YASKAWA

YASKAWA AC Drive L1000A

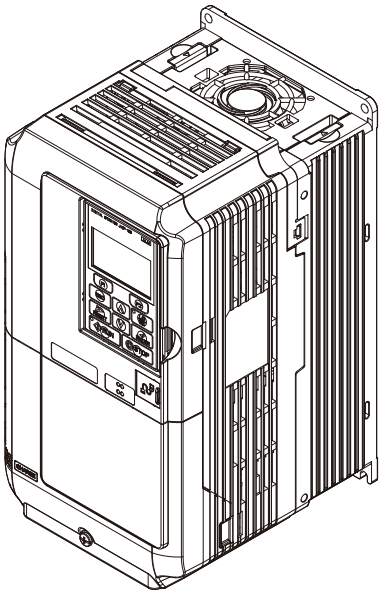
AC Drive for Elevator Applications

Quick Start Guide

Type: CIMR-LC□A □□□□□□□□

Models: 200 V Class: 4.0 to 45 kW
400 V Class: 4.0 to 75 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 33A

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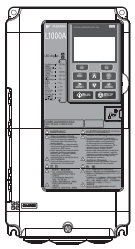
1 Safety Instructions and General Warnings

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

◆ Applicable Documentation

The following manuals are available for L1000A series drives:



L1000A Series AC Drive Technical Manual
This manual gives detailed instructions on installation, wiring, operation procedures, functions, troubleshooting, maintenance, and inspections to perform before operation. Contact your sales representative for ordering this book or download it from www.yaskawa.eu.com.
L1000A 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. This guide provides basic programming and simple setup and adjustment.

◆ 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

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.

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.

When using a PM motor, make sure to block the rotor before performing work on the motor or drive output circuit.

A PM motor generates electrical power if rotated. If connected to the drive, the drive main circuit will be charged even if the power supply is off. Touching live parts in the drive or output circuit may 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.

⚠ WARNING

Do not use improper combustible materials.

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

Attach the drive to metal or other noncombustible material.

Do not connect AC line power to output terminals U, V, and W.

Make sure that the power supply lines are connected to main circuit input terminals R/L1, S/L2, T/L3.

Do not connect the AC power line to the output motor terminals of the drive. Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.

Tighten all terminal screws to the specified tightening torque.

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

⚠ CAUTION

Crush Hazard

Do not carry the drive by the front cover.

Failure to comply may result in minor or moderate injury from the main body of the drive falling.

Burn Hazard

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

NOTICE

Equipment Hazard

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

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

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

Improper equipment sequencing could result in damage to the drive.

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

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

Do not operate damaged equipment.

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

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

Install adequate branch circuit short circuit protection per applicable codes.

Failure to comply could result in damage to the drive.

The drive is suitable for circuits capable of delivering not more than 100,000 RMS symmetrical Amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400V Class).

Do not use unshielded cable for control wiring.

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

Do not allow unqualified personnel to use the product.

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

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

NOTICE

Do not modify the drive circuitry.

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

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

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

Failure to comply could result in damage to the drive.

Do not connect unapproved LC or RC interference suppression filters, capacitors, or overvoltage protection devices to the output of the drive.

Using unapproved filters could result in damage to the drive or motor equipment.

Check the motor rotation and elevator movement direction prior to starting up the drive.

The drive puts out voltage in phase sequence U-V-W with an Up command. Make sure the elevator moves up if the motor is supplied with this phase sequence.

Always remove the ropes when performing Rotational Auto-Tuning.

During Rotational Auto-Tuning the drive turns the motor for a certain time. Not removing the ropes might result in damage to the equipment.

When using a PM motor, make sure the motor can handle the maximum current delivered by the drive.

Operating the motor with too high current may result in demagnetization.

◆ 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.

In the drives LC2A0145/0185 and LC4A0112/0150 the wire bending space (space between terminals and cable entry point) provided is smaller than recommended in the IEC61800-5-1.

◆ Precautions for UL/cUL Standards Compliance

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

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

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

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

This drive has undergone the UL short-circuit test, which certifies that during a short circuit in the power supply the current flow will not rise above 100,000 amps maximum at 240 V for 200 V class drives and 480 V for 400 V class drives.

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

Note: The UL listing of the drives LC2A0145/0185 and LC4A0112/0150 is pending.

2 Mechanical Installation

◆ Upon Receipt

Perform the following tasks after receiving the drive:

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

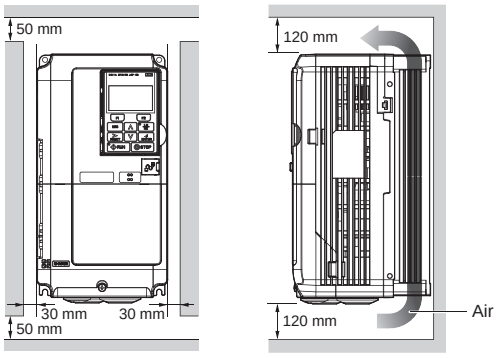
◆ Installation Environment

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

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	–10 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 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.



◆ Degree of Protection

The degree of protection of L1000A drives is IP20. Install the drive in a cabinet if higher degree of protection is required.

