitor maintenance period as a percentage.
o4-07	Softcharge Relay Maintenance Set	Sets as a percentage the value from which to start the count for the soft charge bypass relay maintenance time.
o4-09	IGBT Maintenance Setting	Sets the value from which to start the count for the IGBT maintenance period as a percentage.

8.4 Replace Cooling Fans

To replace a cooling fan, contact Yaskawa or your nearest sales representative.

◆ Replace the Cooling Fan, Drive Models 2018, 2033 - 2075, 4009, 4024 - 4045

■ Safety Precautions

⚠ DANGER Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.
If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠ CAUTION Burn Hazard

Do not touch a hot drive heatsink. De-energize the drive, wait for a minimum of 15 minutes, then make sure that the heatsink is cool before you replace the cooling fans.
If you touch a hot drive heatsink, it can burn you.

NOTICE

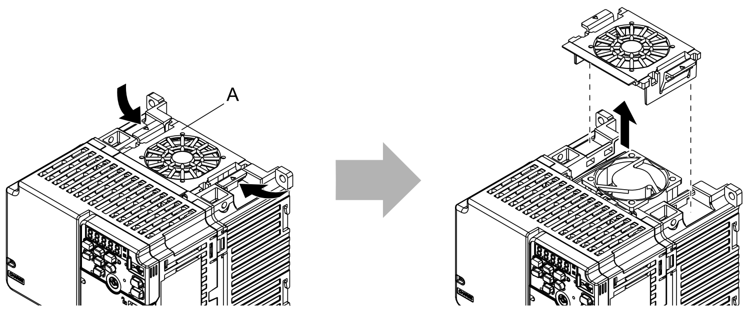
Use the instructions in this manual to replace the cooling fans. When you do maintenance on the fans, replace all the fans to increase product life.
If you install the fans incorrectly, it can cause damage to the drive.

■ Number of Cooling Fans

Model	Cooling Fans
2018	1
2033 - 2075	2
4009	1
4024 - 4045	2

■ Remove a Fan

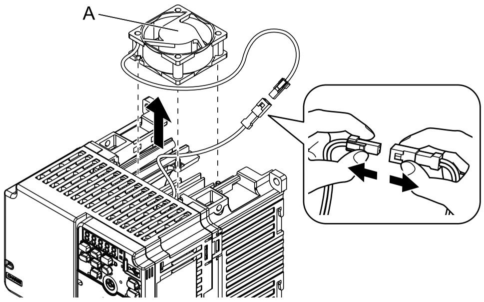
1. To remove the fan finger guard from the drive, push the hooks on the left and right sides of it and pull up.



A - Fan finger guard

Figure 8.1 Remove the Fan Finger Guard

2. Pull the cooling fan straight up from the drive. Disconnect the power supply connector and remove the fan from the drive.



A - Cooling fan

Figure 8.2 Remove the Cooling Fan

■ Install a Fan

Reverse the removal procedure to install a cooling fan.

1. Connect the power supply connector between the drive and cooling fan.

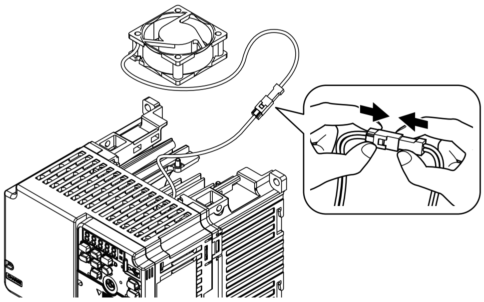
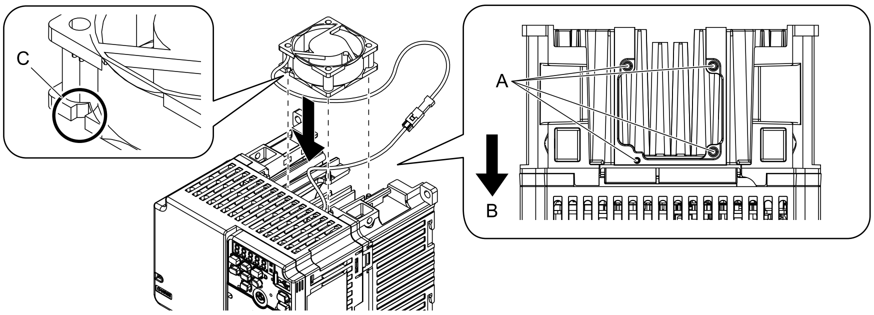


Figure 8.3 Connect the Power Supply Connector

2. Align the notches on the fan with the pins on the drive and install the cooling fans in the drive.

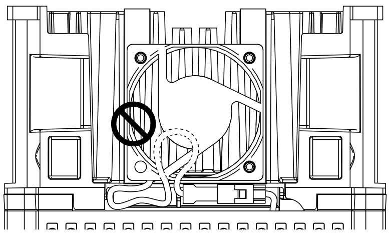


A - Alignment pins on drive
B - Front of drive
C - Notch on fan

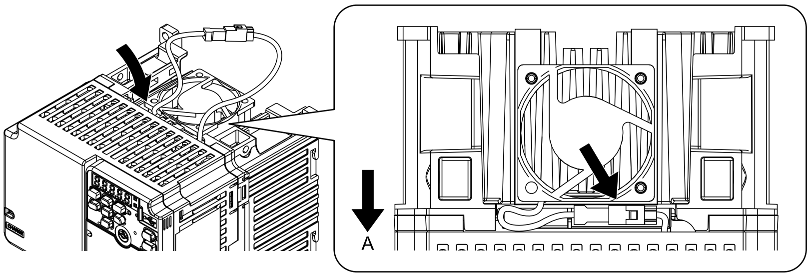
Figure 8.4 Install the Cooling Fan

Note:

When you install the cooling fan, make sure that you do not pinch cables between the cooling fan and the drive.



3. Put the cable and connector in the recess of the drive.



A - Front of drive

Figure 8.5 Put the Cable and Connector in the Drive Recess

Note:

The connector installation position is different for different models.

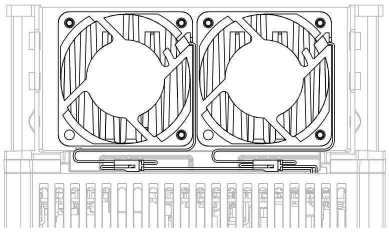


Figure 8.6 Put the Connector in the Recess

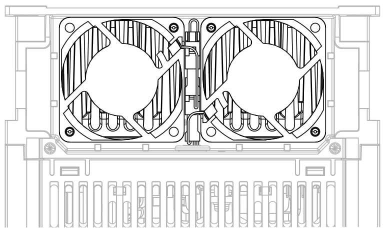


Figure 8.7 Put the Connector in Between the Fans

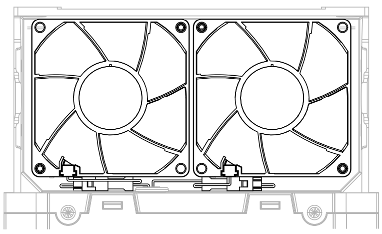


Figure 8.8 Put the Connector in Between the Drive and Fan

4. Insert the fan cover straight until the hook clicks into place.

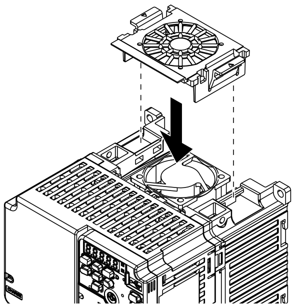


Figure 8.9 Reattach the Fan Finger Guard

5. Energize the drive and set *o4-03 = 0 [Fan Operation Time Setting = 0 h]* to reset the cooling fan operation time.

◆ Replace the Cooling Fan, Drive Models 2025, 4015, 4018

■ Safety Precautions

⚠ DANGER **Electrical Shock Hazard**

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.
If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠ CAUTION **Burn Hazard**

Do not touch a hot drive heatsink. De-energize the drive, wait for a minimum of 15 minutes, then make sure that the heatsink is cool before you replace the cooling fans.
If you touch a hot drive heatsink, it can burn you.

NOTICE

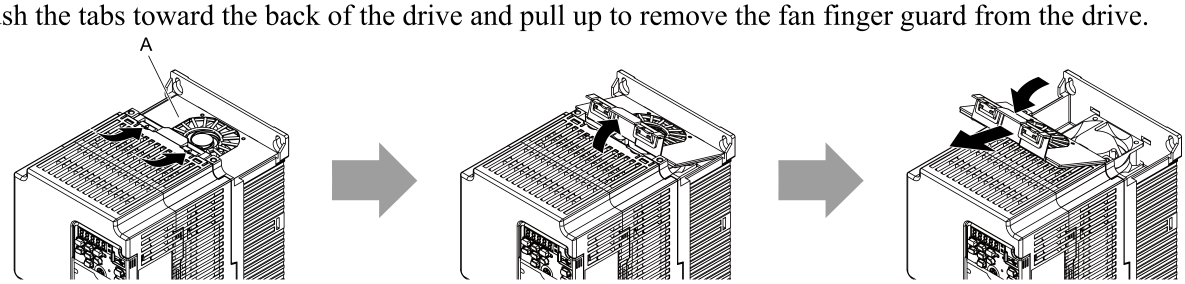
Use the instructions in this manual to replace the cooling fans. When you do maintenance on the fans, replace all the fans to increase product life.
If you install the fans incorrectly, it can cause damage to the drive.

■ Number of Cooling Fans

Model	Cooling Fans
2025	1
4015, 4018	1

■ Remove a Fan

1. Push the tabs toward the back of the drive and pull up to remove the fan finger guard from the drive.



A - Fan finger guard

Figure 8.10 Remove the Fan Finger Guard

2. Pull the cooling fan straight up from the drive. Disconnect the power supply connector and remove the fan from the drive.

Periodic Inspection and Maintenance

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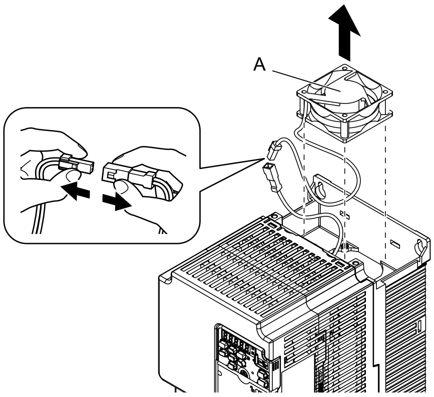


A - Cooling fan

Figure 8.11 Remove the Cooling Fan

■ Install a Fan

Reverse the removal procedure to install a cooling fan.

1. Connect the power supply connector between the drive and cooling fan.

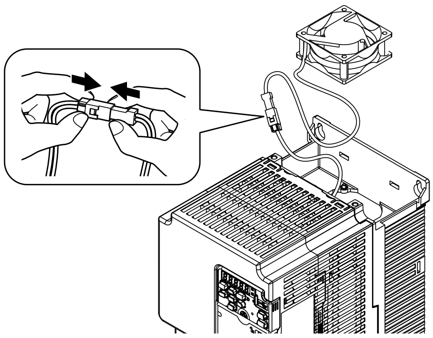
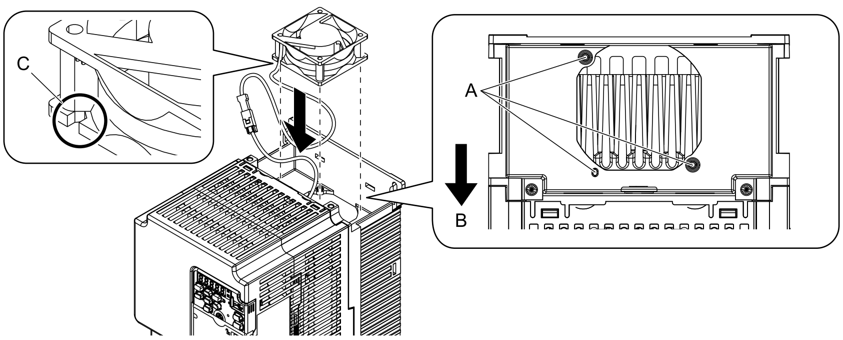


Figure 8.12 Connecting the power supply connector

2. Install the cooling fans so that they align with the pins on the drive.

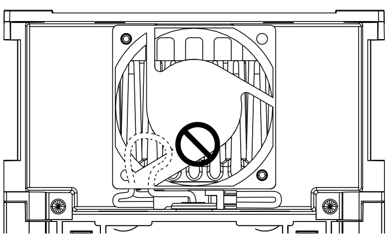


A - Alignment pins on drive
B - Front of drive
C - Notches

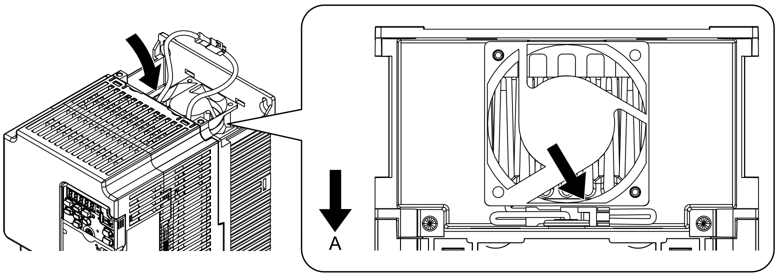
Figure 8.13 Installing the cooling fans

Note:

When you install the cooling fan, make sure that you do not pinch cables between the cooling fan and the drive.



3. Put the cable and connector in the recess of the drive.



A - Front of drive

Figure 8.14 Putting the cable and connector in the recess

4. Insert the tabs of the fan cover into the holes in the drive and press in the fan cover until the hook clicks into place.

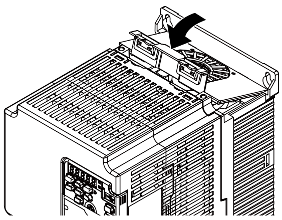


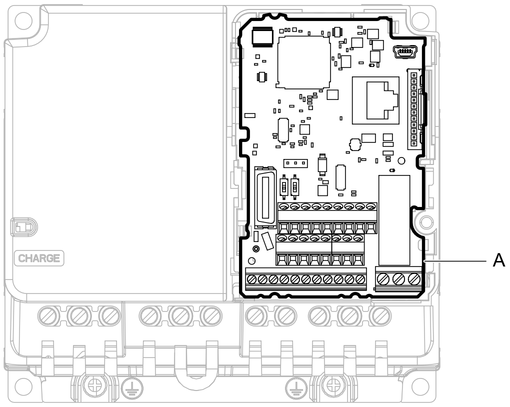
Figure 8.15 Reattach the Fan Finger Guard

5. Energize the drive and set *o4-03 = 0 [Fan Operation Time Setting = 0 h]* to reset the cooling fan operation time.

8.5 Replace the Drive

◆ About the Control Circuit Board

You can remove the control circuit board of the drive and install a new board. If there is a failure in the drive, you can use this feature to easily replace the control circuit board.



A - Control circuit board

Figure 8.16 Control Circuit Terminal Block

◆ Safety Precautions

⚠ DANGER Electrical Shock Hazard

Disconnect all power to the drive and wait for the time specified on the warning label before you remove covers. Check the drive for dangerous voltages before servicing or repair work.
If you do work on the drive when it is energized and there is no cover over the electronic circuits, it will cause serious injury or death from electrical shock. The drive has internal capacitors that stay charged after you de-energize the drive.

⚠ DANGER Electrical Shock Hazard

Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.
If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠ WARNING Electrical Shock Hazard

Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive. If personnel are not approved, it can cause serious injury or death.

NOTICE Damage to Equipment

When you touch the drive and circuit boards, make sure that you observe correct electrostatic discharge (ESD) procedures.
If you do not follow procedures, it can cause ESD damage to the drive circuitry.

Before you wire the main circuit terminal block, also refer to *Wire to the Main Circuit Terminal Block on page 54*.

◆ Remove the Control Circuit Board

Remove the front cover and keypad from the drive.

1. Push the tabs to the left that hold the control board to the drive.

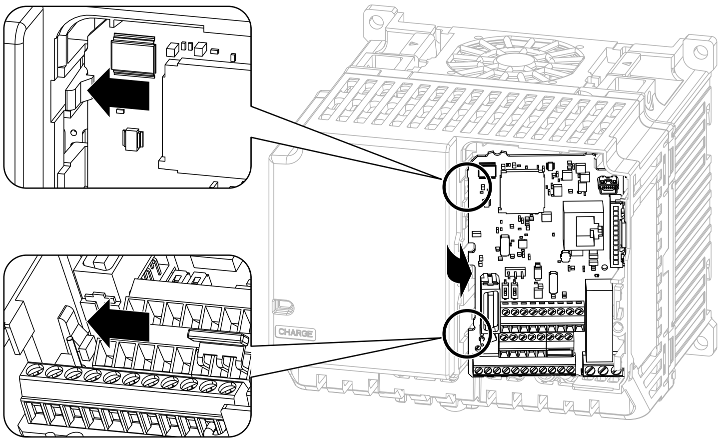


Figure 8.17 Unhook the Tabs

2. Pull the left side of the control circuit board out first.

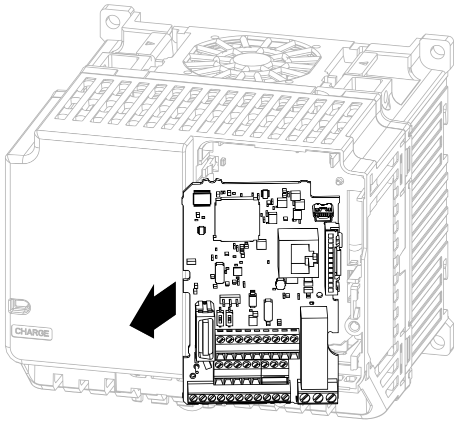


Figure 8.18 Remove the Control Circuit Board

◆ Put the Control Circuit Board in a New Drive

Remove the keypad, front cover, and control circuit board of the new drive.

Wire the main circuit terminals of the new drive, then attach the wired control circuit board.

1. Wire the main circuit terminals.

   Note:

   To wire terminals +1 and +2, remove the jumper between terminals +1 and +2.

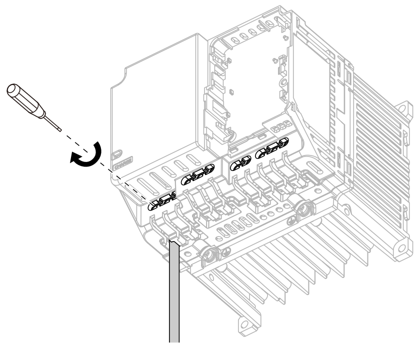


Figure 8.19 Wire the Main Circuit Terminals

2. Attach the wired control circuit board to the drive.
   Push the control circuit board until the hooks click into place on the drive.

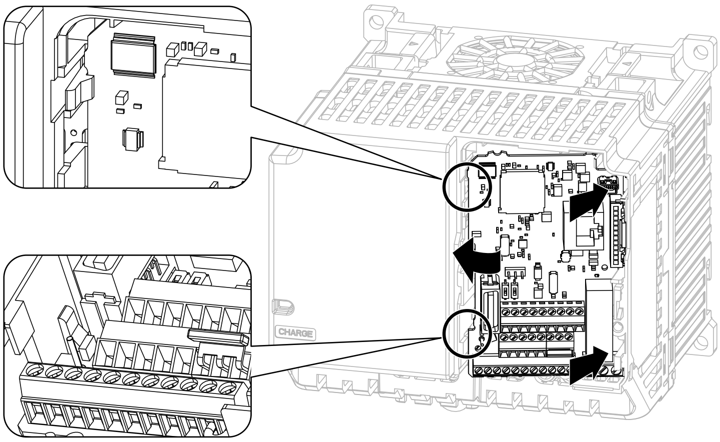


Figure 8.20 Attach the Control Circuit Board

3. Attach the keypad and front cover to the new drive.
4. Energize the drive and set these parameters:
   - *o2-04 [Drive Model (KVA) Selection]*: Set this parameter to the model number of the new drive.
   - *o4-01 to o4-13 [Maintenance Period]*: Reset the performance life monitors for the components.

8.6 Storage Guidelines

The chemicals in the electrolytic capacitors and other electronic parts of the drive change over time. When you store the drive for long periods of time, use the information in this section to help keep the performance life estimates.

◆ Storage Location

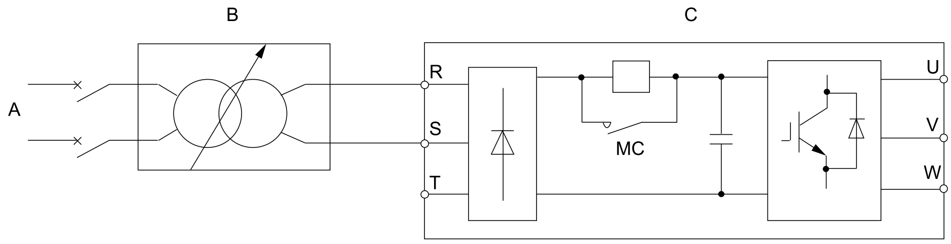
- Temperature and Humidity
  When you store the drive for approximately one month, for example during shipping, you can put the drive in a location where the temperature is -20 °C to +70 °C (-4 °F to +158 °F). Correctly package and store the drive during shipping to prevent vibration and impact damage.
  Do not put the drive in direct sunlight or where there will be condensation or ice. Put the drive in a location where the relative humidity is 95% or less.
- Dust and Oil Mist
  Do not keep the drive locations with dust or oil mist. For example, cement factories and cotton mills.
- Corrosive Gas
  Do not keep the drive in locations with corrosive gas. For example, chemical plants, refineries, and sewage plants.
- Salt Damage
  Do not keep the drive in salty locations. For example, locations near the ocean, and salt damage-designated locations.

Do not keep the drive in unsatisfactory locations. Keep all drives in storage rooms that are safe from unsatisfactory elements.

◆ Regular Application of Power

To prevent deterioration of the capacitors, Yaskawa recommends that you apply power to the drive a minimum of one time each year for a minimum of 30 minutes.

If you store the drive for longer than two years and do not apply power, Yaskawa recommends that you use a variable power source and gradually increase the power from 0 V to the rated drive voltage over a period of 2 to 3 minutes. Apply power for a minimum of 1 hour with no load to reform the main circuit electrolytic capacitor. When you operate the drive after you apply power, wire the drive correctly and check for drive faults, overcurrents, motor vibration, motor speed differences, and other defects during operation.



A - AC power supply
B - Variable power source
C - Drive

Figure 8.21 Power Distribution Method

Periodic Inspection and Maintenance

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Disposal

9.1 Section Safety

WARNING

Electrical Shock Hazard

De-energize the drive and wait 5 minutes minimum until the Charge LED turns off. Remove the front cover and terminal cover to do work on wiring, circuit boards, and other parts. Use terminals for their correct function only.

Incorrect wiring, incorrect ground connections, and incorrect repair of protective covers can cause death or serious injury.

Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive.

If personnel are not approved, it can cause serious injury or death.

Do not wear loose clothing or jewelry when you do work on the drive. Tighten loose clothing and remove all metal objects, for example watches or rings.

Loose clothing can catch on the drive and jewelry can conduct electricity and cause serious injury or death.

Crush Hazard

Wear eye protection when you do work on the drive.

If you do not use correct safety equipment, it can cause serious injury or death.

CAUTION

Crush Hazard

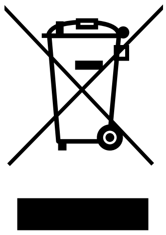
Tighten terminal cover screws and hold the case safely when you move the drive.

If the drive or covers fall, it can cause moderate injury.

9.2 Disposal Instructions

Correctly dispose of the product and packing material as specified by applicable regional, local, and municipal laws and regulations.

9.3 WEEE Directive



The wheelie bin symbol on this product, its manual, or its packaging identifies that you must recycle it at the end of its product life.

You must discard the product at an applicable collection point for electrical and electronic equipment (EEE). Do not discard the product with usual waste.

10

Specifications

10.1 Model Specifications

◆ Three-Phase 200 V Class

Table 10.1 Ratings

Model			2018	2025	2033	2047	2060	2075
Maximum Applicable Motor Output (kW) *1		HD	4.0	5.5	7.5	11	15	18.5
Maximum Applicable Motor Output (HP) *1		HD	5	7.5	10	15	20	25
Input	Rated Input Current (A)	HD	18.9	24	37	52	68	96
Output	Rated Output Capacity (kVA) *3	HD	6.7	9.5	12.6	17.9	22.9	28.6
	Rated Output Current (A)	HD	17.6	25.0	33.0	47.0	60.0	75.0
	Overload Tolerance		150% of the rated output current for 60 seconds, or 165% for 30 seconds. The permitted frequency of overload is one time each 10 minutes.					
	Carrier Frequency		8 kHz without derating the drive capacity. Derate the drive capacity to use values to 15 kHz maximum.					
	Maximum Output Voltage		Three-phase 200 V to 240 V **Note:** The maximum output voltage is proportional to the input voltage.					
	Maximum Output Frequency		120 Hz					
Measures for Harmonics	DC reactor		External options					
Braking Device	Braking Transistor		Standard internal characteristics					
EMC Filter	EMC Filter IEC61800-3		Factory option Models 2xxxE: Category C3 (Conducted emission)					
Power Supply	Rated Voltage, Rated Frequency		• Three-phase AC power supply 200 V to 240 V at 50/60 Hz • DC power supply 270 V to 340 V					
	Permitted Voltage Fluctuation		-15% to +10%					
	Permitted Frequency Fluctuation		±5%					
	Input Power (kVA)	HD	8.7	11.0	17.0	24.0	31.0	44.0

*1 The maximum applicable motor output complies with 208 V motor ratings as specified in NEC Table 430.250. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*2 The maximum applicable motor output is based on 4-pole, general-purpose 220 V motor ratings. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*3 The rated output capacity is calculated with a rated output voltage of 220 V.

◆ Three-Phase 400 V Class

Table 10.2 Ratings

Model		Duty Rating	4009	4015	4018	4024	4031	4039	4045
Maximum Applicable Motor Output (kW) *1		HD	4.0	5.5	7.5	11.0	15.0	18.5	22.0
Maximum Applicable Motor Output (HP) *1		HD	5	10	10	15	20	25	30
Input	Rated Input Current (A)	HD	10.4	15	20	29	39	50.5	59.7

Model		Duty Rating	4009	4015	4018	4024	4031	4039	4045
Output	Rated Output Capacity (kVA) *2	HD	7	11.3	13.7	18.3	23.6	29.7	34.3
	Rated Output Current (A)	HD	9.2	14.8	18.0	24.0	31.0	39.0	45.0
	Overload Tolerance		150% of the rated output current for 60 seconds, or 165% for 30 seconds. The permitted frequency of overload is one time each 10 minutes.						
	Carrier Frequency		8 kHz without derating the drive capacity. Derate the drive capacity to use values to 15 kHz maximum.						
	Maximum Output Voltage		Three-phase 380 V to 480 V **Note:** The maximum output voltage is proportional to the input voltage.						
	Maximum Output Frequency		120 Hz						
Measures for Harmonics	DC reactor		External options						
Braking Device	Braking Transistor		Standard internal characteristics						
EMC Filter	EMC Filter IEC61800-3		Factory option Models 4xxxE: Category C2 (Conducted emission)						
Power supply	Rated Voltage, Rated Frequency		Three-phase AC power supply 380 V to 480 V at 50/60 Hz						
	Permitted Voltage Fluctuation		-15% to +10%						
	Permitted Frequency Fluctuation		±5%						
	Input Power (kVA)	HD	9.5	14	18	27	36	47	55

*1 The maximum applicable motor output complies with 380 V motor ratings as specified in Annex G of IEC 60947-4-1. The rated output current of the drive output amps must be equal to or more than the motor rated current.

*2 The rated output capacity is calculated with a rated output voltage of 440 V.

Specifications

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10.2 Drive Specifications

Note:
- To get the OLV specifications, do Rotational Auto-Tuning.
- To get the longest product life, install the drive in an environment that meets the necessary specifications.

Table 10.3 Control Characteristics

Item	Specification
Control Methods	• V/f Control • Open Loop Vector • Closed Loop Vector
Frequency Control Range	0.01 Hz to 120 Hz
Frequency Accuracy (Temperature Fluctuation)	Digital inputs: ±0.01% of the maximum output speed (-10 °C to +40 °C (14 °F to 104 °F)) Analog inputs: ±0.1% of the maximum output speed (25 °C ±10 °C (77 °F ±18 °F))
Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/2048 of the maximum output speed (11-bit)
Output Frequency Resolution	0.001 Hz
Frequency Setting Signal	Main speed frequency reference: 0 Vdc to 10 Vdc (20 kΩ), 4 mA to 20 mA (250 Ω), 0 mA to 20 mA (250 Ω) Main speed reference: Pulse train input (maximum 32 kHz)
Starting Torque	• V/f: 150%/3 Hz • OLV: 150%/1 Hz • CLV: 150%/0 min^{-1} (r/min) **Note:** Correctly select the drive and motor capacity for this starting torque in these control methods: • OLV • CLV
Speed Control Range	• V/f: 1:40 • OLV: 1:100 • CLV: 1:1500
Zero Speed Control	Possible in these control methods: • CLV
Torque Limits	You can use parameter settings for different limits in four quadrants in these control methods: • OLV • CLV
Acceleration and Deceleration Times	0.0 s to 6000.0 s The drive can set four pairs of different acceleration and deceleration times.
Braking Torque	Approximately 20% without a resistor Approximately 125% with a dynamic braking option • Short-time average deceleration torque Motor output 0.1/0.2 kW: over 150% Motor output 0.4/0.75 kW: over 100% Motor output 1.5 kW: over 50% Motor output 2.2 kW and larger: over 20% **Note:** • Short-time average deceleration torque refers to the torque needed to decelerate the motor (uncoupled from the load) from the rated speed to zero. Motor characteristics can change the actual specifications. • Motor characteristics change the continuous regenerative torque and short-time average deceleration torque for motors 2.2 kW and larger.

Table 10.4 Protection Functions

Item	Specification
Motor Protection	Electronic thermal overload protection
Momentary Overcurrent Protection	Drive stops when the output current is more than 200% of the HD output current.
Overload Protection	Drive stops when the output current is more than these overload tolerances: • HD: 150% of the rated output current for 60 seconds, or 165% for 30 seconds. The permitted frequency of overload is one time each 10 minutes. **Note:** If output frequency < 6 Hz, the drive can trigger the overload protection function when the output current is in the overload tolerance range.
Overvoltage Protection	200 V class: Stops when the DC bus voltage is more than approximately 410 V 400 V class: Stops when the DC bus voltage is more than approximately 820 V
Undervoltage Protection	Three-phase 200 V class: Stops when the DC bus voltage decreases to less than approximately 190 V Three-phase 400 V class: Stops when the DC bus voltage decreases to less than approximately 380 V

Item	Specification
Momentary Power Loss Ride-thru	Stops when power loss is longer than 15 ms and continues operation if power loss is shorter than 2 s (depending on parameter settings). **Note:** • Load size and motor speed can cause the stop time to be shorter. • Drive capacity will change the continuous operation time. A Momentary Power Loss Recovery Unit is necessary to continue operation through a 2 s power loss on models 2018 to 2033 and 4009 to 4018.
Heatsink Overheat Protection	Thermistor
Stall Prevention	Stall prevention is available during acceleration, deceleration, and during run.
Ground Fault Protection	Electronic circuit protection **Note:** This protection detects ground faults during run. The drive will not provide protection when: • There is a low-resistance ground fault for the motor cable or terminal block • Energizing the drive when there is a ground fault.
DC Bus Charge LED	Charge LED illuminates when DC bus voltage is more than 50 V.

Table 10.5 Environment

Item	Specification
Area of Use	Indoors
Power Supply	Overvoltage Category III
Ambient Temperature Setting	IP20/UL Open Type: -10°C to +50 °C (14 °F to 122 °F) IP20/UL Type 1: -10 °C to +40 °C (14 °F to 104 °F) • When you install the drive in an enclosure, use a cooling fan or air conditioner to keep the internal air temperature in the permitted range. • Do not let the drive freeze.
Humidity	95% RH or less Do not let condensation form on the drive.
Storage Temperature	-20 °C to +70 °C (-4 °F to +158 °F) (short-term temperature during transportation)
Surrounding Area	Pollution degree 2 or less Install the drive in an area without: • Oil mist, corrosive or flammable gas, or dust • Metal powder, oil, water, or other unwanted materials • Radioactive materials or flammable materials, including wood • Harmful gas or fluids • Salt • Direct sunlight
Altitude	1000 m (3281 ft) Maximum **Note:** Derate the output current by 1% for each 100 m (328 ft) to install the drive in altitudes between 1000 m to 4000 m (3281 ft to 13123 ft). It is not necessary to derate the rated voltage in these conditions: • Installing the drive at 2000 m (6562 ft) or lower • Installing the drive between 2000 m to 4000 m (6562 ft to 13123 ft) and grounding the neutral point on the power supply. Contact Yaskawa or your nearest sales representative when not grounding the neutral point.
Vibration	• 10 Hz to 20 Hz: 1 G (9.8 m/s^2, 32.15 ft/s^2) • 20 Hz to 55 Hz: 0.6 G (5.9 m/s^2, 19.36 ft/s^2)
Installation Orientation	Install the drive vertically for sufficient airflow to cool the drive.

Table 10.6 Standard

Item	Specification
Harmonized Standard	• UL 61800-5-1 • EN 61800-3 • IEC/EN 61800-5-1 • Two Safe Disable inputs and one EDM output according to EN ISO 13849-1 (Cat.3, PL e), EN 61800-5-2 SIL3
Enclosure protection design	IP20/UL Open Type IP20/UL Type 1 **Note:** Install a UL Type 1 kit (optional) on an IP20/UL Open Type drive to change the drive to an IP20/UL Type 1 enclosure.

10.3 Drive Derating

You must derate the drive capacity to operate the drive above the rated temperature, altitude, and default carrier frequency.

◆ Carrier Frequency Settings and Rated Current Values

The tables in this section show how the drive rated output current changes when the *C6-03 [Carrier Frequency Upper Limit]* value changes. The output current value changes linearly as the carrier frequency changes. You can use the values from the tables to calculate a frequency that is not shown.

■ Three-Phase 200 V Class Models

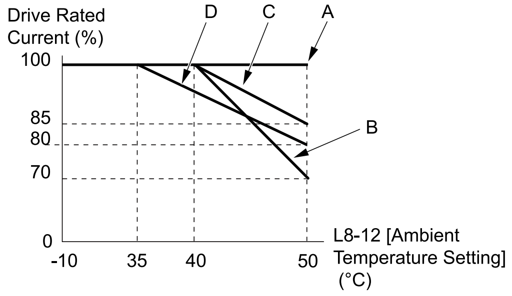
Model	Rated Current (A)					
	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz
2018	17.6	17.6	17.6	16.6	15.3	14.1
2025	25.0	25.0	25.0	23.6	21.8	20
2033	33.0	33.0	33.0	31.1	28.8	26
2047	47.0	47.0	47.0	44.3	41.0	38
2060	60.0	60.0	60.0	56.6	52.3	48
2075	75.0	75.0	75.0	70.7	65.4	60

■ Three-Phase 400 V Class Models

Model	Rated Current (A)					
	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz
4009	9.2	9.2	9.2	8.1	6.8	5.5
4015	14.8	14.8	14.8	13.1	11.0	8.9
4018	18.0	18.0	18.0	13.1	11.0	11
4024	24.0	24.0	24.0	21.3	17.8	14
4031	31.0	31.0	31.0	27.5	23.0	19
4039	39.0	39.0	39.0	34.5	29.0	23
4045	45.0	45.0	45.0	39.9	33.4	27

◆ Derating Depending on Ambient Temperature

When you install drives in a place where ambient temperatures are higher than the rated conditions or install drives side-by-side in the enclosure panel, set *L8-12 [Ambient Temperature Setting]* and *L8-35 [Installation Method Selection]*. Derate the output current as specified in Figure 10.1.



A - L8-35 = 0 [IP20/UL Open Type]
B - L8-35 = 1 [Side-by-Side Mounting]
C - L8-35 = 2 [IP20/UL Type 1]
D - L8-35 = 3 [Finless Installation]

Figure 10.1 Derating Depending on Drive Installation Method

Refer to *L8-12: Ambient Temperature Setting on page 379* and *L8-35: Installation Method Selection on page 380* for details.

◆ Altitude Derating

Install the drive in a location that has an altitude of 1000 m (3281 ft) or lower.

Derate the output current by 1% for each 100 m (328 ft) to install the drive in altitudes between 1000 to 4000 m (3281 to 13123 ft).

It is not necessary to derate the rated voltage in these conditions:

- Installing the drive at 2000 m (6562 ft) or lower
- Installing the drive between 2000 to 4000 m (6562 to 13123 ft) and grounding the neutral point on the power supply.
  If you do not ground the drive with a neutral network, contact Yaskawa or your nearest sales representative.

10.4 Drive Exterior and Mounting Dimensions

◆ IP20/UL Open Type

■ Models 2018, 4009

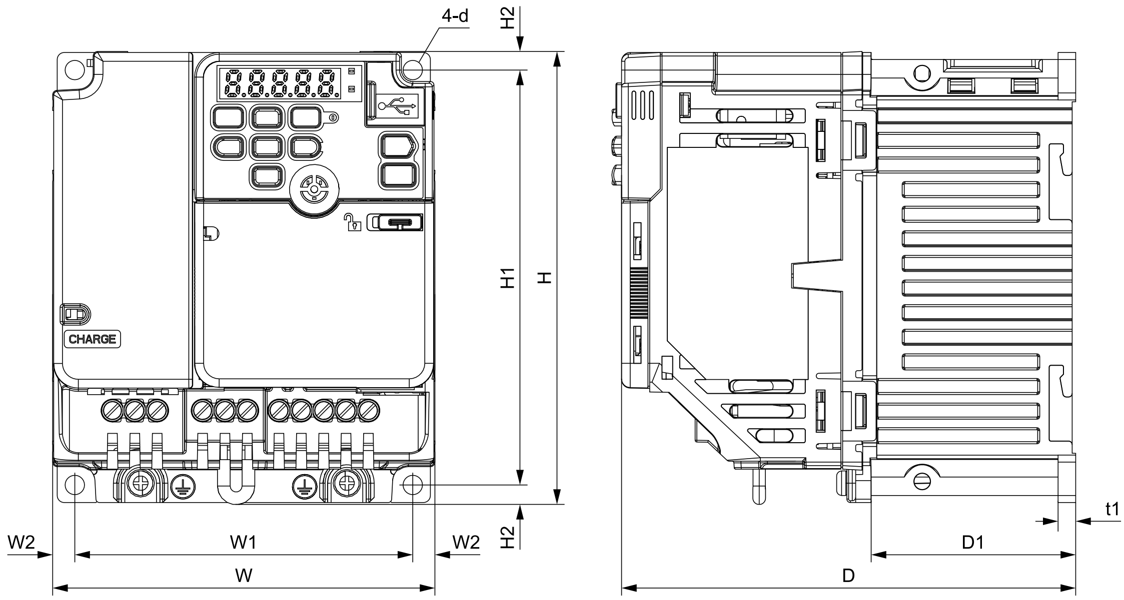


Figure 10.2 Exterior and Mounting Dimensions

Three-Phase 200 V Class

Table 10.7 IP20/UL Open Type, without Built-in EMC Filter

Model	Dimensions mm (in)										Est. Weight kg (lb)
	W	H	D	W1	W2	H1	H2	D1	t1	d	
2018A	140 (5.51)	128 (5.04)	143 (5.63)	128 (5.04)	6 (0.24)	118 (4.65)	5 (0.20)	65 (2.56)	5 (0.20)	M5	2.0 (4.4)

Table 10.8 IP20/UL Open Type, with Built-in EMC Filter

Model	Dimensions mm (in)										Est. Weight kg (lb)
	W	H	D	W1	W2	H1	H2	D1	t1	d	
2018E	140 (5.51)	128 (5.04)	193 (7.60)	128 (5.04)	6 (0.24)	118 (4.65)	5 (0.20)	65 (2.56)	5 (0.20)	M5	2.4 (5.3)

Three-Phase 400 V Class

Table 10.9 IP20/UL Open Type, without Built-in EMC Filter

Model	Dimensions mm (in)										Est. Weight kg (lb)
	W	H	D	W1	W2	H1	H2	D1	t1	d	
4009A	140 (5.51)	128 (5.04)	143 (5.63)	128 (5.04)	6 (0.24)	118 (4.65)	5 (0.20)	65 (2.56)	5 (0.20)	M5	2.0 (4.4)

Table 10.10 IP20/UL Open Type, with Built-in EMC Filter

Model	Dimensions mm (in)										Est. Weight kg (lb)
	W	H	D	W1	W2	H1	H2	D1	t1	d	
4009E	140 (5.51)	128 (5.04)	193 (7.60)	128.0 (5.04)	6 (0.24)	118 (4.65)	5 (0.20)	65 (2.56)	5 (0.20)	M5	2.6 (5.7)

■ Models 2018 to 2075, 4015 to 4045

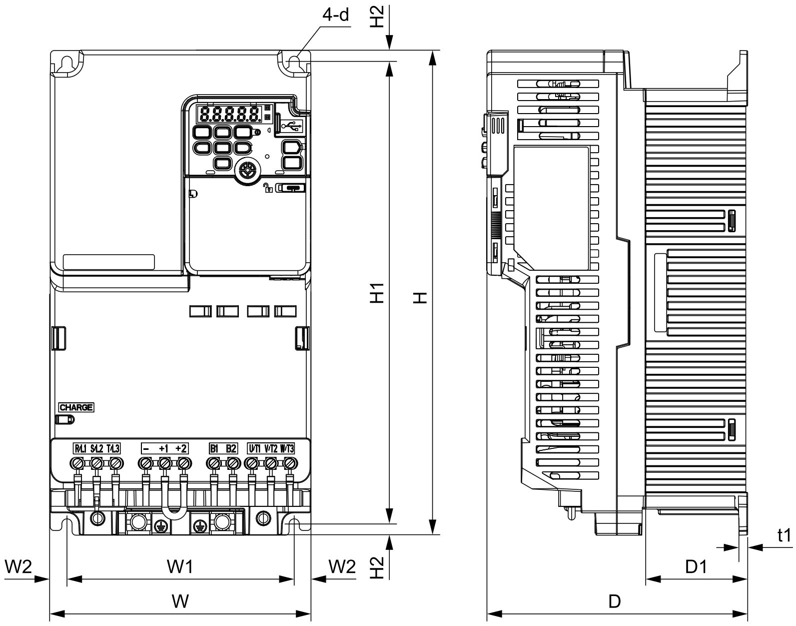


Figure 10.3 Exterior and Mounting Dimensions

Three-Phase 200 V Class

Table 10.11 IP20/UL Open Type, without Built-in EMC Filter

Model	Dimensions mm (in)										Est. Weight kg (lb)
	W	H	D	W1	W2	H1	H2	D1	t1	d	
2025A	140 (5.51)	260 (10.24)	140 (5.51)	122 (4.80)	9 (0.35)	248 (9.76)	6 (0.24)	55 (2.17)	5 (0.20)	M5	3.4 (7.5)
2033A	140 (5.51)	260 (10.24)	140 (5.51)	122 (4.80)	9 (0.35)	248 (9.76)	6 (0.24)	55 (2.17)	5 (0.20)	M5	3.6 (7.9)
2047A	180 (7.09)	300 (11.81)	143 (5.63)	160 (6.30)	10 (0.39)	284 (11.18)	8 (0.31)	55 (2.17)	5 (0.20)	M5	5.5 (12.1)
2060A	220 (8.66)	350 (13.78)	187 (7.36)	192 (7.56)	14 (0.55)	336 (13.23)	7 (0.28)	78 (3.07)	5 (0.20)	M6	7.5 (16.5)
2075A	220 (8.66)	350 (13.78)	187 (7.36)	192 (7.56)	14 (0.55)	336 (13.23)	7 (0.28)	78 (3.07)	5 (0.20)	M6	8.0 (17.6)

Table 10.12 IP20/UL Open Type, with Built-in EMC Filter

Model	Dimensions mm (in)										Est. Weight kg (lb)
	W	H	D	W1	W2	H1	H2	D1	t1	d	
2025E	140 (5.51)	260 (10.24)	196 (7.72)	122 (4.80)	9 (0.35)	248 (9.76)	6 (0.24)	55 (2.17)	5 (0.20)	M5	3.9 (8.6)
2033E	140 (5.51)	260 (10.24)	196 (7.72)	122 (4.80)	9 (0.35)	248 (9.76)	6 (0.24)	55 (2.17)	5 (0.20)	M5	4.1 (9.0)
2047E	180 (7.09)	300 (11.81)	196 (7.72)	160 (6.30)	10 (0.39)	284 (11.18)	8 (0.31)	55 (2.17)	5 (0.20)	M5	6.0 (13.2)
2060E	220 (8.66)	350 (13.78)	216 (8.50)	192 (7.56)	14 (0.55)	336 (13.23)	7 (0.28)	78 (3.07)	5 (0.20)	M6	8.5 (18.7)
2075E	220 (8.66)	350 (13.78)	216 (8.50)	192 (7.56)	14 (0.55)	336 (13.23)	7 (0.28)	78 (3.07)	5 (0.20)	M6	9.0 (19.9)

Three-Phase 400 V Class

Table 10.13 IP20/UL Open Type, without Built-in EMC Filter

Model	Dimensions mm (in)										Est. Weight kg (lb)
	W	H	D	W1	W2	H1	H2	D1	t1	d	
4015A	140 (5.51)	260 (10.24)	140 (5.51)	122 (4.80)	9 (0.35)	248 (9.76)	6 (0.24)	55 (2.17)	5 (0.20)	M5	3.0 (6.6)
4018A	140 (5.51)	260 (10.24)	140 (5.51)	122 (4.80)	9 (0.35)	248 (9.76)	6 (0.24)	55 (2.17)	5 (0.20)	M5	3.2 (7.1)
4024A	180 (7.09)	300 (11.81)	143 (5.63)	160 (6.30)	10 (0.39)	284 (11.18)	8 (0.31)	55 (2.17)	5 (0.20)	M5	4.6 (10.2)
4031A	180 (7.09)	300 (11.81)	143 (5.63)	160 (6.30)	10 (0.39)	284 (11.18)	8 (0.31)	55 (2.17)	5 (0.20)	M5	4.8 (10.6)
4039A	190 (7.48)	350 (13.78)	204 (8.03)	160 (6.30)	15 (0.59)	336 (13.23)	7 (0.28)	94 (3.70)	5 (0.20)	M6	6.5 (14.3)
4045A	190 (7.48)	350 (13.78)	204 (8.03)	160 (6.30)	15 (0.59)	336 (13.23)	7 (0.28)	94 (3.70)	5 (0.20)	M6	6.5 (14.3)

Table 10.14 IP20/UL Open Type, with Built-in EMC Filter

Model	Dimensions mm (in)										Est. Weight kg (lb)
	W	H	D	W1	W2	H1	H2	D1	t1	d	
4015E	140 (5.51)	260 (10.24)	196 (7.72)	122 (4.80)	9 (0.35)	248 (9.76)	6 (0.24)	55 (2.17)	5 (0.20)	M5	3.9 (8.6)
4018E	140 (5.51)	260 (10.24)	196 (7.72)	122 (4.80)	9 (0.35)	248 (9.76)	6 (0.24)	55 (2.17)	5 (0.20)	M5	3.9 (8.6)
4024E	180 (7.09)	300 (11.81)	196 (7.72)	160 (6.30)	10 (0.39)	284 (11.18)	8 (0.31)	55 (2.17)	5 (0.20)	M5	5.5 (12.1)
4031E	180 (7.09)	300 (11.81)	196 (7.72)	160 (6.30)	10 (0.39)	284 (11.18)	8 (0.31)	55 (2.17)	5 (0.20)	M5	5.5 (12.1)
4039E	190 (7.48)	350 (13.78)	251 (9.88)	160 (6.30)	15 (0.59)	336 (13.23)	7 (0.28)	94 (3.70)	5 (0.20)	M6	8.0 (17.6)
4045E	190 (7.48)	350 (13.78)	251 (9.88)	160 (6.30)	15 (0.59)	336 (13.23)	7 (0.28)	94 (3.70)	5 (0.20)	M6	8.5 (18.7)

10.5 Peripheral Devices and Options

These tables show the available peripheral devices and options for the drive. Contact Yaskawa or your nearest sales representative to make an order.

- Selection: Refer to the drive catalog for information about available products.
- Installation and wiring: Refer to the instruction manual for each option.

Table 10.15 Main Circuit Options

Name	Model	Intended Use
AC reactor	LR3 series and B series	To improve the drive input power factor. • To prevent damage to the drive when the power supply capacity is large. You must only use this option when the power supply capacity is more than 600 kVA. • To decrease harmonic current. • To improve the power supply total power factor.
Braking Resistor	RH Series	To decrease the regenerative energy of the motor and decrease the deceleration time (duty cycle of 3% ED). You must also use the installation attachment.

Table 10.16 Engineering Tools

Name	Model	Intended Use
DriveWizard	-	To use a PC to program drives and manage parameters.

11

Parameter List

11.1 How to Read the Parameter List

◆ Icons and Terms that Identify Parameters and Control Methods

Icon	Description
V/f	The parameter is available when operating the drive with V/f Control.
OLV	The parameter is available when operating the drive with Open Loop Vector Control.
CLV	The parameter is available when operating the drive with Closed Loop Vector Control.
Hex.	Hexadecimal numbers that represent MEMOBUS addresses to change parameters over network communication.
RUN	The parameter can be changed settings during run.
Expert	The parameter that is available in Expert Mode only. *1

*1 Set *A1-01 = 3 [Access Level Selection = Expert Level]* to display and set Expert Mode parameters on the keypad.

Note:

An icon like V/f identifies parameters that are available in the specified control method.

An icon like V/f identifies parameters that are **not** available in the specified control method.

11.2 Parameter Groups

Represents the type of product parameters.

Parameter	Name	Ref.
A	**Initialization Parameters**	250
A1	Initialization	250
A2	User Parameters	250
b	**Application**	253
b1	Operation Mode Selection	253
b2	Magnetic Flux Compensation	253
b4	Timer Function	253
b6	Dwell Function	253
C	**Tuning**	255
C1	Accel & Decel Time	255
C2	Jerk Characteristics	255
C3	Slip Compensation	256
C4	Torque Compensation	256
C5	Speed Control Loop	257
C6	Carrier Frequency	258
D	**Reference Settings**	259
d1	Speed Reference	259
E	**Motor Parameters**	261
E1	V/f Pattern for Motor 1	261
E2	Motor Parameters	261
F	**Options**	263
F1	Encoder Option Setup	263
F5	Digital Output Option	263
H	**Terminal Functions**	264
H1	Digital Inputs	264
H2	Digital Outputs	266
H3	Analog Inputs	270
H4	Analog Outputs	271
H5	Modbus Communication	271
L	**Protection Functions**	273
L1	Motor Protection	273
L2	Power Loss Ride Through	273

Parameter	Name	Ref.
L3	Stall Prevention	273
L4	Speed Detection	274
L5	Fault Restart	274
L6	Torque Detection	275
L7	Torque Limit	275
L8	Drive Protection	276
n	**Special Adjustment**	279
n2	Auto Freq Regulator (AFR)	279
n5	Feed Forward Control	279
n6	Online Tuning	279
o	**Keypad-Related Settings**	280
o1	Keypad Display	280
o2	Keypad Operation	281
o3	Copy Keypad Function	282
o4	Maintenance Monitor Settings	282
o5	Log Function	283
S	**Elevator Parameters**	285
S1	Brake Sequence	285
S2	Slip Compensation for Elevators	285
S3	Start/Stop Optimization	286
S4	Rescue Operation	286
S5	Elevator Functionality	287
S6	Error Detection	287
T	**Motor Tuning**	288
T1	Induction Motor Auto-Tuning	288
U	**Monitors**	289
U1	Operation Status Monitors	289
U2	Fault Trace	291
U3	Fault History	292
U4	Maintenance Monitors	293
U5	PID Monitors	296
U6	Operation Status Monitors	297

11.3 A: Initialization Parameters

◆ A1: Initialization

No. (Hex.)	Name	Description	Default (Range)	Ref.
A1-00 (0100) RUN	Language Selection	V/f OLV CLV Sets the language for the LCD keypad. **Note:** • When you use *A1-03 [Initialize Parameters]* to initialize the drive, the drive will not reset this parameter. 0 : English 1 : Japanese 2 : German 3 : French 4 : Italian 5 : Spanish 6 : Portuguese 7 : Chinese 8 : Czech 9 : Russian 10 : Turkish 11 : Polish 12 : Greek	0 (0 - 12)	302
A1-01 (0101) RUN	Access Level Selection	V/f OLV CLV Sets user access to parameters. The access level controls which parameters the keypad will display, and which parameters the user can set. 0 : Operation Only 1 : User Parameters 2 : Advanced Level 3 : Expert Level	2 (0 - 3)	302
A1-02 (0102)	Control Method Selection	V/f OLV CLV Sets the control method for the drive application and the motor. 0 : V/f Control 2 : Open Loop Vector 3 : Closed Loop Vector	0 (0, 2, 3)	303
A1-03 (0103)	Initialize Parameters	V/f OLV CLV Sets parameters to default values. 0 : No Initialization 1110 : User Initialization 2220 : 2-Wire Initialization	0 (0 - 2220)	303
A1-04 (0104)	Password	V/f OLV CLV Entry point for the password set in *A1-05 [Password Setting]*. The user can view the settings of parameters that are locked without entering the password. Enter the correct password in this parameter to change parameter settings.	0000 (0000 - 9999)	304
A1-05 (0105)	Password Setting	V/f OLV CLV Set the password to lock parameters and prevent changes to parameter settings. Enter the correct password in *A1-04 [Password]* to unlock parameters and accept changes.	0000 (0000 - 9999)	304

◆ A2: User Parameters

No. (Hex.)	Name	Description	Default (Setting Range)	Ref.
A2-01 (0106)	User Parameter 1	V/f OLV CLV Sets the parameter number to show on the first line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	A1-00	305
A2-02 (0107)	User Parameter 2	V/f OLV CLV Sets the parameter number to show on the second line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	A1-02	305
A2-03 (0108)	User Parameter 3	V/f OLV CLV Sets the parameter number to show on the third line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-18	305
A2-04 (0109)	User Parameter 4	V/f OLV CLV Sets the parameter number to show on the fourth line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-19	305
A2-05 (010A)	User Parameter 5	V/f OLV CLV Sets the parameter number to show on the fifth line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-23	305

No. (Hex.)	Name	Description	Default (Setting Range)	Ref.
A2-06 (010B)	User Parameter 6	V/f OLV CLV Sets the parameter number to show on the sixth line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-24	305
A2-07 (010C)	User Parameter 7	V/f OLV CLV Sets the parameter number to show on the seventh line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-25	305
A2-08 (010D)	User Parameter 8	V/f OLV CLV Sets the parameter number to show on the eighth line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-26	305
A2-09 (010E)	User Parameter 9	V/f OLV CLV Sets the parameter number to show on the ninth line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-01	305
A2-10 (010F)	User Parameter 10	V/f OLV CLV Sets the parameter number to show on the 10th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-02	305
A2-11 (0110)	User Parameter 11	V/f OLV CLV Sets the parameter number to show on the 11th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-03	305
A2-12 (0111)	User Parameter 12	V/f OLV CLV Sets the parameter number to show on the 12th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-04	305
A2-13 (0112)	User Parameter 13	V/f OLV CLV Sets the parameter number to show on the 13th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-05	305
A2-14 (0113)	User Parameter 14	V/f OLV CLV Sets the parameter number to show on the 14th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-06	305
A2-15 (0114)	User Parameter 15	V/f OLV CLV Sets the parameter number to show on the 15th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-07	305
A2-16 (0115)	User Parameter 16	V/f OLV CLV Sets the parameter number to show on the 16th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-08	305
A2-17 (0116)	User Parameter 17	V/f OLV CLV Sets the parameter number to show on the 17th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-28	305
A2-18 (0117)	User Parameter 18	V/f OLV CLV Sets the parameter number to show on the 18th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	d1-29	305
A2-19 (0118)	User Parameter 19	V/f OLV CLV Sets the parameter number to show on the 19th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	C1-01	305
A2-20 (0119)	User Parameter 20	V/f OLV CLV Sets the parameter number to show on the 20th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	C1-02	305
A2-21 (011A)	User Parameter 21	V/f OLV CLV Sets the parameter number to show on the 21st line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	C2-01	305
A2-22 (011B)	User Parameter 22	V/f OLV CLV Sets the parameter number to show on the 22nd line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	C2-02	305
A2-23 (011C)	User Parameter 23	V/f OLV CLV Sets the parameter number to show on the 23rd line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	C2-03	305
A2-24 (011D)	User Parameter 24	V/f OLV CLV Sets the parameter number to show on the 24th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	C2-04	305
A2-25 (011E)	User Parameter 25	V/f OLV CLV Sets the parameter number to show on the 25th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	C2-05	305
A2-26 (011F)	User Parameter 26	V/f OLV CLV Sets the parameter number to show on the 26th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	E2-03	305
A2-27 (0120)	User Parameter 27	V/f OLV CLV Sets the parameter number to show on the 27th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	S1-02	305

No. (Hex.)	Name	Description	Default (Setting Range)	Ref.
A2-28 (0121)	User Parameter 28	V/f OLV CLV Sets the parameter number to show on the 28th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	S1-03	305
A2-29 (0122)	User Parameter 29	V/f OLV CLV Sets the parameter number to show on the 29th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	S1-06	305
A2-30 (0123)	User Parameter 30	V/f OLV CLV Sets the parameter number to show on the 30th line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	S1-07	305
A2-31 (0124)	User Parameter 31	V/f OLV CLV Sets the parameter number to show on the 31st line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	-	305
A2-32 (0125)	User Parameter 32	V/f OLV CLV Sets the parameter number to show on the 32nd line in Setup Mode. You can select a maximum of 32 parameters for the drive and set them to parameters *A2-01* to *A2-32*.	-	305
A2-33 (0126)	User Parameter Auto Selection	V/f OLV CLV Sets the automatic save feature for changes to parameters *A2-17 to A2-32 [User Parameters 17 to 32]*. 0 : Disabled: Manual Entry Required 1 : Enabled: Auto Save Recent Parms	1 (0, 1)	305

11.4 b: Application

◆ b1: Operation Mode Selection

No. (Hex.)	Name	Description	Default (Setting Range)	Ref.
b1-01 (0180)	Speed Reference Selection 1	V/f OLV CLV Sets the input method for the speed reference. 0 : Keypad 1 : Analog Input 2 : Memobus/Modbus Communications	1 (0 - 2)	306
b1-02 (0181)	Run Command Selection 1	V/f OLV CLV Sets the Up/Down command source in Remote mode. Wire the motor so the elevator goes up when an Up command is issued. 0 : Keypad 1 : Digital Input 2 : Memobus/Modbus Communications	1 (0 - 2)	307
b1-03 (0182)	Stopping Method Selection	V/f OLV CLV Sets the method to stop the motor after removing a Run command or entering a Stop command. 0 : Ramp to Stop 1 : Coast to Stop	0 (0 - 1)	308
b1-08 (0187)	Run Command Select in PRG Mode	V/f OLV CLV Sets the conditions for the drive to accept an Up/Down command entered from an external source when using the keypad to set parameters. 0 : Disregard RUN while Programming 1 : Accept RUN while Programming	1 (0 - 1)	308
b1-14 (01C3)	Phase Order Selection	V/f OLV CLV Sets the phase order for output terminals U/T1, V/T2, and W/T3. This parameter can align the Forward Run command from the drive and the forward direction of the motor without changing wiring. 0 : Standard 1 : Switch Phase Order	0 (0, 1)	309

◆ b2: Magnetic Flux Compensation

No. (Hex.)	Name	Description	Default (Range)	Ref.
b2-08 (0190) Expert	Magnetic Flux Compensation Value	V/f OLV CLV Sets how much current the drive injects when DC Injection Braking at Start starts (Initial Excitation) as a percentage of *E2-03 [Motor No-Load Current]*.	0% (0 - 1000%)	309

◆ b4: Timer Function

No. (Hex.)	Name	Description	Default (Range)	Ref.
b4-01 (01A3) Expert	Timer Function ON-Delay Time	V/f OLV CLV Sets the ON-delay time for the timer input.	0.0 s (0.0 - 3000.0 s)	310
b4-02 (01A4) Expert	Timer Function OFF-Delay Time	V/f OLV CLV Sets the OFF-delay time for the timer input.	0.0 s (0.0 - 3000.0 s)	310

◆ b6: Dwell Function

No. (Hex.)	Name	Description	Default (Range)	Ref.
b6-01 (01B6) Expert	Dwell Reference at Start	V/f OLV CLV Sets the output frequency that the drive will hold momentarily when the motor starts.	0.0 (Determined by A1-02)	311
b6-02 (01B7) Expert	Dwell Time at Start	V/f OLV CLV Sets the length of time that the drive will hold the output frequency when the motor starts.	0.0 s (0.0 - 10.0 s)	311

No. (Hex.)	Name	Description	Default (Range)	Ref.
b6-03 (01B8) Expert	Dwell Reference at Stop	V/f OLV CLV Sets the output frequency that the drive will hold momentarily when ramping to stop the motor.	0.0 (Determined by A1-02)	311
b6-04 (01B9) Expert	Dwell Time at Stop	V/f OLV CLV Sets the length of time for the drive to hold the output frequency when ramping to stop the motor.	0.0 s (0.0 - 10.0 s)	311

11.5 C: Tuning

◆ C1: Accel & Decel Time

No. (Hex.)	Name	Description	Default (Range)	Ref.
C1-01 (0200) RUN	Acceleration Ramp 1	V/f OLV CLV Sets the ramp to accelerate from zero to maximum output speed.	1.50 s (0.00 - 600.00 s)	313
C1-02 (0201) RUN	Deceleration Ramp 1	V/f OLV CLV Sets the ramp to decelerate from maximum output speed to zero.	1.50 s (0.00 - 600.00 s)	313
C1-03 (0202) RUN	Acceleration Ramp 2	V/f OLV CLV Sets the ramp to accelerate from zero to maximum output speed.	1.50 s (0.00 - 600.00 s)	313
C1-04 (0203) RUN Expert	Deceleration Ramp 2	V/f OLV CLV Sets the ramp to decelerate from maximum output speed to zero.	1.50 s (0.00 - 600.00 s)	313
C1-05 (0204) RUN Expert	Acceleration Ramp 3	V/f OLV CLV Sets the ramp to accelerate from zero to maximum output speed.	1.50 s (0.00 - 600.00 s)	313
C1-06 (0205) RUN Expert	Deceleration Ramp 3	V/f OLV CLV Sets the ramp to decelerate from maximum output speed to zero.	1.50 s (0.00 - 600.00 s)	313
C1-07 (0206) RUN Expert	Acceleration Ramp 4	V/f OLV CLV Sets the ramp to accelerate from zero to maximum output speed.	1.50 s (0.00 - 600.00 s)	314
C1-08 (0207) RUN Expert	Deceleration Ramp 4	V/f OLV CLV Sets the ramp to decelerate from maximum output speed to zero.	1.50 s (0.00 - 600.00 s)	314
C1-09 (0208) RUN Expert	Fast Stop Ramp	V/f OLV CLV Sets the ramp that the drive will decelerate to zero for Emergency Stop. **Note:** Decelerating too quickly can cause an *ov [Overvoltage]* fault that shuts off the drive while the motor coasts to a stop. Set a Fast Stop time in *C1-09* that prevents motor coasting and makes sure that the motor stops quickly and safely.	1.50 s (0.00 - 600.00 s)	314
C1-10 (0209) Expert	Accel/Decel Time Setting Units	V/f OLV CLV Sets the setting units for *C1-01 to C1-08 [Accel/Decel Times 1 to 4]*, and *C1-09 [Fast Stop Time]*. 0 : 0.01 s (0.00 to 600.00 s) 1 : 0.1 s (0.0 to 6000.0 s)	0 (0, 1)	314
C1-11 (020A) Expert	Accel/Decel Switching Speed	V/f OLV CLV Sets the speed at which the drive will automatically change acceleration and deceleration times.	0.0% (0.0 - 100.0%)	315
C1-15 (0260)	Inspect Dec Ramp	V/f OLV CLV Sets the deceleration ramp used for inspection run.	0.00 s (0.00 - 2.00 s)	315

