YASKAWA

YASKAWA AC Drive L1000H

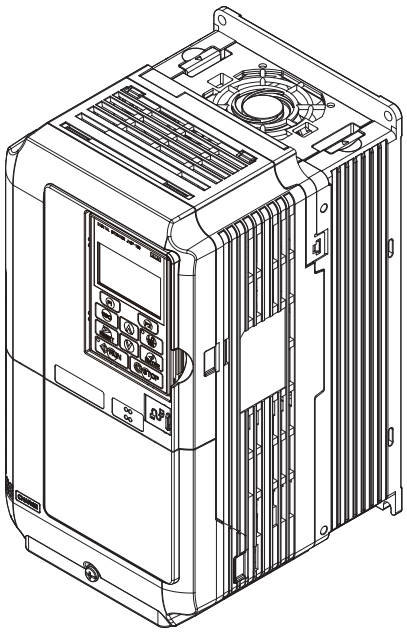
AC Drive for Elevator Applications

Quick Start Guide

Type: CIMR-LC □A [ ] -9110
CIMR-LC □F [ ] -9120

Models: 200 V Class: 1.5 to 110 kW
400 V Class: 1.5 to 110 kW

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



MANUAL NO. TOEP C710616 92D

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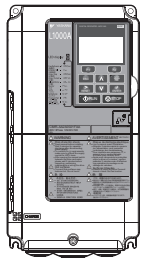
1 Safety Instructions and General Warnings

YASKAWA 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.

◆ Applicable Documentation

The following manuals are available for L1000H series drives:



L1000H Series AC Drive Technical Manual
This manual provides detailed information on parameter settings, drive functions, and MEMOBUS/Modbus specifications. Use this manual to expand drive functionality and to take advantage of higher performance features.
L1000H Series AC Drive Quick Start Guide
Read this manual first. This guide is packaged together with the product. It contains basic information required to install and wire the drive, in addition to an overview of fault diagnostics, maintenance, and parameter settings. Use the information in this book to prepare the drive for a trial run with the application and for basic operation.

◆ General Warnings

⚠ WARNING

- **Read and understand the manuals available 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.

⚠ WARNING

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

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

⚠ 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

Inadvertent Movement Hazard

Clear all personnel above or inside the elevator car before performing a test run.

Failure to comply could result in death or serious injury.

Electrical Shock Hazard

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

YASKAWA is not responsible for the damage caused by modification of the product made by the user. Failure to comply could result in death or serious injury from operation of damaged equipment.

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 change wiring, remove covers, connectors or options cards, or attempt to service the drive with power applied to the drive.

Failure to comply could result in death or serious injury. Disconnect all power to the drive and check for unsafe voltages before servicing.

Always ground the motor-side grounding terminal.

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

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

Failure to comply could result in death or serious injury.

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

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.

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

When an EMC filter is installed, the leakage current exceeds 3.5 mA. Therefore according to IEC/EN 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/EN 60755.

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.

⚠ WARNING

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

Drive Short-Circuit Current Rating

Install adequate branch circuit protection according to applicable local codes and this Installation Manual.

Failure to comply could result in fire and damage to the drive or injury to personnel.

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

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 in drive installation, repair or maintenance.

Failure to comply could result in death or serious injury by fire. Attach the drive or braking resistors to metal or other noncombustible material.

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.

- 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 (or R/L1 and S/L2 for single-phase power).

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 unit.

Failure to comply could result in damage to the sensitive devices within the drive. Use power off resistance checks to determine shortcircuits.

NOTICE

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.

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.

Only connect recommended devices to the drives braking transistor terminals.

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

Carefully review instruction manual TOBP C720600 0☐ when connecting a braking option to the drive.

Do not modify the drive circuitry.

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

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

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

Failure to comply could result in damage to the drive.

Improper application of devices on drive output circuits can damage the drive

Do not connect unapproved LC or RC interference suppression filters, capacitors, ground fault circuits, or overvoltage protection devices to the drive.

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 IEC/EN 61800-5-1: 2007, 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 IEC/EN 664.
- Ground the neutral point of the main power supply for 400 V Class drives.

In the drives L☐4☐0112 through 4☐0150, the wire bending space (space between terminals and cable entry point) provided is smaller than recommended in the IEC/EN61800-5-1.

We declared the CE marking based on the harmonized standards. Refer to the Technical Manual or contact YASKAWA for more detailed information.

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.

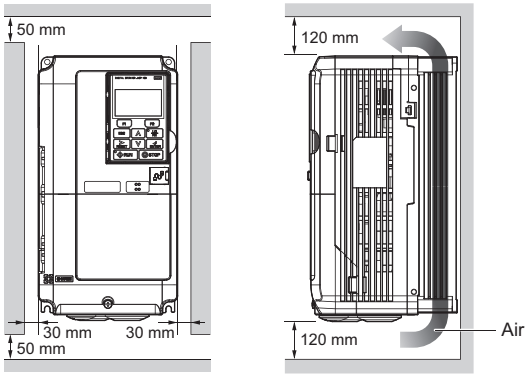
◆ Installation Environment

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	IP20 enclosure: -10 to +50 °C Drive reliability improves in environments without wide temperature fluctuations. When using the drive in an enclosure panel, install a cooling fan or air conditioner in the area to ensure that the air temperature inside the enclosure does not exceed the specified levels. Do not allow ice to develop on the drive.
Humidity	95% RH or less and free of condensation
Storage Temperature	-20 °C to +60 °C
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 (for details refer to the Technical Manual)
Vibration	10 to 20 Hz at 9.8 m/s^2 20 to 55 Hz at 5.9 m/s^2
Orientation	Install the drive vertically to maintain maximum cooling effects.

◆ 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.



◆ Instructions on Installation

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

WARNING! *Be sure to observe the following instructions and precautions. Failure to comply could result in minor or moderate injury and damage to the drive from falling equipment.*

- *Before using wires to suspend the drive vertically and horizontally, make sure that the drive front cover, terminal blocks and other drive components are securely fixed with screws.*
- *Do not subject the drive to vibration or impact greater than 1.96 m/s^2 (0.2 G) while it is suspended by the wires.*
- *Do not overturn the drive while it is suspended by the wires.*
- *Do not leave the drive suspended by the wires for long periods of time.*

◆ Degree of Protection

The degree of protection of L1000H drives is IP20. Install the drive in a cabinet if higher degree of protection is required.

◆ Dimensions

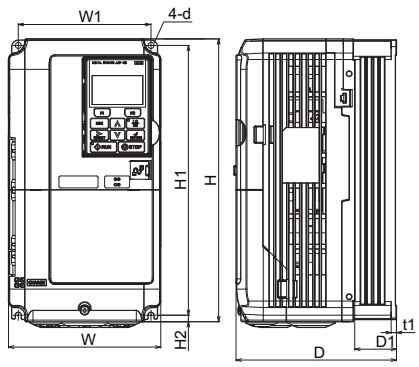


Figure 1

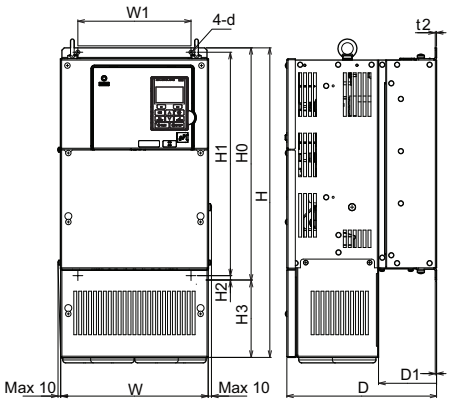
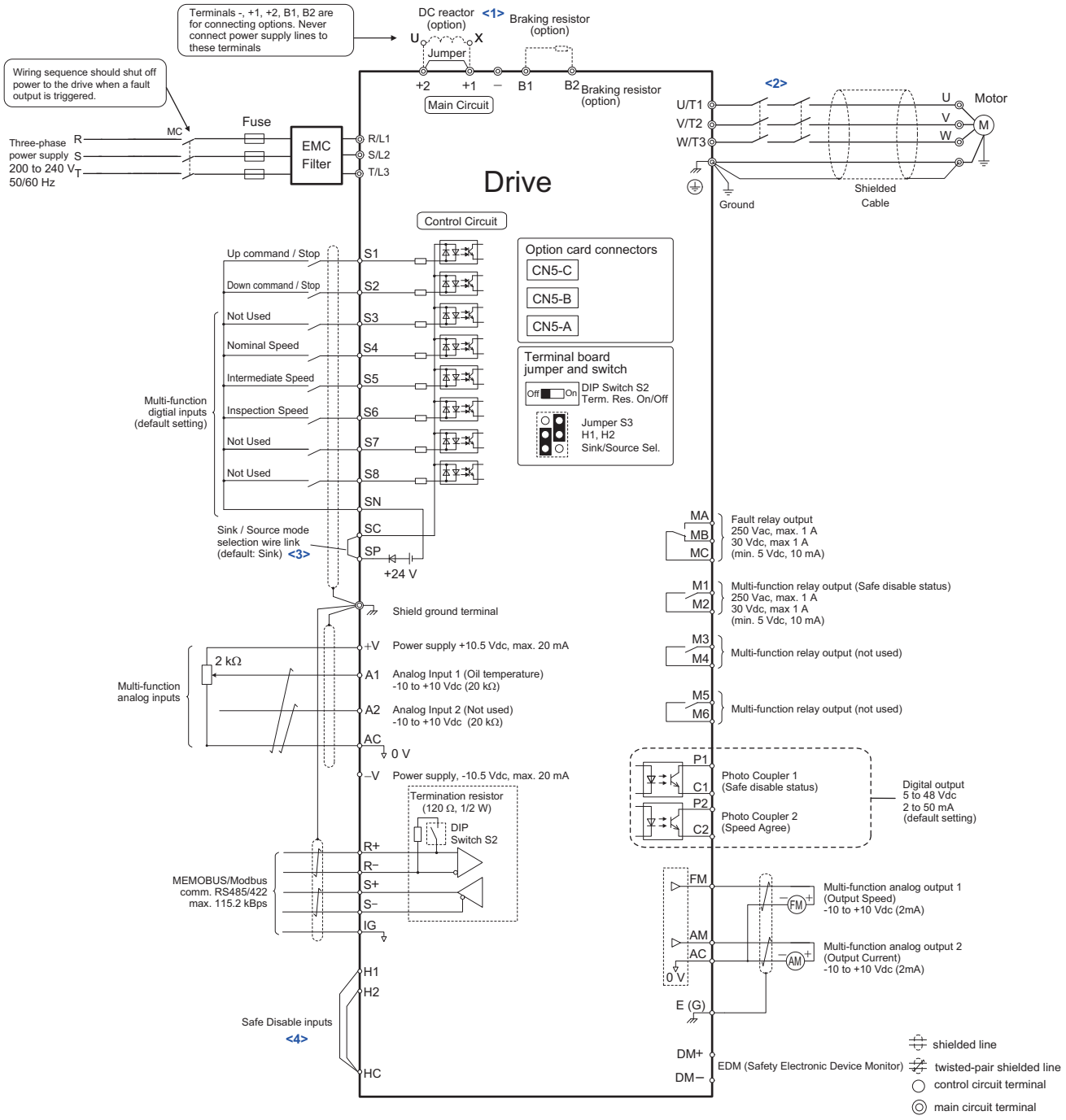


Figure 2

Model CIMR-L□	Fig.	Dimensions (mm)												Weight (kg)
		W	H	D	W1	H0	H1	H2	H3	D1	t1	t2	d	
4□0005	1	140	260	147	122	–	248	6	–	38	5	–	M5	3.2
4□0006		140	260	164	122	–	248	6	–	55	5	–	M5	3.4
4□0009		140	260	164	122	–	248	6	–	55	5	–	M5	3.5
4□0015		140	260	167	122	–	248	6	–	55	5	–	M5	3.9
4□0018		140	260	167	122	–	248	6	–	55	5	–	M5	3.9
4□0024		180	300	167	160	–	284	8	–	55	5	–	M5	5.4
4□0031		180	300	187	160	–	284	8	–	75	5	–	M5	5.7
4□0039		220	350	197	192	–	335	8	–	78	5	–	M6	8.3
4□0045	2	254	465	258	195	400	385	7.5	65	100	2.3	2.3	M6	23
4□0060		279	515	258	220	450	435	7.5	65	100	2.3	2.3	M6	27
4□0075		329	630	258	260	510	495	7.5	120	105	2.3	3.2	M6	39
4□0091		329	630	258	260	510	495	7.5	120	105	2.3	3.2	M6	39
4□0112		329	630	283	260	550	535	7.5	80	110	2.3	2.3	M6	43
4□0150		329	630	283	260	550	535	7.5	80	110	2.3	2.3	M6	45

3 Electrical Installation

The figure below shows the main and control circuit wiring.



<1> Remove the jumper when installing a DC reactor. Models 4☐0045 through 4☐0150 come with a built-in DC reactor.
<2> The drive provides a stop function in compliance with Stop Category 0 (EN 60204-1) and "Safe Torque Off" (IEC/EN 61800-5-2). It has been designed to meet the requirements of the ISO/EN 13849-1, Category 3 PLd, and IEC/EN 61508, SIL2 (Models CIMR-L☐☐A☐) or SIL3 (Models CIMR-L☐☐F☐). Using this function the number of motor contactors can be reduced to one. Refer to *Safe Disable Input Function on page 42* for details.
<3> Never short terminals SP and SN, as doing so will damage the drive.
<4> Disconnect the wire jumper between H1-HC and H2-HC when utilizing the Safe Disable inputs.

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 may 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 M5-M6) to interlock operation in such situations.

◆ Wiring Specification

■ Main Circuit

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

Model CIMR-L□	EMC Filter		Main Fuse [Bussmann]	Recom. Motor Cable (mm²)	Main Circuit Terminal Sizes			
	Manufacturer: Schaffner	Manufacturer: Block			R/L1,S/L2,T/L3, U/T1,V/T2,W/T3, –, +1, +2	+3	B1, B2	⏚
4□0005	FS5972-18-07	FB-40008A	FWH-70B	2.5	M4	–	M4	M4
4□0006								
4□0009		FB-40014A	FWH-90B					
4□0015	FS5972-35-07	FB-40025A	FWH-80B					M5
4□0018			FWH-100B	4				
4□0024		FB-40044A	FWH-125B	6	M5		M5	M6
4□0031	FS5972-60-07		FWH-200B					
4□0039		FB-40060A	FWH-250A	16	M6			
4□0045					M8		M8	M8
4□0060	FS5972-100-35	FB-40072A		25				
4□0075		FB-40105A				M8	–	
4□0091	FS5972-170-35			35				
4□0112		FB-40170A	FWH-350A	50	M10	M10	–	M10
4□0150			FWH-400A	70				

Tightening Torque Values

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

Terminal Size	M4	M5 <1>	M6	M8	M10
Tightening Torque (N·m)	1.2 to 1.5	2.0 to 2.5	4.0 to 6.0	9.0 to 11.0	18.0 to 23.0

<1> The tightening torque differs for the following terminals.
For use with CIMR-L□4A0024 and 4A0031
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2: 3.6 to 4.0 N·m
B1, B2: 2.7 to 3.0 N·m

■ Control Circuit

The control terminal board is equipped with screwless terminals. Always use wires within the specifications listed below. For safe wiring, YASKAWA recommends solid wires or flexible stranded wires with ferrules. Use ferrules with a length of 8 mm.

