



iMASTER – A1

User's Manual

CONTENTS

1. A1 series VFD	1
1.1 Information before Use	1
1.1.1 Check of product.....	1
1.1.2 Parts	1
1.1.3 Preparation of device and Parts for operation	1
1.1.4 Installation	2
1.1.5 Distribution	2
1.2 Names and Uses of Parts	2
1.2.1 End product.....	2
1.2.2 Remove the front cover	3
2. Specifications.....	4
2.1 Specifications.....	4
2.1.1 200V class (032A ~ 310A)	4
2.1.2 400V class (016A ~ 217A)	5
2.1.3 400V class (260A ~ 296A)	6
2.1.4 Other commons.....	7
3. Installation	1 0
3.1 Installation	1 0
3.1.1 Cautions before installation.....	1 0
3.1.2 A1 Dimension (IP00)	1 2
4. Wiring	2 0
4.1 Wiring.....	2 0
4.1.1 Installation method of VFD keypad to panel	2 0
4.1.2 Wiring precaution	2 1
4.1.3 A1 Terminal Connection Diagram and Description	2 5
4.1.4 Terminal wiring diagram (Power terminal block)	2 7
4.1.5 Control terminal line diagram (Basic I/O terminal block)	2 9
5. Peripheral Devices.....	3 3
5.1 Peripheral Devices.....	3 3
5.1.1 Composition of peripheral devices	3 3
5.1.2 Dynamic braking unit (DBU) and Resistors	3 5
6. Keypad.....	3 6
6.1 Keypad View & Operation	3 6
6.1.1 Keypad View.....	3 6
6.1.2 Keypad operation	3 9
7. Quick Start Guide	5 1
7.1 Frequency Command Source to Up/Down Arrow Keys	5 1
7.2 Frequency Command Source to Input Analog Voltage/ Current	5 2
7.3 Frequency Command Source to Input Terminal – Multi Speed Frequency	5 3

7.4Frequency Command Source to Input Terminal – Up/Down	5 4
7.5Frequency Command Source to Modbus RS–485	5 5
7.6Run Command Source to Run / Stop Keys on Keypad	5 6
7.7Run Command Source to Input Terminal	5 6
7.8Run Command Source to Modbus RS–485.....	5 7

8. A1 Parameters 5 8

8.1A1 Parameters Overview	5 8
8.1.1 VFD running status	5 9
8.1.2 Frequency reference indication	5 9
8.1.3 Trip information	5 9
8.1.4 Time counter.....	6 1
8.1.5 VFD firmware Information.....	6 1
8.1.6 Standard DI, DO (RN0~RN3, AL0–AL1–AL2)	6 2
8.1.7 Standard AI (O, OI)	6 3
8.1.8 Standard AO (FM, AMI).....	6 4
8.1.9 Start/stop/direction	6 5
8.1.10 Start/Stop mode	6 7
8.1.11 Frequency reference.....	6 8
8.1.12 Acceleration/Deceleration.....	7 0
8.1.13 Speed search.....	7 0
8.1.14 Over voltage suppression.....	7 1
8.1.15 KEB	7 1
8.1.16 DWELL	7 1
8.1.17 Frequency limits	7 1
8.1.18 Fault functions.....	7 2
8.1.19 Motor thermal protection.....	7 3
8.1.20 System Overload/Underload detection.....	7 3
8.1.21 PID.....	7 4
8.1.22 DBR Duty Cycle	7 6
8.1.23 Monitoring/Scaling.....	7 6
8.1.24 Droop.....	7 6
8.1.25 RS–485 (Modbus)	7 6
8.1.26 Fieldbus (option)	7 7
8.1.27 User parameters	7 8
8.1.28 System	7 9
8.1.29 Motor control.....	7 9
8.1.30 Motor data.....	8 1
8.2Parameter detail	8 3
8.2.1 VFD running status	8 3
8.2.2 Frequency reference indication	8 5
8.2.3 Trip information	8 6
8.2.4 Time counter.....	8 8
8.2.5 VFD firmware information.....	9 0
8.2.6 Standard DI, DO.....	9 1
8.2.7 Standard AI (O, OI)	1 0 0
8.2.8 Standard AO (FM, AMI).....	1 0 5
8.2.9 Start/Stop/Direction	1 0 9
8.2.10 Start/Stop mode	1 1 4
8.2.11 Frequency reference.....	1 1 7

8.2.12	Acceleration/Deceleration.....	1 2 7
8.2.13	Speed Search.....	1 3 1
8.2.14	Over voltage suppression.....	1 3 2
8.2.15	KEB.....	1 3 7
8.2.16	DWELL.....	1 3 8
8.2.17	Frequency limits.....	1 3 9
8.2.18	Fault functions.....	1 4 0
8.2.19	Motor thermal protection.....	1 4 5
8.2.20	System Overload/Underload detection.....	1 4 6
8.2.21	PID.....	1 4 8
8.2.22	DBR Duty cycle.....	1 5 6
8.2.23	Monitoring/Scaling.....	1 5 7
8.2.24	Droop.....	1 5 8
8.2.25	RS-485 (Modbus).....	1 6 1
8.2.26	Fieldbus (option).....	1 6 8
8.2.27	User parameters.....	1 6 9
8.2.28	System.....	1 7 0
8.2.29	Motor control.....	1 7 2
8.2.30	Motor data.....	1 8 1
9.	Checking and Trouble shooting.....	1 8 6
9.1	Error code.....	1 8 6
9.1.1	Error code list.....	1 8 6
9.2	Trouble Shooting.....	1 8 8
9.2.1	Trip monitor display.....	1 8 8
9.2.2	oC (Over Current).....	1 8 9
9.2.3	SC (Short Circuit).....	1 9 0
9.2.4	ETH (Motor Overload).....	1 9 1
9.2.5	IoLt (VFD Overload).....	1 9 2
9.2.6	ov (DC link Over Voltage).....	1 9 3
9.2.7	Lv (DC link Under Voltage).....	1 9 4
9.2.8	ot (Over Temperature).....	1 9 5
9.2.9	PF (Input Power Loss).....	1 9 6
9.2.10	FF (Fan Fault).....	1 9 7
9.2.11	VFD doesn't turn on.....	1 9 8
10.	Functional Safety.....	1 9 9
10.1	Functional Safety.....	1 9 9
10.1.1	Safety standard product.....	1 9 9
10.1.2	Safety function description and wiring diagram.....	1 9 9

1. A1 series VFD

1.1 Information before Use

1.1.1 Check of product

Bring the VFD out of the box, check the rating shown on a side of the product body and whether the VFD type and rated output are exactly what you ordered. Check also whether the product has been damaged during delivery.

Model: A1–140A^(Note1)–2E– 00

A1		140A		2	E	00
name		Max. Applicable Motor Capacity		Input Voltage	Keypad	IP
A1	032A	7.5	[kW]	2: 3Phase 200 ~ 240[V]	E: LED C: LCD	00: IP00 54: IP54
	045A	11	[kW]			
	064A	15	[kW]			
	076A	18.5	[kW]			
	090A	22	[kW]			
	114A	30	[kW]			
	140A	37	[kW]			
	170A	45	[kW]			
	205A	55	[kW]			
	261A	75	[kW]			
	310A	90	[kW]			
	016A	7.5	[kW]	4: 3Phase 380 ~ 480[V]		
	023A	11	[kW]			
	032A	15	[kW]			
	038A	18.5	[kW]			
	045A	22	[kW]			
	058A	30	[kW]			
	075A	37	[kW]			
	090A	45	[kW]			
	110A	55	[kW]			
	149A	75	[kW]			
	176A	90	[kW]			
	217A	110	[kW]			
	260A	132	[kW]			
	296A	160	[kW]			

1.1.2 Parts

If you have any doubt about the product or found the product damaged, call our company's branch offices (see the back cover of the manual)

1.1.3 Preparation of device and Parts for operation

Preparation for operation might slightly vary. Prepare parts according to the use.

1.1.4 Installation

Make sure you install the product correctly considering the place, direction or surroundings in order to prevent decrease in the life and performance of the VFD.

1.1.5 Distribution

Connect the power supply, electric motor and operating signals (control signals) to the terminal block. If you fail to connect them correctly, the VFD and peripheral devices might be damaged.

1.2 Names and Uses of Parts

1.2.1 End product



1.2.2 Remove the front cover



2. Specifications

2.1 Specifications

2.1.1 200V class (032A ~ 310A)

Model A1-xxxA ^(Note1) -2				032	045	064	076	090	114	
Motor Applied [kW] ^(Note2)			HD	5.5	7.5	11	15	18.5	22	
			ND	7.5	11	15	18.5	22	30	
Rated Output	Rated Output ^(Note3) Current [A]		HD	24	32	45	64	76	90	
			ND	32	45	64	76	90	114	
	Rated Capacity [kVA]	HD	200V	8	11	16	22	26	31	
			240V	10	13	19	27	32	37	
		ND	200V	11	16	22	26	31	39	
			240V	13	19	27	32	37	47	
	Output Frequency [Hz]			0~400Hz ^(Note4)						
	Output Voltage [V]			3 Phase 200~240V ^(Note5)						
Rated Input	Available Voltage [V]			3 phase 200~240V (±10%)						
	Input Frequency [Hz]			50/ 60Hz (±5%)						
	Rated Input Current [A]		HD	23	32	45	64	77	92	
			ND	31	45	64	77	91	116	
	Power loss [kW]		HD	0.15	0.21	0.31	0.42	0.52	0.62	
ND			0.21	0.31	0.42	0.52	0.62	0.84		
EMC Filter				Built-in 61800-3 C3						

Model A1-xxxA ^(Note1) -2				140	170	205	261	310	-	
Motor Applied [kW] ^(Note2)			HD	30	37	45	55	75	-	
			ND	37	45	55	75	90	-	
Rated Output	Rated Output ^(Note3) Current [A]		HD	114	140	170	211	261	-	
			ND	140	170	205	261	310	-	
	Rated Capacity [kVA]	HD	200V	39	48	59	73	90	-	
			240V	47	58	71	88	108	-	
		ND	200V	48	59	71	90	107	-	
			240V	58	71	85	108	129	-	
	Output Frequency [Hz]			0~400Hz ^(Note4)						
	Output Voltage [V]			3 Phase 200~240V ^(Note5)						
Rated Input	Available Voltage [V]			3 phase 200~240V (±10%)						
	Input Frequency [Hz]			50/ 60Hz (±5%)						
	Rated Input Current [A]	HD	102.9	126.9	154.4	187.7	257.3	-		
		ND	126.9	154.4	188.7	257.3	308.8	-		
	Power loss [kW]	HD	0.60	0.74	0.90	1.10	1.50	-		
ND		0.74	0.90	1.10	1.50	1.80	-			
EMC Filter				Built-in 61800-3 C3						

2.1.2 400V class (016A ~ 217A)

Model A1-xxxA ^(Note1) -4				016	023	032	038	045	058	
Motor Applied [kW] ^(Note2)				HD	5.5	7.5	11	15	18.5	22
				ND	7.5	11	15	18.5	22	30
Rated Output	Rated Output ^(Note3) Current [A]			HD	12	16	23	32	38	45
				ND	16	23	32	38	45	58
	Rated Capacity [kVA]	HD	380V	8	11	15	21	25	30	
			480V	10	13	19	27	32	37	
		ND	380V	11	15	21	25	30	38	
			480V	13	19	27	32	37	48	
	Output Frequency [Hz]				0~400Hz ^(Note4)					
	Output Voltage [V]				3 Phase 380~480V ^(Note5)					
Rated Input	Available Voltage [V]				3-phase 380~480V (±10%)					
	Input Frequency [Hz]				50/ 60Hz (±5%)					
	Rated Input Current [A]			HD	12	16	23	32	38	46
				ND	16	23	32	38	45	59
	Power loss [kW]			HD	0.15	0.21	0.31	0.42	0.52	0.62
				ND	0.21	0.31	0.42	0.52	0.62	0.84
EMC Filter					Built-in 61800-3 C3					

Model A1-xxxA ^(Note1) -4				075	090	110	149	176	217
Motor Applied [kW] ^(Note2)			HD	30	37	45	55	75	90
			ND	37	45	55	75	90	110
Rated Output	Rated Output ^(Note3) Current [A]		HD	58	75	90	110	149	176
			ND	75	90	110	149	176	217
	Rated Capacity [kVA]	HD	380V	38	49	59	72	98	116
			480V	48	62	75	91	124	146
		ND	380V	49	59	72	98	116	143
			480V	62	75	91	124	146	180
	Output Frequency [Hz]			0~400Hz ^(Note4)					
	Output Voltage [V]			3 Phase 380~480V ^(Note5)					
Rated Input	Available Voltage [V]			3-phase 380~480V (±10%)					
	Input Frequency [Hz]			50/ 60Hz (±5%)					
	Rated Input Current [A]		HD	59.6	73.5	89.4	109.2	149.0	178.8
			ND	73.5	89.4	109.2	149.0	178.8	218.5
	Power loss [kW]		HD	0.60	0.74	0.90	1.10	1.50	1.80
ND			0.74	0.90	1.10	1.50	1.80	2.20	
EMC Filter				Built-in 61800-3 C3					

2.1.3 400V class (260A ~ 296A)

Model A1-xxxA ^(Note1) -4				260	296	-	-	-	-
Motor Applied [kW] ^(Note2)			HD	110	132	-	-	-	-
			ND	132	160	-	-	-	-
Rated Output	Rated Output ^(Note3) Current [A]		HD	217	260	-	-	-	-
			ND	260	296	-	-	-	-
	Rated Capacity [kVA]	HD	380V	143	171	-	-	-	-
			480V	180	216	-	-	-	-
		ND	380V	171	195	-	-	-	-
			480V	216	246	-	-	-	-
	Output Frequency [Hz]			0~400Hz ^(Note4)					
	Output Voltage [V]			3 Phase 380~480V ^(Note5)					
Rated Input	Available Voltage [V]			3-phase 380~480V (±10%)					
	Input Frequency [Hz]			50/ 60Hz (±5%)					
	Rated Input Current [A]	HD	218.5	262.2	-	-	-	-	
		ND	262.2	317.8	-	-	-	-	
	Power loss [kW]	HD	2.20	2.64	-	-	-	-	
ND		2.64	3.20	-	-	-	-		
EMC Filter				Built-in 61800-3 C3					

Note 1) The number that has included at model name means rated current of VFD

Note 2) Motor Applied indicates the maximum capacity applied to use of a standard 4 pole standard motor.

Note 3) The output of rated current is limited according to setting of the carrier frequency.

Note 4) In case of Sensorless, you can set the frequency at up to 300Hz by selecting 2 as the '**98.01' (Motor control mode)**

Note 5) The maximum output voltage does not go up over the supplied power voltage. You can select the output voltage as you want below the supplied power voltage.

2.1.4 Other commons

1) Control & Operation

Features		Performance Specification
Control Method ^(Note1)		V/F control, Sensorless Vector
Output Frequency Range ^(Note2)		0.5 ~ 400Hz (Sensorless Vector Control: 0.5 ~ 300Hz)
Frequency Accuracy		Digital command $\pm 0.01\%$ of Max Frequency / Analog Frequency $\pm 0.1\%$ ($25 \pm 10^\circ\text{C}$)
Frequency Resolution		Digital Setting : 0.01Hz (below 100Hz), 0.1Hz (above 100Hz) Analog setting: 0.06Hz (DC 0~10V, 4~20mA)
Voltage/ frequency Characteristic		Constant torque, Variable torque
Carrier Frequency		1~10kHz (default: ND 2kHz, HD 3kHz)
Overload Current Rate		Heavy Duty(150%, 1min), Normal Duty(120%, 1min)
Acceleration/Deceleration		0.1~3000 sec (Linear, S curve, U curve), 2 ND Acceleration and Deceleration
DC Injection Braking		Separately configurable start and stop up to 10 sec, 100 % motor rated current
Input Signal	Frequency	- Set by Keypad (LED, LCD) - Input voltage: DC 0~10V (Input impedance 10KΩ) - Input current: DC 4~20mA (Input impedance 200Ω)
	Run/Stop	- Run / Stop key - Input Terminal: Forward Run/Reverse Run - Input Terminal: Start, Stop, FW/RV Selection
	Intelligent Input Terminal	- Run selection 1~2, Run source 1~3 - Frequency selection 1~2 - Multi-speed Inputs 1~3 - Jogging 1~2 - External trip 1~5 - UP/DOWN - PID Integral Reset, PID Disable 2nd Acceleration / Deceleration - Emergency Stop - Reset - Parameter lock

Features		Performance Specification
Output Signal	Intelligent Output Terminal (RN0–RN1,RN2–RN3, AL0–AL1–AL2)	▪ Run (VFD Running Status Signal) ▪ FA1 (Frequency Arrival Signal 1) ▪ FA2 (Frequency Arrival Signal 2) ▪ OL (Overload Alarm) ▪ OD (PID Error Deviation Signal) ▪ AL (Fault Signal)
	FM Output	Analog Output Meter (DC 0~10V full scale. Max • 1mA) Output Frequency, Output Current, Output Voltage, Output Power and Output Torque
	AMI Output	Analog Output Meter (4~20mA full scale. Max • 250Ω) Output Frequency, Output Current, Output Voltage, Output Power and Output Torque

2) Application & Protection Functions

Features	Performance Specification
Application Specification Functions	▪ Curved Acceleration / Deceleration Profile, ▪ Upper and Lower Limiters, ▪ 8–stage Speed Profile, ▪ Carrier Frequency Change (1 to 10Khz), ▪ Frequency Skip ▪ Process Jogging, ▪ Electronic Thermal Level Adjustment, ▪ Retry Function, ▪ Trip History Monitor, ▪ Auto Tuning, ▪ V/f Characteristic Selection, ▪ Speed Search ▪ Automatic Torque Boost, ▪ Frequency Conversion Display,
Protection Functions	▪ Over Current / Short Circuit ▪ DC link Over Voltage /DC link Under Voltage, ▪ Motor Overload, ▪ VFD Overload ▪ EEPROM Error, ▪ Communication Error, ▪ IGBT Over Temperature, ▪ Input Phase loss, ▪ Ground Fault, ▪ External Event ▪ Fan Fault ▪ OVS Control Fail ▪ Safety

3) Use Environment & Option

Feature		Performance Specification
Environment specification	Ambient Temperature	CT (Heavy Duty) load: – 10 ~ 50°C VT (Normal Duty) load: – 10~ 40°C (It is recommended that you use less than 80% load when you use VT load at 50°C. And if ambient temperature is above 40°C, Carrier frequency should be lower than default value.)
	Storage temperature	–20~60°C
	Ambient humidity	Below 90% RH (Installed with no dew condensation)
	Vibration	5.9m/s ² (0.6G). 10~55Hz
	Shock	10 Hz to 20Hz, 9.8m/s ² Max, 20Hz to 55Hz, 5.9m/s ² Max
	Location	Under 1000m above sea level, indoors (Installed away from corrosive gasses dust)
Standard Compliant		UL 508C, IEC 61800–3
Protective Design		IP00 open–chassis, NEMA Type 1 enclosure.
Option		Fieldbus, Ext I/O, Encoder, Remote operator, Bracket, AC reactor, Noise filter, Braking resistor, Dynamic braking unit (EMC filter and DC reactor are Built in.)

Note 1) **'98.01'(Motor control mode)** to 2 (sensorless vector control) Selected, refer to below

- Set a value more than 2kHz at **'98.03'(PWM carrier frequency)**
- Sensorless vector performance will be reduced when using a motor less than half of the rated capacity of the VFD.
- Multiple motors cannot be driven by sensorless vector control.

Note 2) To operate the motor over rated frequency, consult the motor manufacturer about the maximum allowable rotation speed.

3. Installation

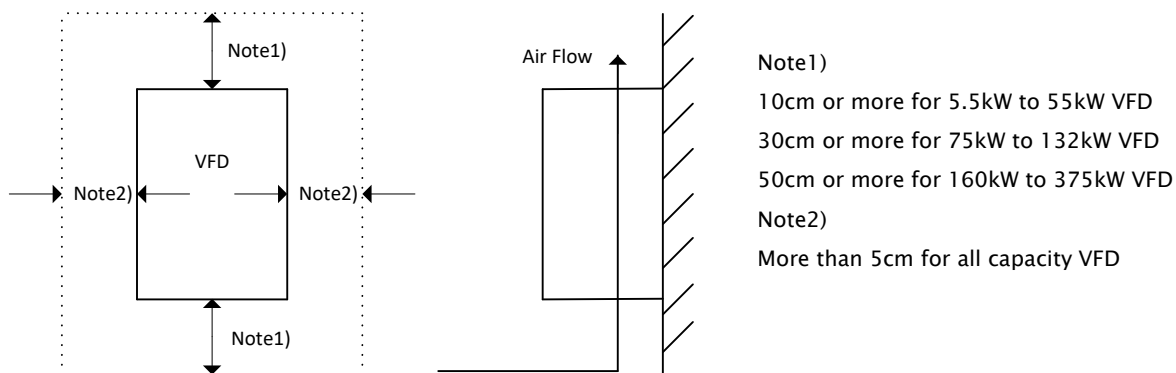
3.1 Installation

3.1.1 Cautions before installation

⚠ CAUTION

Failure to following recommendation may result in VFD damage, Personal Injury, or Fire.

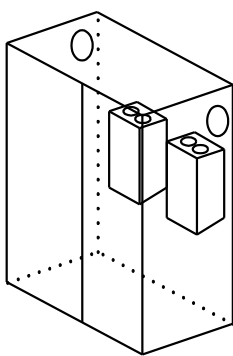
- Be sure to install the unit on flame resistant material such as metal.
- Be sure not to place anything flammable such as corrosive gas, explosive gas, inflammable gas, grinding fluid mist, salt in the vicinity
- Do not carry the unit by the top cover, but always by supporting the base of the unit
- Be sure not to let foreign matter enter such as cut wire refuse, spatter from welding, iron refuse, wire, dust, etc.
- Be sure to install the VFD in a place which can support the weight according to the specification in the manual.
- Be sure to install the unit on a perpendicular wall which is not subject to vibration.
- Be sure not to install and operate a damaged VFD or one with the missed parts
- Be sure to install the unit in an area which is not exposed to direct sunlight and well ventilated. Avoid an environment which tends to be high in temperature, high in humidity or to have condensation.



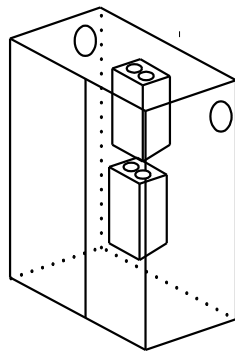
It is critical to mount the VFD to the proper surface in order to prevent any possible risk of fire. The temperature of the VFD heatsink can rise very high. The surface must be made of a non-flammable material (i.e. steel). Attention should also be made to the air gap surrounding the VFD. Especially, when there is a heat source such as a braking resistor or reactor.

⚠ CAUTION

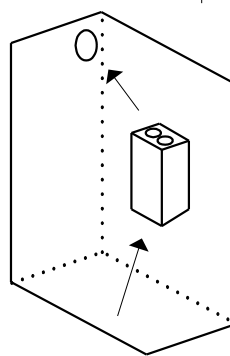
- Avoid direct ray of light or a warm and humid place.
- Install the VFD in a place free from dust, corrosive gas, explosive gas, combustible gas, mist of coolant and sea damage.
- Allowable Temperature range (14 to 122°F, –10 to 50°C).
- Allowable humidity range (Below 90% RH).



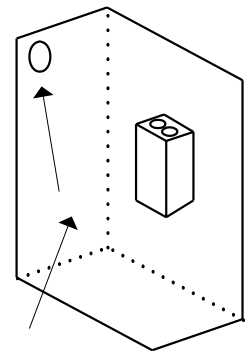
Acceptable (O)



Unacceptable (X)



Acceptable (O)



Unacceptable (X)

Mount the VFD in a vertical position using screws or bolts. The mounting surface should also be free from vibration and can easily hold the weight of the VFD.

3.1.2 A1 Dimension (IP00)

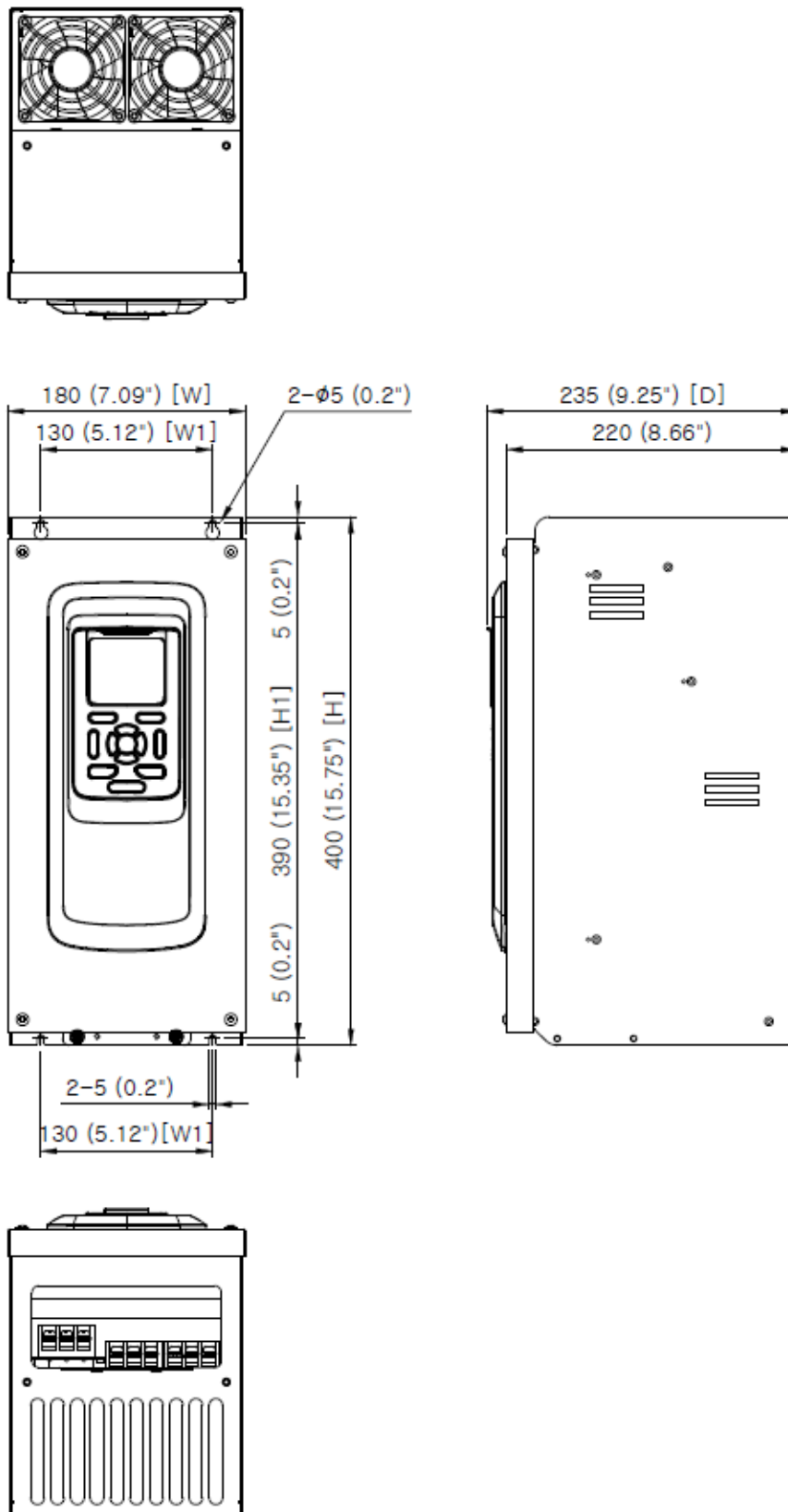
Summarized that is the dimension of A1 models

Respective drawing and sizes are specified in 1) ~ 4)

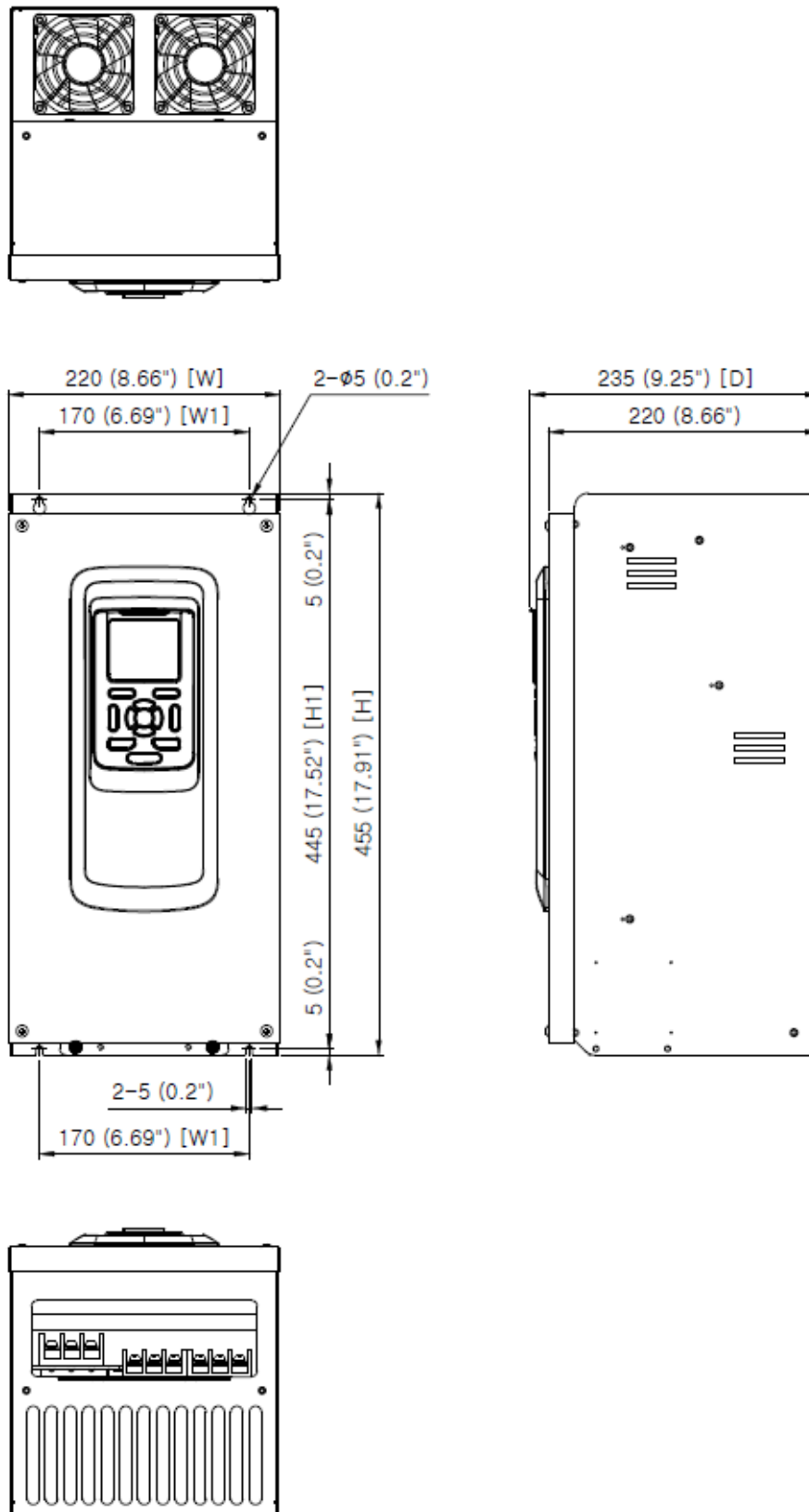
Model	Frame	W [mm]	W1 [mm]	H [mm]	H1 [mm]	D [mm]	Weight [KG]
A1-032A-2	F1	180	130	400	390	235	8.00
A1-045A-2	F1	180	130	400	390	235	8.00
A1-064A-2	F1	180	130	400	390	235	8.00
A1-076A-2	F2	220	170	455	445	235	11.00
A1-090A-2	F2	220	170	455	445	235	11.00
A1-114A-2	F3	270	200	550	532	265	18.30
A1-140A-2	F3	270	200	550	532	265	24.04
A1-170A-2	F4	295	200	660	642	265	34.26
A1-205A-2	F4	295	200	660	642	265	34.26
A1-261A-2	F5	345	230	760	735	275	45.08
A1-310A-2	F5	345	230	760	735	275	46.04
A1-016A-4	F1	180	130	400	390	235	8.00
A1-023A-4	F1	180	130	400	390	235	8.00
A1-032A-4	F1	180	130	400	390	235	8.00
A1-038A-4	F2	220	170	455	445	235	11.00
A1-045A-4	F2	220	170	455	445	235	11.00
A1-058A-4	F2	220	170	455	445	235	11.00
A1-075A-4	F3	270	200	550	532	265	23.30
A1-090A-4	F3	270	200	550	532	265	23.50
A1-110A-4	F4	295	200	660	642	265	30.74
A1-149A-4	F4	295	200	660	642	265	30.94
A1-176A-4	F5	345	230	760	735	275	44.40
A1-217A-4	F5	345	230	760	735	275	44.92
A1-260A-4	F6	385	280	800	775	275	55.48
A1-296A-4	F6	385	280	800	775	275	56.24

Model	Frame	W [inch]	W1 [inch]	H [inch]	H1 [inch]	D [inch]	Weight [lbs]
A1-032A-2	F1	7.09	5.12	15.75	15.35	9.25	17.63
A1-045A-2	F1	7.09	5.12	15.75	15.35	9.25	17.63
A1-064A-2	F1	7.09	5.12	15.75	15.35	9.25	17.63
A1-076A-2	F2	8.66	6.69	17.91	17.52	9.25	24.25
A1-090A-2	F2	8.66	6.69	17.91	17.52	9.25	24.25
A1-114A-2	F3	10.63	7.87	21.65	20.94	10.43	18.3
A1-140A-2	F3	10.63	7.87	21.65	20.94	10.43	53.00
A1-170A-2	F4	11.61	7.87	25.98	25.28	10.43	75.53
A1-205A-2	F4	11.61	7.87	25.98	25.28	10.43	75.53
A1-261A-2	F5	13.58	9.06	29.92	28.94	10.83	99.38
A1-310A-2	F5	13.58	9.06	29.92	28.94	10.83	101.50
A1-016A-4	F1	7.09	5.12	15.75	15.35	9.25	17.63
A1-023A-4	F1	7.09	5.12	15.75	15.35	9.25	17.63
A1-032A-4	F1	7.09	5.12	15.75	15.35	9.25	17.63
A1-038A-4	F2	8.66	6.69	17.91	17.52	9.25	24.25
A1-045A-4	F2	8.66	6.69	17.91	17.52	9.25	24.25
A1-058A-4	F2	8.66	6.69	17.91	17.52	9.25	24.25
A1-075A-4	F3	10.63	7.87	21.65	20.94	10.43	51.37
A1-090A-4	F3	10.63	7.87	21.65	20.94	10.43	51.81
A1-110A-4	F4	11.61	7.87	25.98	25.28	10.43	67.77
A1-149A-4	F4	11.61	7.87	25.98	25.28	10.43	68.21
A1-176A-4	F5	13.58	9.06	29.92	28.94	10.83	97.89
A1-217A-4	F5	13.58	9.06	29.92	28.94	10.83	99.03
A1-260A-4	F6	15.16	11.02	31.50	30.51	10.83	122.31
A1-296A-4	F6	15.16	11.02	31.50	30.51	10.83	123.99

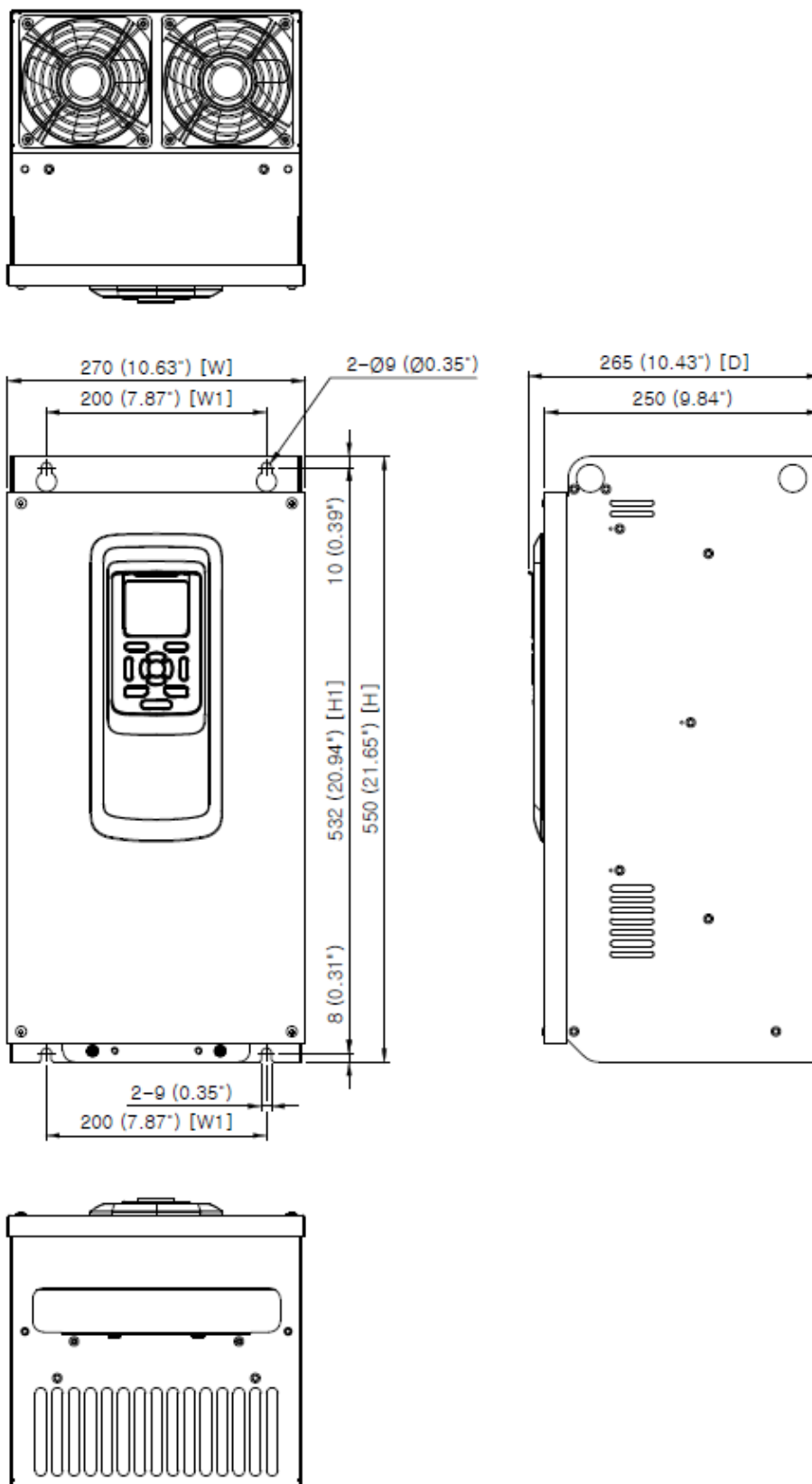
- 1) F1 (A1-032A-2, A1-045A-2, A1-064A-2 / A1-016A-4, A1-023A-4, A1-032A-4)



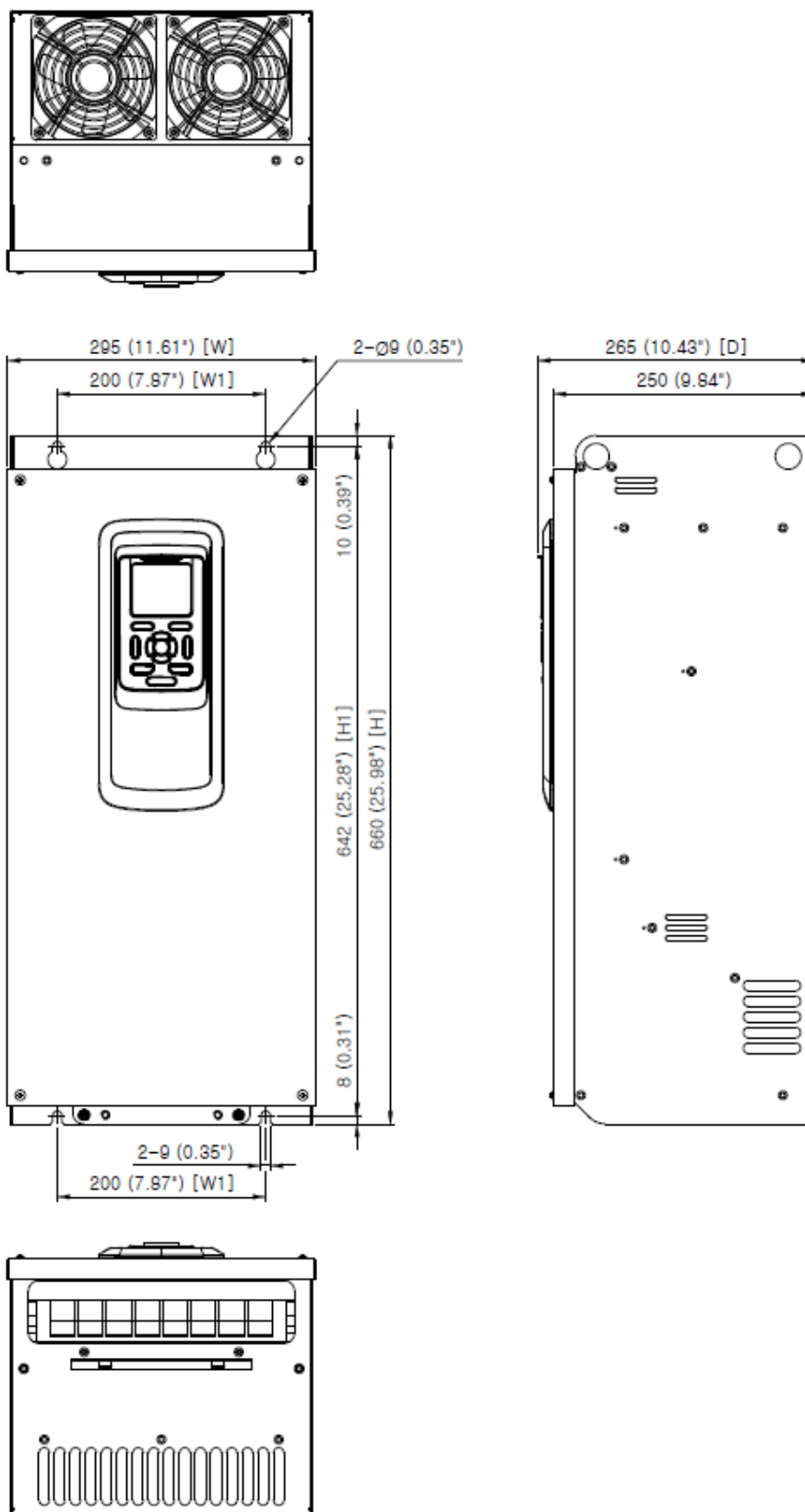
2) F2 (A1-076A-2, A1-090A-2/ A1-038A-4, A1-045A-4, A1-058A-4)



