L1000V

Quick Start Guide

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NOTICE

- **To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance.**

  Ensure the end user receives this 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.**

1 Safety Instructions and General Warnings

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

◆ General Warnings

⚠ WARNING

- **Read and understand this manual before installing, operating or servicing this drive.**
- **All warnings, cautions, and instructions must be followed.**
- **All work must be performed by qualified personnel.**
- **The drive must be installed according to this manual and local codes.**

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

The following conventions are used to indicate safety messages in this manual:

⚠ WARNING

Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a property damage message.

◆ Safety Warnings

⚠ WARNING

Electrical Shock Hazard

- **Do not attempt to modify or alter the drive in any way not explained in this manual.**
  Failure to comply could result in death or serious injury.
  Yaskawa is not responsible for any modification of the product made by the user. This product must not be modified.
- **Do not touch any terminals before the capacitors have fully discharged.**
  Failure to comply could result in death or serious injury.
  Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.
- **Do not allow unqualified personnel to use equipment.**
  Failure to comply could result in death or serious injury.
  Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of AC drives.
- **Do not remove covers or touch circuit boards while the power is on.**
  Failure to comply could result in death or serious injury.
- **Make sure the protective earthing conductor complies with technical standards and local safety regulations.**
  The leakage current of this drive exceeds 3.5 mA. Therefore, according to IEC 61800-5-1, automatic power supply interruption in case of discontinuity of the protective earthing conductor must be provided or a protective earthing conductor with a cross section of at least 10 mm^2 (Cu) or 16 mm^2 (Al) must be used.
- **Use appropriate equipment for residual current monitoring/detection (RCM/RCD).**
  This drive can cause a residual current with a DC component in the protective earthing conductor. Where a residual current operated protective or monitoring device is used for protection in case of direct or indirect contact, always use an RCM or RCD of type B according to IEC 60755.
- **Always ground the motor-side grounding terminal.**
  Improper equipment grounding could result in death or serious injury by contacting the motor case.

⚠ WARNING

- **Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.**
  Failure to comply could result in death or serious injury.
  Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.

- **Never short the output circuits of the drive.**
  Do not short the output circuits of the drive. Failure to comply could result in death or serious injury.

Sudden Movement Hazard

- **Stay clear of the motor during rotational Auto-Tuning. The motor may start operating suddenly.**
  During automatic starting of equipment, the machine may start moving suddenly, which could result in death or serious injury.

- **System may start unexpectedly upon application of power, resulting in death or serious injury.**
  Clear all personnel from the drive, motor, and machine area before applying power. Secure covers, couplings, shaft keys, and machine loads before applying power to the drive.

Fire Hazard

- **Do not use an improper voltage source.**
  Failure to comply could result in death or serious injury by fire.
  Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

- **Do not use improper combustible materials.**
  Failure to comply could result in death or serious injury by fire.
  Attach the drive to metal or other noncombustible material.

- **Do not connect AC line power to output terminals U, V, and W.**
- **Make sure that the power supply lines are connected to main circuit input terminals R/L1, S/L2, T/L3.**
  Do not connect the AC power line to the output motor terminals of the drive. Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.

- **Tighten all terminal screws to the specified tightening torque.**
  Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

⚠ CAUTION

Crush Hazard

- **Do not carry the drive by the front cover.**
  Failure to comply may result in minor or moderate injury from the main body of the drive falling.

Burn Hazard

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

NOTICE

Equipment Hazard

- **Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.**
  Failure to comply may result in ESD damage to the drive circuitry.
- **Never connect or disconnect the motor from the drive while the drive is outputting voltage.**
  Improper equipment sequencing could result in damage to the drive.
- **Do not perform a withstand voltage test on any part of the drive.**
  Failure to comply could result in damage to the sensitive devices within the drive.
- **Do not operate damaged equipment.**
  Failure to comply could result in further damage to the equipment.
  Do not connect or operate any equipment with visible damage or missing parts.
- **Install adequate branch circuit short circuit protection per applicable codes.**
  Failure to comply could result in damage to the drive.
  The drive is suitable for circuits capable of delivering not more than 30,000 RMS symmetrical Amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400V Class).
- **Do not use unshielded cable for control wiring.**
  Failure to comply may cause electrical interference resulting in poor system performance. Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.
- **Do not allow unqualified personnel to use the product.**
  Failure to comply could result in damage to the drive or braking circuit.
  Carefully review the braking option instruction manual when connecting a braking option to the drive.

NOTICE

- **Do not modify the drive circuitry.**
  Failure to comply could result in damage to the drive and will void warranty.
  Yaskawa is not responsible for modification of the product made by the user. This product must not be modified.
- **Check all the wiring to ensure that all connections are correct after installing the drive and connecting other devices.**
  Failure to comply could result in damage to the drive.
- **Do not connect unapproved LC or RC interference suppression filters, capacitors, or overvoltage protection devices to the output of the drive.**
  Using unapproved filters could result in damage to the drive or motor equipment.
- **Check the motor rotation and elevator movement direction prior to starting up the drive.**
  The drive puts out voltage in phase sequence U-V-W with an Up command. Make sure the elevator moves up if the motor is supplied with this phase sequence.
- **Always remove the ropes when performing Rotational Auto-Tuning.**
  During Rotational Auto-Tuning the drive turns the motor for a certain time. Not removing the ropes might result in damage to the equipment.

◆ Precautions for CE Low Voltage Directive Compliance

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

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

Ground the neutral point of the main power supply for 400 V Class drives.

◆ Precautions for UL/cUL Standards Compliance

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

Do not install the drive to an area greater than pollution severity 2 (UL standard).

Use UL-listed copper wires (rated at 75°C) and closed-loop connectors or CSA-certified ring connectors. For details refer to the Technical Manual.

Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national state or local codes for wiring. Use a class 2 (UL regulations) power supply for the control circuit terminal. For details refer to the Technical Manual.

This drive has undergone the UL short-circuit test, which certifies that during a short circuit in the power supply the current flow will not rise above 30,000 amps maximum at 240 V for 200 V class drives and 480 V for 400 V class drives.

The drive internal motor overload protection is UL listed and in accordance with the NEC and CEC. The setup can be done using the parameters L1-01/02. For details refer to the Technical Manual.

2 Mechanical Installation

◆ Upon Receipt

Perform the following tasks after receiving the drive:

- Inspect the drive for damage. If the drive appears damaged upon receipt, contact your supplier.
- Verify receipt of the correct model by checking the information on the nameplate. If you have received the wrong model, contact your supplier.

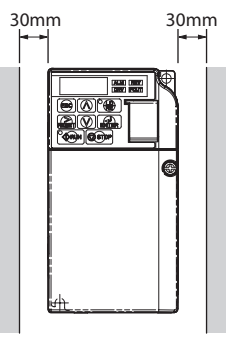
◆ Installation Environment

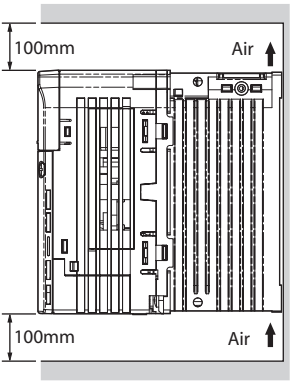
For optimum performance life of the drive, install the drive in an environment that meets the conditions listed below.

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	-10°C to +40°C (NEMA Type 1) -10°C to +50°C (Open-Chassis Type) When using an enclosure panel, install a cooling fan or air conditioner in the area to ensure that the air temperature inside the enclosure does not exceed the specified levels. Do not allow ice to develop on the drive.
Humidity	95% RH or less and free of condensation
Storage Temperature	-20°C to +60°C
Surrounding Area	Install the drive in an area free from: • oil mist and dust • metal shavings, oil, water or other foreign materials • radioactive materials • combustible materials (e.g., wood) • harmful gases and liquids • excessive vibration • chlorides • direct sunlight
Altitude	1000 m or lower, up to 3000 m with derating
Vibration	10 - 20 Hz at 9.8 m/s^2, 20 - 55 Hz at 5.9 m/s^2
Orientation	Install the drive vertically to maintain maximum cooling effects.

◆ Installation Orientation and Spacing

Always install the drive in an upright position. Leave space around the unit for proper cooling as shown in the figure on the right.

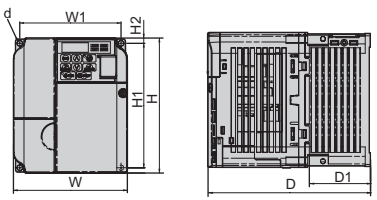




◆ Degree of Protection

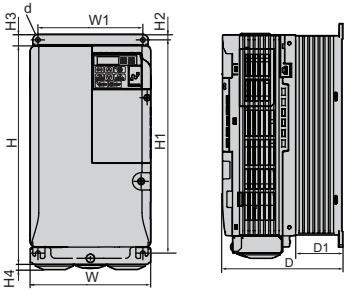
The degree of protection of L1000V drives are IP20 for 2V0018B and 4V0009B and NEMA Type1 for all other models. Install the drive in a cabinet if higher degree of protection is required.

