Cat.No. I62E-EN-01

L7Z

Quick Start Guide

OMRON

L7Z Quick Start Guide

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Warnings

⚠ CAUTION

Cables must not be connected or disconnected, nor signal tests carried out, while the power is switched on.

The Varispeed L7 DC bus capacitor remains charged even after the power has been switched off. To avoid an electric shock hazard, disconnect the frequency inverter from the mains before carrying out maintenance. Then wait for at least 5 minutes after all LEDs have gone out.
Do not perform a withstand voltage test on any part of the inverter. It contains semiconductors, which are not designed for such high voltages.

Do not remove the digital operator while the mains supply is switched on. The printed circuit board must also not be touched while the inverter is connected to the power.

Never connect general LC/RC interference suppression filters, capacitors or overvoltage protection devices to the inverter input or output.

To avoid unnecessary over current faults, etc., being displayed, the signaling contacts of any contactor or switch fitted between inverter and motor must be integrated into the inverter control logic (e.g. baseblock).

This is absolutely imperative!

This manual must be read thoroughly before connecting and operating the inverter. All safety precautions and instructions for use must be followed.

The inverter must be operated with the appropriate line filters, following the installation instructions in this manual and with all covers closed and terminals covered.
Only then will adequate protection be provided. Please do not connect or operate any equipment with visible damage or missing parts. The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

◆ Safety Precautions and Instructions

■1. General

Please read these safety precautions and instructions for use thoroughly before installing and operating this inverter. Also read all of the warning signs on the inverter and ensure they are never damaged or removed.

Live and hot inverter components may be accessible during operation. Removal of housing components, the digital operator or terminal covers runs the risk of serious injuries or damage in the event of incorrect installation or operation. The fact that frequency inverters control rotating mechanical machine components can give rise to other dangers.

The instructions in this manual must be followed. Installation, operation and maintenance may only be carried out by qualified personnel. For the purposes of the safety precautions, qualified personnel are defined as individuals who are familiar with the installation, starting, operation and maintenance of frequency inverters and have the proper qualifications for this work. Safe operation of these units is only possible if they are used properly for their intended purpose.

The DC bus capacitors can remain live for about 5 minutes after the inverter is disconnected from the power. It is therefore necessary to wait for this time before opening its covers. All of the main circuit terminals may still carry dangerous voltages.

Children and other unauthorized persons must not be allowed access to these inverters.

Keep these Safety Precautions and Instructions for Use readily accessible and supply them to all persons with any form of access to the inverters.

■2. Intended Use

Frequency inverters are intended for installation in electrical systems or machinery.

Their installation in machinery and systems must conform to the following product standards of the Low Voltage Directive:

EN 50178, 1997-10,Equipping of Power Systems with Electronic Devices

EN 60204-1, 1997-12Machine Safety and Equipping with Electrical Devices

Part 1: General Requirements (IEC 60204-1:1997)/

Please note: Includes Corrigendum of September 1998

EN 61010-1, A2, 1995Safety Requirements for Information Technology Equipment

(IEC 950, 1991 + A1, 1992 + A2, 1993 + A3, 1995 + A4, 1996, modified)

CE marking is carried out to EN 50178, using the line filters specified in this manual and following the appropriate installation instructions.

■3. Transportation and storage

The instructions for transportation, storage and proper handling must be followed in accordance with the technical data.

■4. Installation

Install and cool the inverters as specified in the documentation. The cooling air must flow in the specified direction. The inverter may therefore only be operated in the specified position (e.g. upright). Maintain the specified clearances. Protect the inverters against impermissible loads. Components must not be bent nor insulation clearances changed. To avoid damage being caused by static electricity, do not touch any electronic components or contacts.

■5. Electrical Connection

Carry out any work on live equipment in compliance with the national safety and accident prevention regulations. Carry out electrical installation in compliance with the relevant regulations. In particular, follow the installation instructions ensuring electromagnetic compatibility (EMC), e.g. shielding, grounding, filter arrangement and laying of cables. This also applies to equipment with the CE mark. It is the responsibility of the manufacturer of the system or machine to ensure conformity with EMC limits.

Contact your supplier or Omron-Yaskawa Motion Control representative when using leakage current circuit breaker in conjunction with frequency inverters.

In certain systems it may be necessary to use additional monitoring and safety devices in compliance with the relevant safety and accident prevention regulations. The frequency inverter hardware must not be modified.

If Permanent Magnet Motors are used:

If a PM motor is turned by any external force, high voltage is generated in the windings.

- During wiring, maintenance or inspection make sure, that the motor is stopped and can not turn.
- If the inverter is turned off and the motor must be turned, make sure that motor and inverter output are electrically disconnected.

■6. Inverter Setup

This L7 inverter can drive induction motors as well as permanent magnet motors.
Always select the appropriate control mode:

- For induction motors use V/f, Open Loop Vector or Closed Loop Vector control (A1-01 = 0, 2 or 3).
- For permanent magnet motors use no other control mode than Closed Loop Vector for PM (A1-01 = 6).

A wrong control mode selection can damage the inverter and motor.

If a motor is exchanged or operated the first time, always set up the motor control relevant parameters using the nameplate data or perform autotuning. Do not change the parameters recklessly. To ensure a safe operation with PM motors always set the:

- correct motor data
- the PG open detection parameters
- the speed deviation detection parameters
- the over acceleration detection parameters

Wrong parameter settings can cause dangerous behavior or motor and inverter damage.

Refer to *page 12, Start Up Procedure* for details about the correct start up procedure.

■7. Notes

The Varispeed L7 frequency inverters are certified to CE, UL, and c-UL.

◆ EMC Compatibility

■1. Introduction

This manual was compiled to help system manufacturers using Omron-Yaskawa Motion Control frequency inverters to design and install electrical switch gear. It also describes the measures necessary to comply with the EMC Directive. The manual's installation and wiring instructions must therefore be followed.

Our products are tested by authorized bodies using the standards listed below.

Product standard: EN 61800-3:1996
EN 61800-3; A11:2000

■2. Measures to Ensure Conformity of Omron-Yaskawa Motion Control Frequency Inverters to the EMC Directive

Omron-Yaskawa Motion Control frequency inverters do not necessarily have to be installed in a switch cabinet.

It is not possible to give detailed instructions for all of the possible types of installation. This manual therefore has to be limited to general guidelines.

All electrical equipment produces radio and line-borne interference at various frequencies. The cables pass this on to the environment like an aerial.

Connecting an item of electrical equipment (e.g. drive) to a supply without a line filter can therefore allow HF or LF interference to get into the mains.

The basic countermeasures are isolation of the wiring of control and power components, proper grounding and shielding of cables.

A large contact area is necessary for low-impedance grounding of HF interference. The use of grounding straps instead of cables is therefore definitely advisable.

Moreover, cable shields must be connected with purpose-made ground clips.

■3. Laying Cables

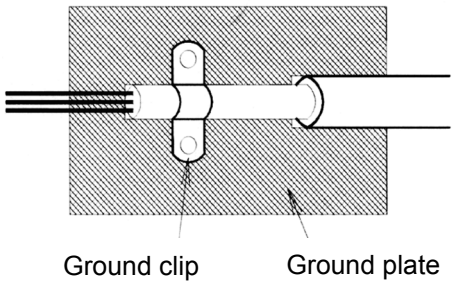
Measures Against Line-Borne Interference:

Line filter and frequency inverter must be mounted on the same metal plate. Mount the two components as close to each other as possible, with cables kept as short as possible.

Use a power cable with well-grounded shield. Use a shielded motor cable not exceeding 20 meters in length. Arrange all grounds so as to maximize the area of the end of the lead in contact with the ground terminal (e.g. metal plate).

Shielded Cable:

- Use a cable with braided shield.
- Ground the maximum possible area of the shield. It is advisable to ground the shield by connecting the cable to the ground plate with metal clips (see following figure).



The grounding surfaces must be highly conductive bare metal. Remove any coats of varnish and paint.

– Ground the cable shields at both ends.

– Ground the motor of the machine.

Installation

◆ Mechanical Installation

■Unpacking the Inverter

Check the following items after unpacking the inverter.

Item	Method
Has the correct model of Inverter been delivered?	Check the model number on the nameplate on the side of the Inverter.
Is the Inverter damaged in any way?	Inspect the entire exterior of the Inverter to see if there are any scratches or other damage resulting from shipping.
Are any screws or other components loose?	Use a screwdriver or other tools to check for tightness.

If you find any irregularities in the above items, contact the agency from which you purchased the Inverter or your Omron-Yaskawa Motion Control representative immediately.

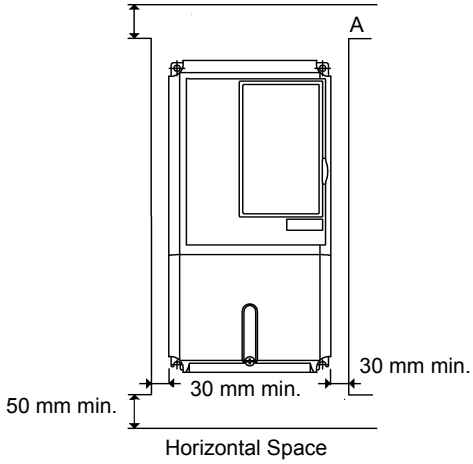
■Checking the Installation Site

Before installing the inverter check the following:

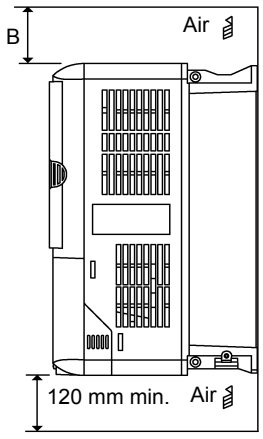
- Make sure that the ambient temperature is not exceeded
- Install the Inverter in a clean location which is free from oil mist and dust. It can be installed in a totally enclosed panel that is completely shielded from floating dust.
- When installing or operating the Inverter, always take special care so that metal powder, oil, water, or other foreign matter does not get into the Inverter.
- Do not install the Inverter on combustible material, such as wood.
- Install the Inverter in a location free from radioactive materials and combustible materials.
- Install the Inverter in a location free from harmful gasses and liquids.
- Install the Inverter in a location without excessive oscillation.
- Install the Inverter in a location free from chlorides.
- Install the Inverter in a location free from direct sunlight.

■Installation Orientation

Install the Inverter vertically so as not to reduce the cooling effect. When installing the Inverter, always provide the following installation space to allow normal heat dissipation.



Horizontal Space



Vertical Space

A	B
50 mm	120 mm

IMPORTANT

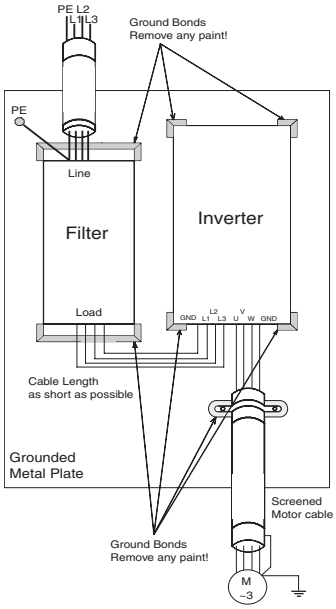
1. The same space is required horizontally and vertically for IP00, IP20 and NEMA 1 Inverters.
2. Always remove the top protection cover after installing an Inverter with an output of 18.5 kW or less in a panel.
   Always provide enough space for suspension eye bolts and the main circuit lines when installing an Inverter with an output of 22 kW or more in a panel.

