

SOHO VD VECTOR INVERTER

User's Manual

*400V Class 5.5kW ~ 400kW
200V Class 2.2kW ~ 45kW*

Contents


1	SAFETY.....	1
1.1	Warnings	1
1.2	Safety instruction	2
1.3	Running the motor	3
2	RECEIVING PRODUCTS.....	3
2.1	Type Designation Code	3
2.2	Inverter Type	4
2.3	Storing and Warranty	4
2.4	Power Rating	5
2.5	Mounting	5
2.6	Usage of Auxiliary equipment	9
2.7	Specification	10
2.8	System configuration	12
3	INSTALLATION.....	13
3.1	Installation Condition	13
3.2	Cooling	14
3.3	Installation of keypad on the external panel	15
4	WIRING.....	16
4.1	Cautions in Wiring	16
4.2	Dynamic Brake Resistor	18
4.3	AC Reactor	18
4.4	Wiring Diagram	19
4.5	Power Connection	22
4.5.1	Installation Instruction	23
4.5.2	Insulation of Cable and Motor	24
4.6	Control Connection	24
4.6.1	Control Cable	24
4.6.2	Encoder Cable.....	24
4.6.3	Control I/O terminal signals.....	25
5	Composition of Operation Main Menu.....	26
6	KEYPAD.....	27
6.1	Instruction	27
6.2	Operation.....	27
6.2.1	Main Menu Page[0] Operation	29
6.2.2	Main Menu Page[1] Drive Monitor	30
6.2.3	Main Menu Page[2] Parameter Edit	32

SOHO VD VECTOR INVERTER


6.2.4	Main Menu Page[3] Auto Tuning	33
6.2.5	Main Menu Page[4] Fault Record	34
6.2.6	Main Menu Page[5] Initialize	35
6.2.7	Main Menu Page[6] Password	36
6.2.8	Usage of MENU KEY (Error, Warning, checking inverter status)	37
7	Operation.....	38
7.1	Inverter Turing-on Procedure.....	38
7.2	Inverter Operation Procedure.....	38
7.2.1	Open Loop Control Procedure	39
7.2.2	Closed Loop Control Procedure	40
7.3	AUTO-Tuning Procedure	41
7.3.1	Checking point before Auto Tuning	41
7.3.2	Auto Tuning operation and completion.....	42
7.4	Basic Open Loop Control Operation Procedure	43
7.4.1	Basic Design	43
7.4.2	Motor Spec. and Open Loop Control method setting	44
7.4.3	Reference and Digital Input setting	47
7.4.4	Digital and Analog Output setting	48
7.4.5	Operation Pattern Setting	49
7.4.6	Brake Control parameter setting using Digital Output	52
8	Description of Parameters.....	54
8.1	Parameter table	54
8.2	Description of parameters	76
9	Protection.....	126
9.1	Warning	126
9.2	Error	127
9.3	Fault	127
10	Troubleshooting.....	129
11	Maintenance and Inspection.....	130

SOHO VD VECTOR INVERTER


1. SAFETY

	<p>ONLY A COMPETENT ELECTRICIAN SHOULD CARRY OUT THE ELECTRICAL INSTALLATION.</p>
---	---

1.1 WARNINGS

	1	Internal Components and circuit boards (excepting the isolated I/O terminals) apply an electric current when SOHO VD inverter is connected to the main voltage. This voltage is extremely dangerous and may cause death or severe injury if you come in contact with it.
	2	When SOHO-VD is connected to the main power, the current is flowing in the motor connections (U, V, W), DC-Link (P, N) and Dynamic Brake Resistor Connections (R+R,-) even if the motor is not running.
	3	The control I/O terminals are isolated from the main voltage but the relay outputs and other I/Os may have dangerous voltage connected even if the power is disconnected from the SOHO-VD .
	4	SOHO-VD inverter has a large capacitive leakage current.
	5	If a SOHO-VD inverter is used as a part of the machine, the machine manufacturer is obliged to take care that the inverter has a main switch and power fuse in the machine.
	6	Spare parts can be delivered only by Seoho Electrics,Ltd.

1.2 SAFETY INSTRUCTIONS


	1	Do NOT make any connections when the SOHO-VD is connected to the main voltage.
	2	Do NOT make any measurements when the SOHO VD is connected to the main voltage.
	3	After disconnecting the main power, wait until the cooling fan stops and the indicator of keypad goes out. Wait a further 5 minutes before doing any work on SOHO-VD connections. Do NOT open even the cover within this time.
	4	Do NOT make any voltage withstand tests on any parts of the SOHO-VD inverter.
	5	Disconnect motor cables from SOHO-VD before making any measurements on the motor cables or motors.

SOHO VD VECTOR INVERTER

6	Do NOT touch the IC-circuits on the circuit boards. Static voltage discharge may destroy the components.
7	Make sure that the cover of SOHO-VD inverter is closed before connecting the main voltage.

Ground

The ground terminal of **SOHO-VD**



has to contact with ground wire.

Ground of SOHO-VD inverter prevent high voltage accidents that are caused by switching.

Warning Sign

Please be more cautious for the following warning signs for user's safety.




= Dangerous Voltage



= General Warning

1.3 Running the motor

	1	Before running the motor, be cautious not to have any safety accident. Make sure that the motor is mounted properly. Check the parameters are set properly.
	2	Maximum motor speed (frequency) should always be set according to the motor and machine connected to the motor.
	3	Before reversing the rotation of the motor shaft, make sure that this can be done safely.

2. Receiving Products

2.1 Checking

This **SOHO-VD inverter** has been subjected to demanding factory tests before shipment. After unpacking, check if the device does not show any sign of damage and any missing parts. (Refer to the type designation code in table 2.1-1)

In the event of damage, please contact the insurance company involved or the supplier. If the delivery is not in compliance with the order, please contact the supplier immediately..


TYPE	SOHO160VD4Y	Inverter Model
Serial No.	0420001D	Serial Number
Power Rating	160[kW]	Inverter Nominal Power
Rated Current	325[A]	Inverter Rated Current
Max. Current	473[A]	Inverter Max, Current
Voltage	380[V]~460[V]	Inverter Input Voltage Range
 Seoho Electric		

Table 2.1-1 Inverter Label (This is attached the side of inverter.)

2.2 Inverter Type

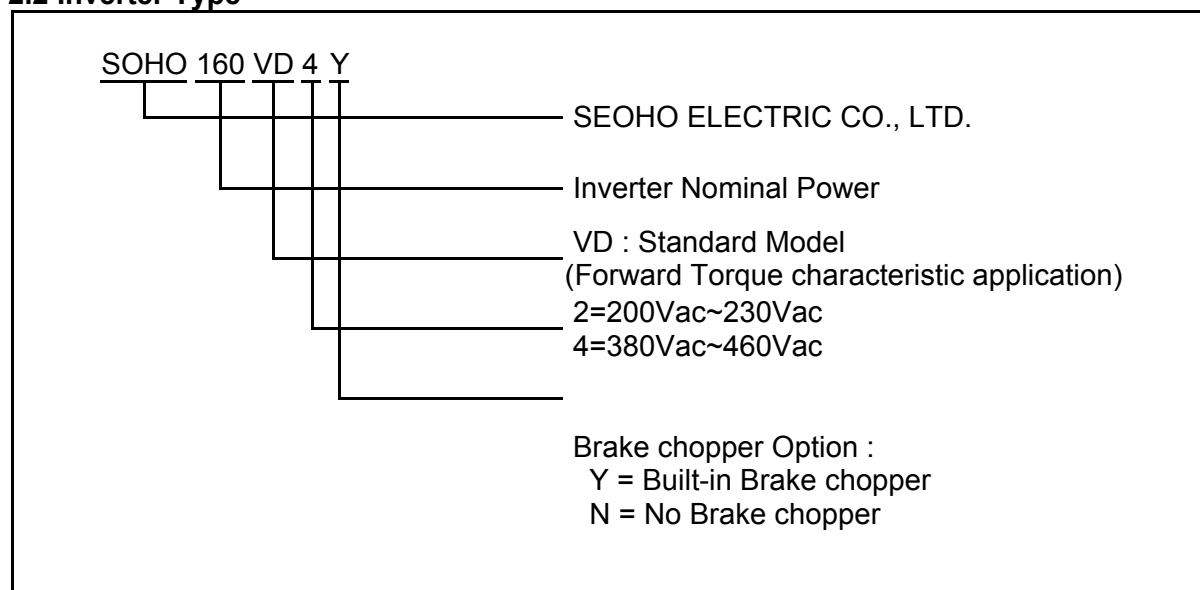


Table 2.2-1 Inverter Type

2.3 Storing and Warranty

Check the ambient conditions in the storage room before the first commissioning. (temperature: -40 °C ~ +50 °C, relative humidity < 95%, no condensation allowed).
Seoho electric, Ltd. will not be responsible for the damage caused by ambient conditions.

The period of manufacturer's warranty is 12 months from the date of delivery.

The local distributor may have a different warranty period, which is specified in their terms and conditions and warranty terms.

If any queries concerning the warranty arise, please contact your distributor.

SOHO VD VECTOR INVERTER

2.4 Power rating

I_{CT} = rated input and output current (constant torque load)

I_{CTMAX} = short term overload current 1min/10min (constant torque load)

* = ask factory for detail

Main Voltage 380V - 460V, 50/60Hz. VD Series (Constant Torque)						
Inverter Type	Motor shaft power and current			Size	Dimension W×H×D(mm)	Weight(kg)
	P(kW)	I_{CT}	I_{CTmax}			
SOHO 5.5 VD4 SOHO 7.5 VD4	5.5 7.5	13 18	20 27	M3	170×365×175	7
SOHO 11 VD4 SOHO 15 VD4 SOHO 18.5 VD4 SOHO 22 VD4	11 15 18.5 22	24 32 42 48	36 48 63 72	M4	255×372×252	10
SOHO 30 VD4 SOHO 37 VD4 SOHO 45 VD4	30 37 45	60 75 90	90 113 135	M6	230×575×300	23
SOHO 55 VD4 SOHO 75 VD4 SOHO 90 VD4	55 75 90	110 150 180	165 225 250	M7	250×850×330	43
SOHO 110 VD4 SOHO 132 VD4 SOHO 160 VD4 SOHO 200 VD4	110 132 160 200	210 270 325 410	315 405 472 615	M8	496 x 860 x 375	80
SOHO 250 VD4 SOHO 315 VD4	250 315	510 600	715 900	M9	590×1400×410	200
SOHO 400 VD4	400	750	1000	M10	796×1400×500	290

Table 2.4-1 380V-460V Power ratings and dimensions

SOHO VD VECTOR INVERTER

2.5 Mounting

SOHO VD inverter should be mounted in a vertical position on the wall or on the back plane of a cubicle. Follow the requirement for cooling. See chapter 3.2 for dimensions.

To ensure a safe installation, make sure that the mounting surface is relatively flat.

Fixing is done with four or more screws or bolts depending on the size of the unit. See Figure 2.5-1.

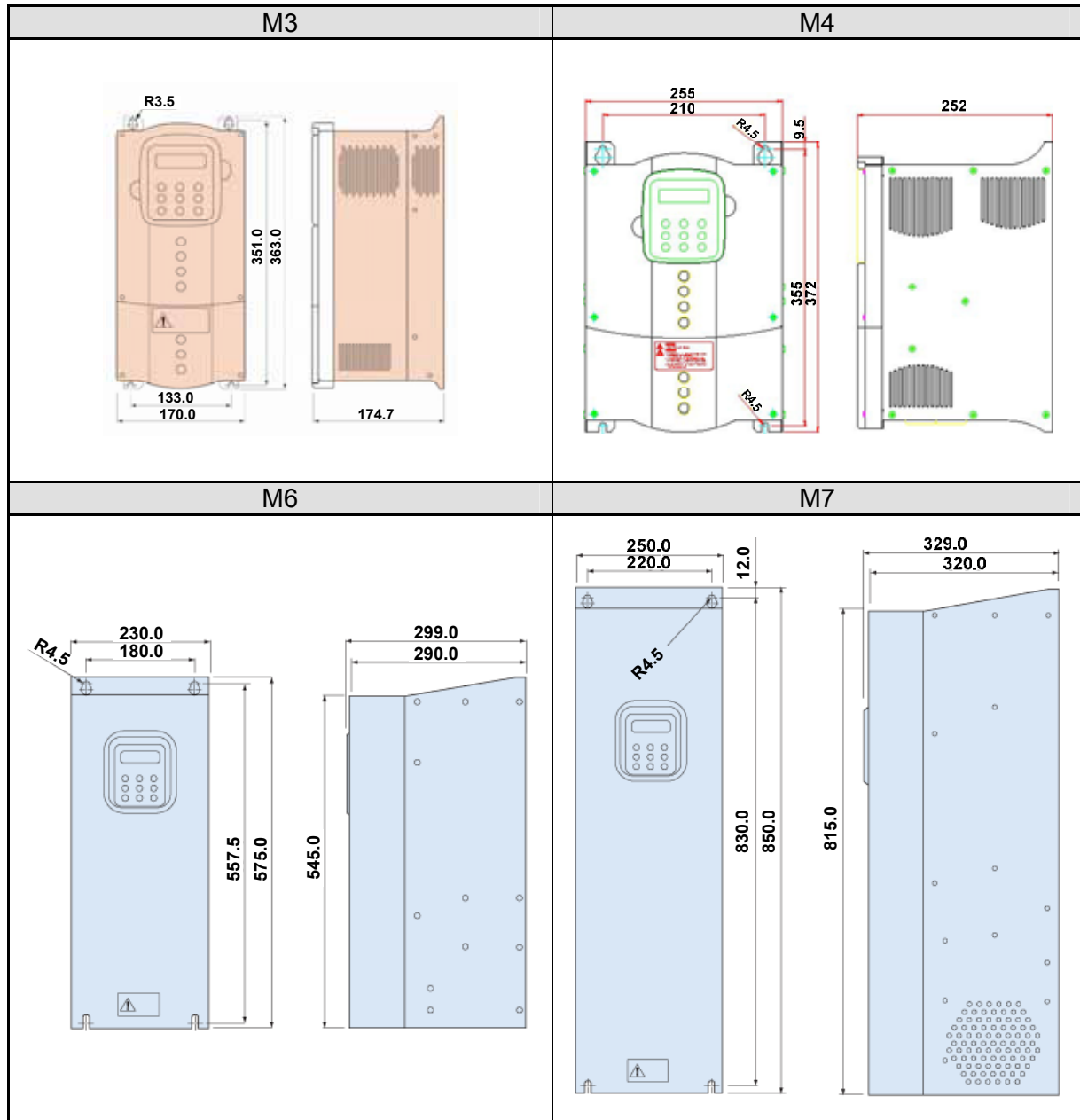


Figure 2.5-1(a) Mounting dimensions

SOHO VD VECTOR INVERTER

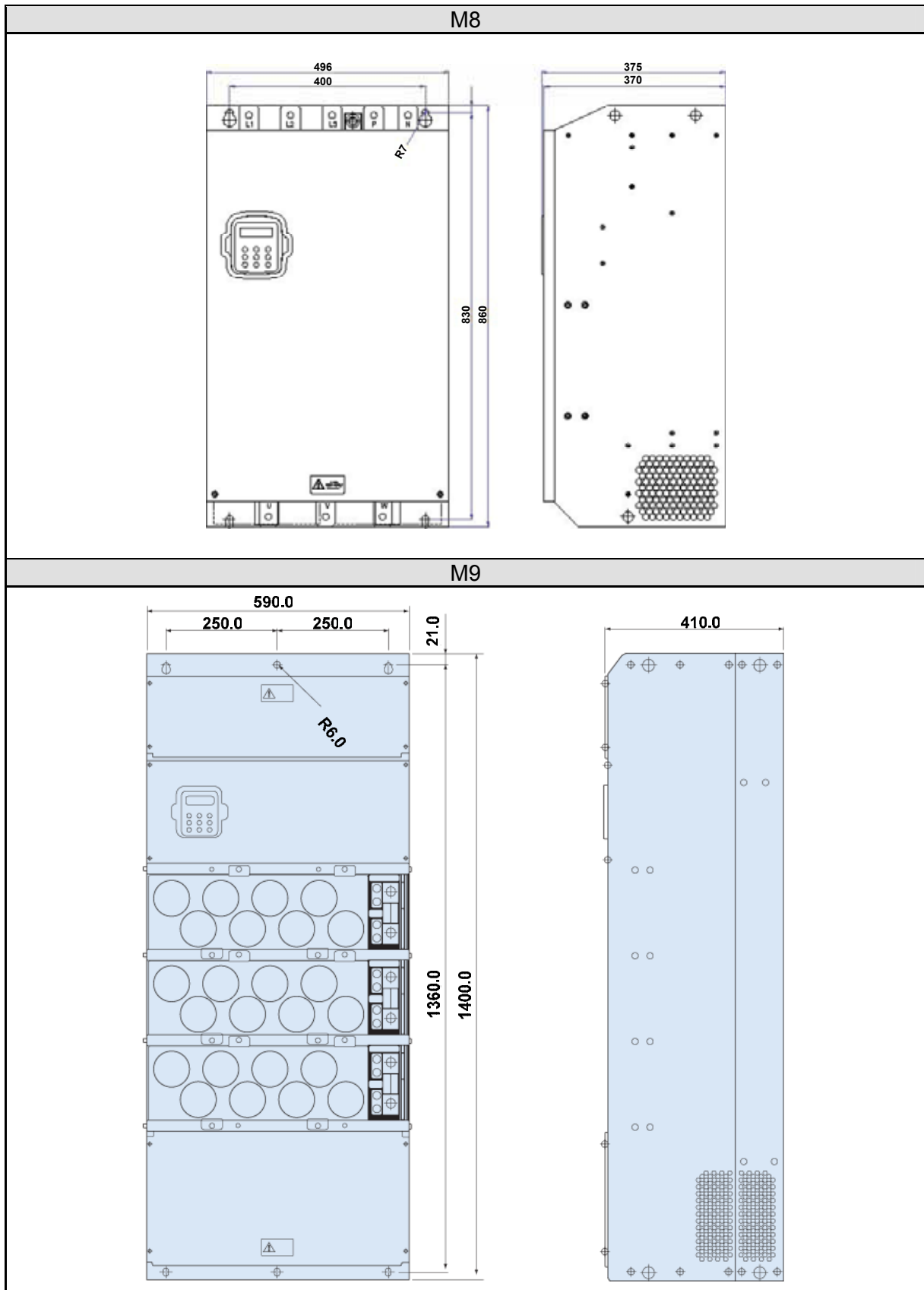


Figure 2.5-1(b) Mounting dimensions

SOHO VD VECTOR INVERTER

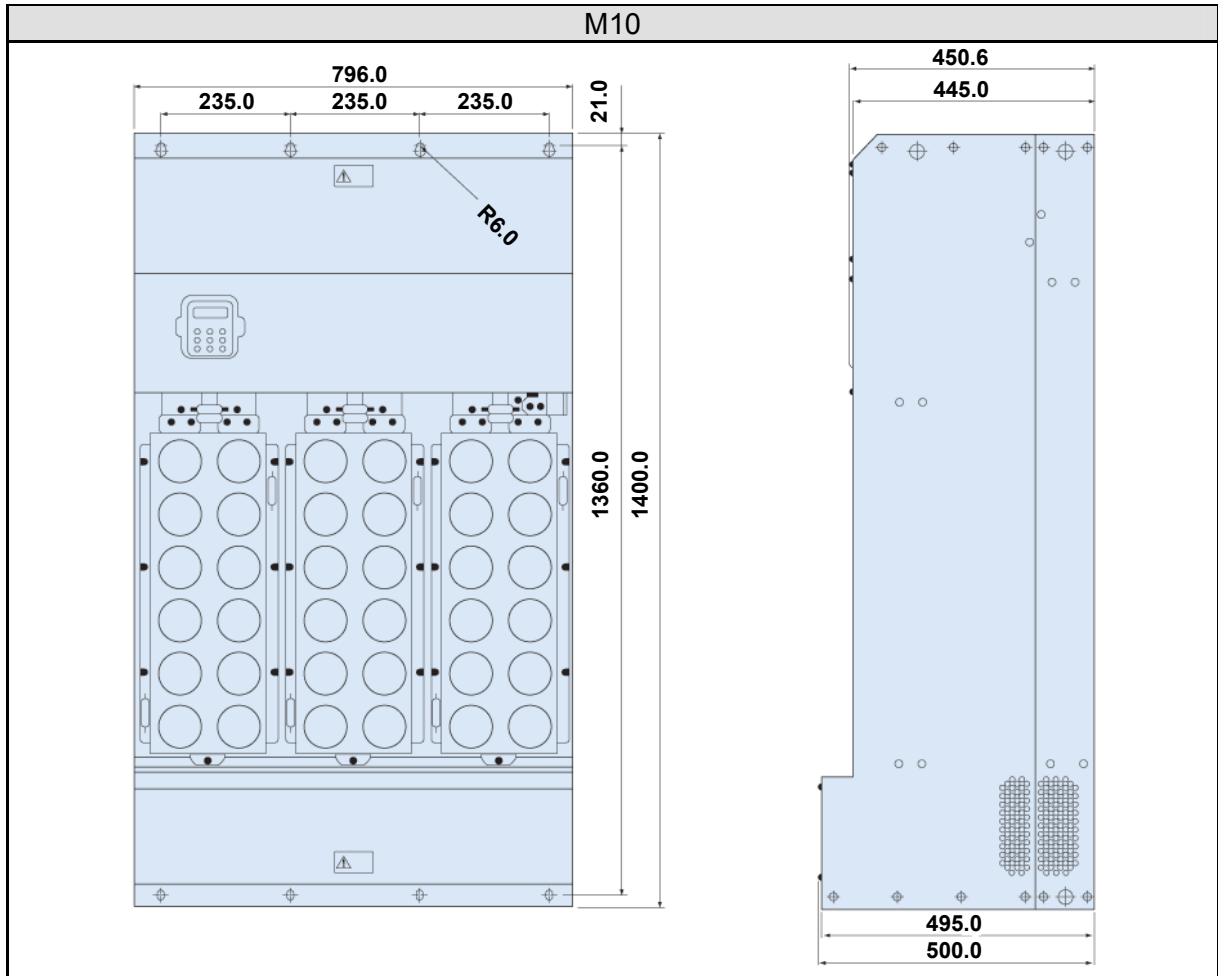


Figure 2.5-1(c) Mounting dimensions

2.6 Usage of auxiliary equipment

When using a **SOHO VD Inverter**, it is recommended to use right auxiliary equipments. If the auxiliary equipments are not right for SOHO VD inverter, it can cause damage to the inverter. Therefore, follow the recommended specifications for configuration.

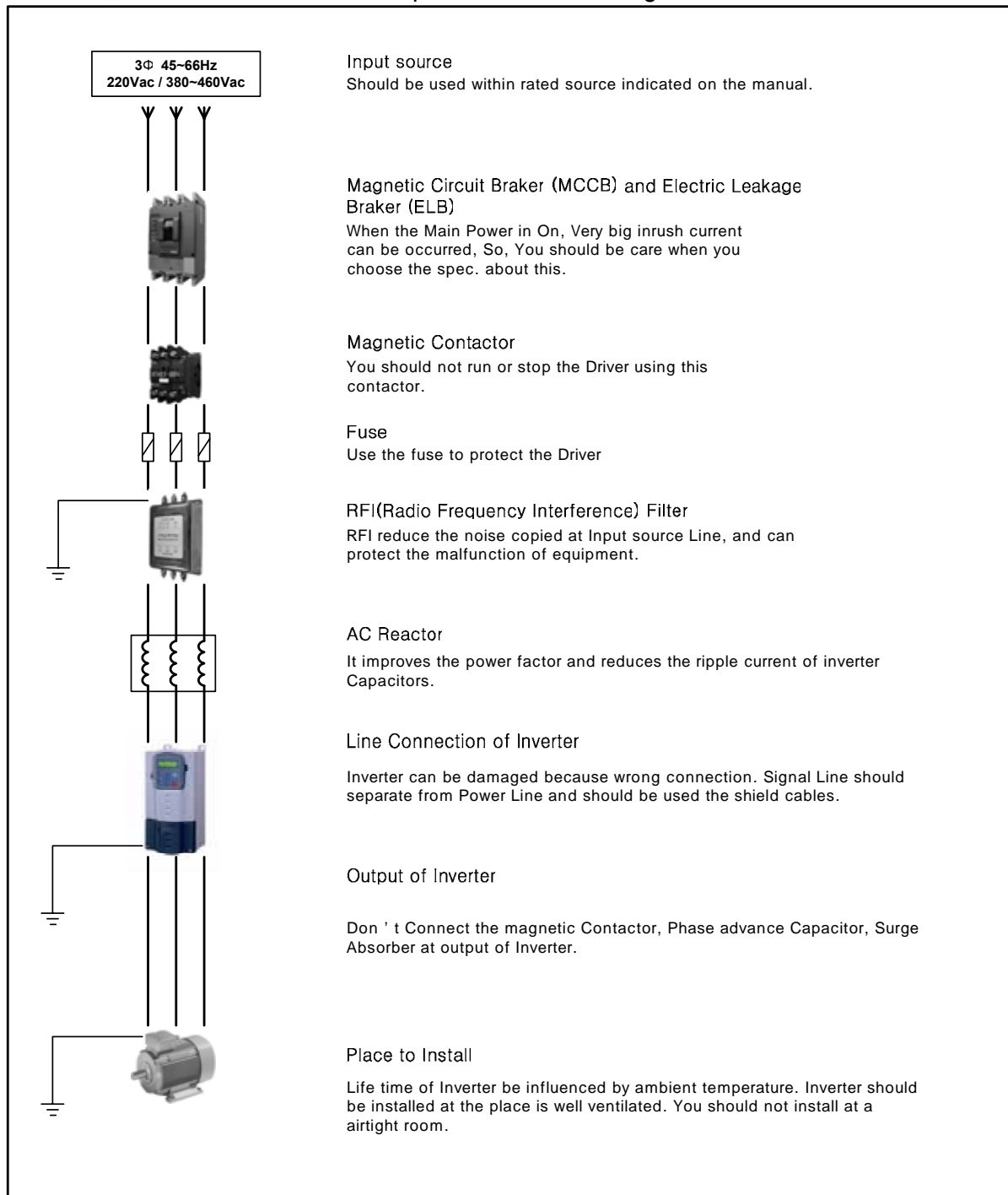


Figure 2.6-1 auxiliary equipment

SOHO VD VECTOR INVERTER

2.7 Specifications

Main Connection	Input Voltage V_{in}	3 Phase 380V _{ac} ~ 460V _{ac} ; ±10%		
	Input Frequency	50Hz ~ 60Hz (±10%)		
	Connection to the Main	Don't turn on and off the inverter more than 2 times within 1 min.		
Rated Output	Output Voltage	0 ~ 95% of V_{in}		
	Continuous Output current	I _{CT} : ambient max. +40 °C Over load 1.5×I _{CT} (1min./10min.) I _{VT} : ambient max. +40 °C, no overloading		
	Starting Torque	150%~200%(0.5Hz) in Sensor less V/F Control 150% ~200% (0Hz) in Sensor less Vector Control		
	Output Frequency/speed	Sensor less : 0.0 ~ 300.0[Hz] / 0.0 ~ 3000.0[Hz] Sensor : 0 ~ 8000 [rpm]		
	Frequency/speed resolution	Sensor less V/f : 0.01Hz / 0.1Hz Sensor less & Sensor Vector : 1[rpm]		
Control Characteristics	Control Method	Sensor less V/F Frequency Control Sensor less V/F Speed Control Sensor less Vector Speed Control Sensor less Torque Control Sensor Vector Speed Control Sensor Torque Control		
	Switching Frequency	V/F Control : 1.0 ~ 10.0[kHz] Sensor less & Sensor Vector Control : 1.0 ~ 5.0[kHz]		
	Frequency reference	Analog Input	resolution 10bit, accuracy ±0.1%	
		Keypad reference	Resolution 0.01Hz / 0.1Hz	
	Field weakening point	Auto Tuning		
	Acceleration Time	V/F Control - 0.5 ~ 3000.0[sec] Sensor less & Sensor Vector Control - 0.00 ~ 3000.00[sec]		
	Deceleration Time	V/F Control - 0.5 ~ 3000.0[sec] Sensor less & Sensor Vector Control - 0.00 ~ 3000.00[sec]		
Environmental Limits	Surrounding Temperature	-10 °C ~ +40 °C		
	Storage Temperature	-40 °C ~ +60 °C		
	Relative Humidity	95%, no condensation allowed		
Control Connections	Analog Input voltage	0V(-10V) ~ +10V _{DC} , resolution 10bit		
	Analog Input current	0(4) ~ 20mA, resolution 10bit		
	Digital Input	Negative Logic		
	Aux. supply Voltage	+24V ±20%, Max. 100mA		
	Analog Output	0 (or 4) ~ 20mA, R _L < 500Ω, resolution 10bit		
	Digital Output(DO3)	Open collector, I _{CE} : 1A / V _{CE} : 250V		
	Relay Output	DO1	Max switch voltage : 250V _{ac} or 30V _{dc} Max switch current : 5A _{ac} or 5A _{dc}	
DO2		Max switch voltage : 250V _{ac} or 30V _{dc} Max switch current : 5A _{ac} or 5A _{dc}		

2.8 System Configuration

Figure 2-8.1 shows a block diagram of the SOHO VD inverter. Diode Bridge produces the DC voltage for the IGBT inverter Bridge block. The IGBT bridge produces a symmetrical three-phase PWM modulated AC voltage to the motor. The power drawn from the supply is almost entirely active power.

The Motor Control block is based on microprocessor software. The microprocessor controls the motor according to the saved software (V/F, vector) in Flash memory, measured signals, parameter value settings and commands from the Control I/O block and the Keypad. And it calculates the IGBT switching positions. Gate Drivers amplify these signals to drive the IGBT inverter bridge. If the over-current occurs at the IGBT, the gate driver breaks the IGBT gate signal and sends the fault signal to the microprocessor.

The Keypad is a link between the user and the inverter. With the Keypad or personal Computer, the user can set parameter values, read status data and give control commands. The Keypad is detachable and can be mounted externally and connected via a cable to the inverter.

The optional DBR information can be referenced from this manual.

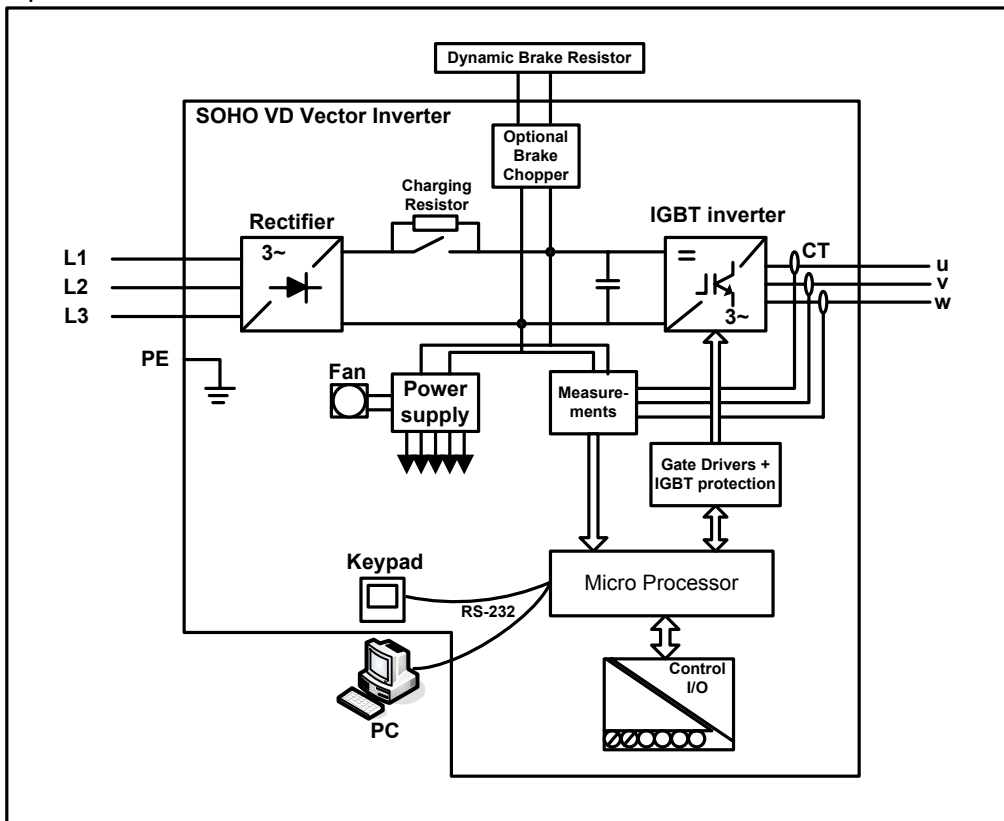



Figure 2.8-1 VD Inverter Block Diagram

3. Installation

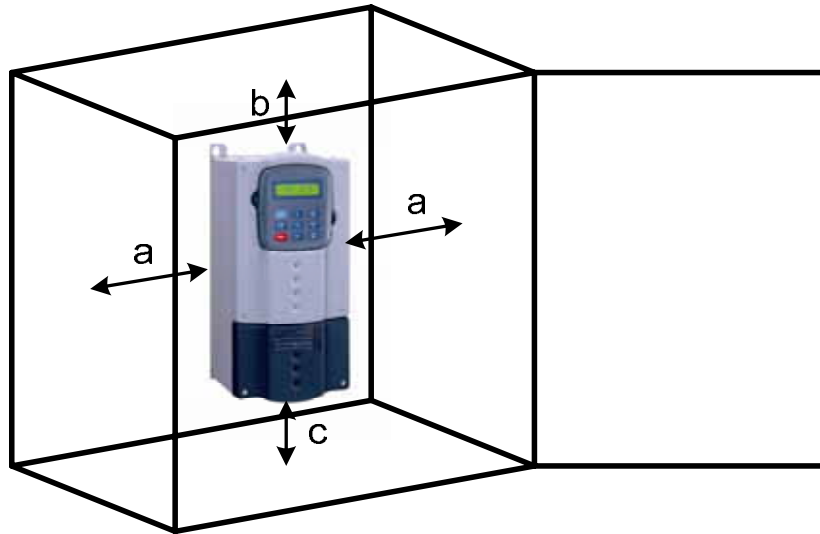
3.1 Installation Condition

Please install the **SOHO-VD inverter** on the places satisfying the following conditions.

	1	Avoid rain, hot temperature and high humidity place.
	2	Avoid the direct sunlight.
	3	The place should be protected from dirt, metal dust, and welding flame.
	4	Install so as to be bearable to the vibration.
	5	Defective main power may cause the inverter damages. - Using the same power source with welding machine - Using a generator as the power source - Sudden changes in the main voltage.
	6	Keep away from flammables.
	7	Install on the nonflammable materials as street..

3.2 Cooling

Figure 3.2-1 Installation space



The specified space around the **SOHO-VD** inverter unit ensures proper cooling air circulation. See table 4-1 for dimensions. If multiple units are to be installed above each other, the distance between the units must be $b + c$ and air from the outlet of the lower unit must be directed away from the inlet of the upper unit.

SIZE	Dimension(mm)			
	a	a2	b	c
M3	20	10	150	50
M4	20	10	150	60
M6	30	10	160	80
M7	75	75	300	100
M8	250	75	300	-
M10	200	75	300	-

Table 3.2-1 Installation space dimension
a2 = distance from the inverter unit to other inverter unit

3.3 Installation of keypad on the external panel

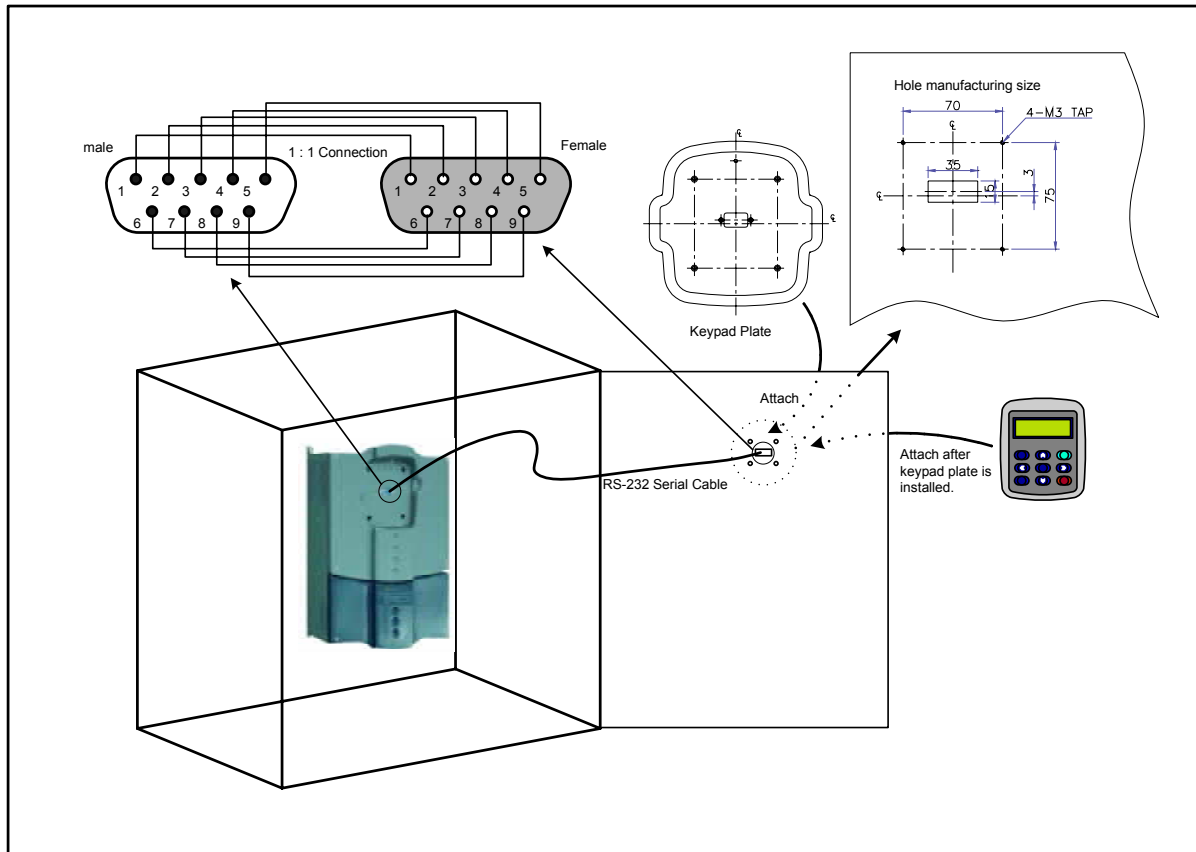



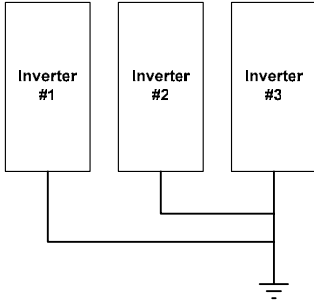
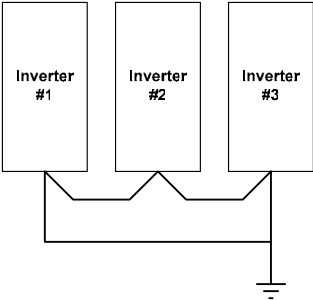
Figure 3.3-1 Installation of keypad on the external panel

When installing the **SOHO VD** Keypad on the external panel, refer to the figure 3.3-1. First, make holes on the spot of the panel as shown in the figure 3.3-1. Then, install the keypad plate with bolts. The keypad that is installed on the external panel is connected by RS232 serial cable, which is 1:1 connection. Refer to the figure 3.3-1.

SOHO VD VECTOR INVERTER

4. WIRING

4.1 Cautions in wiring

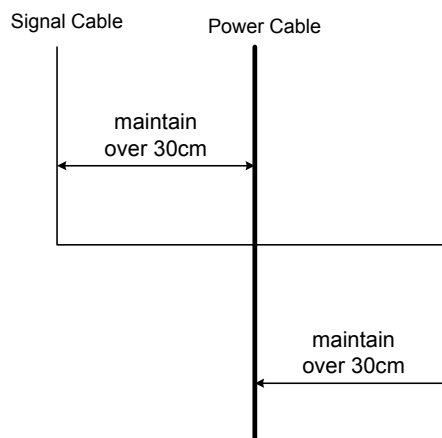
	<p>1</p> <p>Connect the ground cable surely.. If multiple units are to be installed, Do not look the ground cables.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>(a) Good</p> </div> <div style="text-align: center;">  <p>(b) NOT good</p> </div> </div>
	<p>2</p> <p>Only a competent electrician should carry out the wiring</p>
	<p>3</p> <p>Make sure that the input main voltage is switched off.</p>
	<p>4</p> <p>Do NOT connect AC power source to the output terminals (U, V, W).</p>
	<p>5</p> <p>In the case of installing an earth leakage breaker at the input (L1, L2, L3), Make inquiries to a competent electrician for the set-up of leakage current.</p>
	<p>6</p> <p>Power cables, the earth leakage breaker and a Magnetic contactor should be used with the rated capacity.</p>
	<p>7</p> <p>Attach surge filters to the Magnetic contactors that are installed around inverter.</p>
	<p>8</p> <p>Do NOT run or stop the inverter and/or the electric motor connected to it using Magnetic contactors [located at the main power input(L1,L2,L3) and/or output(U,V,W)]</p>
	<p>9</p> <p>Fasten the terminal screws to the relevant torque value and make sure that there are not loose terminals..</p>
	<p>10</p> <p>When several motors are running by one inverter, install a thermal relay for each.</p>
	<p>11</p> <p>Use twisted and shielded cable for signal cables. For encoder signal cables, use the shielded cable containing 6 wires in the cable. The wires in the cable should be twisted and shielded by twos. Although the encoder signal cables have a good quality, they could be affected by surrounding noises during wiring. It needs a special attention.</p>

SOHO VD VECTOR INVERTER



The signal cables must be isolated from the power cables. For an unavoidable case, install perpendicular to each other as shown below.