◆ C2: Jerk Characteristics

No. (Hex.)	Name	Description	Default (Range)	Ref.
C2-01 (020B)	Jerk at Accel Start	V/f OLV CLV Sets the jerks acceleration time at start.	0.50 s (0.00 - 10.00 s)	315
C2-02 (020C)	Jerk at Accel End	V/f OLV CLV Sets the jerk acceleration time at completion.	0.50 s (0.00 - 10.00 s)	315
C2-03 (020D)	Jerk at Decel Start	V/f OLV CLV Sets the jerk deceleration time at start.	0.50 s (0.00 - 10.00 s)	315

No. (Hex.)	Name	Description	Default (Range)	Ref.
C2-04 (020E)	Jerk at Decel End	V/f OLV CLV Sets the jerk deceleration time at completion.	0.50 s (0.00 - 10.00 s)	316
C2-05 (020F)	Jerk below Leveling Speed	V/f OLV CLV Sets the jerk deceleration time below leveling speed.	0.50 s (0.00 - 10.00 s)	316

◆ C3: Slip Compensation

No. (Hex.)	Name	Description	Default (Range)	Ref.
C3-01 (020F) RUN Expert	Slip Compensation Gain	V/f OLV CLV Sets the gain for the slip compensation function. Usually it is not necessary to change this setting. **Note:** Correctly set these parameters before changing the slip compensation gain: • *E2-01 [Motor Rated Current (FLA)]* • *E2-02 [Motor Rated Slip]* • *E2-03 [Motor No-Load Current]*	1.0 (0.0 - 2.5)	316
C3-02 (0210) RUN Expert	Slip Compensation Delay Time	V/f OLV CLV Sets the slip compensation delay time when speed is unstable or when the slip compensation response is too slow. Usually it is not necessary to change this setting.	2000 ms (0 - 10000 ms)	316
C3-03 (0211) Expert	Slip Compensation Limit	V/f OLV CLV Sets the upper limit for the slip compensation function as a percentage of the motor rated slip.	200% (0 - 250%)	316
C3-04 (0212) Expert	Slip Compensation at Regen	V/f OLV CLV Sets the slip compensation function during regenerative operation. 0 : Disabled 1 : Enabled Above 6Hz	0 (0 - 1)	317
C3-05 (0213) Expert	Output Voltage Limit Selection	V/f OLV CLV Sets the automatic reduction of motor magnetic flux when the output voltage is saturated. 0 : Disabled 1 : Enabled	0 (0, 1)	317

◆ C4: Torque Compensation

No. (Hex.)	Name	Description	Default (Range)	Ref.
C4-01 (0215) RUN	Torque Compensation Gain	V/f OLV CLV Sets the gain for the torque compensation function.	1.00 (0.00 - 2.50)	318
C4-02 (0216) RUN	Torque Compensation Delay Time	V/f OLV CLV Sets the torque compensation delay time. Usually it is not necessary to change this setting.	Determined by A1-02 (0 - 60000 ms)	318
C4-03 (0217) Expert	Torque Compensation @ FWD Start	V/f OLV CLV Set the amount of torque reference for forward start as a percentage of the motor rated torque.	0.0% (0.0 - 200.0%)	318
C4-04 (0218) Expert	Torque Compensation @ REV Start	V/f OLV CLV Sets the amount of torque reference for reverse start as a percentage of the motor rated torque.	0.0% (-200.0 - 0.0%)	318
C4-05 (0219) Expert	Torque Compensation Time	V/f OLV CLV Sets the starting torque constant to use with *C4-03 and C4-04 [Torque Compensation @ FWD/REV Start]*.	10 ms (0 - 200 ms)	319

◆ C5: Speed Control Loop

No. (Hex.)	Name	Description	Default (Range)	Ref.
C5-01 (021B) RUN	Speed Control Loop Proportional Gain 1	V/f OLV CLV Sets the gain to adjust Speed Control Loop response.	Determined by A1-02 (0.00 - 300.00)	319
C5-02 (021C) RUN	Speed Control Loop Integral Time 1	V/f OLV CLV Sets the Speed Control Loop integral time.	Determined by A1-02 (0.000 - 60.000 s)	320
C5-03 (021D) RUN	Speed Control Loop Proportional Gain 2	V/f OLV CLV Sets the gain to adjust Speed Control Loop response.	Determined by A1-02 (0.00 - 300.00)	320
C5-04 (021E) RUN	Speed Control Loop Integral Time 2	V/f OLV CLV Sets the Speed Control Loop integral time.	Determined by A1-02 (0.000 - 60.000 s)	320
C5-06 (0220)	Speed Control Loop Delay Time Constant	V/f OLV CLV Sets the filter time constant of the torque reference output from the speed loop. Usually it is not necessary to change this setting.	0.004 (0.000 - 0.500 s)	320
C5-07 (0221)	Speed Control Settings Switching Speed	V/f OLV CLV Sets the speed where the drive will switch between these parameters: • *C5-01 and C5-03 [Speed Control Loop Proportional Gain 1/2]* • *C5-02 and C5-04 [Speed Control Loop Integral Time 1/2]*	Determined by A1-02 (0.0 - 100.0%)	320
C5-08 (0222) Expert	ASR Integral Limit	V/f OLV CLV Sets the upper limit of the ASR integral amount as a percentage of the rated load.	400% (0 - 400%)	321
C5-13 (0272) RUN	ASR Proportional Gain 3	V/f OLV CLV Sets the gain to adjust ASR response at leveling speed. The setting is active for deceleration only.	Determined by A1-02 (0.00 - 300.00)	321
C5-14 (0273) RUN	ASR Integral Time 3	V/f OLV CLV Sets the ASR integral time at leveling speed. The setting is active for deceleration only.	Determined by A1-02 (0.000 - 10.000 s)	321
C5-16 (0271) Expert	ASR Filter Time during Pos. Lock	V/f OLV CLV Sets a delay to the torque command output from speed control loop during Position Lock. Usually it is not necessary to change this setting.	0.000 s (0.000 - 0.500 s)	321
C5-19 (0274) RUN	ASR P Gain during Position Lock	V/f OLV CLV Sets the Speed Control Loop Proportional gain used during Position Lock.	Determined by A1-02 (0.00 - 300.00)	321
C5-20 (0275) RUN	ASR I Time during Position Lock	V/f OLV CLV Sets the Speed Control Loop Integral time used during Position Lock.	0.100 s (0.000 - 10.000 s)	322
C5-29 (0B18) Expert	Speed Control Response	V/f OLV CLV Sets the level of speed control responsiveness. Usually it is not necessary to change this setting. 0 : Standard 1 : High Performance 1	1 (0, 1)	322
C5-50 (0B14) Expert	Notch Filter Frequency	V/f OLV CLV Sets the machine resonance frequency. **Note:** Set *C5-50 = 0 [0 Hz]* to disable the notch filter.	0 Hz (0, or 20 to 1000 Hz)	322
C5-51 (0B15) Expert	Notch Filter Bandwidth	V/f OLV CLV Sets the notch width of the notch filter. **Note:** Set *C5-50 = 0 [Notch Filter Frequency = 0 Hz]* to disable the notch filter.	1.0 (0.5 - 5.0)	322

◆ C6: Duty & Carrier Frequency

No. (Hex.)	Name	Description	Default (Range)	Ref.
C6-03 (0225)	Carrier Frequency Upper Limit	V/f OLV CLV Sets the carrier frequency upper limit.	Determined by o2-04 (1.0 - 15.0 kHz)	322
C6-06 (0228) Expert	PWM Modulation Method	V/f OLV CLV Sets PWM modulation method. 0 : 2/3 Phase Auto-Modulation 2 : 3-Phase Modulation	0 (0, 2)	323
C6-07 (0229) Expert	2/3 Phase Switchover Level	V/f OLV CLV Sets the carrier frequency to 2/3 of the set carrier level.	1.5 (0.5 - 3.0)	323
C6-09 (022B) Expert	Carrier Freq at Rotational Tune	V/f OLV CLV Sets the Auto-Tuning carrier frequency. Usually it is not necessary to change this setting. 0 : 5kHz 1 : use C6-03	0 (0, 1)	323
C6-21 (0245) Expert	Carrier Frequency @ Inspection	V/f OLV CLV Sets the carrier frequency during Inspection Operation. 0 : Use the value set to C6-03 1 : 2 kHz	1 (0, 1)	323
C6-34 (116E) Expert	Carrier Freq Reduce Start Level	V/f OLV CLV Sets the level of the overload totalizer at which the drive starts to decrease the carrier frequency to the value set in *L8-39 [Reduced Carrier Frequency]*.	50% (5 - 90%)	323

11.6 d: Reference Settings

◆ d1: Speed Reference

No. (Hex.)	Name	Description	Default (Range)	Ref.
d1-01 (0280) RUN	Speed Reference 1	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)	324
d1-02 (0281) RUN	Speed Reference 2	V/f OLV CLV Sets the speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)	324
d1-03 (0282) RUN	Speed Reference 3	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)	324
d1-04 (0283) RUN	Speed Reference 4	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)	324
d1-05 (0284) RUN	Speed Reference 5	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)	324
d1-06 (0285) RUN	Speed Reference 6	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)	325
d1-07 (0286) RUN	Speed Reference 7	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)	325
d1-08 (0287) RUN	Speed Reference 8	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)	325
d1-18 (02C0)	Speed Reference Selection Mode	V/f OLV CLV Sets the priority of the speed reference digital inputs. If d1-18 = 0, multi-speed references d1-01 to d1-08 are used. If d1-18 = 1, values from parameters d1-19 to d1-23 have priority. 0 : Multi-speed Mode1 (d1-01 to 08) 1 : High speed has priority	1 (0 - 1)	325
d1-19 (02C1) RUN	Nominal Speed	V/f OLV CLV Sets the speed reference when multi-function input “Nominal Speed” is on.	50.00 Hz (0.00 - 120.00 Hz)	325
d1-20 (02C2) RUN	Intermediate Speed 1	V/f OLV CLV Sets the speed reference when intermediate speed 1 is selected by digital inputs.	0.00 Hz (0.00 - 120.00 Hz)	325
d1-21 (02C3) RUN	Intermediate Speed 2	V/f OLV CLV Sets the speed reference when intermediate speed 2 is selected by digital inputs.	0.00 Hz (0.00 - 120.00 Hz)	325
d1-22 (02C4) RUN	Intermediate Speed 3	V/f OLV CLV Sets the speed reference when intermediate speed 3 is selected by digital inputs.	0.00 Hz (0.00 - 120.00 Hz)	326
d1-23 (02C5) RUN	Releveling Speed	V/f OLV CLV Sets the speed reference when releveling speed is selected by digital inputs.	0.00 Hz (0.00 - 120.00 Hz)	326
d1-24 (02C6) RUN	Inspect Oper Spd	V/f OLV CLV Sets the speed reference when inspection speed is selected by digital inputs.	30.00 Hz (0.00 - 120.00 Hz)	326
d1-25 (02C7) RUN	Rescue Oper Spd	V/f OLV CLV Sets the speed reference when rescue speed is selected by digital inputs.	5.00 Hz (0.00 - 15.00 Hz)	326
d1-26 (02C8) RUN	Leveling Speed	V/f OLV CLV Sets the speed reference when leveling speed is selected by digital inputs.	4.00 Hz (0.00 - 120.00 Hz)	326

No. (Hex.)	Name	Description	Default (Range)	Ref.
d1-28 (02CA)	Nom/Lev Spd Det	V/f OLV CLV Sets the speed reference level to detect that leveling speed has been selected when multi speed input commands are used.	0.00 Hz (0.00 - 120.00 Hz)	326
d1-29 (02CB)	Inspect Spd Det	V/f OLV CLV Sets the speed reference level to detect that inspection speed has been selected when multi speed input commands are used.	0.00 Hz (0.00 - 120.00 Hz)	326

11.7 E: Motor Parameters

◆ E1: V/f Pattern for Motor 1

No. (Hex.)	Name	Description	Default (Range)	Ref.
E1-01 (0300)	Input AC Supply Voltage	V/f OLV CLV Sets the drive input voltage. **NOTICE** **Damage to Equipment** **Set *E1-01 [Input AC Supply Voltage]* to align with the drive input voltage (not motor voltage).** **If this parameter is incorrect, the protective functions of the drive will not operate correctly and it can cause damage to the drive.**	200 V Class: 230 V, 400 V: 400 V (200 V Class: 155 - 255 V, 400 V Class: 310 - 510 V)	327
E1-04 (0303)	Maximum Output Frequency	V/f OLV CLV Sets the maximum output frequency for the V/f pattern.	Determined by A1-02 (10.0 - 120.0 Hz)	327
E1-05 (0304)	Maximum Output Voltage	V/f OLV CLV Sets the maximum output voltage for the V/f pattern.	200 V Class: 190 V, 400 V Class: 380.0 V (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)	327
E1-06 (0305)	Base Frequency	V/f OLV CLV Sets the base frequency for the V/f pattern.	Determined by A1-02 (0.0 - 120.0 Hz)	327
E1-07 (0306)	Middle Output Frequency	V/f OLV CLV Sets a middle output frequency for the V/f pattern.	Determined by A1-02 (0.0 - 120.0 Hz)	328
E1-08 (0307)	Middle Output Frequency Voltage	V/f OLV CLV Sets a middle output voltage for the V/f pattern.	Determined by A1-02 and o2-04 (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)	328
E1-09 (0308)	Minimum Output Frequency	V/f OLV CLV Sets the minimum output frequency for the V/f pattern.	Determined by A1-02 (0.0 - 120.0 Hz)	328
E1-10 (0309)	Minimum Output Voltage	V/f OLV CLV Sets the minimum output voltage for the V/f pattern.	Determined by o2-04 (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)	328
E1-11 (030A) Expert	Middle Output Frequency 2	V/f OLV CLV Sets a middle output frequency for the V/f pattern.	0.0 Hz (0.0 - 120.0 Hz)	328
E1-12 (030B) Expert	Middle Output Frequency Voltage 2	V/f OLV CLV Sets a middle point voltage for the V/f pattern.	0.0 V (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)	328
E1-13 (030C) Expert	Base Voltage	V/f OLV CLV Sets the base voltage for the V/f pattern.	0.0 V (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)	328

◆ E2: Motor Parameters

No. (Hex.)	Name	Description	Default (Range)	Ref.
E2-01 (030E)	Motor Rated Current (FLA)	V/f OLV CLV Sets the motor rated current in amps.	Determined by o2-04 (10% to 200% of the drive rated current)	329
E2-02 (030F)	Motor Rated Slip	V/f OLV CLV Sets motor rated slip.	Determined by o2-04 (0.00 - 20.00 Hz)	329
E2-03 (0310)	Motor No-Load Current	V/f OLV CLV Sets the no-load current for the motor in amps when operating at the rated frequency and the no-load voltage.	Determined by o2-04 (0 to E2-01)	329
E2-04 (0311)	Motor Pole Count	V/f OLV CLV Sets the number of motor poles.	4 (2 - 48)	329
E2-05 (0312)	Motor Line-to-Line Resistance	V/f OLV CLV Sets the line-to-line resistance for the motor stator windings.	Determined by o2-04 (0.000 - 65.000 Ω)	330

No. (Hex.)	Name	Description	Default (Range)	Ref.
E2-06 (0313)	Motor Leakage Inductance	V/f OLV CLV Sets the voltage drop from motor leakage inductance when the motor is operating at the rated frequency and rated current. This value is a percentage of Motor Rated Voltage.	Determined by o2-04 (0.0 - 60.0%)	330
E2-07 (0314)	Motor Saturation Coefficient 1	V/f OLV CLV Sets the motor iron-core saturation coefficient at 50% of the magnetic flux.	0.50 (0.00 - 0.50)	330
E2-08 (0315)	Motor Saturation Coefficient 2	V/f OLV CLV Sets the motor iron-core saturation coefficient at 75% of the magnetic flux.	0.75 (E2-07 - 0.75)	330
E2-09 (0316) Expert	Motor Mechanical Loss	V/f OLV CLV Sets the mechanical loss of the motor. It is set as a percentage of *E2-11 [Motor Rated Power]*. Usually it is not necessary to change this setting.	0.0% (0.0 - 10.0%)	330
E2-10 (0317)	Motor Iron Loss	V/f OLV CLV Sets the motor iron loss.	Determined by o2-04 (0 - 65535 W)	331
E2-11 (0318)	Motor Rated Power	V/f OLV CLV Sets the motor rated output in the units from *o1-58 [Motor Power Unit Selection]*.	Determined by o2-04 (0.00 - 650.00 kW)	331

11.8 F: Simple Feedback Settings

◆ F1: Encoder/PG Feedback Settings

No. (Hex.)	Name	Description	Default (Range)	Ref.
F1-02 (0300) Expert	Operation Selection at PG Open Circuit (PGo)	V/f OLV CLV Sets stopping method for a PGo fault. 0 : Ramp to stop (uses the deceleration ramp set to C1-02) 1 : Coast to Stop 2 : Fast Stop (uses the Fast Stop ramp set to C1-09) 3 : Alarm Only	1 (0 - 3)	332
F1-03 (0304) Expert	Operation Selection at Overspeed (oS)	V/f OLV CLV Sets the stopping method for an oS fault.	1 (0 - 3)	332
F1-04 (0304) Expert	Operation Selection at Deviation	V/f OLV CLV Sets the stopping method for a speed deviation fault.	3 (0 - 3)	332
F1-05 (0384)	Encoder 1 Rotation Selection	V/f OLV CLV Sets the output sequence for the A and B pulses from the encoder, assuming that the motor is operating in the up direction. 0 : Pulse A leads in Up Direction 1 : Pulse B leads in Up Direction	0 (0, 1)	332
F1-08 (0300) Expert	Overspeed Detection Level	V/f OLV CLV Sets the speed feedback value limit before the drives triggers an oS fault.	115% (0 - 120%)	333
F1-09 (0300) Expert	Overspeed Detection Delay Time	V/f OLV CLV Sets the time limit before the drives triggers an oS fault.	0.0 s (0.0 - 2.0 s)	333
F1-10 (0300) Expert	Excessive Speed Deviation Detection Level	V/f OLV CLV Sets the limit before the drives triggers an dEv error. The limit is determined by the difference between the speed reference and the speed feedback.	10% (0 - 50%)	333
F1-11 (0300) Expert	Excessive Speed Deviation Detection Delay Time	V/f OLV CLV Sets the time limit before the drives triggers an dEv error.	0.5 s (0.0 - 10.0 s)	333
F1-14 (0300) Expert	PG Open-Circuit Detection Time	V/f OLV CLV Sets the time limit before the drives triggers a PGo fault.	2.0 s (0.0 - 10.0 s)	333
F1-49 (380D) Expert	PGo Fault Threshold	V/f OLV CLV Detects missing A/B track PG input pulses on JOHB-PGX3-AE option card, even if one line connection is missing (especially A- or B-).	1.0 Hz (0.1 - 10.0 Hz)	333

◆ F5: Digital Output Option

No. (Hex.)	Name	Description	Default (Range)	Ref.
F5-07 (039F) Expert	Terminal M1-M2 Function Select	V/f OLV CLV Sets the function of terminal M1-M2 on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = Programmable (F5-01 to F5-08)]* to enable this function.	F (0 - 1FF)	333

Parameter List

11

11.9 H: Terminal Functions

◆ H1: Digital Inputs

No. (Hex.)	Name	Description	Default (Range)	Ref.
H1-01 (0438) Expert	Terminal S1 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S1.	40 (F, 40)	334
H1-02 (0439) Expert	Terminal S2 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S2.	41 (F, 41)	334
H1-03 (0400)	Terminal S3 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S3.	50 (3 - 79)	335
H1-04 (0401)	Terminal S4 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S4.	54 (3 - 79)	335
H1-05 (0402)	Terminal S5 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S5.	51 (3 - 79)	335
H1-06 (0403)	Terminal S6 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S6.	53 (3 - 79)	335
H1-07 (0404)	Terminal S7 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S7.	F (3 - 79)	335

■ H1-xx: MFDI Setting Values

Setting Value	Function	Description	Ref.
3	Multi-Step Speed Reference 1	V/f OLV CLV Uses speed references *d1-01 to d1-16* to set a multi-step speed reference.	335
4	Multi-Step Speed Reference 2	V/f OLV CLV Uses speed references *d1-01 to d1-16* to set a multi-step speed reference.	335
5	Multi-Step Speed Reference 3	V/f OLV CLV Uses speed references *d1-01 to d1-16* to set a multi-step speed reference.	335
7	Accel/Decel Time Selection 1	V/f OLV CLV Sets the drive to use *Acceleration/Deceleration Time 1 [C1-01, C1-02]* or *Acceleration/Deceleration Time 2 [C1-03, C1-04]*.	335
8	Baseblock Command (N.O.)	V/f OLV CLV Sets the command that stops drive output and coasts the motor to stop when the input is ON. ON : Baseblock (drive output stop) OFF : Normal operation	336
9	Baseblock Command (N.C.)	V/f OLV CLV Sets the command that stops drive output and coasts the motor to stop when the input terminal is OFF. ON : Normal operation OFF : Baseblock (drive output stop)	336
F	Not Used	V/f OLV CLV Use this setting for unused terminals or to use terminals in through mode.	336
14	Fault Reset	V/f OLV CLV Sets the command to reset the current fault when the Run command is inactive. **Note:** The drive ignores the fault reset command when the Run command is active. Remove the Run command before trying to reset a fault.	336
15	Fast Stop (N.O.)	V/f OLV CLV Sets the command to ramp to stop in the deceleration time set in *C1-09 [Fast Stop Time]* when the input terminal is ON while the drive is operating.	337
17	Fast Stop (N.C.)	V/f OLV CLV Sets the command to ramp to stop in the deceleration time set in *C1-09 [Fast Stop Time]* when the input terminal is ON while the drive is operating.	337
18	Timer Function	V/f OLV CLV Sets the command to start the timer function. Use this setting with *Timer Output [H2-xx = 12]*.	337
1 A	Accel/Decel Time Selection 2	V/f OLV CLV Set this function and *H1-xx = 7 [Accel/Decel Time Selection 1]* together. Sets the drive to use *Acceleration/ Deceleration Time 3 [C1-05, C1-06]* or *Acceleration/Deceleration Time 4 [C1-07, C1-08]*.	338

Setting Value	Function	Description	Ref.
20	External Fault (NO-Always-Ramp)	V/f OLV CLV When the terminal activates, the drive ramps to stop in the selected deceleration time. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive always detects external faults whether the drive is stopped or running.	338
21	External Fault (NC-Always-Ramp)	V/f OLV CLV When the terminal deactivates, the drive ramps to stop in the selected deceleration time. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive always detects external faults whether the drive is stopped or running.	338
22	External Fault (NO-@Run-Ramp)	V/f OLV CLV When the terminal activates during run, the drive ramps to stop in the selected deceleration time. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive does not detect external faults while the drive is stopped.	338
23	External Fault (NC-@Run-Ramp)	V/f OLV CLV When the terminal deactivates during run, the drive ramps to stop in the selected deceleration time. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive does not detect external faults while the drive is stopped.	338
24	External Fault (NO-Always-Coast)	V/f OLV CLV When the terminal activates, the drive shuts off the output and the motor coasts to stop. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive always detects external faults whether the drive is stopped or running.	338
25	External Fault (NC-Always-Coast)	V/f OLV CLV When the terminal deactivates, the drive shuts off the output and the motor coasts to stop. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive always detects external faults whether the drive is stopped or running.	338
26	External Fault (NO-@Run-Coast)	V/f OLV CLV When the terminal activates during run, the drive shuts off the output and the motor coasts to stop. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive does not detect external faults while the drive is stopped.	338
27	External Fault (NC-@Run-Coast)	V/f OLV CLV When the terminal deactivates during run, the drive shuts off the output and the motor coasts to stop. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive does not detect external faults while the drive is stopped.	338
28	External Fault (NO-Always-FStop)	V/f OLV CLV When the terminal activates, the drive stops the motor in the deceleration time set to *C1-09 [Fast Stop Time]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF. Stopped drives and running drives will detect external faults.	338
29	External Fault (NC-Always-FStop)	V/f OLV CLV When the terminal deactivates, the drive stops the motor in the deceleration time set to *C1-09 [Fast Stop Time]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF. Stopped drives and running drives will detect external faults.	338
2A	External Fault (NO-@Run-FStop)	V/f OLV CLV When the terminal activates during run, the drive stops the motor in the deceleration time set to *C1-09 [Fast Stop Time]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF. Stopped drives will not detect external faults.	338
2B	External Fault (NC-@Run-FStop)	V/f OLV CLV When the terminal deactivates during run, the drive stops the motor in the deceleration time set to *C1-09 [Fast Stop Time]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF. Stopped drives will not detect external faults.	338
2C	External Fault (NO-Always-Alarm)	V/f OLV CLV When the terminal activates, the keypad shows *EFx [External Fault (Input Terminal Sx)]* and the output terminal set for *Alarm [H2-01 to H2-03 = 10]* activates. The drive continues operation. Stopped drives and running drives will detect external faults.	338
2E	External Fault (NO-@Run-Alarm)	V/f OLV CLV When the terminal activates during run, the keypad shows *EFx [External Fault (Input Terminal Sx)]* and the output terminal set for *Alarm [H2-01 to H2-03 = 10]* activates. The drive continues operation. Stopped drives will not detect external faults.	338
2F	External Fault (NC-@Run-Alarm)	V/f OLV CLV When the terminal deactivates during run, the keypad shows *EFx [External Fault (Input Terminal Sx)]* and the output terminal set for *Alarm [H2-01 to H2-03 = 10]* activates. The drive continues operation. Stopped drives will not detect external faults.	338
40 Expert	Up Command	V/f OLV CLV Sets the Up command for 2-wire sequence 1. Set this function and *H1-xx = 41 [Down Command)]* together. ON : Up OFF : Stop **Note:** • If you turn ON the Up command terminal and the Down command terminal, it will cause an *EF [Up/Down Command Input Error]* alarm and the motor will ramp to stop. • Initialize the drive with a 2-wire sequence to set the Up command to terminal S1.	339

Setting Value	Function	Description	Ref.
41 Expert	Down Command	V/f OLV CLV Sets the Down command for 2-wire sequence 1. Set this function and *H1-xx = 40 [Up Command]* together. ON : Down OFF : Stop **Note:** • If you turn ON the Up command terminal and the Down command terminal, it will cause an *EF [Up/Down Command Input Error]* alarm and the motor will ramp to stop. • Initialize the drive with a 2-wire sequence to set the Down command to terminal S2.	339
50	Nominal Speed	V/f OLV CLV Sets the speed reference nominal speed.	339
51	Intermed Speed	V/f OLV CLV Sets the speed reference intermediate speed 1. In combination with nominal and releveling speed you can set intermediate speed 2 and 3.	339
52	Releveling Speed	V/f OLV CLV Sets the speed reference releveling speed.	339
53	Leveling Speed	V/f OLV CLV Sets the speed reference leveling speed.	340
54	Inspection Speed	V/f OLV CLV Sets the speed reference inspection speed.	340
55	Rescue Operation	V/f OLV CLV Activates rescue operation.	340
56	Motor Contractor Feedback	V/f OLV CLV Used for motor contactor supervision and fault detection.	340
67	Communications Test Mode	V/f OLV CLV Set the function for the drive to self-test RS-485 serial communications operation.	340
79	Brake Feedback	V/f OLV CLV Used for brake supervision and detection of incorrect operation.	340

◆ H2: Digital Outputs

No. (Hex.)	Name	Description	Default (Range)	Ref.
H2-01 (040B)	Term MA/MB-MC Function Selection	V/f OLV CLV Sets the function set for MFDO terminal MA-MC or MB-MC. **Note:** Set this parameter to *F* when the terminal is not being used or to use the terminal in through mode.	E (0 - 158)	341
H2-02 (040C)	Term P1-C1 Function Selection	V/f OLV CLV Sets the function for MFDO terminal P1-C1. **Note:** Set this parameter to *F* when the terminal is not being used or to use the terminal in through mode.	6 (0 - 158)	341
H2-03 (040D)	Term P2-C2 Function Selection	V/f OLV CLV Sets the function for MFDO terminal P2-C2. **Note:** Set this parameter to *F* when the terminal is not being used or to use the terminal in through mode.	50 (0 - 158)	341

■ H2-xx: MFDO Setting Values

<table>
<tr><th>Setting Value</th><th>Function</th><th>Description</th><th>Ref.</th></tr>
<tr><td>0</td><td>During Run</td><td>V/f OLV CLV
The terminal activates when you input a Run command and when the drive is outputting voltage.
ON : Drive is running
OFF : Drive is stopping</td><td>342</td></tr>
<tr><td>1</td><td>Zero Speed</td><td>V/f OLV CLV
The terminal activates when the output frequency is less than E1-09 [Minimum Output Frequency] or S1-01 [Zero Speed Level at Stop].
Note:
Parameter A1-02 [Control Method Selection] selects which parameter is the reference.
<table>
<tr><th>A1-02 Setting</th><th>Control Method Selection</th><th>Parameter Used as the Reference</th></tr>
<tr><td>0</td><td>V/f</td><td>E1-09</td></tr>
<tr><td>2</td><td>OLV</td><td>S1-01</td></tr>
<tr><td>3</td><td>CLV</td><td>S1-01</td></tr>
</table>
ON : Output frequency < value of E1-09 or S1-01.
OFF : Output frequency ≥ E1-09 or S1-01.</td><td>342</td></tr>
<tr><td>2</td><td>Speed Agree 1</td><td>V/f OLV CLV
The terminal activates when the output frequency is in the range of the frequency reference ± L4-02 [Speed Agree Detection Width].
ON : The output frequency is in the range of “frequency reference ± L4-02”.
OFF : The output frequency does not align with the frequency reference although the drive is running.</td><td>342</td></tr>
<tr><td>3</td><td>User-Set Speed Agree 1</td><td>V/f OLV CLV
The terminal activates when the output frequency is in the range of L4-01 [Speed Agree Detection Level] ± L4-02 [Speed Agree Detection Width] and in the range of the frequency reference ± L4-02.
Note:
The detection function operates in the two motor rotation directions. The drive uses the L4-01 value as the forward/reverse detection level.
ON : The output frequency is in the range as defined by the result of “L4-01 ± L4-02” and the range of frequency reference ± L4-02.
OFF : The output frequency is not in the range of “L4-01 ± L4-02” nor the range of frequency reference ± L4-02.</td><td>343</td></tr>
<tr><td>4</td><td>Frequency Detection 1</td><td>V/f OLV CLV
The terminal deactivates when the output frequency is higher than the value of L4-01 [Speed Agree Detection Level] + L4-02 [Speed Agree Detection Width]. After the terminal deactivates, the terminal stays deactivated until the output frequency = L4-01.
Note:
The detection function operates in the two motor rotation directions. The drive uses the L4-01 value as the forward/reverse detection level.
ON : The output frequency is less than L4-01 or is not more than L4-01 + L4-02.
OFF : The output frequency is more than L4-01 + L4-02.</td><td>343</td></tr>
<tr><td>5</td><td>Frequency Detection 2</td><td>V/f OLV CLV
The terminal activates when the output frequency is higher than the value of L4-01 [Speed Agree Detection Level]. After the terminal activates, the terminal stays activated until the output frequency is at the value of L4-01 - L4-02.
Note:
The detection function operates in the two motor rotation directions. The drive uses the L4-01 value as the forward/reverse detection level.
ON : The output frequency is more than L4-01.
OFF : The output frequency is less than “L4-01 - L4-02,” or it is not more than L4-01.</td><td>344</td></tr>
<tr><td>6</td><td>Drive Ready</td><td>V/f OLV CLV
The terminal activates when the drive is ready and running.</td><td>344</td></tr>
<tr><td>7</td><td>DC Bus Undervoltage</td><td>V/f OLV CLV
The terminal activates when the DC bus voltage or control circuit power supply is at the voltage set in L2-05 [Undervoltage Detection Lvl (Uv1)] or less. The terminal also activates when there is a fault with the DC bus voltage.
ON : The DC bus voltage ≤ L2-05
OFF : The DC bus voltage > L2-05</td><td>344</td></tr>
<tr><td>8</td><td>During Baseblock (N.O.)</td><td>V/f OLV CLV
The terminal activates during baseblock. When the drive is in baseblock, the drive output transistor stops switching and does not make DC bus voltage.
ON : During baseblock
OFF : The drive is not in baseblock.</td><td>345</td></tr>
<tr><td>B</td><td>Torque Detection 1 (N.O.)</td><td>V/f OLV CLV
The terminal activates when the drive detects overtorque or undertorque.
ON : The output current/torque > L6-02 [Torque Detection Level 1], or the output current/torque < L6-02 for longer than the time set in L6-03 [Torque Detection Time 1].</td><td>345</td></tr>
<tr><td>E</td><td>Fault</td><td>V/f OLV CLV
The terminal activates when the drive detects a fault.
Note:
The terminal will not activate for CPF00 and CPF01 [Control Circuit Error] faults.</td><td>345</td></tr>
</table>

Setting Value	Function	Description	Ref.
F	Not Used	V/f OLV CLV Use this setting for unused terminals or to use terminals in through mode.	345
10	Alarm	V/f OLV CLV The terminal activates when the drive detects a minor fault.	345
11	Fault Reset Command Active	V/f OLV CLV The terminal activates when the drive receives the Reset command from the control circuit terminal, serial communications, or the communication option.	345
12	Timer Output	V/f OLV CLV Sets the terminal as the timer output. Use this setting with the timer input set in *H1-xx = 18 [MFDI Function Selection = Timer Function]*.	345
13	Speed Agree 2	V/f OLV CLV The terminal activates when the output frequency is in the range of the frequency reference ± *L4-04 [Speed Agree Detection Width(+/-)]*. **Note:** The detection function operates in the two motor rotation directions. ON : The output frequency is in the range of "frequency reference ± *L4-04*". OFF : The output frequency is not in the range of "frequency reference ± *L4-04*".	346
14	User-Set Speed Agree 2	V/f OLV CLV The terminal activates when the output frequency is in the range of *L4-03 [Speed Agree Detection Level(+/-)]* ± *L4-04 [Speed Agree Detection Width(+/-)]* and in the range of the frequency reference ± *L4-04*. **Note:** The detection level set in *L4-03* is a signed value. The drive will only detect in one direction. ON : The output frequency is in the range as defined by the result of "*L4-03* ± *L4-04*" and the range of frequency reference ± *L4-04*. OFF : The output frequency is not in the range of "*L4-03* ± *L4-04*" nor the range of frequency reference ± *L4-04*.	346
15	Frequency Detection 3	V/f OLV CLV The terminal deactivates when the output frequency is more than "*L4-03 [Speed Agree Detection Level(+/-)]* + *L4-04 [Speed Agree Detection Width(+/-)]*". After the terminal deactivates, the terminal stays deactivated until the output frequency is at the value of *L4-03*. **Note:** The detection level set in *L4-03* is a signed value. The drive will only detect in one direction. ON : The output frequency is less than *L4-03* or is not more than *L4-03* + *L4-04*. OFF : The output frequency is higher than *L4-03* + *L4-04*.	346
16	Frequency Detection 4	V/f OLV CLV The terminal activates when the output frequency is higher than the value of *L4-03 [Speed Agree Detection Level (+/-)]*. After the terminal activates, the terminal stays activated until the output frequency = *L4-03* - *L4-04*. **Note:** The detection level set in *L4-03* is a signed value. The drive will only detect in one direction. ON : The output frequency is more than *L4-03*. OFF : The output frequency is less than "*L4-03* - *L4-04*," or it is not more than *L4-03*.	347
18	Torque Detection 2 (N.O.)	V/f OLV CLV The terminal activates when the drive detects overtorque or undertorque. ON : The output current/torque > *L6-05 [Torque Detection Level 2]*, or the output current/torque < *L6-05* for longer than the time set in *L6-06 [Torque Detection Time 2]*.	347
1A	During Reverse	V/f OLV CLV The terminal activates when the motor operates in the reverse direction. ON : The motor is operating in the reverse direction. OFF : The motor is operating in the forward direction or the motor stopped.	348
1B	During Baseblock (N.C.)	V/f OLV CLV The terminal deactivates during baseblock. When the drive is in baseblock, the drive output transistor stops switching and does not make DC bus voltage. ON : The drive is not in baseblock. OFF : During baseblock	348
1E	Executing Auto-Restart	V/f OLV CLV The terminal activates when the Auto Restart function is trying to restart after a fault.	348
1F	Motor Overload Alarm (oL1)	V/f OLV CLV The terminal activates when the electronic thermal protection value of the motor overload protective function is a minimum of 90% of the detection level.	348
20	Drive Overheat Pre-Alarm (oH)	V/f OLV CLV The terminal activates when the drive heatsink temperature is at the level set with *L8-02 [Overheat Alarm Level]*.	348
21	Safe Torque OFF	V/f OLV CLV The terminal activates (safety stop state) when the safety circuit and safety diagnosis circuit are operating correctly and when terminals H1-HC and H2-HC are OFF (Open). ON : Safety stop state OFF : Safety circuit fault or RUN/READY	349

Setting Value	Function	Description	Ref.
2F	Maintenance Notification	V/f OLV CLV The terminal activates when drive components are at their estimated maintenance period. Tells you about the maintenance period for these items: • IGBT • Cooling Fan • Capacitor • Soft charge bypass relay	349
30	During Torque Limit	V/f OLV CLV The terminal activates when the torque reference is the torque limit set with *L7 parameters*.	349
33	Zero Servo Complete	V/f OLV CLV The terminal activates when positioning in the range set with *b9-02 [Zero Servo Completion Window]* completes after sending the Zero-Servo command.	349
37	During Frequency Output	V/f OLV CLV The terminal activates when the drive outputs frequency. ON : The drive is outputting frequency. OFF : The drive is not outputting frequency.	349
47	Input Phase Loss	V/f OLV CLV Indicates input phase loss. 0 : No error 1 : Input Phase Loss error detected	350
50	Brake Control	V/f OLV CLV This setting can be used in the brake sequence for the elevator application. Closing the output terminal should cause the brake to release, and opening the terminal should apply the brake. Close : Release brake. Open : Apply brake	350
51	Output Contactor Control	V/f OLV CLV Assigning this command to an output terminal can send a signal to the controller to close the output contactor. The output contactor should open when the terminal is released. Closed : Close output contactor	350
52	Door Zone	V/f OLV CLV The terminal activates when the speed has reached the value set in *L4-13 [Door Zone Level]*, and the controller should open the elevator door.	350
54	Light Load Direction	V/f OLV CLV Indicates the light load direction detected during emergency operation with light load search. When the terminal is closed the light load direction is up, when it is open the light load direction is down. Closed : Light load direction is up Open : Light load direction is down	350
58	Safe Disable Status	V/f OLV CLV This terminal closes if the Safe Disable inputs H1-HC are closed and opens when terminals H1-HC are open. Closed : Safe Disable terminals H1-HC and H2-HC are open, drive is in a baseblock state Open : Safe Disable terminals H1-HC and H2-HC are closed (normal operation)	350
62	Modbus Reg 1 Status Satisfied	V/f OLV CLV The terminal activates when the bit specified by *H2-08 [Modbus Register 1 Bit Select]* for the MEMOBUS register address set with *H2-07 [Modbus Register 1 Address Select]* activates.	351
63	Modbus Reg 2 Status Satisfied	V/f OLV CLV The terminal activates when the bit specified by *H2-10 [Modbus Register 2 Bit Select]* for the MEMOBUS register address set with *H2-09 [Modbus Register 2 Address Select]* activates.	351
66	Comparator1	V/f OLV CLV The terminal activates if the monitor value set with *H2-20 [Comparator 1 Monitor Selection]* is in range of the values of *H2-21 [Comparator 1 Lower Limit] and H2-22 [Comparator 1 Upper Limit]* for the time set in *H2-24 [Comparator 1 On-Delay Time]*.	351
67	Comparator2	V/f OLV CLV The terminal activates if the monitor value set with *H2-26 [Comparator 2 Monitor Selection]* is not in the range of the values of *H2-27 [Comparator 2 Lower Limit]* and *H2-28 [Comparator 2 Upper Limit]* for the time set in *H2-30 [Comparator 2 On-Delay Time]*.	351
69	External Power 24V Supply	V/f OLV CLV The terminal activates when there is an external 24V power supply between terminals PS-AC. ON : The external 24V power supply is supplying power. OFF : The external 24V power supply is not supplying power.	352
6 A	Data Logger Error	V/f OLV CLV The terminal activates when the drive detects a *LoG [Com Error / Abnormal SD card]*.	352
100 - 16A	Inverse output of 0 to 6A	V/f OLV CLV Causes inverse output of the function for the selected MFDO. Uses the last two digits of 1xx to select which function to inversely output.	352

◆ H3: Analog Inputs

No. (Hex.)	Name	Description	Default (Range)	Ref.
H3-01 (0410)	Terminal A1 Signal Level Select	V/f OLV CLV Sets the input signal level for MFAI terminal A1. 0 : 0 to 10V (Lower Limit at 0) 1 : -10 to +10V (Bipolar Reference)	0 (0, 1)	353
H3-02 (0434)	Terminal A1 Function Selection	V/f OLV CLV Sets the function for MFAI terminal A1.	F (0 - 1F)	353
H3-03 (0411) RUN	Terminal A1 Gain Setting	V/f OLV CLV Sets the gain of the analog signal input to MFAI terminal A1.	100.0% (-999.9 - +999.9%)	354
H3-04 (0412) RUN	Terminal A1 Bias Setting	V/f OLV CLV Sets the bias of the analog signal input to MFAI terminal A1.	0.0% (-999.9 - +999.9%)	354
H3-09 (0417)	Terminal A2 Signal Level Select	V/f OLV CLV Sets the input signal level for MFAI terminal A2. 0 : 0-10V (LowLim=0) 1 : -10 to +10V (Bipolar Reference) 2 : 4 to 20 mA 3 : 0 to 20 mA	0 (0 - 3)	354
H3-10 (0418)	Terminal A2 Function Selection	V/f OLV CLV Sets the function for MFAI terminal A2.	F (0 - 1F)	354
H3-11 (0419) RUN	Terminal A2 Gain Setting	V/f OLV CLV Sets the gain of the analog signal input to MFAI terminal A2.	100.0% (-999.9 - +999.9%)	354
H3-12 (041A) RUN	Terminal A2 Bias Setting	V/f OLV CLV Sets the bias of the analog signal input to MFAI terminal A2.	0.0% (-999.9 - +999.9%)	355
H3-13 (041B)	Analog Input FilterTime Constant	V/f OLV CLV Sets the time constant for primary delay filters on MFAI terminals.	0.03 s (0.00 - 2.00 s)	355
H3-16 (02F0)	Terminal A1 Offset	V/f OLV CLV Sets the offset level for analog signals input to terminal A1. Usually it is not necessary to change this setting.	0 (-500 - +500)	355
H3-17 (02F1)	Terminal A2 Offset	V/f OLV CLV Sets the offset level for analog signals input to terminal A2. Usually it is not necessary to change this setting.	0 (-500 - +500)	355

■ H3-xx: MFAI Setting Values

Setting Value	Function	Description	Ref.
0	Speed Reference	V/f OLV CLV The input value from the MFAI terminal set with this function becomes the master speed reference.	355
2	Auxiliary Speed Reference 1	V/f OLV CLV Sets Reference 2 through multi-step speed reference to enable the command reference (Auxiliary Speed Reference 1) from the analog input terminal set here. This value is a percentage where the *E1-04 [Maximum Output Frequency]* setting is a setting value of 100%.	356
E	Motor Temperature (PTC Input)	V/f OLV CLV Uses the motor Positive Temperature Coefficient (PTC) thermistor to prevent heat damage to the motor as a percentage of the current value when the 10 V analog signal is input.	356
F	Not Used	V/f OLV CLV Use this setting for unused terminals or to use terminals in through mode.	356

◆ H4: Analog Outputs

No. (Hex.)	Name	Description	Default (Range)	Ref.
H4-01 (041D) Expert	Terminal AM Analog Output Select	V/f OLV CLV Sets the monitoring number to be output from the MFAO terminal AM. Set the *x-xx* part of the *Ux-xx [Monitor]*. For example, set *H4-01 = 102* to monitor *U1-02 [Output Frequency]*.	102 (000 - 999)	357
H4-02 (041E) RUN Expert	Terminal AM Analog Output Gain	V/f OLV CLV Sets the gain of the monitor signal that is sent from MFAO terminal AM. Sets the analog signal output level from the terminal AM at 10 V or 20 mA as 100% when an output for monitoring items is 100%.	100.0% (-999.9 - +999.9%)	357
H4-03 (041F) RUN Expert	Terminal AM Analog Output Bias	V/f OLV CLV Sets the bias of the monitor signal that is sent from MFAO terminal AM. When an output for monitoring items is 0%, this parameter sets the analog signal output level from the AM terminal at 10 V or 20 mA as 0%.	0.0% (-999.9 - +999.9%)	358
H4-07 (0423) Expert	Terminal FM Signal Level Select	V/f OLV CLV Sets the MFAO terminal FM output signal level. 0 : 0 to 10 Vdc 1 : -10 to +10 Vdc	0 (0, 1)	358

◆ H5: Modbus Communication

No. (Hex.)	Name	Description	Default (Range)	Ref.
H5-01 (0425)	Drive Node Address	V/f OLV CLV Sets the communication slave address for drives. **Note:** • Re-energize the drive or set *H5-20 = 1 [Communication Parameters Reload = Reload Now]* after you change the parameter setting. • Setting 0 will not let the drive respond to MEMOBUS/Modbus communications.	1FH (0 - FFH)	358
H5-02 (0426)	Communication Speed Selection	V/f OLV CLV Sets the communications speed for MEMOBUS/Modbus communications. **Note:** Re-energize the drive or set *H5-20 = 1 [Communication Parameters Reload = Reload Now]* after you change the parameter setting. 0 : 1200 bps 1 : 2400 bps 2 : 4800 bps 3 : 9600 bps 4 : 19.2 kbps 5 : 38.4 kbps 6 : 57.6 kbps 7 : 76.8 kbps 8 : 115.2 kbps	3 (0 - 8)	358
H5-03 (0427)	Communication Parity Selection	V/f OLV CLV Sets the communications parity used for MEMOBUS/Modbus communications. **Note:** Re-energize the drive or set *H5-20 = 1 [Communication Parameters Reload = Reload Now]* after you change the parameter setting. 0 : No parity 1 : Even parity 2 : Odd parity	0 (0 - 2)	359
H5-04 (0428) Expert	Communication Error Stop Method	V/f OLV CLV Sets the motor Stopping Method when the drive detects *CE [MEMOBUS/Modbus Communication Err]* issues. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only	3 (0 - 3)	359
H5-05 (0429) Expert	Comm Fault Detection Selection	V/f OLV CLV Sets the function that detects *CE [Modbus Communication Error]* issues during MEMOBUS/Modbus communications. 0 : Disabled 1 : Enabled	1 (0, 1)	359
H5-06 (042A) Expert	Drive Transmit Wait Time	V/f OLV CLV Sets the time to wait to send a response message after the drive receives a command message from the master. **Note:** Restart the drive after changing the parameter setting.	5 ms (0 - 65 ms)	359

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No. (Hex.)	Name	Description	Default (Range)	Ref.
H5-09 (0435) Expert	CE Detection Time	V/f OLV CLV Sets the detection time for *CE [Modbus Communication Error]* issues when communication stops.	2.0 s (0.0 - 25.0 s)	360
H5-10 (0436) Expert	Modbus Register 0025H Unit Sel	V/f OLV CLV Sets the unit of measure used for the MEMOBUS/Modbus communications monitor register 0025H (output voltage reference monitor). 0 : 0.1 V units 1 : 1 V units	0 (0, 1)	360
H5-11 (043C) RUN Expert	Comm ENTER Command Mode	V/f OLV CLV Sets the function to make the Enter command necessary to change parameters through MEMOBUS/Modbus communications. 0 : ENTER Command Required 1 : ENTER Command Not Required	0 (0, 1)	360
H5-12 (043D) Expert	Run Command Method Selection	V/f OLV CLV Sets the input method for the Run command when *b1-02 = 2 [Run Command Selection 1 = Memobus/Modbus Communications]* or *b1-16 = 2 [Run Command Selection 2 = Memobus/Modbus Communications]*. 0 : FWD/Stop, REV/Stop 1 : Run/Stop, FWD/REV	0 (0, 1)	360
H5-18 (11A2) Expert	Motor Speed Filter over Comms	V/f OLV CLV Sets the filter time constant used when monitoring motor speed during MEMOBUS/ Modbus communications or with a communication option.	0 ms (0 - 100 ms)	361
H5-20 (0B57) Expert	Communication Parameters Reload	V/f OLV CLV Sets the function to immediately enable updated MEMOBUS/Modbus communications parameters. 0 : Reload at Next Power Cycle 1 : Reload Now	0 (0, 1)	361
H5-25 (1589) RUN Expert	Function 5A Register 1 Selection	V/f OLV CLV Returns the contents of the specified MEMOBUS/Modbus communications register when responding to the master device.	0044H (U1-05) (0000H - FFFFH)	361
H5-28 (158C) RUN Expert	Function 5A Register 4 Selection	V/f OLV CLV Returns the contents of the specified MEMOBUS/Modbus communications register when responding to the master device.	0049H (U1-10) (0000H - FFFFH)	362

11.10 L: Protection Functions

L1: Motor Protection

No. (Hex.)	Name	Description	Default (Range)	Ref.
L1-01 (0480)	Motor Overload (oL1) Protection	V/f OLV CLV Sets the motor overload protection with electronic thermal protectors. 0 : No 1 : Variable Torque 2 : Constant Torque 10:1 Speed Range 3 : Constant Torque 100:1 SpeedRange	1 (0 - 3)	363
L1-02 (0481) Expert	Motor Overload Protection Time	V/f OLV CLV Sets the operation time for the electronic thermal protector of the drive to prevent damage to the motor. Usually it is not necessary to change this setting.	1.0 min (0.1 - 5.0 min)	365
L1-03 (0482) Expert	Motor Thermistor oH Alarm Select	V/f OLV CLV Sets drive operation when the PTC input signal entered into the drive is at the *oH3 [Motor Overheat Alarm]* detection level. 0 : Ramp to Stop 1 : Coast to Stop 2 : Emergency Stop (Use C1-09) 3 : Alarm Only	3 (0 - 3)	365
L1-04 (0483) Expert	Motor Thermistor oH Fault Select	V/f OLV CLV Sets the drive operation when the PTC input signal to the drive is at the *oH4 [Motor Overheat Fault (PTC Input)]* detection level. 0 : Ramp to Stop 1 : Coast to Stop 2 : Emergency Stop (Use C1-09)	1 (0 - 2)	366
L1-05 (0484) Expert	Motor Thermistor Filter Time	V/f OLV CLV Sets the primary delay time constant for the PTC input signal entered to the drive. This parameter prevents accidental motor overheat faults.	0.20 s (0.00 - 10.00 s)	366
L1-08 (1103) Expert	oL1 Current Level for Motor 1	V/f OLV CLV Sets the reference current for the motor 1 thermal overload detection. When the current level > 0.0 A, you cannot set this value < 10% of the continuous rated output current.	0.0 A (0.0 - 2250.0 A)	366
L1-13 (046D) Expert	Motor Overload Memory Selection	V/f OLV CLV Sets the function that keeps the current electronic thermal protector value when the drive stops receiving power. 0 : Disabled 1 : Enabled	1 (0, 1)	366

L2: Power Loss Ride Through (Undervoltage Detection)

No. (Hex.)	Name	Description	Default (Range)	Ref.
L2-05 (0489) Expert	Undervoltage Detection Lvl (Uv1)	V/f OLV CLV Sets the voltage at which a *Uv1 [DC Bus Undervoltage]* fault is triggered. Usually it is not necessary to change this setting. **NOTICE** **Damage to Equipment** **When you set this parameter to a value lower than the default, you must install an AC reactor on the input side of the power supply.** **If you do not install an AC reactor, it will cause damage to the drive circuitry.**	Determined by E1-01 (200 V Class: 150 - 210 V, 400 V Class: 300 - 420 V)	367

L3: Stall Prevention

No. (Hex.)	Name	Description	Default (Range)	Ref.
L3-01 (048F) Expert	Stall Prevention during Accel	V/f OLV CLV Sets the method of the Stall Prevention During Acceleration. 0 : Disabled 1 : Enabled	1 (0 - 1)	367
L3-02 (0490) Expert	Stall Prevent Level during Accel	V/f OLV CLV Sets the output current level at which the Stall Prevention function operates during acceleration where the drive rated output current is 100%.	Determined by L8-38 (0 - 165%)	368

No. (Hex.)	Name	Description	Default (Range)	Ref.
L3-03 (0491) Expert	Stall Prevent Limit during Accel	V/f OLV CLV Sets the lower limit for the stall prevention level used in the constant output range as a percentage of the drive rated output current.	50% (0 - 100%)	368
L3-05 (0493) Expert	Stall Prevention during RUN	V/f OLV CLV Sets the function to enable and disable Stall Prevention During Run. **Note:** An output frequency less than 6 Hz disables Stall Prevention during Run. The setting values of *L3-05* and *L3-06 [Stall Prevent Level during Run]* do not have an effect. 0 : No 1 : Deceleration Time 1 (C1-02)	1 (0 - 1)	368
L3-06 (0494) Expert	Stall Prevent Level during Run	V/f OLV CLV Sets the output current level at which the Stall Prevention function is enabled during run when the drive rated output current is 100%. **Note:** This parameter is applicable when *L3-05 = 1 [Stall Prevention during RUN = Deceleration Time 1 (C1-02)]*.	Determined by L8-38 (30 - 165%)	369

◆ L4: Speed Detection

No. (Hex.)	Name	Description	Default (Range)	Ref.
L4-01 (0499) Expert	Speed Agree Detection Level	V/f OLV CLV Sets the level to detect speed agree or motor speed. Sets the level to detect speed agree or motor speed when *H2-01 to H2-03 = 2, 3, 4, 5 [MFDO Function Selection = Speed Agree 1, User-set Speed Agree 1, Frequency Detection 1, Frequency Detection 2]*.	0.0 Hz (0.0 - 120.0 Hz)	369
L4-02 (049A) Expert	Speed Agree Detection Width	V/f OLV CLV Sets the width to detect speed agree or motor speed. Sets the width to detect speed agree or motor speed when *H2-01 to H2-03 = 2, 3, 4, 5 [MFDO Function Selection = Speed Agree 1, User-set Speed Agree 1, Frequency Detection 1, Frequency Detection 2]*.	2.0 Hz (0.0 - 20.0 Hz)	369
L4-03 (049B) Expert	Speed Agree Detection Level(+/-)	V/f OLV CLV Sets the level to detect speed agree or motor speed. Sets the level to detect speed agree or motor speed when *H2-01 to H2-03 = 13, 14, 15, 16 [MFDO Function Selection = Speed Agree 2, User-set Speed Agree 2, Frequency Detection 3, Frequency Detection 4]*.	0.0 Hz (-120.0 - 120.0 Hz)	369
L4-04 (049C) Expert	Speed Agree Detection Width(+/-)	V/f OLV CLV Sets the width to detect speed agree or motor speed. Sets the width to detect speed agree or motor speed when *H2-01 to H2-03 = 13, 14, 15, 16 [MFDO Function Selection = Speed Agree 2, User-set Speed Agree 2, Frequency Detection 3, Frequency Detection 4]*.	2.0 Hz (0.0 - 20.0 Hz)	370
L4-13 (04F6) Expert	Door Zone Level	V/f OLV CLV Sets the speed level for the elevator door to open. When the elevator car decelerates to the speed level set in this parameter, an MFDO terminal set for *H2-xx = 52 [MFDO Function Selection = Door Zone]* will be active.	0.0% (0.0 - 100.0%)	370

◆ L5: Fault Restart

No. (Hex.)	Name	Description	Default (Range)	Ref.
L5-01 (049E) Expert	Number of Auto-Restart Attempts	V/f OLV CLV Sets the number of times that the drive will try to restart.	2 (0 - 10 times)	370
L5-02 (049F) Expert	Fault Contact at Restart Select	V/f OLV CLV Sets the function that sends signals to the MFDO terminal set for *Fault [H2-xx = E]* while the drive is automatically restarting. 0 : Active Only when Not Restarting 1 : Always Active	1 (0, 1)	371
L5-06 (046E) Expert	Undervoltage Fault Restart Selection	V/f OLV CLV Determines whether a limit should be placed on the number of reset attempts after a Uv1 fault. 0 : Restrict auto-reset attempts to L5-01 after Uv1 1 : No Limit on auto-reset attempts to L5-01	0 (0, 1)	371

◆ L6: Torque Detection

No. (Hex.)	Name	Description	Default (Range)	Ref.
L6-01 (04A1) Expert	Torque Detection Selection 1	V/f OLV CLV Sets torque detection conditions that will trigger an overtorque or undertorque response from the drive. 0 : Disabled 1 : oL @ Speed Agree - Alarm only 2 : oL @ RUN - Alarm only 3 : oL @ Speed Agree - Fault 4 : oL @ RUN - Fault 5 : UL @ Speed Agree - Alarm only 6 : UL @ RUN - Alarm only 7 : UL @ Speed Agree - Fault 8 : UL @ RUN - Fault	0 (0 - 8)	372
L6-02 (04A2) Expert	Torque Detection Level 1	V/f OLV CLV Sets the detection level for Overtorque/Undertorque Detection 1. In V/f control, drive rated output current = 100% value. In vector control, motor rated torque = 100% value.	150% (0 - 300%)	373
L6-03 (04A3) Expert	Torque Detection Time 1	V/f OLV CLV Sets the detection time for Overtorque/Undertorque Detection 1.	0.1 s (0.0 - 10.0 s)	373
L6-04 (04A4) Expert	Torque Detection Selection 2	V/f OLV CLV Sets the speed range that detects overtorque and undertorque and the operation of drives (operation status) after detection. 0 : Disabled 1 : oL @ Speed Agree - Alarm only 2 : oL @ RUN - Alarm only 3 : oL @ Speed Agree - Fault 4 : oL @ RUN - Fault 5 : UL @ Speed Agree - Alarm only 6 : UL @ RUN - Alarm only 7 : UL @ Speed Agree - Fault 8 : UL @ RUN - Fault	0 (0 - 8)	373
L6-05 (04A5) Expert	Torque Detection Level 2	V/f OLV CLV Sets the detection level for Overtorque/Undertorque Detection 2. In V/f control, drive rated output current = 100% value. In vector control, motor rated torque = 100% value.	150% (0 - 300%)	374
L6-06 (04A6) Expert	Torque Detection Time 2	V/f OLV CLV Sets the detection time for Overtorque/Undertorque Detection 2.	0.1 s (0.0 - 10.0 s)	374

◆ L7: Torque Limit

No. (Hex.)	Name	Description	Default (Range)	Ref.
L7-01 (04A7) RUN Expert	Forward Torque Limit	V/f OLV CLV Sets the torque limit value for forward motoring as a percentage, where motor rated torque is the 100% value.	200% (0 - 300%)	375
L7-02 (04A8) RUN Expert	Reverse Torque Limit	V/f OLV CLV Sets the torque limit value for reversed motoring as a percentage, where motor rated torque is the 100% value.	200% (0 - 300%)	375
L7-03 (04A9) RUN Expert	Forward Regenerative Trq Limit	V/f OLV CLV Sets the torque limit value for forward regenerative conditions as a percentage of the motor rated torque.	200% (0 - 300%)	375
L7-04 (04AA) RUN Expert	Reverse Regenerative Trq Limit	V/f OLV CLV Sets the torque limit value for reversed regenerative conditions as a percentage of the motor rated torque.	200% (0 - 300%)	376
L7-06 (04AC) Expert	Torque Limit Integral Time	V/f OLV CLV Sets the integral time constant for the torque limit function.	200 ms (5 - 10000 ms)	376

No. (Hex.)	Name	Description	Default (Range)	Ref.
L7-07 (04C9) Expert	Torque Limit during Accel/Decel	V/f OLV CLV Sets the torque limit function during acceleration and deceleration. 0 : Proportional only 1 : Proportional & Integral control	0 (0, 1)	376
L7-16 (044D) Expert	Torque Limit Process at Start	V/f OLV CLV Assigns a time filter to allow the torque limit to build at start. 0 : Disabled 1 : Enabled	1 (0, 1)	376

◆ L8: Drive Protection

No. (Hex.)	Name	Description	Default (Range)	Ref.
L8-02 (04AE) Expert	Overheat Alarm Level	V/f OLV CLV Sets the *oH* detection level in temperature.	Determined by o2-04 (50 - 130 °C)	377
L8-03 (04AF) Expert	Overheat Pre-Alarm Selection	V/f OLV CLV Sets operation after the drive detects an *oH* alarm. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only 4 : Operate at Reduced Speed (L8-19)	3 (0 - 4)	377
L8-05 (04B1)	Input Phase Loss Protection Sel	V/f OLV CLV Sets the function to enable and disable input phase loss detection. 0 : Disable 2 : Standard + dv/dt 6 : dV/dt at start, standard during travel	Depends on o2-04 (0, 2, 6)	378
L8-06 (04B2) Expert	Input Phase Loss Detection Level	V/f OLV CLV When ripple is observed in the DC bus, expansion of the input bias is calculated and becomes the input phase if the difference between the max and minimum values of the ripple are greater than L8-06.	Determined by o2-04 (0.0 - 50.0%)	378
L8-07 (04B3) Expert	Output Phase Loss Protection Sel	V/f OLV CLV Sets the function to enable and disable output phase loss detection. The drive detects LF [Output Phase Loss] if there is a phase loss on one (or more than one) of the U, V, or W phases on the output side. **Note:** • The drive can incorrectly start output phase loss detection in these conditions: –The motor rated current is very small compared to the drive rating. –The drive is operating a PM motor with a small load. • When *L8-07 = 1*, set these parameters: –*S1-02 [DC Injection Current at Start]* > 15% (when *A1-02 = 0, 2 [Conrtol Method Selection = V/f or OLV]*) –*S1-04 [DC Inj/Pos LockTime at Start]* > 100 ms If you set these parameters incorrectly, the drive can incorrectly start output phase loss detection. 0 : Disabled 1 : Enabled	0 (0, 1)	378
L8-09 (04B5) Expert	Output Ground Fault Detection	V/f OLV CLV Sets the function to enable and disable ground fault protection. 0 : Disabled 1 : Enabled	1 (0, 1)	379
L8-10 (04B6)	Heatsink Fan Operation Selection	V/f OLV CLV Sets operation of the heatsink cooling fan. 0 : During Run, w/ L8-11 Off-Delay 1 : Always On 2 : Temperature-Dependent Fan Ctrl.	0 (0 - 2)	379
L8-11 (04B7) Expert	Heatsink Fan Off-Delay Time	V/f OLV CLV Sets the length of time that the drive will wait before it stops the cooling fan after it cancels the Run command when *L8-10 = 0 [Heatsink Fan Operation Selection = During Run, w/ L8-11 Off-Delay]*.	60 s (0 - 300 s)	379