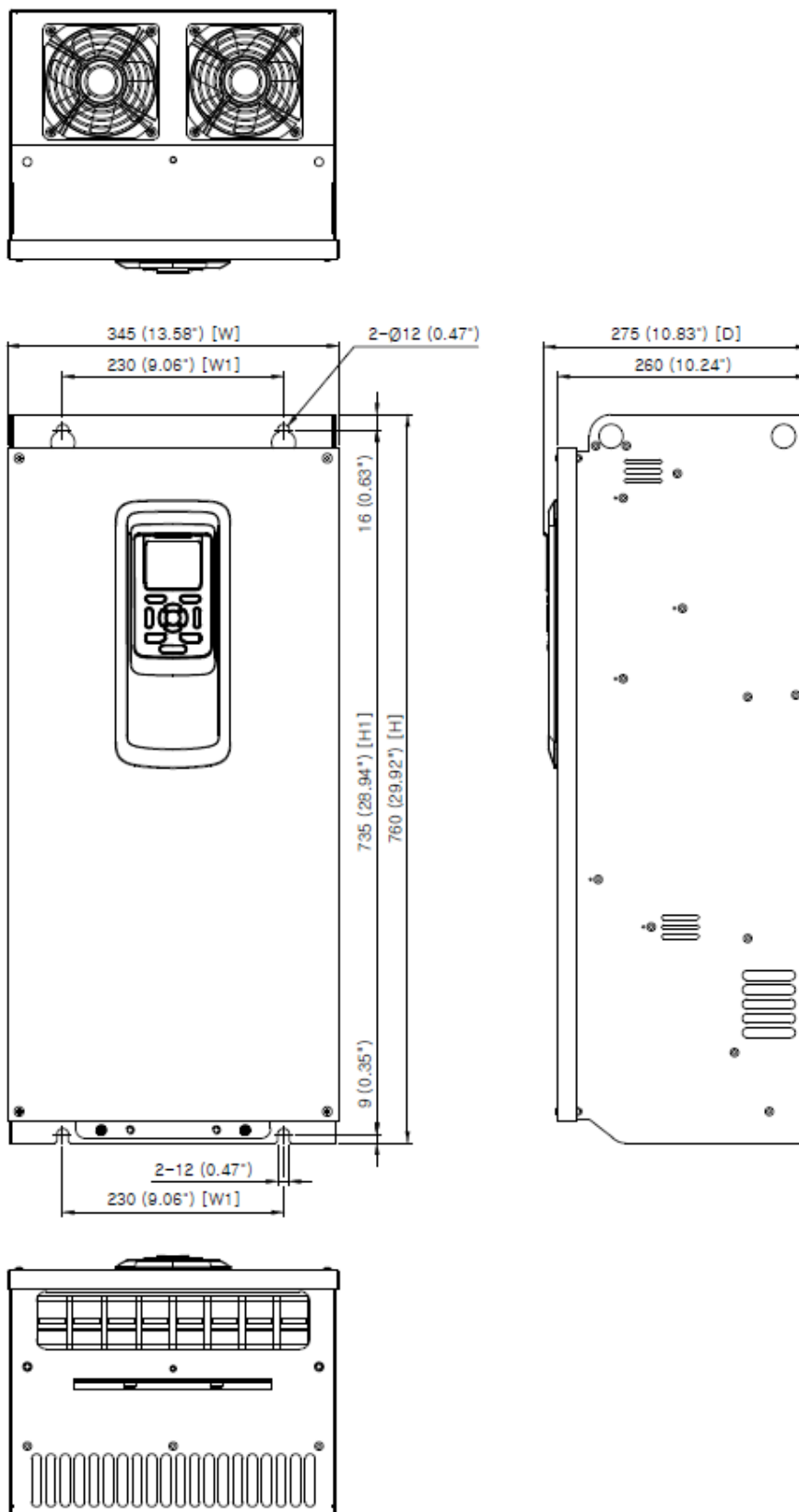
3) F3 (A1-114A-2, A1-140A-2/ A1-075A-4, A1-090A-4)



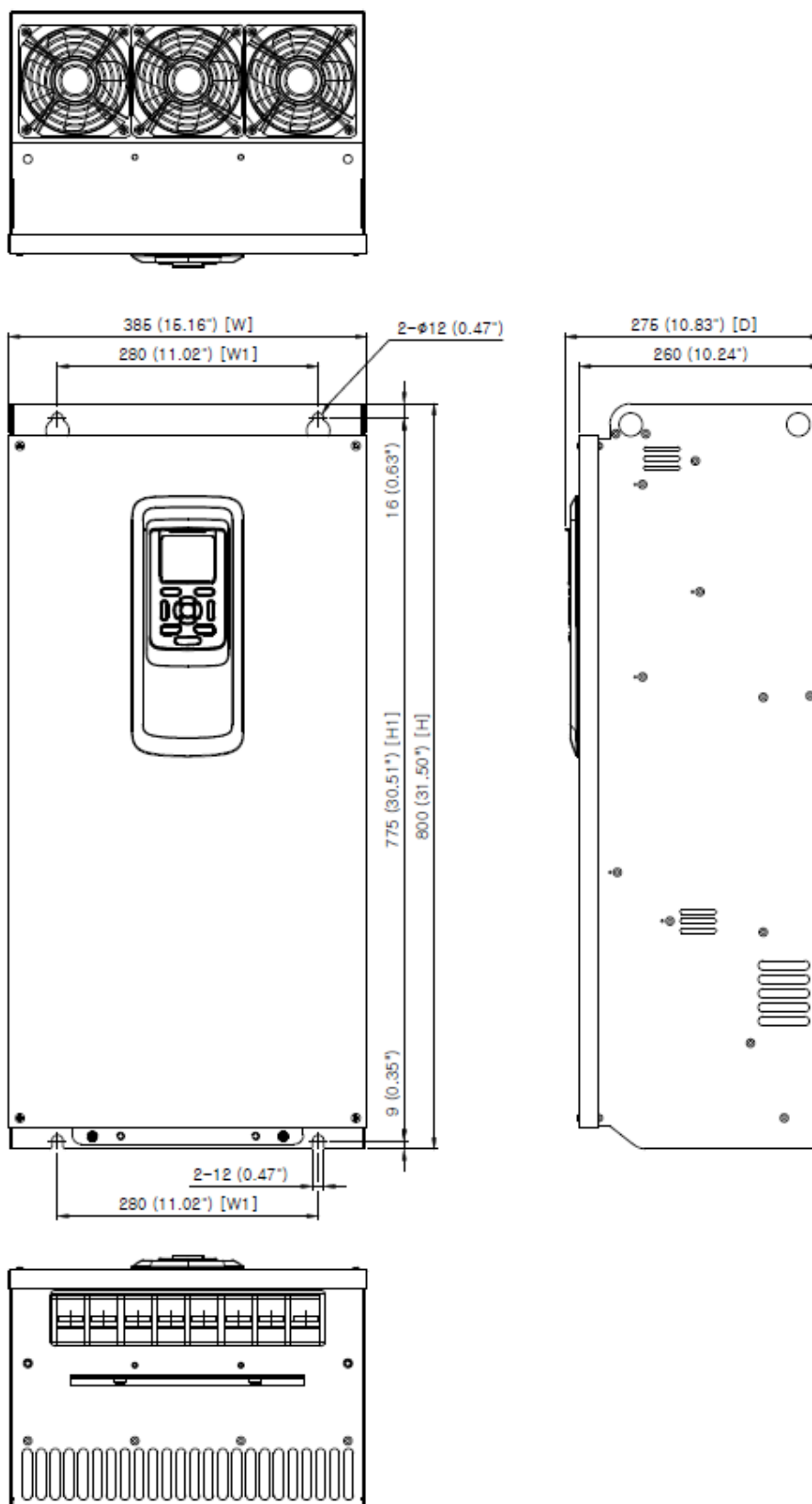
4) F4 (A1-170A-2, A1-205A-2/ A1-110A-4, A1-149A-4)



5) F5 (A1-261A-2, A1-310A-2/ A1-176A-4, A1-217A-4)



6) F6 (A1-260A-4, A1-296A-4)

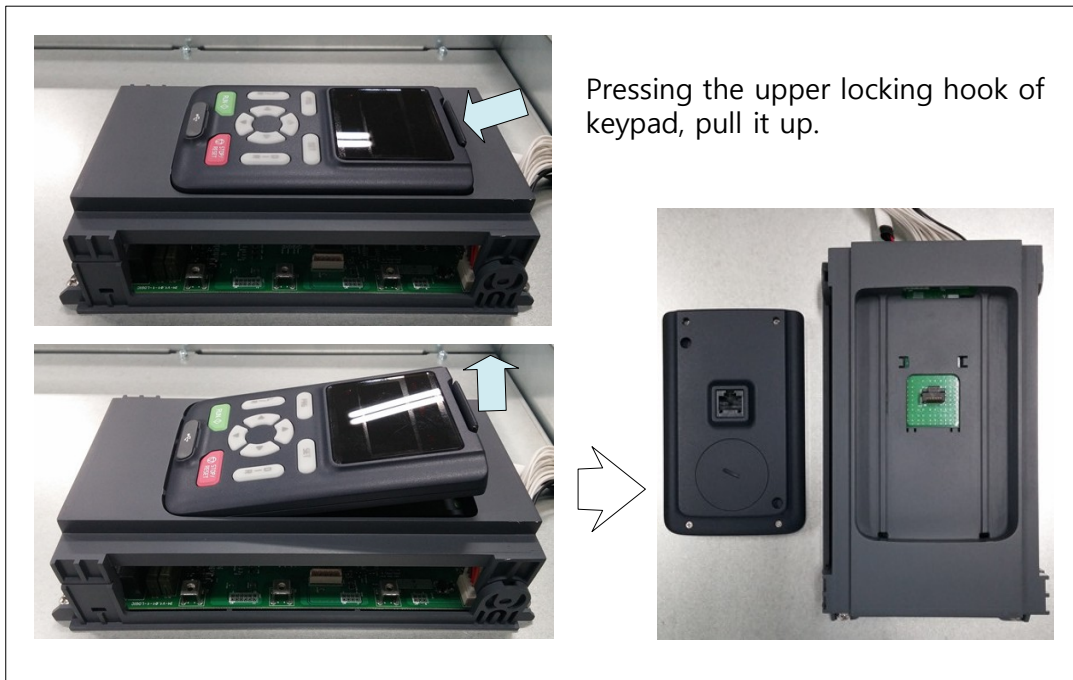


4. Wiring

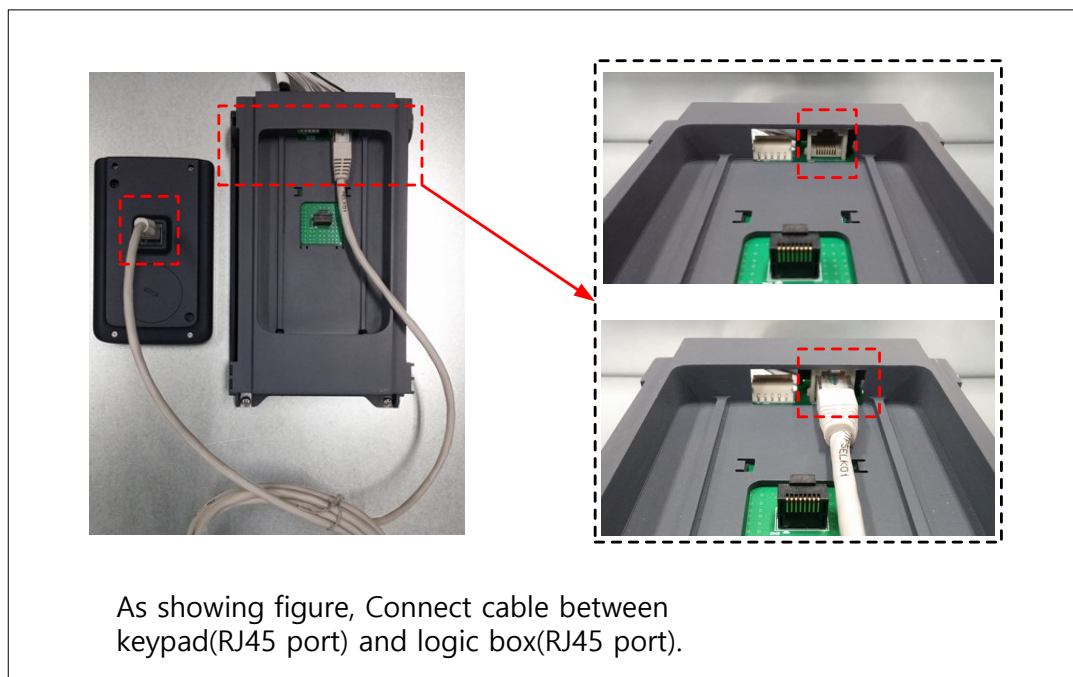
4.1 Wiring

4.1.1 Installation method of VFD keypad to panel

- 1) Separate the Keypad from case



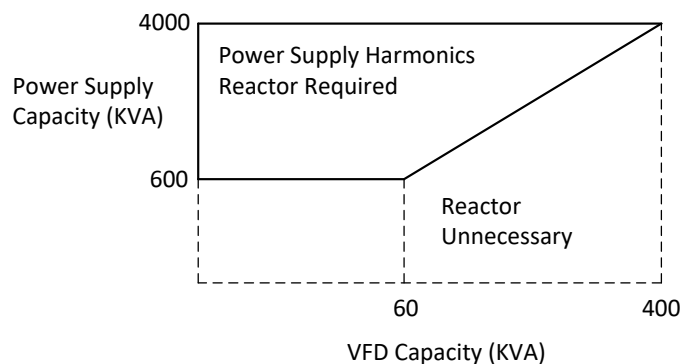
- 2) Connection



4.1.2 Wiring precaution

1) Main Power Terminals: R(L1), S(L2), T(L3)

- Connect the main power terminals (R(L1), S(L2) and T(L3)) to the power supply through an electromagnetic contactor or an earth-leakage breaker. These devices isolate the utility power supply from the VFD and prevent the spread of damage.
- This unit is designed to be used on a three-phase power supply. If using on a single phase power supply, please contact ADT for proper sizing.
- Do not operate under the following conditions.
 - Unbalanced power supply voltage more than 3%
 - Power supply capacity more than 10 times of the capacity of VFD and case beyond 600kVA.



- Turning on/off the power supply more than three times in one minute, It could be damaged the recharge circuit of the VFD.

2) VFD Output Terminals: U(T1), V(T2), W(T3)

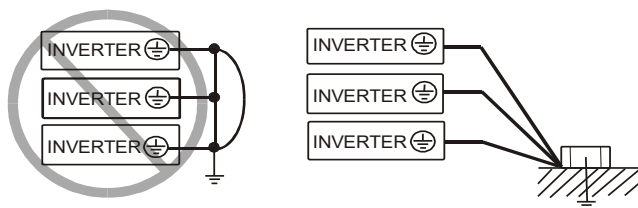
- Make sure to use a heavier gauge wire when you have long motor leads. This will help to reduce the voltage drop.
- Do not install power factor correction capacitors or a surge absorber to the output of the VFD. The VFD will trip or sustain damage to the output transistors.
- If the motor cable length is more than 65 feet, it is possible that a surge voltage will be generated and may damage the motor. This is due to phenomena called "Reflective Wave". Install a dv/dt filter in front of the motor to protect it.
- In the case of two or more motors on the output of a VFD, install an independent overload protection device for each motor. Set the rated current value of the overload device to 1.1 times the motor rated current.

3) Regenerative Braking Unit Terminals: P, N ($\geq 30\text{kW}$ (40HP) Units)

- VFDs rated greater than and equal to 30KW (40HP) do not contain an internal BRD circuit. If regenerative braking is going to occur, then an external BRD circuit (Option) is required along with a resistor. (Option)
- Connect external regenerative braking unit terminals (P,N) to terminals (P,N) on the VFD.
- The braking resistor is then wired into the External BRD board, not directly to the VFD.
- The cable length between the VFD and the BRD board, BRD board and the resistor, should be less than 16 feet and twist the connecting wires to reduce inductance.

4) Earth Ground: G

- Make sure that you securely ground the VFD and motor for prevention of electric shock.
- The VFD and motor must be connected to an appropriate safety earth ground and follow all local electrical codes.
- In case connecting 2 or more VFDs, use caution not to create a ground loop situation which may cause the VFD to malfunction. Use a star configuration grounding technique.



Earth Ground (G) Connection

Grounding wire should be as short as possible and should be connected to the ground point as near as possible to the VFD.

VFD Frame	Grounding Wire Size (mm ² /kcmil)	
	200V class	400V class
F1	14/27.6	8/15.9
F2	22/43.4	14/27.6
F3	53.5/ 105.6	33.6/ 66.4
F4	85.0/ 167.8	53.5/ 105.6
F5	85.0/ 167.8	85.0/167.8
F6	85.0/ 167.8	85.0/167.8

5) Specifications of power terminal block and internal fuse

Tightening torque and wire range for field wiring terminals are marked adjacent to the terminal or the wiring diagram. Select a molded case circuit breaker (MCCB) with a rated current 1.5 to 2 times higher than the VFD rated current

Distribution fuse size information is shown in the table below.

The fuse must be a UL listed (in case of using in the USA), 600V, inverse time rated fuse with the current ratings shown in the table below.

Class	Motor Output (kW)	VFD Model	Power lines R,S,T, U,V,W,P,N			Screw Size of Terminal	Torque N·m (lb·in)	FUSE [A]
			AWG	kcmil	Lug width (mm/inch)			
200V Class	7.5	A1-032A-2	8	17	11.8/0.46	M4	0.20~0.60	40A
	11	A1-045A-2	8	17	11.8/0.46	M4	0.20~0.60	60A
	15	A1-064A-2	6	26	13/0.51	M5	0.40~0.80	80A
	18.5	A1-076A-2	4	42	13/0.51	M5	0.40~0.80	100A
	22	A1-090A-2	8 * 2P	(17)*2P	13/0.51	M5	0.40~0.80	125A
	30	A1-114A-2	1/0	106	22/0.87	M8	0.80~1.20 (7.08~10.6)	150A
	37	A1-140A-2	3*2P	(52.6)*2P	22/0.87	M8	0.80~1.20 (7.08~10.6)	FWH-350A
	45	A1-170A-2	2*2P	(66.4)*2P	22/0.87	M8	0.80~1.20 (7.08~10.6)	FWH-400A
	55	A1-205A-2	1*2P	(83.7)*2P	22/0.87	M8	0.80~1.20 (7.08~10.6)	FWH-400A
	75	A1-261A-2	2/0*2P	(133.1)*2P	27/1.06	M10	0.80~1.80 (7.08~15.9)	FWH-600A
	90	A1-310A-2	3/0*2P	(167.8)*2P	27/1.06	M10	0.80~1.80 (7.08~15.9)	FWH-700A
400V Class	7.5	A1-016A-4	12	6.5	11.8/0.46	M4	0.20~0.60	20A
	11	A1-023A-4	10	10	11.8/0.46	M4	0.20~0.60	30A
	15	A1-032A-4	8	17	11.8/0.46	M4	0.20~0.60	40A
	18.5	A1-038A-4	8	17	13/0.51	M5	0.40~0.80	50A
	22	A1-045A-4	8	17	13/0.51	M5	0.40~0.80	60A
	30	A1-058A-4	6	26	13/0.51	M5	0.40~0.80	80A
	37	A1-075A-4	2	66.4	16/0.63	M6	0.80~1.00 (7.08~8.85)	FWH-250A
	45	A1-090A-4	2	66.4	16/0.63	M6	0.80~1.00 (7.08~8.85)	FWH-250A

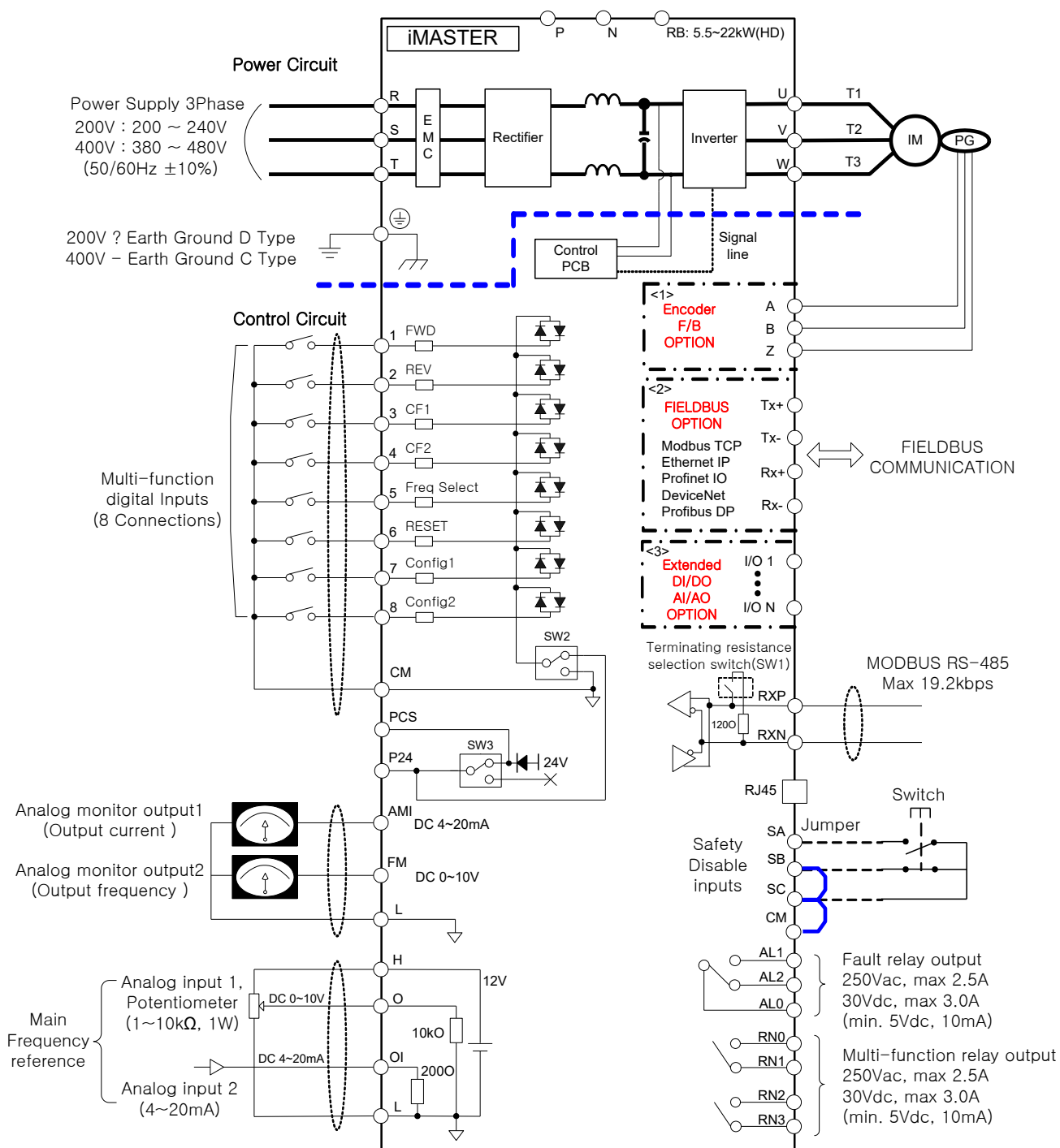
	55	A1-110A-4	1/0 or 4*2P	105.5 or (41.7)*2P	22/0.87	M8	0.80~1.20 (7.08~10.6)	FWH- 250A
	75	A1-149A-4	3*2P	(52.6)*3P	22/0.87	M8	0.80~1.20 (7.08~10.6)	FWH- 350A
	90	A1-176A-4	2*2P	(66.4)*2P	22/0.87	M8	0.80~1.20 (7.08~10.6)	FWH- 400A
	110	A1-217A-4	1/0*2P	(105.5)*2P	22/0.87	M8	0.80~1.20 (7.08~10.6)	FWH- 500A
	132	A1-260A-4	2/0*2P	(133.1)*2P	24/0.94	M10	0.80~1.80 (7.08~15.9)	FWH- 600A
	160	A1-296A-4	3/0*2P	(167.8)*2P	27/1.06	M10	0.80~1.80 (7.08~15.9)	FWH- 700A

*Fuse of Bussmann was used when UL certified

4.1.3 A1 Terminal Connection Diagram and Description

1) A1 VFD terminal connection overview is shown below. There are three segments of Connections

- Power Circuit
- Control Circuit
- Communication Circuit

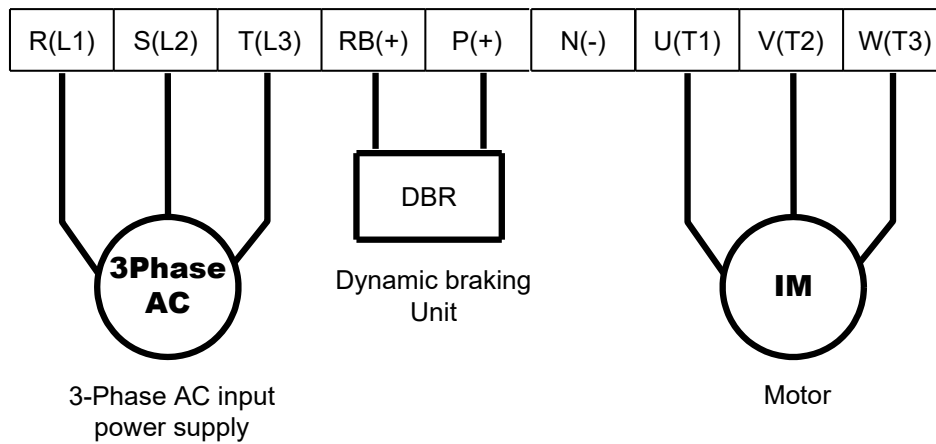


A1 VFD terminal names and descriptions are summarized

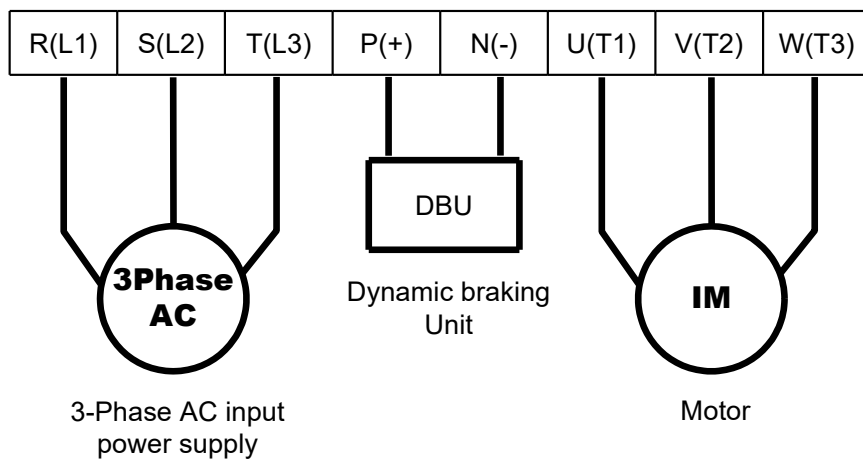
Terminal Name	In/Out	Functional Description	Value
Main Circuit Connector			
R,S,T (L1, L2, L3)	IN	3 Phase 50/60 Hz, AC input power supply.	200 ~240V ±10% 380 ~480 V ±10%
U,V,W (T1,T2,T3)	OUT	3 Phase PWM output power for motor	–
P,N	–	Optional External Braking Unit Connector. [1] 30~132 kW (40 ~ 250 HP) models	–
[2] RB	–	[3] Dynamic Braking Resistor connector 5.5~22kW	–
G	–	Ground Terminal	–
Control Circuit Connector			
P24	OUT	Power Supply for external device (Always ON)	24VDC ±7%, P24+PCS = 300mA
PCS	OUT	Power Supply for external device such as PLC (Available ON or OFF)	
Multi function digital Input[1:8]	IN	8 Bit Intelligent input terminal. By programming the respective terminal, can be used as command	Contact Closed : ON Contact Open : OFF Min ON Time : 12 ms
CM	–	Common Terminal for Intelligent Input and Monitor Output	–
AMI	OUT	Analog Current Output	4~20mA, 250 Ω
FM	OUT	Analog Voltage Output	0~10Vdc, 1mA
L	–	DC Power Supply Common	–
H (P1 2)	OUT	Power Supply for Potentiometer	12VDC
O	IN	Analog Voltage for Frequency Reference	0 ~ 10 VDC, 10 kΩ
OI	IN	Analog Current for Frequency Reference	4~ 20mA, 200 Ω
AL0, AL1, AL2	OUT	Intelligent output terminal: OUTPUT RELAY 1, 2 Run status signal(RUN), Frequency arrival signal(FA1), Set frequency arrival signal(FA2), Overload advance notice signal(OL), PID error deviation signal(OD), Alarm signal(AL)	AC 250V / 2.5A (resistor load) 0.2A (inductor load) DC 30V / 3.0A (resistor load) 0.7A (resistor load)
RN0, RN1 RN2, RN3	OUT	Intelligent output terminal OUTPUT RELAY 3	
SA	IN	Safety Input terminal:	–
SB		SA closed, SB open: Drive output disabled	
SC		Common terminal for Safety Input, CM connection	
Communication Connector			
RXP	IN/OUT	RS 485 Positive Communication Terminal	
RXN	IN/OUT	RS 485 Negative Communication Terminal	

4.1.4 Terminal wiring diagram (Power terminal block)

Terminal view of corresponding VFD are shown below

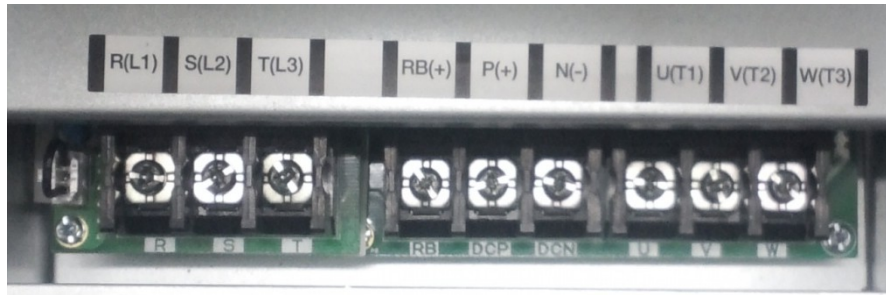


F1, F2 Power Terminal

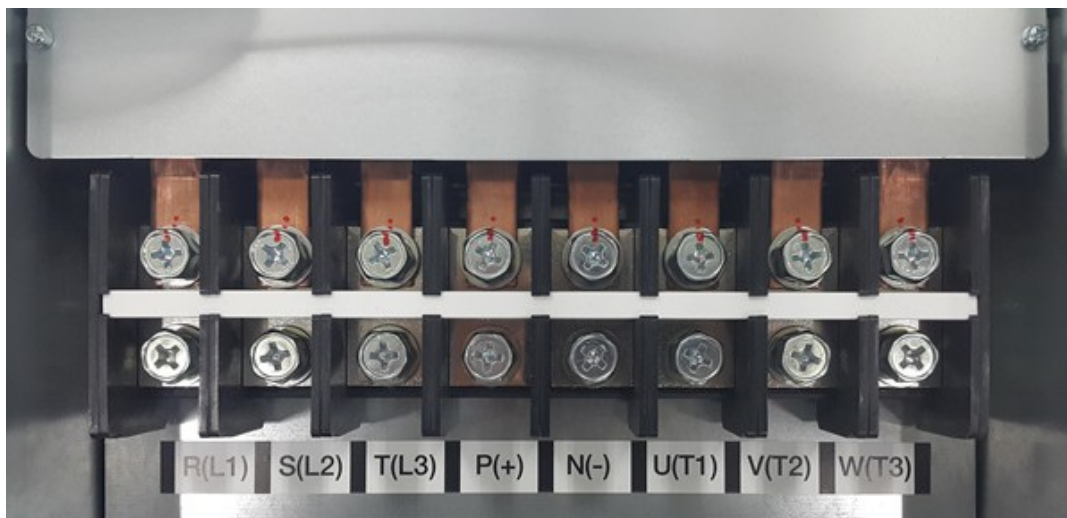


F3~F6 Power Terminal

Power terminal (F1,F2)



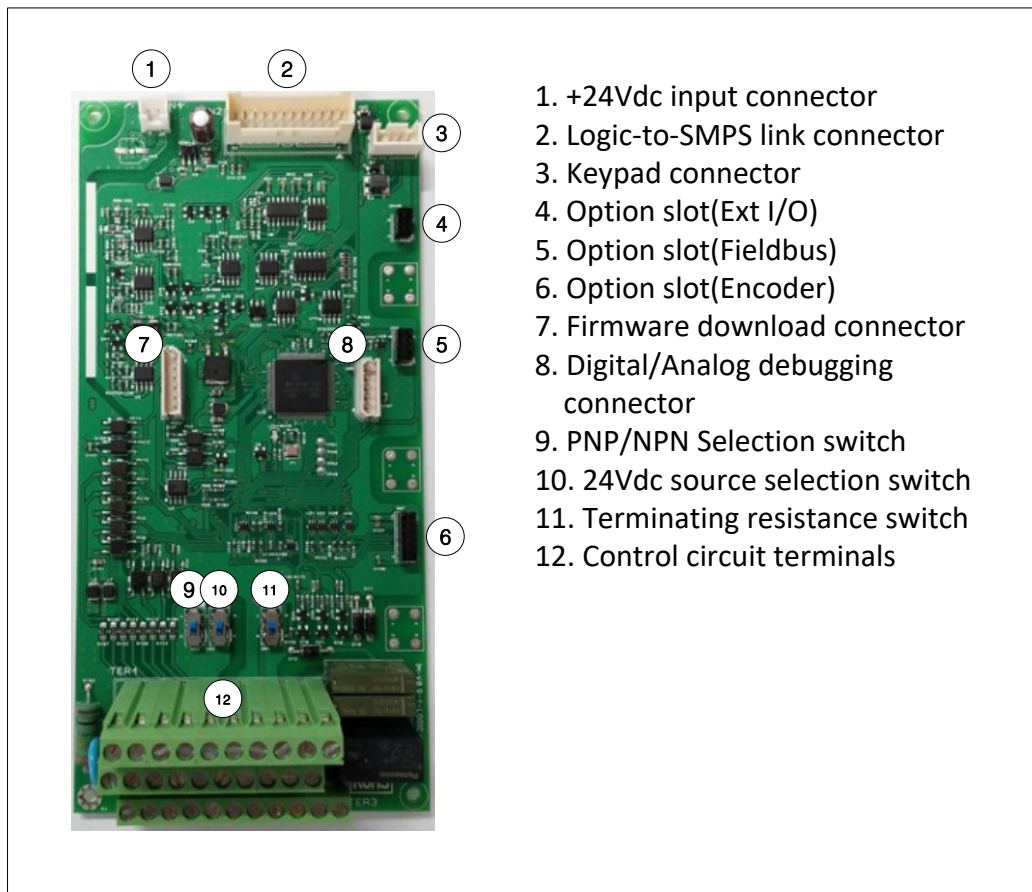
Power terminal (F3~F6)



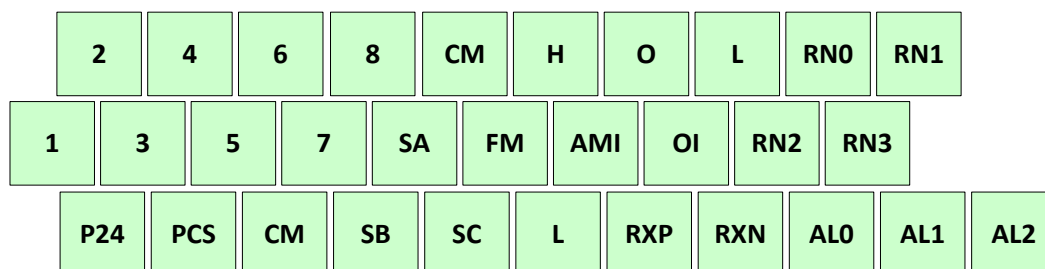
4.1.5 Control terminal line diagram (Basic I/O terminal block)

1) External control connection terminals

The layout of external control connection terminals of the drive is shown below.

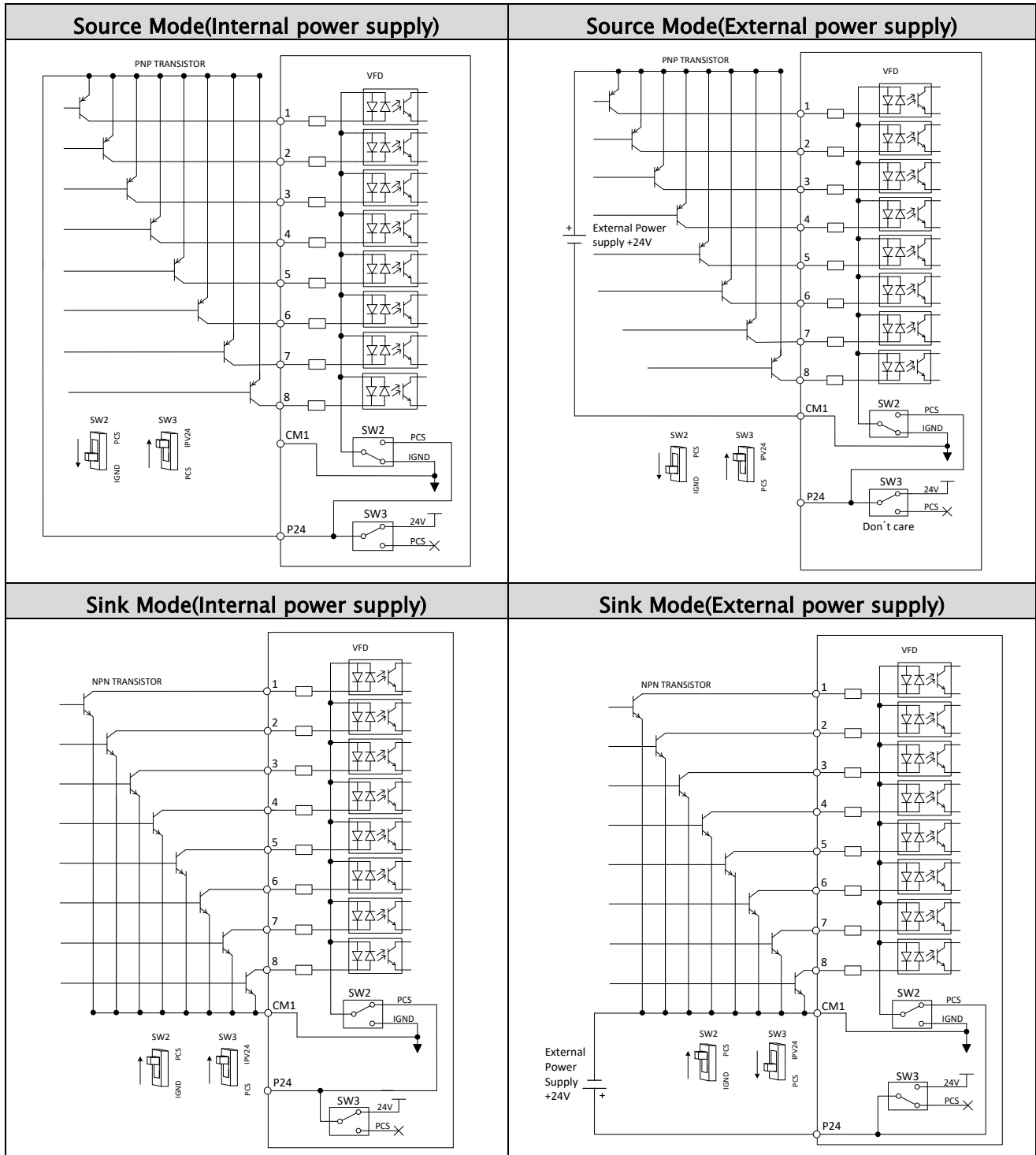


2) Control circuit terminals layout

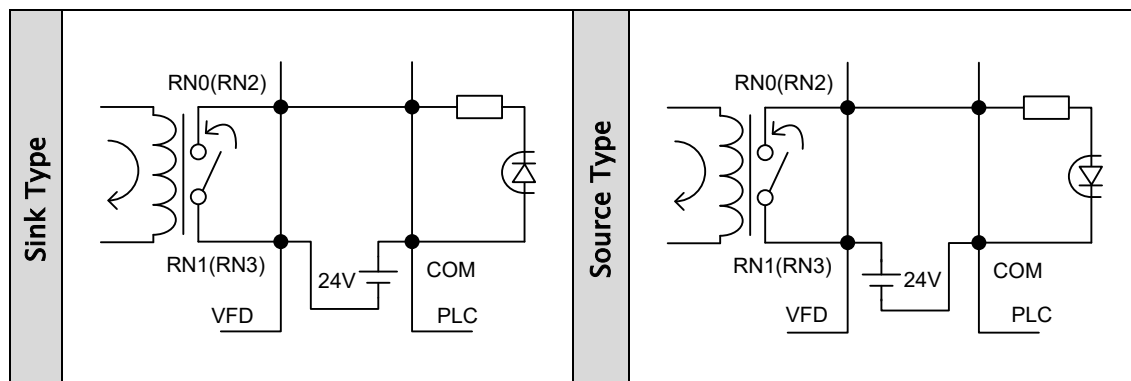


3) Configuration for Sinking and Source Modes

- SW2: Sink/Source switch
- SW: Power selection switch (Internal 24V or External 24V)



4) Sinking and Source Modes selection (Output signal)



5) Communication Connect

RXP	RXN
Transmit/Receive +side	Transmit/Receive -side

The termination resistor of the RS 485 2nd communication has a purpose of preventing the distortion and attenuation of the communication line. This resistor means the impedance matching resistor in long distance transport of RS 485 data. The termination resistor is inserted only in the final stage in single line.

<Terminating resistance selection switch (SW1)>

Default Status: Terminating resistance ON

Regarding terminating resistance, only applied to RXP–RXN terminals

Turn off the switch when master communicate more than one of VFD

(For example master: PLC, DCS, PC and etc)

RS–485 Terminating resistance SW1 On:

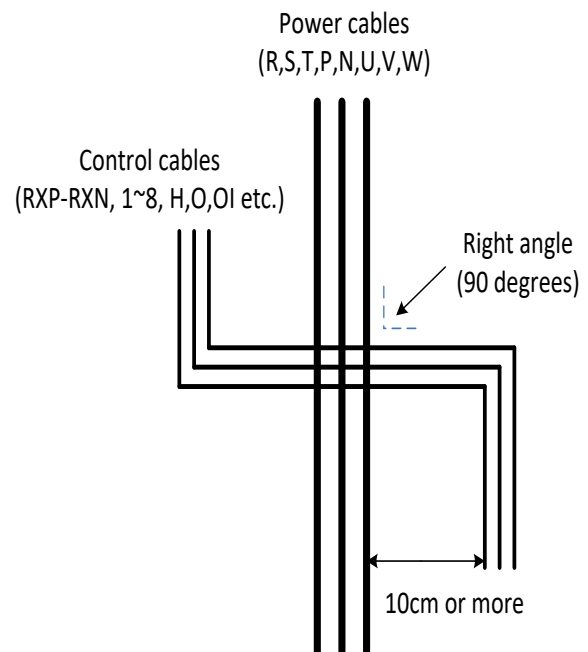


RS–485 Terminating resistance SW1 Off:



6) Internal Wiring

- Control circuit wires are insulated from power lines (R,S,T,U,V,W)
- Use twisted screened cable for input and output wires of the control circuit terminals
- Limit the connection wires to 65 feet
- Separate the control circuit wiring from the main power and relay control wiring
- When using relays for the FW terminal or an intelligent input terminal, use a control relay that is designed to work with 24 Vdc.
- When a relay is used as an intelligent output, connect a diode for surge protection parallel to the relay coil.
- Do not short the analog voltage terminals H and L or the internal power terminals P24 and all CM's to prevent any VFD damage
- When connecting a thermistor to the TH and all CM's terminals, twist the thermistor cables and separate them from the rest. Limit the connection wires to 65 feet.



5. Peripheral Devices

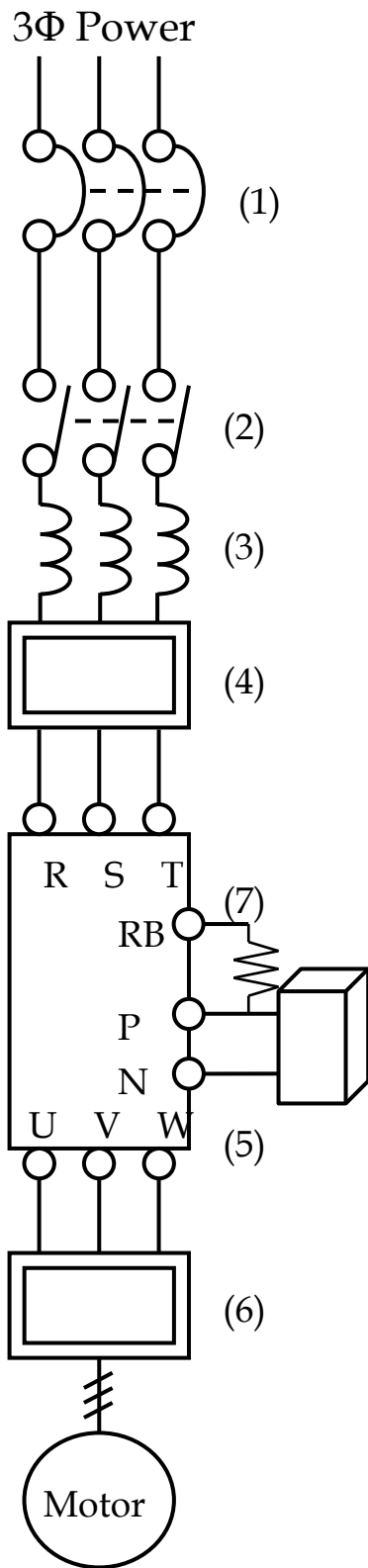
5.1 Peripheral Devices

5.1.1 Composition of peripheral devices

For better system performance enhancement, optional accessories may be used with VFD.