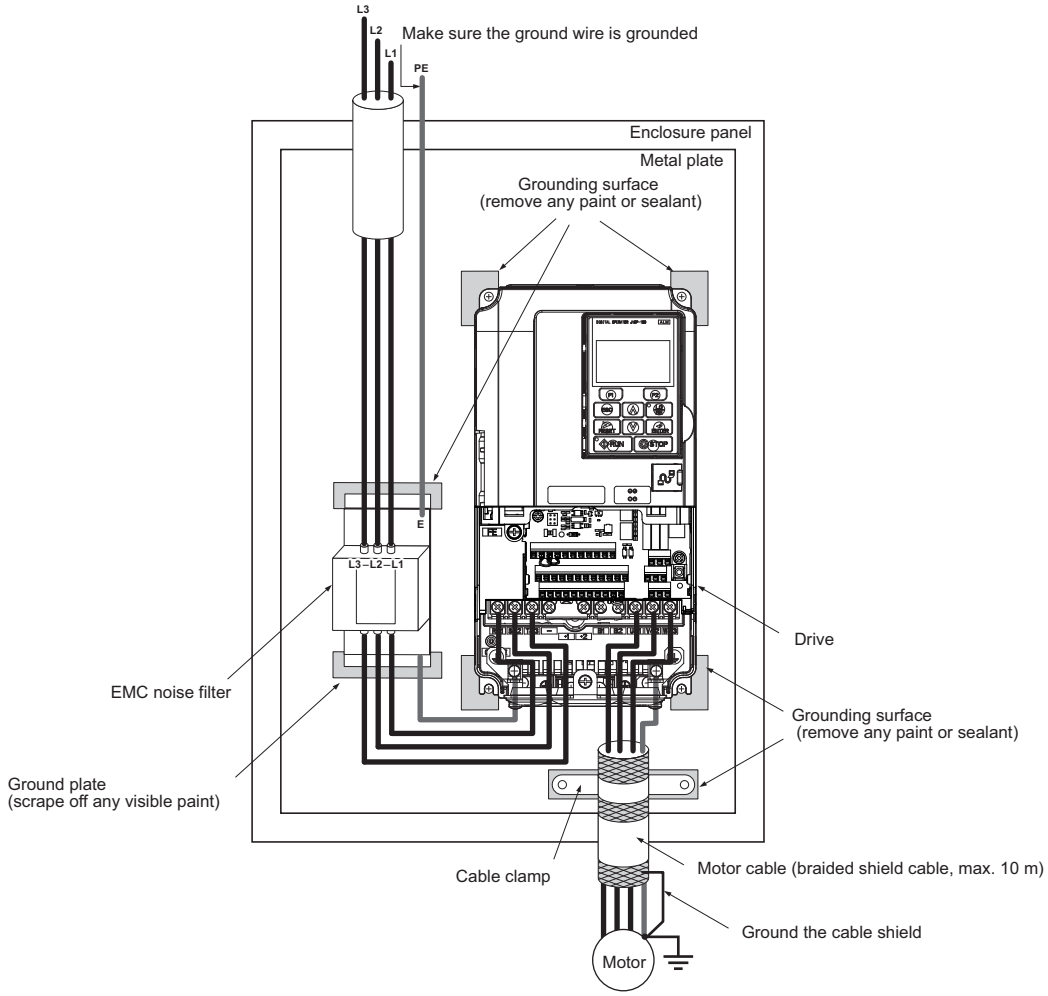
Wire Type	Wire Size (mm²)
Solid	0.2 to 1.5
Stranded	0.2 to 1.0
Stranded wire with ferrule	0.25 to 0.5

◆ EMC Filter Installation

This drive has been tested in accordance with European standards IEC/EN 61800-3. In order to comply to the EMC standards, 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 11* 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. Make sure the ground conductor complies with technical standards and local safety rules. When an EMC filter is installed, the leakage current exceeds 3.5 mA. Therefore according to IEC/EN 61800-5-1, at least one of the conditions below must be satisfied:
   – The cross-section of the protective earthing conductor must be at least 10 mm^2 (Cu) or 16 mm^2 (Al).
   – The power supply must be disconnected automatically in case of discontinuity of the protective earthing conductor.
6. Install an AC or DC reactor for IEC/EN 12015 compliance. Refer to the Technical Manual 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 11*.
- When using residual current monitoring or detection devices (RCM / RCD), make sure the devices are designed for use with AC drives (e.g., type B according to IEC/EN 60755).
- If using an input switch, make sure that the switch does not operate more frequently than once every 30 minutes.
- When frequently switching on/off power supply (e. g. for energy saving reasons) make sure the power is not cycled more than 54 times per day.
- 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.
  – When using an advancing capacitor switch.
  – With a large capacity power supply transformer (over 600 kVA).

■ 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.

Note: The drive provides a Safe Disable function that can be utilized to reduce the number of motor contactors to one. Refer to *Safe Disable Input Function on page 42* for details.

■ Ground Connection

Take the following precautions when grounding the drive:

- Make sure the ground conductor complies with the general technical standards and local regulations.
- Keep ground wires as short as possible.
- Always make sure the ground impedance is conform to the requirements of local safety and installation regulations.
- Never share the ground wire with other devices such as welding machines, etc.
- Do not loop the ground wire when using more than one drive.

■ Control Circuit Wiring Precautions

Consider 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 M1 to M6, MA, MB, and MC (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, H1, and H2 when the Safe Disable function is utilized.

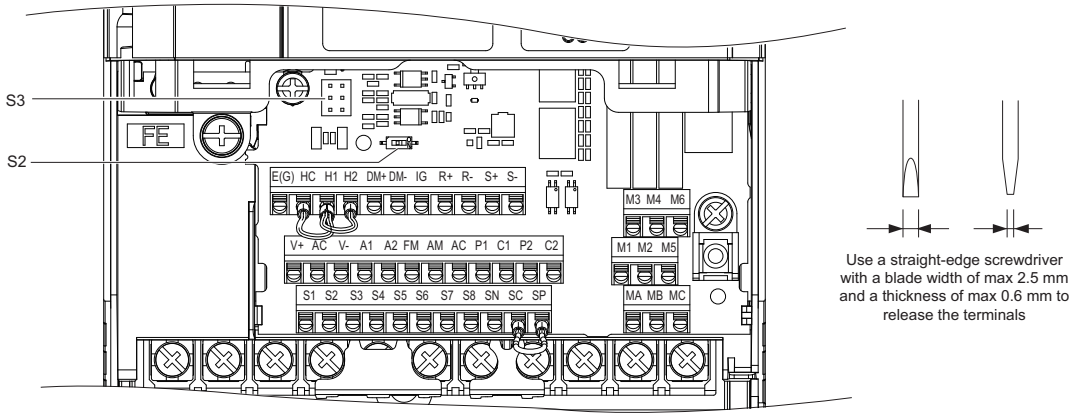
■ Main Circuit Terminals

<table>
<tr><th colspan="2">Terminal</th><th colspan="3">Type</th><th rowspan="2">Function</th></tr>
<tr><th>400 V Class</th><th>Model CIMR-L□</th><th>4□0005 to 4□0039</th><th>4□0045, 4□0060</th><th>4□0075 to 4□0150</th></tr>
<tr><td colspan="2">R/L1, S/L2, T/L3</td><td colspan="3">Main circuit power supply input</td><td>Connects line power to the drive</td></tr>
<tr><td colspan="2">U/T1, V/T2, W/T3</td><td colspan="3">Drive output</td><td>Connects to the motor</td></tr>
<tr><td colspan="2">B1, B2</td><td colspan="2">Braking resistor</td><td>Not available</td><td>Available for connecting a braking resistor or a braking resistor unit option</td></tr>
<tr><td colspan="2">+2</td><td rowspan="3">• DC reactor connection (+1, +2) (remove the shorting bar between +1 and +2)
• DC power supply input (+1, –)</td><td colspan="2">Not available</td><td rowspan="3">For connection
• of the drive to a DC power supply (terminals +1 and – are not UL approved)
• of dynamic braking options</td></tr>
<tr><td colspan="2">+1, –</td><td rowspan="2">DC power supply input (+1, –)</td><td rowspan="2">• DC power supply input (+1, –)
• Braking unit connection (+3, –)</td></tr>
<tr><td colspan="2">+3</td></tr>
<tr><td colspan="2">⏚</td><td colspan="3">–</td><td>Grounding terminal</td></tr>
</table>

Note: Use terminal B1 and – terminals when installing the braking unit (CDBR type) to the drives with built-in braking transistor (4□0005 to 4□0060).

■ Control Circuit Terminals

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



DIP switch S2 and jumper S3 are located on the terminal board. Set them as described below.

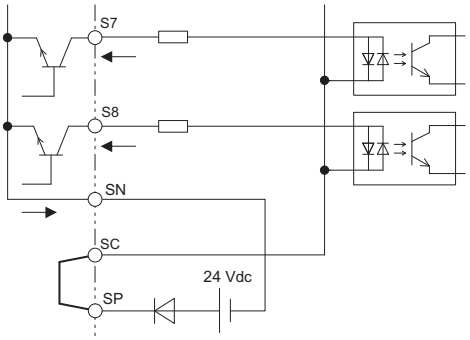
S2	RS422/485 Termination Resistor	Off On
S3	Safe Disable Input Sink/Source/External Supply Selection	Sink / Source / External 24 Vdc Power Supply

■ Sinking/Sourcing Mode (NPN/PNP Selection)

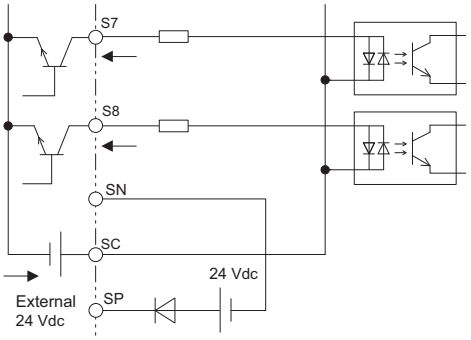
Use a wire link between terminals SC and SP or SC and SN to select between Sink mode, Source mode or external power supply for the digital inputs S1 to S8 as shown below (Default: Sink mode, internal power supply).

Note: Never short terminals SP and SN as doing so will damage the drive.

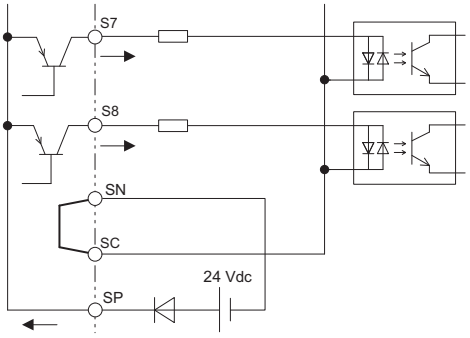
Internal Power Supply – Sinking Mode (NPN) (default)



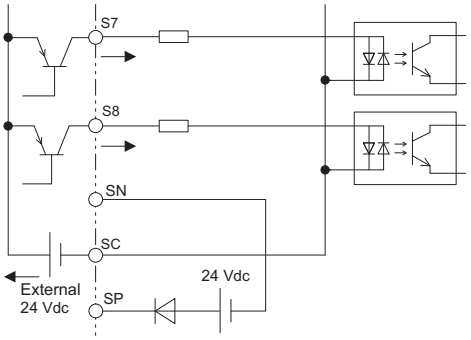
External Power Supply – Sinking Mode (NPN)



Internal Power Supply – Sourcing Mode (PNP)



External Power Supply – Sourcing Mode (PNP)



■ Control Circuit Terminal Functions

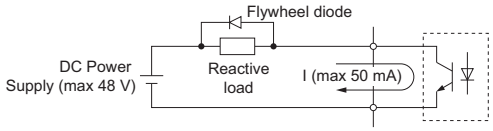
Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Digital Inputs	S1	Multi-function Up Command (Closed: Up, Open: Stop)	Photocoupler 24 Vdc, 8 mA Use the wire link between terminals SC and SN or between SC and SP to select sinking or sourcing, and to select the power supply.
	S2	Multi-function Down Command (Closed: Down, Open: Stop)	
	S3	Multi-function input 3 (Not used)	
	S4	Multi-function input 4 (Nominal Speed)	
	S5	Multi-function input 5 (Intermediate Speed)	
	S6	Multi-function input 6 (Inspection Speed)	
	S7	Multi-function input 7 (Not used)	
	S8	Multi-function input 8 (Not used)	
Digital Input Power Supply	SC	Multi-function input common	Photocoupler, 24 Vdc, 8 mA Use the wire link between terminals SC and SN or between SC and SP to select sinking or sourcing, and to select the power supply.
	SN	0 V	
	SP	+24 Vdc	
Safe Disable Inputs	H1	Safe Disable input 1	24 Vdc, 8 mA One or both open: Drive output disabled Both closed: Normal operation Internal impedance: 3.3 kΩ Off time of at least 1 ms Set the S3 jumper to select sinking or sourcing, and to select the power supply.
	H2	Safe Disable input 2	
	HC	Safe Disable function common	Common for the Safe Disable function
Analog Inputs	+V	Power supply for analog inputs	10.5 Vdc (max. allowable current 20 mA)
	–V	Power supply for analog inputs	-10.5 Vdc (max. allowable current 20 mA)
	A1	Multi-function analog input 1 (Oil Temperature)	-10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ)
	A2	Multi-function analog input 2 (Not used)	-10 to 10 Vdc, 0 to 10 Vdc (input impedance: 20 kΩ)
	AC	Analog Input common	0 V
	E (G)	Ground for shielded lines and option cards	–
Fault Relay	MA	N.O. output	30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA
	MB	N.C. output	
	MC	Fault output common	
Multi-Function Relay Output	M1	Relay output 1 (Safe Disable Status)	
	M2		
	M3	Relay output 2 (Not used)	
	M4		
	M5	Relay output 3 (Not used)	
	M6		
Multi-Function Photocoupler Output	P1	Photocoupler output 1 (Safe Disable Status)	Photocoupler output 48 Vdc, 2 to 50 mA
	C1		
	P2	Photocoupler output 2 (Speed Agree)	
	C2		
Monitor Output	FM	Analog monitor output 1 (Output speed)	-10 to +10 Vdc, 0 to +10 Vdc
	AM	Analog monitor output 2 (Output current)	
	AC	Monitor common	0 V
Safety Monitor Output	DM+	Safety monitor output	Outputs status of Safe Disable function. Refer to *Safe Disable Monitor Output Function and Digital Operator Display on page 44* for details..
	DM–	Safety monitor output common	

NOTICE: *The terminals HC, H1, H2 are used for the Safe Disable function. Safe Disable can be used to enable/disable the drive. If special requirement are fulfilled, it can also be utilized for reducing the number of motor contactors to one. Refer to **Safe Disable Input Function on page 42** for details. Always remove the wire link between HC, H1, or H2 when using Safe Disable.*

NOTICE: *The wiring length to terminals HC, H1 and H2 should not exceed 30 m.*

NOTICE: *When connecting a reactive load such as a relay coil to a photo coupler output, attach a flywheel diode to the load (relay coil)*

like shown below. Ensure the diode rating is greater than the circuit voltage.



4 Keypad Operation

◆ Digital Operator and Keys

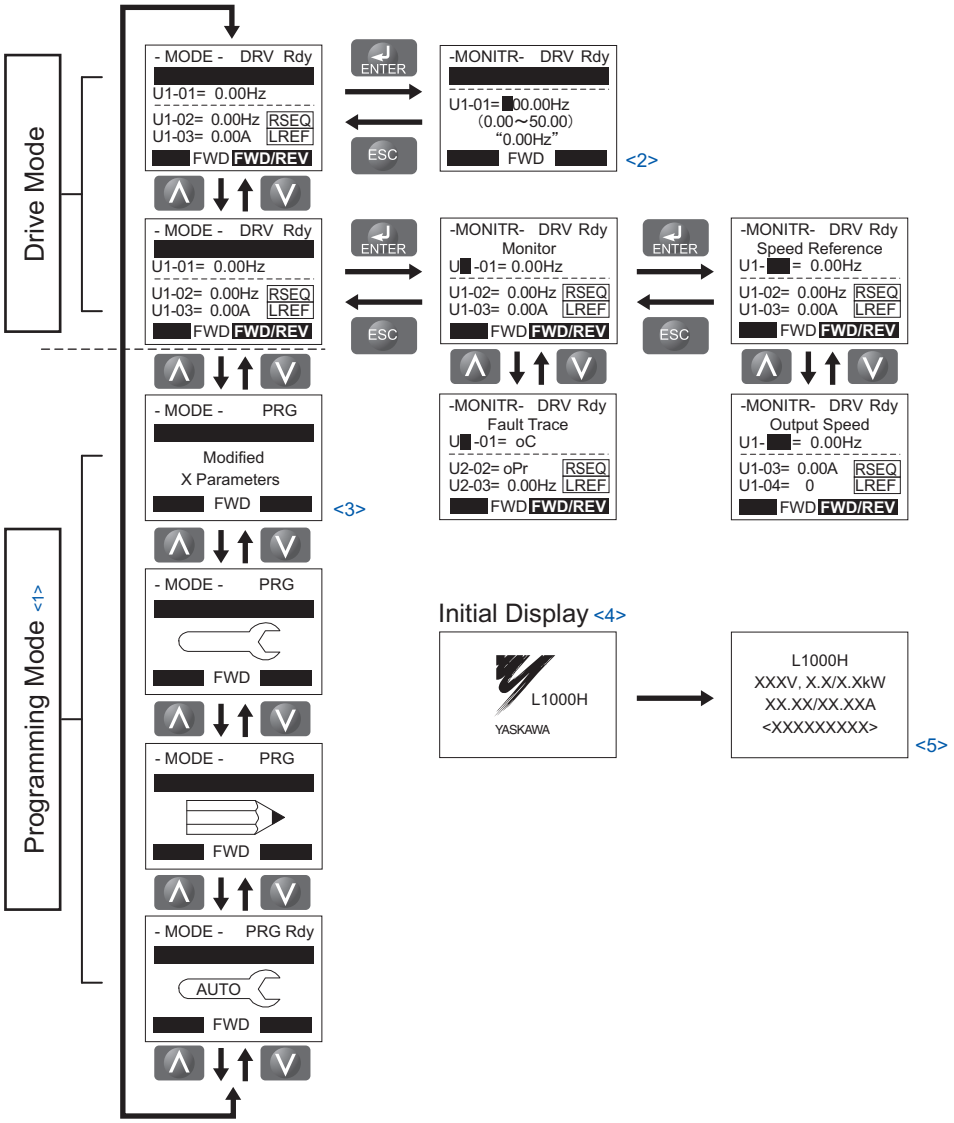
The digital operator is used to program the drive, to start and stop it, and to display fault information. The LEDs indicate the operating status of the drive.