◆ Dimensions

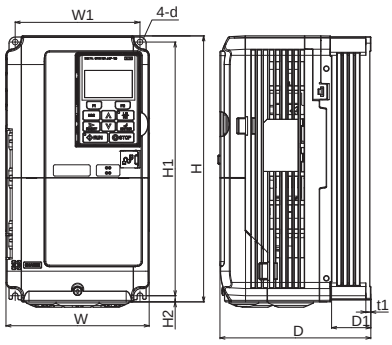


Figure 1

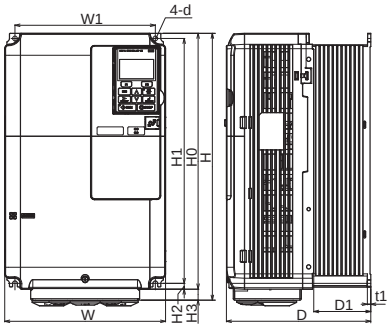


Figure 2

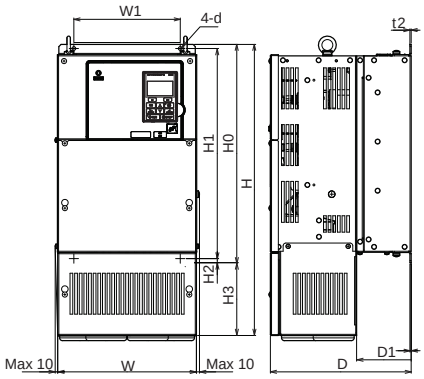
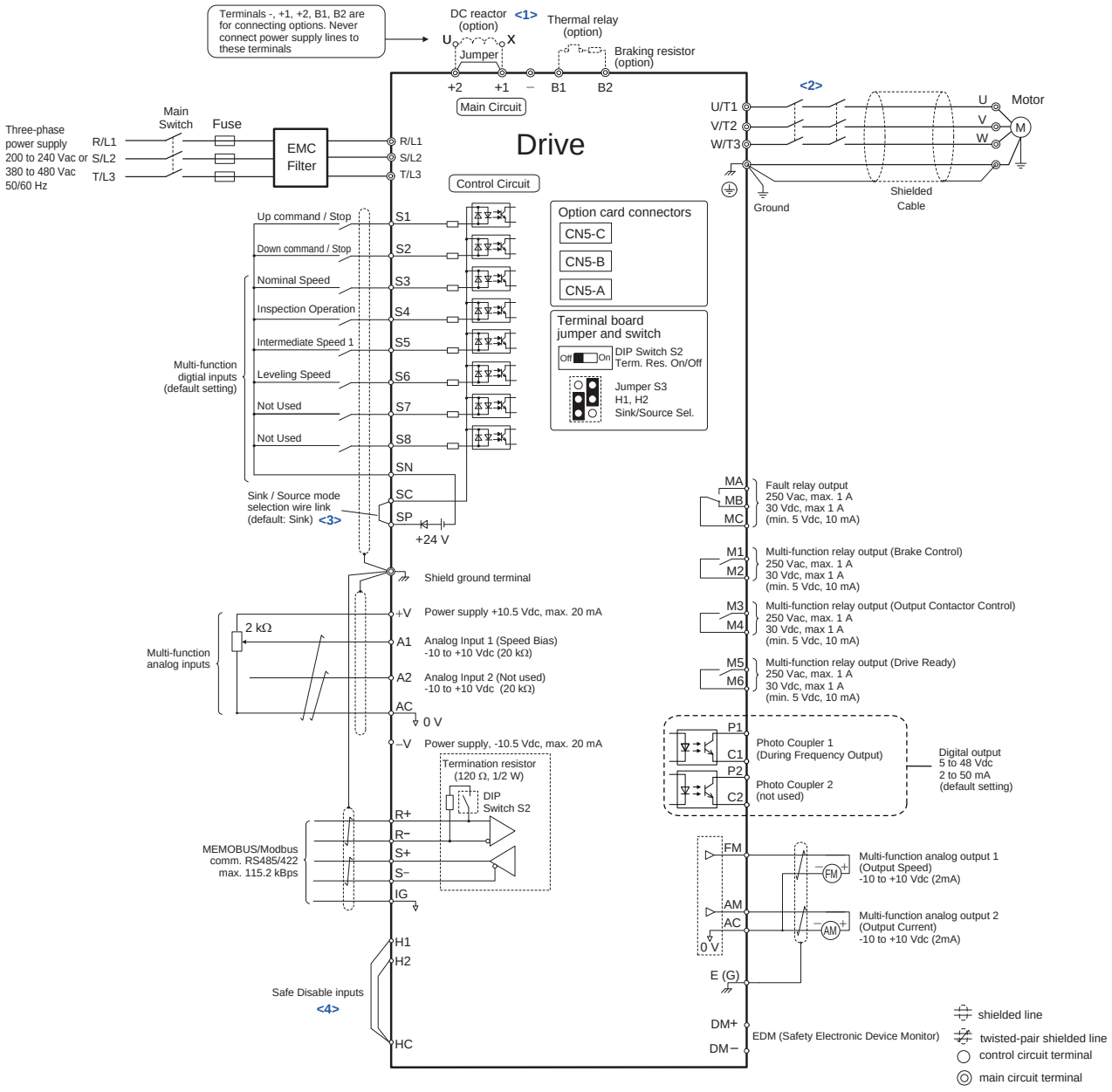


Figure 3

Model CIMR-LC	Fig.	Dimensions (mm)												Weight (kg)
		W	H	D	W1	H0	H1	H2	H3	D1	t1	t2	d	
2A0018	1	140	260	164	122	–	248	6	–	55	5	–	M5	3.5
2A0025		140	260	167	122	–	248	6	–	55	5	–	M5	4.0
2A0033		140	260	167	122	–	248	6	–	55	5	–	M5	4.0
2A0047		180	300	187	160	–	284	8	–	75	5	–	M5	5.6
2A0060		220	350	197	192	–	335	8	–	78	5	–	M6	8.7
2A0075	2	220	365	197	192	350	335	8	15	78	5	–	M6	9.7
2A0085	3	254	534	258	195	400	385	7.5	134	100	2.3	2.3	M6	23
2A0115		279	614	258	220	450	435	7.5	164	100	2.3	2.3	M6	28
2A0145		329	630	283	260	550	535	7.5	80	110	2.3	2.3	M6	40
2A0180		329	630	283	260	550	535	7.5	80	110	2.3	2.3	M6	40
4A0009	1	140	260	164	122	–	248	6	–	55	5	–	M5	3.5
4A0015		140	260	167	122	–	248	6	–	55	5	–	M5	3.9
4A0018		140	260	167	122	–	248	6	–	55	5	–	M5	3.9
4A0024		180	300	167	160	–	284	8	–	55	5	–	M5	5.4
4A0031		180	300	187	160	–	284	8	–	75	5	–	M5	5.7
4A0039		220	350	197	192	–	335	8	–	78	5	–	M6	8.3
4A0045	3	254	465	258	195	400	385	7.5	65	100	2.3	2.3	M6	23
4A0060		279	515	258	220	450	435	7.5	65	100	2.3	2.3	M6	27
4A0075		329	630	258	260	510	495	7.5	120	105	2.3	3.2	M6	39
4A0091		329	630	258	260	510	495	7.5	120	105	2.3	3.2	M6	39
4A0112		329	630	283	260	550	535	7.5	80	110	2.3	2.3	M6	43
4A0150		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 CIMR-LC2A0085 through 0180 and 4A0045 through 0150 come with a built-in DC reactor.
<2> The drive provides a stop function in compliance with Stop Category 0 (EN60204-1) and "Safe Torque Off" (IEC61800-5-2). It has been designed to meet the requirements of the EN954-1/ISO13849-1, Category 3 and IEC61508, SIL2. Using this function the number of motor contactors can be reduced to one. Refer to *Safe Disable Input Function on page 41* 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 can not start can occur, e.g. when the Digital Operator is left in the Programming Mode. Use the "Drive Ready" output (default set to terminals 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-LC	EMC Filter [Schaffner]	Main Fuse [Bussmann]	Recom. Motor cable (mm^2)	Main Circuit Terminal Sizes			
				R/L1,S/L2,T/L3, U/T1,V/T2,W/T3, -, +1, +2	+3	B1, B2	⏚
2A0018	FS5972-35-07	FWH-90B	2.5	M4	–	M4	M4
2A0025		FWH-100B	6				M5
2A0033	FS5972-60-07	FWH-200B	10				
2A0047			16	M6		M5	M6
2A0060	FS5972-100-35			M8			
2A0075		FWH-300A	25				
2A0085	FS5972-170-40		35			M8	M8
2A0115		FWH-350A	50	M10		M10	
2A0145	FS5972-250-37	FWH-400A	70		M10	–	M10
2A0180			95				
4A0009	FS5972-18-07	FWH-90B	2.5	M4	–	M4	M4
4A0015	FS5972-35-07	FWH-80B					M5
4A0018		FWH-100B	4				
4A0024		FWH-125B	6	M5		M5	M6
4A0031	FS5972-60-07	FWH-200B					
4A0039		FWH-250A	16	M6			
4A0045				M8		M8	M8
4A0060	FS5972-100-35		25				
4A0075					M8	–	
4A0091	FS5972-170-40		35				
4A0112		FWH-350A	50	M10	M10	–	M10
4A0150		FWH-400A	70				