◆ Electrical Connection

■Installation of Inverters and EMC filters

For an EMC rules compliant installation consider the following points:

- Use a line filter.
- Use shielded motor cables.
- Mount the inverter and filter on a grounded conductive plate.
- Remove any paint or dirt before mounting the parts in order to reach the lowest possible grounding impedance.



■Wiring Main Circuit Inputs

Consider the following precautions for the main circuit power supply input.

- If a moulded case circuit breaker is used for the power supply connection (R/L1, S/L2, and T/L3), ensure that the circuit breaker is suitable for the Inverter.
- If an earth leakage breaker is used, it should be able to detect all kinds of current should be used in order to ensure a safe earth leakage current detection
- A magnetic contactor or other switching device can be used at the inverter input. The inverter should not be powered up more than once per hour.
- The input phases (R/S/T) can be connected in any sequence.
- If the Inverter is connected to a large-capacity power transformer (600 kW or more) or a phase advancing capacitor is switched nearby, an excessive peak current could flow through the input power circuit, causing an inverter damage. As a countermeasure install an optional AC Reactor at the inverter input or a DC reactor at the DC reactor connection terminals.
- Use a surge absorber or diode for inductive loads near the Inverter. Inductive loads include magnetic contactors, electromagnetic relays, solenoid valves, solenoids, and magnetic brakes.

■Wiring the Output Side of the Main Circuit

The following precautions should be considered for the output circuit wiring.

- Never connect any power source to the inverter output terminals. Otherwise the inverter can be damaged.
- Never short or ground the output terminals. Otherwise the inverter can be damaged.
- Do not use phase correction capacitors. Otherwise the inverter and capacitors can be damaged.
- Check the control sequence to make sure, that the magnetic contactor (MC) between the Inverter and motor is not turned ON or OFF during inverter operation. If the MC is turned ON during the Inverter is operation, a large inrush current will be created and the inverter's over current protection may operate.

■Ground Connection

The following precautions should be considered for the ground connection.

- Do not share the ground wire with other devices, such as welding machines or power tools.
- Always use a ground wire, that complies with technical standards on electrical equipment and minimize the length of the ground wire.

Leakage current is caused by the Inverter. Therefore, if the distance between the ground electrode and the ground terminal is too long, potential on the ground terminal of the Inverter will become unstable.

- When more than one Inverter is used, do not to loop the ground wire.

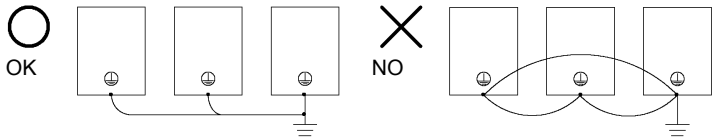


Fig 1 Ground Wiring

■Control Circuit Wiring Precautions

Consider the following precautions for wiring the control circuits.

- Separate control circuit wiring from main circuit wiring (terminals R/L1, S/L2, T/L3, B1, B2, U/T1, V/T2, W/T3, ⊖, ⊕1, ⊕2, and ⊕3, PO, NO) and other high-power lines.
- Separate wiring for control circuit terminals MA, MB, MC, M1, M2, M3, M4, M5, and M6 (contact outputs) from wiring to other control circuit terminals.
- If an optional external power supply is used, it should be 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 have to be grounded on both cable ends.

■Main Circuit Terminals

Main circuit terminal functions are summarized according to terminal symbols in *Table 1*. Wire the terminals correctly for the desired purposes.

Table 1 Main Circuit Terminal Functions (200 V Class and 400 V Class)

Purpose	Terminal Symbol	Model: CIMR-L7Z□□□□	
		200 V Class	400 V Class
Main circuit power input	R/L1, S/L2, T/L3	23P7 to 2055	43P7 to 4055
	R1/L11, S1/L21, T1/L31	2022 to 2055	4022 to 4055
Inverter outputs	U/T1, V/T2, W/T3	23P7 to 2055	43P7 to 4055
DC bus terminals	⊕1, ⊖	23P7 to 2055	43P7 to 4055
Braking Resistor Unit connection	B1, B2	23P7 to 2018	43P7 to 4018
DC reactor connection	⊕1, ⊕2	23P7 to 2018	43P7 to 4018
Braking Unit connection	⊕3, ⊖	2022 to 2055	4022 to 4055
Ground	⏚	23P7 to 2055	43P7 to 4055
Control Power Supply	PO, NO	23P7 to 2055	43P7 to 4055

■Control Circuit Terminals

Fig 2 shows the control terminal arrangement. The functions of the control circuit terminals are shown in *Table 2*. Use the appropriate terminals for the correct purposes.

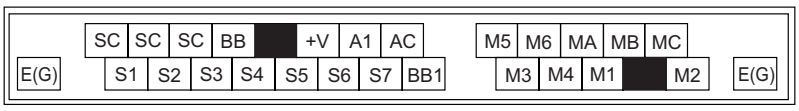


Fig 2 Control terminal arrangement

Table 2 Control Circuit Terminals with default settings

Type	No.	Signal Name	Function		Signal Level
Digital input signals	S1	Forward run/stop command	Forward run when ON; stopped when OFF.		24 VDC, 8 mA Photo-coupler
	S2	Reverse run/stop command	Reverse run when ON; stopped when OFF.		
	S3	Nominal speed	Nominal speed when ON.	Functions are selected by setting H1-01 to H1-05.	
	S4	Inspection Run	Inspection RUN when ON.		
	S5	Intermediate speed	Intermediate speed when ON.		
	S6	Leveling speed	Leveling speed when ON.		
	S7	Not used	–		
	BB	Hardware baseblock	Both inputs must be enabled to enable the inverter output		
	BB1	Hardware baseblock 1			
	SC	Digital input common	–		–
Analog input signals	+V	15 V power supply*1	15 V power supply for analog references		15 V (Max. current: 20 mA)
	A1	Frequency reference	0 to +10 V/100%		0 to +10 V(20 kΩ)
	AC	Analog reference neutral	–		–
	E(G)	Shield wire, optional ground line connection point	–		–
Digital output signals	M1	Brake command (1NO contact)	Brake command when ON.	Multi-function contact outputs	Relay contacts Contact capacity: 1 A max. at 250 VAC 1 A max. at 30 VDC*2
	M2				
	M3	Contactor Control (1NO contact)	Contactor Control when ON		
	M4				
	M5	Inverter Ready (1NO contact)	Inverter Ready when ON.		
	M6				
	MA	Fault output signal (SPDT) (1 Change over contact)	Fault when CLOSED across MA and MC Fault when OPEN across MB and MC		
	MB				
	MC				

*1. Do not use this power supply for supplying any external equipment.
*2. When driving a reactive load, such as a relay coil with DC power supply, always insert a flywheel diode as shown in *Fig 3*.

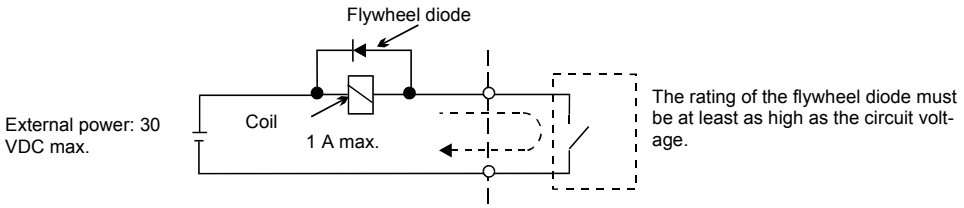


Fig 3 Flywheel Diode Connection

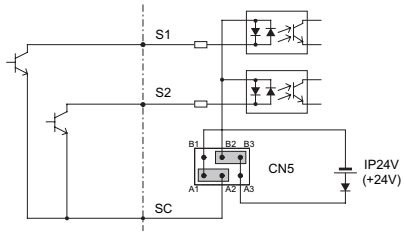
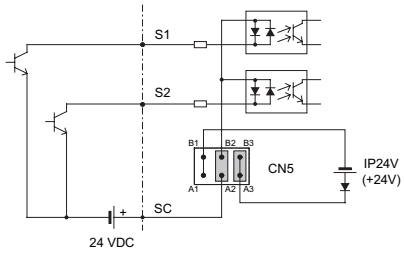
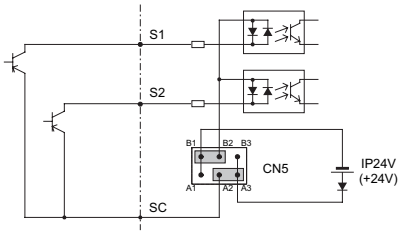
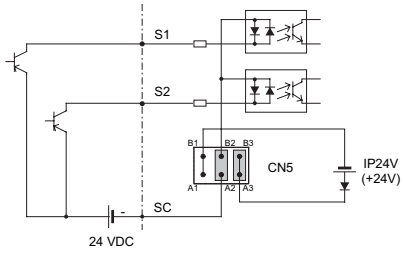
IMPORTANT

1. In *Fig 4* the wiring of the digital inputs S1 to S7 and BB, BB1 is shown for the connection of contacts or NPN transistors (0V common and sinking mode). This is the default setting.
   For the connection of PNP transistors or for using a 24V external power supply, refer to *Table 3*.
2. A DC reactor is an option only for Inverters of 18.5 kW or less. Remove the short circuit bar when connecting a DC reactor.

