YASKAWA

YASKAWA AC Drive L1000H

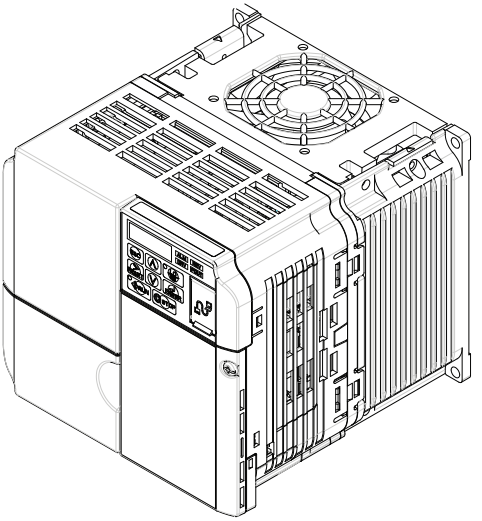
AC Drive for Hydraulic Elevator Applications

Quick Start Guide

Type: CIMR-LC ☐☐☐☐☐☐☐☐-0011

Models: 400 V Class, Three-Phase Input: 3.0 to 15.0 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 C710606 91A

L1000H

Quick Start Guide

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.

◆ General Warnings

⚠ WARNING

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

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

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

Indicates a property damage message.

◆ Safety Warnings

⚠ WARNING

Electrical Shock Hazard

- **Do not attempt to modify or alter the drive in any way not explained in this manual.**
  Failure to comply could result in death or serious injury.
  YASKAWA is not responsible for any modification of the product made by the user. This product must not be modified.

- **Do not touch any terminals before the capacitors have fully discharged.**
  Failure to comply could result in death or serious injury.
  Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 VDC. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.

- **Do not allow unqualified personnel to use equipment.**
  Failure to comply could result in death or serious injury.
  Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of AC drives.

- **Do not remove covers or touch circuit boards while the power is on.**
  Failure to comply could result in death or serious injury.

- **Make sure the protective earthing conductor complies with technical standards and local safety regulations.**
  The leakage current of this drive exceeds 3.5 mA. Therefore, according to IEC 61800-5-1, automatic power supply interruption in case of discontinuity of the protective earthing conductor must be provided or a protective earthing conductor with a cross section of at least 10 mm^2 (Cu) or 16 mm^2 (Al) must be used.

- **Use appropriate equipment for residual current monitoring/detection (RCM/RCD).**
  This drive can cause a residual current with a DC component in the protective earthing conductor. Where a residual current operated protective or monitoring device is used for protection in case of direct or indirect contact, always use an RCM or RCD of type B according to IEC 60755.

- **Always ground the motor-side grounding terminal.**
  Improper equipment grounding could result in death or serious injury by contacting the motor case.

⚠ WARNING

- **Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.**
  Failure to comply could result in death or serious injury.
  Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.
- **Never short the output circuits of the drive.**
  Do not short the output circuits of the drive. Failure to comply could result in death or serious injury.

Sudden Movement Hazard

- **Stay clear of the motor during rotational Auto-Tuning. The motor may start operating suddenly.**
  During automatic starting of equipment, the machine may start moving suddenly, which could result in death or serious injury.
- **System may start unexpectedly upon application of power, resulting in death or serious injury.**
  Clear all personnel from the drive, motor, and machine area before applying power. Secure covers, couplings, shaft keys, and machine loads before applying power to the drive.

Fire Hazard

- **Do not use an improper voltage source.**
  Failure to comply could result in death or serious injury by fire.
  Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.
- **Do not use improper combustible materials.**
  Failure to comply could result in death or serious injury by fire.
  Attach the drive to metal or other noncombustible material.
- **Do not connect AC line power to output terminals U, V, and W.**
- **Make sure that the power supply lines are connected to main circuit input terminals R/L1, S/L2, T/L3 (or R/L1 and S/L2 for single-phase drives).**
  Do not connect the AC power line to the output motor terminals of the drive. Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.
- **Tighten all terminal screws to the specified tightening torque.**
  Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

⚠ CAUTION

Crush Hazard

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

Burn Hazard

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

NOTICE

Equipment Hazard

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

NOTICE

- **Do not modify the drive circuitry.**
  Failure to comply could result in damage to the drive and will void warranty.
  YASKAWA is not responsible for modification of the product made by the user. This product must not be modified.
- **Check all the wiring to ensure that all connections are correct after installing the drive and connecting other devices.**
  Failure to comply could result in damage to the drive.
- **Do not connect unapproved LC or RC interference suppression filters, capacitors, or overvoltage protection devices to the output of the drive.**
  Using unapproved filters could result in damage to the drive or motor equipment.

◆ Precautions for CE Low Voltage Directive Compliance

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

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

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

◆ Precautions for UL/cUL Standards Compliance

This drive is tested in accordance with UL standard UL508C and complies with UL requirements.

2 Mechanical Installation

◆ Upon Receipt

Please perform the following tasks after receiving the drive:

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

◆ Installation Environment

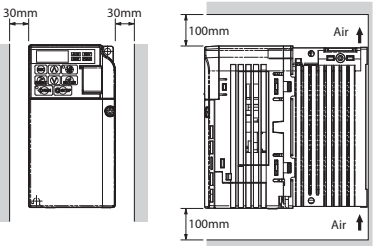
For optimum performance life of the drive, install the drive in an environment that meets the conditions listed below.

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

◆ Installation Orientation and Spacing

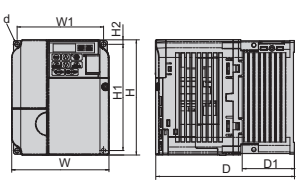
Always install the drive in an upright position. Leave space around the unit for proper cooling as shown in the figure on the right.

Note: Several units can be installed closer together than shown in the figure by using “Side-by-Side” mounting. For details please refer to the Technical Manual.



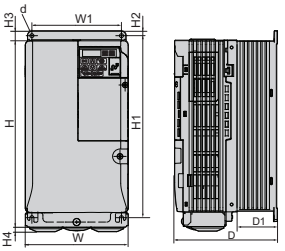
◆ Dimensions

Model CIMR-LC	Dimensions (mm)											Weight (kg)
	Fig.	W	H	D	W1	H1	H2	H3	H4	D1	d	
4V0007B	A	108	128	154	96	118	5	-	-	58	M4	1.7
4V0009B		140	128	143	128	118	5	-	-	65	M4	2.4
4V0015F	B	140	254	140	122	248	6	13	6	55	M5	3.8
4V0018F		140	254	140	122	248	6	13	6.2	55	M5	3.8
4V0024F		180	290	143	160	284	8	15	6	55	M5	5.2
4V0031F		180	290	163	160	284	8	15	6	75	M5	5.5