No. (Hex.)	Name	Description	Default (Range)	Ref.
L8-12 (04B8) Expert	Ambient Temperature Setting	V/f OLV CLV Sets the ambient temperature of the drive installation area. **Note:** The setting range changes when the *L8-35 [Installation Method Selection]* value changes: • *0 [IP20/UL Open Type]*: -10 °C to +60 °C • *1 [Side-by-Side Mounting]*: -10 °C to +50 °C • *2 [IP20/UL Type 1]*: -10 °C to +50 °C • *3 [Finless Installation]*: -10 °C to +50 °C	40 °C (-10 °C - +60 °C)	379
L8-15 (04BB) Expert	Drive oL2 @ Low Speed Protection	V/f OLV CLV Sets the function to decrease the drive overload level at which the drive will trigger *oL2 [Drive Overload]* during low speed operation (6 Hz or slower) to prevent damage to the main circuit transistors. **Note:** Contact Yaskawa or your nearest sales representative before disabling this function at low speeds. If you frequently operate drives with high output current in low speed ranges, it can cause heat stress and decrease the life span of drive IGBTs. 0 : Disabled (No Additional Derate) 1 : Enabled (Reduced oL2 Level)	1 (0, 1)	380
L8-18 (04BE) Expert	Software Current Limit Selection	V/f OLV CLV Set the software current limit selection function to prevent damage to the main circuit transistor caused by too much current. 0 : Disabled 1 : Enabled	0 (0, 1)	380
L8-19 (04BF) Expert	Freq Reduction @ oH Pre-Alarm	V/f OLV CLV Sets the ratio at which the drive derates the frequency reference during an *oH* alarm.	0.8 (0.1 - 0.9)	380
L8-35 (04EC) Expert	Installation Method Selection	V/f OLV CLV Sets the type of drive installation. 0 : IP20/UL Open Type 1 : Side-by-Side Mounting 2 : IP20/UL Type 1 3 : Finless Installation	Determined by o2-04 (0 - 3)	380
L8-38 (04EF)	Automatic Torque Boost Function	V/f OLV CLV Sets the operation of Automatic Torque Boost function. When the output current, integrated overload value, or heatsink temperature are more than a specified level, the drive increases the output current limit and decreases the carrier frequency. When you set this parameter to *0 [Disabled]* to give priority to operations with low audible noise, select a larger capacity drive to prevent insufficient torque if necessary. Usually it is not necessary to change this setting. 0 : Disabled 3 : Enabled	3 (0, 3)	381
L8-39 (04F0) Expert	Reduced Carrier Frequency	V/f OLV CLV Sets the decreased carrier frequency used by Automatic Torque Boost function.	Determined by o2-04 (2.0 - Determined by o2-04 kHz)	382
L8-41 (04F2) Expert	High Current Alarm Selection	V/f OLV CLV Sets the function to cause an *HCA [Current Alarm]* when the output current is more than 150% of the drive rated current. 0 : No 1 : Yes	0 (0, 1)	382
L8-42 (04F3) Expert	Input Phase Loss Detection Time 2	V/f OLV CLV Sets the amount of time that an Input Phase Loss condition has to be present before a fault is triggered.	2 s	382
L8-43 (04F4) Expert	High Current Alarm Selection	V/f OLV CLV Sets the amount of time that an Output Phase Loss condition has to be present before a fault is triggered.	0.5 s (0.0 - 2.0 s)	382
L8-55 (045F) Expert	Internal DB TransistorProtection	V/f OLV CLV Sets the protection function for the internal braking transistor. 0 : RF Disabled/BOL Disabled 1 : RF Enabled/BOL Enabled	1 (0 - 1)	382
L8-62 (04D8)	Input Phase Loss Detection	V/f OLV CLV Sets stopping method when an input phase loss fault (PF) occurs. 0 : Ramp to stop 1 : Coast to stop 2 : Stop (Use C1-09) 3 : Alarm Only	0 (0 - 3)	383
L8-65 (04DB) Expert	PF Detection Minimum Current Level	V/f OLV CLV Percentage of rated current. Used for standard method and dv/dt method. The parameter is only active during run, and is not evaluated for dv/dt detection method at start.	10% (0 - 100%)	383

No. (Hex.)	Name	Description	Default (Range)	Ref.
L8-70 (04E0)	PF dv/dt Level	V/f OLV CLV	2100 V/sec (0 - 10,000 V/sec)	383
L8-79 (04E9)	dv/dt Tune Factor	V/f OLV CLV	130% (99 - 150%)	383
L8-88 (04F2) Expert	Safe Disable Operation Mode	V/f OLV CLV Determines the operation performed by the drive when the Safe Disable input is activated. 0 : Mode 0 (Alarm-On, Ready-Off) 1 : Mode 1 (Alarm-Off, Ready-On)	0 (0, 1)	383

11.11 n: Special Adjustment

◆ n2: Speed Feedback Detection Control (AFR) Tuning

No. (Hex.)	Name	Description	Default (Range)	Ref.
n2-01 (0584) Expert	Speed Feedback Detection Control (AFR) Gain	V/f **OLV** CLV Sets the gain of the AFR function as a magnification value. Usually it is not necessary to change this setting.	1.50 (0.00 - 10.00)	384
n2-02 (0585) Expert	Speed Feedback Detection Control (AFR) Time Constant 1	V/f **OLV** CLV Sets the time constant that sets the rate of change for the AFR function. Usually it is not necessary to change this setting.	50 ms (0 - 2000 ms)	384
n2-03 (0586) Expert	Speed Feedback Detection Control (AFR) Time Constant 2	V/f **OLV** CLV Sets the time constant that sets the speed difference of the AFR function. Use this parameter for speed searches or regeneration. Usually it is not necessary to change this setting.	750 ms (0 - 2000 ms)	384

◆ n5: Feed Forward Control

No. (Hex.)	Name	Description	Default (Range)	Ref.
n5-01 (05B0) Expert	Feed Forward Control Selection	V/f OLV **CLV** Sets the feed forward function. 0 : Disabled 1 : Enabled	0 (0, 1)	386
n5-02 (05B1) Expert	Motor Inertia Acceleration Ramp	V/f OLV **CLV** Sets the length of time for the motor to accelerate from the stopped to the maximum frequency with a single motor at the rated torque.	Determined by o2-04 (0.001 - 10.000 s)	386
n5-03 (05B2) Expert	Feed Forward Control Gain	V/f OLV **CLV** Sets the ratio between load inertia and motor inertia. Inertia Tuning automatically sets the Feed Forward Control Gain value.	1.00 (0.00 - 100.00)	387

◆ n6: Online Tuning

No. (Hex.)	Name	Description	Default (Range)	Ref.
n6-01 (0570) Expert	Online Tuning Selection	V/f **OLV** CLV Sets the type of motor data that Online Tuning uses for OLV control. 0 : Disabled 1 : Line-to-Line Resistance Tuning 2 : Voltage Correction Tuning	1 (0 - 2)	388
n6-05 (05C7) Expert	Online Tuning Gain	V/f **OLV** CLV Sets the compensation gain when *n6-01 = 2 [Online Tuning Selection = Voltage Correction Tuning]*. Usually it is not necessary to change this setting.	1.0 (0.1 - 50.0)	388

Parameter List

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11.12 o: Keypad-Related Settings

◆ o1: Keypad Display

No. (Hex.)	Name	Description	Default (Range)	Ref.
o1-01 (0500) RUN Expert	User Monitor Selection	V/f OLV CLV Sets the *U monitor* for the Drive Mode. This parameter is only available with an LED keypad.	106 (104 - 830)	389
o1-02 (0501) RUN Expert	Monitor Selection at Power-up	V/f OLV CLV Sets the monitor item that the keypad screen shows after you energize the drive. Refer to “U: Monitors” for information about the monitor items that the keypad screen can show. This parameter is only available with an LED keypad. 1 : Frequency Reference (U1-01) 2 : Direction 3 : Output Frequency (U1-02) 4 : Output Current (U1-03) 5 : User Monitor (*o1-01*)	1 (1 - 5)	389
o1-03 (0502)	Keypad Display Unit Selection	V/f OLV CLV Sets the display units for the frequency reference and output frequency. 0 : 0.01 Hz 1 : 0.01% (100% = E1-04) 2 : min^{-1} (r/min) units 3 : User Units (o1-10 & o1-11) 4 : Elevator Unit1 - m/s, s, s 5 : Elevator Unit3-ft/(min,s^2,s^3)	1 (0 - 5)	389
o1-04 (0503) Expert	V/f Pattern Display Unit	V/f OLV CLV Sets the setting units for parameters that set the V/f pattern frequency. 0 : Hz 1 : Revolutions Per Minute (RPM)	Determined by A1-02 (0, 1)	390
o1-05 (0504) RUN Expert	LCD Contrast Adjustment	V/f OLV CLV Sets the contrast of the LCD display on the keypad.	5 (0 - 10)	390
o1-10 (0520) Expert	User Units Maximum Value	V/f OLV CLV Sets the value that the drive shows as the maximum output frequency.	Determined by o1-03 (1 - 60000)	391
o1-11 (0521) Expert	User Units Decimal Position	V/f OLV CLV Sets the number of decimal places for frequency reference and monitor values. 0 : No Decimal Places (XXXXX) 1 : One Decimal Places (XXXX.X) 2 : Two Decimal Places (XXX.XX) 3 : Three Decimal Places (XX.XXX)	Determined by o1-03 (0 - 3)	391
o1-24 to o1-35: (11AD - 11B8) RUN	Custom Monitor 1 to 12	V/f OLV CLV Sets a maximum of 12 monitors as user monitors. This parameter is only available when using an LCD keypad.	o1-24: 101 o1-25: 102 o1-26: 103 o1-27 to o1-35: 0 (0, 101 - 999)	391
o1-36 (11B9) RUN	LCD Backlight Brightness	V/f OLV CLV Sets the intensity of the LCD keypad backlight.	3 (1 - 5)	392
o1-37 (11BA) RUN	LCD Backlight ON/OFF Selection	V/f OLV CLV Sets the automatic shut off function for the LCD backlight. 0 : OFF 1 : ON	1 (0, 1)	392
o1-38 (11BB) RUN Expert	LCD Backlight Off-Delay	V/f OLV CLV Sets the time until the LCD backlight automatically turns off.	300 s (10 - 600 s)	392
o1-39 (11BC) RUN Expert	Show Initial Setup Screen	V/f OLV CLV Sets the function to show the LCD keypad initial setup screen each time you energize the drive. This parameter is only available with an LCD keypad. 0 : No 1 : Yes	1 (0, 1)	392

◆ o2: Keypad Operation

No. (Hex.)	Name	Description	Default (Range)	Ref.
o2-01 (0505) Expert	LO/RE Key Function Selection	V/f OLV CLV Sets the function that lets you use LO/RE to switch between LOCAL and REMOTE Modes. 0 : Disabled 1 : Enabled	0 (0, 1)	393
o2-02 (0506) Expert	STOP Key Function Selection	V/f OLV CLV Sets the function to use STOP on the keypad to stop the drive when the Run command source for the drive is REMOTE (external) and not assigned to the keypad. 0 : Disabled 1 : Enabled	0 (0, 1)	393
o2-03 (0507) Expert	User Parameter Default Value	V/f OLV CLV Sets the function to keep the settings of changed parameters as user parameter defaults to use during initialization. 0 : No change 1 : Set defaults 2 : Clear all	0 (0 - 2)	393
o2-04 (0508) Expert	Drive Model (KVA) Selection	V/f OLV CLV Sets the Drive Model code. Set this parameter after replacing the control board.	Determined by the drive (-)	394
o2-05 (0509) Expert	Home Mode Freq Ref Entry Mode	V/f OLV CLV Sets the function that makes it necessary to push to use the keypad to change the frequency reference value while in Drive Mode. 0 : ENTER Key Required 1 : Immediate / MOP-style	0 (0, 1)	394
o2-06 (050A) Expert	Keypad Disconnect Detection	V/f OLV CLV Sets the function that stops the drive if you disconnect the keypad connection cable from the drive or if you damage the cable while the keypad is the Run command source. 0 : Disabled 1 : Enabled	0 (0, 1)	394
o2-07 (0527) Expert	Keypad RUN Direction @ Power-up	V/f OLV CLV Sets the direction of motor rotation when the drive is energized and the keypad is the Run command source. 0 : Forward 1 : Reverse	0 (0, 1)	395
o2-09 (050D) Expert	Reserved	-	-	395
o2-19 (061F) Expert	Parameter Write during Uv	V/f OLV CLV Lets you change parameters during *Uv [Undervoltage]*. 0 : Disable 1 : Enabled	0 (0, 1)	395
o2-23 (11F8) RUN Expert	External 24V Powerloss Detection	V/f OLV CLV Sets the function to give a warning if the backup external 24 V power supply turns off when the main circuit power supply is in operation. 0 : Disabled 1 : Enabled	0 (0, 1)	395
o2-26 (1563) Expert	Alarm Display at Ext. 24V Power	V/f OLV CLV When you connect a backup external 24 V power supply, this parameter sets the function to trigger an alarm when the main circuit power supply voltage decreases. **Note:** The drive will not run when it is operating from one 24-V external power supply. 0 : Disabled 1 : Enabled	0 (0, 1)	396
o2-27 (1565) Expert	bCE Detection Selection	V/f OLV CLV Sets drive operation if the Bluetooth device is disconnected when you operate the drive in Bluetooth Mode. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use *C1-09*) 3 : Alarm Only 4 : No Alarm Display	3 (0 - 4)	396

◆ o3: Copy Keypad Function

No. (Hex.)	Name	Description	Default (Range)	Ref.
o3-01 (0515)	Copy Keypad Function Selection	V/f OLV CLV Sets the function that saves and copies drive parameters to a different drive with the keypad. 0 : Copy Select 1 : Backup (drive → keypad) 2 : Restore (keypad → drive) 3 : Verify (check for mismatch)	0 (0 - 3)	396
o3-02 (0516)	Copy Allowed Selection	V/f OLV CLV Sets the copy function when *o3-01 = 1 [Copy Keypad Function Selection = Backup (drive → keypad)]*. 0 : Disabled 1 : Enabled	0 (0, 1)	396
o3-04 (0B3E)	Select Backup/Restore Location	V/f OLV CLV Sets the storage location for drive parameters when you back up and restore parameters. This parameter is only available when using an LCD keypad. 0 : Memory Location 1 1 : Memory Location 2 2 : Memory Location 3 3 : Memory Location 4	0 (0 - 3)	397
o3-06 (0BDE) Expert	Auto Parameter Backup Selection	V/f OLV CLV Sets the function that automatically backs up parameters. This parameter is only available when using an LCD keypad. 0 : Disabled 1 : Enabled	1 (0, 1)	397
o3-07 (0BDF) Expert	Auto Parameter Backup Interval	V/f OLV CLV Sets the interval at which the automatic parameter backup function saves parameters from the drive to the keypad. **Note:** This parameter is only available when using an LCD keypad. 0 : Every 10 minutes 1 : Every 30 minutes 2 : Every 60 minutes 3 : Every 12 hours	1 (0 - 3)	397

◆ o4: Maintenance Monitor Settings

No. (Hex.)	Name	Description	Default (Range)	Ref.
o4-01 (050B) Expert	Elapsed Operating Time Setting	V/f OLV CLV Sets the initial value of the cumulative drive operation time in 10-hour units.	0 h (0 - 9999 h)	398
o4-02 (050C) Expert	Elapsed Operating Time Selection	V/f OLV CLV Sets the condition that counts the cumulative operation time. 0 : U4-01 Shows Total Power-up Time 1 : U4-01 Shows Total RUN Time	1 (0, 1)	398
o4-03 (050E) Expert	Fan Operation Time Setting	V/f OLV CLV Sets the value from which to start the cumulative drive cooling fan operation time in 10-hour units.	0 h (0 - 9999 h)	398
o4-05 (051D) Expert	Capacitor Maintenance Setting	V/f OLV CLV Sets the *U4-05 [CapacitorMaintenance]* monitor value.	0% (0 - 150%)	398
o4-07 (0523) Expert	Softcharge Relay Maintenance Set	V/f OLV CLV Sets the *U4-06 [PreChargeRelayMainte]* monitor value.	0% (0 - 150%)	398
o4-09 (0525) Expert	IGBT Maintenance Setting	V/f OLV CLV Sets the *U4-07 [IGBT Maintenance]* monitor value.	0% (0 - 150%)	399
o4-11 (0510) Expert	Fault Trace/History Init (U2/U3)	V/f OLV CLV Resets the records of Monitors *U2-xx [Fault Trace]* and *U3-xx [Fault History]*. 0 : Disabled 1 : Enabled	0 (0, 1)	399

No. (Hex.)	Name	Description	Default (Range)	Ref.
o4-12 (0512) Expert	kWh Monitor Initialization	V/f OLV CLV Resets the monitor values for *U4-10 [kWh, Lower 4 Digits]* and *U4-11 [kWh, Upper 5 Digits]*. 0 : No Reset 1 : Reset	0 (0, 1)	399
o4-13 (0528) Expert	RUN Command Counter @ Initialize	V/f OLV CLV Resets the monitor values for *U4-02 [Num of Run Commands]*, *U4-24 [Number of Runs (Low)]*, and *U4-25 [Number of Runs (High)]*. 0 : No Reset 1 : Reset	0 (0, 1)	399
o4-22 (154F) RUN Expert	Time Format	V/f OLV CLV Sets the time display format. This parameter is only available when using an LCD keypad. 0 : 24 Hour Clock 1 : 12 Hour Clock 2 : 12 Hour JP Clock	0 (0 - 2)	400
o4-23 (1550) RUN Expert	Date Format	V/f OLV CLV Sets the date display format. This parameter is only available when using an LCD keypad. 0 : YYYY/MM/DD 1 : DD/MM/YYYY 2 : MM/DD/YYYY	0 (0 - 2)	400
o4-24 (310F) RUN Expert	bAT Detection Selection	V/f OLV CLV Sets the operation when the drive detects *bAT [Keypad Battery Low Voltage]* and *TiM [Keypad Time Not Set]*. This parameter is only available when you use an LCD keypad. 0 : Disable 1 : Enable (Alarm Detected) 2 : Enable (Fault Detected)	0 (0 - 2)	400

◆ o5: Log Function

No. (Hex.)	Name	Description	Default (Range)	Ref.
o5-00 (1E81) RUN	Log Type	V/f OLV CLV Sets the type of data log function. This parameter is only available when you use an LCD keypad. 0 : Long Term Log 1 : Short Term Log	0 (0, 1)	403
o5-01 (1551) RUN Expert	Log Start/Stop Selection	V/f OLV CLV Sets the data log function. This parameter is only available when using an LCD keypad. 0 : OFF 1 : ON	0 (0 - 1)	403
o5-02 (1552) RUN Expert	Log Sampling Interval	V/f OLV CLV Sets the data log sampling cycle. This parameter is only available when using an LCD keypad.	1000 ms (100 - 60000 ms)	403
o5-03 (1553) RUN Expert	Log Monitor Data 1	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	101 (000, 101 - 999)	403
o5-04 (1554) RUN Expert	Log Monitor Data 2	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	102 (000, 101 - 999)	404
o5-05 (1555) RUN Expert	Log Monitor Data 3	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	103 (000, 101 - 999)	404
o5-06 (1556) RUN Expert	Log Monitor Data 4	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	107 (000, 101 - 999)	404
o5-07 (1557) RUN Expert	Log Monitor Data 5	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	108 (000, 101 - 999)	404

No. (Hex.)	Name	Description	Default (Range)	Ref.
o5-08 (1558) RUN Expert	Log Monitor Data 6	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	000 (000, 101 - 999)	404
o5-09 (1559) RUN Expert	Log Monitor Data 7	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	000 (000, 101 - 999)	405
o5-10 (155A) RUN Expert	Log Monitor Data 8	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	000 (000, 101 - 999)	405
o5-11 (155B) RUN Expert	Log Monitor Data 9	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	000 (000, 101 - 999)	405
o5-12 (155C) RUN Expert	Log Monitor Data 10	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	000 (000, 101 - 999)	405
o5-15 (1E82) RUN	Trigger Type Selection	V/f OLV CLV Sets the type of trigger for the short-term data log. This parameter is only available when you use an LCD keypad. 0 : Digital Trigger 1 : Analog Trigger	0 (0, 1)	405
o5-16 (1E83) RUN	Digital Trigger Object	V/f OLV CLV Sets the function for the digital trigger target from the setting values for multi-function digital outputs. This parameter is only available when you use an LCD keypad.	E (0 - FF)	406
o5-17 (1E84) RUN	Analog Trigger Object	V/f OLV CLV Sets the monitor for the analog trigger target. This parameter is only available when you use an LCD keypad. **Note:** • Set the *x-xx* part of the *Ux-xx [Monitor]*. For example, set *o5-17 = 101* to monitor *U1-01 [Frequency Reference]*. When the *x* part of *Ux* is a letter, replace the letter (hexadecimal number) with a decimal number. For example, set *o5-17 = 1301* to monitor *Ud-01*. • When it is not necessary to set a data log monitor, set this parameter to *000*.	102 (0 - 9999)	406
o5-18 (1E85) RUN	Analog Trigger Level	V/f OLV CLV Sets the level to compare with the analog trigger target. This parameter is only available when you use an LCD keypad.	0.0% (-999.9% - +999.9%)	406
o5-19 (1E86) RUN	Trigger Condition	V/f OLV CLV Sets the condition with which to detect the trigger. This parameter is only available when you use an LCD keypad. 0 : Rising Edge 1 : Falling Edge	0 (0, 1)	406
o5-20 (1E87) RUN	Pre-Trigger Setting	V/f OLV CLV Sets the percentage of data to save before the drive detects the trigger for the short-term data log. This parameter is only available when you use an LCD keypad.	90% (0% - 100%)	406
o5-21 (1E88) RUN	Trend Log Sampling Time Selection	V/f OLV CLV Sets the sampling cycle for the trend log to save data before the drive detects the trigger. The trend log works at the same time as the short-term data log. This parameter is only available when you use an LCD keypad. 0 : Trend Log Disabled 1 : 0.1 s (About 1 hour) 2 : 1 s (About 10 hours) 3 : 10 s (About 100 hours) 4 : 60 s (About 600 hours)	0 (0 - 4)	407

11.13 S: Elevator Parameters

◆ S1: Brake Sequence

No. (Hex.)	Name	Description	Default (Range)	Ref.
S1-01 (0680)	Zero Speed Level at Stop	V/f OLV CLV Determines the speed to begin applying DC Injection when the drive is ramping to stop (b1-03 = 0). Set as a percentage of the maximum output frequency (E1-04).	Determined by A1-02 (0.000 - 9.999%)	408
S1-02 (0681)	DC Injection Current at Start	V/f OLV CLV Determines the amount of current to use for DC Injection at start. Set as a percentage of the drive rated current.	50% (0 - 75%)	408
S1-03 (0682)	DC Injection Current at Stop	V/f OLV CLV Determines the amount of current to use for DC Injection at stop. Set as a percentage of the drive rated current. When using OLV Control, the DC injection current is determined by multiplying S1-03 by S3-25 or S3-26.	50% (0 - 75%)	408
S1-04 (0683)	DC Inj/Pos LockTime at Start	V/f OLV CLV Determines how long the drive should perform DC Injection at start. During this time, the drive allows motor flux to develop, which is essential for applying torque quickly once the brake is released. A setting of 0.00 disables S1-04.	0.40 s (0.00 - 10.00 s)	408
S1-05 (0684)	DC Inj/Pos LockTime at Stop	V/f OLV CLV Determines how long the drive should perform DC Injection at stop. A setting of 0.00 disables S1-05.	0.60 s (0.00 - 10.00 s)	408
S1-06 (0685)	Brake Release Delay Time	V/f OLV CLV Determines the time that must pass after an Up/Down command is entered before the output terminal set for "Brake control" (H2-xx = 50) is triggered. Adjusting this delay time can help when there is not enough time to develop the appropriate amount of motor flux. Be sure to also increase the time S1-04 when setting S1-06 to relatively long delay time.	0.20 s (0.00 - 10.00 s)	408
S1-07 (0686)	Brake Close Delay Time	V/f OLV CLV Determines the time that must pass after zero speed is reached before the output terminal set for "Brake control" (H2-xx = 50) is released.	0.10 s (0.00 - 10.00 s)	409
S1-10 (0687)	Run Command Delay Time	V/f OLV CLV Determines the time that must pass after zero speed is reached before the output terminal set for "Brake control" (H2-xx = 50) is released.	0.10 s (0.00 - 10.00 s)	409
S1-11 (0688)	Output Reactor Open Delay Time	V/f OLV CLV Determines the time that must pass for an output terminal set for “Output contactor control” (H2-xx = 51) to be released after the drive has stopped and drive output has been shut off.	0.10 s (0.00 - 10.00 s)	409
S1-12 (06E0)	Output Contactor During Autotune	V/f OLV CLV Sets the function to automatically activate an MFDO terminal set for *H2-xx = 51 [Output Contactor Control]* when the drive starts Auto-Tuning. 0 : Disable 1 : Enable 2 : Enabled during A-Tuning and STo	0 (0 - 2)	409

◆ S2: Slip Compensation for Elevators

No. (Hex.)	Name	Description	Default (Range)	Ref.
S2-01 (068F)	Motor Rated Speed	V/f OLV CLV Sets the rated speed of the motor.	1380 rpm (300 - 1800 rpm)	409
S2-02 (0690)	Slip Comp Gain during Motoring	V/f OLV CLV Slip compensation for leveling speed can be set separately for motoring and regenerative states to help improve the accuracy of leveling.	0.7 (0.0 - 5.0)	409
S2-03 (0691)	Slip Comp Gain during Regen	V/f OLV CLV Slip compensation for leveling speed can be set separately for motoring and regenerative states to help improve the accuracy of leveling.	1.0 (0.0 - 5.0)	410
S2-05 (0693) Expert	Slip Compensation Torque Detection Delay Time	V/f OLV CLV Sets a delay time before detecting torque for slip compensation.	1000 ms (0 - 10000 ms)	410
S2-06 (0694) Expert	Slip Compensation Torque Detection Filter Time Constant	V/f OLV CLV Sets the filter time constant applied to the torque signal used for the slip compensation value calculation.	500 ms (0 - 2000 ms)	410

S3: Start/Stop Optimization

No. (Hex.)	Name	Description	Default (Range)	Ref.
S3-02 (0698) RUN	Position Lock Gain 2 at Start	V/f OLV CLV Sets gain level 2 for the Position Lock function. Position Lock at start compensates the motor torque to keep the car position to prevent rollback when the brake is released.	0.00 (0.00 - 100.00)	410
S3-03 (0699) RUN	Position Lock Gain at Stop	V/f OLV CLV Sets the Position Lock gain at stop. Position Lock at stop compensates the motor torque to keep the car position until the brake is fully applied.	5 (0 - 100)	410
S3-04 (069A)	Position Lock Bandwidth	V/f OLV CLV Sets the bandwidth around the stop position in which an MFDO terminal set for *H2-xx = 33 [Zero Servo Complete]* activates.	10 (0 - 16383)	410
S3-34 (06C4) Expert	Position Lock Torque Bias 1	V/f OLV CLV Sets an intermediate value for the torque bias used for Anti-Rollback when the drive does Position Lock at start. Usually it is not necessary to change this setting.	0.0% (0.0 - 100.0%)	411
S3-35 (06C5) Expert	Position Lock Torque Bias 2	V/f OLV CLV Sets a maximum value for the torque bias used for Anti-Rollback when the drive does Position Lock at start. Usually it is not necessary to change this setting.	0.0% (0.0 - 100.0%)	411
S3-37 (06C7) Expert	Torque Bias 1 Pos.Dev. Lvl	V/f OLV CLV Sets the position deviation level at which *S3-34 [Position Lock Torque Bias 1]* activates. Usually it is not necessary to change this setting.	0 ms (0 - 32767 ms)	411
S3-38 (06C8) Expert	Torque Bias 2 Pos.Dev. Lvl	V/f OLV CLV Sets the position deviation level when the drive should switch from the Anti-Rollback torque bias set in *S3-34 [Position Lock Torque Bias 1]* to the torque bias set in *S3-35 [Position Lock Torque Bias 2]*. Usually it is not necessary to change this setting.	0 ms (0 - 32767 ms)	411
S3-39 (06C9)	Position Lock Integral Gain	V/f OLV CLV Sets the drive responsiveness for Anti-Rollback during Position Lock. Usually it is not necessary to change this setting.	0.00 (-30.00 - +30.00)	411
S3-40 (06CA) Expert	Position Lock Movement Detection	V/f OLV CLV Sets the amount of pulses for movement detection during Anti-Rollback.	1 (0 - 100)	411
S3-41 (06CB) Expert	PosLock Gain2 Reduction Factor	V/f OLV CLV Sets a reduction factor for the Anti-Rollback Gain set in *S3-02 [Position Lock Gain 2 at Start]*.	0.50 (0.00 - 1.00)	411

S4: Rescue Operation

No. (Hex.)	Name	Description	Default (Range)	Ref.
S4-01 (06A6)	Light Load Direction Search Selection	V/f OLV CLV Enables and disables the Light Load Direction Search. 0 : Disabled 3 : Advanced Search	0 (0, 3)	412
S4-05 (06AA) Expert	Rescue Operation Torque Limit	V/f OLV CLV Sets a time limit for Light Load Direction Search.	100% (0% - 300%)	412
S4-20 (06B1)	Light Load Search Override	V/f OLV CLV Sets the evacuation in Light Load Direction determined by drive. 0 : Controller Direction 1 : Inverter Direction	0 (0 - 1)	412

◆ S5: Elevator Functionality

No. (Hex.)	Name	Description	Default (Range)	Ref.
S5-01 (06AB)	Short Floor Operation Selection	V/f OLV CLV Sets the function to enable and disable the Short Floor function. 0 : Disabled 1 : Standard Short Floor	0 (0 - 2)	413
S5-02 (06AC)	Short Floor Nominal Speed	V/f OLV CLV Sets the nominal speed used to calculate the distance for the Short Floor function when *d1-18 = 0 or 3 [Speed Reference Selection Mode = Multi-speed Model1 (d1-01 to 08) or Multi-speed Mode2 (d1-02 to 08)]*.	0.0% (0.0 - 100.0%)	413
S5-76 (01A9)	Phase, Encoder Direction Switch	V/f OLV CLV Aligns the Up command from the drive and the up direction of the motor without changing wiring. This parameter can change the settings for *b1-14 [Phase Order Selection]*. 0 : Keep Rotation Direction 1 : Switch Phase Order 2 : Switch Phase & Encoder Direction	0 (0 - 2)	414

◆ S6: Error Detection

No. (Hex.)	Name	Description	Default (Range)	Ref.
S6-01 (06B3)	Motor Contactor Response Error (SE1) Detection/Reset Selection	V/f OLV CLV Determines when the drive should detect a motor contactor response error (SE1). SE1 is triggered if there is no response from the motor contactor within the time set in S6-10 after the contactor control output has been set. 0 : Detect during stop, SE1 must be manually reset 1 : Detect during stop, SE1 can be automatically reset 2 : No SE1 detection	0 (0 - 2)	414
S6-02 (06B4)	Starting Current Error (SE2) Detection Delay Time	V/f OLV CLV Sets a delay time for starting current error (SE2). SE2 is detected when the drive output current is below 25% after the Up/Down command has been entered and the brake release time and the time set to S6-02 have both passed. The brake control command will not be issued (brake stays applied).	200 ms (0.00 - [S1-04 - S1-06] ms)	414
S6-03 (06B5) Expert	Start I Error(SE2) Detect Level	V/f OLV CLV Sets the level of current applied to the motor when the Brake Control command is activated, as a percentage of *E2-03 [Motor No-Load Current]*.	25% (0 - 100%)	414
S6-04 (06B6)	Output Current Error (SE3) Detection Delay Time	V/f OLV CLV Sets a delay time for detecting an output current fault (SE3). SE3 is detected when the drive output current drops below 25% after the brake has released.	200 ms (0 - 5000 ms)	414
S6-05 (06B7)	Brake Response Error (SE4) Detection Time	V/f OLV CLV Sets a delay time for detecting a brake response error (SE4). SE4 is detected when an output terminal set for "Brake release" (H2-xx = 50) and an input terminal set for "Brake feedback" (H1-xx = 79) do match for the time set to S6- 05.	500 ms (0 - 10000 ms)	414
S6-15 (06BB)	Speed Reference Loss Detection	V/f OLV CLV Enables speed reference loss detection when D1-18 = 1 and H1-xx ≠ 53. 0 : Disabled 1 : Enabled	0 (0, 1)	415
S6-16 (06BC) Expert	Restart after Baseblock Selection	V/f OLV CLV Sets the function to let the drive restart the motor after returning to normal operation from Baseblock state (*H1-xx = 8/9 [Baseblock Command (N.O.)/Baseblock Command (N.C.)]*) or from Safe Torque-Off state (Safe Disable inputs H1 and H2 enabled) while the Up/Down command is still active. 0 : Disabled 1 : Enabled	0 (0, 1)	415

Parameter List

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11.14 T: Motor Tuning

◆ T1: Induction Motor Auto-Tuning

No. (Hex.)	Name	Description	Default (Range)	Ref.
T1-01 (0701)	Auto-Tuning Mode Selection	V/f OLV CLV Sets the type of Auto-Tuning. 0 : Rotational Auto-Tuning 1 : Stationary Auto-Tuning 1 2 : Stationary Line-Line Resistance	Determined by A1-02 (Determined by A1-02)	416
T1-02 (0702)	Motor Rated Power	V/f OLV CLV Uses the units set in *o1-58 [Motor Power Unit Selection]* to set the motor rated output power.	Determined by o2-04 (0.00 - 650.00 kW)	416
T1-03 (0703)	Motor Rated Voltage	V/f OLV CLV Sets the rated voltage (V) of the motor. Enter the base speed voltage for constant output motors.	400 V Class: 400.0 V (400 V Class: 0.0 - 511.0 V)	416
T1-04 (0704)	Motor Rated Current	V/f OLV CLV Sets the rated current (A) of the motor.	Determined by o2-04 (10% to 200% of the drive rated current)	416
T1-05 (0705)	Motor Base Frequency	V/f OLV CLV Sets the base frequency (Hz) of the motor.	50.0 Hz (0.0 - 120.0 Hz)	417
T1-06 (0706)	Number of Motor Poles	V/f OLV CLV Sets the number of motor poles.	4 (2 to 20)	417
T1-07 (0707)	Motor Base Speed	V/f OLV CLV Sets the motor base speed for Auto-Tuning (min^{-1} (r/min)).	1380 min^{-1} (r/min) (300 - 18000 min^{-1} (r/min))	417
T1-08 (0708)	Encoder Pulse Count (PPR)	V/f OLV CLV Sets the number of PG (pulse generator, encoder) pulses.	1024 ppr (0 - 60,000 ppr)	417
T1-09 (0709)	Motor No-Load Current	V/f OLV CLV Sets the no-load current of the motor.	- (0 A - T1-04; max. of 2999.9)	417
T1-10 (070A)	Motor Rated Slip Frequency	V/f OLV CLV Sets motor rated slip.	0.000 Hz (0.000 - 20.000 Hz)	417
T1-11 (070B)	Motor Iron Loss	V/f OLV CLV Sets the iron loss to calculate the energy-saving coefficient.	Determined by E2-10 or E4-10 (0 - 65535 W)	417
T1-13 (0BDC)	No-Load Voltage	V/f OLV CLV Sets the no-load voltage of the motor. When the no-load voltage at rated speed is available, for example on the motor test report, set the voltage in this parameter. If the no-load voltage is not available, do not change this parameter. **Note:** To get the same qualities as a Yaskawa 1000-series drive or previous series drive, set this parameter = *T1-03 [Motor Rated Voltage]*.	T1-03 × 0.85 (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)	418

11.15 U: Monitors

◆ U1: Operation Status Monitors

No. (Hex.)	Name	Description	MFAO Signal Level
U1-01 (0040)	Frequency Reference	V/f OLV CLV Shows the frequency reference value. Parameter *o1-03 [Keypad Display Unit Selection]* sets the display units. Unit: 0.01 Hz	10 V = Maximum frequency (0 V to +10 V)
U1-02 (0041)	Output frequency	V/f OLV CLV Shows the output frequency. Parameter *o1-03 [Keypad Display Unit Selection]* sets the display units. Unit: 0.01 Hz	10 V = Maximum frequency (0 V to +10 V)
U1-03 (0042)	Output Current	V/f OLV CLV Shows the actual output current. The keypad shows the value of *U1-03* in amperes (A). Unit: When the drive model changes, the display units for this parameter also change. • 0.01 A units: 2018 - 2033, 4009 - 4018 • 0.1A units: 2045 - 2075, 4024 - 4045	10 V = Drive rated current
U1-04 (0043)	Control method selection	V/f OLV CLV Shows the drive control method. 0 : V/f Control 2 : Open Loop Vector 5 : PM Open Loop Vector 6 : PM Advanced Open Loop Vector 8 : EZ Vector Control	No signal output available
U1-05 (0044)	Motor Speed	V/f OLV CLV Shows the detected motor speed. Parameter *o1-03 [Keypad Display Unit Selection]* sets the display units. Unit: 0.01 Hz	10 V = Maximum frequency (0 V to +10 V)
U1-06 (0045)	Output Voltage Ref	V/f OLV CLV Shows the output voltage reference. Unit: 0.1 V	200 V Class: 10 V = 200 Vrms 400 V Class: 10 V = 400 Vrms
U1-07 (0046)	DC Bus Voltage	V/f OLV CLV Shows the DC bus voltage. Unit: 1 V	200 V Class: 10 V = 400 V 400 V Class: 10 V = 800 V
U1-08 (0047)	Output Power	V/f OLV CLV Shows the internally-calculated output power. When you change *A1-02 [Control Method Selection]*, it will also change the signal level of the analog output. • A1-02 = 0: Drive capacity (kW) • A1-02 = 2: *Motor Rated Power [E2-11]* (kW) • A1-02 = 5, 6: *PM Motor Rated Power [E5-02]* (kW) • A1-02 = 8: *Motor Rated Power [E9-07]* (kW) Unit: When the drive model changes, the display units for this parameter also change. • 0.01 kW: B001 - B018, 2001 - 2042, 4001 - 4023 • 0.1 kW: 2056 - 2082, 4031 - 4060	10 V: Drive capacity (motor rated power) kW (0 V to +10 V)
U1-09 (0048)	Torque Reference	V/f OLV CLV Shows the internal torque reference value. Unit: 0.1%	10 V = Motor rated torque (0 V to +10 V)
U1-10 (0049)	Input Terminal Status	V/f OLV CLV Shows the status of the MFDO terminal where ı = ON and ı = OFF. For example, *U1-10* shows when terminals S1 and S3 are ON. bit0 : Terminal S1 (MFDI 1) bit1 : Terminal S2 (MFDI 2) bit2 : Terminal S3 (MFDI 3) bit3 : Terminal S4 (MFDI 4) bit4 : Terminal S5 (MFDI 5) bit5 : Terminal S6 (MFDI 6) bit6 : Terminal S7 (MFDI 7) bit7 : Not used (normal value of [ı]).	No signal output available

Parameter List

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No. (Hex.)	Name	Description	MFAO Signal Level
U1-11 (004A)	Output Terminal Status	V/f OLV CLV Shows the status of the MFDO terminal where = ON and = OFF. For example, *U1-11* shows  when terminals MA and P2 are ON. **Note:** When *H2-xx = 100 to 1A7 [U1-11 Inverse U1-11 Output of Function]*, *U1-11* does not show the status in inverse. bit0 : Terminal MA/MB-MC bit1 : Terminal P1-C1 bit2 : Terminal P2-C2 bit3 : Not used (normal value of [ ]). bit4 : Not used (normal value of [ ]). bit5 : Not used (normal value of [ ]). bit6 : Not used (normal value of [ ]). bit7 : Not used (normal value of [ ]).	No signal output available
U1-12 (004B)	Drive Status	V/f OLV CLV Shows drive status where = ON and = OFF. For example, *U1-12* shows  during run with the Reverse Run command. bit0 : During Run bit1 : During zero-speed bit2 : During reverse bit3 : During fault reset signal input bit4 : During speed agreement bit5 : Drive Ready bit6 : During minor fault detection bit7 : During fault detection	No signal output available
U1-13 (004E)	Terminal A1 Level	V/f OLV CLV Shows the signal level of terminal A1. Unit: 0.1%	10 V = 100% (Also available for -10 V to +10 V)
U1-14 (004F)	Terminal A2 Level	V/f OLV CLV Shows the signal level of terminal A2. Unit: 0.1%	10 V = 100% (Also available for -10 V to +10 V)
U1-16 (0053)	SFS Output Frequency	V/f OLV CLV Shows the output frequency after soft start. Shows the frequency with acceleration and deceleration times and S-curves. Parameter *o1-03 [Keypad Display Unit Selection]* sets the display units. Unit: 0.01 Hz	10 V = Maximum frequency (0 V to +10 V)
U1-18 (0061)	oPE Fault Parameter	V/f OLV CLV Shows the parameter number that caused the *oPE02 [Parameter Range Setting Error]* or *oPE08 [Parameter Selection Error]*.	No signal output available
U1-19 (0066)	MEMOBUS/Modbus Error Code	V/f OLV CLV Shows the contents of the MEMOBUS/Modbus communication error where 1 = “error” and 0 = “no error”. For example, *U1-19* shows “00000001” when there is a CRC error. bit0 : CRC Error bit1 : Data Length Error bit2 : Not used (normal value of 0). bit3 : Parity Error bit4 : Overrun Error bit5 : Framing Error bit6 : Timed Out bit7 : Not used (normal value of 0).	No signal output available
U1-25 (004D)	Software number	V/f OLV CLV Shows the ID.	No signal output available
U1-26 (005B)	SoftwareNumber ROM	V/f OLV CLV Shows the ROM ID.	No signal output available
U1-50 (1199) Expert	Virtual Analog Input	V/f OLV CLV Shows the virtual analog input value.	Determined by H7-40
U1-93 (1BC2) Expert	Carrier Frequency	V/f OLV CLV Shows actual carrier frequency. (When PWM is OFF, this parameter shows the *C6-03 [Carrier Frequency]* value.) Unit: 0.1 kHz	No signal output available

◆ U2: Fault Trace

No. (Hex.)	Name	Description	MFAO Signal Level
U2-01 (0080)	Current Fault	V/f OLV CLV Shows the fault that the drive has when viewing the monitor.	No signal output available
U2-02 (0081)	Previous Fault	V/f OLV CLV Shows the fault that occurred most recently.	No signal output available
U2-03 (0082)	Freq Reference@Fault	V/f OLV CLV Shows the frequency reference at the fault that occurred most recently. Use *U1-01 [Frequency Reference]* to monitor the frequency reference value. Unit: 0.01 Hz	No signal output available
U2-04 (0083)	Output Freq @ Fault	V/f OLV CLV Shows the output frequency at the fault that occurred most recently. Use *U1-02 [Output Frequency]* to monitor the actual output frequency. Unit: 0.01 Hz	No signal output available
U2-05 (0084)	Output Current@Fault	V/f OLV CLV Shows the output current at the fault that occurred most recently. Use *U1-03 [Output Current]* to monitor the output current. The keypad shows the value of *U1-03* in amperes (A). When you use MEMOBUS/Modbus communications to show the monitor, the current is “8192 = continuous rated output current (A)”. Use the formula: “Numerals being displayed / 8192 × continuous rated output current (A)” to use the MEMOBUS/Modbus communication current value shown in the monitor.	No signal output available
U2-06 (0085)	Motor Speed @ Fault	V/f OLV CLV Shows the motor speed at the fault that occurred most recently. Use *U1-05 [Motor Speed]* to monitor the motor speed. Unit: 0.01 Hz	No signal output available
U2-07 (0086)	Output Voltage@Fault	V/f OLV CLV Shows the output voltage reference at the fault that occurred most recently. Use *U1-06 [Output Voltage Ref]* to monitor the output voltage reference. Unit: 0.1 V	No signal output available
U2-08 (0087)	DC Bus Voltage@Fault	V/f OLV CLV Shows the DC bus voltage at the fault that occurred most recently. Use *U1-07 [DC Bus Voltage]* to monitor the DC bus voltage. Unit: 1 V	No signal output available
U2-09 (0088)	Output Power @ Fault	V/f OLV CLV Shows the output power at the fault that occurred most recently. Use *U1-08 [Output Power]* to monitor the output power. Unit: 0.1 kW	No signal output available
U2-10 (0089)	Torque Ref @ Fault	V/f OLV CLV Shows the torque reference at the fault that occurred most recently as a percentage of the motor rated torque. Use *U1-09 [Torque Reference]* to monitor the torque reference. Unit: 0.1%	No signal output available
U2-11 (008A)	Input Terminal Status @ Fault	V/f OLV CLV Shows the status of the MFDI terminals at the most recent fault where I = ON and ı = OFF. For example, *U2-11* shows  when terminals S1 and S3 are ON. Use *U1-10 [Input Terminal Status]* to monitor the actual MFDI terminal status. bit0 : Terminal S1 bit1 : Terminal S2 bit2 : Terminal S3 bit3 : Terminal S4 bit4 : Terminal S5 bit5 : Terminal S6 bit6 : Terminal S7 bit7 : Not used (normal value of [ı]).	No signal output available

No. (Hex.)	Name	Description	MFAO Signal Level
U2-12 (008B)	Output Terminal Status @ Fault	V/f OLV CLV Shows the status of the MFDO terminals at the most recent fault where = ON and = OFF. For example, *U2-12* shows when terminals MA and P2 are ON. Use *U1-11 [Output Terminal Status]* to monitor the actual MFDO terminal status. bit0 : Terminal MA/MB-MC bit1 : Terminal P1-C1 bit2 : Terminal P2-C2 bit3 : Not used (normal value of [ ]). bit4 : Not used (normal value of [ ]). bit5 : Not used (normal value of [ ]). bit6 : Not used (normal value of [ ]). bit7 : Not used (normal value of [ ]).	No signal output available
U2-13 (008C)	Operation Status @ Fault	V/f OLV CLV Shows the status of the MFDO terminals at the most recent fault where = ON and = OFF. For example, *U2-13* shows during run. Use *U1-12 [Drive Status]* to monitor the actual MFDO terminal status. bit0 : During Run bit1 : During zero-speed bit2 : During reverse bit3 : During fault reset signal input bit4 : During speed agreement bit5 : Drive Ready bit6 : During minor fault detection bit7 : During fault detection	No signal output available
U2-14 (008D)	Elapsed Time @ Fault	V/f OLV CLV Shows the cumulative operation time of the drive at the fault that occurred most recently. Use *U4-01 [Cumulative Ope Time]* to monitor the cumulative operation time. Unit: 1 h	No signal output available
U2-15 (07E0)	SFS Output @ Fault	V/f OLV CLV Shows the output frequency after soft start at the fault that occurred most recently. Use *U1-16 [SFS Output Frequency]* to monitor the output frequency after soft start. Unit: 0.01 Hz	No signal output available
U2-16 (07E1)	q-Axis Current@Fault	V/f OLV CLV Shows the q-Axis current of the motor at the fault that occurred most recently. Use *U6-01 [Iq Secondary Current]* to monitor the q-Axis current of the motor. Unit: 0.1 %	No signal output available
U2-17 (07E2)	d-Axis Current@Fault	V/f OLV CLV Shows the d-Axis current of the motor at the fault that occurred most recently. Use *U6-02 [Id ExcitationCurrent]* to monitor the d-Axis current of the motor. Unit: 0.1%	No signal output available
U2-20 (008E)	Heatsink Temp @Fault	V/f OLV CLV Shows the heatsink temperature at the fault that occurred most recently. Use *U4-08 [Heatsink Temperature]* to monitor the temperature of the heatsink. Unit: 1 °C	No signal output available

◆ U3: Fault History

No. (Hex.)	Name	Description	MFAO Signal Level
U3-01 (0090)	1st MostRecent Fault	V/f OLV CLV Shows the fault history of the most recent fault.	No signal output available
U3-02 (0091)	2nd MostRecent Fault	V/f OLV CLV Shows the fault history of the second most recent fault.	No signal output available
U3-03 (0092)	3rd MostRecent Fault	V/f OLV CLV Shows the fault history of the third most recent fault.	No signal output available
U3-04 (0093)	4th MostRecent Fault	V/f OLV CLV Shows the fault history of the fourth most recent fault.	No signal output available
U3-05 (0804)	5th MostRecent Fault	V/f OLV CLV Shows the fault history of the fifth most recent fault.	No signal output available

No. (Hex.)	Name	Description	MFAO Signal Level
U3-06 (0805)	6th MostRecent Fault	V/f OLV CLV Shows the fault history of the sixth most recent fault.	No signal output available
U3-07 (0806)	7th MostRecent Fault	V/f OLV CLV Shows the fault history of the seventh most recent fault.	No signal output available
U3-08 (0807)	8th MostRecent Fault	V/f OLV CLV Shows the fault history of the eighth most recent fault.	No signal output available
U3-09 (0808)	9th MostRecent Fault	V/f OLV CLV Shows the fault history of the ninth most recent fault.	No signal output available
U3-10 (0809)	10th MostRecentFault	V/f OLV CLV Shows the fault history of the tenth most recent fault.	No signal output available
U3-11 (0094)	ElapsedTime@1stFault	V/f OLV CLV Shows the cumulative operation time when the most recent fault occurred. Unit: 1 h	No signal output available
U3-12 (0095)	ElapsedTime@2ndFault	V/f OLV CLV Shows the cumulative operation time when the second most recent fault occurred. Unit: 1 h	No signal output available
U3-13 (0096)	ElapsedTime@3rdFault	V/f OLV CLV Shows the cumulative operation time when the third most recent fault occurred. Unit: 1 h	No signal output available
U3-14 (0097)	ElapsedTime@4thFault	V/f OLV CLV Shows the cumulative operation time when the fourth most recent fault occurred. Unit: 1 h	No signal output available
U3-15 (080E)	ElapsedTime@5thFault	V/f OLV CLV Shows the cumulative operation time when the fifth most recent fault occurred. Unit: 1 h	No signal output available
U3-16 (080F)	ElapsedTime@6thFault	V/f OLV CLV Shows the cumulative operation time when the sixth most recent fault occurred. Unit: 1 h	No signal output available
U3-17 (0810)	ElapsedTime@7thFault	V/f OLV CLV Shows the cumulative operation time when the seventh most recent fault occurred. Unit: 1 h	No signal output available
U3-18 (0811)	ElapsedTime@8thFault	V/f OLV CLV Shows the cumulative operation time when the eighth most recent fault occurred. Unit: 1 h	No signal output available
U3-19 (0812)	ElapsedTime@9thFault	V/f OLV CLV Shows the cumulative operation time when the ninth most recent fault occurred. Unit: 1 h	No signal output available
U3-20 (0813)	ElapsedTime@10 Fault	V/f OLV CLV Shows the cumulative operation time when the tenth most recent fault occurred. Unit: 1 h	No signal output available

◆ U4: Maintenance Monitors

No. (Hex.)	Name	Description	MFAO Signal Level
U4-01 (004C)	Cumulative Ope Time	V/f OLV CLV Shows the cumulative operation time of the drive. Use *o4-01 [Elapsed Operating Time Setting]* to reset this monitor. Use *o4-02 [Elapsed Operating Time Selection]* to select the cumulative operation times from: • The time from when the drive is energized until it is de-energized. • The time at which the Up/Down command is turned ON. The maximum value that the monitor will show is *99999*. After this value is more than *99999*, the drive automatically resets it and starts to count from *0* again. Unit: 1 h **Note:** The MEMOBUS/Modbus communication data is shown in 10 h units. Use register 0099H for data in 1 h units.	10 V: 99999 h
U4-02 (0075)	Num of Run Commands	V/f OLV CLV Shows how many times that the drive has received a Run command. Use parameter *o4-13 [RUN Command Counter @ Initialize]* to reset this monitor. The maximum value that the monitor will show is *65535*. After this value is more than *65535*, the drive automatically resets it and starts to count from *0* again. Unit: 1	10 V: 65535 times

No. (Hex.)	Name	Description	MFAO Signal Level
U4-03 (0067)	Cooling Fan Ope Time	V/f OLV CLV Shows the cumulative operation time of the cooling fans. Use *o4-03 [Fan Operation Time Setting]* to reset this monitor. The maximum value that the monitor will show is *99999*. After this value is more than *99999*, the drive automatically resets it and starts to count from *0* again. Unit: 1 h **Note:** The MEMOBUS/Modbus communication data is shown in 10 h units. Use register 009BH for data in 1 h units.	10 V: 99999 h
U4-04 (007E)	Cool Fan Maintenance	V/f OLV CLV Shows the cumulative operation time of the cooling fans as a percentage of the estimated performance life of the cooling fans. The default value is 0. The value counts up from 0. Use *o4-03 [Fan Operation Time Setting]* to reset this monitor. Unit: 1% **Note:** Replace the cooling fans when this monitor is at 90%.	10 V: 100%
U4-05 (007C)	CapacitorMaintenance	V/f OLV CLV Shows the operation time of the electrolytic capacitors for the main circuit and control circuit as a percentage of the estimated performance life of the electrolytic capacitors. The default value is 0. The value counts up from 0. Use *o4-05 [Capacitor Maintenance Setting]* to reset this monitor. Unit: 1% **Note:** Replace the electrolytic capacitor when this monitor is at 90%.	10 V: 100%
U4-06 (07D6)	PreChargeRelayMainte	V/f OLV CLV Shows the operation time of the soft charge bypass relay as a percentage of the estimated performance life of the soft charge bypass relay. The default value is 0. The value counts up from 0. Use *o4-07 [Softcharge Relay Maintenance Set]* to reset this monitor. Unit: 1% **Note:** Replace the drive when this monitor is at 90%.	10 V: 100%
U4-07 (07D7)	IGBT Maintenance	V/f OLV CLV Shows the operation time of the IGBTs as a percentage of the estimated performance life of the IGBTs. The default value is 0. The value counts up from 0. Use *o4-09 [IGBT Maintenance Setting]* to reset this monitor. Unit: 1% **Note:** Replace the drive when this monitor is at 90%.	10 V: 100%
U4-08 (0068)	Heatsink Temperature	V/f OLV CLV Shows the heatsink temperature of the drive. Unit: 1 °C	10 V: 100 °C
U4-09 (005E)	LED Check	V/f OLV CLV Turns on all of the keypad LEDs to make sure that the LEDs operate correctly. 1. With *U4-09* displayed, press . All LEDs on the keypad will turn on. **Note:** When Safety input 2 CH is open (STo), READY will flash.	No signal output available
U4-10 (005C)	kWh, Lower 4 Digits	V/f OLV CLV Shows the lower 4 digits of the watt hour value for the drive. Unit: 1 kWh **Note:** The watt hour is displayed in 9 digits. Monitor *U4-11 [kWh, Upper 5 Digits]* shows the upper 5 digits and *U4-10* shows the lower 4 digits. Example for 12345678.9 kWh: *U4-10*: 678.9 kWh *U4-11*: 12345 MWh	No signal output available
U4-11 (005D)	kWh, Upper 5 Digits	V/f OLV CLV Shows the upper 5 digits of the watt hour value for the drive. Unit: 1 MWh **Note:** Monitor *U4-11* shows the upper 5 digits and *U4-10 [kWh, Lower 4 Digits]* shows the lower 4 digits. Example for 12345678.9 kWh: *U4-10*: 678.9 kWh *U4-11*: 12345 MWh	No signal output available

No. (Hex.)	Name	Description	MFAO Signal Level
U4-13 (07CF)	Peak Hold Current	V/f OLV CLV Shows the hold value of the peak value (rms) for the drive output current. Use *U4-14 [PeakHold Output Freq]* to show the drive output speed at the time that the drive holds the output current. The drive will hold the peak hold current at the next start up and restart of the power supply. The drive keeps the value that was under hold during baseblock (during stop). The keypad shows the value of *U4-13* in amperes (A). When you use MEMOBUS/Modbus communications to show the monitor, the current is "8192 = continuous rated output current (A)". Use the formula: "Numerals being displayed / 8192 × continuous rated output current (A)" to use the MEMOBUS/Modbus communication current value shown in the monitor.	No signal output available
U4-14 (07D0)	PeakHold Output Freq	V/f OLV CLV Shows the output frequency at which the peak value (rms) of the drive output current is held. The peak hold current can be monitored by *U4-13 [Peak Hold Current]*. The peak hold output frequency will be cleared at the next startup and restart of the power supply. The drive keeps the value that was under hold during baseblock (during stop). Unit: 0.01 Hz	No signal output available
U4-16 (07D8)	Motor oL1 Level	V/f OLV CLV Shows the integrated value of *oL1 [Motor Overload]* as a percentage of *oL1* detection level. Unit: 0.1%	10 V: 100%
U4-17 (07D9)	Drive Overload Calculations (OL2)	V/f OLV CLV Shows the level of the drive overload detection (oL2). A value of 100% equals the oL2 detection level. Unit: 0.1%	10 V: 100%
U4-18 (07DA)	Reference Source	V/f OLV CLV Shows the selected frequency reference source. The keypad shows the frequency reference source as "XY-nn" as specified by these rules: X: *External Reference 1/2 Selection [H1-xx = 2]* selection status • 1: *b1-01 [Frequency Reference Selection 1]* Y-nn: Frequency reference source • 0-01: Keypad (*d1-01 [Reference 1]*) • 1-00: Analog input (unassigned) • 1-01: MFAI terminal A1 • 1-02: MFAI terminal A2 • 2-02 to 2-17: Multi-step speed reference (*d1-02 to d1-17 [Reference 2 to 16, Jog Reference]*) • 3-01: MEMOBUS/Modbus communication	No signal output available
U4-19 (07DB)	Modbus Spd Ref (dec)	V/f OLV CLV Shows the speed reference sent to the drive from the MEMOBUS/Modbus communications as a decimal. Unit: When *o1-03 [Speed Display Unit Selection]* changes, the display units for this parameter also change: • *o1-03 = 0 [0.01 Hz]*: 0.01 Hz • *o1-03 = 4 [Elevator Unit1 - m/s, s, s] or 5 [Elevator Unit2 - m/(s, s^2, s^3)]*: 0.01 m/s • *o1-03 = 6 [Elevator Unit3-ft/(min,s^2,s^3)]*: 0.1 ft/min	10 V: Maximum frequency (Also available for -10 V to +10 V)
U4-20 (07DC)	Option Spd Ref(dec)	V/f OLV CLV Shows the speed reference sent to the drive from the communication option as a decimal. Unit: When *o1-03 [Speed Display Unit Selection]* changes, the display units for this parameter also change: • *o1-03 = 0 [0.01 Hz]*: 0.01 Hz • *o1-03 = 4 [Elevator Unit1 - m/s, s, s] or 5 [Elevator Unit2 - m/(s, s^2, s^3)]*: 0.01 m/s • *o1-03 = 6 [Elevator Unit3-ft/(min,s^2,s^3)]*: 0.1 ft/min	No signal output available

No. (Hex.)	Name	Description	MFAO Signal Level
U4-21 (07DD)	Run Command Source	V/f OLV CLV Shows the selected Run command source. The keypad shows the Run command source as "XY-nn" as specified by these rules: X: *External Reference 1/2 Selection [H1-xx = 2]* selection status • 1: *b1-02 [Run Command Selection 1]* Y: Run command source • 0: Keypad • 1: Control circuit terminal • 3: MEMOBUS/Modbus communications nn: Run command limit status data • 00: No limit status. • 01: The Run command was left ON when the drive stopped in the Programming Mode. • 03: The Run command is in standby after the drive was energized until the soft charge bypass contactor turns ON. **Note:** The drive will detect *Uv1 [DC Bus Undervoltage]* or *Uv [Undervoltage]* if the soft charge bypass contactor does not turn ON after 10 s. • 04: Restart after run stop is prohibited. • 05: Fast stop has been executed using the MFDI terminal. Or, the motor has ramped to stop by pressing the STOP key on the keypad. • 07: During baseblock while coast to stop with timer. • 08: Frequency reference is below *E1-09 [Minimum Output Frequency]* during baseblock. • 09: Waiting for the Enter command from PLC.	No signal output The keypad shows the Run command source as "XY-nn" as specified by these rules: available
U4-22 (07DE)	Modbus CmdData (hex)	V/f OLV CLV Shows the operation signal (register 0001H) sent to the drive from MEMOBUS/Modbus communications as a 4-digit hexadecimal number (zero suppress). The keypad shows the operation signal as specified by these rules: bit0 : Up command/Stop bit1 : Down command/Stop bit2 : External fault bit3 : Fault Reset bit4 : Multi-function input 1 bit5 : Multi-function input 2 bit6 : Multi-function input 3 bit7 : Multi-function input 4 bit8 : Multi-function input 5 bit9 : Multi-function input 6 bitA : Multi-function input 7 bitE : Not used (normal value of 0). bitF : Not used (normal value of 0).	No signal output available
U4-24 (07E6)	Num of Travels(Low)	V/f OLV CLV Shows the lower 4 digits of the drive travel count. Unit: 1 time **Note:** The drive travel count is an 8-digit number. Monitor *U4-25 [Num of Travels(High)]* shows the upper 4 digits and *U4-24* shows the lower 4 digits.	No signal output available
U4-25 (07E7)	Num of Travels(High)	V/f OLV CLV Shows the upper 4 digits of the drive travel count. Unit: 1 time **Note:** The drive travel count is an 8-digit number. Monitor *U4-25* shows the upper 4 digits and *U4-24 [Num of Travels(Low)]* shows the lower 4 digits.	No signal output available
U4-64 (3044)	RemainDirect ChngLow	V/f OLV CLV Shows the lower 3 digits of remaining Travel Direction Change Counter value. Unit: 1 time **Note:** The remaining Travel Direction Change Counter value is an 8-digit number from 0 to 65,535,000. Monitor *U4-65 [RemainDirectChngHigh]* shows the upper 5 digits and *U4-64* shows the lower 3 digits. The value counts down from a preset value set in *o4-42 [TravelDirectChange Cnt PresetLvl]*. Example for 12,498,760 times: *U4-64*: 760 *U4-65*: 12498	No signal output available

◆ U5: PID Monitors

U5-30 ... U5-33 missing

◆ U6: Operation Status Monitors

No. (Hex.)	Name	Description	MFAO Signal Level
U6-01 (0051)	Iq Secondary Current	V/f OLV CLV Shows the value calculated for the motor secondary current (q-Axis) as a percentage of the motor rated secondary current. Unit: 0.1%	10 V: Motor secondary rated current (0 V to +10 V)
U6-02 (0052)	Id ExcitationCurrent	V/f OLV CLV Shows the value calculated for the motor excitation current (d-Axis) as a percentage of the motor rated secondary current. Unit: 0.1%	10 V: Motor secondary rated current (0 V to +10 V)
U6-03 (0054)	ASR Input	V/f OLV CLV Shows the ASR input value as a percentage of the maximum frequency. Unit: 0.01%	10 V: Maximum frequency (0 V to +10 V)
U6-04 (0055)	ASR Output	V/f OLV CLV Shows the ASR output value as a percentage of the motor rated secondary current. Unit: 0.01%	10 V: Motor secondary rated current (0 V to +10 V)
U6-05 (0059)	OutputVoltageRef: Vq	V/f OLV CLV Shows the drive internal voltage reference for motor secondary current control (q-Axis). Unit: 0.1 V	200 V Class: 10 V = 200 Vrms 400 V Class: 10 V = 400 Vrms (0 V to +10 V)
U6-06 (005A)	OutputVoltageRef: Vd	V/f OLV CLV Shows the drive internal voltage reference for motor excitation current control (d-Axis). Unit: 0.1 V	200 V Class: 10 V = 200 Vrms 400 V Class: 10 V = 400 Vrms (0 V to +10 V)
U6-07 (005F) Expert	q-Axis ACR Output	V/f OLV CLV Shows the output value for current control related to motor secondary current (q axis). Unit: 0.1 %	200 V Class: 10 V = 200 Vrms 400 V Class: 10 V = 400 Vrms (0 V to +10 V)
U6-08 (0060) Expert	d-Axis ACR Output	V/f OLV CLV Shows the output value for current control related to motor excitation current (d axis). Unit: 0.1 %	200 V Class: 10 V = 200 Vrms 400 V Class: 10 V = 400 Vrms (0 V to +10 V)
U6-11 (07C6)	Iq SecondaryCurr Ref	V/f OLV CLV Shows the output value for current control related to the q-Axis Current Reference. Unit: 0.1%	10 V = Motor secondary rated current (Also available for -10 V to +10 V)
U6-12 (07C7)	Id ExcitationCur Ref	V/f OLV CLV Shows the output value for current control related to the d-Axis Current Reference. Unit: 0.1%	10 V = Motor secondary rated current (Also available for -10 V to +10 V)
U6-18 (07CD)	Enc 1 Pulse Counter	V/f OLV CLV Shows the number of pulses for speed detection (PG1). Unit: 1 pulse	10 V: 65536
U6-22 (0062)	ZeroServo Pulse Move	V/f OLV CLV Shows the distance that the rotor moved from its last position when Zero Servo is available. The value shown in this monitor = 4 × [No. of PG pulses]. **Note:** It shows the number of moving PG pulses during *S1-04 [DC Inj/Pos Lock Time at Start]* at start. Unit: 1 pulse	10 V = Number of pulses per revolution (Also available for -10 V to +10 V)
U6-25 (006B) Expert	ASR Output Level	V/f OLV CLV Shows the primary delay filter input value of the ASR (speed control loop). Unit: 0.01%	No signal output available
U6-26 (006C) Expert	Feed Fwd Cont Output	V/f OLV CLV Shows the Feed Forward control output. Unit: 0.01%	No signal output available
U6-27 (006D) Expert	FeedFwd Estimate Spd	V/f OLV CLV Shows the feed forward estimated speed. Unit: When *o1-03 [Speed Display Unit Selection]* changes, the display units for this parameter also change: • *o1-03 = 0 [0.01 Hz]*: 0.01 Hz • *o1-03 = 4 [Elevator Unit1 - m/s, s, s] or 5 [Elevator Unit2 - m/(s, s^2, s^3)]*: 0.01 m/s • *o1-03 = 6 [Elevator Unit3-ft/(min,s^2,s^3)]*: 0.1 ft/min	No signal output available

No. (Hex.)	Name	Description	MFAO Signal Level
U6-36 (0720) Expert	Comm Errors-Host	V/f OLV CLV Shows the number of inter-CPU communication errors. When you de-energize the drive, this value resets to 0.	No signal output available
U6-37 (0721) Expert	Comm Errors-Sensor	V/f OLV CLV Shows the number of inter-CPU communication errors. When you de-energize the drive, this value resets to 0.	No signal output available

11.16 Parameters that Change from the Default Settings with A1-02 [Control Method Selection]

The values for the parameters in the table depend on the values for parameter *A1-02*. When you change the setting for *A1-02*, the default settings will change.