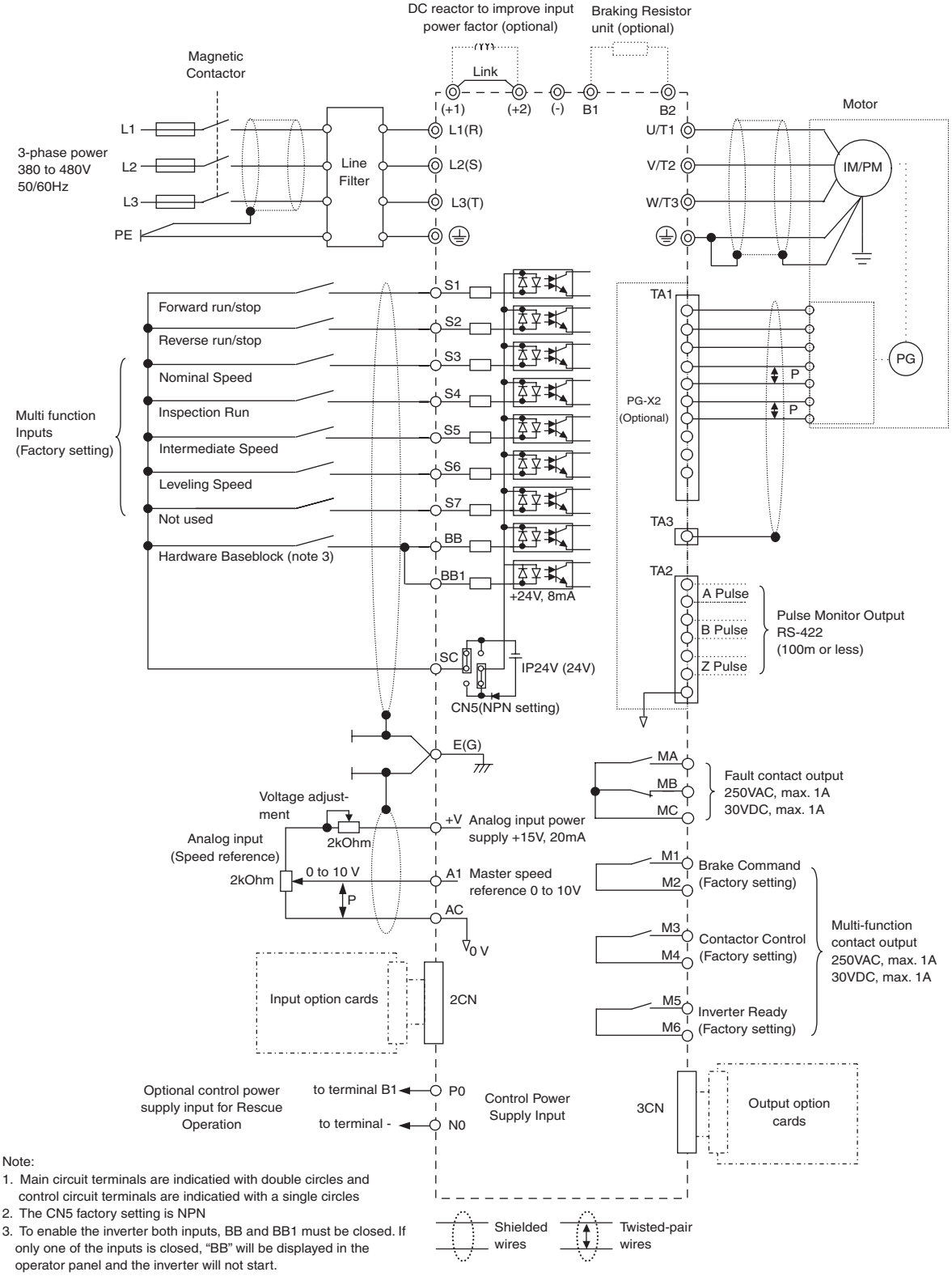
■ Sinking/Sourcing Mode (NPN/PNP Selection)

The input terminal logic can be switched over between sinking mode (0-V common, NPN) and sourcing mode (+24V common, PNP) by using the jumper CN5. An external power supply is also supported, providing more freedom in signal input methods.

Table 3 Sinking/Sourcing Mode and Input Signals

Internal Power Supply – Sinking Mode (NPN) 	External Power Supply – Sinking Mode (NPN) 
Internal Power Supply – Sourcing Mode (PNP) 	External Power Supply – Sourcing Mode (PNP) 

■Wiring the Inverter



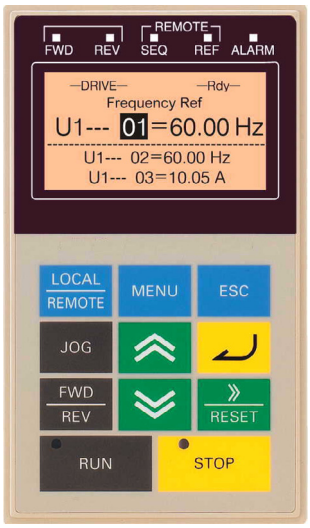
Note:
1. Main circuit terminals are indicatied with double circles and control circuit terminals are indicatied with a single circles
2. The CN5 factory setting is NPN
3. To enable the inverter both inputs, BB and BB1 must be closed. If only one of the inputs is closed, “BB” will be displayed in the operator panel and the inverter will not start.

Fig 4 Wiring Diagram

Keypad Operation

◆ Digital Operator Display (optional)

The key names and functions of the Digital Operator are described below



Drive Status Indicators

FWD: Lights up when a forward run command is input.
REV: Lights up when a reverse run command is input.
SEQ: Lights up when any other run command source than the digital operator is selected
REF: Lights up when any other frequency reference source than the digital operator is selected
ALARM: Lights up when an error or alarm has occurred.

Data Display

Displays monitor data, parameter numbers and parameter settings.

Mode Display (displayed at the upper left of data display)

DRIVE: Lights up in Drive Mode.
QUICK: Lights up in Quick Programming Mode.
ADV: Lights up in Advanced Programming Mode.
VERIFY: Lights up in Verify Mode.
A. TUNE: Lights up in Autotuning Mode.

Keys

Execute operations such as setting parameters, monitoring, jogging, and autotuning.

■Digital Operator Keys

Key	Name	Function
LOCAL / REMOTE	LOCAL/REMOTE Key	Switches between operation via the Digital Operator (LOCAL) and the settings in b1-01 and b1-02 (REMOTE). This key can be enabled or disabled by setting parameter o2-01.
MENU	MENU Key	Selects menu items (modes).
ESC	ESC Key	Returns to the status before the DATA/ENTER key was pressed.
JOG	JOG Key	Starts jog operation when the inverter is operated by the Digital Operator and d1-18 is set to 0.
FWD / REV	FWD/REV Key	Selects the rotation direction of the motor when the Inverter is operated by the Digital Operator.
RESET	Shift/RESET Key	Sets the active digit when programming parameters. Also acts as the Reset key when a fault has occurred.
^	Increment Key	Selects menu items, sets parameter numbers, and increments set values. Used to move to the next item or data.
v	Decrement Key	Selects menu items, sets parameter numbers, and decrements set values. Used to move to the previous item or data.
↵	DATA/ENTER Key	Enters menus and parameters, and set validates parameter changes.
RUN	RUN Key	Starts the Inverter operation when the Inverter is controlled by the Digital Operator.
STOP	STOP Key	Stops Inverter operation. This key can be enabled or disabled using parameter o2-02 when operating from a source different than the operator.

Note: Except in diagrams, Keys are referred to the key names listed in the above table.

Power Up and Basic Parameter Setup

◆ Start Up Procedure

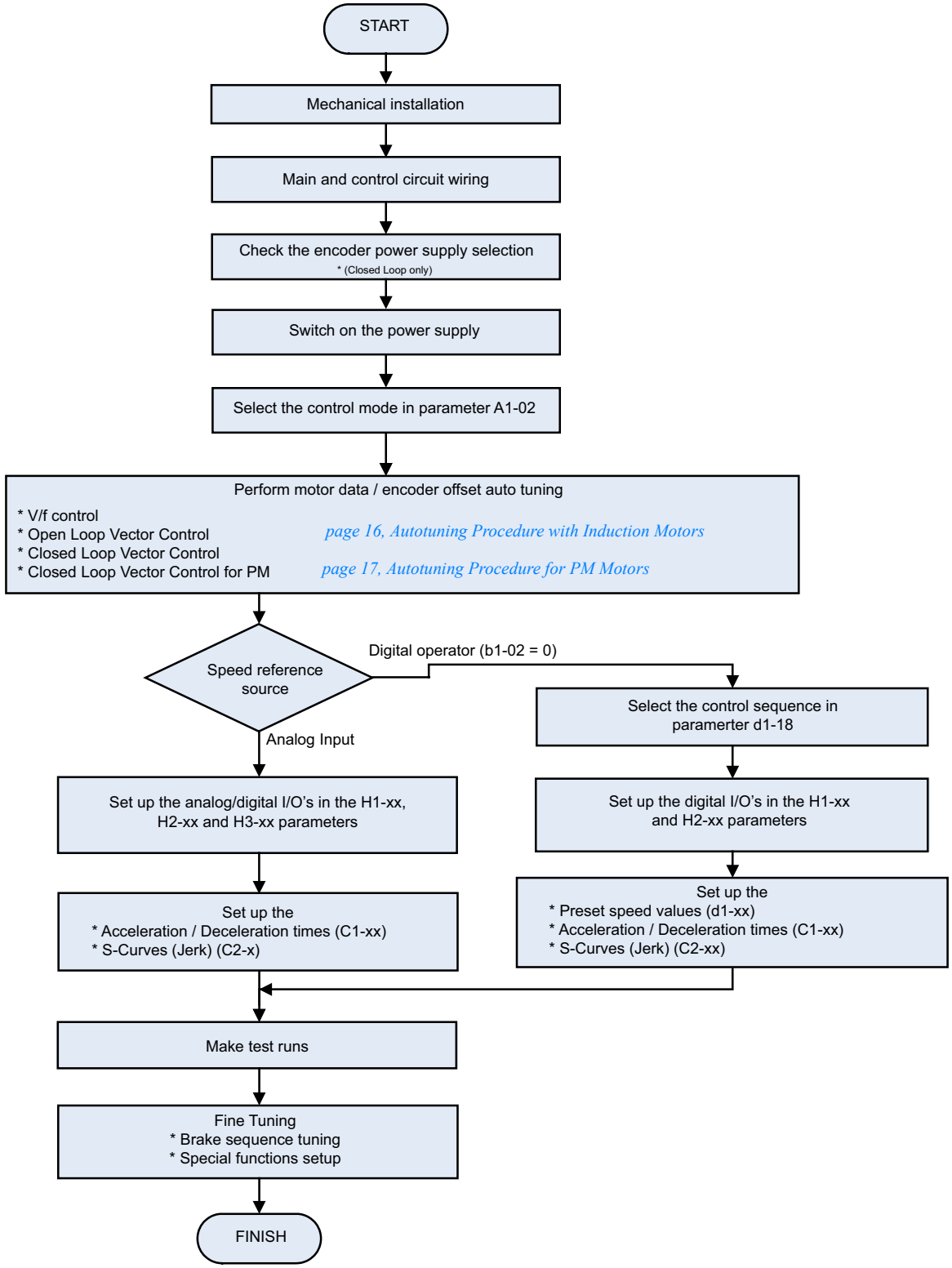


Fig 5 Basic Start Up Sequence

◆ Before Power Up

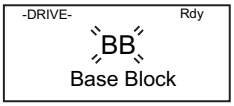
The following points should be checked carefully before the power is switched on.

- Check if the power supply meets the inverter specification.
- Check if the power supply cables are tightly connected to the right terminals (L1, L2, L3).
- Check if the motor cables are tightly connected to the right terminals on the inverter side (U, V, W) as well as on the motor side.
- Check if the braking unit / braking resistor is connected correctly.
- Check if the Inverter control circuit terminal and the control device are wired correctly.
- Set all Inverter control circuit terminals to OFF.
- When a PG card is used, check if it is wired correctly.

◆ Display after Power Up

After normal power up without any problems the operator display shows the following messages

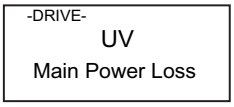
Display for normal operation



The Baseblock message blinks.

When a fault occurs or an alarm is active, a fault or alarm message will appear. In this case, refer to *page 28, Factory settings are in bold.*.

Display for fault operation



A fault or alarm message is shown on the display.
The example shows a low voltage alarm.

◆ Control Mode Selection

As the first thing after power up one of the four control modes must be selected depending on the machine type. The Closed Loop Vector modes require PG feedback cards. *Table 4* shows the required / possible PG cards for each mode.

Table 4 Control Mode Selection

Machine Type	Control Mode	A1-02 setting	PG Card
Induction motor without encoder	V/f control	0	-
	Open Loop Vector Control	2	-
Induction motor with incremental encoder	Closed Loop Vector Control	3	PG-B2 / PG-X2
Permanent magnet motor with Hiperface® or EnDat 2.1 encoder	Closed Loop Vector Control for PM motors	6	PG-F2
Yaskawa IPM motor with incremental encoder	Closed Loop Vector Control for PM motors	6	PG-X2

⚠ CAUTION

- For Permanent Magnet motors do not use any other control mode than Closed Loop Vector for PM (A1-02 = 6). Using any other control mode can cause damage to the equipment or can cause dangerous behavior.