Tightening Torque Values

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

Terminal Size	M4	M5	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

■ Control Circuit

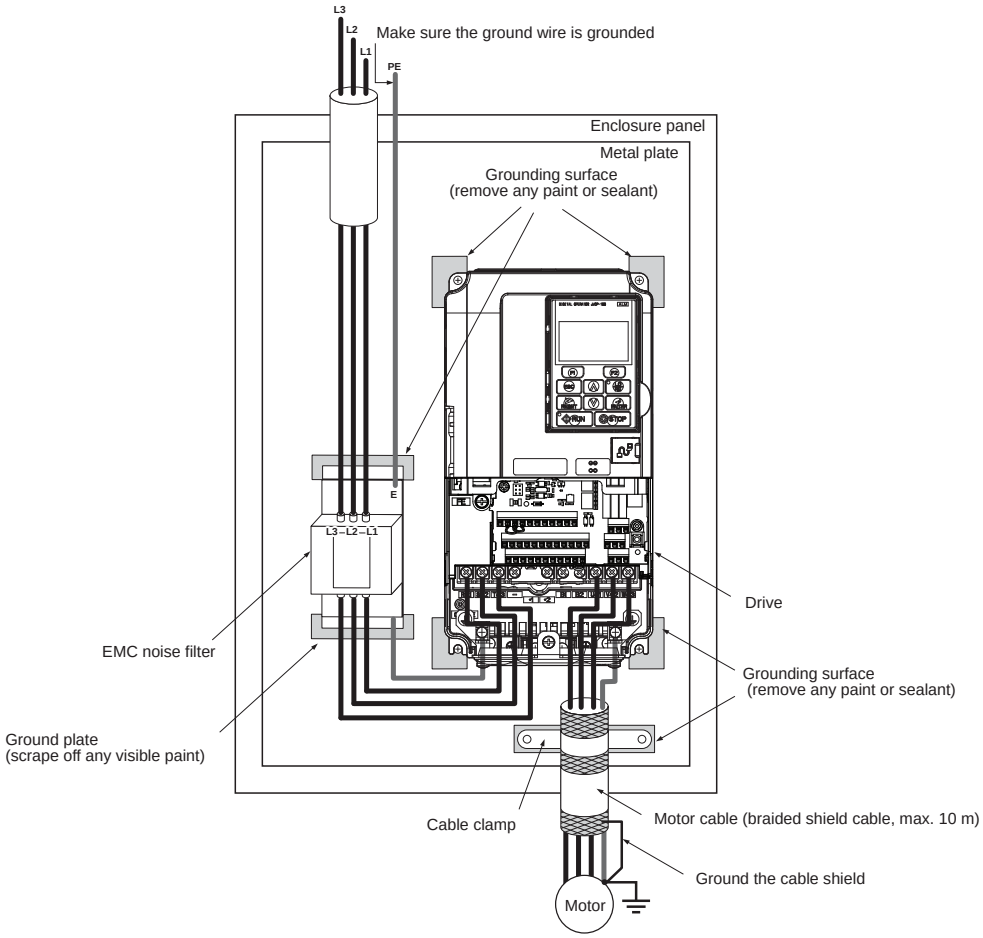
The control terminal board is equipped with screwless terminals. Always use wires within the specifications listed below. For safe wiring, Yaskawa recommends solid wires or flexible stranded wires with ferrules. Use ferrules with a length of 8 mm.

Wire Type	Wire size (mm^2)
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 EN61800-3. Install the drive and wire the main circuit as described below.

1. Install an appropriate EMC noise filter to the input side. See the table in ***Main Circuit on page 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. Install an AC or DC reactor for EN12015 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***.
- If using a ground fault circuit breaker, make sure the breaker is designed for use with AC drives (e.g., type B according to ICE60755).
- If using an input switch, make sure that the switch does not operate more frequently than once every 30 minutes.
- Use a DC reactor or AC reactor on the input side of the drive:
  - To suppress harmonic current.
  - to improve the power factor on the power supply side.
  - 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 41* for details.

■ Ground Connection

Take the following precautions when grounding the drive:

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

■ Control Circuit Wiring Precautions

Note the following precautions for wiring the control circuits:

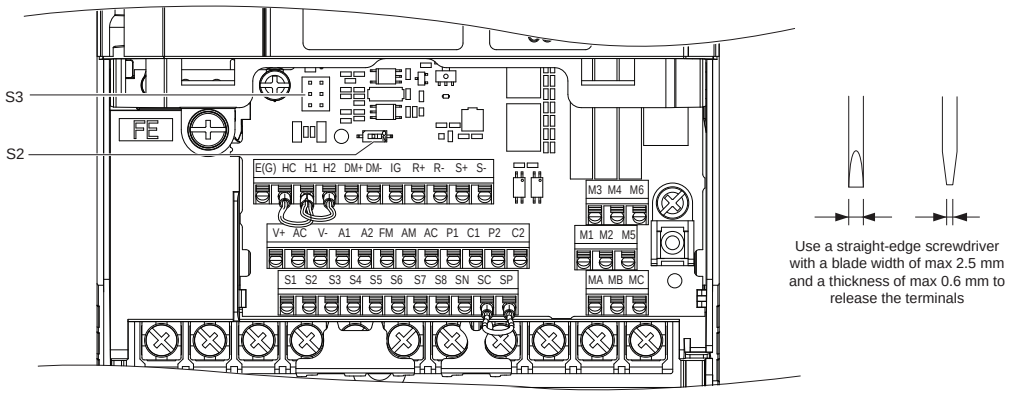
- Separate control circuit wiring from main circuit wiring and other high-power lines.
- Separate wiring for control circuit terminals M1 to M6, MA, MB, and MC (contact output) from wiring to other control circuit terminals.
- Use twisted-pair or shielded twisted-pair cables for control circuits to prevent 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" rowspan="2">Terminal</th><th colspan="3">Type</th><th rowspan="3">Function</th></tr>
<tr><th>200 V Class</th><th rowspan="2">Model CIMR-LC</th><th>2A0018 to 2A0075</th><th>2A0085, 2A0115</th><th>2A0145, 2A0180</th></tr>
<tr><th>400 V Class</th><th>4A0009 to 4A0039</th><th>4A0045, 4A0060</th><th>4A0075 to 4A0150</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="2">• DC reactor connection (+1, +2). Remove the jumper between +1 and +2
• DC power supply input (+1, –)</td><td colspan="2">Not available</td><td rowspan="3">For connecting
• the drive to a DC power supply (terminals +1 and – are not EU or UL approved)
• braking options
• a DC reactor</td></tr>
<tr><td colspan="2">+1, –</td><td>• DC power supply input (+1, –)</td><td>• DC power supply input (+1, –)
• Braking transistor connection (+3, –)</td></tr>
<tr><td colspan="2">+3</td><td colspan="2">Not available</td></tr>
<tr><td colspan="2">⏚</td><td colspan="3">–</td><td>Grounding terminal</td></tr>
</table>

■ 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.

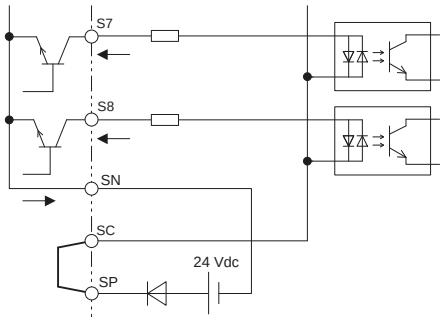
S2	RS422/485 Termination Resistor	Off ■ On
S3	Safe Disable Input Sink/Source/External Supply Selection	Source / Sink / External 24 Vdc Power Supply

■ Sinking/Sourcing Mode (NPN/PNP Selection)

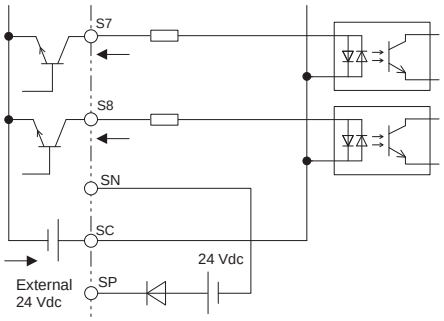
Use a wire link between terminals SC and SP or SC and SN to select between Sink mode, Source mode or external power supply for the digital inputs S1 to S8 as shown below (Default: Sink mode, internal power supply).