Table 11.1 A1-02 = 0, 2, 3 [V/f, OLV, CLV]

No.	Name	Range	Unit	Control Method		
				V/f [A1-02 = 0]	OLV [A1-02 = 2]	CLV [A1-02 = 3]
C3-01	Slip Compensation Gain	0.0 - 2.5	0.1	0.0	1.0	-
C3-02	Slip Compensation Delay Time	0 - 10000	1 ms	2000	200	-
C3-05	Output Voltage Limit Operation Selection	0, 1	-	-	0	-
C4-02	Torque Compensation Delay Time	0 - 10000	1 ms	200	20	-
E1-08	Mid Point A Voltage	0.0 - 510.0	0.1 V	15.0 *1	25.0	-
E1-09	Minimum Output Frequency	0.0 - 400.0	0.1 Hz	1.5 *1	0.3	0.0
E1-10	Minimum Output Voltage	0.0 - 510.0	0.1 V	9.0 *1	5.0	2.5
S1-01	Zero Speed Level at Stop	0.0000 to 9.9999	0.001%	1.000	2.400	0.200

*1 The default setting changes when the drive model and *E1-03 [V/f Pattern Selection]* change.

11.17 Defaults by Drive Model

The values for the parameters in these tables depend on the values for parameter *o2-04*. Changing the settings for *o2-04* will change the default settings.

◆ Three-Phase 200 V Class

Parameter	Name	Unit	Default					
-	**Drive Model**	**-**	**2018**	**2025**	**2033**	**2047**	**2060**	**2075**
o2-04	**Drive Model Selection**	**Hex.**	**68**	**6A**	**6B**	**6D**	**6E**	**6F**
E2-11	**Motor Rated Power**	**kW**	**3.7**	**5.5**	**7.5**	**11**	**15**	**18.5**
E2-01	Motor Rated Current (FLA)	A	14	19.6	26.6	39.7	53	65.8
E2-02	Motor Rated Slip	Hz	2.73	1.5	1.3	1.7	1.6	1.67
E2-03	Motor No-Load Current	A	4.5	5.1	8	11.2	15.2	15.7
E2-05	Motor Line-to-Line Resistance	Ω	0.771	0.399	0.288	0.23	0.138	0.101
E2-06	Motor Leakage Inductance	%	19.6	18.2	15.5	19.5	17.2	20.1
E2-10	Motor Iron Loss	W	112	172	262	245	272	505
L2-05	Undervoltage Detection Lvl (Uv1)	-	190	190	190	190	190	190
L8-02	Overheat Alarm Level	°C	115	105	115	125	120	135
L8-09	Output Ground Fault Detection	-	0	1	1	1	1	1
L8-38	Carrier Frequency Reduction	-	1	2	2	2	2	2
T1-02	Motor Rated Power	kW	3.7	5.5	7.5	11	15	18.5
T1-04	Motor Rated Current	A	14	19.6	26.6	39.7	53	65.8

◆ Three-Phase 400 V Class

Parameter	Name	Unit	Default						
-	**Drive Model**	**-**	**4009**	**4015**	**4018**	**4024**	**4031**	**4039**	**4060**
o2-04	**Drive Model Selection**	**Hex.**	**72**	**73**	**74**	**75**	**76**	**77**	**78**
E2-11	**Motor Rated Power**	**kW**	**4.0**	**5.5**	**7.5**	**11**	**15**	**18.5**	**22**
E2-01	Motor Rated Current (FLA)	A	7	9.8	13.3	19.9	26.5	32.9	38.6
E2-02	Motor Rated Slip	Hz	2.7	1.5	1.3	1.7	1.6	1.67	1.7
E2-03	Motor No-Load Current	A	2.3	2.6	4	5.6	7.6	7.8	9.2
E2-05	Motor Line-to-Line Resistance	Ω	3.333	1.595	1.152	0.922	0.55	0.403	0.316
E2-06	Motor Leakage Inductance	%	19.3	18.2	15.5	19.6	17.2	20.1	23.5
E2-10	Motor Iron Loss	W	130	193	263	385	440	508	586
L2-05	Undervoltage Detection Lvl (Uv1)	-	380	380	380	380	380	380	380
L8-02	Overheat Alarm Level	°C	110	120	120	120	120	125	115
L8-09	Output Ground Fault Detection	-	0	0	0	1	1	1	1
L8-38	Carrier Frequency Reduction	-	1	2	2	2	2	2	2
T1-02	Motor Rated Power	kW	4.0	5.5	7.5	11	15	18.5	22
T1-04	Motor Rated Current	A	7	9.8	13.3	19.9	26.5	32.9	38.6

12

Parameter Details

12.1 A: Initialization Parameters

A parameters [Initialization Parameters] set the operating environment and operating conditions for the drive.

◆ A1: Initialization

A1 parameters set the operating environment and operating conditions for the drive. For example, these parameters set the keypad language, the control method, and the parameter access level for the drive.

■ A1-00: Language Selection

No. (Hex.)	Name	Description	Default (Range)
A1-00 (0100) RUN	Language Selection	V/f OLV CLV Sets the language for the LCD keypad.	0 (0 - 12)

Note:
- This parameter is only available when you use an LCD keypad or a Bluetooth LCD Keypad.
- When you use *A1-03 [Initialize Parameters]* to initialize the drive, the drive will not reset this parameter.

0 : English

1 : Japanese

2 : German

3 : French

4 : Italian

5 : Spanish

6 : Portuguese

7 : Chinese

8 : Czech

9 : Russian

10 : Turkish

11 : Polish

12 : Greek

■ A1-01: Access Level Selection

No. (Hex.)	Name	Description	Default (Range)
A1-01 (0101) RUN	Access Level Selection	V/f OLV CLV Sets user access to parameters. The access level controls which parameters the keypad will display, and which parameters the user can set.	2 (0 - 3)

0 : Operation Only

Access to *A1-00, A1-01, A1-04 [Password]*, and the *U Monitors*.

1 : User Parameters

Access to *A1-00, A1-01, A1-04*, and *A2-01 to A2-32 [User Parameters 1 to 32]*.

2 : Advanced Level

Access to all parameters, but not Expert Mode parameters.

3 : Expert Level

Access to all parameters including Expert Mode parameters.

Table 12.1 shows which keypad screens are available for each *A1-01* settings.

Table 12.1 Access Level and Available Keypad Screens

Mode	Keypad Screen	*A1-01 [Access Level Selection]* Setting			
		0	1	2	3
Drive Mode	Monitors	Yes	Yes	Yes	Yes
Programming Mode	Parameters	Yes	Yes	Yes	Yes
	User Custom Parameters	No	Yes	Yes	Yes
	Parameter Backup/Restore	No	No	Yes	Yes
	Modified Parameters/Fault Log	No	No	Yes	Yes
	Auto-Tuning	No	No	Yes	Yes
	Initial Setup Screen	No	No	Yes	Yes
	Diagnostic Tools	No	No	Yes	Yes

Note:
- When you use *A1-04* and *A1-05 [Password Setting]* to set a password, you cannot change the values set in *A1-01 to A1-03*, or *A2-01 to A2-32*.
- When you use MEMOBUS/Modbus communications, you must send the Enter command from the controller to the drive and complete the serial communication write process before you can use the keypad to change parameter settings.

■ A1-02: Control Method Selection

No. (Hex.)	Name	Description	Default (Range)
A1-02 (0102)	Control Method Selection	V/f OLV CLV Sets the control method for the drive application and the motor.	0 (0, 2, 3)

Note:
When you change the control methods, the parameter values specified by *A1-02* are changed to their default values.

Sets the control method for the drive application and the motor.

0 : V/f Control

Use this control method in these applications and conditions:

- For general variable-speed control applications in which a high level of responsiveness or high-precision speed control is not necessary.
- Applications in which more than one motor are connected to one drive
- When there is not sufficient data to set the motor parameters
- When it is not possible to do Auto-Tuning. The speed control range is 1:40.

2 : Open Loop Vector

Use this control method for general variable-speed control applications in which high-precision speed control is necessary. In this control method, a feedback signal from the motor is not necessary to have high torque response and high torque when operating at low speeds. The speed control range is 1:120.

3 : Closed Loop Vector

Use this control method for general variable-speed control applications in which these qualities are necessary:

- A high level of responsiveness
- High-precision speed control up to zero speed
- A speed feedback signal from the motor is necessary for this control method. The speed control range is 1:1500.

■ A1-03: Initialize Parameters

No. (Hex.)	Name	Description	Default (Range)
A1-03 (0103)	Initialize Parameters	V/f OLV CLV Sets parameters to default values.	0 (0 - 2220)

Note:
- After you initialize the drive, the drive automatically sets *A1-03 = 0*.
- User Parameters can save the parameter values for your application and use these values as default values for drive initialization.

0 : No Initialization

1110 : User Initialization

Sets parameters to the values set by the user as user settings. Set *o2-03 = 1 [User Parameter Default Value = Set defaults]* to save the user settings.

You can save the parameter settings that were adjusted for the test run as user-set default values to the drive. When you make changes to the parameter values after you save the settings as User Parameter Settings, the drive will set the parameters to the User Parameter Setting value when you initialize with *A1-03 = 1110*.

Follow this procedure to save User Parameter setting values, and to do a User Initialization.

1. Set parameters correctly for the application.
2. Set *o2-03 = 1 [User Parameter Default Value = Set defaults]*.
   This saves parameter settings for a User Initialization.
   The drive will then automatically set *o2-03 = 0*.
3. Set *A1-03 = 1110* to reset to the saved parameter settings.
   When you initialize the drive, the drive sets the parameter values to the User Parameter setting values.

2220 : 2-Wire Initialization

Sets MFDI terminal S1 to Forward Run and terminal S2 to Reverse Run, and resets all parameters to default settings.

■ A1-04: Password

No. (Hex.)	Name	Description	Default (Range)
A1-04 (0104)	Password	V/f OLV CLV Entry point for the password set in *A1-05 [Password Setting]*. The user can view the settings of parameters that are locked without entering the password. Enter the correct password in this parameter to change parameter settings.	0000 (0000 - 9999)

If the password entered in *A1-04* does not agree with the password setting in *A1-05*, you cannot change these parameters:

- *A1-01 [Access Level Selection]*
- *A1-02 [Control Method Selection]*
- *A1-03 [Initialize Parameters]*
- *A2-01 to A2-32 [User Parameter 1 to 32]*

To lock parameter settings after making changes without changing the password, enter the incorrect password in *A1-04* and push ↵.

Enter the Password to Unlock Parameters

Use this procedure to unlock parameter settings.

Set the password in *A1-05 [Password Setting]*, and show the Parameter Setting Mode screen on the keypad.

This procedure verifies the password, and makes sure that the parameter settings are unlocked.

1. Push ∧ or ∨ to select “A: Initialization Parameters”, then push ↵.
2. Push ∧ or ∨ to select *[A1-04]*, then push ↵.
   You can now change parameter settings.
3. Push > or < to move the digit and enter the password.
4. Push ↵ to confirm the password.
   The drive unlocks the parameters and automatically shows the Parameters Screen.
5. Push ∧ or ∨ to show *[A1-02]*, then push ↵.
   The keypad shows the setting value for *[A1-02]*.
6. Push ∧ or ∨ to make sure that you can change the setting value.

Push F1 (Back) until the keypad shows the Parameter Setup Mode screen.

■ A1-05: Password Setting

No. (Hex.)	Name	Description	Default (Range)
A1-05 (0105)	Password Setting	V/f OLV CLV Set the password to lock parameters and prevent changes to parameter settings. Enter the correct password in *A1-04 [Password]* to unlock parameters and accept changes.	0000 (0000 - 9999)

This parameter can lock these parameter settings:

- *A1-01 [Access Level Selection]*
- *A1-02 [Control Method Selection]*
- *A1-03 [Initialize Parameters]*
- *A2-01 to A2-32 [User Parameter 1 to 32]*

Note:
- Usually, the keypad will not show *A1-05*. To show and set *A1-05*, show *A1-04 [Password]* and then push STOP and ∨ on the keypad at the same time.
- After you set *A1-05*, the keypad will not show it again until you enter the correct password in *A1-04*. Make sure that you remember the *A1-05* setting value. If you do not know the *A1-05* setting value, contact the manufacturer or your nearest sales representative.
- When *A1-03 = 2220 [2-Wire Initialization]*, the drive is initialized to *A1-05 = 0000*. Be sure to set the password again when a password is necessary for the application.
- Change the setting value in *A1-05* to change the password. The new setting value becomes the new password.
- When you use the password to unlock and change a parameter, enter a value other than the password in *A1-04* to lock the parameter again with the same password.

◆ A2: User Parameters

You can register frequently used parameters and recently changed parameters here to access them quickly. Use Setup Mode to show the saved parameters.

■ A2-01 to A2-32: User Parameters 1 to 32

No. (Hex.)	Name	Description	Default (Range)
A2-01 to A2-32 (0106 - 0125)	User Parameters 1 to 32	V/f OLV CLV You can select a maximum of 32 parameters for the drive and save the values to parameters *A2-01 to A2-32*. Use Setup Mode to show the saved parameters. You can immediately access these saved parameters.	Parameters in General-Purpose Setup Mode

Note:
- You must set *A1-01 = 1 [Access Level Selection = User Parameters]* to access parameters *A2-01 to A2-32*.

The drive saves these parameters to *A2-01 to A2-32*.

- The drive saves a maximum of 32 parameters.

  Note:
  Set *A1-01 = 2 [Advanced Level]* or *A1-01 = 3 [Expert Level]* to save the necessary parameters.

- The drive automatically saves changed parameters to *A2-17 to A2-32*.

  Note:
  Set *A2-33 = 1 [User Parameter Auto Selection = Enabled]*.

■ A2-33: User Parameter Auto Selection

No. (Hex.)	Name	Description	Default (Range)
A2-33 (0126)	User Parameter Auto Selection	V/f OLV CLV Sets the automatic save feature for changes to parameters *A2-17 to A2-32 [User Parameters 17 to 32]*.	Determined by A1-06 (0, 1)

0 : Disabled: Manual Entry Required

Set User Parameters manually.

1 : Enabled: Auto Save Recent Parms

The drive automatically registers changed parameter *A2-17 to A2-32*. The drive automatically saves the most recently changed parameter to *A2-17*, and saves a maximum of 16 parameters. After the drive registers 16 parameters, when you save a new parameter, the drive will remove a parameter from the User Parameter list to make space for the new parameter. The drive removes parameters with First In, First Out.

Use Setup Mode to show the saved parameters.

Note:
In General-Purpose Setup Mode, the drive saves parameters starting with *A2-27* because the drive saves parameters *A2-26* and lower by default.

12.2 b: Application

b parameters set these functions:

- Frequency reference source/Run command source
- Stopping method settings
- Timer Function
- Dwell function
- Energy-Saving Control

◆ b1: Operation Mode Selection

b1 parameters set the operation mode for the drive.

■ b1-01: Speed Reference Selection 1

No. (Hex.)	Name	Description	Default (Setting Range)
b1-01 (0180)	Speed Reference Selection 1	V/f OLV CLV Sets the input method for the speed reference.	1 (0 - 2)

Note:

- Push LO/RE on the keypad to set the input mode to LOCAL and enter the speed reference from the keypad.
- When the drive receives a Up/Down command when the speed reference is 0 Hz or less than the *E1-09 [Minimum Output Frequency]* value, the RUN LED on the keypad will flash. Examine the setting for the speed reference input and enter a value ≥ E1-09.

0 : Keypad

Use the keypad to enter the frequency reference.

Use ∧ and ∨ on the keypad to change the frequency reference.

1 : Analog Input

Use MFAI terminals A1 and A2 to input an analog frequency reference with a voltage or current input signal.

- Voltage Input
  Refer to Table 12.2 to use a voltage signal input to one of the MFAI terminals.

Table 12.2 Frequency Reference Voltage Input

Terminal	Terminal Signal Level	Parameter Settings				Note
		Signal Level Selection	Function Selection	Gain	Bias	
A1	0 - 10 V (Lower Limit at 0)	H3-01 = 0	H3-02 = 0 [Frequency Reference]	H3-03	H3-04	-
	0 - 10 V (Without Lower Limit)	H3-01 = 1				
A2	0 - 10 V (Lower Limit at 0)	H3-01 = 0	H3-10 = 0 [Frequency Reference]	H3-11	H3-12	Set DIP switch S1 to “V” for voltage input.
	0 - 10 V (Without Lower Limit)	H3-01 = 1				

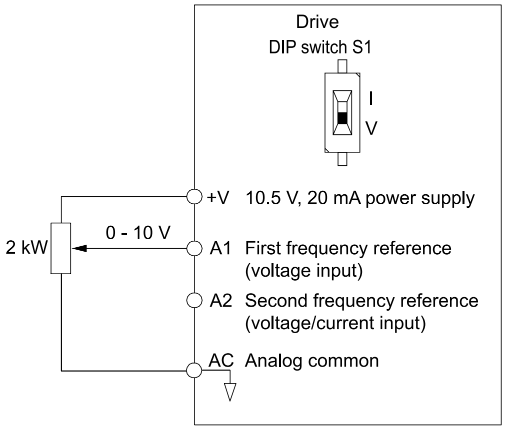


Figure 12.1 Example of Setting the Frequency Reference with a Voltage Signal to Terminal A1

Note:

You can also use this diagram to wire terminal A2.

- Current Input
  Refer to Table 12.3 to use a current signal input to one of the MFAI terminals.

Table 12.3 Frequency Reference Current Input

Terminal	Signal Level	Parameter Settings				Note
		Signal Level Selection	Function Selection	Gain	Bias	
A2	4 - 20 mA	H3-09 = 2	H3-10 = 0 [Frequency Reference]	H3-11	H3-12	Set DIP switch S1 to "I" for current input.
	0 - 20 mA	H3-09 = 3				

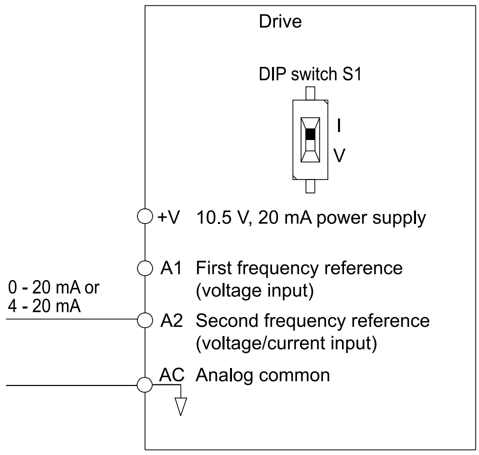


Figure 12.2 Example of Setting the Frequency Reference with a Current Signal to Terminal A2

Changing between Master and Auxiliary Frequency References

Use the multi-step speed reference function to change the frequency reference input between terminals A1 and A2.

2 : Memobus/Modbus Communications

Use MEMOBUS/Modbus communications to enter the frequency reference.

■ b1-02: Up/Down Command Selection

No. (Hex.)	Name	Description	Default (Range)
b1-02 (0181)	Run Command Selection 1	V/f OLV CLV Sets the Up/Down command source in Remote mode. Wire the motor so the elevator goes up when an Up command is issued.	1 (0 - 2)

0 : Keypad

Use the keypad to enter the Up/Down command. Use this setting only when performing a test tun.

Note:

The LO/RE on the keypad is on while keypad is the Up/Down command source.

1 : Digital Input

The drive uses the control circuit terminals to enter the Up/Down command. Select the input method for the Up/Down command with an *H1-xx* parameter. Set *H1-xx = 40 or 41 [Up Command or Down Command]*.

- 2-wire Sequence 1
  This sequence has two input types: Up/Stop and Down/Stop. Set *A1-03 = 2220 [Initialize Parameters = 2-Wire Initialization]* to initialize the drive and set terminals S1 and S2 for a 2-wire sequence.

2 : Memobus/Modbus Communications

Use MEMOBUS/Modbus communications to enter the Run command.

■ b1-03: Stopping Method Selection

No. (Hex.)	Name	Description	Default (Range)
b1-03 (0182)	Stopping Method Selection	V/f OLV CLV Sets the method to stop the motor after removing a Run command or entering a Stop command.	0 (0 - 1)

Select the applicable stopping method for the application from these options:

0 : Ramp to Stop

When you enter the Stop command or turn OFF the Run command, the drive ramps the motor to stop.

The drive ramps the motor to stop as specified by the deceleration time. The default setting for the deceleration time is *C1-02 [Deceleration Time 1]*. The actual deceleration time changes as the load conditions change (for example, mechanical loss and inertia).

1 : Coast to Stop

When you enter the Stop command or turn OFF the Run command, the drive turns OFF the output and coasts the motor to stop.

Load conditions will have an effect on the deceleration rate as the motor coasts to stop (for example, mechanical loss and inertia).

■ b1-08: Up/Down Command Select in PRG Mode

No. (Hex.)	Name	Description	Default (Range)
b1-08 (0187)	Run Command Select in PRG Mode	V/f OLV CLV Sets the conditions for the drive to accept an Up/Down command entered from an external source when using the keypad to set parameters.	1 (0 - 1)

As a safety precaution, when the drive is in Programming Mode, it will not respond to a Up/Down command.

This parameter helps prevent accidents that can occur if the motor starts to rotate because the drive received a Up/Down command from an external source while the user is programming the drive. You can also set the drive to not show the Programming Mode when a Up/Down command is active.

Note:

Refer to this table for Drive Mode and Programming Mode functions.

Mode	Keypad Screen	Function
Drive Mode	Monitors	Sets monitor display.
Programming Mode	Parameters	Changes parameter settings.
	User Custom Parameters	Shows the User Parameters.
	Parameter Backup/Restore	Saves parameters to the keypad as backup.
	Modified Parameters/Fault Log	Shows modified parameters and fault history.
	Auto-Tuning	Auto-Tunes the drive.
	Initial Setup	Changes initial settings.
	Diagnostic Tools	Sets data logs and backlight.

0 : Disregard RUN while Programming

The drive does not accept the Up/Down command when setting the parameters in the Programming Mode.

1 : Accept RUN while Programming

The drive accepts a Up/Down command entered from an external source when setting the parameters in Programming Mode.

■ b1-14: Phase Order Selection

No. (Hex.)	Name	Description	Default (Range)
b1-14 (01C3)	Phase Order Selection	V/f OLV CLV Sets the phase order for output terminals U/T1, V/T2, and W/T3. This parameter can align the Forward Run command from the drive and the forward direction of the motor without changing wiring.	0 (0, 1)

0 : Standard

1 : Switch Phase Order

◆ b2: Magnetic Flux Compensation

b2 parameter sets the Magnetic Flux Compensation function.

■ b2-08: Magnetic Flux Compensation Value

No. (Hex.)	Name	Description	Default (Range)
b2-08 (0190) Expert	Magnetic Flux Compensation Value	V/f OLV CLV Sets how much current the drive injects when DC Injection Braking at Start starts (Initial Excitation) as a percentage of *E2-03 [Motor No-Load Current]*.	0% (0 - 1000%)

This parameter is effective when you start a high-capacity motor (a motor with a large secondary circuit time constant). This function can quickly increase motor flux to make high starting torque (a process called initial excitation).

The current level for DC Injection Braking at start changes linearly from the setting of *b2-08* to the setting of *S1-04 [DC Inj/Pos LockTime at Start]* as shown in Figure 12.3.

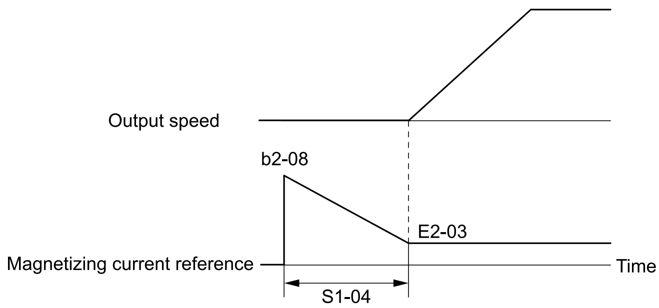


Figure 12.3 DC Current Level during DC Injection Braking at Start

Note:
- If *b2-08 < 100%*, flux will develop very slowly.
- When *b2-08 = 0%*, the DC current level will be the DC Injection current set in *S1-02 [DC Injection Current at Start]* and *S1-03 [DC Injection Current at Stop]*.
- If you set *b2-08* too high, DC Injection Braking at start can cause a large noise. Adjust *b2-08* to decrease the volume to the permitted level.

◆ b4: Timer Function

The drive uses timers to delay activating and deactivating MFDO terminals.

Timers prevent sensors and switches from making chattering noise.

There are two types of timers:

- Timers that set a delay for timer inputs and timer outputs.
  These timers delay activating and deactivating of the MFDIs and MFDOs.
  To enable this function, set *H1-xx = 18 [MFDI Function Selection = Timer Function], and set H2-01 to H2-03 = 12 [MFDO Function Selection = Timer Output]*.
- Timers that set a delay to activate and deactivate MFDO terminals.
  These timers delay activating and deactivating MFDO terminals.
  To enable this function, set delay times in parameters *b4-03 to b4-08*.

Timer Function Operation

- Timers that Set a Delay for Timer Inputs and Timer Outputs
  Triggers timer output if the timer input is active for longer than the time set in *b4-01 [Timer Function ON-Delay Time]*. Triggers timer output late for the time set in *b4-02 [Timer Function OFF-Delay Time]*. Figure 12.4 shows an example of how the timer function works.

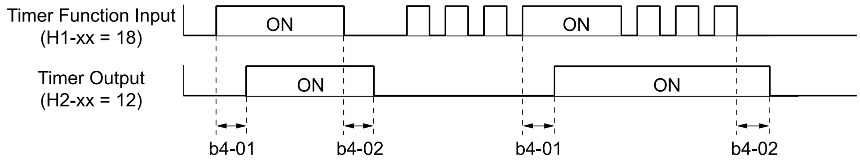


Figure 12.4 Example of Timer Function Operation

b4-01: Timer Function ON-Delay Time

No. (Hex.)	Name	Description	Default (Range)
b4-01 (01A3) Expert	Timer Function ON-Delay Time	V/f OLV CLV Sets the ON-delay time for the timer input.	0.0 s (0.0 - 3000.0 s)

b4-02: Timer Function OFF-Delay Time

No. (Hex.)	Name	Description	Default (Range)
b4-02 (01A4) Expert	Timer Function OFF-Delay Time	V/f OLV CLV Sets the OFF-delay time for the timer input.	0.0 s (0.0 - 3000.0 s)

b6: Dwell Function

The Dwell function momentarily holds the output frequency at start and stop.

This prevents motor speed loss when you start and stop heavy loads. The Dwell function is also enabled when backlash on the machine side causes sudden movement at the start of acceleration and deceleration.

At the start of acceleration, the drive uses the output frequency and acceleration time set for the Dwell function to automatically operate at low speed to minimize the effects of backlash. Then, the drive can accelerate again. The Dwell function operates the same for deceleration.

For conveyor applications, the Dwell function also lets the drive interlock the output frequency and a delay time for the holding brake on the load side.

The Dwell function momentarily stops during acceleration to prevent a PM motor from stepping out. Figure 12.5 shows how the Dwell function works.

Note:

When you use the Dwell function at stop, set *b1-03 = 0 [Stopping Method Selection = Ramp to Stop]*.

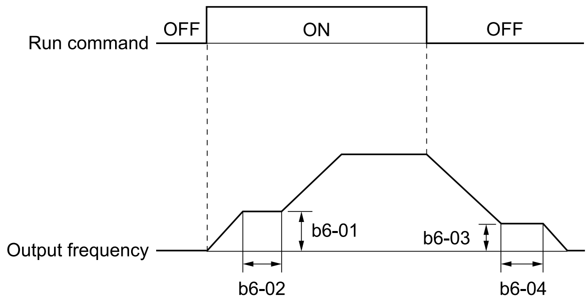


Figure 12.5 Time Chart for the Dwell Function at Start/Stop

b6-01: Dwell Reference at Start

No. (Hex.)	Name	Description	Default (Range)
b6-01 (01B6) Expert	Dwell Reference at Start	V/f OLV CLV Sets the output frequency that the drive will hold momentarily when the motor starts.	0.0 (Determined by A1-02)

When the drive accelerates to the output frequency set in *b6-01*, it holds that frequency for the time set in *b6-02 [Dwell Time at Start]*, and starts to accelerate again.

b6-02: Dwell Time at Start

No. (Hex.)	Name	Description	Default (Range)
b6-02 (01B7) Expert	Dwell Time at Start	V/f OLV CLV Sets the length of time that the drive will hold the output frequency when the motor starts.	0.0 s (0.0 - 10.0 s)

b6-03: Dwell Reference at Stop

No. (Hex.)	Name	Description	Default (Range)
b6-03 (01B8) Expert	Dwell Reference at Stop	V/f OLV CLV Sets the output frequency that the drive will hold momentarily when ramping to stop the motor.	0.0 (Determined by A1-02)

When the drive decelerates to the output frequency set in *b6-03*, it holds that frequency for the time set in *b6-04 [Dwell Time at Stop]* and starts to decelerate again.

b6-04: Dwell Time at Stop

No. (Hex.)	Name	Description	Default (Range)
b6-04 (01B9) Expert	Dwell Time at Stop	V/f OLV CLV Sets the length of time for the drive to hold the output frequency when ramping to stop the motor.	0.0 s (0.0 - 10.0 s)

12.3 C: Tuning

C parameters adjust drive operation, including:

- Acceleration Time
- Deceleration Time
- Slip Compensation
- Torque Compensation
- Carrier Frequency

◆ C1: Accel & Decel Speed

You can set four different acceleration and deceleration time pairs in the drive. When you activate and deactivate H1-xx = 7, 1A [MFDI Function Select = Accel/Decel Ramp Selection 1, Accel/Decel Time Selection 2], you can switch acceleration and deceleration times during run.

Acceleration time parameters always set the time to accelerate from 0 Hz to *E1-04 [Maximum Output Frequency]*. Deceleration time parameters always set the time to decelerate from *E1-04* to 0 Hz.

C1-01 [Acceleration Ramp 1] and *C1-02 [Deceleration Ramp 1]* are the default active accel/decel settings.

■ Use MFDIs to Switch Acceleration Ramps

Table 12.4 shows the different acceleration and deceleration times.

Table 12.4 Accel/Decel Ramps and Active Parameters

H1-xx = 7 [Accel/Decel Ramp Selection 1]	H1-xx = 1A [Accel/Decel Ramp Selection 2]	Active Parameter	
		Acceleration Time	Deceleration Time
OFF	OFF	C1-01 [Acceleration Ramp 1]	C1-02 [Deceleration Ramp 1]
ON	OFF	C1-03 [Acceleration Ramp 2]	C1-04 [Deceleration Ramp 2]
OFF	ON	C1-05 [Acceleration Ramp 3]	C1-06 [Deceleration Ramp 3]
ON	ON	C1-07 [Acceleration Ramp 4]	C1-08 [Deceleration Ramp 4]

Figure 12.6 shows an operation example to change acceleration and deceleration times. It is necessary to set *b1-03 = 0 [Stopping Method Selection = Ramp to Stop]* for this example.

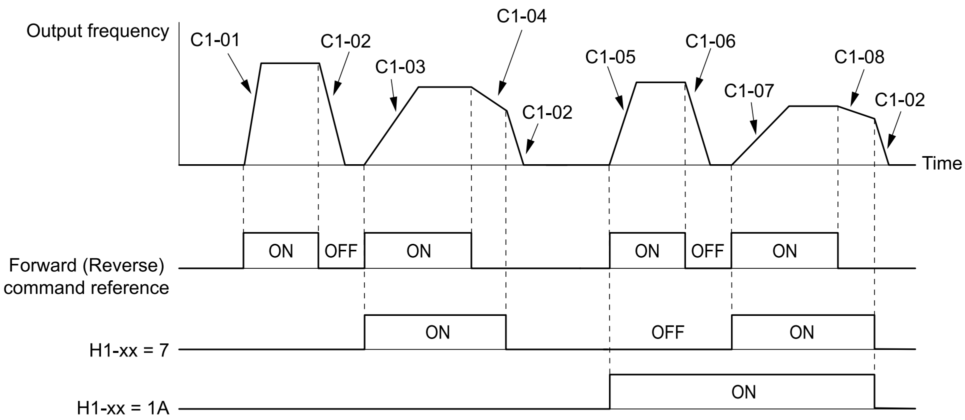


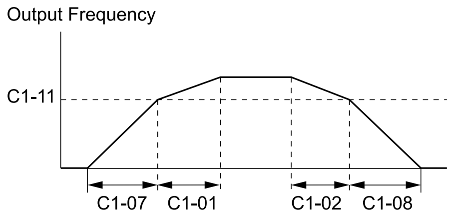
Figure 12.6 Timing Diagram of Acceleration and Deceleration Times

■ Use Output Speed Level to Switch Acceleration and Deceleration Times

The drive can use output Speed to automatically switch between different acceleration and deceleration times. When the output Speed = *C1-11 [Accel/Decel Time Switching Speed]*, the drive automatically switches the acceleration and deceleration times. Set *C1-11 = 0.0%* to disable this function.

Note:

- Acceleration and deceleration times set to MFDIs are more important than the automatic switch using the speed level set in *C1-11*. For example, if you set the switchover speed to *C1-11*, the drive will not automatically switch acceleration and deceleration times when the MFDI terminal set for *Accel/Decel Speed Selection 1 [H1-xx = 7]* is activated.



When the output frequency ≥ C1-11, drive uses Accel/Decel Time 1(C1-01, C1-02)
When the output frequency < C1-11, drive uses Accel/Decel Time 4(C1-07, C1-08)

Figure 12.7 Accel/Decel Time Switching Speed

■ C1-01: Acceleration Ramp 1

No. (Hex.)	Name	Description	Default (Range)
C1-01 (0200) RUN	Acceleration Ramp 1	V/f OLV CLV Sets the ramp to accelerate from zero to maximum output speed.	1.50 s (0.00 - 600.00 s)

■ C1-02: Deceleration Ramp 1

No. (Hex.)	Name	Description	Default (Range)
C1-02 (0201) RUN	Deceleration Ramp 1	V/f OLV CLV Sets the ramp to decelerate from maximum output speed to zero.	1.50 s (0.00 - 600.00 s)

■ C1-03: Acceleration Ramp 2

No. (Hex.)	Name	Description	Default (Range)
C1-03 (0202) RUN	Acceleration Ramp 2	V/f OLV CLV Sets the ramp to accelerate from zero to maximum output speed.	1.50 s (0.00 - 600.00 s)

■ C1-04: Deceleration Ramp 2

No. (Hex.)	Name	Description	Default (Range)
C1-04 (0203) RUN Expert	Deceleration Ramp 2	V/f OLV CLV Sets the ramp to decelerate from maximum output speed to zero.	1.50 s (0.00 - 600.00 s)

■ C1-05: Acceleration Ramp 3

No. (Hex.)	Name	Description	Default (Range)
C1-05 (0204) RUN Expert	Acceleration Ramp 3	V/f OLV CLV Sets the ramp to accelerate from zero to maximum output speed.	1.50 s (0.00 - 600.00 s)

■ C1-06: Deceleration Ramp 3

No. (Hex.)	Name	Description	Default (Range)
C1-06 (0205) RUN Expert	Deceleration Ramp 3	V/f OLV CLV Sets the ramp to decelerate from maximum output speed to zero.	1.50 s (0.00 - 600.00 s)

■ C1-07: Acceleration Ramp 4

No. (Hex.)	Name	Description	Default (Range)
C1-07 (0206) RUN Expert	Acceleration Ramp 4	V/f OLV CLV Sets the ramp to accelerate from zero to maximum output speed.	1.50 s (0.00 - 600.00 s)

■ C1-08: Deceleration Ramp 4

No. (Hex.)	Name	Description	Default (Range)
C1-08 (0207) RUN Expert	Deceleration Ramp 4	V/f OLV CLV Sets the ramp to decelerate from maximum output speed to zero.	1.50 s (0.00 - 600.00 s)

■ C1-09: Fast Stop Ramp

No. (Hex.)	Name	Description	Default (Range)
C1-09 (0208) RUN Expert	Fast Stop Ramp	V/f OLV CLV Sets the ramp that the drive will decelerate to zero for Emergency Stop.	1.50 s (0.00 - 600.00 s)

The Emergency Stop function will be triggered in the following circumstances.

- The Emergency Stop operation will be triggered by the input of the Emergency Stop command via the multi-function digital input terminal.
- The Emergency Stop operation is will be triggered when by the input of the Fast Stop command is input via the multi-function digital input terminal.

Set *H1-xx = 15, 17 [MFDI Function Select = Fast Stop (N.O.), Fast Stop (N.C.)]*.

When the Emergency Stop command is input, the Emergency Stop operation will be triggered at the deceleration time set to *C1-09*. The drive cannot be restarted after initiating a Emergency Stop operation until deceleration is complete. Complete deceleration and cycle the Run command to clear the Emergency Stop input.

The terminal set for *H2-xx = 4C [MFDO Function Select = During Fast Stop]* will be ON during Emergency Stop.

Note:

Decelerating too quickly can cause an *ov [Overvoltage]* fault that shuts off the drive while the motor coasts to a stop. Set a Emergency Stop time in *C1-09* that prevents motor coasting and makes sure that the motor stops quickly and safely.

■ C1-10: Accel/Decel Time Setting Units

No. (Hex.)	Name	Description	Default (Range)
C1-10 (0209) Expert	Accel/Decel Time Setting Units	V/f OLV CLV Sets the setting units for *C1-01 to C1-08 [Accel/Decel Times 1 to 4]*, and *C1-09 [Fast Stop Time]*.	0 (0, 1)

0 : 0.01 s (0.00 to 600.00 s)

Sets acceleration and deceleration times in 0.01 s units. The setting range is 0.0 to 6000.0 s.

If one of these parameters is set to 1000.0 s or longer, you cannot set *C1-10 = 0*:

- *C1-01 to C1-09, and C1-15*

When one of those parameters is set to a value between 600.1 s and 1000.0 s, you can set *C1-10 = 0*, but the time will change to 600.00 s.

1 : 0.1 s (0.0 to 6000.0 s)

Sets acceleration and deceleration times in 0.1 s units. The setting range is 0.0 to 6000.0 s.

■ C1-11: Accel/Decel Switching Speed

No. (Hex.)	Name	Description	Default (Range)
C1-11 (020A) Expert	Accel/Decel Switching Speed	V/f OLV CLV Sets the speed at which the drive will automatically change acceleration and deceleration times.	0.0% (0.0 - 100.0%)

When the output speed is at the *C1-11* value, the drive automatically switches the acceleration and deceleration times. Set this parameter to *0.0%* to disable this function.

■ C1-15: Inspect Dec Ramp

No. (Hex.)	Name	Description	Default (Range)
C1-15 (0260)	Inspect Dec Ramp	V/f OLV CLV Sets the deceleration ramp used for inspection run.	0.00 s (0.00 - 2.00 s)

◆ C2: Jerk Characteristics

Use Jerk characteristics to smooth acceleration and deceleration and to minimize abrupt shock to the load.

Set Jerk characteristic time during acceleration/deceleration at start and acceleration/deceleration at stop.

The following figure explains how Jerk are applied.

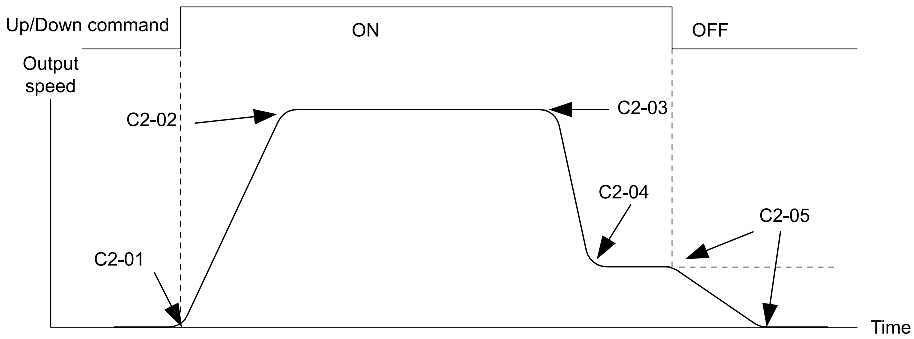


Figure 12.8 Jerk Timing Diagram - Forward/Reverse Operation

When o1-03 is set to between 0 and 4, the jerk settings are expressed in seconds. Then the actual accel/decel time including jerk settings can be calculated as follows:

- Actual accel ramp = accel ramp setting + (C2-01 + C2-02) / 2
- Actual decel ramp = decel ramp setting + (C2-03 + C2-04) / 2

■ C2-01: Jerk at Accel Start

No. (Hex.)	Name	Description	Default (Range)
C2-01 (020B)	Jerk at Accel Start	V/f OLV CLV Sets the jerks acceleration time at start.	0.50 s (0.00 - 10.00 s)

■ C2-02: Jerk at Accel End

No. (Hex.)	Name	Description	Default (Range)
C2-02 (020C)	Jerk at Accel End	V/f OLV CLV Sets the jerk acceleration time at completion.	0.50 s (0.00 - 10.00 s)

■ C2-03: Jerk at Decel Start

No. (Hex.)	Name	Description	Default (Range)
C2-03 (020D)	Jerk at Decel Start	V/f OLV CLV Sets the jerk deceleration time at start.	0.50 s (0.00 - 10.00 s)

■ C2-04: Jerk at Decel End

No. (Hex.)	Name	Description	Default (Range)
C2-04 (020E)	Jerk at Decel End	V/f OLV CLV Sets the jerk deceleration time at completion.	0.50 s (0.00 - 10.00 s)

■ C2-05: Jerk below Leveling Speed

No. (Hex.)	Name	Description	Default (Range)
C2-05 (020F)	Jerk below Leveling Speed	V/f OLV CLV Sets the jerk deceleration time below leveling speed.	0.50 s (0.00 - 10.00 s)

◆ C3: Slip Compensation

The Slip Compensation function improves the speed accuracy of an induction motor. As loads on induction motors increase, motor slip increases and motor speed decreases. By adjusting the output frequency in accordance with the motor load, it compensates the slip and makes the motor speed equal to the frequency reference.

■ C3-01: Slip Compensation Gain

No. (Hex.)	Name	Description	Default (Range)
C3-01 (020F) RUN Expert	Slip Compensation Gain	V/f OLV CLV Sets the gain for the slip compensation function. Usually it is not necessary to change this setting.	1.0 (0.0 - 2.5)

Note:

Correctly set these parameters before changing the slip compensation gain:
- *E2-01 [Motor Rated Current (FLA)]*
- *E2-02 [Motor Rated Slip]*
- *E2-03 [Motor No-Load Current]*

Adjust this parameter as follows if necessary:

- If the motor speed is slower than the speed reference, increase this parameter in 0.1-unit increments.
- If the motor speed is slower than the speed reference value, decrease this parameter value in 0.1-unit increments.

■ C3-02: Slip Compensation Delay Time

No. (Hex.)	Name	Description	Default (Range)
C3-02 (0210) RUN Expert	Slip Compensation Delay Time	V/f OLV CLV Sets the slip compensation delay time when speed is unstable or when the slip compensation response is too slow. Usually it is not necessary to change this setting.	2000 ms (0 - 10000 ms)

Use these settings to adjust this parameter as necessary:

- When the speed is not stable, increase the setting.
- When the slip compensation response is too slow, decrease the setting.

■ C3-03: Slip Compensation Limit

No. (Hex.)	Name	Description	Default (Range)
C3-03 (0211) Expert	Slip Compensation Limit	V/f OLV CLV Sets the upper limit for the slip compensation function as a percentage of the motor rated slip.	200% (0 - 250%)

If you increase the value of *C3-01 [Slip Compensation Gain]* and the motor speed is slow, use this parameter. The drive uses this parameter when the slip is at the upper limit of slip compensation. Make sure that you measure the motor speed when you increase this parameter value. Set this parameter to make the frequency reference and the slip compensation limit less than the permitted range of the machine.

The slip compensation limit is constant in the constant torque range (frequency reference ≤ *E1-06 [Base Frequency]*). In the constant output range where the frequency reference > *E1-06*, the slip compensation limit increases with the *C3-03* value and the output frequency as shown in Figure 12.9.

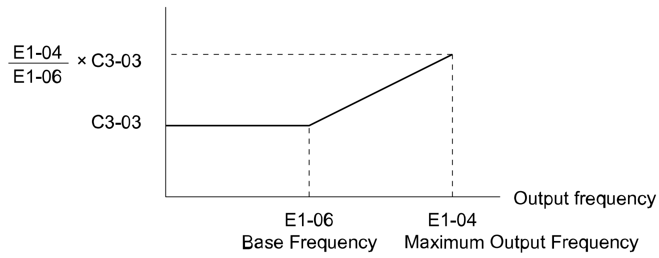


Figure 12.9 Slip Compensation Limit

■ C3-04: Slip Compensation at Regen

No. (Hex.)	Name	Description	Default (Range)
C3-04 (0212) Expert	Slip Compensation at Regen	V/f OLV CLV Sets the slip compensation function during regenerative operation.	0 (0 - 1)

If you apply a regenerative load when slip compensation function during regeneration is active, the quantity of regeneration can increase immediately. In this condition, it is necessary to use a dynamic braking option (braking resistor or braking resistor unit).

0 : Disabled

The drive does not provide slip compensation during regeneration.

The load and operation status (regenerative operation) can cause the motor speed to be higher or lower than the frequency reference.

1 : Enabled Above 6Hz

Slip compensation function is enabled during regeneration. Slip compensation is disabled at output frequencies of 6 Hz or less.

■ C3-05: Output Voltage Limit Selection

No. (Hex.)	Name	Description	Default (Range)
C3-05 (0213) Expert	Output Voltage Limit Selection	V/f OLV CLV Sets the automatic reduction of motor magnetic flux when the output voltage is saturated.	0 (0, 1)

The drive will decrease flux and increase current to compensate torque when voltage is saturated. Make sure that the drive has sufficient output current capacity before you enable this parameter. When this parameter = *1 [Enabled]*, the output current will increase by 10% at a maximum (at rated load) before it is enabled.

Enable this parameter to increase speed precision when you move heavy loads at high speeds in these conditions:

- Power supply voltage is low
- Motor rated voltage is high

Do not enable this parameter in these conditions:

- Operating a motor in the middle speed range or low speed range
- Power supply voltage is a minimum of 10% more than the motor rated voltage

When you enable this parameter, if the power supply voltage is much less than the motor rated voltage, torque control will not be accurate.

0 : Disabled

1 : Enabled

◆ C4: Torque Compensation

Torque compensation is a function that increases voltage to increase output torque as compensation for insufficient torque production at start-up or low-speed operation.

Voltage drops due to motor winding resistance cause torque generating voltage to decrease, which causes insufficient torque. If the main circuit cable connecting the drive and motor is long, this can also cause insufficient torque due to voltage drops.

Note:

Set the motor parameters and V/f pattern properly before setting *C4 parameters*.

■ C4-01: Torque Compensation Gain

No. (Hex.)	Name	Description	Default (Range)
C4-01 (0215) RUN	Torque Compensation Gain	V/f OLV CLV Sets the gain for the torque compensation function.	1.00 (0.00 - 2.50)

For these control methods and states, adjust the setting value.

A1-02 [Control Method Selection]	Status	Adjustment
0 [V/f Control]	Torque is not sufficient during low-speed operation of 10 Hz or less.	Increase the setting in 0.05-unit increments.
	There is vibration in the motor or the motor hunts when operating the drive with a light load.	Decrease the setting in 0.05-unit decrements.
	The cable length between the drive and motor is too long.	Increase the setting in 0.05-unit increments.

Note:

- Adjust *C4-01* to make sure that output current is not more than the drive rated current while the drive operates at low speed.
- When *A1-02 = 2 [Open Loop Vector]*, do not change this parameter under normal conditions. Torque accuracy will decrease.

■ C4-02: Torque Compensation Delay Time

No. (Hex.)	Name	Description	Default (Range)
C4-02 (0216) RUN	Torque Compensation Delay Time	V/f OLV CLV Sets the torque compensation delay time. Usually it is not necessary to change this setting.	Determined by A1-02 (0 - 60000 ms)

Set this parameter in these conditions:

- If there is vibration in the motor, increase the setting.
- If the motor speed or motor torque response is too slow, decrease the setting.

■ C4-03: Torque Compensation @ FWD Start

No. (Hex.)	Name	Description	Default (Range)
C4-03 (0217) Expert	Torque Compensation @ FWD Start	V/f OLV CLV Set the amount of torque reference for forward start as a percentage of the motor rated torque.	0.0% (0.0 - 200.0%)

The torque compensation function is performed using the time constant set in *C4-05 [Torque Compensation Time]*.

This is available only when you start the motor with the forward Up/Down command. Set this parameter to 0.0 to disable this function.

■ C4-04: Torque Compensation @ REV Start

No. (Hex.)	Name	Description	Default (Range)
C4-04 (0218) Expert	Torque Compensation @ REV Start	V/f OLV CLV Sets the amount of torque reference for reverse start as a percentage of the motor rated torque.	0.0% (-200.0 - 0.0%)

The torque compensation function is performed using the time constant set in *C4-05 [Torque Compensation Time]*.

This is available only when you start the motor with the reverse Up/Down command. Set this parameter to 0.0 to disable this function.

C4-05: Torque Compensation Time

No. (Hex.)	Name	Description	Default (Range)
C4-05 (0219) Expert	Torque Compensation Time	V/f OLV CLV Sets the starting torque constant to use with *C4-03 and C4-04 [Torque Compensation @ FWD/ REV Start]*.	10 ms (0 - 200 ms)

C5: Speed Control Loop

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

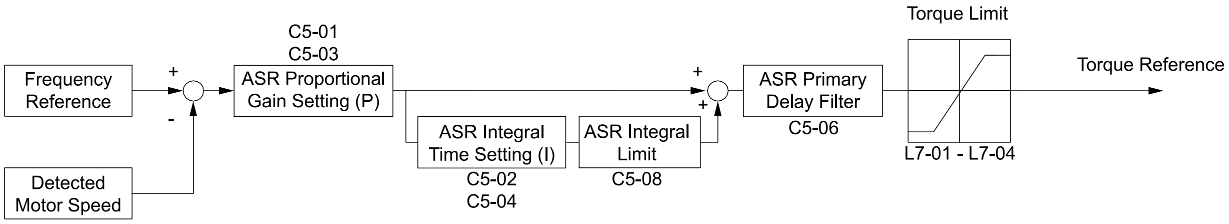


Figure 12.10 Speed Control Block Diagram

Adjusting the Speed Control Loop Parameters

Perform Auto-Tuning and set up all motor data correctly prior to adjusting Speed Control Loop parameters.

Analog output signals should be used to monitor the speed reference after softstarter (U1-16) and the motor speed (U1-05) when adjusting the Speed Control Loop. Refer to H4: Multi-Function Analog Outputs on page 134 for details on setting up analog output functions.

Generally when tuning the Speed Control Loop, first optimize the Speed Control Loop gain, then adjust the integral time settings. Always make adjustments with the load connected to the motor.

The drive provides three different gain and integral time settings for the speed loop. They are automatically switched over if the switching speed in parameter C5-07 is set larger than 0%. If no switching speed is defined (C5-07 = 0) the drive will use one set of speed loop parameters only (C5-01 and C5-02).

However, in order to achieve adequate performance in all sections of a trip, for the most installations it will be necessary to use two or all three sets of speed loop settings.

Speed Control Loop Adjustment Procedure

Do this procedure to adjust Speed Control Loop parameters:

1. Check parameter C5-07 and set a speed loop setting switching point.
2. Start a trip and check for any problems like rollback, vibration, overshoot, etc.
3. Adjust C5-03 and C5-04 in order to improve the performance at start. Increase C5-03, then shorten C5-04 if the speed response is slow. Set them in the opposite way if vibration occurs.
   If undershoot occurs at stop, decrease *C5-03* and increase *C5-04*.
4. Adjust C5-01 and C5-02 in order to solve problems that occur at speeds higher than C5-07. Increase C5-01, then shorten C5-02 if overshoot when reaching the top speed occurs.
   If overshooting occurs when acceleration ends, decrease the value set in *C5-01* and increase the value set in *C5-02*.
5. Adjust C5-13 and C5-14 in order to improve the stopping behavior. Increase C5-13, then shorten C5-14 if the landing accuracy is poor. Adjust them in the opposite way if vibrations occur.
6. Repeat steps 2 to 5 until the desired riding comfort has been reached.

C5-01: Speed Control Loop Proportional Gain 1

No. (Hex.)	Name	Description	Default (Range)
C5-01 (021B) RUN	Speed Control Loop Proportional Gain 1	V/f OLV CLV Sets the gain to adjust Speed Control Loop response.	Determined by A1-02 (0.00 - 300.00)

A higher gain provides a higher speed response. Usually, the gain increases with larger loads. Too much gain will cause vibration.

Note:
- The drive usually sets Motor 1 ASR with *C5-01* and *C5-02 [Speed Control Loop Integral Time 1]*. When you set *H1-xx = 77 [MFDI Function Select = Speed Control Loop Gain Switch]*, you can switch between *C5-01* and *C5-03 [Speed Control Loop Proportional Gain 2]*. You can also use *C5-01* as an alternative to *C5-03* and *C5-02* as an alternative to *C5-04* when the speed is less than or equal to the speed set in *C5-07 [Speed Control Settings Switching Speed]*.
- The drive automatically adjusts *C5-01* in ASR Tuning.

■ C5-02: Speed Control Loop Integral Time 1

No. (Hex.)	Name	Description	Default (Range)
C5-02 (021C) RUN	Speed Control Loop Integral Time 1	V/f OLV CLV Sets the Speed Control Loop integral time.	Determined by A1-02 (0.000 - 60.000 s)

When you increase the integral time, the responsiveness will decrease. An integral time that is too short can cause oscillation.

■ C5-03: Speed Control Loop Proportional Gain 2

No. (Hex.)	Name	Description	Default (Range)
C5-03 (021D) RUN	Speed Control Loop Proportional Gain 2	V/f OLV CLV Sets the gain to adjust Speed Control Loop response.	Determined by A1-02 (0.00 - 300.00)

A higher gain provides a higher speed response. Usually, the gain increases with larger loads. Too much gain will cause vibration.

■ C5-04: Speed Control Loop Integral Time 2

No. (Hex.)	Name	Description	Default (Range)
C5-04 (021E) RUN	Speed Control Loop Integral Time 2	V/f OLV CLV Sets the Speed Control Loop integral time.	Determined by A1-02 (0.000 - 60.000 s)

When you increase the integral time, the responsiveness will decrease. An integral time that is too short can cause oscillation.

■ C5-06: Speed Control Loop Delay Time Constant

No. (Hex.)	Name	Description	Default (Range)
C5-06 (0220)	Speed Control Loop Delay Time Constant	V/f OLV CLV Sets the filter time constant of the torque reference output from the speed loop. Usually it is not necessary to change this setting.	0.004 (0.000 - 0.500 s)

If you have a load with low rigidity or if oscillation is a problem, decrease *C5-01* in 2-unit decrements or decrease *C5-06* in 0.001-unit decrements.

■ C5-07: Speed Control Settings Switching Speed

No. (Hex.)	Name	Description	Default (Range)
C5-07 (0221)	Speed Control Settings Switching Speed	V/f OLV CLV Sets the speed where the drive will switch between these parameters:	Determined by A1-02 (0.0 - 100.0%)

Switching the proportional gain and integral time in the low or high speed range can help to achieve optimal performance and riding comfort in all sections of a trip.

If C5-07 is set higher than 0% then the speed loop settings automatically change with the output speed as shown:

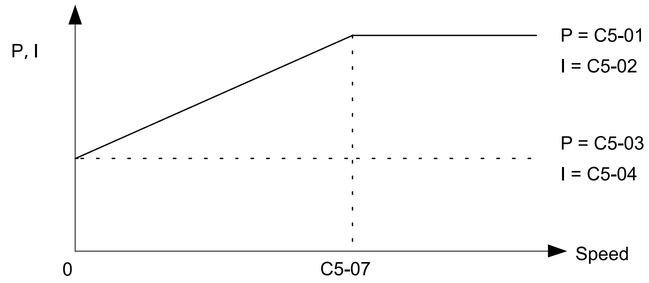


Figure 12.11 Settings at Low and High Speed during Acceleration

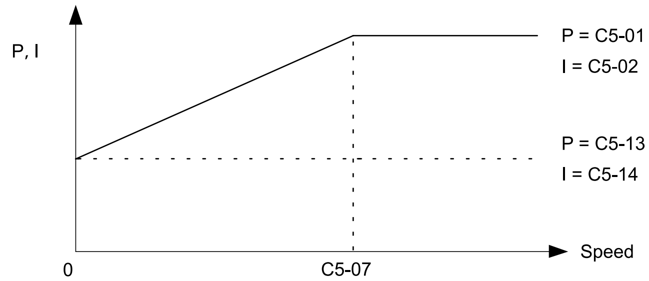


Figure 12.12 Settings at Low and High Speed during Deceleration, Leveling Speed is Selected

■ C5-08: ASR Integral Limit

No. (Hex.)	Name	Description	Default (Range)
C5-08 (0222) Expert	ASR Integral Limit	V/f OLV CLV Sets the upper limit of the ASR integral amount as a percentage of the rated load.	400% (0 - 400%)

■ C5-13: ASR Proportional Gain 3

No. (Hex.)	Name	Description	Default (Range)
C5-13 (0272) RUN	ASR Proportional Gain 3	V/f OLV CLV Sets the gain to adjust ASR response at leveling speed. The setting is active for deceleration only.	Determined by A1-02 (0.00 - 300.00)

■ C5-14: ASR Integral Time 3

No. (Hex.)	Name	Description	Default (Range)
C5-14 (0273) RUN	ASR Integral Time 3	V/f OLV CLV Sets the ASR integral time at leveling speed. The setting is active for deceleration only.	Determined by A1-02 (0.000 - 10.000 s)

■ C5-16: ASR Filter Time during Pos. Lock

No. (Hex.)	Name	Description	Default (Range)
C5-16 (0271) Expert	ASR Filter Time during Pos. Lock	V/f OLV CLV Sets a delay to the torque command output from speed control loop during Position Lock. Usually it is not necessary to change this setting.	0.000 s (0.000 - 0.500 s)

If vibration is a problem, increase this parameter gradually in 0.01-unit increments.

■ C5-19: ASR P Gain during Position Lock

No. (Hex.)	Name	Description	Default (Range)
C5-19 (0274) RUN	ASR P Gain during Position Lock	V/f OLV CLV Sets the Speed Control Loop Proportional gain used during Position Lock.	Determined by A1-02 (0.00 - 300.00)

- If the motor rolls back immediately after the brake releases, increase this parameter, and decrease *C5-20 [ASR I Time during Position Lock]*.
- If vibrations occur, decrease this parameter, and increase *C5-20*.

C5-20: ASR I Time during Position Lock

No. (Hex.)	Name	Description	Default (Range)
C5-20 (0275) RUN	ASR I Time during Position Lock	V/f OLV CLV Sets the Speed Control Loop Integral time used during Position Lock.	0.100 s (0.000 - 10.000 s)

- If the motor rolls back immediately after the brake releases, increase *C5-19 [ASR P Gain during Position Lock]*, and decrease this parameter.
- If vibrations occur, decrease *C5-19*, and increase this parameter.

C5-29: Speed Control Response

No. (Hex.)	Name	Description	Default (Range)
C5-29 (0B18) Expert	Speed Control Response	V/f OLV CLV Sets the level of speed control responsiveness. Usually it is not necessary to change this setting.	1 (0, 1)

If a high level of speed control responsiveness is necessary, set *C5-29 = 1*,then adjust the speed control (ASR) parameter.

0 : Standard

1 : High Performance 1

C5-50: Notch Filter Frequency

No. (Hex.)	Name	Description	Default (Range)
C5-50 (0B14) Expert	Notch Filter Frequency	V/f OLV CLV Sets the machine resonance frequency.	0 Hz (0, or 20 to 1000 Hz)

Machine resonance can cause high-frequency noise and vibration during operation. A notch filter can help prevent the noise and vibration. Notch filters set the resonant frequency of the machine to remove specific vibrational frequency components caused by machine resonance.

Note:
- Correctly set the value for the notch filter frequency. If the frequency value is too low for the speed loop response frequency, the speed control function will not function correctly. Set the frequency to be a minimum of 4 times the speed loop response frequency.
- Set *C5-50 = 0 [0 Hz]* to disable the notch filter.

C5-51: Notch Filter Bandwidth

No. (Hex.)	Name	Description	Default (Range)
C5-51 (0B15) Expert	Notch Filter Bandwidth	V/f OLV CLV Sets the notch width of the notch filter.	1.0 (0.5 - 5.0)

Note:

Set *C5-50 = 0 [Notch Filter Frequency = 0 Hz]* to disable the notch filter.

C6: Carrier Frequency

C6 parameters are used to set the selection of carrier frequency.