Autotuning

The motor data autotuning function sets the V/f pattern parameters (E1-□□), motor data parameters (E2-□□, E5-□□) and the encoder data (F1-01) automatically. The steps which have to be performed during the autotuning depend on the tuning mode selection.

◆ Autotuning Mode Selection

The autotuning mode has to be selected according to selected control mode and the mechanical system (motor no load rotation possible or not). *Table 5* shows the selectable tuning mode for each control mode.

Table 5 Motor Data Autotuning Modes

Autotuning Mode	Function	Tuning Mode Selection (T1-01)	Control Mode			
			V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
Standard tuning with rotating motor	Tunes all motor parameters.	0	No	Yes	Yes	Yes
IM tuning with not rotating motor	Tunes the basic motor parameters.	1	No	Yes	Yes	No
IM Line-to-line resistance tuning	Tunes the line-to-line resistance only	2	Yes	Yes	Yes	No
Encoder offset tuning	Tunes the offset between the encoder and magnetic zero position.	4	No	No	No	Yes

■Autotuning Modes

Autotuning with Rotating Motor (T1-01 = 0)

This autotuning mode can be used in any Vector control mode. After the motor nameplate data have been input, the inverter will operate the motor for approximately 1~2 minutes and set the required motor parameters automatically.

IMPORTANT

Use this tuning mode only, if the motor can rotate freely which means that the ropes must be removed and the brake must be open. The gearbox can remain connected to the motor.

Autotuning with Not Rotating Motor (T1-01 = 1)

This autotuning mode can be used for Open Loop and Closed Loop Vector control for IM only. The inverter supplies power to the motor for approximately 1 minute and some of the motor parameters are set automatically while the motor does not turn. The motor no-load current and the rated slip value will automatically be fine tuned during the first time operation.
Verify the rated slip value (E2-02) and the no-load current (E2-03) after the first run with nominal speed.

Autotuning for Line-to-Line Resistance (T1-01 = 2)

Non-rotating autotuning for line-to-line resistance can be used in V/f control, Open Loop Vector control and Closed loop Vector control. The Inverter supplies power to the motor for approximately 20 seconds to measure the motor line-to-line resistance and cable resistance. The motor does not turn during this tuning procedure.

Encoder Offset Tuning (T1-01=4)

This tuning mode is available in Closed Loop Vector control for PM motors only. It automatically sets the offset between the magnetic pole and the encoder zero position. It can be used to retune the offset after an encoder change without changing the motor data settings.

IMPORTANT

General Precautions:

1. Use rotating autotuning whenever high precision is required or for a motor that is not connected to a load.
2. Use not rotating autotuning whenever the load cannot be disconnected from the motor (e.g. the ropes can't be removed).
3. Make sure, that the mechanical brake is *not* open for not rotating autotuning.
4. During autotuning the motor contactors have to be closed.
5. For autotuning the BB and BB1 signals must be ON (Inverter must not be in base block condition).
6. Confirm, that the motor is mechanically fixed and can not move.
7. Power is supplied during auto tuning, even though the motor does not turn. Do not touch the motor until auto-tuning has been completed.
8. Remove the feather key from the motor shaft before performing a tuning with rotating motor with a stand alone motor (no traction sheave or gear mounted).
9. To cancel autotuning, press the STOP key on the Digital Operator.

Precautions for rotating and encoder offset autotuning:

1. The load should be disconnected which means, that the ropes have to be removed and the brake must be open.
2. If the load can't be removed, the tuning can be done with a balanced car. The tuning result accuracy will be lower which can result in a performance loss.
3. Make sure that the brake is open during autotuning.
4. During autotuning the motor can be started and stopped repeatedly. When the tuning is finished, "END" will be displayed in the operator panel. Do not touch the motor until this display is shown and the motor has completely stopped.

◆ Autotuning Alarms and Faults

■Data Input Errors

The inverter will show a "Data Invalid" message and will not perform autotuning if:

- the motor speed, rated frequency and pole pair number do not correspond.

$$\text{Motor Speed} < \frac{\text{Base Frequency} \cdot 60}{2 \cdot \text{Motor pole}}$$

- the rated current does not correspond to the rated power value
  The inverter calculates the motor power using the input current value and data from the internal motor data table. The calculated value must be between 50% and 150% of the input value for the rated power.

■Other Alarms and Faults During Autotuning

For an overview of possible autotuning alarms or faults and corrective actions refer to *page 27, Auto-tuning Faults*.

◆ Autotuning Procedure with Induction Motors

Fig 6 shows the autotuning procedure for an induction motor with or without encoder in V/f-, Open loop vector and Closed loop vector control.

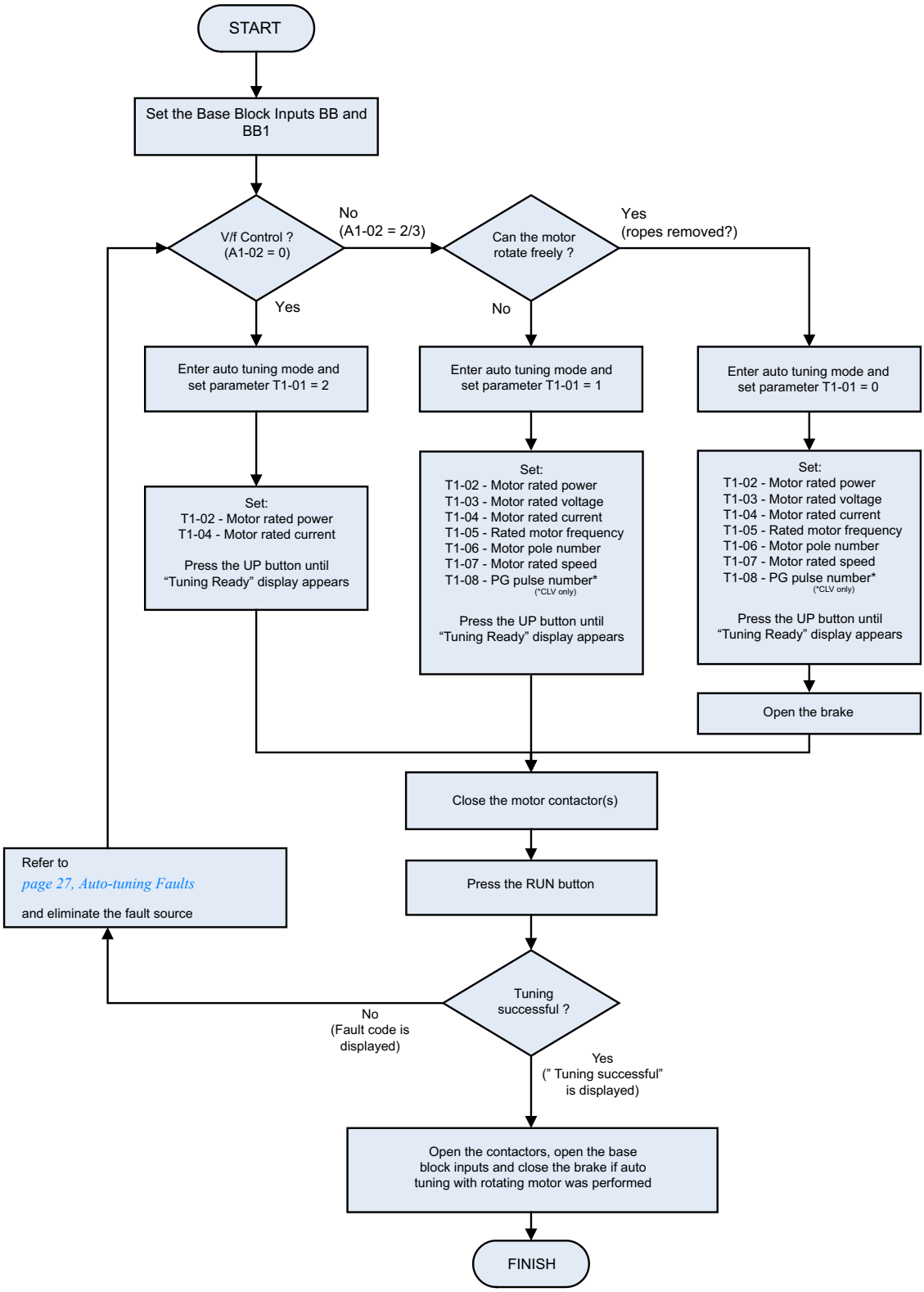
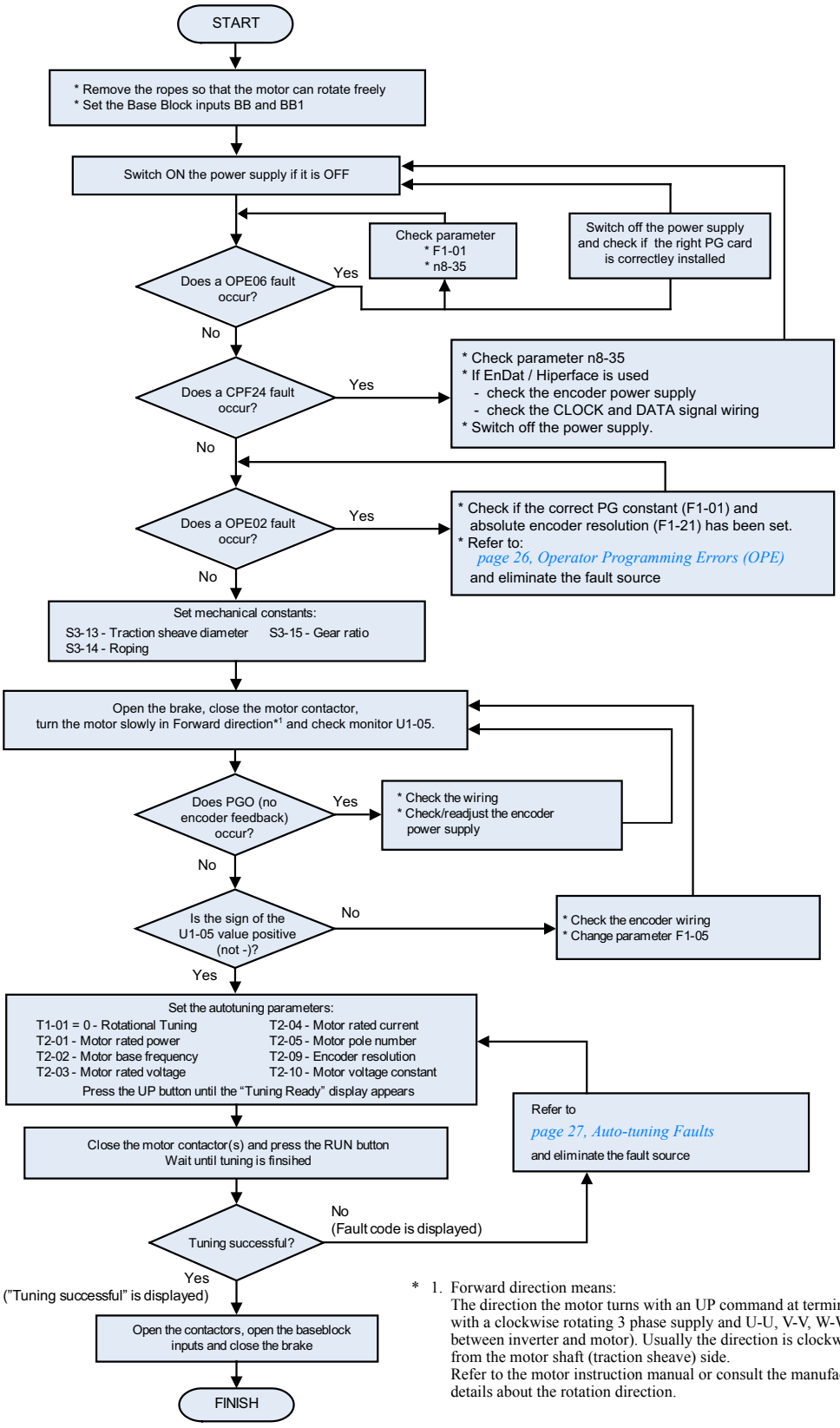


Fig 6 Autotuning for Induction Motors

◆ Autotuning Procedure for PM Motors

Fig 7 shows the autotuning procedure for permanent magnet motors. Before tuning make sure that the control mode is set to PM Closed Loop Vector (A1-02 = 6).