A

IP20 / Open Chassis

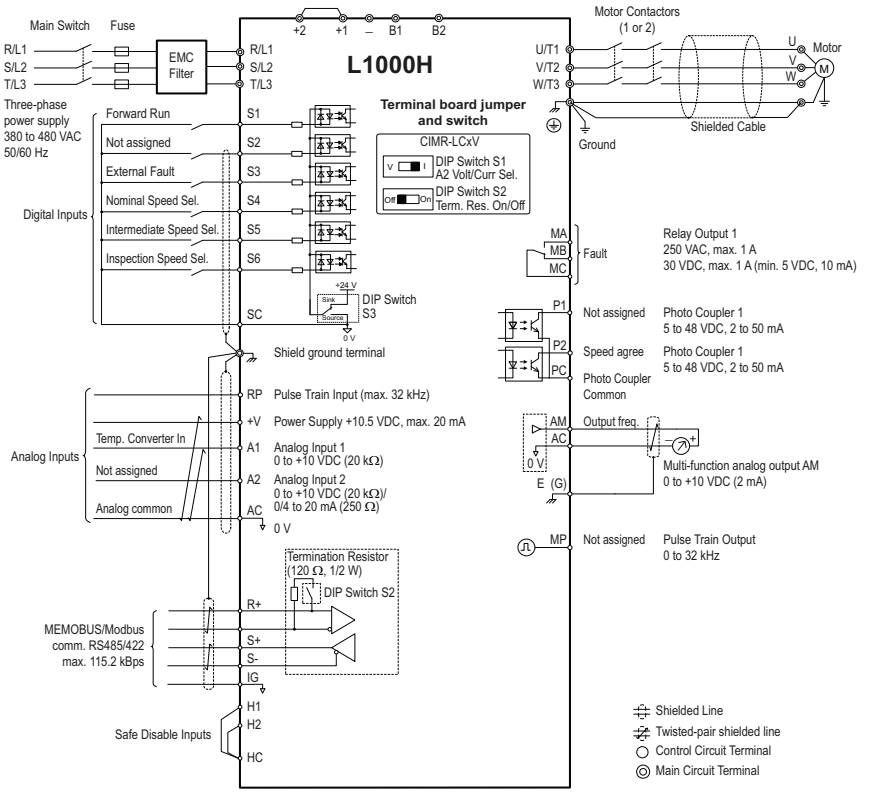


B

IP20 / NEMA Type 1

3 Electrical Installation

The figure below shows the main and control circuit wiring.



◆ Wiring Specification

■ Main Circuit

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

Model CIMR-LC	EMC Filter [Schaffner]	AC Reactors	Recom. Motor cable (mm²)	Main Circuit Terminal Sizes		
				R/L1,S/L2,T/L3, U/T1,V/T2,W/T3, - , +1, +2	B1, B2	⏚
4V0007	FS23639-10-07	B 0903084	2.5	M4	M4	M4
4V0009	FS23639-15-07		2.5	M4	M4	M4
4V0015	FS23639-30-07	B 0903085	6	M4	M4	M5
4V0018			10	M4	M4	M5
4V0024	FS23639-50-07	B 0903086	10	M5	M5	M5
4V0031		B 0903087	16	M5	M5	M6

■ Input Fuse Selection

Branch circuit protection shall be provided by any of the following:

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

Model CIMR-LC	Main Fuse (Manufacturer: Ferraz) 600 VAC, 200 kAIR	Fuse Ampere Rating (A)	Fuse Type (Manufacturer: Bussmann) 500 VAC, 200 kAIR	Fuse Ampere Rating (A)
4V0007	TRS20R	20	FWH-90B	90
4V0009	TRS30R	30	FWH-90B	90
4V0015	A6T50	50	FWH-80B	80
4V0018	A6T60	60	FWH-100B	100
4V0024	A6T70	70	FWH-125B	125
4V0031	A6T80	80	FWH-200B	200

■ Control Circuit

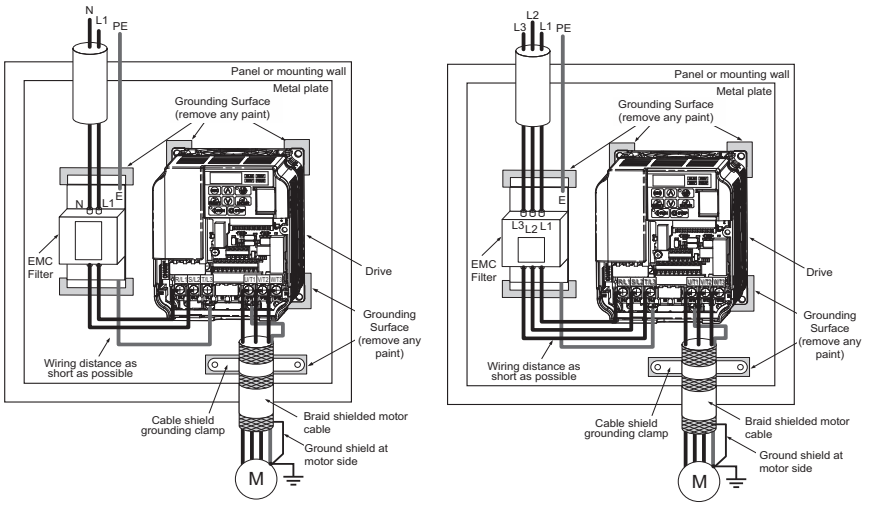
The control terminal board is equipped with screwless terminals. Always use wires within the specification listed below. For safe wiring it is recommended to use solid wires or flexible wires with ferrules. The stripping length respectively ferrule length should be 8 mm.

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

◆ EMC Filter Installation

This drive has been tested in accordance with European standards EN61800-3. 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 list above 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 the drive and motor wiring
4. Remove any paint or dirt from ground connections for minimal ground impedance
5. Install an AC reactor for EN12015 compliance. Refer to Main Circuit on page 12 or contact your supplier for details



EMC Standards Compliant Wiring of Single and Three Phase Units

◆ Main and Control Circuit Wiring

■ Wiring the Main Circuit Input

Consider the following precautions for the main circuit input.

- Use fuses recommended in Main Circuit on page 12 only.
- 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 60755).
- If using a ground fault circuit breaker, make sure that it can detect both DC and high frequency current.
- 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 transistor (over 600 kVA).

■ Wiring the Main Circuit Output

Consider the following precautions for the output circuit wiring.

- Do not connect any other load than a 3 phase motor to the drives output.
- Never connect a power source to the drives output.
- Never short or ground the output terminals.
- Do not use phase correction capacitors.
- If using a contactor between the drive and motor, it should never be operated when the drive is outputting a voltage. Operating while there is voltage output can cause large peak currents, thus tripping the over current detection or damage the drive.

■ Ground Connection

Take the following precautions when grounding the drive:

- The drive must always be connected to ground in accordance to the general technical standards and local regulations.

  As the leakage current produced by the drive exceeds 3.5 mA, according to IEC 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.
- Keep ground wires as short as possible.

- Always make sure the ground impedance is conformed 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.

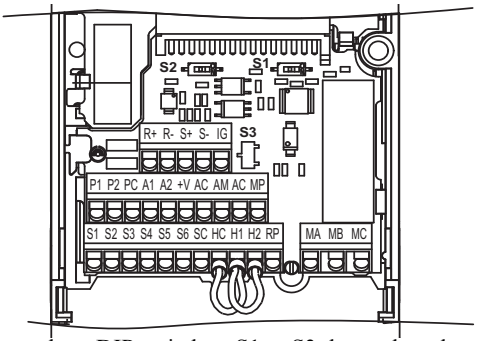
- Separate control circuit wiring from main circuit wiring and other high-power lines.
- Separate wiring for control circuit terminals MA, MB, MC (contact output) from wiring to other control circuit terminals.
- For external control power supply use a UL Listed Class 2 power supply.
- Use twisted-pair 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.
- If flexible wires with ferrules are connected they might fit tightly into the terminals. To disconnect them, grasp the wire end with a pair of pliers, release the terminal using a straight-edge screw driver, 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.