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

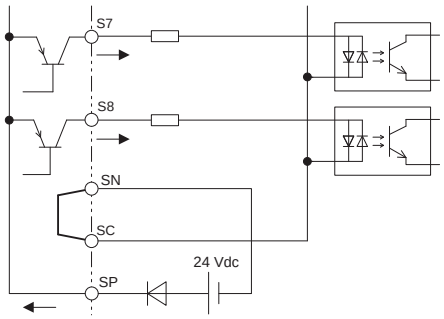
Internal Power Supply – Sinking Mode (NPN) (default)



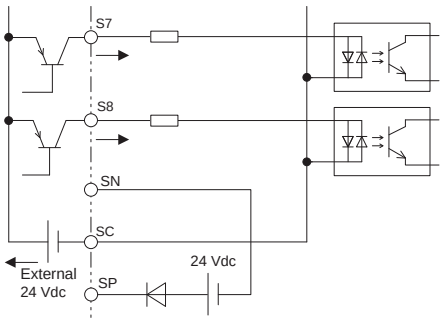
External Power Supply – Sinking Mode (NPN)



Internal Power Supply – Sourcing Mode (PNP)



External Power Supply – Sourcing Mode (PNP)



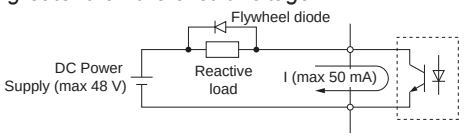
■ Control Circuit Terminal Functions

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Digital Inputs	S1	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	Down Command (Closed: Down, Open: Stop)	
	S3	Multi-function input 3 (Nominal Speed)	
	S4	Multi-function input 4 (Inspection Operation)	
	S5	Multi-function input 5 (Intermediate Speed 1)	
	S6	Multi-function input 6 (Leveling Speed)	
	S7	Multi-function input 7 (Not used)	
	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 (Speed Reference Bias)	–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 (Brake Control)	
	M2		
	M3	Relay output 2 (Output Contactor Control)	
	M4		
	M5	Relay output 3 (Drive Ready)	
	M6		
Multi-Function Photocoupler Output	P1	Photocoupler output 1 (During frequency output 2)	Photocoupler output 48 Vdc, 2 to 50 mA
	C1		
	P2	Photocoupler output 2 (Not used)	
	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. Closed when both Safe Disable channels are closed. Up to +48 Vdc 50 mA.
	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 41*** *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

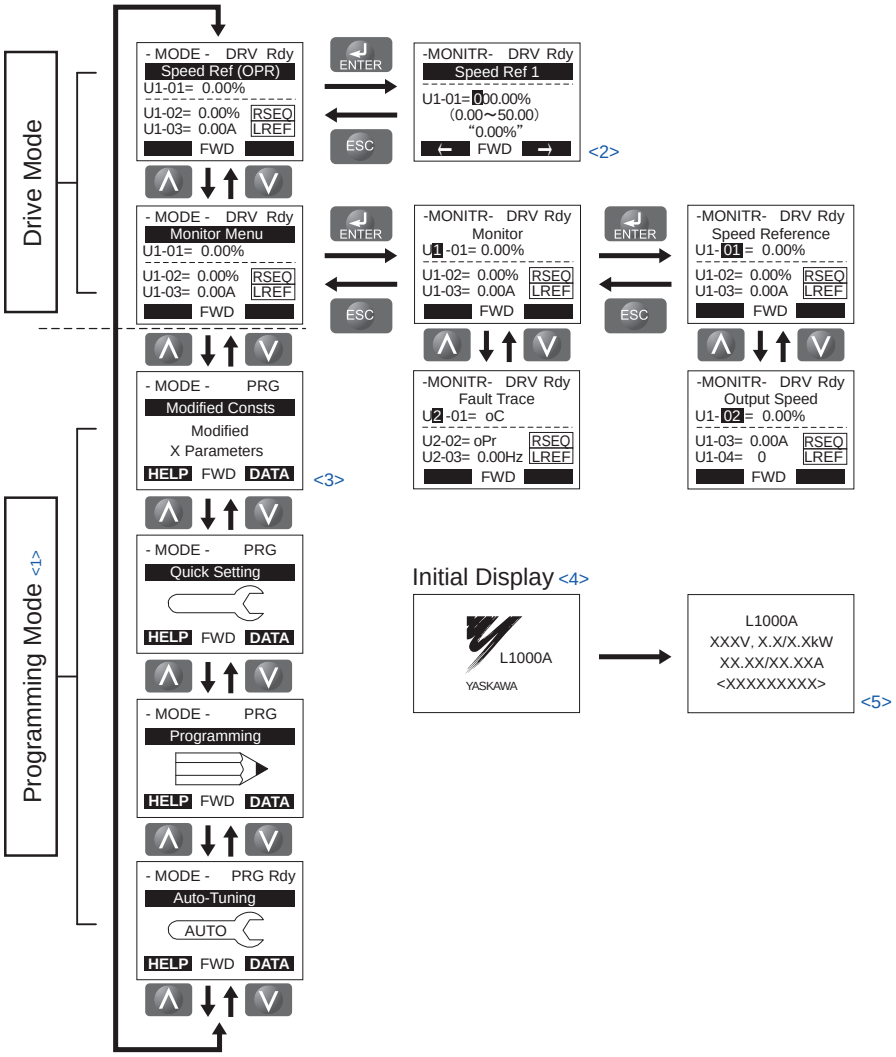
The digital operator is used to program the drive, to start and stop it, and to display fault information. The LEDs indicate the operating status of the drive.

■ 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	Starts the drive in the LOCAL mode. 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 a Fast Stop command via the digital inputs, or when a Run 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 next item, selects parameter numbers and increments 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	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).
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.