- Note1: Be sure to consider the capacity of the circuit breaker to be used.
- Note2: Be sure to use larger wire for power lines if the distance exceeds 20m.
- Note3: Be sure to use a grounding wire same size of power line or similar.

Name		Function
(1)	Circuit Breaker	High current flows in the VFD while power is supplied. Be careful when you select the switch because the VFD.
(2)	Electric contactor	This does not have to be necessarily installed, but if you do, do not start or stop the VFD frequently with the contactor. It might decrease the life of the VFD.
(3)	Input AC Reactor	Recommended to use when the unbalance voltage rate is 3% or more and power supply is 500 kVA or more, and there is a rapid change in the power supply. It also reduces harmonics and improves the power factor.
(4)	Input Noise Filter	Reduces radiation noise emitted from wire at the input.
(5)	Dynamic Braking Unit	Applied 30~132kW(HD) Used for applications that need to increase the brake torque of the VFD or to frequently start/stop and to run high inertia load.
(6)	Output Noise Filter	Reduces noise emitted from the VFD motor leads. This helps to minimize interference with sensitive equipment (ie: sensors or weight scale).
(7)	Braking Resistor	Applied 5.5~22kW(HD) Used for applications that need to increase the brake torque of the VFD or to frequently start/stop and to run high inertia load.



5.1.2 Dynamic braking unit (DBU) and Resistors

1) Dynamic Braking Resistor

200V Drive		150% Torque, 5% ED		400V Drive		150% Torque, 5% ED	
VFD Model	kW	Ω	W	VFD Model	kW	Ω	W
A1-032A-2	5.5	20	800	A1-016A-4	5.5	85	800
A1-045A-2	7.5	15	1200	A1-023A-4	7.5	60	1200
A1-064A-2	11	10	2400	A1-032A-4	11	40	2400
A1-076A-2	15	8	2400	A1-038A-4	15	30	2400
A1-090A-2	18.5	5	3600	A1-045A-4	18.5	20	3600
A1-114A-2	22	5	3600	A1-058A-4	22	20	3600

2) Dynamic Braking Unit

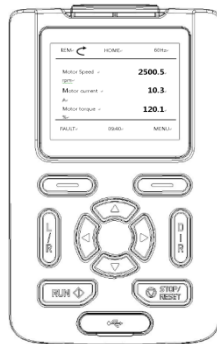
Input V	VFD Model	kW	DB Unit Model	Ω	kW	Condition for using
3 PHASE 200V	A1-140A-2	30	FBU100-037-2	4.5	10	150% breaking 10%ED
	A1-170A-2	37		4.5	10	
	A1-205A-2	45	FBU100-075-2	2.5	10	
	A1-261A-2	55		2.5	20	
	A1-310A-2	75		2.5	20	
3 PHASE 400V	A1-075A-2	30	FBU100-037-4	12	10	
	A1-090A-2	37		12	10	
	A1-110A-4	45	FBU100-075-4	6	10	
	A1-149A-4	55		6	20	
	A1-176A-4	75		6	20	
	A1-217A-4	90	FBU100-090-4	5	26	
	A1-260A-4	110	FBU100-132-4	3.4	40	
	A1-296A-4	132		3.4	40	

6. Keypad

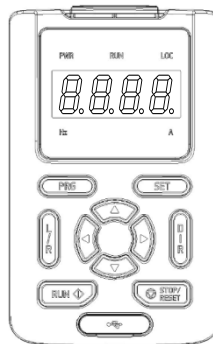
6.1 Keypad View & Operation

6.1.1 Keypad View

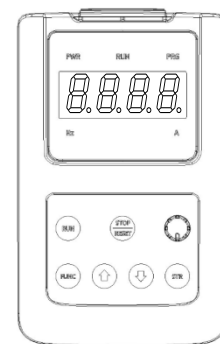
Standard Keypad is used in VFD parameter setting, Monitor display and VFD operations.



LCD TYPE



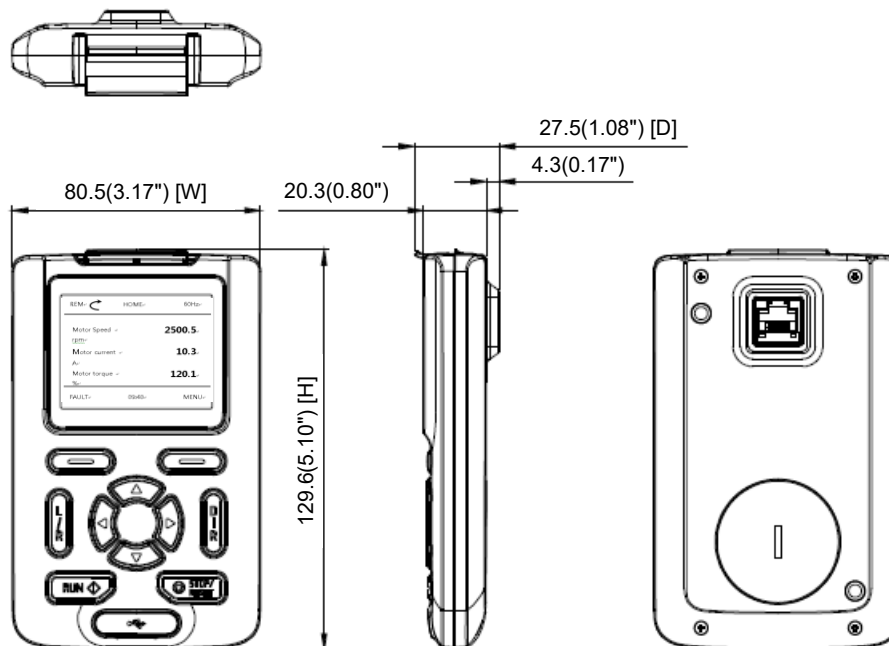
LED TYPE



LED-knob TYPE

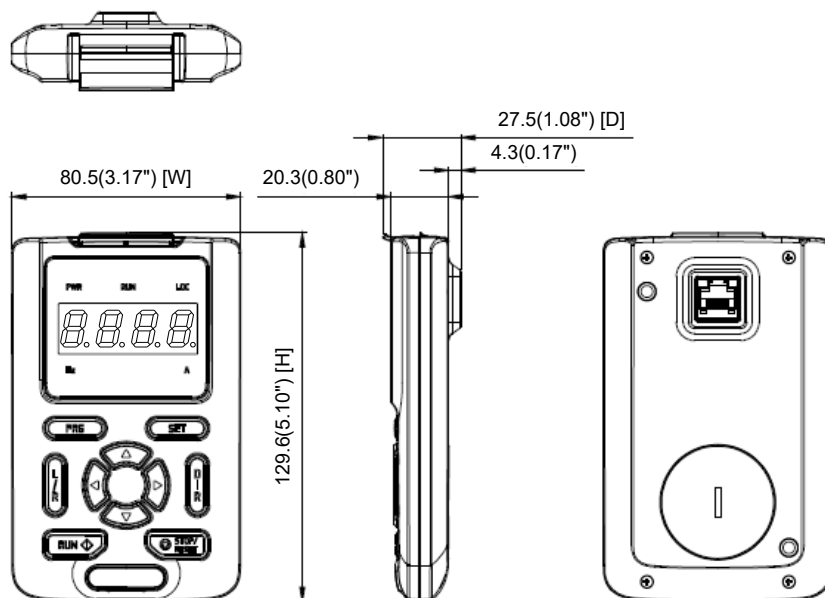
1) Dimensions – LCD TYPE

Unit : mm(inch)



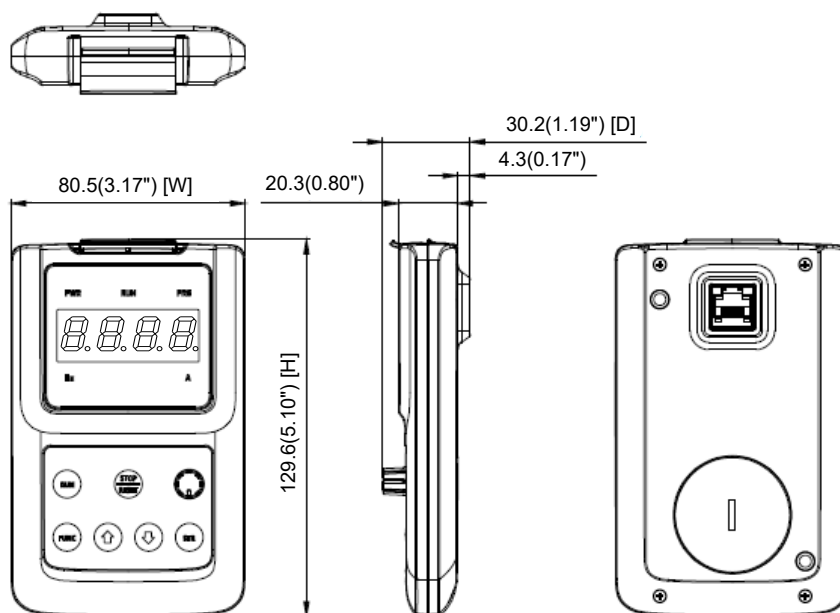
2) Dimensions – LED TYPE

Unit : mm(inch)



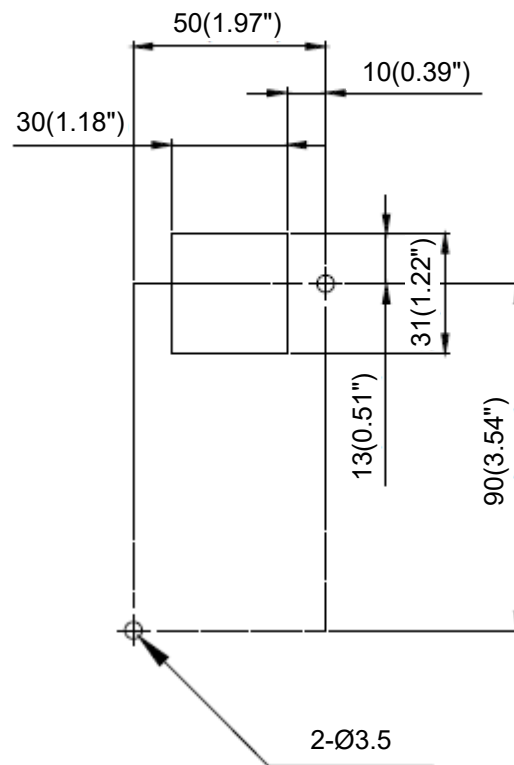
3) Dimensions – LED_KNOB TYPE

Unit : mm(inch)



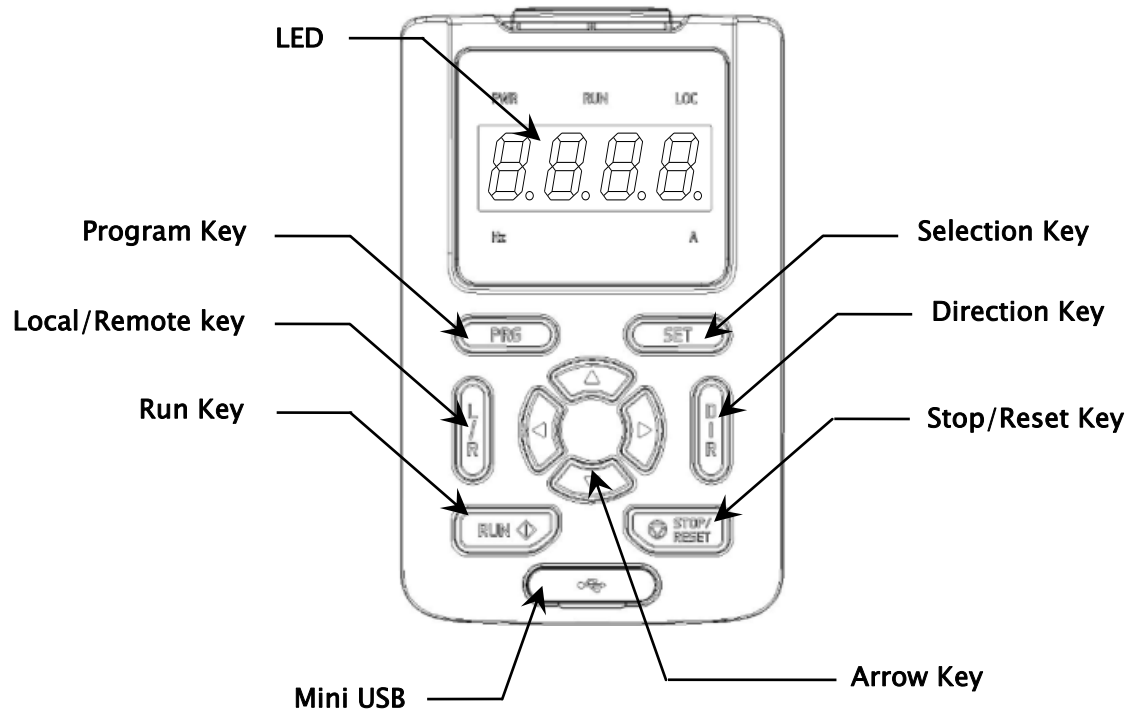
4) Dimensions – Panel Mount

Unit : mm(inch)



6.1.2 Keypad operation

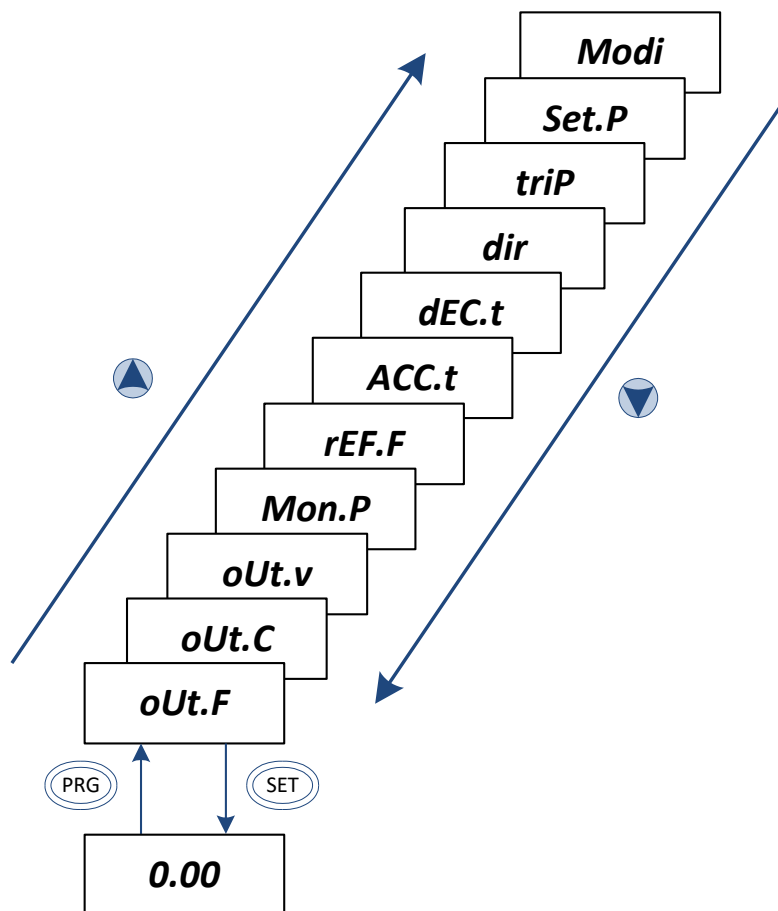
1) Configuration of LED Keypad



KEY	Function
PRG	• Move to fault history • previous • Cancel at setting mode
SET	• Move to menu • Reset the fault when the fault is occurred • Select the parameters • Save the value of parameter
Arrow keys	• Move to display or group • Move the position when set the parameter value
Dir key	• Change the direction at Remote mode
Mode key	• Change local or remote mode • Start/Stop/Dir keys enable at remote mode
Start key	• Start the VFD at Remote mode
Stop key	• Stop the VFD at Remote mode
Mini USB	Communicate with PC tool

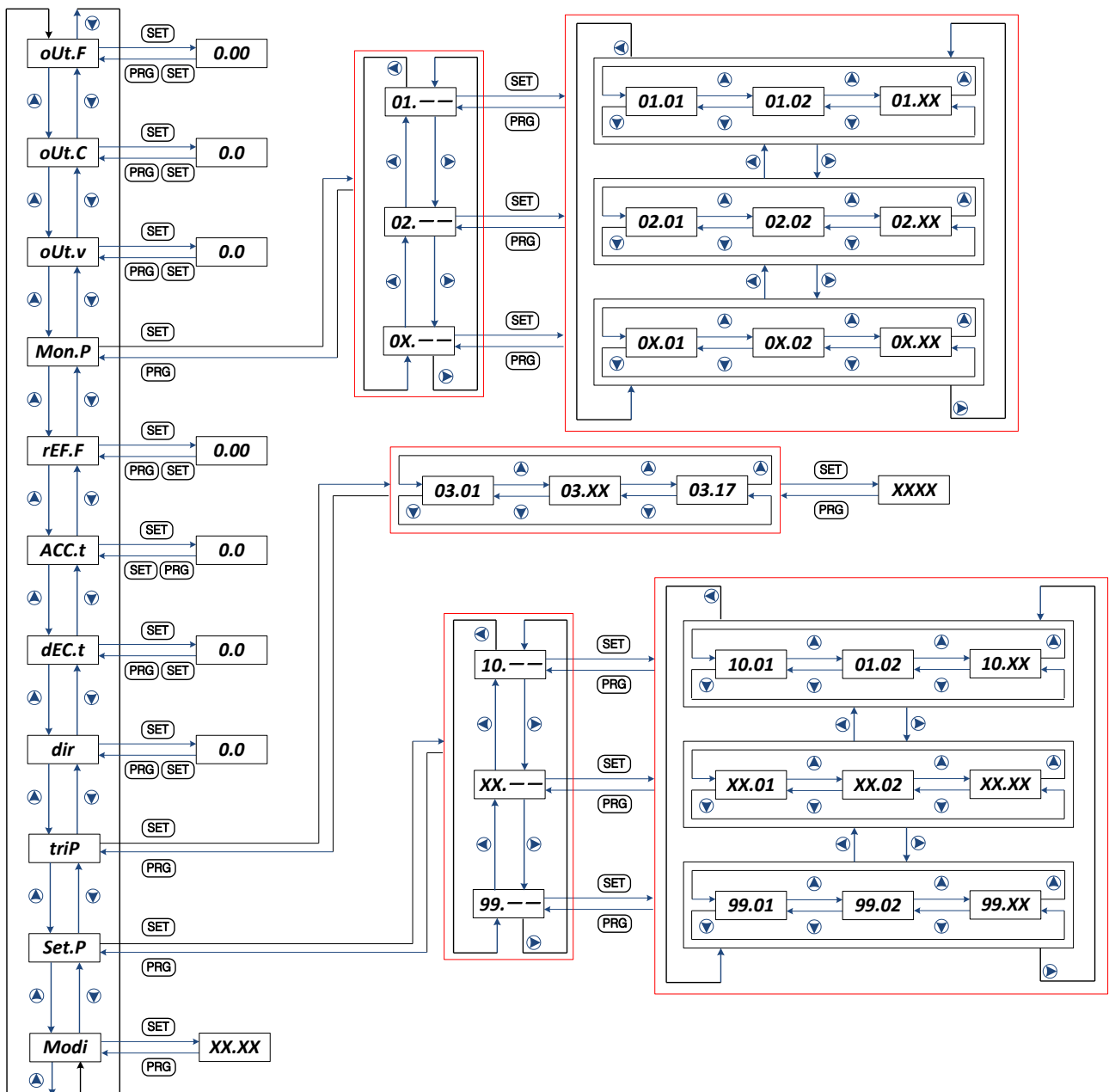
2) LED keypad Control method

(1) Movement in main MENU

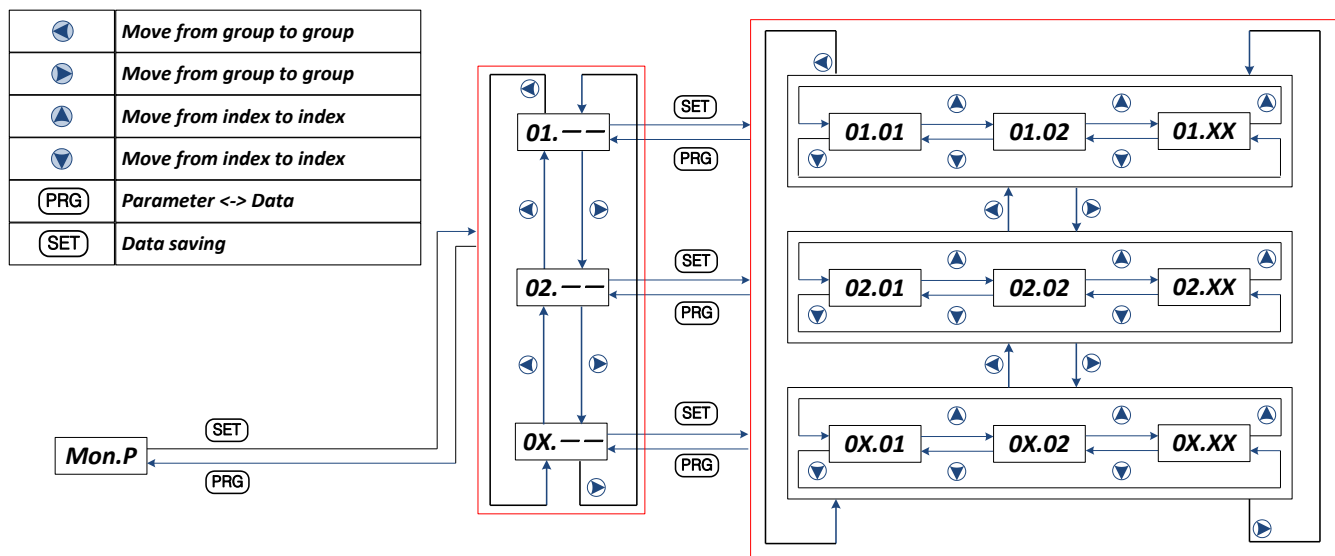


<i>oUt.F</i>	<i>Output frequency monitor (01.01)</i>
<i>oUt.C</i>	<i>Output current monitor (01.05)</i>
<i>oUt.v</i>	<i>Output voltage monitor (01.08)</i>
<i>Mon.P</i>	<i>Parameter monitors (01.XX ~ 05.XX)</i>
<i>rEF.F</i>	<i>Frequency ref input (22.01)</i>
<i>ACC.t</i>	<i>Acceleration time 1 (23.04)</i>
<i>dEC.t</i>	<i>Deceleration time 1 (23.05)</i>
<i>dir</i>	<i>Direction (20.13)</i>
<i>triP</i>	<i>Trip monitoring (03.01 ~ 03.XX)</i>
<i>Set.P</i>	<i>Parameter settings (10.XX ~ 99.XX)</i>
<i>Modi</i>	<i>Display only be modified parameters</i>

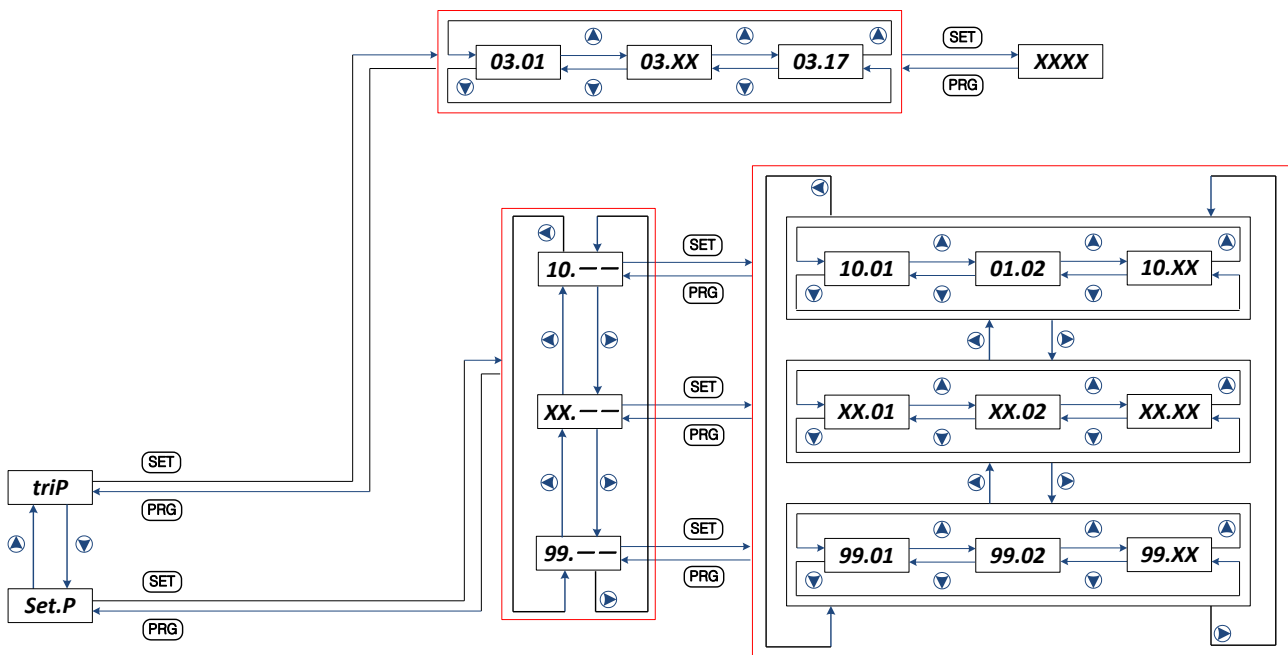
(1) Parameter movement



(2) Move to parameters Monitor group



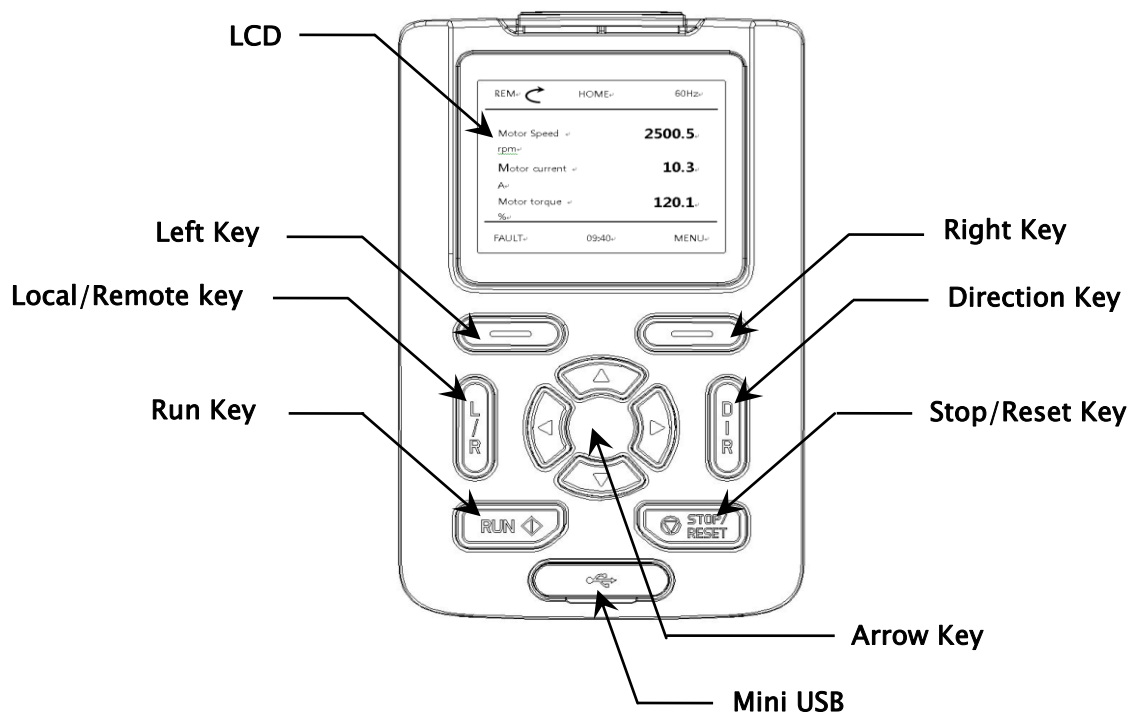
(3) Move to Trip monitor & Parameters Setting group



(4) Initialize Trip History or Parameter Setting

- '97.01' (Initialization mode) = 0 saving: Initialize Trip History
- '97.01' (Initialization mode) = 1 saving: Initialize Parameter Setting

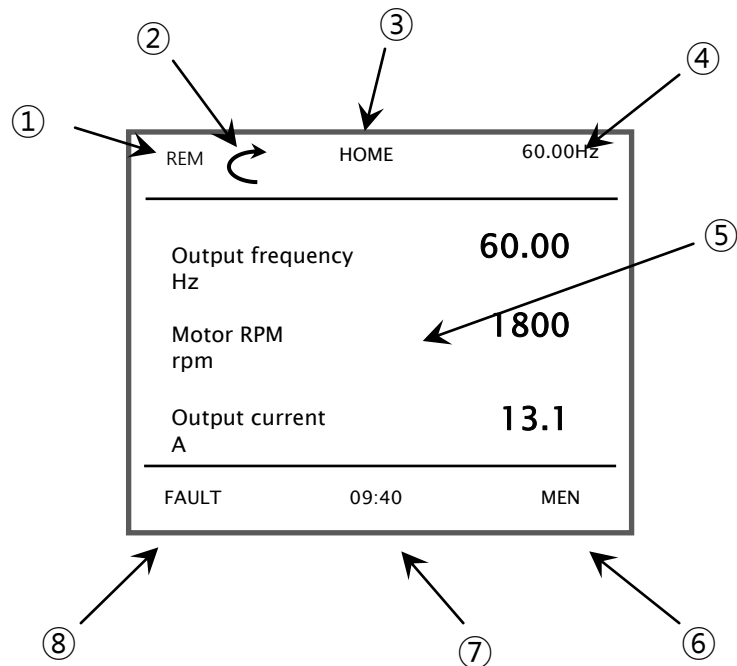
3) Configuration of LCD Keypad



KEY	Function
Left key	• Move to fault history • previous • Cancel at setting mode
Right key	• Move to menu • Reset the fault when the fault is occurred • Select the parameters • Save the value of parameter
Arrow keys	• Move to display or group • Move the position when set the parameter value
Dir key	• Change the direction at Remote mode
Mode key	• Change local or remote mode • Start/Stop/Dir keys enable at remote mode
Start key	• Start the VFD at Remote mode
Stop key	• Stop the VFD at Remote mode
Mini USB	Communicate with PC tool

4) LCD keypad Control method

(1) LCD keypad monitor



No	Function	Display	Description
1	Control location	LOC	VFD is controlled by VFD Keypad
		REM	VFD is controlled by terminal block
2	Running Status	↻ Rotation	VFD is stop
		↻ Rotation	VFD is running to forward
		↻ Rotation	VFD is running to reverse
		↻ Flickering	VFD is stopping from forward
		↻ Flickering	VFD is stopping from reverse
3	Current Status	Home	Home mode
		Menu	Menu mode
		Fault	Fault status
4	Reference Value	00.00Hz	Display referenced value
5	Current View	-	Display selected item
6	Multi Right Key	Menu	Move to menu view
		Select	Select the item
		Save	Save the parameter data
		Reset	Reset the fault when fault is occurred
		Read	Read all parameters for copy
		Write	Write all parameters for copy
7	Time	00:00	Display the current time
8	Multi Left Key	Back	Move to previous view
		Cancel	Cancel at parameter view
		Fault	Move to fault view

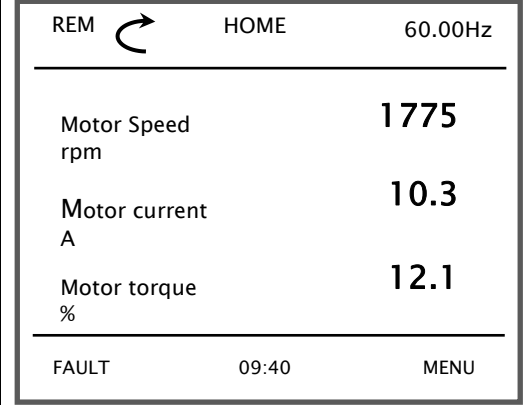
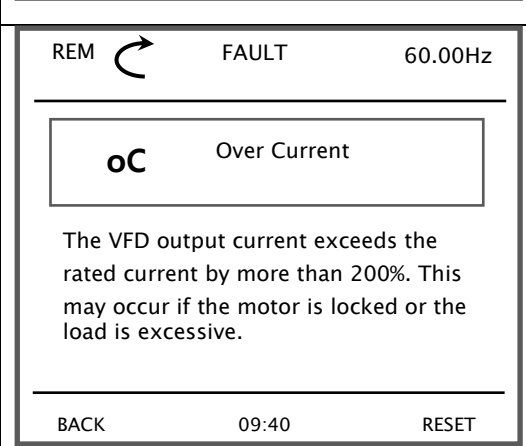
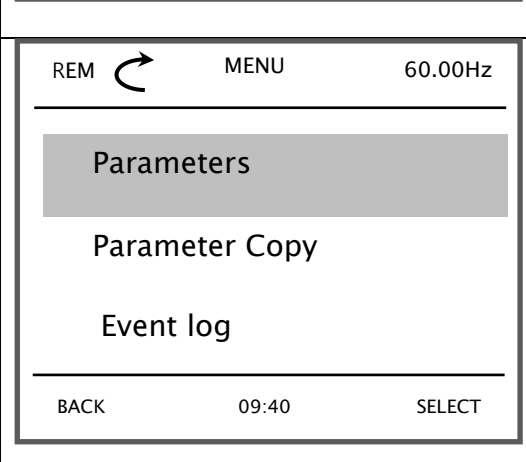
(2) LCD KEYPAD MAP

Display Sequence			Comment
1	2	3	
HOME	Parameters	01~99 Parameters Group	Set detailed parameters.
	Parameters Copy	Parameter Backup	Copy the parameters from the main unit to the LCD keypad.
		Parameter Restore	Copy parameters from the LCD keypad to the main unit.
		Parameter Verify	Compares the parameters of the LCD keypad and the main unit to inform you of the differences.
	Auto Tuning	Auto Tuning Start?	Auto-tuning is executed.
	Scheduling	Setup RUN time	00:00 (hour : minute)
		Setup STOP time	When the reserved operation is activated, it operates at the start time and stops at the stop time.
		Activate/Deactivate	Reservation operation is available only in LOC state: always available, REM: keypad operation only.
	Settings	Data & Time	00.00.00 00:00 (Year.month.day hour : minute)
		Language	ENG(영어) / KOR(한글)
		Background Color	Blue, Orange, Green, Cyan, Magenta
		Reset to defaults	Initialize the LCD keypad settings.
	Options	Reference	Set the command frequency.
		Edit Home View	Select 3 parameters to be monitored on the home screen.
	System info		Displays system information and firmware version.

※ Edit Home View Parameters

View Parameters	Unit
01.01 Output frequency	Hz
01.02 Motor RPM	Rpm
01.03 Encoder Speed	Rpm
01.04 Rotation direction	Rpm
01.05 Output current	FWD, REV, STOP
01.06 Output current	A
01.07 DC voltage	V
01.08 Output voltage	V
01.09 Output power	kW
40.02 PID reference	%, Hz, Kpa
40.17 PID FB monitor	%, Hz, Kpa
40.18 PID output monitor	%

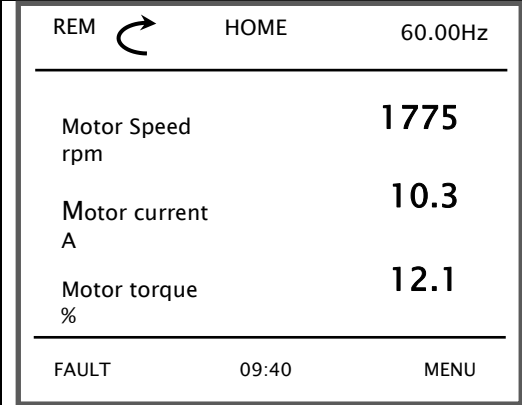
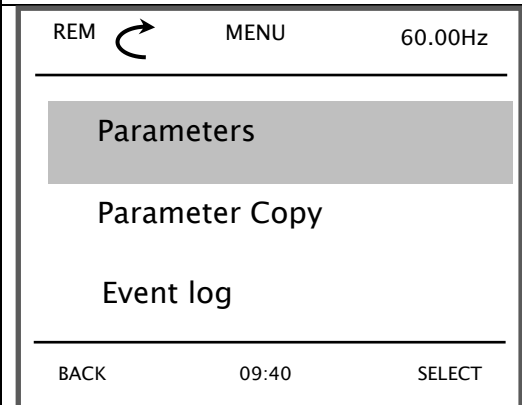
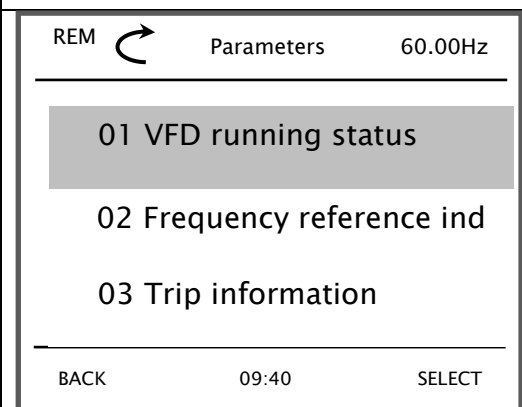
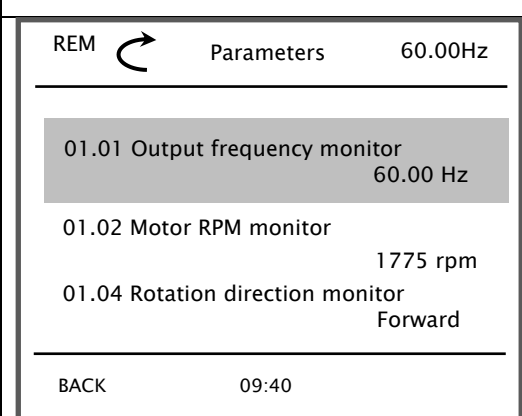
(3) Mode shift in home mode

	Power on, the display emerges as shown on the left. The present mode is the HOME mode 1. Press fault key once (left key) – Go to below A 2. Press menu key once (right key) – Go to below B
	A. The display emerges as shown on the left. The present mode is the FAULT mode
	B. The display emerges as shown on the left. The present mode is the MENU mode

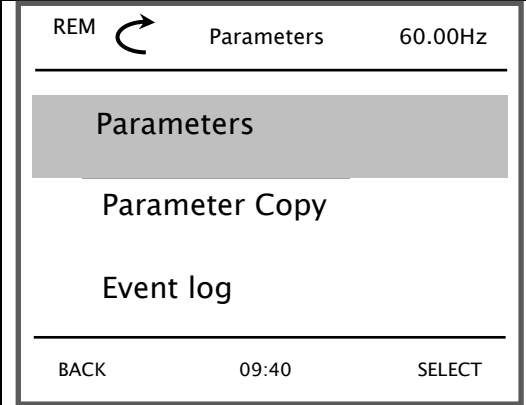
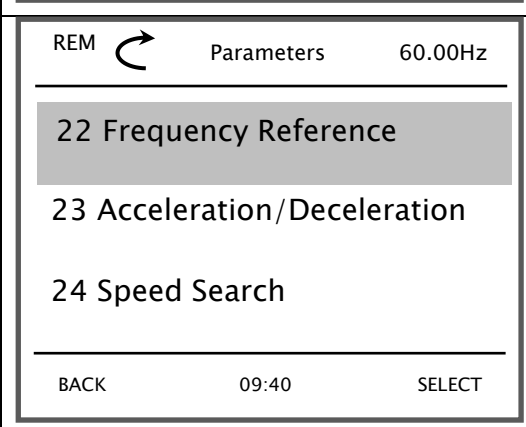
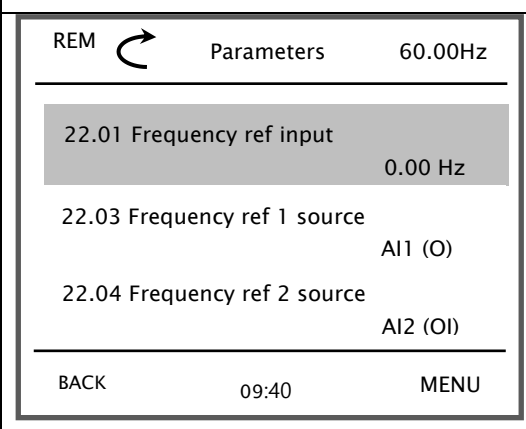
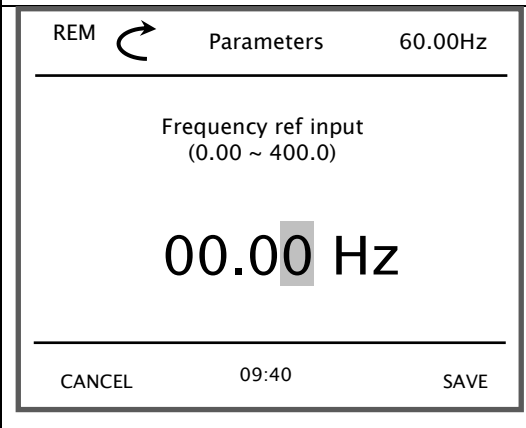
※ Menu mode has six kinds of sub menu

- Parameters: change the value of parameter
- Parameter copy: all parameters read, write and verify
- Event Info: save the fault history automatically
- System info: display the system information
- Settings: configuration of LCD keypad
- Options: home display values

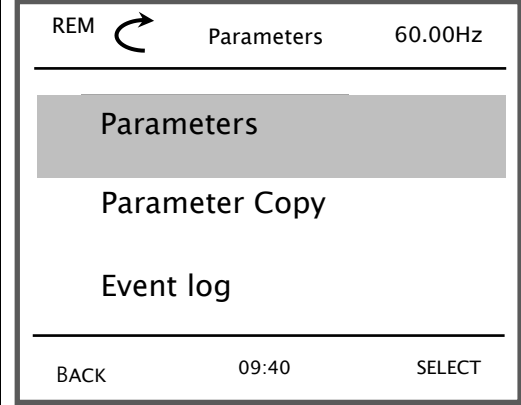
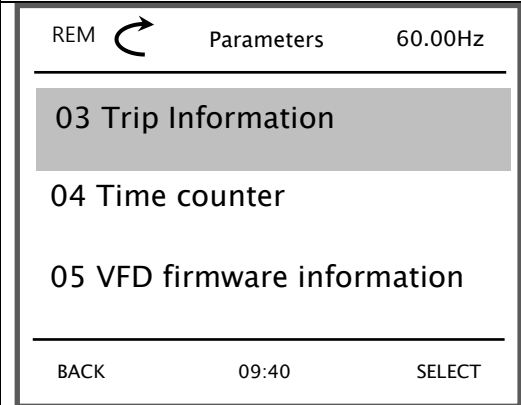
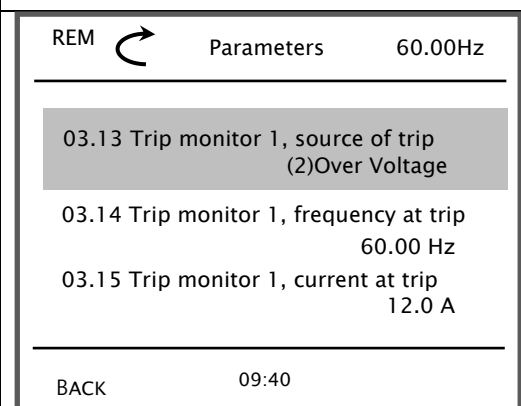
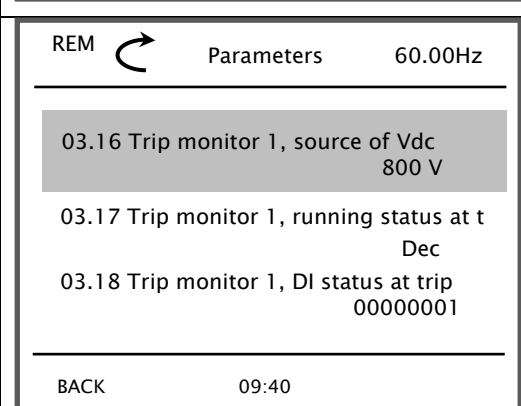
(4) Group shift in parameters mode

	Power on, the display emerges as shown on the left. The present mode is the HOME mode –Press the MENU key(right key) once
	You have shifted to Parameters mode –Press the SELECT key(right key) once
	The Display group of Parameters mode is emerged –Press the SELECT key(right key) once
	The sub menu of Display group mode is emerged

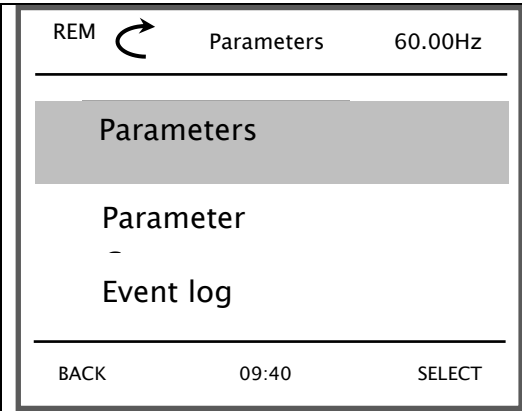
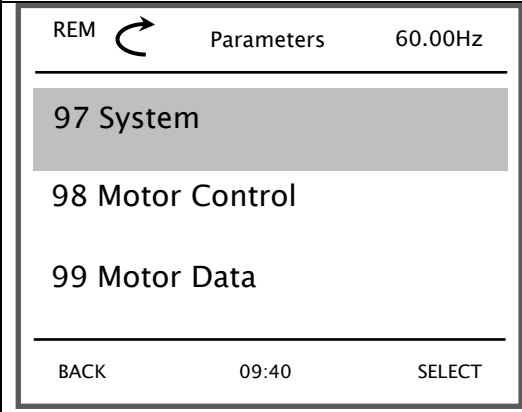
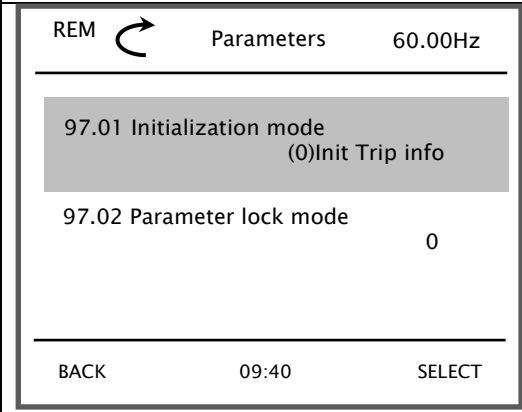
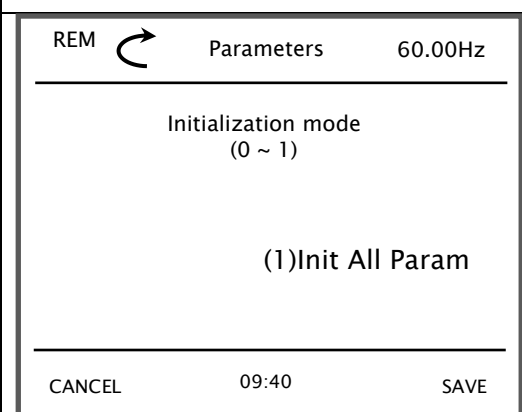
(5) Set the frequency reference

	You have shifted to Parameters mode –Press the SELECT key (right key) once
	The Display group of Parameters mode is emerged. Move to 22 group –Press the SELECT key (right key) once
	The sub menu of Display group mode is emerged
	Set the value and press the SAVE key (right key)

(6) Fault history monitoring

	You have shifted to Parameters mode –Press the SELECT key (right key) once
	The Display group of Parameters mode is emerged. Move to 03 group –Press the SELECT key (right key) once
	There are five of trip history and details
	More details are shown next page as below <i>'03.19' (Trip monitor 1, DO status at trip)</i> <i>'03.20' (Trip monitor 1, IGBT Temperature at trip)</i> <i>'03.21' (Trip monitor 1, Occurred time – Year)</i> <i>'03.22' (Trip monitor 1, Occurred time – Month, Day)</i> <i>'03.22' (Trip monitor 1, Occurred time – Hour, Minute)</i> <i>'03.23' (Trip monitor 1, Occurred time – Second)</i>

(7) Parameter setting

	You have shifted to Parameters mode -Press the SELECT key(right key) once
	The Display group of Parameters mode is emerged. Move to 97 group -Press the SELECT key(right key) once
	The details of System mode are emerged. -Press the SELECT key(right key) once
	-Press the up arrow once It change to (1)Init All Param If you want initialize, Press the SAVE key(right key) once

7. Quick Start Guide

In order to run the VFD, the run command source and frequency command source must be determined. Select one frequency command source and one run command source from list below and follow the instruction in the section referenced.