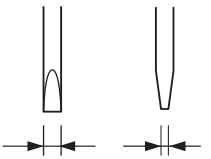
■ Main Circuit Terminals

Terminal	Type	Function
R/L1, S/L2, T/L3	Main circuit power supply input	Connects line power to the drive. Drives with single-phase 200 V input power have no T/L3 terminal.
U/T1, V/T2, W/T3	Drive output	Connects to the motor.
B1, B2	Braking resistor	For connecting a braking resistor or the braking resistor unit option.
+1, +2	DC reactor connection	Linked at shipment. Remove the link to install a DC choke.
+1, –	DC power supply input	For connecting a DC power supply.
⏚ (2 terminals)	Ground Terminal	Ground with 10 Ω or less

■ Control Circuit Terminals

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





Use a straght-edge screwdriver with a blade width of max 2.5 mm and a thickness of max 0.6 mm to release the terminals

There are three DIP switches, S1 to S3, located on the terminal board

SW1	Switches analog input A2 between voltage and current input
SW2	Enables or disables the internal RS422/485 comm. port terminal resistance.
SW3	Used to select sourcing (PNP)/sinking (NPN, default) mode for the digital inputs (PNP requires external 24 VDC power supply)

■ Control Circuit Terminal Functions

Type	No.	Terminal Name (Signal)	Function (Signal Level), Default Setting
Multi-Function Digital Inputs	S1 to S6	Multi-function digital input 1 to 6	Photocoupler inputs, 24 VDC, 8 mA Note: Drive preset to sinking mode (NPN). When using source mode, set DIP switch S3 to "SOURCE" and use an external 24 VDC (±10%) power supply.
	SC	Multi-function input common	Sequence common
Multi-Function Analog/ Pulse Inputs	RP	Not used	
	+V	Analog input power supply	+10.5 V (max allowable current 20 mA)
	A1	Multi-function analog input 1	0 to +10 VDC (20 kΩ) resolution 1/1000 0/4 to 20 mA (250 Ω) resolution: 1/500 (A2 only)
	A2	Multi-function analog input 2	
	AC	Analog input common	0 V
Safe Disable Inputs	HC	Safe Disable Input common	+24 V (max 10 mA allowed)
	H1	Safe Disable Input 1	One or both open: Drive output disabled (time from input open to drive output switch off is less than 1 ms) Both Closed: Normal operation
	H2	Safe Disable Input 2	
Multi-Function Relay Output	MA	N.O. (fault)	Digital relay output 30 VDC, 10 mA to 1 A 250 Vac, 10 mA to 1 A
	MB	N.C. output (fault)	
	MC	Digital output common	
Multi-Function PHC Output	P1	Photocoupler output 1	Digital photocoupler output 48 VDC, 2 to 50 mA
	P2	Photocoupler output 2	
	PC	Photocoupler output common	
Monitor Output	MP	Pulse train output	32 kHz (max)
	AM	Analog monitor output	0 to 10 VDC (2 mA or less), Resolution: 1/1000 (10 bit)
	AC	Monitor common	0 V
MEMO-BUS/ Commu-nication	R+	Communications input (+)	MEMOBUS/Modbus communication.: RS-485 or RS-422, 115.2 kbps (max)
	R–	Communications input (–)	
	S+	Communications output (+)	
	S-	Communications output (–)	

NOTICE! *The terminals HC, H1, H2 are used for the Safe Disable function which cuts the output voltage in less than 1 ms if at least one of the inputs H1 or H2 is opened. It is designed in accordance with the EN954-1, safety category 3 and EN61508, SIL2. It and can be utilized to perform a safe stop as defined by the EN60204-1, stop category 0. Do not remove the wire link between HC, H1, or H2 unless the Safe Disable function is used. Refer to the Technical Manual when using this function.*

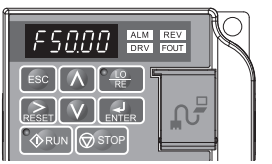
NOTICE! *The wiring length to the terminals HC, H1 and H2 should not exceed 30 m.*

4 Keypad Operation

L1000H drives have a built-in LED display with operation keys. For easier setup the optionally available clear text LCD operator panel JVOP-180 is recommended.