12



SOHO VD VECTOR INVERTER

4.2 Dynamic Brake Resistor

See table 4.2-1 for the standard brake resistor of **SOHO-VD**.

Please, note that the following information is only for horizontal movement applications. Please, ask the factory or the head office for details on recommended DBR for vertical loads and equipments that have a high frequency in use.

Inverter Type	Resistance	Power (5%ED)*	Inverter Type	Resistance	Power (5%ED)*
SOHO 5.5 VD4	100Ω	0.3kW	SOHO 45 VD4	12Ω	2.5kW
SOHO 7.5 VD4	74Ω	0.4kW	SOHO 55 VD4	10Ω	3kW
SOHO 11 VD4	51Ω	0.6kW	SOHO 75 VD4	7.2Ω	4kW
SOHO 15 VD4	37Ω	1kW	SOHO 90 VD4	6.2Ω	5kW
SOHO 18.5 VD4	30Ω	1kW	SOHO 110 VD4	5.0Ω	6kW
SOHO 22 VD4	25Ω	1.2kW	SOHO 132 VD4	4.2Ω	7kW
SOHO 30 VD4	18Ω	1.5kW	SOHO 160 VD4	3.5Ω	8kW
SOHO 37 VD4	15Ω	2kW	SOHO 200 VD4	2.8Ω	10kW

Table 4.2-1 SOHO-VD: Standard Dynamic Brake Resistor (*=ask the factory)

% Ask the factory for the detail of DBR information (* and 200V class inverter)

4.3 AC Reactor

The standard AC Reactor specifications are followed.

Inverter Type	Inductance	Current	Inverter Type	Inductance	Current
SOHO 5.5 VD4	1mH	15A	SOHO 75 VD4	0.15mH	190A
SOHO 7.5 VD4	1mH	21A	SOHO 90 VD4	0.15mH	190A
SOHO 11 VD4	0.6mH	35A	SOHO 110 VD4	0.15mH*2	190A*2
SOHO 15 VD4	0.6mH	35A	SOHO 132 VD4	0.15mH*2	190A*2
SOHO 18.5 VD4	0.5mH	54A	SOHO 160 VD4	0.15mH*2	190A*2
SOHO 22 VD4	0.5mH	54A	SOHO 200 VD4	0.15mH*3	190A*3
SOHO 30 VD4	0.3mH	97A	SOHO 250 VD4	0.15mH*3	190A*3
SOHO 37 VD4	0.3mH	97A	SOHO 315 VD4	0.15mH*4	190A*4
SOHO 45 VD4	0.3mH	97A	SOHO 400 VD4	0.15mH*4	190A*4
SOHO 55 VD4	0.15mH	190A	-	-	-

Table 4.3-1 SOHO-VD Inverter AC Reactor

SOHO VD VECTOR INVERTER

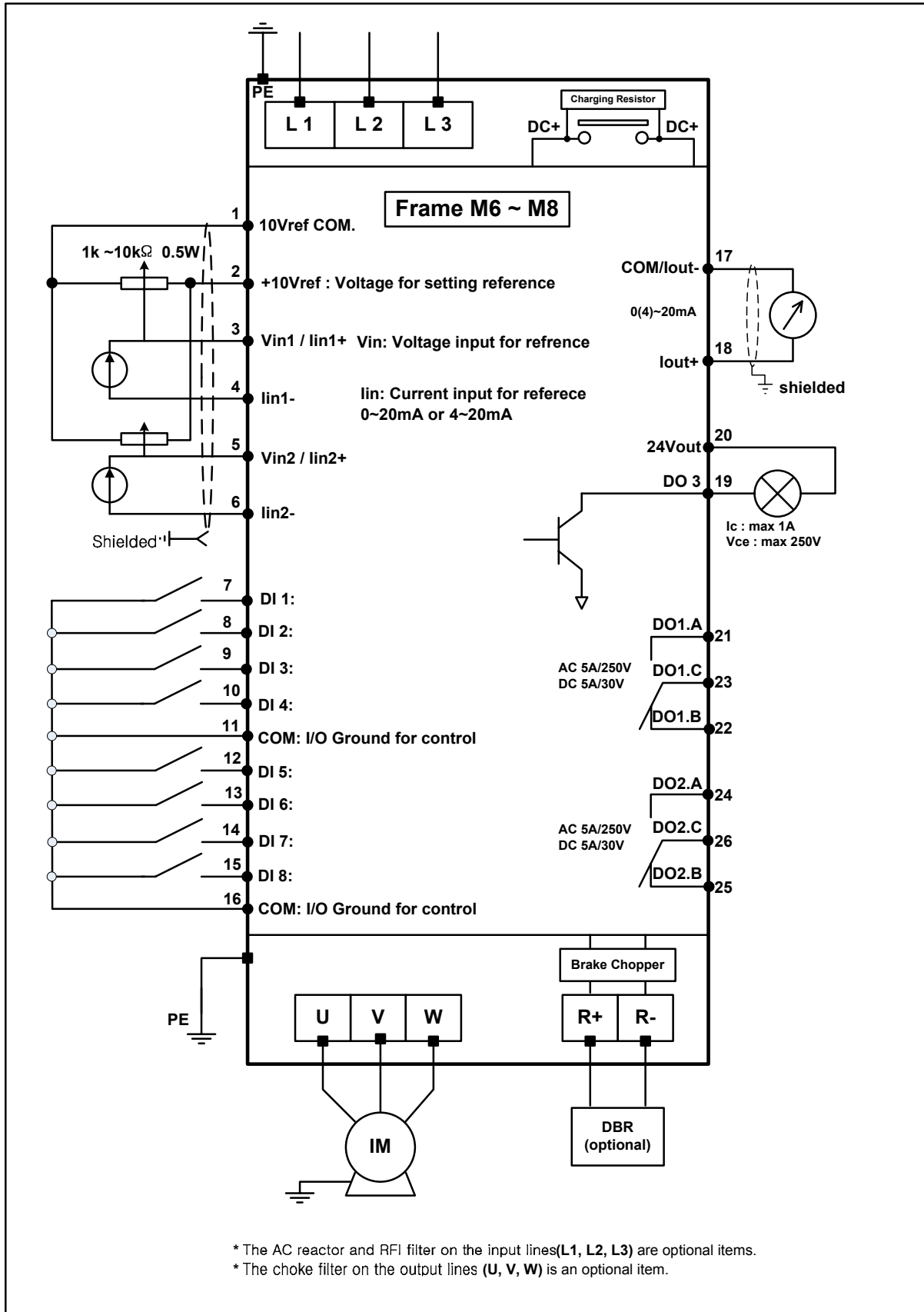


Figure 4.4-2 SOHO VD inverter Frame M6-M8

SOHO VD VECTOR INVERTER

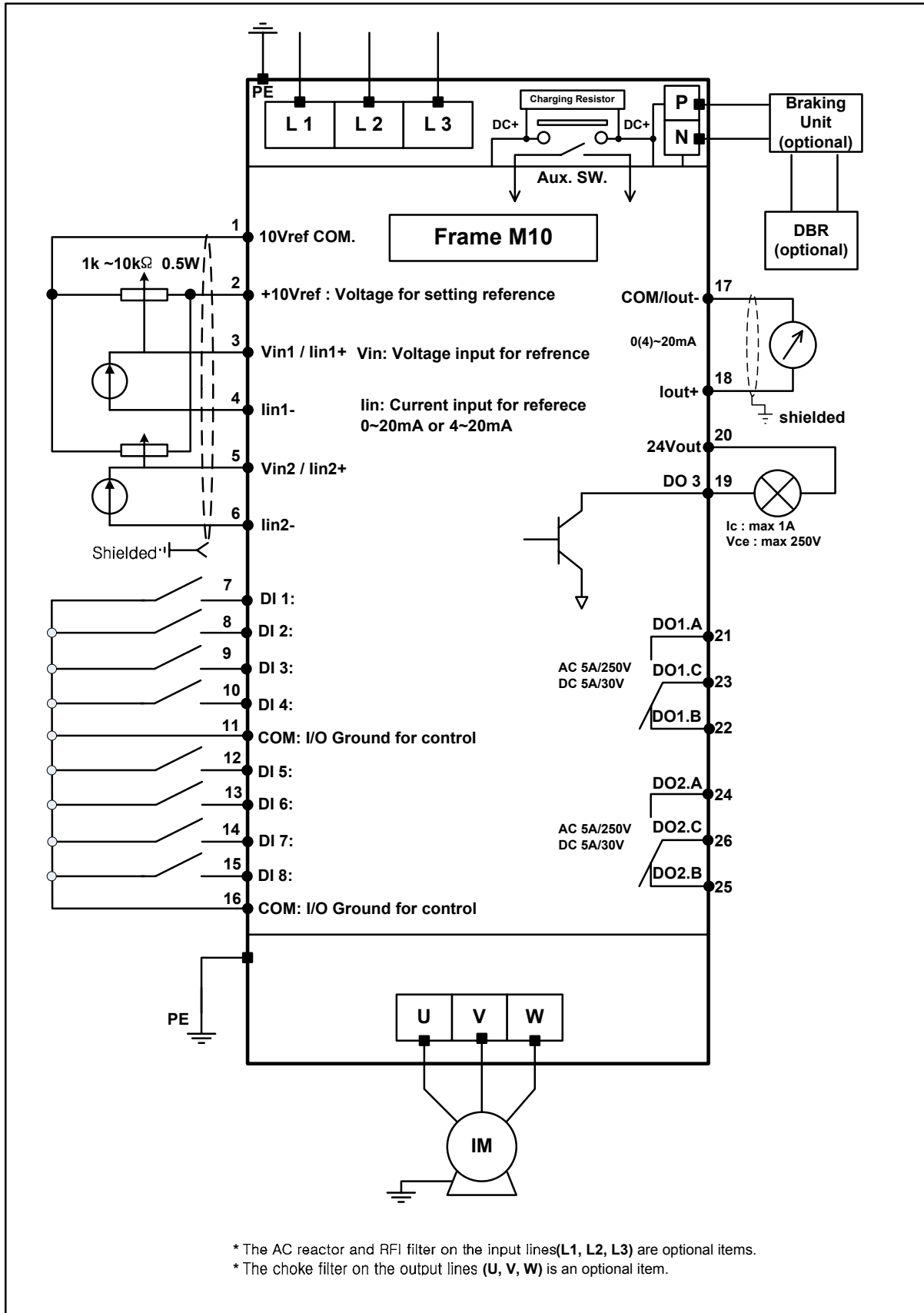


Figure 4.4-3 SOHO VD inverter Frame M10

SOHO VD VECTOR INVERTER

4.5 Power Connections

Use heat-resistant cables (600V, +75°C or higher). The Power cables and the fuses have to be dimensioned in accordance with the rated output current of the unit and the size of the cables. The minimum dimensions for the Cu-cables and corresponding fuses are given in the table 4.5-1. The fuses have been selected so that they will also function as an overload protection for the cables.

If overheat protecting function of the inverter is used as the overload protecting function, the selection of a cable must be followed by table 4.5-1

If 3 or more cables are used in parallel, Please be cautious for that every cable must have its own overload protection.

These instructions concern the cases about that there is one motor and one cable connection from the inverter to the motor.


For other cases, ask the factory for more information.

TYPE		I_{CT} [A]	FUSE [A]	Cu-Cable In.output/GND[mm ²]
400V	30 kW	60	63	22 / 14
	37 kW	75	80	22 / 14
	45 kW	90	100	38 / 14
	55 kW	110	125	38 / 22
	75 kW	150	160	60 / 22
	90 kW	180	200	60 / 22
	110 kW	210	250	80 / 38
	132 kW	270	315	100 / 38
	160 kW	325	400	100 / 38
	200 kW	410	500	2*(100 / 60)
	250 kW	510	630	2*(100 / 60)
	315 kW	*	*	*
400 kW	*	*	*	
200V ~ 230V	15 kW	57	63	22 / 14
	18.5 kW	70	80	22 / 14
	22 kW	83	100	38 / 14
	30 kW	113	125	38 / 22
	37 kW	139	160	60 / 22
	45 kW	165	200	60 / 22

*=ask the factory

Table 4.5-1 Output Current, I_{CT} , power, motor cable and fuses.

4.5.1 Installation Instructions

	1 Place the motor cables further away from the other cables. <ul style="list-style-type: none">- Avoid long parallel runs with other signal cables.- The maximum motor cable is 50m.- The motor cable should cross other signal cables at a right angle of 90 degrees if inevitable.
	2 See chapter 4.5.2 for cable insulation check.
	3 Connecting cables: <ul style="list-style-type: none">-Remove the cover of the motor and power cables.-Open the cover of SOHO-VD inverter-Connect the motor and control cables to the correct terminals. (refer to Figure 4.4-1~4.4.3)-Check if control cables do not make any contacts with electrical components in the device.-Connect the brake resistor cable (optional).-Ensure the earth cable is connected to the terminal of the inverter and motor.-Connect the separate shield of power cables to motor, supply panel and the protective earth of the inverter.-Ensure that the external control cable or internal wirings are not trapped between the cover and the body of the unit.

4.5.2 Cable and Motor insulation check

order	Check items
CHECK 1	Motor Cable Insulation Check
	Disconnect the motor cables from the output terminals (U, V and W). Measure the insulation resistance of the motor cable between each phase conductor, and measure between each phase conductor and the protective ground conductor. The insulation resistance must be $\geq 1M\Omega$
CHECK 2	Main power cable Insulation Check
	Disconnect the main power cables from the terminals L1, L2 and L3. Measure the insulation resistance of the main power cables between each phase conductor, and measure between each phase conductor and the protective ground conductor. The insulation resistance must be $\geq 1M\Omega$
CHECK 3	Motor Insulation Check
	Disconnect the motor cables from the motor. Measure the insulation resistance of each motor winding. The measurement voltage has to be at least equal to the main voltage but not exceed 1000V. The insulation resistance must be $\geq 1M\Omega$

4.6 Control Connections

Basic connection diagram is shown in figure 4.4-1~ 4.4-3

4.6.1 Control cable

The control cables should be at least 0.5 mm² shielded cables. The maximum wire size fitting in the terminals is 2.5 mm².

4.6.2 Encoder cable

For the encoder cable, use the shielded cable containing 6 wires. The wires in the cable should be shielded by two each. See Figure 4.6-1. Pay attention to the cable installation in order to isolate from the main power cable and noise environment.



Figure 4.6-1 Encoder Cable

4.6.3 Control I/O Terminal Signals

No	Terminal	Function	Specification
1	Vref.COM	Voltage Reference Ground	GND for Voltage reference signal
2	Vref.+10V	+10V Voltage supply Terminal	+10V output
3	AI 1 . P	Vref (+) input / Iref (+) input	Voltage 1 / Current 1 Reference Input Signal Signal range : 0(-10V _{DC}) ~ +10V _{DC} Signal range : 0(4) ~ 20mA
4	AI 1 . N	Iref (-) input	
5	AI 2 . P	Vref (+)input / Iref (+)input	Voltage 2 / Current 2 Reference Signal Signal range : 0(-10V _{DC}) ~ +10V _{DC}

SOHO VD VECTOR INVERTER

6	AI 2 . N	Iref (-) input	Signal range : 0(4) ~ 20mA	
7	DI 1	Digital Input 1	Forward Operation (Forward Run)	Users can set up
8	DI 2	Digital Input 2	Reverse Operation (Reverse Run)	
9	DI 3	Digital Input 3	Users can set up (refer to the parameter table)	
10	DI 4	Digital Input 4	Users can set up (refer to the parameter table)	
11	DI. COM	Digital Input Ground	Ground for Digital Input	
12	DI 5	Digital Input 5	Users can set up (refer to the parameter table)	
13	DI 6	Digital Input 6	Users can set up (refer to the parameter table)	
14	DI 7	Digital Input 7	Users can set up (refer to the parameter table)	
15	DI 8	Digital Input 8	Users can set up (refer to the parameter table)	
16	DI. COM	Digital Input Ground	Ground for Digital Input	
17	AO 1.N	Analog Output (-) / DI.COM	Analog Output (Users can set up) 0~20mA / 4~20mA	
18	AO 1.P	Analog Output (+)		
19	DO3.OC	Digital output 3	Open Collector output : Users can set up	
20	24Vout	24V supply voltage	+24V output (DO3. for Open Collector output terminal)	
21	DO1.A	Digital output 1 (a-contactor)	Relay Output (Users can set up)	
22	DO1.B	Digital output 1 (b-contactor)		
23	DO1.C	Digital output 1 (Common)		
24	DO2.A	Digital output 2 (a-contactor)	Relay Output (Users can set up)	
25	DO2.B	Digital output 2 (b-contactor)		
26	DO2.C	Digital output 2 (Common)		

Table 4.6-1 Description of control terminal

5. Composition of Operation Main Menu

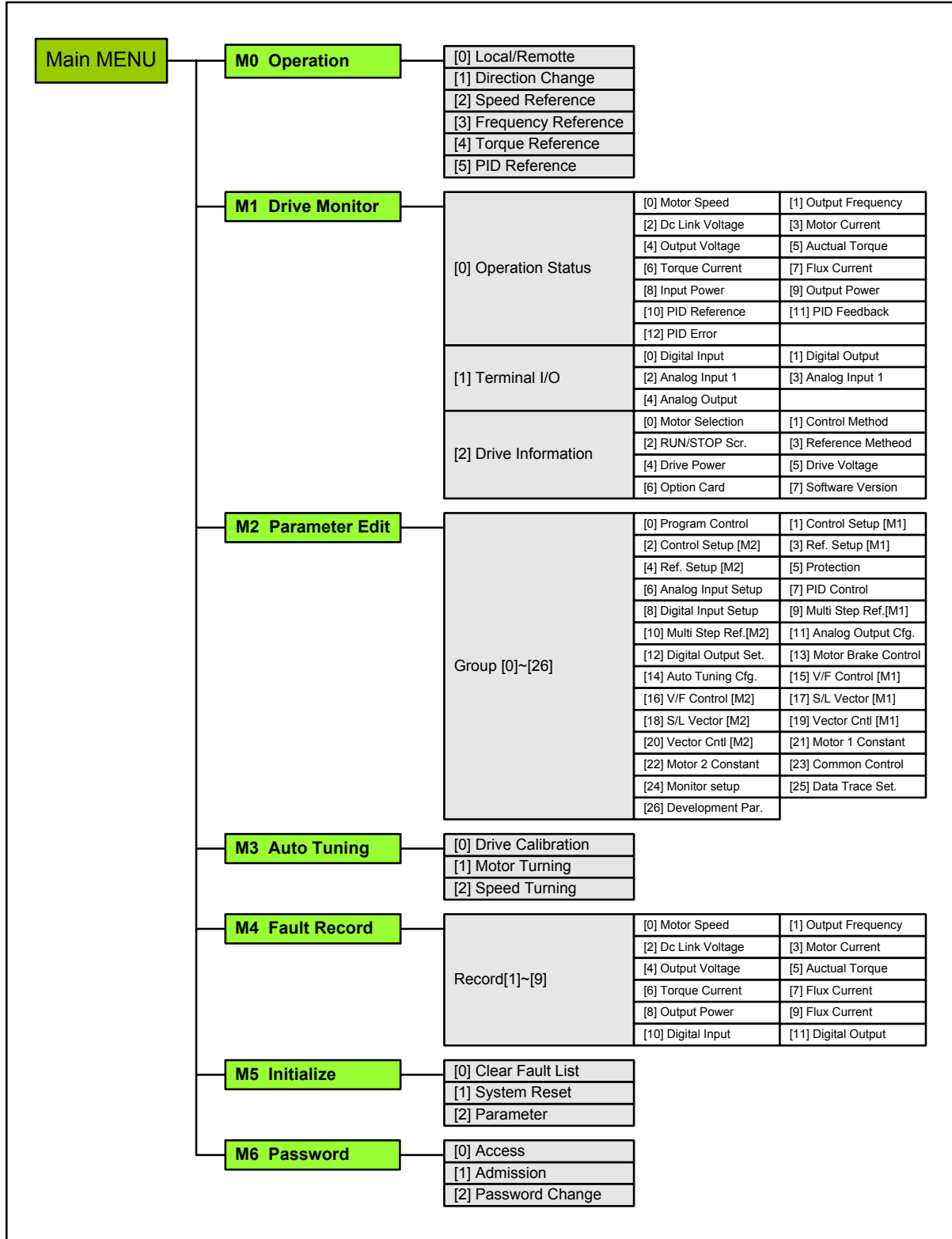


Figure 5-1 Composition of Main Menu for SOHO-VD inverter

6. Usage for KEYPAD

6.1 KEYPAD description

The keypad of SOHO-VD inverter is composed with 9 keys, (ESC, ENTER, RUN, STOP, MENU, Left, Right, UP and Down scroll key). Users can set up parameters and monitor the operation status and start/ stop the motor with keypad, etc. See figure 6.1-1

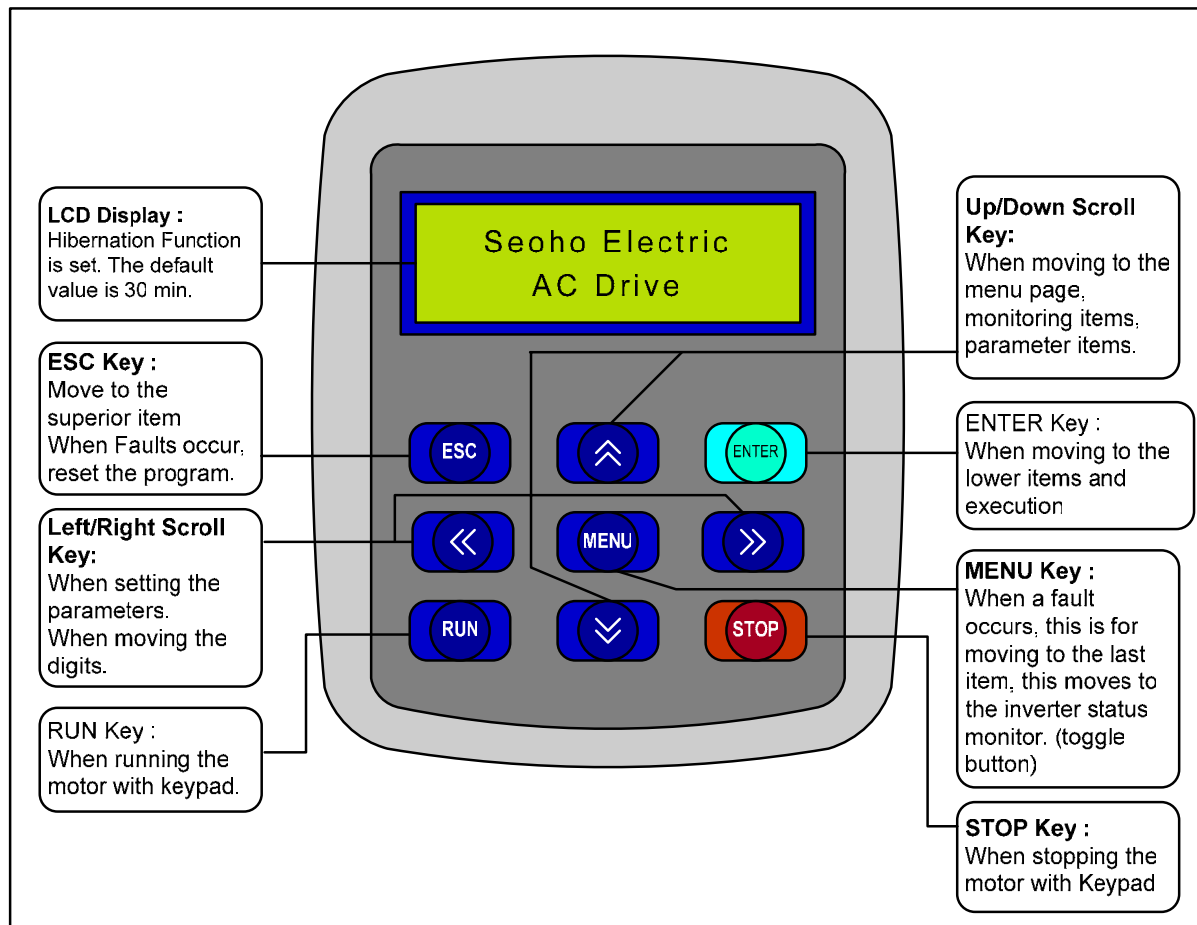











Figure 6.1-1 KEYPAD

6.2 KEYPAD operation

The data of KEYPAD is composed with Main Menu and low-level sub-Menu as Figure 6.2-1. Push the button, , to move from Main Menu to low-level sub-menu. And Push the button, , to escape from low-level sub-Menu to Main Menu. Use the buttons,  , to Increase or decrease the data value. Use the button,  , to move cursors when setting-up parameters. When monitoring/checking the status of inverter and listing the Error/Fault, use the button, . When operating by KEYPAD, users can start/stop the motor with the buttons,  and . The detailed usage can be referred from chapter 6.2.1 ~ 6.2.9.

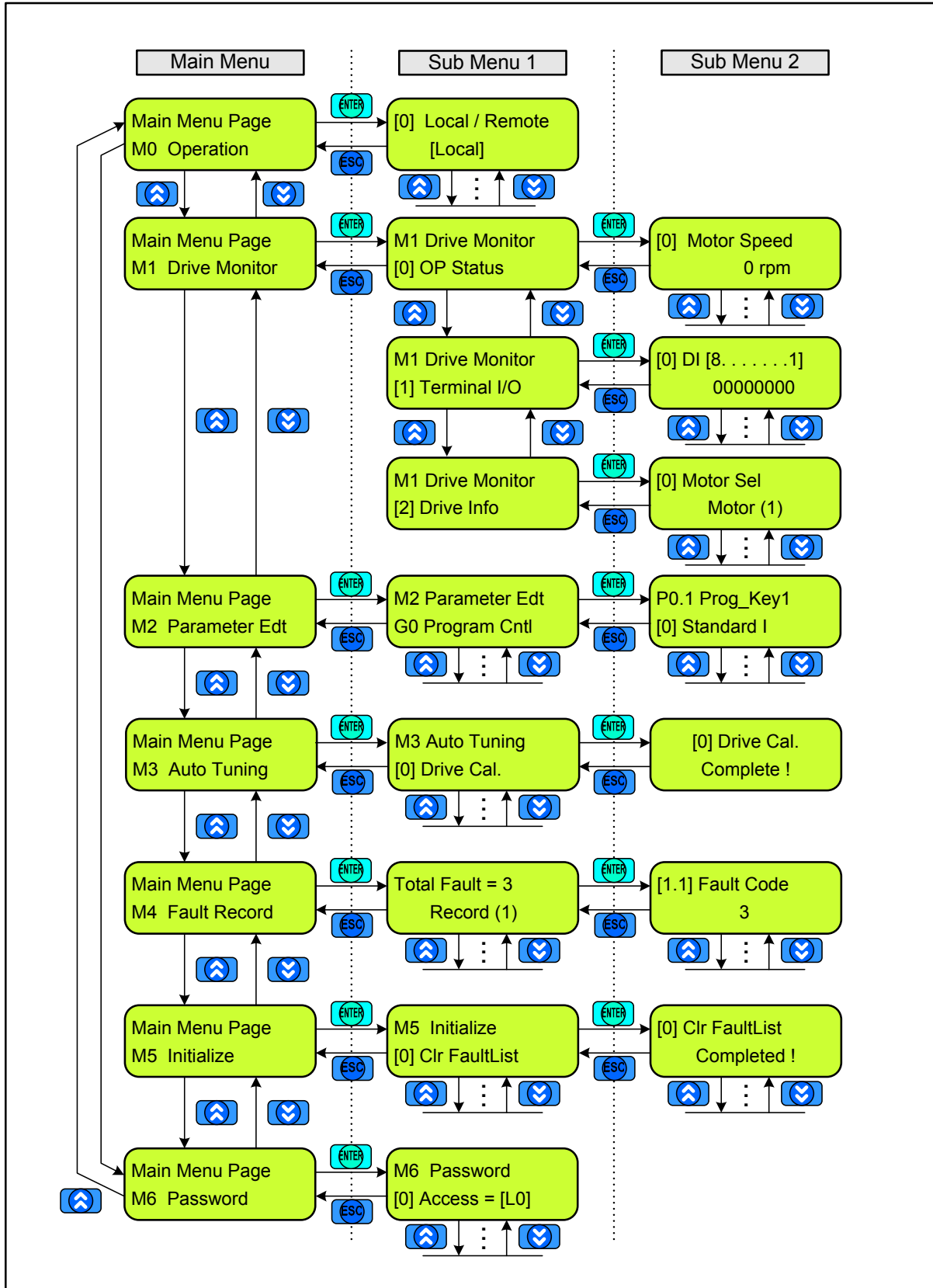


Figure 6.2-1 KEYPAD usage

6.2.2 Main Menu Page[1] Drive Monitor

In M1 Drive Monitor Page, it allows to monitor the operation status of inverter, I/O reference status and setting information. Refer to Figure 6.2-3 for the setting instruction and usage of KEYPAD.

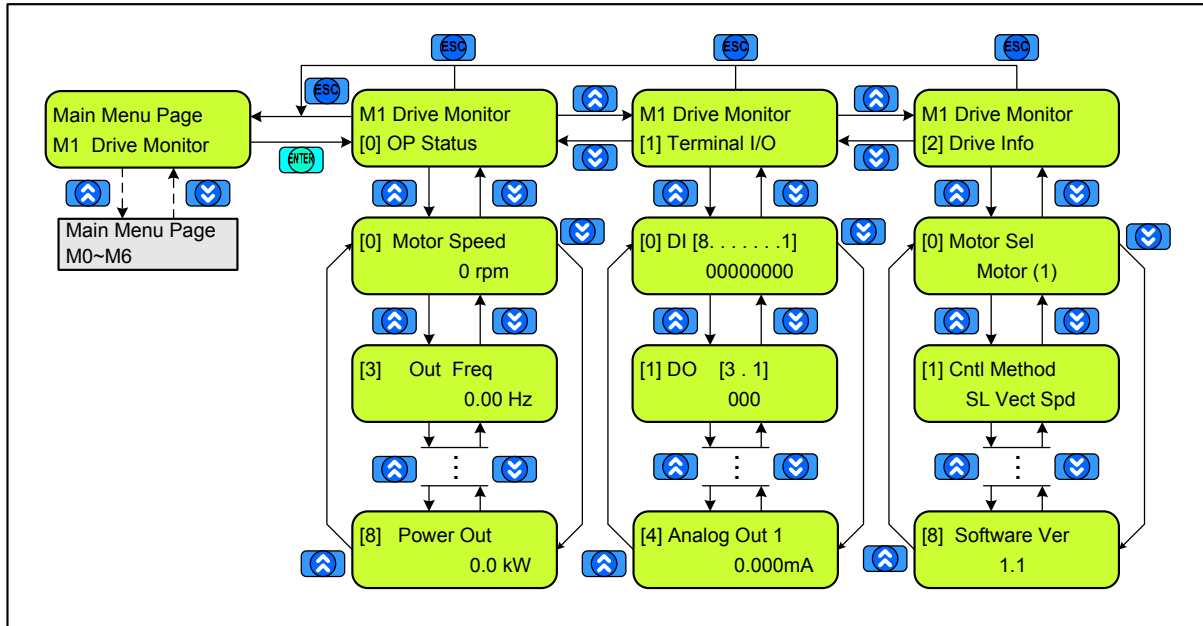


Figure 6.2-3 Drive Monitor Menu Page

M1 Drive Monitor Menu Page			
Sub Menu	Item	Unit	Description
[0] Operation Status	[0] Motor Speed	rpm	Indication of motor speed
	[1] Output Frequency	Hz	Indication of output frequency
	[2] DC Link Voltage	Vdc	Indication of DC Link Voltage
	[3] Motor Current	Arms	Indication of Motor Current
	[4] Output Voltage	Vrms	Indication of Output Voltage
	[5] Actual Torque	Nm	Indication of motor Torque
	[6] Torque Current	A	Indication of Torque current
	[7] Flux Current	A	Indication of Flux current
	[8] Input Power	kW	Indication of Input Power
	[9] Output Power	kW	Indication of Output Power
	[10]PID Reference		
	[11]PID Feedback		
	[12]PID Error		
[1] Terminal I/O	[0] Digital Input		Indication of status for digital input. Refer to Figure 5.2-3(a)
	[1] Digital Output		Indication of status for digital output. Refer to Figure 5.2-3(b)
	[2] Analog Input 1	V or mA	Indication of Analog Voltage(0[-10]~10V) or Analog Current (0[4]~20mA) for AI 1 port
	[3] Analog Input 2	V or mA	Indication of AI 2 Analog Voltage(0[-10]~10V) or Analog Current (0[4]~20mA) for AI 2 port
	[4] Analog Output	mA	Indication of Analog output current (0[4]~20mA)
M1 Drive Monitor Menu Page			
Sub Menu	Item	Unit	Description
[2]	[0] Motor Sel		Indication of selected motor if multi-motor

SOHO VD VECTOR INVERTER

Drive Information			control.
	[1] Control Method		Indication of Motor Control Method
	[2] RUN/STOP Source		Indication of the source where start/stop signal for the motor comes from. (KEYPAD, I/O Terminal, communication, etc.)
	[3] Reference Method		Indication of the source where frequency, speed and torque Reference are supplied from (KEYPAD, I/O Terminal, communication, etc.)
	[4] Drive Power	kW	Indication of the inverter rated power
	[5] Drive Voltage	V	Indication of the inverter Voltage Range Ex) 400 : 400V class inverter
	[6] Option Card		Indication of option card number (0: not installed / over 1 : number of the installed option card)
[7] Software Version		Indication of the inverter program version	

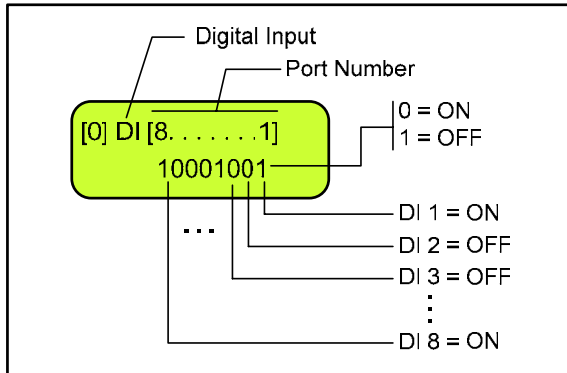


Figure 6.2-3(a) Status of Digital input

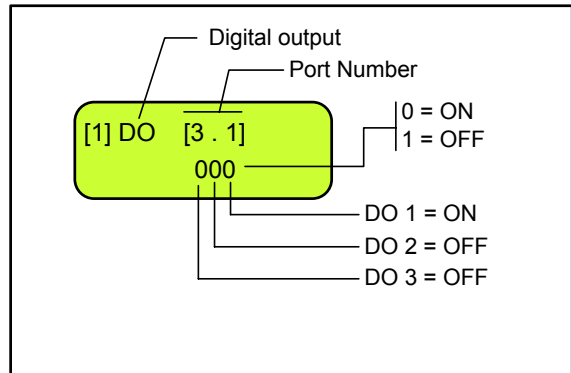


Figure 6.2-3(b) Status of Digital Output

6.2.3 Main Menu Page[2] Parameter Edit

In M2 Parameter Edit Page, The parameter can be set depending on the motor spec., control method and external I/O reference method, etc. The user-prohibited parameter groups or items would be skipped without any indication. Refer to the parameter description of Appendix D for parameter groups and items

After finishing the set-up for parameters, move to the indicating screen that shows “Main Menu Page” so the changed parameters would be saved. Then, the inverter would keep the saved parameters after the main power is off. If a user turns off the main power at the parameter item indicating screen, parameters will be returned to the old data when the main power is back again. Refer to Figure 6.2-4 for KEYPAD usage and the setting instruction in M2 Parameter Edit page.

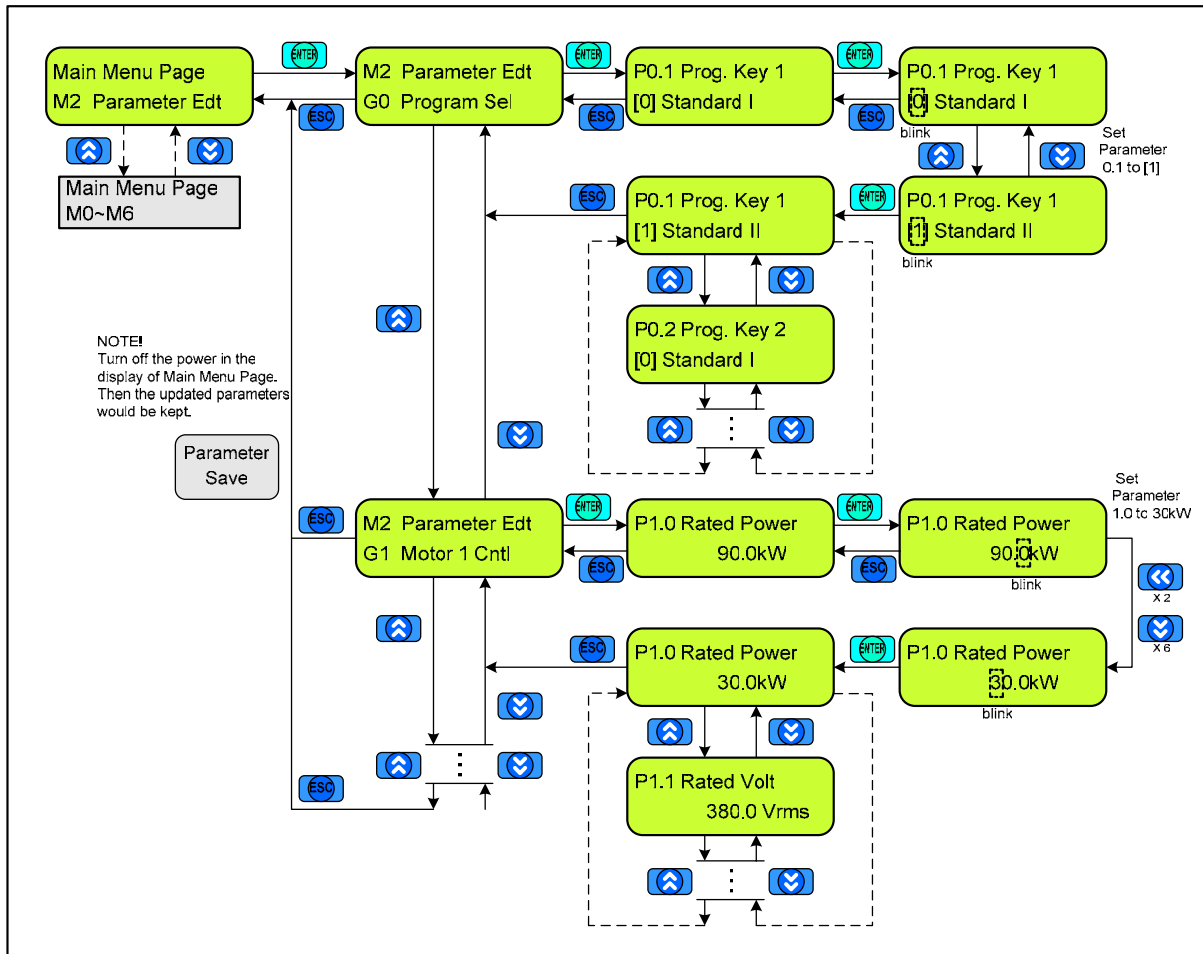


Figure 6.2-4 Parameter Menu Page

6.2.4 Main Menu Page[3] Auto Tuning

In M3 Auto Tuning Page, in the case of using speed control or torque control for motor, users can use Auto Tuning to find parameter values that are not easy to find for users and gain value of speed control loop or torque control loop.

The usage of Auto Tuning is restricted by installed environment and condition of motor and parameters for motor control method (par.1.6).