Default frequency command source is Analog Input Voltage, default run command source is Intelligent Input Terminal Connector (Input Terminal 1: Fwd, Input Terminal 2: Rev).

Frequency command can be done by

- Keypad – Up/Down Arrow Keys – (7.1)
- Input Terminal –
 - ❖ Analog Input Voltage/Current – (7.2)
 - ❖ Multi Frequency – (7.3)
 - ❖ Up/Down – (7.4)
- Modbus – RS485 (RXN, RXP) – (7.5)

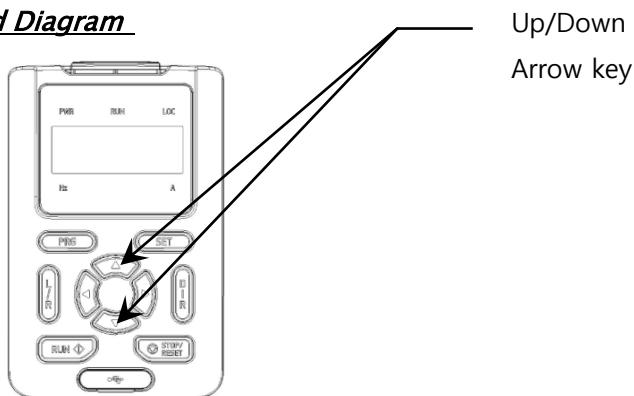
And running/stopping command can be done by

- Keypad RUN/STOP Keys – (7.6)
- Intelligent Input Terminal Connector – (7.7)
- Modbus – RS485 (RXN, RXP) – (7.8)

7.1 Frequency Command Source to Up/Down Arrow Keys

- Keypad Diagram
- Programming A1 Parameters

❖ Keypad Diagram



❖ Programming A1 Parameters

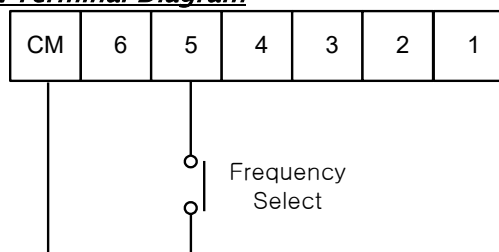
- On Keypad, program following parameters with corresponding values:

Code	Set Value	Description
22.03	6	Frequency Command Source to Keypad

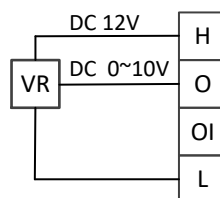
7.2 Frequency Command Source to Input Analog Voltage/ Current

- Input Terminal Diagram
- Programming A1 Parameters
- Programming Frequency Set Point

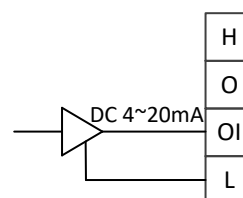
❖ Input Terminal Diagram



Input Voltage Source Setup



Input Current Source Setup



❖ Programming A1 Parameters

- On Keypad, program following parameters with corresponding values

Code	Set Value	Description
22.03	1	Frequency Command Source1 to Input Terminal(0~10V).
22.04	2	Frequency Command Source2 to Input Terminal(4~20mA).
22.06	0	Set Terminal 5 to Frequency Select Operation. If Closed, Select Current Source. If opened, Voltage Source.

❖ Setting Frequency Setpoint

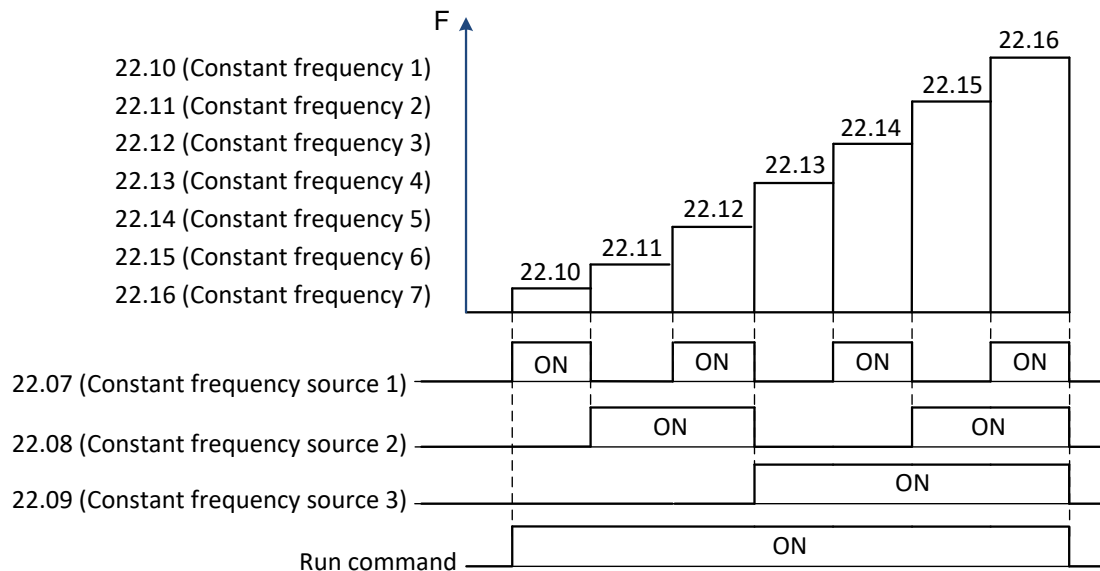
- Program following parameters with specified frequency values.

Frequency setpoint follows analog reference (0 ~ 10V / 4 ~ 20 mA) from 0 to 60 Hz. Analog input settings can be modified using '11.06 ~ 11.08', '11.14 ~ 11.17'.

7.3 Frequency Command Source to Input Terminal – Multi Speed Frequency

- Input Terminal Diagram
- Programming A1 Parameters

❖ Diagram



❖ Programming A1 Parameters

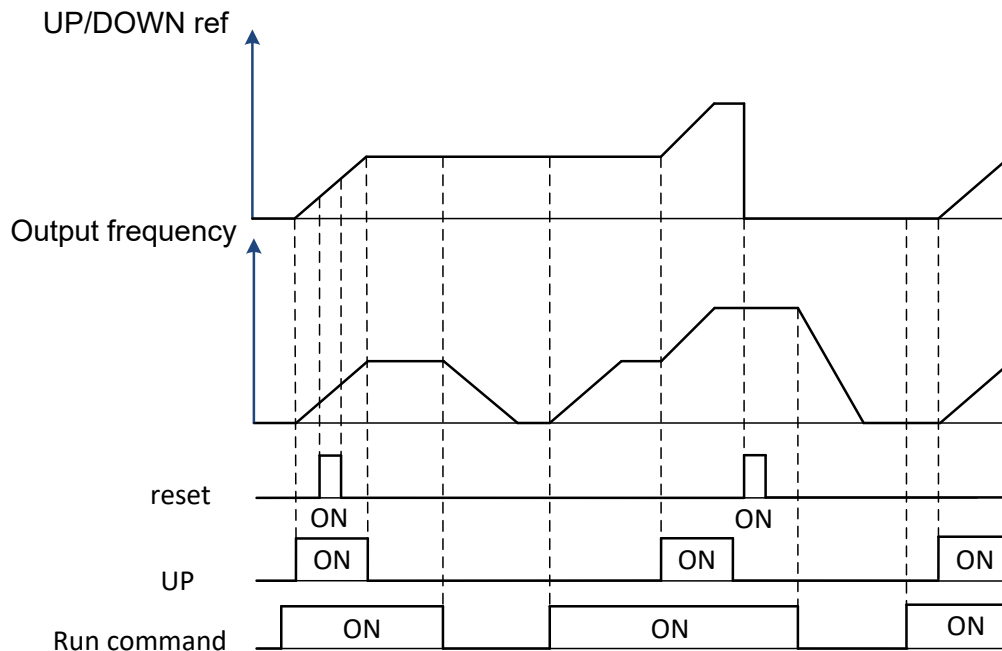
- On Keypad, program following parameters with corresponding values:

Code	Set Value	Description
22.07	0	Set Terminal 3 to Multi Speed Set CF1
22.08	0	Set Terminal 4 to Multi Speed Set CF2
22.09	8	Set Terminal 5 to Multi Speed Set CF3
22.10		
~	-	Set Frequency Value to Multi Speed by combination of CF1 ~ CF3.
22.16		

7.4 Frequency Command Source to Input Terminal – Up/Down

- Input Terminal Diagram
- Programming A1 Parameters

❖ Diagram



❖ Programming A1 Parameters

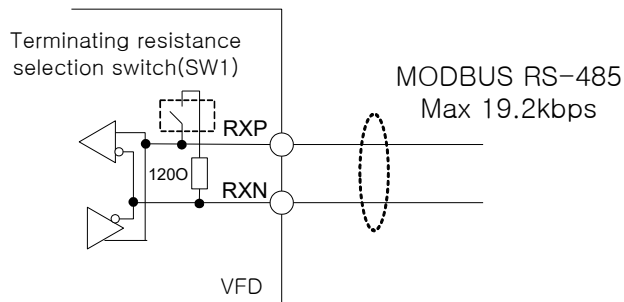
- On Keypad, program following parameters with corresponding values:

Code	Set Value	Description
22.25	–	UP/DOWN Enable, Initial value, Up/Down Source, Reset Source, etc.
~	–	
22.34	–	

7.5 Frequency Command Source to Modbus RS–485

- Diagram
- Programming A1 Parameters
- Set Frequency Setpoint

❖ Diagram



Terminal connector	Signal Descriptions
RXP	RS – 485+
RXN	RS – 485–

❖ Programming A1 Parameters

- On Keypad, program following parameters with corresponding values:

Code	Set Value	Description
22.03	3	Frequency Command by Modbus RS–485
50.01	1	Communication node (1 ~ 32)
50.02	0	Modbus baud rate (2,400bps ~ 19,200bps)

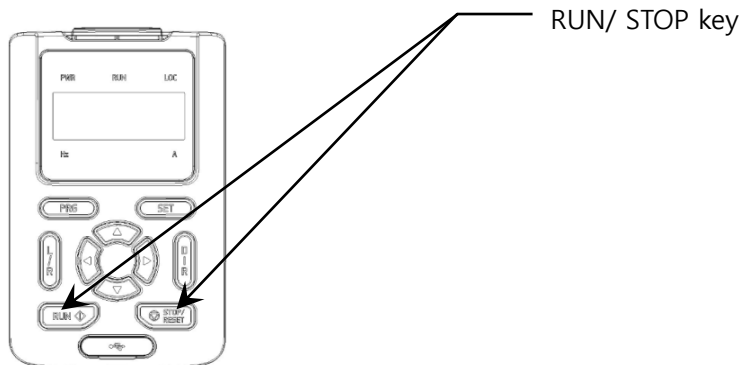
❖ Set Frequency Setpoint

- Integer data represents 0.01 Hz (ex: 6000 = 60.00 Hz)
- Ref to '8.2.23 RS–485(Modbus)'.

7.6 Run Command Source to Run / Stop Keys on Keypad

- Diagram
- Programming A1 Parameters

❖ Diagram



❖ Programming A1 Parameters

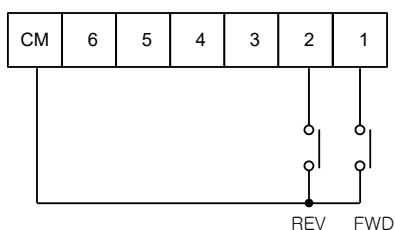
- On Keypad, program following parameters with corresponding values:

Code	Set Value	Description
20.02	9	Run Command Source to RUN / STOP Keys on Keypad

7.7 Run Command Source to Input Terminal

- Diagram
- Programming A1 Parameters

❖ Diagram



❖ Programming Run Command Source

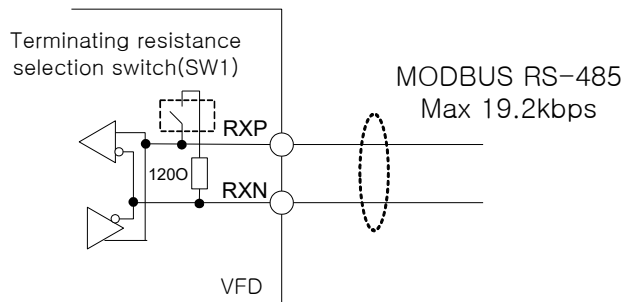
- On Keypad, program following parameters with corresponding values

Code	Set Value	Description
20.02	3	Run Command Source to Input Terminal (2 Wire 2, Refer to '8.2.9 Start/Stop/Direction)

7.8 Run Command Source to Modbus RS-485

- Diagram
- Programming A1 Parameters
- Set Frequency Setpoint

❖ Diagram



Terminal connector	Signal Descriptions
RXP	RS - 485+
RXN	RS - 485-

❖ Programming A1 Parameters

- On Keypad, program following parameters with corresponding values:

Code	Set Value	Description
20.02	7	Run Command by Modbus RS-485
50.01	1	Communication node (1 ~ 32)
50.02	0	Modbus baud rate (2,400bps ~ 19,200bps)

❖ Set Frequency Setpoint

- Data: (FWD: 0x0001, REV: 0x0002, RST: 0x0004)
- Ref to '8.2.23 RS-485(Modbus)'.

8. A1 Parameters

8.1 A1 Parameters Overview

A1 parameters are organized to various groups as summarized

Group	Contents	Page
01	VFD running status	83
02	Frequency reference indication	85
03	Trip information	86
04	Time counter	88
05	VFD firmware information	90
10	Standard DI, DO	91
11	Standard AI (O, OI)	100
12	Standard AO (FM, AMI)	105
20	Start/Stop/direction	109
21	Start/Stop mode	114
22	Frequency reference	117
23	Acceleration/Deceleration	127
24	Speed search	131
25	Over voltage suppression	132
26	KEB	137
27	DWELL	138
30	Frequency limits	139
31	Fault functions	140
32	Motor thermal protection	145
33	System Overload/Underload	146
40	PID	148
41	DBR duty Cycle	156
42	Monitoring/Scaling	157
43	Droop	158
50	RS-485 (Modbus)	161
51	Fieldbus (option)	168
96	User parameters	169
97	System	170
98	Motor control	172
99	Motor data	181

8.1.1 VFD running status

No.	Name	Range	Page
01.01	Output frequency monitor	0.00 to 400.0 [Hz]	83
01.02	Motor RPM monitor	0 to 60000 [rpm]	83
01.03	Encoder Speed	0 to 60000 [rpm]	83
01.04	Rotation direction monitor	STP / FWD / REV	83
01.05	Output current monitor	0.0 to 2000 [A]	83
01.07	DC voltage monitor	0 to 1000 [V]	83
01.08	Output voltage monitor	0 to 1000 [V]	84
01.09	Output power monitor	0.0 to 1000 [kW]	84

8.1.2 Frequency reference indication

No.	Name	Range	Page
02.01	Final frequency reference monitor	0.00 to 400.0 [Hz]	85
02.02	Modbus frequency reference monitor	0.00 to 400.0 [Hz]	85
02.03	Fieldbus frequency reference monitor	0.00 to 400.0 [Hz]	85

8.1.3 Trip information

No.	Name	Range	Page
03.01	Current trip, Source of Trip	–	86
03.02	Current trip, Frequency at Trip	0.00 to 400.0 [Hz]	86
03.03	Current trip, Current at Trip	0.0 to 2000 [A]	86
03.04	Current trip, Vdc at Trip	0 to 1000 [V]	86
03.05	Current trip, Running Status at Trip	STP, ACC, STD, DEC	86
03.06	Current trip, DI Status at Trip	0x00 to 0xFF	86
03.07	Current trip, DO Status at Trip	0x00 to 0xFF	86
03.08	Current trip, IGBT Temperature at Trip	0.0 to 160.0 [°C]	86
03.09	Current trip, Occurred time (Year)	2000 to 2099 [Year]	87
03.10	Current trip, Occurred time (Month, Day)	101 to 1231 [Month, Day]	87
03.11	Current trip, Occurred time (Hour, Minute)	0 to 2359 [Hour, Minute]	87
03.12	Current trip, Occurred time (Second)	0 to 59 [Sec]	87
03.13	Trip monitor 1, Source of Trip	–	87
03.14	Trip monitor 1, Frequency at Trip	0.00 to 400.0 [Hz]	87
03.15	Trip monitor 1, Current at Trip	0.0 to 2000 [A]	87
03.16	Trip monitor 1, Vdc at Trip	0 to 1000 [V]	87
03.17	Trip monitor 1, Running Status at Trip	STP, ACC, STD, DEC	87
03.18	Trip monitor 1, DI Status at Trip	0x00 to 0xFF	87
03.19	Trip monitor 1, DO Status at Trip	0x00 to 0xFF	87
03.20	Trip monitor 1, IGBT Temperature at Trip	0.0 to 160.0 [°C]	87
03.21	Trip monitor 1, Occurred time (Year)	2000 to 2099 [Year]	87
03.22	Trip monitor 1, Occurred time (Month, Day)	101 to 1231 [Month, Day]	87
03.23	Trip monitor 1, Occurred time (Hour, Minute)	0 to 2359 [Hour, Minute]	87
03.24	Trip monitor 1, Occurred time (Second)	0 to 59 [Sec]	87
03.25	Trip monitor 2, Source of Trip	–	87
03.26	Trip monitor 2, Frequency at Trip	0.00 to 400.0 [Hz]	87
03.27	Trip monitor 2, Current at Trip	0.0 to 2000 [A]	87
03.28	Trip monitor 2, Vdc at Trip	0 to 1000 [V]	87
03.29	Trip monitor 2, Running Status at Trip	STP, ACC, STD, DEC	87
03.30	Trip monitor 2, DI Status at Trip	0x00 to 0xFF	87

No.	Name	Range	Page
03.31	Trip monitor 2, DO Status at Trip	0x00 to 0xFF	87
03.32	Trip monitor 2, IGBT Temperature at Trip	0.0 to 160.0 [°C]	87
03.33	Trip monitor 2, Occurred time (Year)	2000 to 2099 [Year]	87
03.34	Trip monitor 2, Occurred time (Month, Day)	101 to 1231 [Month, Day]	87
03.35	Trip monitor 2, Occurred time (Hour, Minute)	0 to 2359 [Hour, Minute]	87
03.36	Trip monitor 2, Occurred time (Second)	0 to 59 [Sec]	87
03.37	Trip monitor 3, Source of Trip	–	87
03.38	Trip monitor 3, Frequency at Trip	0.00 to 400.0 [Hz]	87
03.39	Trip monitor 3, Current at Trip	0.0 to 2000 [A]	87
03.40	Trip monitor 3, Vdc at Trip	0 to 1000 [V]	87
03.41	Trip monitor 3, Running Status at Trip	STP, ACC, STD, DEC	87
03.42	Trip monitor 3, DI Status at Trip	0x00 to 0xFF	87
03.43	Trip monitor 3, DO Status at Trip	0x00 to 0xFF	87
03.44	Trip monitor 3, IGBT Temperature at Trip	0.0 to 160.0 [°C]	87
03.45	Trip monitor 3, Occurred time (Year)	2000 to 2099 [Year]	87
03.46	Trip monitor 3, Occurred time (Month, Day)	101 to 1231 [Month, Day]	87
03.47	Trip monitor 3, Occurred time (Hour, Minute)	0 to 2359 [Hour, Minute]	87
03.48	Trip monitor 3, Occurred time (Second)	0 to 59 [Sec]	87
03.49	Trip monitor 4, Source of Trip	–	87
03.50	Trip monitor 4, Frequency at Trip	0.00 to 400.0 [Hz]	87
03.51	Trip monitor 4, Current at Trip	0.0 to 2000 [A]	87
03.52	Trip monitor 4, Vdc at Trip	0 to 1000 [V]	87
03.53	Trip monitor 4, Running Status at Trip	STP, ACC, STD, DEC	87
03.54	Trip monitor 4, DI Status at Trip	0x00 to 0xFF	87
03.55	Trip monitor 4, DO Status at Trip	0x00 to 0xFF	87
03.56	Trip monitor 4, IGBT Temperature at Trip	0.0 to 160.0 [°C]	87
03.57	Trip monitor 4, Occurred time (Year)	2000 to 2099 [Year]	87
03.58	Trip monitor 4, Occurred time (Month, Day)	101 to 1231 [Month, Day]	87
03.59	Trip monitor 4, Occurred time (Hour, Minute)	0 to 2359 [Hour, Minute]	87
03.60	Trip monitor 4, Occurred time (Second)	0 to 59 [Sec]	87
03.61	Trip monitor 5, Source of Trip	–	87
03.62	Trip monitor 5, Frequency at Trip	0.00 to 400.0 [Hz]	87
03.63	Trip monitor 5, Current at Trip	0.0 to 2000 [A]	87
03.64	Trip monitor 5, Vdc at Trip	0 to 1000 [V]	87
03.65	Trip monitor 5, Running Status at Trip	STP, ACC, STD, DEC	87
03.66	Trip monitor 5, DI Status at Trip	0x00 to 0xFF	87
03.67	Trip monitor 5, DO Status at Trip	0x00 to 0xFF	87
03.68	Trip monitor 5, IGBT Temperature at Trip	0.0 to 160.0 [°C]	87
03.69	Trip monitor 5, Occurred time (Year)	2000 to 2099 [Year]	87
03.70	Trip monitor 5, Occurred time (Month, Day)	101 to 1231 [Month, Day]	87
03.71	Trip monitor 5, Occurred time (Hour, Minute)	0 to 2359 [Hour, Minute]	87
03.72	Trip monitor 5, Occurred time (Second)	0 to 59 [Sec]	87
03.73	Trip Counter	0 to 40000	87

8.1.4 Time counter

No.	Name	Range	Page
04.01	Power on–day counter	0 to 65535 [Day]	88
04.02	Power on–time counter	0 to 1439 [Minute]	88
04.03	Run–day counter	0 to 65535 [Day]	88
04.04	Run–time counter	0 to 1439 [Minute]	88
04.05	Fan on–day counter	0 to 65535 [Day]	88
04.06	Fan on–time counter	0 to 1439 [Minute]	88
04.07	IGBT temperature	0.0 to 160.0 [°C]	89
04.08	Fieldbus status	0x00 to 0xFF	89

8.1.5 VFD firmware Information

No.	Name	Range	Page
05.01	Firmware name	STD: Standard	90
05.02	Firmware version	0.000 to 9.999	90
05.03	Current time (Year)	2000 to 2099 [Year]	90
05.04	Current time (Month, Day)	101 to 1231 [Month, Day]	90
05.05	Current time (Hour, Minute)	0 to 2359 [Hour, Minute]	90
05.06	Current time (Second)	0 to 59 [Sec]	90

8.1.6 Standard DI, DO (RN0~RN3, AL0~AL1~AL2)

No.	Name	Edit	Range	Default	Page
10.01	DI Status	–	0x00 to 0xFF	–	91
10.02	DI delayed status	–	0x00 to 0xFF	–	91
10.03	DI forced selection	X	0x00 to 0xFF	0x00	91
10.04	DI forced data	O	0x00 to 0xFF	0x00	91
10.05	DI contact type selection	X	0x00 to 0xFF	0x00	92
10.06	DI1 ON delay time	O	0 to 30000 [mSec]	10 mSec	92
10.07	DI1 OFF delay time	O	0 to 30000 [mSec]	10 mSec	92
10.08	DI2 ON delay time	O	0 to 30000 [mSec]	10 mSec	92
10.09	DI2 OFF delay time	O	0 to 30000 [mSec]	10 mSec	92
10.10	DI3 ON delay time	O	0 to 30000 [mSec]	10 mSec	92
10.11	DI3 OFF delay time	O	0 to 30000 [mSec]	10 mSec	92
10.12	DI4 ON delay time	O	0 to 30000 [mSec]	10 mSec	93
10.13	DI4 OFF delay time	O	0 to 30000 [mSec]	10 mSec	93
10.14	DI5 ON delay time	O	0 to 30000 [mSec]	10 mSec	93
10.15	DI5 OFF delay time	O	0 to 30000 [mSec]	10 mSec	93
10.16	DI6 ON delay time	O	0 to 30000 [mSec]	10 mSec	93
10.17	DI6 OFF delay time	O	0 to 30000 [mSec]	10 mSec	93
10.18	DI7 ON delay time	O	0 to 30000 [mSec]	10 mSec	93
10.19	DI7 OFF delay time	O	0 to 30000 [mSec]	10 mSec	93
10.20	DI8 ON delay time	O	0 to 30000 [mSec]	10 mSec	93
10.21	DI8 OFF delay time	O	0 to 30000 [mSec]	10 mSec	93
10.22	DO (RN0~RN3, AL0~AL2) delayed status	O	0x00 to 0xFF	–	94
10.23	DO (RN0~RN3, AL0~AL2) forced selection	X	0x00 to 0xFF	0x00	94
10.24	DO (RN0~RN3, AL0~AL2) forced data	O	0x00 to 0xFF	0x00	94
10.25	DO1 (RN0~RN1), DO2 (RN2~RN3) contact type selection	X	0x00 to 0xFF	0x00	94
10.26	DO1 (RN0~RN1) source	X	0. Run 1. FA1 2. FA2 3. OL 4. OD 5. AL	1	95
10.27	DO1 (RN0~RN1) ON delay time	O	0.0 to 3000 [Sec]	0.0 Sec	98
10.28	DO2 (RN0~RN1) OFF delay time	O	0.0 to 3000 [Sec]	0.0 Sec	98
10.29	DO2 (RN2~RN3) source	X	0. Run 1. FA1 2. FA2 3. OL 4. OD 5. AL	0	98
10.30	DO2 (RN2~RN3) ON delay time	O	0.0 to 3000 [Sec]	0.0 Sec	98
10.31	DO2 (RN2~RN3) OFF delay time	O	0.0 to 3000 [Sec]	0.0 Sec	98

No.	Name	Edit	Range	Default	Page
10.32	Alarm Relay (AL0–AL1–AL2) source	X	0. Run 1. FA1 2. FA2 3. OL 4. OD 5. AL	5	98
10.33	Alarm Relay (AL0–AL1–AL2) ON delay time	O	0.0 to 3000 [Sec]	0.0 Sec	98
10.34	Alarm Relay (AL0–AL1–AL2) OFF delay time	O	0.0 to 3000 [Sec]	0.0 Sec	98
10.35	VFD Overload warning level	X	10.0 to 200.0 [%]	100.0 %	99
10.36	FA2 reference at acceleration	X	'10.37' to '30.01' [Hz]	0.00 Hz	99
10.37	FA2 reference at deceleration	X	0.00 to '10.36' [Hz]	0.00 Hz	99
10.38	PID Error Tolerance	X	0.0 to 100.0 [%]	100.0 %	99

8.1.7 Standard AI (O, OI)

No.	Name	Edit	Range	Default	Page
11.01	AI (O, OI) forced selection	X	0x00 to 0xFF	0x00	100
11.02	AI1 (O) actual value	–	0.0 to 100.0 [%]	–	100
11.03	AI1 (O) scaled value	–	0.00 to 400.0 [Hz] – Frequency 0.0 to 100.0 [%] – PID	–	100
11.04	AI1 (O) forced value	O	0.0 to 100.0 [%]	0.00 %	100
11.05	AI1 (O) filter time	O	0 to 30000 [ms]	100 ms	101
11.06	AI1 (O) source min	X	0.0 to 100.0 [%]	0.00 %	101
11.07	AI1 (O) source max	X	0.0 to 100.0 [%]	100.0 %	101
11.08	AI1 (O) scaled at AI1 min	X	0.00 to 400.0 [Hz] – Frequency 0.0 to 100.0 [%] – PID	0.00 Hz	102
11.09	AI1 (O) scaled at AI1 max	X	0.00 to 400.0 [Hz] – Frequency 0.0 to 100.0 [%] – PID	60.00 Hz	102
11.10	AI2 (OI) actual value	–	0.0 to 100.0 [%]	–	102
11.11	AI2 (OI) scaled value	–	0.0 to 100.0 [%]	–	102
11.12	AI2 (OI) forced value	O	0.0 to 100.0 [%]	0.00 %	103
11.13	AI2 (OI) filter time	O	0 to 30000 [ms]	100 ms	103
11.14	AI2 (OI) source min	X	0.0 to 100.0 [%]	0.00 %	103
11.15	AI2 (OI) source max	X	0.0 to 100.0 [%]	100.0 %	104
11.16	AI2 (OI) scaled at AI2 min	X	0.00 to 400.0 [Hz] – Frequency 0.0 to 100.0 [%] – PID	0.00 Hz	104
11.17	AI2 (OI) scaled at AI2 max	X	0.00 to 400.0 [Hz] – Frequency 0.0 to 100.0 [%] – PID	60.00 Hz	104

8.1.8 Standard AO (FM, AMI)

No.	Name	Edit	Range	Default	Page
12.01	AO (FM, AMI) forced selection	X	0x00 to 0xFF	0x00	105
12.02	AO1 (FM) actual value	–	0.0 to 100.0 [%]	–	105
12.03	AO1 (FM) source	–	0. Out Frequency 1. Out Ampere 2. Out Voltage 3. Out Power 4. Out Torque	0	105
12.04	AO1 (FM) forced value	O	0.0 to 100.0 [%]	0.00 %	106
12.05	AO1 (FM) filter time	O	0 to 30000 [ms]	100 ms	106
12.06	AO1 (FM) source min	X	0.0 to 100.0 [%]	0.00 %	107
12.07	AO1 (FM) source max	X	0.0 to 100.0 [%]	100.0 %	107
12.08	AO1 (FM) out at AO1 min	X	0.0 to 100.0 [%]	0.00 %	108
12.09	AO1 (FM) out at AO1 max	X	0.0 to 100.0 [%]	100.0 %	108
12.10	AO2 (AMI) actual value	–	0.0 to 100.0 [%]	–	108
12.11	AO2 (AMI) source	–	0. Out Frequency 1. Out Ampere 2. Out Voltage 3. Out Power 4. Out Torque	1	108
12.12	AO2 (AMI) forced value	O	0.0 to 100.0 [%]	0.00 %	108
12.13	AO2 (AMI) filter time	O	0 to 30000 [ms]	100 ms	108
12.14	AO2 (AMI) source min	X	0.0 to 100.0 [%]	0.00 %	108
12.15	AO2 (AMI) source max	X	0.0 to 100.0 [%]	100.0 %	108
12.16	AO2 (AMI) out at AO2 min	X	0.0 to 100.0 [%]	0.00 %	108
12.17	AO2 (AMI) out at AO2 max	X	0.0 to 100.0 [%]	100.0 %	108

8.1.9 Start/stop/direction

No.	Name	Edit	Range	Default	Page
20.01	Ext1 / Ex2 selection	X	0. Ext1 1. Ext2 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	0	109
20.02	Ext1 commands	X	0. Not Selected 1. 1 Wire 2. 2 Wire 1 3. 2 Wire 2 4. 2 Wire 3 5. 3 Wire 1 6. 3 Wire 2 7. Modbus 8. Fieldbus 9. Keypad	3	110
20.03	Ext1 in source 1	X	0. Not Selected 1. Selected 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	2	112
20.04	Ext1 in source 2	X		3	112
20.05	Ext1 in source 3	X		0	112

No.	Name	Edit	Range	Default	Page
20.06	Ext2 commands	X	0. Not Selected 1. 1 Wire 2. 2 Wire 1 3. 2 Wire 2 4. 2 Wire 3 5. 3 Wire 1 6. 3 Wire 2 7. Modbus 8. Fieldbus 9. Keypad	0	112
20.07	Ext2 in source 1	X	0. Not Selected	0	112
20.08	Ext2 in source 2	X	1. Selected	0	112
20.09	Ext2 in source 3	X	2. DI1	0	112
20.10	Jogging enable	X	3. DI2	0	113
20.11	Jogging 1 start source	X	4. DI3	0	113
20.12	Jogging 2 start source	X	5. DI4	0	113
20.13	Direction	X	6. DI5	0	113
			7. DI6	0	113
			8. DI7	0	113
			9. DI8	0	113
			0. Forward	0	113
			1. Reverse	0	113

8.1.10 Start/Stop mode

No.	Name	Edit	Range	Default	Page
21.01	Torque boost mode	X	0. Manual torque boost 1. Automatic torque boost	0	114
21.02	Magnetization time	X	0.0 to 3000 [Sec]	0.0 Sec	114
21.03	Magnetization Level	X	0.0 to 200.0 [%]	30.0 %	114
21.04	Stop mode	O	0. Ramp (Dec) 1. Coast (Free-run)	0	114
21.05	DC current control (DC brake)	X	0. Disable 1. Enable	0	115
21.06	DC hold frequency	X	0.00 to 10.00 [Hz]	0.50 Hz	115
21.07	DC hold time	X	0.0 to 3000 [Sec]	0.0 Sec	115
21.08	Dc hold delay time	X	0.0 to 50.0 [Sec]	0.0 Sec	115
21.09	DC current reference	X	0.0 to 100.0 [%]	10.0 %	115
21.10	Emergency stop mode	O	0. Ramp (Dec) 1. Coast (Free-run)	0	116
21.11	Emergency stop source	O	0. Active 1. Inactive 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	1	116

8.1.11 Frequency reference

No.	Name	Edit	Range	Default	Page
22.01	Frequency ref input (keypad)	O	0.00 to 400.0 [Hz]	0.00 Hz	118
22.03	Frequency ref 1 source	X	0. Not Selected 1. AI1 (O) 2. AI2 (OI) 3. Modbus 4. Field bus 5. PID 6. Keypad 7. UP / DOWN	1	118
22.04	Frequency ref 2 source	X		2	118
22.05	Frequency ref 1 /ref 2 combination	X	0. '22.03' 1. '22.03' + '22.04' 2. '22.03' - '22.04' 3. '22.03' x '22.04' 4. MIN ('22.03', '22.04') 5. MAX ('22.03', '22.04')	0	119
22.06	Frequency ref 1 /ref 2 selection	X	0. '22.05' setting value 1. '22.04' setting value 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	6	119
22.07	Constant frequency source 1	X	0. Not selected 1. Selected 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	4	120
22.08	Constant frequency source 2	X		5	121
22.09	Constant frequency source 3	X		0	121
22.10	Constant frequency 1	X	0.00 to 400.0 [Hz]	5.00 Hz	121
22.11	Constant frequency 2	X	0.00 to 400.0 [Hz]	10.00 Hz	121
22.12	Constant frequency 3	X	0.00 to 400.0 [Hz]	20.00 Hz	121
22.13	Constant frequency 4	X	0.00 to 400.0 [Hz]	30.00 Hz	121
22.14	Constant frequency 5	X	0.00 to 400.0 [Hz]	40.00 Hz	121
22.15	Constant frequency 6	X	0.00 to 400.0 [Hz]	50.00 Hz	121
22.16	Constant frequency 7	X	0.00 to 400.0 [Hz]	60.00 Hz	121
22.17	Jogging 1 ref	X	0.00 to 400.0 [Hz]	0.00 Hz	122
22.18	Jogging 2 ref	X	0.00 to 400.0 [Hz]	0.00 Hz	122

No.	Name	Edit	Range	Default	Page
22.19	Skip frequency 1 low	X	0.00 to 400.0 [Hz]	0.00 Hz	123
22.20	Skip frequency 1 high	X	0.00 to 400.0 [Hz]	0.00 Hz	123
22.21	Skip frequency 2 low	X	0.00 to 400.0 [Hz]	0.00 Hz	123
22.22	Skip frequency 2 high	X	0.00 to 400.0 [Hz]	0.00 Hz	123
22.23	Skip frequency 3 low	X	0.00 to 400.0 [Hz]	0.00 Hz	123
22.24	Skip frequency 3 high	X	0.00 to 400.0 [Hz]	0.00 Hz	123
22.25	UP/DOWN function	X	0. Disable 1. Enable	0	124
22.26	UP/DOWN initial value	X	0.00 to 400.0 [Hz] – frequency 0.0 to 100.0 [%] – PID	0.00 Hz	124
22.27	UP/DOWN up source	X	0. Not selected 1. Selected 2. DI1 3. DI2 4. DI3	0	124
22.28	UP/DOWN down source	X	5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	0	124
22.29	UP/DOWN ref changing time	X	0.0 to 3000 [Sec]	10.0 Sec	125
22.30	UP/DOWN min value	X	0.00 to 400.0 [Hz] – frequency 0.0 to 100.0 [%] – PID	0.00 Hz	125
22.31	UP/DOWN max value	X	0.00 to 400.0 [Hz] – frequency 0.0 to 100.0 [%] – PID	60.00 Hz	125
22.32	UP/DOWN ref monitor	X	0.00 to 400.0 [Hz] – frequency 0.0 to 100.0 [%] – PID	–	125
22.33	UP/DOWN initial value saving	X	0. Not saving 1. Saving	0	125
22.34	UP/DOWN ref reset source	X	0. Not selected 1. Selected 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	0	126

8.1.12 Acceleration/Deceleration

No.	Name	Edit	Range	Default	Page
23.03	Ramp set selection	–	0. Acc/Dec Time1 1. Acc/Dec Time2 2. Frequency 3. DI1 4. DI2 5. DI3 6. DI4 7. DI5 8. DI6 9. DI7 10. DI8	0	127
23.04	Acceleration time 1	O	0.0 to 3000 [Sec]	30.0 Sec	128
23.05	Deceleration time 1	O	0.0 to 3000 [Sec]	30.0 Sec	128
23.06	Acceleration time 2	O	0.0 to 3000 [Sec]	30.0 Sec	128
23.07	Deceleration time 2	O	0.0 to 3000 [Sec]	30.0 Sec	129
23.08	Acceleration pattern selection	O	0. Linear	0	129
23.09	Deceleration pattern selection	O	1. S Curve 2. U Curve	0	129
23.10	Acceleration time transition frequency	O	0.00 to 400.0 [Hz]	0.00 Hz	130
23.11	Deceleration time transition frequency	O	0.00 to 400.0 [Hz]	0.00 Hz	130
23.12	Jogging acceleration time	O	0.0 to 3000 [Sec]	30.0 Sec	130
23.13	Jogging deceleration time	O	0.0 to 3000 [Sec]	30.0 Sec	130
23.14	Emergency stop time	O	0.0 to 3000 [Sec]	3.0 Sec	130

8.1.13 Speed search

No.	Name	Edit	Range	Default	Page
24.01	Speed search start mode	O	0. Start from 0 Hz 1. Start from frequency corresponding motor speed	0	131
24.02	Speed search current Limit	O	50.0 to 180.0 [%]	100.0%	131
24.03	Voltage increment in speed search mode	O	10 to 500 [%]	100 %	131
24.04	Speed search delay ratio	O	0.50 ~ 5.00 [x1]	1.00	131

8.1.14 Over voltage suppression

No.	Name	Edit	Range	Default	Page
25.01	OVS selection	O	0: Disable 1: Enable	0	133
25.02	Maximum OVS output frequency	O	"30.01" to 300.0 [Hz]	80.00 Hz	133
25.03	OVS P gain	O	0 to 10000	1000	133
25.04	OVS I gain	O	0 to 10000 [Sec]	100 Sec	133
25.05	OVS D gain	O	0 to 10000 [Sec]	0 Sec	134
25.06	q-Current reference	O	-100.0 to 100.0	0.0	134
25.07	Filter bandwidth	O	0.0 to 1000 [ms]	1 ms	134
25.08	Limit time	O	0.0 to 100 [Sec]	0.5 Sec	135

8.1.15 KEB

No.	Name	Edit	Range	Default	Page
26.01	KEB selection	X	0: Disable 1: Enable ('26.02' decelerating to slope) 2: Enable (Voltage control)	0	135
26.02	KEB gain	X	1 to 1000	100	135
26.03	KEB Voltage control P gain	X	0.01 to 10.00	1.00	135
26.04	KEB Voltage control I gain	X	0.01 to 10.00	1.00	135

8.1.16 DWELL

No.	Name	Edit	Range	Default	Page
27.01	DWELL reference at start	X	0.00 to 400.0 [Hz]	0.00 Hz	138
27.02	DWELL time at start	X	0.0 to 10.0 [Sec]	0.0 Sec	138
27.03	DWELL reference at stop	X	0.00 to 400.0 [Hz]	0.00 Hz	138
27.04	DWELL time at stop	X	0.0 to 10.0 [Sec]	0.0 Sec	138