◆ Dimensions



A

IP20 / Open Chassis



B

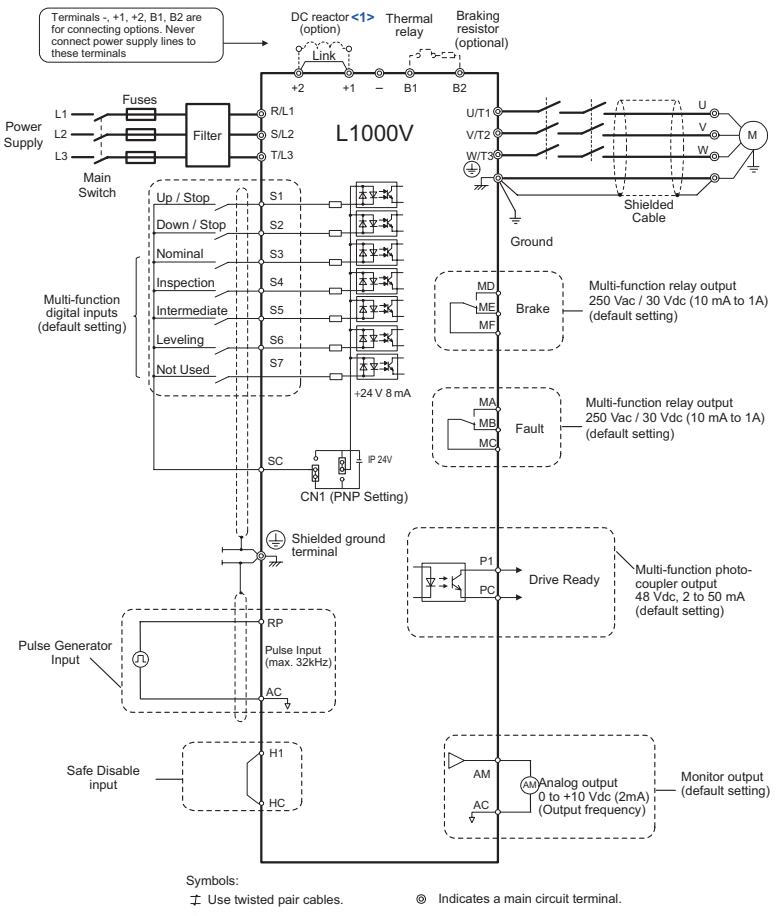
IP20 / NEMA Type 1

Model CIMR-LC□	Dimensions (mm)											Weight (kg)
	Fig.	W	H	D	W1	H1	H2	H3	H4	D1	d	
2V0018B	A	140	153	143	128	128	5	-	-	65	M4	2.6
2V0025F	B	140	254	140	122	248	6	13	6.2	55	M5	3.8
2V0033F		140	254	140	122	248	6	13	6.2	55	M5	3.8
2V0047F		180	290	163	160	284	8	15	6.2	75	M5	5.5
2V0060F		220	350	187	192	336	7	15	7.2	78	M6	9.2

Model CIMR-LC□	Dimensions (mm)											Weight (kg)
	Fig.	W	H	D	W1	H1	H2	H3	H4	D1	d	
4V0009B	A	140	153	143	128	118	5	-	-	65	M4	2.6
4V0015F	B	140	254	140	122	248	6	13	6	55	M5	3.8
4V0018F		140	254	140	122	248	6	13	6.2	55	M5	3.8
4V0024F		180	290	143	160	284	8	15	6	55	M5	5.2
4V0031F		180	290	163	160	284	8	15	6	75	M5	5.5

3 Electrical Installation

The figure below shows the main and control circuit wiring.



1 Remove the jumper when installing a DC reactor. This terminals are shorted at shipment.

Note: **1.** The drive should be implemented in the system in a way so that a drive fault causes the safety chain to open. Always use terminal MA-MB-MC for this purpose.

2. Even though no fault is present conditions where the drive can not start can occur, e.g. when the Digital Operator is left in the Programming Mode. Use the "Drive Ready" output (default set to terminals P1-PC) to interlock operation in such situations.

◆ Wiring Specification

■ Main Circuit

Use the fuses and line filters listed up in the table below when wiring the main circuit. Make sure not to exceed the given tightening torque values.

Model CIMR-LC□	EMC Filter	Reactor		Main Fuse [Ferraz]	Recom. Motor cable (mm²)	Main Circuit Terminal Sizes		
		IP00	IP20			R/L1,S/L2,T/L3, U/T1,V/T2,W/T3, - , +1, +2	B1, B2	⏚
2V0018B	under development			TRS60R	6	M4	M4	M4
2V0025F	under development			A6T70	10	M4	M4	M5
2V0033F				A6T100	16	M4	M4	M5
2V0047F	under development			A6T150	25	M6	M5	M6
2V0060F	under development			A6T200	35	M8	M5	M6
4V0009B	FS236391507	B0903084	B0903088	TRS30R	2.5	M4	M4	M4
4V0015F	FS236393007	B0903085	B0903089	A6T50	6	M4	M4	M5
4V0018F				A6T60	10	M4	M4	M5
4V0024F	FS236395007	B0903086	B0903090	A6T70	10	M5	M5	M5
4V0031F		B0903087	B0903091	A6T80	16	M5	M5	M6

Tightening Torque Values

Tighten the main circuit terminals using the torque values provided by the table below.

Terminal Size	M4	M5	M6	M8
Tightening Torque (N✍m)	1.2 to 1.5	2.0 to 2.5	4.0 to 5.0	9.0 to 11.0

■ Control Circuit

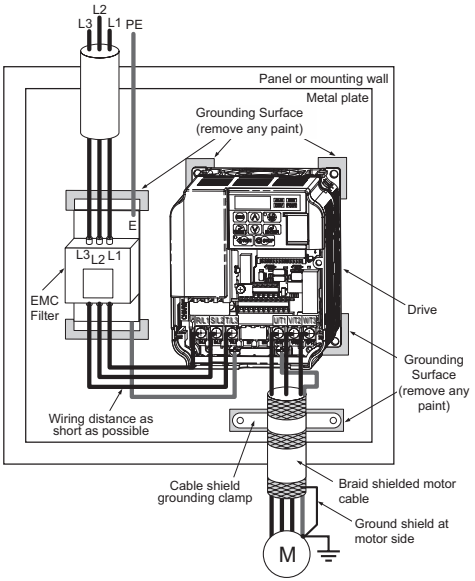
The control terminal board is equipped with screwless terminals. Always use wires within the specification listed below. For safe wiring it is recommended to use solid wires or flexible wires with ferrules. The stripping length respectively ferrule length should be 8 mm.

Wire Type	Wire size (mm²)
Solid	0.2 to 1.5
Flexible	0.2 to 1.0
Flexible with ferrule	0.25 to 0.5

◆ EMC Filter Installation

This drive has been tested in accordance with European standards EN61800-3. Install the drive and wire the main circuit as described below.

1. Install an appropriate EMC noise filter to the input side. See the table in Main Circuit on page 13 or refer to the Technical Manual for details.
2. Place the drive and EMC noise filter in the same enclosure.
3. Use braided shield cable for motor and control circuit wiring.
4. Remove any paint or dirt from ground connections for minimal ground impedance.
5. Install an AC or DC reactor for EN12015 compliance. See the table in Main Circuit on page 13 or contact your supplier for details.



◆ Main and Control Circuit Wiring

■ Wiring the Main Circuit Input

Note the following precautions when wiring the main circuit input.

- Use only fuses recommended in Main Circuit on page 13.

- If using a ground fault circuit breaker, make sure the breaker is designed for use with AC drives (e.g., type B according to ICE60755).
- If using an input switch, make sure that the switch does not operate more frequently than once every 30 minutes.
- Use a DC reactor or AC reactor on the input side of the drive:
  - To suppress harmonic current.
  - to improve the power factor on the power supply side.

■ Wiring the Main Circuit Output

Note the following precautions for the output circuit wiring:

- Do not connect any load other than a three-phase motor to the output side of the drive.
- Never connect a power source to the drive output.
- Never short or ground the output terminals.
- Do not use phase correction capacitors.
- Check the control sequence to make sure that the motor contactor is not turned ON or OFF during drive operation. Turning on the motor contactor while voltage is output causes an inrush current that is likely to trigger the drive's overcurrent protection.

■ Ground Connection

Take the following precautions when grounding the drive:

- Never share the ground wire with other devices such as welding machines, etc.
- Always use a ground wire that complies with electrical equipment technical standards. Keep ground wires as short as possible. Because leakage current is caused by the drive, potential on the ground terminal of the drive will become unstable if the distance between the ground electrode and the ground terminal is too long.
- Always make sure the ground impedance is conform to the requirements of local safety and installation regulations.
- Do not loop the ground wire when using more than one drive.

■ Control Circuit Wiring Precautions

Note the following precautions for wiring the control circuits:

- Separate control circuit wiring from main circuit wiring and other high-power lines.
- Separate wiring for control circuit terminals MA, MB, MC, and MD, ME, MF (contact output) from wiring to other control circuit terminals.
- Use twisted-pair or shielded twisted-pair cables for control circuits to prevent operating faults.
- Ground the cable shields with the maximum contact area of the shield and ground.
- Cable shields should be grounded on both cable ends.

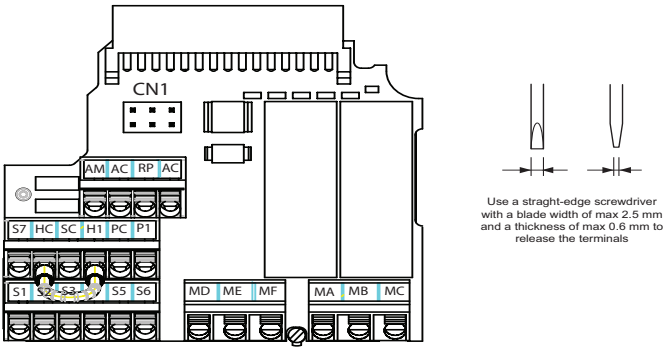
- Note that flexible wires with ferrules may fit tightly into the terminals. To disconnect them, grasp the wire end with a pair of pliers, release the terminal using a straight-edge screwdriver, turn the wire for about 45°, and pull it gently out of the terminal. For details, refer to the Technical Manual. Use this procedure for removing the wire link between HC and H1 when the Safe Disable function is utilized.

■ Main Circuit Terminals

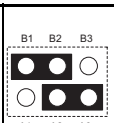
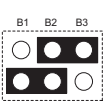
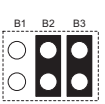
Terminal	Type	Function
R/L1, S/L2, T/L3	Main circuit power supply input	Connects line power to the drive. Drives with single-phase 200 V input power have no T/L3 terminal.
U/T1, V/T2, W/T3	Drive output	Connects to the motor.
B1, B2	Braking resistor	For connecting a braking resistor or the braking resistor unit option.
+1, +2	DC reactor connection	Linked at shipment. Remove the link to install a DC choke.
+1, –	DC power supply input	For connecting a DC power supply.