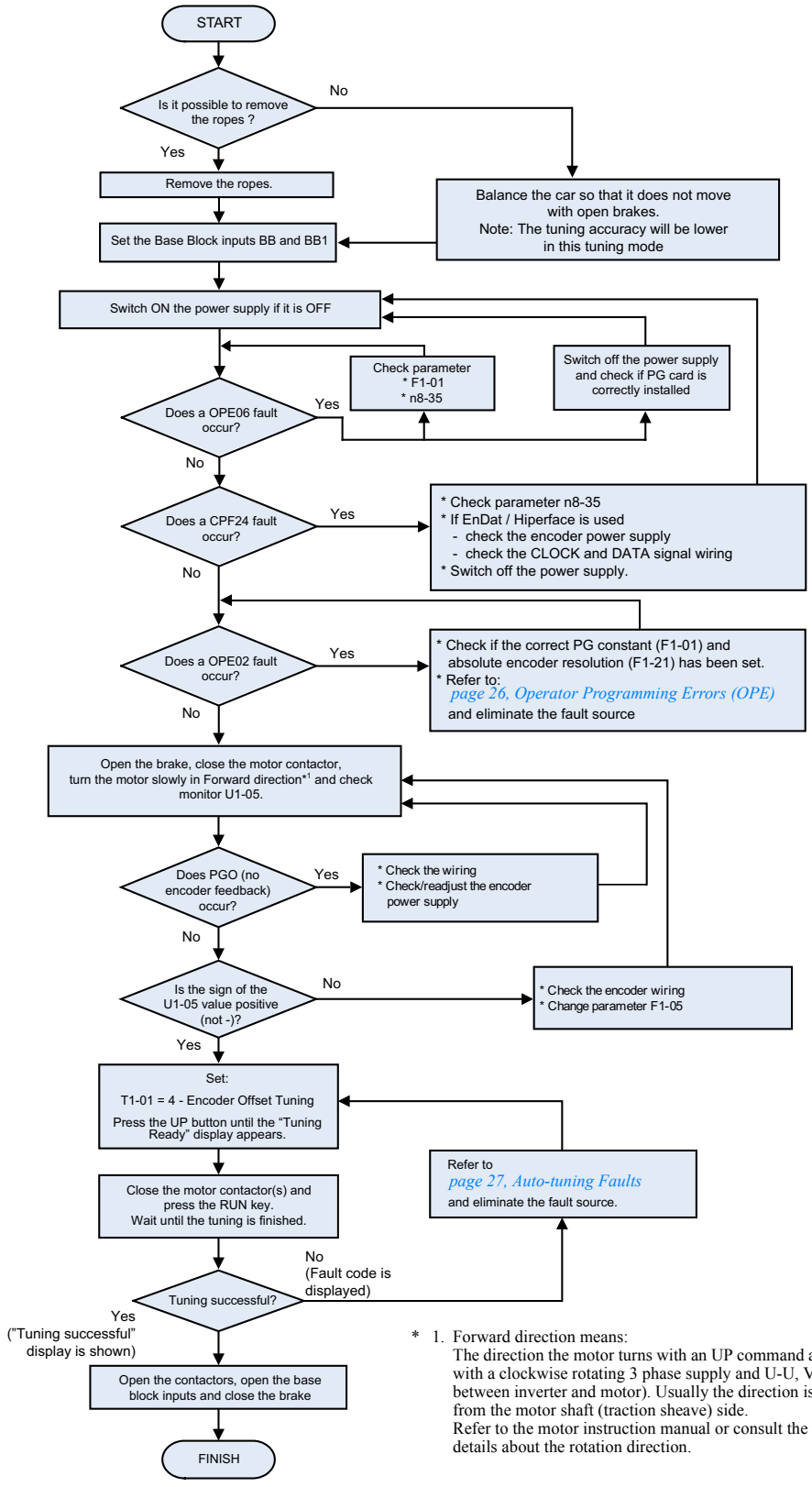


* 1. Forward direction means:
The direction the motor turns with an UP command at terminal S1 (i.e. with a clockwise rotating 3 phase supply and U-U, V-V, W-W wiring between inverter and motor). Usually the direction is clockwise seen from the motor shaft (traction sheave) side.
Refer to the motor instruction manual or consult the manufacturer for details about the rotation direction.

Fig 7 Autotuning for Permanent Magnet Motors

◆ PM Motor Encoder Offset Tuning

Fig 8 shows the autotuning procedure for an encoder offset tuning. The procedure should be performed if the encoder has been changed or has not been aligned correctly. Before tuning make sure that PM losed loop vector control is selected (A1-02 = 6) and that the E1-□□ and E5-□□ parameters are set up correctly.



* 1. Forward direction means:
The direction the motor turns with an UP command at terminal S1 (i.e. with a clockwise rotating 3 phase supply and U-U, V-V, W-W wiring between inverter and motor). Usually the direction is clockwise seen from the motor shaft (traction sheave) side.
Refer to the motor instruction manual or consult the manufacturer for details about the rotation direction.

Fig 8 Encoder Offset Autotuning

Ride Profile and Sequence Setup

◆ Up and Down Commands and Speed Reference Selection

■Up / Down Command Source Selection

The input source for the Up and Down signal can be selected in parameter b1-02. The factory setting is Up/Down command by the terminals S1/S2 (b1-02 = 1).

■Travel start in Up or Down direction

To start in the elevator in Up or Down direction the following conditions have to be fulfilled:

- At least one speed reference must be selected if digital inputs are used for speed reference selection.
- The hardware base block signal (Terminal BB and BB1) must be set (not base block condition).
- The Up/Down signal must be set to start in the corresponding direction.

■Travel stop

The inverter can be stopped as follows:

- The direction command (UP or Down) signal is removed.
- The speed reference selection signal is removed if digital inputs are used for speed reference selection.
- If d1-18 is set to 3 and all speed inputs are removed

■Speed Reference Source Selection

The speed reference source can be selected using parameter b1-01. The factory setting is the digital operator (b1-01 = 0), i.e. the speeds can be selected using digital inputs.

◆ Speed Selection Sequence Using Digital Inputs

If the digital inputs are used for speed selection, the speed selection method and the speed priority depends on the setting of parameter d1-18 (Speed priority selection).

■Multi-Step Speed Operation 1/2 (Binary Input) (d1-18=0/3)

If d1-18 = 0

8 preset speed steps (defined in the parameters d1-01 to d1-08) can be selected using 3 binary coded digital inputs. The Up/Down command starts the inverter. It stops when the Up/Down command is removed.

If d1-18 = 3

7 preset speed steps (defined in the parameters d1-02 to d1-08) can be selected using 3 binary coded digital inputs. The Up/Down command starts the inverter. It is stopped when the Up/Down command is removed or when no speed is selected (all D/Is off).

Multi-function Digital Input Settings (H1-01 to H1-05) (Example)

Terminal	Parameter Number	Set Value	Details
S4	H1-02	3	Multi-step speed command 1
S5	H1-03	4	Multi-step speed command 2
S6	H1-04	5	Multi-step speed command 3

Speed Selection Table

The following table shows the combinations of the digital input and the according speed.

If b1-02 is set to “1”, frequency reference 1 is input as analog reference at terminal A1.

Speed	Multi-step Speed Command 1	Multi-step Speed Command 2	Multi-step Speed Command 3	Selected Frequency	
				d1-18 = 0	d1-18 = 3
1	OFF	OFF	OFF	Frequency reference 1 d1-01	Stop
2	ON	OFF	OFF	Frequency reference 2 d1-02	Frequency reference 2 d1-02
3	OFF	ON	OFF	Frequency reference 3 d1-03	Frequency reference 3 d1-03
4	ON	ON	OFF	Frequency reference 4 d1-04	Frequency reference 4 d1-04
5	OFF	OFF	ON	Frequency reference 5 d1-05	Frequency reference 5 d1-05
6	ON	OFF	ON	Frequency reference 6 d1-06	Frequency reference 6 d1-06
7	OFF	ON	ON	Frequency reference 7 d1-07	Frequency reference 7 d1-07
8	ON	ON	ON	Frequency reference 8 d1-08	Frequency reference 8 d1-08

■Separate Speed Selection Inputs, High Speed Has Priority (d1-18=1)

With this setting 6 different speeds (defined in the parameters d1-09 to d1-17) can be set and selected using four digital inputs.

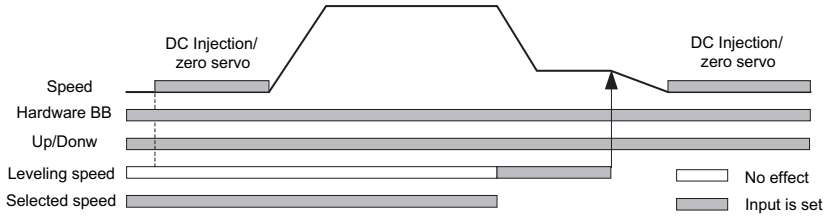
Digital Input Factory Settings

Terminal	Parameter Number	Set Value	Details
S3	H1-01	80	Nominal speed selection (d1-09)
S4	H1-02	84	Inspection speed selection (d1-14)
S5	H1-03	81	Intermediate speed selection (d1-10)
S6	H1-04	83	Leveling speed selection (d1-17)

Higher Speed has Priority and a Leveling Speed Input is Selected (H1-□□=83)

If d1-18 is set to 1 and one multi-function digital input is set to leveling speed selection (H1-□□=83), the inverter decelerates to the leveling speed (d1-17) when the selected speed signal is removed. Inspection Speed can not be selected as travel speed. The higher speed has priority over the leveling speed, i.e. as long as a higher speed is selected, the leveling signal is disregarded (see the fig. below)

The inverter stops when the leveling signal or the Up/Down signal is removed.

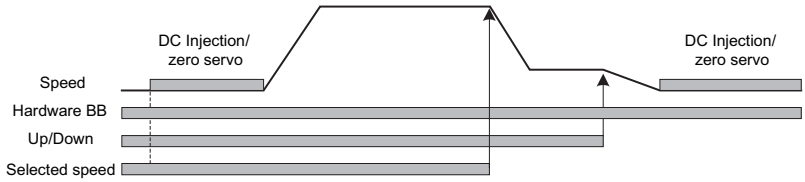


Higher Speed Priority is Selected and a Leveling Speed Input is Not Selected (H1-□□≠83)

When the leveling speed command is not selected for any digital input, the inverter decelerates to the leveling speed (d1-17) when the selected speed signal is removed. Inspection Speed can not be selected as travel speed To select the leveling speed as travel speed the frequency reference loss detection must be disabled (S3-09=0).