Even if the motor is not running, the output of inverter is still generating so please be more careful. Carry out the process after certainly knowing the method of Auto Tuning first at chapter 7.3. Refer to Figure 6.2-5 for KEYPAD usage and the setting instruction for Auto Tuning.

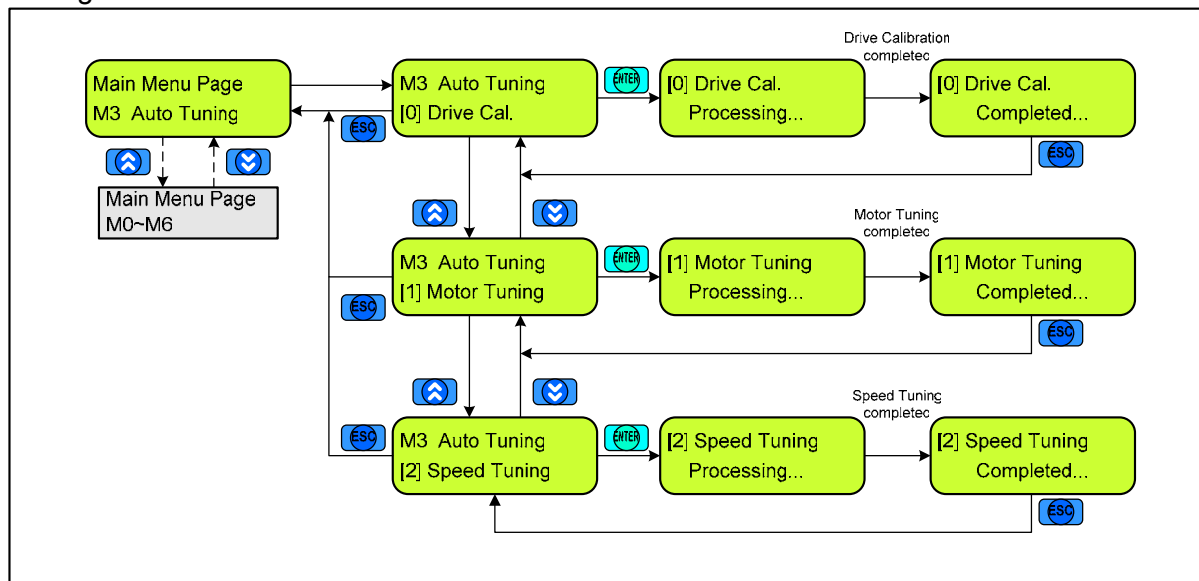


Figure 6.2-5 Auto Tuning Menu Page

No	M3 Auto Tuning	Description
[0]	Drive Calibration	Adjust automatically sensor-related parameters of Drive after initializing parameters or changing the switching frequency of the inverter
[1]	Motor Tuning	Recognize the parameter value of motor and set the related parameters automatically
[2]	Speed Tuning	Set the related parameter automatically after finding the gain value of speed control loop Carry out this motor tuning when using S/L Vector Speed Control or Vector Speed Control No need to use this when using V/F Frequency Control or V/F Speed control method.

6.2.5 Main Menu Page[4] Fault Record

In M4 Fault record page, users can monitor the number of Faults, Fault code and operation status when it occurs. Total 9 Faults are saved from Record(1) to the last occurred Fault. If Faults are occurred more than 9, the oldest Fault record is erased. Refer to Figure 6.2-6 for KEYPAD usage and the setting instruction.

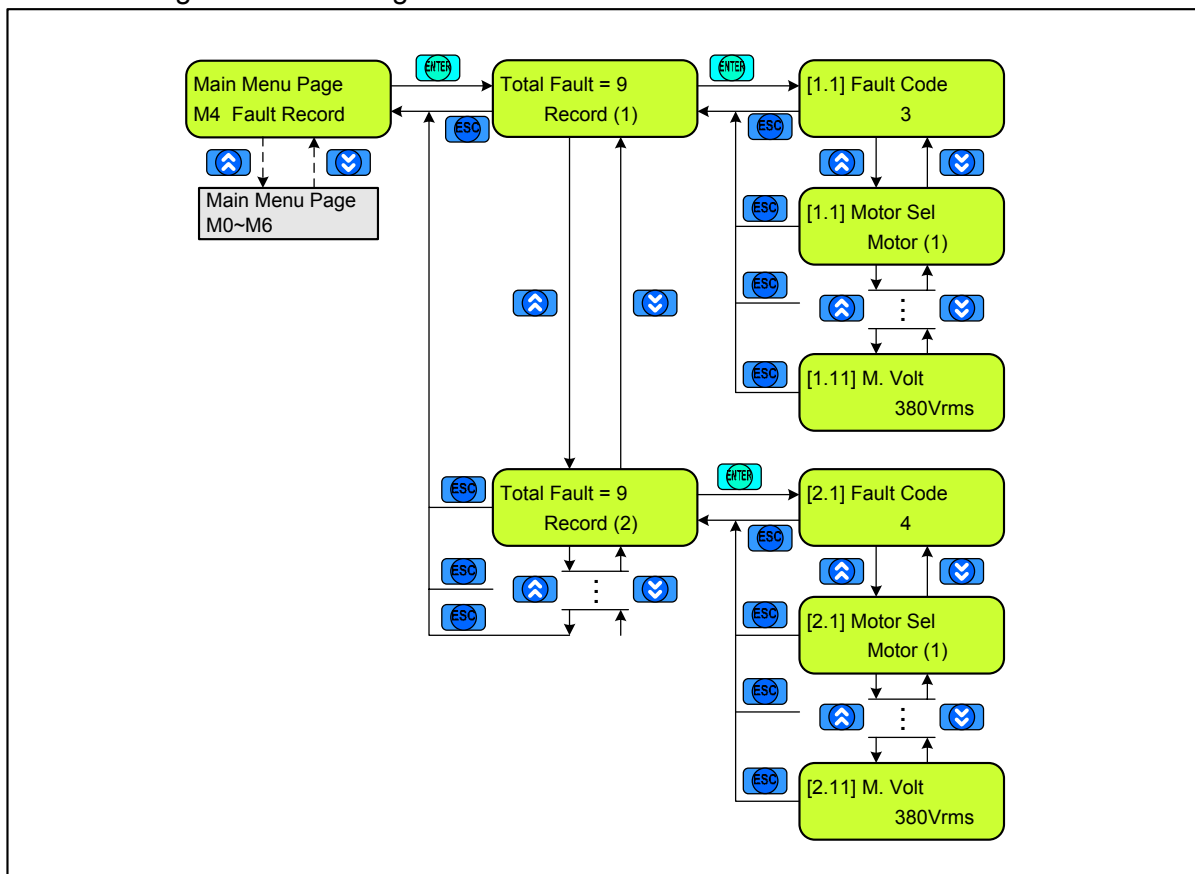


Figure 6.2-6 M4 Fault Record Menu Page

M4 Fault Record	No	Unit	Description
Total = x (x : Total occurred Faults number) Record (y) y : occurred order y=1~9 1 = the newst occurred Fault	[y.1] Fault Code		Fault details (Refer to the Fault Code table)
	[y.2] Motor Selection		Indication of the used motor.
	[y.3] Control Method		Indication of control method when Faults occur
	[y.4] Speed command	rpm	Indication of speed command when Faults occur
	[y.5] Motor Speed	rpm	Indication of Motor Speed when Faults occur
	[y.6] Frequency	Hz	Indication of output frequency when Faults occur
	[y.7] Torque command	Nm	Indication of Torque command when Faults occur
	[y.8] Actual Torque	Nm	Indication of output torque when Faults occur
	[y.9] DC Link Voltage	Vdc	Indication of DC link voltage when Faults occur
	[y.10] Motor Current	Arms	Indication of Motor Current when Faults occur
	[y.11] Motor Voltage	Vrms	Indication of Motor Voltage when Faults occur

6.2.6 Main Menu Page[5] Initialize

In M5 Initialize page, users can remove of the recorded Fault list, reset the system of inverter Drive and return to the default parameter values. Refer to Figure 6.2-7 for KEYPAD usage and the setting instruction.

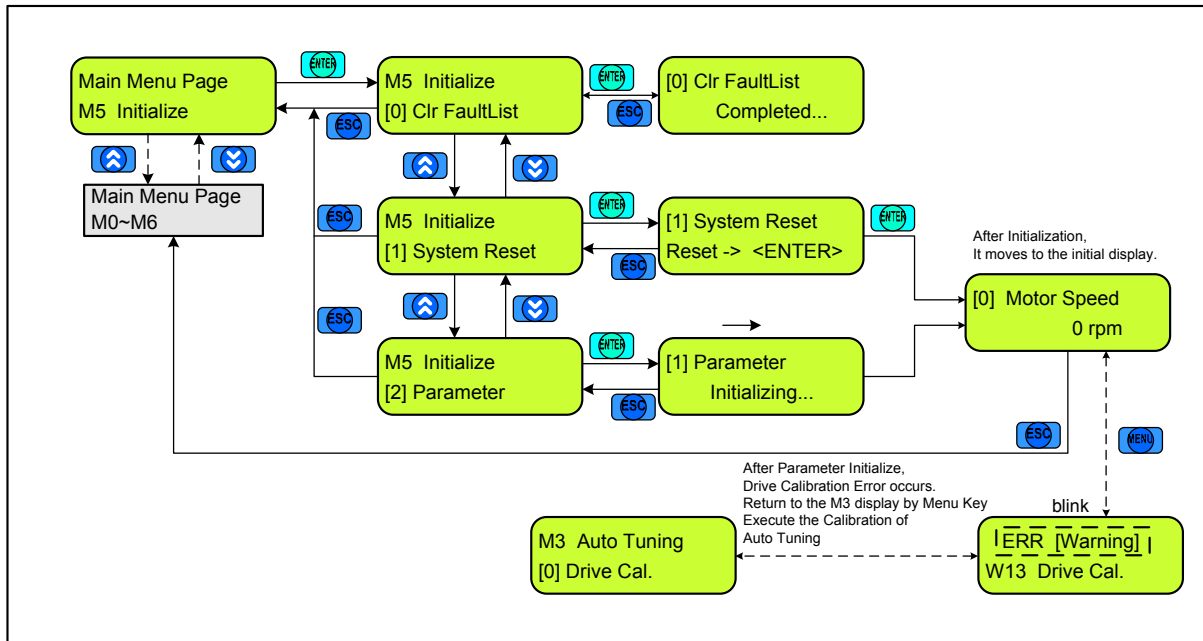


Figure 6.2-7 Initialize Menu Page

No	M5 Initialize	Description
[0]	Clear Fault List	remove the recorded fault details
[1]	System Reset	reset the system of the inverter (Same effect to give the main power back again after turn off the inverter.)
[2]	Parameter	return all the parameters to the default value If Drive Calibration Warning (W14) occurs, this carries out the Drive Calibration function of Auto Tuning[0] of Main Menu Page[3]

6.2.7 Main Menu Page[6] Password

In M6 password Page, users can check what access level of parameters can be edited. If a user wants to change the inverter parameters for more professional level, the user must be certified for higher level access. Certifying the higher level access can be done at "Admission" with the relevant password for each level. Then, the parameters of the higher level can be accessed. It is recommended to use Access level from 0 to 1 for normal users (L[0] ~ L[1]). If users want higher level, please contact the head office. If users are certified higher than L[1], it will be returned to L[0] automatically after 1 hour passes. Refer to Figure 6.2-8 for KEYPAD usage and the setting instruction.

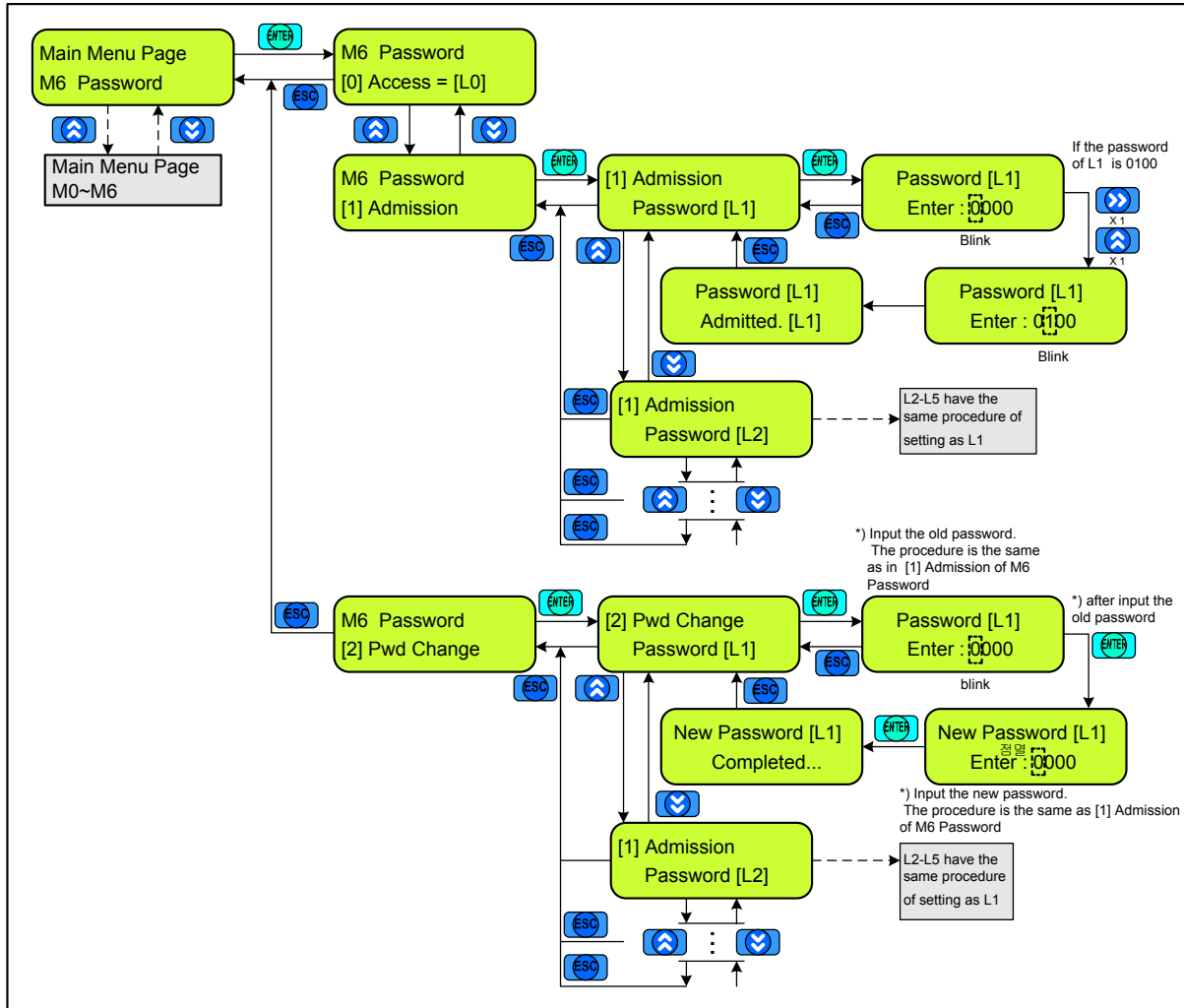



Figure 6.2-8 Password Menu Page


No	M6 Password	Description
[0]	Access Level	Indication of certified Access level
[1]	Admission	L[1] : Password 0 0 0 0
		L[2] ~ L[5] : Contact the head office
[2]	Password Change	Change the password for the certified level (users can directly change the password)

6.2.8 Usage of MENU key (Error, Warning occurrence and inverter status)

MENU key is used to return to the normal screen when error or warning occurs. And it is also used to indicate the current status of the inverter. Refer to Figure 6.2-9.

In cases of error or warning, the source of the trouble is indicated.

Push the "MENU" button,  and return to the normal screen then correct the relevant parameters or remove the occurrence source by checking the status of inverter.

If the occurrence source is not removed, the error or warning sign appears every 10 seconds while operating KEYPAD. In this case, hit the "MENU" button,  and then it will return to the last setting screen. Refer to Figure 6.2-9 for KEYPAD operation.

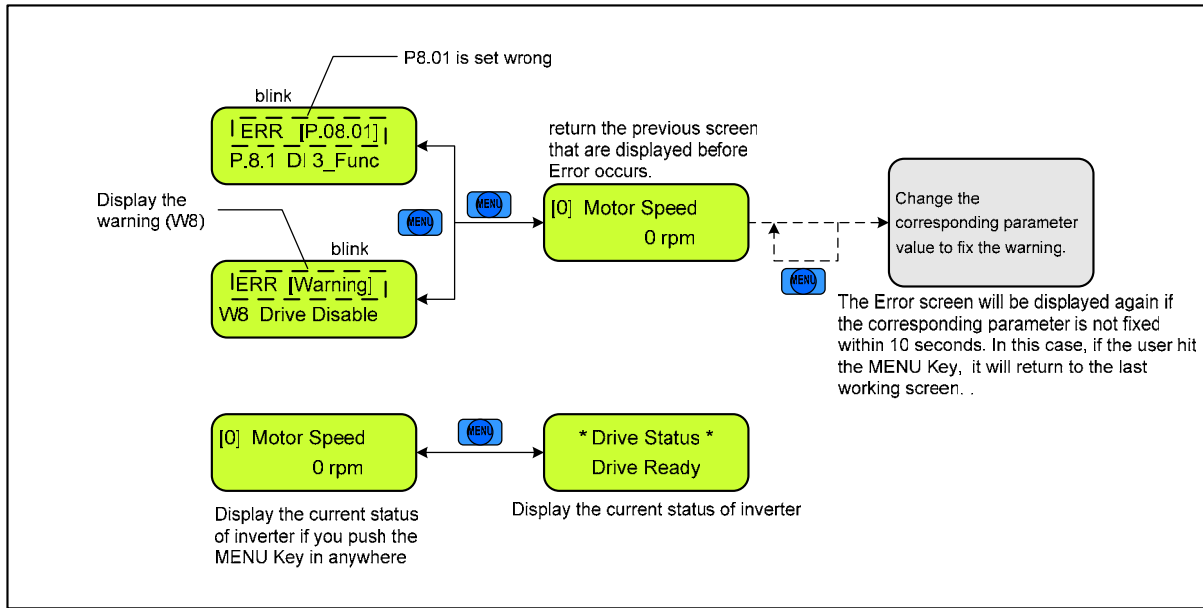


Figure 6.2-9 Checking Error, Warning and inverter status by using Menu key

7. Operation

7.1 Inverter Turning-on Procedure

In order to connect a main voltage to an inverter, as Figure 7.1-1, check the main voltage to connect the inverter, motor, DBR(Dynamic Brake Resister), and etc. If a brake is connected to the motor, the brake should be opened forcibly or a device that can control the brake to be opened or closed.

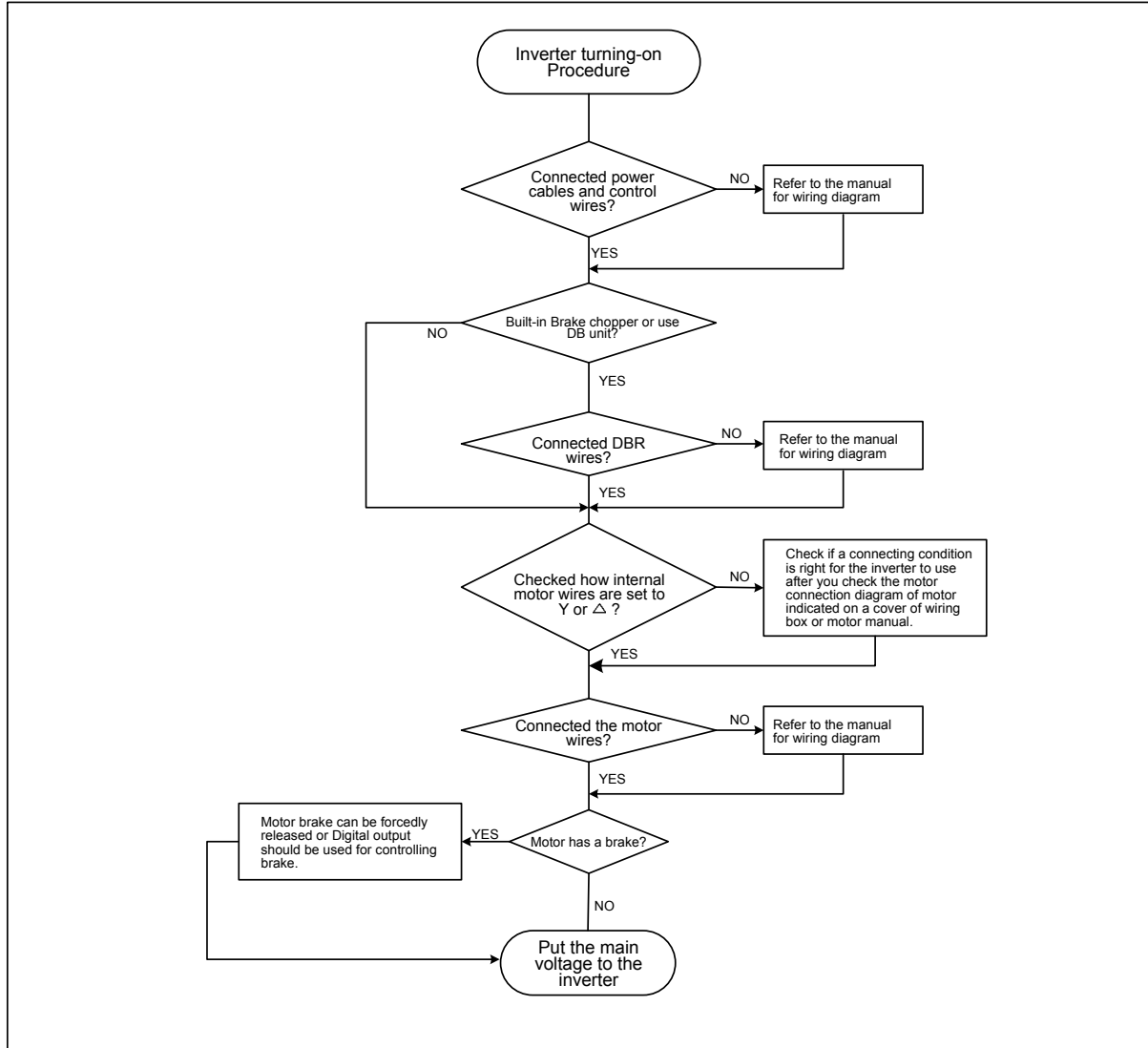


Figure 7.1-1 The processing flowchart of turning on the inverter

7.2 Inverter operation procedure (setup for the control method)

If you finish with preparation for connecting the main voltage to the inverter, you can operate the motor after setting a control method as Figure 7.2-1. There are control methods, which are V/F Frequency & Speed Control, Open loop control of S/L Vector speed & torque control, and Closed loop control of Vector speed & Torque control. Except for the V/F Frequency control method, the rest of control methods will work only when you operate Auto Tuning. Refer to the chapter 7.3 for Auto Tuning.

7.2.1 Open Loop Control Procedure

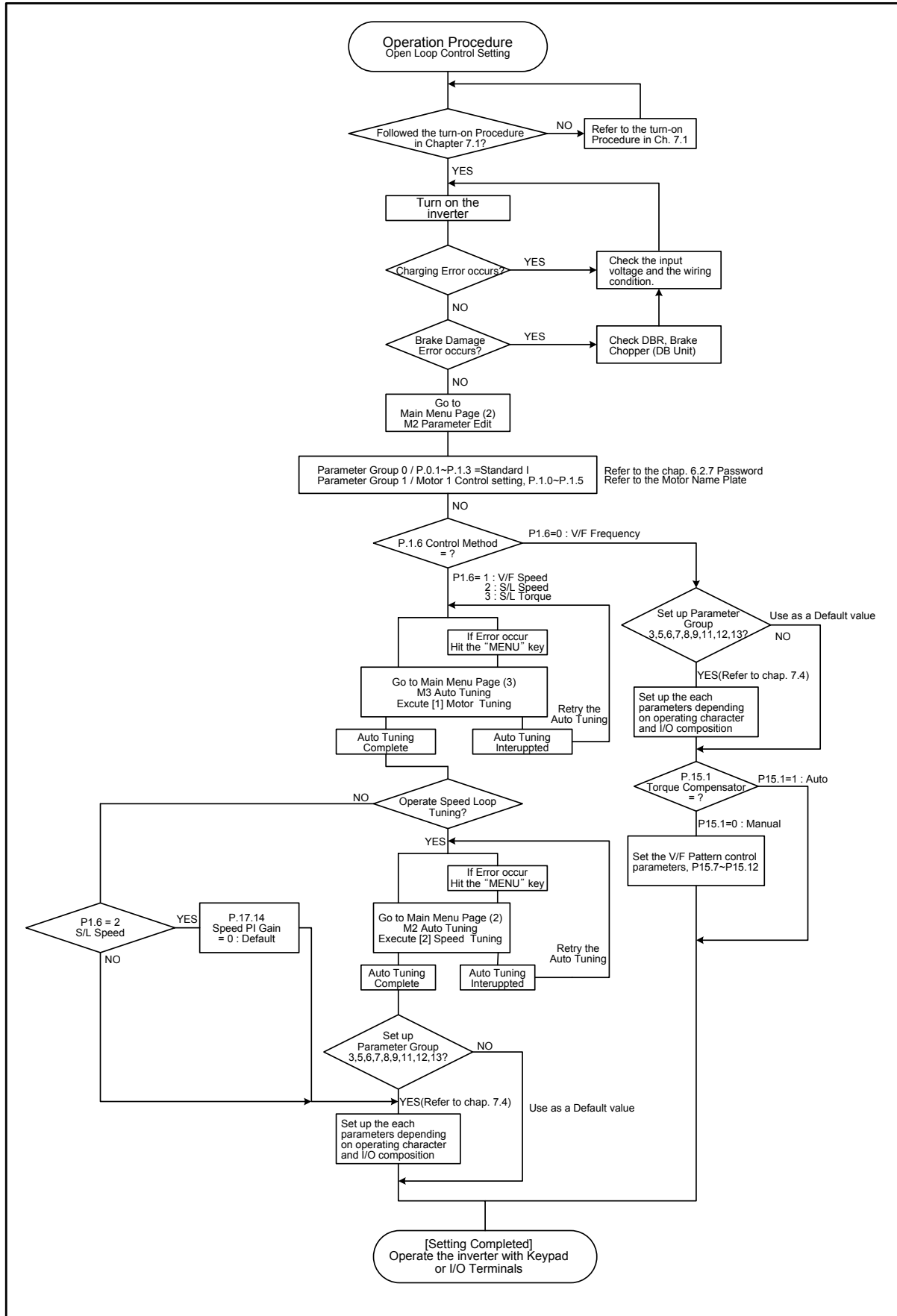


Figure 7.2-1 The processing flowchart of Open Loop Control operation

7.2.2 Closed Loop Control Procedure

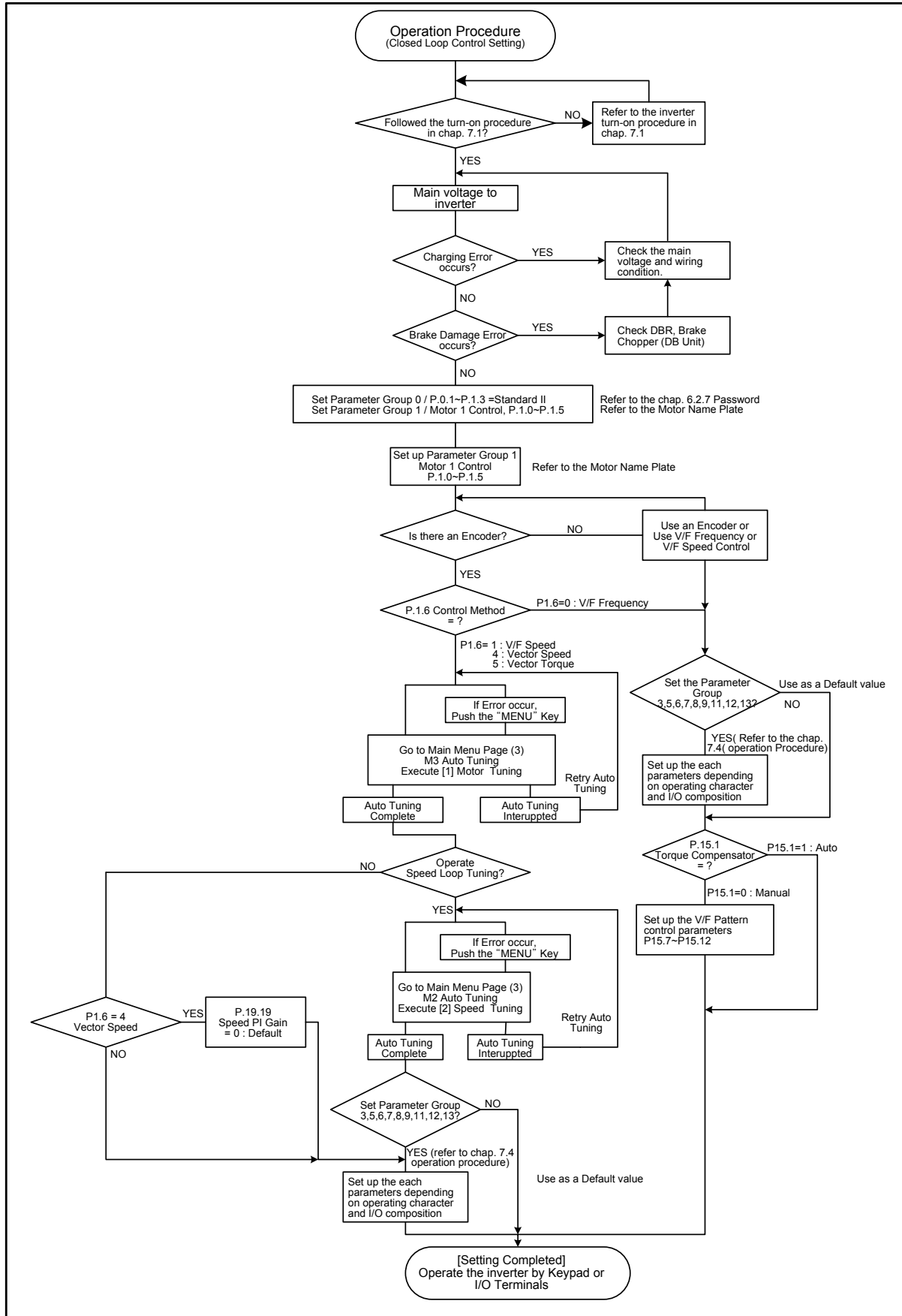


Figure 7.2-2 The processing flowchart of Closed Loop Control operation

7.3 Auto-Tuning Procedure

7.3.1 Checking point before Auto Tuning

Step	Checklist
Check 1	Is a motor Shaft connected to the other machine?
	In a process of Auto Tuning the motor can rotate up to about 5% of the rated speed. In this case, if the motor is connected to a processing line or other machine, check out whether or not there is any effect from the motor rotation. If there is a possibility of causing a fatal problem, you need to operate Auto Tuning after you separate the motor from other device. If it is difficult to separate you need to make a condition for operation that will not cause any problem even if the motor rotates. The best condition of Auto Tuning is when there is no load of the motor and mechanical devices are connected as they are. Especially in Speed Tuning, you can get more exact result when the entire mechanical devices are connected.
Check 2	Does the motor have any load or is it connected to a Mechanical Brake?
	If the Brake is installed to the motor, it should possibly be released during the Auto-Tuning process. You can release the Brake by your hands or connect the Brake Control Circuit to the Digital Output terminal of the inverter. If the Brake can be released, check if P.14.0=0(free). After it is released, if the load that is more than 50% of the rated load is impressed, Auto tuning may not be smooth. If you are in a situation that you have to operate Auto Tuning while the Brake is closed, you need to set up P.14.0=1(Locked). And only Motor Tuning is possible to operate, but not a Speed Tuning. If the Speed Tuning does not operate, set P17.14, P18.14, P19.19, P20.19 to 0(Default) and then use. In this case, you use the factory-setting values for a speed controller.
Check 3	Is there a big difference between the motor power and the inverter power?
	Auto Tuning may not operate well if power of the motor to connect to the inverter is too small in comparison with that of the inverter. The motor power should be at least over 1/5 of the inverter power.
Check 4	Did you input the motor specification in Parameter Group1?
	Set up the rated power, voltage, current, speed, and number of poles of the motor to the parameter items that are conformed to the Parameter Group 1. Refer to the rating plate information on the motor.
Check 5	Is an encoder connected to the motor?
	In case of using Vector Control, an encoder should be installed to the motor. But without installing it, V/F Control or S/L Vector Control can operate Auto Tuning.

7.3.2 Auto Tuning Operation & Completion

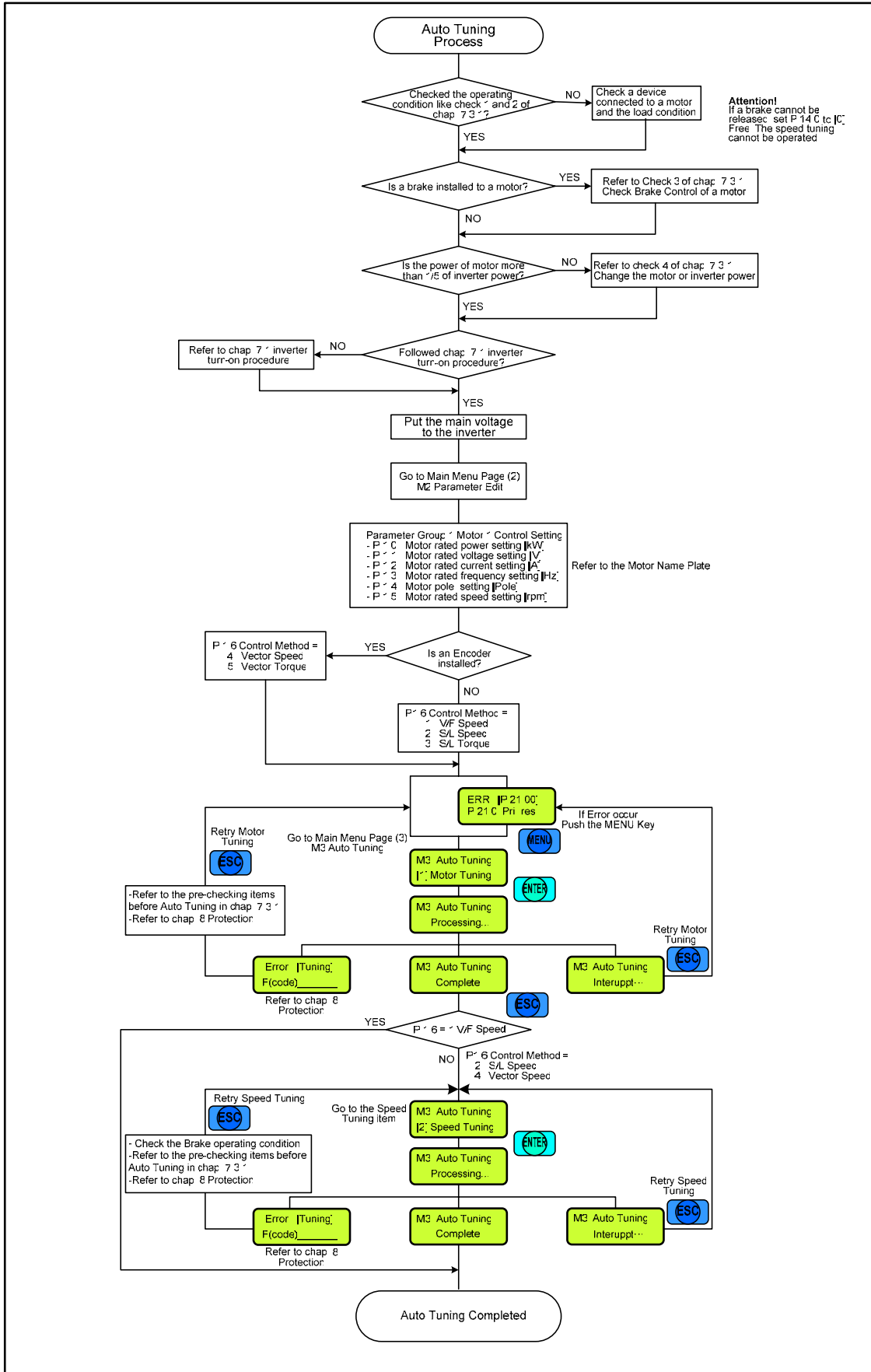


Figure 7.3-1 The processing flowchart of Auto Tuning

SOHO VD VECTOR INVERTER

7.4 Basic Open Loop Control Operation Procedure

The chapter 7.4 explains the most basic application method for operating the inverter with Open Loop Control.

7.4.1 Basic Design

The following design allows you to use all the basic I/O functions when you use SOHO VD inverter. You can adjust it depending on the given condition on the field.

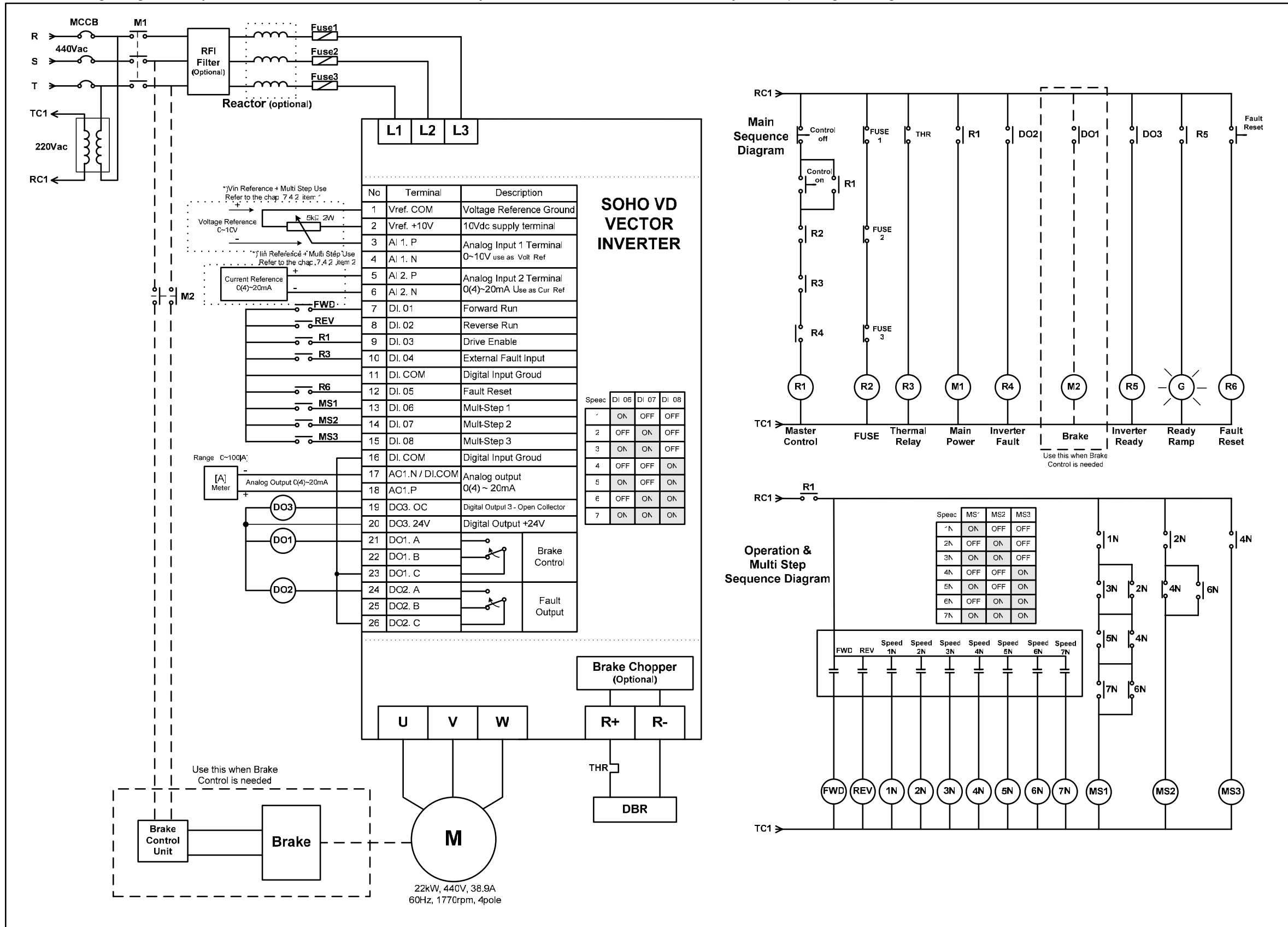


Figure 7.4-1 Basic Design for Inverter Use

7.4.2 Motor Specification & Open Loop Control Method Setting

This is how you set up a parameter for the motor specification and Open Loop Control method when you use the same motor specification as below.