◆ LED Operator and Keys

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

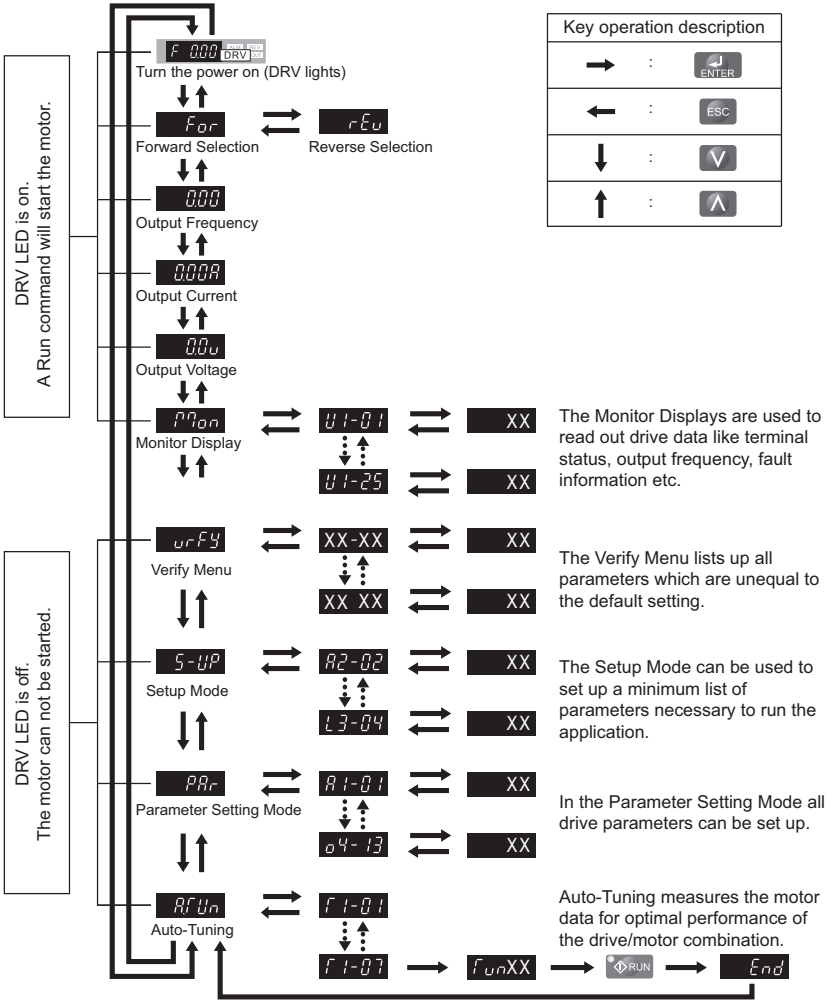


■ Keys and Functions

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

◆ Menu Structure and Modes

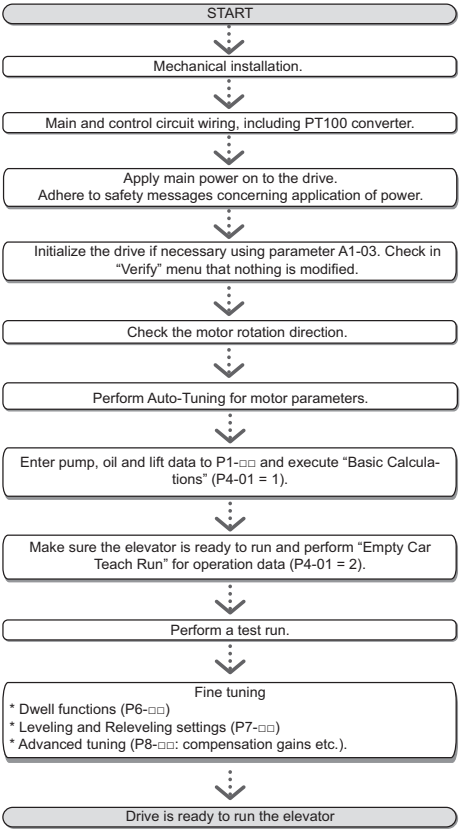
The following illustration explains the operator keypad menu structure.



5 Start Up

◆ Drive Setup Procedure

The illustration below shows the basic setup procedure. Each step is explained more detailed on the following pages.



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

◆ 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 setting 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.

◆ Auto-Tuning (T1-☐☐)

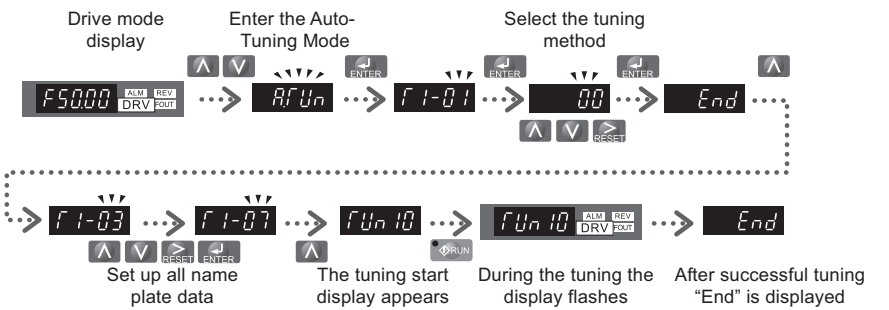
Auto-Tuning automatically sets up the motor data relevant drive parameters. Two different modes are supported.

Tuning Mode	Parameter	Description
Rotational Auto-Tuning	T1-01 = 0	The motor must be able to rotate without load during the tuning process in order to achieve a high accuracy.
Terminal resistance tuning	T1-01 = 2	Perform if the motor cable is long or if the cable has been changed.

⚠ CAUTION

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

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



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

NOTICE! *The Safe Disable inputs must be closed during Auto-Tuning.*

■ Precautions

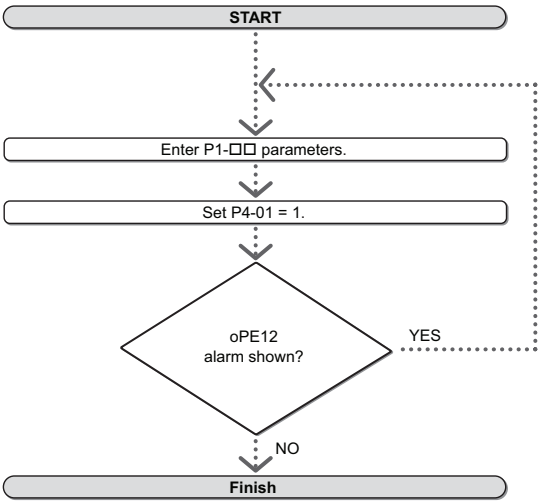
- Always try to perform Rotational Auto-Tuning as it gives more accurate results than Non-Rotational Tuning/Terminal Resistance Tuning. Perform non-rotational tuning if the load can not be disconnected (e. g. pump can not be disconnected from the motor).
- When using the same motor type in multiple installations but normally having it not available without load, perform an Auto-Tuning with an unloaded motor and then set the motor data parameters (E1-□□/E2-□□) manually in the other installations.
- 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).
- 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.

◆ 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 trial 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.

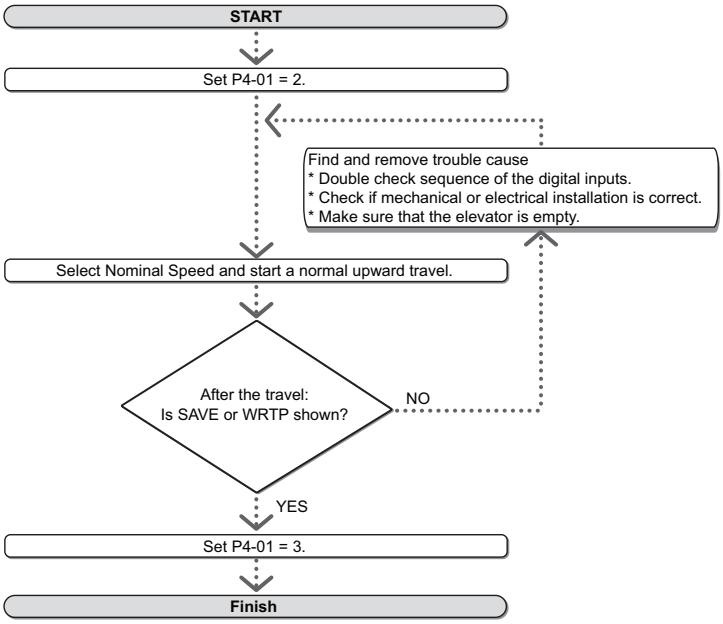
In case that the drive shows oPE12 alarm (ALM LED flashing), check and correct the P1 settings.

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

Teaching Mode	Parameter	Description	Range/Unit
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	0.800 m/s
P1-17	Intermediate Speed	Elevator data	0.600 m/s
P1-18	Inspection Speed	Elevator data	0.300 m/s
P1-19	Leveling Speed	Elevator data	0.060 m/s

■ 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”.
- 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

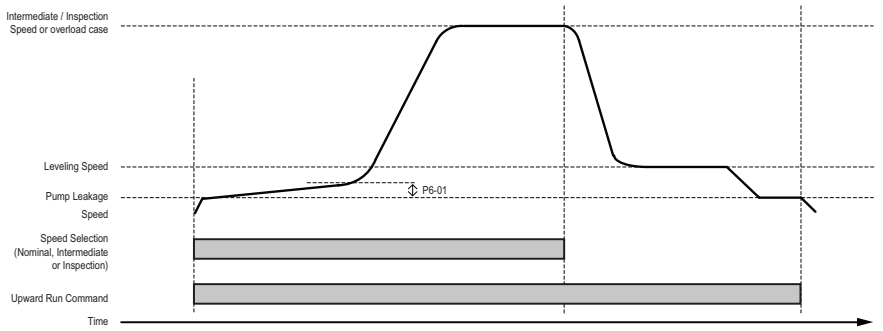
- Empty Car Teach Run must be done just once. Data for Intermediate Speed and Inspection Speed are calculated automatically.
- Don't expect proper travel comfort during teach run. Empty Car Teach Run is just a preparation for calculating required data. Load or oil temperature is not compensated.
- Motor 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.