C6-03: Carrier Frequency Upper Limit

No. (Hex.)	Name	Description	Default (Range)
C6-03 (0225)	Carrier Frequency Upper Limit	V/f OLV CLV Sets the carrier frequency upper limit.	Determined by o2-04 (1.0 - 15.0 kHz)

C6-06: PWM Modulation Method

No. (Hex.)	Name	Description	Default (Range)
C6-06 (0228) Expert	PWM Modulation Method	V/f OLV CLV Sets PWM modulation method.	0 (0, 2)

0 : 2/3 Phase Auto-Modulation

2 : 3-Phase Modulation

Note:

The continuous rated output current of the drive is decreased with setting 2. Contact Yaskawa or your nearest sales representative for more information.

C6-07: 2/3 Phase Switchover Level

No. (Hex.)	Name	Description	Default (Range)
C6-07 (0229) Expert	2/3 Phase Switchover Level	V/f OLV CLV Sets the carrier frequency to 2/3 of the set carrier level.	1.5 (0.5 - 3.0)

The switching level is a point where output voltage < on delay time / carrier period × 200 V × 1.5 × *C6-07*.

When *C6-07 = 0*, the modulation method of PWM at low speed is 3-phase modulation.

C6-09: Carrier Freq at Rotational Tune

No. (Hex.)	Name	Description	Default (Range)
C6-09 (022B) Expert	Carrier Freq at Rotational Tune	V/f OLV CLV Sets the Auto-Tuning carrier frequency. Usually it is not necessary to change this setting.	0 (0, 1)

If you set *C6-09 = 0* for a high-frequency or low-impedance motor, it can cause *oC [Overcurrent]*. To prevent *oC*, set the carrier frequency to a high value and set *C6-09 = 1* before you do Auto-Tuning.

0 : 5kHz

Note:

When *A1-02 = 7 [Control Method Selection = CLV/PM]*, the carrier frequency is 2 kHz.

1 : use C6-03

C6-21: Carrier Frequency @ Inspection

No. (Hex.)	Name	Description	Default (Range)
C6-21 (0245) Expert	Carrier Frequency @ Inspection	V/f OLV CLV Sets the carrier frequency during Inspection Operation.	1 (0, 1)

0 : Use the value set to C6-03

1 : 2 kHz

C6-34: Carrier Freq Reduce Start Level

No. (Hex.)	Name	Description	Default (Range)
C6-34 (116E) Expert	Carrier Freq Reduce Start Level	V/f OLV CLV Sets the level of the overload totalizer at which the drive starts to decrease the carrier frequency to the value set in *L8-39 [Reduced Carrier Frequency]*.	50% (5 - 90%)

12.4 d: References

d parameters [References] set the frequency reference input method and dead band range. They also set torque control, field weakening, and field forcing functions.

⚠ WARNING Sudden Movement Hazard
Use fast stop circuits to safely and quickly stop the drive. After you wire the fast stop circuits, you must check their operation. Test the operation of the fast stop function before you use the drive.
If you do not test the fast stop circuit before you operate the drive, it can cause serious injury or death.

⚠ WARNING Sudden Movement Hazard
You must install external safety circuitry. The drive does not have protection against accidental load drops. Install electrical and/or mechanical safety circuit mechanisms that are isolated from the drive circuitry.
If you do not use external safety circuitry, the drive could drop the load and cause serious injury or death.

◆ d1: Speed Reference

■ d1-01: Speed Reference 1

No. (Hex.)	Name	Description	Default (Range)
d1-01 (0280) RUN	Speed Reference 1	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)

■ d1-02: Speed Reference 2

No. (Hex.)	Name	Description	Default (Range)
d1-02 (0281) RUN	Speed Reference 2	V/f OLV CLV Sets the speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)

■ d1-03: Speed Reference 3

No. (Hex.)	Name	Description	Default (Range)
d1-03 (0282) RUN	Speed Reference 3	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)

■ d1-04: Speed Reference 4

No. (Hex.)	Name	Description	Default (Range)
d1-04 (0283) RUN	Speed Reference 4	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)

■ d1-05: Speed Reference 5

No. (Hex.)	Name	Description	Default (Range)
d1-05 (0284) RUN	Speed Reference 5	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)

d1-06: Speed Reference 6

No. (Hex.)	Name	Description	Default (Range)
d1-06 (0285) RUN	Speed Reference 6	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)

d1-07: Speed Reference 7

No. (Hex.)	Name	Description	Default (Range)
d1-07 (0286) RUN	Speed Reference 7	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)

d1-08: Speed Reference 8

No. (Hex.)	Name	Description	Default (Range)
d1-08 (0287) RUN	Speed Reference 8	V/f OLV CLV Sets the Speed reference in the units from *o1-03 [Frequency Display Unit Selection]*.	0.00 Hz (0.00 - 120.00 Hz)

d1-18: Spd Ref Sel Mode

No. (Hex.)	Name	Description	Default (Range)
d1-18 (02C0)	Speed Reference Selection Mode	V/f OLV CLV Sets the priority of the speed reference digital inputs.	1 (0 - 1)

0 : Use Multi-Speed references d1-01 to d1-08

Up to eight separate preset speed references can be programmed to the drive using parameters d1-01 through d1-08 and can be selected using binary coded digital inputs. When *d1-18 = 0*, parameters d1-19 through d1-23 are not displayed.

1 : High speed reference has priority

Six different speeds (d1-19 to d1-23, d1-26) can be programmed to the drive and can be selected using dedicated digital inputs. Each of the speed references set to d1-19 through d1-23 takes priority over the leveling speed set to d1-26. When *d1-18 = 1*, parameter d1-01 to d1-08 are not displayed.

d1-19: Nominal Speed

No. (Hex.)	Name	Description	Default (Range)
d1-19 (02C1) RUN	Nominal Speed	V/f OLV CLV Sets the speed reference when multi-function input “Nominal Speed” is on.	50.00 Hz (0.00 - 120.00 Hz)

d1-20: Intermed Speed 1

No. (Hex.)	Name	Description	Default (Range)
d1-20 (02C2) RUN	Intermediate Speed 1	V/f OLV CLV Sets the speed reference when intermediate speed 1 is selected by digital inputs.	0.00 Hz (0.00 - 120.00 Hz)

d1-21: Intermed Speed 2

No. (Hex.)	Name	Description	Default (Range)
d1-21 (02C3) RUN	Intermediate Speed 2	V/f OLV CLV Sets the speed reference when intermediate speed 2 is selected by digital inputs.	0.00 Hz (0.00 - 120.00 Hz)

d1-22: Intermed Speed 3

No. (Hex.)	Name	Description	Default (Range)
d1-22 (02C4) RUN	Intermediate Speed 3	V/f OLV CLV Sets the speed reference when intermediate speed 3 is selected by digital inputs.	0.00 Hz (0.00 - 120.00 Hz)

d1-23: Releveling Speed

No. (Hex.)	Name	Description	Default (Range)
d1-23 (02C5) RUN	Releveling Speed	V/f OLV CLV Sets the speed reference when releveling speed is selected by digital inputs.	0.00 Hz (0.00 - 120.00 Hz)

d1-24: Inspect Oper Spd

No. (Hex.)	Name	Description	Default (Range)
d1-24 (02C6) RUN	Inspect Oper Spd	V/f OLV CLV Sets the speed reference when inspection speed is selected by digital inputs.	30.00 Hz (0.00 - 120.00 Hz)

d1-25: Rescue Oper Spd

No. (Hex.)	Name	Description	Default (Range)
d1-25 (02C7) RUN	Rescue Oper Spd	V/f OLV CLV Sets the speed reference when rescue speed is selected by digital inputs.	5.00 Hz (0.00 - 15.00 Hz)

d1-26: Leveling Speed

No. (Hex.)	Name	Description	Default (Range)
d1-26 (02C8) RUN	Leveling Speed	V/f OLV CLV Sets the speed reference when leveling speed is selected by digital inputs.	4.00 Hz (0.00 - 120.00 Hz)

d1-28: Nom/Lev Spd Det

No. (Hex.)	Name	Description	Default (Range)
d1-28 (02CA)	Nom/Lev Spd Det	V/f OLV CLV Sets the speed reference level to detect that leveling speed has been selected when multi speed input commands are used.	0.00 Hz (0.00 - 120.00 Hz)

d1-29: Inspect Spd Det

No. (Hex.)	Name	Description	Default (Range)
d1-29 (02CB)	Inspect Spd Det	V/f OLV CLV Sets the speed reference level to detect that inspection speed has been selected when multi speed input commands are used.	0.00 Hz (0.00 - 120.00 Hz)

12.5 E: Motor Parameters

E parameters cover drive input voltage, V/f pattern, and motor parameters.

◆ E1: V/f Pattern for Motor 1

E1 parameters set the drive input voltage and motor V/f characteristics. To switch drive operation from one motor to another motor, set the V/f characteristics for motor 1.

■ E1-01: Input AC Supply Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-01 (0300)	Input AC Supply Voltage	V/f OLV CLV Sets the drive input voltage.	200 V Class: 230 V, 400 V: 400 V (200 V Class: 155 - 255 V, 400 V Class: 310 - 510 V)

NOTICE Damage to Equipment
Set *E1-01 [Input AC Supply Voltage]* to align with the drive input voltage (not motor voltage). If this parameter is incorrect, the protective functions of the drive will not operate correctly and it can cause damage to the drive.

Values Related to the Drive Input Voltage

The value set in *E1-01* is the base value that the drive uses for the motor protective functions in Table 12.5. With a 400 V class drive, the detection level changes for some motor protective functions.

Table 12.5 Values Related to the Drive Input Voltage

Voltage	E1-01 Setting	Approximate Values		
		ov Detection Level	BTR Operation Level (rr Detection Level) *1	L2-05 [Undervoltage Detection Lvl (Uv1)]
400 V class	Setting value ≥ 400 V	820 V	788 V	380 V
	Setting value < 400 V	820 V	788 V	350 V

*1 This is the protection function enabled in drives with built-in braking transistors. These values show the level that will trigger the built-in braking transistor. Refer to “YASKAWA AC Drive 72060001 Series Option Braking Unit and Braking Resistor Unit Installation Manual (TOBPC72060001)” for more information.

■ E1-04: Maximum Output Frequency

No. (Hex.)	Name	Description	Default (Range)
E1-04 (0303)	Maximum Output Frequency	V/f OLV CLV Sets the maximum output frequency for the V/f pattern.	Determined by A1-02 (10.0 - 120.0 Hz)

■ E1-05: Maximum Output Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-05 (0304)	Maximum Output Voltage	V/f OLV CLV Sets the maximum output voltage for the V/f pattern.	200 V Class: 190 V, 400 V Class: 380.0 V (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)

■ E1-06: Base Frequency

No. (Hex.)	Name	Description	Default (Range)
E1-06 (0305)	Base Frequency	V/f OLV CLV Sets the base frequency for the V/f pattern.	Determined by A1-02 (0.0 - 120.0 Hz)

E1-07: Middle Output Frequency

No. (Hex.)	Name	Description	Default (Range)
E1-07 (0306)	Middle Output Frequency	V/f OLV CLV Sets a middle output frequency for the V/f pattern.	Determined by A1-02 (0.0 - 120.0 Hz)

E1-08: Middle Output Frequency Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-08 (0307)	Middle Output Frequency Voltage	V/f OLV CLV Sets a middle output voltage for the V/f pattern.	Determined by A1-02 and o2-04 (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)

Note:

Default setting is determined by *A1-02 [Control Method Selection]*, and *o2-04 [Drive Model Selection]*.

E1-09: Minimum Output Frequency

No. (Hex.)	Name	Description	Default (Range)
E1-09 (0308)	Minimum Output Frequency	V/f OLV CLV Sets the minimum output frequency for the V/f pattern.	Determined by A1-02 (0.0 - 120.0 Hz)

E1-10: Minimum Output Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-10 (0309)	Minimum Output Voltage	V/f OLV CLV Sets the minimum output voltage for the V/f pattern.	Determined by o2-04 (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)

E1-11: Middle Output Frequency 2

No. (Hex.)	Name	Description	Default (Range)
E1-11 (030A) Expert	Middle Output Frequency 2	V/f OLV CLV Sets a middle output frequency for the V/f pattern.	0.0 Hz (0.0 - 120.0 Hz)

Note:

Set this parameter to *0.0 Hz* to disable the function.

E1-12: Middle Output Frequency Voltage 2

No. (Hex.)	Name	Description	Default (Range)
E1-12 (030B) Expert	Middle Output Frequency Voltage 2	V/f OLV CLV Sets a middle point voltage for the V/f pattern.	0.0 V (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)

Note:

Set this parameter to *0.0 V* to disable the function.

E1-13: Base Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-13 (030C) Expert	Base Voltage	V/f OLV CLV Sets the base voltage for the V/f pattern.	0.0 V (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)

Note:

- After Auto-Tuning, the value of *E1-13 = E1-05 [Maximum Output Voltage]*.
- When *E1-13 = 0.0*, use the value of *E1-05* to control the voltage.

◆ E2: Motor Parameters

E2 parameters [Motor Parameters] are used to set induction motor data. To switch drive operation from one motor to another motor, configure the first motor (motor 1).

If Auto-Tuning cannot be performed, set the *E2 parameters* manually. Performing Auto-Tuning automatically sets the *E2 parameters* to the optimal values.

■ E2-01: Motor Rated Current (FLA)

No. (Hex.)	Name	Description	Default (Range)
E2-01 (030E)	Motor Rated Current (FLA)	V/f OLV CLV Sets the motor rated current in amps.	Determined by o2-04 (10% to 200% of the drive rated current)

Note:
- If *E2-01 < E2-03 [Motor No-Load Current]*, the drive will detect *oPE02 [Parameter Range Setting Error]*.
- When the drive model changes, the display units for this parameter also change.
  – 0.01 A: 4009
  – 0.1 A: 4015 to 4045

The value set for *E2-01* becomes the reference value for motor protection and the torque limit. Enter the motor rated current written on the motor nameplate. Auto-Tuning the drive will automatically set *E2-01* to the value input for *T1-04 [Motor Rated Current]*.

■ E2-02: Motor Rated Slip

No. (Hex.)	Name	Description	Default (Range)
E2-02 (030F)	Motor Rated Slip	V/f OLV CLV Sets motor rated slip.	Determined by o2-04 (0.00 - 20.00 Hz)

This parameter value becomes the base slip compensation value. The drive automatically sets this parameter during Auto-Tuning. When you cannot do Auto-Tuning, calculate the motor rated slip with the information on the motor nameplate and this formula:

E2-02 = f - (n × p) / 120

- f: Motor rated frequency (Hz)
- n: Rated motor speed (min^{-1} (r/min))
- p: Number of motor poles

■ E2-03: Motor No-Load Current

No. (Hex.)	Name	Description	Default (Range)
E2-03 (0310)	Motor No-Load Current	V/f OLV CLV Sets the no-load current for the motor in amps when operating at the rated frequency and the no-load voltage.	Determined by o2-04 (0 to E2-01)

Note:
When the drive model changes, the display units for this parameter also change.
- 0.01 A: 4009
- 0.1 A: 4015 - 4045

The drive automatically sets this parameter during Auto-Tuning. When you cannot do Auto-Tuning, you can also use the motor no-load current on the motor test report to enter this value manually. Get the test report from the motor manufacturer.

Note:
The default setting of the no-load current is for a 4-pole motor recommended by Yaskawa.

■ E2-04: Motor Pole Count

No. (Hex.)	Name	Description	Default (Range)
E2-04 (0311)	Motor Pole Count	V/f OLV CLV Sets the number of motor poles.	4 (2 - 48)

Auto-Tuning automatically sets this parameter to the value of [Number of Motor Poles].

■ E2-05: Motor Line-to-Line Resistance

No. (Hex.)	Name	Description	Default (Range)
E2-05 (0312)	Motor Line-to-Line Resistance	V/f OLV CLV Sets the line-to-line resistance for the motor stator windings.	Determined by o2-04 (0.000 - 65.000 Ω)

Note:

This value is the motor line-to-line resistance. Do not set this parameter with the per-phase resistance.

Auto-Tuning automatically sets this parameter. If you cannot do Auto-Tuning, use the test report from the motor manufacturer to configure the settings. You can calculate the motor line-to-line resistance with one of these formulas:

- E-type insulation: [the resistance value (Ω) shown on the test report at 75 °C] × 0.92
- B-type insulation: [the resistance value (Ω) shown on the test report at 75 °C] × 0.92
- F-type insulation: [the resistance value (Ω) shown on the test report at 115 °C] × 0.87

■ E2-06: Motor Leakage Inductance

No. (Hex.)	Name	Description	Default (Range)
E2-06 (0313)	Motor Leakage Inductance	V/f OLV CLV Sets the voltage drop from motor leakage inductance when the motor is operating at the rated frequency and rated current. This value is a percentage of Motor Rated Voltage.	Determined by o2-04 (0.0 - 60.0%)

The drive automatically sets this parameter during Auto-Tuning.

Note:

The motor nameplate does not usually show the quantity of voltage drop. If you do not know the value of the motor leakage inductance, contact the motor manufacturer to receive a copy of the motor test report.

■ E2-07: Motor Saturation Coefficient 1

No. (Hex.)	Name	Description	Default (Range)
E2-07 (0314)	Motor Saturation Coefficient 1	V/f OLV CLV Sets the motor iron-core saturation coefficient at 50% of the magnetic flux.	0.50 (0.00 - 0.50)

The drive uses this coefficient when it operates with constant output. The drive uses this coefficient when it operates the motor in the constant output range.

■ E2-08: Motor Saturation Coefficient 2

No. (Hex.)	Name	Description	Default (Range)
E2-08 (0315)	Motor Saturation Coefficient 2	V/f OLV CLV Sets the motor iron-core saturation coefficient at 75% of the magnetic flux.	0.75 (E2-07 - 0.75)

The drive uses this coefficient when it operates with constant output. The drive uses this coefficient when it operates the motor in the constant output range.

■ E2-09: Motor Mechanical Loss

No. (Hex.)	Name	Description	Default (Range)
E2-09 (0316) Expert	Motor Mechanical Loss	V/f OLV CLV Sets the mechanical loss of the motor. It is set as a percentage of *E2-11 [Motor Rated Power]*. Usually it is not necessary to change this setting.	0.0% (0.0 - 10.0%)

Adjust this parameter in these conditions. The drive adds the configured mechanical loss to the torque reference value as a torque compensation value:

- There is a large quantity of torque loss from motor bearing friction.
- There is a large quantity of torque loss in fans and pumps.

■ E2-10: Motor Iron Loss

No. (Hex.)	Name	Description	Default (Range)
E2-10 (0317)	Motor Iron Loss	V/f OLV CLV Sets the motor iron loss.	Determined by o2-04 (0 - 65535 W)

■ E2-11: Motor Rated Power

No. (Hex.)	Name	Description	Default (Range)
E2-11 (0318)	Motor Rated Power	V/f OLV CLV Sets the motor rated output in the units from *o1-58 [Motor Power Unit Selection]*.	Determined by o2-04 (0.00 - 650.00 kW)

The drive automatically sets this parameter to the value input for "Motor Rated Power" during Auto-Tuning.

12.6 F: Simple Feedback Settings

◆ F1: Encoder/PG Feedback Settings

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

■ F1-02: Operation Selection at PG Open Circuit (PGo)

No. (Hex.)	Name	Description	Default (Range)
F1-02 (0300) Expert	Operation Selection at PG Open Circuit (PGo)	V/f OLV CLV Sets stopping method for a PGo fault.	1 (0 - 3)

0 : Ramp to stop (uses the deceleration ramp set to C1-02)

1 : Coast to Stop

2 : Fast Stop (uses the Fast Stop ramp set to C1-09)

3 : Alarm Only

Note:

Due to potential damage to motor and machinery, the “Alarm only” setting should be used only under special circumstances.

■ F1-03: Operation Selection at Overspeed (oS)

No. (Hex.)	Name	Description	Default (Range)
F1-03 (0304) Expert	Operation Selection at Overspeed (oS)	V/f OLV CLV Sets the stopping method for an oS fault.	1 (0 - 3)

0 : Ramp to stop (uses the deceleration ramp set to C1-02)

1 : Coast to Stop

2 : Fast Stop (uses the Fast Stop ramp set to C1-09)

3 : Alarm Only

Note:

Due to potential damage to motor and machinery, the “Alarm only” setting should be used only under special circumstances.

■ F1-04: Operation Selection at Deviation

No. (Hex.)	Name	Description	Default (Range)
F1-04 (0304) Expert	Operation Selection at Deviation	V/f OLV CLV Sets the stopping method for a speed deviation fault.	3 (0 - 3)

0 : Ramp to stop (uses the deceleration ramp set to C1-02)

1 : Coast to Stop

2 : Fast Stop (uses the Fast Stop ramp set to C1-09)

3 : Alarm Only

Drive continues operating while “dEv” flashes on the screen.

■ F1-05: Encoder 1 Rotation Selection

No. (Hex.)	Name	Description	Default (Range)
F1-05 (0384)	Encoder 1 Rotation Selection	V/f OLV CLV Sets the output sequence for the A and B pulses from the encoder, assuming that the motor is operating in the up direction.	0 (0, 1)

Refer to the option card installation manual for more information about how to set the encoder pulse output sequence and make sure that it is correct.

0 : Pulse A leads in Up Direction

1 : Pulse B leads in Up Direction

■ F1-08: Overspeed Detection Level

No. (Hex.)	Name	Description	Default (Range)
F1-08 (0300) Expert	Overspeed Detection Level	V/f OLV CLV Sets the speed feedback value limit before the drives triggers an oS fault.	115% (0 - 120%)

■ F1-09: Overspeed Detection Delay Time

No. (Hex.)	Name	Description	Default (Range)
F1-09 (0300) Expert	Overspeed Detection Delay Time	V/f OLV CLV Sets the time limit before the drives triggers an oS fault.	0.0 s (0.0 - 2.0 s)

■ F1-10: Excessive Speed Deviation Detection Level

No. (Hex.)	Name	Description	Default (Range)
F1-10 (0300) Expert	Excessive Speed Deviation Detection Level	V/f OLV CLV Sets the limit before the drives triggers an dEv error. The limit is determined by the difference between the speed reference and the speed feedback.	10% (0 - 50%)

■ F1-11: Excessive Speed Deviation Detection Delay Time

No. (Hex.)	Name	Description	Default (Range)
F1-11 (0300) Expert	Excessive Speed Deviation Detection Delay Time	V/f OLV CLV Sets the time limit before the drives triggers an dEv error.	0.5 s (0.0 - 10.0 s)

■ F1-14: PG Open-Circuit Detection Time

No. (Hex.)	Name	Description	Default (Range)
F1-14 (0300) Expert	PG Open-Circuit Detection Time	V/f OLV CLV Sets the time limit before the drives triggers a PGo fault.	2.0 s (0.0 - 10.0 s)

■ F1-49: PGo Fault Threshold

No. (Hex.)	Name	Description	Default (Range)
F1-49 (380D) Expert	PGo Fault Threshold	V/f OLV CLV Detects missing A/B track PG input pulses on JOHB-PGX3-AE option card, even if one line connection is missing (especially A- or B-).	1.0 Hz (0.1 - 10.0 Hz)

◆ F5: Digital Output Option

F5 parameters set the output mode and function of output signals when you use digital output option card DO-A3.

When you install a DO-A3 to the drive, you can output isolated digital signals to monitor the drive operation status.

- 6 points of photocoupler output (48 V, 50 mA or less)
- 2 points of relay contact output (250 Vac, 30 Vdc: 1 A or less)

Refer to the DO-A3 option manual for more information about how to install, wire, and set the DO-A3 card.

■ F5-07: Terminal M1-M2 Function Select

No. (Hex.)	Name	Description	Default (Range)
F5-07 (039F) Expert	Terminal M1-M2 Function Select	V/f OLV CLV Sets the function of terminal M1-M2 on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = Programmable (F5-01 to F5-08)]* to enable this function.	F (0 - 1FF)

12.7 H: Terminal Function Selection

H parameters set functions for external input and output terminals.

◆ H1: Digital Inputs

H1 Parameters set the MFDI terminal functions.

■ H1-03 to H1-07 Terminal S3 to S7 Function Selection

The drive has 7 MFDI terminals. Refer to Table 12.6 for drive default settings and functions.

Table 12.6 MFDI Default Settings and Functions

No.	Name	Default	Function
H1-01	Term S1 Function Selection	40	Up Command
H1-02	Term S2 Function Selection	41	Down Command
H1-03	Term S3 Function Selection	50	Nominal Speed
H1-04	Term S4 Function Selection	54	Inspection Operation
H1-05	Term S5 Function Selection	51	Intermediate Speed
H1-06	Term S6 Function Selection	53	Leveling Speed
H1-07	Term S7 Function Selection	F	Not Used (Through Mode)

Refer to the Table 12.7 and use *H1-xx [MFDI Function Select]* to set the function.

Table 12.7 MFDI Setting Values

Setting Value	Function	Reference	Setting Value	Function	Reference
3	Multi-Step Speed Reference 1	335	40	Up Command	339
4	Multi-Step Speed Reference 2	335	41	Down Command	339
5	Multi-Step Speed Reference 3	335	50	Nominal Speed	339
7	Accel/Decel Time Selection 1	335	51	Intermediate Speed	339
8	Baseblock Command (N.O.)	336	52	Releveling Speed	339
9	Baseblock Command (N.C.)	336	53	Leveling Speed	340
F	Through Mode	336	54	Inspection Operation	340
14	Fault Reset	336	55	Rescue Operation	340
15	Fast Stop (N.O.)	337	56	Motor Contactor Feedback	340
17	Fast Stop (N.C.)	337	67	Communications Test Mode	340
18	Timer Function	337	79	Brake Feedback	340
1A	Accel/Decel Time Selection 2	338	103 - 179	Inverse Inputs of 1 to 79	-
20 to 2F	External fault	338			

■ H1-01: Terminal S1 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-01 (0438) Expert	Terminal S1 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S1.	40 (F, 40)

■ H1-02: Terminal S2 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-02 (0439) Expert	Terminal S2 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S2.	41 (F, 41)

H1-03: Terminal S3 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-03 (0400)	Terminal S3 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S3.	50 (3 - 79)

H1-04: Terminal S4 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-04 (0401)	Terminal S4 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S4.	54 (3 - 79)

H1-05: Terminal S5 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-05 (0402)	Terminal S5 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S5.	51 (3 - 79)

H1-06: Terminal S6 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-06 (0403)	Terminal S6 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S6.	53 (3 - 79)

H1-07: Terminal S7 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-07 (0404)	Terminal S7 Function Selection	V/f OLV CLV Sets the function for MFDI terminal S7.	F (3 - 79)

MFDI Setting Values

Selects a function for MFDI.

3: Multi-Step Speed Reference 1

Setting Value	Function	Description
3	Multi-Step Speed Reference 1	V/f OLV CLV Uses speed references *d1-01 to d1-08* to set a multi-step speed reference.

4: Multi-Step Speed Reference 2

Setting Value	Function	Description
4	Multi-Step Speed Reference 2	V/f OLV CLV Uses speed references *d1-01 to d1-08* to set a multi-step speed reference.

5: Multi-Step Speed Reference 3

Setting Value	Function	Description
5	Multi-Step Speed Reference 3	V/f OLV CLV Uses speed references *d1-01 to d1-08* to set a multi-step speed reference.

7: Accel/Decel Time Selection 1

Setting Value	Function	Description
7	Accel/Decel Time Selection 1	V/f OLV CLV Sets the drive to use *Acceleration/Deceleration Time 1 [C1-01, C1-02]* or *Acceleration/Deceleration Time 2 [C1-03, C1-04]*.

Note:

Refer to *C1: Accel & Decel Speed on page 312* for more information.

■ 8: Baseblock Command (N.O.)

Setting Value	Function	Description
8	Baseblock Command (N. O.)	V/f OLV CLV Sets the command that stops drive output and coasts the motor to stop when the input is ON.

The keypad flashes *bb [Baseblock]*. If you cancel the baseblock command when the Run command is active, the drive will restart the motor and use the speed search function.

⚠ WARNING Sudden Movement Hazard

When you use a mechanical holding brake with the drive, you must close the brake if an input terminal triggers the Baseblock command to stop drive output.
If you enter the baseblock command, the motor will suddenly coast and the load will slip, which can cause serious injury or death.

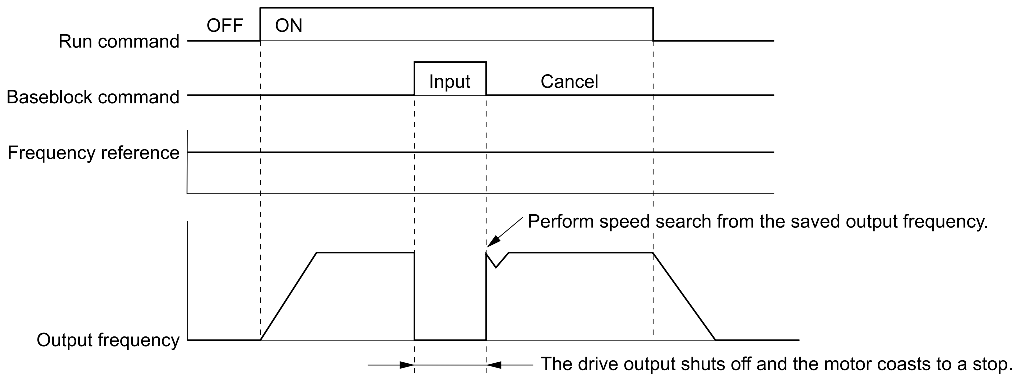


Figure 12.13 Baseblock Command Time Chart

ON : Baseblock (drive output stop)

OFF : Normal operation

■ 9: Baseblock Command (N.C.)

Setting Value	Function	Description
9	Baseblock Command (N. C.)	V/f OLV CLV Sets the command that stops drive output and coasts the motor to stop when the input terminal is OFF.

The keypad flashes *bb [Baseblock]*. If you cancel the baseblock command when the Run command is active, the drive will restart the motor and use the speed search function.

ON : Normal operation

OFF : Baseblock (drive output stop)

⚠ WARNING Sudden Movement Hazard

When you use a mechanical holding brake with the drive, you must close the brake if an input terminal triggers the Baseblock command to stop drive output.
If you enter the baseblock command, the motor will suddenly coast and the load will slip, which can cause serious injury or death.

■ F: Not Used

Setting Value	Function	Description
F	Not Used	V/f OLV CLV Use this setting for unused terminals or to use terminals in through mode.

■ 14: Fault Reset

Setting Value	Function	Description
14	Fault Reset	V/f OLV CLV Sets the command to reset the current fault when the Run command is inactive.

If the drive detects a fault, the drive will activate the fault relay output, turn off the output, and the motor will coast to stop.

If the drive detects a fault for which you can set the stopping method, apply the appropriate Stopping Method. Then push [>] (RESET) on the keypad to turn the Run command OFF, or activate the fault reset terminal to reset the fault.

Note:

The drive ignores the fault reset command when the Run command is active. Remove the Run command before trying to reset a fault.

■ 15: Fast Stop (N.O.)

Setting Value	Function	Description
15	Fast Stop (N.O.)	V/f OLV CLV Sets the command to ramp to stop in the deceleration time set in *C1-09 [Fast Stop Time]* when the input terminal is ON while the drive is operating.

If you cancel the fast stop input, the drive will not restart the motor until you meet these conditions:

- Fully stop the motor
- Cancel the Run command
- Cancel the fast stop command

Note:

- To use the N.C. switch to input the fast stop command, set 17 (Fast Stop (N.C.)).
- Refer to *C1-09: Fast Stop Ramp on page 314* for more information.
- Set *C1-09 [Fast Stop Time]* to a correct deceleration time. If the deceleration time is too short, it can cause an overvoltage fault and failure to stop the motor from coasting.

■ 17: Fast Stop (N.C.)

Setting Value	Function	Description
17	Fast Stop (N.C.)	V/f OLV CLV Sets the command to ramp to stop in the deceleration time set in *C1-09 [Fast Stop Time]* when the input terminal is ON while the drive is operating.

If you cancel the fast stop input, the drive will not restart the motor until you meet these conditions:

- Fully stop the motor
- Cancel the Run command
- Cancel the fast stop command

Note:

- To use the N.O. switch to input the fast stop command, set 15 (Fast Stop (N.O.)).
- Refer to *C1-09: Fast Stop Ramp on page 314* for more information.
- Set *C1-09 [Fast Stop Time]* to a correct deceleration time. If the deceleration time is too short, it can cause an overvoltage fault and failure to stop the motor from coasting.

Figure 12.14 shows an example of how fast stop operates.

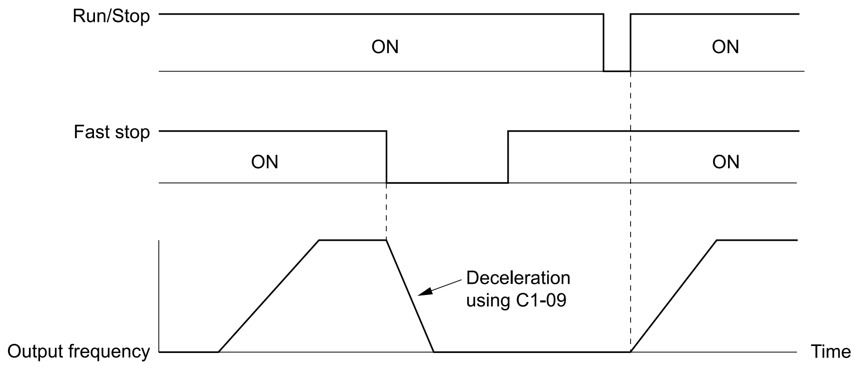


Figure 12.14 Fast Stop Time Chart

■ 18: Timer Function Input

Setting Value	Function	Description
18	Timer Function Input	V/f OLV CLV Triggers the timer set up by parameters *b4-01* and *b4-02*. Mist be set in conjunction with the timer function output *[H2-xx = 2]*.

Parameter Details

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■ 1A: Accel/Decel Time Selection 2

Setting Value	Function	Description
1 A	Accel/Decel Time Selection 2	V/f OLV CLV Set this function and *H1-xx = 7 [Accel/Decel Time Selection 1]* together. Sets the drive to use *Acceleration/Deceleration Time 3 [C1-05, C1-06]* or *Acceleration/Deceleration Time 4 [C1-07, C1-08]*.

Note:

Refer to *C1: Accel & Decel Speed on page 312* for more information.

■ 20 to 2F: External Fault

Setting Value	Function	Description
20 to 2F	External Fault	V/f OLV CLV Sets a command to stop the drive when a failure or fault occurs on an external device.

⚠ WARNING Incorrect Operation

Yaskawa recommends that you use *H1-xx = 21, 23, 25, 27, 29, 2B, 2D, 2F [External Fault (N.C.)]*. If a circuit error occurs in the MFDI, the drive cannot stop the output when the terminal set to *H1-xx = 20, 22, 24, 26, 28, 2A, 2C, 2E [External Fault (N.O.)]* turns ON.

If an external fault is input to the drive, the keypad will show *EFx [External Fault (Terminal Sx)]*, where x is the number of the terminal (terminal Sx) to which the external fault signal is assigned. For example, when an external fault signal is input to terminal S3, the keypad will show *EF3 [External Fault (Terminal S3)]*.

Use these conditions to select the value to set in *H1-xx*:

- Signal input method from peripheral devices
- External fault detection method
- Motor stopping method (operation after external fault detection)

Table 12.8 shows the relation between the conditions and the value set to *H1-xx*.

Table 12.8 Stopping Methods for External Fault

Setting	Signal Input Method from Peripheral Devices *1		External Fault Detection Method *2		Stopping Method			
	N.O.	N.C.	Always Detected	Detected during RUN Only	Ramp to Stop (Fault)	Coast to Stop (Fault)	Fast Stop (Fault)	Continuous Operation (Alarm Only)
20	x	-	x	-	x	-	-	-
21	-	x	x	-	x	-	-	-
22	x	-	-	x	x	-	-	-
23	-	x	-	x	x	-	-	-
24	x	-	x	-	-	x	-	-
25	-	x	x	-	-	x	-	-
26	x	-	-	x	-	x	-	-
27	-	x	-	x	-	x	-	-
28	x	-	x	-	-	-	x	-
29	-	x	x	-	-	-	x	-
2A	x	-	-	x	-	-	x	-
2B	-	x	-	x	-	-	x	-
2C	x	-	x	-	-	-	-	x
2D	-	x	x	-	-	-	-	x
2E	x	-	-	x	-	-	-	x
2F	-	x	-	x	-	-	-	x

*1 Set the terminal to N.O. (detects external fault when switched ON) or N.C. (detects external fault when switched OFF).
*2 Set the drive to always detect each fault or to detect only during run.

40: Up Command

Setting Value	Function	Description
40 Expert	Up Command	V/f OLV CLV Sets the Up command for 2-wire sequence 1. Set this function and *H1-xx = 41 [Down Command)]* together.

ON : Up
OFF : Stop

Note:
- If you turn ON the Up command terminal and the Down Run command terminal, it will cause an *EF [Up/Down Command Input Error]* alarm and the motor will ramp to stop.
- Initialize the drive with a 2-wire sequence to set the Up command to terminal S1.

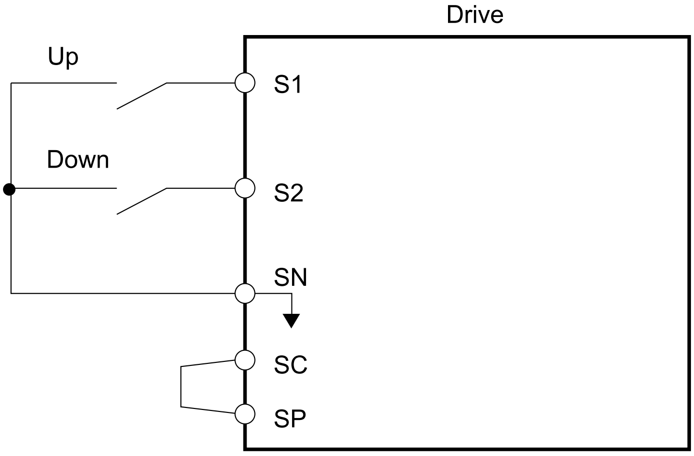

Figure 12.15 2-Wire Sequence Wiring Example

41: Down Command

Setting Value	Function	Description
41 Expert	Down Command	V/f OLV CLV Sets the Down command for 2-wire sequence 1. Set this function and *H1-xx = 40 [Up Command]* together.

ON : Reverse Run
OFF : Stop

Note:
- If you turn ON the Up command terminal and the Down command terminal, it will cause an *EF [Up/Down Command Input Error]* alarm and the motor will ramp to stop.
- Initialize the drive with a 2-wire sequence to set the Down command to terminal S2.

50: Nominal Speed

Setting Value	Function	Description
50	Nominal Speed	V/f OLV CLV Sets the speed reference nominal speed.

51: Intermed Speed

Setting Value	Function	Description
51	Intermed Speed	V/f OLV CLV Sets the speed reference intermediate speed 1. In combination with nominal and releveling speed you can set intermediate speed 2 and 3.

52: Releveling Speed

Setting Value	Function	Description
52	Releveling Speed	V/f OLV CLV Sets the speed reference releveling speed.

Parameter Details

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53: Leveling Speed

Setting Value	Function	Description
53	Leveling Speed	V/f OLV CLV Sets the speed reference leveling speed.

54: Inspection Speed

Setting Value	Function	Description
54	Inspection Speed	V/f OLV CLV Sets the speed reference inspection speed.

55: Rescue Operation

Setting Value	Function	Description
55	Rescue Operation	V/f OLV CLV Activates rescue operation.

56: Motor Contractor Feedback

Setting Value	Function	Description
56	Motor Contractor Feedback	V/f OLV CLV Used for motor contactor supervision and fault detection.

67: Communications Test Mode

Setting Value	Function	Description
67	Communications Test Mode	V/f OLV CLV Set the function for the drive to self-test RS-485 serial communications operation.

The Self-Diagnostics function connects the transmission terminal of the control terminal block to the reception terminal. The function transmits the data that the drive sent to make sure that the drive can communicate correctly.

Note:

Refer to *Self-Diagnostics on page 154* for more information.

79: Brake Feedback

Setting Value	Function	Description
79	Brake Feedback	V/f OLV CLV Used for brake supervision and detection of incorrect operation.

H2: Digital Outputs

H2 parameters set the MFDO terminal functions.

H2-01 to H2-03 Terminal MA/MB-MC, P1-C1, P2-C2 Function Selection

The drive has three MFDO terminals. Table 12.9 shows the default function settings for the terminals.

Table 12.9 MFDO Terminals Default Function Settings

No.	Name	Default	Function
H2-01	Term MA/MB-MC Function Selection (Contact)	E	Fault
H2-02	Term P1-C1 Function Selection	6	Drive Ready
H2-03	Term P2-C2 Function Selection	50	Brake Control

Refer to Table 12.10 to set *H2-xx [MFDO Function Select]*.

Table 12.10 MFDO Setting Values

Setting Value	Function	Reference	Setting Value	Function	Reference
0	During Run	342	3	User-Set Speed Agree 1	343
1	Zero Speed	342	4	Frequency Detection 1	343
2	Speed Agree 1	342	5	Frequency Detection 2	344

Setting Value	Function	Reference
6	Drive Ready	344
7	DC Bus Undervoltage	344
8	During Baseblock (N.O.)	345
B	Torque Detection 1 (N.O.)	345
E	Fault	345
F *1	Not Used	345
10	Alarm	345
11	Fault Reset Command Active	345
12	Timer Output	345
13	Speed Agree 2	346
14	User-Set Speed Agree 2	346
15	Frequency Detection 3	346
16	Frequency Detection 4	347
18	Torque Detection 2 (N.O.)	347
1A	During Reverse	348
1B	During Baseblock (N.C.)	348
1E	Executing Auto-Restart	348
1F	Motor Overload Alarm (oL1)	348
20	Drive Overheat Pre-Alarm (oH)	348
21	Safety Monitor Output Status	349
2F	Maintenance Notification	349
30	During Torque Limit	349
33	Zero Servo Complete	349
37	During Frequency Output	349
47	Input Phase Loss	350
50	Brake Control	350
51	Output Contactor Control	350
52	Door Zone	350
54	Light Load Direction	350
58	Safe Disable Status	350
62	Modbus Reg 1 Status Satisfied	351
63	Modbus Reg 2 Status Satisfied	351
66	Comparator1	351
67	Comparator2	351
69	External Power 24V Supply	352
6A	Data Logger Error	352
100 to 16A	Inverse output of 0 to 6A Sets an inverse output of the function for the MFDO. Put a 1 at the front of the function setting to set inverse output. For example, set *H2-xx = 10E* for the inverse output of *E [Fault]*.	352

*1 Inverse output is not available.

■ H2-01: Term MA/MB-MC Function Selection

No. (Hex.)	Name	Description	Default (Range)
H2-01 (040B)	Term MA/MB-MC Function Selection	V/f OLV CLV Sets the function set for MFDO terminal MA-MC or MB-MC.	E (0 - 158)

Note:

Set this parameter to *F* when the terminal is not being used or to use the terminal in through mode.

■ H2-02: Term P1-C1 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H2-02 (040C)	Term P1-C1 Function Selection	V/f OLV CLV Sets the function for MFDO terminal P1-C1.	6 (0 - 158)

Note:

Set this parameter to *F* when the terminal is not being used or to use the terminal in through mode.

■ H2-03: Term P2-C2 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H2-03 (040D)	Term P2-C2 Function Selection	V/f OLV CLV Sets the function for MFDO terminal P2-C2.	50 (0 - 158)

Note:

Set this parameter to *F* when the terminal is not being used or to use the terminal in through mode.

◆ MFDO Setting Values

Selects the function configured to MFDO.

■ 0: During Run

Setting Value	Function	Description
0	During Run	V/f OLV CLV The terminal activates when you input a Run command and when the drive is outputting voltage.

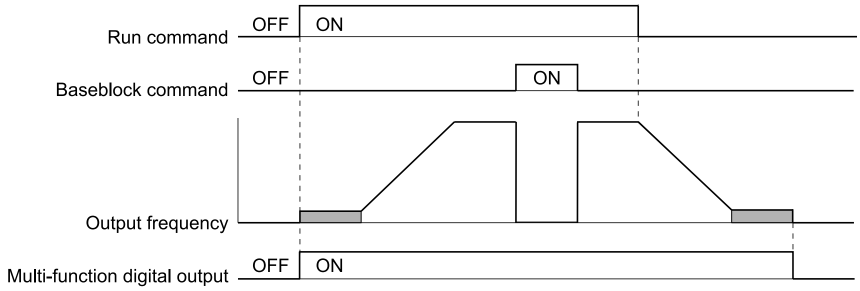


Figure 12.16 Drive Running Time Chart

ON : Drive is running

The drive is receiving a Run command or outputting voltage.

OFF : Drive is stopping

■ 1: Zero Speed

Setting Value	Function	Description
1	Zero Speed	V/f OLV CLV The terminal activates when the output frequency is less than *E1-09 [Minimum Output Frequency]* or *S1-01 [Zero Speed Level at Stop]*.

Note:

Parameter *A1-02 [Control Method Selection]* selects which parameter is the reference.

A1-02 Setting	Control Method Selection	Parameter Used as the Reference
0	V/f	*E1-09*
2	OLV	*S1-01*
3	CLV	*S1-01*

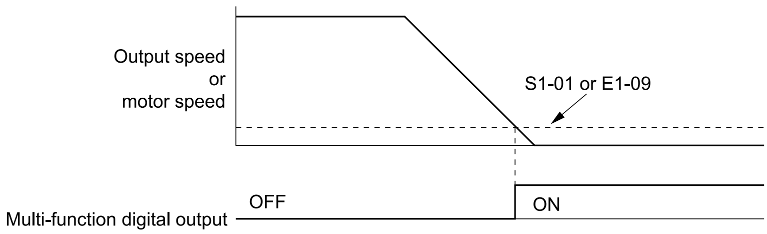


Figure 12.17 Zero Speed Time Chart

ON : Output frequency < value of *E1-09* or *S1-01*.

OFF : Output frequency ≥ value of *E1-09* or *S1-01*.

■ 2: Speed Agree 1

Setting Value	Function	Description
2	Speed Agree 1	V/f OLV CLV The terminal activates when the output frequency is in the range of the frequency reference ± *L4-02 [Speed Agree Detection Width]*.

Note:

The detection function operates in the two motor rotation directions.

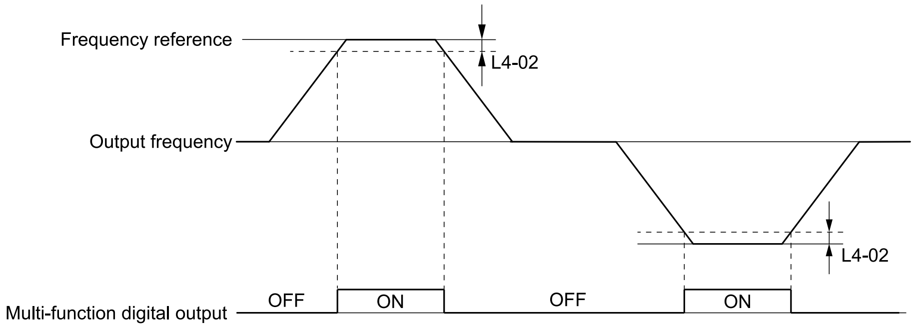


Figure 12.18 Speed Agree 1 Time Chart

ON : The output frequency is in the range of "frequency reference ± *L4-02*".

OFF : The output frequency does not align with the frequency reference although the drive is running.

■ 3: User-Set Speed Agree 1

Setting Value	Function	Description
3	User-Set Speed Agree 1	V/f OLV CLV The terminal activates when the output frequency is in the range of *L4-01 [Speed Agree Detection Level]* ± *L4-02 [Speed Agree Detection Width]* and in the range of the frequency reference ± *L4-02*.

Note:

The detection function operates in the two motor rotation directions. The drive uses the *L4-01* value as the forward/reverse detection level.

ON : The output frequency is in the range of "*L4-01* ± *L4-02*" and the range of frequency reference ± *L4-02*.

OFF : The output frequency is not in the range of "*L4-01* ± *L4-02*" nor the range of frequency reference ± *L4-02*.

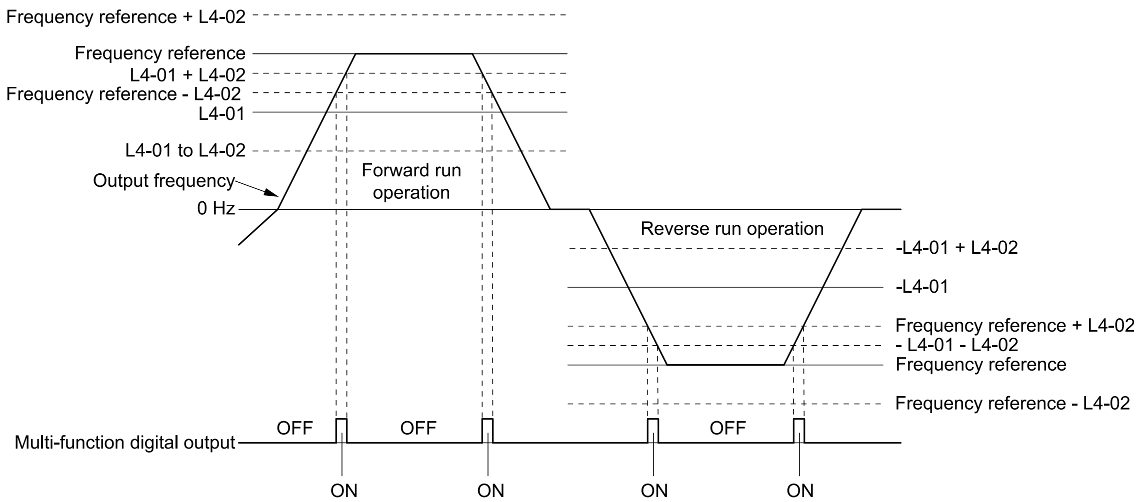


Figure 12.19 User-Defined Speed Agree 1 Time Chart

■ 4: Frequency Detection 1

Setting Value	Function	Description
4	Frequency Detection 1	V/f OLV CLV The terminal deactivates when the output frequency is higher than the value of *L4-01 [Speed Agree Detection Level]* + *L4-02 [Speed Agree Detection Width]*. After the terminal deactivates, the terminal stays deactivated until the output frequency = *L4-01*.

Note:

The detection function operates in the two motor rotation directions. The drive uses the *L4-01* value as the forward/reverse detection level.

ON : The output frequency is less than the value of *L4-01* or does not exceed the value of *L4-01* + *L4-02*.

OFF : The output frequency is higher than the value of *L4-01* + *L4-02*.

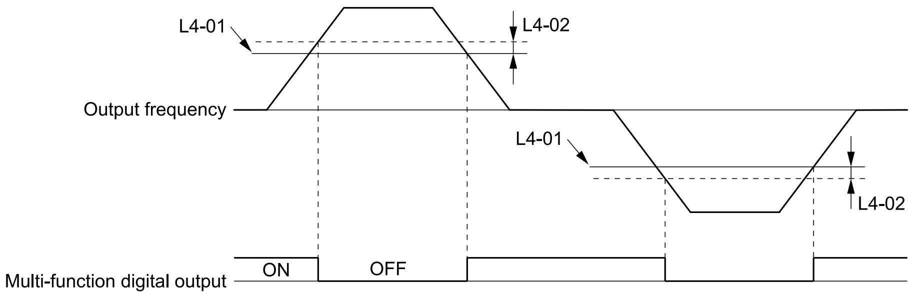


Figure 12.20 Frequency Detection 1 Time Chart

Note:

Figure 12.20 shows the result of the configuration when *L4-07 = 1 [Speed Agree Detection Selection = Detection Always Enabled]*. The default setting of *L4-07* is *0 [No detection during baseblock]*. When the speed agreement detection selection is "No Detection during Baseblock", the terminal is deactivated when the drive output stops.

■ 5: Frequency Detection 2

Setting Value	Function	Description
5	Frequency Detection 2	V/f OLV CLV The terminal activates when the output frequency is higher than the value of *L4-01 [Speed Agree Detection Level]*. After the terminal activates, the terminal stays activated until the output frequency is at the value of *L4-01 - L4-02*.

Note:

The detection function operates in the two motor rotation directions. The drive uses the *L4-01* value as the forward/reverse detection level.

ON : The output frequency is higher than the value of *L4-01*.

OFF : The output frequency is less than the value of "*L4-01 - L4-02*," or it is not more than the value of *L4-01*.

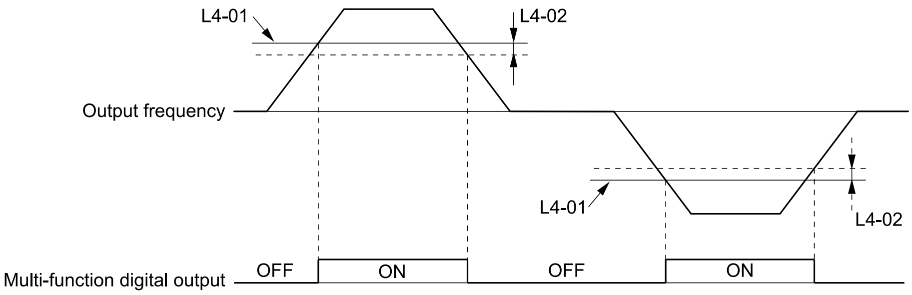


Figure 12.21 Frequency Detection 2 Time Chart

■ 6: Drive Ready

Setting Value	Function	Description
6	Drive Ready	V/f OLV CLV The terminal activates when the drive is ready and running.

The terminal deactivates in these conditions:

- When the power supply is OFF
- During a fault
- When there is problem with the control power supply
- When there is a parameter setting error and the drive cannot operate although there is a Run command
- When you enter a Run command and it immediately triggers an overvoltage or undervoltage fault because the drive has an overvoltage or undervoltage fault during stop
- When the drive is in Programming Mode and will not accept a Run command
- When the Safe Disable function is active

■ 7: DC Bus Undervoltage

Setting Value	Function	Description
7	DC Bus Undervoltage	V/f OLV CLV The terminal activates when the DC bus voltage or control circuit power supply is at the voltage set in *L2-05 [Undervoltage Detection Lvl (Uv1)]* or less. The terminal also activates when there is a fault with the DC bus voltage.

ON : The DC bus voltage ≤ *L2-05*
OFF : The DC bus voltage > *L2-05*

■ 8: During Baseblock (N.O.)

Setting Value	Function	Description
8	During Baseblock (N.O.)	V/f OLV CLV The terminal activates during baseblock. When the drive is in baseblock, the drive output transistor stops switching and does not make DC bus voltage.

ON : During baseblock
OFF : The drive is not in baseblock.

■ B: Torque Detection 1 (N.O.)

Setting Value	Function	Description
B	Torque Detection 1 (N.O.)	V/f OLV CLV The terminal activates when the drive detects overtorque or undertorque.

ON : The output current/torque > *L6-02 [Torque Detection Level 1]*, or the output current/torque < *L6-02* for longer than the time set in *L6-03 [Torque Detection Time 1]*.

Note:
- When *L6-01* ≥ *5*, the drive will detect when the output current/torque is less than *L6-02* for longer than *L6-03*.
- Refer to *L6: Torque Detection on page 371* for more information.

■ E: Fault

Setting Value	Function	Description
E	Fault	V/f OLV CLV The terminal activates when the drive detects a fault.

Note:
The terminal will not activate for *CPF00* and *CPF01 [Control Circuit Error]* faults.

■ F: Not Used

Setting Value	Function	Description
F	Not Used	V/f OLV CLV Use this setting for unused terminals or to use terminals in through mode.

■ 10: Alarm

Setting Value	Function	Description
10	Alarm	V/f OLV CLV The terminal activates when the drive detects a minor fault.

■ 11: Fault Reset Command Active

Setting Value	Function	Description
11	Fault Reset Command Active	V/f OLV CLV The terminal activates when the drive receives the Reset command from the control circuit terminal, serial communications, or the communication option.

■ 12: Timer Output

Setting Value	Function	Description
12	Timer Output	V/f OLV CLV Sets the terminal as the timer output. Use this setting with the timer input set in *H1-xx = 18 [MFDI Function Selection = Timer Function]*.

Note:
Refer to *b4: Timer Function on page 309* for more information.

■ 13: Speed Agree 2

Setting Value	Function	Description
13	Speed Agree 2	V/f OLV CLV The terminal activates when the output frequency is in the range of the frequency reference ± *L4-04 [Speed Agree Detection Width(+/-)]*.

Note:

The detection function operates in the two motor rotation directions.

ON : The output frequency is in the range of "frequency reference ± *L4-04*".

OFF : The output frequency is not in the range of "frequency reference ± *L4-04*".

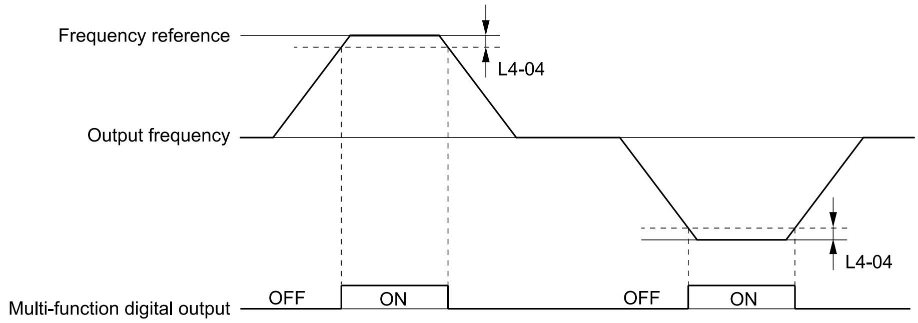


Figure 12.22 Speed Agree 2 Time Chart

■ 14: User-Set Speed Agree 2

Setting Value	Function	Description
14	User-Set Speed Agree 2	V/f OLV CLV The terminal activates when the output frequency is in the range of *L4-03 [Speed Agree Detection Level(+/-)]* ± *L4-04 [Speed Agree Detection Width(+/-)]* and in the range of the frequency reference ± *L4-04*.

Note:

The detection level set with *L4-03* is a signed value. The drive will only detect in one direction.

ON : The output frequency is in the range of "*L4-03* ± *L4-04*" and the range of frequency reference ± *L4-04*.

OFF : The output frequency is not in the range of "*L4-03* ± *L4-04*" nor the range of frequency reference ± *L4-04*.

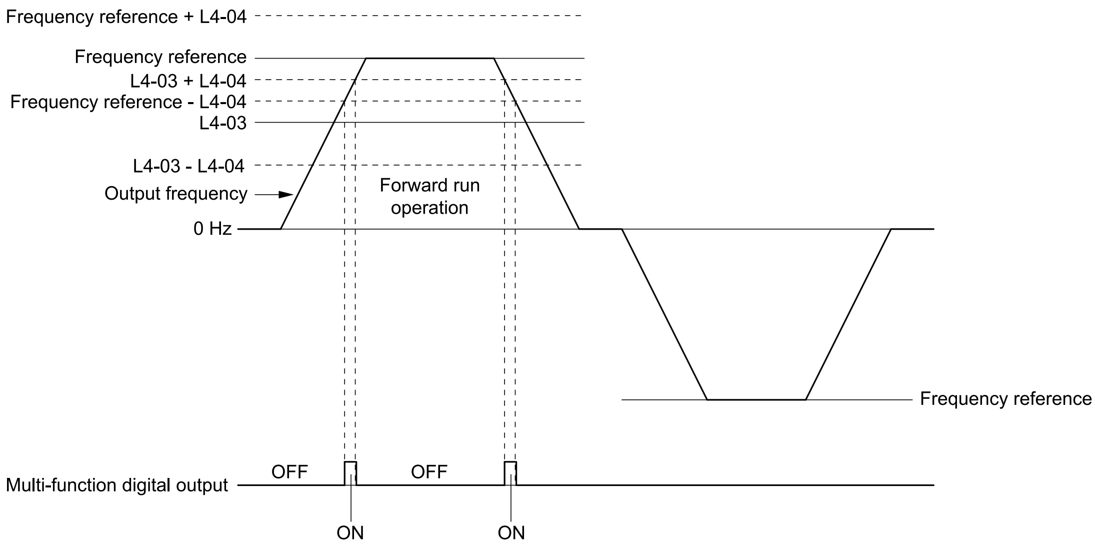


Figure 12.23 Example of User-set Speed Agree 2 (L4-03 Is Positive)

■ 15: Frequency Detection 3

Setting Value	Function	Description
15	Frequency Detection 3	V/f OLV CLV The terminal deactivates when the output frequency is more than "*L4-03 [Speed Agree Detection Level(+/-)]* + *L4-04 [Speed Agree Detection Width(+/-)]*". After the terminal deactivates, the terminal stays deactivated until the output frequency is at the value of *L4-03*.

Note:

The detection level set with *L4-03* is a signed value. The drive will only detect in one direction.

ON : The output frequency is less than the value of *L4-03* or it is not more than the value of *L4-03* + *L4-04*.

OFF : The output frequency is higher than the value of *L4-03* + *L4-04*.

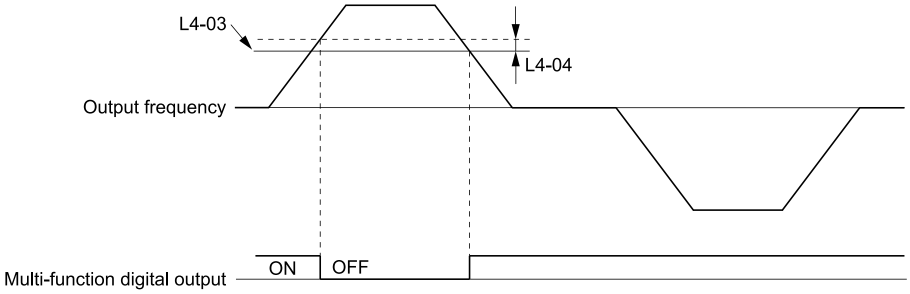


Figure 12.24 Example of Frequency Detection 3 (value of L4-03 Is Positive)

Note:

Figure 12.24 shows the result of the configuration when *L4-07 = 1 [Speed Agree Detection Selection = Detection Always Enabled]*. The default setting of *L4-07* is *0 [No detection during baseblock]*. When the speed agreement detection selection is "No Detection during Baseblock", the terminal is deactivated when the drive output stops.

■ 16: Frequency Detection 4

Setting Value	Function	Description
16	Frequency Detection 4	V/f OLV CLV The terminal activates when the output frequency is higher than the value of *L4-03 [Speed Agree Detection Level(+/-)]*. After the terminal activates, the terminal stays activated until the output frequency = *L4-03 - L4-04*.

Note:

The detection level set with *L4-03* is a signed value. The drive will only detect in one direction.

ON : The output frequency is higher than the value of *L4-03*.

OFF : The output frequency is less than the value of "*L4-03 - L4-04*," or it is not more than the value of *L4-03*.

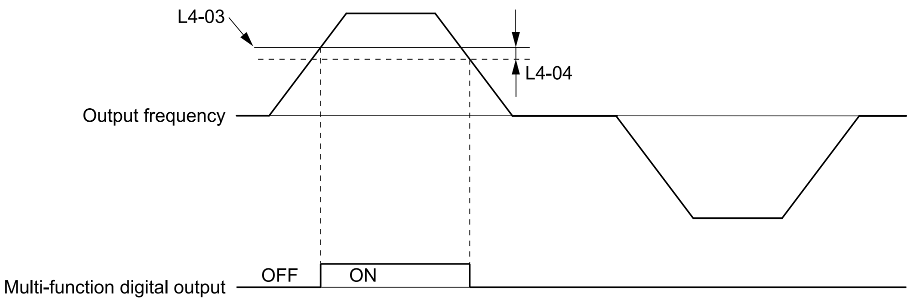


Figure 12.25 Example of Frequency Detection 4 (value of L4-03 Is Positive)

■ 18: Torque Detection 2 (N.O.)