■ Control Circuit Terminals

The figure below shows the control circuit terminal arrangement. The drive is equipped with screwless terminals.



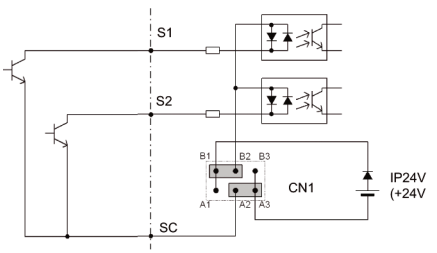
Jumper CN1 are located on the terminal board. Set them as described below.

CN1	Safe Disable Input/ S1 to S7 Sink/Source/External Supply Selection	 Sink	 Source	 External 24 Vdc Power Supply

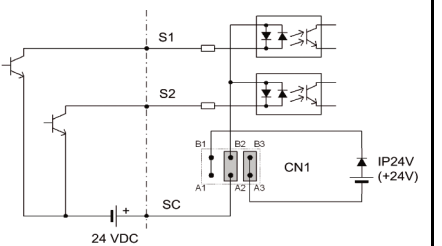
■ Sinking/Sourcing Mode (NPN/PNP Selection)

The digital input terminals S1 to S7can be switched over between sinking mode (0-V common, NPN) and sourcing mode (+24V common, PNP) by using the jumper CN1. An external power supply is also supported, providing more freedom in signal input methodes.

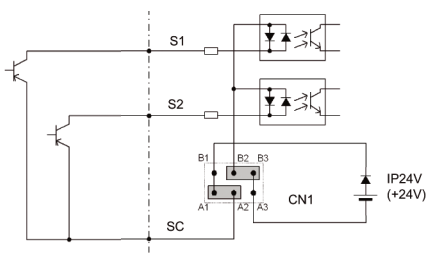
Internal Power Supply – Sinking Mode (NPN) (default)



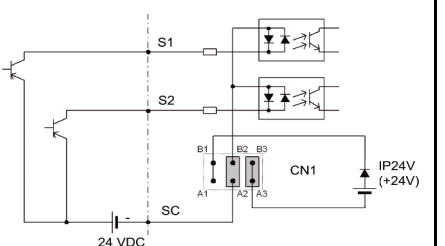
External Power Supply – Sinking Mode (NPN)



Internal Power Supply – Sourcing Mode (PNP)



External Power Supply – Sourcing Mode (PNP)



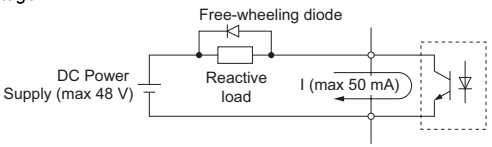
■ Control Circuit Terminal Functions

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Digital Inputs	S1	Up Command (Closed: Up, Open: Stop)	Photocoupler 24 Vdc, 8 mA Use the junper CN1 (see page 16 and 17) to select sinking or sourcing, and to select the power supply.
	S2	Down Command (Closed: Down, Open: Stop)	
	S3	Multi-function input 3 (Nominal Speed)	
	S4	Multi-function input 4 (Inspection Operation)	
	S5	Multi-function input 5 (Intermediate Speed 1)	
	S6	Multi-function input 6 (Leveling Speed)	
	S7	Multi-function input 7 (Not used)	
	SC	Multi-function input common	Sequence common
Safe Disable Inputs	HC	Safe Disable Input common	+24 V (max 10 mA allowed)
	H1	Safe Disable Input	If H1 is open: Drive output disabled (time from input open to drive output switch off is less than 1 ms) If H1 closed : Normal operation
Multi-Function Relay Output	MA	N.O. output (Fault)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA
	MB	N.C. output (Fault)	
	MC	Fault output common	
Multi-Function Relay Output	MD	N.O. (Brake)	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA
	ME	N.C. output (Brake)	
	MF	Digital output common	
Multi-Function PHC Output	P1	Photocoupler output (Drive Ready)	Digital photocoupler output 48 Vdc, 2 to 50 mA
	PC	Photocoupler output common	
Monitor Output	AM	Analog monitor output	0 to 10 Vdc (2 mA or less), Resolution: 1/1000 (10 bit)
	AC	Monitor common	0 V
Analog/ Pulse Inputs	RP	Pulse train input	Response frequency: 0.5 to 32 kHz, Duty: 30 to 70%, High: 3.5 to 13.2 V, Low: 0.0 to 0.8 V, input impedance: 3 kΩ)
	AC	Frequency reference common	0 V

NOTICE! *The wiring length to terminals HC and H1 should not exceed 30 m.*

NOTICE! *When connecting a reactive load such as a relay coil to a photo coupler output, attach a freewheeling diode to the load (relay coil) like shown below. Ensure the diode rating is greater than*

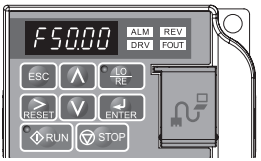
the circuit voltage.



4 Keypad Operation

◆ LED Operator and Keys

The LED operator is used to program the drive, to start/stop it, and to display fault information. The LEDs indicate the drive status.

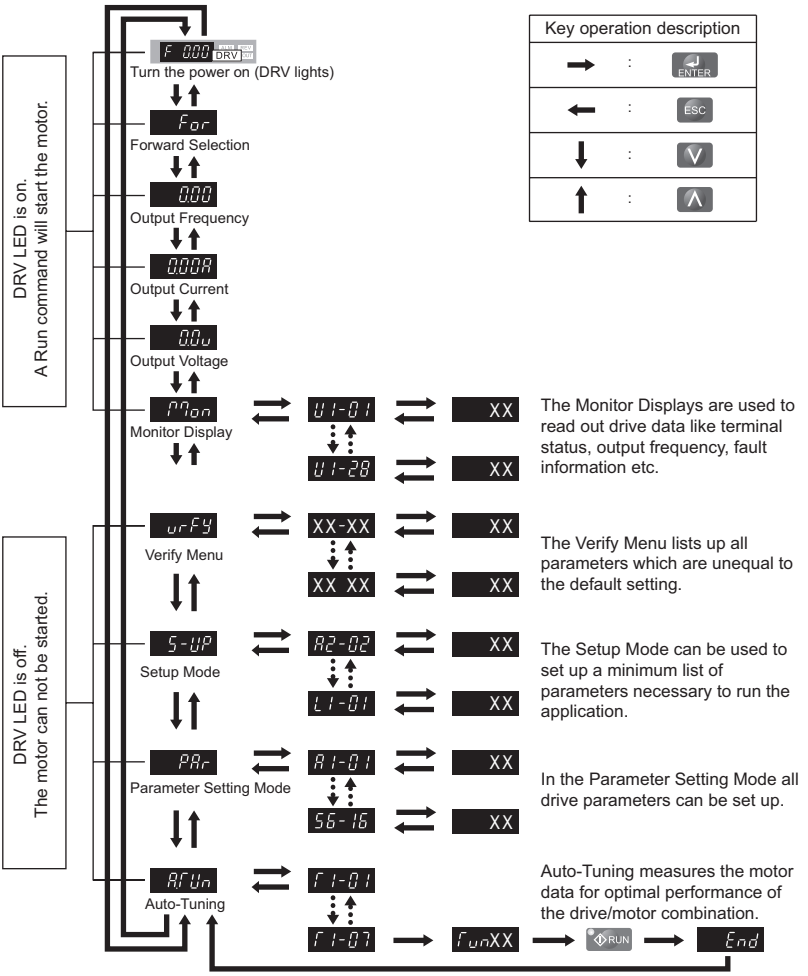


■ Keys and Functions

Display	Name	Function
F50.00	Data Display Area	Displays the frequency reference, parameter number, etc.
ESC	ESC Key	Returns to the previous menu.
RESET	RESET Key	Moves the cursor to the right. Resets a fault.
RUN	RUN Key	The Run LED is on, when the drive is operating the motor. flashes during deceleration to stop or when the frequency reference is 0. flashes quickly the drive is disabled by a DI, the drive was stopped using a fast stop DI or a run command was active during power up.
	Up Arrow Key	Scrolls up to select parameter numbers, setting values, etc.
	Down Arrow Key	Scrolls down to select parameter numbers, setting values, etc.
STOP	STOP Key	Stops the drive.
ENTER	ENTER Key	Selects modes, parameters and is used to store settings.
ALM	ALM LED Light	Flashing: The drive is in an alarm state. On: The drive is in a fault state and the output is stopped.
REV	REV LED Light	On: The motor rotation direction is reverse. Off: The motor rotation direction is forward.
DRV	DRV LED Light	On: The drive is ready to operate the motor. Off: The drive is in the Verify, Setup, Parameter Setting or Auto tuning mode.
FOUT	FOUT LED Light	On: The output frequency is displayed on the data screen. Off: Anything else than the output frequency is displayed on the data screen.

◆ Menu Structure and Modes

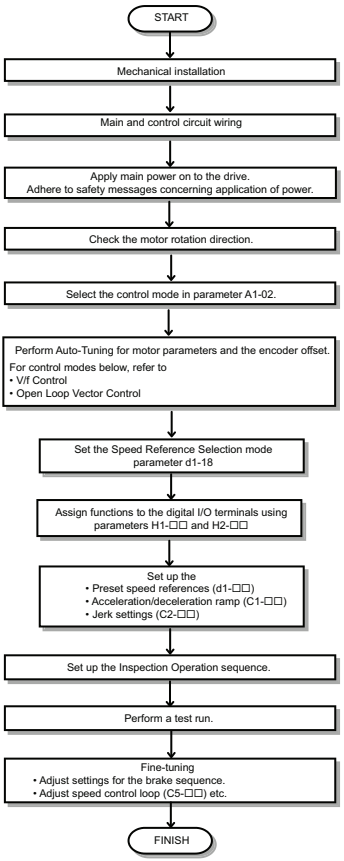
The following illustration explains the operator keypad menu structure.