◆ Drive Sequence and Run Command

■ 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.

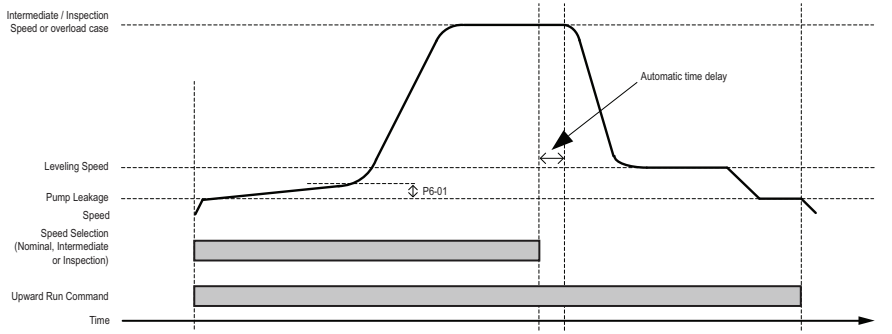


Speeds must be set so that Nominal Speed > Intermediate Speed > Inspection Speed > Leveling Speed. The speeds are set as m/s values in parameters P1-16 to P1-19. Not keeping this rule will cause oPE12 alarm. Correct settings and repeat teaching function.

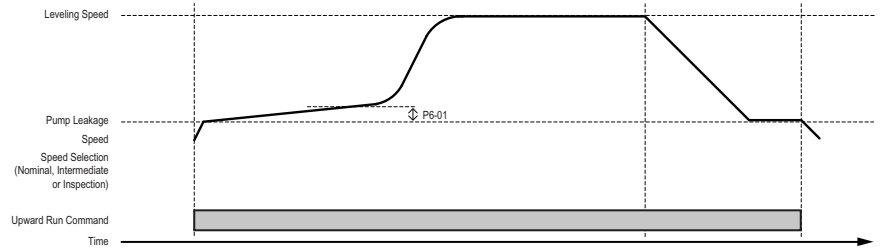
In case that more than one speed selection input is closed, always the lowest speed will be active.

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

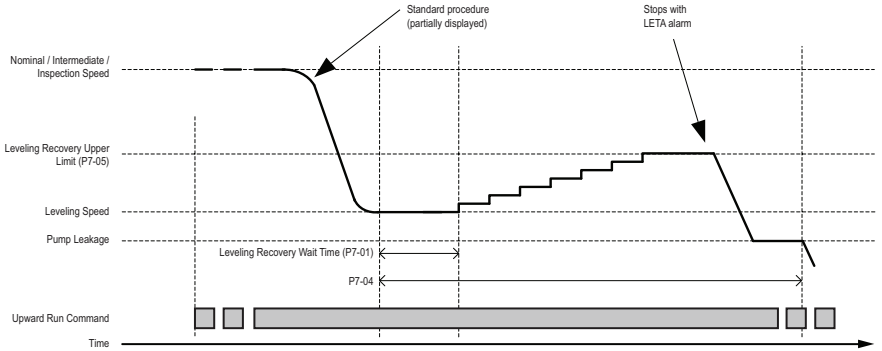
The drive will cancel normal procedure in the following cases:

- The Run command is removed while the speed selecting input is still closed
  > ramp to stop.
- The Run command is removed while the drive is decelerating to Leveling Speed
  > SEQF fault shown and coast to stop (immediate power off).
- One of the digital inputs is set to “External Fault” (refer to parameter in section 6)
  > 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.



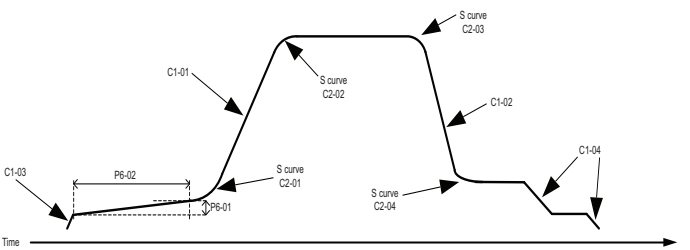
◆ Energy Saving Mode / Overload Operation

In order to lower the energy consumption, the drive can be set to limit the maximum speed in case of high car load. To use this function, lower the value for parameter L3-02 (Stall Prevention Level during Acceleration). In case that the drives output current exceeds the set value, the drive keeps the speed in that moment. Normal speed reference and compensations are skipped except if leveling speed is compensated. By that, the speed can be limited down to a minimum value, which depends on the current setting of the ramp times/S curves. This minimum frequency can be seen in monitor U7-08.

NOTICE! *Energy Saving / Overload Mode can be switched off by setting parameter L3-01 to 0. Don't do so in case that the drive might get overloaded. Overloaded operation when setting L3-01 = 0 may yield incorrect travel.*

◆ 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.

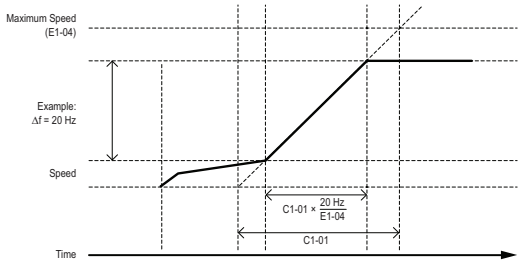


In case that the default ramps do not match, increase or decrease, based on these defaults.

The effective ramp time can be calculated as follows:.

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

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.



◆ Reference and Run Source

The "LO/RE" key on the drive's operator keypad is normally used for switching from remote mode to local mode. Local mode means frequency reference and run signal are input from the operator panel. To use this function (e.g. for testing a motor without pump or a pump without the remaining elevator installation) set O2-01 = 0.

Status	Description
LOCAL	The Run/ Stop command and the frequency reference are entered at the operator keypad.
REMOTE	Hydraulic lift sequence.

◆ Fine Adjustments

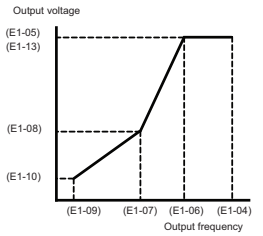
Problem	Possible Cause	Corrective Action
Elevator too slow when heavily loaded.	Torque reference value too high because elevator was not empty at teach run.	• Repeat Empty Car Teach Run. • Increase P8-02 value by 10% at a time.
	Drive is overloaded and settings for Energy Saving/Overload function are 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.

6 Parameter Table

This parameter table shows the most important parameters. Default settings are bold type. Refer to the Technical Manual for a complete list of parameters.