8.1.17 Frequency limits

No.	Name	Edit	Range	Default	Page
30.01	Maximum frequency	O	0.00 to 400.0 [Hz]	60.00 Hz	139
30.02	Minimum frequency	O	0.00 to 400.0 [Hz]	0.00 Hz	139
30.03	Start frequency	X	0.10 to 60.00 [Hz] : VF,SLV mode 0.00 to 60.00 [Hz] : Vector control mode	0.50 Hz 0.00 Hz	139

8.1.18 Fault functions

No.	Name	Edit	Range	Default	Page
31.01	External event 1 source	–	0. Active 1. Inactive 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	1	140
31.02	External event 2 source	–		1	140
31.03	External event 3 source	–		1	140
31.04	External event 4 source	–		1	140
31.05	External event 5 source	–		1	140
31.06	Fault reset selection	X	0. Not Selected 1. Selected 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	7	140
31.07	Restart mode selection	X	0. No Restart 1. Restart from 0Hz 2. Resume at frequency corresponding motor speed 3. Resume at motor speed, then decelerated stop	0	141
31.08	Alarm relay operation mode	X	0. Inactive for the Under Voltage trip signal 1. Inactive during auto reset 2. Active every trip 3. Inactive during auto reset (Only active for the Under Voltage trip signal endlessly)	0	141
31.09	Restart delay time	X	0.3 to 10.0 [Sec]	1.0 Sec	141
31.10	Automatic reset item 1	X	0x00 ~ 0xFF	0x00	142
31.11	Automatic reset item 2	X	0x00 ~ 0xFF	0x00	142
31.12	User reset item selection	X	0~29	0	142
31.13	Restart trial 1	X	0~10	0	142
31.14	Restart trial 2	X	0~10	0	142
31.15	Earth Fault	X	0.0 to 100.0 [%] 0.0: Disable	0.0 %	143
31.16	Supply phase loss	O	0 to 30 [Sec] 0: Disable	10 Sec	143
31.17	Stall function	X	0. No Operation 1. VFD overload 2. Over Voltage 3. VFD overload and Over Voltage	3	143
31.18	Stall current limit	X	20.0 to 200.0 [%] : HD rated 20.0 to 165.0 [%] : ND rated	180.0 % 150.0 %	143
31.19	Stall deceleration time	O	0.1 to 30.0 [Sec] : 30kW upper 0.1 to 30.0 [Sec] : 22kW lower	10.0 Sec 1.0 Sec	144

No.	Name	Edit	Range	Default	Page
31.22	RS485 Modbus time out check enable	O	0. Always running 1. Only During VFD is Running	0	144
31.23	RS485 Modbus time out	O	0 to 60 [Sec] 0: Disable	0 Sec	144
31.24	Low voltage fault level	X	90.0 to 180.0 [%]	100 %	144

8.1.19 Motor thermal protection

No.	Name	Edit	Range	Default	Page
32.01	Electronic thermal overload level	X	20.0 to 120.0 [%]	100.0 %	145
32.02	Electronic thermal overload profile	X	0. Self Cooling 1. Forced Cooling 2. Disable Electronic thermal overload detection	1	145
32.03	Fan operation mode	X	0. Always running 1. Only During VFD is running	0	145
32.04	Fan off delay time	X	0.0 to 1000.0 [Sec]	30.0 Sec	145

8.1.20 System Overload/Underload detection

No.	Name	Edit	Range	Default	Page
33.01	System Load Detection Selection	X	0: Disabled 1: Overload Detection 2: Underload Detection 3: Overload/Underload Detection 4: Overload Detection with Fault(oLdt) 5: Underload Detection with Fault(uLdt) 6: Overload/Underload Detection with Fault(oLdt, uLdt)	0	146
33.02	System Overload Detection Level	X	20.0 to 200.0[%]	100.0%	146
33.03	System Underload Detection Level	X	20.0 to 200.0[%]	100.0%	146
33.04	System Overload/Underload Detection Time	X	0.0 to 60.0[sec]	10.0 Sec	147
33.05	System Overload/Underload Detection Safe Zone	X	0.0 to '30.01'[Hz]	0.00Hz	147

8.1.21 PID

No.	Name	Edit	Range	Default	Page
40.01	PID function	X	0. Disable 1. Enable	0	148
40.02	PID reference	O	'40.25' to '40.26'	0.0 %	148
40.03	PID reference source	X	0. N/A 1. AI1(O), AI2 (OI) 2. '40.02' 3. Modbus 4. Fieldbus	2	149
40.04	PID feedback source	X	0. AI1 (O) 1. AI2 (OI)	1	149
40.05	PID P gain	O	0.1 to 2000.0 [%]	100.0 %	149
40.06	PID I gain	O	0.0 to 3600.0 [Sec]	1.0 Sec	150
40.07	PID D gain	O	0.00 to 10.00 [Sec]	0.00 Sec	150
40.08	PID Err limit	O	0.0 to 100.0 [%]	100.0 %	150
40.09	PID output high limit	O	–100.0 to 100.0 [%]	100.0 %	150
40.10	PID output low limit	O	–100.0 to 100.0 [%]	0.0 %	150
40.11	PID output invert	X	0. Disable 1. Enable	0	150
40.12	PID scale factor	X	0.1 to 1000 [%]	100.0 %	150
40.13	Pre PID frequency	X	0.00 to 400.0 [Hz]	0.00 Hz	151
40.14	PID sleep frequency	X	0.00 to 400.0 [Hz]	0.00 Hz	151
40.15	PID sleep/wake up delay time	X	0.0 to 30.0 [Sec]	0.0 Sec	151
40.16	PID wake up frequency	X	'40.14' to 400.0 [Hz]	0.00 Hz	152
40.17	PID feedback monitor	–	0.0 to 100.0 [%]	–	152
40.18	PID output monitor	–	0.0 to 100.0 [%]	–	152

No.	Name	Edit	Range	Default	Page
40.19	PID integral reset source	X	0. Not selected 1. Selected 2. DI1 3. DI2 4. DI3 5. DI4	0	152
40.20	PID disable source	X	6. DI5 7. DI6 8. DI7 9. DI8	0	153
40.21	ref source 1 at PID disable	X	0. Not selected 1. AI1 (O) 2. AI2 (OI) 3. Modbus	1	153
40.22	ref source 2 at PID disable	X	4. Fieldbus 5. PID 6. Keypad 7. UP/DOWN	2	154
40.23	ref 1 /ref 2 combination at PID disable	X	0. '40.21' 1. '40.21' + '40.22' 2. '40.21' - '40.22' 3. '40.21' x '40.22' 4. MIN ('40.21', '40.22') 5. MAX ('40.21', '40.22')	0	154
40.24	ref 1 /ref 2 selection at PID disable	X	0. '40.23' setting value 1. '40.22' setting value 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	0	154
40.25	PID Control physics quantity select		0. % 1. Hz 2. Kpa	0	155
40.26	PID Control Maximum physics quantity		'40.27' to 200.0 % '40.27' to '30.01' Hz '40.27' to 200.0 Kpa Setting range determined by '40.25' settings	100.00 % 60.00 Hz 100.00 Kpa	155
40.27	PID Control Minimum physics quantity		0.00 to '40.26'	0.00	155

8.1.22 DBR Duty Cycle

No.	Name	Edit	Range	Default	Page
41.01	DBR Mode	X	0: DBR disabled 1: Only during VFD running 2: Always	1	156
41.02	DBR Duty cycle	X	0.0~50.0%	10.0	156

8.1.23 Monitoring/Scaling

No.	Name	Edit	Range	Default	Page
42.01	Frequency scaling	X	0.00 to 400.0 [Hz]	60.00 Hz	157
42.02	Rpm display scale factor	O	1 to 9999	100	157
42.10	Flux braking operating frequency	X	0 to 10.00 [Hz]	5.00 Hz	157

8.1.24 Droop

No.	Name	Edit	Range	Default	Page
43.01	Droop type	O	0: No droop control 1: Open loop 2: F/B (0~10V) 3: F/B (4~20mA)	0	158
43.02	Droop start frequency	O	0.00 to 400.0 [Hz]	0.00 Hz	158
43.04	Droop gain	O	0.00 to 50.00	5.00	159
43.05	Droop start torque	O	0.0 to 100.0 [%]	0.0 %	159
43.06	Droop ramp time	O	1.0 to 100.0 [Sec]	20.0 Sec	159

8.1.25 RS-485 (Modbus)

No.	Name	Edit	Range	Default	Page
50.01	Modbus node ID	X	1 to 32	1	161
50.02	Modbus baud rate	X	1. 2,400 [bps] 2. 4,800 [bps] 3. 9,600 [bps] 4. 19,200 [bps]	3	161

8.1.26 Fieldbus (option)

No.	Name	Edit	Range	Default	Page
51.01	Fieldbus option type	X	0: Modbus 1: Profibus-DP 2: Device-Net 3: Ethernet series 4: CC-Link	0	168
51.02	Fieldbus station number	X	1 to 32: Ethernet series 1 to 63: Device-Net 1 to 125: Profibus-DP 1 to 64 : CC-Link	1	168
51.03	Fieldbus byte swap	X	0: Normal 1: Swap	0	168
51.08	Fieldbus input data 1	X	0x0000 to 0xFFFF	0x0603	168
51.09	Fieldbus input data 2	X	0x0000 to 0xFFFF	0x0001	168
51.10	Fieldbus input data 3	X	0x0000 to 0xFFFF	0x0202	168
51.11	Fieldbus input data 4	X	0x0000 to 0xFFFF	0x0203	168
51.12	Fieldbus input data 5	X	0x0000 to 0xFFFF	0x0201	168
51.13	Fieldbus input data 6	X	0x0000 to 0xFFFF	0x0101	168
51.14	Fieldbus input data 7	X	0x0000 to 0xFFFF	0x0102	168
51.15	Fieldbus input data 8	X	0x0000 to 0xFFFF	0x010C	168
51.16	Fieldbus input data 9	X	0x0000 to 0xFFFF	0x010d	168
51.17	Fieldbus input data 10	X	0x0000 to 0xFFFF	0x0111	168
51.18	Fieldbus input data 11	X	0x0000 to 0xFFFF	0x0115	168
51.19	Fieldbus input data 12	X	0x0000 to 0xFFFF	0x0000	168
51.20	Fieldbus output data 1	X	0x0000 to 0xFFFF	0x0202	168
51.21	Fieldbus output data 2	X	0x0000 to 0xFFFF	0x0203	168
51.22	Fieldbus output data 3	X	0x0000 to 0xFFFF	0x0201	168
51.23	Fieldbus output data 4	X	0x0000 to 0xFFFF	0x0002	168
51.24	Fieldbus output data 5	X	0x0000 to 0xFFFF	0x0000	168
51.25	Fieldbus output data 6	X	0x0000 to 0xFFFF	0x0000	168
51.26	Fieldbus output data 7	X	0x0000 to 0xFFFF	0x0000	168
51.27	Fieldbus output data 8	X	0x0000 to 0xFFFF	0x0000	168
51.28	Fieldbus output data 9	X	0x0000 to 0xFFFF	0x0000	168
51.29	Fieldbus output data 10	X	0x0000 to 0xFFFF	0x0000	168
51.30	Fieldbus output data 11	X	0x0000 to 0xFFFF	0x0000	168
51.31	Fieldbus output data 12	X	0x0000 to 0xFFFF	0x0000	168
51.32	Fieldbus status	X	0x0000 to 0xFFFF	-	168
51.33	Fieldbus version	X	0x0000 to 0xFFFF	-	168
51.34	CC-Link baudrate selection	X	0 to 4	0	168

8.1.27 User parameters

No.	Name	Edit	Range	Default	Page
96.01	User parameter selection	X	0. Disable 1. Enable	0	169
96.02	User para. config 1	X	'00.00' ~ '99.99'	'22.03'	169
96.03	User para. config 2	X	'00.00' ~ '99.99'	'20.02'	169
96.04	User para. config 3	X	'00.00' ~ '99.99'	'01.01'	169
96.05	User para. config 4	X	'00.00' ~ '99.99'	'23.04'	169
96.06	User para. config 5	X	'00.00' ~ '99.99'	'23.05'	169
96.07	User para. config 6	X	'00.00' ~ '99.99'	'99.02'	169
96.08	User para. config 7	X	'00.00' ~ '99.99'	'99.01'	169
96.09	User para. config 8	X	'00.00' ~ '99.99'	'99.04'	169
96.10	User para. config 9	X	'00.00' ~ '99.99'	'99.03'	169
96.11	User para. config 10	X	'00.00' ~ '99.99'	'30.01'	169
96.12	User para. config 11	X	'00.00' ~ '99.99'	'00.00'	169
96.13	User para. config 12	X	'00.00' ~ '99.99'	'00.00'	169
96.14	User para. config 13	X	'00.00' ~ '99.99'	'00.00'	169
96.15	User para. config 14	X	'00.00' ~ '99.99'	'00.00'	169
96.16	User para. config 15	X	'00.00' ~ '99.99'	'00.00'	169
96.17	User para. config 16	X	'00.00' ~ '99.99'	'00.00'	169
96.18	User para. config 17	X	'00.00' ~ '99.99'	'00.00'	169
96.19	User para. config 18	X	'00.00' ~ '99.99'	'00.00'	169
96.20	User para. config 19	X	'00.00' ~ '99.99'	'00.00'	169
96.21	User para. config 20	X	'00.00' ~ '99.99'	'00.00'	169
96.22	User para. config 21	X	'00.00' ~ '99.99'	'00.00'	169
96.23	User para. config 22	X	'00.00' ~ '99.99'	'00.00'	169
96.24	User para. config 23	X	'00.00' ~ '99.99'	'00.00'	169
96.25	User para. config 24	X	'00.00' ~ '99.99'	'00.00'	169
96.26	User para. config 25	X	'00.00' ~ '99.99'	'00.00'	169
96.27	User para. config 26	X	'00.00' ~ '99.99'	'00.00'	169
96.28	User para. config 27	X	'00.00' ~ '99.99'	'00.00'	169
96.29	User para. config 28	X	'00.00' ~ '99.99'	'00.00'	169
96.30	User para. config 29	X	'00.00' ~ '99.99'	'00.00'	169
96.31	User para. config 30	X	'00.00' ~ '99.99'	'00.00'	169
96.32	User para. config 31	X	'00.00' ~ '99.99'	'00.00'	169
96.33	User para. config 32	X	'00.00' ~ '99.99'	'00.00'	169

8.1.28 System

No.	Name	Edit	Range	Default	Page
97.01	Initialization mode	X	0: Clear trip history 1: Clear all parameters	0	170
97.02	Parameter lock mode	X	0: All parameters are locked except '97.02', '97.03' by '97.03' 1: All parameters are locked except '97.02', '97.03', '22.01' by '97.03' 2: All parameters are locked except '97.02', '97.03' by '97.02' 3: All parameters are locked except '97.02', '97.03', '22.01' by '97.02' 4: All parameters are locked except '97.02', '97.03', '22.01', '23.04', '23.05' by '97.02'	0	170
97.03	Parameter lock source	X	0. Not Selected 1. Selected ^(*) 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	0	170
97.04	Current time setting (Year)	O	2000 ~ 2099	2016	171
97.05	Current time setting (Month, Day)	O	101 ~ 1231	224	171
97.06	Current time setting (Hour, Minute)	O	0 ~ 2359	0	171
97.07	Current time setting (Second)	O	0 ~ 59	0	171

(*) If the **'97.02'** code set 0 or 1, please be careful as the parameter prohibition setting is forcibly activated when the **'97.03'** code 1 is set.

8.1.29 Motor control

No.	Name	Edit	Range	Default	Page
98.01	Motor control mode	X	0. CT (V/f) 1. VT (V/f) 2. SLV 3. VECTOR(Encoder Option)	0	172
98.02	HD/ND (torque type) selection	X	0. HD type 1. ND type	0	173
98.03	PWM carrier frequency	O	1.0 to 10.0 [kHz]	3.0 kHz	173
98.04	PWM carrier mode	O	0. Normal 1. Swing PWM1	0	173
98.05	Voltage gain factor	O	20.0 to 110.0 [%]	100.0 %	174
98.06	Flux braking function	O	0. Disable 1. Enable	1	174
98.07	Flux braking reference	O	100 to 140 [%]	110 %	174
98.09	Manual torque boost voltage reference	X	0.00 to 50.00 [%]	1.0 %	174
98.10	Manual torque boost frequency reference	X	0.0 to 100.0 [%]	100.0 %	175

No.	Name	Edit	Range	Default	Page
98.11	Backward slip compensation	X	0.0 to 200.0 [%]	0.0 %	175
98.12	Regeneration slip compensation	X	0.0 to 200.0 [%]	0.0 %	175
98.13	Motor type	X	0. IM 1. PM SLV(Progressing) 2. IM SLV(Progressing) 3. PM Vector(Progressing)	0	175
98.14	Vector control speed controller P gain	O	0 to 1000	100	175
98.15	Vector control speed controller I gain	O	0.0 to 1000.0	100.0	176
98.16	Forward torque Limit	O	0.0 to 200.0 [%]	150.0 %	176
98.17	Forward regeneration torque limit	O	0.0 to 200.0 [%]	150.0 %	176
98.18	Reverse torque Limit	O	0.0 to 200.0 [%]	150.0 %	176
98.19	Reverse regeneration torque limit	O	0.0 to 200.0 [%]	150.0 %	176
98.20	Zero speed torque Limit	O	0.0 to 200.0 [%]	150.0 %	176
98.21	Zero speed regeneration torque limit	O	0.0 to 200.0 [%]	150.0 %	176
98.22	Torque limit setting method	X	0. AI1(O - L) : 0 ~ 10 [V] 1. AI2(OI - L) : 4 ~ 20 [mA] 2. Keypad('98.16' ~ '98.21') 3. Modbus 4. Feildbus 5. UP/DOWN Function	2	176
98.23	Speed controller output low pass filter time constant	O	0 to 100 [msec]	0 ms	177
98.24	Zero speed command source select	O	0. Not Selected 1. Selected(forced) 2. DI1 3. DI2 4. DI3 5. DI4 6. DI5 7. DI6 8. DI7 9. DI8	0	177
98.30	Speed/Torque Mode select	O	0. Speed control 1. Torque control (without speed control)	0	177
98.31	Torque rise time in torque mode	O	0.0 to 3000.0 [sec]	0.0 s	177
98.32	Torque fall time in torque mode	O	0.0 to 3000.0 [sec]	0.0 s	177
98.37	Speed limit bias in torque mode	O	0.01 to 10.00 [Hz]	1.00 Hz	178

8.1.30 Motor data

No.	Name	Edit	Range		Default	Page
99.01	Motor type	X	2.2L: 2.2kW 3.7L: 3.7kW 5.5L: 5.5kW 7.5L: 7.5kW 11L: 11kW 15L: 15kW 18.5L: 18.5kW 22L: 22kW 30L: 30kW 37L: 37kW 45L: 45kW 55L: 55kW 75L: 75kW 90L: 90kW	2.2H: 2.2kW 3.7H: 3.7kW 5.5H: 5.5kW 7.5H: 7.5kW 11H: 11kW 15H: 15kW 18.5H: 18.5kW 22H: 22kW 30H: 30kW 37H: 37kW 45H: 45kW 55H: 55kW 75H: 75kW 90H: 90kW 110H: 110kW 132H: 132kW 160H: 160kW 200H: 200kW 220H: 220kW 250H: 250kW 280H: 280kW 320H: 320kW 350H: 350kW	153	181
99.02	Motor rated voltage	X	200V/220V/230V/240V /380V/400V/415V/440V/460V/480V		Per Capacity	181
99.03	Motor rated frequency	X	0.00 to 400.0 [Hz]		60.00 Hz	181
99.04	Motor rated current	X	0.1 to 800.0 [A]		Per Capacity	181
99.05	Motor flux current	X	0.1 to 400.0 [A]		Per Capacity	182
99.06	Motor rated slip frequency	X	0.01 to 10.0 [%]		Per Capacity	182
99.07	Motor pole setting	X	2: 2 Poles 4: 4 Poles 6: 6 Poles 8: 8 Poles		4	182
99.08	Auto tuning	X	0. Disable 1. Enable		0	182
99.09	Motor data selection	X	0. Standard data 1. Auto tuning data		0	183
99.10	Motor resistance R1	X	0.1 to 30.0 [Ohm]		Per Capacity	183
99.11	Motor transient inductance Lsig	X	0.01 to 100.0 [mH]		Per Capacity	183
99.12	Motor resistance R1 (Auto tuned data)	X	0.1 to 30.0 [Ohm]		Per Capacity	183
99.13	Motor Transient inductance Lsig (Auto tuned data)	X	0.01 to 100.0 [mH]		Per Capacity	183

No.	Name	Edit	Range	Default	Page
99.15	Encoder PPR	X	0 to 9999	1024	183
99.16	Encoder direction setting	X	0. Counterclockwise 1. Clockwise	0	183
99.17	Encoder low pass filter time constant	X	0 to 10000 [msec]	0 msec	184
99.18	Encoder frequency deviation error frequency	X	0.00 to 10.00 [Hz]	3.00 Hz	184
99.19	Encoder frequency deviation error detection time	X	0.0 to 10.0 [sec]	0.0 sec	184
99.20	Overspeed error detection level	X	100.0 to 120.0 [%]	110.0 %	184
99.21	Overspeed error detection time	X	0.0 to 3.0 [sec]	0.0 sec	184
99.22	Encoder pulse error detection method select	X	0. Disable detection 1. Detect all encoder error 2. A and B all pulse error 3. A or B pulse error	0	184
99.23	Encoder pulse error detection time	X	0.0 to 60.0 [sec]	3.0 sec	185

8.2 Parameter detail

8.2.1 VFD running status

- **01.01 Output frequency monitor**

- *Range: 0.00 ~ 400.0 Hz*

Real time display of output frequency of the VFD

It displays in 0.01 unit if the frequency is under 100Hz

It displays in 0.1 unit if the frequency is above 100Hz

- **01.02 Motor RPM monitor**

- *Range: 0 ~ 60000 RPM*

below determined by equation:

$120 \times '01.01' (\text{Output frequency}) \times '42.02' (\text{RPM display scale factor}) / '99.07' (\text{Motor Pole setting})$

ex1) $'01.01' = 60\text{Hz}$, $'42.02' = 100$, $'99.07' = 4$: $'01.02' = 1800\text{rpm}$

ex2) $'01.01' = 60\text{Hz}$, $'42.02' = 50$, $'99.07' = 4$: $'01.02' = 900\text{rpm}$

- **01.03 Encoder Speed**

- *Range: 0 ~ 60000 RPM*

- **01.04 Rotation direction monitor**

- *STP: Stop*
- *FWD: Forward Run*
- *REV: Reverse Run*

Real time display of rotation of the VFD

- **01.05 Output current monitor**

- *Range: 0.0 ~ 2000 A*

Real time display of output current of the VFD

It displays in 0.1 unit if the output current is under 1000A

It displays in 1 unit if the output current is above 1000A

- **01.07 DC voltage monitor**

- *Range: 0 ~ 1000 V*

Real time voltage on DC bus

- **01.08 Output voltage monitor**

- *Range: 0 ~ 1000 V*

Real time display of output voltage of the VFD

- **01.09 Output power monitor**

- *Range: 0.0 ~ 1000 kW*

Real time display of power consumption of the VFD

It displays in 0.1 unit if the motor current is under 1000kW

It displays in 1 unit if the motor current is above 1000kW

below determined by equation:

Power: $\sqrt{3} \times V \times I$

ex) **'01.09'** = $1.37 \times \text{'01.05' (Motor current monitor)} \times \text{'01.08' (Output voltage monitor)}$

8.2.2 Frequency reference indication

- **02.01 Final frequency reference monitor**

- *Range: 0.00 ~ 400.0 Hz*

Displays the reference by panel
refer to '**22.XX**' block diagram

- **02.02 Modbus frequency reference monitor**

- *Range: 0.00 ~ 400.0 Hz*

Displays the reference by modbus
It can be shown the value even without setting '**22.03**' and '**22.04**'
❖ *Related Parameters: '**50.01**', '**50.02**'*

- **02.03 Field frequency reference monitor**

- *Range: 0.00 ~ 400.0 Hz*

Displays the reference by Fieldbus
It can be shown the value even without setting '**22.03**' and '**22.04**'
❖ *Related Parameters: '**51.01**' ~ '**51.26**'*

8.2.3 Trip information

When fault occurs, the VFD automatically displays this parameter

Additional information of the fault can be accessed by using up arrow key

- **03.01 Current trip, Source of trip**

Displays source of trip

- **03.02 Current trip, Frequency at trip**

Displays frequency at trip

- **03.03 Current trip, Current at trip**

Displays current at trip

- **03.04 Current trip, Vdc at trip**

Displays Vdc at trip

- **03.05 Current trip, Running Status at trip**

Displays VFD status at trip

- **03.06 Current trip, DI Status at trip**

Displays digital input status at trip
refer to '**10.01**' (DI status)

- **03.07 Current trip, DO Status at trip**

Displays digital output status at trip
refer to '**10.22**' (DO status)

- **03.08 Current trip, IGBT Temperature at trip**

Displays IGBT temperature at trip

- **03.09 Current trip, Occurred time (Year)**

Displays year at trip
If today is 2016, it shows 2016

- **03.10 Current trip, Occurred time (Month, Day)**

Displays month and day at trip
If today is December 31th, it shows 1231

- **03.11 Current trip, Occurred time (Hour, Minute)**

Displays hour and minutes at trip
If time is 11:59PM, it shows 2359

- **03.12 Current trip, Occurred time (Second)**

Displays second at trip
If second of time is 59, it shows 59

1. The five of trip history will save in the '**03.13**' ~ '**03.72**' parameter as above
2. If new trip is occurred, it saves and the oldest trip history will be deleted
3. The trip count never be changed if someone will not initialize a value

8.2.4 Time counter

- **04.01 Power on–day counter**

- *Range: 0 ~ 65536 Day*

The counter runs when the VFD power is on

- **04.02 Power on–time counter**

- *Range: 0 ~ 1439 min*

The counter runs when the VFD power is on

Whenever the counter rolls over, '**04.01**' (*Power on–day counter*) is incremented and this parameter turns to zero

- **04.03 Run–day counter**

- *Range: 0 ~ 65536 Day*

The counter runs when the VFD modulates

- **04.04 Run–time counter**

- *Range: 0 ~ 1439 min*

The counter runs when the VFD modulates

Whenever the counter rolls over, '**04.03**' (*Run–day counter*) is incremented and this parameter turns to zero

- **04.05 Fan on–day counter**

- *Range: 0 ~ 65536 Day*

The counter runs when the cooling fan is running

- **04.06 Fan on –time counter**

- *Range: 0 ~ 1439 min*

The counter runs when the cooling fan is running

Whenever the counter rolls over, '**04.05**' (*Fan on–day counter*) is incremented and this parameter turns to zero

- **04.07 IGBT temperature**

- *Range: 0.0 ~ 160.0 °C*

It displays IGBT temperature by NCT sensor

- **04.08 Fieldbus status**

- *Range: 0x00 ~ 0xFF*

It displays status of fieldbus option card

8.2.5 VFD firmware information

- **05.01 Firmware name**

- *STD: Standard*

It displays firmware name
General VFD shows STD

- **05.02 Firmware version**

- *Range: 0.000 ~ 9.999*

It displays firmware version

- **05.03 Current time (Year)**

- *Range: 2000 ~ 2099*

It displays current year
If today is 2016, it shows 2016

- **05.04 Current time (Month, Day)**

- *Range: 101 ~ 1231*

It displays current month and day
If today is December 31th, it shows 1231

- **05.05 Current time (Hour, Minute)**

- *Range: 0 ~ 2359*

It displays current hour and minute
If time is 11:59PM, it shows 2359

- **05.06 Current time (Second)**

- *Range: 0 ~ 59*

It displays current second
If second of time is 59, it shows 59

8.2.6 Standard DI, DO

- **10.01 DI status**

- *Range: 0x00 ~ 0xFF*

It displays the status of digital input

Example Data: 0000000000001111

Meaning: DI8~DI5 OFF, DI4~DI1 ON

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
It displays when extension I/O card is connected								DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1

- **10.02 DI Delayed status**

- *Range: 0x00 ~ 0xFF*

It displays the status of digital input that delayed

Example Data: 0000000011110000

Meaning: DI8~DI5 ON, DI4~DI1 OFF

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
It displays when extension I/O card is connected								DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1

- **10.03 DI Forced selection**

- *Range: 0x00 ~ 0xFF*
- *Initial value: 0x00*

The statuses of the digital input can be overridden for example testing purposes

A bit in parameter '**10.04' (DI forced data)** is provided for each digital input and its value is applied whenever the corresponding bit in this parameter is 1

- **10.04 DI Forced data**

- *Range: 0x00 ~ 0xFF*
- *Initial value: 0x00*

Allows the data value of a forced digital input to be changed from 0 to 1

It is only possible to forced an input that has been selected in parameter '**10.03' (DI forced selection)**

● 10.05 DI contact type selection

- Range: 0x00 ~ 0xFF
- Initial value: 0x00

It is possible to change the status of DI input type as N.O or N.C

Example Data: 0000000011110000

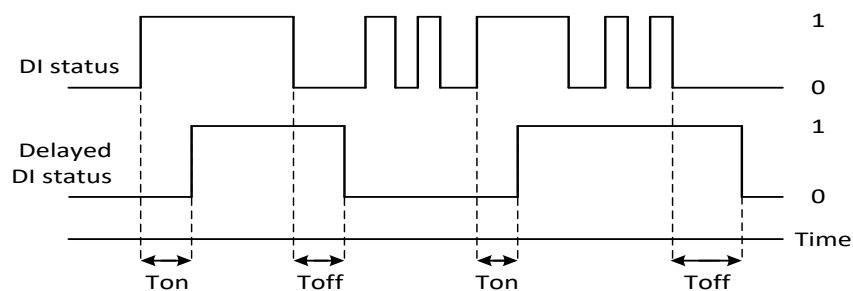
Meaning: DI8~DI5 Normal close type, DI4~DI1 Normal open type

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
It displays when extension I/O card is connected								DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1

● 10.06 DI1 ON delay time

- Range: 0 ~ 30000 mSec in 1 mSec
- Initial value: 10 mSec

Defines the activation delay for digital input DI1



- Ton: '10.06' (DI1 On delay time)
- Toff: '10.07' (DI1 Off delay time)

● 10.07 DI1 OFF delay time

- Range: 0 ~ 30000 Sec in 1 mSec
- Initial value: 10 mSec

Defines the activation ON delay for digital input DI1

● 10.08 DI2 ON delay time

- See the parameter '10.05' (DI1 ON delay)

● 10.09 DI2 OFF delay time

- See the parameter '10.06' (DI1 OFF delay)

● 10.10 DI3 ON delay time

- See the parameter '10.05' (DI1 ON delay)

● 10.11 DI3 OFF delay time

- See the parameter '10.06' (DI1 OFF delay)

- 10.12 DI4 ON delay time
 - See the parameter '10.05' (DI1 ON delay)
- 10.13 DI4 OFF delay time
 - See the parameter '10.06' (DI1 OFF delay)
- 10.14 DI5 ON delay time
 - See the parameter '10.05' (DI1 ON delay)
- 10.15 DI5 OFF delay time
 - See the parameter '10.06' (DI1 OFF delay)
- 10.16 DI6 ON delay time
 - See the parameter '10.05' (DI1 ON delay)
- 10.17 DI6 OFF delay time
 - See the parameter '10.06' (DI1 OFF delay)
- 10.18 DI7 ON delay time
 - See the parameter '10.05' (DI1 ON delay)
- 10.19 DI7 OFF delay time
 - See the parameter '10.06' (DI1 OFF delay)
- 10.20 DI8 ON delay time
 - See the parameter '10.05' (DI1 ON delay)
- 10.21 DI8 OFF delay time
 - See the parameter '10.06' (DI1 OFF delay)

● 10.22 DO (RN0~RN3, AL0~AL2) delayed status

- Range: 0x00 ~ 0xFF

It displays the relay outputs Terminal Status

Example Data: 0000000000000011

Meaning: AL OFF, DO2~DO1 ON

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
It displays when extension I/O card is connected													AL	D02	D01

● 10.23 DO (RN0~RN3, AL0~AL2) forced selection

- Range: 0x00 ~ 0xFF
- Initial value: 0x00

The statuses of the digital output can be overridden for example testing purposes

A bit in parameter '**10.22' (DO forced data)** is provided for each digital output and its value is applied whenever the corresponding bit in this parameter is 1

● 10.24 DO (RN0~RN3, AL0~AL2) forced data

- Range: 0x00 ~ 0xFF
- Initial value: 0x00

Allows the data value of a forced digital output to be changed from 0 to 1

It is only possible to forced an output that has been selected in parameter '**10.22' (DO forced selection)**

● 10.25 DO1 (RN0~RN1), DO2 (RN2~RN3) contact type selection

- Range: 0x00 ~ 0xFF
- Initial value: 0x00

It is possible to change the status of DO1 and DO2 output type as N.O or N.C

Example Data: 0000000000000010

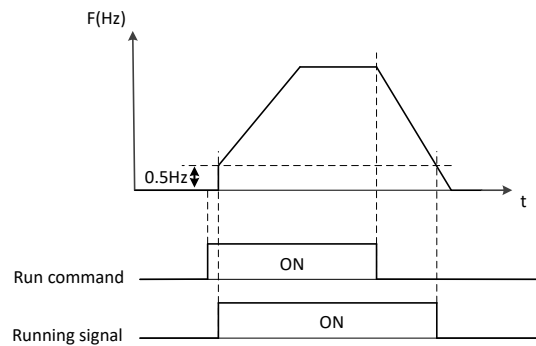
Meaning: DO2 (RN2~RN3) Normal close type, DO1 (RN0~RN1) Normal open type

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
It displays when extension I/O card is connected													AL	D02	D01

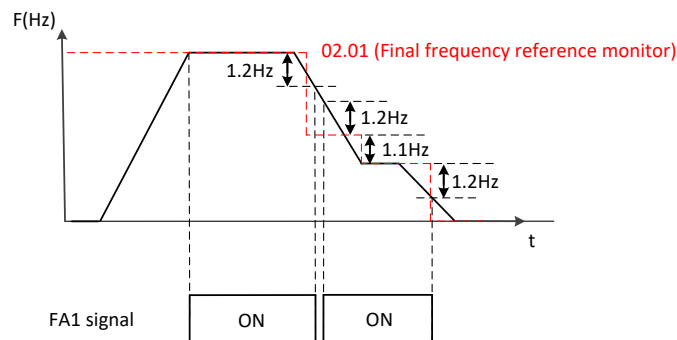
10.26 DO1 (RN0–RN1) source

- 0: RUN VFD Run Signal
- 1: FA1 Frequency Arrival 1 ----- Initial value
- 2: FA2 Frequency Arrival 2
- 3: OL Overload Warning Signal
- 4: OD Output Deviation Excess for PID control
- 5: AL Fault Signal
- 6: MO Modbus communication control signal
- 7: SOL System overload detection signal
- 8: SUL System Underload detection signal
- 9: SOL/SUL System overload/Underload detection signal
- 10: External brake control signal

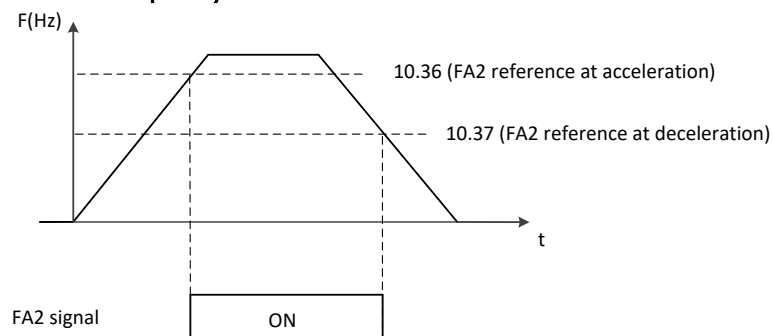
Set 0: RUN VFD Run Signal



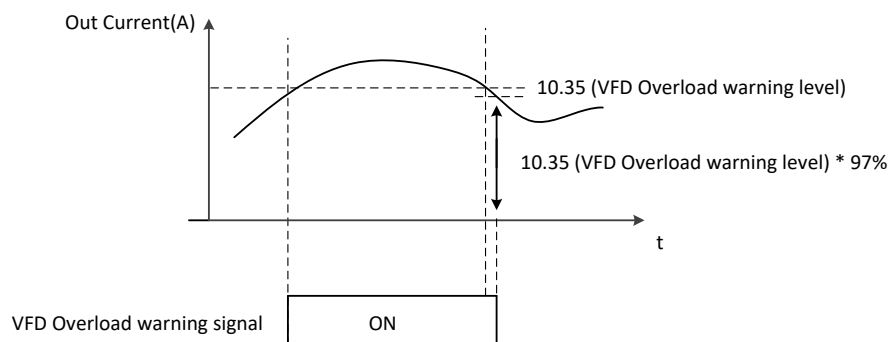
Set 1: FA1 Frequency Arrival 1



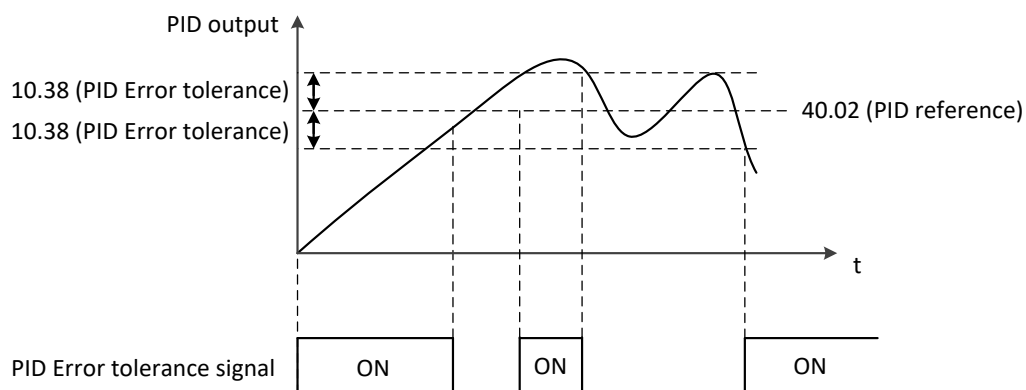
Set 2: FA2 Frequency Arrival 2



▪ **Set 3: OL Overload Warning Signal**



▪ **Set 4: OD Output Deviation Excess for PID control**



▪ **Set 5: AL Fault Signal**

▪ **Set 6: Modbus communication control signal**

You can control digital output (DO) using the special address 0x1001.
Check the 50. RS-485 (Modbus) parameter for instructions on how to use the communication frame.

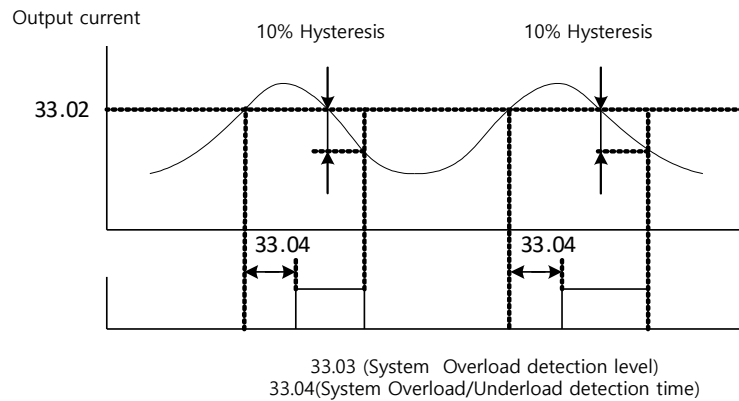
1st byte

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved							

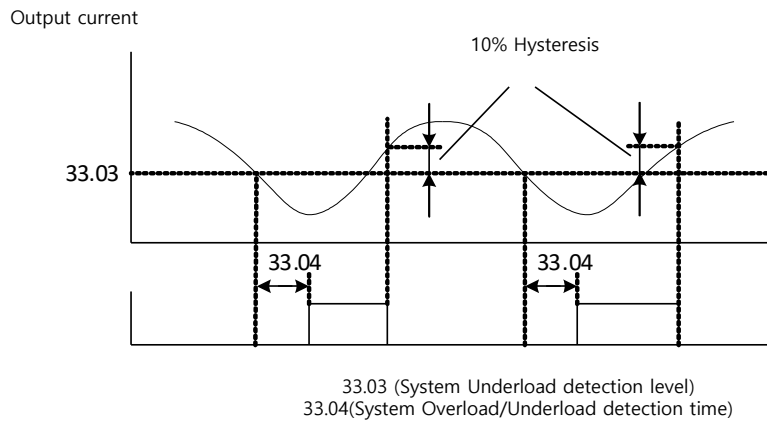
2nd byte

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved					AL0~2	RN2~3	RN0~1

- **Set 7: system overload detection signal**



- **Set 8: system Underload detection signal**



- **Set 9: System overload/Underload detection signal**

If the system is under overload or Underload, it is detected and the signal is output.

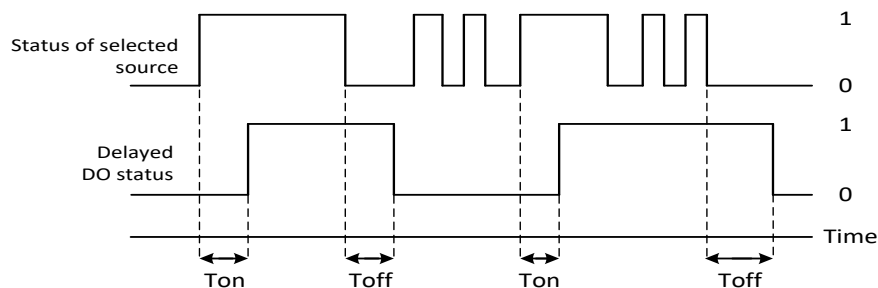
- **Set 10: External brake control signal**

When using the '52.01' external brake parameters, contact signal for external brake control is transmitted depending on the operating condition.