■ Keys and Functions

Key	Name	Function
F1 F2	Function Key (F1, F2)	The functions assigned to F1 and F2 vary depending on the menu that is currently displayed. The name of each function appears in the lower half of the display window.
ESC	ESC Key	• Returns to the previous display. • Moves the cursor one space to the left. • Pressing and holding this button will return to the Speed Reference display.
RESET	RESET Key	• Moves the cursor to the right. • Resets the drive to clear a fault situation.
RUN	RUN Key	The Run LED: • is on, when the drive is operating the motor. • flashes when decelerating to stop (“ramp to stop”), or when the speed reference is 0. • flashes quickly when the drive is disabled by a DI, when the drive was stopped using an Emergency Stop command via the digital inputs, or when an Up/Down command is active during power up.
	Up Arrow Key	Scrolls up to display the next item, selects parameter numbers and increments setting values.
	Down Arrow Key	Scrolls down to display the previous item, selects parameter numbers and decrements setting values.
STOP	STOP Key	Stops drive operation.
ENTER	ENTER Key	• Enters parameter values and settings. • Selects a menu item to move between displays.
LO RE	LO/RE Selection Key	Not used.
ALM	ALM LED Light	On: When the drive detects a fault. Flashing: • When an alarm occurs. • When oPE is detected. • When a fault or error occurs during Auto-Tuning.

◆ Menu Structure and Modes

The following illustration explains the operator keypad menu structure.

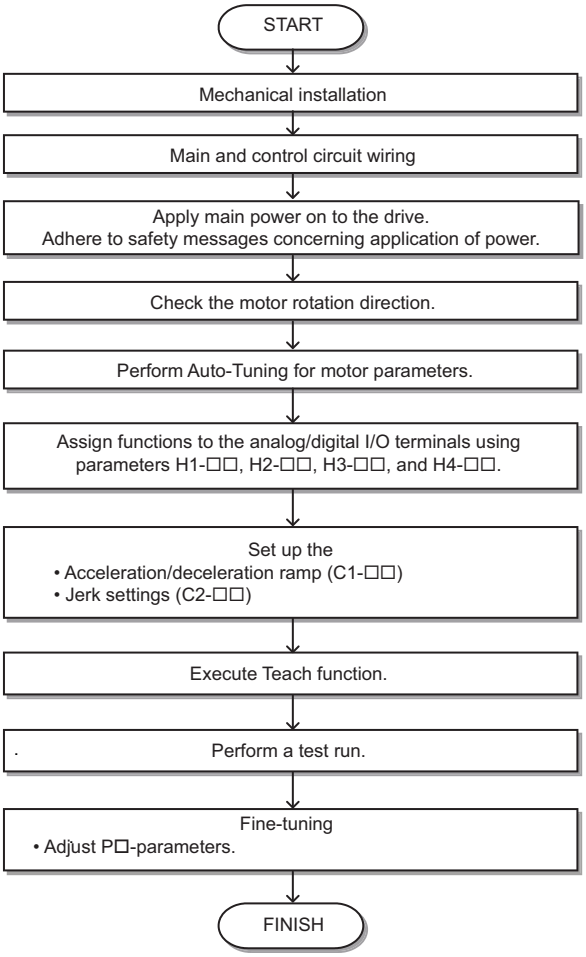


<1> Drive cannot operate the motor.
<2> Flashing characters are shown as 0.
<3> X characters are shown in this manual. The LCD Operator will display the actual setting values.
<4> The speed reference appears after the initial display which shows the product name.
<5> The information that appears on the display will vary depending on the drive.

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.



Note: Set parameter H5-11 to 1 when setting parameters using MEMOBUS/Modbus communications.

◆ Mechanical Installation and Wiring

Install the mechanical equipment and the hydraulic valve as described in the manufacturers documentation. L1000H drives are designed to work with EV4 valves made by Blain Hydraulics GmbH, Heilbronn, GERMANY.

◆ Power On

Before turning on the power supply:

- Make sure all wires are connected properly. Also make sure motor phases are connected in the right sequence.
- Make sure that 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. In case of any error refer to *Troubleshooting on page 38*.

◆ Motor Rotation Direction Setup

Depending on the elevator configuration it might be necessary to change the motor direction in order to have the pump producing oil flow in up direction when the Run command is given to the drive. Do the following to check the motor rotation direction and set parameter b1-14 accordingly.

- With default settings of b1-14 = 0, the drive puts out voltage in U-V-W phase sequence when a Run command is input. Check the motor rotation with this phase sequence (for most motors clockwise seen from the shaft side). Disconnect the motor from the pump if possible or set a slow speed which will not cause problems to the pump while giving the Run command.
- If the pump flow is correct with a U-V-W sequence, keep parameter b1-14 set to 0.
- If the pump flow is incorrect with a U-V-W sequence, set parameter b1-14 to 1.

Note: Always perform motor rotation direction setup prior to setting the encoder rotation direction.

◆ Digital Operator Display Unit Selection

The drive allows to choose between different display units for speed related parameters and monitors, acceleration and deceleration ramps and jerk settings. The units can be selected using parameter o1-03 like shown below.

o1-03 Setting	Display Unit		
	Speed Setting/Monitors (d1-□□, U1-02, U1-02,...)	Accel/Decel Ramps (C1-□□)	Jerk Settings (C2-□□)
0 (default)	0.01 Hz	0.01 s	0.01 s
1	0.01%		
2	1 rpm		
3	User defined		

◆ Motor Data and Encoder Auto-Tuning

■ Auto-Tuning Types

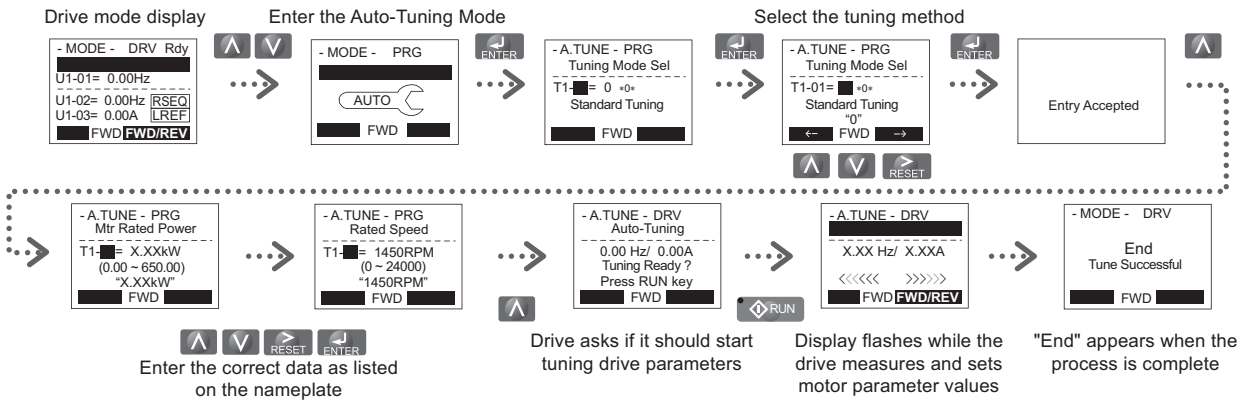
Auto-Tuning automatically programs the drive's motor and motor control related parameters. Select between Auto-Tuning methods listed below.

Motor Data Tuning Modes for Induction Motors

Type	Setting	Requirements and Benefits
Rotational Auto-Tuning	T1-01 = 0	• Rotational Auto-Tuning gives the most accurate results, and is therefore highly recommended if possible. • Motor must run freely or with light load (<30%), i.e. ropes have to be removed.
Stationary Auto-Tuning 1	T1-01 = 1	• Automatically calculates motor parameters needed for vector control. • Use if ropes cannot be removed. Note that the accuracy is less then with Rotational Auto-tuning.
Stationary Auto-Tuning for Line-to-Line Resistance	T1-01 = 2	• Used when the drive was set up properly before and the motor cable has changed.
Stationary Auto-Tuning 2	T1-01 = 4	• A motor test report is available. The no-load current and the rated slip have must be entered from the test report, all other motor-related parameters are calculated automatically. • Use if ropes cannot be removed and if slip and no-load current data are available.

■ Tuning Mode Selection and Data Input

For Auto-Tuning, enter the Auto-Tuning menu (via the T parameters) and perform the steps shown in the figure below. Data required from the motor nameplate will vary depending on the type of Auto-Tuning selected. This example shows the procedure for performing Rotational Auto-Tuning of an induction motor.



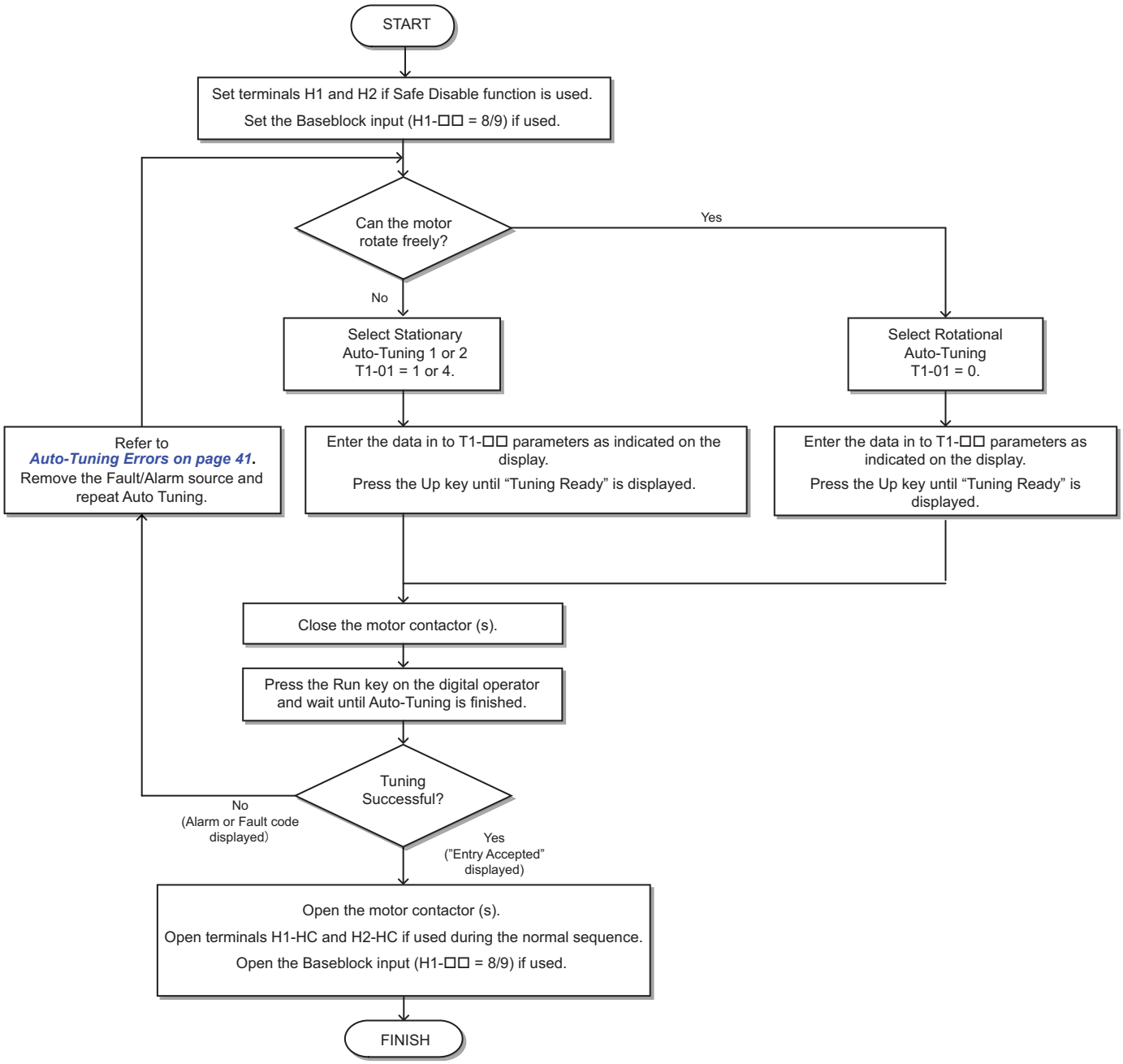
If Auto-Tuning cannot be performed for some reason (no-load operation impossible, etc.), then set the maximum frequency and voltage in the E1-☐☐ parameters and enter the motor data manually into the E2-☐☐ parameters. Refer to *Auto-Tuning Errors on page 41*.

■ Precautions

- Rotational Auto-Tuning T1-01 = 0 (recommended method)
  - Rotational Auto-Tuning provides more accurate tuning results compared to Non-Rotating Auto-Tuning.
  - Perform Rotational Auto-Tuning when the pump can be set to bypass mode (remove ropes from traction sheave).
- Stationary Auto-Tuning T1-01 = 1, 2, or 4 (alternate method)
  - 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.
- When using a motor contactor, make sure it remains closed during the Auto-Tuning process.
- Ensure H1 and H2 signals are ON when performing Auto-Tuning.
- Ensure the motor is securely mounted and bolted in place prior to Auto-Tuning.
- 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.

■ Auto-Tuning Procedure

Auto-Tuning Induction Motors

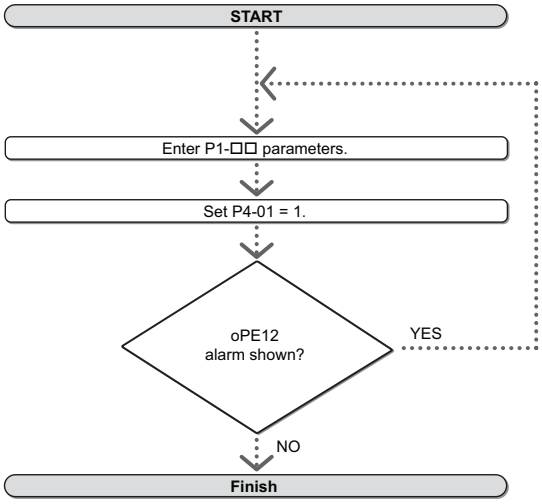


◆ Teaching Function

Teaching function automatically sets up the data, needed by the drive to control the elevator speed. Teaching is done in two steps:

Teaching Mode	Parameter	Description
Basic Calculations	P4-01 = 1	Based on pump, oil and elevator data, the drive sets e. g. frequency references.
Empty Car Teach Run	P4-01 = 2	Determines remaining operation data during an empty car teach run.
Save Teach Results	P4-01 = 3	Save the results of empty car teach run.

■ Step 1: Basic Calculations - P4-01 = 1



Perform as following to provide the basic parameters:

- Enter the programming menu.
- Enter the pump parameter data as received with the valve package or calculated on the web page http://www.blain.de/calc into P1-□□ parameters.
- Set P4-01 = 1.

If teaching finished successfully, the display will first show “END” directly followed by “0”. Parameter P4-01 will be reset to 0 automatically.