5 Start Up

◆ Drive Setup Procedure

The illustration below shows the basic setup procedure. The steps from switching on power are explained more detailed on the following pages.



◆ Power On

Before turning on the power supply,

- Make sure all wires are connected properly.
- Make sure no screws, loose wire ends or tools are left in the drive.
- After turning the power on, the drive mode display should appear and no fault or alarm should be displayed.

◆ Control Mode Selection (A1-02)

There are two control modes available. Select the control mode that best suits the application the drive will control.

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

◆ Motor Rotation Direction Setup

Depending on the elevator configuration it might be necessary to change the motor direction in order to have the elevator traveling up when the Up command is given to the drive. Do the following to check the motor rotation direction.

- The drive puts out voltage in U-V-W phase sequence when an Up command is input. Check the motor rotation with this phase sequence (for most motors clockwise seen from the shaft side).
- If the motor drives the elevator in up direction with a U-V-W sequence, make sure parameter b1-14 is set to 0 (default).
- If the motor drives the elevator in down direction with a U-V-W sequence, set parameter b1-14 to 1.

◆ Motor Data

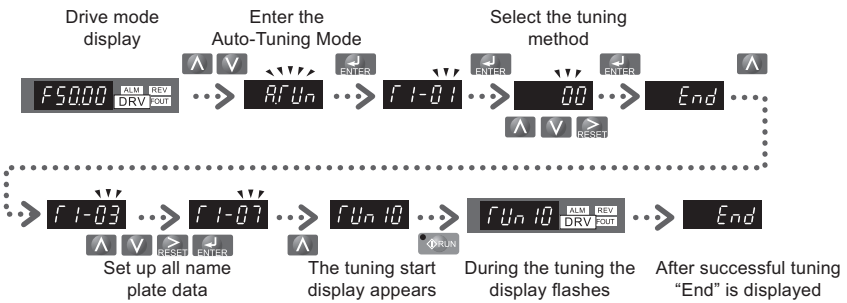
■ Auto-Tuning Types

Auto-Tuning automatically programs the drive's motor and motor control related parameters. Select between Auto-Tuning methods listed below.

Type	Setting	Requirements and Benefits	Control Mode (A1-02)	
			V/f (0)	OLV (2)
Rotational Auto-Tuning	T1-01 = 0	• Rotational Auto-Tuning gives the most accurate results, and is therefore highly recommended if possible.	No	Yes
Stationary Auto-Tuning for Line-to-Line Resistance	T1-01 = 2	• Used for V/f Control or in vector control modes when the drive was set up properly before and the motor cable has changed.	Yes	Yes

■ Tuning Mode Selection and Data Input

For Auto-Tuning enter the Auto-Tuning menu and perform the steps shown in the figure below. The number of name plate data to be entered depends on the selected type of Auto-Tuning. This example shows Rotational Auto-Tuning.



If Auto-Tuning can not be performed for any reason (no-load operation impossible, etc.), then set the maximum frequency and voltage in the E1-□□ parameters and enter the motor data manually into the E2-□□.

■ Precautions

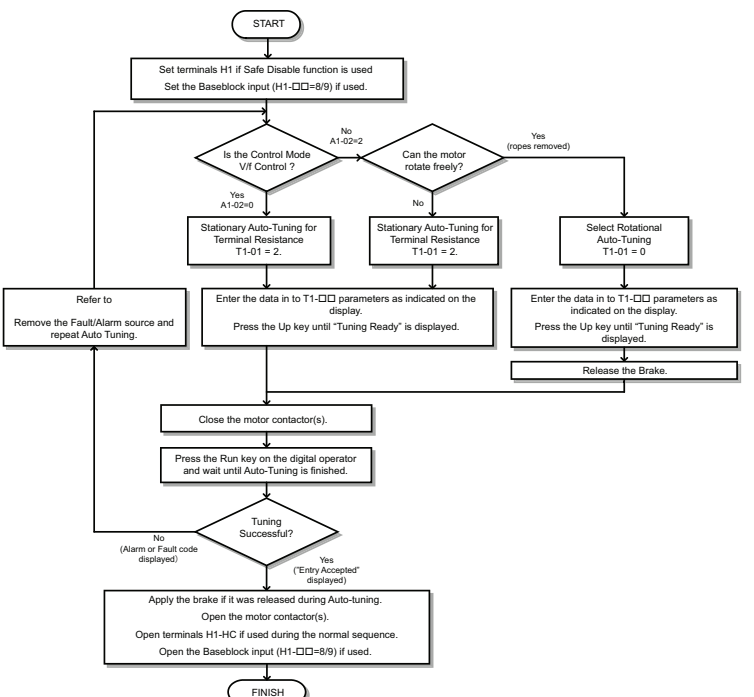
- Always try to perform Rotational Auto-Tuning as it gives more accurate results than Non-Rotating Auto-Tuning. Perform Non-Rotating Auto-Tuning if the load can not be disconnected (e.g. ropes can not be removed).
- Make sure that the mechanical brake is closed for all Auto-Tuning methods except for Rotational Auto-Tuning.
- Motor contactors must be closed during the Auto-Tuning process.
- H1 and HC signals must be ON when performing Auto-Tuning.
- Confirm that the motor is mechanically fixed.

- Do not touch the motor until the Auto-Tuning process is complete. Voltage is applied to the motor during the tuning process, even though the motor may not be rotating.
- To cancel Auto-Tuning, press the STOP key on the digital operator.
- During Auto-Tuning the motor is started and stopped repeatedly and may also rotate. When the tuning is finished, "END" will appear on the operator panel. Do not touch the motor until this display is shown and the motor has completely stopped.

⚠ CAUTION

Never touch the motor until the Auto-Tuning is finished. Even thought the motor may not be rotating when Auto-Tuning, voltage is still applied to the motor during the tuning process.

■ Auto-Tuning Procedure



◆ Up and Down Commands and Speed Reference Selection

■ Speed Reference Selection

The speed reference selection is fixed to speed parameters d1- □□ and uses digital inputs to switch over between different reference values.

■ Up / Down Command Source Selection

The input for the Up and Down signal can be selcted in parameter b1-02.

b1-02	Up/Down source	Run command input
0	Operator keypad	RUN and STOP keys on the operator
1 (default)	Digital inputs	Terminal S1: Run in Up direction Terminal S2: Run in Down direction

■ Travel Start and Stop

Travel Start

To start the elevator in up or down direction, the following conditions must be fulfilled:

- A speed reference greater than zero must be selected.
- The Safe Disable signals at terminal H1 must be closed.
- An Up or Down Signal must be set at the source specified in b1-02.

Travel Stop

The drive stops under the following conditions:

- The Up or Down command is cleared.
- d1-18 is set to 1 or 2 and the Up/Down or Leveling Speed signal (H1-□□ = 53) is cleared.
- A fault occurs. The stopping method depends on the fault occurred and certain parameter settings.
- The Safe Disable input is opened or a Base Block signal is input. In this case the brake is closed immediately and the drive output shuts off.

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

Use parameter d1-18 to determine how different travel speeds are selected by digital inputs.

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

d1-18	Speed Selection
2	Separate speed inputs, Speed references are set in d1-19 to d1-24 and d1-26, Leveling speed has priority

■ Multi-Speed Inputs 1, 2 (d1-18 = 0)

Speed Selection

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

Terminal	Parameter Number	Set Value	Details
S4	H1-03	3	Multi-Speed Reference 1
S5	H1-04	4	Multi-Speed Reference 2
S6	H1-05	5	Multi-Speed Reference 3

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

Digital Inputs			Selected Speed
Multi-Speed Reference 1	Multi-Speed Reference 2	Multi-Speed Reference 3	d1-18 = 0
0	0	0	Speed reference 1 d1-01
1	0	0	Speed reference 2 d1-02
0	1	0	Speed reference 3 d1-03
1	1	0	Speed reference 4 d1-04
0	0	1	Speed reference 5 d1-05
1	0	1	Speed reference 6 d1-06
0	1	1	Speed reference 7 d1-07
1	1	1	Speed reference 8 d1-08

0 = Off, 1 = On

Eight separate speed settings (defined in parameters d1-01 to d1-08) can be selected by three digital input signals.

■ Separate Speed Inputs (d1-18 = 1 or 2)

With this setting, six different speeds (defined in the parameters d1-19 to d1-24 and d1-26) can be set and selected using four digital inputs.

Speed Selection

When d1-18 = 1 or 2, Multi-function digital inputs are preset as shown below.

Terminal	Parameter Number	Set Value	Details
S3	H1-03	50	Nominal speed (d1-19)
S4	H1-04	51	Intermediate speed 1 (d1-20)
S5	H1-05	52	Releveling speed (d1-23)
S6	H1-06	53	Leveling speed (d1-26)

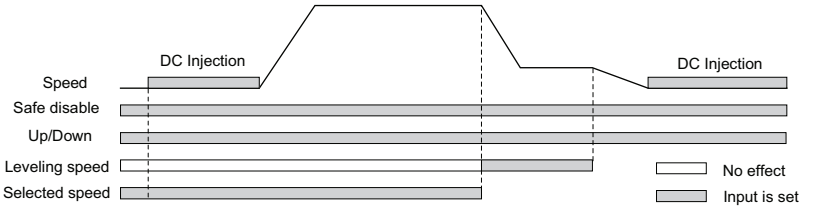
Depending on the assignment of speed selection functions to the digital input (H1-□□ settings), the different speed settings can be activated like shown in the table below.