- **10.27 DO1 (RN0–RN1) ON delay time**

- *Range: 0.0 ~ 3000 Sec in 0.1 Sec*
- *Initial value: 0.0 Sec*

Defines the activation delay for relay output DO1



- Ton: '10.27' DO1 (RN0–RN1) On delay time
- Toff: '10.28' DO1 (RN0–RN1) Off delay time

- **10.28 DO1 (RN0–RN1) OFF delay time**

- *Range: 0.0 ~ 3000 Sec in 0.1 Sec*
- *Initial value: 0.0 Sec*

Defines the activation ON delay for relay output DO1

- **10.29 DO2 (RN2–RN3) source**

- *See the parameter '10.26' (DO1 source)*

- **10.30 DO2 (RN2–RN3) ON delay time**

- *See the parameter '10.27 (DO1 ON delay)*

- **10.31 DO2 (RN2–RN3) OFF delay time**

- *See the parameter '10.28 (DO1 OFF delay)*

- **10.32 Alarm (AL0–AL1–AL2) relay source**

- *See the parameter '10.26' (DO1 source))*

- **10.33 Alarm (AL0–AL1–AL2) relay ON delay time**

- *See the parameter '10.27 (DO1 ON delay)*

- **10.34 Alarm (AL0–AL1–AL2) OFF delay time**

- *See the parameter '10.28 (DO1 OFF delay)*

- **10.35 VFD overload warning level**

- *Range: 10.0 ~ 200.0 % in 0.1 %*
- *Initial value: 100.0 %*

Program a level of the VFD motor current

- **10.36 FA2 reference at acceleration**

- *Range: '10.37' ~ 400Hz in 0.01 Hz*
- *Initial value: 0.0 Hz*

Program the frequency arrival threshold during acceleration

❖ *Related Parameters: '10.26'*

- **10.37 FA2 reference at deceleration**

- *Range: 0.00 ~ '10.36' Hz in 0.01 Hz*
- *Initial value: 0.0 Hz*

Program the frequency arrival threshold during deceleration

❖ *Related Parameters: '10.26'*

- **10.38 PID Error tolerance**

- *Range: 0.0 ~ 100.0 % in 0.1 %*
- *Initial value: 100.0 %*

Program the allowable PID loop error magnitude

❖ *Related Parameters: '10.26'*

8.2.7 Standard AI (O, OI)

- **11.01 AI (O, OI) forced selection**

- *Range: 0x00 ~ 0xFF*
- *Initial value: 0x00*

Example Data: 0000000000000010

Meaning: R01, AI2 ON, AI1 OFF

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
It displays when extension I/O card is connected														AI2 (OI)	AI1 (O)

The statuses of the analog input can be overridden for example testing purposes

A bit in parameters '**11.04' (AI1 forced value)**' and '**11.12' (AI2 forced value)**' are provided for each analog input and its value is applied whenever the corresponding bit in this parameter is 1

- **11.02 AI1 (O) actual value**

- *Range: 0.00 ~ 100.0 % in 0.01 %*

Displays the value of analog input AI1 (O) in V

(Depending on the input is set to voltage by a hardware setting)

- **11.03 AI1 (O) scaled value**

- *Range: 0.00 ~ 400.00 Hz in 0.01 Hz – frequency*
- *Range: 0.00 ~ 100.0 % in 0.01 % – PID*

Displays the value of analog input AI1 (O) after scaling

❖ *Related Parameters: '11.08', '11.09'*

- **11.04 AI1 (O) forced value**

- *Range: 0.00 ~ 100.0 % in 0.01 %*
- *Initial value: 0.00 %*

Allows the data value of a forced analog input to be changed from 0.0 to 100.0

It is only possible to forced an input that has been selected in parameter

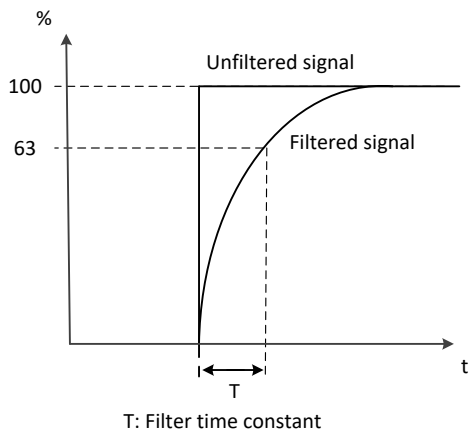
'11.01' (AI forced selection)

● 11.05 AI1 (O) filter time

- Range: 0 ~ 30000 ms in 1 ms
- Initial value: 100 ms

Defines the filter time constant for analog input AI1 (O)

The filter time is that VFD is realized 63% of 100%

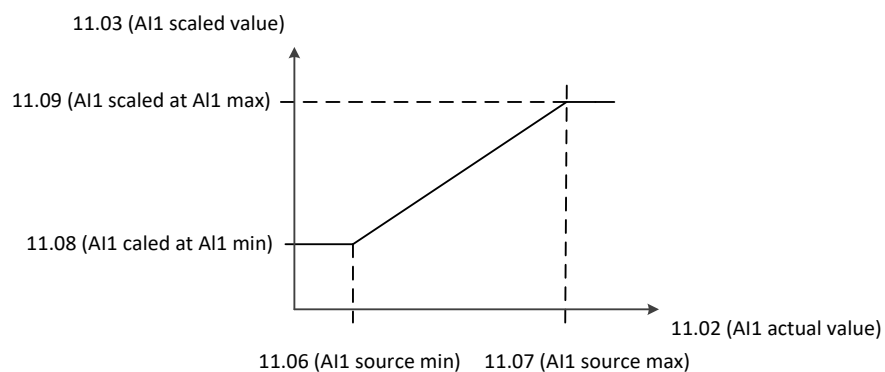


● 11.06 AI1 (O) source min

- Range: 0.00 ~ 100.0 % in 0.01 %
- Initial value: 0.00 %

Defines the minimum site value for analog input AI1

Set the value actually sent to the drive when the analog signal from plant is wound to its minimum setting.



● 11.07 AI1 (O) source max

- Range: 0.00 ~ 100.0 % in 0.01 %
- Initial value: 100.0 %

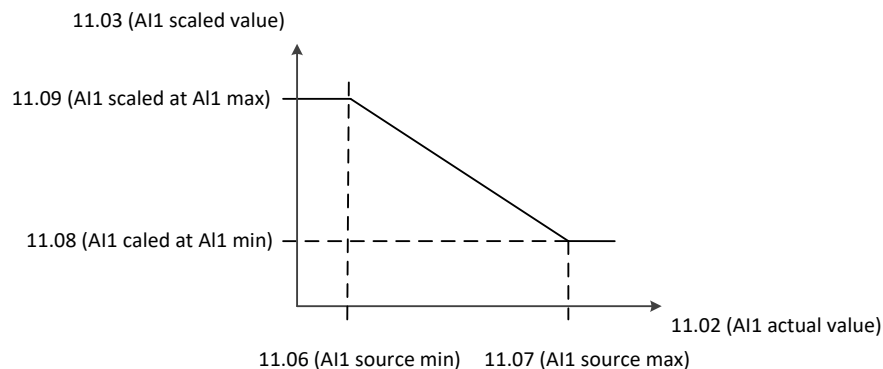
Defines the maximum site value for analog input AI1

Set the value actually sent to the drive when the analog signal from plant is wound to its maximum setting.

● 11.08 AI1 (O) scaled at AI1 min

- Range: 0.00 ~ 400.0 Hz in 0.01 Hz – Frequency
- Range: 0.0 ~ 100.0 % in 0.1 % – PID
- Initial value: 0.00 Hz

Defines the real internal value that corresponds to the minimum analog input AI1 value defined by parameter **'11.06' (AI1 source min)**



- ✧ Changing the polarity settings of **'11.08' (AI1 scaled at AI1 min)** and **'11.09' (AI1 scaled at AI1 max)** can effectively invert the analog input

● 11.09 AI1 (O) scaled at AI1 max

- Range: 0.00 ~ 400.0 Hz in 0.01 Hz – Frequency
- Range: 0.0 ~ 100.0 % in 0.1 % – PID
- Initial value: 60.00 Hz

Defines the real internal value that corresponds to the maximum analog input AI1 value defined by parameter **'11.07' (AI1 source max)**

● 11.10 AI2 (OI) actual value

- Range: 0.00 ~ 100.0 % in 0.01 %

Displays the value of analog input AI2 (OI) in mA
(Depending on the input is set to current by a hardware setting)

● 11.11 AI2 (OI) scaled value

- Range: 0.00 ~ 400.00 Hz in 0.01 Hz – frequency
- Range: 0.00 ~ 100.0 % in 0.01 % – PID

Displays the value of analog input AI2 after scaling

- ✧ Related Parameters: **'11.16', '11.17'**

- **11.12 AI2 (OI) forced value**

- *Range: 0.00 ~ 100.0 % in 0.01 %*
- *Initial value: 0.00 %*

Allows the data value of a forced analog input to be changed from 0.0 to 100.0

It is only possible to forced an input that has been selected in parameter

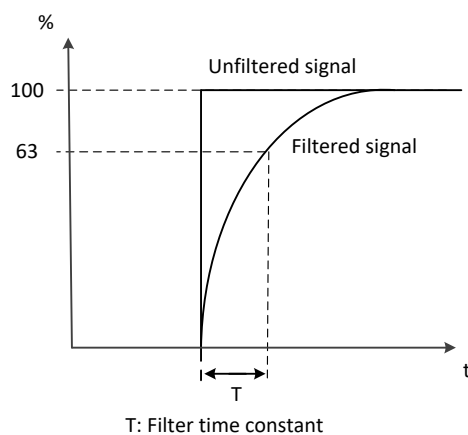
'11.01' (AI forced selection)

- **11.13 AI2 (OI) filter time**

- *Range: 0 ~ 30000 ms in 1 ms*
- *Initial value: 100 ms*

Defines the filter time constant for analog input AI2 (OI)

The filter time is that VFD is realized 63% of 100%

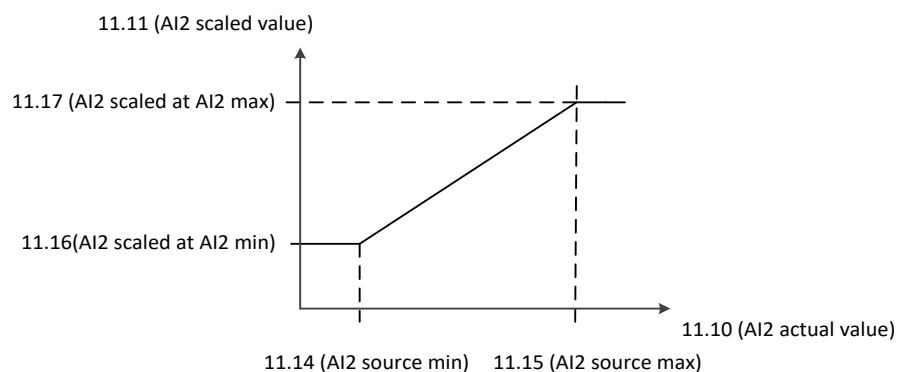


- **11.14 AI2 (OI) source min**

- *Range: 0.00 ~ 100.0 % in 0.01 %*
- *Initial value: 0.0 %*

Defines the minimum site value for analog input AI2 (OI)

Set the value actually sent to the drive when the analog signal from plant is wound to its minimum setting.



- **11.15 AI2 (OI) source max**

- *Range: 0.00 ~ 100.0 % in 0.01 %*
- *Initial value: 100.0 %*

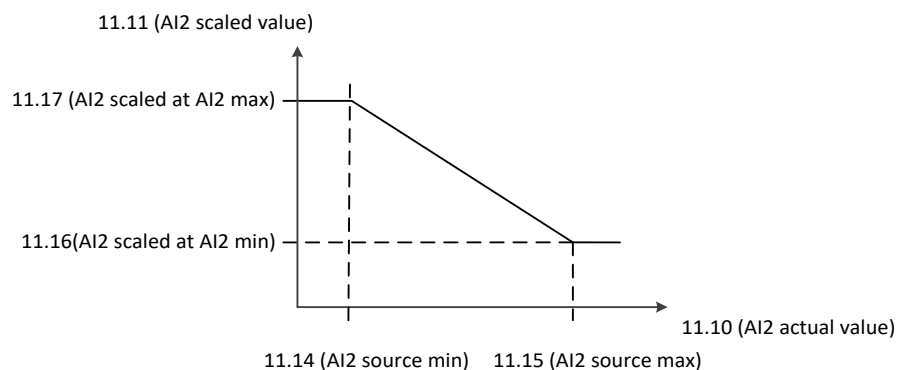
Defines the maximum site value for analog input AI2 (OI)

Set the value actually sent to the drive when the analog signal from plant is wound to its maximum setting.

- **11.16 AI2 (OI) scaled at AI2 min**

- *Range: 0.00 ~ 400.0 Hz in 0.01 Hz – Frequency*
- *Range: 0.0 ~ 100.0 % in 0.1 % – PID*
- *Initial value: 0.00 Hz*

Defines the real internal value that corresponds to the minimum analog input AI2 value defined by parameter **'11.14' (AI2 source min)**



✧ Changing the polarity settings of **'11.16' (AI2 scaled at AI2 min)** and **'11.17' (AI2 scaled at AI2 max)** can effectively invert the analog input

- **11.17 AI2 scaled at AI2 max**

- *Range: 0.00 ~ 400.0 Hz in 0.01 Hz – Frequency*
- *Range: 0.0 ~ 100.0 % in 0.1 % – PID*
- *Initial value: 60.00 Hz*

Defines the real internal value that corresponds to the maximum analog input AI2 value defined by parameter **'11.15' (AI 2 source max)**

8.2.8 Standard AO (FM, AMI)

- **12.01 AO (FM, AMI) forced selection**

- *Range: 0x00 ~ 0xFF*
- *Initial value: 0x00*

Example Data: 0000000000000010

Meaning: R01, AO2 (AMI) ON, AO1 (FM) OFF

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
It displays when extension I/O card is connected														AO2 (AMI)	AO1 (FM)

The statuses of the analog input can be overridden for example testing purposes

A bit in parameters '**12.04' (AO1 forced value)** and '**12.12' (AO2 forced value)** are provided for each analog input and its value is applied whenever the corresponding bit in this parameter is 1

- **12.02 AO1 (FM) actual value**

- *Range: 0.00 ~ 100.0 % in 0.01 %*

Displays the value of AO1 (FM) in V

- **12.03 AO1 (FM) source**

- *0: Out Frequency ----- Initial value*
- *1: Out Ampere*
- *2: Out Voltage*
- *3: Out Power*
- *4: Out torque*

Program what output performance to be monitored from following selections

- **Set 0: Output Frequency**
The highest analog output value is the maximum frequency value. The indicator accuracy after the adjustment is about +/- 5%.
- **Set 1: Output Current**
The highest analog value is the 200% of rated VFD current. The indicator accuracy after the adjustment is about +/- 10%.
- **Set 2: Output Voltage**
The highest analog value is the 100% of rated VFD voltage out. The indicator accuracy after the adjustment is about +/- 10%.

- **Set 3: Output Power**

The highest analog value is the 200% of rated VFD power out. The indicator accuracy after the adjustment is about $\pm 10\%$.

- **Set 4: Output Torque**

The highest analog value is the 200% of rated VFD output torque. The indicator accuracy after the adjustment is about $\pm 10\%$.

- **12.04 AO1 (FM) forced value**

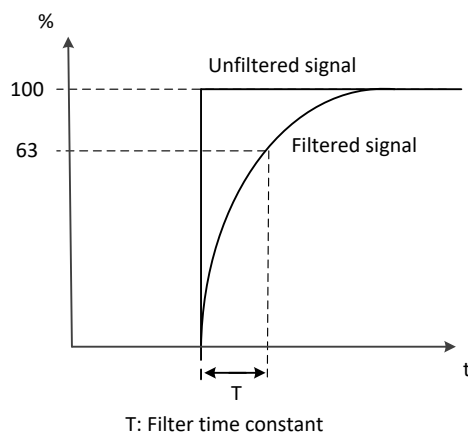
- *Range: 0.00 ~ 100.0 % in 0.01 %*
- *Initial value: 0.0 %*

Allows the data value of a forced analog output to be changed from 0.0 to 100.0
It is only possible to forced an input that has been selected in parameter
'12.01' (AO forced selection)

- **12.05 AO1 (FM) filter time**

- *Range: 0 ~ 30000 ms in 1 ms*
- *Initial value: 100 ms*

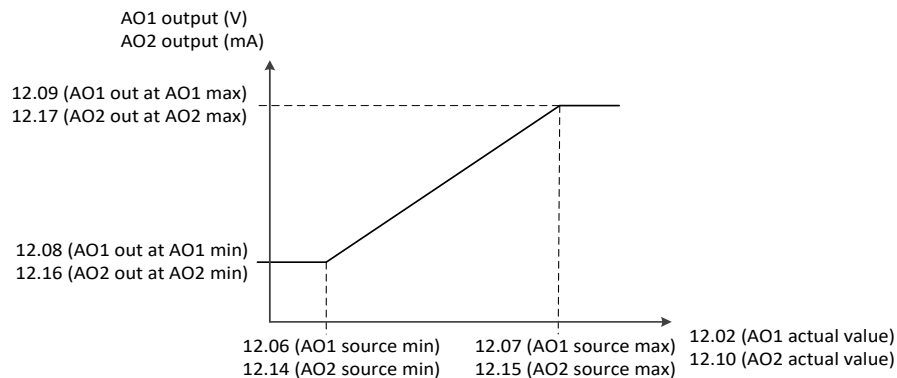
Defines the filter time constant for analog input AO1
The filter time is that VFD is realized 63% of 100%



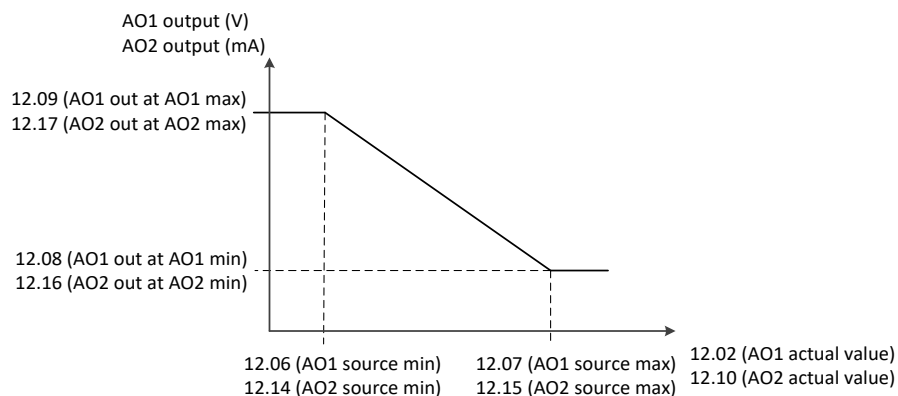
● 12.06 AO1 (FM) source min

- *Range: 0.00 ~ 100.0 % in 0.01 %*
- *Initial value: 0.0 %*

Defines the real minimum value of the signal selected by parameter **'12.03' (AO1 source)** that corresponds to the minimum required AO1 output value



- ✧ Changing the polarity settings of **'12.08' (AO1 out at AO1 min)** and **'12.09' (AO1 out at AO1 max)** can effectively invert the analog output



● 12.07 AO1 (FM) source max

- *Range: 0.00 ~ 100.0 % in 0.01 %*
- *Initial value: 100.0 %*

Defines the real maximum value of the signal selected by parameter **'12.03' (AO1 source)** that corresponds to the maximum required AO1 output value defined by parameter **'12.09' (AO1 out at AO1 max)**

- **12.08 AO1 (FM) out at AO1 min**

- *Range: 0.00 ~ 100.0 % in 0.01 %*
- *Initial value: 0.0 %*

Defines the real minimum output value for analog output AO1
See also drawing at parameter *'12.06' (AO1 source min)*

- **12.09 AO1 (FM) out at AO1 max**

- *Range: 0.00 ~ 100.0 % in 0.01 %*
- *Initial value: 100.0 %*

Defines the real maximum output value for analog output AO1
See also drawing at parameter *'12.07' (AO1 source max)*

- **12.10 AO2 (AMI) actual value**

- *Range: 0.00 ~ 100.0 % in 0.01 %*

Displays the value of AO2 (AMI) in mA

- **12.11 AO2 (AMI) source**

- *See the parameter *'12.03' (AO1 source)**

- **12.12 AO2 (AMI) forced value**

- *See the parameter *'12.04' (AO1 forced value)**

- **12.13 AO2 (AMI) filter time**

- *See the parameter *'12.05' (AO1 filter time)**

- **12.14 AO2 (AMI) source min**

- *See the parameter *'12.06' (AO1 source min)**

- **12.15 AO2 (AMI) source max**

- *See the parameter *'12.07' (AO1 source max)**

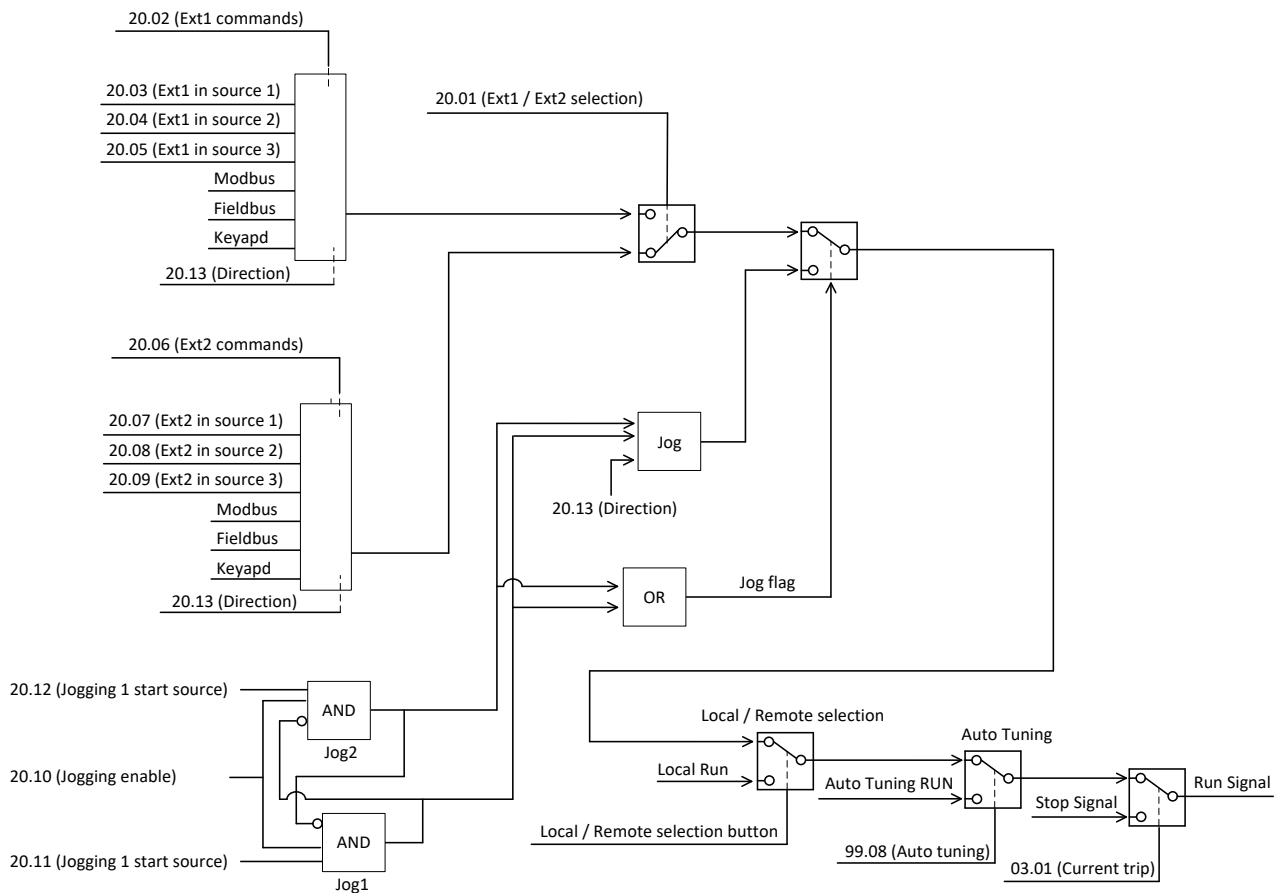
- **12.16 AO2 (AMI) out at AO2 min**

- *See the parameter *'12.08' (AO1 out at AO1 min)**

- **12.17 AO2 (AMI) out at AO2 max**

- *See the parameter *'12.09' (AO1 out at AO1 max)**

8.2.9 Start/Stop/Direction



● 20.01 Ext1/Ext2 selection

- 0: Ext1 ----- Initial value
- 1: Ext2
- 2: DI1
- 3: DI2
- 4: DI3
- 5: DI4
- 6: DI5
- 7: DI6
- 8: DI7
- 9: DI8

It can use to external commands as local/remote function

- **Set 0: Ext1**
It works by value at '20.02' (Ext1 commands)
- **Set 1: Ext2**
It works by value at '20.03' (Ext2 commands)
- **Set 2~9: DI1~DI8**
It works by digital input which is selected

- **20.02 Ext1 commands**

- *0: Not selected*
- *1: 1 Wire*
- *2: 2 Wire 1 ----- Initial value*
- *3: 2 Wire 2*
- *4: 2 Wire 3*
- *5: 3 Wire 1*
- *6: 3 Wire 2*
- *7: Modbus*
- *8: Fieldbus*
- *9: Keypad*

Selects the source of start, stop and direction commands for external control location 1 (EXT1)

- **Set 0: Not selected**

No start or stop command sources selected.

- **Set 1: 1 Wire**

The source of the start and stop commands is selected by parameter **'20.03' (Ext1 in source 1)**

The state transitions of the source bits are interpreted as follows:

State of source 1 ('20.03')	Command
1	Start
0	Stop

- **Set 2: 2 Wire 1**

The source selected by **'20.03' (Ext1 in source 1)** is the start signal

The source selected by **'20.04' (Ext1 in source 2)** determines the direction

The state transitions of the source bits are interpreted as follows:

State of source 1 ('20.03')	State of source 2 ('20.04')	Command
0	Any	Stop
1	0	Start forward
1	1	Start reverse

- **Set 3: 2 Wire 2**

The source selected by **'20.03' (Ext1 in source 1)** is the forward start signal

The source selected by **'20.04' (Ext1 in source 2)** is the reverse start signal

The state transitions of the source bits are interpreted as follows:

State of source 1 ('20.03')	State of source 2 ('20.04')	Command
0	0	Stop
1	0	Start forward
0	1	Start reverse
1	1	Stop

- **Set 4: 2 Wire 3**

The source of the start and stop commands are selected by parameters
'20.03' (Ext1 in source 1) and *'20.04' (Ext1 in source 2)*

The state transitions of the source bits are interpreted as follows:

State of source 1 (<i>'20.03'</i>)	State of source 2 (<i>'20.04'</i>)	Command
0 → 1	1	Start
Any	0	Stop

- ✧ when *'20.04' (Ext1 in source 2)* is 0,
The start and stop keys on the control panel are disabled

- **Set 5: 3 Wire 1**

The source of the start and stop commands are selected by parameters
'20.03' (Ext1 in source 1) and *'20.04' (Ext1 in source 2)*

The source selected by *'20.05' (Ext1 in source 3)* determines the direction

The state transitions of the source bits are interpreted as follows:

State of source 1 (<i>'20.03'</i>)	State of source 2 (<i>'20.04'</i>)	State of source 3 (<i>'20.05'</i>)	Command
0 → 1	1	0	Start forward
0 → 1	1	1	Start reverse
Any	0	Any	Stop

- ✧ when *'20.04' (Ext1 in source 2)* is 0,
The start and stop keys on the control panel are disabled

- **Set 6: 3 Wire 2**

The source of the start and stop commands are selected by parameters
'20.03' (Ext1 in source 1), *'20.04' (Ext1 in source 2)* and
'20.05' (Ext1 in source 3)

The source selected by *'20.05' (Ext1 in source 3)* determines the direction

The state transitions of the source bits are interpreted as follows:

State of source 1 (<i>'20.03'</i>)	State of source 2 (<i>'20.04'</i>)	State of source 3 (<i>'20.05'</i>)	Command
0 → 1	Any	1	Start forward
Any	0 → 1	1	Start reverse
Any	Any	0	Stop

- **Set 7: Modbus**

The start and stop command are taken from terminal RXP–RXN

- **Set 8: Fieldbus**

The start and stop command are taken from fieldbus adapter

- **Set 9: Keypad**

The start and stop command are taken from keypad on the VFD

- **20.03 Ext1 in source 1**

- *0: Not selected*
- *1: Selected*
- *2: DI1 ----- Initial value*
- *3: DI2*
- *4: DI3*
- *5: DI4*
- *6: DI5*
- *7: DI6*
- *8: DI7*
- *9: DI8*

Selects source 1 for parameter '*20.02*' (*Ext1 commands*)

- **Set 0: Not selected**
Always off
- **Set 1: selected**
Always on
- **Set 2~9 : DI1~ DI8**
It works by digital input which is selected

- **20.04 Ext1 in source 2**

- *See the parameter '20.03' (Ext1 in source 1)*

- **20.05 Ext1 in source 3**

- *See the parameter '20.03' (Ext1 in source 1)*

- **20.06 Ext2 commands**

- *See the parameter '20.02' (Ext1 commands)*

- **20.07 Ext2 in source 1**

- *See the parameter '20.03' (Ext1 in source 1)*

- **20.08 Ext2 in source 2**

- *See the parameter '20.03' (Ext1 in source 1)*

- **20.09 Ext2 in source 3**

- *See the parameter '20.03' (Ext1 in source 1)*

- **20.10 Jogging enable**

- *0: Not selected ----- Initial value*
- *1: Selected*
- *2: DI1*
- *3: DI2*
- *4: DI3*
- *5: DI4*
- *6: DI5*
- *7: DI6*
- *8: DI7*
- *9: DI8*

Selects the method for a jog enable

- **Set 0: Not selected**
Always off
- **Set 1: selected**
Always on
- **Set 2~9 : DI1~ DI8**
It works by digital input which is selected

- **20.11 Jogging 1 start source**

- *See the parameter '20.10' (jogging enable)*

Selects the source for the activation of jogging function 1

- ✧ Both of jogging sources have interlocked each other.
If one of the jogging operates, other jogging can't operate

- **Set 0: Not selected**
Always off
- **Set 1: selected**
Always on
- **Set 2~9 : DI1~ DI8**
It works by digital input which is selected

- **20.12 Jogging 2 start source**

- *See the parameter '20.10' (jogging enable)*

- **20.13 Direction**

- *0: Forward ----- Initial value*
- *1: Reverse*

Sets the direction of VFD to forward or reverse at keypad operation only

8.2.10 Start/Stop mode

● 21.01 Torque boost mode

- 0: Manual torque boost ----- Initial value
- 1: Automatic torque boost

Select a torque boost mode

It is working only V/F mode at '**98.01' (Motor control mode)** and will compensate for starting torque.

If '**21.01' (torque boost mode) = 1**, recommended the following

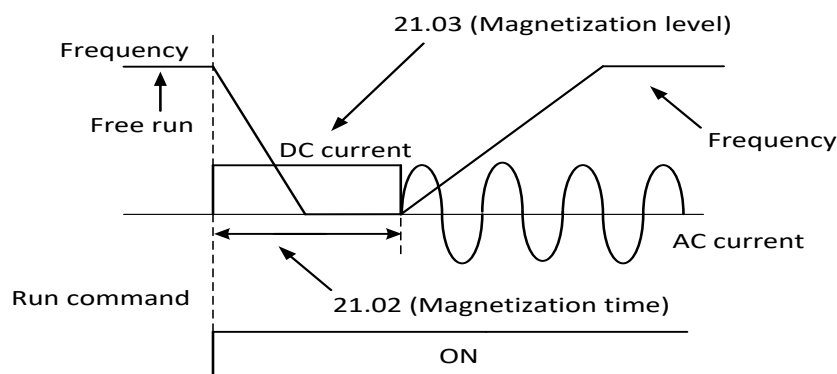
1. Put the plate data of motor in '**99.01' ~ '99.07'**
2. Get the motor data by the Auto Tuning
3. Use auto tuning data at '**99.09' (Motor data selection)**

● 21.02 Magnetization time

- Range: 0.0 ~ 3000 Sec in 0.1 Sec
- Initial value: 0.0 Sec

Set the time for DC Injection Braking duration before VFD start

It will be operated when '**21.02' (Magnetization time)** and '**21.02' (Magnetization level)** have set above zero



● 21.03 Magnetization Level

- Range: 0.0 ~ 200.0 % in 0.1 %
- Initial value: 30.0 %

Set the level for DC Injection Braking duration before VFD start

● 21.04 Stop mode

- 0: Ramp to Stop (Deceleration) ----- Initial value
- 1: Coast to Stop (Free Run to Stop)

Select a stop method when Stop command is given.

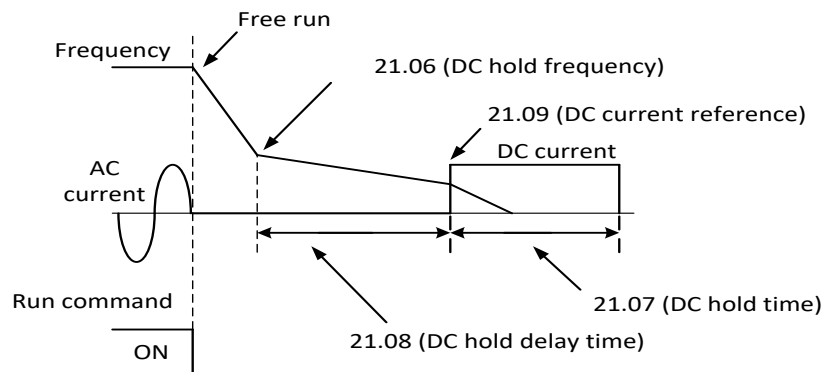
● 21.05 DC current control (DC Brake)

- 0: Disable ----- Initial value
- 1: Enable

It can select to use the DC Injection braking function

By adding the forced to the rotor, slowing the motor to stop

❖ Related Parameters: '21.05' ~ '21.09'



● 21.06 DC hold frequency

- Range: 0.00 ~ 10.00 Hz in 0.01 Hz
- Initial value: 0.50 Hz

Program the VFD frequency out when DC injection braking function kicks in.

If set '**21.06' (DC hold frequency)** to 0.5Hz, when VFD frequency out reaches to 0.5 Hz, DC braking function is activated.

● 21.07 DC hold time

- Range: 0.0 ~ 3000 Sec in 0.1 Sec
- Initial value: 0.0 Sec

Program the DC Injection Braking duration

● 21.08 DC hold delay time

- Range: 0.0 ~ 50.0 Sec in 0.1 Sec
- Initial value: 0.0 Sec

Program the delay time when the DC braking function actually starts form when VFD out is the frequency value in '**21.06' (DC hold frequency)**

● 21.09 DC current reference

- Range: 0.0 ~ 100.0 % in 0.1 %
- Initial value: 10.0 %

Program the level of DC injection braking forced of rated electric power of A1

- **21.10 Emergency stop mode**

- *0: Ramp to Stop (Deceleration) ----- Initial value*
- *1: Coast to Stop (Free Run to Stop)*

Selects the way the motor is stopped when an emergency stop command is received. The source of the emergency stop signal is selected by '**21.11**' (*Emergency stop source*)

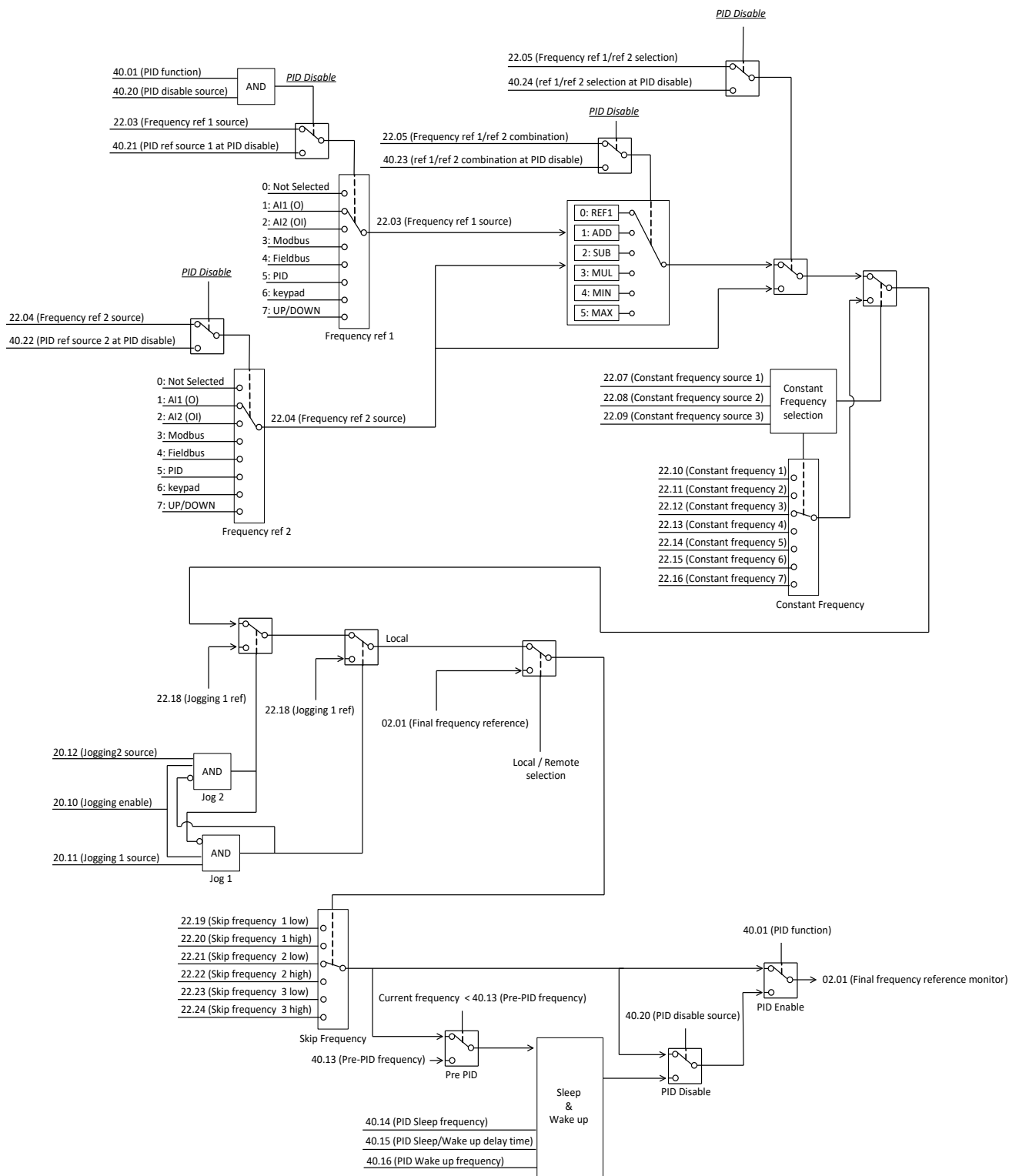
- **21.11 Emergency stop source**

- *0: Active*
- *1: Inactive ----- Initial value*
- *2: DI1*
- *3: DI2*
- *4: DI3*
- *5: DI4*
- *6: DI5*
- *7: DI6*
- *8: DI7*
- *9: DI8*

Selects the source of the emergency stop signal

- **Set 0: Active**
Always on
- **Set 1: Inactive**
Always off
- **Set 2~9 : DI1~ DI8**
It works by digital input which is selected

8.2.11 Frequency reference



- **22.01 Frequency reference input (Only Keypad)**

- *Range: 0.00 ~ 400Hz in 0.01 Hz*
- *Initial value: 0.00 Hz*

Program the frequency reference that can be used at local mode

If it is remote mode, the parameter has to be keypad as below

'22.03' (Frequency ref 1 source) = keypad or '22.04' (Frequency ref 2 source) = keypad

- **22.03 Frequency ref 1 source**

- *0: Not selected*
- *1: AI1 (O) scaled ----- Initial value*
- *2: AI2 (OI) scaled*
- *3: Modbus*
- *4: Fieldbus*
- *5: PID*
- *6: Keypad*
- *7: UP/DOWN*

Selects the source of the Frequency ref 1

- **Set 0: Not selected**
Always off
- **Set 1: AI1 (O) scaled**
It can set the frequency reference by the DC 0~10V
- **Set 2: AI2 (OI) scaled**
It can set the frequency reference by the DC 4~20mA
- **Set 3: Modbus**
It can set the frequency reference by the modbus communication
- **Set 4: Fieldbus**
Always on It can set the frequency reference by the fieldbus communication
- **Set 5: PID**
Always on It can set the frequency reference by the PID control
- **Set 6: Keypad**
Always on It can set the frequency reference by the Keypad
- **Set 7: UP/DOWN**
Always on It can set the frequency reference by the UP/DOWN function

- **22.04 Frequency ref 2 source**

- *See the parameter '22.03' (Frequency ref 1 source)*

- **22.05 Frequency ref 1 /ref 2 combination**

- 0: '22.03' ----- Initial value
- 1: '22.03' + '22.04'
- 2: '22.03' – '22.04'
- 3: '22.03' x '22.04'
- 4: MIN ('22.03', '22.03')
- 5: MAX ('22.03', '22.03')

Selects a mathematical function between the reference sources selected by parameters
'22.03' (Frequency ref 1 source) and '22.04' (Frequency ref 2 source)

- Set 0: '22.03'
'22.03' (Frequency ref 1 source)
- Set 1: '22.03' + '22.04'
'22.03' (Frequency ref 1 source) + '22.04' (Frequency ref 2 source)
- Set 2: '22.03' – '22.04'
'22.03' (Frequency ref 1 source) – '22.04' (Frequency ref 2 source)
- Set 3: '22.03' x '22.04'
'22.03' (Frequency ref 1 source) x '22.04' (Frequency ref 2 source)
- Set 4: MIN ('22.03' + '22.04')
MIN '22.03' (Frequency ref 1 source), '22.04' (Frequency ref 2 source)
- Set 5: MAX ('22.03' + '22.04')
MAX '22.03' (Frequency ref 1 source), '22.04' (Frequency ref 2 source)

- **22.06 Frequency ref 1 /ref 2 selection**

- 0: '22.05' setting value
- 1: '22.04' setting value
- 2: DI1
- 3: DI2
- 4: DI3
- 5: DI4
- 6: DI5 ----- Initial value
- 7: DI6
- 8: DI7
- 9: DI8

Configures the selection between frequency references 1 and 2

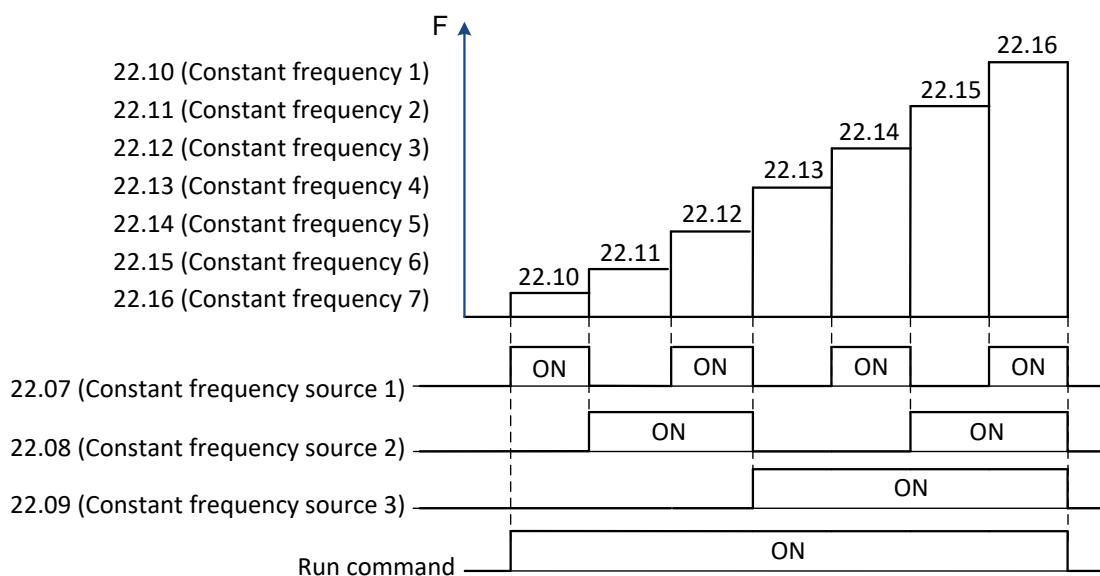
- Set 0: '22.05' setting value
The frequency is used by '22.05' (Frequency ref 1 /ref 2 combination) set value
- Set 1: '22.04' setting value
The frequency is used by '22.04' (Frequency ref 2 source)
- Set 2~9 : DI1 ~ DI8
If the digital input which is selected has OFF, it will applied by ref 1
If the digital input which is selected has ON, it will applied by ref 2

● 22.07 Constant frequency source 1

- 0: Not selected
- 1: Selected
- 2: DI1
- 3: DI2
- 4: DI3 ----- Initial value
- 5: DI4
- 6: DI5
- 7: DI6
- 8: DI7
- 9: DI8

Selects the source of the constant frequency

- **Set 0: Not selected**
Always off
- **Set 1: selected**
Always on
- **Set 2~9 : DI1~ DI8**
It works by digital input which is selected



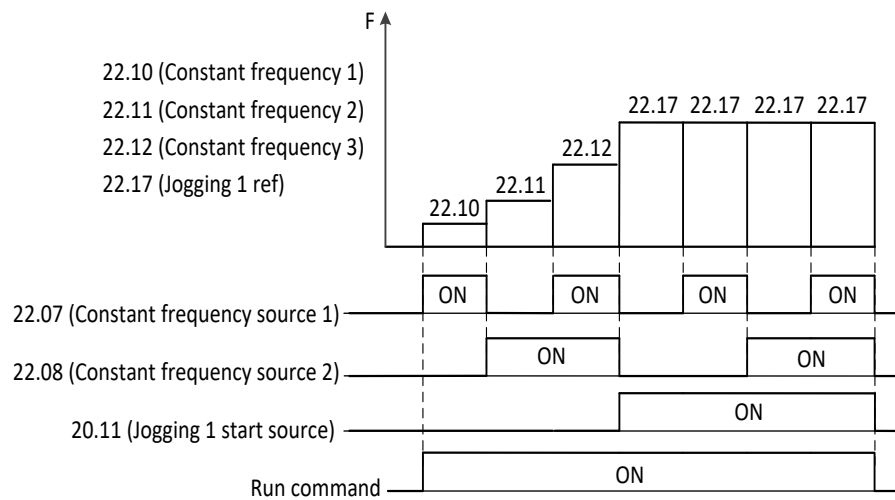
Source defined by par '22.07'	Source defined by par '22.08'	Source defined by par '22.09'	Constant frequency active
OFF	OFF	OFF	None
ON	OFF	OFF	'22.10' (Constant frequency1)
OFF	ON	OFF	'22.11' (Constant frequency2)
ON	ON	OFF	'22.12' (Constant frequency3)
OFF	OFF	ON	'22.13' (Constant frequency4)
ON	OFF	ON	'22.14' (Constant frequency5)
OFF	ON	ON	'22.15' (Constant frequency6)
ON	ON	ON	'22.16' (Constant frequency7)

- **22.08 Constant frequency source 2**
 - *See the parameter '20.07' (Constant frequency source 1)*
- **22.09 Constant frequency source 3**
 - *See the parameter '20.07' (Constant frequency source 1)*
- **22.10 Constant frequency 1**
 - *Range: 0.00 ~ 400Hz in 0.01 Hz*
 - *Initial value: 5.00 Hz*
 - *See the parameter '20.07' (Constant frequency source 1)*
- **22.11 Constant frequency 2**
 - *See the parameter '20.07' (Constant frequency source 1)*
- **22.12 Constant frequency 3**
 - *See the parameter '20.07' (Constant frequency source 1)*
- **22.13 Constant frequency 4**
 - *See the parameter '20.07' (Constant frequency source 1)*
- **22.14 Constant frequency 5**
 - *See the parameter '20.07' (Constant frequency source 1)*
- **22.15 Constant frequency 6**
 - *See the parameter '20.07' (Constant frequency source 1)*
- **22.16 Constant frequency 7**
 - *See the parameter '20.07' (Constant frequency source 1)*

- **22.17 Jogging 1 ref**

- *Range: 0.00 ~ 400Hz in 0.01 Hz*
- *Initial value: 0.00 Hz*

Jogging frequency is used to move/rotate the motor in small increment at low frequency. It is selected using input terminal.