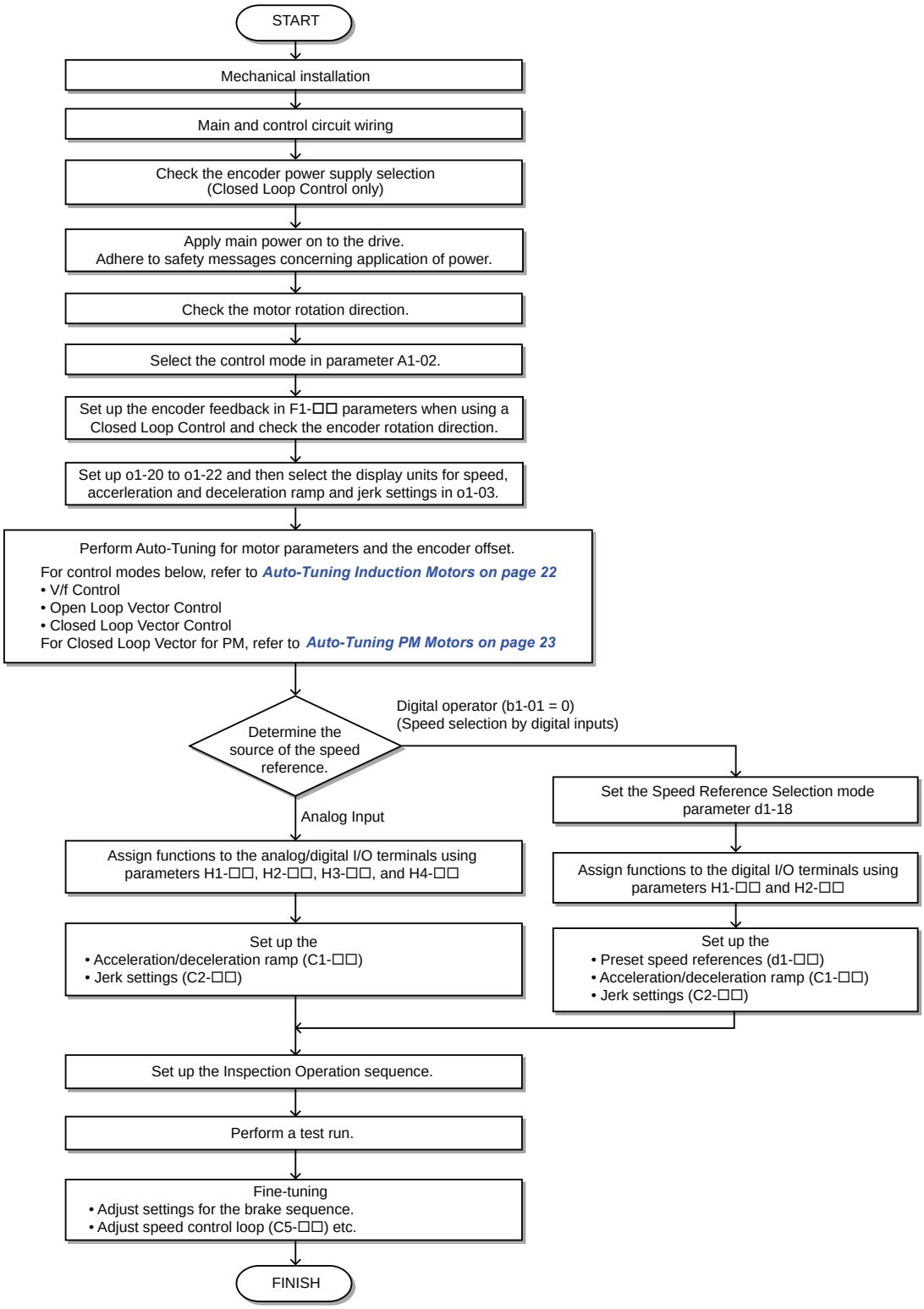


<1> Drive cannot operate the motor.
<2> Flashing characters are shown as 0.
<3> X characters are shown in this manual. The LCD Operator will display the actual setting values.
<4> The speed reference appears after the initial display which shows the product name.
<5> The information that appears on the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



◆ 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.
- If an encoder option card is used make sure the encoder is wired correctly and the power supply on the option card is set according to the encoder specification.

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 36*.

◆ Control Mode Selection

When the drive is first powered up, one of the four control modes must be selected to match the application. Note that Closed Loop Vector modes require encoder feedback cards. The table below indicates possible control modes depending on the motor type and shows the required encoder feedback card.

Machine Type	Control Mode	A1-02 setting	Encoder Option Card
Induction motor without encoder	V/f Control	0	No card required
	Open Loop Vector Control	2	No card required
Induction motor with incremental encoder	Closed Loop Vector Control	3	PG-B3 / PG-X3
Permanent magnet motor with EnDat 2.1/01 or EnDat 2.2/01 encoder	Closed Loop Vector Control for PM motors	7	PG-F3
Yaskawa IPM motor with incremental encoder	Closed Loop Vector Control for PM motors	7	PG-X3

◆ Motor Rotation Direction Setup

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

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

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

◆ Encoder Setup

■ Encoder Resolution Setup

Set the encoder resolution (incremental signal in case of absolute encoders with Sin/Cos tracks) in parameter F1-01.

■ Encoder Rotation Direction Setup

Perform the following steps to make sure the encoder rotation direction is set up correctly in the drive.

If information about the signal sequence of the encoder are available

- Check the sequence of encoder phases A and B when the motor drives the elevator in up direction.
- If the encoder A phase leads phase B, make sure F1-05 is set to 0 (default).
- If the encoder B phase leads phase A, make sure F1-05 is set to 1.

If no information about the signal sequence of the encoder are available

- Turn the motor manually in elevator up direction while checking the value of monitor U1-05.
- If the value in U1-05 is positive, the set encoder direction is correct.
- If the value in U1-05 is negative, alter the setting of parameter F1-05.

Note: Always set the motor rotation direction prior to the encoder rotation direction. Refer to *Motor Rotation Direction Setup on page 19*.

◆ Digital Operator Display Unit Selection

The drive allows to choose between different display units for speed related parameters and monitors, acceleration and deceleration rates 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 Rates (C1-□□)	Jerk Settings (C2-□□)
0	0.01 Hz	0.01 s	0.01 s
1 (default)	0.01%		
2	1 rpm		
3	User defined		
4	0.01 m/s		
5	0.01 m/s	0.01 m/s^2	0.01 m/s^3

When using setting 4 or 5 certain mechanical data have to be programmed to the drive prior to changing o1-03. Perform the following steps.

1. Make sure motor data are set up correctly. Verify the setting of the maximum output frequency in parameter E1-04 and the setting for the number of motor poles in parameter E2-04 or E5-04.
2. Set the traction sheave diameter in units of mm to parameter o1-20.
3. Set the correct roping to parameter o1-21.
4. If a mechanical gear is used, set the gear ratio ($n_{Motor}/n_{Traction\ Sheave}$) to parameter o1-22. If a gearbox is not used, make sure o1-22 is set to 1.0.
5. Change parameter o1-03 to setting 4 or 5. The unit and setting values of related parameters will be changed automatically.

◆ 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 (A1-02 = 0, 2, or 3)

Type	Setting	Requirements and Benefits	Control Mode (A1-02)		
			V/f (0)	OLV (2)	CLV (3)
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.	No	Yes	Yes
Stationary Auto-Tuning 1	T1-01 = 1	• Automatically calculates motor parameters needed for vector control. • Use if ropes can not be removed. Note that the accuracy is less then with Rotational Auto-tuning.	No	Yes	Yes
Stationary Auto-Tuning for Line-to-Line Resistance	T1-01 = 2	• Used for V/f Control or in vector control modes when the drive was set up properly before and the motor cable has changed.	Yes	Yes	Yes
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 can not be removed and if slip and no-load current data are available.	No	Yes	Yes

Motor Data Tuning Modes for Permanent Magnet Motors (A1-02 = 7)

Type	Setting	Requirements and Benefits
Motor Data Input	T2-01 = 0	• Use if a motor test report is available • Input motor data like on test report. Make sure to convert data into the correct unit before if necessary.
Stationary Auto-Tuning	T2-01 = 1	• Use if a motor test report is not available • Input motor data like on name plate. Make sure to convert data into the correct unit before. The drive automatically calculates the motor data.

Type	Setting	Requirements and Benefits
Stationary Auto-Tuning for Stator Resistance	T2-01 = 2	• Tunes stator resistance only. • Should be performed if the motor cable has changed.
Rotational Back EMF Constant Auto-Tuning	T2-01 = 11	• Used the Motor Induction Voltage (E5-24) if no data are available. • Should be performed after Motor data have been set and the encoder offset has been adjusted. • The motor must be uncoupled from the mechanical system (remove ropes).

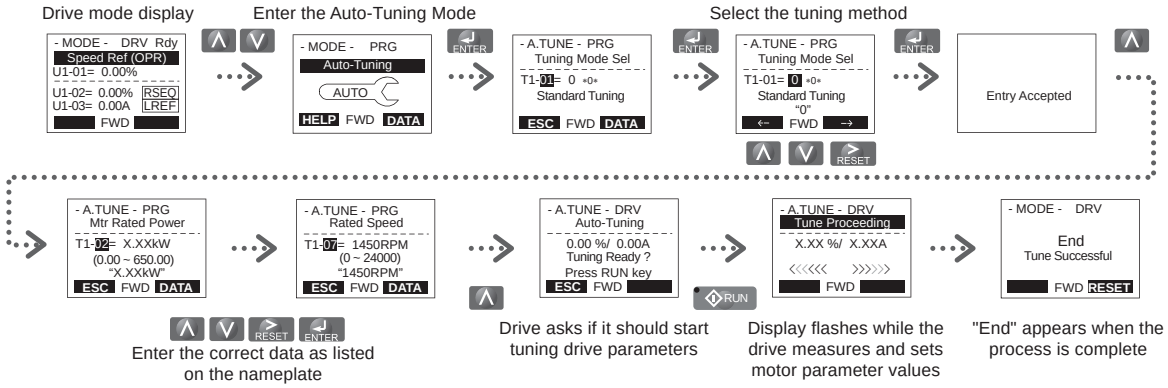
Encoder Offset Tuning Modes for Permanent Magnet Motors (A1-02 = 7)

Encoder Offset Tuning measures the angle between the encoder zero pulse and the rotor orientation. It needs to be performed when a drive is setup the first time or after initialization, when the motor rotation direction or encoder rotation direction has been changed or when the encoder was replaced.