The inverter stops when the direction signal Up/Down is removed.

When no speed selection input is set the leveling speed is taken as the speed reference.



The inverter stops when the direction signal (UP or DOWN signal) is removed.

IMPORTANT

With this configuration the drive stops with a "FRL" (frequency reference loss fault) when no speed reference input is selected during the start.
To disable the FRL detection, set parameter S3-09 to "0".

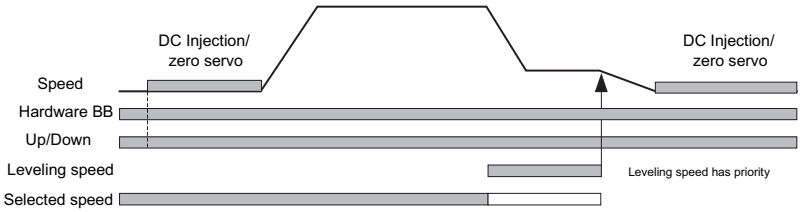
■Separate Speed Selection Inputs, Leveling Speed Has Priority (d1-18=2)

The related parameters and the digital input pre-settings are the same as for the High Speed Priority setting (d1-18=1).

Leveling Speed has Priority and a Leveling Speed Input is Selected (H1-□□=83)

If d1-18 is set to "2" and one multi-function digital input is set to leveling speed (H1-□□=83) the inverter decelerates to the leveling speed (d1-17) when the leveling speed selection input is activated. The leveling signal has priority over the selected speed, i.e. the selected speed is disregarded. The selected travel speed must be different from inspection speed.

The inverter stops when the leveling speed command is removed.

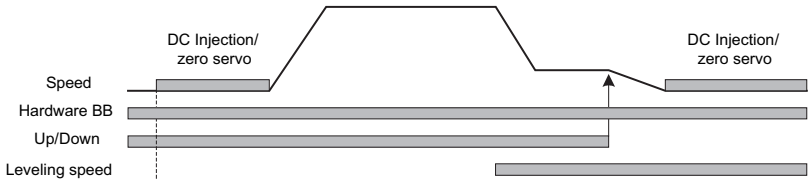


Leveling Speed Priority is Selected and a Nominal Speed Input is Not Selected (H1-□□≠80))

If d1-18 is set to "2" and no digital input is set to nominal speed selection, the speed reference with speed selection input set is nominal speed (d1-09). When the leveling speed signal is set, the inverter starts to decelerate to the leveling speed. The leveling speed signal has priority over all other speed signals, i.e. the intermediate speed 1 and 2 and the revelling signals are disregarded when leveling speed is selected.

The inverter can be stopped by removing the leveling speed signal or the Up/Down command.

CAUTION: This sequence can be risky if e.g. the speed selection doesn't work for any reason (broken wire etc.).



◆ Acceleration / Deceleration / Jerk Settings

The acceleration time indicates the time to increase the speed from 0% to 100% of the maximum speed set in E1-04. The deceleration time indicates the time to decrease the speed from 100% to 0% of E1-04.

The standard acceleration/deceleration times are set in the parameters C1-01/02, the jerk settings (S-curve) are set in the C2-□□ parameters as shown in *Fig 9*.

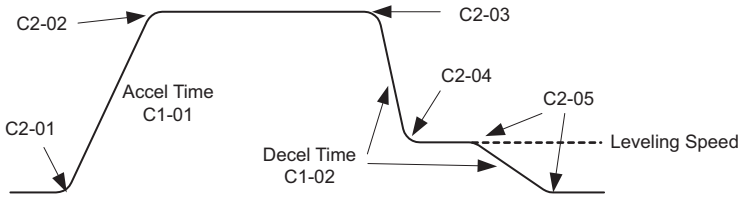


Fig 9 Acceleration / Deceleration and Jerk (S-curve) settings

◆ Brake Sequence

The figure below shows the standard brake sequence.

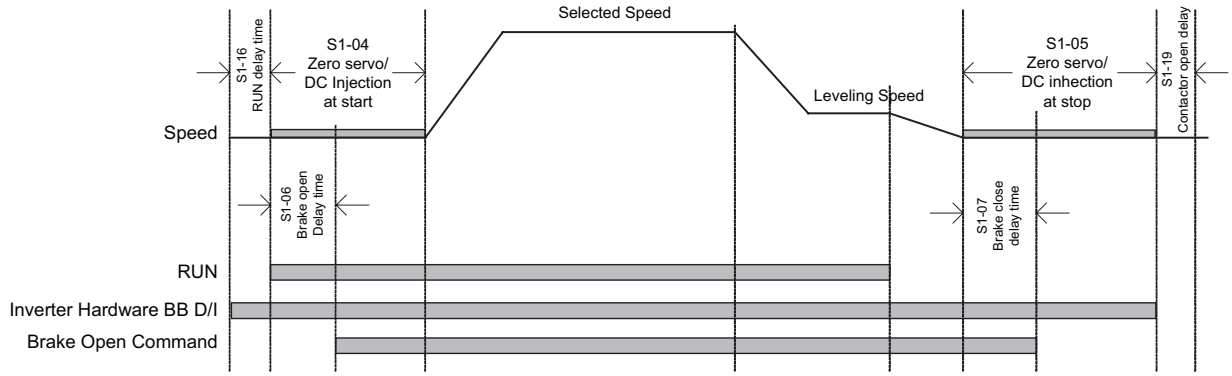


Fig 10 Timing chart of Brake sequence without torque compensation at start

◆ Inertia Compensation (Feed Forward)

Feed Forward Control is used to eliminate the speed overshoot or undershoot by compensating inertia effects. It can be enabled by setting parameter n5-01 to 1. After that the motor acceleration time n5-05 must be tuned.

■Motor Acceleration Time Auto Tuning (n5-05)

Before the n5-02 auto tuning is performed, the motor data autotuning and the general setup should have been finished. Do the tuning with the factory settings for the n5-□□ parameters.

Use the following procedure:

1. Set n5-05 to “1” to enable the auto tuning and go back to the speed reference display.
2. Set the base block input.
3. Enable the inspection speed input. “FFCAL” will blink in the display to signalize that the calculation is active.
4. Set an UP command. The inverter will accelerate the motor up to the nominal speed. Release the UP command a few seconds after the top speed has been reached.

5. When the motor has stopped, apply a DOWN command. The inverter will accelerate the motor in the opposite direction to the nominal speed. Release the DOWN command a few seconds after the nominal speed has been reached.

To abort the tuning set parameter n5-05 to “0”.

1. The order of giving the UP or DOWN command has no influence.
2. n5-01 should not be changed from the factory value for the tuning.
3. After the run in both directions is finished, parameter n5-05 is automatically set back to “0”.
4. The autotuning will be performed only if the inspection speed input is set.
5. Do not change the mechanical constants (load, inertia) between the runs.

■Feed Forward Compensation P-Gain Setup

- Increase the gain to improve the responsiveness to the speed reference.
- Decrease the gain if vibrations or oscillations occur.

Troubleshooting

◆ Fault and Alarm Detection

Faults and Alarms are functions that indicate unusual inverter / application conditions.

An alarm does not necessarily switch of the inverter but a message is displayed on the keypad and an alarm output is generated at the multi-function outputs (H2-01 to H2-03) if programmed. An alarm automatically disappears if the alarm condition is not present anymore.

A fault switches the inverter off immediately, a message is displayed on the keypad and the fault output is switched. The fault must be reset manually after the cause has been removed.

The following tables shows a list of faults and alarms with their corrective actions.

Display	Displayed as		Meaning	Corrective Actions
	Alarm	Fault		
BUS Option Com Err (flashing)	❍		Option Communications Alarm After initial communication was established, the connection was lost.	Check the connections and all user-side software configurations.
CF Out of Control		❍	A torque limit was reached continuously for 3 seconds or longer during a deceleration stop in Open Loop Vector control.	Check the motor parameters.
CPF00 CPF01 COM-ERR(OP&INV)		❍	• Digital Operator/LED Monitor Communication Fault 1 / 2 • Communication fault between Operator and inverter • CPU External RAM Fault	• Disconnect the Digital Operator/LED Monitor and then connect it again. • Replace the Inverter. • Cycle the Inverter power supply. • Replace the Inverter.
CPF02 - CPF 04		❍	• Baseblock circuit error • EEPROM error • CPU Internal A/D Converter Fault	• Perform an initialization to factory defaults. • Cycle the Inverter power supply. • Replace the Inverter.
CPF24 Option Comm Err		❍	Hiperface serial communication error Detected when no data were received from the encoder for 200 msec	Check the encoder connection or replace the encoder if necessary
DEV Speed Deviation		❍	F1-04 = 0, 1 or 2 and A1-02 = 3 or 6 The speed deviation is higher than the F1-10 value for the time F1-11 or longer.	• Reduce the load. • Lengthen the acceleration time and deceleration time. • Check the mechanical system. • Check the settings of F1-10 and F1-11. • Check the sequence and if the brake is opened when the inverter starts to increase the speed.
	❍		F1-04 = 3 and A1-02 = 3 or 6 The speed deviation is higher than the F1-10 value for the time F1-11 or longer.	
DV3		❍	Wrong rotation direction Detected when the speed deviation is higher than 30% and the torque reference and acceleration have opposite signs.	• Check the PG wiring • Correct the wiring • Verify the PG direction and execute an encoder offset auto tuning • Reduce the load and check the brake
DV4		❍	Wrong rotation direction Detected when F1-19 is not 0, the speed reference and motor speed have opposite signs and the detection threshold set in F1-19 is exceeded.	• Verify the PG direction and execute an encoder offset auto tuning • Reduce the load and check the brake
DV6 Over Acceleration	❍	❍	An over acceleration of the car was detected (A1-02 = 6 only)	• Reduce the load • Check the PG direction, check F1-22 and perform an encoder offset tuning. • Verify the settings of S3-13, S3-14 and S3-15. • Adjust the acceleration and deceleration times.
EF0 Opt External Flt		❍	External fault input from Communications Option Card	• Check for an external fault condition. • Verify the parameters. • Verify communication signals
EF□ Ext Fault S□	❍	❍	External fault at terminal S□ (□ stands for terminals S3 to S7)	Eliminate the cause of the external fault condition.
EF External Fault (flashing)	❍		Forward/Reverse Run Commands Input Together Both the forward and the reverse run commands are input simultaneously for 500ms or more. This alarm stops the motor.	Check external sequence logic, so that only one input is received at a time.
Ext Run Active Cannot Reset	❍		Fault reset was tried during run.	• Remove the direction signal and retry a fault reset. • If a PLC handles the fault reset, check the sequence.