Setting Value	Function	Description
18	Torque Detection 2 (N.O.)	V/f OLV CLV The terminal activates when the drive detects overtorque or undertorque.

Use the *L6 [Torque Detection]* parameters to set torque detection.

ON : The output current/torque > *L6-05 [Torque Detection Level 2]*, or the output current/torque < *L6-05* for longer than the time set in *L6-06 [Torque Detection Time 2]*.

Note:

- When *L6-04* ≥ *5*, the drive will detect when the output current/torque is less than *L6-05* for longer than *L6-06*.
- Refer to *L6: Torque Detection on page 371* for more information.

Parameter Details

12

1A: During Reverse

Setting Value	Function	Description
1A	During Reverse	V/f OLV CLV The terminal activates when the motor operates in the reverse direction.

ON : The motor is operating in the reverse direction.

OFF : The motor is operating in the forward direction or the motor stopped.

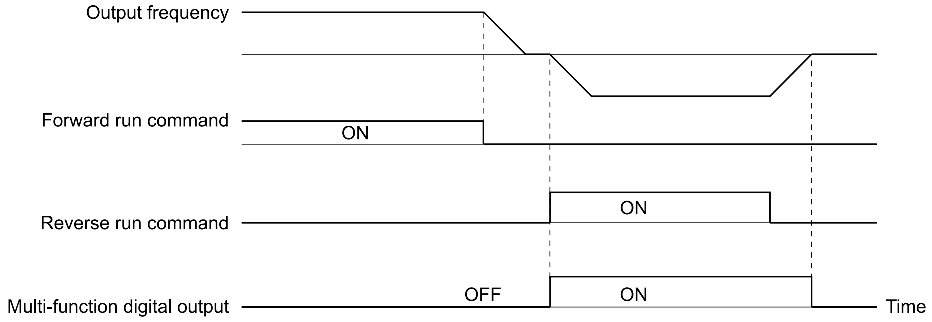


Figure 12.26 Reverse Operation Output Time Chart

1B: During Baseblock (N.C.)

Setting Value	Function	Description
1B	During Baseblock (N.C.)	V/f OLV CLV The terminal deactivates during baseblock. When the drive is in baseblock, the drive output transistor stops switching and does not make DC bus voltage.

ON : The drive is not in baseblock.

OFF : During baseblock

1E: Executing Auto-Restart

Setting Value	Function	Description
1E	Executing Auto-Restart	V/f OLV CLV The terminal activates when the Auto Restart function is trying to restart after a fault.

The terminal deactivates when the Auto Restart function automatically resets a fault. The terminal deactivates when the Auto Restart function detects the fault again because there were too many restart attempts as specified by *L5-01 [Number of Auto Restart Attempts]*.

Note:

Refer to *L5: Fault Restart on page 370* for more information.

1F: Motor Overload Alarm (oL1)

Setting Value	Function	Description
1F	Motor Overload Alarm (oL1)	V/f OLV CLV The terminal activates when the electronic thermal protection value of the motor overload protective function is a minimum of 90% of the detection level.

Note:

Refer to *L1-01: Motor Overload (oL1) Protection on page 363* for more information.

20: Drive Overheat Pre-Alarm (oH)

Setting Value	Function	Description
20	Drive Overheat Pre-Alarm (oH)	V/f OLV CLV The terminal activates when the drive heatsink temperature is at the level set with *L8-02 [Overheat Alarm Level]*.

Note:

Refer to *L8-02: Overheat Alarm Level on page 377* for more information.

■ 21: Safe Torque OFF

Setting Value	Function	Description
21	Safe Torque OFF	V/f OLV CLV The terminal activates (safety stop state) when the safety circuit and safety diagnosis circuit are operating correctly and when terminals H1-HC and H2-HC are OFF (Open).

Note:

EDM = External Device Monitor

ON : Safety stop state

Terminals H1-HC and H2-HC are OFF or released (safety stop state).

OFF : Safety circuit fault or RUN/READY

Terminal H1-HC or terminal H2-HC is OFF or released (safety circuit fault), or the two terminals are ON or short circuited (RUN/READY).

■ 2F: Maintenance Notification

Setting Value	Function	Description
2F	Maintenance Notification	V/f OLV CLV The terminal activates when drive components are at their estimated maintenance period.

Tells you about the maintenance period for these items:

- IGBT
- Cooling Fan
- Capacitor
- Soft charge bypass relay

Note:

Refer to *Maintenance on page 218* for more information.

■ 30: During Torque Limit

Setting Value	Function	Description
30	During Torque Limit	V/f OLV CLV The terminal activates when the torque reference is the torque limit set with *L7 parameters*.

Note:

Refer to *L7: Torque Limit on page 374* for more information.

■ 33: Zero Servo Complete

Setting Value	Function	Description
33	Zero Servo Complete	V/f OLV CLV The terminal activates when positioning in the range set with *b9-02 [Zero Servo Completion Window]* completes after sending the Zero-Servo command.

Note:

Refer to "b9: Zero Servo" for more information.

■ 37: During Frequency Output

Setting Value	Function	Description
37	During Frequency Output	V/f OLV CLV The terminal activates when the drive outputs frequency.

ON : The drive is outputting frequency.

OFF : The drive is not outputting frequency.

Note:

The terminal deactivates in these conditions:
- During Stop
- During Baseblock
- During DC Injection Braking (initial excitation)
- During Short Circuit Braking
- Pole Position Detection Complete

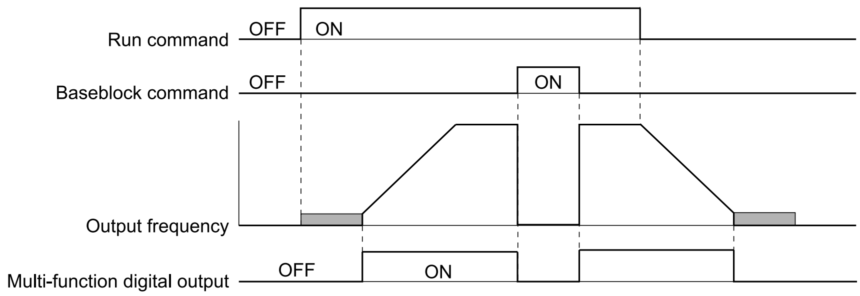


Figure 12.27 Active Frequency Output Time Chart

■ 47: Input Phase Loss

Setting Value	Function	Description
47	Input Phase Loss	V/f OLV CLV Indicates input phase loss.

0 : No error

1 : Input Phase Loss error detected

■ 50: Brake Control

Setting Value	Function	Description
50	Brake Control	V/f OLV CLV This setting can be used in the brake sequence for the elevator application. Closing the output terminal should cause the brake to release, and opening the terminal should apply the brake.

Close : Release brake.

Open : Apply brake

■ 51: Output Contactor Control

Setting Value	Function	Description
51	Output Contactor Control	V/f OLV CLV Assigning this command to an output terminal can send a signal to the controller to close the output contactor. The output contactor should open when the terminal is released.

Closed : Close output contactor

■ 52: Door Zone

Setting Value	Function	Description
52	Door Zone	V/f OLV CLV The terminal activates when the speed has reached the value set in *L4-13 [Door Zone Level]*, and the controller should open the elevator door.

■ 54: Light Load Direction

Setting Value	Function	Description
54	Light Load Direction	V/f OLV CLV Indicates the light load direction detected during emergency operation with light load search. When the terminal is closed the light load direction is up, when it is open the light load direction is down.

Closed : Light load direction is up

Open : Light load direction is down

■ 58: Safe Disable Status

Setting Value	Function	Description
58	Safe Disable Status	V/f OLV CLV This terminal closes if the Safe Disable inputs H1-HC are closed and opens when terminals H1-HC are open.

Closed : Safe Disable terminals H1-HC and H2-HC are open, drive is in a baseblock state

Open : Safe Disable terminals H1-HC and H2-HC are closed (normal operation)

■ 62: Modbus Reg 1 Status Satisfied

Setting Value	Function	Description
62	Modbus Reg 1 Status Satisfied	V/f OLV CLV The terminal activates when the bit specified by *H2-08 [Modbus Register 1 Bit Select]* for the MEMOBUS register address set with *H2-07 [Modbus Register 1 Address Select]* activates.

■ 63: Modbus Reg 2 Status Satisfied

Setting Value	Function	Description
63	Modbus Reg 2 Status Satisfied	V/f OLV CLV The terminal activates when the bit specified by *H2-10 [Modbus Register 2 Bit Select]* for the MEMOBUS register address set with *H2-09 [Modbus Register 2 Address Select]* activates.

■ 66: Comparator1

Setting Value	Function	Description
66	Comparator1	V/f OLV CLV The terminal activates if the monitor value set with *H2-20 [Comparator 1 Monitor Selection]* is in range of the values of *H2-21 [Comparator 1 Lower Limit] and H2-22 [Comparator 1 Upper Limit]* for the time set in *H2-24 [Comparator 1 On-Delay Time]*.

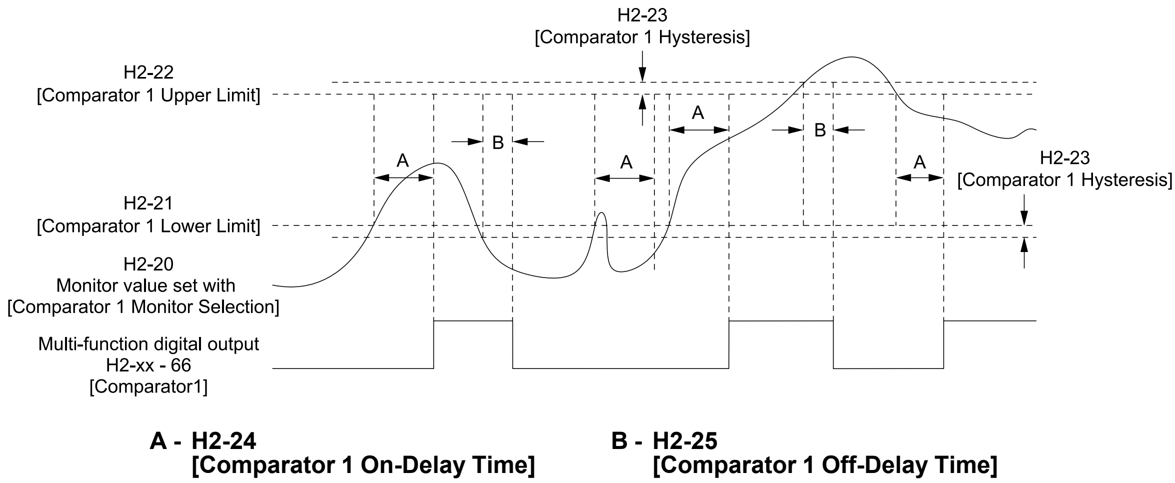


Figure 12.28 Comparator 1 Output Time Chart

Note:

The drive compares the monitors set with *H2-20* as absolute values.

■ 67: Comparator2

Setting Value	Function	Description
67	Comparator2	V/f OLV CLV The terminal activates if the monitor value set with *H2-26 [Comparator 2 Monitor Selection]* is not in the range of the values of *H2-27 [Comparator 2 Lower Limit]* and *H2-28 [Comparator 2 Upper Limit]* for the time set in *H2-30 [Comparator 2 On-Delay Time]*.

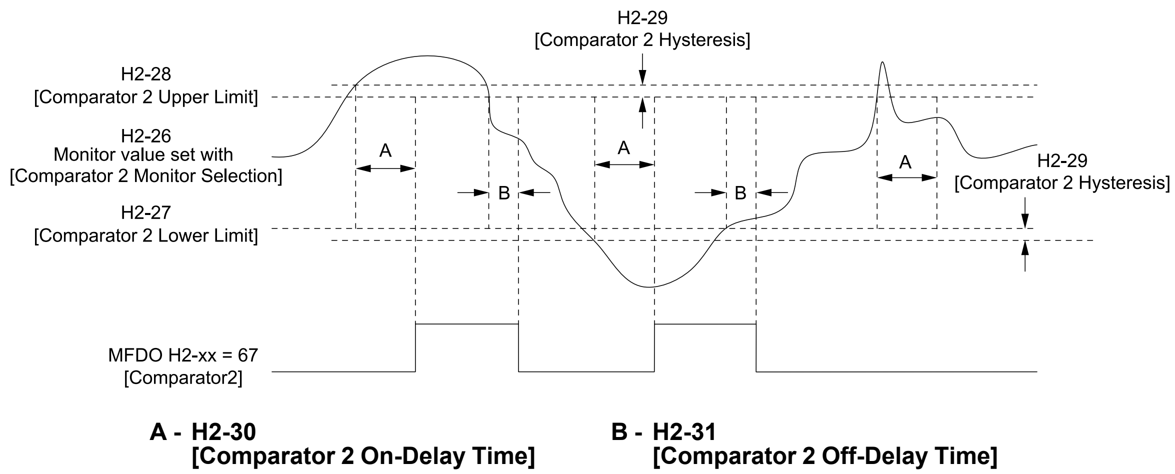


Figure 12.29 Comparator 2 Output Time Chart

Note:
The drive compares the monitors set with *H2-26* as absolute values.

■ 69: External Power 24V Supply

Setting Value	Function	Description
69	External Power 24V Supply	V/f OLV CLV The terminal activates when there is an external 24V power supply between terminals PS-AC.

ON : The external 24V power supply is supplying power.
OFF : The external 24V power supply is not supplying power.

■ 6A: Data Logger Error

Setting Value	Function	Description
6 A	Data Logger Error	V/f OLV CLV The terminal activates when the drive detects a *LoG [Com Error / Abnormal SD card]*.

■ 100 to 16A: Inverse output of 0 to 6A

Setting Value	Function	Description
100 - 16A	Inverse output of 0 to 6A	V/f OLV CLV Causes inverse output of the function for the selected MFDO. Uses the last two digits of 1xx to select which function to inversely output.

For example, set *H2-xx = 10E* for the inverse output of *E [Fault]*.

◆ H3: Analog Inputs

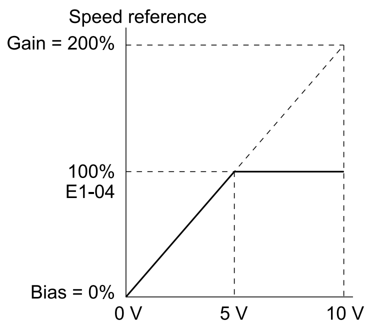
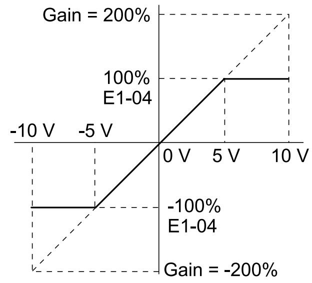
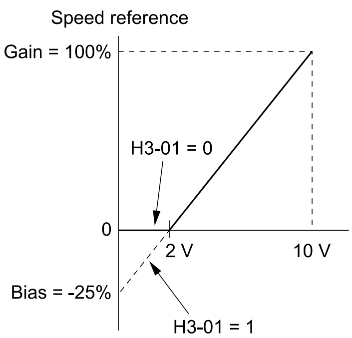
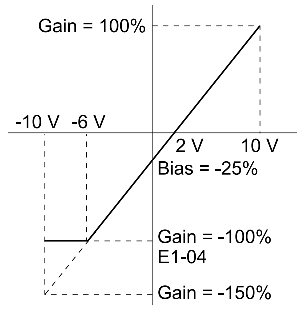
⚠ WARNING Sudden Movement Hazard
Do test runs and examine the drive to make sure that the command references are correct. If you set the command reference incorrectly, it can cause damage to the drive or serious injury or death.

Drives have three analog input terminals, terminals A1, A2, and A3. *H3 parameters* select the functions set to these analog input terminals and adjust signal levels.
Table 12.11 shows the functions that you can set to analog input terminals. Use *H3-02, H3-06, and H3-10 [MFAI Function Selection]* to set functions.

Table 12.11 MFAI Setting Values

Setting Value	Function	Ref.	Setting Value	Function	Ref.
0	Speed Reference	355	E	Motor Temperature (PTC Input)	356
2	Auxiliary Speed Reference 1	356	F	Not Used	356

Note:
All analog input scaling uses gain and bias for adjustment. Set the gain and bias values correctly.

Example Analog Input Settings	Setting of Terminal A1	Speed Reference
Speed reference with the gain setting adjusted	• *H3-02 = 0 [Terminal A1 Function Selection = Speed Reference]* • *H3-03: 200.0 [Terminal A1 Gain Setting = 200%]* • *H3-04 = 0.0 [Terminal A1 Bias Setting = 0.0%]*	• When you input a 10 V signal, the speed reference will be 200%. • When you input a 5 V signal, the speed reference will be 100%. When you input a 5 V or more signal, *E1-04 [Maximum Output Frequency]* will limit the drive output and the speed reference will be 100%. H3-01 = 0  H3-01 = 1 
Speed reference with the negative number bias set	• *H3-02 = 0 [Speed Reference]* • *H3-03 = 100.0 [100.0%]* • *H3-04 = -25.0 [-25.0%]*	• When you input a 0 V signal, the speed reference will be -25%. • When *H3-01 = 0 [Terminal A1 Signal Level Select = 0 to 10V (Lower Limit at 0)]*: – When you input a 0 V to 2 V signal, the speed reference will be 0%. – When you input a 2 V to 10 V signal, the speed reference will be 0% to 100%. • When *H3-01 = 1 [-10 to +10V (Bipolar Reference)]*: – When you input a 0 V to 2 V signal, it enables signals of positive and negative polarities and the motor rotates in down direction. H3-01 = 0  H3-01 = 1 

■ H3-01: Terminal A1 Signal Level Select

No. (Hex.)	Name	Description	Default (Range)
H3-01 (0410)	Terminal A1 Signal Level Select	V/f OLV CLV Sets the input signal level for MFAI terminal A1.	0 (0, 1)

0 : 0 to 10V (Lower Limit at 0)

The voltage signal is 0 Vdc to 10 Vdc. The minimum input level limit is 0%. The drive will read a negative input signal caused by gain and bias settings as 0%.

1 : -10 to +10V (Bipolar Reference)

The voltage signal is -10 Vdc to 10 Vdc. Signals of both positive and negative polarities are enabled. When the drive uses this setting as the speed reference, an Up command will run the motor in down direction and a Down command will run the motor in up direction. The gain and bias settings will cause the signal to be a negative number.

■ H3-02: Terminal A1 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H3-02 (0434)	Terminal A1 Function Selection	V/f OLV CLV Sets the function for MFAI terminal A1.	F (0 - 1F)

H3-03: Terminal A1 Gain Setting

No. (Hex.)	Name	Description	Default (Range)
H3-03 (0411) RUN	Terminal A1 Gain Setting	V/f OLV CLV Sets the gain of the analog signal input to MFAI terminal A1.	100.0% (-999.9 - +999.9%)

When 10 V is input, this parameter sets the reference quantity for the function set for terminal A1 as a percentage.

Use this parameter and *H3-04 [Terminal A1 Bias Setting]* to adjust the characteristics of the analog input signal to terminal A1.

H3-04: Terminal A1 Bias Setting

No. (Hex.)	Name	Description	Default (Range)
H3-04 (0412) RUN	Terminal A1 Bias Setting	V/f OLV CLV Sets the bias of the analog signal input to MFAI terminal A1.	0.0% (-999.9 - +999.9%)

When 0 V is input, this parameter sets the bias for the function set for terminal A1 as a percentage.

Use this parameter and *H3-03 [Terminal A1 Gain Setting]* to adjust the characteristics of the analog input signal to terminal A1.

H3-09: Terminal A2 Signal Level Select

No. (Hex.)	Name	Description	Default (Range)
H3-09 (0417)	Terminal A2 Signal Level Select	V/f OLV CLV Sets the input signal level for MFAI terminal A2.	0 (0 - 3)

0 : 0-10V (LowLim=0)

The voltage signal is 0 Vdc to 10 Vdc. The minimum input level limit is 0%. The drive will read a negative input signal caused by gain and bias settings as 0%.

1 : -10 to +10V (Bipolar Reference)

The voltage signal is -10 Vdc to 10 Vdc. Signals of both positive and negative polarities are enabled. When the drive uses this setting as the speed reference, an Up command will run the motor in down direction and a Down command will run the motor in up direction. The gain and bias settings will cause the signal to be a negative number.

2 : 4 to 20 mA

The current signal is 4 mA to 20 mA. The minimum input level limit is 0%. The drive will read a negative input signal caused by gain and bias settings as 0%.

3 : 0 to 20 mA

The current signal is 0 mA to 20 mA. The minimum input level limit is 0%. The drive will read a negative input signal caused by gain and bias settings as 0%.

Note:

When *H3-09 = 0, 1*, set DIP switch S1 to the V side (voltage). When *H3-09 = 2, 3*, set DIP switch S1 to the I side (current). The default setting is the I side (current).

H3-10: Terminal A2 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H3-10 (0418)	Terminal A2 Function Selection	V/f OLV CLV Sets the function for MFAI terminal A2.	F (0 - 1F)

H3-11: Terminal A2 Gain Setting

No. (Hex.)	Name	Description	Default (Range)
H3-11 (0419) RUN	Terminal A2 Gain Setting	V/f OLV CLV Sets the gain of the analog signal input to MFAI terminal A2.	100.0% (-999.9 - +999.9%)

When 10 V (or 20 mA) is input, this parameter sets the reference quantity for the function set for terminal A2 as a percentage.

Use this parameter and *H3-12 [Terminal A2 Bias Setting]* to adjust the characteristics of the analog input signal to terminal A2.

■ H3-12: Terminal A2 Bias Setting

No. (Hex.)	Name	Description	Default (Range)
H3-12 (041A) RUN	Terminal A2 Bias Setting	V/f OLV CLV Sets the bias of the analog signal input to MFAI terminal A2.	0.0% (-999.9 - +999.9%)

When 0 V (4 mA or 0 mA) is input, this parameter sets the bias for the function set for terminal A2 as a percentage.

Use this parameter and *H3-11 [Terminal A2 Gain Setting]* to adjust the characteristics of the analog input signal to terminal A2.

■ H3-13: Analog Input FilterTime Constant

No. (Hex.)	Name	Description	Default (Range)
H3-13 (041B)	Analog Input FilterTime Constant	V/f OLV CLV Sets the time constant for primary delay filters on MFAI terminals.	0.03 s (0.00 - 2.00 s)

Apply the primary delay filter to the analog input to enable an analog input signal without the use of high-frequency noise components. An analog input filter prevents irregular drive control. Drive operation becomes more stable as the programmed time becomes longer, but it also becomes less responsive to quickly changing analog signals.

■ H3-16: Terminal A1 Offset

No. (Hex.)	Name	Description	Default (Range)
H3-16 (02F0)	Terminal A1 Offset	V/f OLV CLV Sets the offset level for analog signals input to terminal A1. Usually it is not necessary to change this setting.	0 (-500 - +500)

Adds the offset value for the analog input value. For voltage input, this parameter will set the offset when a signal of 0 V is input.

■ H3-17: Terminal A2 Offset

No. (Hex.)	Name	Description	Default (Range)
H3-17 (02F1)	Terminal A2 Offset	V/f OLV CLV Sets the offset level for analog signals input to terminal A2. Usually it is not necessary to change this setting.	0 (-500 - +500)

Adds the offset value for the analog input value. For voltage input, this parameter will set the offset when a signal of 0 V is input. For current input, this parameter will set the offset when a signal of *4 mA [H3-09 = 2]* or *0 mA [H3-09 = 3]* is input.

◆ MFAI Setting Values

This section gives information about the functions set with *H3-02, H3-06, and H3-10*.

■ 0: Speed Reference

Setting Value	Function	Description
0	Speed Reference	V/f OLV CLV The input value from the MFAI terminal set with this function becomes the master speed reference.

- You can copy the configuration to more than one of the analog input terminals A1 through A3. When you set more than one analog input terminal with the master speed reference, the sum value becomes the frequency bias.

- If you use this function to set the analog input value as the master speed reference, set *b1-01 = 1 [Speed Reference Selection 1 = Analog Input]*. This setting value is the default value for terminals A1 and A2.
- The speed reference is the sum of the input values for terminals A1 and A2 when they are used at the same time. For example, when a 20% bias is input to terminal A2 while a speed reference of 50% is input from terminal A1, the calculated speed reference will be 70% of the maximum output speed.

■ 2: Auxiliary Speed Reference 1

Setting Value	Function	Description
2	Auxiliary Speed Reference 1	V/f OLV CLV Sets Reference 2 through multi-step speed reference to enable the command reference (Auxiliary Speed Reference 1) from the analog input terminal set here. This value is a percentage where the *E1-04 [Maximum Output Frequency]* setting is a setting value of 100%.

Refer to *Speed Selection Using Digital Inputs (b1-01 = 0) on page 99* for more information.

■ E: Motor Temperature (PTC Input)

Setting Value	Function	Description
E	Motor Temperature (PTC Input)	V/f OLV CLV Uses the motor Positive Temperature Coefficient (PTC) thermistor to prevent heat damage to the motor as a percentage of the current value when the 10 V analog signal is input.

- You can use the Positive Temperature Coefficient (PTC) thermistor as an auxiliary or alternative detection function for *oL1 [Motor Overload]* problems to help prevent heat damage to motors. If the PTC input signal is more than the overload alarm level, *oH3 [Motor Overheat (PTC Input)]* will flash on the keypad.
- When the drive detects *oH3*, the motor stops with the setting in *L1-03 [Motor Thermistor oH Alarm Select]*. When the drive detects *oH4*, the motor stops with the setting in *L1-04 [Motor Thermistor oH Fault Select]*. When the drive incorrectly detects motor overheating problems, set *L1-05 [Motor Thermistor Filter Time]*.

■ F: Not Used

Setting Value	Function	Description
F	Not Used	V/f OLV CLV Use this setting for unused terminals or to use terminals in through mode.

When you set a terminal that you do not use to *F*, you can use the signal that is input to that terminal as the PLC analog signal input from MEMOBUS/Modbus communications or the communication option.

◆ H4: Analog Outputs

H4 parameters set the drive analog monitors. These parameters select monitor parameters, adjust gain and bias, and select output signal levels.

■ Calibrate Meters Connected to MFAO Terminal AM

Use these parameters to calibrate meters connected to terminal AM:

- H4-02 [Terminal AM Analog Output Gain]
- H4-03 [Terminal AM Analog Output Bias]

Set these parameters where the output voltage of 10 V are 100% of the signal level.

No.	Name	Range	Default
H4-02	Terminal AM Analog Output Gain	-999.9 - +999.9%	100.0%
H4-03	Terminal AM Analog Output Bias	-999.9 - +999.9%	0.0%

Figure 12.30 and Figure 12.31 show the gain and bias.

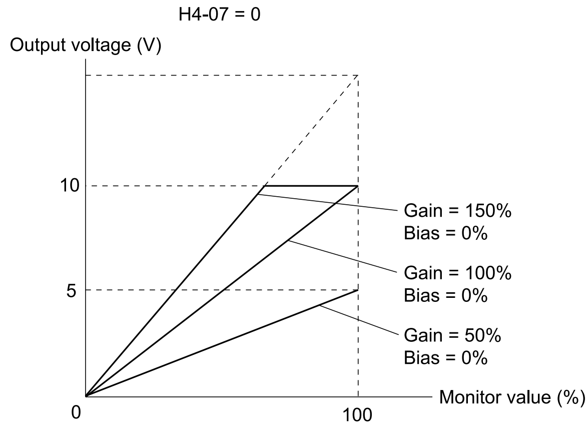


Figure 12.30 Analog Output Gain/Bias Configuration Example 1

For example, when the parameter value set to analog output is 0, and a 3 V signal is to be output to terminal AM, set *H4-03 [AM Analog Output Bias] = 30%.*

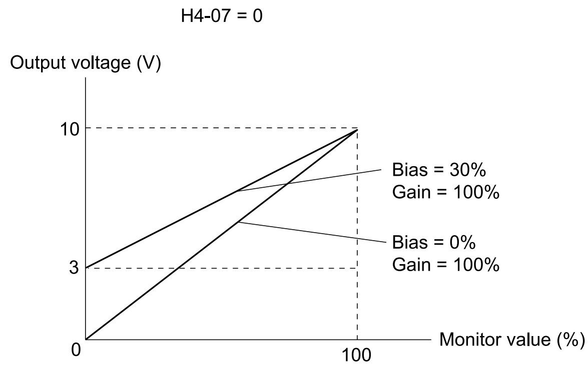


Figure 12.31 Analog Output Gain/Bias Configuration Example 2

■ Calibrate Terminal AM

Stop the drive to calibrate meters. Use this procedure to calibrate:

1. Show *H4-02 [Terminal AM Analog Output Gain]* on the keypad.
   Terminal AM outputs the analog signal when the monitor item that you set in *H4-01 [Terminal AM Analog Output Select]* is 100%.
2. Adjust *H4-02* while referencing the meter scale connected to terminal AM.
3. Show *H4-03 [Terminal AM Analog Output Bias]* on the keypad.
   The analog signal at the time when the monitor item selected with *H4-01* is 0% is output from terminal AM.
4. Adjust *H4-03* while referencing the meter scale connected to terminal AM.

■ H4-01: Terminal AM Analog Output Select

No. (Hex.)	Name	Description	Default (Range)
H4-01 (041D) Expert	Terminal AM Analog Output Select	V/f OLV CLV Sets the monitoring number to be output from the MFAO terminal AM.	102 (000 - 999)

Set the *x-xx* part of the *Ux-xx [Monitor]*. For example, set *H4-01 = 102* to monitor *U1-02 [Output Frequency]*.

Note:
• You cannot use all of the monitors in all of the control methods.

■ H4-02: Terminal AM Analog Output Gain

No. (Hex.)	Name	Description	Default (Range)
H4-02 (041E) RUN Expert	Terminal AM Analog Output Gain	V/f OLV CLV Sets the gain of the monitor signal that is sent from MFAO terminal AM.	100.0% (-999.9 - +999.9%)

The analog signal output from the AM terminal is a maximum of 10 V (or 20 mA). Use *H4-07 [Terminal AM Signal Level Select]* to set the signal level.

■ H4-03: Terminal AM Analog Output Bias

No. (Hex.)	Name	Description	Default (Range)
H4-03 (041F) RUN Expert	Terminal AM Analog Output Bias	V/f OLV CLV Sets the bias of the monitor signal that is sent from MFAO terminal AM.	0.0% (-999.9 - +999.9%)

The analog signal output from the AM terminal is a maximum of 10 V (or 20 mA). Use *H4-07 [Terminal AM Signal Level Select]* to set the signal level.

■ H4-07: Terminal FM Signal Level Select

No. (Hex.)	Name	Description	Default (Range)
H4-07 (0423) Expert	Terminal FM Signal Level Select	V/f OLV CLV Sets the MFAO terminal FM output signal level.	0 (0, 1)

0 : 0 to 10 Vdc

1 : -10 to +10 Vdc

◆ H5: Memobus/Modbus Communication

H5 parameters configure the drive to use MEMOBUS/Modbus communications.

You can use the MEMOBUS/Modbus protocol over the RS-485 port (terminals D+ and D-) in the drive to use serial communication with lift controllers.

■ H5-01: Drive Node Address

No. (Hex.)	Name	Description	Default (Range)
H5-01 (0425)	Drive Node Address	V/f OLV CLV Sets the communication slave address for drives.	1FH (0 - FFH)

Note:
- Re-energize the drive or set *H5-20 = 1 [Communication Parameters Reload = Reload Now]* after you change the parameter setting.
- Setting 0 will not let the drive respond to MEMOBUS/Modbus communications.

To enable the drive to communicate with the controller (master) over MEMOBUS/Modbus communications, you must set the drive with a slave address. Set *H5-01 ≠ 0*.

Set a node address that is different from the master and other slave devices.

■ H5-02: Communication Speed Selection

No. (Hex.)	Name	Description	Default (Range)
H5-02 (0426)	Communication Speed Selection	V/f OLV CLV Sets the communications speed for MEMOBUS/Modbus communications.	3 (0 - 8)

Note:
Re-energize the drive or set *H5-20 = 1 [Communication Parameters Reload = Reload Now]* after you change the parameter setting.

0 : 1200 bps

1 : 2400 bps

2 : 4800 bps

3 : 9600 bps

4 : 19.2 kbps

5 : 38.4 kbps

6 : 57.6 kbps

7 : 76.8 kbps

8 : 115.2 kbps

■ H5-03: Communication Parity Selection

No. (Hex.)	Name	Description	Default (Range)
H5-03 (0427)	Communication Parity Selection	V/f OLV CLV Sets the communications parity used for MEMOBUS/Modbus communications.	0 (0 - 2)

Note:

Re-energize the drive or set *H5-20 = 1 [Communication Parameters Reload = Reload Now]* after you change the parameter setting.

0 : No parity

1 : Even parity

2 : Odd parity

■ H5-04: Communication Error Stop Method

No. (Hex.)	Name	Description	Default (Range)
H5-04 (0428) Expert	Communication Error Stop Method	V/f OLV CLV Sets the motor Stopping Method when the drive detects *CE [MEMOBUS/Modbus Communication Err]* issues.	3 (0 - 3)

0 : Ramp to Stop

The drive ramps the motor to stop in the deceleration time. The output terminal set for *Fault [H2-01 to H2-03 = E]* activates.

1 : Coast to Stop

The output turns off and the motor coasts to stop. The output terminal set for *Fault [H2-01 to H2-03 = E]* activates.

2 : Fast Stop (Use C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. The output terminal set for *Fault [H2-01 to H2-03 = E]* activates.

3 : Alarm Only

The keypad shows *CE* and the drive continues operation. The output terminal set for *Alarm [H2-01 to H2-03 = 10]* activates.

■ H5-05: Comm Fault Detection Selection

No. (Hex.)	Name	Description	Default (Range)
H5-05 (0429) Expert	Comm Fault Detection Selection	V/f OLV CLV Sets the function that detects *CE [Modbus Communication Error]* issues during MEMOBUS/Modbus communications.	1 (0, 1)

If the drive does not receive data from the master during the time set in *H5-09 [CE Detection Time]*, it will detect a *CE* error.

0 : Disabled

Does not detect *CE*. The drive continues operation.

1 : Enabled

Detects *CE*. If the drive detects *CE*, it will operate as specified by the setting of *H5-04 [Communication Error Stop Method]*.

■ H5-06: Drive Transmit Wait Time

No. (Hex.)	Name	Description	Default (Range)
H5-06 (042A) Expert	Drive Transmit Wait Time	V/f OLV CLV Sets the time to wait to send a response message after the drive receives a command message from the master.	5 ms (0 - 65 ms)

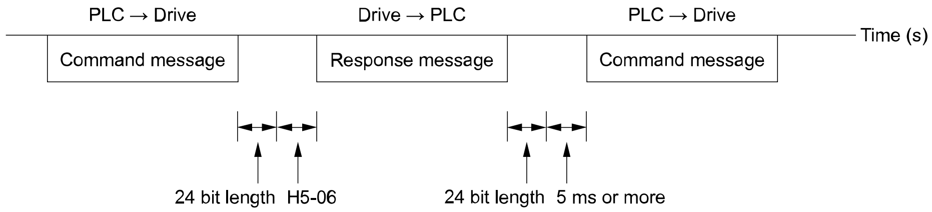


Figure 12.32 Drive Transmit Wait Time

■ H5-09: CE Detection Time

No. (Hex.)	Name	Description	Default (Range)
H5-09 (0435) Expert	CE Detection Time	V/f OLV CLV Sets the detection time for *CE [Modbus Communication Error]* issues when communication stops.	2.0 s (0.0 - 25.0 s)

■ H5-10: Modbus Register 0025H Unit Sel

No. (Hex.)	Name	Description	Default (Range)
H5-10 (0436) Expert	Modbus Register 0025H Unit Sel	V/f OLV CLV Sets the unit of measure used for the MEMOBUS/Modbus communications monitor register 0025H (output voltage reference monitor).	0 (0, 1)

0 : 0.1 V units

1 : 1 V units

■ H5-11: Comm ENTER Command Mode

No. (Hex.)	Name	Description	Default (Range)
H5-11 (043C) RUN Expert	Comm ENTER Command Mode	V/f OLV CLV Sets the function to make the Enter command necessary to change parameters through MEMOBUS/Modbus communications.	0 (0, 1)

0 : ENTER Command Required

Make all parameter changes then input the Enter command. You must use the Enter command to enable changes to parameters.

1 : ENTER Command Not Required

It is not necessary to input the Enter command to change parameters.

■ H5-12: Run Command Method Selection

No. (Hex.)	Name	Description	Default (Range)
H5-12 (043D) Expert	Run Command Method Selection	V/f OLV CLV Sets the input method for the Run command when *b1-02 = 2 [Run Command Selection 1 = Memobus/Modbus Communications]* or *b1-16 = 2 [Run Command Selection 2 = Memobus/ Modbus Communications]*.	0 (0, 1)

0 : FWD/Stop, REV/Stop

The drive uses bit 0 in command data 0001H of the MEMOBUS register in the motor forward Run command (bit 0 = 1) and the stop command (bit 0 = 0). The drive uses bit 1 in the motor reverse Run command (bit 1 = 1) and the stop command (bit 1 = 0).

1 : Run/Stop, FWD/REV

The drive uses bit 0 in command data 0001H of the MEMOBUS register in the motor Run command (bit 0 = 1) and the stop command (bit 0 = 0). The drive uses bit 1 in the direction of motor rotation command (Forward run (bit1 = 0) or Reverse run (bit 1 = 1)).

■ H5-18: Motor Speed Filter over Comms

No. (Hex.)	Name	Description	Default (Range)
H5-18 (11A2) Expert	Motor Speed Filter over Comms	V/f OLV CLV Sets the filter time constant used when monitoring motor speed during MEMOBUS/Modbus communications or with a communication option.	0 ms (0 - 100 ms)

Sets the filter time constant when you monitor the output frequency or motor speed during MEMOBUS/Modbus communications or use of the communication option.

These are the MEMOBUS registers:

- 003EH (Output Frequency)
- 003FH (Output Frequency)
- 0044H (*U1-05*: Motor Speed)
- 00ACH (*U1-05*: Motor Speed)
- 00ADH (*U1-05*: Motor Speed)

■ H5-20: Communication Parameters Reload

No. (Hex.)	Name	Description	Default (Range)
H5-20 (0B57) Expert	Communication Parameters Reload	V/f OLV CLV Sets the function to immediately enable updated MEMOBUS/Modbus communications parameters.	0 (0, 1)

0 : Reload at Next Power Cycle

1 : Reload Now

Note:
- The setting value automatically returns to *H5-20 = 0* after you enable MEMOBUS/Modbus communications parameter changes.
- The setting values of these parameters are enabled:
  - *H5-01 [Drive Node Address]*
  - *H5-02 [Communication Speed Selection]*
  - *H5-03 [Communication Parity Selection]*
  - *H5-06 [Drive Transmit Wait Time]*

■ H5-25: Function 5A Register 1 Selection

No. (Hex.)	Name	Description	Default (Range)
H5-25 (1589) RUN Expert	Function 5A Register 1 Selection	V/f OLV CLV Returns the contents of the specified MEMOBUS/Modbus communications register when responding to the master device.	0044H (U1-05) (0000H - FFFFH)

Note:
Refer to *Writing to More than One Holding Register/Reading the Indicated Register on page 151* for more information.

■ H5-26: Function 5A Register 2 Selection

No. (Hex.)	Name	Description	Default (Range)
H5-26 (158A) RUN Expert	Function 5A Register 2 Selection	V/f OLV CLV Returns the contents of the specified MEMOBUS/Modbus communications register when responding to the master device.	0045H (U1-06) (0000H - FFFFH)

Note:
Refer to *Writing to More than One Holding Register/Reading the Indicated Register on page 151* for more information.

■ H5-27: Function 5A Register 3 Selection

No. (Hex.)	Name	Description	Default (Range)
H5-27 (158B) RUN Expert	Function 5A Register 3 Selection	V/f OLV CLV Returns the contents of the specified MEMOBUS/Modbus communications register when responding to the master device.	0042H (U1-03) (0000H - FFFFH)

Note:

Refer to *Writing to More than One Holding Register/Reading the Indicated Register on page 151* for more information.

■ H5-28: Function 5A Register 4 Selection

No. (Hex.)	Name	Description	Default (Range)
H5-28 (158C) RUN Expert	Function 5A Register 4 Selection	V/f OLV CLV Returns the contents of the specified MEMOBUS/Modbus communications register when responding to the master device.	0049H (U1-10) (0000H - FFFFH)

Note:

Refer to *Writing to More than One Holding Register/Reading the Indicated Register on page 151* for more information.

12.8 L: Protection Functions

L parameters set the following functions.

- Motor Overload Protection
- Operation During Momentary Power Loss
- Stall Prevention
- Speed Detection
- Auto Restart
- Detection of Overtorque/Undertorque
- Torque Limit
- Hardware Protection

◆ L1: Motor Protection

L1 parameters set the motor overload protection function.

■ L1-01: Motor Overload (oL1) Protection

No. (Hex.)	Name	Description	Default (Range)
L1-01 (0480)	Motor Overload (oL1) Protection	V/f OLV CLV Sets the motor overload protection with electronic thermal protectors.	1 (0 - 3)

This parameter enables and disables the motor overload protection with electronic thermal protectors.

The cooling capability of the motor changes when the speed control range of the motor changes. Use an electronic thermal protector that aligns with the permitted load characteristics of the motor to select motor protection.

The electronic thermal protector of the drive uses these items to calculate motor overload tolerance and supply overload protection for the motor:

- Output Current
- Output Frequency
- Motor thermal characteristics
- Time characteristics

If the drive detects motor overload, the drive will trigger an *oL1 [Motor Overload]* and stop the drive output.

Set *H2-01 = 1F [Term MA/MB-MC Function Selection = Motor Overload Alarm (oL1)]* to set a motor overload alarm. If the motor overload level is more than 90% of the *oL1* detection level, the output terminal activates and triggers an overload alarm.

0 : Disabled

Disable motor protection when motor overload protection is not necessary or when the drive is operating more than one motor.

Refer to Figure 12.33 for an example of the circuit configuration to connect more than one motor to one drive.

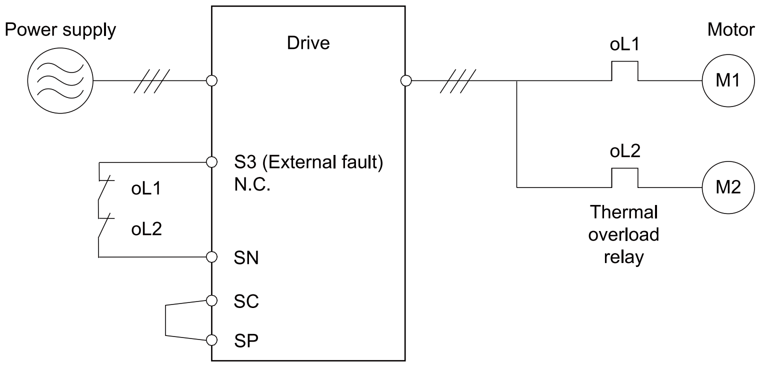


Figure 12.33 Protection Circuit Configuration to Connect More than One Motor to One Drive

NOTICE

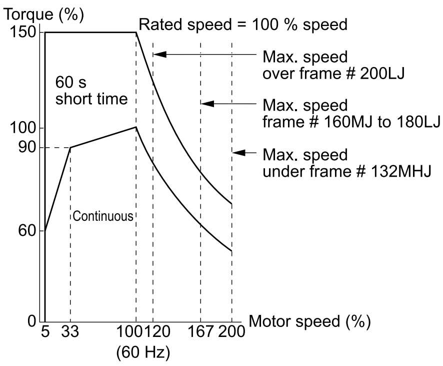
When you connect more than one motor to one drive or when the motor amp rating is higher than the drive amp rating, set L1-01 =0 [Motor Overload (oL1) Protection = Disabled] and install thermal overload relays for each motor.
The electronic thermal protection of the drive will not function and it can cause damage to the motor.

1 : Variable Torque

Use this setting for general-purpose motors with a 60 Hz base frequency.

The overload tolerance decreases as motor speed decreases because the cooling fan speed decreases and the ability of the motor to cool decreases in the low speed range.

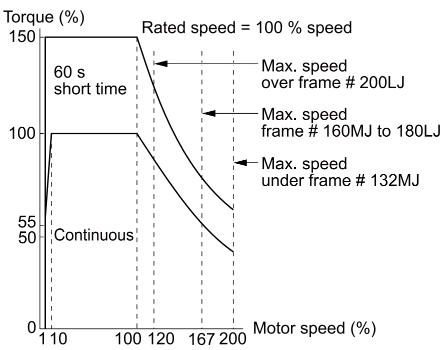
The overload tolerance characteristics of the motor change the trigger point for the electronic thermal protector. This provides motor overheat protection from low speed to high speed across the full speed range.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to operate with commercial line power. Operate at a 60 Hz base frequency to maximize the motor cooling ability.	If the motor operates at frequencies less than 60 Hz, the drive will detect *oL1*. The drive triggers a fault relay output and the motor coasts to stop.

2 : Constant Torque 10:1 Speed Range

Use this setting for drive-dedicated motors with a speed range for constant torque of 1:10.

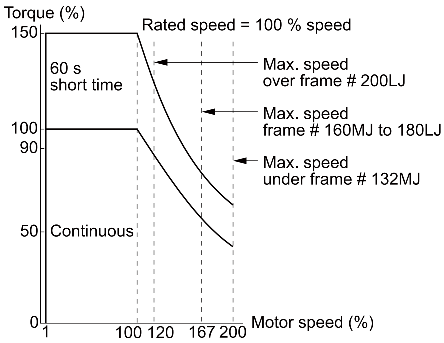
The speed control for this motor is 10% to 100% when at 100% load. Operating slower than 10% speed at 100% load will cause motor overload.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation in the low speed range (10% base frequency).	The motor operates continuously at 10% to 100% base frequency. Operating slower than 10% speed at 100% load will cause motor overload.

3 : Constant Torque 100:1 SpeedRange

Use this setting for vector motors with a speed range for constant torque of 1:100.

The speed control for this motor is 1% to 100% when at 100% load. Operating slower than 1% speed at 100% load will cause motor overload.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation in the low speed range (1% base frequency).	The motor operates continuously at 1% to 100% base frequency. Operating slower than 1% speed at 100% load will cause motor overload.

■ L1-02: Motor Overload Protection Time

No. (Hex.)	Name	Description	Default (Range)
L1-02 (0481) Expert	Motor Overload Protection Time	V/f OLV CLV Sets the operation time for the electronic thermal protector of the drive to prevent damage to the motor. Usually it is not necessary to change this setting.	1.0 min (0.1 - 5.0 min)

Set the overload tolerance time to the length of time that the motor can operate at 150% load from continuous operation at 100% load.

When the motor operates at 150% load continuously for 1 minute after continuous operation at 100% load (hot start), the default setting triggers the electronic thermal protector.

Figure 12.34 shows an example of the electronic thermal protector operation time. Motor overload protection operates in the range between a cold start and a hot start.

This example shows a general-purpose motor operating at the base frequency with *L1-02* set to 1.0 min.

- Cold start
  Shows the motor protection operation time characteristics when the overload occurs immediately after starting operation from a complete stop.
- Hot start
  Shows the motor protection operation time characteristics when overload occurs from continuous operation below the motor rated current.

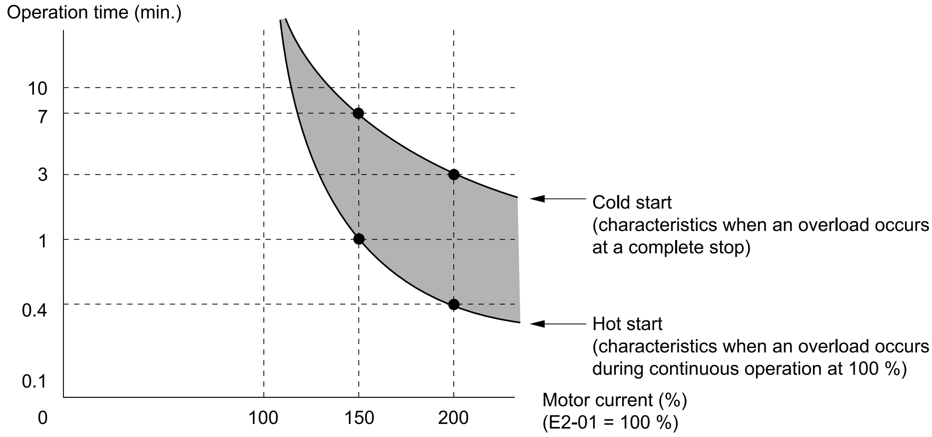


Figure 12.34 Protection Operation Time for a General-purpose Motor at Rated Output Frequency

■ L1-03: Motor Thermistor oH Alarm Select

No. (Hex.)	Name	Description	Default (Range)
L1-03 (0482) Expert	Motor Thermistor oH Alarm Select	V/f OLV CLV Sets drive operation when the PTC input signal entered into the drive is at the *oH3 [Motor Overheat Alarm]* detection level.	3 (0 - 3)

0 : Ramp to Stop

The drive ramps the motor to stop in the deceleration ramp. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

1 : Coast to Stop

The output turns off and the motor coasts to stop. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

2 : Emergency Stop (Use C1-09)

The drive stops the motor in the deceleration ramp set in *C1-09 [Emergency Stop Ramp]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

3 : Alarm Only

The keypad shows *oH3* and the drive continues operation. The output terminal set for *Alarm [H2-01 to H2-05 = 10]* activates.

■ L1-04: Motor Thermistor oH Fault Select

No. (Hex.)	Name	Description	Default (Range)
L1-04 (0483) Expert	Motor Thermistor oH Fault Select	V/f OLV CLV Sets the drive operation when the PTC input signal to the drive is at the *oH4 [Motor Overheat Fault (PTC Input)]* detection level.	1 (0 - 2)

0 : Ramp to Stop

The drive ramps the motor to stop in the deceleration ramp. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

1 : Coast to Stop

The output turns OFF and the motor coasts to stop. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

2 : Emergency Stop (Use C1-09)

The drive stops the motor in the deceleration ramp set in *C1-09 [Emergency Stop Ramp]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

■ L1-05: Motor Thermistor Filter Time

No. (Hex.)	Name	Description	Default (Range)
L1-05 (0484) Expert	Motor Thermistor Filter Time	V/f OLV CLV Sets the primary delay time constant for the PTC input signal entered to the drive. This parameter prevents accidental motor overheat faults.	0.20 s (0.00 - 10.00 s)

■ L1-08: oL1 Current Level for Motor 1

No. (Hex.)	Name	Description	Default (Range)
L1-08 (1103) Expert	oL1 Current Level for Motor 1	V/f OLV CLV Sets the reference current for the motor 1 thermal overload detection. When the current level > 0.0 A, you cannot set this value < 10% of the continuous rated output current.	0.0 A (0.0 - 2250.0 A)

When *L1-08 = 0.0 A*, the drive uses *E2-01 [Motor Rated Current (FLA)]* to detect the motor overload protection. In PM control mode, the drive uses *E5-03 [PM Motor Rated Current (FLA)]* to detect the motor overload protection.

When *L1-08 ≠ 0.0 A*, the set value is the reference for motor overload protection.

Note:
- The display units are different for different models:
  – Models 2022 to 2041, 4012 to 4023: 0.01 A
  – Models 2059 to 2519, 4030 to 4380: 0.1 A
- When the current level > 0.0 A, you cannot set this value < 10% of the continuous rated output current.

■ L1-13: Motor Overload Memory Selection

No. (Hex.)	Name	Description	Default (Range)
L1-13 (046D) Expert	Motor Overload Memory Selection	V/f OLV CLV Sets the function that keeps the current electronic thermal protector value when the drive stops receiving power.	1 (0, 1)

0 : Disabled

1 : Enabled

Sets if the drive will calculate the motor again when the drive is energized again.

◆ L2: Power Loss Ride Through (Undervoltage Detection)

■ L2-05: Undervoltage Detection Lvl (Uv1)

No. (Hex.)	Name	Description	Default (Range)
L2-05 (0489) Expert	Undervoltage Detection Lvl (Uv1)	V/f OLV CLV Sets the voltage at which a *Uv1 [DC Bus Undervoltage]* fault is triggered. Usually it is not necessary to change this setting.	Determined by E1-01 (200 V Class: 150 - 210 V, 400 V Class: 300 - 420 V)

NOTICE **Damage to Equipment**
When you set this parameter to a value lower than the default, you must install an AC reactor on the input side of the power supply.
If you do not install an AC reactor, it will cause damage to the drive circuitry.

◆ L3: Stall Prevention

L3 parameters set the Stall Prevention function and overvoltage suppression function.

■ Stall Prevention

If the load is too heavy or the acceleration and deceleration times are too short, the motor can slip too much because it cannot work at the same rate as the frequency reference. If the motor stalls during acceleration, current increases as the slip increases to cause an *oC [Overcurrent]*, *oL2 [Drive Overload]*, or *oL1 [Motor Overload]* and the drive will stop. If the motor stalls during deceleration, too much regenerative power will flow back into the DC bus capacitors, and cause the drive to fault out from *ov [Overvoltage]* and the drive will stop.

The stall prevention function will let the motor get to the set speed without stalling and it is not necessary for you to change the acceleration or deceleration time settings. You can set a separate stall prevention functions for acceleration, operating at constant speeds, and deceleration.

■ L3-01: Stall Prevention during Accel

No. (Hex.)	Name	Description	Default (Range)
L3-01 (048F) Expert	Stall Prevention during Accel	V/f OLV CLV Sets the method of the Stall Prevention During Acceleration.	1 (0 - 1)

Stall prevention during acceleration prevents the stalling and stopping of motors when the drive detects *oC [Overcurrent]*, *oL2 [Drive Overloaded]*, or *oL1 [Motor Overload]* when you apply a large load during acceleration or when you set sudden acceleration times related to load inertia.

0 : Disable

The Stall Prevention function does not operate during acceleration, and acceleration occurs for the set acceleration time. If the acceleration time is too short, the motor does not fully accelerate during the set time, which causes the drive to detect *oL1* or *oL2* and the motor to stop.

1 : Enabled

Enables the Stall Prevention During Acceleration function. Operation is different for different control methods.

When the output current is more than the value set in *L3-02 [Stall Prevent Level during Accel]*, the drive stops acceleration. The drive stops deceleration when the output current is less than *L3-02* - 15%. The Stall Prevention function level automatically decreases for constant output ranges.

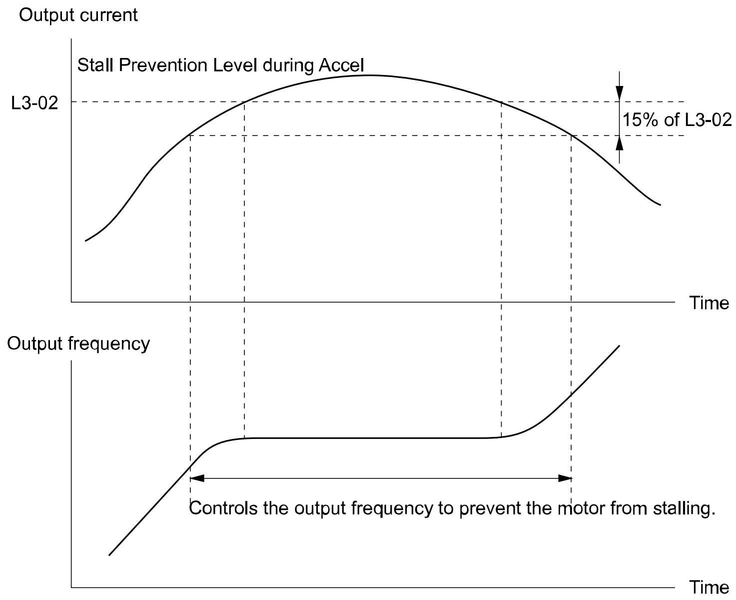


Figure 12.35 Stall Prevention During Acceleration when Using Induction Motors

■ L3-02: Stall Prevent Level during Accel

No. (Hex.)	Name	Description	Default (Range)
L3-02 (0490) Expert	Stall Prevent Level during Accel	V/f OLV CLV Sets the output current level at which the Stall Prevention function operates during acceleration where the drive rated output current is 100%.	Determined by L8-38 (0 - 165%)

Note:
- If you use a motor that is small compared to the drive and the motor stalls, decrease the setting value.
- When you operate the motor in the constant power range, set *L3-03 [Stall Prevent Limit during Accel]*.

■ L3-03: Stall Prevent Limit during Accel

No. (Hex.)	Name	Description	Default (Range)
L3-03 (0491) Expert	Stall Prevent Limit during Accel	V/f OLV CLV Sets the lower limit for the stall prevention level used in the constant output range as a percentage of the drive rated output current.	50% (0 - 100%)

The stall prevention level set in *L3-02 [Stall Prevent Level during Accel]* is automatically reduced when the motor is running within the constant output range. Parameter *L3-03* is the limit value used to prevent the stall prevention level during constant output ranges to fall below the minimum required level.

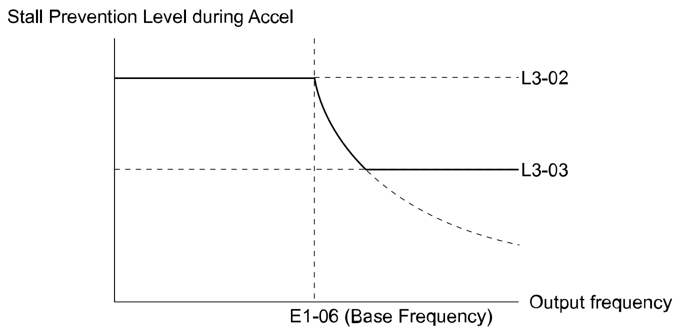


Figure 12.36 Stall Prevent Level during Accel/Limit

■ L3-05: Stall Prevention during RUN

No. (Hex.)	Name	Description	Default (Range)
L3-05 (0493) Expert	Stall Prevention during RUN	V/f OLV CLV Sets the function to enable and disable Stall Prevention During Run.	1 (0 - 1)

Stall Prevention function during run prevents the motor from stalling by automatically reducing the speed when an *oL1 [Motor Overload]* occurs while the motor is running at constant speed.

Note:

An output frequency less than 6 Hz disables Stall Prevention during Run. The setting values of *L3-05* and *L3-06 [Stall Prevent Level during Run]* do not have an effect.

0 : No

The drive runs at the set frequency reference. A heavy load can cause the motor to stall and trip the drive with *oC [Overcurrent]* or *oL1*.

1 : Deceleration Time 1 (C1-02)

The drive will decelerate for the time set in *C1-02 [Deceleration Time 1]* when the current is more than the Stall Prevention level set in *L3-06*. When the current level is less than the "*L3-06* setting value - 2%" for 100 ms, the drive accelerates again for the acceleration time applicable at that time until it is at the set frequency.

■ L3-06: Stall Prevent Level during Run

No. (Hex.)	Name	Description	Default (Range)
L3-06 (0494) Expert	Stall Prevent Level during Run	V/f OLV CLV Sets the output current level at which the Stall Prevention function is enabled during run when the drive rated output current is 100%.	Determined by L8-38 (30 - 165%)

Note:

This parameter is applicable when *L3-05 = 1 [Stall Prevention during RUN = Deceleration Time 1 (C1-02)]*.

◆ L4: Speed Detection

L4 parameters set the output of signals to the MFDO terminals, for example frequency agree and speed detection.

■ L4-01: Speed Agree Detection Level

No. (Hex.)	Name	Description	Default (Range)
L4-01 (0499) Expert	Speed Agree Detection Level	V/f OLV CLV Sets the level to detect speed agree or motor speed.	0.0 Hz (0.0 - 120.0 Hz)

Sets the level to detect speed agree or motor speed when *H2-01 to H2-03 = 2, 3, 4, 5 [MFDO Function Selection = Speed Agree 1, User-set Speed Agree 1, Frequency Detection 1, Frequency Detection 2]*.

■ L4-02: Speed Agree Detection Width

No. (Hex.)	Name	Description	Default (Range)
L4-02 (049A) Expert	Speed Agree Detection Width	V/f OLV CLV Sets the width to detect speed agree or motor speed.	2.0 Hz (0.0 - 20.0 Hz)

Sets the width to detect speed agree or motor speed when *H2-01 to H2-03 = 2, 3, 4, 5 [MFDO Function Selection = Speed Agree 1, User-set Speed Agree 1, Frequency Detection 1, Frequency Detection 2]*.

■ L4-03: Speed Agree Detection Level(+/-)

No. (Hex.)	Name	Description	Default (Range)
L4-03 (049B) Expert	Speed Agree Detection Level(+/-)	V/f OLV CLV Sets the level to detect speed agree or motor speed.	0.0 Hz (-120.0 - 120.0 Hz)

Sets the level to detect speed agree or motor speed when *H2-01 to H2-03 = 13, 14, 15, 16 [MFDO Function Selection = Speed Agree 2, User-set Speed Agree 2, Frequency Detection 3, Frequency Detection 4]*.

■ L4-04: Speed Agree Detection Width(+/-)

No. (Hex.)	Name	Description	Default (Range)
L4-04 (049C) Expert	Speed Agree Detection Width(+/-)	V/f OLV CLV Sets the width to detect speed agree or motor speed.	2.0 Hz (0.0 - 20.0 Hz)

Sets the width to detect speed agree or motor speed when *H2-01 to H2-03 = 13, 14, 15, 16 [MFDO Function Selection = Speed Agree 2, User-set Speed Agree 2, Frequency Detection 3, Frequency Detection 4]*.

■ L4-13: Door Zone Level

No. (Hex.)	Name	Description	Default (Range)
L4-13 (04F6) Expert	Door Zone Level	V/f OLV CLV Sets the speed level for the elevator door to open. When the elevator car decelerates to the speed level set in this parameter, an MFDO terminal set for *H2-xx = 52 [MFDO Function Selection = Door Zone]* will be active.	0.0% (0.0 - 100.0%)

The drive outputs the *Door Zone* signal when one of these conditions and speed reference < *L4-13* are true at the same time:

- The drive is in the baseblock state
- The drive is during DC Injection Braking
- The soft start output < *L4-13*

◆ L5: Fault Restart

The Auto Restart function tries to keep machines operating when the drive detects a transient fault.

The drive can do a self-diagnostic check and continue the operation after a fault. If the cause of the fault goes away, the drive does speed search and restarts. It will not stop and the drive will not record a fault history. Use *L5-02 [Fault Contact at Restart Select]* to select the operation of fault relay signals during Auto Restart operation.

Sets if the drive will do Auto Restart and the number of times the drive will try to do Auto Restart in a set time. If the number of Auto Restart tries is more than the set value during the set time, drive output shuts off and operation stops. If this happens, remove the cause of the fault and manually restart the drive.

⚠ WARNING Sudden Movement Hazard
Check the application condition in advance before you use the fault restart function. Failure to obey can cause death or serious injury.

The drive can do Auto Restart when these faults occur:

Table 12.12 List of Faults during which Auto Restart is Available

Fault	Name	Parameters to Disable Auto Restart
GF	Ground Fault	L5-08
LF	Output Phase Loss	-
oC	Overcurrent	-
oH1	Heatsink Overheat	L5-08
oL1	Motor Overload	L5-07
oL2	Drive Overload	L5-07
oL3	Overtorque Detection 1	L5-07
oL4	Overtorque Detection 2	L5-07
ov	Overvoltage	L5-08
rr	Dynamic Braking Transistor Fault	-
SE1	Sequence Error 1	-
SE2	Sequence Error 2	-
SE3	Sequence Error	-
UL3	Undertorque Detection 1	-
UL4	Undertorque Detection 2	-

■ L5-01: Number of Auto-Restart Attempts

No. (Hex.)	Name	Description	Default (Range)
L5-01 (049E) Expert	Number of Auto-Restart Attempts	V/f OLV CLV Sets the number of times that the drive will try to restart.	2 (0 - 10 times)

The drive resets the number of Auto Restart attempts to 0 in these conditions:

- The drive operates correctly for 10 minutes after a fault restart.
- When you manually clear a fault after the drive triggers protective functions.
- When you re-energize the drive.