The rated specification of the motor to be used for the inverter system					
Power	22 kW	Current	38.9 A	Speed	1770 rpm
Voltage	440 V	Frequency	60 Hz	Pole	4 pole

(1) Parameter Setting for Motor Specification

Parameter Group1: Control Setup [Motor 1]				
Order	Code	Parameter Name	Set Value	Explanation
1	P1.0	Motor Rated Power	22 kW	Rated power of motor
2	P1.1	Motor Rated Voltage	440 V	Rated voltage of motor
3	P1.2	Motor Rated Current	38.9 A	Rated current of motor
4	P1.3	Motor Rated Frequency	60 Hz	Rated frequency of motor
5	P1.4	Number of Poles	4 Pole	Number of poles of motor
6	P1.5	Motor Rated Speed	1770 rpm	Rated speed of motor

(2) Motor Control Setting

① V/F Frequency Control Setting

▶ When you use Automatic Torque Compensation (recommended)

Parameter Group1: Control Setup [Motor 1]				
Order	Code	Parameter Name	Set Value	Explanation
1	P1.6	Control Method	[0] V/F Frequency Control	V/F Frequency Control
Parameter Group 15: V/F Control Motor 1				
2	P15.0	Torque Compensation	[1] Auto	Automatic Torque Compensation (recommended)

“Refer to the Speed or Frequency reference and Digital Input Setting” → Go to the Chapter 7.4.3

▶ Refer to Figure 7.4-2 if you want to adjust the output rated voltage (V) or the rated frequency (F) of your own accord

Parameter Group 15: V/F Control Motor 1				
Order	Code	Parameter Name	Set Value	Explanation
1	P15.0	Torque Compensation	[0] Manual	Users can adjust the amount of compensation
2	P15.6	V/F Pattern	[2] Custom	Users can adjust the V/F curve
3	P15.7	Zero Frequency Voltage	1.5 %	100% = 440V (P.1.1 set value)
4	P15.8	Mid. Frequency	5 Hz	Mid-point frequency
5	P15.9	Mid. Frequency Voltage	10 %	Output voltage at mid-point frequency(P15.8)
6	P15.10	Max. Voltage Frequency	60 Hz	Frequency at maximum output voltage
7	P15.11	Max. Output Voltage	100 %	Output Voltage at mid-point frequency(P15.10)

“Refer to the Speed or Frequency reference and Digital Input Setting” → Go to the Chapter 7.4.3

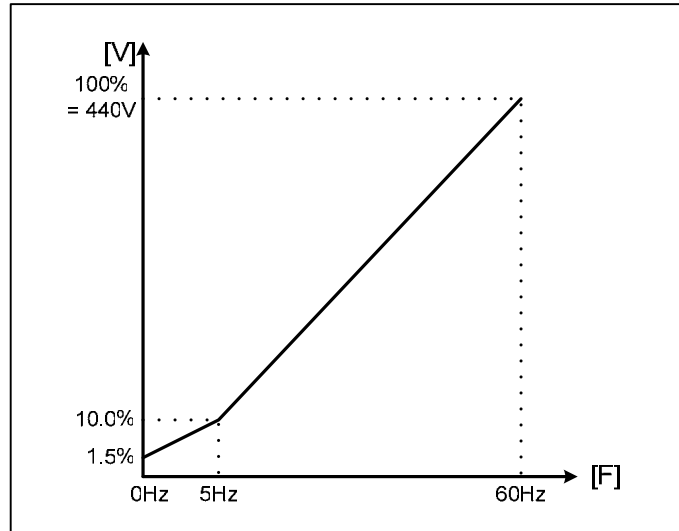


Figure 7.4-2 V/F pattern user setting example

② V/F Speed Control Setting

Parameter Group 15: Motor 1 Control				
Order	Code	Parameter Name	Set Value	Explanation
1	P1. 6	Control Method	[1] V/F Speed Control	V/F Speed Control
Parameter Group 14: Auto Tuning Configuration				
2	P14.0	Brake Condition	[0] Free	When a Brake is not installed to a motor, or can be released during Auto Tuning
			[1] locked	When a Brake is installed to a motor, and it cannot be released during Auto Tuning
Main Menu Page[3] Auto Tuning				
3	M3-[1]	Operate Motor Tuning (see the Chapter 7.3)		

“Refer to the Speed or Frequency reference and Digital Input Setting” → Go to the Chapter 7.4.3

③ S/L Speed Control Setting

► When a Brake is not installed to a motor or can be released during Auto Tuning

Parameter Group 1 : Motor 1 Control				
Order	Code	Parameter Name	Set Value	Explanation
1	P1. 6	Control Method	[2] S/L Speed Control	Sensor less Speed Control
Parameter Group 14 : Auto Tuning Configuration				
Order	Code	Parameter Name	Set Value	Explanation
2	P14.0	Brake Condition	[0] Free	Motor is not in a stall status
Main Menu Page[3] Auto Tuning				
3	[1]	Operate Motor Tuning (see the chapter 7.3)		
4	[2]	Operate Speed Tuning (see the chapter 7.3)		

“Refer to the Speed or Frequency reference and Digital Input Setting” Move to the Chapter 7.4.3

► When a Brake is installed to a motor and cannot be released during Auto Tuning.

SOHO VD VECTOR INVERTER

You cannot do Auto Tuning = [2] Speed Tuning

Order	Parameter Group 1 : Motor 1 Control			
	Code	Parameter Name	Set Value	Explanation
1	P1.6	Control Method	[2] S/L Speed Control	Sensor less Speed Control
Parameter Group 14 : Auto Tuning Configuration				
2	P14.0	Motor Locked Condition	[1] Locked	Motor is in stall status
Main Menu Page[3] Auto Tuning				
3	M3-[1]	Operate Motor Tuning (see the chapter 7.3)		
Parameter Group 17 : Sensor less Vector Control				
4	P17.15	Speed PI Gain	[0] Default Gain	Use Default value for PI Gain of Speed Control Loop. If needed, change P.17.14, P17.15.

"Refer to the Speed or Frequency reference and Digital Input Setting" Move to the Chapter 7.4.3

7.4.3 Speed or Frequency Reference & Digital Input Setting

This is a parameter setting when you configure Reference and I/O with Analog Input and Digital Input as the Figure 7.4-1. When there is no Multi-Step Digital Input, Analog Inputs are automatically recognized as speed or frequency references. The Multi-Step references are automatically recognized if there is more than one Digital Input related to Multi-Step signals.

(1) Parameter Setting for Speed or Frequency Reference + Multi Step

Order	Parameter Group 3 : Reference Setup			
	Code	Parameter Name	Set Value	Explanation
1	P3.0	RUN/STOP Method	[0] Terminal	RUN/STOP with DI.01 & DI.02
2	P3.1	Reference Method	[0] Terminal	Use Analog input and Multi Step for speed or frequency reference
Parameter Group 6 : Analog Input Setup				
Order	Code	Parameter Name	Set Value	Explanation
3	P6.0	Reference Mode	[1] r1 only	Use only r1 for Analog Input
4	P6.1	Analog Input 1 Function	[1] reference 1	Use Analog Input 1 for r1
5	P6.2	Analog Input 1 Type	[0] 0~10V	Use Voltage Input(0~10V) for Speed Reference
Parameter Group 8 : Digital Input Setup				
6	P8.0	RUN/STOP	[0] FWD → DI.01 REV → DI.02	Set Digital Inputs for RUN/STOP
7	P8.1	DI.03 Function	[1] Drive Enable	Set DI.03 Function to "Drive Enable"
8	P8.2	DI.04 Function	[8] External Fault A	Set DI.04 Function to "External Fault" (A contact)
9	P8.3	DI.05 Function	[5] Fault Reset	Set DI.05 Function to "Fault Reset"
10	P8.4	DI.06 Function	[2] Multi Step 0	Set DI.06 Function to "Multi Step 0"
11	P8.5	DI.07 Function	[3] Multi Step 1	Set DI.07 Function to "Multi Step 1"
12	P8.6	DI.08 Function	[4] Multi Step 2	Set DI.08 Function to "Multi Step 2"

"Digital & Analog Output Setting" → Go to the Chapter 7.4.4

(2) Parameter Setting for Current(0[4]~20mA) Input Reference + Multi Step

Order	Parameter Group 3 : Reference Setup			
	Code	Parameter Name	Set Value	Explanation
1	P3.0	RUN/STOP Method	[1] Terminal	RUN/STOP with DI.01 and DI.02
2	P3.1	Reference Method	[1] Terminal	Use Analog input and Multi Step for Reference
Parameter Group 6 : Analog Input Setup				

SOHO VD VECTOR INVERTER

3	P6.0	Reference Mode	[1] r1 only	Use only r1 for Analog Input
4	P6.13	Analog Input 2 Function	[1] reference 1	Use Analog Input 1 for r1
5	P6.14	Analog Input 2 Type	[3] 4~20mA	Use Current Input 4~20mA
			[4] 0~20mA	Use Current Input 0~20mA
Order	Parameter Group 8 : Digital Input Setup			
	Code	Parameter Name	Set Value	Explanation
6	P8.0	RUN/STOP	[0] FWD → DI.01 REV → DI.02	Use Digital Input for RUN/STOP
7	P8.1	DI.03 Function	[1] Drive Enable	Set DI.03 Function to Drive Enable
8	P8.2	DI.04 Function	[8] External Fault A	Set DI.04 Function to "External Fault (A contact)"
9	P8.3	DI.05 Function	[5] Fault Reset	Set DI.05 Function to "Fault Reset"
10	P8.4	DI.06 Function	[2] Multi Step 0	Set DI.06 Function to "Multi Step 0"
11	P8.5	DI.07 Function	[3] Multi Step 1	Set DI.07 Function to "Multi Step 1"
12	P8.6	DI.08 Function	[4] Multi Step 2	Set DI.08 Function to "Multi Step 2"

"Digital & Analog Output Setting" Go to the Chapter 7.4.4

7.4.4 Digital and Analog Output Setting

This is a parameter setting for configuring with Digital Output as Figure 7.4-1 Basic Design.

Order	Parameter Group 11 : Analog Output Configuration			
	Code	Parameter Name	Set Value	Explanation
1	P11.0	AO 1 Output Selection	[2] Motor Current	In parameter setting, set Analog Output to Motor Current
2	P11.1	AO 1 Output Type	[0] 0~20mA	A range of Analog output is 0~20mA
			[1] 4~20mA	A range of Analog output is 4~20mA
3	P11.5	AO 1 Output at 20mA	100	This is an output setting value when Analog output is 20mA. (if a user wants 60Hz at 20mA, set this to 60. If a user wants 315A at 20mA, set this to 315. The reference is depends on the analog output selection. P11.0)
Parameter Group 12 : Digital Output Setup				
4	P12.0	DO 1 Function	[4] Brake Control	Set Digital Output Function to Magnetic Brake of Motor. (When you use Motor Brake Control, refer to the Chapter 7.4.6 Brake Control Setting)
5	P12.1	DO 2 Function	[2] Fault Out A	When Fault occurs set Digital Output Function to work (A contact)
6	P12.3	DO 3 Function	[1] Drive Ready	Operate when the inverter is ready

".Refer to the Operation Pattern Setting" Go to the Chapter 7.4.5

7.4.5 Operation Pattern Setting

It explains parameter settings when you set the Operation Pattern as Figure 7.4-3 and 7.4-4. The Figure 7.4-1 shows the basic input method.

(1) When you use V/F Frequency and V/F Speed Control

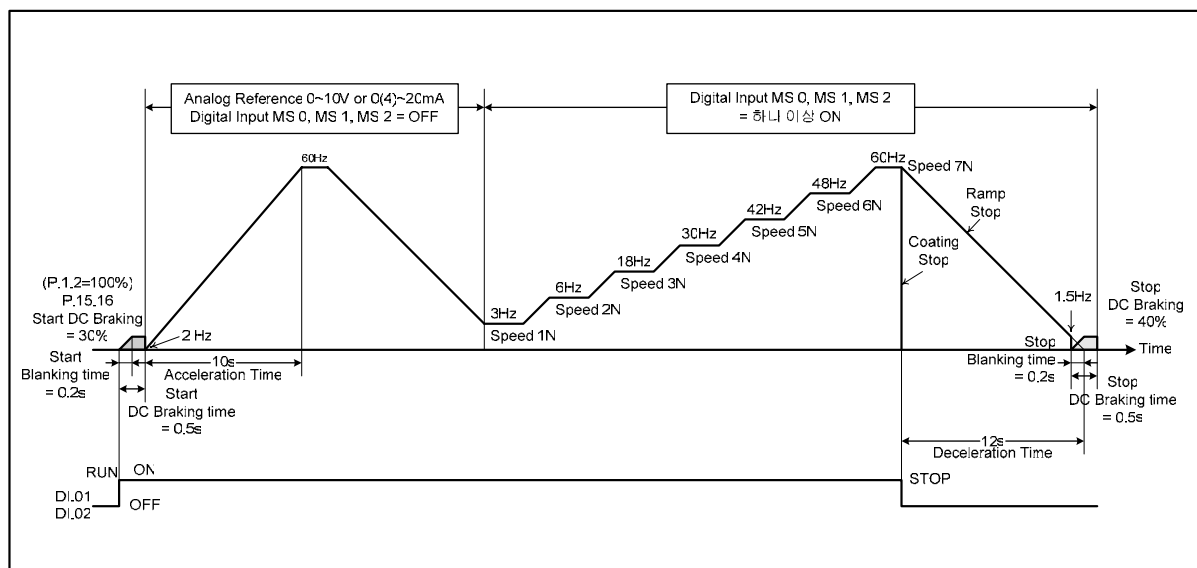


Figure 7.4-3 Operation Pattern Setting of V/F Frequency and V/F Speed Control

① Reference Setup Setting

Order	Parameter Group 3 : Reference Setup			
	Code	Parameter Name	Set Value	Explanation
1	P3.3	STOP Mode	[0] Ramp Stop	When Run-Input signal is turned OFF, inverter stops after Decel Time
			[1] Free-Run Stop	When Run-Input Signal is turned OFF, Inverter output is also turned OFF immediately.
2	P3.9	Accel.Switching Ref[1-2]	100%	100% = Rated Speed or Rated Frequency of Motor
3	P3.10	Accel.Switching Ref[2-3]	100%	100% = Rated Speed or Rated Frequency of Motor
4	P3.16	Accel.Time Region 1	10s	Accel.Time Region 1 – See the explanation of parameter
5	P3.17	Accel.Time Region 2	10s	Accel.Time Region 2 – See the explanation of parameter
6	P3.18	Accel.Time Region 3	10s	Accel.Time Region 3 – See the explanation of parameter
7	P3.26	Decel.Switching Ref[1-2]	100%	100% = Rated Speed or Rated Frequency of Motor
8	P3.27	Decel.Switching Ref[2-3]	100%	100% = Rated Speed or Rated Frequency of Motor
9	P3.33	Decel.Time Region 1	12s	Decel.Time Region 1 –See the explanation of parameter
10	P3.34	Decel.Time Region 2	12s	Decel.Time Region 2 – See the explanation of parameter
11	P3.35	Decel.Time Region 3	12s	Decel.Time Region 3 – See the explanation of parameter

② Multi Step Reference Setting

SOHO VD VECTOR INVERTER

Order	Parameter Group 9 : Multi Step Reference (100% = Rated Speed or Rated Frequency of Motor)			
	Code	Parameter Name	Set Value	Explanation
1	P9.1	Multi Step 1 Reference	5%	60Hz X 5% = 3Hz
2	P9.2	Multi Step 2 Reference	10%	60Hz X 10% = 6Hz
3	P9.3	Multi Step 3 Reference	30%	60Hz X 30% = 18Hz
4	P9.4	Multi Step 4 Reference	50%	60Hz X 50% = 30Hz
5	P9.5	Multi Step 5 Reference	70%	60Hz X 70% = 42Hz
6	P9.6	Multi Step 6 Reference	80%	60Hz X 80% = 48Hz
7	P9.7	Multi Step 7 Reference	100%	60Hz X 100% = 60Hz

③ Parameter Setting for V/F Frequency or V/F Speed Control

Order	Parameter Group 15 : V/F Control [Motor 1]			
	Code	Parameter Name	Set Value	Explanation
1	P15.1	Minimum Frequency	2 Hz	Set up for Minimum Output Frequency
2	P15.2	Maximum Frequency	60 Hz	Set up for Maximum Output Frequency
3	P15.15	Start DC Brake Time	0.5s	Operating time of DC Brake while running
4	P15.16	Start DC Brake Blanking Time	0.2s	When starting, Accel time for DC Brake current
5	P15.17	Start DC Brake Current	30%	When starting, DC Brake current
6	P15.18	Stop DC Brake Time	0.7s	Operating time of DC Brake while stopping
7	P15.19	Stop DC Brake Blanking Time	0.3s	When stopping, Accel time for DC Brake current
8	P15.20	Stop DC Brake Current	40%	When stopping, DC Brake current
9	P15.21	Stop DC Brake Frequency	1.5Hz	Operating frequency of DC Brake while stopping

<Inverter Setting completed!> *When you use the Brake Control of Motor go to "The Chapter 7.4.6. Brake Control Setting using Digital Output"

(2) When you use S/L Vector Speed Control

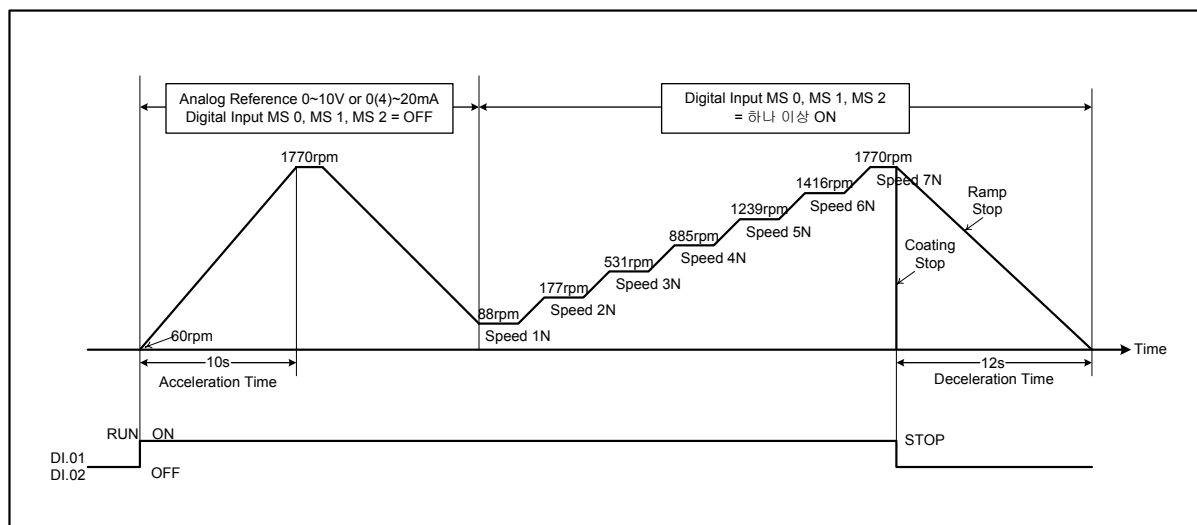


Figure 7.4-4 Operation Pattern Setting of S/L Vector Speed Control

① Reference Setup Setting

Order	Parameter Group 3 : Reference Setup			
	Code	Parameter Name	Set Value	Explanation
1	P3.3	STOP Mode	[0] Ramp Stop	When Run-Input signal is turned OFF, inverter stops after Decel Time
			[1] Free-Run Stop	When Run-Input signal is turned OFF, inverter output also is turned OFF immediately.
2	P3.9	Accel.Switching Ref[1-2]	100%	100% = Rated Speed or Rated Frequency of Motor
3	P3.10	Accel.Switching Ref[2-3]	100%	100% = Rated Speed or Rated Frequency of Motor
4	P3.16	Accel.Time Region 1	10s	Accel.Time Region 1 – See the explanation of parameter
5	P3.17	Accel.Time Region 2	10s	Accel.Time Region 2 – See the explanation of parameter
6	P3.18	Accel.Time Region 3	10s	Accel.Time Region 3 – See the explanation of parameter
7	P3.26	Decel.Switching Ref[1-2]	100%	100% = Rated Speed or Rated Frequency of Motor
8	P3.27	Decel.Switching Ref[2-3]	100%	100% = Rated Speed or Rated Frequency of Motor
9	P3.33	Decel.Time Region 1	12s	Decel.Time Region 1 – See the explanation of parameter
10	P3.34	Decel.Time Region 2	12s	Decel.Time Region 2 – See the explanation of parameter
11	P3.35	Decel.Time Region 3	12s	Decel.Time Region 3 – See the explanation of parameter

② Multi Step Reference Setting

Order	Parameter Group 9 : Multi Step Reference (100% = Rated Speed or Rated Frequency of Motor)			
	Code	Parameter Name	Set Value	Explanation
1	P9.1	Multi Step 1 Reference	5%	1770rpm X 5% = 88rpm
2	P9.2	Multi Step 2 Reference	10%	1770rpm X 10% = 177rpm

SOHO VD VECTOR INVERTER

3	P9.3	Multi Step 3 Reference	30%	1770rpm X 30% = 531rpm
4	P9.4	Multi Step 4 Reference	50%	1770rpm X 50% = 885rpm
5	P9.5	Multi Step 5 Reference	70%	1770rpm X 70% = 1239rpm
6	P9.6	Multi Step 6 Reference	80%	1770rpm X 80% = 1416rpm
7	P9.7	Multi Step 7 Reference	100%	1770rpm X 100% = 1770rpm

③ Operation Pattern Setting for Using S/L Speed Control

Order	Parameter Group 17 : Sensor less Speed Control			
	Code	Parameter Name	Set Value	Explanation
1	P17.1	Minimum Speed	60 rpm	Set up Minimum Speed
2	P17.2	Maximum Speed	1770 rpm	Set up Maximum Speed
3	P17.3	Over Speed Limit	1820 rpm	Set up Over Speed Limit

<Completed Inverter Setup!> *When you use the Brake Control of Motor go to the Chapter 7.4.6. " Brake Control Setting using Digital Output"

7.4.6 Brake Control Parameter Setting Using Digital Output

This explains a parameter setting when you control the Brake that is connected to a motor as Figure 7.4-1, using Digital Output as Figure 7.4-5 and Figure 7.4-6.

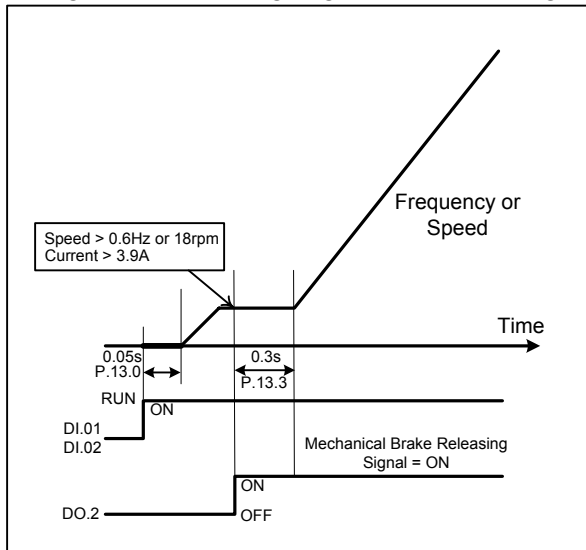


Figure 7.4-5 Mechanical Brake Releasing Signal

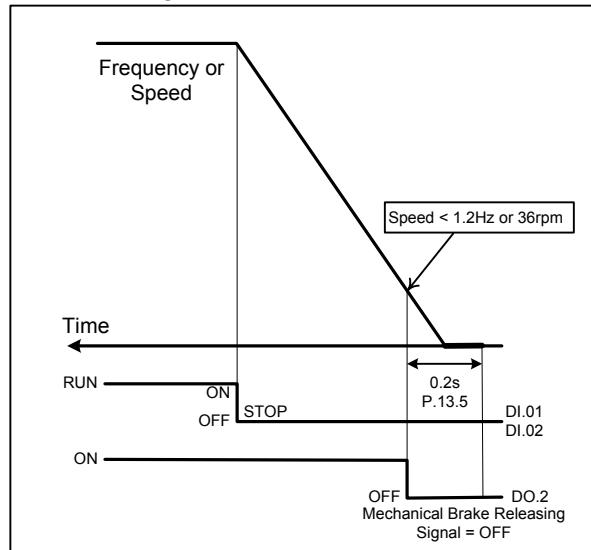


Figure 7.4-6 Mechanical Brake Closing Signal

SOHO VD VECTOR INVERTER

Parameter Group 12 : Digital Output Setup				
Order	Code	Parameter Name	Set Value	Explanation
1	P12.1	DO.2 Function	[4] Magnetic Brake	Set DO.2 for Brake Control
Parameter Group 13 : Magnetic Brake Control				
2	P13.0	M1 Locked state Up_ref	1%	Digital Output ON for Frequency or Speed Reference (60Hz, 1770rpm) X 1% = 0.6Hz, 18rpm
3	P13.1	M1 Locked state Down_ref	1%	
4	P13.2	M1 Open Current	10%	Current of Digital Output ON 38.9A X 10% = 3.9A
5	P13.5	M1 Open Response Time	0.3s	Set up for the time that passes until the Brake is completely opened after Digital Output is ON. The speed or frequency reference is maintained for the M1 Open Response Time.
6	P13.4	M1 Close Reference	2%	Frequency of Digital Output OFF & Speed Reference (60Hz, 1770rpm) X 2% = 1.2Hz, 36rpm

< Digital Output Setting for Brake Control Completed!>

SOHO VD VECTOR INVERTER

8.1 Parameters

Parameter Group 0: Program Control

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P 0.1	Program selection Key1 Prog. Key 1		0	[0] Standard I [1] Standard II [2] Special application I [3] Special application II	1	
P 0.2	Program selection Key2 Prog. Key 2		0	[0] Standard I [1] Standard II [2] Special application I [3] Special application II	1	
P 0.3	Program selection Key3 Prog. Key 3		0	[0] Standard I [1] Standard II [2] Special application I [3] Special application II	1	

Parameter Group 1: Control Setup [Motor 1]

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P 1.0	Rated Power M1_Rtd_Pwr	kW	0	1 ~ 1000	0	
P 1.1	Rated Voltage M1_Rtd_Volt	Vrms	380.0	200 ~ 600	0	
P 1.2	Rated Current M1_Rtd_Curr	Arms	0	0 ~ 2000	0	
P 1.3	Rated Frequency M1_Rtd_Freq	Hz	60.0	0 ~ 500	0	
P 1.4	Number of Poles M1_Pole	Pole	4	0 ~ 24	0	
P 1.5	Rated Speed M1_Rtd_Spd	RPM	1750	0 ~ 30000	0	
P 1.6	Control Method M1_Control		0	[0] V/F Freq. Control [1] V/F Speed Control [2] SL Vect Speed Control [3] Vect. Speed Control	0	
P 1.7	Switching Frequency M1_PWM_Freq	kHz	2.5	1 ~ 10	1	

Parameter Group 2: Control Setup [Motor 2]

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P 2.0	Rated Power M2_Rtd_Pwr	kW	0	1 ~ 1000	3	
P 2.1	Rated Voltage M2_Rtd_Volt	Vrms	380.0	200 ~ 600	3	
P 2.2	Rated Current M2_Rtd_Curr	Arms	0	0 ~ 2000	3	
P 2.3	Rated Frequency M2_Rtd_Freq	Hz	60.0	0 ~ 500	3	
P 2.4	Number of Poles M2_Pole	Pole	4	2 ~ 24	3	
P 2.5	Rated Speed M2_Rtd_Spd	Rpm	1750	0 ~ 30000	3	
P 2.6	Control Method M2_Control		0	[0] V/F Freq. Control [1] V/F Speed Control [2] SL Vect Speed Control [3] Vect. Speed Control	3	
P 2.7	Switching Frequency M2_PWM_Freq	kHz	2	1 ~ 10	3	

SOHO VD VECTOR INVERTER

Parameter Group 3: Reference Setup [Motor1]

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P 3.0	RUN/STOP Method RUN/STOP		0	[0] Terminal (MultiStep+Analog) [1] Keypad [2] Communication (Profibus, etc.)	0	
P 3.1	Reference Method Ref Method		0	[0] Terminal (Multi-Step+Analog) [1] Keypad [2] Communication (Profibus, etc.)	0	
P 3.2	Stop Command Detection Time Stop Detec.	s	0	0 ~ 10	0	
P 3.3	STOP Mode Stop Mode		0	[0] Ramp STOP [1] Free-Run STOP [2] Mixed stop	0	
P 3.4	STOP Hold Time StopHold Tm	s	0	0 ~ 30	0	
P 3.5	Output Off Hold Time Out_off Tm	s	0.5	0.05 ~ 30	0	
P 3.6	Mixed-mode STOP Reference Out_off Ref	%	20.0	0 ~ 500	0	
P 3.7	Acc/Dec Ramp Enable Acc/Dec_En		0	[0] Disabled [1] Enabled	0	
P 3.8	Acceleration Time Range AccTm_Range		0	[0] x 1 sec [1] x 10 sec		
P 3.9	Acc Switching Ref 1-2 AccSw 1-2	%	100.0	0 ~ 500	0	
P 3.10	Acc Switching Ref 2-3 AccSw 2-3	%	100.0	0 ~ 500	0	
P 3.16	Acc Time I.1 AccTm I.1	s	5.00	0.01 ~ 300	0	
P 3.17	Acc Time I.2 AccTm I.2	s	5.00	0.01 ~ 300	0	
P 3.18	Acc Time I.3 AccTm I.3	s	5.00	0.01 ~ 300	0	
P 3.24	Acc Time II AccTm II	s	30	0.01 ~ 300	0	
P 3.25	Decel Time Range DecTm_Rng		0	[0] x 1 sec [1] x 10 sec	0	
P 3.26	Dec Switching Ref 1-2 DecSw 1-2	%	100.0	0 ~ 500	0	
P 3.27	Dec Switching Ref 2-3 DecSw 2-3	%	100.0	0 ~ 500	0	
P 3.33	Decel Time I.1 DecTm I.1	s	10	0.01 ~ 300	0	
P 3.34	Decel Time I.2 DecTm I.2	s	20	0.01 ~ 300	0	
P 3.35	Decel Time I.3 DecTm I.3	s	5	0.01 ~ 300	0	
P 3.41	Decel Time II DecTm II	s	50	0.01 ~ 300	0	

SOHO VD VECTOR INVERTER

P 3.42	Counter Deceleration Function C_Decel_EN		0	[0] Disabled [1] Enabled	0	
P 3.43	Counter Deceleration Time C_Decel_Tm	s	5.0	0.01 ~ 300	0	
P 3.44	S-Curve Enable S-Curve_EN		1	[0] Disabled [1] Enabled	0	
P 3.45	S-Curve Time [Accel.] S-Crv_Acc	s	1	0.001 ~ 30	0	
P 3.47	S-Curve Time [Decel] S-Crv_Dec	s	1	0.001 ~ 30	0	
P 3.49	ES-Mode ES_Mode		0	[0] Ramp Stop [1] Free-RUN Stop [2] Mixed stop	0	
P3.50	ES-Decel Time ES-DecTime	s	1	0.001 ~ 30	0	

Parameter Group 4: Reference Setup [Motor 2]

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P4.0	RUN/STOP Method RUN/STOP		0	[0] Terminal (Multi-Step+Analog) [1] Keypad [2] Communication (Profibus, etc.)	3	
P4.1	Reference Method Ref Method		0	[0] Terminal (Multi-Step+Analog) [1] Keypad [2] Communication (Profibus, etc.)	3	
P4.2	Stop Command Detection Time Stop Detec.	s	0	0 ~ 10	3	
P4.3	STOP Mode Stop Mode		0	[0] Ramp STOP [1] Coasting STOP [2] Mixed STOP (Ramp + Coasting)	3	
P4.4	STOP Hold Time StopHold Tm	s	0	0 ~ 30	3	
P4.5	Output Off Hold Time Out_off Tm	s	0.25	0.05 ~ 30	3	
P4.6	Mixed-mode STOP Reference Out_off Ref	%	20	0 ~ 500	3	
P4.7	Acc/Dec Ramp Bypass Acc/Dec_En		0	[0] Disabled [1] Enabled	3	
P4.8	Acceleration Time Range AccTm_Range		0	[0] 0~300 sec [1] 0~3000 sec	3	
P4.9	Acc Switching Ref 1-2 AccSw 1-2	%	100.0	0 ~ 500	3	
P4.10	Acc Switching Ref 2-3 AccSw 2-3	%	100.0	0 ~ 500	3	
P4.16	Acc Time I.1 AccTm I.1	s	5.00	0.01 ~ 300	3	
P4.17	Acc Time I.2 AccTm I.2	s	5.00	0.01 ~ 300	3	

SOHO VD VECTOR INVERTER

P4.18	Acc Time I.3 AccTm I.3	s	5.00	0.01 ~ 300	3	
P4.24	Acc Time II AccTm II	s	10	0.01 ~ 300	3	
P4.25	Decel Time Range DecTm_Rng		0	[0] 0~300s [1] 0~3000 s	3	
P4.26	Dec Switching Ref 1-2 DecSw 1-2	%	100.0	0 ~ 500	3	
P4.27	Dec Switching Ref 2-3 DecSw 2-3	%	100.0	0 ~ 500	3	
P4.33	Decel Time I.1 DecTm I.1	s	5.00	0.01 ~ 300	3	
P4.34	Decel Time I.2 DecTm I.2	s	5.00	0.01 ~ 300	3	
P4.35	Decel Time I.3 DecTm I.3	s	5.00	0.01 ~ 300	3	
P4.41	Decel Time II DecTm II	s	10	0.01 ~ 300	3	
P4.42	Counter Deceleration Function C_Decel_EN		0	[0] Disabled [1] Enabled	1	
P4.43	Counter Deceleration Time C_Decel_Tm	s	5.0	0.01 ~ 300	1	
P4.44	S-Curve Bypass S-Curve_EN		1	[0] Disabled [1] Enabled	3	
P4.45	S-Curve Time [Accel.] .S-Crv_Acc	s	1	0.01 ~ 300	3	
P4.47	S-Curve Time [Decel] S-Crv_Dec	s	1	0.01 ~ 300	3	
P4.49	ES-Mode ES_Mode		1	[0] Ramp Stop [1] Coasting STOP [2] Mixed STOP	3	
P4.50	ES-Decel Time ES-DecTime	s	1	0.01 ~ 10	3	

Parameter Group 5: Protection

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P5.0	Current Limit [Motor1] Cur_Lmt[M1]	%	130.0	50 ~ 250	1	
P5.1	Current Limit [Motor2] Cur_Lmt[M2]	%	130.0	50 ~ 250	3	
P5.2	Non-Current Protection NC_Protect		0	[0] Disabled [1] Enabled	1	
P5.3	Non-Current Time-over NC TimeOver	ms	100	0 ~ 3000	1	
P5.4	Under Current Protection UC Protect		0	[0] Disabled [1] Enabled	1	
P5.5	Under Current Trip UC Trip	%	50	0 ~ 50	1	
P5.6	Under Current Time-Over UC TimeOver	ms	50	0 ~ 3000	1	

SOHO VD VECTOR INVERTER

P5.7	Max. Continuous Current MaxCon_Curr	%	100.0	0 ~ 300	1	
P5.8	Over-Load current Over_Load	%	150.0	50 ~ 250	1	
P5.9	Over-Load Time-over OL_TimeOver	s	60.00	0 ~ 300	1	
P5.10	Over-Load Fault [Action] OL Action		0	[0] Stop [1] Output Off [2] Ignore	1	
P5.11	Over-Current Trip OL Trip	%	170	50 ~ 300	1	
P5.12	Zero-sequence Trip ZC Trip	%	50	0 ~ 250	1	
P5.13	Over-Voltage Limiting Function OV_Ltd_Fn		1	[0] Disabled [1] Enabled	1	
P5.14	Over Voltage Limit OV Limit	V	700	0 ~ 1000	1	
P5.15	Over Voltage trip OV Trip	V	760	0 ~ 1000	1	
P5.16	UV comepnsation UV_Comp_Fn		0	[0] Disabled [1] Enabled	1	
P5.17	Under Voltage compensation Limit UV_Comp_V	V	0	0 ~ 1000	1	
P5.18	Under Voltage Trip UV_Trip	V	400.0	0 ~ 1000	1	
P5.19	Open Phase Protection OP_Ph_Trip		0	[0] Disabled [1] Enabled	1	
P5.20	Supply Frequency Input_Freq	Hz	60	10 ~ 120	1	
P5.21	Built-in Dynamic Brake Blt-in DB		0	[0] Disabled [1] Enabled	1	
P5.22	DB Switching Frequency DB Freq.	kHz	1	1 ~ 5	1	
P5.23	DB Start Voltage DB start	V	730.0	0 ~ 1000	1	
P5.24	DB Full Voltage DB Full	V	750.0	0 ~ 1000	1	
P5.25	Over-Heating Fault [Action] OH_Action		0	[0] Stop [1] Ignore	1	
P5.26	HOV Protection HOV_Protec		1	[0] Disabled [1] Enabled	1	
P5.27	HOC Protection HOC_Protec		0	[0] Disabled [1] Enabled	1	
P5.28	HZC Protection HZC_Protec		0	[0] Disabled [1] Enabled	1	
P5.29	Auto Restart Count RestartCnt		0	0- 15	1	
P5.30	Retry Delay Time RetryDelay	s	1	0 ~ 100	1	
P5.31	Auto Reset (OC) A.Rst_OC		0	[0] Disabled [1] Enabled	1	

SOHO VD VECTOR INVERTER

P5.32	Auto Reset (OV) A.Rst_OV		0	[0] Disabled [1] Enabled	1	
P5.33	Auto Reset (UV) A.Rst_UV		0	[0] Disabled [1] Enabled	1	
P5.34	Auto Reset (HOV) A.Rst_HOV		0	[0] Disabled [1] Enabled	1	
P5.35	Auto Reset (HOC) A.Rst_HOC		0	[0] Disabled [1] Enabled	1	
P5.36	Out of Control Auto Reset A.Rst_CnEr		0	[0] Disabled [1] Enabled	1	
P5.37	Out of Control Time CntlErr_Tm	s	4.0	0.1 ~ 100	1	

Parameter Group 6: Analog Input

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P6.0	Reference Mode A.Ref Mode		1	[0] Disabled [1] R1 only [2] R2 only [3] R1+R2 [4] R1-R2 [5] R2-R1 [6] R1 x R2	0	
P6.1	AI.1 Function AI1 Func.		1	[0] Disabled [1] Reference 1 [2] Reference 2 [3] PI Feedback 1 [4] PI Feedback 2	0	
P6.2	AI.1_Type AI1 Type		0	[0] 0~ 10V [1] -10 ~ 10V [2] Custom Setting [V] [3] 4 ~ 20mA [4] 0 ~ 20mA [5] Custom Setting [mA]	0	
P6.3	AI.1 Filter AI1 Filter		1	[0] Disable [1] Enable	0	
P6.4	AI.1 Filter Time Const AI1 Tm_Ct	s	0.01	0.005 ~ 1	0	
P6.5	AI.1 Offset adjustment AI1 Offset		0	-3 ~ 3	0	
P6.6	AI.1 min Voltage AI1 Min_V	V	0	0 ~ 10	0	
P6.7	AI.1 min Current AI1_Min_mA	mA	0	0 ~ 20	0	
P6.8	AI.1 Minimum AI1 Min.	%	0	0 ~ 500	0	
P6.9	AI.1 max Voltage AI1 Max_V	V	10.00	0 ~ 10	0	
P6.10	AI.1 max Current AI1 Max_mA	mA	20.00	0 ~ 20	0	
P6.11	AI.1 Maximum AI1 Max	%	100	0 ~ 500	0	
P6.12	AI.1 Inversion AI1 Inv.		0	[0]Disable [1] Enable	0	