Display	Displayed as		Meaning	Corrective Actions
	Alarm	Fault		
FF_CAL	❍		Feed forward motor acceleration time active	• Perform the complete tuning procedure • Abort the tuning by setting n5-05 = 0.
FRL Ref Missing		❍	No speed was selected before the inverter start.	Check the speed selection/start sequence.
GF Ground Fault		❍	The ground current at the Inverter output exceeded 50% of the Inverter rated output current and L8-09=1 (Enabled).	• Remove the motor and run the Inverter without the motor. • Check the motor for a phase to ground short. • Check the output current with a clampmeter to verify the DCCT reading. • Check the control sequence for wrong motor contactor signals.
LF Output Phase Loss		❍	An open-phase occurred at the Inverter output. The fault is detected when the output current falls below 5% of the inverter rated current and L8-07=1	• Reset the fault after correcting its cause. • Check the motor and Inverter capacity.
OC Over Current		❍	The Inverter's output current exceeded the over current detection level.	• Remove the motor and run the Inverter without the motor. • Check the motor for a phase-to-phase short. • Verify the accel/decel times • (C1-□□). • Check the Inverter for a phase-to-phase short at the output.
OH Heatsink Overtemp		❍	L8-03 = 0,1 or 2 and the temperature of the Inverter's cooling fin exceeded the L8-02 value.	• Check for dirt build-up on the fans or heatsink. • Reduce the ambient temperature around the drive. • Replace the cooling fan(s).
			Inverter's Cooling Fan Stopped	
	❍		L8-03 = 3 and the temperature of the Inverter's cooling fin exceeded the L8-02 value.	
OH1 Heatsink Max Temp		❍	The temperature of the Inverter's heatsink exceeded 105 °C.	• Check for dirt build-up on the fans or heatsink. • Reduce the ambient temperature around the drive. • Replace the cooling fan(s).
			Inverter's Cooling Fan Stopped	
OL1 Motor Overload		❍	Detected when L1-01 is set to 1,2 or 3 and the Inverter's output current exceeded the motor overload curve. The overload curve is adjustable using parameter E2-01 (Motor Rated Current), L1-01 (Motor Protection Selection) and L2-02 (Motor Protection Time Constant)	• Recheck the cycle time and the size of the load as well as the accel/decel times • (C1-□□). • Check the V/f characteristics (E1-□□). • Check the setting of Motor Rated Current Setting (E2-01).
OL2 Inv Overload		❍	The Inverter output current exceeded the Inverter's overload capability.	• Recheck the cycle time and the size of the load as well as the accel/decel times • (C1-□□). • Check the V/f characteristics (E1-□□). • Check the setting of Motor Rated Current Setting (E2-01).
OS Motor Over speed Det		❍	F1-03 = 0, 1 or 2 and A1-02 is set to 3 or 6. The motor speed feedback (U1-05) exceeded the F1-08 value for the time F1-09.or longer.	• Adjust the ASR settings in the C5 parameter group. • Check the reference circuit and reference gain. • Check the settings in F1-08 and F1-09.
	❍		F1-03 = 3 and A1-02 is set to 3 or 6. The motor speed feedback (U1-05) exceeded the F1-08 value for the time F1-09.or longer.	
OV DC Bus Overvolt	❍ (only in stop condition)	❍	The DC bus voltage has exceeded the overvoltage detection level. Default detection levels are: 200 V class: 410 VDC 400 V class: 820 VDC	• Increase the deceleration time (C1-02/04/06/08) or connect a braking option. • Check the power supply and decrease the voltage to meet the inverter's specifications. • Check the braking chopper / resistor.
PF Input Phase Loss		❍	Too big DC bus voltage ripple. Only detected when L8-05=1 (enabled)	• Tighten the input terminal screws • Check the power supply voltage
PGO PG Open (PG Disconnection)		❍	F1-02 = 0, 1 or 2 and A1-02 = 3 or 6 No PG (encoder) pulses are received for the time F1-14 or longer.	• Fix the broken/disconnected wiring. • Fix the wiring. • Supply power to the PG • properly. • Check the sequence and if the brake is opened when the inverter starts to increase the speed.
	❍		F1-02 = 3 and A1-02 = 3 or 6. No PG (encoder) pulses are received for the time F1-14 or longer.	

Display	Displayed as		Meaning	Corrective Actions
	Alarm	Fault		
PUF DC Bus Fuse Open		❍	The fuse in the main circuit is blown. Warning: Never run the Inverter after replacing the DC bus fuse without checking for shorted components.	• Check the motor and the motor cables for short circuits or insulation failures (phase-to-phase). • Replace the inverter after correcting the fault.
RR DynBrk Transistr		❍	The built-in dynamic braking transistor failed.	• Cycle power to the Inverter. • Replace the Inverter.
SE1 Sequence Error 1		❍	No output contactor response S1-16 or longer.	Check the output contactor.
SE2 Sequence Error 2		❍	The output current at start was below 25% of no-load current.	Check the output contactor.
SE3 Sequence Error 3		❍	The output current during run was below 25% of no-load current.	Check the output contactor.
SVE Zero Servo Fault		❍	The motor position moved during Zero Servo Operation.	• Increase the torque limit. • Decrease the load torque. • Check for signal noise.
UV1 DC Bus Undervolt	❍ (only in stop condition)	❍	The DC bus voltage is below the under voltage Detection Level (L2-05). The default settings are: 200V class: 190 VDC 400 V class: 380 VDC	• Check the input voltage. • Check the wiring of the input terminals. • Check the input voltage and the wiring of the input terminals. • Extend the settings in • C1-01/03/05/07
			Main Circuit MC Operation Failure No MC response during Inverter operation.	Replace the Inverter.
UV2 CTL PS Undervolt		❍	Control Power Supply Undervoltage Undervoltage of the control circuit while the Inverter was running.	• Remove all connection to the control terminals and cycle the power to the Inverter. • Replace the Inverter.

◆ Operator Programming Errors (OPE)

An Operator Programming Error (OPE) occurs when two or more parameter related to each other are set inappropriate or an individual parameter setting is incorrect. The Inverter does not operate until the parameter setting is set correctly; however, no other alarm or fault outputs will occur. If an OPE occurs, change the related parameter by checking the cause shown in the table below. When an OPE error is displayed, press the ENTER key to see U1-34 (OPE Detected). This monitor displays the parameter that is causing the OPE error.

Display	Meaning	Corrective Actions
OPE01 kVA Selection	Inverter kVA Setting Error	Enter the correct kVA setting in o2-04.
OPE02 Limit	Parameter Setting out of Range	Verify the parameter settings.
	Hiperface selected (n8-35=4) and: • F1-01 is different from 512 or 1024 • F1-21 is set to 2	
	EnDat selected (n8-35=5) and: • F1-01 is different from 512 or 2048 • F1-21 is set to 0 or 1	
OPE03 Terminal	Multi-function Input Selection Error (H1-01 to H1-05): • Functions were selected duplicative. • External Baseblock NO (8) and External Baseblock NC (9) were selected at the same time. The Emergency Stop Command NO (15) and NC(17) are set simultaneously.	Verify the parameter settings in H1-□□
OPE05 Sequence Select	RUN/Reference Command Selection Error The Reference Source Selection b1-01 and/or the RUN Source Selection parameter b1-02 are set to 3 (option board) but no option board is installed.	• Verify that the board is installed. Remove the power supply and re-install the option board again • Recheck the setting of b1-01 and b1-02.
OPE06 PG Opt Missing	Control method selection error / PG-card missing	Verify the control method selection in parameter A1-02 and/or the installation of the PG option board.
OPE08 Constant Selection	Function Selection Error	Verify the control method and the function.
OPE10 V/f Ptrn Setting	V/f Parameter Setting Error	Check parameters (E1-□□). A frequency/voltage value may be set higher than the maximum frequency/voltage.

◆ Auto-tuning Faults

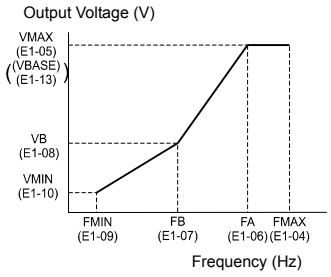
Auto-tuning faults are shown below. When the following faults are detected, the fault is displayed on the digital operator and the motor coasts to stop. No fault or alarm outputs will be operated.

Display	Meaning	Corrective Actions
Accelerate	Acceleration error (detected during rotating autotuning only) The motor did not accelerate in the specified time.	• Increase C1-01 (Acceleration Time 1). • Increase L7-01 and L7-02 (Torque Limits) if they are low. • Remove the ropes and repeat the tuning.
End - 1 V/f Over Setting	V/f Settings Alarm Displayed after auto-tuning is complete The torque reference exceeded 100% and the no-load current exceeded 70% during auto-tuning.	• Check and correct the motor settings • If the motor and the machine are connected, disconnect the motor from the machine.
End - 2 Saturation	Motor Core Saturation Fault Displayed after auto-tuning is complete. Detected only for rotating autotuning	• Check the input data. • Check the motor wiring. • If the motor and the machine are connected, disconnect the motor from the machine.
End - 3 Rated FLA Alm	Rated Current Setting Alarm Displayed after auto-tuning is complete During auto-tuning, the measured value of motor rated current (E2-01) was higher than the set value.	Check the motor rated current value.
Fault	Motor data fault	• Check the input data. • The motor and inverter capacity do not fit. Check the Inverter and motor capacity. • Check the motor rated current and no-load current.
I-det. Circuit	Current detection error The current exceeded the motor rated current or any output phase is open	Check wiring of the Inverter and the mounting.
KE_ERR (PM motor only)	Voltage constant error	Check the motor wiring
LD_ERR (PM motor only)	Inductance error	Check the motor wiring
Leakage Inductance Fault	The leakage inductance measurement caused an error. The leakage inductance tuning current was too high or too low (Closed Loop Vector for PM only)	• Check the motor wiring. • Check the motor rated current input value • Reduce or increase the current level for leakage inductance tuning by changing parameter n8-46.
Minor Fault	Any of the above listed alarms occured during autotuning or the inverter was in Base Block condition when the tuning was started.	• Leave the tuning menu, check the alarm content and remove the cause as described in the alarm list above. • Check the input data. • Make sure that the inverter is not in Base Block condition during the tuning.
Motor Speed	Motor Speed Fault Detected only for rotating autotuning The torque reference exceeded 100% during acceleration. Detected only when A1-02 is set to 2 (Open Loop Vector control).	• If the motor is connected to the machine, disconnect it. • Increase C1-01 (Acceleration Time 1). • Check the input data (particularly the number of PG pulses and the number of motor poles). • Perform not rotating auto tuning
No-Load Current	No-Load Current Fault	• Check the input data. • Check the motor wiring. • If the motor is connected to the machine, disconnect it. • If the setting of T1-03 is higher than the Inverter input power supply voltage (E1-01), change the input data.
Resistance	Line-to-Line Resistance Fault	
Rated slip	Rated Slip Fault	
RS_ERR (PM motor only)	Line-to-line resistance error	• Check the motor wiring • Check the motor input data
STOP key	STOP key input	-
Z_SRCH_ERR (PM motor only)	All encoders: The motor speed exceeded 20 rpm at the auto tuning start. The magnetic pole position tuning could not be performed in the specified time.	• Remove the ropes and repeat the tuning • Check the encoder rotation direction and if necessary change F1-05.
	Encoder with Z-pulse: The difference between two measurements of the magnet pole position was higher than 3°.	
	Serial encoders: The difference between two measurements of the magnet pole position was higher than 5° or an encoder serial communication error has occurred during the tuning.	• Check the encoder wiring (order, shield etc.) • Check the encoder power supply. Replace the encoder.