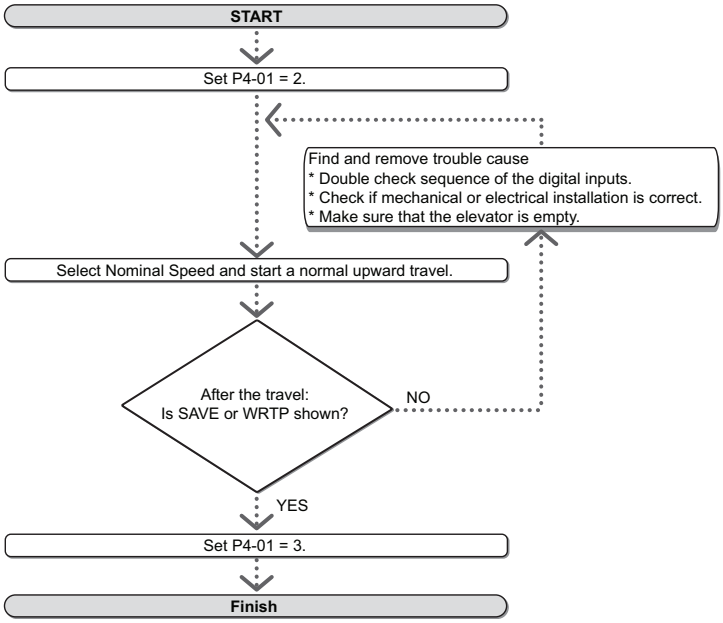
In case that the drive shows oPE12 alarm (ALM LED flashing), check and correct the P1 settings and repeat setting P4-01 = 1.

The following table shows the data to be input:

Teaching Mode	Parameter	Description	Range/Unit
P1-01	Hydraulic Oil ISO VG Number	0: Manual Setting, 1: ISO VG 22, 2: ISO VG 32, 3: ISO VG 46, 4: ISO VG 68	0 to 4
P1-02*	Temperature at 100 cSt	Manual or preselected by P1-01	0 to 100 °C
P1-03*	Temperature at 25 cSt	Manual or preselected by P1-01	0 to 100 °C
P1-04	Ram Diameter	Elevator data	10 to 1000 mm
P1-05	Number of rams	Elevator data	1 to 10
P1-06	Suspension ratio	Elevator data	1 to 10
P1-07	Empty car static pressure	Elevator data	1 to 100 bar
P1-08	Pay load	Elevator data	1 to 50000 kg
P1-09	Dynamic pressure increase	Elevator data	1 to 30 bar
P1-11	Flow at 100cSt & at max. pressure	Pump data: refer to the parameter data supplied with the valve package or use the following web page to calculate the values: http://www.blain.de/calc	2.0 to 1600.0 l/min
P1-12	Flow at 25cSt & at max. pressure		2.0 to 1600.0 l/min
P1-13	Pump Rated Speed		500 to 4000.0 l/min
P1-14	Flow at empty car pressure & at 100cSt		2.0 to 1600.0 l/min
P1-15	Flow at 1 bar pressure & at 100cSt		2.0 to 1600.0 l/min
P1-16	Nominal Speed	Elevator data	0.000 to 1.200 m/s
P1-17	Intermediate Speed	Elevator data	0.000 to 1.200 m/s
P1-18	Inspection Speed	Elevator data	0.000 to 0.300 m/s
P1-19	Leveling Speed	Elevator data	0.000 to 0.150 m/s

* Only available when A1-01 = 2:

■ Step 2: Empty Car Teach Run - P4-01 = 2



The second teaching step is Empty Car Teach Run. Before doing this step make sure that Basic Calculations teaching has been done successfully and that the distance between switches in the shaft allows at least 1 second leveling travel.

- Set parameter P4-01 to 2. The drive will show “TEACH”. If it shows “NEGTEMP” instead, double-check Oil Temperature sensor and repeat setting P4-01 = 2.
- Select Nominal Speed and start a normal upward travel procedure in the same way as for normal elevator operation. Even though the drive is in Programming Mode and the Alarm LED is blinking it will run with normal sequence. After releasing the Run command, the drive will show either “SAVE” or “WRTP”.
- In both cases, press “Enter” to get back to parameter P4-01 and change it to 3. The drive will show “END” and “0” shortly, meaning the command setting has been accepted and P4-01 is set back to “0” automatically.

In case the drive shows “SAVE” or “WRTP”, P4-01 must be set either to 3 for saving or to 0 for cancelation. When intending to re-execute teach run in such a case, first set P4-01 to 0, then restart the procedure by setting P4-01 to 2.

“WRTP” means, the drive re-executed automatically the “Basic Calculations” Teaching. This is done when the oil temperature differs significantly from the oil temperature while executing “Basic Calculations”.

All parameters, modified from the Teaching function can be viewed in the “Verify” and “Programming” menu. Manual modification is possible but normally not necessary.

■ Precautions

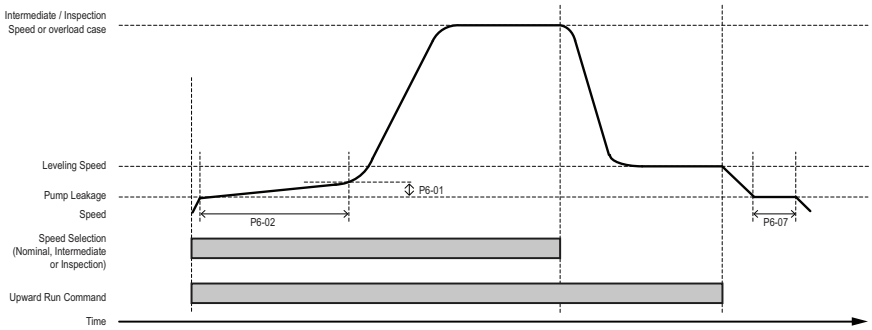
- Empty Car Teach Run must be done just once. Data for Intermediate Speed and Inspection Speed are calculated automatically.
- Don’t expect proper travel comfort during teach run. Empty Car Teach Run is just a preparation for calculating required data. Load or oil temperature is not compensated.
- Motor contactors must be closed during the Auto-Tuning process.
- H1, H2 and HC signals must be ON when performing Auto-Tuning (keep wire link).
- The teaching can be cancelled by setting P4-01 to 0.
- In case that parameters P1-16 to P1-19 are changed, basic calculation “Teaching” is repeated automatically.

◆ Drive Sequence and Run Command for Up-Travel

■ Travel Procedure

After executing Auto-Tuning and Teaching function, other adjustments are not needed in most cases.

The sequence is shown in the figure below. The Run command and Speed selection command must be set given according to this sequence.

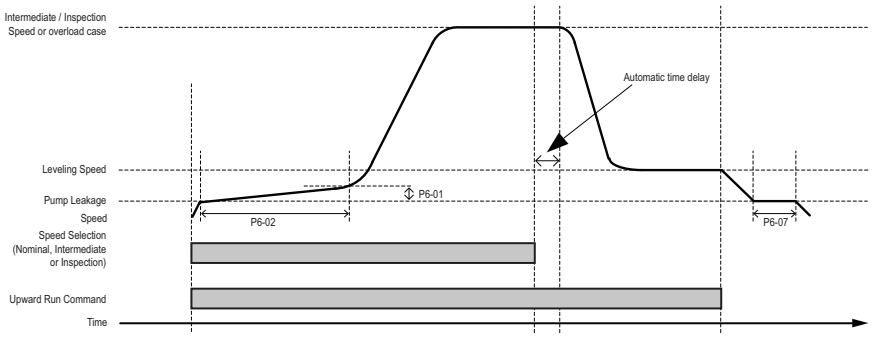


Speeds must be set so that Nominal Speed > Intermediate Speed > Inspection Speed > Leveling Speed. The speeds are set as m/s values in parameters P1-16 to P1-19. These values are calculated for P3-01 to P3-04 as frequency references and must keep the rule P3-01 > P3-02 > P3-03 > P3-04. Not keeping this rule will cause oPE12 alarm. Correct settings and repeat teaching function.

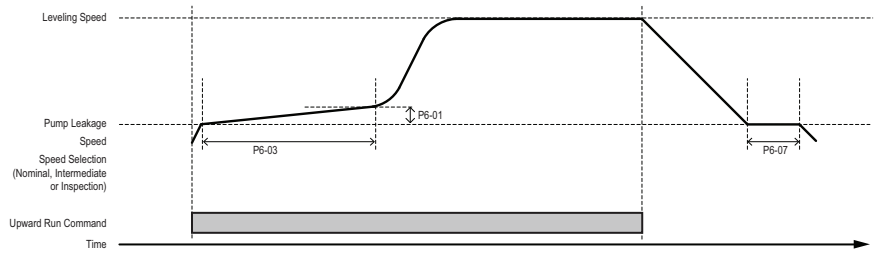
In case that more than one speed selection input is closed, always the lowest speed will be active.

In case that the drive is running with a speed which is slower than nominal speed, the sequence is slightly adapted, to ensure shortest possible run time with maximum comfort.

In case of Nominal Speed (no overload case), the drive starts deceleration to Leveling Speed immediately when opening the speed selection input. In case that the drive runs with a slower speed, the deceleration to Leveling Speed is delayed by a time, calculated automatically by the drive. Refer to the figure below.



■ Re-leveling RUN



■ Travel Stop

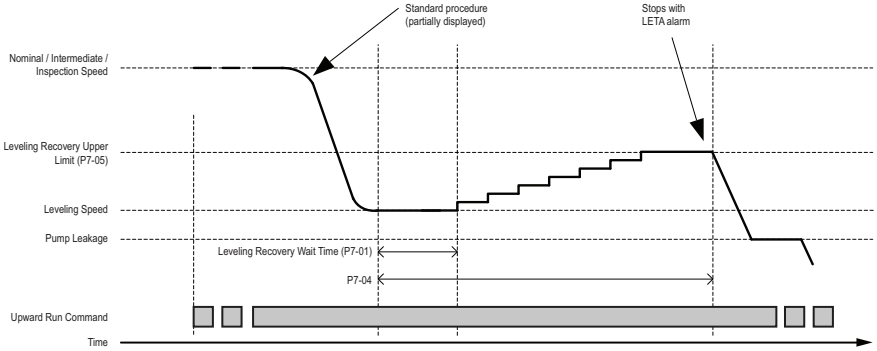
The drive will cancel normal procedure in the following cases:

- The Run command is removed while the Speed Selecting input is still closed or the drive is decelerating to Leveling Speed
  > SEQF fault shown and coast to stop (immediate power off).
- A digital input, set to “External Fault” (refer to parameter in section 6), is activated
  > stop as defined by the input.
- Removing the wire link from the safety inputs (H1, H2, HC) or activating a digital input, set to “Base Block”
  > coast to stop.

■ Leveling Control

In case of wrong setup (e. g. P1 parameter incorrectly entered), the pump might not generate enough flow to move the car after deceleration from the selected speed to leveling speed.

To allow recovery in such a case, the drive increases the speed automatically in steps up to a maximum value. Refer to the figure below.



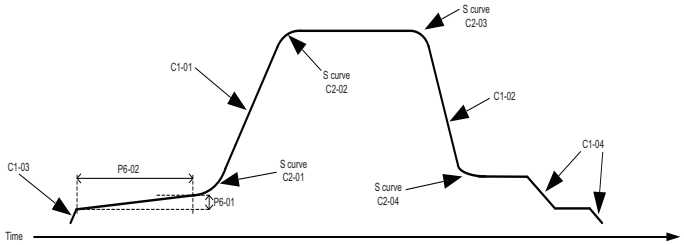
◆ Energy Saving Mode / Overload Operation

Overload operation is active under either of the following conditions:

1. Motor current (U1-03) exceeds level P8-07 for longer than P8-08 and Soft-starter output frequency (U1-16) is higher than $f_{MIN\ OL}$. Valid for Nominal and Intermediate speed.
2. Torque has not been captured neither in normal operation nor in condition 1 when speed selector is opened. Valid for Nominal, Intermediate and Inspection speed.

◆ Acceleration/Deceleration and S curve settings

The acceleration and deceleration ramps are set in C1-□□, while the S curves are defined in C2-01 to C2-04. Refer to the below.

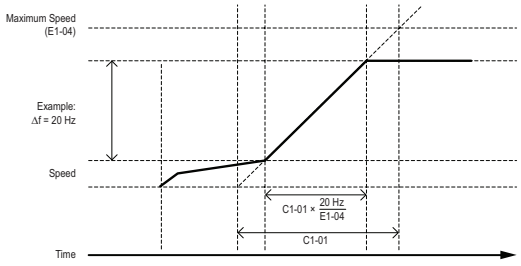


In case that the default ramps do not match, increase or decrease, based on these defaults.

The effective ramp time can be calculated as follows:.

$$\text{Accel/Decel time} = \text{C1-0x} \times \frac{\Delta f}{\text{E1-04}}$$

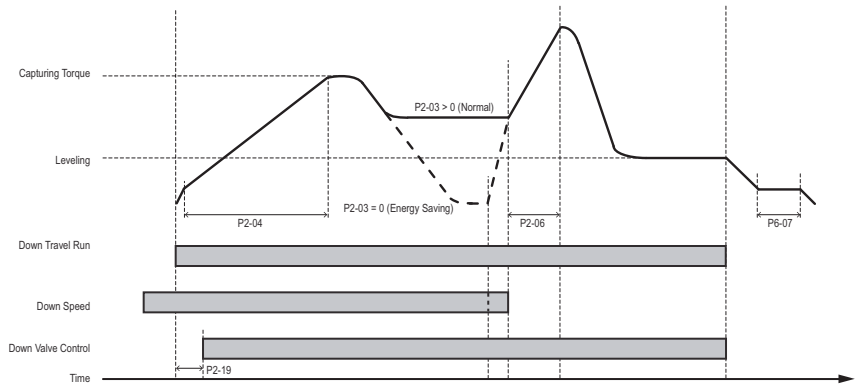
Refer to the figure below. In this example, E1-04 = 60 Hz and C1-01 = 4 s would yield an effective time of 1.3 s.



◆ Drive Sequence and Run Command for Down Travel

■ Travel Procedure

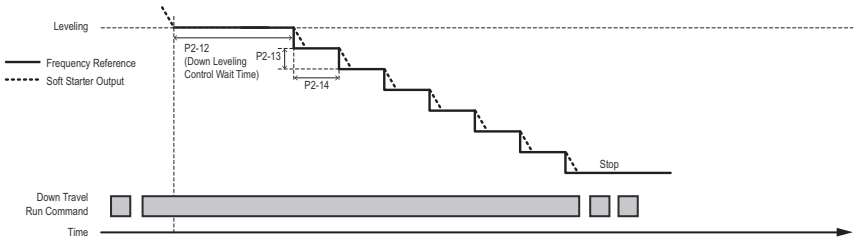
The down travel sequence is shown in the figure below. The Down Travel Run command and the Down Speed Command must be set given according to this sequence.



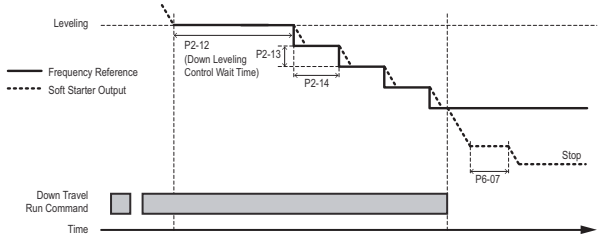
■ Leveling Control

In case of wrong setup (e. g. P1 parameter incorrectly entered), the car might move too slow at the end of the travel.

To allow recovery in such a case, the drive decreases the speed automatically in steps down to zero value in case the Down Travel RUN command is still on. Refer to the figure below.

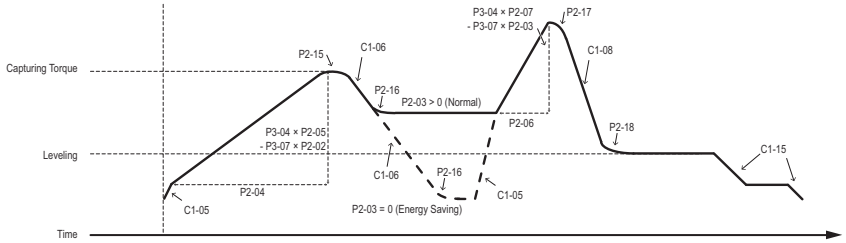


In case the Down Travel RUN command is switched off before reaching zero value, the drive decelerates with Dwell at Stop, if the frequency is still above Stop Dwell level. Refer to the figure below.



◆ Acceleration/Deceleration and S curve settings

The acceleration and deceleration ramps are set in C1-□□, while the S curves are defined in P2-15 to P2-18. Refer to the below.