SOHO VD VECTOR INVERTER

P6.13	AI.1 Discreteness AI1 D_Step		0	[0] Disabled [1] 128 steps [2] 64 steps [3] 32 steps [4] 16 steps [5] 8 steps	0	
P6.14	AI. 1 Dead-Zone AI1 Dead-Z		1	[0] Disabled [1] Enabled.	0	
P6.15	AI.2 Function AI2 Func.		2	[0] Disabled [1]Reference 1 [2]Reference 2 [3]PI Feedback 1 [4]PID Feedback 2	0	
P6.16	AI.2 Type AI2 Type		0	[0] 0~ 10(5)V [1] -10 ~ 10V [2] User [V] [3] 4 ~ 20mA [4] 0 ~ 20mA [5] User [mA]	0	
P6.17	AI.2 Filter AI2 Filter		1	[0] Disable [1] Enable	0	
P6.18	AI.2 Filter Time Const AI2 Tm_Ct	s	0.01	0.005 ~ 1	0	
P6.19	AI.2 Offset adjust AI2 Offset		0	-3 ~ 3	0	
P6.20	AI.2 min Voltage AI2 Mn_V	V	0	0 ~ 10	0	
P6.21	AI.2 min Current AI2 Mn_mA	mA	0	0 ~ 20	0	
P6.22	AI.2 Minimum AI2 Mn.	%	0	0 ~ 500	0	
P6.23	AI.2 max Voltage AI2 Max_V	V	10.00	0 ~ 10	0	
P6.24	AI.2 max Current AI2 Max_mA	mA	20.00	0 ~ 20	0	
P6.25	AI.2 Maximum AI2 Max.	%	100.0	0 ~ 500	0	
P6.26	AI.2 Inversion AI2 Inv		0	[0] Disable [1] Enable	0	
P6.27	AI.2 Discreteness AI2 D-Step		0	[0] Disabled [1] 128 steps [2] 64 steps [3] 32 steps [4] 16 steps [5] 8 steps	0	
P 6.28	AI. 2 Dead-Zone AI2 Dead-Z		0	[0] Disabled [1] Enabled.	0	
P6.29	AI.3 Function AI3 Func.		0	[0]Disabled [1]Reference 1 [2]Reference 2 [3]PID Feedback 1 [4]PID Feedback 2	2	
P6.30	AI.3 Type AI3 Type		0	[0] 0~ 10V [1] -10 ~ 10V [2] User [V] [3] 4 ~ 20mA [4] 0 ~ 20mA [5] User [mA]	2	
P6.31	AI.3 Filter AI3 Filter		1	[0] Disable [1] Enable	2	

SOHO VD VECTOR INVERTER

P6.32	AI.3 Filter Time Const AI3 Tm_Ct	s	0.01	0.005 ~ 1	2	
P6.33	AI.3 Offset adjustment AI3 Offset		0	-3 ~ 3	2	
P6.34	AI.3 min Voltage AI3 Min_V	V	0.00	0 ~ 10	2	
P6.35	AI.3 min Current AI3 Min_mA	mA	0.00	0 ~ 20	2	
P6.36	AI.3 Minimum AI3 Mn.	%	0.0	0 ~ 500	2	
P6.37	AI.3 max Voltage AI3 Max_V	V	10.00	0 ~ 10	2	
P6.38	AI.3 max Current AI3 Max_mA	mA	20.00	0 ~ 20	2	
P6.39	AI.3 Maximum AI3 Max.	%	100.0	0 ~ 500	2	
P6.40	AI.3 Inversion AI3 Inv		0	[0] Disable [1] Enable.	2	
P6.41	AI.3 Discreteness AI3 D-Step		0	[0] Disabled [1] 128 steps [2] 64 steps [3] 32 steps [4] 16 steps [5] 8 steps	2	
P 6.42	AI. 3 Dead-Zone AI3 Dead-Z		0	[0] Disabled [1] Enabled.	2	
P6.43	AI.4 Function AI4 Func		0	[0] Disabled [1]Reference 1 [2]Reference 2 [3]PID Feedback 1 [4]PID Feedback 2	2	
P6.44	AI.4 Type AI4 Type		0	[0] 0~10V [1] -10 ~ 10V [2] User [V] [3] 4 ~ 20mA [4] 0 ~ 20mA [5] User [mA]	2	
P6.45	AI.4 Filter AI4 Filter		1	[0] Disable [1] Enable	2	
P6.46	AI.4 Filter Time Const AI4 Tm_Ct	s	0.01	0.005 ~ 1	2	
P6.47	AI.4 Offset adjustment AI4 Offset		0	-3 ~ 3	2	
P6.48	AI.4 min Voltage AI4 Mn_V	V	0.00	0 ~ 10	2	
P6.49	AI.4 min Current AI4 Mn_mA	mA	0.00	0 ~ 20	2	
P6.50	AI.4 Minimum AI4 Mn.	%	0.0	0 ~ 500	2	
P6.51	AI.4 max Voltage AI4 Max_V	V	10.00	0 ~ 10	2	
P6.52	AI.4 max Current AI4 Max_mA	mA	20.00	0 ~ 20	2	
P6.53	AI.4 Maximum AI4 Max.	%	100.0	0 ~ 500	2	
P6.54	AI.4 Inversion AI4 Inv		0	[0] Disable [1] Enable	2	

SOHO VD VECTOR INVERTER

P6.55	AI.4 Discreteness AI4 D-Step		0	[0] Disabled [1] 128 steps [2] 64 steps [3] 32 steps [4] 16 steps [5] 8 steps	2	
P 6.56	AI. 4 Dead-Zone AI4 Dead-Z		0	[0] Disabled [1] Enabled.	2	
P6.57	AI.5 Function AI.5_Func		0	[0] Disabled [1]Reference 1 [2]Reference 2 [3]PID Feedback 1 [4]PID Feedback 2	2	
P6.58	AI.5 Type AI5 Type		0	[0] 0~ 10V [1] -10 ~ 10V [2] User [V] [3] 4 ~ 20mA [4] 0 ~ 20mA [5] User [mA]	2	
P6.59	AI.5 Filter AI5 Filter		1	[0] Disable [1] Enable	2	
P6.60	AI.5 Filter Time Const AI5 Tm_Ct	s	0.05	0.005 ~ 1	2	
P6.61	AI.5 Offset adjustment AI5 Offset		0	-3 ~ 3	2	
P6.62	AI.5 min Voltage AI5 Min_V	V	0.00	0 ~ 10	2	
P6.63	AI.5 min Current AI5 Min_mA	mA	0.00	0 ~ 20	2	
P6.64	AI.5 Minimum AI5 Min.	%	0.0	0 ~ 500	2	
P6.65	AI.5 max Voltage AI5 Max_V	V	10.00	0 ~ 10	2	
P6.66	AI.5 max Current AI5 Max_mA	mA	20.00	0 ~ 20	2	
P6.67	AI.5 Maximum AI5 Max.	%	100.0	0 ~ 500	2	
P6.68	AI.5 Inversion AI5 Inv		0	[0] Disable [1] Enable	2	
P6.69	AI.5 Discreteness AI5 D-Step		0	[0] Disabled [1] 128 stes [2] 64 steps [3] 32 steps [4] 16 steps [5] 8 steps	2	
P 6.70	AI. 5 Dead-Zone AI5 Dead-Z		0	[0] Disabled [1] Enabled.	2	

Parameter Group 7: PID Control

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P7.0	PID Control Mode PID Mode		0	[0] Disabled [1] Process PID Control [2] General PID Control [3] PID Compensation	0	
P7.1	Reference Mode Ref. Mode		2	[0] Keypad Operator [1] Set Value [2] Analog Input	0	

SOHO VD VECTOR INVERTER

P7.2	PID Set-Point [Parameter] Set Value	%	0	0 ~ 400	0	
P7.3	Feedback Mode Feedback		2	[0] f1 only [1] f2 only [2] f1 + f2 [3] f1 – f2 [4] f2 – f1 [5] f1 x f2	0	
P7.4	Reference Sign Change REF_Sgn_Neg		0	[0] Disabled [1] Enabled	0	
P7.5	Feedback Sign Change FB_Sng_Neg		0	[0] Disabled [1] Enabled	0	
P7.6	Control Period Cntl Period	ms	10	5 ~ 1000	0	
P7.7	Proportional Gain P-Gain	%	0	0 ~ 3000	0	
P7.8	Integration Time Integ_Time	s	0	0 ~ 300	0	
P7.9	Differentiator Time Constant Dif_Time	ms	0	0 ~ 30000	0	
P7.10	Feed-forward Gain FF-Gain	%	0	0 ~ 100	0	
P7.11	Zero-Shift Factor 1 ZERO_Adj 1	%	100	30 ~ 100		
P7.12	Proportional Gain 2 P-Gain 2	%	0	0 ~ 1000	0	
P7.13	Integration Time 2 Int_Time 2	s	0	0 ~ 300	0	
P7.14	Differentiator Time Constant 2 Dif_Time 2	ms	0	0 ~ 30000	0	
P7.15	Feed-Forward Gain 2 FF-Gain 2	%	0	0 ~ 100	0	
P7.16	Zero-Shift Factor 2 ZERO_Adj 2	%	100	30 ~ 100		
P7.17	Output Inversion Output_INV		0	[0] Disabled [1] Enabled	0	
P7.18	Integrator Upper Limit Int_UP_Lmt	%	-100	-400 ~ 400	0	
P7.19	Integrator Lower Limit Int_LO_Lmt	%	100	-400 ~ 400	0	
P7.20	Output Upper Limit Out_UP_Lmt	%	-100	-400 ~ 400	0	
P7.21	Output Lower Limit Out_LO_Lmt	%	100	-400 ~ 400	0	
P7.22	Output Scale Out_Scale	%	100	-250 ~ 250	0	
P7.23	AUTO RUN/STOP Auto_ON/OFF		0	[0] Disabled [1] Enabled	0	
P7.24	Auto Stop Delay Time AutoSt_Dly	s	0	0 ~ 3000	0	
P7.25	Auto Start Error Condition AutoSt_Err	%	10	0 ~ 50	0	

Parameter Group 8: Digital Input Setup

Par.	Parameter Name	Unit	Default	Range	Access	
------	----------------	------	---------	-------	--------	--

SOHO VD VECTOR INVERTER

NO.	LCD Disply				Level	
P8.0	Run/Stop Control RUN/STOP		1	[0] 1.FWD / 2.REV [1] 1.RUN / 2.DIR	0	
P8.1	DI 3 Function DI.3 Func.		2	[0] Disabled [1] Drive enable [2] multi-step0 [3]multi-step1 [4]multi-step2 [5] Fault Reset [6] JOG [7] AI_REF_Disable [8] AI_Local/Remote [9] Ext. Fault A [10] Ext. Fault B [11] Motor Selection [12] MB Brake State [13] Acc./Dec. Switching [14] Ref. Increment [15] Ref. Decrement [16] Accel/Decel Bypass [17] PID cntl_Enable [18] Auto PID Mode [19] PID Gain Selection [20] PID Integrator Reset	0	DI9~ DI16 = access level 2
P8.2	DI 4 Function DI.4 Func.					
P8.3	DI 5 Function DI.5 Func.					
P8.4	DI 6 Function DI.6 Func.					
P8.5	DI 7 Function DI.7 Func.					
P8.6	DI 8 Function DI.8 Func.					
P8.7	DI 9 Function DI.9 Func.					
P8.8	DI 10 Function DI.10 Func.					
P8.9	DI 11 Function DI.11 Func.					
P8.10	DI 12 Function DI.12 Func.					
P8.11	DI 13 Function DI.13 Func.					
P8.12	DI 14 Function DI.14 Func.					
P8.13	DI 15 Function DI.15 Func.					
P8.14	DI 16 Function DI.16 Func.					
P8.15	Blank Time after Motor change	s	0.5	0.1 ~ 2	0	
P8.16	Ref. Up/Down Time Ref. UP/DN	s	5	1 ~ 30	0	
P8.17	START Delayed JOG Detection Dly_JOG_Tm	s	0	0 ~ 300	0	
P8.18	"RUN" Delay Time RUN_Delay	s	0	0 ~ 2	0	

Parameter Group 9: Multi-Step Reference [Motor 1]

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P9.0	JOG Reference JOG Ref.	%	5.0	0 ~ 100	0	
P9.1	Multi Step.1 Ref. Step.1 Ref.	%	10.0	0 ~ 500	0	
P9.2	Multi Step.2 Ref. Step.2 Ref.	%	20.0	0 ~ 500	0	
P9.3	Multi Step.3 Ref. Step.3 Ref.	%	30.0	0 ~ 500	0	
P9.4	Multi Step.4 Ref. Step.4 Ref.	%	40.0	0 ~ 500	0	
P9.5	Multi Step.5 Ref. Step.5 Ref.	%	60.0	0 ~ 500	0	
P9.6	Multi Step.6 Ref. Step.6 Ref.	%	80.0	0 ~ 500	0	
P9.7	Multi Step.7 Ref. Step.7 Ref.	%	100.0	0 ~ 500	0	

SOHO VD VECTOR INVERTER

Parameter Group 10: Multi-Step Reference [Motor 2]

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P10.0	JOG Reference JOG Ref.	%	5.0	0 ~ 100	3	
P10.1	Multi Step.1 Ref. Step.1 Ref.	%	10.0	0 ~ 500	3	
P10.2	Multi Step.2 Ref. Step.2 Ref.	%	20.0	0 ~ 500	3	
P10.3	Multi Step.3 Ref. Step.3 Ref.	%	30.0	0 ~ 500	3	
P10.4	Multi Step.4 Ref. Step.4 Ref.	%	40.0	0 ~ 500	3	
P10.5	Multi Step.5 Ref. Step.5 Ref.	%	60.0	0 ~ 500	3	
P10.6	Multi Step.6 Ref. Step.6 Ref.	%	80.0	0 ~ 500	3	
P10.7	Multi Step.7 Ref. Step.7 Ref.	%	100.0	0 ~ 500	3	

Parameter Group 11: Analog Output Configuration

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P11.0	AO.1 output Selection AO1 Sel		0	[0] Output Frequency [1] Motor Speed [2] Motor Current [3] Motor Voltage [4] Actual Torque [5] Output Power [6] DC-Link Voltage [7] Trim 0 mA [8] Trim 4mA [9] Trim 20mA	0	
P11.1	AO.1 Type AO1 Type		0	[0] 0~20Ma [1] 4~20mA	0	
P11.2	AO.1 Adjustment 0mA AO1 Tr_0		0	0 ~ 0.2	0	
P11.3	AO.1 Adjustment 4mA AO1 Tr_4		0	0.2 ~ 0.3	0	
P11.4	AO.1 Adjustment 20mA AO1 Tr20		1	0.5 ~ 1	0	
P11.5	AO.1 Output at 20mA AO1 Scale		3.0	1 ~ 3000	0	
P11.6	AO.1 Inversion AO1 Inv.		0	[0] Disable [1] Enable	0	
P11.7	AO.2 output Selection AO2 Sel		0	[0] Output Frequency [1] Motor Speed [2] Motor Current [3] Motor Voltage [4] Actual Torque [5] Output Power [6] DC- Link Voltage [7] Trim 0 mA [8] Trim 4mA [9] Trim 20mA	2	
P11.8	AO.2 Type AO2 Type		0	[0] 0~20mA [1] 4~20mA	2	
P11.9	AO.2 Adjustment 0mA AO2 Tr_0		0	0 ~ 0.2	2	

SOHO VD VECTOR INVERTER

P11.10	AO.2 Adjustment 4mA AO2 Tr_4		0	0.2 ~ 0.3	2	
P11.11	AO.2 Adjustment 20mA AO2 Tr20		0	0.5 ~ 1	2	
P11.12	AO.2 Output at 20mA AO2 Scale		0	1 ~ 3000	2	
P11.13	AO.2 Inversion AO2 Inv.		0	[0] Disable [1] Enable	2	
P11.14	AO.3 output Selection AO3 Sel		0	[0] Output Frequency [1] Motor Speed [2] Motor Current [3] Motor Voltage [4] Actual Torque [5] Output Power [6] DC-Link Voltage [7] Trim 0 mA [8] Trim 4mA [9] Trim 20mA	2	
P11.15	AO.3 Type AO3 Type		0	[0] 0~20mA [1] 4~20mA	2	
P11.16	AO.3 Adjustment 0mA AO3 Tr_0	pu	0	0 ~ 0.2	2	
P11.17	AO.3 Adjustment 4mA AO3 Tr_4	pu	0	0.2 ~ 0.3	2	
P11.18	AO.3 Adjustment 20mA AO3 Tr20	pu	0	0.5 ~ 1	2	
P11.19	AO.3 Output at 20mA AO3 Scale		0	1 ~ 3000	2	
P11.20	AO.3 Inversion AO3 Inv.		0	[0] Disable [1] Enable	2	

Parameter Group 12: Digital Output Setup

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P12.0	DO 1 Function DO.1 Func.			[0] Disabled [1] Drive Ready		
P12.1	DO 2 Function DO.2 Func.			[2] Fault Out A [3] Fault Out B		
P12.2	DO 3 Function DO.3 Func.			[4] Motor Brake [5] Aux. Motor Brake		
P12.3	DO 4 Function DO.4 Func.			[6] RUN/STOP Status [7] Warning Status		
P12.4	DO 5 Function DO.5 Func.			[8] Direction [9] JOG INPUT STATE		
P12.5	DO 6 Function DO.6 Func.		4	[10] 0V/OC Limiting Function [11] OL Trip	0	
P12.6	DO 7 Function DO.7 Func.			[12] OL Warning [13] REF. STEADY STATE		
P12.7	DO 8 Function DO.8 Func.			[14] Freq. Supervision 1 [LL] [15] Freq. Supervision1 [HL]		
P12.8	DO 9 Function DO.9 Func.			[16] Freq. Supervision2 [LL] [17] Freq. Supervision2 [HL]		
P12.9	DO 10 Function DO.10 Func.			[18] Torque Supervision[LL] [19] Torque Supervision[HL]		
P12.10	DO 11 Function DO.11 Func.			[20] Reference Supervision[LL] [21] Reference Supervision[HL]		
P12.11	Frequency Supervision Limit 1		0	0 ~ 300	0	

SOHO VD VECTOR INVERTER

	Freq_SV1					
P12.12	Frequency Supervision Limit 2 Freq_SV2		0	0 ~ 300	0	
P12.13	Torque Supervision Limit Torq_SV		0	0 ~ 300	0	
P12.14	Reference Supervision Limit Ref_SV		0	0 ~ 500	0	

Parameter Group 13: Magnetic Brake Control

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P 13.0	M1 Locked State Up Reference M1_OP_RefU	%	2.5	0 ~ 10	0	
P 13.1	M1 Locked State Down Ref. M1_OP_RefD	%	0	0 ~ 10	0	
P 13.2	M1 Open Current M1_OP_Curr		0	0 ~ 150	0	
P 13.3	M1 Open Response Time M1_OP_Tm	s	0.35	0 ~ 5	0	
P 13.4	M1 Close Reference M1_CL_Spd	s	2	0 ~ 100	0	
P 13.6	M2 Locked State UP Ref. M2_OP_RefU	%	0.5	0 ~ 10	3	
P 13.7	M2 Locked State Down Ref. M2_OP_RefD	%	0	0 ~ 10	3	
P 13.8	M2 OPEN Current M2_OP_Curr	s	20	0 ~ 150	3	
P 13.9	M2 Open Response Time M2_OP_Tm	%	0.35	0 ~ 2	3	
P 13.10	M2 Close Reference M2_CL_Spd	s	2	0 ~ 100	3	

Parameter Group 14: Auto Tuning Configuration

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P14.0	Motor tuning Condition Tuning_Con		0	[0] Free [1] Locked	0	
P14.1	Excitation Slip Frequency Excit_Slip	%	60	10 - 200	1	
P14.2	Min. Tuning Speed Tune_Spd_L	rpm	75	0 - 500	1	
P14.3	Max. Tuning Speed Tune_Spd_H	rpm	200	0 - 500	1	

Parameter Group 15: V/F Control [Motor 1]

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P15.0	Torque Compensation Torq_Comp		0	[0] Manual Compensation [1] Auto Compensation	0	

SOHO VD VECTOR INVERTER

P15.1	Min. output Frequency Min_Freq	Hz	0	0 ~ 3000	0	
P15.2	Max output Frequency Max_Freq	Hz	0	1 ~ 3000	0	
P15.3	Torque Compensation Flux Current FLux_Curr	%	100.0	0 ~ 150	0	
P15.4	Torque Compensation Time Const TC_TmConst	ms	500.0	50 ~ 3000	0	
P15.5	Speed Detection Time Constant Spd_Det_Tm	ms	100.0	50 ~ 3000	0	
P15.6	V/F Pattern V/F Curve		0	[0] Linear V/F Curve [1] Square V/F Curve [2] User V/F Curve	0	
P15.7	Zero Frequency Voltage Zr_Freq_Vt	%	1.5	0 ~ 100	0	
P15.8	Mid. Frequency Mid_Frq	Hz	5	1 ~ 3000	0	
P15.9	Mid. Frequency Voltage Mid_Volt	%	15.0	0 ~ 100	0	
P15.10	Max Voltage Frequency Max_V_Freq	Hz	60.0	0 ~ 300	0	
P15.11	Max output Voltage Max_Volt	%	100.0	0 ~ 150	0	
P15.12	Voltage Limiter Max_V_Ltd		1	[0]= Disable [1]= Enable	0	
P15.13	Acceleration Compensation Acc_Comp	%	0	0 ~ 20	0	
P15.14	Deceleration Compensation Dec_Comp	%	0	0 ~ 20	0	
P15.15	Start DC Brake [Time] St_Brk_Tm	s	0.35	0 ~ 30	0	
P15.16	Start DC Brake [Blank time] St_Brk_B	s	0.5	0 ~ 30	0	
P15.17	Start DC Brake [Current] St_Brk_I	%	20.0	0 ~ 150	0	
P15.18	Stop DC Brake [Time] Sp_Brk_Tm	s	0.50	0 ~ 30	0	
P15.19	Stop DC Brake [Blank Time] Sp_Brk_B	s	0	0 ~ 30	0	
P15.20	Stop DC Brake [Current] Stp_Brk_I	%	50.0	0 ~ 150	0	
P15.21	Stop DC Brake [Frequency] Stp_Brk_f	Hz	0	0 ~ 20	0	
P15.22	CC Proportional-Gain	%	0	0 ~ 1000	0	

SOHO VD VECTOR INVERTER

	CC_P_G					
P15.23	CC Integral-Gain CC_I_G_Sc	%	100.0	0 ~1000	0	
P15.24	Stabilization Time Const StbT_cons	ms	10	10 ~ 100	0	
P15.25	Stabilization Gain Stb_Gain	%	10	0 – 50	0	
P15.26	Stabilization Limit Stb_Limit	%	0.1	0 –1	0	
P15.27	Unity Curr Range: Freq U_Curr_f	%	250.0	100.0 – 500.0	0	

Parameter Group 16: V/F Control [Motor 2]

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P16.0	Torque Compensation Torq_Comp		0	[0] Manual [1] Auto	3	
P16.1	Min. output Frequency Min_Freq	Hz	2	0 ~ 3000	3	
P16.2	Max output Frequency Max_Freq	Hz	60	0 ~ 3000	3	
P16.3	Torque Compensation Flux Current FLux_Curr	%	75	0 ~ 150	3	
P16.4	Torque Compensation Time Const TC_TmConst	ms	500.0	100 ~ 2000	4	
P16.5	Speed Detection Time Constant Spd_Det_Tm	ms	200.0	100 ~ 200	4	
P16.6	V/F Pattern V/F Curve		0	[0] Linear [1] Square [2] User	3	
P16.7	Zero Frequency Voltage Zr_Freq_Vt	%	1.5	0 ~ 100	3	
P16.8	Mid. Frequency Mid_Frq	Hz	5	1 ~ 3000	3	
P16.9	Mid. Frequency Voltage Mid_Volt	%	13	0 ~ 100	3	
P16.10	Max Voltage Frequency Max_V_Freq	Hz	60.0	0 ~ 100	3	
P16.11	Max output Voltage Max_Volt	%	100.0	0 ~ 150	3	
P16.12	Voltage Limiter Max_V_Ltd		1	[0]= Disable [1]= Enable	0	
P16.13	Acceleration Compensation Acc_Comp	%	0	0 ~ 20	3	
P16.14	Deceleration Compensation Dec_Comp	%	0	0 ~ 20	3	

SOHO VD VECTOR INVERTER

P16.15	Start DC Brake [Time] St_Brk_Tm	s	0.5	0 ~ 30	3	
P16.16	Start DC Brake [Blank time] St_Brk_B	s	0	0 ~ 30	3	
P16.17	Start DC Brake [Current] St_Brk_I	%	75	5 ~ 150	3	
P16.18	Stop DC Brake [Time] Sp_Brk_Tm	s	0.5	0 ~ 30	3	
P16.19	Stop DC Brake [Blank Time] Sp_Brk_B	s	0	0 ~ 30	3	
P16.20	Stop DC Brake [Current] Stp_Brk_I	%	75.0	5 ~ 150	3	
P16.21	Stop DC Brake [Frequency] Stp_Brk_f	Hz	0	0 ~ 20	3	
P16.22	CC Proportional-Gain CC_P_G	%	0	0 ~ 0	3	
P16.23	CC Integral-Gain CC_I_G_Sc	%	0	0 ~ 0	3	
P16.24	Stabilization Time Const StbT_cons	ms	10	10 ~ 100	3	
P16.25	Stabilization Gain Stb_Gain	%	0	0 ~ 50	3	
P16.26	Stabilization Limit Stb_Limit	%	0.1	0 ~ 1	3	
P16.27	Unity Curr Range: Freq U_Curr_f	%	280	100 ~ 500	3	

Parameter Group 17: Sensor less Vector Control [Motor 1]

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P17.0	Speed Detection time constant Spd_Dt_Tm	ms	10	1 ~ 100	0	
P17.1	Min. Speed Min. Speed	rpm	60	0 ~ 30000	0	
P17.2	Max. Speed Max. Speed	rpm	1800	0 ~ 30000	0	
P17.3	Over Speed Limit OS_Limit	rpm	2200	0 ~ 30000	0	
P17.4	Flux Excitation Time St_Delay	s	0.075	0.001 ~ 1	0	
P17.5	Starting Flux Start_Flux	%	110	50 ~ 200	0	
P17.6	Base Flux Base Flux	%	95	50 ~ 200	0	
P17.7	Start Flux-END Speed SF_End_Spd	%	30	5 ~ 50	0	
P17.8	Base Flux-START Speed BF_St_Spd	%	75	30 ~ 85	0	

SOHO VD VECTOR INVERTER

P17.9	FW Voltage FW_Voltage	%	95	50 ~ 150	0	
P17.10	FW Profile Time Constant FW_Tm_Con	ms	10	1 ~ 1000	0	
P17.11	CC P-Gain CC_P-Gain	%	100.0	0 ~ 1000	0	
P17.12	CC I-Gain CC_I-Gain	%	100.0	0 ~ 1000	0	
P17.13	CC Zero-Shift Factor CC_Zero_S	%	50	10 ~ 100	0	
P17.14	Speed PI Gain Spd_Gain		1	[0] Default Gain [1] Auto-Tuning Gain	0	
P17.15	Load Observer Activation Load_Comp		0	[0] Disabled [1] Enabled	0	
P17.16	Load Observer Time Constant LC_Tm_Con	ms	50	10 ~ 1000	0	
P17.17	Load Compensation Minimum Frequency LC_Freq	Hz	1	0.25 ~ 300	0	
P17.18	SC P-Gain SC_P-Gain	%	100.0	0 ~ 1000	0	
P17.19	SC I-Gain SC_I-Gain	%	100.0	0 ~ 1000	0	
P17.20	SC Zero-Shift Factor SC_Zero_S	%	60.0	10 ~ 100	0	

Parameter Group 18: Sensor less Vector Control [Motor 2]

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P18.0	Speed Detection time constant Spd_Dt_Tm	ms	10	1 ~ 100	3	
P18.1	Min. Speed Min. Speed	rpm	60	0 ~ 30000	3	
P18.2	Max. Speed Max. Speed	rpm	1800	0 ~ 30000	3	
P18.3	Over Speed Limit OS_Limit	rpm	2200	0 ~ 30000	3	
P18.4	Flux Excitation Time St_Delay	s	0.075	0.001 ~ 1	3	
P18.5	Starting Flux Start_Flux	%	110	50 ~ 200	3	
P18.6	Base Flux Base Flux	%	95	50 ~ 200	3	
P18.7	Start Flux-END Speed SF_End_Spd	%	30	5 ~ 50	3	
P18.8	Base Flux-START Speed BF_St_Spd	%	75	30 ~ 85	3	
P18.9	FW Voltage FW_Voltage	%	95	50 ~ 150	3	
P18.10	FW Profile Time Constant FW_Tm_Con	ms	50	10 ~ 1000	3	
P18.11	CC P-Gain CC_P-Gain	%	100.0	0 ~ 1000	3	

SOHO VD VECTOR INVERTER

P18.12	CC I-Gain CC_I-Gain	%	100.0	0 ~ 1000	3	
P18.13	CC Zero-Shift Factor CC_Zero_S	%	50	10 ~ 100	3	
P18.14	Speed PI Gain Spd_Gain		1	[0] Default [1] Auto-Tuning	0	
P18.15	Load Observer Activation Load_Comp		0	[0] Disabled [1] Enabled		
P18.16	Load Observer Time Constant LC_Tm_Con	ms	50	10 ~ 1000		
P18.17	Load Compensation Minimum Frequency LC_Freq	Hz	1	0.25 ~ 300		
P18.18	SC P-Gain SC_P-Gain	%	100.0	0 ~ 1000	3	
P18.19	SC I-Gain SC_I-Gain	%	100.0	0 ~ 1000	3	
P18.20	SC Zero-Shift Factor SC_Zero_S	%	70.0	10 ~ 100	3	

Parameter Group 19: Vector Control 1

Par. NO.	Parameter Name LCD Display	Unit	Default	Range	Access Level	
P19.0	No. of Encoder Pulse N_PG_Pulse	ppr	1000	100 ~ 30000	0	
P19.1	Inversion of PG Direction PG_DIR_INV		0	[0] Disabled [1] Enabled	0	
P19.2	Spd Detect time Constant Spd_Det_tm	ms	5	1 ~ 100	0	
P19.3	Min. Speed Min_Speed	rpm	0	0 ~ 1000	0	
P19.4	Max. Speed Max_Speed	rpm	1500	0 ~ 1000	0	
P19.5	Over Speed Limit OS_Limit	rpm	2500	0 ~ 1000	0	
P19.6	Flux Excitation Time St_Delay	s	0.075	0.02 ~ 30	0	
P19.7	Starting Flux Start_Flux	%	110	30 ~ 150	0	
P19.8	Base Flux Base_Flux	%	95	30 ~ 150	0	
P19.9	Start Flux END Speed SF_E_Spd	%	30	5 ~ 100	0	
P19.10	Base Flux START Speed BF_St_Spd	%	75	30 ~ 200	0	
P19.11	FW Voltage FW_Volt	%	95	50 ~ 150	0	
P19.12	Flux Profile Time Const FW_Tm_Con	ms	50	10 ~ 1000	0	
P19.13	CC P-Gain CC_P-Gain	%	100	0 ~ 1000	0	
P19.14	CC I-Gain CC_I-Gain	%	100	0 ~ 1000	0	
P19.15	CC Zero-Shift factor	%	50	10 ~ 99	0	

SOHO VD VECTOR INVERTER

	CC ZERO_S					
P19.16	FC P-Gain FC_P-Gain	%	100	0 ~ 1000	0	
P19.17	FC I-Gain FC_I-Gain	%	100	0 ~ 1000	0	
P19.18	Max Field Current Mx_Fld_Cu	%	100	10 ~ 150	0	
P19.19	Speed PI-Gain Selection Spd_Gain		1	[0] Default [1] Auto-Tuning	0	
P19.20	Load Observer Load_Comp		0	[0] Disable [1] Enable	0	
P19.21	Load Observer Time Constant LC_Tm_Con	ms	50	10 ~ 1000	0	
P19.22	SC P-Gain SC P-Gain	%	100	0 ~ 1000	0	
P19.23	SC I-Gain SC I-Gain	%	100	0 ~ 1000	0	
P19.24	SC Zero-Shift factor SC ZERO_S	%	70	10 ~ 99	0	

Parameter Group 20: Vector Control 2

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P20.0	No. of Encoder Pulse N_PG_Pulse	ppr	1000	100 ~ 30000	3	
P20.1	Inversion of PG Direction PG_DIR_INV		0	[0] Disabled [1] Enabled	0	
P20.2	Spd Detect time Constant Spd_Det_tm	ms	5	1 ~ 100	3	
P20.3	Min. Speed Min_Speed	rpm	0	0 ~ 1000	3	
P20.4	Max. Speed Max_Speed	rpm	1500	0 ~ 1000	3	
P20.5	Over Speed Limit OS_Limit	rpm	2500	0 ~ 1000	3	
P20.6	Flux Excitation Time St_Delay	s	0.075	0.02 ~ 30	3	
P20.7	Starting Flux Start_Flux	%	115	30 ~ 150	3	
P20.8	Base Flux Base_Flux	%	105	30 ~ 150	3	
P20.9	Start Flux END Speed SF_E_Spd	%	30	5 ~ 100	3	
P20.10	Base Flux START Speed BF_St_Spd	%	75	30 ~ 200	3	
P20.11	FW Voltage FW_Volt	%	95	50 ~ 150	3	
P20.12	Flux Profile Time Const FW_Tm_Con	ms	50	10 ~ 1000	3	
P20.13	CC P-Gain CC P-Gain	%	100	0 ~ 1000	3	
P20.14	CC I-Gain CC I-Gain	%	100	0 ~ 1000	3	
P20.15	CC Zero-Shift factor	%	50	10 ~ 99	3	

SOHO VD VECTOR INVERTER

	CC ZERO_S					
P20.16	FC P-Gain FC_P-Gain	%	100	0 ~ 1000	3	
P20.17	FC I-Gain FC_I-Gain	%	100	0 ~ 1000	3	
P20.18	Max Field Current Mx_Fld_Cu	%	100	10 ~ 150	3	
P20.19	Speed PI-Gain Selection Spd_Gain		1	[0] Default [1] Auto-Tuning	3	
P20.20	Load Observer Load_Comp		0	[0] Disable [1] Enable	3	
P20.21	Load Observer Time Constant LC_Tm_Con	ms	50	10 ~ 1000	3	
P20.22	SC P-Gain SC P-Gain	%	100	0 ~ 1000	3	
P20.23	SC I-Gain SC I-Gain	%	100	0 ~ 1000	3	
P20.24	SC Zero-Shift factor SC ZERO_S	%	70	10 ~ 99	3	

Parameter Group 21: Motor 1 Constant

Par. NO.	Parameter Name LCD Display	Unit	Default	Range	Access Level	
P21.0	Stator Resistance 1 Pri_Res0	mΩ	0	0 ~ 5000	1	
P21.1	Stator Resistance 2 Pri_Res1	mΩ	0	0 ~ 5000	1	
P21.2	Rotator Resistance Sec_Res	mΩ	0	0 ~ 5000	1	
P21.3	Stator Inductance Stator_Ind	mH	0	0 ~ 10000	1	
P21.4	Rotor Inductance Rotor_Ind	mH	0	0 ~ 10000	1	
P21.5	Leakage Inductance Lkg_Ind	mH	0	0 ~ 1000	1	
P21.6	Rotational Inertia R. Inertia	Nm.s	0	0 ~ 10000	1	
P21.7	Iron Loss Compensation Iron_LOSS	%	100	0 ~ 300	1	

Parameter Group 22: Motor 2 Constant

Par. NO.	Parameter Name LCD Display	Unit	Default	Range	Access Level	
P22.0	Stator Resistance 1 Pri_Res0	mΩ	0	0 ~ 5000	3	
P22.1	Stator Resistance 2 Pri_Res1	mΩ	0	0 ~ 5000	3	
P22.2	Rotator Resistance Sec_Res	mΩ	0	0 ~ 5000	3	
P22.3	Stator Inductance Stator_Ind	mH	0	0 ~ 10000	3	
P22.4	Rotor Inductance Rotor_Ind	mH	0	0 ~ 10000	3	
P22.5	Leakage Inductance Lkg_Ind	mH	0	0 ~ 1000	3	
P22.6	Rotational Inertia R. Inertia	Nm.s	0	0 ~ 10000	3	
P22.7	Iron Loss	%	0	0 ~ 300	3	

SOHO VD VECTOR INVERTER

	Compensation Iron_LOSS				
--	----------------------------------	--	--	--	--

Parameter Group 24: Monitor Setup

Par. NO.	Parameter Name LCD Disply	Unit	Default	Range	Access Level	
P24.0	LCD Idle Time Keypad_Idl	min	30	1 ~ 250	0	
P24.1	LCD Contrast LCD_Ctrst		2	0 ~ 10	0	
P24.2	Key Repetition Time Key_Rpt_Tm	s	50	0.25 ~ 2.5	0	
P24.3	Speed Monitor Selection Spd_M_Sel		0	[0] Speed Estimation [1] Measurement of Speed	0	
P24.4	Speed Detection time Constant Spd_Det_Tm	ms	10	1 ~ 1000	0	
P24.15	Monitor Filter Time Constant Mon_Tm_Con	ms	300	1 ~ 1000	0	

8.2. Parameter Description

Parameter Access Level description

Level 0: readable / writable

Level 1: readable /not writable (have to be authorized to write)

Level 2-5: not readable /not writable (have to be authorized to read and write)

8.2.0 Parameter Group 0 : Program selection

P 0.1 Program Key1

P 0.2 Program Key2

P 0.3 Program Key3

Select software to use operations. Program Key 1, 2, 3 should have the same software package. After setting up the software, reset the system in Main Menu Page[5](=initialize). Then, the selected software will be applied.

The setting procedure is followed.

Set P 0.1 Program Key 1 → Set P 0.2 Program Key 2 as P 0.1 → P 0.3 Program Key 3 as P 0.1 → Move to Main Menu Page[5] Initialize → Execute the [1]"System Reset". Normally, the software is set up at the factory.

[0] Standard I :

※ V/F Frequency Control

This controls the motor output voltage and output frequency.

Refer to P 1.6 and P 2.6 for setting the control mode.

Related Parameters: Parameter Group 1, 2, 15, 16

※ V/F Speed Control

In this control method, the motor speed corresponds to the set value of frequency reference. Refer to the Parameter 1.6 and Parameter 2.6 for setting the control method. Related Parameters: Parameter Group 1, 2, 15, 16

※ Sensor less Vector Speed Control

In this control method, it controls a motor with no rotation speed feedback of the

motor. Magnetic flux and torque current are controlled respectively. This control can be used when there should be enough torque, or there is a sharp fluctuation in load at start-up or low speed. Related Parameter s: Parameter Group 1, 2, 14, 17, 18, 21, 22. And Auto-Tuning is necessary. The related parameters to Auto-Tuning are Parameter Group 1, 2, 14, 21, 22. The parameters in Group 21 or 22 are automatically generated by Auto-Tuning.

[1] Standard II :

※ V/F Frequency Control

※ V/F Speed Control

Refer to [0] Standard I

※ Vector Speed Control

This control method carries out the high special quality and high accuracy performance in speed control. Magnetic flux and torque current are controlled respectively. This control can be used when there should be enough torque, or there is a sharp fluctuation in load at start-up or low speed.

Related Parameters: Parameter Group 1, 2, 14, 19, 20, 21, 22. And Auto-Tuning is necessary. The related parameters to Auto-Tuning are Parameter Group 1, 2, 14, 21, 22. The parameters in Group 21 or 22 are automatically generated by Auto-Tuning.

[2] Special I : not supported

[3] Special II : not supported

8.2.1 Parameter Group 1 : Control Setup [Motor 1]

P 1.0 Rated Power

Set up the rated power of a motor. Refer to the rating plate on the motor.

P 1.1 Rated Voltage

Set up the rated voltage of a motor. Refer to the rating plate on the motor.

P 1.2 Rated Current

Set up the rated current of a motor. Refer to the rating plate on the motor.

P 1.3 Rated Frequency

Set up the rated frequency of a motor. Refer to the rating plate on the motor.

P 1.4 Number of Poles

Set up number of poles of a motor. Refer to the rating plate on the motor.

P 1.5 Rated Speed

Set up the rated speed of a motor. Refer to the rating plate on the motor.

P 1.6 Control Method

[0] V/F Frequency Control

This can be used when Standard I or Standard II is used for Program Key.

[1] V/F Speed Control

This can be used when Standard I or Standard II is used for Program Key.

[2] Sensor less Vector Speed Control

This can be used when Standard I is used for Program Key.

[3] Vector Speed Control

This can be used when Standard II is used for Program Key.

※ When Standard I is used in P 0.1~P 0.3 Program Keys

One of the following control methods can be selected for a control mode.

- [0] V/F Frequency Control,
- [1] V/F Speed Control,
- [2] Sensor less Vector Speed Control,

※ When Standard II is used in P 0.1~P 0.3 Program Keys

One of the following control methods can be selected for a control mode.

- [0] V/F Frequency Control,
- [1] V/F Speed Control,
- [3] Vector Speed Control

P 1.7 Switching Frequency

Set up the switching frequency for the internal switching part of the inverter. If the switching frequency low, the noise signal from inverter gets reduced and the leakage current gets smaller, but the noise sounds become loud.

If it does not bother with high temperature and noise sound, set the switching frequency low. If this parameter is changed, execute [0] Drive Calibration in Main Menu page [3] Auto Tuning.

8.2.2 Parameter Group 2 : Control Setup [Motor 2]

These parameters are used when switching to the other motor (motor 2) from one motor (motor 1). In this case, the two motors usually use the different setup values. In Parameter Group 8, Digital Input Setup, Motor 1 or 2 can be selected by setting the Digital Input Function to [11] Motor Selection. It should be careful to establish the external circuit not to interrupt each other when switching motors.

P 2.0 Rated Power

P 2.1 Rated Voltage

P 2.2 Rated Current

P 2.3 Rated Frequency

P 2.4 Number of Poles

P 2.5 Rated Speed

P 2.6 Control Method

P 2.7 Switching Frequency

Refer to the parameter group 1.