Selected Speed	Leveling and Nominal Speed assigned (H1-□□=50 and H1-□□=53)				Leveling speed not assigned (H1-□□ ≠ 53)			Nominal Speed not assigned (H1-□□ ≠ 50)		
	50	51	52	53	50	51	52	51	52	53
Nominal Speed (d1-19)	1	0	0	A	1	0	0	0	0	0
Intermediate Speed 1 (d1-20)	0	1	0	A	0	1	0	1	0	0
Intermediate Speed 2 (d1-21)	1	1	1	A	1	1	1	N/A	N/A	N/A
Intermediate Speed 3 (d1-22)	0	1	1	A	0	1	1	1	1	0
Revelling Speed (d1-23)	0	0	1	A	0	0	1	0	1	0
Leveling Speed (d1-26)	0	0	0	1	0	0	0	X	X	1
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 when d1-18=1, 0 when d1-18=2
B: No influence
N/A = Not available

Higher Speed has Priority and the Leveling Speed Input is Assigned (d1-18 = 1 and H1-☐☐ = 53) (Default)

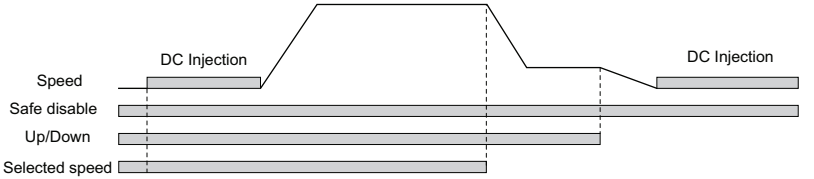
The higher speed has priority over the leveling speed, meaning the leveling signal is disregarded as long as any other speed selection input is active. The drive decelerates to the leveling speed (d1-26) when the selected speed reference signal is removed.



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

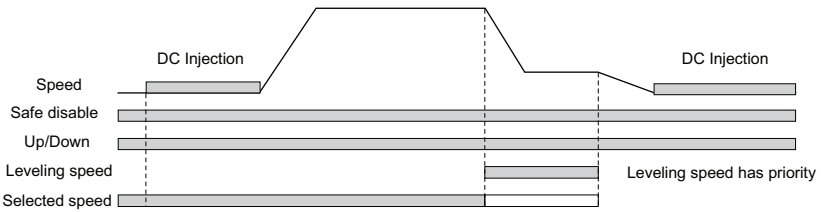
The drive decelerates to the leveling speed (d1-26) when the selected speed reference signal is removed.

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



Leveling Speed has Priority and the Leveling Speed Input is Assigned (d1-18 = 2, H1-☐☐ = 53)

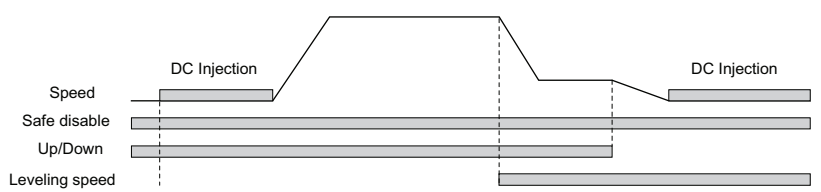
The leveling signal has priority over other speed references. The drive decelerates to the leveling speed (d1-26) when the leveling speed selection input is activated.



Leveling Speed Priority is Selected and the Nominal Speed Input is Not Assigned (d1-18 = 2, H1-☐☐ ≠ 50)

The drive runs at nominal speed (d1-19) when no speed selection input is set. When the leveling speed signal is set, the drive decelerates to the leveling speed. The leveling speed signal has priority over all other speed signals.

CAUTION! *This sequence can be risky if the speed selection doesn't work for some reason (broken wire, etc.)*



◆ I/O Signal Setup

Note: The default setting functions can be seen in the connection diagram on page page 12.

■ Multi-Function Digital Inputs

Assign functions to each digital input terminal using the H1-☐☐ parameters.

■ Multi-Function Digital Outputs

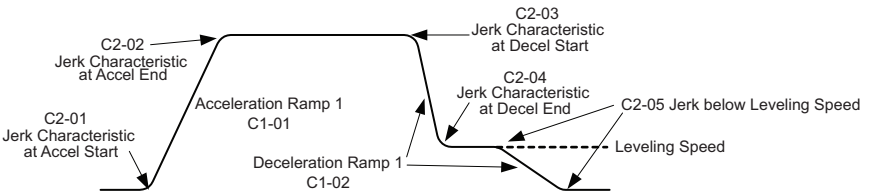
Determine the function for each digital output terminal with the H2-☐☐ parameters. The setting value of these parameters consists of three digits, where the middle and right digit determines the function, and the left digit sets the output characteristics. The output characteristics can be either “Output as selected” (0) or “Inverse output” (1).

■ Multi-Function Analog Output

Use the H4-☐☐ parameters to set up the output value of the analog monitor outputs and to adjust the output signal levels.

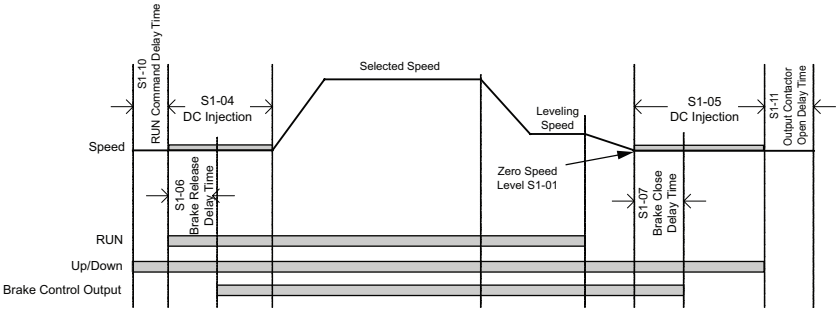
◆ Acceleration Ramp, Deceleration Ramp, and Jerk Settings

The acceleration and deceleration ramps are set in the parameters C1-01 and C1-02, while the jerk settings are set in the C2-☐☐ parameters as shown in the figure below.



◆ Brake Sequence

The figure below shows the brake sequence and parameters that can be used for adjustment.



◆ Inspection Operation

■ Start in Inspection Mode

Inspection operation is performed when an Up or Down signal is input while one of the conditions below 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 or 2 and a digital input programmed for Inspection Operation Speed (H1-□□ = 54) is enabled.

The start is performed using the same acceleration characteristics, brake sequence and contactor sequence like in normal operation. The carrier frequency is set to 2 kHz during Inspection Operation.

■ Stop in Inspection Mode

To stop the drive in Inspection Mode either remove the Up or Down signal or unselect the Inspection Operation Speed Reference (conditions listed for Start in Inspection Mode must become untrue).

The stop can be performed using a deceleration ramp, depending on the setting of parameter C1-15 (Inspection Operation Deceleration Ramp).

- If C1-15 = 0, the drive immediately closes the brake, shuts off the drive output and opens the motor contactor.
- If C1-15 > 0, the drive decelerates to stop, closes the brake, shuts the output off and opens the motor contactor.

6 Fine Adjustments

This section provides tips for improving the ride quality after the basic setup is complete and lists solutions to potential problems. Refer to the Technical Manual for detailed description.

◆ Potential Problems and Solutions

Problem	Control Mode and Possible Cause		Corrective Action
Rollback at start	V/f and OLV	Not enough torque when the brake is released	• Increase the DC Injection Braking current at start using parameter S1-02. • Set the time for DC Injection Braking at start (S1-04) to as short a value as possible, but make sure that brake releases completely before the motor starts to turn. • Increase the minimum (E1-10) and medium (E1-08) V/f pattern voltages. Make sure, that the starting and leveling current does not rise too high.
	All	Motor torque is not fully established when the brake is released	Lengthen the brake release delay time (S1-06) and the time for DC Injection Braking / Position Lock at start (S1-04).
		Motor contactors close too late	Make sure, that the contactors are closed before the Up/Down command is set.
Shock at start	All	Motor starts turning when the brake is not completely released or runs against the brake	Increase the DC Injection Braking time at start using parameter S1-04.
		Acceleration rate is changing too quickly	Decrease the Jerk at start. Increase C2-01 if set in s.
		Rollback occurs during brake opening.	See above under “Rollback at start”.
Motor or machine vibrates in the low or medium speed range	V/f	Output voltage is too high	Reduce the V/f pattern settings (E1-08, E1-10).
	OLV	Torque compensation is responding too quickly	Increase the torque compensation delay time (C4-02).
		Output voltage is too high	Reduce the V/f pattern settings (E1-08, E1-10).
		The value for the motor slip is set incorrectly	Check the motor slip value in parameter E2-02. Increase or decrease it in steps of 0.2 Hz.
Motor or machine vibrates at high speed or top speed	OLV	Torque compensation is responding too quickly	Increase the torque compensation delay time (C4-02).

Problem	Control Mode and Possible Cause		Corrective Action
Car jerks suddenly due to overshoot as the motor reaches top speed	OLV	Too fast torque compensation or slip compensation	Increase the torque compensation delay time (C4-02). Increase the slip compensation delay time (C3-02).
	All	The acceleration rate changes too quickly	Decrease the jerk at the end of acceleration. Increase C2-02 if set in s.
Motor stops short (undershoot) when the leveling speed is reached	V/f and OLV	Not enough torque at low speed	Increase the minimum and mid voltage levels for the V/f pattern voltage (E1-10 and E1-08 respectively). Make sure that the starting and leveling current does not rise too high.
	OLV	Motor data incorrect	Adjust the motor data (E2-□□), especially the motor slip (E2-02) and no-load current values (E2-03), or perform Auto-Tuning.
		Too much slip compensation	
	All	Deceleration rate changes too quickly.	Decrease the Jerk at the end of deceleration. Increase C2-04 if set in s.
Shock at stop	All	Brake is applied too early, causing the motor to run against the brake	Increase the delay time for the brake (S1-07). If necessary, also increase the DC Injection Braking time at stop S1-05.
		Motor contactor is released though the brake has not yet fully closed	Check the motor contactor sequence.
High frequency motor noise	All	The carrier frequency is too low	Increase the carrier frequency in parameter C6-03. If the carrier frequency must be set higher than the default setting, a current derating must be considered
Vibrations which increase with the speed	All	Mechanical problems	Check bearings and gearbox.
		Rotational parts (motor armature, handwheel, brake disk/drum) are not properly balanced	Balance the rotating parts.