In case that the default ramps do not match, increase or decrease, based on these defaults.

The effective ramp time can be calculated as follows:.

$$\text{Accel/Decel time} = \text{C1-0x} \times \frac{\Delta f}{\text{E1-04}}$$

◆ Up and Down Commands and Speed Reference Selection

■ Up / Down Command Source Selection

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

b1-02	Up/Down source	Up/Down Command Input
1 (default)	Digital inputs	Terminal S1: Run in the Up direction Terminal S2: Run in the Down direction
2	Serial Communication	Serial Communications using the RS422/485 port
3	Option Board	Communications option card

■ Travel Start and Stop

Travel Start

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

- A speed reference greater than zero must be selected.
- The Safe Disable signals at terminals H1 and H2 must both 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.
- A fault occurs. The stopping method depends on the fault occurred and certain parameter settings.
- The Safe Disable inputs are opened or a Base Block signal is input. In this case the drive output shuts off.

◆ I/O Signal Setup

Note: The default setting functions can be seen in the connection diagram on page *10*.

■ 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 Inputs

The function of each analog input can be assigned in the H3-☐☐ parameters.

■ Multi-Function Analog Outputs

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

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.

Problem	Possible Cause	Corrective Action
Elevator too slow when heavily loaded.	Torque reference value too high because elevator was not empty at teach run.	• Repeat Empty Car Teach Run. • Increase P8-02 value by 10% at a time.
	Drive is overloaded and settings for Energy Saving/Overload function are wrong.	• Set L3-01 = 1. • Limit car load or select bigger drive.
	Worn-out pump.	Replace the pump.
Elevator too slow in case of heated up oil.	Incorrect temperature measurement.	• Check temperature sensor installation. • Check if value for analogue input bias (H3-04) is set correctly. • Increase P8-01 value carefully.
	Wrong temperature reference (p1-16), too small temperature compensation gain or worn-out pump.	Replace the pump.
Harsh starting and stopping.	Too short ramp times	• Increase C1 parameters carefully. • Increase S curve times carefully.
Leveling time okay when running with Nominal Speed (not overload case) but too long when running with slower speed.	Insufficient distance compensation before deceleration.	Increase parameter P8-05 carefully in steps of 0.01.
Uncomfortable, harsh ending of travel.	Leveling Control might increase pump speed too early.	Increase parameter Leveling Recovery Wait Time (P7-01).
	Stop Dwell time too short.	Increase parameter P6-07.
	Too short ramp times.	Increase C1-04 slightly.
	No leveling travel.	Change C1-□□ and C2-□□ parameters or increase switch distance to reach leveling speed.
Uncomfortable, harsh begin of travel in normal operation.	Insufficient Start Dwell.	Increase parameter Start Dwell Time (P6-02).
	Too high leakage frequency.	Reduce leakage frequency at start dwell by 10% to 20%.
	Too small start swell ramp (P6-01).	Increase start dwell ramp 0.5 Hz at a time.
	Too little C2-01 time.	Increase C2-01 time.
Energy Saving / Overload function is enabled but the drive limits the speed to a value, lower than the frequency shown in U7-08.	Drive too heavy loaded for the given car load.	Limit car load or select a bigger drive.
Car speed is good for Nominal Speed, but not for Intermediate or Inspection Speed.	Incorrect torque references.	Decrease values, set in P3-11 (for Intermediate Speed) or P3-12 (for Inspection Speed) in small steps.

◆ Potential Problems and Solutions

For detailed information on pumps and valves, please refer to Blain Documentation.

Problem	Possible Cause	Corrective Action
Up Direction Travel		
Elevator too slow then heavily loaded	Torque reference value is too high (incorrect empty car teach run)	Repeat Empty Car Teach Run Increase P8-02 value by 10% at a time
	Drive is overloaded and settings for overload function is incorrect	Set L3-01 = 1 Limit car load or select bigger drive
	Worn-out pump	Replace the pump
Elevator too slow with increased oil temperature	Incorrect temperature measurement	Check temperature sensor & converter installation Make sure temperature converter has power (12 to 35 V DC) Make sure temperature sensor dipped in oil Check if value for analogue input bias (H3-04) is set correctly Increase P8-01 value by 10% at a time
	Wrong temperature reference (P3-16)	Check temperature reference (P3-16) and compare with the actual (U7-02)
	Worn-out pump	Replace the pump
Harsh starting and stopping	Too short ramp times	Increase C1 parameters Increase S-curve times

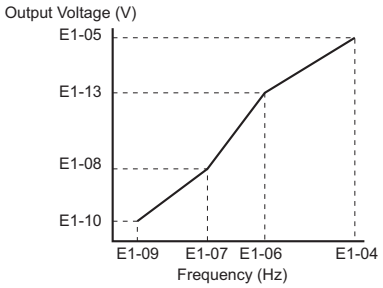
Problem	Possible Cause	Corrective Action
Uncomfortable, harsh begin of travel in normal operation	Insufficient start dwell time (P6-02)	Increase start dwell time (P6-02)
	Too high leakage frequency (P3-07)	Reduce leakage frequency (P3-07) by 20%
	Too small start dwell ramp (P6-01)	Increase start dwell ramp 0.5 Hz at a time
	Too little C2-01 time	Increase C2-01 time
Uncomfortable, harsh ending of travel	Too short ramp time	Increase C1-04 time
	No leveling travel	Reduce C1-□□ and/or C2-□□ deceleration path parameters or increase switch distance to reach leveling travel
	Stop dwell time is too short	Increase parameter P6-07 by 20% at a time
	Leveling control upper limit is too high	Decrease P7-05 by 1 Hz at a time
Leveling time too long when running with slower speed than nominal speed	Insufficient deceleration time compensation before deceleration	Increase parameter P8-05 carefully in steps of 0.01
Car speed is good for Nominal Speed, but not for Intermediate or Inspection Speed	Incorrect torque references	Decrease values, set in P3-11 (for Intermediate Speed) or P3-12 (for Inspection Speed) in small steps
Energy Saving/Overload function is enabled but the drive limits the speed to a value, lower than the frequency shown in U7-08	Drive too heavy loaded for the given car load	Limit car load or select bigger drive
	Deceleration path ramp (C1-02) and S-curves (C2-03 & C2-04) times are too long	Decrease deceleration path parameters
Temperature reading (U7 -02) is unexpectedly high/low	Broken power connection to the temperature converter	Correct the power connection
After decelerating to leveling speed the drive ramps down to a lower speed	Leveling recovery upper limit (P7-05) is lower than leveling speed (P3-04)	Increase P7-05 parameter Decrease leveling speed frequency when P3-04 > 20 Hz
oPE12 alarm is displayed on the operator	Check speed frequency references	Make sure that P3-01 > P3-02 > P3-03 > P3-04 or P3-04 > P3-07 × P6-05 or P3-04 > P3-07 × P6-06
Excessive vibration in the car	Pump pulsations resonates with the natural frequency of the elevator structure	Change the pump with a higher or lower flow or use a pulsation damper (refer to spare part list; Annexure 1)
LETA alarm is displayed on the operator	Leveling run after deceleration is longer than 60 s	Check lift controller signaling sequence Make sure speed compensations are done accurately Incorrect input data and incorrect basic calculations Incorrect empty car teach run procedure
SEQF alarm is displayed on the operator	Check the deceleration path parameters	Reduce C1-□□ and/or C2-□□ deceleration path parameters or increase the switch distance in the shaft
	Run (S2) and Speed Selection (e.g. S4) signals are swapped	Correct the signalling
Elevator controller sends a travel signal but the drive does not work	The drive is at alarm mode	Trace the cause, remove it and press reset button to cancel the alarm
	Check if signaling from controller to the drive is correct	Verify the controller signal wiring
Down Direction Travel		
No Down Start	Solenoid D not energized or voltage too low	Lift coil to check magnetic pull. See A below
	Adjustment 6 turned in too far	Turn out adjustment 6
	Adjustment 8 turned out too far	Turn in adjustment 8 cautiously **Attention:** Danger of travelling through
	0-Ring uo on Down Valve X is leaking	Change O-ring
No full speed	Solenoid C not energized or voltage too low	Lift coil to check magnetic pull. See A below
	Adjustment 7 turned in too far	Turn out adjustment 7
	Down Valve flow guide X too small	Check insert size
No down leveling. Elevator stops before floor level	Solenoid C and D reversed	Lift coil to check magnetic pull. See A below
	Adjustment 9 turned in too far	Turn out adjustment 9 to about 0.05 m/s leveling speed
	Spring 9F in adjustment 9 is broken	Replace adjustment 9 complete

Problem	Possible Cause	Corrective Action
No down leveling. Elevator travels through floor level	Adjustment 8 turned in too far. Filter of adjustment 8 blocked or adjustment 8 is damaged	Turn out adjustment 8 about 1/2 turn
	Adjustment 9 turned out too far	Turn in adjustment 9 to about 0.05 m/s leveling speed
	Solenoid valve C: Dirt or damage between needle DN and seat DS	Clean or change needle and seat
	Inner 0-Ring FO on flange 7F is leaking	Change O-Ring
Elevator sinks quickly	Elevator sinks quickly	Tighten Solenoid D tube
	Adjustment 8 turned in too far	Turn out adjustment 8 about 1/2 turn
Elevator sinks slowly due to inner leakage (Re-leveling)	For possible down leakage points, see “Technical Documentation System Leakage”	Replace one seal at a time and test before proceeding to the next point of possible leakage, if still necessary
	Solenoid valve D: Dirt or damage between needle DN and seat DS	Clean or change needle and seat
	O-Ring XO of Down Valve X is leaking	Change 0-Ring When Down Valve is compensated, replace Down Valve
	O-Ring VO of Check Valve V is leaking	Change Check Valve
	O-Ring WO of Leveling Valve W is leaking	Change O-Ring
	Inner 0-Ring FO on flange 4F is leaking	Change O-Ring
	0-Ring HO of Manual Lowering H is leaking	Replace Manual Lowering
Elevator sinks due to inner leakage of auxiliary equipment	HP: Hand pump is leaking	Remove suction tube and observe if hand pump leaks Replace complete hand pump
	HX/MX Adjustment 8M turned in too far	Turn out adjustment 8M
	HX/MX: Down valve 9M is leaking Dirt or damage between the needle DN and seat DS	Clean or change needle and seat
	HX/MX: O-Ring XO of Down Valve YM is leaking	Change O-Ring
	HX/MX: Manual Lowering is leaking (HX/MX)	Replace Manual Lowering
	Contraction of oil during cooling especially from 35 °C or above	Consider oil cooler if hot oil is a problem

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 8: Czech 9: Russian 10: Turkish 11: Polish 12: Greek **Note:1.** Language selection settings 8 to 12 can be selected from an LCD operator with version (REV) F or later. The version number of the LCD operator's PRG software is shown on the back of the digital operator. **Note:2.** Language selection settings 8 to 12 are available in drive software PRG: 7017 or later.
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) **3: Customer access**
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	Up/Down Command Selection	**1: Digital input terminals** 2: MEMOBUS/Modbus communications 3: Option Card
b1-14	Phase Order Selection	Output phase order with an Up command. **0: U-V-W** 1: U-W-V
Operation Mode Selection		
b2-01	DC Injection Braking Start Frequency	Sets the frequency at which DC Injection Braking starts when Ramp to Stop (b1-03 = 3) is selected. If b2-01 < E1-09, DC Injection Braking starts at E1-09.
b2-02	DC Injection Braking Current	Sets the DC Injection Braking current as a percentage of the drive rated current. In OLV the DC excitation current is determined by E2-03.
b2-03	DC Injection Braking Time/ DC Excitation Time at Start	Sets the time of DC Injection Braking at start in units of 0.01 seconds. Disabled when set to 0.00 seconds.
b2-04	DC Injection Braking Time at Stop	Sets the DC Injection Braking time at stop. Disabled when set to 0.00 seconds.
Acceleration/ Deceleration		
C1-01	Acceleration Time 1	Sets the acceleration time 1 from 0 to the max. output frequency.
C1-02	Deceleration Time 2	Sets the deceleration time 1 from the max. output frequency to 0.
C1-03 to C1-15	Acceleration/ Deceleration Times 2 to 4	Set the acceleration/deceleration times (set like C1-01/02).
C2-01	S-Curve 1	S-curve at acceleration start.
C2-02	S-Curve 2	S-curve at acceleration end.
C2-03	S-Curve 3	S-curve at deceleration start.
C2-04	S-Curve 4	S-curve at deceleration end.
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.
Torque Compensation		
C4-01	Torque Compensation Gain	• Increase C4-01 if torque response is slow. • Decrease if speed/torque oscillations occur.
C4-02	Torque Compensation Delay Time	• Increase C4-02 if speed/torque oscillation occurs. • Decrease if torque response is too slow.
Carrier Frequency		
C6-03	Carrier Frequency	Sets the carrier frequency. Settings above the default requires output current derating.
V/f Pattern		
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.

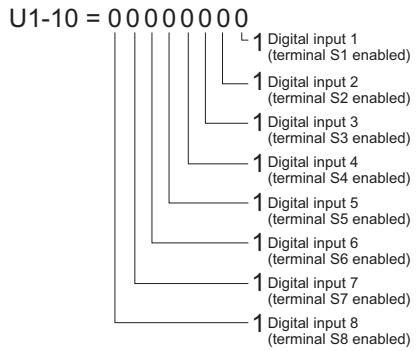
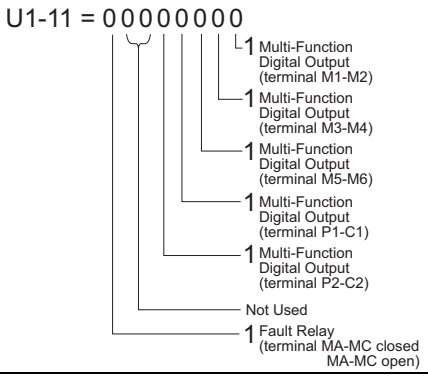
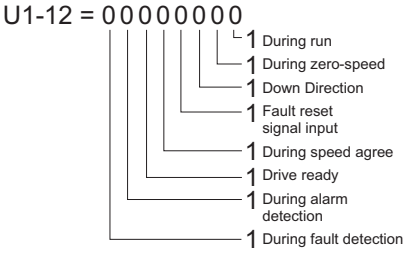
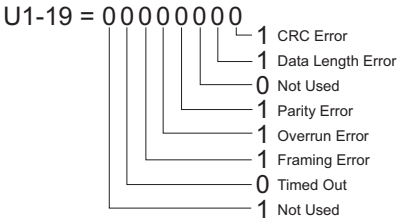
No.	Name	Description
E1-04	Maximum Output Frequency	V/f pattern settings  For linear V/f characteristics, set the same values to E1-07 and E1-09. With these settings, the drive will disregard the value set to E1-08. Parameters must be set so that: E1-09 ≤ E1-07 < E1-06 ≤ E1-04
E1-05	Maximum Voltage	
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	
Motor Parameters		
E2-01	Rated Current	Motor data for Induction Motors.
E2-02	Rated Slip	
E2-03	No-Load Current	
E2-04	Motor Poles	
E2-05	Line-to-Line Resistance	
E2-06	Leakage Inductance	
Multi-Function Digital Inputs		
H1-01 to H1-08	DI S1 to S8 Function Selection	Selects the function of terminals S1 to S8.
Note: Major functions are listed at the end of the table.		
Multi-Function Digital Outputs		
H2-01	DO M1/M2 Function	Sets the function for the relay output M1-M2.
H2-02	DO M3/M4 Function	Sets the function for the photocoupler output M3-M4.
H2-03	DO M5/M6 Function	Sets the function for the photocoupler output M5-M6.
H2-04	DO P1 Function	Sets the function for the photocoupler output P1.
H2-05	DO P2 Function	Sets the function for the photocoupler output P2.
Note: Major functions are listed at the end of the table.		
Multi-Function Analog Inputs		
H3-01, H3-09	Terminal A1, A2 Signal Level Sel.	**0: 0 to 10 V** 1: -10 to 10 V
H3-02, H3-10	Terminal A1, A2 Function Selection	**1F: Through mode** 20: Temperature input
H3-03, H3-11	Terminal A1, A2 Gain Setting	Sets the level of the input value selected in H3-02 and H3-10 when 10 V is input at terminals A1 and A2.
H3-04, H3-12	Terminal A1, A2 Bias Setting	Sets the level of the input value selected in H3-02 and H3-10 when 0 V is input at terminals A1 and A2.