8.2.3 Parameter Group 3 : Reference Setup [Motor1]

These parameters are applied when using Motor 1.

P 3.0 RUN/STOP Method

This selects the input method of Run and Stop signal.

[0] Terminal

Use I/O terminals (DI1, DI2 etc.) for the method of inputting the command signals for operation.

[1] Keypad

Use Keypad for the method of inputting the command signals for operation.

[2] Communication

Use serial communication through PC or Profibus for the method of inputting the command signals for operation.

P 3.1 Reference Mode

Set the method of inputting the speed or frequency reference. The reference is displayed by frequency [Hz] for V/F Frequency Control and by speed [RPM] for speed control.

[0] Terminal

Command the speed or frequency by I/O terminals. The reference sources are selected from Voltage, current or multi-steps.

[1] Keypad

Command the speed or frequency reference by Keypad.

[2] Communication.

Command the RUN/STOP signal through serial com. port. Select this when Profibus is used.

P 3.2 STOP Command Detection Time

The VD inverter executes the stop mode after elapse of the set time in this parameter. Refer to the figure D 3.1

P 3.3 STOP Mode

This figures how the motor decrease the speed of motor after the stop mode is executed. Refer to the figure D 3.1

[0] Ramp Stop

The speed of motor decreases to 0 within the deceleration time

[1] Free-Run Stop

The inverter cuts off the output immediately as soon as the stop mode is executed.

[2] Mixed STOP

This is the mode that is combined the two stop modes that are mentioned above.

First, it works as the ramp stop mode. Then, the stop mode is converted to Free-Run stop once the speed of motor goes below the reference set value of P 3.7

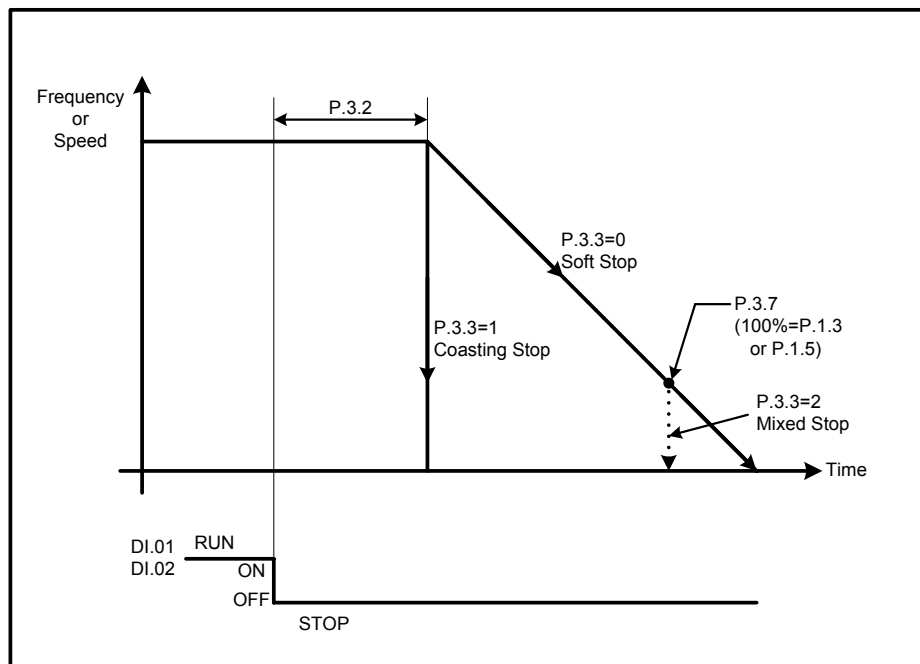


Figure D.3.1- Inverter Stop Function

P 3.4 STOP Hold Time

The inverter maintains the operation mode for the set time in P 3.4 even though the speed of motor is 0. And it is converted to the stop mode after this set value of P 3.4 passes. Refer to the figure D 3.2.

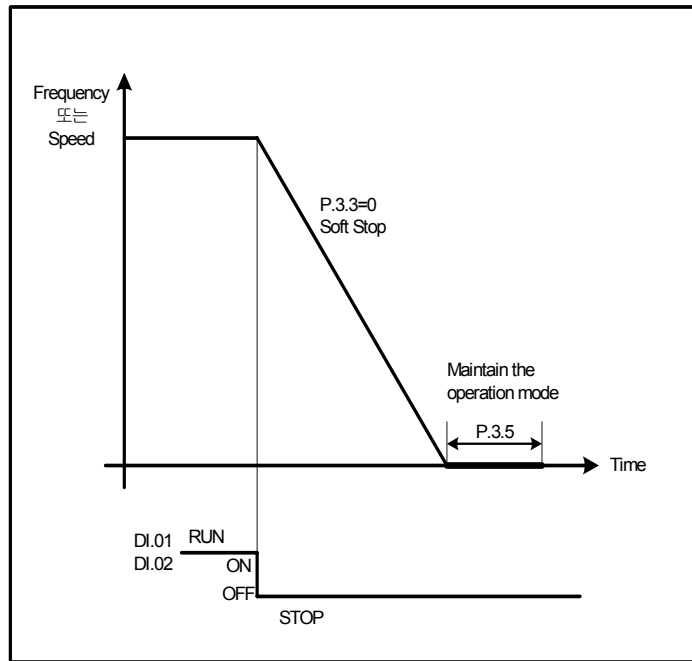


Figure D.3.2-Stop Hold Time

P 3.5 Output Off Hold Time

This sets the time from the moment that the inverter is stopped until the inverter generates the output again in operation mode. Even though the operation signal comes in, within the set time value of "Output Off Hold Time" after the motor is stopped, the inverter doesn't generate the output. Refer to the figure D 3.3. % this is only applied when Free-Run stop is used.

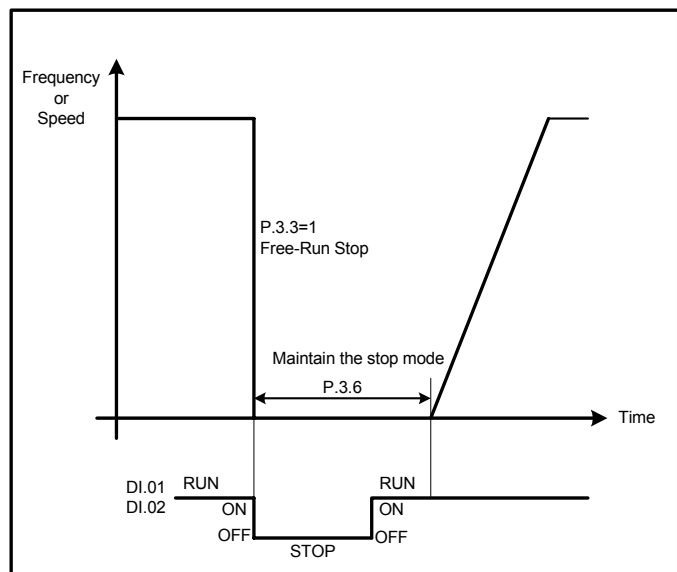


Figure D.3.3-Output Off Hold Time

P 3.6 Mixed-mode STOP Reference

This sets the speed reference that converts Ramp Stop to Free-Run Stop when the stop mode is the Mixed Stop. Refer to the Figure D 3.1.

P 3.7 Acceleration / Deceleration Ramp Enable

[0] Disable: There are no Acceleration./ Deceleration time.

[1] Enable: The speed of motor is accelerated or decelerated by the set value of Acceleration / Deceleration time.

P 3.8 Acceleration Time Range

[0] X 1 sec

Use this option when the acceleration time is between 0 and 300 [s].

[1] X 10 sec

Use this option when the acceleration time is over 300 and goes up to 3000 [s].
(The acceleration time should be over 300.)

P 3.9 Acceleration Switch Ref 1-2

This is the frequency or speed reference that determines “acceleration range 1”
Refer to the figure 8.2-4

P 3.10 Acceleration Switch Ref 2-3

This is the frequency or speed reference that determines “acceleration range 2”
Refer to the figure 8.2-4

P 3.16 Acceleration Time | .1

This is the acceleration time from 0 to P3.9. (Acceleration range 1)
Refer to the figure 8.2-4

P 3.17 Acceleration Time | .2

This is the acceleration time from P3.9 to P3.10.
(From Acceleration range 1 to Acceleration range 2)
Refer to the figure 8.2-4

P 3.18 Acceleration Time | .3

This is the acceleration time from P3.10 to the maximum reference.
(Acceleration range 3) Refer to the figure 8.2-4

SOHO VD VECTOR INVERTER

Refer to the following figure 8.2-4 for detailed setting instructions

Condition	#Speed or Frequency reference:0 ~ 10V #motor rated frequency or speed : 60Hz, 1770rpm	
Operation Up to the Motor rated Frequency Or Motor rated speed (operation up to 100%)	When there is Only one range	
	When the operation range is divided.	
Operation over the Motor rated Frequency Or Motor rated speed (operation over 100%)	When there is Only one range	
	When the operation range is divided.	

Figure 8.2-4 setting for Acceleration time and range.

P 3.24 Acceleration Time II

When DI Function is set to [12] Acc./Dec Switching, the value of Acceleration Time II is applied to the Acceleration time from zero speed (or frequency) to the rated speed (or frequency) as DI receives the switching signal.

P 3.25 Deceleration Time Range

[0] X 1 sec

Use this option when the deceleration time is between 0 and 300 [s].

[1] X 10 sec

Use this option when the deceleration time is over 300 and goes up to 3000 [s].
(The deceleration time should be over 300.)

P 3.26 Deceleration Switch Ref 1-2

This is the frequency or speed reference that determines “deceleration range 1”
Refer to the figure 8.2-5

P 3.27 Deceleration Switch Ref 2-3

This is the frequency or speed reference that determines “deceleration range 2”
Refer to the figure 8.2-5

P 3.33 Deceleration Time I .1

This is the deceleration time from Max. reference to P3.27. (Deceleration range 3)
Refer to the figure 8.2-5

P 3.34 Deceleration Time I .2

This is the deceleration time from P3.27 to P3.26. (Deceleration range 2)
Refer to the figure 8.2-5

P 3.35 Deceleration Time I .3

This is the deceleration time from P3.26 to 0. (Deceleration range 1)
Refer to the figure 8.2-5

SOHO VD VECTOR INVERTER

Refer to the following figure 8.2-5 for detailed setting instructions

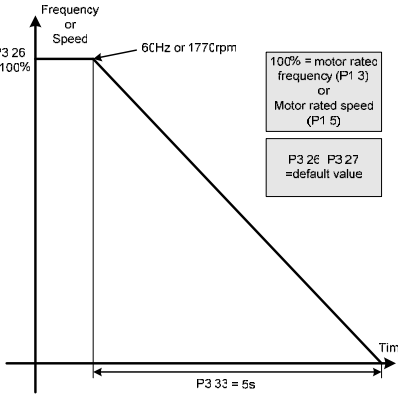
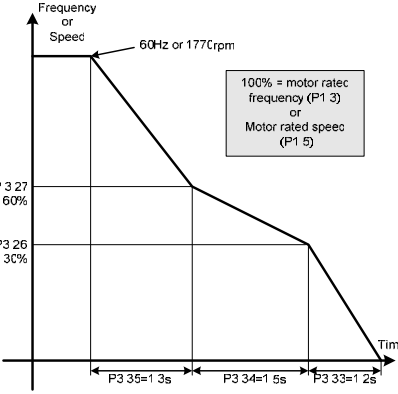
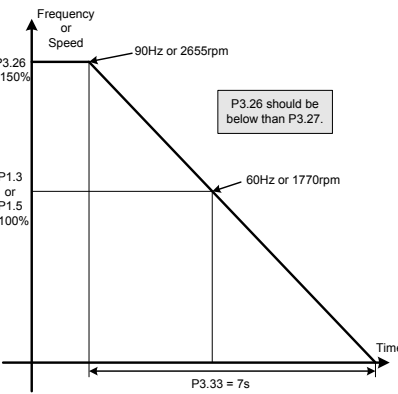
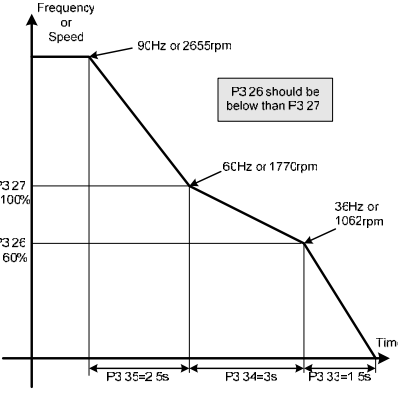
Condition	#Speed or Frequency reference:0 ~ 10V #motor rated frequency or speed : 60Hz, 1770rpm	
Operation Up to the Motor rated Frequency Or Motor rated speed (operation up to 100%)	When there is Only one range	 <p style="font-size: small;"> P1.3 = 60Hz (motor rated freq.) P1.5 = 1770rpm (motor rated spd) P3.26 = 100% (default-) P3.27 = 200% (default) P3.33 = 5s P3.34, P3.35 = not used P6.6 = 0.00V (AI 1 Min. Volt) P6.8 = 0 % (AI 1 Min.Scale) P6.9 = 10.00 V (AI 1 Max. Volt) P6.10 = 100 % (AI 1 Max.Scale) P15.2 = 60 Hz (Max. Freq.) P17.2 = 1770 rpm (Max. Speed) P.19.4 = 1770 rpm (Max.Speed) </p>
	When the operation range is divided.	 <p style="font-size: small;"> P1.3 = 60Hz (motor rated freq.) P1.5 = 1770rpm (motor rated spd) P3.26 = 30% P3.27 = 60% P3.33 = 1.2 s P3.34 = 1.5s P3.35 = 1.3s P6.6 = 0.00V (AI 1 Min. Volt) P6.8 = 0 % (AI 1 Min.Scale) P6.9 = 10.00 V (AI 1 Max. Volt) P6.10 = 100 % (AI 1 Max.Scale) P15.2 = 60 Hz (Max. Freq.) P17.2 = 1770 rpm (Max. Speed) P.19.4 = 1770 rpm (Max. Speed) </p>
Operation over the Motor rated Frequency Or Motor rated speed (operation over 100%)	When there is Only one range	 <p style="font-size: small;"> P1.3 = 60Hz (motor rated freq.) P1.5 = 1770rpm (motor rated spd) P3.26 = 150% P3.27 = 200% (default) P3.33 = 7 s P3.17, P3.18 = not used P6.6 = 0.00V (AI 1 Min. Volt) P6.8 = 0% (AI 1 Min.Scale) P6.9 = 10.00 V (AI 1 Max. Volt) P6.10 = 150% (AI 1 Max.Scale) P15.2 = 90 Hz (Max. Freq.) P17.2 = 2655 rpm (Max. Speed) P.19.4 = 2655 rpm (Max.Speed) </p>
	When the operation range is divided.	 <p style="font-size: small;"> P1.3 = 60Hz (motor rated freq.) P1.5 = 1770rpm (motor rated spd) P3.26 = 60% P3.27 = 100% P3.33 = 1.5 s P3.34 = 3.0 s P3.35 = 2.5 s P6.6 = 0.00V (AI 1 Min. Volt) P6.8 = 0% (AI 1 Min.Scale) P6.9 = 10.00 V (AI 1 Max. Volt) P6.10 = 150% (AI 1 Max.Scale) P15.2 = 90 Hz (Max. Freq.) P17.2 = 2655 rpm (Max. Speed) P.19.4 = 2655 rpm (Max.Speed) </p>

Figure 8.2-5 setting for Deceleration time and range.

P 3.41 Deceleration Time II

When DI Function is set to [12] Acc./Dec Switching, the value of Deceleration Time II is applied to the Deceleration time from the rated speed (or frequency) to zero speed (or frequency) as DI receives the switching signal.

P 3.42 Counter Deceleration Function

This selects whether the inverter uses the counter deceleration function or not.

P 3.43 Counter Deceleration Time

This sets the counter deceleration time. This is applied when a counter direction deceleration is occurred.

P 3.44 S-Curve Enable

Select the usage of S-Curve.

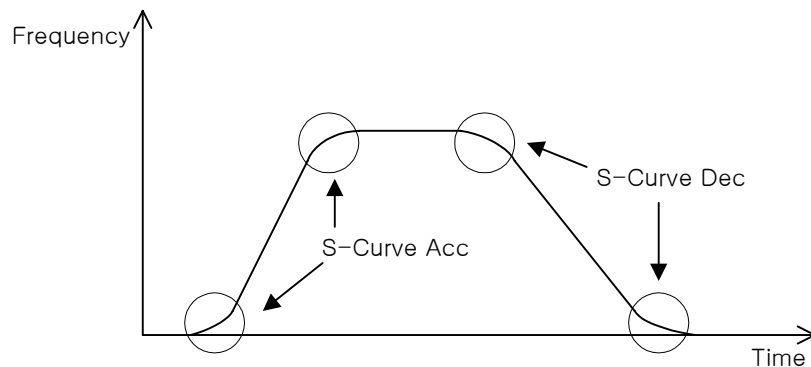
- [0] Disable
Not use the S-Curve
- [1] Enable
Use the S-Curve.

P 3.45 S-Curve Time [Acceleration]

Decides how long the inverter applies the S-Curve while accelerating. The set value is applied from the beginning to the end of acceleration uniformly.

P 3.47 S-Curve Time [Deceleration]

Decides how long the inverter applies the S-Curve while decelerating.



P 3.49 Emergency Stop Mode

Emergency Stop Mode stops the motor as Enable signal is removed while the operating. Digital Input Function should be set to [1] Drive Enable. Refer to the STOP Mode.

- [0] Ramp Stop
- [1] Coasting Stop
- [2] Mixed Stop

P 3.50 Emergency Stop Deceleration Time

Emergency Stop Mode sets the deceleration time for stopping as Enable signal is removed while the operating. Digital Input Function should be set to [1] Drive Enable. This is only applied when the stop mode is the Ramp stop mode.

8.2.4 Parameter Group 4 : Reference Setup [motor 2]

These parameters are applied when **Motor 2** is on operation. Refer to the Group 3.

P 4.0 RUN/STOP Method

P 4.1 Reference Method

P 4.2 STOP Command Detection Time

P 4.3 STOP Mode

- P 4.4 STOP Hold Time**
- P 4.5 Output Off Hold Time**
- P 4.6 Mixed mode STOP Reference**
- P 4.7 Acceleration/Deceleration Bypass**
- P 4.8 Acceleration Time Range**
- P 4.9 Acceleration Switch Ref 1-2**
- P 4.10 Acceleration Switch Ref 2-3**
- P 4.16 Acceleration Time I .1**
- P 4.17 Acceleration Time I .2**
- P 4.18 Acceleration Time I .3**
- P 4.24 Acceleration Time II**
- P 4.25 Deceleration Time Range**
- P 4.26 Deceleration Switch Ref 1-2**
- P 4.27 Deceleration Switch Ref 2-3**
- P 4.33 Deceleration Time I .1**
- P 4.34 Deceleration Time I .2**
- P 4.35 Deceleration Time I .3**
- P 4.41 Deceleration Time II**
- P 4.42 Counter Deceleration Function**
- P 4.43 Counter Deceleration Time**
- P 4.44 S-Curve Bypass**
- P 4.45 S-Curve Time [Acceleration]**
- P 4.46 S-Curve Time [Deceleration]**
- P 4.49 Emergency Stop Mode**
- P 4.50 Emergency Stop Deceleration Time**

8.2.5 Parameter Group 5 : Protection

P 5.0 Current Limit [Motor 1]

P 5.1 Current Limit [Motor 2]

These set the current limit in percentage depending on the rated motor current.

P 5.2 Non-Current Protection

Decides whether the inverter uses the protection or not when the output current is not generated while operating.

P 5.3 Non-Current Time-over

While operating the inverter, the protection starts working if there is no output current until the set time value of "Non-current Time-over" is exceeded. "Non-Current Protection" should be enabled.

P 5.4 Under Current Protection

Determines whether it uses the protection or not when there is no current or less than the current value of "Under Current Trip" due to a problem of motor.

[0] Disable

[1] Enable

P 5.5 Under Current Trip

The level of the Under Current Protection is determined by the rated motor current in percentage.

P 5.6 Under Current Time-over

If the output current is not generated or less than the "Under Current Trip" level, and the time value of "Under Current Time-Over" is exceeded with the condition, Under Current Protection starts working.

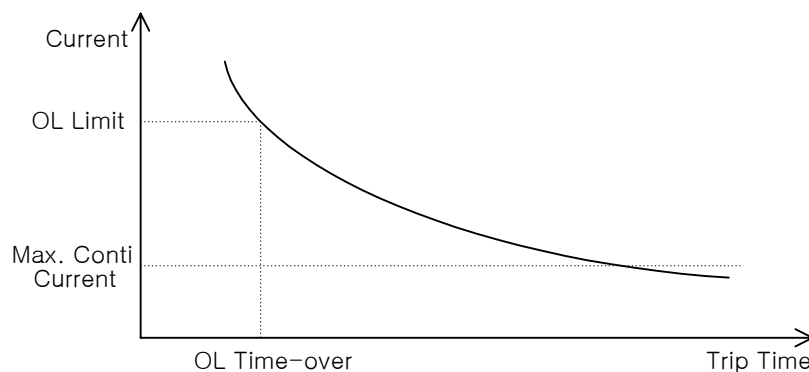
P 5.7 Max. Continuous Current

Set the maximum current for the possible continuous operation.

P 5.8 Over-Load Current

P 5.9 Over-Load Time-over

If the output current is less than the “Over Load Current”, and the current lasts for the time value of “Over Load Time over”, The over Load Protection starts working. If the output current is less than “Over Load current and more than Maximum continuous current, I^2T is accumulated until Over Voltage Protection starts working.



[Over Load Curve]

P 5.10 Over Load Fault [Action]

Select the Over Load Function when the fault conditions occur.

- [0] STOP
- [1] Ignore

P 5.11 Over Current Trip

The Fault occurs when the output exceeds the Over Current trip level.

P 5.12 Zero-sequence Current trip

If the current addition of the three phases is less than the set value, the protection starts working.

P 5.13 Over Voltage Limiting Function

Determines whether it uses the Over Voltage Limiting Function or not.

- [0] Disable
- [1] Enable

P 5.14 Over Voltage Limit

Set the output voltage that controls the Over Voltage Limiting Function in normal status. If the Over Voltage Limiting Function is working on deceleration, the deceleration time gets slower than the set value.

P 5.15 Over Voltage Trip

Determine when to start the Over Voltage Function.

P 5.16 Under Voltage Compensation

Determines whether it compensate or not for the Under Voltage case.

P 5.17 Under Voltage Compensation Level

Determine the level of compensation for the Under Voltage case.

P 5.18 Under Voltage trip

Fault occurs if the inverter input voltage is below the Under Voltage Trip level.

P 5.19 Open Phase Protection

The inverter generates a fault when the open phase happens.

P 5.20 Supply Frequency

The frequency of Input Voltage

P 5.21 Built-in DB(Dynamic Brake)

In the case of increase in DC Link Voltage, if users don't want the Over Voltage Protection, connect a Dynamic Brake Resistor to keep the normal operation. The excessive voltage is wasted by heat through the DBR. This parameter selects whether the DB switching device works or not.

[0] Disable

[1] Enable

P 5.22 DB Switching Frequency

Determine the frequency for the DB switching Device.

P 5.23 DB Start Voltage

Determine the frequency for the DB switching Device.

P 5.24 DB Full Voltage

Determine the voltage that DB switching device can maintain on-state not responding to the DB switching frequency.

P 5.25 Over-Heating Fault[Action]

Select the Over Heat Function when the fault conditions occur.

[0] STOP

[1] Ignore

P 5.26 HOV Protection

Determine whether the inverter uses Over Voltage Protection due to hardware.

[0] Disable

[1] Enable

P 5.27 HOC Protection

Determine whether the inverter uses Over Current Protection due to hardware.

[0] Disable

[1] Enable

P 5.28 HZC Protection

Determine whether the inverter uses Zero Current Protection due to hardware.

[0] Disable

[1] Enable

This is applied to the inverters over 30kW.

P 5.29 Auto-Restart Count

This is for the case when users want to keep operating even though a protection is still working. After the output is broke, the inverter starts again automatically if the condition for restarting is qualified. This parameter sets the numbers how many times the inverter allows to restart.

P 5.30 Retry Delay Time

This sets the minimum stand-by time until restarting even though cancellation conditions are qualified after a fault occurs.

P 5.31 Auto Reset (Over Current)

Determines whether the inverter uses the Auto-Reset function or not when Over Current Protection is working.

[0] Disable

[1] Enable

P 5.32 Auto Reset (Over Voltage)

Determines whether the inverter uses the Auto-Reset function or not when Over Voltage Protection is working.

- [0] Disable
- [1] Enable

P 5.33 Auto Reset (Under Voltage)

Determines whether the inverter uses the Auto-Reset function or not when Over Voltage Protection is working.

- [0] Disable
- [1] Enable

P 5.34 Auto Reset (HOV)

Determines whether the inverter uses the Auto-Reset function or not when Hardware Over-Voltage Protection is working.

- [0] Disable
- [1] Enable

P 5.35 Auto Reset (HOC)

Determines whether the inverter uses the Auto-Reset function or not when Hardware Over-Current Protection is working.

- [0] Disable
- [1] Enable

P 5.36 Out of Control Auto Reset

The inverter can reset the functions with fault message when its status is out of control.

P 5.37 Out of Control Time

The inverter gives a fault when the time value of P5.36 is elapsed in out of control status.

8.2.6 Parameter Group 6 : Analog Input

P 6.0 Reference Mode

The Analog Input Functions in this group should set to [1] Reference 1 or [2] Reference 2 to use the reference mode,

[0] Disable

Not use the Analog Input Terminals.

[1] R1 only

When Analog Input # Function is [1] Reference 1, this parameter makes the controller use only R1, the Analog Input reference for the operating reference.

[2] R2 only

When Analog Input # Function is [2] Reference 2, this parameter makes the controller use only R2, the Analog Input reference for the operating reference.

[3] R1 + R2

The signal, the Analog Input of [1] Reference 1, and the signal, the Analog Input of [2] Reference 2, are added. The added signal becomes the operating reference.

[4] R1- R2

The signal, the Analog Input of [2] Reference 2, is subtracted from the signal, the Analog Input of [1] Reference 1. The subtracted signal becomes the operating reference.

[5] R2 – R1

The signal, the Analog Input of [1] Reference 1, is subtracted from the signal, the Analog Input of [2] Reference 2. The subtracted signal becomes the operating reference.

[6] R1 × R2

The operating reference is multiplied the Analog Input of [1] Reference 1 by the Analog Input of [2] Reference 2.

P 6.1 Analog Input 1 Function

Selects the function of AI.1

- [0] Disable
- [1] Reference 1
- [2] Reference 2
- [3] PID Feedback 1
- [4] PID Feedback 2

P 6.2 Analog Input 1 Type

Select the signal that is connected to AI.1 in analog input terminals.

- [0] 0 – 10V
- [1] -10 – +10V

The direction of rotation is determined by polarity.

- [2] User[V]

The range of reference can be set up by users besides 0~10V and -10V ~ +10V.

- [3] 4 – 20mA
- [4] 0 – 20mA
- [5] User[mA]

The range of reference can be set up by users besides 0 ~ 20mA and 4mA~20mA.

P 6.3 Analog Input 1 Filter

Determine whether it uses the filter for the analog input reference or not. (For AI.1)

- [0] Disable
- [1] Enable

P 6.4 Analog Input 1 Filter Time Constant

Set the filtering time constant of the Analog Input reference. (For AI.1)

P 6.5 Analog Input 1 Offset adjustment

Set the Offset value of the Analog Input reference. (For AI.1)

P 6.6 Analog Input 1 min Voltage

P 6.7 Analog Input 1 min Current

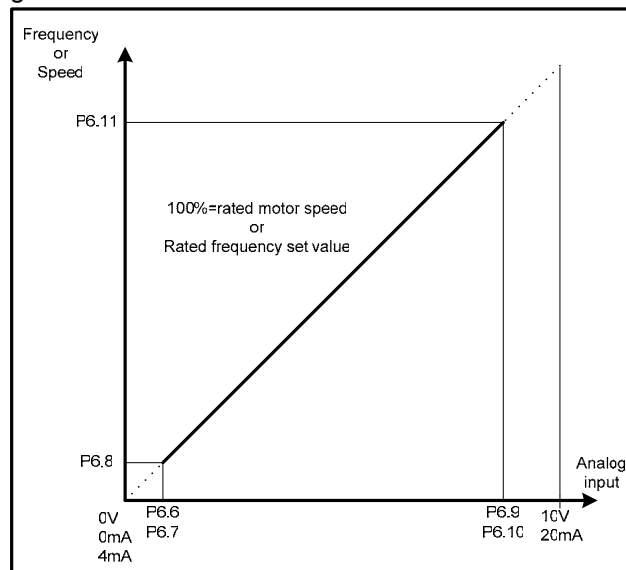
P 6.8 Analog Input 1 Minimum

P 6.9 Analog Input 1 max. Voltage

P 6.10 Analog Input 1 max. Current

P 6.11 Analog Input 1 Maximum

Refer to the Figure.



P 6.12 Analog Input 1 Inversion

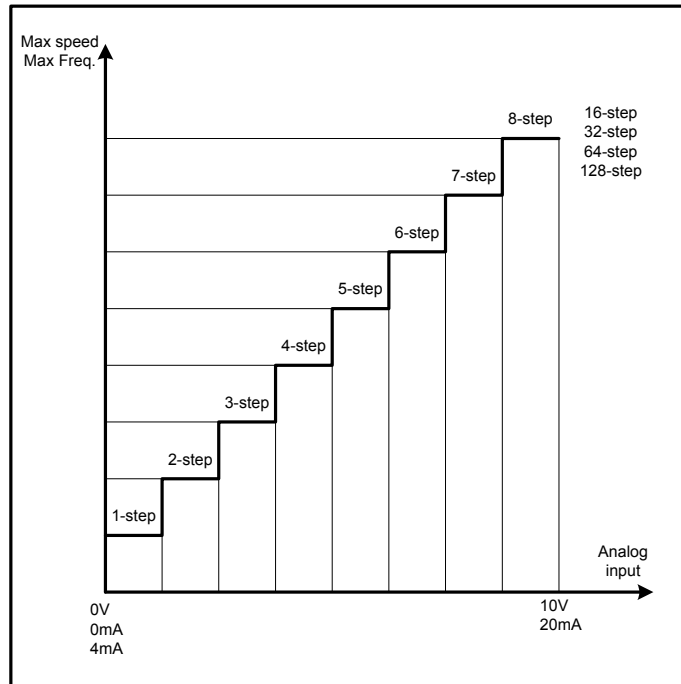
Determine whether the Analog Input reference from AI.1 is inverted or not.

[0] Disabled

[1] Enable

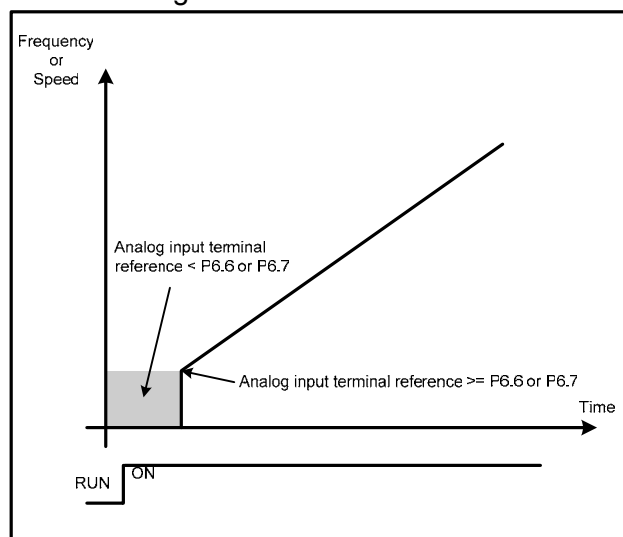
P 6.13 Analog Input 1 Discreteness

Divide steps up to the maximum frequency, and they have same output in the same steps. Overall, it is non-continuous, but it can have the same output in the same step.



P 6.14 Analog input 1 Dead-Zone

This is the zone that the inverter is not operating. If the analog input reference is smaller than the value of P6.6 or P6.7, the inverter does not generate the output even though the "RUN" signal comes in.



P 6.15 Analog Input 2 Function

P 6.16 Analog Input 2 Type

P 6.17 Analog Input 2 Filter

- P 6.18 Analog Input 2 Filter Time Const**
 - P 6.19 Analog Input 2 Offset adjustment**
 - P 6.20 Analog Input 2 min Voltage**
 - P 6.21 Analog Input 2 min Current**
 - P 6.22 Analog Input 2 Minimum**
 - P 6.23 Analog Input 2 max. Voltage**
 - P 6.24 Analog Input 2 max. Current**
 - P 6.25 Analog Input 2 Maximum**
 - P 6.26 Analog Input 2 Inversion**
 - P 6.27 Analog Input 2 Discreteness**
 - P 6.28 Analog input 2 Dead-Zone**
- Refer to the parameters from P6.1 to P6.14

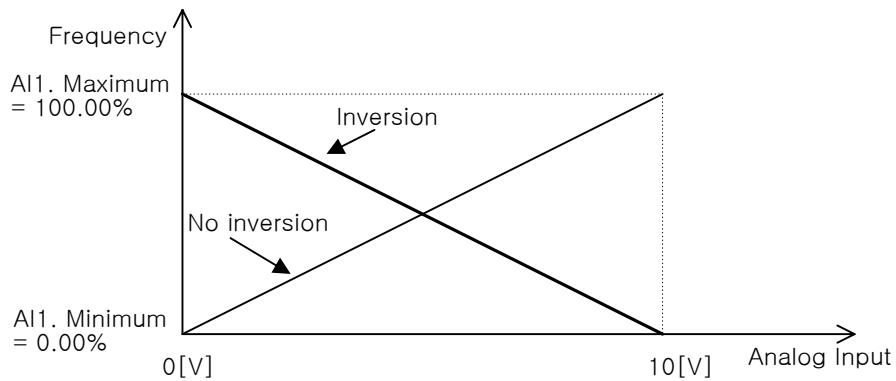
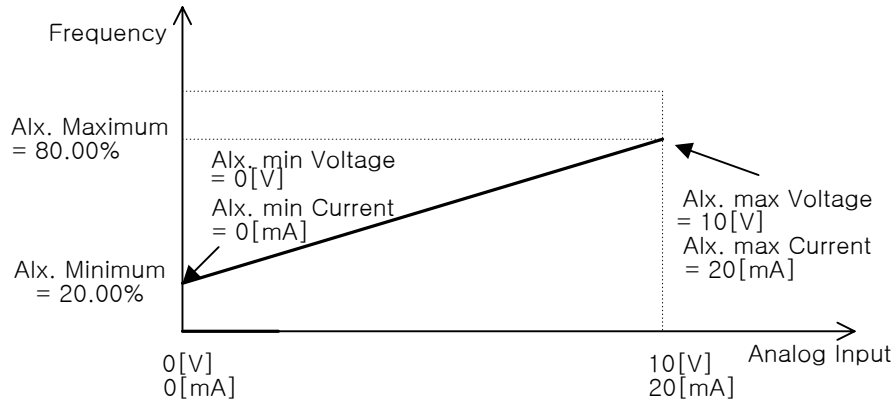
- P 6.29 Analog Input 3 Function**
 - P 6.30 Analog Input 3 Type**
 - P 6.31 Analog Input 3 Filter**
 - P 6.32 Analog Input 3 Filter Time Const**
 - P 6.33 Analog Input 3 Offset adjustment**
 - P 6.34 Analog Input 3 min Voltage**
 - P 6.35 Analog Input 3 min Current**
 - P 6.36 Analog Input 3 Minimum**
 - P 6.37 Analog Input 3 max. Voltage**
 - P 6.38 Analog Input 3 max. Current**
 - P 6.39 Analog Input 3 Maximum**
 - P 6.40 Analog Input 3 Inversion**
 - P 6.41 Analog Input 3 Discreteness**
 - P 6.42 Analog input 3 Dead-Zone**
- Set the parameters when the option card is installed to your inverter.
Refer to the parameters from P6.1 to P6.14

- P 6.43 Analog Input 4 Function**
 - P 6.44 Analog Input 4 Type**
 - P 6.45 Analog Input 4 Filter**
 - P 6.46 Analog Input 4 Time Const**
 - P 6.47 Analog Input 4 Offset Adjustment**
 - P 6.48 Analog Input 4 min Voltage**
 - P 6.49 Analog Input 4 min Current**
 - P 6.50 Analog Input 4 Minimum**
 - P 6.51 Analog Input 4 max. Voltage**
 - P 6.52 Analog Input 4 max. Current**
 - P 6.53 Analog Input 4 Maximum**
 - P 6.54 Analog Input 4 Inversion**
 - P 6.55 Analog Input 4 Discreteness**
 - P 6.56 Analog input 4 Dead-Zone**
- Set the parameters when the option card is installed to your inverter.
Refer to the parameters from P6.1 to P6.14

- P 6.57 Analog Input 5 Function**
- P 6.58 Analog Input 5 Type**
- P 6.59 Analog Input 5 Filter**
- P 6.60 Analog Input 5 Filter Time Const**
- P 6.61 Analog Input 5 Offset Adjustment**
- P 6.62 Analog Input 5 min Voltage**
- P 6.63 Analog Input 5 min Current**
- P 6.64 Analog Input 5 Minimum**
- P 6.65 Analog Input 5 max. Voltage**

- P 6.66 Analog Input 5 max. Current**
- P 6.67 Analog Input 5 Maximum**
- P 6.68 Analog Input 5 Inversion**
- P 6.69 Analog Input 5 Discreteness**
- P 6.70 Analog input 5 Dead-Zone**

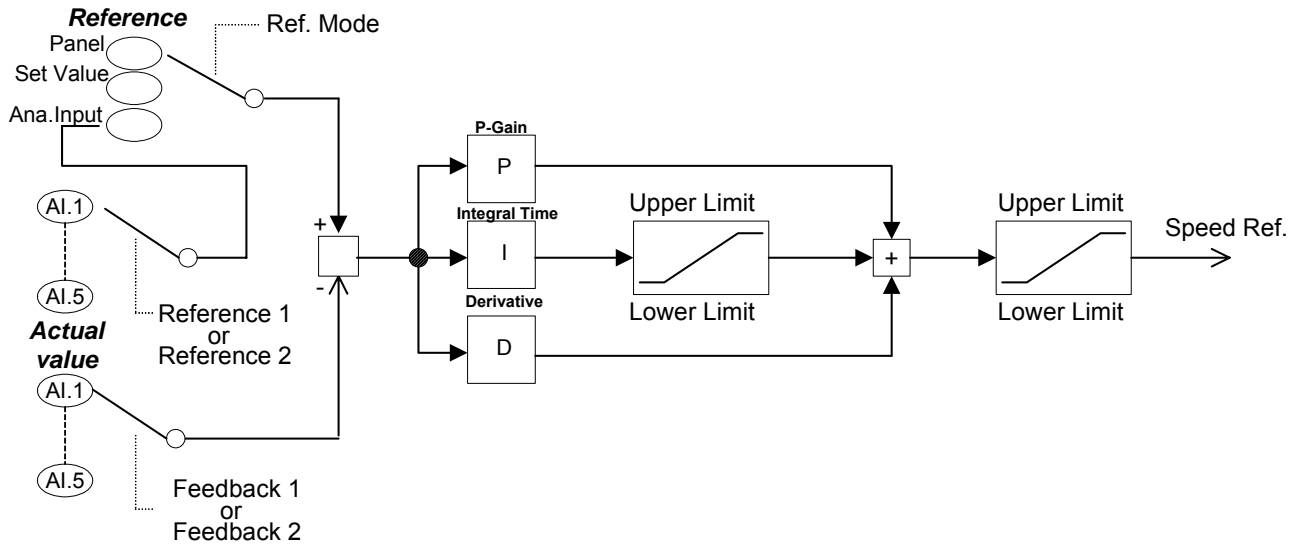
Set the parameters when the option card is installed to your inverter.
Refer to the parameters from P6.1 to P6.14



x : 1, 2, 3, 4, 5

8.2.7 Parameter Group 7 : Process PID Control

PID can control processes by the amount of flowing water, airflow, pressure and etc.
PID Process Controller is added to the outside of speed control loop, so it can realize multi-functions without using separate PID Controller or PLC.
Process PID Controller can be used by selecting [2] PID Process Control of P 3.1



P 7.0 PID Control Mode

[0] Disable

NOT use PID Function

[1] Process PID Control

This applies to the systems that are controlled by temperature, pressure, amount of water, height of water, amount of wind and etc. Only forward operation is available in this control mode.

[2] General PID Control

This is a PID Control for general purposes. In this mode, forward and reverse operations are available.

[3] PID Compensation

PID output is used to compensate for a part of reference.

P 7.1 Reference Mode

Selects a reference input method when PID operation is used.