L5-02: Fault Contact at Restart Select

No. (Hex.)	Name	Description	Default (Range)
L5-02 (049F) Expert	Fault Contact at Restart Select	V/f OLV CLV Sets the function that sends signals to the MFDO terminal set for *Fault [H2-xx = E]* while the drive is automatically restarting.	1 (0, 1)

0 : Active Only when Not Restarting

1 : Always Active

L5-06: Undervoltage Fault Restart Selection

No. (Hex.)	Name	Description	Default (Range)
L5-06 (046E) Expert	Undervoltage Fault Restart Selection	V/f OLV CLV Determines whether a limit should be placed on the number of reset attempts after a Uv1 fault.	0 (0, 1)

0 : Restrict auto-reset attempts to L5-01 after Uv1

1 : No Limit on auto-reset attempts to L5-01

L6: Torque Detection

Overview

The overtorque/undertorque detection function prevents damage to machinery and loads.

Overtorque is when there is too much load on the machine. If the motor current or output torque is at the overtorque detection level for the overtorque detection time, the drive will output an alarm and turn off the output.

Undertorque is when a load suddenly decreases. When the motor current or output torque is at the undertorque detection level for the undertorque detection time, the drive will output an alarm and turn off the output.

You can use the undertorque detection function to detect these conditions, for example:

- Machine belt cuts
- Unusual operation of the electromagnetic contactor on the drive output side
- Clogged output side air filters in fans and blowers
- Damage to blade tips and broken string

Note:

If there is *oC [Overcurrent]* or *oL1 [Motor Overload]*, the drive can stop during overtorque conditions. Use torque detection to identify overload conditions before the drive detects *oC* or *oL1* and stops. Use this function to detect issues that occur in the application.

Parameter Settings

You can individually set the two overtorque/undertorque detection functions with the drive. Use the information in Table 12.13 to set the parameters.

Table 12.13 Overtorque/Undertorque Detection Parameters

Configuration Parameter	Overtorque/Undertorque Detection 1	Overtorque/Undertorque Detection 2
MFDO Function Select • Terminal MA-MC • Terminal P1-C1 • Terminal P2-C2	H2-01, H2-02, and H2-03 = B N.O.: Activated when detected	H2-01, H2-02, and H2-03 = 18 N.O.: Activated when detected
	H2-01, H2-02, and H2-03 = 17 N.C.: Disactivated when detected	H2-01, H2-02, and H2-03 = 19 N.C.: Disactivated when detected
Detection conditions and selection of operation after detection	L6-01	L6-04
Detection Level	L6-02	L6-05
Detection Time	L6-03	L6-06

■ Overtorque Detection Time Chart

When you use Overtorque/Undertorque Detection 1, the drive detects overtorque if the motor current or motor torque is at the detection level set in *L6-02 [Torque Detection Level 1]* for the time set in *L6-03 [Torque Detection Time 1]*. Parameter *L6-01 [Torque Detection Selection 1]* sets the operation after detection.

When you use Overtorque/Undertorque Detection 2, set *L6-04 [Torque Detection Selection 2]*, *L6-05 [Torque Detection Level 2]*, and *L6-06 [Torque Detection Time 2]*.

Set the terminal that outputs the alarm in *H2-01 to H2-03 [MFDO Function Select]*.

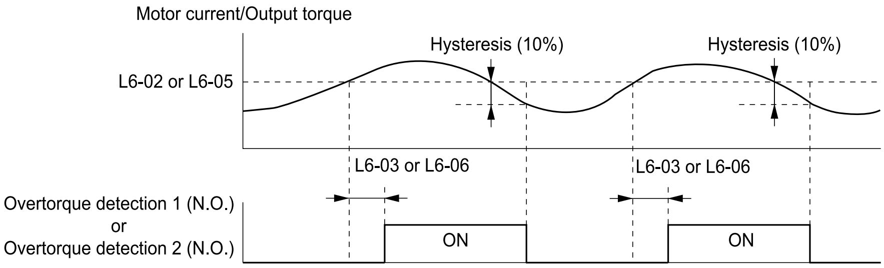


Figure 12.37 Overtorque Detection Time Chart

Note:

The drive applies a hysteresis of approximately 10% of the drive rated output current or the motor rated torque to the overtorque/undertorque detection function.

■ Undertorque Detection Time Chart

When you use Overtorque/Undertorque Detection 1, the drive detects undertorque if the motor current or motor torque is less than or equal to the detection level set in *L6-02* for the time set in *L6-03*. Parameter *L6-01* sets the operation after detection.

When you use Overtorque/Undertorque Detection 2, set the operation in *L6-04, L6-05, and L6-06*.

Set the terminal that outputs an alarm in *H2-01 to H2-03*.

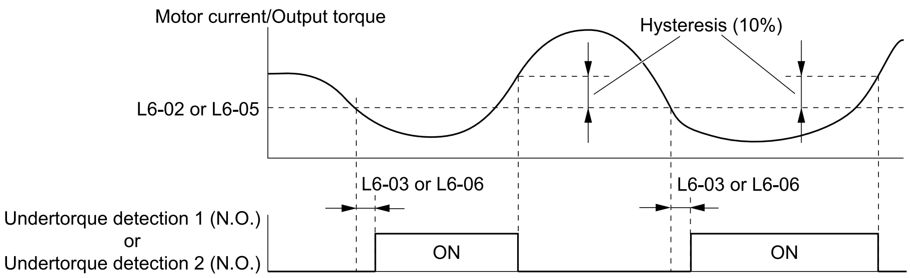


Figure 12.38 Undertorque Detection Time Chart

Note:

The drive applies a hysteresis of approximately 10% of the drive rated output current or the motor rated torque to the overtorque/undertorque detection function.

■ L6-01: Torque Detection Selection 1

No. (Hex.)	Name	Description	Default (Range)
L6-01 (04A1) Expert	Torque Detection Selection 1	V/f OLV CLV Sets torque detection conditions that will trigger an overtorque or undertorque response from the drive.	0 (0 - 8)

The drive detects overtorque if the motor current or output torque is more than the level set in *L6-02 [Torque Detection Level 1]* for the length of time set in *L6-03 [Torque Detection Time 1]*. The drive detects undertorque if the motor current or output torque is less than the level set in *L6-02* for the length the time set in *L6-03*.

0 : Disabled

The drive will not detect overtorque or undertorque.

1 : oL @ Speed Agree - Alarm only

The drive detects overtorque when the output frequency aligns with the frequency reference. Detection does not occur during acceleration/deceleration. The drive outputs an *oL3 [Overtorque Detection 1]* and operation continues.

2 : oL @ RUN - Alarm only

When the Run command is enabled, the drive constantly detects overtorque. The drive outputs an *oL3* and operation continues.

3 : oL @ Speed Agree - Fault

The drive detects overtorque when the output frequency aligns with the frequency reference. Detection does not occur during acceleration/deceleration. The drive outputs an *oL3* and operation stops.

4 : oL @ RUN - Fault

When the Run command is enabled, the drive constantly detects overtorque. The drive outputs an *oL3* and operation stops.

5 : UL @ Speed Agree - Alarm only

The drive detects undertorque when the output frequency aligns with the frequency reference. Detection does not occur during acceleration/deceleration. The drive outputs a *UL3 [Undertorque Detection 1*] and operation continues.

6 : UL @ RUN - Alarm only

When the Run command is enabled, the drive constantly detects undertorque. The drive outputs a *UL3* and operation continues.

7 : UL @ Speed Agree - Fault

The drive detects undertorque when the output frequency aligns with the frequency reference. Detection does not occur during acceleration/deceleration. The drive outputs a *UL3* and operation stops.

8 : UL @ RUN - Fault

When the Run command is enabled, the drive constantly detects undertorque. The drive outputs a *UL3* and operation stops.

■ L6-02: Torque Detection Level 1

No. (Hex.)	Name	Description	Default (Range)
L6-02 (04A2) Expert	Torque Detection Level 1	V/f OLV CLV Sets the detection level for Overtorque/Undertorque Detection 1. In V/f control, drive rated output current = 100% value. In vector control, motor rated torque = 100% value.	150% (0 - 300%)

Note:
- Set the torque detection level as a percentage of the drive rated output current in all control methods to set the mechanical weakening detection level.

■ L6-03: Torque Detection Time 1

No. (Hex.)	Name	Description	Default (Range)
L6-03 (04A3) Expert	Torque Detection Time 1	V/f OLV CLV Sets the detection time for Overtorque/Undertorque Detection 1.	0.1 s (0.0 - 10.0 s)

■ L6-04: Torque Detection Selection 2

No. (Hex.)	Name	Description	Default (Range)
L6-04 (04A4) Expert	Torque Detection Selection 2	V/f OLV CLV Sets the speed range that detects overtorque and undertorque and the operation of drives (operation status) after detection.	0 (0 - 8)

The drive detects overtorque if the motor current or output torque is more than the level set in *L6-05 [Torque Detection Level 2]* for the length of time set in *L6-06 [Torque Detection Time 2]*. The drive detects undertorque if the motor current or output torque is less than the level set in *L6-05* for the length the time set in *L6-06*.

0 : Disabled

The drive will not detect overtorque or undertorque.

1 : oL @ Speed Agree - Alarm only

The drive detects overtorque when the output frequency aligns with the frequency reference. Detection does not occur during acceleration/deceleration. The drive outputs an *oL4 [Overtorque Detection 2]* and operation continues.

2 : oL @ RUN - Alarm only

When the Run command is enabled, the drive constantly detects overtorque. The drive outputs an *oL4* and operation continues.

3 : oL @ Speed Agree - Fault

The drive detects overtorque when the output frequency aligns with the frequency reference. Detection does not occur during acceleration/deceleration. The drive outputs an *oL4 [Overtorque Detection 2]* and operation stops.

4 : oL @ RUN - Fault

When the Run command is enabled, the drive constantly detects overtorque. The drive outputs an *oL4* and operation stops.

5 : UL @ Speed Agree - Alarm only

The drive detects undertorque when the output frequency aligns with the frequency reference. Detection does not occur during acceleration/deceleration. The drive outputs a *UL4 [Undertorque Detection 2]* and operation continues.

6 : UL @ RUN - Alarm only

When the Run command is enabled, the drive constantly detects undertorque. The drive outputs a *UL4* and operation continues.

7 : UL @ Speed Agree - Fault

The drive detects undertorque when the output frequency aligns with the frequency reference. Detection does not occur during acceleration/deceleration. The drive outputs a *UL4* and operation stops.

8 : UL @ RUN - Fault

When the Run command is enabled, the drive constantly detects undertorque. The drive outputs a *UL4* and operation stops

■ L6-05: Torque Detection Level 2

No. (Hex.)	Name	Description	Default (Range)
L6-05 (04A5) Expert	Torque Detection Level 2	V/f OLV CLV Sets the detection level for Overtorque/Undertorque Detection 2. In V/f control, drive rated output current = 100% value. In vector control, motor rated torque = 100% value.	150% (0 - 300%)

Note:

Overtorque/Undertorque Detection 2 cannot set the detection level for the analog input terminal.

■ L6-06: Torque Detection Time 2

No. (Hex.)	Name	Description	Default (Range)
L6-06 (04A6) Expert	Torque Detection Time 2	V/f OLV CLV Sets the detection time for Overtorque/Undertorque Detection 2.	0.1 s (0.0 - 10.0 s)

◆ L7: Torque Limit

■ Overview

The torque limit function limits the internal torque reference for the drive to and keeps the torque from the motor constant. This function limits the torque applied to loads and regenerative torque to a value less than a set quantity. This function also prevents damage to machinery and increases the reliability of continuous operation. You can set torque limits individually for the four quadrants, which include torque direction (motoring/ regeneration) and direction of motor rotation (forward/reverse). When the torque reference value is at the set torque limit, the MFDO terminal set for *During Torque Limit [H2-xx = 30]* activates.

Note:

- The drive output current limits maximum output torque. The drive limits torque to 150% of the rated output current for 60 seconds, or 165% of the rated output current for 30 seconds. The actual output torque is not more than the limits of the drive rated output current when you set the torque limit to a high value.
- When you use torque limits, do not lower the torque limit value too much. When the torque limit function is triggered, falls and rollbacks can occur because of sudden acceleration stops and stalls of the motor.

Configuring Settings

Use one of these methods to set torque limits:

- Individually set the four torque limit quadrants using *L7-01 to L7-04 [Torque Limit]*.
- Use a communication option to set all four torque limit quadrants together.

Figure 12.39 shows the configuration method for each quadrant.

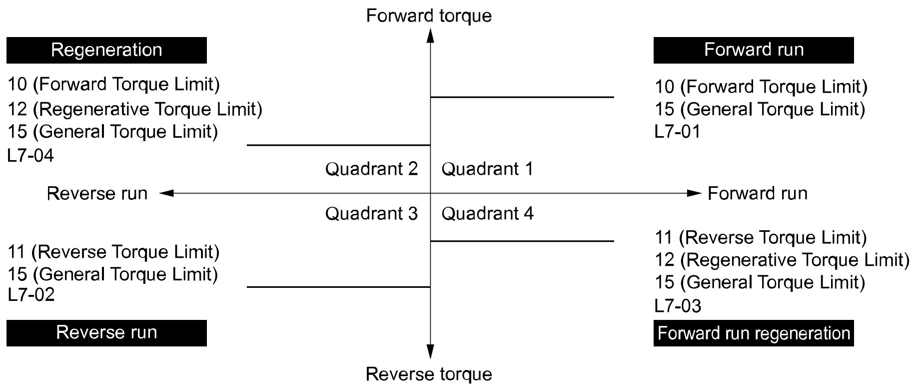


Figure 12.39 Torque Limits and Analog Input Setting Parameters

Note:
- When *L7-01 to L7-04* and analog inputs or communication option torque limits set torque limits for the same quadrant, the drive enables the lowest value.
  In this example of parameter settings, the torque limit for quadrant 1 is 130% and the torque limit for quadrants 2, 3, and 4 is 150%.
  Settings: *L7-01 = 130%, L7-02 to L7-04 = 200%*
- The drive output current limits maximum output torque. The torque limit is 150% of the rated output current for HD and to 120% of the rated output current for ND. The actual output torque is not more than the limits of the drive rated output current when you set the torque limit to a high value.

L7-01: Forward Torque Limit

No. (Hex.)	Name	Description	Default (Range)
L7-01 (04A7) RUN Expert	Forward Torque Limit	V/f OLV CLV Sets the torque limit value for forward motoring as a percentage, where motor rated torque is the 100% value.	200% (0 - 300%)

Note:
- You must think about drive capacity when a large quantity of torque is necessary. If you set the value too high, the drive can detect *oC [Overcurrent]*.
- If you set the value too low with large loads, the motor can stall.

L7-02: Reverse Torque Limit

No. (Hex.)	Name	Description	Default (Range)
L7-02 (04A8) RUN Expert	Reverse Torque Limit	V/f OLV CLV Sets the torque limit value for reversed motoring as a percentage, where motor rated torque is the 100% value.	200% (0 - 300%)

Note:
- You must think about drive capacity when a large quantity of torque is necessary. If you set the value too high, the drive can detect *oC [Overcurrent]*.
- If you set the value too low with large loads, the motor can stall.

L7-03: Forward Regenerative Trq Limit

No. (Hex.)	Name	Description	Default (Range)
L7-03 (04A9) RUN Expert	Forward Regenerative Trq Limit	V/f OLV CLV Sets the torque limit value for forward regenerative conditions as a percentage of the motor rated torque.	200% (0 - 300%)

Note:
- You must think about drive capacity when a large quantity of torque is necessary. If you set the value too high, the drive can detect *oC [Overcurrent]*.
- If you set the value too low with large loads, the motor can stall.

■ L7-04: Reverse Regenerative Trq Limit

No. (Hex.)	Name	Description	Default (Range)
L7-04 (04AA) RUN Expert	Reverse Regenerative Trq Limit	V/f OLV CLV Sets the torque limit value for reversed regenerative conditions as a percentage of the motor rated torque.	200% (0 - 300%)

Note:
- You must think about drive capacity when a large quantity of torque is necessary. If you set the value too high, the drive can detect *oC [Overcurrent]*.
- If you set the value too low with large loads, the motor can stall.

■ L7-06: Torque Limit Integral Time

No. (Hex.)	Name	Description	Default (Range)
L7-06 (04AC) Expert	Torque Limit Integral Time	V/f OLV CLV Sets the integral time constant for the torque limit function.	200 ms (5 - 10000 ms)

Decrease the setting value to increase torque limit responsiveness when you use torque limits and *L7-07 = 1 [Torque Limit during Accel/Decel = Proportional & Integral control]*.

If there is hunting when torque limits are active, increase the setting value.

■ L7-07: Torque Limit during Accel/Decel

No. (Hex.)	Name	Description	Default (Range)
L7-07 (04C9) Expert	Torque Limit during Accel/ Decel	V/f OLV CLV Sets the torque limit function during acceleration and deceleration.	0 (0, 1)

0 : Proportional only

The torque limit function works with proportional control during acceleration and deceleration, and switches to integral control at constant speed. Use this setting when quickly reaching the target speed is more important than the torque limit during speed changes.

1 : Proportional & Integral control

The torque limit function always uses integral control. Use this setting when a very accurate torque limit is necessary during speed changes, for example in winding machine applications.

If you make the torque limit the most important, it can:

- Increase the acceleration and deceleration times.
- Not let the motor speed reach the frequency reference value during run at constant speed.

■ L7-16: Torque Limit Process at Start

No. (Hex.)	Name	Description	Default (Range)
L7-16 (044D) Expert	Torque Limit Process at Start	V/f OLV CLV Assigns a time filter to allow the torque limit to build at start.	1 (0, 1)

0 : Disabled

There is torque limit at start without a delay time.

Use this setting to maximize the response time when sudden acceleration or deceleration at start is necessary.

1 : Enabled

There is a delay time of 64 ms at start to build the torque limit.

◆ L8: Drive Protection

L8 parameters set protective functions that prevent faults such as overheating, phase loss, and ground faults.

■ L8-02: Overheat Alarm Level

No. (Hex.)	Name	Description	Default (Range)
L8-02 (04AE) Expert	Overheat Alarm Level	V/f OLV CLV Sets the *oH* detection level in temperature.	Determined by o2-04 (50 - 130 °C)

If the heatsink temperature is more than the temperature set in this parameter, the drive detects an overheat pre-alarm. To enable this function, set one of *H2-01 to H2-03 [MFDO Function Select]* to *20 [Drive Overheat Pre-Alarm (oH)]*.

If the temperature increases to the overheat fault level, the drive will trigger an *oH1 [Heatsink Overheat]* fault and stop operation.

■ L8-03: Overheat Pre-Alarm Selection

No. (Hex.)	Name	Description	Default (Range)
L8-03 (04AF) Expert	Overheat Pre-Alarm Selection	V/f OLV CLV Sets operation after the drive detects an *oH* alarm.	3 (0 - 4)

0 : Ramp to Stop

The drive ramps the motor to stop in the deceleration time. The output terminal set for *Fault [H2-01 to H2-03 = E]* activates.

1 : Coast to Stop

The output turns off and the motor coasts to stop. The output terminal set for *Fault [H2-01 to H2-03 = E]* activates.

2 : Fast Stop (Use C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. The output terminal set for *Fault [H2-01 to H2-03 = E]* activates.

3 : Alarm Only

The keypad shows *oH* and the drive continues operation. The output terminal set for *Alarm [H2-01 to H2-03 = 10]* activates.

4 : Operate at Reduced Speed (L8-19)

The drive decelerates to the level set in *L8-19 [Freq Reduction @ oH Pre-Alarm]* and continues operation. *oH* flashes on the keypad.

If the overheat pre-alarm is still ON after 10 s, the drive decelerates again. When the alarm is output, the drive decelerates each 10 seconds. If the drive decelerates 10 times and the alarm continues to be output, the output terminal set for *oH Pre-Alarm Reduction Limit [H2-01 to H2-03 = 4D]* activates. When the alarm is not output during deceleration, the drive accelerates until it is at the frequency reference that was applicable before the alarm was turned off. Figure 12.40 shows the output of the alarm and the drive operation at a decreased output frequency.

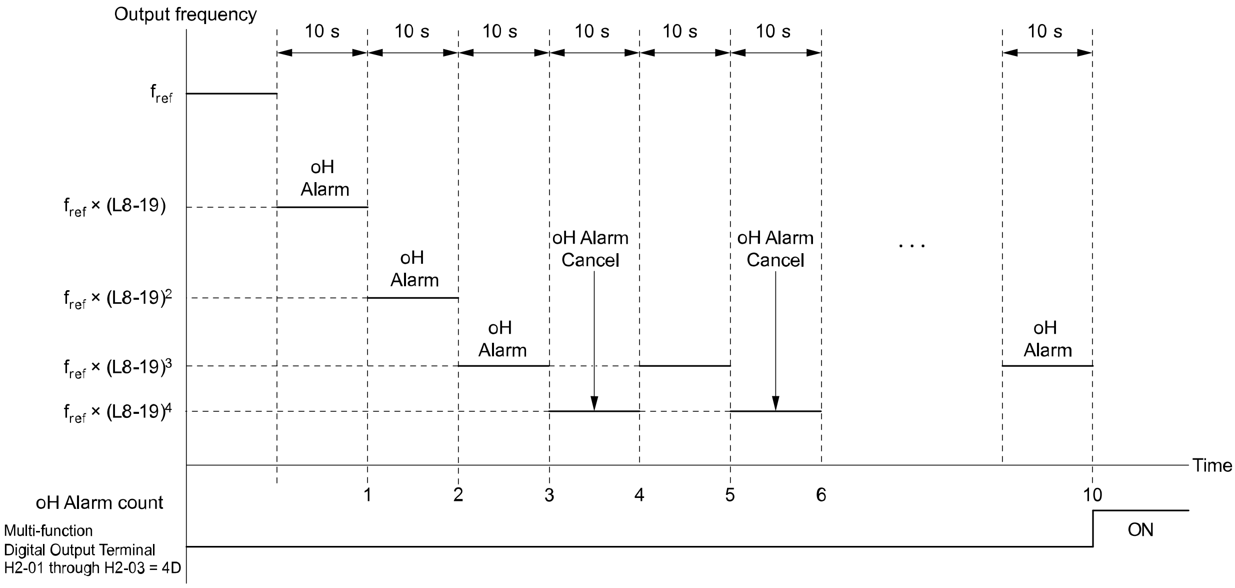


Figure 12.40 Drive Operation at a Decreased Output Frequency when the Overheat Alarm is Output

■ L8-05: Input Phase Loss Protection Sel

No. (Hex.)	Name	Description	Default (Range)
L8-05 (04B1)	Input Phase Loss Protection Sel	V/f OLV CLV Sets the function to enable and disable input phase loss detection.	Depends on o2-04 (0, 2, 6)

0 : Disable

2 : Standard + dv/dt

6 : dV/dt at start, standard during travel

■ L8-06: Input Phase Loss Detection Level

No. (Hex.)	Name	Description	Default (Range)
L8-06 (04B2) Expert	Input Phase Loss Detection Level	V/f OLV CLV When ripple is observed in the DC bus, expansion of the input bias is calculated and becomes the input phase if the difference between the max and minimum values of the ripple are greater than L8-06.	Determined by o2-04 (0.0 - 50.0%)

100% detection level = voltage (200V or 400 V) × √2

■ L8-07: Output Phase Loss Protection Sel

No. (Hex.)	Name	Description	Default (Range)
L8-07 (04B3) Expert	Output Phase Loss Protection Sel	V/f OLV CLV Sets the function to enable and disable output phase loss detection. The drive detects LF [Output Phase Loss] if there is a phase loss on one (or more than one) of the U, V, or W phases on the output side.	0 (0, 1)

Note:
- The drive can incorrectly start output phase loss detection in these conditions:
  - –The motor rated current is very small compared to the drive rating.
  - –The drive is operating a PM motor with a small load.
- When *L8-07 = 1*, set these parameters:
  - –*S1-02 [DC Injection Current at Start]* > 15% (when *A1-02 = 0, 2 [Conrtol Method Selection = V/f or OLV]*)
  - –*S1-04 [DC Inj/Pos LockTime at Start]* > 100 ms

  If you set these parameters incorrectly, the drive can incorrectly start output phase loss detection.

0 : Disabled

1 : Enabled

If the drive loses one or more output phases, it will trigger *LF [Output Phase Loss]*.

The output turns off and the motor coasts to stop.

L8-09: Output Ground Fault Detection

No. (Hex.)	Name	Description	Default (Range)
L8-09 (04B5) Expert	Output Ground Fault Detection	V/f OLV CLV Sets the function to enable and disable ground fault protection.	1 (0, 1)

0 : Disable

The drive will not detect ground faults.

1 : Enabled

If there is high leakage current or a ground short circuit in one or two output phases, the drive will detect *GF [Ground Fault]*.

Note:

If the ground path impedance is low, the drive can detect *oC [Overcurrent]*, *SC [Out Short Circuit or IGBT Fault]*, or *ov [DC Bus Overvoltage]* instead of *GF*.

L8-10: Heatsink Fan Operation Selection

No. (Hex.)	Name	Description	Default (Range)
L8-10 (04B6)	Heatsink Fan Operation Selection	V/f OLV CLV Sets operation of the heatsink cooling fan.	0 (0 - 2)

0 : During Run, w/ L8-11 Off-Delay

The drive turns on the fan when a Run command is active.

1 : Always On

The fan turns on when you supply power to the drive. When you release the Run command and the delay time set in *L8-11 [HeatsinkCoolingFan Off DelayTime]* is expired, the fan stops. his setting extends the fan lifetime.

2 : Temperature-Dependent Fan Ctrl.

The fan turns on when the drive detects that the main circuit is overheating.

L8-11: Heatsink Fan Off-Delay Time

No. (Hex.)	Name	Description	Default (Range)
L8-11 (04B7) Expert	Heatsink Fan Off-Delay Time	V/f OLV CLV Sets the length of time that the drive will wait before it stops the cooling fan after it cancels the Run command when *L8-10 = 0 [Heatsink Fan Operation Selection = During Run, w/ L8-11 Off-Delay]*.	60 s (0 - 300 s)

L8-12: Ambient Temperature Setting

No. (Hex.)	Name	Description	Default (Range)
L8-12 (04B8) Expert	Ambient Temperature Setting	V/f OLV CLV Sets the ambient temperature of the drive installation area.	40 °C (-10 °C - +60 °C)

Note:

The setting range changes when the *L8-35 [Installation Method Selection]* value changes:
- *0 [IP20/UL Open Type]*: -10 °C to +60 °C
- *1 [Side-by-Side Mounting]*: -10 °C to +50 °C
- *2 [IP20/UL Type 1]*: -10 °C to +50 °C
- *3 [Finless Installation]*: -10 °C to +50 °C

The drive automatically adjusts the drive rated current to the best value as specified by the set temperature. Set the ambient temperature of the area where you install the drive to a value that is more than the drive rating.

Refer to *Derating Depending on Ambient Temperature on page 240* for information about derating as specified by ambient temperature.

■ L8-15: Drive oL2 @ Low Speed Protection

No. (Hex.)	Name	Description	Default (Range)
L8-15 (04BB) Expert	Drive oL2 @ Low Speed Protection	V/f OLV CLV Sets the function to decrease the drive overload level at which the drive will trigger *oL2 [Drive Overload]* during low speed operation (6 Hz or slower) to prevent damage to the main circuit transistors.	1 (0, 1)

Note:

Contact Yaskawa or your nearest sales representative before disabling this function at low speeds. If you frequently operate drives with high output current in low speed ranges, it can cause heat stress and decrease the life span of drive IGBTs.

0 : Disabled (No Additional Derate)

The drive does not decrease the overload protection level.

1 : Enabled (Reduced oL2 Level)

When the drive detects *oL2* during low speed operation, it automatically decreases the overload detection level.

At zero speed, the drive derates the overload by 50%.

■ L8-18: Software Current Limit Selection

No. (Hex.)	Name	Description	Default (Range)
L8-18 (04BE) Expert	Software Current Limit Selection	V/f OLV CLV Set the software current limit selection function to prevent damage to the main circuit transistor caused by too much current.	0 (0, 1)

0 : Disabled

When the output current is at the software current limit value, the drive does not restrict the output voltage.

Note:

The drive may detect an *oC [Overcurrent]* when loads are particularly heavy or the acceleration time is particularly short.

1 : Enabled

When the output current is at the software current limit value, the drive decreases output voltage to decrease output current.

When the output current decreases to the software current limit level, the drive starts usual operation.

■ L8-19: Freq Reduction @ oH Pre-Alarm

No. (Hex.)	Name	Description	Default (Range)
L8-19 (04BF) Expert	Freq Reduction @ oH Pre-Alarm	V/f OLV CLV Sets the ratio at which the drive derates the frequency reference during an *oH* alarm.	0.8 (0.1 - 0.9)

When these two conditions are correct, this function is enabled:

- *L8-03 = 4 [Overheat Pre-Alarm Ope Selection = Run@L8-19 Rate]*
- *oH* alarm is output

■ L8-35: Installation Method Selection

No. (Hex.)	Name	Description	Default (Range)
L8-35 (04EC) Expert	Installation Method Selection	V/f OLV CLV Sets the type of drive installation.	Determined by o2-04 (0 - 3)

Note:

- Parameter *A1-03 [Initialize Parameters]* does not initialize this parameter.
- This parameter is set to the correct value when the drive is shipped. Change the value only in these conditions:
  - Side-by-Side installation
  - When you install a UL Type 1 kit on an IP20/UL Open Type drive to convert the drive to an IP20/UL Type 1 drive.
  - Mounting a standard drive with the heatsink outside the enclosure panel.

The overload protection detection level for the drive is automatically adjusted to the optimal value in accordance with the setting value. Refer to *Derating Depending on Ambient Temperature on page 240* for information about derating as specified by ambient temperature.

0 : IP20/UL Open Type

Use this setting to install IP20/UL Open Type drives.

Make sure that there is 30 mm (1.18 in) minimum of space between drives or between the drive and side of the enclosure panel.

1 : Side-by-Side Mounting

Use this setting to install more than one drive side-by-side.

2 : IP20/UL Type 1

Use this setting to install IP20/UL Type 1 or IP55 drives.

3 : Finless Installation

Use this setting to install Finless Type drives.

■ L8-38: Automatic Torque Boost Function

No. (Hex.)	Name	Description	Default (Range)
L8-38 (04EF)	Automatic Torque Boost Function	V/f OLV CLV Sets the operation of Automatic Torque Boost function. When the output current, integrated overload value, or heatsink temperature are more than a specified level, the drive increases the output current limit and decreases the carrier frequency. When you set this parameter to *0 [Disabled]* to give priority to operations with low audible noise, select a larger capacity drive to prevent insufficient torque if necessary. Usually it is not necessary to change this setting.	3 (0, 3)

When the output current is at a specified level, the drive automatically decreases the carrier frequency to the value set in *L8-39 [Reduced Carrier Frequency]*. When the drive decreases the carrier frequency, it also increases the overload tolerance, and the drive can output more torque. When the drive is stopped (in baseblock), the carrier frequency goes back to the value set in *C6-03 [Carrier Frequency]*.

The drive also automatically decreases the carrier frequency when:

- The integrated drive overload value is more than *C6-34 [Carrier Freq Reduce Start Level]*
- The drive heatsink temperature is more than a specified level

When the drive decreases the carrier frequency, the overload capacity for *oL2 [Drive Overload]* or overheat capacity for *oH [Heatsink Overheat]* increases temporarily. It lets the drive operate through transient load/temperature peaks and not trip.

0 : Disabled

The drive will not change the carrier frequency, rated current, or startup current at high loads.

If the frequency of operation or ambient temperature cause too much heat in the drive, it automatically decreases the rated current and the maximum current.

Note:

Load conditions or operation conditions can cause insufficient motor torque. Select a larger capacity drive to prevent insufficient torque if necessary.

3 : Enabled

The drive automatically decreases the carrier frequency at high loads to increase the startup current.

When the drive is hot, it also automatically decreases the carrier frequency to keep the rated current and startup current.

Note:

When the drive decreases the carrier frequency, the motor will make a large audible noise.

In separate technical data, Yaskawa summarized the differences in rated current and startup current when the output frequency, setting of the Automatic Torque Boost function, or drive temperature condition change. Contact Yaskawa or your nearest sales representative for more information.

Note:

If insufficient torque or *oL2* occurs when you enable this function, decrease *L8-39 [Reduced Carrier Frequency]*.

■ L8-39: Reduced Carrier Frequency

No. (Hex.)	Name	Description	Default (Range)
L8-39 (04F0) Expert	Reduced Carrier Frequency	V/f OLV CLV Sets the decreased carrier frequency used by Automatic Torque Boost function.	Determined by o2-04 (2.0 - Determined by o2-04 kHz)

When *L8-38 = 3 [Automatic Torque Boost Function = Enabled]*, the drive decreases the carrier frequency to the value set in this parameter.

■ L8-41: High Current Alarm Selection

No. (Hex.)	Name	Description	Default (Range)
L8-41 (04F2) Expert	High Current Alarm Selection	V/f OLV CLV Sets the function to cause an *HCA [Current Alarm]* when the output current is more than 150% of the drive rated current.	0 (0, 1)

0 : No

The drive will not detect *HCA*.

1 : Yes

If the output current is more than 150% of the drive rated current, the drive will detect *HCA*.

The MFDO terminal set for an *Alarm [H2-01 to H2-03 = 10]* activates.

■ L8-42: Input Phase Loss Detection Time 2

No. (Hex.)	Name	Description	Default (Range)
L8-42 (04F3) Expert	Input Phase Loss Detection Time 2	V/f OLV CLV Sets the amount of time that an Input Phase Loss condition has to be present before a fault is triggered.	2 s

■ L8-43: Output Phase Loss Detection Time

No. (Hex.)	Name	Description	Default (Range)
L8-43 (04F4) Expert	High Current Alarm Selection	V/f OLV CLV Sets the amount of time that an Output Phase Loss condition has to be present before a fault is triggered.	0.5 s (0.0 - 2.0 s)

■ L8-55: Internal DB TransistorProtection

No. (Hex.)	Name	Description	Default (Range)
L8-55 (045F) Expert	Internal DB TransistorProtection	V/f OLV CLV Sets the protection function for the internal braking transistor.	1 (0 - 1)

0 : RF Disabled/BOL Disabled

Disables braking transistor protection.

Use this setting, if enabling the braking transistor can cause an *rF [Braking Resistor Fault]* in these conditions:

- With a regenerative converter, for example D1000.
- With a regenerative unit, for example R1000.
- When connecting braking resistor options to the drive, for example CDBR units.
- Without an internal braking transistor.

1 : RF Enabled/BOL Enabled

Protects internal braking transistor when using a braking transistor or optional braking resistors.

These models have a built-in braking transistor:

- 2022 to 2144
- 4012 to 4188

■ L8-62: Input Phase Loss Detection

No. (Hex.)	Name	Description	Default (Range)
L8-62 (04D8)	Input Phase Loss Detection	V/f OLV CLV Sets stopping method when an input phase loss fault (PF) occurs.	0 (0 - 3)

0 : Ramp to stop

Decelerate to stop using the active deceleration time.

1 : Coast to stop

2 : Stop (Use C1-09)

Decelerate to stop using the deceleration time in C1-09.

3 : Alarm Only

Drive continues operation.

■ L8-65: PF Min Current

No. (Hex.)	Name	Description	Default (Range)
L8-65 (04DB) Expert	PF Detection Minimum Current Level	V/f OLV CLV Percentage of rated current. Used for standard method and dv/dt method. The parameter is only active during run, and is not evaluated for dv/dt detection method at start.	10% (0 - 100%)

■ L8-70: PF dv/dt Level

No. (Hex.)	Name	Description	Default (Range)
L8-70 (04E0)	PF dv/dt Level	V/f OLV CLV	2100 V/sec (0 - 10,000 V/sec)

■ L8-79: dv/dt Tune Factor

No. (Hex.)	Name	Description	Default (Range)
L8-79 (04E9)	dv/dt Tune Factor	V/f OLV CLV	130% (99 - 150%)

■ L8-88: Safe Disable Operation Mode

No. (Hex.)	Name	Description	Default (Range)
L8-88 (04F2) Expert	Safe Disable Operation Mode	V/f OLV CLV Determines the operation performed by the drive when the Safe Disable input is activated.	0 (0, 1)

When the Safe Disabled Input is triggered, the operator displays and alarm, and the corresponding output terminal will react as follows:

L8-88 Setting	Safe Disable Operation Selection	Alarm Display during Safety Disable	Alarm Output *[H2-xx = 10]*	Drive Ready *[H2-xx = 6]*
0 [Mode 0]	STo	OFF	OFF	OFF
	SToF	ALM flashes	ON	OFF
1 [Mode 1]	STo	OFF	OFF	ON
	SToF	ALM flashes	OFF	ON

0 : Mode 0 (Alarm-On, Ready-Off)

1 : Mode 1 (Alarm-Off, Ready-On)

12.9 n: Special Adjustment

n parameters set these functions:

- Function to prevent hunting
- High-slip braking
- Motor line-to-line resistance online tuning
- Fine-tune the parameters that adjust motor control

◆ n2: Speed Feedback Detection Control (AFR) Tuning

The speed feedback detection reduction function (or AFR: Automatic Frequency Regulator) helps the speed become stable when you suddenly apply or remove a load.

Note:

Before you change *n2-xx parameters*, do one of these procedures:
- Set the motor parameters and V/f pattern correctly.
- Do Rotational Auto-Tuning.

■ n2-01: Speed Feedback Detection Control (AFR) Gain

No. (Hex.)	Name	Description	Default (Range)
n2-01 (0584) Expert	Speed Feedback Detection Control (AFR) Gain	V/f OLV CLV Sets the gain of the AFR function as a magnification value. Usually it is not necessary to change this setting.	1.50 (0.00 - 10.00)

Adjust this parameter in these conditions:

- If hunting or oscillation occurs with light loads, increase the setting value in 0.05-unit increments and examine the response.
- When torque is not sufficient with heavy loads or to make the torque or speed response better, decrease the setting value in 0.05-unit increments and examine the response.

■ n2-02: Speed Feedback Detection Control (AFR) Time Constant 1

No. (Hex.)	Name	Description	Default (Range)
n2-02 (0585) Expert	Speed Feedback Detection Control (AFR) Time Constant 1	V/f OLV CLV Sets the time constant that sets the rate of change for the AFR function. Usually it is not necessary to change this setting.	50 ms (0 - 2000 ms)

Adjust this parameter in these conditions:

- If there is hunting or oscillation with a light load, increase the setting value in 50 ms increments and examine the response. If the load inertia is large, increase the setting value in 50 ms increments and examine the response.
- If torque is not sufficient with a heavy load or if you must increase torque or speed responsiveness, decrease the setting value in 10 ms increments and examine the response.

Note:
- Set *n2-02 ≤ n2-03*. If *n2-02 > n2-03*, the drive will detect *oPE08 [Parameter Selection Error]*.
- When you change the value in *n2-02*, also change the value in *C4-02 [Torque Compensation Delay Time]* by the same ratio.

■ n2-03: Speed Feedback Detection Control (AFR) Time Constant 2

No. (Hex.)	Name	Description	Default (Range)
n2-03 (0586) Expert	Speed Feedback Detection Control (AFR) Time Constant 2	V/f OLV CLV Sets the time constant that sets the speed difference of the AFR function. Use this parameter for speed searches or regeneration. Usually it is not necessary to change this setting.	750 ms (0 - 2000 ms)

Adjust this parameter in these conditions:

- If the drive detects *ov [Overvoltage]* when acceleration stops under high-inertia loads, increase the setting value in 50 ms increments.
  If the drive detects *ov* when the load changes suddenly, increase the setting value in 50 ms increments.

- To increase the responsiveness of torque and speed, decrease the setting value in 10 ms increments and examine the response.

Note:
• Set *n2-02* ≤ *n2-03*. If *n2-02* > *n2-03*, the drive will detect *oPE08 [Parameter Selection Error]*.

◆ n5: Feed Forward Control

■ About Feed Forward Control

Feed forward control increases the responsiveness of acceleration and deceleration as specified by the speed reference.

Use feed forward control for applications where a high speed control proportional gain setting in *C5-01, C5-03, and C5-13 [ASR Proportional Gain]* would lead to problems with overshoot, undershoot, or oscillation. When you use this function in CLV control, it also helps prevent overshoot. Refer to Figure 12.41. Refer to Figure 12.42 for more information about parameters related to feed forward control.

Set *A1-02 = 3 [Control Method Selection = CLV]* to enable feed forward control.

Note:
• You cannot use feed forward control to increase responsiveness in applications where you apply loads externally during run at constant speed.
• When you use the Droop control function, set *n5-01 = 0 [Feed Forward Control Selection = Disabled]*.

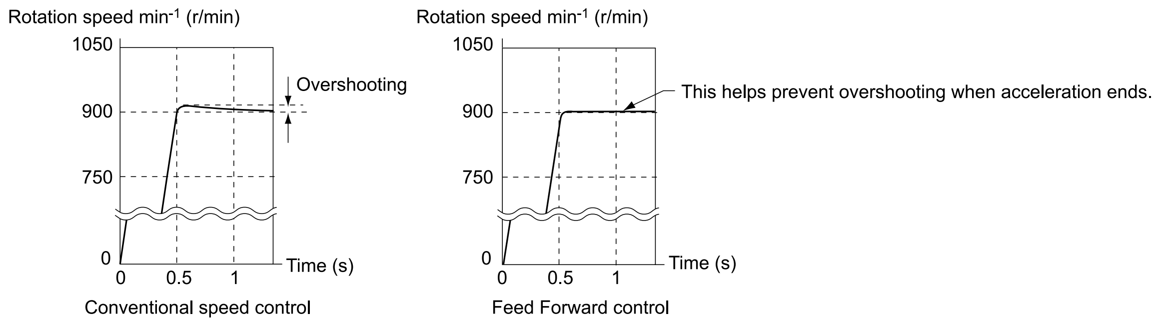


Figure 12.41 Suppress Overshooting with Feed Forward Control

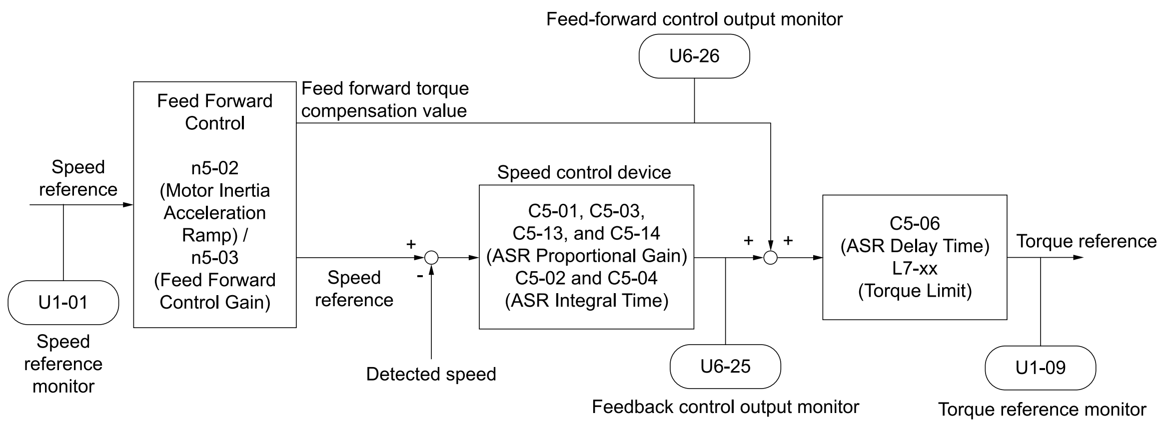


Figure 12.42 Configure Feed Forward Control

■ Before You Use Feed Forward Control

Do one of these procedures before you use feed forward control.

- Run Auto-Tuning to set motor parameters.
  When you cannot do Auto-Tuning, manually set motor parameters with the information on the motor nameplate or test reports. Set the *E2 parameters*.
- Set *C5 parameters [Automatic Speed Regulator (ASR)]* individually to adjust the speed control loop (ASR).
- Refer to Figure 12.42 and set the parameters related to feed forward control individually.

Parameter Details
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■ Speed Feedback Compensation

When you enable the Speed Feedback Compensation, it can reduce oscillation and increase responsiveness to the speed reference by compensating for phase delay.

Note:

1. Set *n5-07 = 1 [Speed Feedback Compensation Sel = Enabled]* to use the Speed Feedback Compensation.
2. Set *C5-17 [Motor Inertia]* and *C5-18 [Load Inertia Ratio]* to the correct values before you use the Speed Feedback Compensation.
3. If the value of *C5-17* × *C5-18* is relatively large, the estimated speed will be very slow.
4. Decrease the value of *C5-17* × *C5-18* if oscillation is a problem.
5. Set *C5-18* ≥ *1.1* to enable the Speed Feedback Compensation. If you set *C5-18* ≤ *1.0*, the Speed Feedback Compensation is disabled.

■ How to Adjust the Speed Feedback Compensation

Follow this procedure to set up the Speed Feedback Compensation:

1. Set the drive for Closed Loop Vector.
2. Enter the correct data from the motor nameplate and the motor test report to the *E2-xx parameters [Motor Parameters]*.
3. Set all *C5-xx parameters [Auto Speed Regulator (ASR)]* to their most appropriate values.
4. Set *n5-07 = 2 [Speed Feedback Compensation Sel = Test Mode]* to operate the Speed Feedback Compensation in test mode.
5. Connect the ropes to the motor.
6. Start operating the elevator while looking at the Speed Feedback Compensation output monitor shown in *U6-56 [SpdFbkCmp Output]* and the motor speed feedback shown in *U1-05 [Speed Feedback]*.
7. Adjust *n5-08 [Speed Fdbk Comp ProportionalGain]* and *C5-18 [Load Inertia Ratio]* to make the monitor values in *U6-56* and *U1-05* relatively low.

Figure 12.43 shows a block diagram for the Speed Feedback Compensation.

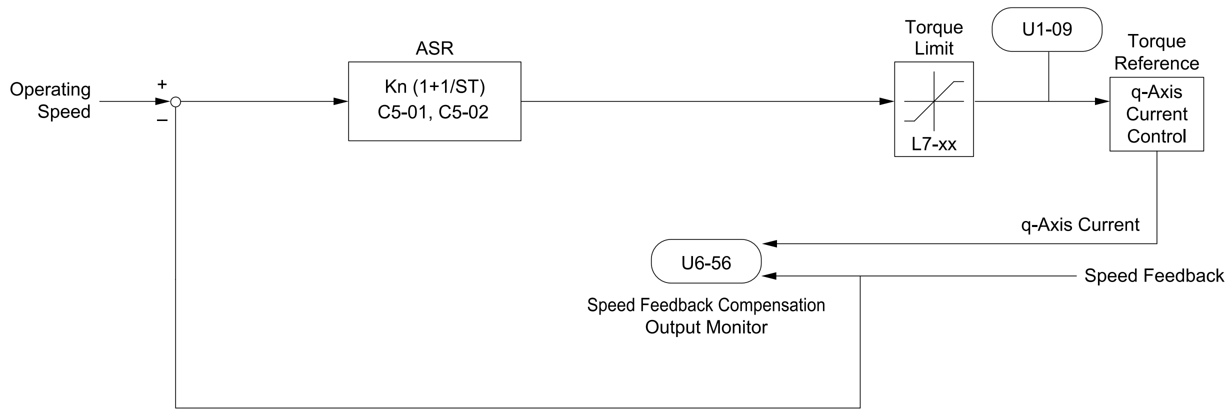

Figure 12.43 Speed Feedback Compensation Operation

■ n5-01: Feed Forward Control Selection

No. (Hex.)	Name	Description	Default (Range)
n5-01 (05B0) Expert	Feed Forward Control Selection	V/f OLV CLV Sets the feed forward function.	0 (0, 1)

0 : Disabled

1 : Enabled

■ n5-02: Motor Inertia Acceleration Ramp

No. (Hex.)	Name	Description	Default (Range)
n5-02 (05B1) Expert	Motor Inertia Acceleration Ramp	V/f OLV CLV Sets the length of time for the motor to accelerate from the stopped to the maximum frequency with a single motor at the rated torque.	Determined by o2-04 (0.001 - 10.000 s)

Calculate the motor acceleration ramp as shown here or measure the motor acceleration ramp and set *n5-02* to this value.

Calculate the Motor Acceleration Ramp

Use this formula to find the motor acceleration ramp:

$$\text{n5-02} = \frac{2\pi \cdot J_{Motor} \cdot n_{rated}}{60 \cdot T_{rated}}$$

- J_{Motor} = Moment of inertia of motor (kg m^2)
- n_{rated} = Motor rated speed (min^{-1}, r/min)
- T_{rated} = Motor rated torque (N m)

You can also use this formula to find the motor acceleration ramp:

$$\text{n5-02} = \frac{4\pi \cdot J_{Motor} \cdot f_{rated}}{p \cdot T_{rated}}$$

- f_{rated} = Motor rated frequency (Hz)
- P = Number of motor poles

Calculate the Motor Acceleration Ramp

Use this procedure to calculate the motor acceleration ramp:

1. Use *A1-02 [Control Method Selection]* to set the control method.
2. Disconnect the motor and load.
3. Run Auto-Tuning to set motor parameters.
   When you cannot do Auto-Tuning, manually set motor parameters with the information on the motor nameplate or test reports. Set the *E2 parameters*.
4. Set *C5 parameters [Automatic Speed Regulator (ASR)]*.
5. Set *C1-01 [Acceleration Ramp 1] = 0*.
6. Set *L7-01 [Forward Torque Limit]* to 100%.
7. Set the speed reference to the same value as the motor rated speed.
8. Measure the length of time for the motor to reach the rated speed.
   Show *U1-05 [Speed Feedback]* on the keypad and enter the Up/Down command.
9. Stop the motor.
10. Set *n5-02* to the measured motor acceleration ramp value.

Reset all of the parameters that you changed to the previous setting values.

■ n5-03: Feed Forward Control Gain

No. (Hex.)	Name	Description	Default (Range)
n5-03 (05B2) Expert	Feed Forward Control Gain	V/f OLV CLV Sets the ratio between load inertia and motor inertia. Inertia Tuning automatically sets the Feed Forward Control Gain value.	1.00 (0.00 - 100.00)

Use this procedure to set *n5-03*:

Set *n5-02 [Motor Inertia Acceleration Ramp]*.

1. Connect the motor and load.
2. Set *C1-01 [Acceleration Ramp 1] = 0*.
3. Use *L7-01 to L7-04 [Torque Limit]* to set the expected test run torque limit levels.
4. Set the speed reference as specified by the high speed range of the machine.
5. Measure the length of time for the motor to reach the command reference speed.
   Show *U1-05 [Speed Feedback]* on the keypad and enter the Up/Down command.
6. Stop the motor.
7. Replace the values in the this formula and set *n5-03* to the value of the formula.

$$\text{n5-03} = \frac{t_{accel} \cdot T_{Lim\_Test} \cdot f_{rated}}{\text{n5-02} \cdot f_{ref\_Test} \cdot 100} - 1$$

   - t_{accel} = Acceleration ramp (s)
   - f_{rated} = Motor rated frequency (Hz)
   - T_{Lim_Test} = Test run torque limit (%)
   - f_{ref_Test} = Test run speed reference (Hz)

⚠ WARNING **Sudden Movement Hazard**

Machinery can accelerate suddenly. Do not use this function with machinery that must not accelerate suddenly.

Sudden starts can cause serious injury or death.

Reset all of the parameters that you changed to the previous setting values.

Note:
- If response to the speed reference is slow, increase the value set in *n5-03*.
- Increase the value set in *n5-03* when response to the speed reference is slow.
  - The speed is overshooting.
  - A negative torque reference is output when acceleration ends.

◆ n6: Online Tuning

n6 parameters are used to set the online tuning function for motor line-to-line resistance.

The Online Tuning for motor line-to-line resistance is used to prevent degradation of speed control accuracy due to motor temperature fluctuation and motor stalls due to insufficient torque.

■ n6-01: Online Tuning Selection

No. (Hex.)	Name	Description	Default (Range)
n6-01 (0570) Expert	Online Tuning Selection	V/f OLV CLV Sets the type of motor data that Online Tuning uses for OLV control.	1 (0 - 2)

0 : Disabled

1 : Line-to-Line Resistance Tuning

The drive adjusts the motor line-to-line resistance during run. This procedure is applicable for speed values 6 Hz and less. It also adjusts the motor resistance value to increase the overload capacity in the low speed range.

2 : Voltage Correction Tuning

The drive adjusts the output voltage during run to increase overload tolerance and minimize the effects of high temperatures on speed precision.

■ n6-05: Online Tuning Gain

No. (Hex.)	Name	Description	Default (Range)
n6-05 (05C7) Expert	Online Tuning Gain	V/f OLV CLV Sets the compensation gain when *n6-01 = 2 [Online Tuning Selection = Voltage Correction Tuning]*. Usually it is not necessary to change this setting.	1.0 (0.1 - 50.0)

When you use a motor that has a large secondary circuit time constant, decrease the setting value.

If the drive detects *oL1 [Motor Overload]*, increase the setting value in 0.1-unit increments.

12.10 o: Keypad-Related Settings

o parameters set keypad functions.

Note:

You cannot use the optional LED keypad to set these parameters.

Table 12.14 Parameters You Cannot Set with the LED Keypad

No.	Name
o1-24 to o1-29	Custom Monitor 1 to 12
o1-39	Show Initial Setup Screen
o2-27	bCE Detection Selection
o3-04	Select Backup/Restore Location
o3-05	Select Items to Backup/Restore
o3-06	Auto Parameter Backup Selection
o3-07	Auto Parameter Backup Interval
o4-22	Time Format
o4-23	Date Format
o4-24	bAT Detection Selection
o5-01	Log Start/Stop Selection
o5-02	Log Sampling Interval
o5-03 to o5-12	Log Monitor Data 1 to 10

◆ o1: Keypad Display Selection

o1 parameters select the parameters shown on the initial keypad screen and to configure the parameter setting units and display units. These parameters also adjust the backlight and contrast of the LCD display.

■ o1-01: User Monitor Selection

No. (Hex.)	Name	Description	Default (Range)
o1-01 (0500) RUN Expert	User Monitor Selection	V/f OLV CLV Sets the *U monitor* for the Drive Mode. This parameter is only available with an LED keypad.	106 (104 - 830)

When the drive is in Drive Mode, push ∧ on the keypad to cycle through this data: frequency reference → rotational direction → output frequency → output current → *o1-01* selection.

Set the *x-xx* part of *Ux-xx* that is shown in the fifth position in Drive Mode. For example, to show *U1-05 [Motor Speed]*, set *o1-01 = 105*.

Note:

The monitors that you can select are different for different control methods.

■ o1-02: Monitor Selection at Power-up

No. (Hex.)	Name	Description	Default (Range)
o1-02 (0501) RUN Expert	Monitor Selection at Power-up	V/f OLV CLV Sets the monitor item that the keypad screen shows after you energize the drive. Refer to "U: Monitors" for information about the monitor items that the keypad screen can show. This parameter is only available with an LED keypad.	1 (1 - 5)

1 : Frequency Reference (U1-01)

2 : Direction

3 : Output Frequency (U1-02)

4 : Output Current (U1-03)

5 : User Monitor (o1-01)

Shows the monitor item selected in *o1-01 [User Monitor Selection]*.

■ o1-03: Speed Display Unit Selection

No. (Hex.)	Name	Description	Default (Range)
o1-03 (0502)	Keypad Display Unit Selection	V/f OLV CLV Sets the display units for the frequency reference and output frequency.	1 (0 - 5)

Note:
- Select the setting unit of these parameters:
  - –d1-01 to d1-08 [Reference 1 to 8]
  - –U1-01 [Frequency Reference]
  - –U1-02 [Output Frequency]
  - –U1-05 [Motor Speed]
  - –U1-16 [SFS Output Frequency]
  - –U4-14 [PeakHold Output Freq]
- For monitor 2, the setting value is always *0 [0.01 Hz]*.

0 : 0.01 Hz

1 : 0.01% (100% = E1-04)

E1-04 [Maximum Output Frequency] is 100%.

2 : min^{-1} (r/min) units

The drive uses the maximum output speed and number of motor poles to calculate this value automatically.

Note:
When you set *o1-03 = 2*, make sure that you set the number of motor poles in *E2-04 [Motor Pole Count]*.

3 : User Units (o1-10 & o1-11)

The drive uses *o1-10 [User Units Maximum Value]* and *o1-11 [User Units Decimal Position]* to set the unit of measure. The value of parameter *o1-10* is the value when you remove the decimal point from the maximum output speed. Parameter *o1-11* is to the number of digits after the decimal point in the maximum output speed.

To display a maximum output speed of 100.00, set parameters to these values:
- *o1-10 = 10000*
- *o1-11 = 2 [Two Decimal Places (XXX.XX)]*

4 : Elevator Unit1 - m/s, s, s

The drive shows speed in m/s, and acceleration/deceleration rate and jerk in s.

5 : Elevator Unit3-ft/(min,s^2,s^3)

The drive shows speed in ft/min, acceleration/deceleration rate in ft/s^2, and jerk in ft/s^3.

■ o1-04: V/f Pattern Display Unit

No. (Hex.)	Name	Description	Default (Range)
o1-04 (0503) Expert	V/f Pattern Display Unit	V/f OLV CLV Sets the setting units for parameters that set the V/f pattern frequency.	Determined by A1-02 (0, 1)

Note:
- Select the setting unit of these parameters:
  - *–E1-04 [Maximum Output Frequency]*
  - *–E1-06 [Base Frequency]*
  - *–E1-07 [Mid Point A Frequency]*
  - *–E1-09 [Minimum Output Frequency]*
  - *–E1-11 [Mid Point B Frequency]*
- For monitor 2, the setting value is always *0 [Hz Unit]*.

0 : Hz

1 : Revolutions Per Minute (RPM)

When you set *o1-04 = 1*, make sure that you set the number of motor poles in these parameters:
- *E2-04 [Motor Pole Count]*
- *E5-04 [PM Motor Pole Count]*

■ o1-05: LCD Contrast Adjustment

No. (Hex.)	Name	Description	Default (Range)
o1-05 (0504) RUN Expert	LCD Contrast Adjustment	V/f OLV CLV Sets the contrast of the LCD display on the keypad.	5 (0 - 10)

When you decrease the setting value, the contrast of the LCD display decreases. When you increase the setting value, the contrast increases.

■ o1-10: User Units Maximum Value

No. (Hex.)	Name	Description	Default (Range)
o1-10 (0520) Expert	User Units Maximum Value	V/f OLV CLV Sets the value that the drive shows as the maximum output frequency.	Determined by o1-03 (1 - 60000)

To display a maximum output frequency of 100.00, set parameters to these values:

- *o1-10 = 10000*
- *o1-11 = 2 [User Units Decimal Position = Two Decimal Places (XXX.XX)]*

Note:

Set *o1-03 = 3 [Frequency Display Unit Selection = User Units (o1-10 & o1-11)]* before you set *o1-10* and *o1-11*.

■ o1-11: User Units Decimal Position

No. (Hex.)	Name	Description	Default (Range)
o1-11 (0521) Expert	User Units Decimal Position	V/f OLV CLV Sets the number of decimal places for frequency reference and monitor values.	Determined by o1-03 (0 - 3)

0 : No Decimal Places (XXXXX)

1 : One Decimal Places (XXXX.X)

2 : Two Decimal Places (XXX.XX)

3 : Three Decimal Places (XX.XXX)

Note:

Set *o1-03 = 3 [Frequency Display Unit Selection = User Units (o1-10 & o1-11)]* before you set *o1-10 [User Units Maximum Value]* and *o1-11*.

■ o1-24 to o1-35: Custom Monitor 1 to 12

No. (Hex.)	Name	Description	Default (Range)
o1-24 to o1-35: (11AD - 11B8) RUN	Custom Monitor 1 to 12	V/f OLV CLV Sets a maximum of 12 monitors as user monitors. This parameter is only available when using an LCD keypad.	o1-24: 101 o1-25: 102 o1-26: 103 o1-27 to o1-35: 0 (0, 101 - 999)

These parameters save the monitor items selected by the LCD keypad [Custom Monitor].

Note:

- You can show a maximum of three selected monitors on one LCD keypad screen.
  - When you select only one monitor, the text size of this monitor increases. For example, when *o1-25 to o1-35 = 0*, the text size of the monitor saved in o1-24 increases.
  - When you select two monitors, the text size of these monitors increase.
  - When you select four or more monitors, the fourth monitor and all additional monitors are shown on the next screens.
- Monitors selected with *o1-24* to *o1-26* can be displayed as a bar graph, analog gauge, or trend plot.
  - Bar graph display: 3 monitors maximum
    Select with *o1-24*, *o1-25*, and *o1-26*.
  - Analog gauge display: 1 monitor
    Select with *o1-24*.
  - Trend plot display: 2 monitors
    Select with *o1-24* and *o1-25*.
- You can only set parameters *o1-24* to *o1-26* with analog output monitors.
- You can set all monitors to parameters *o1-27* to *o1-35*.

■ o1-36: LCD Backlight Brightness

No. (Hex.)	Name	Description	Default (Range)
o1-36 (11B9) RUN	LCD Backlight Brightness	V/f OLV CLV Sets the intensity of the LCD keypad backlight.	3 (1 - 5)

When you decrease the setting value, the intensity of the backlight decreases.

■ o1-37: LCD Backlight ON/OFF Selection

No. (Hex.)	Name	Description	Default (Range)
o1-37 (11BA) RUN	LCD Backlight ON/OFF Selection	V/f OLV CLV Sets the automatic shut off function for the LCD backlight.	1 (0, 1)

Note:

Use *o1-36 [LCD Backlight Brightness]* to adjust the intensity of the LCD backlight.

0 : OFF

The backlight will automatically turn off after the time set in *o1-38 [LCD Backlight Off-Delay]* is expired.

When the backlight is off, push a key on the keypad to temporarily turn the backlight on. After the backlight turns on, it will turn off automatically after the time set in *o1-38* is expired.

Note:

When the backlight is off, push a key on the keypad to temporarily turn the backlight on. Push any key to start keypad operation. Push RUN to turn the backlight on, then push RUN again to enter an Up/Down command to the drive.

1 : ON

The backlight will always be ON.

■ o1-38: LCD Backlight Off-Delay

No. (Hex.)	Name	Description	Default (Range)
o1-38 (11BB) RUN Expert	LCD Backlight Off-Delay	V/f OLV CLV Sets the time until the LCD backlight automatically turns off.	300 s (10 - 600 s)

When *o1-37 = 0 [LCD Backlight ON/OFF Selection= OFF]*, the backlight will automatically turn off after the time set in *o1-38* expires.

When the backlight is off, push a key on the keypad to temporarily turn the backlight on. After the backlight turns on, it will turn off automatically after the time set in *o1-38* is expired.

■ o1-39: Show Initial Setup Screen

No. (Hex.)	Name	Description	Default (Range)
o1-39 (11BC) RUN Expert	Show Initial Setup Screen	V/f OLV CLV Sets the function to show the LCD keypad initial setup screen each time you energize the drive. This parameter is only available with an LCD keypad.	1 (0, 1)

The initial setup screen shows a menu where you can select the display language, set the date, time, and other basic settings. When you set this parameter to 0, the drive will not show this screen each time you energize the drive.

0 : No

The drive will not show the initial setup display screen each time you energize the drive. The drive will show the Home screen.

1 : Yes

When you input the Up/Down command before you energize the drive or when the you turn on the Up/Down command while the drive shows the initial setup screen, the drive will replace the initial setup screen with the Home screen.