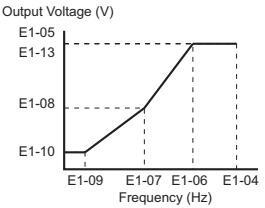
7 Parameter Table

This table below lists the most important parameters with default settings appearing in bold type. Refer to the Technical Manual for a complete list of parameters.

No.	Name	Description
Initialization Parameters		
A1-00	Language Selection	**0: English** 1: Japanese 2: German 3: French 4: Italian 5: Spanish 6: Portuguese 7: Chinese
A1-01	Access Level Selection	0: View and set parameters A1-01 and A1-04 (U□-□□ parameters can also be viewed) 1: User Parameters (access to a set of parameters selected by the user, A2-01 to A2-32) **2: Advanced Access (access to view and set all parameters)**
A1-02	Control Method Selection	**0: V/f Control** 2: Open Loop Vector Control
A1-03	Initialize Parameters	**0: No initialization** 1110: User Initialize (parameter values must be stored using parameter o2-03) 2220: 2-wire initialization 5550: oPE04 error reset
Operation Mode Selection		
b1-02	Run Command Selection1	0: Digital operator **1: Digital input terminals**
b1-14	Output Phase Order Selection	Output phase order with an Up command. **0: U-V-W** 1: U-W-V

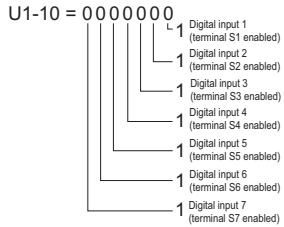
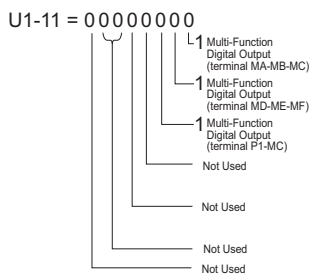
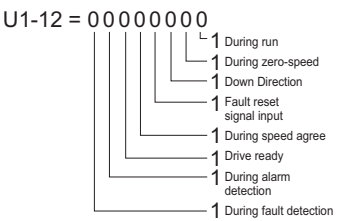
No.	Name	Description
Acceleration/ Deceleration Settings		
C1-□□	Acceleration/Deceleration Ramps	These parameters set the acceleration and deceleration ramps.
C2-□□	Jerk Settings	These parameters adjust the Jerk settings.
Slip Compensation		
C3-01	Slip Compensation Gain	Increase C3-01 if motor slip requires more compensation (motor speed is lower than speed reference) Decrease if slip is overcompensated
C3-02	Slip Compensation Primary Delay Time	Decrease if the drive does not provide motor slip compensation quickly enough Increase if motor oscillation occurs
Speed Control Loop (ASR)		
C5-01	Speed Control Loop Gain 1	Set the speed control loop responsiveness at high speed.Only if H6-01 = 3
C5-02	Speed Control Loop I Time 1	
C5-03	Speed Control Loop Gain 2	Set the speed control loop responsiveness at low speed during start.Only if H6-01 = 3
C5-04	Speed Control Loop I Time 2	
C5-07	Speed Loop Switching Speed	Sets the switching speed for speed loop settings Only if H6-01 = 3.
C5-13	Speed Control Loop Gain 3	Set the speed control loop responsiveness at low speed during stop.Only if H6-01 = 3
C5-14	Speed Control Loop I Time 3	

No.	Name	Description
Carrier Frequency		
C6-02	Carrier Frequency	Sets the carrier frequency. Settings above the default requires output current derating.
Speed Reference		
d1-01 to d1-08	Speed Reference 1 to 8	Speed reference values for multi-speed inputs.
d1-18	Speed Reference Selection	0: Multi-speed references 1 to 8 **1: Higher speed reference has priority** 2: Leveling speed reference has priority
d1-19	Nominal Speed	Speed reference values for separate speed selection inputs.
d1-20	Intermediate Speed 1	
d1-21	Intermediate Speed 2	
d1-22	Intermediate Speed 3	
d1-23	Relevel. Speed	
d1-24	Inspection Operation Speed	
d1-26	Leveling Speed	
d1-28	Leveling Speed Detection Level	Used when d1-18 = 0. If the speed reference selected is lower than d1-28, then the drive uses the leveling speed as the speed reference.
d1-29	Inspection Speed Detection Level	Used when d1-18 = 0. If the speed reference selected is between d1-28 and d1-29, then the speed reference is regarded as the Inspection Speed, and the inspection operation sequence is activated.

No.	Name	Description
V/f Pattern for Motor 1		
E1-01	Input Voltage Setting	This parameter must be set to the power supply voltage. WARNING! Drive input voltage (not motor voltage) must be set in E1-01 for the protective features of the drive to function properly.
E1-04	Maximum Output Frequency	V/f pattern settings  For linear V/f characteristics, set the same values to E1-07 and E1-09. With these settings, the drive will disregard the value set to E1-08. Parameters must be set so that: E1-09 ≤ E1-07 < E1-06 ≤ E1-04
E1-05	Maximum Voltage	
E1-06	Base Frequency	
E1-07	Mid Output Frequency	
E1-08	Mid Output Frequency Voltage	
E1-09	Minimum Output Frequency	
E1-10	Minimum Output Frequency Voltage	
E1-13	Base Voltage	
Induction Motor Parameters		
E2-01	Rated Current	Motor data for Induction Motors.
E2-02	Rated Slip	
E2-03	No-Load Current	
E2-04	Number of Motor Poles	
E2-05	Line-to-Line Resistance	
E2-06	Leakage Inductance	

No.	Name	Description
Multi-Function Digital Inputs / Outputs		
H1-03 to H1-07	Multi-Function Digital Input Terminal S3 to S7 Function Selection	Selects the function of terminals S3 to S7.
H2-01 and H2-03	Terminal MA-MD Function Selection	Sets the function for the relay outputs MA-MB-MC, MD-ME-MF
H2-02	Terminal P1-C1, Function Sel.	Sets the function for the photocoupler output P1-C1.
Encoder Feedback Settings		
H6-01	PG Feedback	PG feedback function selection
H6-09	Encoder Resolution	Sets the encoder pulse number.
Major functions are listed at the end of the table.		
Motor Protection		
L1-01	Motor Overload Protection Selection	0: Disabled **1: General purpose motor (self-cooled)** 2: Drive dedicated motor with a speed range of 1:10 3: Vector motor with a speed range of 1:100
Brake Sequence		
S1-01	Zero Speed Level	Sets the speed to close the brake at stop.
S1-02	DC Injection Current at Start	Adjusts the torque to hold the motor at zero speed during start and stop. Increase if roll-back occurs.
S1-03	DC Injection Current at Stop	
S1-04	DC Inj./ Zero Speed Time at Start	Sets the time between the Up/ Down command and acceleration start.
S1-05	DC Inj./ Zero Speed Time at Stop	Sets the time between reaching the Zero Speed Level and when the drive output shuts off.
S1-06	Brake Release Delay Time	Sets the wait time between the Up/ Down command and the brake release command.
S1-07	Brake Close Delay Time	Sets the wait time between reaching Zero Speed and the brake close command.
Slip Compensation		
S2-02/ S2-03	Slip Compensation Gain Motoring / Regen. Mode	Set the slip compensation gain for motoring operation (S2-02) and during regenerative operation (S2-03).
Induction Motor Auto-Tuning		
T1-01	Auto-Tuning Mode Selection	**0: Rotational Auto-Tuning** 2: Stationary Auto-Tuning for Line-to-Line Resistance
T1-02	Motor Rated Power	Sets the motor rated power as specified on the motor nameplate.
T1-03	Motor Rated Voltage	Sets the motor rated voltage as specified on the motor nameplate.
T1-04	Motor Rated Current	Sets the motor rated current as specified on the motor nameplate.
T1-05	Motor Base Frequency	Sets the rated frequency of the motor as specified on the motor nameplate.
T1-06	Number of Motor Poles	Sets the number of motor poles as specified on the motor nameplate.
T1-07	Motor Base Speed	Sets the rated speed of the motor as specified on the motor nameplate.

Monitor	Description
U1-01	Speed Reference (Hz)
U1-02	Output Speed (Hz)
U1-03	Output Current (A)
U1-05	Motor Speed (Hz)

Monitor	Description
U1-06	Output Voltage Reference (Vac)
U1-07	DC Bus Voltage (Vdc)
U1-08	Output Power (kW)
U1-09	Torque Reference (% of motor rated torque)
U1-10	Displays the input terminal status. 
U1-11	Displays the output terminal status. 
U1-12	Verifies the drive operation status. 
U1-16	Output Speed after Soft Starter

Monitor	Description
U1-18	oPE Fault Parameter
Fault Trace	
U2-01	Current Fault
U2-02	Previous Fault
U2-03	Speed Reference at Previous Fault
U2-04	Output Speed at Previous Fault
U2-05	Output Current at Previous Fault
U2-06	Motor Speed at Previous Fault
U2-07	Output Voltage at Previous Fault
U2-08	DC Bus Voltage at Previous Fault
U2-09	Output Power at Previous Fault
U2-10	Torque Reference at Previous Fault
U2-11	Input Terminal Status at Previous Fault
U2-12	Output Terminal Status at Previous Fault
U2-13	Drive Operation Status at Previous Fault
U2-14	Cumulative Operation Time at Previous Fault
U2-15	Soft Starter Output at Previous Fault
U2-16	Motor q-Axis Current at Previous Fault
U2-17	Motor d-Axis Current at Previous Fault
Fault History	
U3-01 to U3-04	First to 4th Most Recent Fault
U3-05 to U3-10	5th to 10th Most Recent Fault
U3-11 to U3-14	Cumulative Operation Time at 1st to 4th Most Recent Fault
U3-15 to U3-20	Cumulative Operation Time at 5th to 10th Most Recent Fault
* The following faults are not recorded in the error log: CPF00, 01, 02, 03, Uv1, and Uv2.	
Fault Trace	
U4-01	Cumulative Operation time

DI/DO Sel.	Description
Digital Input Function Selections	
3	Multi-step speed reference 1
4	Multi-step speed reference 2
5	Multi-step speed reference 3
F	Through mode (Set when a terminal is not used)
14	Fault reset (Reset when turned ON)
20 to 2F	External fault; Input mode: N.O. contact / N.C. contact Detection mode: Normal/during operation
50	Nominal speed (d1-19)
51	Intermediate speed (d1-20)
52	Releveling speed (d1-23)
53	Leveling speed (d1-26)
54	Inspection operation
56	Motor contactor feedback
79	Brake feedback
Digital Output Function Selections	
0	During Run (ON: Run command is ON or voltage is being output)
6	Drive Ready
E	Fault
F	Not used (through mode)
50	Brake Control
51	Output Contactor Control

8 Troubleshooting

◆ General Fault and Alarms

Faults and alarms indicate problems in the drive or in the machine.