[0] Keypad

Set the reference of Process PID Controller by KEYPAD. The range is from -100% to +100%.

[1] Set Value

The reference of Process PID Controller is set by [1] of P 7.0.

[2] Analog Input

The reference of Process PID Controller uses the analog input value. The Analog input terminal is selected by reference 1 or reference 2. Refer to the Parameter Group 6.0 (Analog Input). AI.1 or AI. 2 terminal can be selected by user's convenience.

P 7.2 PID Set-Point [Parameter]

The value in [1] of P7.0

P 7.3 Feedback Mode

Set the Analog input terminals of Feed back.

AI.1 and AI.2 can be selected by user's convenience. The input range is 0-10[V] or 0-20[mA] or 4-20[mA]. A option card is needed to use AI.3 through AI.5.

[0] F1 only

Parameter Group 6.0: When [4] Feedback 1 of Analog Input function is set, F1 is only used for Feed back signal.

[1] F2 only

Parameter Group 6.0: When [5] Feedback 2 of Analog Input function is set, F2 is only used for Feed back signal.

[2] F1 + F2

Use the feedback signal that is the sum of the value from the terminal of [4] Feedback 1 and the value from the terminal of [5] Feedback 2.

[3] $F1 - F2$

The signal, the value from the terminal of [5] Feedback 2, is subtracted from the signal, the value from the terminal of [4] Feedback 1. The subtracted signal becomes the Feedback signal.

[4] $F2 - F1$

The signal, the value from the terminal of [4] Feedback 1, is subtracted from the signal, the value from the terminal of [5] Feedback 2. The subtracted signal becomes the Feedback signal.

[5] $F1 \times F2$

The Feedback signal is multiplied the Feedback Input of [1] PID Feedback 1 by the Feedback Input of [2] PID Feedback 2.

P 7.4 Reference Sign Change

P 7.5 Feedback Sign Change

Change to opposite sign for reference and feedback signal. (+ -> - and - -> +)

P 7.6 Control Period

Set the PID control Periods.

P 7.7 Proportional Gain

Set the proportional Gain for the PID Controller.

When using only proportional compensator with no integral factors in plant, errors occur for the steady input. In this case, use the integrator in P 7.8

P 7.8 Integration Time

Set the integration Time for PID Controller.

The integrator is effective to remove the errors for the steady input, but it makes the whole system unstable. To make the system stable, use the Proportion and Integration controller. If a user increases the proportional gain, and decreases the integration time, the response gets faster, but the system is unstable. . If a user decreases the proportional gain, and increases the integration time, the response get slower. This is the time that takes to the 100% output level when there is 100% error between reference and the actual value.

P 7.9 Differential Time Constant

Set the differential time constant.

P 7.10 Feed-forward Gain

Set the gain that generates proportional output to the setting value.

P 7.11 Zero-Shift Factor 1

This is used to reduce the over shoot in transient response of PID output. If this parameter is 100%, there could be over shoot for the PID Gain. In that case, reduce the value of this parameter to reduce the over shoot.

P 7.12 Proportional Gain 2

Refer to the P7.7

P 7.13 Integration Time 2

Refer to the P7.8

P 7.14 Differentiator Time Constant 2

Refer to the P7.9

P 7.15 Feed-Forward Gain 2

Refer to the P7.10

P 7.16 Zero-Shift Factor 2

Refer to the P7.11

P 7.17 Output Inversion

This reverses the PID Output.

P 7.18 Integrator Upper Limit

P 7.19 Integrator Lower Limit

Set the lower and upper limit of the integrator.

P 7.20 Output Upper Limit

Set the Upper limit of Integrator output and PID Controller output.
Set in percentage (%) of the maximum operating speed.

P 7.21 Output Lower Limit

Set the lower limit of Integrator output and PID Controller output.
Set in percentage (%) of the maximum operating speed.

P 7.22 Output Scale

Adjust the output scale of the PID output.

P 7.23 Auto RUN/STOP

This decides whether PID control uses Auto RUN/STOP Function or not.
% Auto RUN/STOP Function can be used when PID control Mode is P7.0 [1] PID Process Mode.

P 7.24 Auto STOP Delay Time

When the Auto Stop Delay time is elapsed with the condition of that PID output is below the Output Lower Limit (P7.20), the inverter stops automatically.

P 7.25 Auto START Error Condition

When the number of PID errors that is set in P7.25 “Auto Start Error condition” is occurred, the inverter restarts automatically.

8.2.8 Parameter Group 8 : Digital Input

Refer to the chapter 4 for the location of terminals.

Control B/D Terminal Number and Terminal Name

Name	DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8
Number	7	8	9	10	11	12	13	14

Option B/D Terminal Number and Terminal Name

Name	DI9	DI10	DI11	DI12	DI13	DI14	DI15	DI16
Number	?	?	?	?	?	?	?	?

P 8.0 Run/Stop Control

Set the function of DI1 and DI2.

[0] DI 1 -> FWD, DI 2 -> REV

DI 1 : Run signal & Forward

DI 2 : Run signal & Reverse

The first entering signal will have the priority.

[1] DI 1 ->RUN, DI 2 -> DIR

DI 1 : Run signal.

DI 2 : Open – Forward

Close – Reverse

- P 8.1 DI 3 Function**
- P 8.2 DI 4 Function**
- P 8.3 DI 5 Function**
- P 8.4 DI 6 Function**
- P 8.5 DI 7 Function**
- P 8.6 DI 8 Function**
- P 8.7 DI 9 Function**
- P 8.8 DI 10 Function**
- P 8.9 DI 11 Function**
- P 8.10 DI 12 Function**
- P 8.11 DI 13 Function**
- P 8.12 DI 14 Function**
- P 8.13 DI 15 Function**
- P 8.14 DI 16 Function**

It sets the Functions for Digital Input Terminals.

- [0] Disable
Not used.
- [1] Drive Enable
The signal is used for inverter operation ready.
- [2] Multi-Step 0
Use the signal for Multi-Step 0.
- [3] Multi-Step 1
Use the signal for Multi-Step 1.
- [4] Multi-Step 2
Use the signal for Multi-Step 2.
- [5] Fault Reset
Use the signal for releasing the faults.
- [6] JOG
Use the signal for JOG run
- [7] AI_REF_Disable
Once the terminal that is set to [11] gets a signal in, the controller ignores the Analog input signal.
- [8] AI_Local / Remote
Use the signal for Local or Remote selection.
- [9] Ext. Fault A
Use the signal for external fault input.
- [10] Ext. Fault B
Use the signal for external fault input.
- [11] Motor Selection
Use the signal for motor selection.
Inactivated = Select motor 1
Activated = Select motor 2
- [12] DM Brake State
Use the signal for activating the external Magnetic Brake.
- [13] Acc./Dec. Switching
Use the signal for selecting the Acc./Dec. time 1 or 2.
- [14] Ref. Increment
If a signal enters to this terminal, the reference value is increased up to the maximum. And then, it returns to the actual reference value if the terminal loses the signal
- [15] Ref. Decrement
If a signal enters to the terminal, the reference value is decreased. And then, it returns to the actual reference value if the terminal loses the signal
- [16] Accel/Decel Bypass
If a signal enters to the terminal, controller ignores the Acc./Dec. time.
- [17] PID Cntl_Enable
This decides whether PID is used or not by the terminal. This option can be used when P7.0 is selected.
If PID is not used, the inverter receives references by the set condition of P3.0

- and P3.1
- [18]AUTO PID Mode
This is the same as P7.23, and this is set by terminals.
- [19]PID Gain_Selection
If this terminal is activated, The gain constants of P7.8~P7.11 are used.
If the terminal is not activated, the gain constants of P7.13~P7.16 are used.
- [20]PID Integrator_Reset
This makes the output of integrator to zero.

P 8.15 Blank Time after Motor change

This is a waiting time when the motor is changed from Motor 1 to Motor 2 or from Motor 2 to Motor 1 by the terminal function of [10] Motor Select.

P 8.16 Reference Up/Down Time

This is the Acc./Dec. time for the terminal function of [13] Reference Increment and [14] Reference decrement. One of the terminals should be set to [13] or [14] for this parameter.

P 8.17 Start Delayed JOG Detection

This is the time how long it takes the JOG signal to run the inverter.
The RUN signal gets delayed to be recognized for the set time value

P 8.18 “RUN” Delay Time

This is the time how long it takes the RUN signal to run the inverter.
The Jog signal gets delayed to be recognized for the set time value

8.2.9 Parameter Group 9 : Multi-Step Reference [Motor 1]

These parameters set the multi-step speed and jogging speed for Motor 1.

P 9.1 JOG Reference

Set the Jogging reference in percentage of the motor rated speed.

P 9.2 – P 9.7

Multi Step.1 Ref – Multi Step.7 Ref

These parameters are used for the speed reference when the multi-step operation is used. The input reference is in percentage of the motor rated speed.

Multi-Step 2	Multi-Step 1	Multi-Step 0	Selection of speed
0	0	0	Analog Input signal or Min. Frequency
0	0	1	Step.1 Reference
0	1	0	Step.2 Reference
0	1	1	Step.3 Reference
1	0	0	Step.4 Reference
1	0	1	Step.5 Reference
1	1	0	Step.6 Reference
1	1	1	Step.7 Reference

8.2.10 Parameter Group 10 : Multi-Step Reference [Motor 2]

These parameters set the multi-step speed and jogging speed for Motor 2.
Refer to the D 2.9.

8.2.11 Parameter Group 11 : Analog Output Configuration

These parameters are related to Analog Output.

P 11.0 Analog Output 1 selection

Set the function of Analog output 1. Use the terminal number 17 and 18 on Control Board..

- [0] Output Frequency
- [1] Motor Speed
- [2] Motor Current
- [3] Motor Voltage
- [4] Actual Torque
- [5] Output Power
- [6] DC_Link Voltage
- [7] Trim 0 mA
- [8] Trim 4 mA
- [9] Trim 20 mA

P 11.1 Analog Output 1 Type

Select the range of output signal from Analog output 1 terminal.

- [0] 0 – 20mA
- [1] 4 – 20mA

P 11.2 Analog Output 1 Adjustment 0 mA

First set P11.0 to [7] Trim 0mA, and then, adjust the value of this parameter until the output current becomes 0mA. This is for fine tuning.

P 11.3 Analog Output 1 Adjustment 4 mA

First set P11.0 to [8] Trim 4mA, and then, adjust the value of this parameter until the output current becomes 4mA. This is for fine tuning.

P 11.4 Analog Output 1 Adjustment 20 mA

First set P11.0 to [9] Trim 20mA, and then, adjust the value of this parameter until the output current becomes 20mA. This is for fine tuning.

P 11.5 Analog Output 1 Output at 20mA

Set the value of Analog output selection of P11.0 when the analog output is 20mA.
Ex.) If Analog output selection is [0] Output Frequency and a user wants 50[Hz] at 20mA, Set this parameter to 50.

P 11.6 Analog Output 1 Inversion

This reverses the Analog Output 1

- [0] Disable
- [1] Enable

P 11.7 Analog Output 2 selection

P 11.8 Analog Output 2 Type

P 11.9 Analog Output 2 Adjustment 0 mA

P 11.10 Analog Output 2 Adjustment 4 mA

P 11.11 Analog Output 2 Adjustment 20 mA

P 11.12 Analog Output 2 Output at 20mA

P 11.13 Analog Output 2 Inversion

P 11.14 Analog Output 3 selection

P 11.15 Analog Output 3 Type

P 11.16 AO.3 Adjustment 0 mA

P 11.17 AO.3 Adjustment 4 mA

P 11.18 AO.3 Adjustment 20 mA

P 11.19 AO.3 Output at 20mA

P 11.20 AO.3 Inversion

These parameters are available when the option card is installed to your inverter.

These parameters are related to the Analog Output 2 and Analog Output 3

Refer to the parameters from P11.0 to P11.6

8.2.12 Parameter Group 12 : Digital Output

DO1 ~ DO3 are ready to use in Control Board.

SOHO VD VECTOR INVERTER

DO4 ~ DO8 are served in Option Board.

P 12.0 DO 1 Function

P 12.1 DO 2 Function

P 12.2 DO 3 Function

Select the Function of Digital Output.

[0] Disable

Not use the Digital Output Function.

[1] Drive Ready

It is activated when the inverter operation is ready.

[2] Fault Out A

It is activated when a fault occurs.

[3] Fault Out B

It is activated when a fault occurs.

[4] Motor Brake

If the conditions of Brake control meet the requirements, it is activated or inactivated.

[5] Aux. Motor Brake

If the conditions of Brake control meet the requirements, it is activated or inactivated.

This should be used in parallel with the function of Magnetic Brake 1.

[6] RUN/STOP Status

It is activated when inverter is operating.

[7] Warning Status

It is activated when a warning occurs.

[8] Direction

It is activated when reverse signal enters.

[9] Jog Input State

It is activated when Jogging signal enters.

[10] OV/OC Limiting Function

It is activated when Over Voltage limiting function or Over Current limiting Function is running.

[11] OL Trip

When Over-Load Fault occurs, the terminal is activated when [11] is selected.

[12] OL Warning

When Over-Load Warning occurs, the terminal is activated when [11] is selected.

[13] Ref. Steady State

It is activated when output frequency reaches to the reference.

[14] Frequency Supervision 1 [LL]

It is activated when output frequency is below than the setting value (P12.11)

[15] Frequency Supervision 1 [HL]

It is activated when output frequency is higher than the setting value (P12.11)

[16] Frequency Supervision 2 [LL]

It is activated when output frequency is below than the setting value (P12.12)

[17] Frequency Supervision 2 [HL]

It is activated when output frequency is higher than the setting value (P12.12)

[18] Torque Supervision [LL]

It is activated when the torque is below than the setting value (P12.13)

[19] Torque Supervision [HL]

It is activated when the torque is bigger than the setting value (P12.13)

[20] Reference Supervision [LL]

It is activated when the reference is below than the setting value (P12.14)

[21] Reference Supervision [HL]

It is activated when the reference is higher than the setting value (P12.14)

P 12.3 DO 4 Function

P 12.4 DO 5 Function

P 12.5 DO 6 Function

P 12.6 DO 7 Function

- P 12.7 DO 8 Function**
- P 12.8 DO 9 Function**
- P 12.9 DO 10 Function**
- P 12.10 DO 11 Function**

Refer to P12.0

Option Board is needed to use these extra terminals.

- P 12.11 Output Frequency Supervision Limit 1**
- P 12.12 Output Frequency Supervision Limit 2**

If the output frequency is higher or below than the output frequency supervision limit, It gives a output signal from Digital Output terminal. For this case, the DO function should be set to one of [12][13][14][15]. Refer to P12.0 about the DO functions.

- P 12.13 Torque Supervision Limit**
- P 12.14 Reference Supervision Limit**

This supervises the input reference, and then it sends a signal from DO terminal. The function of DO terminal should be set to [18] or [19]([16] or [17]).

8.2.13 Parameter Group 13 : Magnetic Brake Control

Set up the condition for controlling a brake, when the brake is installed to a motor

P 13.0 M1 Locked State UP_ Reference

Set up the initial speed reference in a state that a brake is locked. It is applied when a motor is pulling up..

P 13.1 M1 Locked State DOWN_ Reference

Set up the initial speed reference in a state that a brake is locked. It is applied when a motor is pulling down.

P 13.2 M1 OPEN Current

Set up the open current reference. If the output current gets bigger than this parameter, the controller will have a condition that satisfies for the contact output.

P 13.3 MB1 Open Response Time

It is the taking time of which a brake is physically opened completely after entering a signal that opens the brake. Apply an approximate value because this value is not correct in general.

1. Output Speed(Frequency) > P13.0 or P 13.1

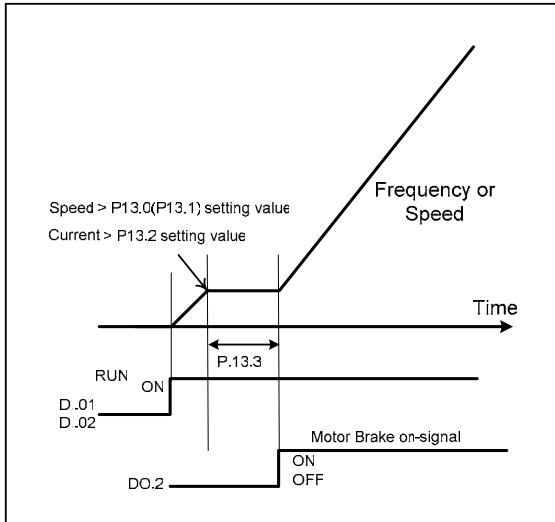
2. Output Current > P13.2

3. Taking time after 1 and 2 (above item) occur > P13.3

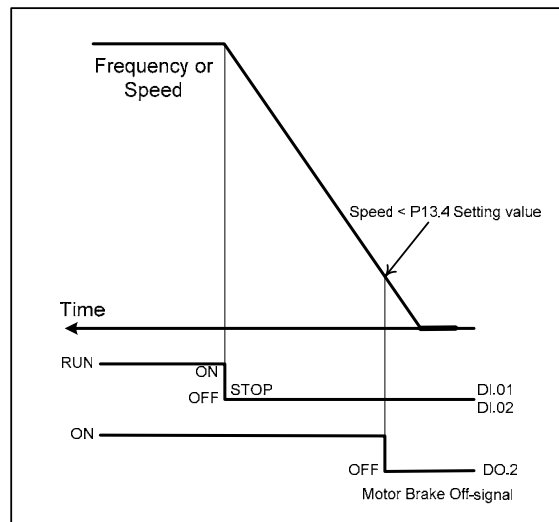
The contact output will start working after the above 3 items are satisfied.

P 13.4 MB1 CLOSE Reference (Motor 1)

If an output speed (frequency) is below the set value of this parameter, the contact output signal for controlling the brake is off, and it lets the brake be closed.



Motor Brake On-signal



Motor Brake Off-signal

- P 13.6 M2 Locked State UP Reference (Motor 2)**
- P 13.7 M2 Locked State DOWN Reference (Motor 2)**
Refer to P 13.0 and P 13.1
- P 13.8 M2 OPEN Current (Motor 2)**
Refer to P 13.2
- P 13.9 MB2 Open Response Time (Motor 2)**
Refer to P. 13.3
- P 13.10 MB2 Close Reference (Motor 2)**
Refer to P 13.4

8.2.14 Parameter Group 14 : Auto Tuning Configuration

It is the parameter that sets necessary details for Speed Tuning.

- P 14.0 Motor tuning Condition**
It is a precondition for auto tuning a motor.
Choose [1] when a motor is in stall status and [0] when there is no load.
- P 14.1 Excitation Slip Frequency**
Set up a slip frequency for motor tuning while the motor is stalled. Mark this with the percentage of a rated slip frequency.
- P 14.2 Min. Tuning Speed**
Set up the minimum tuning speed in case of operating Speed Tuning
- P 14.3 Max. Tuning Speed**
Set up the maximum tuning speed in case of operating Speed Tuning

8.2.15 Parameter Group 15 : V/F Control [Motor 1]

These are the V/F Control parameters for **Motor 1**

- P 15.0 Torque Compensation**
When V/F Control is used, generating torque could be weak. This parameter sets up the Torque Compensation Method to in low frequency range for Motor 1.
[0] Manual
Manual Torque compensation selection

The output voltage is generated for compensation depending on the following parameters: P15.6, P15.7, P15.8, P15.9, P15.10, and P15.11

[1] Auto

Automatic Torque Compensation selection (Recommended)

The output voltage for compensating torque is generated automatically depending on the load. In this case, only excitation current is generated. The output current is increased if the load is increased. The parameters that are related to the Manual torque compensation would be ignored excepting P 15.11 Maximum output voltage.

P 15.1 Min. Output Frequency

Set the minimum operating frequency

P 15.2 Max. Output Frequency

Set the maximum operating frequency

P 15.3 Torque Compensation Flux Current

Set up the Flux Current at DC(0 Hz) if P1.6=[1] V/F Speed Control or P15.0=[1] Auto Compensation is used

P 15.4 Torque Compensation Time Const

Sets up the Torque compensation time constant if P1.6=[1] V/F Speed Control or P15.0=[1] Auto Compensation is used

P 15.5 Speed Detection Time Constant

Sets up the time constant for detecting a motor speed if P1.6=[1] V/F Speed Control is used.

P 15.6 V/F Pattern

Set up the output voltage curve for the inverter output frequency

[0] Liner

It is used for the application of a constant torque. The inverter output voltage, from the speed of zero to the field weakening point, changes in proportion to the output frequency. Refer to the Figure 8.2-19.

[1] Square

The output voltage, from the speed of zero to the field weakening point, changes into a square-law reduced curve for the output frequency. It is used for the square-law reduced load like a fan or pump and etc. Refer to the Figure 8.2-19.

[2] User

The user's random curve can make a V/F curve appointing three points by user's own desire. Refer to the Figure 8.2-19.

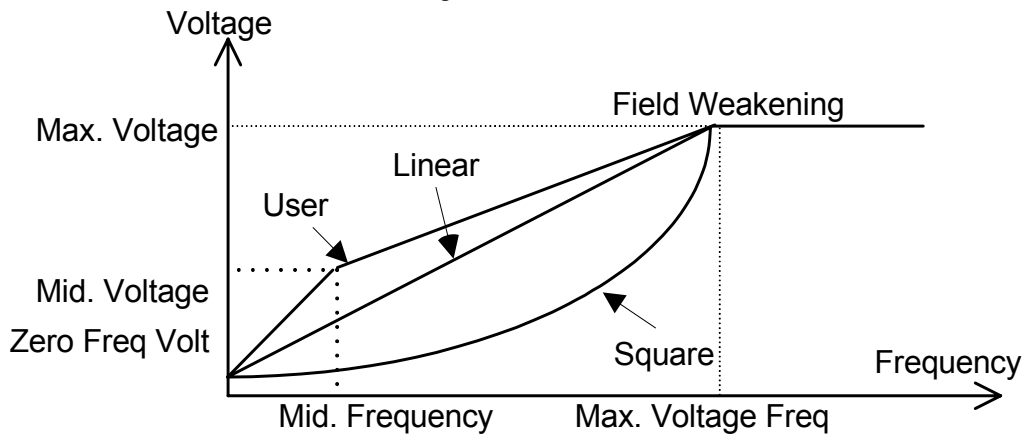


Figure 8.2-19 V/F Pattern

P 15.7 Zero Frequency Voltage

Set up the output voltage at 0 Hz.

You can use it only when a manual torque compensation (P15.0 = [0]) or the V/F Frequency Control mode (P1.6 = [0]).

P 15.8 Mid. Frequency

Set up the mid-point frequency when using a user's random curve

You can use it only when a manual torque compensation (P15.0 = [0]) or the V/F Frequency Control mode (P1.6 = [0]).

P 15.9 Mid. Frequency Voltage

Set up the output voltage at the mid point frequency when using the user's random curve. You can use it only when a manual torque compensation (P15.0 = [0]) or the V/F Frequency Control mode (P1.6 = [0]).

P 15.10 Max Voltage Frequency

Set up the frequency of which the maximum voltage is generated.

You can use it only when a manual torque compensation (P15.0 = [0]) or the V/F Frequency Control mode (P1.6 = [0]).

P 15.11 Max output Voltage

Set up the inverter output voltage in a frequency range of field weakening operation.

You can use it only when a manual torque compensation (P15.0 = [0]) or the V/F Frequency Control mode (P1.6 = [0]).

P 15.12 Voltage Limiter

If this is disabled, the output voltage can be generated depending on the input voltage as long as the input voltage allows the output voltage.

If this is enabled, the output voltage is limited by the value of P15.11

[0] Disable

[1] Enable

P 15.13 Acceleration Compensation

This is the percentage of rated voltage to compensate the output voltage while accelerating. This can be used when the torque compensation is manual. (P15.0 = [0] Manual)

P 15.14 Deceleration Compensation

This is the percentage of rated voltage to compensate the output voltage while decelerating. This can be used when the torque compensation is manual. (P15.0 = [0] Manual)

P 15.15 Start Brake [Time]

Set up the time that generates braking current when starting

When this parameter is set to 0, there will be no braking current when starting.

P 15.16 Start DC Brake [Blank time]

Set up the acceleration time of braking current when starting.

In case that there is braking current during the high-speed rotation, inverter can generate the excitation current without an inverter trip for the set time.

P 15.17 Start Brake [Current]

Set up the amount of braking current to output when starting

P 15.18 Stop DC Brake [Time]

Set up the time that generates the braking current when stopping

There will be no braking current if this is set to 0.

P 15.19 Stop DC Brake [Blank Time]

Set up the acceleration time of the braking current when stopping

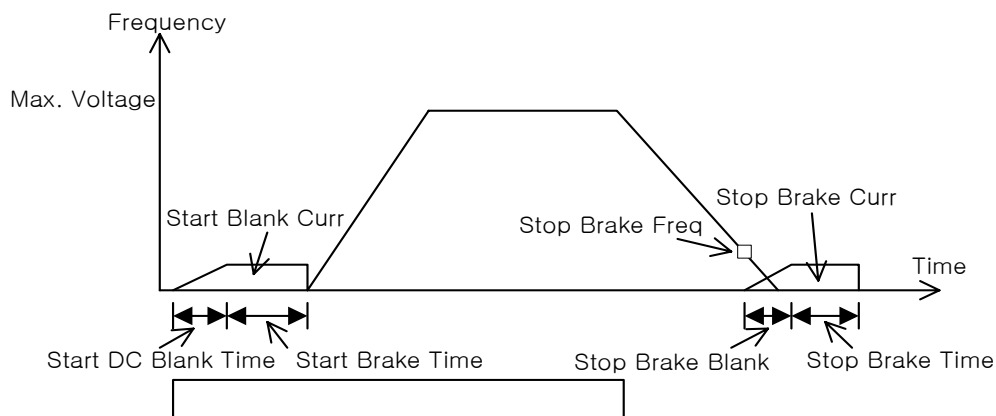
In case that the braking current is generated during the high-speed rotation, inverter can generate the excitation current without an inverter trip during the set time.

P 15.20 Stop DC Brake [Current]

Set up the amount of DC braking current to output when stopping

P 15.21 Stop DC Brake [Frequency]

Set up the frequency to output the DC braking current when stopping



P 15.22 CC Proportional-Gain

Set up the Proportional Gain that is used for the current controller

P 15.23 CC Integral-Gain Scale

Set up the Integral Gain that is used for the current controller

P 15.24 Stabilization Time Const

Set up the stabilization time constant for the stabilization controller.

The stabilization controller can reduce the resonance of motor or other unstable problems, which is automatically detected by the stabilization controller.

P 15.25 Stabilization Gain

Set up the Gain of the stabilization controller

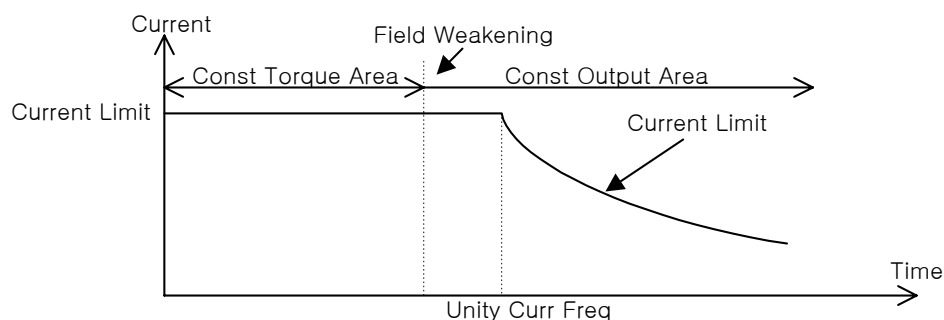
P 15.26 Stabilization Limit

This sets the upper limit of control output for the stabilization controller. If the resonance of motor or other unstable problems is not reduced, increase this value to remove the problems.

P 15.27 Unity Current Range: Freq

Set up the frequency of which the current controller starts to change in the range of field weakening operation. It is set automatically if you operate the auto-tuning function. This is used when the operation is in high speed over the rated frequency, and this parameter is for controlling smooth current in high speed range.

SOHO VD VECTOR INVERTER



8.2.16 Parameter Group 16 : V/F Control [Motor 2]

These are the V/F Control parameters for **Motor 2**

- P 16.0 Torque Compensation
- P 16.1 Min. Output Frequency
- P 16.2 Max. Output Frequency
- P 16.3 Torque Compensation Flux Current
- P 16.4 Torque Compensation Time Constant
- P 16.5 Speed Detection Time Constant
- P 16.6 V/F Pattern
- P 16.7 Zero Frequency Voltage
- P 16.8 Mid. Frequency
- P 16.9 Mid. Frequency Voltage
- P 16.10 Max Voltage Frequency
- P 16.11 Max output Voltage
- P 16.12 Voltage Limiter
- P 16.13 Acceleration Compensation
- P 16.14 Deceleration Compensation
- P 16.15 Start Brake Time
- P 16.16 Start DC Brake Blank time
- P 16.17 Start Brake Current
- P 16.18 Stop DC Brake Time
- P 16.19 Stop DC Brake Blank Time
- P 16.20 Stop DC Brake Current
- P 16.21 Stop DC Brake Frequency
- P 16.22 CC P-Gain
- P 16.23 CC I-Gain Scale
- P 16.24 Stabilization Time Const
- P 16.25 Stabilization Gain
- P 16.26 Stabilization Limit
- P 16.27 Unity Current Range: Freq

Refer to the Group 15

8.2.17 Parameter Group 17 : Sensor less Vector Control [Motor 1]

These are **Motor 1**-parameters for operation of S/L Vector control.

- P 17.0 **Speed Detection time constant**
Set up the time constant for speed detection
- P 17.1 **Min. Speed**
Set up the minimum operation speed
- P 17.2 **Max. Speed**
Set up the maximum operation speed
- P 17.3 **Over Speed Limit**

SOHO VD VECTOR INVERTER

In case that the estimated motor rotational speed exceeds the set value, the inverter output is immediately cut off and display the fault signal.

P 17.4 Flux Excitation Time

Set up the flux excitation time when starting

P 17.5 Starting Flux

Set up the amount of flux to be applied from the speed of zero to the speed of Par.17.7

P 17.6 Base Flux

Set up the amount of flux to be used from the speed of Par.17.8

P 17.7 Start Flux-END Speed

The flux of Par.17.5 is applied to the speed from zero to Par.17.7.

The start flux-end speed is set in the percentage of the maximum speed. (Par.17.2)

P 17.8 Base Flux-START Speed

Set up the speed of which the flux of Par.17.6 starts to be applied

The base flux-start speed is set in the percentage of the maximum speed. (Par.17.2)

P 17.9 FW Voltage

This parameter sets the electromotive Force (EMF). If this value is too high, the output voltage becomes increased in the field weakening area, and if the value is too low, the output voltage becomes decreased in the field weakening area. If this value is over than 100%, the condition of torque control cannot be good because there might be not enough voltage for operating the current controller. In that case, reduce the value if the motor cannot run up to the maximum set speed.

P 17.10 FW Profile Time Const (Field Weakening Time Constant)

Set up the time constant for the flux changes in the field weakening operation

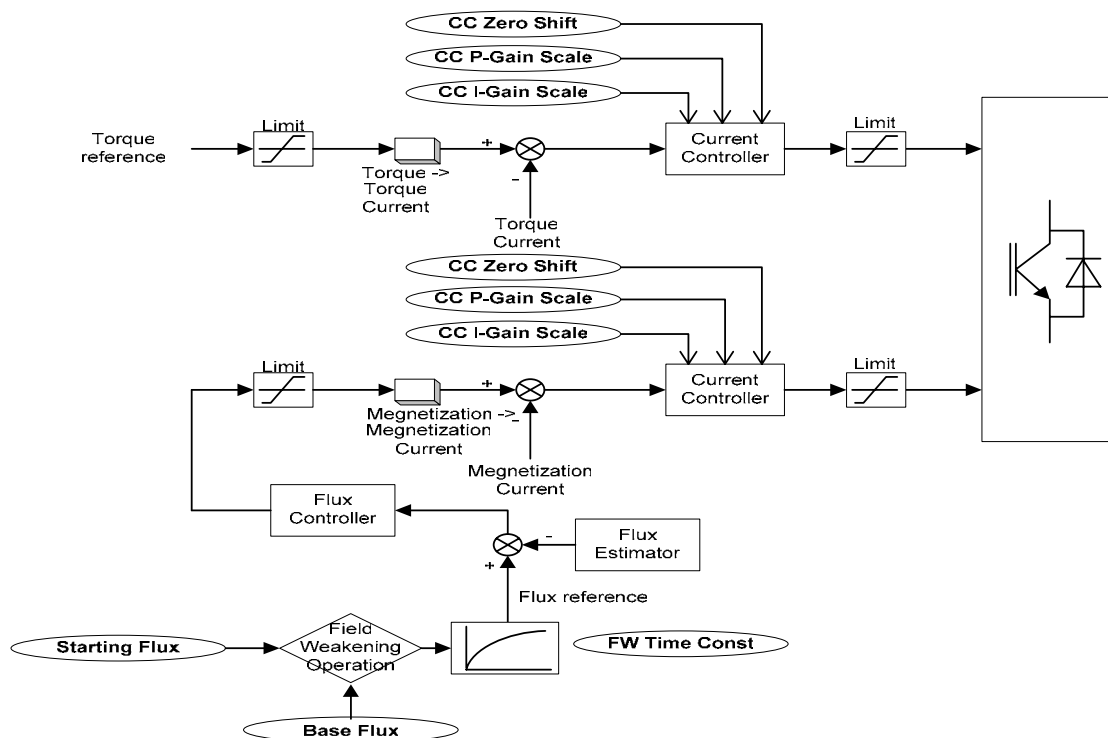
P 17.11 CC P-Gain Scale

Set up the scale in percentage of P-Gain of the current controller that is gained from auto tuning.

P 17.12 CC I-Gain Scale

Set up the scale in percentage of I-Gain of the current controller that is gained from auto tuning.

SOHO VD VECTOR INVERTER



P 17.13 CC zero Shift Factor

It moves a point of zero of PID controller in current controller to the high frequency band, and reduces the overshoot of output current.

P 17.14 Speed PI Gain

In order to set the PI Gain to be used for the speed controller, apply the set gain as a fixed value or use the gain that is set automatically by auto tuning.

[0] Default Gain

[1] Auto-Tuning Gain

P 17.15 Load Observer Activation

Decides the usage of Load Observer.

P 17.16 Load Observer Time Constant

Set up the time constant of Load Observer.

P 17.17 Load Compensation Start Frequency

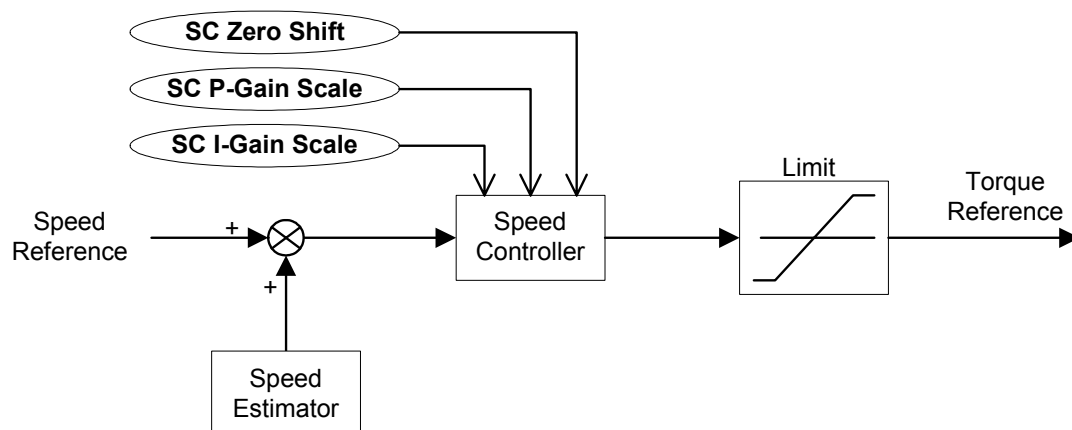
Set up the starting Frequency of Load Observer.

P 17.18 SC P-Gain

Set up the P-Gain of speed controller by auto tuning in percentage

P 17.19 SC I-Gain

Set up the I-Gain of speed controller by auto tuning in percentage



P 17.20 SC zero Shift Factor

It moves a point of zero of PI controller in speed controller to the high frequency band, and reduces the speed overshoot.

8.2.18 Parameter Group 18 : Sensor less Vector Control [Motor 2]

These are the parameters for Sensor Less operation of **Motor 2**

- P 18.0 Spd Detect time Constant**
- P 18.1 Min. Speed**
- P 18.2 Max. Speed**
- P 18.3 Over Speed Limit**
- P 18.4 Flux Excitation Time**
- P 18.5 Starting Flux**
- P 18.6 Base Flux**
- P 18.7 Start Flux-END Speed**
- P 18.8 Base Flux-START Speed**
- P 18.9 FW Voltage**
- P 18.10 FW Profile Time Const (Field Weakening Time Constant)**
- P 18.11 CC P-Gain Scale**
- P 18.12 CC I-Gain Scale**
- P 18.13 CC zero Shift factor**
- P 18.14 Speed PI Gain**
- P 18.15 Load Observer Activation**
- P 18.16 Load Observer Time Constant**
- P 18.17 Load Compensation Start Frequency**
- P 18.18 SC P-Gain**
- P 18.19 SC I-Gain**
- P 18.20 SC zero Shift factor**

Refer to the Group 17.

8.2.19 Parameter Group 19 : Vector Control 1

These are **Motor 1**- parameters for sensor vector control operation.

P 19.0 No. of Encoder Pulse

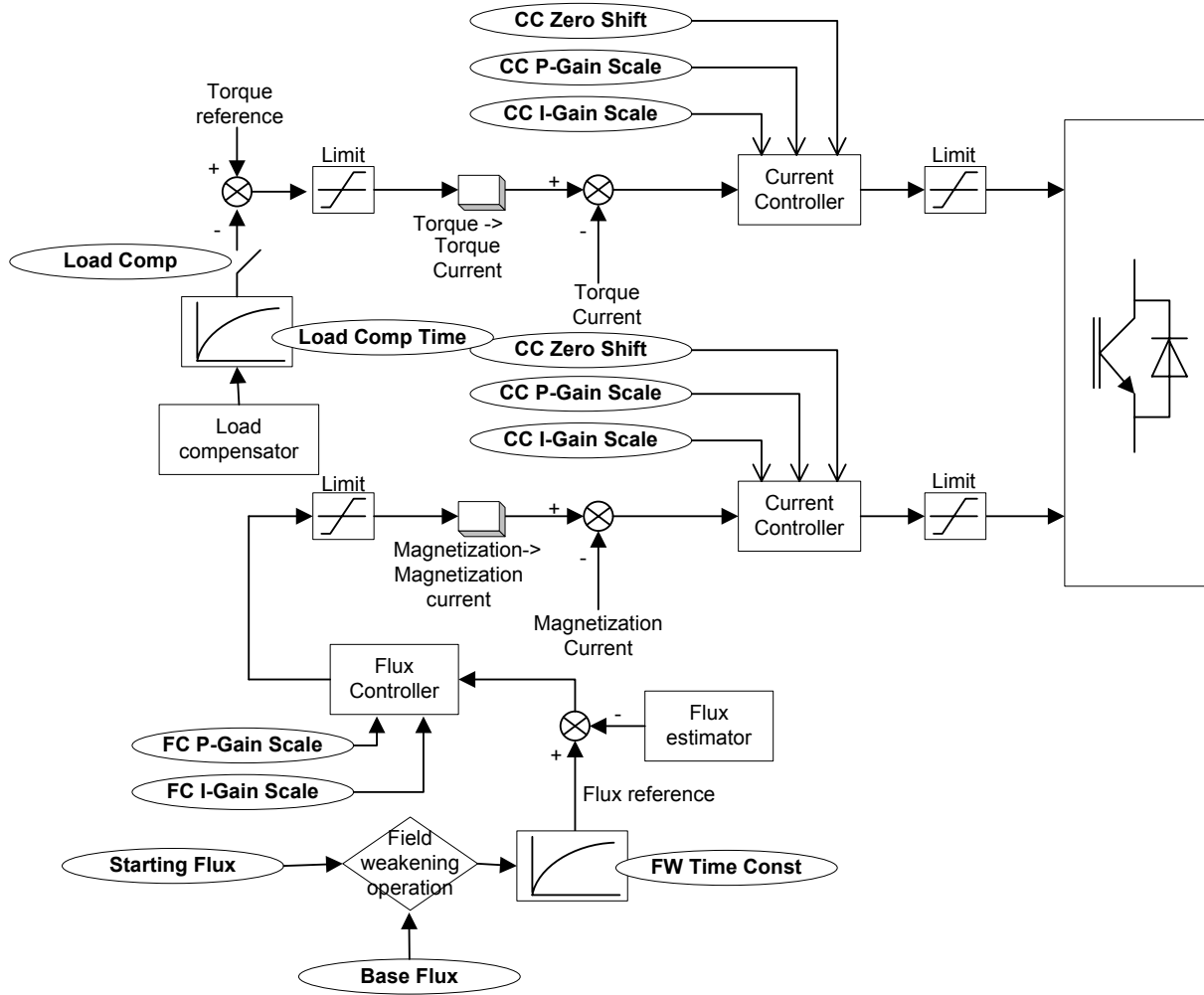
Set up the number of encoder pulse that is attached to an electric motor

P 19.1 Inversion of PG Direction

When a motor is running forward, this function makes the A or B phase go in advance. If the connection of A and B phase is switched, or U, V and W phase are switched, this parameter can change the order of phase in software without disconnect the real wires.