Type	Setting	Requirements and Benefits
Initial Magnet Pole Search Parametes Auto-Tuning	T2-01 = 3	• Attempts to detect the motor rotor position, judges if the encoder offset can be tuned using Stationary Encoder Offset Tuning and sets parameters needed for Initial Magnet Pole Search (n8-36, n8-37). • Should be performed after motor Auto-tuning in order to decide the encoder tuning method. **Important:** When using a PG-X3 card with an incremental encoder and this tuning fails, the motor can not be driven using and incremental encoder. Change the encoder to an absolute encoder.
Stationary Encoder Offset Auto-Tuning	T2-01 = 4	• Tunes the encoder offset without rotating the motor. • If the encoder offset can not be tuned properly by this method run Rotating Encoder Offset Tuning.
Rotational Encoder Offset Auto-Tuning	T2-01 = 10	• Tunes the encoder offset while rotating the motor. • Motor and mechanical system must be uncoupled (ropes must be removed from traction sheave).

■ 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 in Open Loop Vector control.



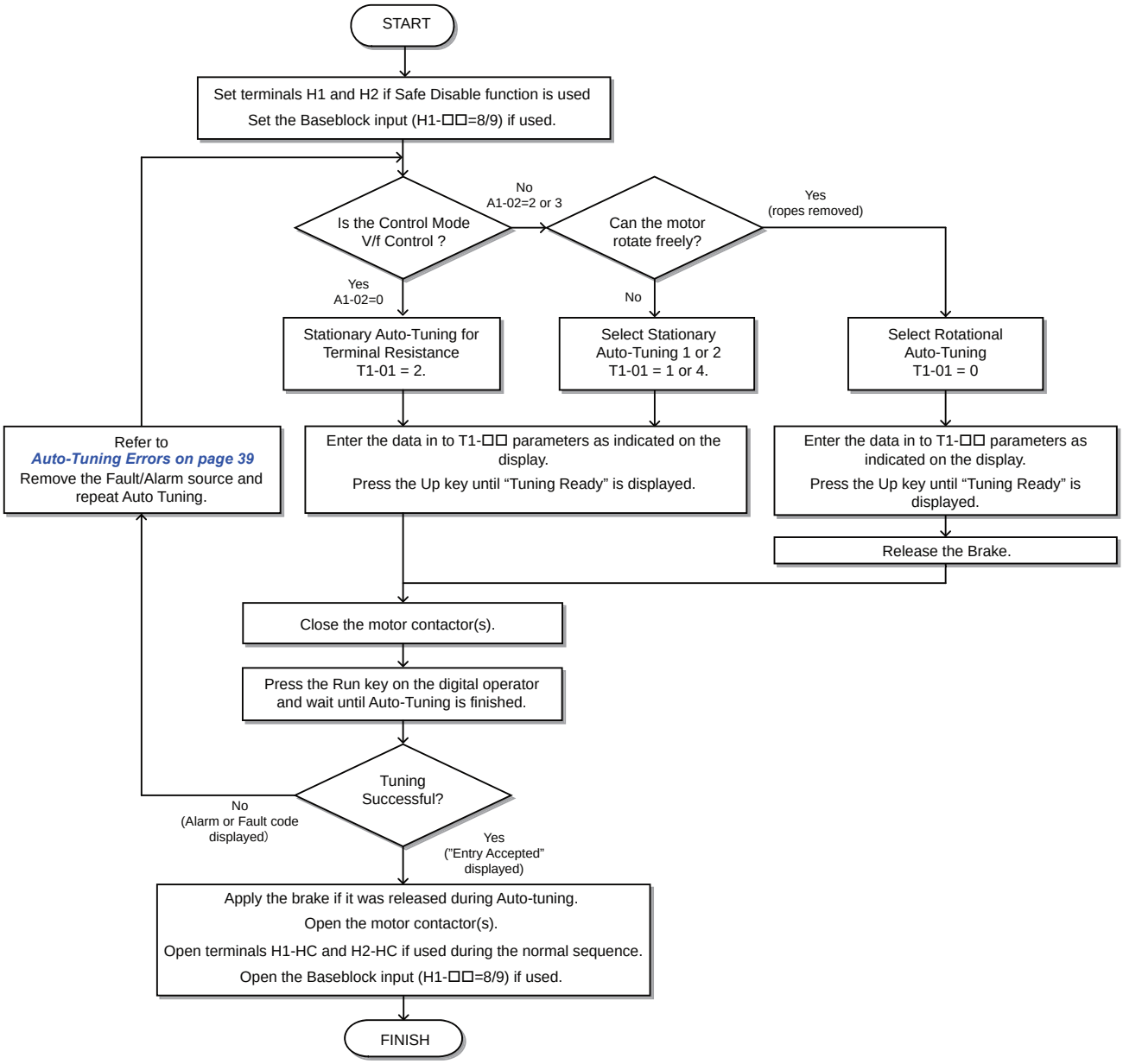
If Auto-Tuning can not be performed for some reason (no-load operation impossible, etc.), then set the maximum frequency and voltage in the E1-☐☐ parameters and enter the motor data manually into the E2-☐☐ parameters for induction motors or E5-☐☐ parameters for PM motors. Refer to *Auto-Tuning Errors on page 39*.