The drive indicates that an alarm has occurred with a code on the data display screen and a flashing ALM LED. The drive output may be shut off depending on the alarm.

The drive indicates that a fault has occurred with a code on the data display screen and a lit ALM LED. The drive output is always switched off immediately and the motor coasts to stop.

To remove an alarm or reset a fault, first figure out what cause the problem, take corrective action, and finally reset the drive by pushing the RESET key on the operator or by cycling the power supply.

The table below lists the most important alarms and faults only. Please refer to the Technical Manual for a complete list.

LED Display	AL	FLT	Possible Cause	Corrective Action
Baseblock bb	❍		The software baseblock function is assigned to one of the digital inputs and the output is off. The drive does not accept Up/Down commands during this time.	• Check the functions assigned to the digital input terminals. • Check the upper controller sequence.
Control Fault CF		❍	The torque limit was reached during deceleration for longer than 3 s and one of the following was true: • the load inertia is too big. • the torque limit is too low. • the motor parameters are set incorrectly.	• Check the load. • Set the torque limit to the most appropriate setting (L7-01 through L7-04). • Check the motor parameters settings.
Control Circuit Fault CPF02 to CPF24		❍	There is a problem in the drive's control circuit.	• Cycle the drive power supply. • Initialize the drive. • Replace the drive if the fault occurs again.
Cannot Reset CrST	❍		Fault reset was input when the Up or Down command was active.	• Turn off the Up and Down command and reset the drive. • Wait until the fault restart time has expired

LED Display	AL	FLT	Possible Cause	Corrective Action
Speed Deviation dEv		❍	F1-04 is set to 0, 1, or 2 and a speed deviation higher than the value in F1-10 occurred longer than the time set in F1-11.	• Reduce the load • Decrease the acceleration and deceleration rate. • Check the mechanical system (lubrication, etc.) • Check the setting of F1-10 and F1-11 • Check the brake sequence to make sure the brake is fully open when acceleration starts.
	❍		F1-04 is set to 3 and a speed deviation higher than the value in F1-10 occurred longer than the time set in F1-11.	
Rotation Direction Fault dv3		❍	A speed deviation higher than 30% occurred while the torque reference and acceleration direction are opposite.	• Check the encoder wiring • Verify the encoder rotation direction. Perform an offset tuning. • Reduce the load. • Check the brake sequence.
Rotation Direction Fault dv4		❍	Motor speed and speed reference directions are opposite and a deviation larger than set in F1-19 occurs.	• Verify the encoder direction. • Perform an encoder tuning. • Check the brake sequence.
Over acceleration dv6		❍	The car acceleration is higher than the value set in parameter S6-10 for longer than the time set in S6-17.	• Adjust acceleration and deceleration rates. • Check the value set to S6-10 is not too small.
Up/Down Command Error EF	❍		The Up and Down command were input simultaneously for longer than 500 ms.	Check the sequence and make sure that the Up and Down command are not enabled at the same time.
External Faults EF03 to EF07	❍	❍	• An external fault was triggered by an external device via one of the digital inputs (S3 to S7). • The digital inputs are set incorrectly.	• Find out why the device tripped the EF. Remove the cause and reset the fault. • Check the functions assigned to the digital inputs.
Speed Reference Missing FrL		❍	Parameter d1-18 is set to 1, leveling speed detection is not assigned to a digital input (H1-□□ ≠ 53) and no speed was selected while an Up or Down command was entered.	• Check the speed selection inputs. • Check the sequence. Make sure the speed is selected before the Up or Down command is input.
Ground Fault GF		❍	• Ground leakage current has exceeded 50% of the drives rated output current. • Cable or motor insulation is broken. • Excessive stray capacitance at drive output.	• Check the output wiring and the motor for short circuits or broken insulation. Replace any broken parts. • Reduce the carrier frequency.
Safe Disable Hbb	❍		The Safe Disable input is open. The drive output is safely disabled and the motor can not be started.	• Check why the upper controller's safety device disabled the drive. Remove the cause and restart. • Check the wiring.Terminals HC, H1 must be linked if the Safe Disable function is not utilized.

LED Display	AL	FLT	Possible Cause	Corrective Action
Output Phase Loss LF		❍	• Output cable is disconnected or the motor winding is damaged. • Drive output wires are loose. • Motor is too small (less than 5% of drive current).	• Check the power supply. • Make sure that all cables are properly connected to the correct terminals.
Overcurrent oC		❍	• Short-circuit or ground fault on the drive output side. • The load is too heavy. • The acceleration or deceleration ramps are too short. • Incorrect motor data or V/f pattern settings. • The motor contactor was switched while the drive was running.	• Check the output wiring and the motor for short circuits or broken insulation. Replace the broken parts. • Check the machine for damages (gears, etc.) and repair any broken parts. • Make sure the brake fully opens. • Check accel/decel settings in C1-☐☐ and C2-☐☐. • Check V/f pattern settings in E1-☐☐. • Check the output contactor sequence.
Heatsink Overheat oH or oH1	❍	❍	• Surrounding temperature is too high. • The cooling fan has stopped. • The heatsink is dirty. • The airflow to the heatsink is restricted.	• Check the surrounding temperature and install cooling devices if necessary. • Check the drive cooling fan. • Clean the heatsink. • Check the airflow around the heatsink.
Motor Overload oL1		❍	• The motor load is too heavy. • Acceleration and deceleration cycle times are too short. • Value set for the motor rated current is incorrect.	• Check the elevator mechanics. • Check the sequence. • Check the rated current setting.
Drive Overload oL2		❍	• The load is too heavy. • The drive is too small. • Too much torque at low speed.	• Check the load. • Make sure that the drive is big enough to handle the load. • The overload capability is reduced at low speeds. Reduce the load or increase the drive size.
DC Overvoltage ov	❍	❍	• DC bus voltage rose too high. • Braking transistor is too small • Braking chopper or resistor is broken. • Unstable motor control in OLV. • Input voltage is too high.	• Make sure the braking resistor and braking chopper are working correctly. • Check motor parameter settings and adjust torque and slip compensation as needed. • Make sure that the power supply voltage meets the drives specifications.
Over Speed oS		❍	• F1-03 is set to 0, 1, or 2 and the motor speed exceeded the value of F1-08 for longer than the time set in F1-09)	• Check and adjust the speed control loop settings (C5-☐☐) • If an external speed reference signal (analog, etc.) is used make sure the signal is ok. • Check the settings of F1-08 and F1-09.
	❍		• F1-03 is set to 3 and the motor speed exceeded the value of F1-08 for longer than the time set in F1-09)	

LED Display	AL	FLT	Possible Cause	Corrective Action
Input Phase Loss PF		❍	• Input voltage drop or phase imbalance. • One of the intput phases is lost. • Drive input wire are loose.	• Check the motor wiring. • Make sure all terminal screws in the drive and motor are properly tightened. • Check the motor and drive capacity.
Encoder Disconnected PGo		❍	• F1-02 is set to 0, 1, or 2 and no signal is received from the encoder for longer than the time set in F1-14.	• Check the encoder wiring and fix it if needed. • Check the encoder power supply. • Check the command sequence. Check if the brake fully opens before acceleration starts.
	❍		• F1-02 is set to 3 and no signal is received from the encoder for longer than the time set in F1-14.	
Braking Transistor Fault rr		❍	• The internal braking transistor is broken or the braking resistor is connected wrong.	• Make sure the braking resistor is connected correctly. • Cycle the power supply. • Replace the drive if the fault reoccurs.
Motor Contactor Response Error SE1		❍	• The motor contactor response was not input within the time set in S1-10.	• Make sure the motor contactor really closes. • Check the setting of S1-10. • Check the motor contactor feedback wiring.
Starting Current Error SE2		❍	• The output current was lower than 25% of the motor no-load current at start.	• Check the motor wiring. • Check the motor contactor and the contactor sequence. Make sure it closes properly during start.
Output Current Error SE3		❍	• The output current was lower than 25% of the motor no-load current during operation.	• Check the motor wiring. • Check the motor contactor and the contactor sequence. Make sure does not open during operation.
Brake Response Error SE4		❍	The brake close command was set but he status of the brake feedback signal did not change.	• Make sure the brake works properly. • Check the brake feedback input.
DC Undervoltage Uv1 (Uv)	❍	❍	• The voltage in the DC bus fell below the undervoltage detection level (L2-05). • The power supply failed or one input phase has been lost. • The power supply is too weak.	• Check the power supply. • Make sure that the power supply can provide enough voltage.
Controller Undervoltage Uv2		❍	The control power supply does not have enough voltage.	• Cycle power to the drive. Check if the fault reoccurs. • Replace the drive if the fault continues to occur.
DC Charge Circuit Fault Uv3		❍	The charge circuit for the DC bus is broken.	• Cycle power to the drive and see if the fault reoccurs. • Replace the drive if the fault reoccurs.