Par.	Name	Description
Initialization Parameters		
A1-01	Access Level Selection	Selects which parameters are accessible via the digital operator. 0:Operation only 1:User Parameters **2:Advanced Access Level**
A1-03	Initialize Parameters	Resets all parameters to default. (returns to 0 after initialization) 0:No Initialize 1110: User Initialize (The user must first set user parameter values and then store them using parameter o2-03) 2220: 2-Wire Initialization 3330: 3-Wire Initialization
Operation Mode Selection		
b1-04	Reverse Operation Selection	**0:Reverse enabled** 1:Reverse prohibited
b1-14	Phase Order Selection	Switches the output phase order. **0:Standard** 1:Switch phase order
DC Injection Braking		
b2-01	DC Injection Braking Start Frequency	Sets the frequency at which DC Injection Braking starts when Ramp to Stop (b1-03 = 0) is selected. 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 Inj. 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 Inj. Braking Time at Stop	Sets the DC Injection Braking time at stop. Disabled when set to 0.00 seconds.
Acceleration/ Deceleration		
C1-01	Accel Time 1	Sets the acceleration time 1 from 0 to the max. output frequency.
C1-02	Decel Time 1	Sets the deceleration time 1 from the max. output frequency to 0.

Par.	Name	Description
C1-03 to C1-08	Accel/Decel Times 2 to 4	Set the accel/decel times 2 to 4 (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 if the speed is lower than the frequency reference. • Decrease if the speed is higher than the frequency reference.
C3-02	Slip Compensation Delay Time	• Decrease the setting when the slip compensation is too slow. • Increase the setting when the speed is not stable.
Torque Compensation		
C4-01	Torque Compensation Gain	• Increase this setting when the torque response is slow. • Decrease this setting when speed/ torque oscillations occur.

Par.	Name	Description
C4-02	Torque Compensation Delay Time	• Increase this setting when speed / torque oscillations occur. • Decrease the setting when the torque response is too slow.
Duty Mode and Carrier Frequency		
C6-02	Carrier Frequency Selection	1:2.0 kHz 2:5.0 kHz 3:8.0 kHz 4:10.0 kHz 5:12.5 kHz 6:15.0 kHz 7 to A: Swing PWM1 to 4 F: User defined
V/f Pattern		
E1-01	Input Voltage Setting	Input Voltage
E1-04	Max. Output Freq.	For a linear V/f characteristics, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Ensure that the four frequencies are set according to these rules or OPE10 fault will occur: E1-04 ≥ E1-06 ≥ E1-07 ≥ E1-09 
E1-05	Max. Output Voltage	
E1-06	Base Frequency	
E1-07	Middle Output Freq.	
E1-08	Mid. Output Voltage	
E1-09	Min. Output Freq.	
E1-10	Min. Output Voltage	
E1-13	Base Voltage	
Motor Data		
E2-01	Motor Rated Current	Automatically set during Auto-Tuning.
E2-02	Motor Rated Slip	Motor rated slip in hertz (Hz). Automatically set by Rotational Auto-Tuning.
E2-03	Motor No-Load Current	Magnetizing current in Ampere. Automatically set by Rotational Auto-Tuning.
E2-04	Motor Poles	Number of motor poles. Automatically set by Auto-Tuning.
E2-05	Motor Line-to-Line Resistance	Sets the phase-to-phase motor resistance in ohms. Automatically set by Auto-Tuning.
E2-06	Motor Leakage Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage. Automatically set by Auto-Tuning.
Digital Input Settings		
H1-01 to H1-06	DI S1 to S6 Function Selection	Selects the function of terminals S1 to S6.
Major functions are listed at the end of the table.		
Digital Output Settings		
H2-01	DO MA/MB Function	Set the function for the relay output MA-MB-MC.
H2-02	DO P1 Function	Sets the function for the photocoupler output P1.
H2-03	DO P2 Function	Sets the function for the photocoupler output P2.
Major functions are listed at the end of the table.		
Analog Input Setting		
H3-01	A1 Signal Level Sel.	**0:0 to +10 V (neg. input is zeroed)** 1:0 to +10 V (bipolar input)
H3-02	A1 Function Sel.	Assign a function to terminal A1.
H3-03	A1 Gain	Sets the input value in % at 10 V analog input.
H3-04	A1 Bias	Sets the input value in % at 0 V analog input.
H3-09	A2 Signal Level Selection	0:0 to +10 V (neg. input is zeroed) 1:0 to +10 V (bipolar input) **2:4 to 20 mA (9 bit input)** 3:0 to 20 mA
H3-10	A2 Function Sel.	Assign a function to terminal A2.
H3-11	A2 Gain	Sets the input value in % at 10 V/20 mA analog input.

Par.	Name	Description
H3-12	A2 Bias	Sets the input value in % at 0 V/0 mA/4 mA analog input.
Analog Input Setting		
H4-01	AM Monitor Selection	Enter value equal to U1-□□ monitor values. Example: Enter "103" for U1-03.
H4-02	AM Gain	Sets terminal AM output voltage equal to 100% monitor value.
H4-02	AM Bias	Sets terminal AM output voltage equal to 0% monitor value.
Pulse Output Setting		
H6-06	MP Monitor Sel.	Enter value equal to U□-□□ monitor values. Example: Enter "102" for U1-02.
H6-07	MP Monitor Scaling	Sets the number of output pulses when the monitor is 100% (in Hz).
Motor Overheat Protection		
L1-01	Motor Overload Prot. Sel.	Sets the motor overload protection. 0:Disabled **1:Standard fan cooled motor** 2:Standard blower cooled motor 3:Vector motor
L1-02	Motor Overload Prot. 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.
L3-04	Stall Prev. Selection during Decel.	0:Disabled - Deceleration as set. OV might occur. **1:General Purpose - Deceleration is hold if DC bus voltage rises high.**

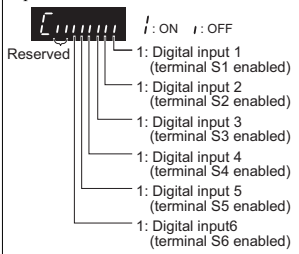
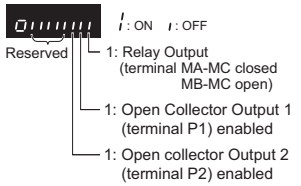
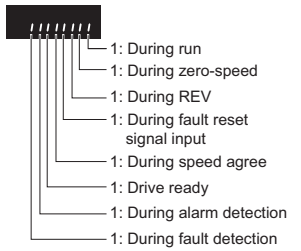
Par.	Name	Description
L3-05	Stall Prev. Selection during Run	0:Disabled - Motor stall or overload might occur. **1:Decel Time 1 - Reduce speed using C1-02.**
L3-06	Stall Prev. Level during Run	Sets the current level at which stall prevention during run starts to operate.
Input Data - Teaching Function		
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 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 to1000 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
P1-12	Flow at 100cSt & at max. pressure	
P1-13	Pump Rated Speed	

Par.	Name	Description
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 0.000 to 1.200 m/s
P1-17	Intermediate Speed	Elevator data 0.000 to 0.600 m/s
P1-18	Inspection Speed	Elevator data 0.000 to 0.400 m/s
P1-19	Leveling Speed	Elevator data 0.000 to 0.150 m/s
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	

Par.	Name	Description
P3-10	Nominal Speed Torque Reference - Empty [%] at P3-16	Teaching output
P3-11	Intermediate Speed Torque Reference - Empty	
P3-12	Inspection Speed Torque Reference - Empty	
P3-13	Leveling Speed Torque Reference - Empty	
P3-16	Temperature Reference	
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.