■ Precautions

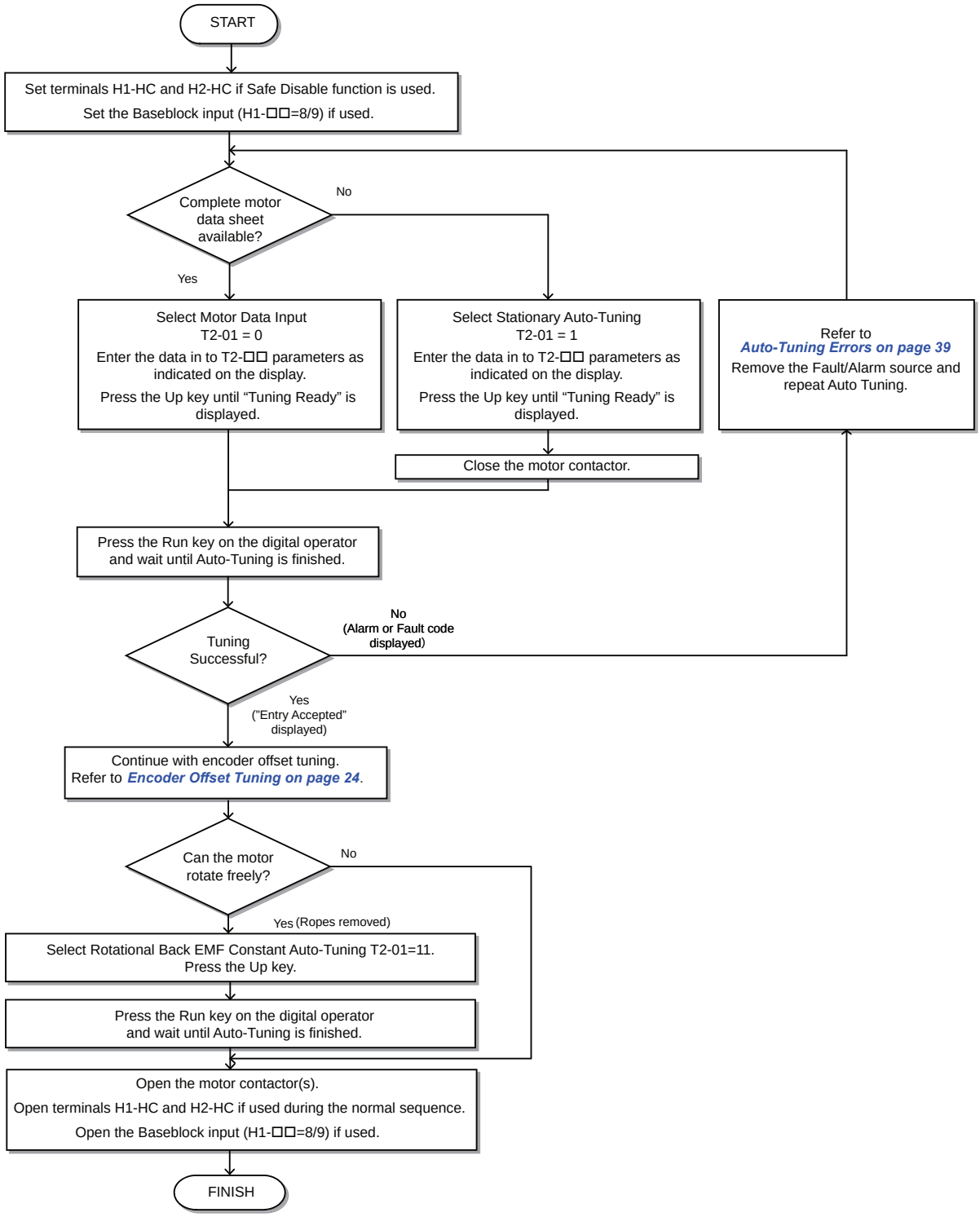
- Always try to perform Rotational Auto-Tuning as it gives more accurate results than Non-Rotating Auto-Tuning. Perform Non-Rotating Auto-Tuning if the load can not be disconnected (e.g. ropes can not be removed).
- Make sure that the mechanical brake is closed for all Auto-Tuning methods except for Rotational Auto-Tuning.
- Motor contactors must be closed during the Auto-Tuning process.
- H1 and H2 signals must be ON when performing Auto-Tuning.
- Confirm that the motor is mechanically fixed.
- Do not touch the motor until the Auto-Tuning process is complete. Voltage is applied to the motor during the tuning process, even though the motor may not be rotating.
- To cancel Auto-Tuning, press the STOP key on the digital operator.
- During Auto-Tuning the motor is started and stopped repeatedly and may also rotate. When the tuning is finished, "END" will appear on the operator panel. Do not touch the motor until this display is shown and the motor has completely stopped.

■ Auto-Tuning Procedure

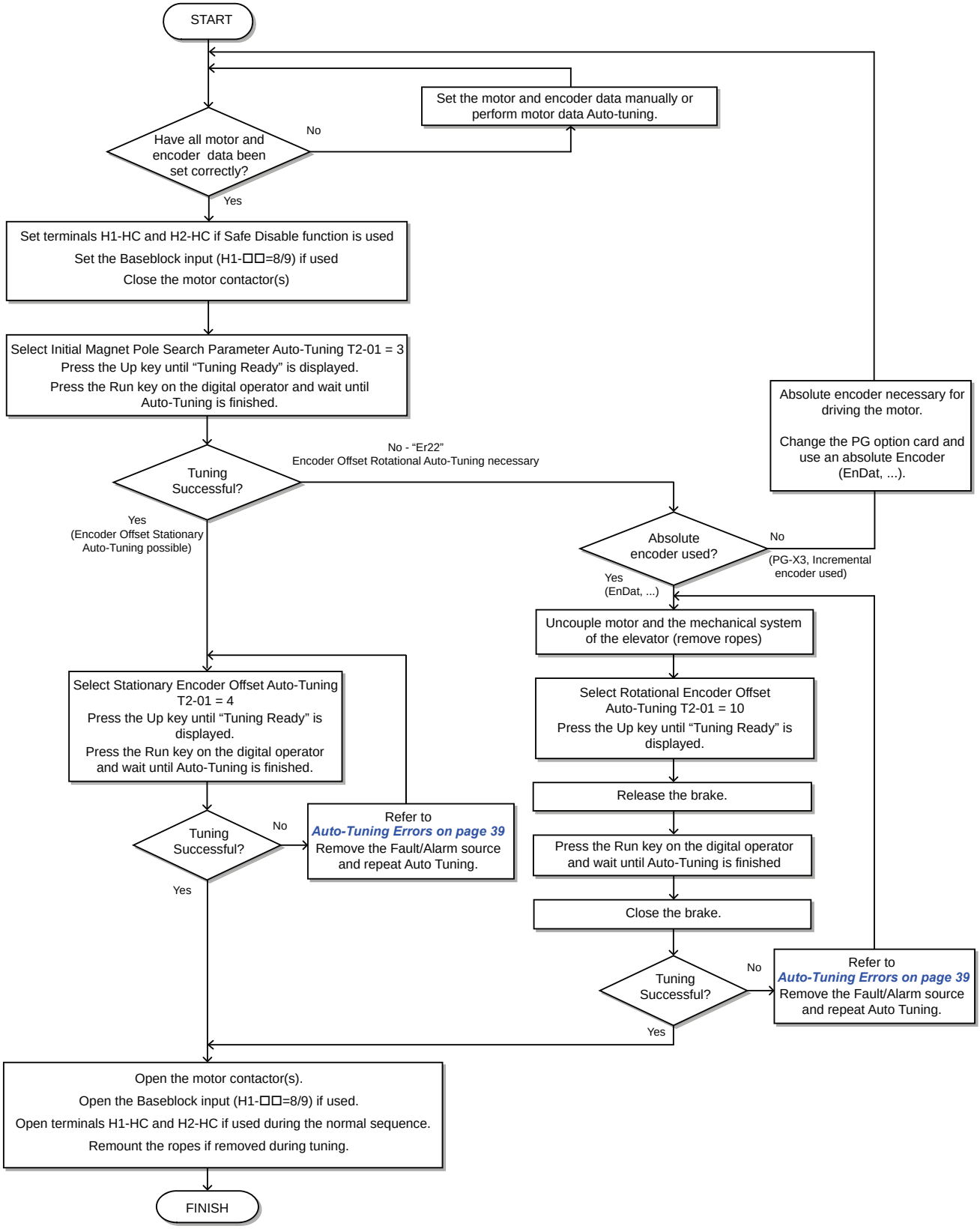
Auto-Tuning Induction Motors



Auto-Tuning PM Motors



Encoder Offset Tuning



◆ Up and Down Commands and Speed Reference Selection

■ Speed Reference Selection

Parameter b1-01 determines the source of the speed reference.

b1-01	Reference source	Speed reference input
0 (default)	Operator keypad (Digital inputs)	Set the speed references in the d1-□□ parameters and use digital inputs to switch over between different reference values.
1	Analog input	Apply the speed reference signal to terminal A1 or A2.
2	Serial Communication	Serial Communications using the RS422/485 port
3	Option Board	Communications option card

■ 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	Run command input
0	Operator keypad	RUN and STOP keys on the operator
1 (default)	Digital inputs	Terminal S1: Run in Up direction Terminal S2: Run in Down direction
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 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.
- d1-18 is set to 1 or 2 and the Up/Down or Leveling Speed signal (H1-□□ = 53) is cleared.
- d1-18 is set to 3 and all speed inputs are 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 brake is closed immediately and the drive output shuts off.