◆ Operator Programming Errors

An Operator Programming Error (oPE) occurs when an inapplicable parameter is set or an individual parameter setting is inappropriate. When an oPE error is displayed, press the ENTER button to display U1-18. Monitor U1-18 will display the parameter that is causing the oPE error.

Digital Operator	Possible Cause	Corrective Action
oPE01	Drive capacity and the value set to o2-04 do not match.	Set to o2-04 to the correct value.
oPE02	Parameters were set outside the allowable setting range.	Set parameters to the proper values.
oPE03	A contradictory setting is assigned to multi-function contact inputs H1-03 through to H1-07. • The same function is assigned to two inputs (this excludes "External fault" and "Not used"). • An input function that must be set in combination with another function was set alone. • Input functions that are not allowed to be used simultaneously have been set.	• Fix any incorrect settings. • Refer to the Technical Manual for more details.
oPE08	A function has been set that cannot be used in the control mode selected (this error often appears after the control mode has been changed).	• Fix any incorrect setting. • Refer to the Technical Manual for more details.
oPE10	The V/f pattern setting is incorrect.	• Check the V/f pattern settings. • Refer to the Technical Manual for more details.

◆ Auto-Tuning Errors

Digital Operator	Cause	Corrective Action
Er-01	Motor data fault The input motor data are not valid. (e.g. the base frequency and base speed do not fit).	Re-enter the data and repeat Auto-Tuning.
Er-02	Minor Fault • The wiring is faulty. • Drive was in baseblock condition or the Safe Disable Input were open during Auto-Tuning.	Check the wiring.
Er-03	The STOP key was pressed and Auto-Tuning was canceled.	Repeat the Auto-Tuning.

Digital Operator	Cause	Corrective Action
Er-04	Resistance fault • Wrong input data. • Auto tuning exceeded the given time frame. • Calculated values out of range.	• Check the input data. • Check the wiring. • Re-enter the data and repeat the Auto-Tuning.
Er-05	No-Load Current Error • Wrong input data. • Auto tuning exceeded the given time frame. • Calculated values out of range.	
Er-08	Rated Slip Error • Wrong input data. • Auto tuning exceeded the given time frame. • Calculated values out of range.	
Er-09	Acceleration Error The motor did not accelerate following the specified acceleration ramp.	• Lengthen the acceleration ramp. Increase C1-01 if set in s. • Check the torque limits L7-01 and L7-02.
Er-11	Motor speed fault. The torque reference was too high.	• Lengthen the acceleration ramp. Increase C1-01 if set in s. • If possible, disconnect the load.
Er-12	Current detection error • One or all output phases are lost. • Current is either too low or exceeds the drives rating. • The current sensors are faulty.	• Check the wiring. Make sure the motor contactor is closed during tuning. • Make sure, that the drive rating fits to the motor. • Check the load. (Auto-Tuning should have been performed without the load connected or with very low load.) • Replace the drive.
End1	Rated current alarm • The torque reference exceeded 20% during Auto-Tuning. • The calculated no-load current is above 80% of the motor rated current.	• Check the V/f pattern setting. • Perform Auto-Tuning without the load connected. • Check the input data and repeat Auto-Tuning.
End2	Motor iron-core saturation coefficient • Calculated core saturation values out of range. • Incorrect data was entered.	• Check the input data. • Check the motor wiring. • Perform Auto-Tuning without load connected.
End3	Rated current setting alarm	Check the input data and repeat tuning.
End4	Adjusted Slip Calculation Error The slip that was calculated is outside the allowable range.	• Make sure the data entered for Auto-Tuning is correct. • Execute Rotational Auto-Tuning instead. If not possible, try Stationary Auto-Tuning 2.
End5	Resistance Tuning Error The resistance value that was calculated is outside the allowable range.	• Double check the data that was entered for the Auto-Tuning process. • Check the motor and motor cable connection for faults.

Digital Operator	Cause	Corrective Action
End6	Leakage Inductance Alarm The leakage inductance value that was calculated is outside the allowable range.	Double check the data that was entered for the Auto-Tuning process.
End7	No-Load Current Alarm • The entered no-load current value was outside the allowable range. • Auto-Tuning results were less than 5% of the motor rated current.	• Check and correct faulty motor wiring. • Double check the data that was entered for the Auto-Tuning process.

9 Instructions for UL and cUL

◆ UL Standards Compliance

This drive is tested in accordance with UL standard UL508C, File No. E131457 and complies with UL requirements. To ensure continued compliance when using this drive in combination with other equipment, meet the following conditions:

■ Installation Area

Do not install the drive to an area greater than pollution severity 2 (UL standard).

■ Main Circuit Terminal Wiring

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

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

Wire Gauge mm^2 (AWG)	Terminal Screws	Crimp Terminal Model Number	Tightening Torque N⋅m (lb⋅in.)
0.75 (18)	M3.5	R1.25-3.5	0.8 to 1.0 (7.1 to 8.9)
	M4	R1.25-4	1.2 to 1.5 (10.6 to 13.3)
1.25 (16)	M3.5	R1.25-3.5	0.8 to 1.0 (7.1 to 8.9)
	M4	R1.25-4	1.2 to 1.5 (10.6 to 13.3)
2 (14)	M3.5	R2-3.5	0.8 to 1.0 (7.1 to 8.9)
	M4	R2-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R2-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R2-6	4.0 to 5.0 (35.4 to 44.3)

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

<1> Use the specified crimp terminals(Model No.:14-NK4) when using CIMR-VC2A0030, VC2A0040, VC4A0023 with the wire 14mm^2(AWG:6).

Note: Use crimp insulated terminals or insulated tubing for wiring these connections. Wires should have a continuous maximum allowable temperature of 75°C 600 V UL approved vinyl sheathed insulation. Ambient temperature should not exceed 30°C.

Input Fuse Selection

Use the fuses listed up in the table on page 13 when wiring the main circuit.

■ Low Voltage Wiring for Control Circuit Terminals

Wire low voltage wires with NEC Class 1 circuit conductors; refer to national state or local codes for wiring. Use a class 2 (UL regulations) power supply for the control circuit terminal.

Control Circuit Terminal Power Supply

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

■ Drive Short-Circuit Rating

This drive has undergone the UL short-circuit test, which certifies that during a short circuit in the power supply the current flow will not rise above 30,000 Amps maximum at 240 V for 200 V class drives and 440 V for 400 V class drives.

- The MCCB and breaker protection and fuse ratings (refer to the preceding table) shall be equal to or greater than the short-circuit tolerance of the power supply being used.
- Suitable for use on a circuit capable of delivering not more than 30,000 RMS symmetrical amperes for 240 V in 200 V class drives (up to 440 V for 400 V class drives) motor overload protection

◆ Drive Motor Overload Protection

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

■ E2-01 Motor Rated Current

Setting Range: Model Dependent
Factory Default: Model Dependent

The motor rated current parameter (E2-01) protects the motor and allows for proper vector control when using open loop vector or flux vector control methods (A1-02 = 2 or 3). The motor protection parameter L1-01 is set as factory default. Set E2-01 to the full load amps (FLA) stamped on the nameplate of the motor.

The operator must enter the rated current of the motor (T1-04) in the menu during auto-tuning. If the auto-tuning operation completes successfully (T1-02 = 0), the value entered into T1-04 will automatically write into E2-01.

■ L1-01 Motor Overload Protection Selection

The drive has an electronic overload protection function (OL1) based on time, output current, and output frequency, which protects the motor from overheating. The electronic thermal overload function is UL-recognized, so it does not require an external thermal overload relay for single motor operation.

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

Overload Protection Settings

Setting	Description
0	Disabled
1	Standard fan cooled motor (default)
2	Inverter duty motor with a speed range of 1:10
3	Vector motor with a speed range of 1:100
4	Permanent Magnet Motor

Disable the electronic overload protection (L1-01 = “0: Disabled”) and wire each motor with its own motor thermal overload when connecting the drive to more than one motor for simultaneous operation.

Enable the motor overload protection (L1-01 = 1, 2, or 3) when connecting the drive to a single motor unless there is another means of preventing motor thermal overload. The electronic thermal overload function causes an OL1 fault, which shuts off the output of the drive and prevents additional overheating of the motor. The motor temperature is continually calculated as long as the drive is powered up.

Setting L1-01 = 1 selects a motor with limited cooling capability below rated (base) speed when running at 100% load. The OL1 function derates the motor any time it is running below base speed.

Setting L1-01 = 2 selects a motor capable of cooling itself over a 10:1 speed range when running at 100% load. The OL1 function derates the motor when it is running at 1/10 or less of its rated speed.

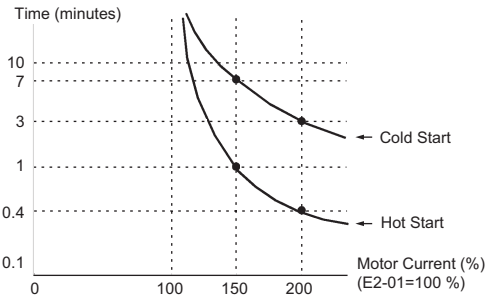
Setting L1-01 = 3 selects a motor capable of cooling itself at any speed – including zero speed – when running at 100% load. The OL1 function does not derate the motor at any speed.

Setting L1-01 = 4 selects protection for a PM motor.

■ L1-02 Motor Overload Protection Time

Setting Range: 0.1 to 5.0 Minutes
Factory Default: 1.0 Minutes

The L1-02 parameter will set the allowed operation time before the OL1 fault will occur when the drive is running at 60 Hz and 150% of the motor's full load amp rating (E2-01). Adjusting the value of L1-02 can shift the set of OL1 curves up the Y-axis of the diagram below but will not change the shape of the curves.



Motor Overload Protection Time

■ L1-03 Motor Overload Alarm Operation Selection

Setting	Description
0	Ramp to Stop
1	Coast to Stop
2	Fast-Stop
3	Alarm Only (factory default)

■ L1-04 Motor Overload Fault Operation Selection

Setting	Description
0	Ramp to Stop
1	Coast to Stop (factory default)
2	Fast-Stop