Par.	Name	Description
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
Leveling Control Functions		
P7-01	Leveling Recovery Wait Time	When Leveling time exceeds this value, Leveling speed is increased as described below.
P7-02	Leveling Recovery Frequency Step	Step width for increasing frequency by Leveling Control Function
P7-03	Leveling Recovery Step Time	Wait time for increasing frequency by Leveling Control
P7-05	Leveling Recovery Upper Limit	Upper limit for Leveling frequency, increased by Leveling Recovery 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.
P8-05	Gain for Leveling delay Time	Gain, applied to automatic deceleration delay time.
Auto-Tuning		
T1-01	Auto-Tuning Mode Selection	0:Rotational Auto-Tuning 2: Terminal resistance only 3: Rotational Auto-Tuning for Energy Saving
T1-02	Rated Power	Sets the motor rated power (kW).
T1-03	Rated Voltage	Sets the motor rated voltage (V).
T1-04	Rated Current	Sets the motor rated current (A).
T1-05	Base Frequency	Sets the motor base frequency (Hz).
T1-06	Motor Poles	Sets the number of motor poles.
T1-07	Base Speed	Sets the motor base speed (RPM).
T1-11	Motor Iron Loss	Iron loss for determining the Energy Saving coefficient. If unknown leave it on default.

Monitor	Description
U1-01	Frequency Reference (Hz)
U1-02	Output Frequency (Hz)
U1-03	Output Current (A)
U1-05	Motor Speed (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	Input Terminal Status 
U1-11	Output Terminal Status 
U1-12	Drive Status 
U1-13	Terminal A1 input level
U1-14	Terminal A2 input level
U1-16	Soft Starter Output (frequency after accel/decel ramps)
U1-18	OPE Fault Parameter
U1-24	Pulse Input frequency

Monitor	Description
Fault Trace	
U2-01	Current Fault
U2-02	Previous Fault
U2-03	Frequency Reference at Previous Fault
U2-04	Output Frequency at Previous Fault
U2-05	Output Current at Previous Fault
U2-06	Motor Speed at Previous Fault
U2-07	Output Voltage at Previous Fault
U2-08	DC Bus Voltage at Previous Fault
U2-09	Output Power at Previous Fault
U2-10	Torque Reference at Previous Fault
U2-11	Input Terminal Status at Previous Fault
U2-12	Output Terminal Status at Previous Fault
U2-13	Drive Operation Status at Previous Fault
U2-14	Cumulative Operation Time at Previous Fault
U2-15	Soft-Starter Speed Reference at Previous Fault
U2-16	Motor q-Axis Current at Previous Fault
U2-17	Motor d-Axis Current at Previous Fault
Fault History	
U3-01 to U3-04	Lists the most recent fault that occurred through the fourth most recent fault.
U3-05 to U3-08	Accumulated operation time at the most recent fault through the fourth most recent fault.
U3-09 to U3-14	Lists the fifth most recent fault that occurred through the tenth most recent fault.
U3-15 to U3-20	Accumulated operation time at fifth most recent fault through the tenth most recent fault.
* The following faults are not recorded in the error log: CPF00, 01, 02, 03, UV1, and UV2.	
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

Monitor	Description
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 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 (Set when a terminal is not used)
14	Fault reset (Reset when turned ON)
20 to 2F	External fault; Input mode: N.O. contact / N.C. contact, Detection mode: Normal/during operation
80	Nominal speed selection
81	Intermediate speed selection
82	Inspection speed selection
Digital Output Function Selections	
0	During Run (ON: run command is ON or voltage is being output)
1	Zero Speed
2	Speed Agree
6	Drive Ready
E	Fault
F	Not used
10	Minor fault (Alarm) (ON: Alarm displayed)

7 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.

This lists up the most important alarms and faults only. Please refer to the Technical Manual for a complete list.

LED Display	AL	FLT	Cause	Corrective Action
Base Block bb	❍		The software base block function is assigned to one of the digital inputs and the input is off. The drive does not accept Run commands.	• Check the digital inputs function selection. • Check the upper controller sequence.
Control Fault CF		❍	The torque limit was reached during deceleration for longer than 3 sec. when in Open Loop Vector control • The load inertia is too big. • The torque limit is too low. • The motor parameters are wrong.	• Check the load. • Set the torque limit to the most appropriate setting (L7-01 through L7-04). • Check the motor parameters.
Control Circuit Fault CPF02 to CPF24		❍	There is a problem in the drive's control circuit.	• Cycle the drive power supply. • Initialize the drive. • Replace the drive if the fault occurs again.
Control Circuit Fault CPF25		❍	There is no terminal board connected to the control board.	• Check if the terminal board is installed properly. • Uninstall and Reapply the terminal board. • Change the drive.
Cannot Reset Cr5r	❍		Fault reset was input when a Run command was active.	Turn off the Run command and reset the drive.
Option External Fault EF	❍	❍	An external fault was tripped by the upper controller via an option card.	• Remove the fault cause, reset the fault and restart the drive. • Check the upper controller program.
External Fault EF	❍		A forward and reverse command were input simultaneously for longer than 500 ms. This alarm stops a running motor.	• Check the sequence and make sure that the forward and reverse input are not set at the same time.

LED Display	AL	FLT	Cause	Corrective Action
External Faults EF1 to EF6	❍	❍	• An external fault was triggered by an external device via one of the digital inputs S1 to S6. • The digital inputs are set up 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 can not be started.	• Check why the upper controller's safety device disabled the drive. Remove the cause and restart. • Check the wiring. • If the Safe Disable function is not utilized for EN60204-1, stop cat. 0 or for disabling the drive, the terminals HC, H1, H2 must be linked.
Safe Disable 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 set correctly by the controller. • If the signals are set correctly and the alarm does not disappear, replace the drive.
Output Phase Loss PF		❍	Output cable is disconnected or the motor winding is damaged. Loose wires at the drive output. Motor is too small (less than 5% of drive current).	• Check the motor wiring. • Make sure all terminal screws in the drive and motor are properly tightened. • Check the motor and drive capacity.
Overcurrent oC		❍	Short circuit or ground fault on the drive output side The load is too heavy. The accel./decel. times are too short. Wrong motor data or V/f pattern settings. A magnetic contactor was switched at the output.	• 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 parameter settings. • 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. The motor is operated at low speed with heavy load. Cycle times of accel./ decel. are too short. Incorrect motor rated current has been set.	• Reduce the motor load. • Use a motor with external cooling and set the correct motor in parameter L1-01 • Check the sequence. • Check the rated current setting.