- P 19.2 Speed Detect time Constant**
Set up the time constant for detecting the motor rotation speed from encoder
- P 19.3 Min. Speed**
Set up the minimum operation speed
- P 19.4 Max. Speed**
Set up the maximum operation speed
- P 19.5 Over speed Limit**
In case that the motor rotation speed measured from encoder exceeds the set point, the inverter output is immediately cut off and display a fault signal.
- P 19.6 Flux Excitation Time**
Set up the flux excitation time when starting
- P 19.7 Starting Flux**
Set up the amount of flux to be applied from the speed of zero to the speed set in Par.19.9
- P 19.8 Base Flux**
Set up the amount of flux to be applied from the speed set in Par.19.10
- P 19.9 Start Flux-END Speed**
The flux set in Par.19.7 is applied from the speed of zero to the speed set in Par.19.9. Set the start flux-end speed in percentage of the maximum operation speed. (P19.4)
- P 19.10 Base Flux-START Speed**
Set up the speed that the flux of Par.19.8 starts to be applied
Set the base flux-start speed in percentage of the maximum operation speed
- P 19.11 FW Voltage**
This parameter sets the electromotive Force (EMF). If this value is too high, the output voltage becomes increased in the field weakening area, and if the value is too low, the output voltage becomes decreased in the field weakening area. If this value is over than 100%, the condition of torque control cannot be good because there might be not enough voltage for operating the current controller. In that case, reduce the value if the motor cannot run up to the maximum set speed.
- P 19.12 FW Profile Time Constant**
Set up the time constant for the flux change in the range of field weakening operation.
- P 19.13 CC P-Gain (Current Control)**
Set up the P-Gain of current controller by auto tuning in the percentage
- P 19.14 CC I-Gain (Current Control)**
Set up the I-Gain of current controller by auto tuning in the percentage
- P 19.15 CC Zero Shift factor(Current Control)**
It moves a point of zero of PI controller in current controller to the high frequency band, and reduces the overshoot of output current.

SOHO VD VECTOR INVERTER



P 19.16 FC P-gain (Flux Control)

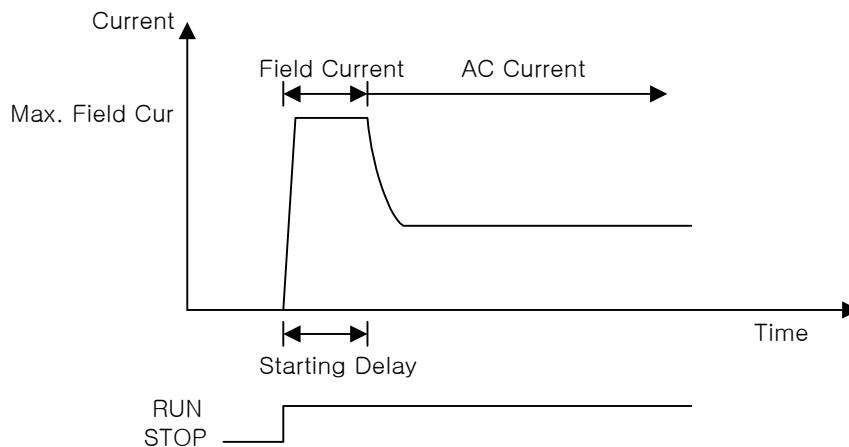
Set up the P-Gain of flux controller by auto tuning in percentage

P 19.17 FC I-Gain (Flux Control)

Set up the I-Gain of flux controller by auto tuning in percentage

P 19.18 Max. Field Current

Set up the limit for the maximum field current when starting



P 19.19 Speed PI Gain Selection

You can set up auto tuning in order to get PI Gain automatically to be used for speed controller

- [0] Default
- [1] Auto-Tuning

P 19.20 Load Observer

Set up the existence of torque compensation for a rapid load change

- [0] Disabled
- [1] Enable

P 19.21 Load Observer Time Constant

Set up the time constant for the torque compensation when there is a load change

P 19.22 SC Proportional Gain (Speed Control)

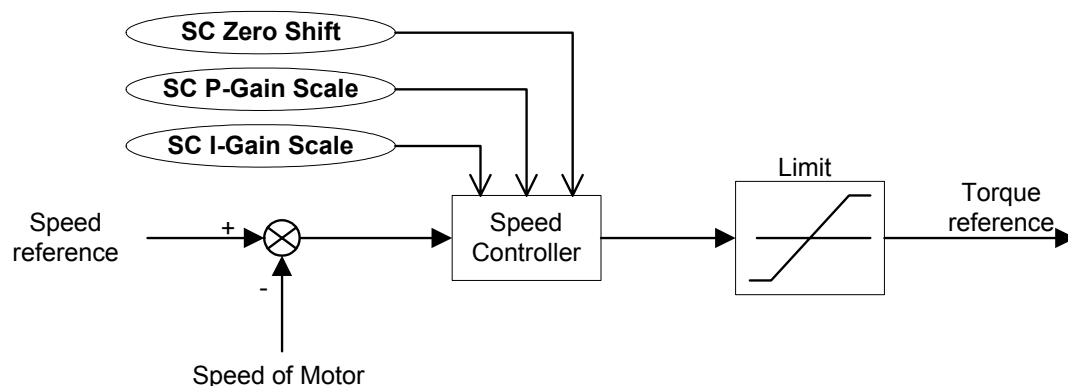
Set up the P-Gain of speed controller by auto tuning in percentage

P 19.23 SC Integral Gain (Speed Control)

Set up the I-Gain of speed controller by auto tuning in percentage

P 19.24 SC Zero Shift Factor(Speed Control)

It moves a point of zero of PI controller in speed controller to the high frequency band, and reduces the speed overshoot.



8.2.20 Parameter Group 20 : Vector Control 2

These are **Motor 2**- parameters for sensor vector control operation.

P 20.0 Number of Encoder Pulse

P 20.1 Inversion of PG Direction

P 20.2 Speed Detect time Constant

P 20.3 Min. Speed

P 20.4 Max. Speed

P 20.5 Over speed Limit

P 20.6 Flux Excitation Time

P 20.7 Starting Flux

P 20.8 Base Flux

P 20.9 Start Flux-END Speed

P 20.10 Base Flux-START Speed

P 20.11 FW Voltage

P 20.12 FW Profile Time Const

P 20.13 CC Proportional Gain (Current Control)

P 20.14 CC Integral Gain (Current Control)

P 20.15 CC Zero Shift factor(Current Control)

- P 20.16 FC P-gain (Flux Control)**
- P 20.17 FC I-Gain (Flux Control)**
- P 20.18 Max. Field Current**
- P 20.19 Speed PI Gain Selection**
- P 20.20 Load Observer**
- P 20.21 Load Observer Time Constant**
- P 20.22 SC P-Gain (Speed Control)**
- P 20.23 SC I-Gain (Speed Control)**
- P 20.24 SC Zero Shift factor(Speed Control)**

Refer to the Group 19.

8.2.21 Parameter Group 21 : Motor 1 Parameter

These are the parameters that are automatically formed by auto-tuning.[**Motor 1**]

- P 21.0 Stator Resistance 1**
Set up the stator resistance 1 of a motor
- P 21.1 Stator Resistance 2**
Set up the stator resistance 2 of a motor
- P 21.2 Rotator Resistance**
Set up the rotator resistance of a motor
- P 21.3 Stator Inductance**
Set up the stator inductance of a motor
- P 21.4 Rotor Inductance**
Set up the rotor inductance of a motor
- P 21.5 Leakage Inductance**
Set up the leakage inductance of a motor
- P 21.6 Rotational Inertia**
Set up the rotational inertia of a motor
- P 21.7 Iron Loss Compensation**
An iron loss impacts on the efficiency of control in the high-speed section. It can reduce controlling efficiency due to the compensation for excessive loss or lack of loss. You can improve its function through adjusting the amount of iron compensation.

8.2.22 Parameter Group 22 : Motor 2 Parameter

These are the parameters that are automatically formed by auto-tuning.[**Motor 2**]

- P 22.0 Stator Resistance 1**
- P 22.1 Stator Resistance 2**
- P 22.2 Rotator Resistance**
- P 22.3 Stator Inductance**
- P 22.4 Rotor Inductance**
- P 22.5 Leakage Inductance**
- P 22.6 Rotational Inertia**
- P 22.7 Iron Loss Compensation**

Refer to the Group 21

8.2.24 Parameter Group 24 : Monitor Setup

- P 24.0 LCD Idle Time**
A power of a keypad's backlight is cut off in case of the passage of a set time

P 24.1 LCD Contrast

Adjust the luminosity of a keypad's window

P 24.2 Key Repetition Time

The reaction time of a keypad's button

P 24.3 Speed Monitor Selection (Speed Monitoring Selection)

[0] Calculation

The motor rotation speed that is displayed on a keypad indicates the calculated speed.

[1] Encoder

The motor rotation speed that is displayed on a keypad indicates the actual rotation speed gained from encoder.

P 24.4 Speed Detection time Constant

In case of that the Speed Monitor Selection is set to Encoder, and this sets up the filtering time when measuring a motor speed from encoder.

P 24.5 Monitor Filter Time Constant

Set the Filtering Time for the Keypad display values

9. Protection

9.1 Warning

Type		Specification	Indication
Warning (at a standstill)	Under Voltage	If DC_Link Voltage is lower than the "Under-Voltage limit" (P.5.18), the warning occurs.	W1
	Over Voltage[S]	If DC_Link Voltage exceeds the Over-Voltage limit (P.5.14), the warning occurs (Software manages).	W2
	Over Voltage[H]	It happens when there is a detection of Over Voltage by hardware.	W3
	Sensor Error	It happens when there is a problem of current sensor & circuit..	W4
	Over Load	This occurs if the output current satisfies the over-load condition of P5.8 and P5.9. If P5.10=[1] ignore, it doesn't occur.	W5
	Detection of Zero-phase-sequence current	There is a detection of current leakage that exceeds P15.12 (ZC Limit).	W6
	Over Heat	It happens when the temperature of heat sink of inverter exceeds 90°C.	W7
	Device Short	It happens when there is a problem with a switching device of inverter.	W8
	Drive Disabled	It happens if there is no "Enable" input signal from the digital input terminal when Digital Input function is set to "Drive Enable".	W9
	Analog Reference 1	Analog Reference is not chosen in the Analog Input Function of P6.1, P6.15 and P6.29.	W10
	Analog Reference 2	Analog Reference 2 is not chosen in the Analog Input Function of P6.1, P6.15 and P6.29.	W11
	PI Feedback 1	Analog Feedback 1 is not chosen in the Analog Input Function of P6.1, P6.15 and P6.29.	W12
	PI Feedback 2	Analog Feedback 2 is not chosen in the Analog Input Function of P6.1, P6.15 and P6.29.	W13
	Drive Calibration Disorder	It occurs after parameter initialization of changing switching Frequency. Execute by [0] Drive Calibration of Auto Tuning.	W14
	Analog Reference 3	Analog Reference 3 is not chosen in the Analog Input Function of P6.1, P6.15 and P6.29.	W15

9.2 Errors

Type		Specification	Indication
Error (Operation Status)	Parameter Damage	A flash memory of parameter is damaged.	P99.1
	Setting error of Output Power, Voltage, and Current	Setting error of rated output, rated voltage, and rated current of the motor	P99.2
	Setting error of Frequency, Speed, and number of poles	Setting error of Frequency, Speed, and number of poles of the motor	P99.3
	Setting error of Inverter Power	Setting error of checking inverter power	P99.4
	Internal Error of Drive	A program initialization error	P99.5
	Parameter Setting Error	A number of the parameter is indicated when there is a parameter setting error (Example: P2.1)	Pxx.xx

SOHO VD VECTOR INVERTER

9.3 Fault

Type		Specification	Indication
Fault (At work)	Over Load	It happens when output current of inverter meets Over Load condition of P.5.7, P.5.8.	F1
	Over Current [S]	It happens when output current of inverter exceeds the set value of P.5.9. (Software manages.)	F2
	Over Current [H]	A state of Over Current by hardware	F3
	Zero-phase-sequence current [S]	It happens when Zero-phase-sequence current exceeds the set value of P15.10 (ZC Limit).	F4
	Zero-phase-sequence current [H]	A detection of Zero-phase-sequence current by hardware	F5
	Low Current	It happens when output current of inverter meets the condition of P.5.4, P.5.5 and so the current is unusually low.	F6
	Over Voltage [S]	It happens when DC_Link voltage of the inside of inverter exceeds the set value of P.5.12. (Software manages.)	F7
	Over Voltage [H]	It happens when there is a detection of Over Voltage by hardware.	F8
	Low Voltage	It happens when DC_Link voltage of the inside of inverter is lower than the set value of P.5.14. In case of using S/L Vector Control, it also happens when the connections between motor and inverter are cut.	F9
	Over-speeding Motor	It happens when the motor's rotating speed exceeds the speed that is set to P17.3(P.18.3, P.19.5, P.20.5).	F10
	Out of Control	It happens when a control condition is not good due to internal and external factors; when a brake is not released; when a load is extremely big; when an input signal does not go into the encoder.	F11
Drive Fault (At work)	Overheated Inverter	It happens when the temperature of heat sink in inverter exceeds 90℃.	F21
	Inverter Fault	It happens when there is a problem with a switching device of inverter.	F22
	Initial Charge Fault	It happens when you fail in charging the DC_link after you turn on the power.	F23
	Dynamic Brake Chopper (DBR)	It happens when DC_link voltage does not go up due to a problem of built-in Brake Chopper after you turn on the power. And it also happens when over current occurs or a device is damaged while Brake Chopper is at work.	F24
	Signal Input of External Fault	It happens when a Fault signal is inputted from external device.	F25

SOHO VD VECTOR INVERTER

	Fault Connection Error of gate drive voltage	It happens when time passes the set time of P5.2 with no current in the condition that P5.1=Enabled.	F26
	Open phase Fault	It happens when one of phases is broken or cut.	F27
Auto Tuning Fault (At work)	Motor Connection Fault	It happens when a connection between inverter and motor is separated.	F41
	Motor Tuning Error 1	It happens when the gained value from a process of Motor Tuning has errors.	F42
	Motor Tuning Error 2	It happens when the gained value from a process of Motor Tuning has errors.	F43
	Motor Tuning Error 3	It happens when the gained value from a process of Motor Tuning has errors.	F44
	Motor Tuning Error 4	It happens when the gained value from a process of Motor Tuning has errors.	F45
	Motor Tuning Error 5	It happens when the gained value from a process of Motor Tuning has errors.	F46
	Motor Tuning Error 6	It happens when the gained value from a process of Motor Tuning has errors.	F47
	Motor Tuning Error 7	It happens when the gained value from a process of Motor Tuning has errors.	F48
		Motor is in a stall status	Auto Tuning fails because a motor is stalled.

10. Troubleshooting

Condition		Check items	Management
When there is no rotation of motor	Inverter output does not occur.	Does the input voltage of inverter work properly?	Check the input voltage of inverter (L1, L2, L3)
		Is the KEYPAD of inverter on?	Call an agent when inverter does not get turned on, even though a contact of KEY PAD is OK
		Is the operation mode & Reference of inverter properly set?	Check a set value of parameter
		Is an operation signal inputted to the inverter?	Check if an operation signal is properly inputted
		Is a speed signal 0?	Check the connection of speed signal and the change of the signals at the terminal
		Did several warnings or faults occur?	Rerun after you release warnings and faults
	Inverter output occurs.	Is a motor properly connected?	Connect the inverter output U, V, and W to the motor input U, V, and W for each phase
		Is a motor stalled or is a load big?	Release or reduce a load
		Check if a Brake properly works when it is attached to a motor	Open a Brake and then operate
	Condition		Check list
When there is no rotation of motor	Inverter output does not occur.	Check if an open-phase occurred to a motor	Connect the inverter output U, V, and W to the motor input U, V, and W for each phase
		Is an output current of inverter equal to, or bigger than a set limit of current?	Check if a parameter setting is right and then increase speed by extending accelerating time
Condition		Check list	Management
When a motor rotates in		Is an inverter output of U, V, and W in its right place respectively?	Change the terminal location of V phase and W phase

SOHO VD VECTOR INVERTER

the opposite direction	Are the forward and reverse operating signals connected properly?	Change the location of the forward and reverse operating signals.
A speed does not increase	Isn't a load big?	Release or reduce a load Extend an accelerating time
A speed does not decelerate smoothly	Is a resistor connected to inverter?	Connect a resistor to inverter
	Isn't a deceleration smooth even though a resistor is connected?	Extend a decelerating time
	Isn't a load big?	Release or reduce a load
	When a load is big, isn't the Main Input voltage getting reduced?	Check the input voltage of the inverter
	Is there any factor that stalls motor?	Get rid of stall factor
	Is an Auto-Tuning properly operated?	Rerun Auto-Tuning
	Does a current of motor resonate?	Reset a parameter
	Is a load unsettled?	Recalculate the power
	Does a speed signal change?	Settle a speed signal

11. Maintenance and Inspection

Checking part	Check list	Checking item	Checking period		Checking method	Criterion
			Daily	Periodically		
General matter	Surroundings	Check a temperature around you, humidity, dust, harmful gas, oil remnants, and etc.	○		Check with your eyes, taste, thermometer, and hygrometer	The surrounding temperature should be $-10 \sim 40^{\circ}\text{C}$. There should be no dewdrops in 20~90% RH of the surrounding humidity. (No condensation allowed)
	General device	Unusual vibration and sound	○		Check with your eyes and ears	There should be no problem.
	Power supply voltage	Check if a voltage changes or is low	○		Check the input voltage of the inverter	It should not exceed $\pm 10\%$ of the rated voltage.
Main Circuit	General matters	Insulation resistance		○	Use 500V-mega(insulation tester) between main circuit terminal and earth terminal	There should be no problem.

SOHO VD VECTOR INVERTER

		Check if a screw is loose		○	Check with your eyes	
		Check if there is a mark of overheating		○	Check with your eyes	
	Terminal Block	Damage		○	Check with your eyes	There should be no damage.
	Smoothing Condenser	Liquid leakage, Deformation	○		Check with you eyes and ears	
	Relay	Tremble		○	Check with your ears	
	Resistor	Crack, Discoloration		○	Check with your eyes	
	Cooling Fan	Vibration, abnormal sound	○		Check with your ears	
	Cooling Water System	Dust, dirt		○	Check with your eyes	
	Wire	Deformed, stripped		○	Check with your eyes	
	Inverter Output	The 3 phase-output		○	Multi-meter Voltmeter	The 3-phase output has to be equal for each phase.
	Motor	Vibration	○		Tightening	It should be fine.
					Output Current of inverter	The 3-phase output has to be equal for each phase.
Overheating		○		Cooling FAN condition	There should be no disorder.	
Control Circuit	Operation	Protective circuit		○	Operate of your own accord	There should be no problem.
	Connection	Tightening		○	Check with your eyes and hands	There should be no problem.
	KEYPAD	Indication, working condition		○	Check with your eyes and hands	There should be no problem.

SOHO VD VECTOR INVERTER

APPENDIX

A.	Introduction of Closed Loop Application (Vector Control).....	A-1
A.1	Basic Design.....	A-1
A.2	Motor Spec. and Setting of "Closed Loop Control"	A-2
A.3	Speed reference and Setting of Digital input.....	A-3
A.4	Setting of Digital output and Analog output.....	A-4
A.5	Setting of operation pattern.....	A-5
A.6	Setting of brake control parameters using terminal output.....	A-6

<Appendix A>

Closed Loop Application(Vector Control)

A.1	Basic Design.....	A-1
A.2	Motor Spec. and Setting of “Closed Loop Control”.....	A-2
A.3	Speed reference and Setting of terminal input	A-3
A.4	Setting of Terminal output and Analog output.....	A-4
A.5	Setting of operation pattern.....	A-5
A.6	Setting of brake control parameters using terminal output...	A-6

A. Closed Loop Application (Vector Control) Operation Procedure

The chapter 7.4 explains the most basic application method for operating the inverter with Close Loop Control.

A.1 Basic Design

The following design allows you to use all the basic I/O functions when you use SOHO VD inverter. You can adjust it depending on the given condition on the field.

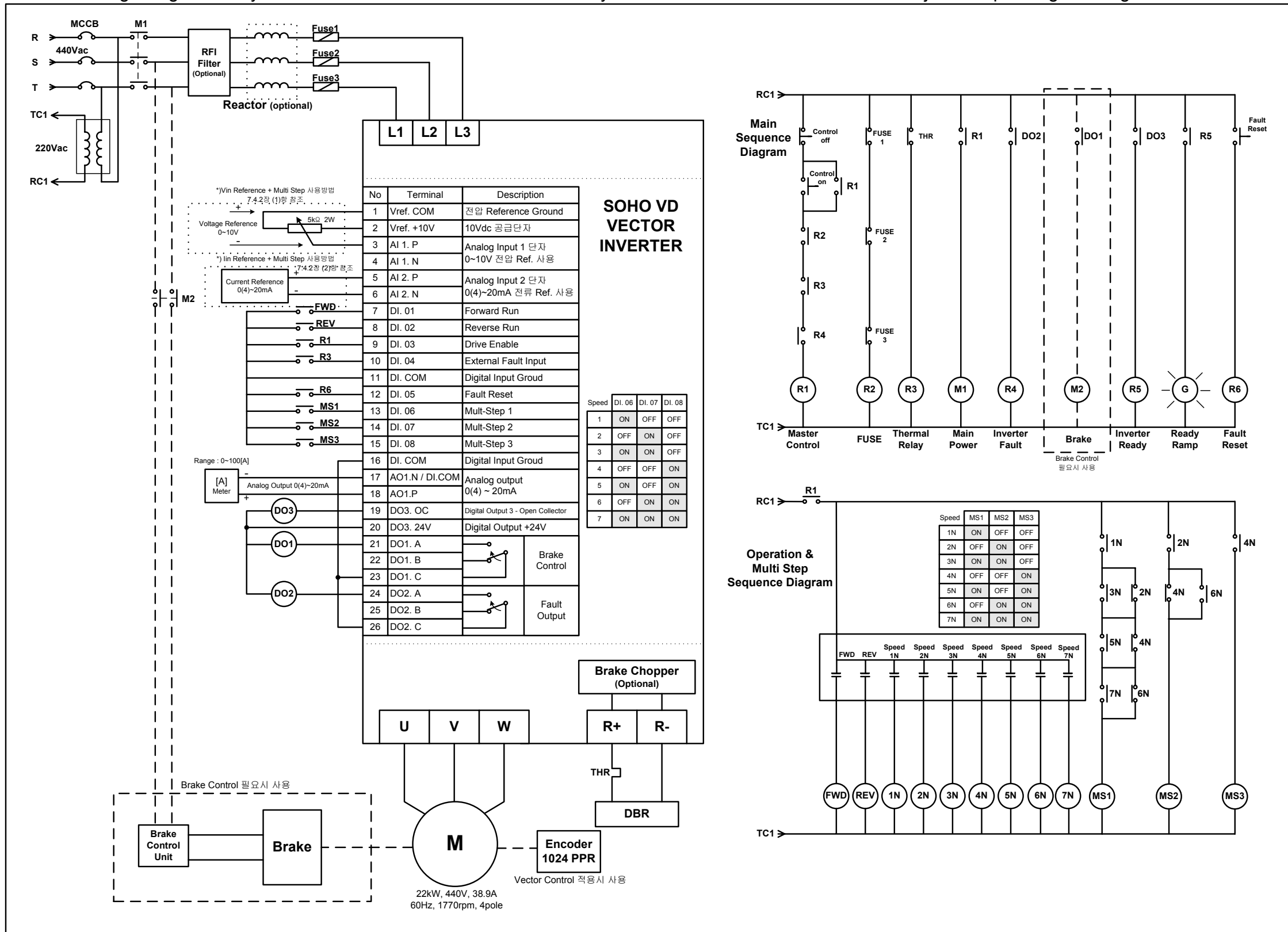


Figure A-1 Basic Design for Inverter Use - Sequence

A.2 Motor Spec. and setting of Closed Loop Control

The following is the example method of setting parameters for Open Loop Control. % An Encoder should be attached to the motor.

Rated specification of the motor					
Rated Power	22 kW	Rated Current	38.9 A	Rated Speed	1770 rpm
Rated Voltage	440 V	Rated Frequency	60 Hz	Pole	4 pole

(1) Setting parameters for motor spec.

Setting order	Parameter Group 1 : Control Setup[Motor 1]			
	Par.Number	Parameter name	Set Value	Description
1	P 1. 0	Motor Rated Power	22 kW	Rated Power of motor
2	P 1. 1	Motor Rated Voltage	440 V	Rated Voltage of motor
3	P 1. 2	Motor Rated Current	38.9 A	Rated Current of motor
4	P 1. 3	Motor Rated Frequency	60 Hz	Rated Frequency of motor
5	P 1. 4	Number of Poles	4 Pole	Number of Pole
6	P 1. 5	Motor Rated Speed	1770 rpm	Rated Speed of motor

(2) Setting of motor Control Method (An encoder should be installed to the motor)

► When a Brake is not installed to the motor or it can be released while auto-tuning

Setting order	Parameter Group 1 : Control Setup[Motor 1] : Control setting for motor 1			
	Par.Number	Parameter name	Set Value	Description
1	P 1. 6	Control Method	[3] = Vector Speed Control	Vector Speed Control
Parameter Group 14 : Auto Tuning Configuration : Setting of Auto-Tuning				
2	P14.0	Motor Tuning Condition	[0] = Free	Motor is not in stall condition.
Main Menu Page[3] Auto Tuning				
3	M3-[1]	Execute the "Motor Tuning" (Refer to chapter 7.3)		
4	M3-[2]	Execute the "Speed Tuning" (Refer to chapter 7.3)		

Move to " Chapter A.3 Speed reference and setting of Digital input " Page A-2

► When a brake is installed to the motor and it cannot be opened while auto-tuning

(Auto Tuning = [2] Speed Tuning cannot be executed in this case)

Setting order	Parameter Group 1 : Control Setup[Motor 1] : control Setting for motor 1			
	Par.Number	Parameter Name	Set Value	Description
1	P 1. 6	Control Method	[3] = Vector Speed Control	Vector Speed Control
Parameter Group 14 : Auto Tuning Configuration : Auto - Tuning Setting				
2	P14.0	Motor Tuning Condition	[1] = Locked	Motor is in stall condition
3	M3-[1]	Execute the "Motor Tuning" (Refer to the chapter 7.3)		
Parameter Group 19 : Vector Control [Motor 1]				
4	P19.19	Speed PI Gain	[0] = Default Gain	Use Default values for PI Gain of Speed Control Loop P19.22, P19.23 can be adjusted for user's desire.

Move to the " chapter A.3 speed reference and setting of Digital input "

A.3 Speed reference and setting of Digital input

This is the setting method to compose the system using analog input and Digital input like figure A-1 Basic Design. In this case, SOHO VD inverter recognizes the Analog input as a speed reference if the multi-step digital input is not detected. If there is one or more multi-

step digital input is detected, the inverter automatically recognizes it as the speed reference.

(1) Parameter setting for Voltage (0[-10]~10V) reference + Multi-Step speed reference

Setting order	Par.Number	Parameter Name	Set Value	Description
Parameter Group 3 : Reference Setup 1 : Speed or Frequency reference for motor 1				
1	P 3. 0	RUN/STOP Method	[0] = Terminal	RUN/STOP with DI.01 and DI.02
2	P 3. 1	Reference Method	[0] = Terminal	Use Analog or Digital input for speed or frequency reference.
Parameter Group 6 : Analog Input Setup : Setting for Analog input				
3	P 6. 0	Reference Mode	[1] = r1 only	Use only r1 for analog input
4	P 6. 1	Analog Input 1 Function	[1] = reference 1	Use r1 for AI1
5	P 6. 2	Analog Input 1 Type	[0] = 0~10V	The type of speed reference Use 0 ~ 10 V
Parameter Group 8 : Digital Input Setup : Setting for Digital input				
6	P 8. 0	RUN/STOP	[0] = FWD → DI.01 REV → DI.02	Setting digital input for RUN/STOP
7	P 8. 1	DI.03 Function	[1] = Drive Enable	Set DI.03 function to "Drive Enable"
8	P 8. 2	DI.04 Function	[9] = External Fault A	Set DI.04 function to "External Fault A"
9	P 8. 3	DI.05 Function	[5] = Fault Reset	Set DI.05 function to "Fault Reset"
10	P 8. 4	DI.06 Function	[2] = Multi Step 0	Set DI.06 function to "multi step 0"
11	P 8. 5	DI.07 Function	[3] = Multi Step 1	Set DI.07 function to "multi step 1"
12	P 8. 6	DI.08 Function	[4] = Multi Step 2	Set DI.08 function to "multi step 2"

Move to " chapter A.4 Setting of Digital output and Analog output "

(2) Parameter setting for current(0[4]~20mA) input reference + Multi-step reference

Setting order	Parameter Group 3 : Reference Setup 1 : Speed or Frequency reference for motor 1			
	Par.Number	Parameter Name	Set Value	Description
1	P 3. 0	RUN/STOP Method	[0] = Terminal	RUN/STOP with DI.01 and DI.02
2	P 3. 1	Reference Method	[0] = Terminal	Use Analog or Digital input for speed or frequency reference.
Parameter Group 6 : Analog Input Setup : Set analog input				
3	P 6. 0	Reference Mode	[1] = r1 only	Use only r1 for analog input
4	P 6.15	Analog Input 2 Function	[1] = reference 1	Use r1 for AI2
5	P 6.16	Analog Input 2 Type	[3] = 4~20mA	Use current input: 4~20mA
			[4] = 0~20mA	Use current input: 0~20mA
Parameter Group 8 : Digital Input Setup : Set Digital Input				
6	P 8. 0	RUN/STOP	[0] = FWD → DI.01 REV → DI.02	Control Run/Stop by digital input setting
7	P 8. 1	DI.03 Function	[1] = Drive Enable	Set DI.03 function to "Drive Enable"
8	P 8. 2	DI.04 Function	[9] = External Fault A	Set DI.04 function to "External Fault A"
9	P 8. 3	DI.05 Function	[5] = Fault Reset	Set DI.05 function to "Fault Reset"
10	P 8. 4	DI.06 Function	[2] = Multi Step 0	Set DI.06 function to "Multi Step 0"
11	P 8. 5	DI.07 Function	[3] = Multi Step 1	Set DI.07 function to "Multi Step 1"
12	P 8. 6	DI.08 Function	[4] = Multi Step 2	Set DI.08 function to "Multi Step 2"

Move to the chapter " A.4 Setting of Digital output and analog output "

A.4 Setting of Digital output and Analog Output

Figure A-1 This is the setting method for digital output composition like basic design.

Setting order	Parameter Group 11 : Analog Output Configuration : Setting for Analog Output			
	Par.Number	Parameter Name	Set Value	Description
1	P11. 0	AO 1 Output Selection	[2] = Motor Current	Set the Analog Output to "Motor Current"
2	P11. 1	AO 1 Output Type	[0] = 0~20mA	Set the Analog Output range to "0~20mA"
			[1] = 4~20mA	Set the Analog Output range to "4~20mA"
3	P11. 5	AO 1 Output at 20mA	100	Set the output value when Analog Output is 20mA. (The maximum display of the used current meter in design is 100A, so set this to 100)
Setting order	Parameter Group 12 : Digital Output Setup : Setting for Digital Output			
	Par.Number	Parameter Name	Set Value	Description
4	P12. 0	DO 1 Function	[4] = Motor Brake	The Digital Output 1 is set to "brake control" (Refer to chapter 7.4.6)
5	P12. 1	DO 2 Function	[2] = Fault Out A	This is activated when Fault occurs. (A contact)
6	P12. 3	DO 3 Function	[1] = Drive Ready	This is activated when the inverter is in "Drive ready" condition.

Move to "chapter A.5 Setting of operation pattern "

A.5 Setting of operation pattern

This explains the parameter setting for the following operation pattern as Figure A-2. The basic input method is figure A-1.

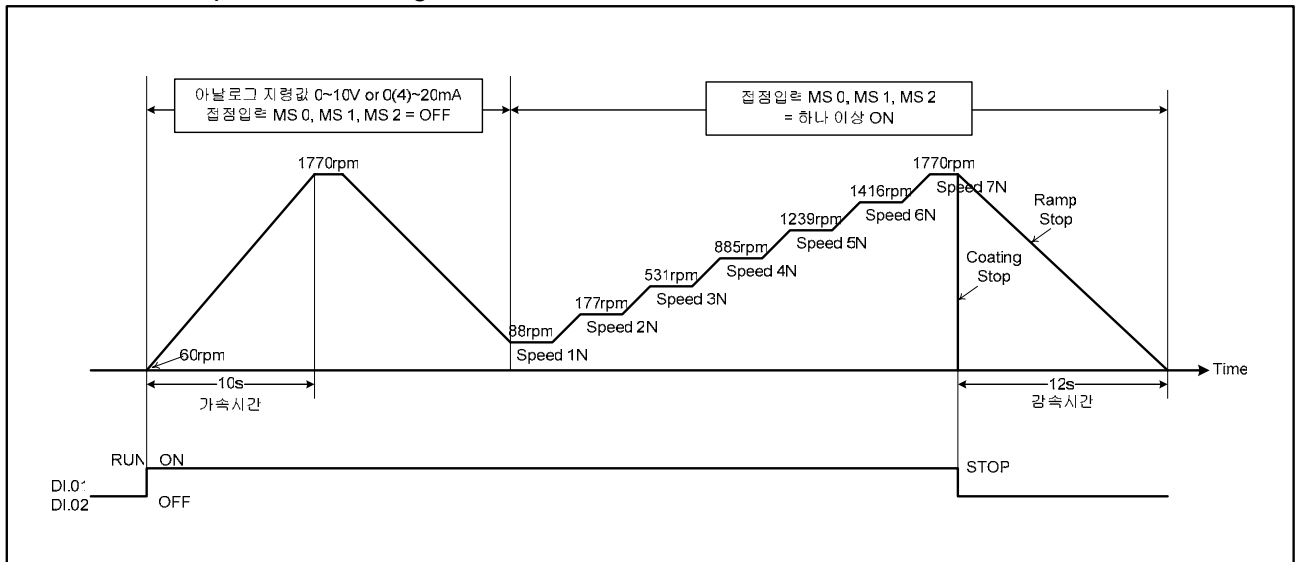


Figure A-2 Example of "Vector Speed Control" – operation pattern.

① Setting of Reference Setup

Setting order	Parameter Group 3 : Reference Setup 1			
	Par.Number	Parameter Name	Set Value	Description
1	P 3. 3	STOP Mode	[0] = Ramp Stop	Inverter controls the output until the

				motor stops completely after RUN signal is OFF.
			[1] = Free-Run Stop	Inverter cuts off the output immediately as RUN signal is OFF.
2	P 3. 9	Accel.Switching Ref[1-2]	100%	100% = Max. speed or Max. frequency
3	P 3.10	Accel.Switching Ref[2-3]	110%	
4	P 3.16	Accel.Time I 1	10s	Accel range 1 – refer to the description
5	P 3.26	Decel.Switching Ref[1-2]	100%	100% = Max. speed or Max. frequency
6	P 3.27	Decel.Switching Ref[2-3]	110%	
7	P 3.33	Decel.Time I 1	12s	Decel range 1 – refer to the description

② Setting for Multi Step Reference

Setting order	Parameter Group 9 : Multi Step Reference (100% = rated motor speed)			
	Par.Number	Parameter Name	Set Value	Description
1	P 9. 1	Multi Step 1 Reference	5%	1770rpm X 5% = 88rpm
2	P 9. 2	Multi Step 2 Reference	10%	1770rpm X 10% = 177rpm
3	P 9. 3	Multi Step 3 Reference	30%	1770rpm X 30% = 531rpm
4	P 9. 4	Multi Step 4 Reference	50%	1770rpm X 50% = 885rpm
5	P 9. 5	Multi Step 5 Reference	70%	1770rpm X 70% = 1239rpm
6	P 9. 6	Multi Step 6 Reference	80%	1770rpm X 80% = 1416rpm
7	P 9. 7	Multi Step 7 Reference	100%	1770rpm X 100% = 1770rpm

③ Operation pattern setting for Vector Control

Setting order	Parameter Group 18 : Vector Control [Motor 1]			
	Par.Number	Parameter Name	Set Value	Description
1	P18. 1	Minimum Speed	60 rpm	Setting for Min. speed
2	P18. 2	Maximum Speed	1770 rpm	Setting for Max. speed
3	P18. 3	Over Speed Limit	1820 rpm	Setting for Limit for over speed

<Setting completed!> If Brake control is used, refer to A.6

A.6 Setting the brake control parameters using digital output

This explains the related parameters when the brake is controlled using digital output as figure A-3 and A-4 like the basic design of Figure A-1.

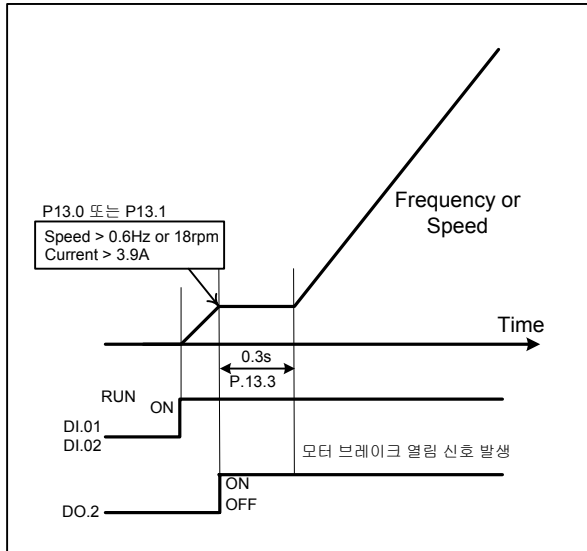


Figure A-3 Brake open signal

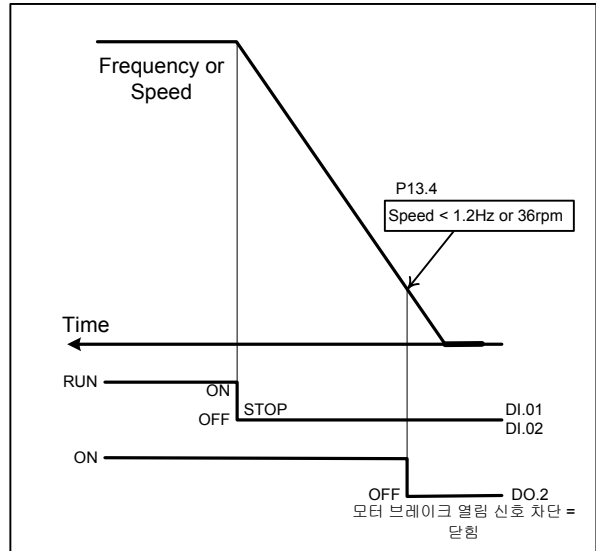


Figure A-4 Brake close signal

Setting order	Parameter Group 12 : Digital Output Setup : setting for Digital Output			
	Par.Number	Parameter Name	Set Value	Description
1	P12. 1	DO.2 Function	[4] = Motor Brake	Set DO.2 to "motor brake"
Parameter Group 13 : Magnetic Brake Control : setting for motor brake control				
2	P13. 0	M1 Locked state Up_Ref	1%	Speed or frequency reference when digital output is ON. (60Hz,1770rpm) X 1% = 0.6Hz, 18rpm
3	P13. 1	M1 Locked state Down_Ref	1%	
4	P13. 2	M1 Open Current	10%	The amount of current when digital output is ON. 38.9A X 10% = 3.9A
5	P13. 3	M1 Open Response Time	0.3s	The speed or frequency reference is kept for the set value of time. The time should be set depending on the elapsed time until the brake is opened completely after digital output is ON.
6	P13. 4	M1 Close Reference	2%	Speed or frequency reference when digital output is OFF. (60Hz,1770rpm) X 2% = 1.2Hz, 36rpm

<Digital output setting is completed for brake control>

SOHO VD VECTOR INVERTER

Warning

1. Please read the manual before using the SOHO VD Vector Inverter for safety.
2. Please let the person who is an expert in Electric do the electric construction and wiring work.

194-53, Anyang 7 Dong,
Manan-gu, Anyang city,
Kyungki-Do, Korea 430-817
Tel) 82-031-4636-672~74
Fax) 82-031-468-3311

Dealer