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

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

d1-18	Speed Selection
0	Multi-speed inputs 1, Speed references are set in d1-01 to d1-08
1 (default)	Separate speed inputs, Speed references are set in d1-19 to d1-24 and d1-26, Higher speed has priority
2	Separate speed inputs, Speed references are set in d1-19 to d1-24 and d1-26, Leveling speed has priority
3	Multi speed inputs 2, Speed references are set in d1-02 to d1-08, Stop if no speed selection input is enabled

■ Multi-Speed Inputs 1, 2 (d1-18 = 0 or 3)

Speed Selection

When d1-18 = 0 or 3, multi-function digital inputs are preset as shown below.

Terminal	Parameter Number	Set Value	Details
S5	H1-05	3	Multi-Speed Reference 1
S6	H1-06	4	Multi-Speed Reference 2
S7	H1-07	5	Multi-Speed Reference 3

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

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

0 = Off, 1 = On

Setting d1-18 = 0

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

Setting d1-18 = 3

Seven separate speeds settings (defined in parameters d1-02 to d1-08) can be selected by three digital input signals. The drive stops when no speed is selected (i.e., all speed selection inputs are switched off).

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

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

Speed Selection

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

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

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

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

0 = Off, 1 = On

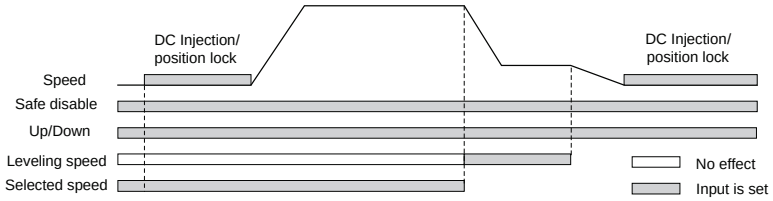
A: No influence when d1-18=1, 0 when d1-18=2

B: No influence

N/A = Not available

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

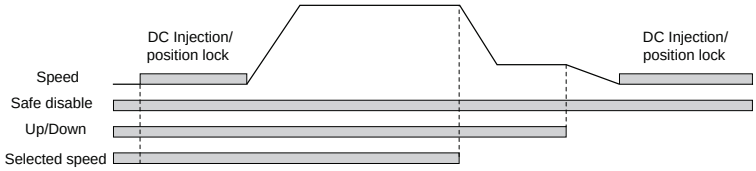
The higher speed has priority over the leveling speed, meaning the leveling signal is disregarded as long as any other speed selection input is active. The drive decelerates to the leveling speed (d1-26) when the selected speed reference signal is removed.



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

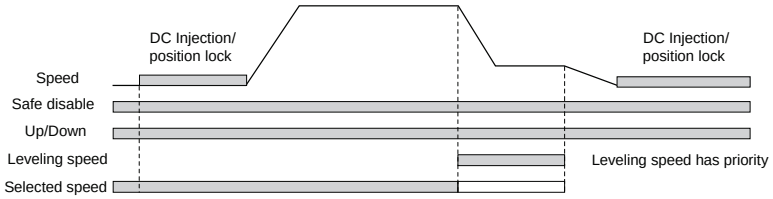
The drive decelerates to the leveling speed (d1-26) when the selected speed reference signal is removed.

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



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

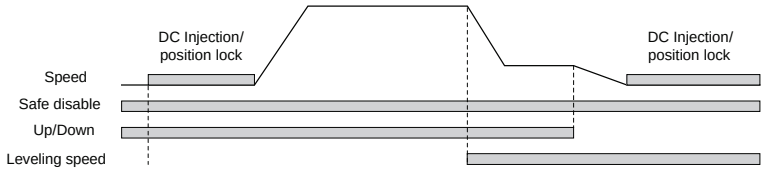
The leveling signal has priority over other speed references. The drive decelerates to the leveling speed (d1-26) when the leveling speed selection input is activated.



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

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

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



◆ I/O Signal Setup

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

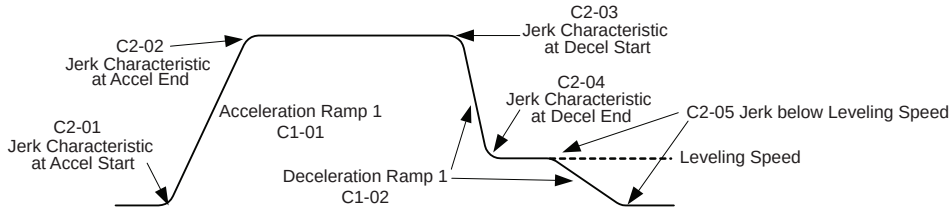
The function of each analog input can be assigned in the H3-☐☐ parameters.

■ 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.

◆ Acceleration Ramp, Deceleration Ramp, and Jerk Settings

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

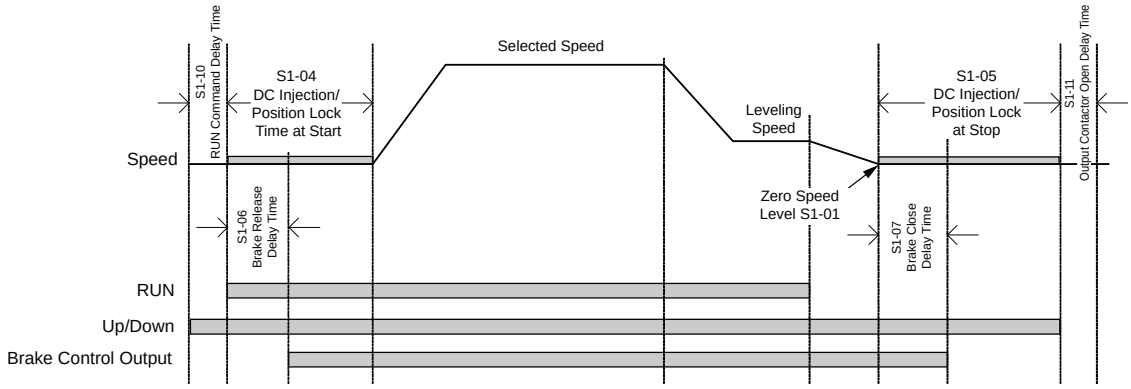


The way of setting these parameters and their setting units change with parameter o1-03 as shown below:

	o1-03 = 0, 1, 2, 3, 4	o1-03 = 5
Accel/Decel Ramps C1-☐☐	Set in units of second as the time to accelerate from zero to the rated speed, respectively as time to decelerate from rated speed to zero.	Set in units of m/s^2 as accel/decel rate used when changing the speed.
Jerk Settings C2-☐☐	Set in units of second as the time used to change the accel/decel rate from zero to the accel/decel ramp setting of C1-☐☐ and vice versa.	Set in units of m/s^3 as the accel/decel change rate.

◆ Brake Sequence

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



◆ Inspection Operation

■ Start in Inspection Mode

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

- Parameter d1-18 is set to 0 or 3 and the selected speed is higher than d1-28 but lower than d1-29.
- Parameter d1-18 is set to 1 or 2 and a digital input programmed for Inspection Operation Speed (H1-□□ = 54) is enabled.

The start is performed using the same acceleration characteristics, brake sequence and contactor sequence like in normal operation. The carrier frequency is set to 2 kHz during Inspection Operation but can be changed using parameter C6-21.

■ Stop in Inspection Mode

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

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

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