◆ o2: Keypad Operation

■ o2-01: LO/RE Key Function Selection

No. (Hex.)	Name	Description	Default (Range)
o2-01 (0505) Expert	LO/RE Key Function Selection	V/f OLV CLV Sets the function that lets you use LO/RE to switch between LOCAL and REMOTE Modes.	0 (0, 1)

0 : Disabled

You cannot use LO/RE to switch between LOCAL and REMOTE Modes.

1 : Enabled

You can use LO/RE to switch between LOCAL and REMOTE Modes when the drive is stopped. When LOCAL Mode is selected, LO/RE on the keypad will come on.

⚠ WARNING Sudden Movement Hazard

Fully examine all mechanical and electrical connections before you change *o2-01 [LO/RE Key Function Selection]*.

Sudden starts can cause serious injury or death. If there is an active Run command when you switch from LOCAL to REMOTE Mode, the drive can start suddenly.

Table 12.15 Function Settings with o2-01 and b1-07

LO/RE Function Selection	Switching from LOCAL Mode to REMOTE Mode	Switching from REMOTE Mode to LOCAL Mode
o2-01 = 0 [Disabled]	The drive will not switch modes.	The drive will not switch modes.
o2-01 = 1 [Enabled]	The drive will not start operating although the Run command is active. When you set Run command to active again, the drive will start to run.	The drive cannot operate because the Run command is not enabled.

■ o2-02: STOP Key Function Selection

No. (Hex.)	Name	Description	Default (Setting Range)
o2-02 (0506) Expert	STOP Key Function Selection	V/f OLV CLV Sets the function to use STOP on the keypad to stop the drive when the Run command source for the drive is REMOTE (external) and not assigned to the keypad.	0 (0, 1)

0 : Disabled

1 : Enabled

STOP stays enabled when the Run command source has not been assigned to the keypad.

To start the drive again after you push STOP to stop operation, turn the external Run command OFF and ON again.

■ o2-03: User Parameter Default Value

No. (Hex.)	Name	Description	Default (Range)
o2-03 (0507) Expert	User Parameter Default Value	V/f OLV CLV Sets the function to keep the settings of changed parameters as user parameter defaults to use during initialization.	0 (0 - 2)

When you set *o2-03 = 1 [Set defaults]*, the drive saves changed parameter settings as user parameter setting values in a part of the memory that is isolated from drive parameters.

When you set *A1-03 = 1110 [Initialize Parameters = User Initialization]* to initialize the drive, the drive resets the internal parameter setting values to those user parameter setting values.

0 : No change

1 : Set defaults

Saves changed parameter setting values as user default settings.

Set *o2-03 = 1* then push ↵ to save the user parameter setting values. After the drive saves the setting value, *o2-03* automatically resets to *0*.

2 : Clear all

Deletes all of the saved user parameter setting values.

Set *o2-03 = 2* then push ↵ to clear the user parameter setting values. The drive will automatically reset *o2-03* to *0*. If you delete the user parameter setting values, you cannot set *A1-03 = 1110* to initialize parameters.

■ o2-04: Drive Model (KVA) Selection

No. (Hex.)	Name	Description	Default (Setting Range)
o2-04 (0508) Expert	Drive Model (KVA) Selection	V/f OLV CLV Sets the Drive Model code. Set this parameter after replacing the control board.	Determined by the drive (-)

NOTICE

Set *o2-04 [Drive Model (KVA) Selection]* correctly.
If you set this parameter incorrectly, it will decrease drive performance, cause the protection function to operate incorrectly, and cause damage to the drive.

Note:
When the setting value of *o2-04* changes, related parameter setting values also change.

Table 12.16 lists the relation between *o2-04* setting values and drive models.

Table 12.16 Drive Models and *o2-04* Settings

Drive Model	o2-04 Setting
4009	6E
4015	6F
4018	9A
4024	9C
4031	9D
4039	9E
4045	9F

■ o2-05: Home Mode Freq Ref Entry Mode

No. (Hex.)	Name	Description	Default (Setting Range)
o2-05 (0509) Expert	Home Mode Freq Ref Entry Mode	V/f OLV CLV Sets the function that makes it necessary to push ↵ to use the keypad to change the frequency reference value while in Drive Mode.	0 (0, 1)

0 : ENTER Key Required

You must push ↵ to use the keypad to change the frequency reference value.

1 : Immediate / MOP-style

The frequency reference changes when you enter it with the keypad. This then changes the output frequency. It is not necessary to push ↵. The drive keeps the frequency reference for 5 seconds after you use ∧ and ∨ on the keypad to change the frequency reference value.

■ o2-06: Keypad Disconnect Detection

No. (Hex.)	Name	Description	Default (Range)
o2-06 (050A) Expert	Keypad Disconnect Detection	V/f OLV CLV Sets the function that stops the drive if you disconnect the keypad connection cable from the drive or if you damage the cable while the keypad is the Run command source.	0 (0, 1)

This parameter continues to operate if the keypad installed to the drive becomes disconnected.

This parameter is enabled in these conditions:

- When *b1-02 = 0 [Run Command Selection 1 = Keypad]* or *b1-16 = 0 [Run Command Selection 2 = Keypad]*
- In LOCAL Mode

0 : Disabled

The drive continues operation when it detects a keypad disconnection.

1 : Enabled

The drive stops operation, detects *oPr [Keypad Connection Fault]*, and the motor coasts to stop when the drive detects a keypad disconnection.

■ o2-07: Keypad RUN Direction @ Power-up

No. (Hex.)	Name	Description	Default (Range)
o2-07 (0527) Expert	Keypad RUN Direction @ Power-up	V/f OLV CLV Sets the direction of motor rotation when the drive is energized and the keypad is the Run command source.	0 (0, 1)

This parameter is enabled in these conditions:

- When *b1-02 = 0 [Run Command Selection 1 = Keypad]*
- In LOCAL Mode

0 : Forward

1 : Reverse

■ o2-09: Reserved

No. (Hex.)	Name	Description	Default (Range)
o2-09 (050D) Expert	Reserved	-	-

■ o2-19: Parameter Write during Uv

No. (Hex.)	Name	Description	Default (Range)
o2-19 (061F) Expert	Parameter Write during Uv	V/f OLV CLV Lets you change parameters during *Uv [Undervoltage]*.	0 (0, 1)

0 : Disable

1 : Enabled

■ o2-23: External 24V Powerloss Detection

No. (Hex.)	Name	Description	Default (Setting Range)
o2-23 (11F8) RUN Expert	External 24V Powerloss Detection	V/f OLV CLV Sets the function to give a warning if the backup external 24 V power supply turns off when the main circuit power supply is in operation.	0 (0, 1)

Note:

The drive will not run when it is operating from one 24-V external power supply.

0 : Disabled

The drive does not detect the loss of the 24-V external power supply.

1 : Enabled

The keypad shows the *L24v [Loss of External Power 24 Supply]* indicator if the drive detects the loss of the 24-V external power supply.

Note:

A minor fault signal is not output from *H2-xx = 10 [MFDO Function Selection = Alarm]*.

■ o2-26: Alarm Display at Ext. 24V Power

No. (Hex.)	Name	Description	Default (Range)
o2-26 (1563) Expert	Alarm Display at Ext. 24V Power	V/f OLV CLV When you connect a backup external 24 V power supply, this parameter sets the function to trigger an alarm when the main circuit power supply voltage decreases.	0 (0, 1)

0 : Disabled

The drive will not detect *EP24v [External Power 24V Supply]* if the main circuit power supply voltage decreases. The [Ready] light on the LED Status Ring flashes quickly to identify that drive operation is not possible.

1 : Enabled

The drive detects *EP24v* when the main circuit power supply voltage decreases.

Note:

A minor fault signal is not output from *H2-xx = 10 [MFDO Function Selection = Alarm]*.

■ o2-27: bCE Detection Selection

No. (Hex.)	Name	Description	Default (Range)
o2-27 (1565) Expert	bCE Detection Selection	V/f OLV CLV Sets drive operation if the Bluetooth device is disconnected when you operate the drive in Bluetooth Mode.	3 (0 - 4)

0 : Ramp to Stop

1 : Coast to Stop

2 : Fast Stop (Use C1-09)

3 : Alarm Only

4 : No Alarm Display

◆ o3: Copy Function

o3 parameters set the operation of the parameter backup function.

■ o3-01: Copy Keypad Function Selection

No. (Hex.)	Name	Description	Default (Range)
o3-01 (0515)	Copy Keypad Function Selection	V/f OLV CLV Sets the function that saves and copies drive parameters to a different drive with the keypad.	0 (0 - 3)

0 : Copy Select

1 : Backup (drive → keypad)

The parameter setting values are read from the drive and saved in the keypad.

2 : Restore (keypad → drive)

Copies the parameter setting values saved in the keypad to a different drive.

3 : Verify (check for mismatch)

Makes sure that the parameter setting values in the drive agree with the parameters saved in the keypad.

■ o3-02: Copy Allowed Selection

No. (Hex.)	Name	Description	Default (Range)
o3-02 (0516)	Copy Allowed Selection	V/f OLV CLV Sets the copy function when *o3-01 = 1 [Copy Keypad Function Selection = Backup (drive → keypad)]*.	0 (0, 1)

Note:

When you select [Parameter Backup] on the keypad menu screen to do the backup function, the drive automatically sets *o3-02 = 1*.

0 : Disabled

1 : Enabled

■ o3-04: Select Backup/Restore Location

No. (Hex.)	Name	Description	Default (Range)
o3-04 (0B3E)	Select Backup/Restore Location	V/f OLV CLV Sets the storage location for drive parameters when you back up and restore parameters. This parameter is only available when using an LCD keypad.	0 (0 - 3)

You can use the LCD keypad to make a maximum of 4 parameter backup sets.

0 : Memory Location 1

1 : Memory Location 2

2 : Memory Location 3

3 : Memory Location 4

■ o3-06: Auto Parameter Backup Selection

No. (Hex.)	Name	Description	Default (Range)
o3-06 (0BDE) Expert	Auto Parameter Backup Selection	V/f OLV CLV Sets the function that automatically backs up parameters. This parameter is only available when using an LCD keypad.	1 (0, 1)

When you connect the drive and keypad, parameters set to the drive are automatically backed up to the keypad as specified by the setting of parameters *o3-06* and *o3-07*.

0 : Disabled

1 : Enabled

Note:

When you replace the LCD keypad then energize the drive, the keypad shows the restore operation screen automatically to restore the drive configuration with the parameters backed up to the LCD keypad. If you connect an LCD keypad that does not have parameter backup data, the keypad will not show the restore operation screen.

■ o3-07: Auto Parameter Backup Interval

No. (Hex.)	Name	Description	Default (Range)
o3-07 (0BDF) Expert	Auto Parameter Backup Interval	V/f OLV CLV Sets the interval at which the automatic parameter backup function saves parameters from the drive to the keypad.	1 (0 - 3)

The drive saves parameter settings to the keypad at these times:

1. After you energize the drive and the auto backup period passes.
2. When you use ROM enter or the keypad to change parameters, the drive saves those changes in the drive, waits for the auto backup period to pass, then saves those parameters in the keypad.

Note:

The drive can write data to the keypad a maximum of 100,000 times. If you write data to the keypad more than 100,000 times, you must replace the keypad.

0 : Every 10 minutes

1 : Every 30 minutes

2 : Every 60 minutes

3 : Every 12 hours

◆ o4: Maintenance Monitors

o4 parameters set the expected service life to help you know when to replace parts. The drive will show an alarm to tell you when the replacement part interval is near.

■ o4-01: Elapsed Operating Time Setting

No. (Hex.)	Name	Description	Default (Range)
o4-01 (050B) Expert	Elapsed Operating Time Setting	V/f OLV CLV Sets the initial value of the cumulative drive operation time in 10-hour units.	0 h (0 - 9999 h)

When you select *o4-01* on the keypad, it will show the current value of *U4-01* in units of 10 hours (h). When you change the setting of *o4-01* through the monitor, the *U4-01* count starts again as specified by the setting of *o4-01*.

Note:

Set this parameter in 10-hour (h) units. When *o4-01 = 30*, *U4-01 [Cumulative Ope Time] = 300 h*.

■ o4-02: Elapsed Operating Time Selection

No. (Hex.)	Name	Description	Default (Range)
o4-02 (050C) Expert	Elapsed Operating Time Selection	V/f OLV CLV Sets the condition that counts the cumulative operation time.	1 (0, 1)

0 : U4-01 Shows Total Power-up Time

Counts the time from when the drive is energized to when it is de-energized.

1 : U4-01 Shows Total RUN Time

Counts the time that the drive outputs voltage.

■ o4-03: Fan Operation Time Setting

No. (Hex.)	Name	Description	Default (Range)
o4-03 (050E) Expert	Fan Operation Time Setting	V/f OLV CLV Sets the value from which to start the cumulative drive cooling fan operation time in 10-hour units.	0 h (0 - 9999 h)

Use monitor *U4-03 [Cooling Fan Ope Time]* to view the total operation time of the cooling fan. When you replace a cooling fan, set *o4-03 = 0* to reset *U4-03*. Select *o4-03* on the keypad to show the current value of *U4-03* in 10-hour (h) units. If you use the monitor to change *o4-03*, the recount of *U4-03* starts with the *o4-03* setting.

Note:

The drive sets *o4-03* in 10-hour (h) units. When *o4-03 = 30*, *U4-03 [Cooling Fan Ope Time]* will show “300 h”.

■ o4-05: Capacitor Maintenance Setting

No. (Hex.)	Name	Description	Default (Range)
o4-05 (051D) Expert	Capacitor Maintenance Setting	V/f OLV CLV Sets the *U4-05 [CapacitorMaintenance]* monitor value.	0% (0 - 150%)

When you replace a drive, set *o4-05 = 0* to reset *U4-05*. When the *o4-05* setting changes, the count of *U4-05* starts again as specified by the setting of *o4-05*. After you complete the configuration, *o4-05* automatically resets to *0*.

Note:

The maintenance period changes for different operating environments.

■ o4-07: Softcharge Relay Maintenance Set

No. (Hex.)	Name	Description	Default (Range)
o4-07 (0523) Expert	Softcharge Relay Maintenance Set	V/f OLV CLV Sets the *U4-06 [PreChargeRelayMainte]* monitor value.	0% (0 - 150%)

When you replace a drive, set *o4-07 = 0* to reset *U4-06*. When the *o4-07* setting changes, the count of *U4-06* starts again as specified by the setting of *o4-07*. After you complete the configuration, *o4-07* automatically resets to *0*.

Note:

The maintenance period changes for different operating environments.

■ o4-09: IGBT Maintenance Setting

No. (Hex.)	Name	Description	Default (Range)
o4-09 (0525) Expert	IGBT Maintenance Setting	V/f OLV CLV Sets the *U4-07 [IGBT Maintenance]* monitor value.	0% (0 - 150%)

When you replace a drive, set *o4-09 = 0* to reset *U4-07*. When the *o4-09* setting changes, the count of *U4-07* starts again as specified by the setting of *o4-09*. After you complete the configuration, *o4-09* automatically resets to *0*.

Note:

The maintenance period changes for different operating environments.

■ o4-11: Fault Trace/History Init (U2/U3)

No. (Hex.)	Name	Description	Default (Range)
o4-11 (0510) Expert	Fault Trace/History Init (U2/U3)	V/f OLV CLV Resets the records of Monitors *U2-xx [Fault Trace]* and *U3-xx [Fault History]*.	0 (0, 1)

Note:

When you initialize the drive with *A1-03 [Initialize Parameters]*, the drive will not reset the records for *U2-xx* and *U3-xx*.

0 : Disabled

Keeps the records of Monitors *U2-xx* and *U3-xx*.

1 : Enabled

Resets the records for Monitors *U2-xx* and *U3-xx*. After the reset, the drive automatically resets *o4-11* to *0*.

■ o4-12: kWh Monitor Initialization

No. (Hex.)	Name	Description	Default (Range)
o4-12 (0512) Expert	kWh Monitor Initialization	V/f OLV CLV Resets the monitor values for *U4-10 [kWh, Lower 4 Digits]* and *U4-11 [kWh, Upper 5 Digits]*.	0 (0, 1)

Note:

When you initialize the drive with *A1-03 [Initialize Parameters]*, the drive will not reset *U4-10* and *U4-11*.

0 : No Reset

Keeps the monitor values for *U4-10* and *U4-11*.

1 : Reset

Resets the values of *U4-10* and *U4-11*. After the reset, the drive automatically resets *o4-12* to *0*.

■ o4-13: RUN Command Counter @ Initialize

No. (Hex.)	Name	Description	Default (Range)
o4-13 (0528) Expert	RUN Command Counter @ Initialize	V/f OLV CLV Resets the monitor values for *U4-02 [Num of Run Commands]*, *U4-24 [Number of Runs (Low)]*, and *U4-25 [Number of Runs (High)]*.	0 (0, 1)

0 : No Reset

Keeps the monitor values for *U4-02*, *U4-24*, and *U4-25*.

1 : Reset

Resets the values of *U4-02*, *U4-24*, and *U4-25*. After the reset, the drive automatically resets *o4-13* to *0*.

■ o4-22: Time Format

No. (Hex.)	Name	Description	Default (Range)
o4-22 (154F) RUN Expert	Time Format	V/f OLV CLV Sets the time display format. This parameter is only available when using an LCD keypad.	0 (0 - 2)

Sets the display of the time shown in the upper-left of the LCD keypad screen.

0 : 24 Hour Clock

1 : 12 Hour Clock

2 : 12 Hour JP Clock

■ o4-23: Date Format

No. (Hex.)	Name	Description	Default (Range)
o4-23 (1550) RUN Expert	Date Format	V/f OLV CLV Sets the date display format. This parameter is only available when using an LCD keypad.	0 (0 - 2)

Sets the date format that the drive uses for the fault history and other records.

0 : YYYY/MM/DD

1 : DD/MM/YYYY

2 : MM/DD/YYYY

■ o4-24: bAT Detection Selection

No. (Hex.)	Name	Description	Default (Range)
o4-24 (310F) RUN Expert	bAT Detection Selection	V/f OLV CLV Sets the operation when the drive detects *bAT [Keypad Battery Low Voltage]* and *TiM [Keypad Time Not Set]*. This parameter is only available when you use an LCD keypad.	0 (0 - 2)

0 : Disable

The drive will not detect *bAT* or *TiM*.

1 : Enable (Alarm Detected)

The keypad shows *bAT* or *TiM* and the drive continues operation. The output terminal set to *Alarm [H2-01 to H2-03 = 10]* activates.

2 : Enable (Fault Detected)

The output turns off and the motor coasts to stop. The output terminal set for *Fault [H2-01 to H2-03 = E]* activates.

◆ o5: Log Function

The data log function saves drive status information as a CSV file in the microSD memory card in the keypad. Monitors *Ux-xx* are the source of data log information. You can record a maximum of 10 monitors.

Change the LCD keypad screen from the main menu to the Diagnostic Tools screen and select the data log function. Set the number of the monitor to record and the sampling time, then start to record the data log.

Table 12.17 Setting Parameters for Data Log Items

No.	Name	Default	Data Log Monitors
o5-03	Log Monitor Data 1	101	*U1-01 [Frequency Reference]*
o5-04	Log Monitor Data 2	102	*U1-02 [Output Frequency]*
o5-05	Log Monitor Data 3	103	*U1-03 [Output Current]*
o5-06	Log Monitor Data 4	107	*U1-07 [DC Bus Voltage]*
o5-07	Log Monitor Data 5	108	*U1-08 [Output Power]*

No.	Name	Default	Data Log Monitors
o5-08	Log Monitor Data 6	000	Not selected
o5-09	Log Monitor Data 7	000	Not selected
o5-10	Log Monitor Data 8	000	Not selected
o5-11	Log Monitor Data 9	000	Not selected
o5-12	Log Monitor Data 10	000	Not selected

Note:
- Do not de-energize the drive or disconnect the keypad from the drive during log transfer communication. A loss of connection can cause the log function to fail after you restore power or connect the keypad.
- You can use a microSDHC card that has a maximum of 32 GB capacity.

■ Log File Specifications

Item	Specification
File storage location	A folder called [Log_File] is created in the root directory of the microSD card.
Filename	GLOG0xxx.csv **Note:** [xxx] identifies a 3-digit decimal number
Maximum number of files	999 (GLOG0001.csv to GLOG0999.csv)
Character code	ASCII code
Line break code	<CR><LF>
Separating character	[,] (Commas)
Header rows	First Row: Drive information including the drive model, software version, control method, and sampling time Second Row: Log data information including the monitor number, number decimal points, and unit code

■ Log File Configuration

The [Log_Files] folder is created in the root directory of the micro SD card. This is where the log data is stored as CSV files. Log data files are created in this configuration. The number of rows changes when the number of selected monitors change.

First Row	Drive information
Second Row	Log data information
Third Row	Log data 1
:	Log data 2
:	Log data 3
:	:
Last Row	Log data n

■ First Row: Drive Information

This example shows the data text strings and data generated for the first row of log data.

Example of generated data: 00,0012,160107111230,LA500,VSLA24011,2,62,1000,000001

No.	Item	Number of Characters	Example	Description
1	Attribute	2	00	[00] shows that the record is a drive information record.
2	File number	4	0012	Generates the [xxx] part (a 3-digit decimal number) of the [GLOG0xxx.csv] filename of the log data in hexadecimal format. Example filename of [GLOG0018.csv]: 018 (Dec.) = 0012 (Hex.)
3	Time stamp *1	12	160107111230	Date file was generated • Date: 20YY/MM/DD • Time in 24-hour format: HH:MM:SS Example data of [160107111230]: 11:12:30 on January 7, 2016
4	Model	5	LA500	Drive model information
5	Software number	9	VSLA24011	Drive software number

No.	Item	Number of Characters	Example	Description
6	Control Method Selection	1	2	Setting value (Hex.) of *A1-02 [Control Method Selection]*
7	Drive capacity	2	62	Setting value (Hex.) of *o2-04 [Drive Model (KVA) Selection]*
8	Sampling time	5 (Maximum)	1000	Setting value (Dec.) of *o5-02 [Log Sampling Interval]* Unit: ms
9	Row number	6	000001	Row number (Hex.) in the data log file

*1 If you do not set the time in the keypad, the text string of [000000000000] is generated to show the time.

■ Second Row: Log Data Information

This example shows the data text strings and data generated for the second row of log data.

Example of generated data:
01,0012,160107111230,0101,0201,0102,0201,0103,0206,0107,0005,0108,0209,0000,0000,0000,0000,0000,0000,0000,0000,0000,0000,0000,0000,0000,0000,000002

No.	Item	Number of Characters	Description
1	Attribute	2	[01] shows that the record is a log data information record.
2	File number	4	Generates the [xxx] part (a 3-digit decimal number) of the [GLOG0xxx.csv] filename of the log data in hexadecimal format.
3	Time stamp	12	Date file was generated
4	Monitor Number 1 *1	4	Monitor number selected by *o5-03 [Log Monitor Data 1]* Ex.: 0101 (Dec.) for *U1-01*
5	Monitor Unit 1 *2	4	Unit code and number of decimal places used for the monitor selected with *o5-03* Example when *U1-01 = 30.00 Hz*: Number of decimal places = 2, Hz unit code = 01, monitor unit 1 = 0201 (Hex.)
6	Monitor number 2	4	Monitor number (Dec.) selected by *o5-04 [Log Monitor Data 2]*
7	Monitor Unit 2	4	Unit code and number of decimal places used for the monitor selected with *o5-04*
:	:	:	:
22	Monitor number 10	4	Monitor number (Dec.) selected by *o5-12 [Log Monitor Data10]*
23	Monitor Unit 10	4	Unit code and number of decimal places used for the monitor selected with *o5-12*
24 to 27	Reserved	4	-
28	Row number	6	Row number (Hex.) in the data log file

*1 If there is no data log monitor selected, the text string of [0000] is generated.
*2 Refer to Table 12.18 for information about unit codes.

Table 12.18 Unit Codes

Unit Code (Hex.)	Unit	Unit Code (Hex.)	Unit	Unit Code (Hex.)	Unit	Unit Code (Hex.)	Unit
00	–	08	PPR	10	H	18	0H
01	Hz	09	kW	11	V	19	–
02	RPM	0A	Ω	12	us	1A	–
03	%	0B	ms	13	min	1B	–
04	VAC	0C	kHz	14	°C	1C	–
05	VDC	0D	PSI	15	W	1D	–
06	A	0E	MPM	16	kWH	1E	–
07	sec	0F	FPM	17	MWH	1F	–

■ Third and Subsequent Rows: Log Data

This example shows the data text strings and data generated for the third row of log data.

Example of generated data:
02,0012,160107111239,1770,1770,00BE,0118,0028,0000,0000,0000,0000,0000,0000,0000,00000C

No.	Item	Number of Characters	Description
1	Attribute	2	[02] shows that the record is a monitor data record.
2	File number	4	Generates the [xxx] part (a 3-digit decimal number) of the [GLOG0xxx.csv] filename of the log data in hexadecimal format.
3	Time stamp	12	Data log data was retrieved (YYMMDDHHMMSS)
4	Log Monitor Data 1	4	Log monitor data (Hex.) of the monitor selected with *o5-03 [Log Monitor Data 1]*
5	Log Monitor Data 2	4	Log monitor data (Hex.) of the monitor selected with *o5-04 [Log Monitor Data 2]*
:	:	:	:
13	Log Monitor Data 10	4	Log monitor data (Hex.) of the monitor selected with *o5-12 [Log Monitor Data 10]*
14	Reserved	4	-
15	Encoding data	4	Log Monitor Data 1 to 10 Code Data (Hex.) Bits 0 through 9 show the encoding of log monitor data 1 1 through 10. A bit value of 1 shows that the data represents a negative value. (Log monitor data 1 through 10 is absolute value data without encoding) Example when log monitor data 2, 5, and 8 show negative values: Bits 1, 4, and 7 have values of 1, and the encoding data = 0010010010 (Bin.) = 0092 (Hex.)
16	Row number	6	Row number (Hex.) in the data log file

■ o5-00: Log Type

No. (Hex.)	Name	Description	Default (Range)
o5-00 (1E81) RUN	Log Type	V/f OLV CLV Sets the type of data log function. This parameter is only available when you use an LCD keypad.	0 (0, 1)

0 : Long Term Log

Saves data continuously over a long time period.

1 : Short Term Log

Saves data over a set length of time before and after the drive detects a trigger event with a short sampling cycle.

■ o5-01: Log Start/Stop Selection

No. (Hex.)	Name	Description	Default (Range)
o5-01 (1551) RUN Expert	Log Start/Stop Selection	V/f OLV CLV Sets the data log function. This parameter is only available when using an LCD keypad.	0 (0 - 1)

0 : OFF

Stops the data log.

1 : ON

Starts the data log as specified by the sampling cycle set in *o5-02 [Log Sampling Interval]*.

■ o5-02: Log Sampling Interval

No. (Hex.)	Name	Description	Default (Range)
o5-02 (1552) RUN Expert	Log Sampling Interval	V/f OLV CLV Sets the data log sampling cycle. This parameter is only available when using an LCD keypad.	1000 ms (100 - 60000 ms)

■ o5-03: Log Monitor Data 1

No. (Hex.)	Name	Description	Default (Range)
o5-03 (1553) RUN Expert	Log Monitor Data 1	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	101 (000, 101 - 999)

Note:

Set the number of the *U monitor* to record the data log.

For example, to show *U1-01 [Frequency Reference]*, set *o5-03 = 101*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2 monitor [Fault Trace]* or *U3 Monitor [Fault History]*.

■ o5-04: Log Monitor Data 2

No. (Hex.)	Name	Description	Default (Range)
o5-04 (1554) RUN Expert	Log Monitor Data 2	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	102 (000, 101 - 999)

Note:

Set the *U monitor* number you will log.

For example, to show *U1-02 [Output Frequency]*, set *o5-04 = 102*. When it is not necessary to set data log monitor, set this parameter to *000*.

■ o5-05: Log Monitor Data 3

No. (Hex.)	Name	Description	Default (Range)
o5-05 (1555) RUN Expert	Log Monitor Data 3	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	103 (000, 101 - 999)

Note:

Sets the number of the *U monitor* you will log.

For example, to show *U1-03 [Output Current]*, set *o5-05 = 103*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot select *U2 monitor [Fault Trace]* or *U3 Monitor [Fault History]*.

■ o5-06: Log Monitor Data 4

No. (Hex.)	Name	Description	Default (Range)
o5-06 (1556) RUN Expert	Log Monitor Data 4	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	107 (000, 101 - 999)

Note:

Sets the number of the *U monitor* you will log.

For example, to show *U1-07 [DC Bus Voltage]*, set *o5-06 = 107*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot select *U2 monitor [Fault Trace]* or *U3 Monitor [Fault History]*.

■ o5-07: Log Monitor Data 5

No. (Hex.)	Name	Description	Default (Range)
o5-07 (1557) RUN Expert	Log Monitor Data 5	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	108 (000, 101 - 999)

Note:

Sets the number of the *U monitor* you will log.

For example, to show *U1-08 [Output Power]*, set *o5-07 = 108*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot select *U2 monitor [Fault Trace]* or *U3 Monitor [Fault History]*.

■ o5-08: Log Monitor Data 6

No. (Hex.)	Name	Description	Default (Setting Range)
o5-08 (1558) RUN Expert	Log Monitor Data 6	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	000 (000, 101 - 999)

Note:

Set the *U monitor* number you want to log.

For example, to display *U1-01 [Frequency Reference]*, set *o5-08 = 101*. When it is not necessary to set a data log monitor, set this parameter to *000*. You cannot set *U2 Monitors [Fault Trace]* or *U3 Monitors [Fault History]*.

■ o5-09: Log Monitor Data 7

No. (Hex.)	Name	Description	Default (Range)
o5-09 (1559) RUN Expert	Log Monitor Data 7	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	000 (000, 101 - 999)

Note:

Set the *U monitor* number you will log.

For example, to show *U1-01 [Frequency Reference]*, set *o5-09 = 101*. When it is not necessary to set data log monitor, set this parameter to *000*.

■ o5-10: Log Monitor Data 8

No. (Hex.)	Name	Description	Default (Range)
o5-10 (155A) RUN Expert	Log Monitor Data 8	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	000 (000, 101 - 999)

Note:

Sets the number of the *U monitor* you will log.

For example, to show *U1-01 [Frequency Reference]*, set *o5-10 = 101*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot select *U2 monitor [Fault Trace]* or *U3 Monitor [Fault History]*.

■ o5-11: Log Monitor Data 9

No. (Hex.)	Name	Description	Default (Range)
o5-11 (155B) RUN Expert	Log Monitor Data 9	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	000 (000, 101 - 999)

Note:

Sets the number of the *U monitor* you will log.

For example, to show *U1-01 [Frequency Reference]*, set *o5-11 = 101*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot select *U2 monitor [Fault Trace]* or *U3 Monitor [Fault History]*.

■ o5-12: Log Monitor Data 10

No. (Hex.)	Name	Description	Default (Range)
o5-12 (155C) RUN Expert	Log Monitor Data 10	V/f OLV CLV Sets the data log monitor. This parameter is only available when using an LCD keypad.	000 (000, 101 - 999)

Note:

Sets the number of the *U monitor* you will log.

For example, to show *U1-01 [Frequency Reference]*, set *o5-12 = 101*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot select *U2 monitor [Fault Trace]* or *U3 Monitor [Fault History]*.

■ o5-15: Trigger Type Selection

No. (Hex.)	Name	Description	Default (Range)
o5-15 (1E82) RUN	Trigger Type Selection	V/f OLV CLV Sets the type of trigger for the short-term data log. This parameter is only available when you use an LCD keypad.	0 (0, 1)

0 : Digital Trigger

A digital signal inside the drive will act as the trigger.

1 : Analog Trigger

An analog signal inside the drive will act as the trigger.

Note:

There are no detection width and detection time settings for the analog trigger in the data log function. If variations in the analog signal are a problem, set *o5-15 = 0* and *o5-16 = 66, 67 [Digital Trigger Object = Comparator 1, 2]*. Use *H2-20 [Comparator 1 Monitor Selection]* to *H2-32 [Comparator 1 Filter Time]* to set the conditions for the comparator function.

■ o5-16: Digital Trigger Object

No. (Hex.)	Name	Description	Default (Range)
o5-16 (1E83) RUN	Digital Trigger Object	V/f OLV CLV Sets the function for the digital trigger target from the setting values for multi-function digital outputs. This parameter is only available when you use an LCD keypad.	E (0 - FF)

■ o5-17: Analog Trigger Object

No. (Hex.)	Name	Description	Default (Range)
o5-17 (1E84) RUN	Analog Trigger Object	V/f OLV CLV Sets the monitor for the analog trigger target. This parameter is only available when you use an LCD keypad.	102 (0 - 9999)

Note:
- Set the *x-xx* part of the *Ux-xx [Monitor]*. For example, set *o5-17 = 101* to monitor *U1-01 [Frequency Reference]*.
  When the *x* part of *Ux* is a letter, replace the letter (hexadecimal number) with a decimal number. For example, set *o5-17 = 1301* to monitor *Ud-01*.
- When it is not necessary to set a data log monitor, set this parameter to *000*.

■ o5-18: Analog Trigger Level

No. (Hex.)	Name	Description	Default (Range)
o5-18 (1E85) RUN	Analog Trigger Level	V/f OLV CLV Sets the level to compare with the analog trigger target. This parameter is only available when you use an LCD keypad.	0.0% (-999.9% - +999.9%)

■ o5-19: Trigger Condition

No. (Hex.)	Name	Description	Default (Range)
o5-19 (1E86) RUN	Trigger Condition	V/f OLV CLV Sets the condition with which to detect the trigger. This parameter is only available when you use an LCD keypad.	0 (0, 1)

0 : Rising Edge

- Digital trigger: The drive detects the trigger when the digital trigger target switches from OFF to ON.
- Analog trigger: The drive detects the trigger when the analog trigger target changes from “less than” to “equal or more than” the trigger level set in *o5-18 [Analog Trigger Level]*.

1 : Falling Edge

- Digital trigger: The drive detects the trigger when the digital trigger target switches from ON to OFF
- Analog trigger: The drive detects the trigger when the analog trigger target changes from “equal to or more than” to “less than” the trigger level set in *o5-18 [Analog Trigger Level]*.

■ o5-20: Pre-Trigger Setting

No. (Hex.)	Name	Description	Default (Range)
o5-20 (1E87) RUN	Pre-Trigger Setting	V/f OLV CLV Sets the percentage of data to save before the drive detects the trigger for the short-term data log. This parameter is only available when you use an LCD keypad.	90% (0% - 100%)

■ o5-21: Trend Log Sampling Time Selection

No. (Hex.)	Name	Description	Default (Range)
o5-21 (1E88) RUN	Trend Log Sampling Time Selection	V/f OLV CLV Sets the sampling cycle for the trend log to save data before the drive detects the trigger. The trend log works at the same time as the short-term data log. This parameter is only available when you use an LCD keypad.	0 (0 - 4)

0 : Trend Log Disabled

The drive does not save the trend log.

1 : 0.1 s (About 1 hour)

Saves a trend log with a sampling cycle of 0.1 s. The drive saves a maximum of approximately one hour of data before it detects the trigger.

2 : 1 s (About 10 hours)

Saves a trend log with a sampling cycle of 1 s. The drive saves a maximum of approximately 10 hours of data before it detects the trigger.

3 : 10 s (About 100 hours)

Saves a trend log with a sampling cycle of 10 s. The drive saves a maximum of approximately 100 hours of data before it detects the trigger.

4 : 60 s (About 600 hours)

Saves a trend log with a sampling cycle of 60 s. The drive saves a maximum of approximately 600 hours of data before it detects the trigger.

12.11 S: Elevator Parameters

S parameters describe various functions and faults needed to operate an elevator application:

- Braking Sequence
- Slip Compensation
- Optimal Adjustments at Start and Stop
- Rescue Operation
- Elevator-related Faults

◆ S1: Brake Sequence

■ S1-01: Zero Speed Level at Stop

No. (Hex.)	Name	Description	Default (Range)
S1-01 (0680)	Zero Speed Level at Stop	V/f OLV CLV Determines the speed to begin applying DC Injection when the drive is ramping to stop (b1-03 = 0). Set as a percentage of the maximum output frequency (E1-04).	Determined by A1-02 (0.000 - 9.999%)

Parameter S1-01 sets the starting speed for DC Injection Braking at stop. Once the output speed falls below the setting of S1-01, the amount of DC Injection Braking current set in S1-03 is injected into the motor for the time set in parameter S1-05.

■ S1-02: DC Injection Current at Start

No. (Hex.)	Name	Description	Default (Range)
S1-02 (0681)	DC Injection Current at Start	V/f OLV CLV Determines the amount of current to use for DC Injection at start. Set as a percentage of the drive rated current.	50% (0 - 75%)

■ S1-03: DC Injection Current at Stop

No. (Hex.)	Name	Description	Default (Range)
S1-03 (0682)	DC Injection Current at Stop	V/f OLV CLV Determines the amount of current to use for DC Injection at stop. Set as a percentage of the drive rated current. When using OLV Control, the DC injection current is determined by multiplying S1-03 by S3-25 or S3-26.	50% (0 - 75%)

■ S1-04: DC Inj/Pos Lock Time at Start

No. (Hex.)	Name	Description	Default (Range)
S1-04 (0683)	DC Inj/Pos LockTime at Start	V/f OLV CLV Determines how long the drive should perform DC Injection at start. During this time, the drive allows motor flux to develop, which is essential for applying torque quickly once the brake is released. A setting of 0.00 disables S1-04.	0.40 s (0.00 - 10.00 s)

■ S1-05: DC Inj/Pos Lock Time at Stop

No. (Hex.)	Name	Description	Default (Range)
S1-05 (0684)	DC Inj/Pos LockTime at Stop	V/f OLV CLV Determines how long the drive should perform DC Injection at stop. A setting of 0.00 disables S1-05.	0.60 s (0.00 - 10.00 s)

■ S1-06: Brake Open Delay Time

No. (Hex.)	Name	Description	Default (Range)
S1-06 (0685)	Brake Release Delay Time	V/f OLV CLV Determines the time that must pass after an Up/Down command is entered before the output terminal set for "Brake control" (H2-xx = 50) is triggered. Adjusting this delay time can help when there is not enough time to develop the appropriate amount of motor flux. Be sure to also increase the time S1-04 when setting S1-06 to relatively long delay time.	0.20 s (0.00 - 10.00 s)

S1-07: Brake Close Delay Time

No. (Hex.)	Name	Description	Default (Range)
S1-07 (0686)	Brake Close Delay Time	V/f OLV CLV Determines the time that must pass after zero speed is reached before the output terminal set for "Brake control" (H2-xx = 50) is released.	0.10 s (0.00 - 10.00 s)

S1-10: Run Command Delay Time

No. (Hex.)	Name	Description	Default (Range)
S1-10 (0687)	Run Command Delay Time	V/f OLV CLV Determines the time that must pass after zero speed is reached before the output terminal set for "Brake control" (H2-xx = 50) is released.	0.10 s (0.00 - 10.00 s)

S1-11: Output Reactor Open Delay Time

No. (Hex.)	Name	Description	Default (Range)
S1-11 (0688)	Output Reactor Open Delay Time	V/f OLV CLV Determines the time that must pass for an output terminal set for "Output contactor control" (H2-xx = 51) to be released after the drive has stopped and drive output has been shut off.	0.10 s (0.00 - 10.00 s)

S1-12: Output Contactor During Autotune

No. (Hex.)	Name	Description	Default (Range)
S1-12 (06E0)	Output Contactor During Autotune	V/f OLV CLV Sets the function to automatically activate an MFDO terminal set for *H2-xx = 51 [Output Contactor Control]* when the drive starts Auto-Tuning.	0 (0 - 2)

⚠ WARNING Sudden Movement Hazard

Use *S1-12 [Output Contactor During Autotune]* to enable and disable automatic switching of the *Motor Contactor Control* output signal during Auto-Tuning. Before you set *S1-12 = 1 or 2 [Enable or Enabled during A-Tuning and STo]*, make sure that you correctly wire the MFDO terminals set for *H2-xx = 51 [MFDO Function Selection = Motor Contactor Control]* and make sure that they are in the correct state.

Incorrect setting procedures can cause serious injury or death.

0 : Disable

1 : Enable

2 : Enabled during A-Tuning and STo

◆ S2: Slip Compensation for Elevators

The slip compensation function automatically adjusts the speed reference for leveling operation depending on the load measured at constant speed. S2 parameters tune the slip compensation function to improve the landing accuracy. Slip Compensation requires that the drive be set for V/f Control or Open Loop Vector Control.

S2-01: Motor Rated Speed

No. (Hex.)	Name	Description	Default (Range)
S2-01 (068F)	Motor Rated Speed	V/f OLV CLV Sets the rated speed of the motor.	1380 rpm (300 - 1800 rpm)

S2-02: Slip Compensation Gain in Motoring Mode

No. (Hex.)	Name	Description	Default (Range)
S2-02 (0690)	Slip Comp Gain during Motoring	V/f OLV CLV Slip compensation for leveling speed can be set separately for motoring and regenerative states to help improve the accuracy of leveling.	0.7 (0.0 - 5.0)

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■ S2-03: Slip Compensation Gain in Regenerative Mode

No. (Hex.)	Name	Description	Default (Range)
S2-03 (0691)	Slip Comp Gain during Regen	V/f OLV CLV Slip compensation for leveling speed can be set separately for motoring and regenerative states to help improve the accuracy of leveling.	1.0 (0.0 - 5.0)

■ S2-05: Slip Compensation Torque Detection Delay Time

No. (Hex.)	Name	Description	Default (Range)
S2-05 (0693) Expert	Slip Compensation Torque Detection Delay Time	V/f OLV CLV Sets a delay time before detecting torque for slip compensation.	1000 ms (0 - 10000 ms)

■ S2-06: Slip Compensation Torque Detection Filter Time Constant

No. (Hex.)	Name	Description	Default (Range)
S2-06 (0694) Expert	Slip Compensation Torque Detection Filter Time Constant	V/f OLV CLV Sets the filter time constant applied to the torque signal used for the slip compensation value calculation.	500 ms (0 - 2000 ms)

◆ S3: Start/Stop Optimization

S3 parameters set the Anti-Roll Back (ARB) functions.

■ S3-02: Position Lock Gain 2 at Start

No. (Hex.)	Name	Description	Default (Range)
S3-02 (0698) RUN	Position Lock Gain 2 at Start	V/f OLV CLV Sets gain level 2 for the Position Lock function. Position Lock at start compensates the motor torque to keep the car position to prevent rollback when the brake is released.	0.00 (0.00 - 100.00)

This parameter sets gain to adjust the internal torque reference directly (Anti-Rollback function).

If there is a problem with rollback when the brake is released, increase the value. If motor oscillation occurs during Position Lock, decrease the value.

Note:

Check the *C5-xx [Auto Speed Regulator (ASR)]* parameters to make sure the speed control loop settings are correct before making any adjustments to the Position Lock gain.

■ S3-03: Position Lock Gain at Stop

No. (Hex.)	Name	Description	Default (Range)
S3-03 (0699) RUN	Position Lock Gain at Stop	V/f OLV CLV Sets the Position Lock gain at stop. Position Lock at stop compensates the motor torque to keep the car position until the brake is fully applied.	5 (0 - 100)

Position Lock at stop compensates the motor torque when the motor speed reaches the larger value of *S1-01 [Zero Speed Level at Stop]* or *E1-09 [Minimum Output Frequency]*.

To increase the ability of the drive to hold the car in place, increase the value. If motor oscillation occurs during Position Lock, decrease the value.

Note:

Check the *C5-xx [Auto Speed Regulator (ASR)]* parameters to make sure the speed control loop settings are correct before making any adjustments to the Position Lock gain.

■ S3-04: Position Lock Bandwidth

No. (Hex.)	Name	Description	Default (Range)
S3-04 (069A)	Position Lock Bandwidth	V/f OLV CLV Sets the bandwidth around the stop position in which an MFDO terminal set for *H2-xx = 33 [Zero Servo Complete]* activates.	10 (0 - 16383)

The drive outputs the *Zero Servo Complete* signal when the elevator car moves from the Position Lock start point to the position of ±*S3-04*.

■ S3-34: Position Lock Torque Bias 1

No. (Hex.)	Name	Description	Default (Range)
S3-34 (06C4) Expert	Position Lock Torque Bias 1	V/f OLV CLV Sets an intermediate value for the torque bias used for Anti-Rollback when the drive does Position Lock at start. Usually it is not necessary to change this setting.	0.0% (0.0 - 100.0%)

■ S3-35: Position Lock Torque Bias 2

No. (Hex.)	Name	Description	Default (Range)
S3-35 (06C5) Expert	Position Lock Torque Bias 2	V/f OLV CLV Sets a maximum value for the torque bias used for Anti-Rollback when the drive does Position Lock at start. Usually it is not necessary to change this setting.	0.0% (0.0 - 100.0%)

■ S3-37: Torque Bias 1 Pos.Dev. Lvl

No. (Hex.)	Name	Description	Default (Range)
S3-37 (06C7) Expert	Torque Bias 1 Pos.Dev. Lvl	V/f OLV CLV Sets the position deviation level at which *S3-34 [Position Lock Torque Bias 1]* activates. Usually it is not necessary to change this setting.	0 ms (0 - 32767 ms)

■ S3-38: Torque Bias 2 Pos.Dev. Lvl

No. (Hex.)	Name	Description	Default (Range)
S3-38 (06C8) Expert	Torque Bias 2 Pos.Dev. Lvl	V/f OLV CLV Sets the position deviation level when the drive should switch from the Anti-Rollback torque bias set in *S3-34 [Position Lock Torque Bias 1]* to the torque bias set in *S3-35 [Position Lock Torque Bias 2]*. Usually it is not necessary to change this setting.	0 ms (0 - 32767 ms)

■ S3-39: Position Lock Integral Gain

No. (Hex.)	Name	Description	Default (Range)
S3-39 (06C9)	Position Lock Integral Gain	V/f OLV CLV Sets the drive responsiveness for Anti-Rollback during Position Lock. Usually it is not necessary to change this setting.	0.00 (-30.00 - +30.00)

If there is still too much deviation from the Position Lock start position after you have already adjusted Position Lock gain 1 and gain 2, increase the value. If motor oscillation occurs during Position Lock, decrease the value.

■ S3-40: Position Lock Movement Detection

No. (Hex.)	Name	Description	Default (Range)
S3-40 (06CA) Expert	Position Lock Movement Detection	V/f OLV CLV Sets the amount of pulses for movement detection during Anti-Rollback.	1 (0 - 100)

■ S3-41: PosLock Gain2 Reduction Factor

No. (Hex.)	Name	Description	Default (Range)
S3-41 (06CB) Expert	PosLock Gain2 Reduction Factor	V/f OLV CLV Sets a reduction factor for the Anti-Rollback Gain set in *S3-02 [Position Lock Gain 2 at Start]*.	0.50 (0.00 - 1.00)

If the motor rotation (i.e., car movement) is below the movement detection level set in *S3-40 [Position Lock Movement Detection]*, the drive will reduce the Anti-Rollback gain according to the gain reduction level set in *S3-41*.

◆ S4: Rescue Operation

Rescue Operation switches to a backup battery or some other UPS during a power outage.

■ S4-01: Light Load Direction Search Selection

No. (Hex.)	Name	Description	Default (Range)
S4-01 (06A6)	Light Load Direction Search Selection	V/f OLV CLV Enables and disables the Light Load Direction Search.	0 (0, 3)

0 : Disabled

3 : Advanced Search

■ S4-05: Rescue Operation Torque Limit

No. (Hex.)	Name	Description	Default (Range)
S4-05 (06AA) Expert	Rescue Operation Torque Limit	V/f OLV CLV Sets a time limit for Light Load Direction Search.	100% (0% - 300%)

■ S4-20: Light Load Search Override

No. (Hex.)	Name	Description	Default (Range)
S4-20 (06B1)	Light Load Search Override	V/f OLV CLV Sets the evacuation in Light Load Direction determined by drive.	0 (0 - 1)

Note:

0 : Controller Direction

The elevator controller decides direction by S1/S2.

1 : Inverter Direction

The drive can override S1/S2 direction of the elevator controller.

◆ S5: Elevator Functionality

S5 parameters set these functions:

- Short Floor Operation
- Direct Landing
- Brake Torque Check

■ Short Floor Function

Short Floor automatically adjusts to decrease the operation time at *d1-26 [Leveling Speed]* when the drive receives the command from an MFDI terminal set for *H1-xx = 53 [Leveling Speed]* before the motor speed reaches *d1-19 [Nominal Speed]*. This function is enabled when *S5-01 = 1 [Short Floor Operation Selection = Standard Short Floor]*. The drive calculates the distance to decelerate from *d1-19* to *d1-26* and automatically decreases the speed to *d1-26*.

Note:

This function is not available during Rescue Operation and Inspection Operation.

Area S in Figure 12.44 indicates the distance to a stop from *d1-19*.

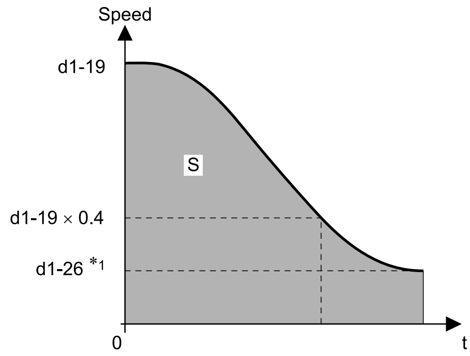

Figure 12.44 Speed During Normal Operation

*1 When *d1-18 = 0 [Speed Reference Selection Mode = Multi-speed Mode1 (d1-01 to 08)]*, the drive recognizes a speed reference lower than *d1-28 [Leveling Speed Detection Level]* as the leveling speed.

Short Floor has two operation patterns:

- When you set *d1-26* after the speed reaches 40% of *d1-19*, the drive keeps the speed for the time until the distance reaches area S.
- When you set *d1-26* before the speed reaches 40% of *d1-19*, the drive accelerates to 40% of *d1-19* and keeps the speed for the time until the distance reaches area S, then decelerates to *d1-26*.

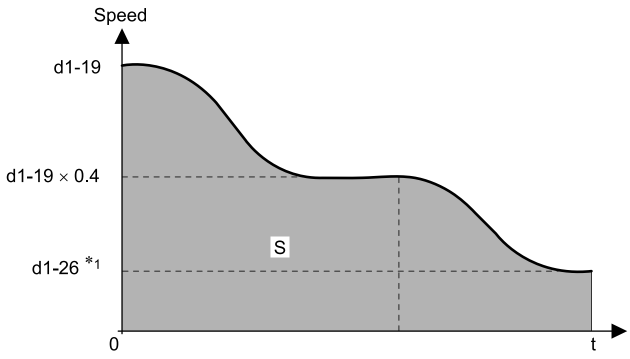

Figure 12.45 Short Floor Function

*1 When *d1-18 = 0 [Speed Reference Selection Mode = Multi-speed Mode1 (d1-01 to 08)]*, the drive recognizes a speed reference lower than *d1-28 [Leveling Speed Detection Level]* as the leveling speed.

■ S5-01: Short Floor Operation Selection

No. (Hex.)	Name	Description	Default (Range)
S5-01 (06AB)	Short Floor Operation Selection	V/f OLV CLV Sets the function to enable and disable the Short Floor function.	0 (0 - 2)

Note:
- The Short Floor and Advanced Short Floor functions are not available during Rescue Operation and Inspection Operation.
- You must not use Short Floor or Advanced Short Floor when you configured the analog input terminals to supply the speed reference.
- When *d1-18 = 0 [Speed Reference Selection Mode = Multi-speed Mode1 (d1-01 to 08)]*, and when the MFDI terminal set for *H1-xx = 53 [Leveling Speed]* deactivates during Short Floor or Advanced Short Floor, the drive will accelerate or decelerate to the specified speed reference at the specified acceleration or deceleration rate.

0 : Disabled

1 : Standard Short Floor

■ S5-02: Short Floor Nominal Speed

No. (Hex.)	Name	Description	Default (Range)
S5-02 (06AC)	Short Floor Nominal Speed	V/f OLV CLV Sets the nominal speed used to calculate the distance for the Short Floor function when *d1-18 = 0 or 3 [Speed Reference Selection Mode = Multi-speed Mode1 (d1-01 to 08) or Multi-speed Mode2 (d1-02 to 08)]*.	0.0% (0.0 - 100.0%)

S5-76: Phase, Encoder Direction Switch

No. (Hex.)	Name	Description	Default (Range)
S5-76 (01A9)	Phase, Encoder Direction Switch	V/f OLV CLV Aligns the Up command from the drive and the up direction of the motor without changing wiring. This parameter can change the settings for *b1-14 [Phase Order Selection]*.	0 (0 - 2)

0 : Keep Rotation Direction

1 : Switch Phase Order

2 : Switch Phase & Encoder Direction

This setting is only available in CLV.

Also refer to *b1-14: Phase Order Selection on page 309*.

S6: Faults for Elevator Applications

S6-01: Motor Contactor Response Error (SE1) Detection/Reset Selection

No. (Hex.)	Name	Description	Default (Range)
S6-01 (06B3)	Motor Contactor Response Error (SE1) Detection/Reset Selection	V/f OLV CLV Determines when the drive should detect a motor contactor response error (SE1). SE1 is triggered if there is no response from the motor contactor within the time set in S6-10 after the contactor control output has been set.	0 (0 - 2)

0 : Detect during stop, SE1 must be manually reset

1 : Detect during stop, SE1 can be automatically reset

2 : No SE1 detection

S6-02: Starting Current Error (SE2) Detection Delay Time

No. (Hex.)	Name	Description	Default (Range)
S6-02 (06B4)	Starting Current Error (SE2) Detection Delay Time	V/f OLV CLV Sets a delay time for starting current error (SE2). SE2 is detected when the drive output current is below 25% after the Up/Down command has been entered and the brake release time and the time set to S6-02 have both passed. The brake control command will not be issued (brake stays applied).	200 ms (0.00 - [S1-04 - S1-06] ms)

S6-03: Start I Error(SE2) Detect Level

No. (Hex.)	Name	Description	Default (Range)
S6-03 (06B5) Expert	Start I Error(SE2) Detect Level	V/f OLV CLV Sets the level of current applied to the motor when the Brake Control command is activated, as a percentage of *E2-03 [Motor No-Load Current]*.	25% (0 - 100%)

After the drive received the Up/Down command and the times of *S1-06 [Brake Release Delay Time] + S6-02 [Start I Error(SE2) Detect DelayT]* have passed, if the drive output current is less than the value set in *S6-03*, the drive detects *SE2 [Starting Current Error]*.

S6-04: Output Current Error (SE3) Detection Delay Time

No. (Hex.)	Name	Description	Default (Range)
S6-04 (06B6)	Output Current Error (SE3) Detection Delay Time	V/f OLV CLV Sets a delay time for detecting an output current fault (SE3). SE3 is detected when the drive output current drops below 25% after the brake has released.	200 ms (0 - 5000 ms)

S6-05: Brake Response Error (SE4) Detection Time

No. (Hex.)	Name	Description	Default (Range)
S6-05 (06B7)	Brake Response Error (SE4) Detection Time	V/f OLV CLV Sets a delay time for detecting a brake response error (SE4). SE4 is detected when an output terminal set for “Brake release” (H2-xx = 50) and an input terminal set for “Brake feedback” (H1-xx = 79) do match for the time set to S6- 05.	500 ms (0 - 10000 ms)

■ S6-15: Speed Reference Loss Detection

No. (Hex.)	Name	Description	Default (Range)
S6-15 (06BB)	Speed Reference Loss Detection	V/f OLV CLV Enables speed reference loss detection when D1-18 = 1 and H1-xx ≠ 53.	0 (0, 1)

0 : Disabled

1 : Enabled

■ S6-16: Restart after Baseblock Selection

No. (Hex.)	Name	Description	Default (Range)
S6-16 (06BC) Expert	Restart after Baseblock Selection	V/f OLV CLV Sets the function to let the drive restart the motor after returning to normal operation from Baseblock state (*H1-xx = 8/9 [Baseblock Command (N.O.)/Baseblock Command (N.C.)]*) or from Safe Torque-Off state (Safe Disable inputs H1 and H2 enabled) while the Up/Down command is still active.	0 (0, 1)

0 : Disabled

The drive does not restart the motor when leaving the Baseblock or Safe Torque-Off state even if an Up/Down command is still active.

1 : Enabled

The drive restarts when the Up/Down command is still active while the Baseblock or Safe Torque-Off state is left. To use this function with the Safe Disable function, set *L8-88 = 1 [Safe Disable Operation Mode = Mode 1 (Alarm-Off, Ready-On)]*.

12.12 T: Auto-Tuning

Numbers identifying the *T parameters* are displayed when an LED keypad is used. The names of the parameters are displayed on the LCD screen of the LCD keypad. Set the following.

- Induction Motor Auto-Tuning

◆ T1: Induction Motor Auto-Tuning

T1 parameters set the Auto-Tuning input data for induction motor tuning.

Note:

- The base frequency of drive dedicated motors and special motors for use with vector control may be lower than the base frequency of general-purpose motors, which is 50 Hz or 60 Hz. In such cases, this lower frequency is used as the value for *E1-06 [Base Frequency]* and *E1-04 [Maximum Output Frequency]* after Auto-Tuning completes. If the maximum output frequency is too low and causes problems, change the setting of *E1-04* after Auto-Tuning completes.
- The following induction motor parameters are set automatically.
  –*E1-xx [V/f Pattern for Motor 1]*
  –*E2-xx [Motor Parameters]*

■ T1-01: Auto-Tuning Mode Selection

No. (Hex.)	Name	Description	Default (Range)
T1-01 (0701)	Auto-Tuning Mode Selection	V/f OLV CLV Sets the type of Auto-Tuning.	Determined by A1-02 (Determined by A1-02)

0 : Rotational Auto-Tuning

Default setting if *A1-02 = 2 [Open Loop Vector]*.

1 : Stationary Auto-Tuning 1

2 : Stationary Line-Line Resistance

Default setting if *A1-02 = 0 [V/f Control]*.

■ T1-02: Motor Rated Power

No. (Hex.)	Name	Description	Default (Range)
T1-02 (0702)	Motor Rated Power	V/f OLV CLV Uses the units set in *o1-58 [Motor Power Unit Selection]* to set the motor rated output power.	Determined by o2-04 (0.00 - 650.00 kW)

■ T1-03: Motor Rated Voltage

No. (Hex.)	Name	Description	Default (Range)
T1-03 (0703)	Motor Rated Voltage	V/f OLV CLV Sets the rated voltage (V) of the motor. Enter the base speed voltage for constant output motors.	400 V Class: 400.0 V (400 V Class: 0.0 - 511.0 V)

If you do Auto-Tuning on a drive-dedicated motor or a specialized motor for vector control, the voltage or frequency can be lower than that of a general-purpose motor. Always compare the data from the nameplate or test report with the Auto-Tuning results and check for differences. Enter the voltage necessary to operate the motor in no-load conditions at rated speed for better control precision around rated speed. If the motor test report or the motor nameplate is not available, enter approximately 90% of the motor rated voltage.

If the drive input power supply voltage is low, enter approximately 90% of the input voltage. When the input power supply voltage is low, the current will increase. Make sure that the main power supply capacity is correct and use a molded-case circuit breaker for the drive.

■ T1-04: Motor Rated Current

No. (Hex.)	Name	Description	Default (Range)
T1-04 (0704)	Motor Rated Current	V/f OLV CLV Sets the rated current (A) of the motor.	Determined by o2-04 (10% to 200% of the drive rated current)

Set the motor rated current between 50% and 100% of the drive rated current for the best performance. Enter the current at the motor base speed.

T1-05: Motor Base Frequency

No. (Hex.)	Name	Description	Default (Range)
T1-05 (0705)	Motor Base Frequency	V/f OLV CLV Sets the base frequency (Hz) of the motor.	50.0 Hz (0.0 - 120.0 Hz)

When Auto-Tuning is carried out, the value of *T1-05* is set to *E1-04 [Maximum Output Frequency]*. If *T1-05 < 40 Hz*, *E1-04* = 40 Hz. If you operate the drive at a speed that is higher than the base frequency, or if you operate in the field weakening range, set *E1-04* to the maximum output frequency after you complete Auto-Tuning.

T1-06: Number of Motor Poles

No. (Hex.)	Name	Description	Default (Range)
T1-06 (0706)	Number of Motor Poles	V/f OLV CLV Sets the number of motor poles.	4 (2 to 20)

T1-07: Motor Base Speed

No. (Hex.)	Name	Description	Default (Range)
T1-07 (0707)	Motor Base Speed	V/f OLV CLV Sets the motor base speed for Auto-Tuning (min^{-1} (r/min)).	1380 min^{-1} (r/min) (300 - 18000 min^{-1} (r/min))

T1-08: Motor no-load voltage

No. (Hex.)	Name	Description	Default (Range)
T1-08 (0708)	Encoder Pulse Count (PPR)	V/f OLV CLV Sets the number of PG (pulse generator, encoder) pulses.	1024 ppr (0 - 60,000 ppr)

T1-09: Motor No-Load Current

No. (Hex.)	Name	Description	Default (Range)
T1-09 (0709)	Motor No-Load Current	V/f OLV CLV Sets the no-load current of the motor.	- (0 A - T1-04; max. of 2999.9)

Note:

The display units are different for different models:
- 2022 - 2041, 4012 - 4023: 0.01 A
- 2059 - 2519, 4030 - 4380: 0.1 A

The value shown is the no-load current that the drive automatically calculates from the values set in *T1-02 [Motor Rated Power]* and *T1-04 [Motor Rated Current]*. Set the no-load current shown on the motor test report. If the motor test report is not available, do not change this parameter.

T1-10: Motor Rated Slip Frequency

No. (Hex.)	Name	Description	Default (Range)
T1-10 (070A)	Motor Rated Slip Frequency	V/f OLV CLV Sets motor rated slip.	0.000 Hz (0.000 - 20.000 Hz)

Shows 0.000 Hz as the default value. Set the rated slip shown on the motor test report. If the motor test report is not available, do not change this parameter.

T1-11: Motor Iron Loss

No. (Hex.)	Name	Description	Default (Range)
T1-11 (070B)	Motor Iron Loss	V/f OLV CLV Sets the iron loss to calculate the energy-saving coefficient.	Determined by E2-10 or E4-10 (0 - 65535 W)

Note:

The default setting is different for different motor codes and motor parameter settings.

The value shown is *E2-10 [Motor Iron Loss]* or *E4-10 [Motor 2 Iron Loss]* for the motor output set in *T1-02 [Motor Rated Power]*. If the motor test report is available, enter the motor iron loss value to *T1-11*.

■ T1-13: No-Load Voltage

No. (Hex.)	Name	Description	Default (Range)
T1-13 (0BDC)	No-Load Voltage	V/f OLV CLV Sets the no-load voltage of the motor. When the no-load voltage at rated speed is available, for example on the motor test report, set the voltage in this parameter. If the no-load voltage is not available, do not change this parameter.	T1-03 × 0.85 (200 V Class: 0.0 - 255.0 V, 400 V Class: 0.0 - 510.0 V)

Note:

To get the same qualities as a Yaskawa 1000-series drive or previous series drive, set this parameter = *T1-03 [Motor Rated Voltage]*.

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Revision History

Date of Publication	Revision Number	Section	Revised Content
June 2020	-	-	First Edition
November 2022	1	3	Revised connection diagrams
		5	Added “Safe Disable Input”
		All	Corrected entire documentation
August 2023	2	6, 10, 11	Added “Network Communications” and related parameter information
		10, 11	Changed access level of some parameters
		All	Corrected entire documentation
October 2024	3	All	Added Closed Loop Vector Control Method
			Corrected entire documentation

LA500

Technical Manual

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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.

Original Instructions

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