No.	Name	Description
Multi-Function Analog Outputs		
H4-01, H4-04	Terminal FM, AM Monitor Selection	Selects the data to be output through multi-function analog output terminals FM and AM.
H4-02, H4-05	Terminal FM, AM Gain	Sets the signal level for terminals FM and AM that are equal to 100% of the monitor output that has been selected.
H4-03, H4-06	Terminal FM, AM Bias	Sets the signal level for terminals FM and AM that are equal to 0% of the monitor value.
H4-07, H4-08	Terminal FM, AM Signal Sel.	**0: 0 to 10 V** 1: -10 to 10 V
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
L1-02	Motor Overload Protection Time	Sets the motor overload protection time in min. Normally no change is necessary.
Stall Prevention		
L3-01	Stall Prevention Selection during Acceleration	0: Disabled - Motor accelerates at active acceleration rate and may stall with too heavy load or too short accel time. 1: General Purpose - Hold acceleration when current is above L3-02. 2: Intelligent - Acceleration in the shortest possible time.
L3-02	Stall Prev. Level during Accel.	Sets the current level for stall prevention during acceleration.
Torque Limit		
L7-01 to L7-04	Torque Limit	Available in Customer Access Level.
Ambient Temperature		
L8-12	Ambient Temperature	Available in Customer Access Level.
Digital Operator Display Selection		
o1-03	Digital Operator Display Unit Selection	**0: 0.01 Hz** 1: 0.01% 2: r/min
Input Data - Teaching Function		
P1-01	Hydraulic Oil ISO VG Number	0: Manual Setting, 1: ISO VG 22, 2: ISO VG 32, 3: ISO VG 46, 4: ISO VG 68
P1-02*	Temperature at 100 cSt	Manual or preselected by P1-01
P1-03*	Temperature at 25 cSt	Manual or preselected by P1-01
* Only available when setting A1-01 = 2.		
P1-04	Ram Diameter	Elevator data
P1-05	Number of rams	Elevator data
P1-06	Suspension ratio	Elevator data
P1-07	Empty car static pressure	Elevator data

No.	Name	Description
P1-08	Pay load	Elevator data
P1-09	Dynamic pressure increase	Elevator data
P1-11	Flow at 100cSt & at max. pressure	Pump data: refer to the parameter data supplied with the valve package or use the following web page to calculate the values: http://www.blain.de/calc
P1-12	Flow at 100cSt & at max. pressure	
P1-13	Pump Rated Speed	
P1-14	Flow at empty car pressure & at 100cSt	Pump data For valves from manufacturer "Blain Hydraulics GmbH", use calculation tool in the internet: http://www.blain.de/calc or the iPhone App “Blain Calculator”
P1-15	Flow at 1 bar pressure & at 100cSt	
P1-16	Nominal Speed	Elevator data
P1-17	Intermediate Speed	Elevator data
P1-18	Inspection Speed	Elevator data
P1-19	Leveling Speed	Elevator data
Down Travel Control		
P2-01	Down Control Initialization Temperature	Enables down travel control
P2-03	Down Energy Factor	Determines the minimum pump frequency during down travel control. Modes: P2-03 = 0.0 Energy Saving P2-03 > 0.0 Normal
P2-04	Down Ramp Time 1	Time for calculated acceleration ramp 1 during down travel control sequence.
P2-06	Down Ramp Time 2	Time for calculated acceleration ramp 2 during down travel control sequence.
P2-07	Down Deceleration Frequency Gain	Factor for adjusting the deceleration frequency level in down travel control.
P2-08	Down Speed Torque Reference	Torque reference value for Down Travel Control
P2-09	Down Torque Gain Correction Factor	Gain value, applied to the torque gain in case of down travel control.
P2-10	Down Temperature Gain Correction Factor	Gain value, applied to the temperature gain in case of down travel control.
P2-11	Down Deceleration Leakage Gain	Gain value, applied to the pump leakage at deceleration.
P2-12	Down Leveling Control Wait Time	Wait time for leveling travel control.
P2-13	Down Leveling Control Step Frequency	Step frequency for leveling travel control.
P2-14	Down leveling control step time	Step time for leveling travel control.
P2-15	S Curve Characteristic 2 at Decel Start	S curve characteristic 2 at deceleration start.
P2-16	S Curve Characteristic 2 at Decel End	S curve characteristic 2 at deceleration end.
P2-17	S Curve Characteristic 3 at Decel Start	S curve characteristic 3 at deceleration start.
P2-18	S Curve Characteristic 3 at Decel End	S curve characteristic 3 at deceleration end.
P2-19	Down Valve Open Delay	Delay for closing digital output H2-0☐ = 40 after H1-0☐ = 83h is closed.
Output Data - Teaching Functions		
P3-01	Nominal Speed Frequency - Empty	Teaching output. Frequency values.
P3-02	Intermediate Speed Frequency - Empty	
P3-03	Inspection Speed Frequency - Empty	
P3-04	Leveling Speed Frequency - Empty	
P3-07	Pump Leakage Empty	
P3-10	Nominal Speed Torque Reference - Empty [%] at P3-16	Teaching output
P3-11	Intermediate Speed Torque Ref-erence - Empty	
P3-12	Inspection Speed Torque Reference - Empty	
P3-13	Leveling Speed Torque Reference - Empty	
P3-16	Temperature Reference	

No.	Name	Description
Operation Mode		
P4-01	Operation Mode Selection	0: Travel Mode 1: Basic Calculations 2: Empty Car Teach Run 3: Save Teach Results
Limits		
P5-01	Maximum Torque Compensation	Sets the upper limit for the amount of compensation.
P5-02	Minimum Torque Compensation	Sets the lower limit for the amount of compensation.
P5-03	Maximum Temperature Compensation	Sets the upper limit for the amount of compensation.
P5-04	Minimum Temperature Compensation	Sets the lower limit for the amount of compensation.
Dwell Functions		
P6-01	Special Dwell Frequency Offset	Refer to drawings in section Start Up
P6-02	Special Dwell Time 1	Used when Nominal, Intermediate or Inspection Speed is selected
P6-03	Special Dwell Time 2	Used for re-leveling operation
P6-05	Special Dwell at Start Leakage Multiplier for Re-Leveling	Gain applied to leakage at Start-Dwell (used for re-leveling operation)
P6-06	Stop Dwell Leakage Multiplier	Gain applied to leakage at Stop Dwell (used for all speed operations)
P6-07	Stop Dwell Time	Time setting for Dwell at stop
P6-08	Down Stop Dwell Time	Time setting for Dwell at Stop in case of Down Travel
Leveling Control Functions		
P7-01	Leveling Control Wait Time	When Leveling time exceeds this value, Leveling speed is increased as described below.
P7-02	Leveling Control Frequency Step	Step width for increasing frequency by Leveling Control Function
P7-03	Leveling Control Step Time	Wait time for increasing frequency by Leveling Control
P7-05	Leveling Control Upper Limit	Upper limit for Leveling frequency, increased by Leveling Control Function
Special Tuning		
P8-01	Temperature Gain	Higher values increase the compensation amount.
P8-02	Torque Gain	Higher values increase the compensation amount.
P8-03	Torque Reference Compensation Gain	Higher values increase the compensation amount.
P8-04	Leveling Speed Multiplier for Re-Leveling	Factor for adapting leveling speed reference in case of re-leveling operation.
P8-05	Gain for Leveling delay Time	Gain, applied to automatic deceleration delay time.
P8-06	Torque Reference Overload Gain	Additional gain value for adjusting torque reference in overload condition.
P8-07	Overload Current	Sets the current level for triggering overload travel function. Set in percent of the drive's rated current.
P8-08	Overload Detection Time	Sets the time the output current must be above P8-07 for triggering overload function. P8-08 = 0 disables overload function.
P8-11	SEQF Detection Gain	SEQF fault will occur during deceleration to leveling speed when opening RUN command while soft-starter output (U1-16) is higher than [(P3-04 + Temperature compensation value + Torque compensation value) × P8-11] SEQF is detected only if Nominal or Intermediate speed is selected in Up travel.
Induction Motor Auto-Tuning		
T1-01	Auto-Tuning Mode Selection	**0: Rotational Auto-Tuning** 1: Stationary Auto-Tuning 1 2: Stationary Auto-Tuning for Line-to-Line Resistance 4: Stationary Auto-Tuning 2
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.
T1-09	Motor No-Load Current	Sets the no-load current and rated slip for the motor. Automatically calculated after setting the T1-02 and T1-04. If know enter the no-load current and slip as indicated on the motor test report. If not, proceed with shown values.
T1-10	Motor Rated Slip	

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

Monitor	Description
U1-10	Displays the input terminal status. 
U1-11	Displays the output terminal status. 
U1-12	Verifies the drive operation status. 
U1-13	Terminal A1 Input Voltage
U1-14	Terminal A2 Input Voltage
U1-16	Output Speed after Soft Starter
U1-18	oPE Fault Parameter
U1-19	Displays the contents of a MEMOBUS/Modbus error. 
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

Monitor	Description
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
U2-20	Heatsink Temperature 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
Note: The following faults are not recorded in the error log: CPF00, CPF01, CPF02, CPF03, Uv1, and Uv2.	
Fault Trace	
U4-01	Cumulative Operation time
U4-24	Number of travels (lower 4 digits)
U4-25	Number of travels (upper 4 digits)
U4-26	Maximum Current during Acceleration
U4-27	Maximum Current during Deceleration
Application Monitors	
U7-02	Current oil temperature value
U7-03	Car Load Monitor. Shows the car load value (% of rated motor torque) from previous travel.
U7-04	Amount of frequency offset for car load compensation
U7-05	Amount of frequency offset for oil temperature compensation
U7-06	Torque Reference-Temperature Compensation Factor: Internal calculation value.
U7-07	Leveling Time at previous Up or Down travel.
U7-08	Minimum possible value for speed, limited by energy saving mode / overload operation function. Refer to section “Start Up”.

DI/DO Sel.	Description
Digital Input Function Selections	
F	Not used (through mode)
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
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)
58	Safe Disable Status

8 Troubleshooting

◆ General Fault and Alarms

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

An alarm is indicated by a code on the data display and the flashing ALM LED. The drive output is not necessarily switched off.

A fault is indicated by a code on the data display and the ALM LED is on. The drive output is always switched off immediately and the motor coast to stop.

To remove an alarm or reset a fault, trace the cause, remove it and reset the drive by pushing the Reset key on the operator or 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.

Digital Operator	AL	FLT	Possible Cause	Corrective Action
Drive Baseblock (bb)	❍		The software baseblock function is assigned to one of the digital inputs and the input 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 (CPF25)		❍	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.
A/D Conversion Error (CPF35)		❍	An A/D conversion error or control circuit error occurred.	• Cycle power to the drive. • Replace the control board or the entire drive if the problem continues.
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.
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 (input terminal S3 to S8) (EF03) to (EF08)	❍	❍	• An external fault was triggered by an external device via one of the digital inputs (S3 to S8). • 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.
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)	❍		Both Safe Disable inputs are open. The drive output is safely disabled and the motor cannot be started.	• Check why the upper controller's safety device disabled the drive. Remove the cause and restart. • Check the wiring. Terminals HC, H1, and H2 must be linked if the Safe Disable function is not utilized.
Safe Disable Circuit Fault (HbbF)	❍		Drive output is disabled while only one of the Safe Disable inputs is open (normally both input signals H1 and H2 should be open). • One channel is internally broken and does not switch off, even if the external signal is removed. • Only one channel is switched off by the upper controller.	• Check the wiring from the upper controller and make sure that both signals are handled correctly. • If the signals are set correctly and the alarm does not disappear, replace the drive.
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.

Digital Operator	AL	FLT	Possible Cause	Corrective Action
Overcurrent (oC)		❍	• Short-circuit or ground fault on the drive output side. • The drive is damaged. • The load is too heavy. • The acceleration or deceleration ramps are too short. • The overcurrent level has exceeded the value set to L8-27. (PM control modes) • 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. • Check the drive output side short circuit for broken output transistor. • B1 and U/V/W • – (negative) and U/V/W Contact your YASKAWA representative or nearest YASKAWA sales office. • Make sure the brake fully opens. • Check accel/decel settings in C1-☐☐ and C2-☐☐. • Correct the value set to overcurrent detection gain (L8-27). • Check V/f pattern settings in E1-☐☐ (E3-☐☐ for motor 2). • 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 Bus 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.
Input Phase Loss (PF)		❍	• Input voltage drop or phase imbalance. • One of the input 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.
Braking Resistor Fault (rF)		❍	• The proper braking resistor option has not been installed. • Regenerative converter, regenerative unit, or braking unit is being used.	• Select the braking resistor option so that fits to the drives braking transistor specification. • Disable the braking transistor protection selection (set L8-55 to 1).
Internal Braking Transistor Fault (rr)		❍	The internal braking transistor is defective 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.
IGBT Short Circuit (SC)		❍	• The motor has been damaged due to overheating or the motor insulation is damaged. • One of the motor cables has shorted out or there is a grounding problem. • The drive is damaged.	• Check the insulation resistance. • Check the wiring to the motor. Turn the power supply off and then on again to check operation. • Check the drive output side short circuit for broken output transistor. • B1 and U/V/W • – (negative) and U/V/W Contact your YASKAWA representative or nearest YASKAWA sales office.
Safety Circuit Fault (SCF)		❍	The safety circuit is damaged.	If the problem continues, replace the control board or the entire drive. Contact YASKAWA or a YASKAWA representative for instructions on replacing the control board.

Digital Operator	AL	FLT	Possible Cause	Corrective Action
DC Bus Undervoltage (Uv1)	❍	❍	• 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.
Control Power Supply 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.
Soft 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.
SEQF		❍	The Run command has been removed during deceleration from selected speed to leveling speed.	• Correct I/O sequence.
NOLOAD	❍		Frequency value, calculated for compensating influence of car load, is negative.	• Elevator car is empty or incorrect parameters setting. • Check torque reference values P3-10 to P3-13 and torque gain P8-01 or repeat teaching function.
NEGTEMP	❍		Teach function executed while oil temperature is input negatively.	• Check temperature sensor connection. • Check H3 and H4 and repeat teaching function.
TEACH	❍		Status message: Teach run is active.	• Perform empty car teach run or cancel it by setting P4-01 to 0.
SAVE	❍		Status message: Teach run has been finished successfully.	• Set P4-01 to 3 to save teaching results.
WRTP	❍		Status message: Teach run has been finished successfully. The drive re-executed Basic Calculations teaching automatically.	• Set P4-01 to 3 to save teaching results.
LETA	❍		Leveling run after deceleration from selected speed took more than 60s: Drive stops, independent from Run command state.	• Check whole system, especially signals for Run command and speed selector.

◆ Operator Programing 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 H1-08. • The same function is assigned to two multi-function inputs.	• Fix any incorrect settings. • Refer to the Technical Manual for more details.
oPE05	The source of the Up/Down command or speed reference is assigned to option card (b1-01 or b1-02 = 3), but no option card is installed.	• Install the required option card. • Correct the values set to b1-01 and b1-02.
oPE07	H3-02 and H3-10 are set to the same value (this excludes settings 0 and F).	• Fix any incorrect settings. • Refer to the Technical Manual for more details.
oPE08	A function has been set that cannot be used in the given situation (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.
oPE12	The frequency references (P3 parameters) are set incorrectly. One of the condition is not kept: P3-01 > P3-02 > P3-03 > P3-04. Or P7-05 > P3-04. Or (P1-15 + P1-23) > P1-14. Or P1-03 > P1-02. Or P1-11 > P1-12 Or P1-16 > P1-17 > P1-18 > P1-19.	• Check and correct values, entered to P1 parameters and repeat set P4-01 to 1 again.