LED Display	AL	FLT	Cause	Corrective Action
Drive Overload oL2		❍	The load is too heavy. The drive capacity is too small. Too much torque at low speed.	• Check the load. • Make sure that the drive is big enough to handle the load. • The overload capability is reduced at low speeds. Reduce the load or increase the drive size.
DC Overvoltage ov	❍	❍	DC bus voltage rose too high. The deceleration time is too short. Stall prevention is disabled. Braking chopper / resistor broken. Unstable motor control in OLV. Too high input voltage.	• Increase the deceleration time. • Enable stall prevention by parameter L3-04. • Make sure the braking resistor and braking chopper are working correctly. • Check motor parameter settings and adjust torque and slip compensation, AFR and hunting prevention as needed. • Make sure that the power supply voltage meets the drives specifications.
Input Phase Loss LF		❍	Input voltage drop or phase imbalance. One of the input phase is lost. Loose wires at the drive input.	• Check the power supply. • Make sure that all cables are properly fixed to the correct terminals.
Braking Transistor Fault rr		❍	The internal braking transistor is broken.	• Cycle the power supply. • Replace the drive if the fault reoccurs.
DC 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 is strong enough.
Controller Undervoltage Uv2		❍	The drives controller power supply voltage is too low.	• Cycle power to the drive. Check if the fault reoccurs. • Replace the drive if the fault continues to occur.
DC Charge Circuit Fault Uv3		❍	The charge circuit for the DC bus is broken.	• Cycle power to the drive. Check if the fault reoccurs. • Replace the drive if the fault reoccurs.
SEQF SEQF		❍	The Run command has been removed during deceleration from selected speed to leveling speed.	• Correct I/O sequence.
NEGTC nEGTC	❍		Frequency value, calculated for compensating influence of car load, is negative.	• Incorrect parameters setting. • Check torque reference values P3-10 to P3-13 and torque gain P8-01 or repeat teaching function.
TEACH rEACH	❍		Status message: Teach run is active.	• Perform empty car teach run or cancel it by setting P4-01 to 0.

LED Display	AL	FLT	Cause	Corrective Action
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 (OPE fault constant). This monitor will display the parameter that is causing the OPE error.

LED Operator Display	Cause	Corrective Action
oPE01	Drive capacity and value set to o2-04 do not match.	Correct the value set to o2-04.
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 H1-01 through to H1-06. • The same function is assigned to two inputs. (this excludes “External fault” and “Not used”) • Input functions which require the setting of other input functions were set alone. • Input functions that are not allowed to be used simultaneously have been set.	• Fix any incorrect settings. • Refer to the Technical Manual for more details.
oPE05	• The run command source (b1-02) or frequency reference source (b1-01) is set to 3 but no option board is installed. • The frequency reference source is set to pulse input but H6-01 is not 0.	• Install the required option board. • Correct the values set to b1-01 and b1-02.
oPE07	Settings to multi-function analog inputs H3-02 and H3-10 and PID functions conflict. • H3-02 and H3-10 are set to the same value. (this excludes settings “0” and “F”) • PID functions have been assigned to both analog inputs and the pulse input at the same time.	• Fix any incorrect setting. • Refer to the Technical Manual for more details.
oPE08	A function has been set that cannot be used in the control mode selected.(might appear after control mode change)	• 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. Condition: P3-01 > P3-02 > P3-03 > P3-04 is not kept. Or Leveling Speed setting is slower than Pump Leakage setting.	• Check and correct values, entered to P1 parameters and repeat set P4-01 to 1 again.

◆ Auto-Tuning Errors

LED Operator Display	Cause	Corrective Action
Er-01 Er-01	Motor data fault The input motor data are not valid. (e.g. the base frequency and base speed do not fit).	Re-enter the data and repeat Auto-Tuning.
Er-02 Er-02	Minor Fault • The wiring is faulty. • The load is too heavy.	• Check the wiring. • Check the load. Always perform Auto-Tuning with the load uncoupled from the motor.
Er-03 Er-03	The STOP button was pressed and Auto-Tuning was canceled.	Repeat the Auto-Tuning.
Er-04 Er-04	Resistance fault • Wrong input data. • Auto tuning exceeded the given time frame. • Calculated values out of range.	• Check the input data. • Check the wiring. • Re-enter the data and repeat the Auto-Tuning.
Er-05 Er-05	No-Load Current Error • Incorrect data was entered. • Auto tuning took too long. • Calculated values out of range.	
Er-08 Er-08	Rated Slip Error • Wrong data input. • Auto tuning exceeded the given time frame. • Calculated values out of range.	
Er-09 Er-09	Acceleration error The motor did not accelerate for the specified acceleration time.	• Increase the acceleration time C1-01. • Check the torque limits L7-01 and L7-02.
Er-11 Er-11	Motor speed fault. The torque reference was too high.	• Increase the acceleration time (C1-01). • If possible, disconnect the load.
Er-12 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, that the drive rating fits to the motor. • Check the load. (Auto-Tuning should have been performed without the load connected.) • Replace the drive.
End1 End1	Rated current alarm • The torque reference exceeded 20% during Auto-Tuning. • The calculated no-load current is above 80% of the motor rated current.	• Check the V/f pattern setting. • Perform Auto-Tuning without the load connected. • Check the input data and repeat Auto-Tuning.
End2 End2	Motor iron-core saturation alarm • 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 End3	Rated current alarm	Check the input data and repeat tuning.

8 Instructions for UL and cUL

◆ UL Standards Compliance

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

■ Installation Area

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

■ Main Circuit Terminal Wiring

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

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

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

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

<1> Use the specified crimp terminals (Model No.:14-NK4) when using LC4V0018 with the wire 14 mm^2(AWG:6).

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

■ Input Fuse Selection

Use the fuses listed up in the table on page 12 when wiring the main circuit.

■ Low Voltage Wiring for Control Circuit Terminals

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

Control Circuit Terminal Power Supply

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

■ Drive Short-Circuit Rating

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

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

◆ Drive Motor Overload Protection

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

■ E2-01 Motor Rated Current

Setting Range: Model Dependent
Factory Default: Model Dependent

The motor rated current parameter (E2-01) sets the current value that is used as a base for motor protection. The motor protection parameter L1-01 is set as factory default. Set E2-01 to the full load amps (FLA) stamped on the nameplate of the motor.

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

■ L1-01 Motor Overload Protection Selection

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

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

Overload Protection Settings

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

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

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

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

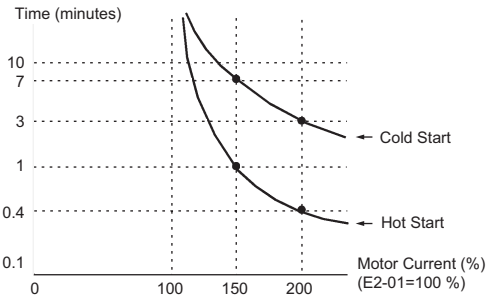
Setting L1-01 = 2 selects a motor capable of cooling itself over a 10:1 speed range when running at 100% load. The OL1 function derates the motor when it is running at 1/10 or less of its rated speed.

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

■ L1-02 Motor Overload Protection Time

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

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



Motor Overload Protection Time

■ L1-03 Motor Overload Alarm Operation Selection

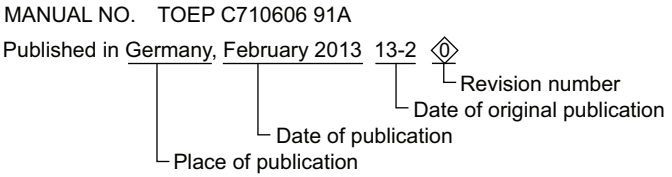
Setting	Description
0	Ramp to Stop
1	Coast to Stop
2	Fast-Stop
3	Alarm Only (factory default)

■ L1-04 Motor Overload Fault Operation Selection

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

Revision History

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



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YASKAWA AC Drive L1000H

AC Drive for Hydraulic Elevator Application

Quick Start Guide

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