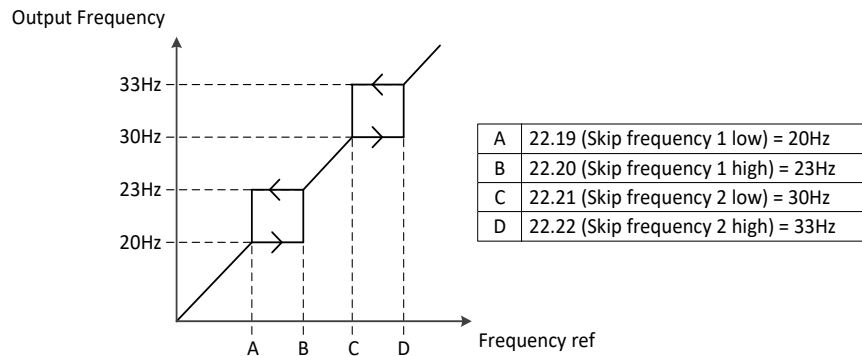
- **22.18 Jogging 1 ref**

- *See the parameter '20.17' (jogging 1 ref)*

- **22.19 Skip frequency 1 low**

- *Range: 0.00 ~ 400Hz in 0.01 Hz*
- *Initial value: 0.00 Hz*

Program 3 output frequency values to mitigate different resonance points at which vibration can cause damages to the equipment such as fans or pumps.



- **22.20 Skip frequency 1 high**

- *See the parameter '20.19' (Skip frequency 1 low)*

- **22.21 Skip frequency 2 low**

- *See the parameter '20.19' (Skip frequency 1 low)*

- **22.22 Skip frequency 2 high**

- *See the parameter '20.19' (Skip frequency 1 low)*

- **22.23 Skip frequency 3 low**

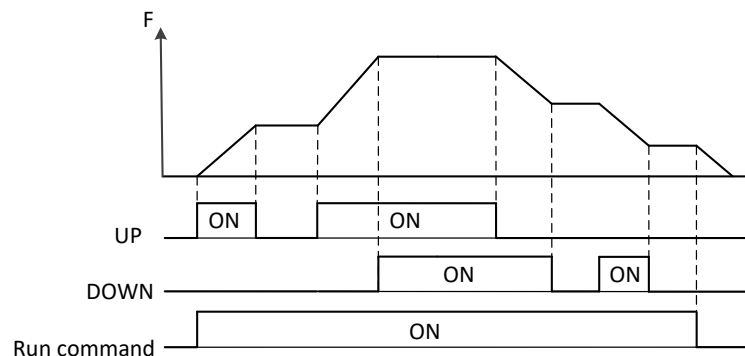
- *See the parameter '20.29' (Skip frequency 1 low)*

- **22.24 Skip frequency 3 high**

- *See the parameter '20.19' (Skip frequency 1 low)*

● 22.25 UP/DOWN function

- 0: Disable ----- Initial value
- 1: Enable



● 22.26 UP/DOWN initial value

- Range: 0.00 ~ 400 Hz in 0.01 Hz – frequency
- Range: 0.0 ~ 100 % in 0.1 % – PID
- Initial value: 0.00 Hz

Program the UP/DOWN initial value

When run command is input, VFD is running to initial value without up or down source

● 22.27 UP/DOWN up source

- 0: Not selected ----- Initial value
- 1: Selected
- 2: DI1
- 3: DI2
- 4: DI3
- 5: DI4
- 6: DI5
- 7: DI6
- 8: DI7
- 9: DI8

Selects the source of the UP/DWON up

- **Set 0: Not selected**
Always off
- **Set 1: selected**
Always on
- **Set 2~9 : DI1~ DI8**
It works by digital input which is selected

● 22.28 UP/DOWN down source

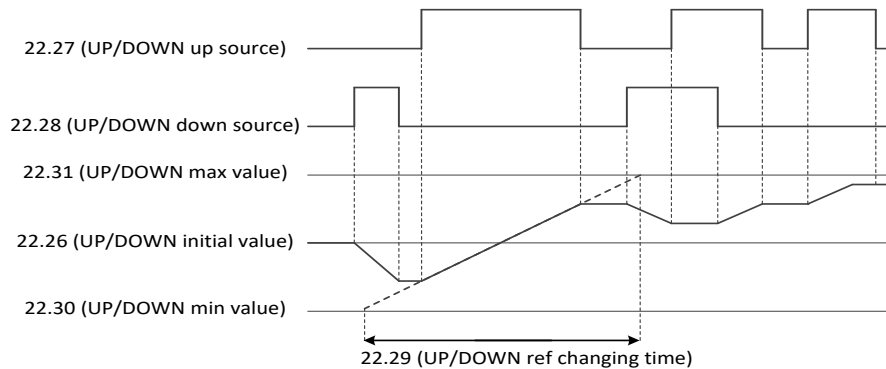
- See the parameter '20.27' (UP/DOWN up source)

● 22.29 UP/DOWN ref changing time

- Range: 0.0 ~ 3000 Sec in 0.1 Hz Sec
- Initial value: 10.0 Sec

It can change the time that UP/DOWN reference is respond

When run command is input, VFD can run to initial value without up or down source



● 22.30 UP/DOWN min value

- Range: 0.00 ~ 400 Hz in 0.01 Hz – frequency
- Range: 0.0 ~ 100 % in 0.1 % – PID
- Initial value: 0.00 Hz

This parameter works when the '**22.25' (UP/DOWN function)** is 1(Enable)

UP/DOWN can't operate below the min value

● 22.31 UP/DOWN max value

- Range: 0.00 ~ 400 Hz in 0.01 Hz – frequency
- Range: 0.0 ~ 100 % in 0.1 % – PID
- Initial value: 60.00 Hz

This parameter works when the '**22.25' (UP/DOWN function)** is 1(Enable)

UP/DOWN can't operate above the max value

● 22.32 UP/DOWN ref monitor

- Range: 0.00 ~ 400 Hz in 0.01 Hz – frequency
- Range: 0.0 ~ 100 % in 0.1 % – PID

This parameter displays UP/DOWN reference value

● 22.33 UP/DOWN initial value saving

- 0: Not saving ----- Initial value
- 1: Saving

Selects that whether initial value going to save or not

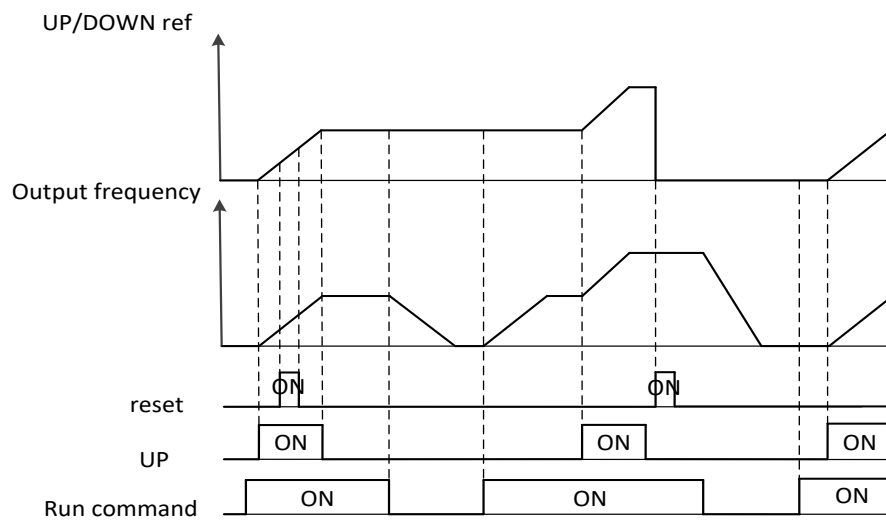
● 22.34 UP/DOWN ref reset source

- 0: Not selected ----- Initial value
- 1: Selected
- 2: DI1
- 3: DI2
- 4: DI3
- 5: DI4
- 6: DI5
- 7: DI6
- 8: DI7
- 9: DI8

Selects the source of the UP/DOWN ref reset

It is not works when the up or down source has inputted

- **Set 0: Not selected**
Always off
- **Set 1: selected**
Always on
- **Set 2~9 : DI1~ DI8**
It works by digital input which is selected



8.2.12 Acceleration/Deceleration

● 23.03 Ramp set selection

- 0: Acc/Dec time 1 ----- Initial value
- 1: Acc/Dec time 2
- 2: Frequency
- 3: DI1
- 4: DI2
- 5: DI3
- 6: DI4
- 7: DI5
- 8: DI6
- 9: DI7
- 10: DI8

▪ Set 0: Acc/Dec time 1

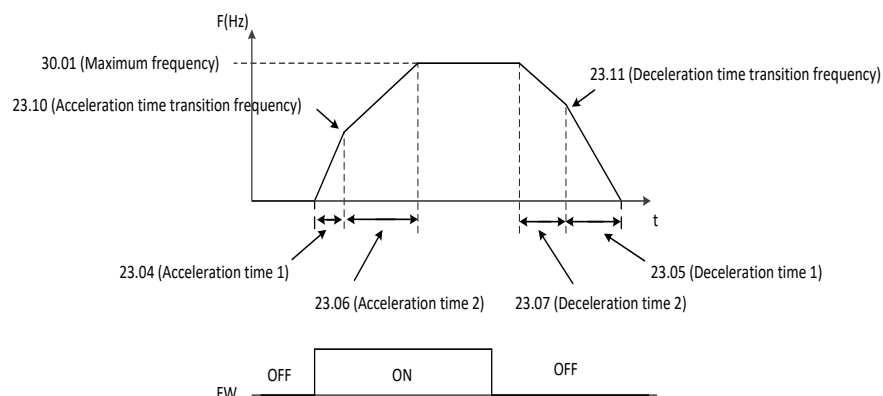
It uses the time '23.04' (Acceleration time 1) and '23.05' (Deceleration time 1)

▪ Set 1: Acc/Dec time 2

It uses the time '23.06' (Acceleration time 2) and '23.07' (Deceleration time 2)

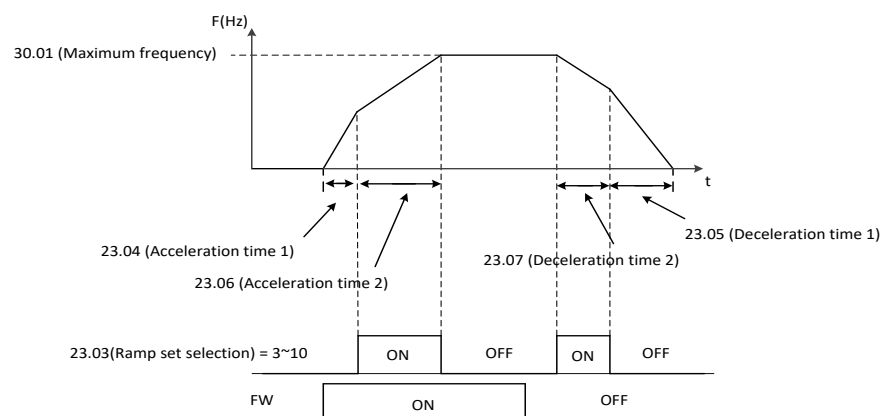
▪ Set 2: Frequency

It changes by the frequency as below picture



▪ Set 3~10 : DI1 ~ DI8

It changes by the digital input as below picture



- **23.04 Acceleration time 1**
 - *Range: 0.1 ~ 3000 Sec in 0.1 Sec*
 - *Initial value: 30.0 Sec*
 - **'23.03' (Ramp set selection)** is 0
Always on
 - **'23.03' (Ramp set selection)** is 1
Always off
 - **'23.03' (Ramp set selection)** is 2
It not works if the output frequency is above
'23.10' (Acceleration time transition frequency)
 - **'23.03' (Ramp set selection)** is 3~9
It works by digital input which is selected
 - ❖ Related Parameters: **'23.06', '23.07', '23.10', '23.11'**

- **23.05 Deceleration time 1**
 - *Range: 0.1 ~ 3000 Sec in 0.1 Sec*
 - *Initial value: 30.0 Sec*
 - **'23.03' (Ramp set selection)** is 0
Always on
 - **'23.03' (Ramp set selection)** is 1
Always off
 - **'23.03' (Ramp set selection)** is 2
It not works if the output frequency is above
'23.11' (Deceleration time transition frequency)
 - **'23.03' (Ramp set selection)** is 3~9
It works by digital input which is selected
 - ❖ Related Parameters: **'23.06', '23.07', '23.10', '23.11'**

- **23.06 Acceleration time 2**
 - *Range: 0.1 ~ 3000 Sec in 0.1 Sec*
 - *Initial value: 30.0 Sec*
 - **23.03' (Ramp set selection)** is 0
Always off
 - **'23.03' (Ramp set selection)** is 1
Always on
 - **'23.03' (Ramp set selection)** is 2
It not works if the output frequency is below
'23.10' (Acceleration time transition frequency)
 - **'23.03' (Ramp set selection)** is 3~9
It works by digital input which is selected
 - ❖ Related Parameters: **'23.06', '23.07', '23.10', '23.11'**

● 23.07 Deceleration time 2

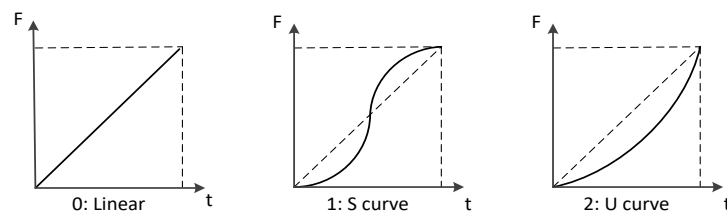
- *Range: 0.1 ~ 3000 Sec in 0.1 Sec*
- *Initial value: 30.0 Sec*

- **'23.03' (Ramp set selection)** is 0
Always off
- **'23.03' (Ramp set selection)** is 1
Always on
- **'23.03' (Ramp set selection)** is 2
It not works if the output frequency is below
'23.11' (Deceleration time transition frequency)
- **'23.03' (Ramp set selection)** is 3~9
It works by digital input which is selected
 - ❖ Related Parameters: **'23.06'**, **'23.07'**, **'23.10'**, **'23.11'**

● 23.08 Acceleration pattern selection

- *0: Linear ----- Initial value*
- *1: S Curve*
- *2: U Curve*

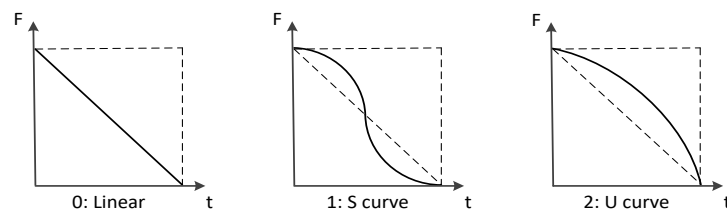
Select acceleration curve type



● 23.09 Deceleration pattern selection

- *0: Linear ----- Initial value*
- *1: S Curve*
- *2: U Curve*

Select deceleration curve type



- **23.10 Acceleration time transition frequency**

- *Range: 0.00 ~ 400Hz in 0.01 Hz*
- *Initial value: 0.00 Hz*

In addition to acceleration time 1 in '**23.04**' (*Acceleration time 1*), '**23.06**' (*acceleration time 2*) can be specified. Its value can also be entered by '**23.03**' (*Ramp set selection*)

❖ Related Parameters: '**23.03**', '**23.04**', '**23.06**'

- **23.11 Deceleration time transition frequency**

- *Range: 0.00 ~ 400Hz in 0.01 Hz*
- *Initial value: 0.00 Hz*

In addition to deceleration time 1 in '**23.05**' (*Deceleration time 1*), '**23.07**' (*Deceleration time 2*) can be specified. Its value can also be entered by '**23.03**' (*Ramp set selection*)

❖ Related Parameters: '**23.03**', '**23.05**', '**23.07**'

- **23.12 Jogging acceleration time**

- *Range: 0.0 ~ 3000 Sec in 0.1 Sec*
- *Initial value: 30.0 Sec*

It works when the jogging is operated

❖ Related Parameters: '**22.17**', '**22.18**'

- **23.13 Jogging deceleration time**

- *Range: 0.0 ~ 3000 Sec in 0.1 Sec*
- *Initial value: 30.0 Sec*

It works when the jogging is ON

❖ Related Parameters: '**22.17**', '**22.18**'

- **23.14 Emergency stop time**

- *Range: 0.0 ~ 3000 Sec in 0.1 Sec*
- *Initial value: 3.0 Sec*

It works when the emergency source is ON

❖ Related Parameters: '**21.11**'

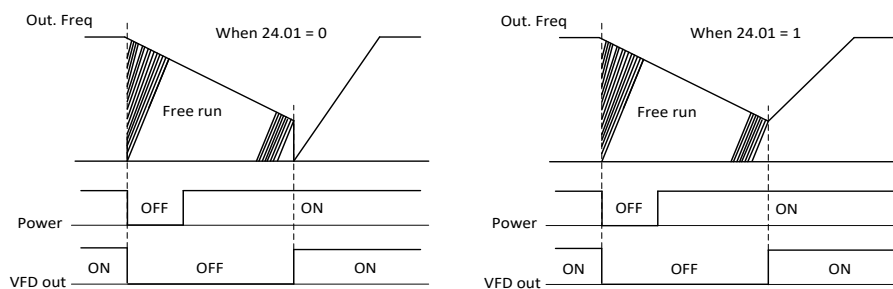
8.2.13 Speed Search

● 24.01 Speed search start mode

- 0: Start from 0 Hz ----- Initial value
- 1: Start from frequency corresponding motor speed

In case of VFD starting operation, the start frequency of the VFD can be selected as follows

❖ Related Parameters: '**24.03**'



● 24.02 Speed search current limit

- Range: 50.0 ~ 180.0 % in 0.1 %
- Initial value: 100.0 %

limits excessively increasing current during speed search. When current reached to the setting level, it controls the voltage increasing level to prevent the overcurrent trip.

● 24.03 Voltage increment in speed search mode

- Range: 10 ~ 500 % in 1 %
- Initial value: 100 %

In case of the lower starting current level during speed search motion on the basis of the motor rated current, the increase level of the output voltage is set from 10% to 300%

● 24.04 Speed search delay ratio

- Range: 0.50 ~ 5.00 x1 in x0.01
- Initial value: 1.00

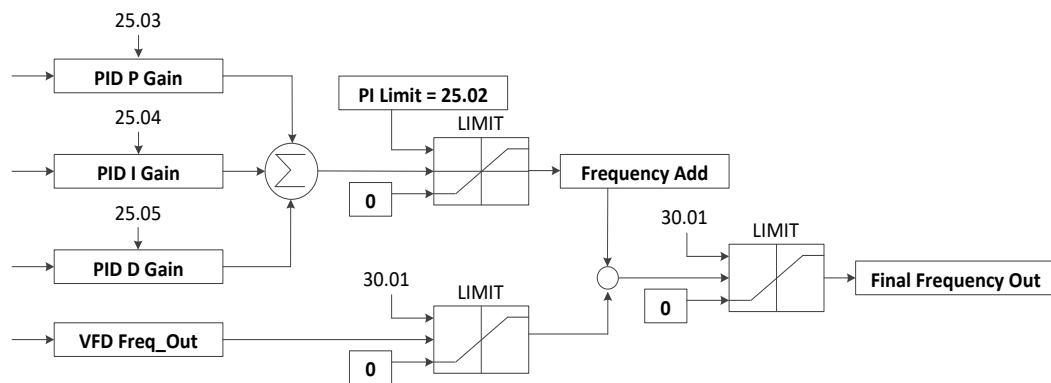
Set the pause time to prevent surge current due to residual magnetic flux before speed search.

8.2.14 Over voltage suppression

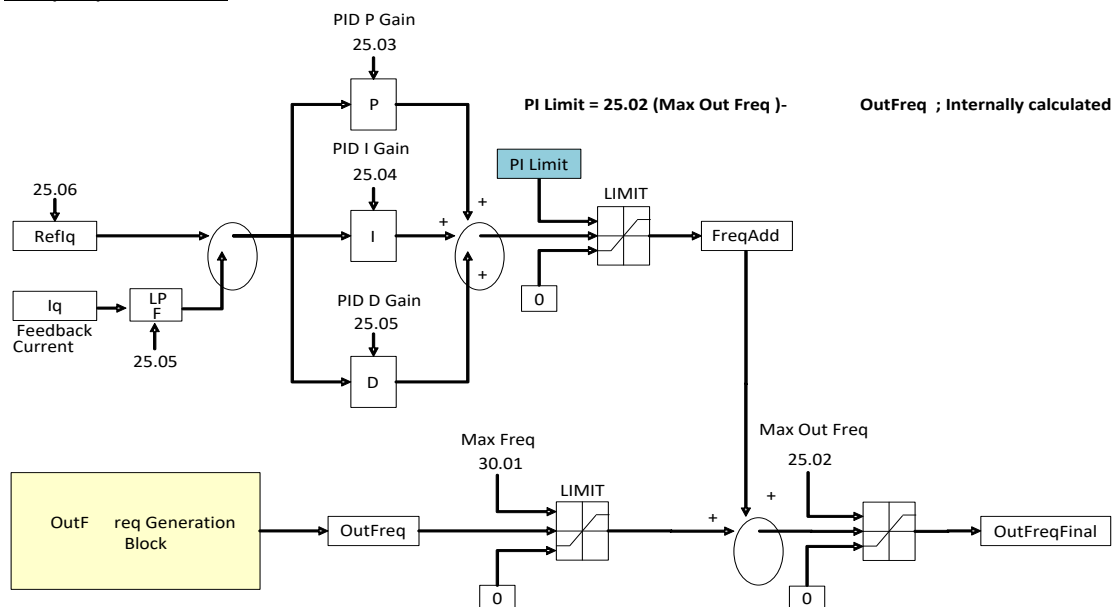
The Overvoltage Suppression (OVS) feature will over speed the motor up to the '**25.02**' (**Maximum OVS Output Frequency**) to prevent motor regeneration and creating an Overvoltage Fault. If the OVS runs at maximum frequency for longer than the '**25.08**' (**Limit Time**), the unit will fault on ovFS.

OVS Functional Description

- By calculating torque in real time, reduce regeneration energy by increasing speed.
- For speed control, PI controller is applied.
- If torque is bigger than 0, "PI Out" become 0 by "PI Limiter"; no increase in frequency value
- If torque is lower than 0, "PI Out" would be increased to "Max Add Req"; frequency value increased
- If output of PI controller is reached to '**25.02**' (**Max Add Freq**) the counter is started.
- When the value of counter is reached to '**25.08**' (**wRegen Time**), the trip (ovFS) will be occur.



Sample parameters



Meaning of 25.02 is changed from Max Add Freq to Max Out Freq

● **25.01 OVS selection**

- *0: Disable ----- Initial value*
- *1: Enable*

Select to enable the Voltage Suppression Control function.

● **25.02 Maximum OVS output frequency**

- *Range: "30.01"(Maximum Frequency) ~ 300.0 Hz in 0.01 Hz*
- *Initial value: 80.00 Hz*

Real time editable a maximum frequency limit for OVS function

❖ Related Parameters:

● **25.03 OVS P gain**

- *Range: 0 ~ 10000 in 1*
- *Initial value: 1000*

Real time editable P gain for OVS PID loop

- $PIOut = err * Kp$
- $Hz = err(\%) * Kp * scalefactor(50 * 1e-6)$

Example

- err 10%, $Kp = 1000$
 ⇒ $PIOut = 0.5Hz$
- ✓ Recommended Value in test bench
 ⇒ 1000 or less than 5000

● **25.04 OVS I gain**

- *Range: 0 ~ 10000 Sec in 1 Sec*
- *Initial value: 100 Sec*

Real time editable I gain for OVS PID loop

- $PIOut = \int(err * Ki)$
- $Hz += err(\%) * Ki * scalefactor(50 * 1e-6), \quad dT = 1ms$

Example (Integration Time to 10Hz on Error)

- err 10%, $Ki = 1000$
 ⇒ Time to 10Hz on 10% Error = 20ms
- err 10%, $Ki = 100$
 ⇒ Time to 10Hz on 10% Error = 200ms
- err 10%, $Ki = 10$
 ⇒ Time to 10Hz on 10% Error = 2000ms
- ✓ Recommended Value in test bench
 ⇒ 100 or less than 500

● 25.05 OVS D gain

- *Range: 0 ~ 10000 Sec in 1Sec*
- *Initial value: 0 Sec*

Real time editable D gain for OVS PID loop. Its value depends on '**25.07' (Filter bandwidth)**', filter bandwidth. Thus, if '**25.07' (Filter bandwidth)**' is not changed, no need to change '**25.05' (OVS D gain)**' value. Most application, this value should not be set over 3000

✓ Recommended Value as a function of '**25.07' (Filter bandwidth)**

- ⇒ If '**25.07' < 10** → '**25.05'** : 0 ~ 500
- ⇒ If '**25.07' < 30** → '**25.05'** : 500 ~ 1000
- ⇒ If '**25.07' < 50** → '**25.05'** : 1000 ~ 1500

● 25.06 q-Current reference

- *Range: -100.0 ~ 100.0 in 0.1*
- *Initial value: 0.0*

Real time editable q axis reference current compensates Torque Estimate Error.

- If Torque estimate offset is bigger than 0
 - ⇒ No increase in output frequency even if regeneration is occurred.
 - ⇒ This situation could be end with OV Trip.
 - ⇒ If so, set '**25.06' (q-Current reference)**' to a positive value
- If Torque estimation offset smaller than 0
 - ⇒ No increase in output frequency even if regeneration is not occurred.
 - ⇒ Output Frequency could be increased to Max. Freq (Reference Frequency + '**25.02' (Maximum OVS output frequency)**) and end up with ovFS (OVS control Fail)
 - ⇒ If so, set '**25.06' (q-Current reference)**' to a negative value

● 25.07 Filter bandwidth

- *Range: 0.0 ~ 1000 milliseconds in 0.1 ms*
- *Initial value: 1 ms*

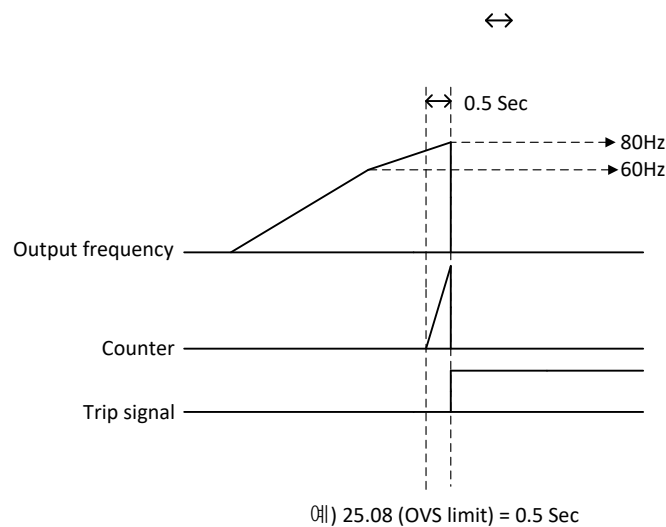
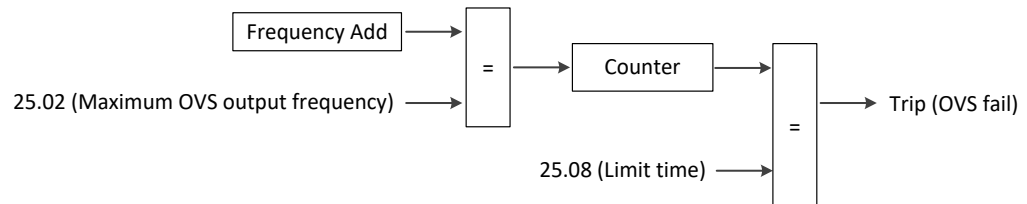
Real time editable Iq feedback Low Pass Filter time constant

- If output Frequency is not stable,
 - ⇒ Increase '**25.07' (Filter bandwidth)**' value
- Recommended Value as a function of '**25.05' (OVS D gain)**', '**25.07' (Filter bandwidth)**' value should be set accordingly
 - ⇒ Not set over 50

25.08 Limit time

- *Range: 0.0 ~ 100 Sec in 0.1 Sec*
- *Initial value: 0.5 Sec*

Real time editable OVS control fails check time. If PID output is saturated to '**25.02**' (**Maximum OVS output frequency**) during this time period, VFD will stop and ovFS will be occurred.



Case1) if frequency is increased at no regeneration condition,

- Cause: when a current feedback value is corrupted by noise.
 - Measures:
 - ✓ Change a '**25.07**' (**Filter bandwidth**) and '**25.05**' (**OVS D gain**)
 - ✓ Please set the '**25.07**' (**Filter bandwidth**) between 5 and 30 (ex 5, 10, 20, 30ms)
- Increasing '**25.07**' (**Filter bandwidth**) results the delay in calculating torque so '**25.05**' (**OVS D gain**) should be set
- Please set the '**25.05**' (**OVS D gain**) between 500 to 1000
- ✓ Experimental values on MG–Set test are
- '25.07' (Filter bandwidth) = 30, '25.05' (OVS D gain) = 1000**

Case2) if overvoltage trip is occurred at normal operation,

- Cause: Torque is over estimated due to motor parameter error or current sensing error.
 - Measures :
 - ✓ Change a '**25.06**' (**q–Current reference**)
- Please set the '**25.07**' (**Filter bandwidth**) between 30 to 100
- If this value is set too high, Frequency output can be saturated to maximum frequency.

Calculated torque output

User can monitor calculated torque by 2 methods

■ Parameters

No.	Name	Description	default	Run-time Edit
'12.03'	wAODef (AO1 source)	0 ~ 4	0	X
'12.11'	wAODef2 (AO2 source)	0 ~ 4	1	X

■ Analog output (DC voltage)

➤ '12.03' (AO1 source)

Set '12.03' = 4 display calculated torque value (-150% ~ +150%) by analog output.

AO1 output	Torque
0V	-150%
5V	0%
10V	+150%

(※ '12.03' = 0~3 are the same as existed function)

■ Analog output (current)

➤ '12.11' (AO2 source)

Set '12.11' = 4 display calculated torque value (-150% ~ +150%) by analog output.

AO2 output	Torque
4mA	-150%
12mA	0%
20mA	+150%

(※ '12.11' = 0~3 are the same as existed function)

➤ Special parameter: Calculated torque read frame by Modbus

- CMD : 03 (Read)

- Parameter : 10 (Calculated Torque)

	Communication Number	CMD	Parameter	Data	CRC
TX	01	03	000A	0001	
RX	01	03	000A	Torque value	

-

※This document are written by result of test bench.

Field engineer should be tuned for each field situation by consider above case study.

8.2.15 KEB

If a power outage occurs, the DC link voltage goes down and a low voltage failure occur blocking output. This function maintains the DC link voltage by controlling the VFD output frequency during the outage, thereby helping maintain the VFD between the instantaneous outage and the low voltage failure for a longer time.

- **26.01 KEB selection**

- *0: Disable ----- Initial value*
- *1: Enable ('26.02' decelerating to slope)*
- *2: Enable (Voltage control)*

Select KEB with when the input power off.

If disable, normal decelerating operation is carried out until low voltage

If enable, VFD DC part is charged with the regenerative energy that is generated from the motor by controlling the VFD output frequency

- **26.02 KEB gain**

- *Range: 1 ~ 1000 in 1*
- *Initial value: 100*

If '26.01' is set to 1, the KEB gain can be control

This is the gain used for controlling the KEB operation by using the inertia moment amount of the load.

If the inertia of load is high, decrease the gain

If the inertia of load is low, increase the gain

- **26.03 KEB Voltage control P gain**

- *Range: 0.01 ~ 10.00 in 0.01*
- *Initial value: 1.00*

KEB voltage control is available when '26.01' is selected as 2.

The P gain must be increased in case of Low voltage trip Occur

Setting the P gain too high may result in an over voltage trip

- **26.04 KEB Voltage control I gain**

- *Range: 0.01 ~ 10.00 in 0.01*
- *Initial value: 1.00*

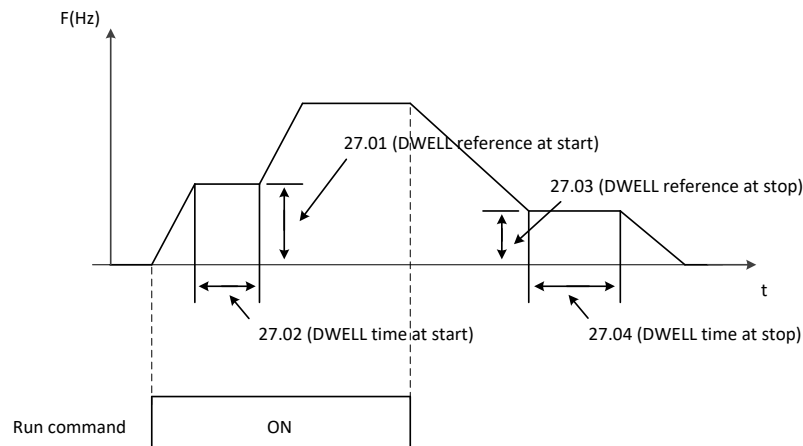
KEB voltage control is available when '26.01' is selected as 2.

If the DC link voltage does not remain at the KEB level, you can raise the I gain to prevent low voltage tripping

8.2.16 DWELL

The DWELL function temporarily holds the frequency reference at a predefined value for a set time then continues accelerating or decelerating.

The DWELL function helps prevent speed loss when starting and stopping a heavy load with induction motors. When running a PM motor in V/f control, the pause in acceleration allows the PM motor rotor to align with the stator field of the motor and reduce the starting current.



- **27.01 DWELL reference at start**

- Range: 0.00 ~ 400.0 Hz in 0.01
- Initial value: 0.00 Hz

Program DWELL frequency at start

- **27.02 DWELL time at start**

- Range: 0.0 ~ 10.0 Sec in 0.1
- Initial value: 0.0 Sec

Program DWELL time at start

- **27.03 DWELL reference at stop**

- Range: 0.00 ~ 400.0Hz in 0.01
- Initial value: 0.00 Hz

Program DWELL frequency at stop

- **27.04 DWELL time at stop**

- Range: 0.0 ~ 10.0 Sec in 0.1
- Initial value: 0.0 Sec

Program DWELL time at stop

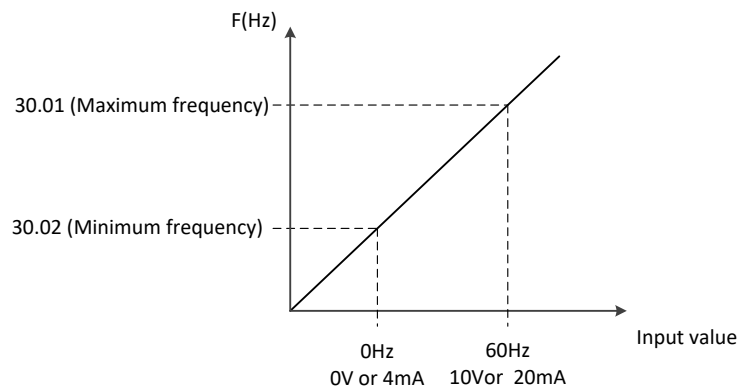
8.2.17 Frequency limits

● 30.01 Maximum frequency

- *Range: 0.00 ~ 400.0 Hz in 0.01 Hz (Sensorless Vector: 0.00 ~ 300.00Hz)*
- *Initial value: 60.00 Hz*

Define the maximum allowed frequency

If Frequency command is analog input, Max freq must also be set to '**11.09**', '**11.17**'.



● 30.02 Minimum frequency

- *Range: 0.00 ~ 400.0 Hz in 0.01 Hz*
- *Initial value: 0.00 Hz*

Define the minimum allowed frequency

If Frequency command is analog input, Min freq must also be set to '**11.08**', '**11.16**'.

● 30.03 Start frequency

- *Range:*
VF, SLV : 0.50 ~ 60.00 Hz in 0.01 Hz
Vector control : 0.00 ~ 60.00 Hz in 0.01 Hz
- *Initial value: 0.50 Hz (VF, SLV), 0.00 Hz (Vector control)*

Define the start frequency

*Caution: If the start frequency is set too high, it operates the same as direct start, and overcurrent and overload errors may occur.

8.2.18 Fault functions

- **31.01 External event 1 source**

- 0: Active (Active high signal)
- 1: Inactive (Active low signal) ----- Initial value
- 2: DI1
- 3: DI2
- 4: DI3
- 5: DI4
- 6: DI5
- 7: DI6
- 8: DI7
- 9: DI8

Define the source of external event 1

- **31.02 External event 2 source**

- See the parameter '31.01' (External event 1 source)

- **31.03 External event 3 source**

- See the parameter '31.01' (External event 1 source)

- **31.04 External event 4 source**

- See the parameter '31.01' (External event 1 source)

- **31.05 External event 5 source**

- See the parameter '31.01' (External event 1 source)

- **31.06 Fault(Trip) reset selection**

- 0: Not selected
- 1: Selected
- 2: DI1
- 3: DI2
- 4: DI3
- 5: DI4
- 6: DI5
- 7: DI6 ----- Initial value
- 8: DI7
- 9: DI8

Selects the source of an external fault reset signal

The signal resets the drive after a fault trip if the cause of the fault no longer exists.

● 31.07 Restart mode selection

- 0: No Restart ----- Initial value
- 1: Restart from 0Hz
- 2: Resume at frequency corresponding motor speed
- 3: Resume at motor speed, then decelerated stop

Select what action to take when a trip occurs that has set at '**31.10**' (*Automatic reset item 1*) and '**31.11**' (*Automatic reset item 2*) if the consecutive trip does not occur within 60 seconds, an accumulated trip count is reset to 0

❖ Related Parameters: '**31.09**' ~ '**31.14**'

● 31.08 Alarm relay operation mode

- 0: Inactive for the Under voltage trip signal ----- Initial value
- 1: Inactive during auto reset
- 2: Active every trip
- 3: Inactive during auto reset (Only active for the Under voltage trip signal endlessly)

Select what action to take when a trip occur that alarm relay

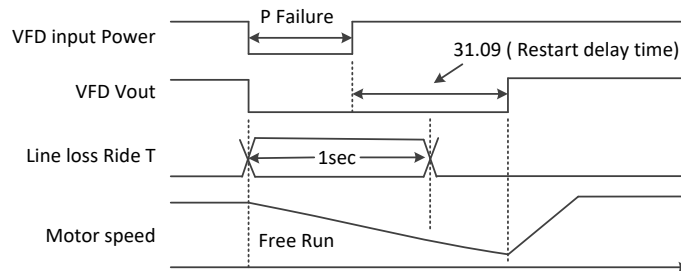
❖ Related Parameters: '**31.07**'

● 31.09 Restart delay time

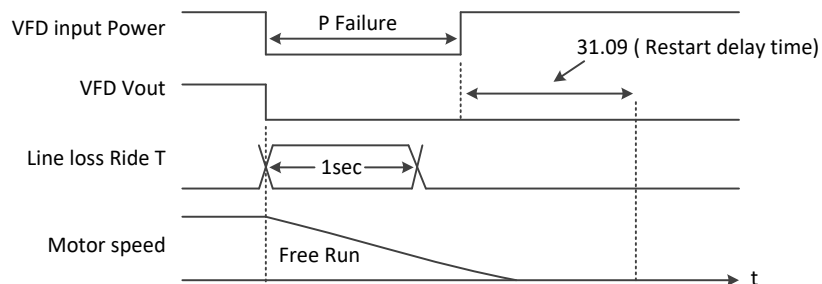
- Range: 0.3 ~ 10.0 Sec in 0.1 Sec
- Initial value: 1.0 Sec

Program delay time when VFD restarts

1) Momentary Power Failure Period < 1 Sec



2) Momentary Power Failure Period > 1 Sec



● 31.10 Automatic reset item 1

- Range: 0x00 ~0xFF
- Initial value: 0x00

Selects faults that are automatically reset the parameter is a 16-bit word with each bit corresponding to a fault type. Whenever a bit is set to 1, the corresponding fault is automatically reset. The bits of this binary number correspond to the following faults

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EE 5	EE 4	EE 3	EE 2	EE 1	User	–	–	–	–	–	–	Sc	Lv	ov	oC

● 31.11 Automatic reset item 2

- See the parameter '31.10' (Automatic reset item 1)

● 31.12 User reset item selection

- Range: 0~29
- Initial value: 0

Defines the fault that can be automatically reset using parameter '31.10' (Automatic reset item 1) or '31.10' (Automatic reset item 1), bit 10

Value	Type of Trip	Value	Type of Trip
0	–	16	–
1	oC (Over Current)	17	SAFE (Safety Fault)
2	ov (Over Voltage)	18	–
3	Lv (low Voltage)	19	ovSF (OVS Fail)
4	Sc (Short circuit)	20	–
5	–	21	–
6	ot (Over Temperature)	22	EE2 (External Emergency 2)
7	EtH(Motor Over Load)	23	EE3 (External Emergency 3)
8	EE1 (External Emergency 1)	24	EE4 (External Emergency 4)
9	E2PE (EEPROM Error)	25	EE5 (External Emergency 5)
10	CE (Communication Error)	26	–
11	–	27	FF (Fan Fault)
12	GF (Ground Fault)	28	Profibus–DP Trip
13	–	29	Device–Net trip
14	Iolt (VFD Over Load)	30	System OL trip
15	PF (Input Phase Loss Fault)	31	System UL trip

● 31.13 Restart trial 1

- Range: 0 ~10 in 1
- Initial value: 0

Defines the number of automatic fault resets at '31.10' (Automatic reset item 1)

● 31.14 Restart trial 2

- Range: 0 ~10 in 1
- Initial value: 0

Defines the number of automatic fault resets at '31.11' (Automatic reset item 2)

- **31.15 Earth Fault**

- *0: Disabled*
- *Range: 0.0 ~ 100.0 % in 0.1 %*
- *Initial value: 0.0 %*

Program to enable the Ground fault detection and its fault level as a percentage of rated current

- **31.16 Supply phase loss**

- *0: Disabled*
- *Range: 0 ~ 30 Sec in 1 Sec*
- *Initial value: 10 Sec*

Enables & sets the time period to determine if an Input Phase Loss occurs. The VFD monitors the ripple on the DC bus voltage and if it occurs for the programmed magnitude and time period an Input Phase Loss fault will occur. The ripple on the DC bus will cause heating to the DC Bus capacitors which will shorten their life.