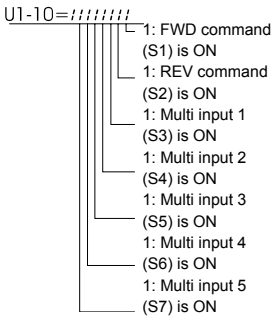
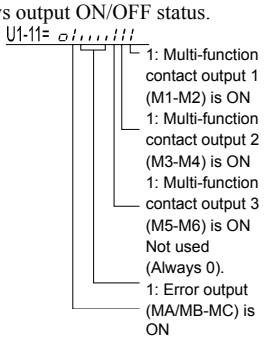
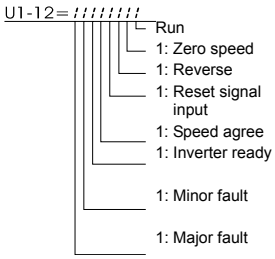
Parameter Table

Note: Factory settings are in bold.

Param. Num.	Name	Description
Initialize Data		
A1-00	Language selection for Digital Operator display (JVOP-160-OY only)	**0: English** 1: Japanese 2: German 3: French 4: Italian 5: Spanish 6: Portuguese
A1-01	Parameter access level	0: Monitoring only (Monitoring drive mode and setting A1-01 and A1-04.) 1: Used to select user parameters (Only parameters set in A2-01 to A2-32 can be read and set.) 2: **Advanced** (Parameters can be read and set in both, quick programming mode (Q) and advanced programming mode (A).)
A1-02	Control method selection	**0: V/f control** 2: Open loop vector 3: Closed Loop Vector 6: Closed Loop Vector for PM motors
A1-03	Initialize	**0: No initializing** 1110: Initializes to user parameters 2220:. Initializes to the factory setting
Sequence / Reference Source		
b1-01	Reference source selection	**0: Digital Operator** 1: Control circuit terminal (analog input) 3: Option Card
b1-02	RUN command source selection	0: Digital Operator **1: Control circuit terminal (digital multi function inputs)** 3: Option Card
Acceleration / Deceleration Settings		
C1-□□	Accel./Decel. time 1	Refer to *page 1-22*
C2-□□	S-curve characteristic	Set the S-curve times at speed changes to reduce the jerk. Refer to *page 1-22*
Slip Compensation		
C3-01	Slip compensation gain	• Increase the value if slip compensation value is too low • Decrease the value if slip is overcompensated
C3-02	Slip compensation delay time	• Reduce the value if the slip compensation responsiveness is low. • When speed is not stable, increase the setting.
Automatic Speed Regulator (ASR)		
C5-01	ASR proportional (P) gain 1	Set the proportional gain 1 and the integral time 1 of the speed control loop (ASR) for the frequency C5-07.
C5-02	ASR integral (I) time 1	
C5-03	ASR proportional (P) gain 2	Set the proportional gain 2 and the integral time 2 of the speed control loop (ASR) for the minimum frequency. The setting is active only for acceleration.
C5-04	ASR integral (I) time 2	
C5-06	ASR delay time	Sets the ASR output delay time.
C5-07	ASR switching frequency	Sets the frequency for switching between Proportion Gain 1, 2,3 and Integral Time 1, 2, 3.

Param. Num.	Name	Description
C5-09	ASR proportional (P) gain 3	Set the proportional gain 3 and the integral time 3 of the speed control loop (ASR) for the minimum frequency. The settings is active for deceleration only.
C5-10	ASR integral (I) time 3	
Carrier Frequency Setup		
C6-02	Carrier frequency selection 1	Selects the carrier frequency for Induction motor control modes.
C6-11	Carrier frequency selection 2	Selects the carrier frequency for PM motor control modes
Speed Settings		
d1-01 to d1-08	Multi speed ref. 1 to 8	Refer to *page 19, Speed Selection Sequence Using Digital Inputs*
d1-09	Nominal speed	
d1-10	Interm. speed 1	
d1-11	Interm. speed 2	
d1-12	Interm. speed 3	
d1-13	Relevel. speed	
d1-14	Inspect. speed	
d1-17	Leveling Speed	
d1-18	Speed priority selection	0: Use Multi-Speed ref. (d1-01 to d1-08) 1: High Speed reference has priority. 2: Leveling speed reference has priority. 3: Use multi-speed reference With no speed selected, the up/ down signal is switched off Refer to *page 1-19*
V/f Pattern Settings		
E1-01	Input voltage setting	This setting is used as a reference value for protection functions.
E1-04	Max. output frequency (FMAX)	 To set V/f characteristics in a straight line, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Always ensure that the four frequencies are set in the following manner: E1-04 (FMAX) ≥ E1-06 (FA) > E1-07 (FB) ≥ E1-09 (FMIN)
E1-05	Max. output voltage (VMAX)	
E1-06	Base frequency (FA)	
E1-08	Mid. output frequency voltage (VB)	
E1-10	Min. output frequency voltage (VMIN)	
E1-13	Base voltage (VBASE)	

Param. Num.	Name	Description
Motor Data Settings		
E2-01	Rated current	Motor Data for induction motors
E2-02	Rated slip	
E2-03	No-load current	
E2-04	Pole number	
E2-05	Line-to-line resistance	
E2-06	Leak inductance	
E5-02	Rated power	Motor Data for PM motors
E5-03	Rated current	
E5-04	Pole number	
E5-05	Line-to-line resistance	
E5-06	d-Inductance	
E5-07	q- Inductance	
E5-09	Motor voltage constant	
Encoder Feedback Settings		
F1-01	PG constant	Sets the number of PG pulses per revolution
F1-05	PG rotation direction	**0: Phase A leads with forward run command. (Phase B leads with reverse run command; Counter Clockwise rotation)** 1: Phase B leads with forward run command. (Phase A leads with reverse run command; Clockwise rotation)
F1-21	Absolute encoder resolution (Hiperface or EnDat)	0: 16384 1: 32768 **2: 8192** (if EnDat is selected (n8-35=5), F1-21 is fixed to 2)
F1-22	Magnet position offset	Sets the Offset between the rotor magnet and encoder zero position.
Digital I/O Settings		
H1-01 to H1-05	Terminal S3 to S7 function selection	Refer to the end of this list for a list of selections
H2-01 to H2-03	Terminal M1-M2 / M3-M4 / M5-M6 function selection	Refer to the end of this list for a list of selections
Motor Protection		
L1-01	Motor protection selection	0: Disabled **1: General-purpose motor protection (fan cooled motor)** 2: Inverter motor protection (externally cooled motor) 3: Vector motor protection When the Inverter power supply is turned off, the thermal value is reset, so even if this parameter is set to 1, protection may not be effective. 5: Permanent magnet constant torque motor protection
Feed Forward Compensation		
n5-01	Feed forward control sel.	**0: Disabled** 1: Enabled
n5-02	Motor acceleration time	
n5-03	Feed forward proportional gain	Speed reference response will increase as the setting of n5-03 is increased.
n5-05	Motor acceleration time tuning	**0: Disabled** 1: Enabled
Brake Sequence		
S1-01	Zero Speed level at stop	Sets the brake close command speed level at stop.
S1-02	DC injection braking current at start	Sets as a percentage of the Inverter rated current.
S1-03	DC injection braking current at stop	
S1-04	DC inj. braking/ Zero speed time at start	Refer to *page 22, Brake Sequence*.
S1-05	DC inj. braking/ Zero speed time at stop	
S1-06	Brake release delay time	
S1-07	Brake close delay time	
S1-20	Zero-servo gain	Zero servo position loop gain for closed loop vector control.
Speed Reference Slip Compensation		
S2-01	Motor rated speed	Sets the motor rated speed.
S2-02	Slip compensation gain in motoring mode	Sets the slip compensation gain in motoring mode. Can be set for leveling accuracy improvement.
S2-03	Slip compensation gain in regenerative mode	Sets the slip compensation gain in regenerative mode. It can be used to improve the leveling accuracy.
Special Functions Setup		
S3-01	Short-floor function selection	Enables or disables the short floor operation function 0: disabled 1: enabled (Standard) 2: enabled (Advanced)
S3-04	Nominal/Leveling speed detection level	Nominal/Leveling speed detection level when multispeed inputs are used. (d1-18=0/3)
S3-08	Output phase order	**0: Output phase order is U-V-W** 1: Output phase order is U-W-V
S3-13	Traction sheave diameter	Sets the diameter of the traction sheave for m/s display units.
S3-14	Roping Ratio	**1: 1:1** 2: 1:2
S3-15	Gear Ratio	Sets the mechanical gear ratio.
Monitor Data		
U1-01	Frequency reference in Hz / rpm	
U1-02	Output frequency in Hz / rpm	
U1-03	Output current in A	
U1-05	Motor speed in Hz / rpm	
U1-06	Output voltage in VAC	
U1-07	DC bus voltage in VDC	

Param. Num.	Name	Description
U1-08	Output power in kW	
U1-09	Torque reference in % of the motor rated torque	
U1-10	Input terminal status	Shows input ON/OFF status. 
U1-11	Output terminal status	Shows output ON/OFF status. 
U1-12	Operation status	Inverter operating status. 
U1-13	Cumulative operation time	
U1-20	Frequency reference after soft-starter	
U1-34	OPE fault parameter	
U1-51	Max Current during acceleration	
U1-52	Max Current during deceleration	
U1-53	Max Current during Top speed	
U1-54	Max Current during leveling speed	
U1-55	Number of travels	
Fault Trace Data		
U2-01	Current fault	
U2-02	Last fault	
U2-03	Reference frequency at fault	
U2-04	Output frequency at fault	
U2-05	Output current at fault	
U2-06	Motor speed at fault	
U2-07	Output voltage reference at fault	
U2-08	DC bus voltage at fault	
U2-09	Output power at fault	
U2-10	Torque reference at fault	
U2-11	Input terminal status at fault	
U2-12	Output terminal status at fault	

Param. Num.	Name	Description
U2-13	Operation status at fault	
U2-14	Cumulative operation time at fault	
Fault History Data		
U3-01 to U3-04	Last fault to Fourth last fault	
U3-05 to U3-08	Cumulative operation time at fault 1 to 4	
U3-09 to U3-14	Fifth last to tenth last fault	
U3-15 to U3-20	Accumulated time of fifth to tenth fault	

* The following errors are not recorded in the error log: CPF00, 01, 02, 03, UV1, and UV2.

Digital Input Function Selections	
3	Multi-step speed reference 1
4	Multi-step speed reference 2
6	Jog frequency command (higher priority than multi-step speed reference)
F	Not used (Set when a terminal is not used)
14	Fault reset (Reset when turned ON)
20 to 2F	External fault; Input mode: NO contact/NC contact, Detection mode: Normal/during operation
80	Nominal Speed Selection (d1-09)
81	Intermediate Speed Selection (d1-10)
82	Releveling Speed Selection (d1-13)
83	Leveling Speed Selection (d1-17)
84	Inspection Run Selection (d1-14)

Digital Output Function Selections	
0	During run 1 (ON: run command is ON or voltage is being output)
6	Inverter operation ready; READY: After initialization or no faults
8	During baseblock (NO contact, ON: during baseblock)
B	Car stuck/undertorque detection 1 NO (NO contact, ON: Overtorque/undertorque detection)
F	Not used. (Set when the terminal is not used.)
10	Minor fault (ON: Alarm displayed)
17	Car stuck/undertorque detection 1 NC (NC Contact, OFF: Torque detection)
1A	During reverse run (ON: During reverse run)
40	Brake Release Command
41	Output Contactor Close Command