◆ Auto-Tuning Errors

Digital Operator	Cause	Corrective Action
(Er-01)	Motor Data Error 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)	Alarm • The wiring is faulty. • Drive was in baseblock condition or the Safe Disable Input were open during Auto-Tuning.	Check the wiring.
(Er-03)	STOP Key Pressed The STOP key was pressed and Auto-Tuning was canceled.	Repeat the Auto-Tuning.
(Er-04)	Line-to-Line 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, decrease C1-01 if set in m/s^2. • Check the torque limits L7-01 and L7-02.
(Er-11)	Motor Speed Error The torque reference was too high.	• Lengthen the acceleration ramp. Increase C1-01. • 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.
(Er-13)	Leakage Inductance Error Drive was unable to complete tuning for leakage inductance within 300 s.	• Check all wiring and correct any mistakes. • Double check the motor rated current value that was entered to T1-04 for Auto-Tuning. • Check the motor rated current value written on the motor nameplate and enter the correct value.
(End1)	Excessive V/f Setting • 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.
(End6)	Leakage Inductance Alarm • The leakage inductance value that was calculated is outside the allowable range.	• Check the control mode and repeat Auto-Tuning. • 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 Safe Disable Input Function

This section briefly explains the Safe Disable function and how to use it in an elevator installation. Refer to the Technical Manual or contact YASKAWA for more detailed information.

◆ Safety Standards

The TUV mark indicates compliance with safety standards.

Figure 1 TUV mark

■ Standard Models (CIMR-L□□A□)

Safety Standards	Applicable Harmonized Standards
Functional Safety	IEC/EN 61508 series (SIL2)
	IEC/EN 61800-5-2 (SIL2)
Safety of Machinery	ISO/EN ISO 13849-1/AC: 2009 (PL d (Cat.3))
EMC	IEC/EN 61800-3: 2004

■ Models in Compliance with IEC/EN 61508 SIL3 (CIMR-L□□F□)

Safety Standards	Applicable Harmonized Standards
Functional Safety	IEC/EN 61508 series: 2010 (SIL3)
	IEC/EN 62061: 2005 (SILCL3)
	IEC/EN 61800-5-2: 2007 (SIL3)
Safety of Machinery	ISO/EN ISO 13849-1/AC: 2009 (PL e (Cat.3))
EMC	IEC/EN 61326-3-1: 2008 (EMC-related)

The Safe Disable function is in compliance with these standards.

◆ Specifications

The Safe Disable circuit consists of two independent hardware input channels that can block the output transistors. It provides a stop function in compliance with “Safe Torque Off” as defined in the IEC/EN 61800-5-2. Safe Disable inputs have been designed to meet the requirements of the ISO/EN 13849-1 and IEC/EN 61508.

Inputs / Outputs		• Inputs: 2 Safe Disable inputs H1, H2 Signal ON level: 18 to 28 Vdc Signal OFF level: -4 to 4 Vdc • Output: 1 Safe Disable Monitor output EDM (DM+, DM-)
Response Time from Input Open to Drive Output Stop		CIMR-L□□A□: less than 1 ms CIMR-L□□F□: less than 3 ms
Response Time from Input Open of H1 and H2 Terminals to EDM		CIMR-L□□A□: less than 1 ms CIMR-L□□F□: less than 4 ms
Failure Probability	**Demand Rate Low**	CIMR-L□□A□: PFD = $5.15E^{-5}$ CIMR-L□□F□: PFD = $8.14E^{-6}$
	Demand Rate High or Continuous	CIMR-L□□A□: PFH = $1.2E^{-9}$ CIMR-L□□F□: PFH = $1.96E^{-9}$
Performance Level		The Safe Disable inputs satisfy the following requirements (DC from EDM considered). CIMR-L□□A□: Performance Level (PL) d according to ISO/EN 13849-1 CIMR-L□□F□: Performance Level (PL) e according to ISO/EN 13849-1
HFT (Hardware Fault Tolerance)		N = 1
Classification of Subsystem		Type B

◆ Precautions

DANGER! *Sudden Movement Hazard. Improper use of the Safe Disable function can result in serious injury or even death. Make sure the entire system or machinery uses the Safe Disable function in compliance with safety requirements. When implementing the Safe Disable function into the safety system of a machine, a thorough risk assessment and validation for the whole system must be carried out to ensure it complies with relevant safety norms (e.g., ISO/EN 13849, IEC/EN 61508, IEC/EN 62061).*

DANGER! *Sudden Movement Hazard. When using a PM motor, even if the drive output is shut off by the Safe Disable function, a break down of two output transistors can cause current to flow through the motor winding, resulting in a rotor movement for a maximum angle of 180 degree (electrically). Ensure this condition will not affect the safety of the application when using the Safe Disable function. This is not a concern with induction motors.*

DANGER! *Electrical Shock Hazard. The Safe Disable function can switch off the drive output, but does not cut the drive power supply and cannot electrically isolate the drive output from the input. Always shut off the drive power supply when performing maintenance or installations on the drive input side as well as the drive output side.*

WARNING! *Sudden Movement Hazard. If the motor is subjected to an external force, use a mechanical brake that meets the safety requirements of entire system or machinery to stop the machine connected to the load. The motor will move when an external gravitational force in the vertical axis is applied even if the Safety Disable function is in operation. Failure to comply may result in serious injury or death.*

WARNING! *Sudden Movement Hazard. Connect the Safe Disable inputs to the devices in compliance with safety requirements. Failure to comply will result in death or serious injury.*

WARNING! *Sudden Movement Hazard. When using the Safe Disable inputs, make sure to remove the wire links between terminals H1, H2, and HC that were installed prior to shipment. Failing to do so will keep the Safe Disable circuit from operating properly and can cause injury or even death.*

WARNING! *All safety features (including Safe Disable) should be inspected periodically. If the system is not operating normally, there is a risk of serious personal injury.*

WARNING! *Only a qualified technician with a thorough understanding of the drive, the instruction manual, and safety standards should be permitted to wire, inspect, and maintain the Safe Disable input. Failure to comply may result in serious injury or death.*

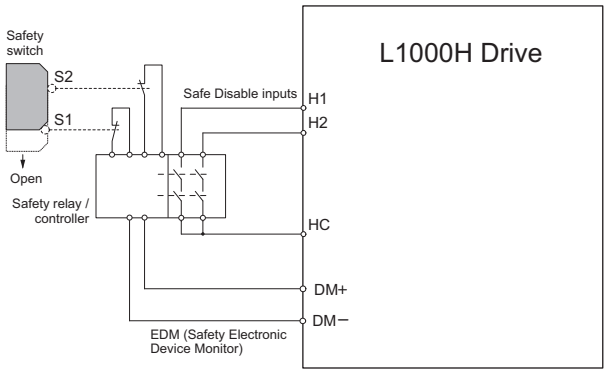
WARNING! *Sudden Movement Hazard. The logic of terminals DM+/DM- is inverted between drive models CIMR-L□□A□ and CIMRL□□F□. Check all wiring to ensure that the sequence is correct after installing the drive and connecting any other devices. Improper wiring connections could result in death or serious injury.*

NOTICE: *From the moment terminal inputs H1 and H2 have opened, it takes up to 1 ms for the drive output of models CIMR-L□□A□ to shut off completely, or up to 3 ms for the drive output of models CIMR-L□□F□ to shut off completely. The sequence set up to trigger terminals H1 and H2 should confirm that both terminals remain open for at least 1 ms in order to properly interrupt the drive output of models CIMR-L□□A□, or for at least 3 ms in order to properly interrupt the drive output of models CIMR-L□□F□. This may result in the Safe Disable Input not activating.*

NOTICE: *The Safe Disable Monitor (output terminals DM+ and DM-) should not be used for any other purpose than to monitor the Safe Disable status or to discover a malfunction in the Safe Disable inputs. The monitor output is not considered a safe output.*

NOTICE: *When utilizing the Safe Disable function, use only the EMC filters recommended in* ***EMC Filter Installation on page 11****.*

NOTICE: *Performance Level d can only be achieved if the EDM output is used like shown in the example below.*



◆ Safe Disable Monitor Output Function and Digital Operator Display

The table below explains the drive output and Safe Disable monitor state depending on the Safe Disable inputs.

Drive Model	Safe Disable Input		Safe Disable Monitor EDM (DM+, DM-)	Safe Disable Monitor (H2-□□ = 58)	Drive Output	Digital Operator Display
	Input 1, H1-HC	Input 2, H2-HC				
CIMR-L□□A□	**Off**	**Off**	Off	On	Safely disabled, “Safe Torque Off”	Hbb (flashes)
	On	**Off**	On	On	Safely disabled, “Safe Torque Off”	HbbF (flashes)
	Off	**On**	On	On	Safely disabled, “Safe Torque Off”	HbbF (flashes)
	On	**On**	On	Off	Baseblock, ready for operation	Normal display
CIMR-L□□F□	**Off**	**Off**	On	On	Safely disabled, “Safe Torque Off”	Hbb (flashes)
	On	**Off**	Off	On	Safely disabled, “Safe Torque Off”	HbbF (flashes)
	Off	**On**	Off	On	Safely disabled, “Safe Torque Off”	HbbF (flashes)
	On	**On**	Off	Off	Baseblock, ready for operation	Normal display

If a fault in the safety circuit of the drive is detected, “SCF” will be displayed in the LCD operator. This indicates damage to the drive. Refer to *General Fault and Alarms on page 38* for details.

■ Validating Safe Disable Function

When you start-up, replace parts or conduct maintenance, you must always perform the following validation test on the safe disable inputs after completing the wiring. (Check results should be maintained as a record of tests performed.)

- When the H1 and H2 signals turn OFF, confirm that “Hbb” is displayed on the LCD operator, and that the motor is not in operation.
- Monitor the ON/OFF status of the H1 and H2 signals and confirm the EDM signal by referring to the table above.

If the ON/OFF status of the signals do not coincide with the display, the following must be considered: an error in the external device, disconnection of the external wiring, short circuit in the external wiring, or a failure in the drive. Find the cause and correct the problem.

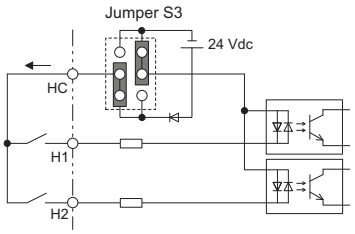
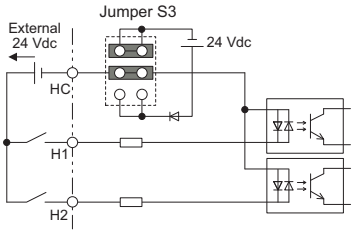
- In normal operation, confirm the EDM signal by referring to the table above.

10 EN81-1 Conform Circuit with one Motor Contactor

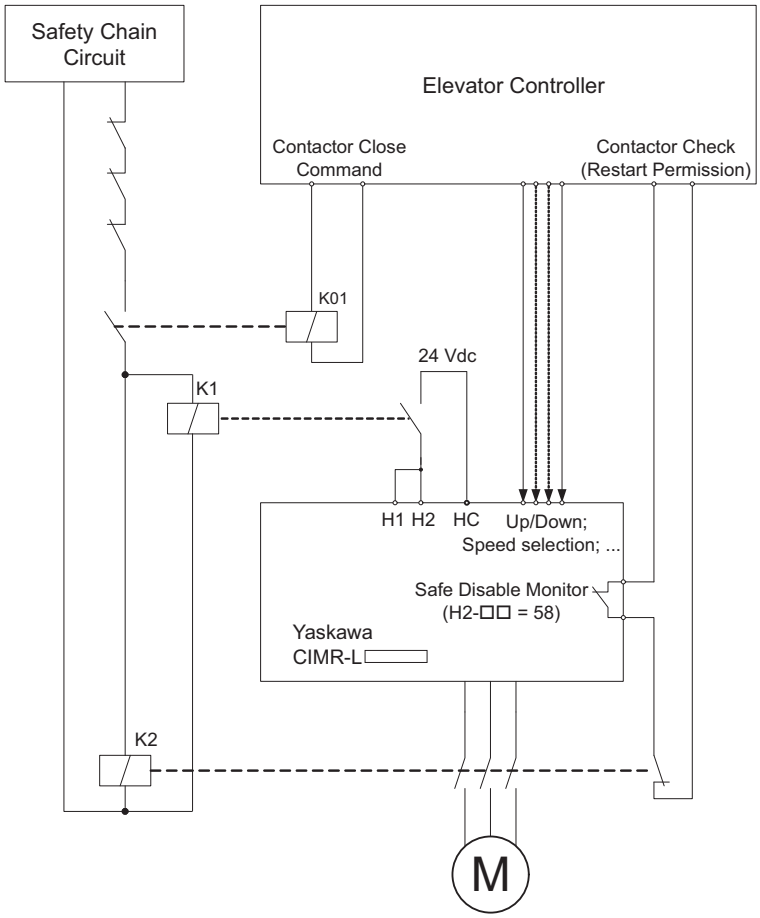
◆ Installation

The safe disable circuit can be utilized to install the drive in an elevator system using only one motor contactor instead of two. In such a system the following guidelines must be followed to comply with EN81-1:1998:

- The circuit must be designed so that the inputs H1 and H2 are opened and the drive output shuts off when the safety chain is interrupted.
- A drive digital output must be programmed as Safe Disable Status (H2-□□ = 58). This feedback signal must be implemented 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.
- All contactors and wiring must be selected and installed in compliance with EN81-1:1998.
- The safe disable inputs H1 and H2 must be used to enable/disable the drive. The input logic must be set to Source Mode, i.e. jumper S3 must be set like shown below.

Drive Internal Power Supply	External 24 Vdc Power Supply
	

The figure below shows a wiring example.



Note: **1.** 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.
2. Terminals H1 and H2 must be closed prior to setting the Up/Down command.

11 UL Standards

◆ Precautions for UL/cUL Standards Compliance

The UL/cUL mark applies to products in the United States and Canada. It indicates that UL has performed product testing and evaluation, and determined that their stringent standards for product safety have been met. For a product to receive UL certification, all components inside that product must also receive UL certification.

This drive is tested in accordance with UL standard UL508C 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 degree 2 (UL standard).

◆ Ambient Temperature

IP20 enclosure: -10 to +50 °C

■ Main Circuit Terminal Wiring

YASKAWA recommends using closed-loop crimp terminals on all drive models. UL/cUL approval requires the use of UL Listed closed-loop crimp terminals when wiring the drive main circuit terminals on models CIMR-L□4□0045 to 4□0150. Use only the tools recommended by the terminal manufacturer for crimping.

The wire gauges listed in the tables below are YASKAWA recommendations. Refer to local codes for proper wire gauge selections.

Note: The mark ⏚ indicates the terminals for protective ground connection. (as defined in IEC/EN 60417-5019)
Grounding impedance; 400 V: 10 Ω or less

Three-Phase 400 V Class

Model CIMR-L□	Terminal	For Europe and China <1>		For Asia <2>		For U.S.A <3>		Screw Size	Tightening Torque N·m (lb.in.)
		Recommended Gauge mm²	Applicable Gauge mm²	Recommended Gauge mm²	Applicable Gauge mm²	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil		
4□0005 4□0006	R/L1, S/L2, T/L3	2.5	2.5 to 6	2	2 to 5.5	14	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2.5	2.5 to 6	2	2 to 5.5	14	14 to 10		
	–, +1, +2	–	2.5 to 6	2	2 to 5.5	–	14 to 10		
	B1, B2	–	2.5 to 6	2	2 to 5.5	–	14 to 10		
	⏚	2.5	2.5 to 6	3.5	2 to 5.5	10	14 to 10		
4□0009	R/L1, S/L2, T/L3	2.5	2.5 to 6	2	2 to 5.5	12	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	2.5	2.5 to 6	2	2 to 5.5	14	14 to 10		
	–, +1, +2	–	2.5 to 6	2	2 to 5.5	–	14 to 10		
	B1, B2	–	2.5 to 6	2	2 to 5.5	–	14 to 10		
	⏚	2.5	2.5 to 6	3.5	2 to 5.5	10	14 to 10		

Model CIMR-L□	Terminal	For Europe and China <1>		For Asia <2>		For U.S.A <3>		Screw Size	Tightening Torque N·m (lb.in.)
		Recommended Gauge mm²	Applicable Gauge mm²	Recommended Gauge mm²	Applicable Gauge mm²	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil		
4□0015	R/L1, S/L2, T/L3	2.5	2.5 to 16	3.5	2 to 14	10	12 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	2.5	2.5 to 16	3.5	2 to 14	10	12 to 6		
	–, +1, +2	–	4 to 16	3.5	2 to 14	–	12 to 6		
	B1, B2	–	4 to 6	2	2 to 5.5	–	12 to 10		
	⏚	2.5	2.5 to 6	3.5	2 to 5.5	10	14 to 10	M5	2.0 to 2.5 (17.7 to 22.1)
4□0018	R/L1, S/L2, T/L3	4	2.5 to 16	5.5	3.5 to 14	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	4	2.5 to 16	5.5	3.5 to 14	10	10 to 6		
	–, +1, +2	–	4 to 16	5.5	3.5 to 14	–	12 to 6		
	B1, B2	–	4 to 6	2	2 to 5.5	–	12 to 10		
	⏚	4	4 to 6	3.5	3.5 to 5.5	10	12 to 10	M5	2.0 to 2.5 (17.7 to 22.1)
4□0024	R/L1, S/L2, T/L3	6	6 to 16	14	5.5 to 14	8	8 to 6	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	6	6 to 16	8	5.5 to 8	8	10 to 6		
	–, +1, +2	–	6 to 16	14	5.5 to 14	–	10 to 6		
	B1, B2	–	6 to 10	3.5	2 to 8	–	10 to 8	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	6	6 to 10	5.5	5.5 to 8	8	10 to 8	M6	5.4 to 6.0 (47.8 to 53.1)
4□0031	R/L1, S/L2, T/L3	10	10 to 16	14	14	6	8 to 6	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	6	6 to 16	14	8 to 14	8	8 to 6		
	–, +1, +2	–	6 to 16	14	14	–	6		
	B1, B2	–	6 to 10	5.5	3.5 to 8	–	10 to 8	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	10	6 to 16	8	5.5 to 14	6	10 to 6	M6	5.4 to 6.0 (47.8 to 53.1)
4□0039	R/L1, S/L2, T/L3	16	16 to 25	14	14 to 22	6	6 to 4	M6	5.4 to 6.0 (47.8 to 53.1)
	U/T1, V/T2, W/T3	16	16 to 25	14	14 to 22	6	6 to 4		
	–, +1, +2	–	16 to 25	14	14 to 22	–	6 to 4		
	B1, B2	–	6 to 10	8	5.5 to 8	–	10 to 8	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	16	10 to 16	8	8 to 14	6	8 to 6	M6	5.4 to 6.0 (47.8 to 53.1)
4□0045 <4>	R/L1, S/L2, T/L3	16	10 to 16	14	14	4	6 to 4	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	16	10 to 16	14	14	4	6 to 4		
	–, +1	–	16 to 35	22	14 to 38	–	6 to 1		
	B1, B2	–	10 to 16	14	8 to 14	–	8 to 4		
	⏚	16	10 to 16	8	8 to 14	6	8 to 6		
4□0060 <4>	R/L1, S/L2, T/L3	16	16 to 25	22	14 to 22	3	4 to 3	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	25	16 to 25	22	14 to 22	3	4 to 3		
	–, +1	–	25 to 35	30	22 to 38	–	4 to 1		
	B1, B2	–	16 to 25	14	14 to 22	–	6 to 3		
	⏚	16	16 to 25	14	14 to 22	6	6		

Model CIMR-L□	Terminal	For Europe and China <1>		For Asia <2>		For U.S.A <3>		Screw Size	Tightening Torque N·m (lb.in.)
		Recommended Gauge mm²	Applicable Gauge mm²	Recommended Gauge mm²	Applicable Gauge mm²	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil		
4□0075 <4>	R/L1, S/L2, T/L3	25	16 to 50	30	22 to 60	2	3 to 1/0	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	25	25 to 50	30	22 to 60	2	3 to 1/0		
	–, +1	–	25 to 50	38	30 to 60	–	3 to 1/0		
	+3	–	16 to 50	22	14 to 60	–	6 to 1/0		
	⏚	16	16 to 25	22	14 to 22	4	6 to 4		
4□0091 <4>	R/L1, S/L2, T/L3	35	25 to 50	38	30 to 60	1/0	2 to 1/0	M8	9 to 11 (79.7 to 97.4)
	U/T1, V/T2, W/T3	35	25 to 50	38	30 to 60	1	2 to 1/0		
	–, +1	–	25 to 50	60	30 to 60	–	3 to 1/0		
	+3	–	25 to 50	30	22 to 60	–	4 to 1/0		
	⏚	16	16 to 25	22	14 to 22	4	6 to 4		
4□0112 <4>	R/L1, S/L2, T/L3	50	35 to 95	60	38 to 100	3/0	1/0 to 4/0	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	50	35 to 95	60	60 to 100	2/0	1/0 to 4/0		
	–, +1	–	50 to 95	100	60 to 100	–	1/0 to 4/0		
	+3	–	25 to 95	50	30 to 100	–	3 to 4/0		
	⏚	25	25	22	22	4	4		
4□0150 <4>	R/L1, S/L2, T/L3	70	50 to 95	80	60 to 100	4/0	3/0 to 4/0	M10	18 to 23 (159 to 204)
	U/T1, V/T2, W/T3	70	70 to 95	80	80 to 100	4/0	3/0 to 4/0		
	–, +1	–	35 to 95	50 × 2P	50 to 100	–	1 to 4/0		
	+3	–	50 to 95	60	50 to 100	–	1/0 to 4/0		
	⏚	35	25 to 35	22	22 to 30	4	4 to 2		

<1> Gauges listed here are for use in Europe and China.
<2> Gauges listed here are for use in Asia except for China.
<3> Gauges listed here are for use in the United States.
<4> Drive models CIMR-L□4□0045 to 4□0150 require the use of closed-loop crimp terminals for UL/cUL compliance. Use only the tools recommended by the terminal manufacturer for crimping.

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 40 °C.

■ Closed-Loop Crimp Terminal Recommendations

YASKAWA recommends using closed-loop crimp terminals on all drive models. UL approval requires the use of crimp terminals when wiring the drive main circuit terminals on models 4□0045 to 4□0150. Use only crimping tools as specified by the crimp terminal manufacturer. YASKAWA recommends crimp terminals made by JST and Tokyo DIP (or equivalent) for the insulation cap.

The table below matches the wire gauges and terminal screw sizes with YASKAWA - recommended crimp terminals, tools, and insulation caps. Refer to the appropriate Wire Gauge and Torque Specifications table for the wire gauge and screw size for your drive model. Place orders with a YASKAWA representatives the YASKAWA sales department.

Wire Gauge	Terminal Screws	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code <1>
			Machine No.	Die Jaw		
14 AWG	M4	R2-4	YA-4	AD-900	TP-003	100-054-028
12 / 10 AWG	M4	R5.5-4	YA-4	AD-900	TP-005	100-054-029
	M5	R5.5-5	YA-4	AD-900	TP-005	100-054-030
8 AWG	M4	8-4	YA-4	AD-901	TP-008	100-054-031
	M5	R8-5	YA-4	AD-901	TP-008	100-054-032

Wire Gauge	Terminal Screws	Crimp Terminal Model Number	Tool		Insulation Cap Model No.	Code <1>
			Machine No.	Die Jaw		
6 AWG	M4	14-NK4	YA-4	AD-902	TP-014	100-054-033
	M5	R14-5	YA-4	AD-902	TP-014	100-054-034
	M6	R14-6	YA-5	AD-952	TP-014	100-051-261
	M8	R14-8	YA-5	AD-952	TP-014	100-054-035
4 AWG	M6	R22-6	YA-5	AD-953	TP-022	100-051-262
	M8	R22-8	YA-5	AD-953	TP-022	100-051-263
3/2/1 AWG	M8	R38-8	YA-5	AD-954	TP-038	100-051-264
	M10	R38-10	YA-5	AD-954	TP-038	100-061-114
1/0 AWG 1/0 AWG × 2P	M8	R60-8	YA-5	AD-955	TP-060	100-051-265
	M10	R60-10	YF-1, YET-300-1	TD-321, TD-311	TP-060	100-051-266
2/0 AWG 2/0 AWG × 2P	M10	70-10	YF-1, YET-300-1	TD-323, TD-312	TP-080	100-054-036
1 AWG × 2P 2 AWG × 2P	M10	38-L10	YF-1, YET-150-1	TD-224, TD-212	TP-038	100-051-556
3/0 AWG	M10	80-10	YF-1, YET-300-1	TD-323, TD-312	TP-080	100-051-267
3/0 AWG × 2P	M10	80-L10	YF-1, YET-150-1	TD-227, TD-214	TP-080	100-051-557
4/0 AWG	M10	R100-10	YF-1, YET-300-1 YF-1, YET-150-1	TD-324, TD-312 TD-228, TD-214	TP-100	100-051-269
4/0 AWG × 2P	M10	100-L10	YF-1, YET-150-1	TD-228, TD-214	TP-100	100-051-559
250 / 300 kcmil	M10	R150-10	YF-1. YET-150-1	TD-229, TD-215	TP-150	100-051-272
250 kcmil × 2P 300 kcmil × 2P	M10	150-L10	YF-1, YET-150-1	TD-229, TD-215	TP-150	100-051-561
350 kcmil	M10	180-10	YF-1, YET-300-1	TD-326, TD-313	TP-200	100-066-687
400 kcmil	M10	200-10	YF-1, YET-300-1	TD-327, TD-314	TP-200	100-051-563
500 kcmil 600 / 650 kcmil 500 kcmil × 2P 600 kcmil × 2P	M10	325-10	YF-1, YET-300-1	TD-328, TD-315	TP-325	100-051-565

<1> Codes refer to a set of three crimp terminals and three insulation caps. Prepare input and output wiring using two sets for each connection.
Example 1: Models with 300 kcmil for both input and output require one set for input terminals and one set for output terminals, so the user should order two sets of [100-051-272].
Example 2: Models with 4/0 AWG × 2P for both input and output require two sets for input terminals and two sets for output terminals, so the user should order four sets of [100-051-560].

Note: Use crimp insulated terminals or insulated shrink tubing for wiring connections. Wires should have a continuous maximum allowable temperature of 75 °C 600 Vac UL-approved vinyl-sheathed insulation.

◆ Installing Input Fuses

NOTICE: *If a fuse is blown or a Residual Current Device (RCD) is tripped, check the wiring and the selection of the peripheral devices to identify the cause. Contact YASKAWA before restarting the drive or the peripheral devices if the cause cannot be identified.*

■ Factory Recommended Branch Circuit Protection

YASKAWA recommends installing one of the following types of branch circuit protection to maintain compliance with UL508C. Semiconductor protective type fuses are preferred. Alternate branch circuit protection devices are also listed below.

Drive Model CIMR-L☐	L1000H in Heavy Duty Mode (C6-01 = 0)				
	AC Drive Input Amps	MCCB Rating Amps <1>	Time Delay Fuse Rating Amps <2>	Non-time Delay Fuse Rating Amps <3>	Bussmann Semiconductor Fuse Rating (Fuse Ampere)
Three-Phase 400 V Class					
4☐0005	4.4	15	7	12	FWH-70B (70)
4☐0006	6	15	10	17.5	FWH-70B (70)
4☐0009	10.4	20	17.5	30	FWH-90B (90)
4☐0015	15	30	25	40	FWH-80B (80)
4☐0018	20	40	35	60	FWH-100B (100)
4☐0024	29	50	50	80	FWH-125B (125)

Drive Model CIMR-L☐	L1000H in Heavy Duty Mode (C6-01 = 0)				
	AC Drive Input Amps	MCCB Rating Amps <1>	Time Delay Fuse Rating Amps <2>	Non-time Delay Fuse Rating Amps <3>	Bussmann Semiconductor Fuse Rating (Fuse Ampere)
4☐0031	39	75	60	110	FWH-200B (200)
4☐0039	47	75	75	125	FWH-250A (250)
4☐0045	43	75	75	125	FWH-250A (250)
4☐0060	58	100	100	150	FWH-250A (250)
4☐0075	71	125	110	200	FWH-250A (250)
4☐0091	86	150	150	250	FWH-250A (250)
4☐0112	105	175	175	300	FWH-350A (350)
4☐0150	142	225	225	400	FWH-400A (400)

<1> Maximum MCCB Rating is 15 A, or 200% of drive input current rating, whichever is larger. MCCB voltage rating must be 600 Vac or greater.
<2> Maximum Time Delay fuse is 175% of drive input current rating. This covers any Class CC, J or T class fuse.
<3> Maximum Non-time Delay fuse is 300% of drive input current rating. This covers any CC, J or T class fuse.

■ Low Voltage Wiring for Control Circuit Terminals

Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national state or local codes for wiring. If external power supply used, it shall be UL Listed Class 2 power source only or equivalent. Refer to NEC Article 725 Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power Limited Circuits for requirements concerning class 1 circuit conductors and class 2 power supplies.

Input / Output	Terminal Signal	Power Supply Specifications
Open Collector Outputs	P1, C1, P2, C2, DM+, DM-	Requires class 2 power supply.
Digital inputs	S1-S8, SN, SC, SP, HC, H1, H2	Use the internal LVLC power supply of the drive. Use class 2 for external power supply.
Analog inputs / outputs	+V, -V, A1, A2, AC, AM, FM	Use the internal LVLC power supply of the drive. Use class 2 for external power supply.

■ Drive Short-Circuit Rating

This drive is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 600 Vac maximum (Up to 480 V for 400 V class drives) when protected by Bussmann Type FWH fuses as specified in *Installing Input Fuses on page 49*.

◆ 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 (IM Motor)

Setting Range: Model Dependent

Default Setting: Model Dependent

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

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

■ L1-01: Motor Overload Protection Selection

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

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

Setting	Description	
0	Disabled	Disabled the internal motor overload protection of the drive.
1	Standard fan-cooled motor (default)	Selects protection characteristics for a standard self cooled motor with limited cooling capabilities when running below the rated speed. The motor overload detection level (oL1) is automatically reduced when running below the motor rated speed.

Setting	Description	
2	Drive duty motor with a speed range of 1:10	Selects protection characteristics for a motor with self-cooling capability within a speed range of 10:1. The motor overload detection level (oL1) is automatically reduced when running below 1/10 of the motor rated speed.
3	Vector motor with a speed range of 1:100	Selects protection characteristics for a motor capable of cooling itself at any speed — including zero speed (externally cooled motor). The motor overload detection level (oL1) is constant over the entire speed range.

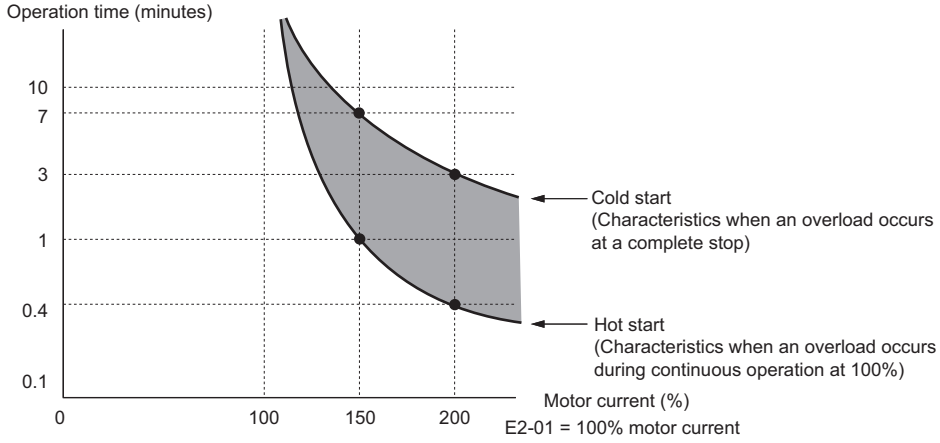
Enable the motor overload protection (L1-01 = 1 to 3, 5) when connecting the drive to a single motor, unless another motor overload preventing device is installed. The drive electronic thermal overload function causes an oL1 fault, which shuts off the output of the drive and prevents additional overheating of the motor. The motor temperature is continually calculated while the drive is powered up.

■ L1-02: Motor Overload Protection Time

Setting Range: 0.1 to 5.0 min

Factory Default: 1.0 min

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



■ L1-03 Motor Overload Alarm Operation Selection

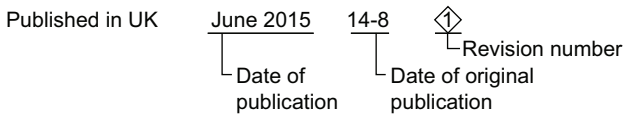
Setting	Description
0	Ramp to Stop
1	Coast to Stop
2	Fast-Stop
3	Alarm Only (default setting)

■ L1-04 Motor Overload Fault Operation Selection

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

Revision History

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



Date of Publication	Rev. No.	Section	Revised Content
June 2015	D	Covers	New YASKAWA Logo & Barcode
		All	Source file formatting changes
March 2015	B	2	Updated dimensions table
		All	Updated descriptions, technical data, parameter list
August 2014	–	–	First edition

YASKAWA AC Drive L1000H

AC Drive for Elevator Applications

Quick Start Guide

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