- **31.17 Stall function**

- *0: No Operation*
- *1: VFD overload*
- *2: Over voltage*
- *3: VFD overload and Over voltage ----- Initial value*

Select a overload or overvoltage restriction modes

- **Set 0: No Operation**
Overload Restriction Mode=Off, Overvoltage Restriction Mode=Off
- **Set 1: VFD overload**
Overload Restriction Mode=On, Overvoltage Restriction Mode=Off
- **Set 2: Over voltage**
Overload Restriction Mode=Off, Overvoltage Restriction Mode=On
- **Set 3: VFD overload and Over voltage**
Overload Restriction Mode=On, Overvoltage Restriction Mode=On
❖ Related Parameters: **'31.18', '31.19'**

- **31.18 Stall current limit**

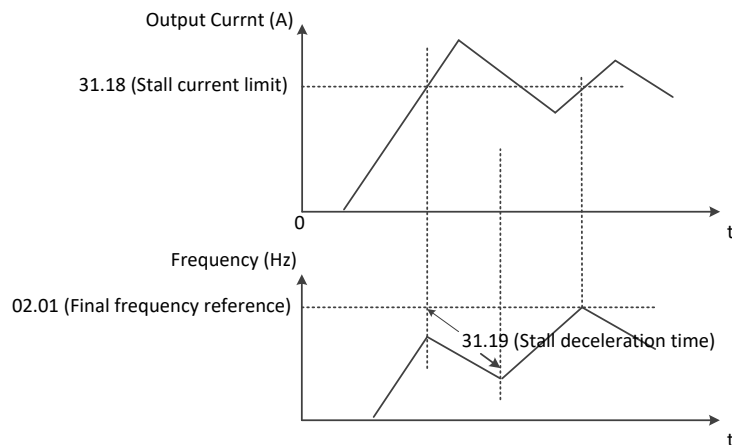
- *Range: 20.0 ~ 200.0 % in 0.1 %*
- *Initial value: 180.0 % (HD), 150.0 % (ND)*

Program the level for overload restriction of the VFD rated current

● 31.19 Stall deceleration time

- Range: 0.1 ~ 30.0 Sec in 0.1 Sec
- Initial value: 10.0 Sec (30kW upper) / 1.0 Sec (22kW lower)

Program the deceleration time for rate when the VFD detects the overload



● 31.22 RS485 Modbus time out check enable

- 0: Always Running ----- Initial value
- 1: Only during VFD is Running

Select a time out detection mode.

❖ Related Parameters: '31.23'

● 31.23 RS485 Modbus time out time

- 0: Disable
- Range: 0 ~ 60 Sec in 1 Sec
- Initial value: 0 Sec

Select a time out detection period when communication discontinues. If no communication event occurs during this time period, a communication fault will occur.

● 31.24 Low voltage fault level

- Range: 90.0 ~ 180.0 % in 0.1 %
- Initial value: 100.0 %

HF : Set as 31.24 code based on DC voltage 400V

LF : Set as 31.24 code based on DC voltage 200V

*Caution : if it is set below the initial value, it is recommended to install an AC reactor at the input stage because there is a risk of inverter damage due to excessive inrush current caused by instantaneous power failure.

EX) 31.24 = 90.0%

HF : $400V \times 31.24 = 400V \times 90.0\% = 360V$

LF : $200V \times 31.24 = 200V \times 90.0\% = 180V$

8.2.19 Motor thermal protection

● 32.01 Electronic thermal overload level

- 20.0 ~ 120.0 % in 0.1 %
- Initial value: 100.0 %

Program a level of the rated motor current (VFD Rated Current)

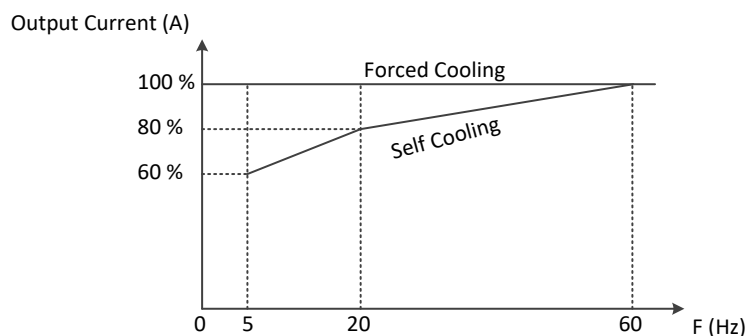
❖ Related Parameters: '32.02'

● 32.02 Electronic thermal overload profile

- 0: Self Cooling
- 1: Forced Cooling ----- Initial value
- 2: Disable Electronic thermal overload detection

Select a cooling method

- **Set 0: Self Cooling**
Fan is mounted on the motor shaft
- **Set 1: Forced Cooling**
Fan is powered by external power source



- **Set 2: Disable Electronic thermal overload detection**
Do not detect ETH fault

● 32.03 Fan operation mode

- 0: Always running ----- Initial value
- 1: Only during VFD is running

Select fan operation

● 32.04 Fan off delay time

- 0.0 to 1000.0 Sec 0.1 Sec
- Initial value: 30.0 Sec

Run only When the '32.03'(Fan operation mode) is 1

❖ Related Parameters: '32.04'

8.2.20 System Overload/Underload detection

The drive provides two independent torque detection functions that trigger an alarm or fault signal when the load is too heavy or suddenly drops

● 33.01 System Load Detection Selection

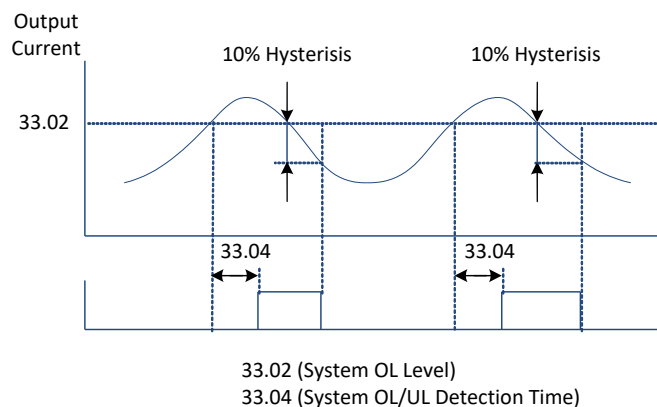
- 0: Disabled
- 1: Overload Detection
- 2: Underload Detection
- 3: Overload/Underload Detection
- 4: Overload Detection with Fault (oLdt)
- 5: Underload Detection with Fault (uLdt)
- 6: Overload/Underload Detection with Fault (oLdt, uLdt)

● 33.02 System Overload Detection Level

- Range: 20.0 ~ 200.0 % in 0.1 %

Sets the System Overload level. This feature is triggered when the motor current exceeds this level. 100% level is based off of the value in 99.04(Motor rated current)

System Overload Detection

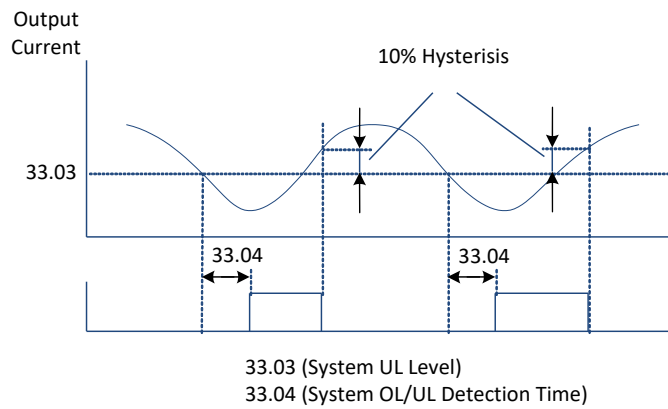


● 33.03 System Underload Detection Level

- Range: 20.0 ~ 200.0 % in 0.1 %

Sets the System Underload level. This feature is triggered when the motor current exceeds this level. 100% level is based off of the value in H05.

System Underload Detection



- **33.04 System Overload/Underload Detection Time**

- *Range: 0.0 ~ 60.0 Sec in 0.1 Sec*
- *Initial value : 10.0 sec*
- Sets the System Overload/Underload Detection time.

- **33.05 System Overload/Underload Detection safe zone**

- *Range: 0.00 ~ Max frequency (30.01) in 0.01 Hz*
- *Initial value : 0.00Hz*

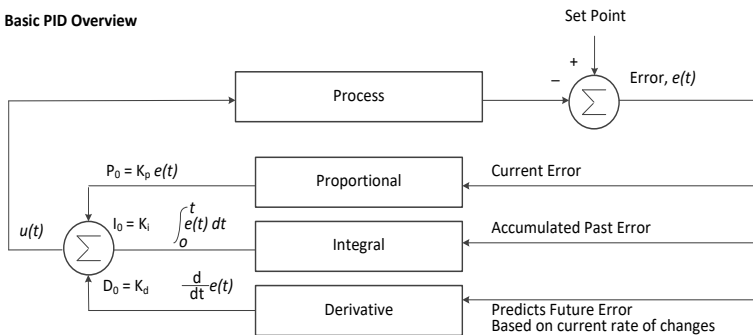
Sets the level at which this feature is disabled.

System Overload/Underload detection doesn't work below '33.05' value

8.2.21 PID

The PID function enables the system running at the reference automatically by regulating the process using the system feedback, error term. It is used for Cubic Feet of Air it moves per minute (CFM) for fan application, Gallons per minute (GPM) for pump application, pressure control, heating application, etc.

Basic PID Overview



PID Functional Description

- Reference: Desired System Output Value
- Error: Difference between System output and reference
- Proportional (P) Term: Current Error
- Integral (I) Term: Accumulated Past Error
- Derivative (D) Term: Predicted Future Error based on current rate of changes

● 40.01 PID function select

- 0: Disable ----- Initial value
- 1: Enable

Select PID function type

❖ Related Parameters: '40.01' ~ '40.24'

● 40.02 PID reference

- The range of settings varies depending on the '40.25'(PID Controlled physics quantity) setting.
- Range if '40.25' is 0 : '40.27' ~ '40.26' [%]
- Range if '40.25' is 1 : '40.27' ~ '40.26' [Hz]
- Range if '40.25' is 2 : '40.27' ~ '40.26' [Kpa]
- ❖ Related Parameter : '40.26' (PID Control Maximum physical quantity)
- ❖ Related Parameter : '40.27' (PID Control Minimum physical quantity)
- Initial value: 0.0 %

It can be worked when '40.03'(PID reference source) set 2

❖ Related Parameters: '40.03'

- **40.03 PID reference source**

- 0: AI1 (O)
- 1: AI2 (OI)
- 2: Keypad ----- Initial value
- 3: Modbus
- 4: Fieldbus
- 5: UP/DOWN

Select PID Reference source

- **Set 0: N/A**
This code is not used (It is recommended not to set)
- **Set 1: AI1(O), AI2 (OI)**
This code is determined by '40.04'(PID feedback source)

if '40.04' is 0 : Set to AI2 (OI)
Set the PID reference by DC 4~20mA through at OI–L terminals
if '40.04' is 1 : Set to AI1 (O)
Set the PID reference by DC 0~10V through at O–L terminals
- **Set 2: Keypad**
Set the PID reference by '40.02'(PID reference) parameter
- **Set 3: Modbus**
Set the PID reference by Modbus communication through at RXP–RXN terminals
- **Set 4: Fieldbus**
Set the PID reference by Fieldbus through at option card adapter
- **Set 5: UP/DOWN**
Set the PID reference by UP/DOWN through external command

- **40.04 PID feedback source**

- 0: AI1 (O)
- 1: AI2 (OI) ----- Initial value

Select the source how to get feedback

- **Set 0: AI1 (O)**
Get the PID feedback by DC 0~10V
- **Set 1: AI2 (OI)**
Get the PID feedback by DC 4~20mA

- **40.05 PID P gain**

- *Range: 0.1 ~ 2000 % in 0.1 %*
- *Initial value: 100.0 %*

Select the PID P gain value

- It sets the output rate of error between reference value and the feedback value
- For faster response speed, enlarge the P gain value
- If P gain is set too large, oscillation or over shooting may occur

● 40.06 PID I gain

- *Range: 0.0 ~ 3600 Sec in 0.1 Sec*
- *Initial value: 1.0 Sec*

Select the Integral time to accumulate PID error value

- For faster response speed, shorten the accumulate time
- If I gain time is set too short, oscillation or over shooting may occur

● 40.07 PID D gain

- *Range: 0.0 ~ 10.00 Sec in 0.01 Sec*
- *Initial value: 0.0 Sec*

Program the derivative time for PID function

- For faster response speed, lengthen the D gain time
- If D gain time is set too long, system may become unstable

● 40.08 PID Err limit

- *Range: 0.0 ~ 100.0 % in 0.1 %*
- *Initial value: 100.0 %*

Program error limit level, ratio to the maximum error

● 40.09 PID output high limit

- *Range: -100.0 ~ 100.0 % in 0.1 %*
- *Initial value: 100.0 %*

Program the maximum PID output as percentage of the maximum output frequency

● 40.10 PID output low limit

- *0: Disable the low limit*
- *Range: -100.0 ~ 100.0 % in 0.1 %*
- *Initial value: 0.0 %*

Program the minimum PID output as a percentage of the minimum output frequency

● 40.11 PID output invert

- *0: Disable ----- Initial value*
- *1: Enable*

Program to enable the PID output invert

● 40.12 PID scale factor

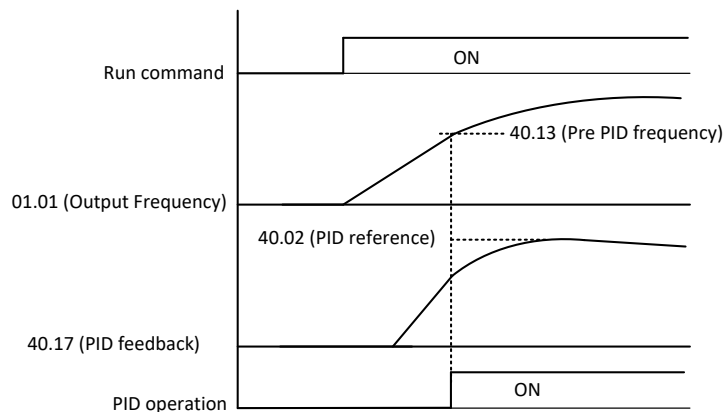
- *Range: 0.1 ~ 1000 % in 0.1 %*
- *Initial value: 100.0 %*

Program the minimum PID output as a percentage of the minimum output frequency

● 40.13 Pre PID frequency

- 0: Disable Pre PID function
- Range: 0.00 ~ 400.0 Hz in 0.01 Hz
- Initial value: 0.00 Hz

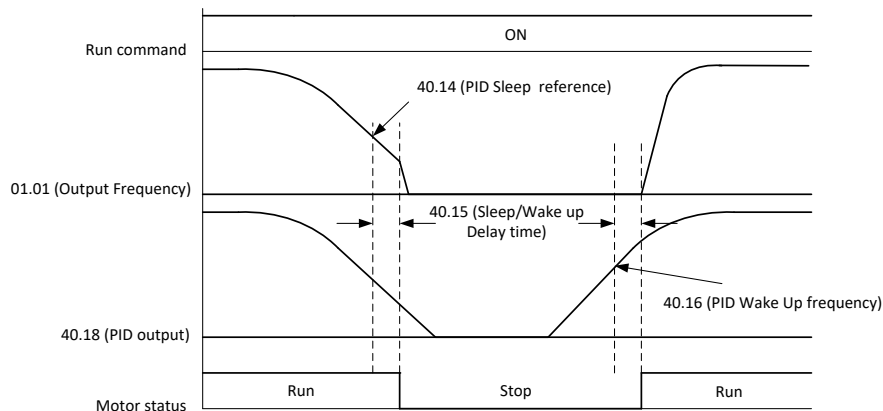
Program the frequency reference when PID function is activated. Once the VFD frequency out reaches this value in '**40.13**' (**Pre PID frequency**) PID control function is enabled and the VFD is operated in closed loop control.



● 40.14 PID sleep frequency

- Range: 0.00 ~ 400.0 Hz in 0.01 Hz
- Initial value: 0.00 Hz

Program the frequency reference when the VFD goes sleep



● 40.15 PID sleep/wake delay time

- Range: 0.0 ~ 30.0 Sec in 0.1 Sec
- Initial value: 0.0 Sec

Program the frequency reference when the VFD goes sleep

- **40.16 PID wake frequency**

- *Range: '40.14' ~ 400.0 Hz in 0.01 Hz*
- *Initial value: 0.00 Hz*

Program the frequency reference when the VFD wakes up from the sleep mode for the specified operation

- **40.17 PID feedback monitor**

- *Range: 0.00 ~ 100.0%*

Real time display of PID feedback

- **40.18 PID output monitor**

- *Range: 0.00 ~ 100.0%*

Real time display of PID output

- **40.19 PID integral reset source**

- *0: Not selected ----- Initial value*
- *1: Selected*
- *2: DI1*
- *3: DI2*
- *4: DI3*
- *5: DI4*
- *6: DI5*
- *7: DI6*
- *8: DI7*
- *9: DI8*

Selects the source of the PID integral reset

- **Set 0: Not selected**
Always off
- **Set 1: selected**
Always on
- **Set 2~9 : DI1~ DI8**
It works by digital input which is selected

● **40.20 PID disable source**

- *0: Not selected ----- Initial value*
- *1: Selected*
- *2: DI1*
- *3: DI2*
- *4: DI3*
- *5: DI4*
- *6: DI5*
- *7: DI6*
- *8: DI7*
- *9: DI8*

Selects the source of the PID disable

- **Set 0: Not selected**
Always off
- **Set 1: selected**
Always on
- **Set 2~9 : DI1~ DI8**
It works by digital input which is selected

● **40.21 ref source 1 at PID disable**

- *0: Not selected*
- *1: AI1 (O) scaled ----- Initial value*
- *2: AI2 (OI) scaled*
- *3: Modbus*
- *4: Fieldbus*
- *5: PID*
- *6: Keypad*
- *7: UP/DOWN*

Selects the source of the ref 1 at PID disable

- **Set 0: Not selected**
Always off
- **Set 1: AI1 (O) scaled**
It can set the frequency reference by the DC 0~10V
- **Set 2: AI2 (OI) scaled**
It can set the frequency reference by the DC 4~20mA
- **Set 3: Modbus**
It can set the frequency reference by the modbus communication
- **Set 4: Fieldbus**
Always on It can set the frequency reference by the fieldbus communication
- **Set 5: PID**
Always on It can set the frequency reference by the PID control
- **Set 6: Keypad**
Always on It can set the frequency reference by the Keypad
- **Set 7: UP/DOWN**
Always on It can set the frequency reference by the UP/DOWN function

- **40.22 ref source 2 at PID disable**
 - See the parameter *'40.21' (ref source 1 at PID disable)*
- **40.23 ref 1 /ref 2 combination at PID disable**
 - 0: *'40.21' ----- Initial value*
 - 1: *'40.21' + '40.22'*
 - 2: *'40.21' - '40.22'*
 - 3: *'40.21' x '40.22'*
 - 4: *MIN ('40.21', '40.22')*
 - 5: *MAX ('40.21', '40.22')*

Selects a mathematical function between the reference sources selected by parameters *'40.21' (ref source 1 at PID disable)* and *'40.22' (ref source 2 at PID disable)*

- Set 0: *'40.21'*
'40.21' (ref source 1 at PID disable)
- Set 1: *'40.21'+ '40.22'*
'40.21' (ref source 1 at PID disable) + '40.22' (ref source 2 at PID disable)
- Set 2: *'40.21'- '40.22'*
'40.21' (ref source 1 at PID disable) - '40.22' (ref source 2 at PID disable)
- Set 3: *'40.21'x '40.22'*
'40.21' (ref source 1 at PID disable) x '40.22' (ref source 2 at PID disable)
- Set 3: *MIN ('40.21', '40.22')*
MIN '40.21' (ref source 1 at PID disable), '40.22' (ref source 2 at PID disable)
- Set 5: *MAX ('40.21', '40.22')*
MAX '40.21' (ref source 1 at PID disable), '40.22' (ref source 2 at PID disable)
- **40.24 ref 1 /ref 2 selection at PID disable**
 - 0: *'40.23' setting value ----- Initial value*
 - 1: *'40.22' setting value*
 - 2: *DI1*
 - 3: *DI2*
 - 4: *DI3*
 - 5: *DI4*
 - 6: *DI5*
 - 7: *DI6*
 - 8: *DI7*
 - 9: *DI8*

Configures the selection between frequency references 1 and 2

- **Set 0: '40.23' setting value**
The frequency is used by *'40.23'(ref 1 /ref 2 combination at PID disable)* set value
- **Set 1: '40.22' setting value**
The frequency is used by *'40.22'(ref source 2 at PID disable)*
- **Set 2~9 : DI1~ DI8**
If the digital input which is selected has OFF, it will applied by ref 1
If the digital input which is selected has ON, it will applied by ref 2

● 40.25 PID Control physics quantity select

- 0: % ----- Initial value
- 1: Hz
- 2: Kpa

● 40.26 PID Control Maximum physics quantity

- Initial
- If '40.25' is 0 : 100 [%]
- If '40.25' is 1 : 60.00 [Hz]
- If '40.25' is 2 : 100.00 [Kpa]

Range

- If '40.25' is 0 : '40.27' [%] ~ 200.0 [%]
- If '40.25' is 1 : '40.27' [Hz] ~ '30.01' [Hz]
- If '40.25' is 2 : '40.27' [Kpa] ~ 200.0 [Kpa]

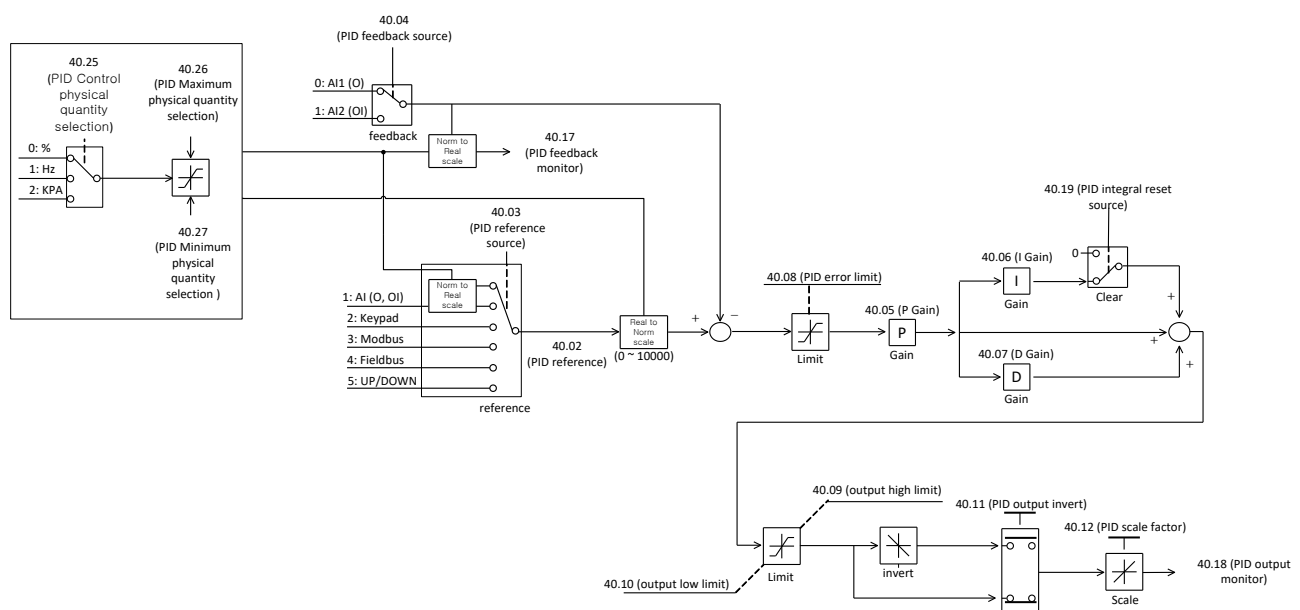
❖ Related parameter : '30.01'(Maximum frequency)

● 40.27 PID Control Minimum physics quantity

- Initial : 0.00
- Range : 0.00 ~ '40.26'

PID Control Diagram

The overall PID control diagram with respective parameters is shown in below



8.2.22 DBR Duty cycle

The DBR function is only applicable under 22kW model.

Regenerative energy from the motor is dissipated by the heat through this braking resistor.

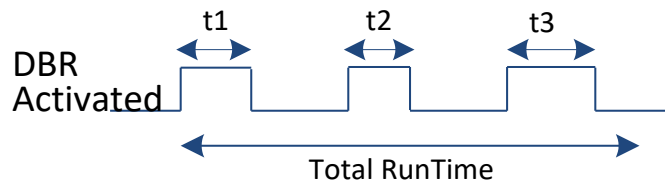
- **41.01 DBR Mode**

- *0: DBR disabled*
- *1: Only during VFD Running (Default)*
- *2: Always*

- **41.02 DBR Duty Cycle**

- *Range: 0.0 ~ 50.0% in 0.1%*
- *Initial value: 10.0*

Select a percentage value of total DBR on time before the overheating fault occurs.



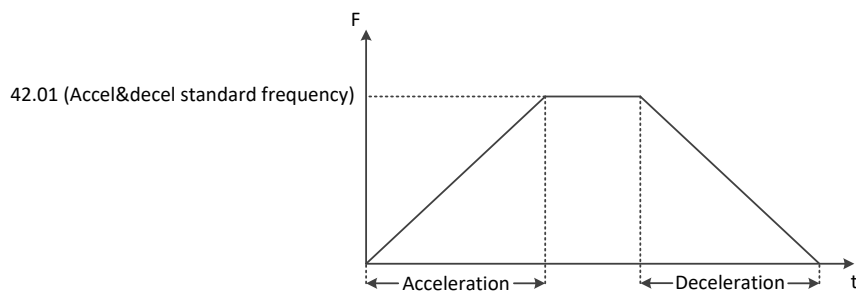
$$\text{DBR Usage Rate} = \frac{t1 + t2 + t3}{\text{Total RunTime}}$$

8.2.23 Monitoring/Scaling

● 42.01 Accel&decel Standard frequency

- Range: 0.00 ~ 400.0 Hz in 0.1 Hz
- Initial value: 60.00 Hz

This parameter is standard of all acceleration and deceleration



● 42.02 RPM display scale factor

- Range: 1 ~ 9999 in 1
- Initial value: 100

Program RPM scale factor for '01.02' (Motor RPM monitor)

Below determined by equation:

$120 \times '01.01' (\text{Output frequency}) \times '42.02' (\text{RPM display scale factor}) / '99.07' (\text{Motor Pole setting})$

ex1) '01.01' = 60Hz, '42.02' = 100, '99.07' = 4: '01.02' = 1800rpm

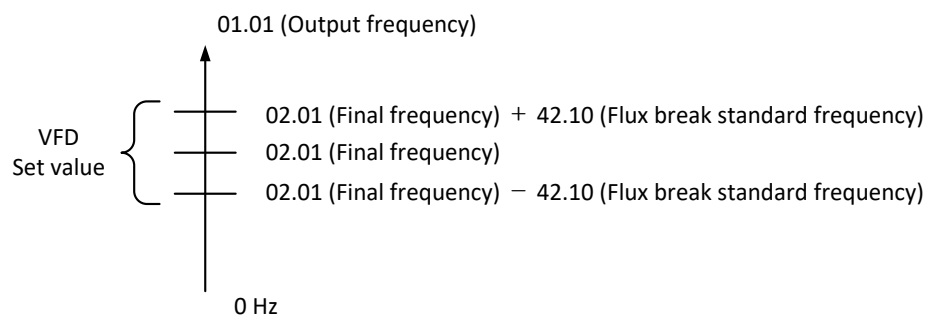
ex2) '01.01' = 60Hz, '42.02' = 50, '99.07' = 4: '01.02' = 900rpm

❖ Related Parameters: '01.02'

● 42.10 Flux break Standard frequency

- Range: 0.00 ~ 10.00Hz in 0.01
- Initial value: 5.00 Hz

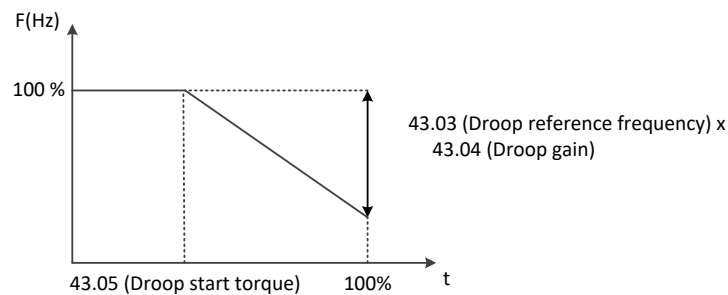
The absolute value that '01.02' (Final frequency reference) – '01.01' (Output frequency) is smaller than '42.10' (Flux break standard frequency), Flux break is disable during deceleration



8.2.24 Droop

Droop control automatically balances the load level between two motors driving the same load. Output frequency is changed by the amount of output torque.

Output frequency decreased or increased depends on the amount of load that detects the output torque in real time.



$$\text{Control frequency} = \frac{(\text{Output torque} - \text{Droop Start Torque})}{100\% - \text{Droop Start Torque}} \times \text{Droop Gain} \times \text{Droop Ref. Freq}$$

● 43.01 Droop type

- 0: No droop control ----- Initial value
- 1: Open loop
- 2: F/B (0~10V)
- 3: F/B (4~20mA)

- **Set 0: No droop control**
Droop control disable
- **Set 1: Open loop**
Droop control without feedback (Open loop)
- **Set 2 : F/B (0~10V)**
Connected the torque output of VFD A to the voltage input (O) of VFD B
- **Set 3 : F/B (4~20mA)**
Connected the torque output of VFD A to the voltage input (OI) of VFD B

● 43.02 Droop start frequency

- Range: 0.00 ~ 400.0 Hz in 0.01 Hz
- Initial value: 0.00 Hz

Set the droop control starting frequency.
The droop control doesn't work under B50 value.

- **43.04 Droop gain**

- *Range: 0.00 ~ 50.00 in 0.01*
- *Initial value: 5.00*

Sets the reduced rate of output frequency when at the 100% output torque gain while operating in the droop control

- **43.05 Droop start torque**

- *Range: 0.0 ~ 100.0 % in 0.1 %*
- *Initial value: 0.0 %*

Set the amount of output torque at start in droop control

- **43.06 Droop ramp time**

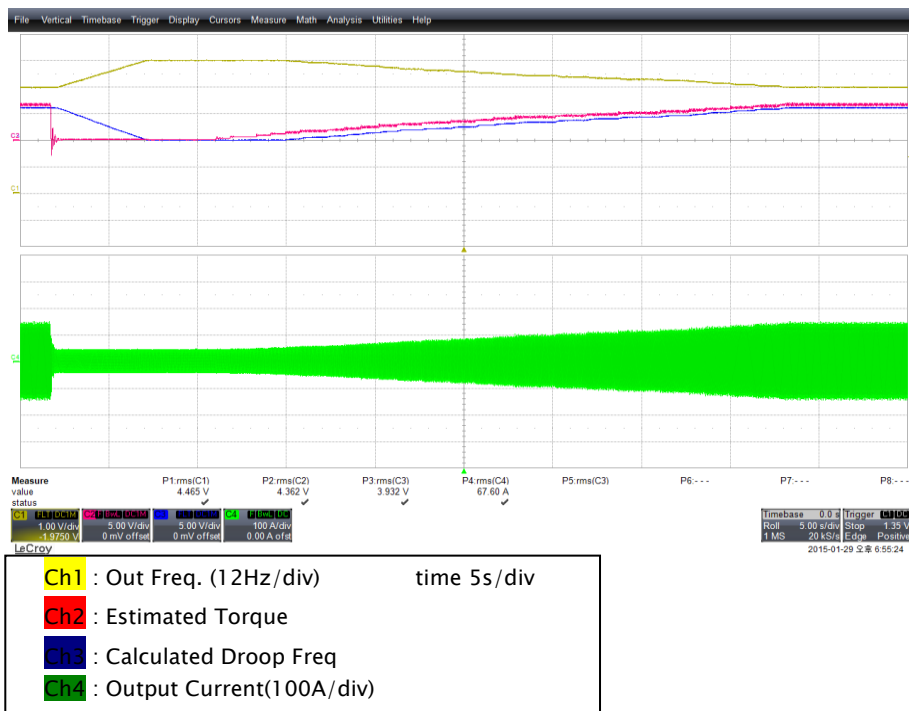
- *Range: 1.0 ~ 100.0 Sec in 0.1 Sec*
- *Initial value: 20.0 Sec*

Set the response time of output change when operating droop control

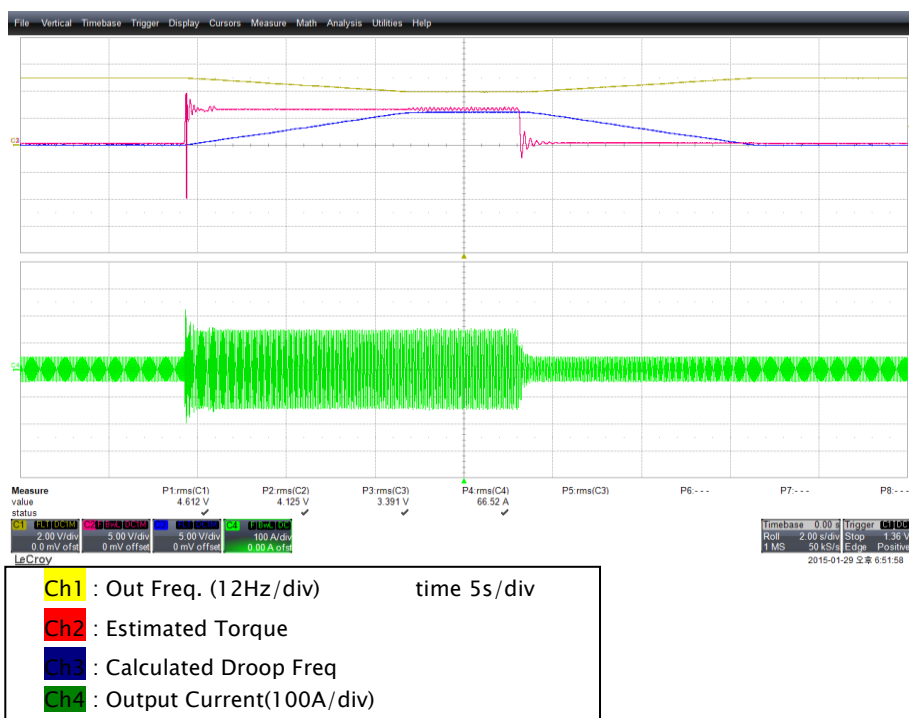
- If this time is short, it occur the vibration
- If this time is long, it occur the delayed response of droop control

Example

- 1) Increased the load ratio up to 100%
Output frequency decreased by the amount of load



- 2) Put 100% step load and removed 100% load in a moment
Put the step load (100%) for 8 seconds and then remove the step load.
The droop control decreased the output frequency for '**43.06'** (*Droop ramp time*) =5s at step load.
The droop control increased the output frequency for '**43.06'** (*Droop ramp time*) =5s at no step load.



8.2.25 RS-485 (Modbus)

- **50.01 Modbus node ID**

- *Range: 1 ~ 32 in 1*
- *Initial value: 1*

Node ID for Modbus communication

❖ Related Parameters: '**50.02**'

- **50.02 Modbus baud rate**

- *1: 2,400 bps*
- *2: 4,800 bps*
- *3: 9,600 bps ----- Initial value*
- *4: 19,200 bps*

Select a baud rate for Modbus communication

1) RXP / PXN / Connector

- RXP: + Transmit/Receive Port
- RXN: – Transmit/Receive Port

Program A1 Parameters to enable remote control

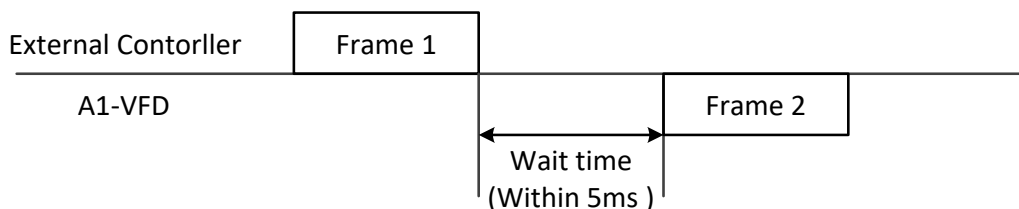
Code	Minimum	Maximum	Initial Value	Unit	Description
'50.01'	1	32	1	–	Modbus node ID
'50.02'	0	4	0	–	9600bps

2) RS485 Interface Description

Item	Description	Remark
Interface	RS485	
Communication method	Half duplex	
Communication speed	9600	Fixing
Communication code	Binary code	
Data bits	8	Fixing
Parity	No.	Fixing
Stop bit	1	Fixing
Starting method	External request	VFD is only slave part.
Wait time	10~1000ms	
Connection type	1 : N (Max32)	
Error check	Frame / CRC / CMD / MAXREQ / parameter	Communication number is selected at '50.01'

Communication sequence

The communication sequence is as follows



- Frame Start: Frame start is recognized by signal line data transmitted
- Frame Complete: Frame completion is recognized by no data during 4, 5-character time
- Frame 1: Transmit from external controller to VFD
- Frame 2: Indication reflects from VFD to external controller

3) Communication Frame Type and Form

External Controller Transmit Frame

Modbus node ID	Command	Parameter	Parameter Count	CRC Hi	CRC Lo
----------------	---------	-----------	-----------------	--------	--------

	Description	Data size	Specifications
Modbus node ID	Target VFD Modbus node ID	1 byte	1~32
Command	Frame type	1 byte	0x03
Parameter	Parameter	2 byte	1 st byte : Group 2 nd byte : Index(Note1)
Parameter number	Request parameter number	2 byte	1 st byte : 0x00 2 nd byte : N(0x01~0x08)
CRC Hi	–	1 byte	Higher 8bit of 16bit CRC
CRC Lo	–	1 byte	Lower 8bit of 16bit CRC

VFD response frame

Modbus node ID	Order	Byte Number	Data 1	...	Data N	CRC Hi	CRC Lo
----------------	-------	-------------	--------	-----	--------	--------	--------

	Description	Data size	Specifications
Modbus node ID	Target VFD Modbus node ID	1 byte	1~32
Command	Frame type	1 byte	0x03
Byte Number	Data Byte number	1 byte	Request parameter number x 2
Data 1	Parameter 1	2 byte	Parameter value
Data N	Parameter N	2 byte	Nth parameter value
CRC Hi	–	1 byte	Higher 8bit of 16bit CRC
CRC Lo	–	1 byte	Lower 8bit of 16bit CRC

* Frame Size = 5 + Request parameter number x 2

External transmit frame

Modbus node ID	Order	Parameter	Data	CRC Hi	CRC Lo
----------------	-------	-----------	------	--------	--------

	Description	Data size	Specifications
Modbus node ID	Target VFD Modbus node ID	1 byte	1~32
Command	Frame type	1 byte	0x06
Parameter	Parameter	2 byte	1 st byte : Group 2 nd byte : Index
Data	Data	2 byte	Setting value
CRC Hi	-	1 byte	Higher 8bit of 16bit CRC
CRC Lo	-	1 byte	Lower 8bit of 16bit CRC

VFD response frame

Modbus node ID	Order	Parameter	Data	CRC Hi	CRC Lo
----------------	-------	-----------	------	--------	--------

	Description	Data size	Specifications
Modbus node ID	Target VFD Modbus node ID	1 byte	1~32
Command	Frame type	1 byte	0x06
Parameter	Parameter	2 byte	1 st byte : Group 2 nd byte : Index
Data	Data	2 byte	Setting value is response
CRC Hi	-	1 byte	Higher 8bit of 16bit CRC
CRC Lo	-	1 byte	Lower 8bit of 16bit CRC

4) Parameter Setting & Trip information**Parameter Setting**1st byte: Group number2nd byte: Parameter number

Ex) The case of '99.01' parameter reading or writing

1st byte: 0x632nd byte: 0x01**Data value is transmitted except decimal point.**

Ex1) Frequency reference 60Hz (Parameter: 0x0004, Data: 0x1770)

Command	Parameter	Communication Data	Data (Conversion hexa to decimal)
0x0006	0x0004	6000(60.00Hz => 6000)	1 st byte : 0x17 2 nd byte : 0x70

Ex2) Acceleration time 1 (Parameter: 0x1704, Data: 0x0064)

Command	Parameter	Communication Data	Data (Conversion hexa to decimal)
0x0006	0x1704	100(10.0sec => 100)	1 st byte : 0x00 2 nd byte : 0x64

Ex3) Run command (Parameter: 0x0002, Data: FWD)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved					RST	REV	FWD

Command	Parameter	Data
0x0006	0x0002	0x0001(FWD: 0x0001, REV: 0x0002, RST: 0x0004)

Trip information items

Value	Type of Trip	Value	Type of Trip
0	–	19	ovSF (OVS Fail)
1	oC (Over Current)	20	–
2	ov (Over Voltage)	21	–
3	Lv (low Voltage)	22	EE2 (External Emergency 2)
4	Sc (Short circuit)	23	EE3 (External Emergency 3)
5	–	24	EE4 (External Emergency 4)
6	ot (Over Temperature)	25	EE5 (External Emergency 5)
7	EtH(Motor Over Load)	26	–
8	EE1 (External Emergency 1)	27	FF (Fan Fault)
9	E2PE (EEPROM Error)	28	FE1 (Profibus–DP Trip)
10	CE (Communication Error)	29	FE2 (Device–Net trip)
11	–	30	oLdt (System Overload Detection Fault)
12	GF (Ground Fault)	31	ULdt (System Underload Detection Fault)
13	–	32	dL (Running Time Out)
14	Iolt (VFD Over Load)	33	FE3 (CC–link Communication Failure Fault)
15	PF (Input Phase Loss Fault)	34	dEv (Encoder Frequency Deviation Fault)
16	–	35	oS (Encoder Overspeed Fault)
17	SAFE (Safety Fault)	36	EnC1 (Encoder Pulse Error1)
18	–	37	EnC2 (Encoder Pulse Error2)

Trip information Parameter

	Current Trip	Previous Trip1	Previous Trip2	Previous Trip3	Previous Trip4	Previous Trip5	Trip count
1 st byte	0x03	0x03	0x03	0x03	0x03	0x03	0x03
2 nd byte	0x01	0x0D	0x19	0x25	0x31	0x3D	0x49

Exception Code

Code	Description
0	ILLEGAL_FUNCTION : When an invalid function command is applied
1	ILLEGAL_DATA_ADDRESS : 1. In case Read/Write command is applied to non-existent parameter 2. In case more than 12 parameter continuous reading commands are applied
2	ILLEGAL_DATA_VALUE : When a data Write command outside the MAX/MIN value is applied
3	SLAVE_DEVICE_FAILURE : 1. When a Write command is applied to a parameter that is prohibited from being changed during running(in running state) 2. In case Write command is applied to Write-Protected or Display-Only parameter

Exception Code Response

When responding to Exception code data, it responds by “SET” the highest bit of the function command frame data.

Frame	Example Response				
Comm.No	0x01	0x01	0x01	0x01	0x01
Command	0x85	0x83	0x86	0x86	0x86
Excetpion Code	0x01	0x02	0x03	0x04	0x04
CRC Lo	0x83	0xC0	0xC3	0x02	0x43
CRC Hi	0x50	0xF1	0xA1	0x61	0xA3

5) 16 bit CRC generation

The step of CRC generation is as follows:

1. All of 16-bit Parameter is 1.0xffff
2. The exclusive OR of 16-bit Parameter and 8-bit Parameter.
3. Shift right side 1bit 16-bit Parameter
4. If the result of step 3 is 1, exclusive OR 16-bit Parameter and 0xa001.
5. Execute 8 times step 3 and step 4.
6. Execute step 2~6 until data completion.
7. Exchange the step 6 result of higher 8bit and lower 8bit.

Ex) the case of d01 output frequency reading.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Communication Number	Command	Parameter		Parameter number	
0x01	0x03	0x01	0x01	0x00	0x01

The sequence of addition Byte (01x01)

16-BIT PARAMETER	MSB	Flag		
(Exclusive OR)	1111	1111	1111	1111
01	0000	0001		
	1111	1111	1111	1110
Shift 1	0111	1111	1111	1111
Shift 2	0011	1111	1111	1111
Polynomial	1010	0000	0000	0001
	1001	1111	1111	1110
Shift 3	0100	1111	1111	1111
Shift 4	0010	0111	1111	1111
Polynomial	1010	0000	0000	0001
	1000	0111	1111	1110
Shift 5	0100	0011	1111	1111
Shift 6	0010	0001	1111	1111
Polynomial	1010	0000	0000	0001
	1000	0001	1111	1110
Shift 7	0100	0000	1111	1111
Shift 8	0010	0000	0111	1111
Polynomial	1010	0000	0000	0001
	1000	0000	0111	1110

Byte 1~6	CRC of operation results
0x01	0x807e
0x03	0x3364
0x01	0x30e1
0x01	0x8831
0x00	0xd449
0x01	0x36d4

Change upper and lower 8 bit of result 0x36d4: 0xd436

Byte7: Upper 8 bit of CRC = 0xd4

Byte8: Lower 8 bit of CRC = 0x36

8.2.26 Fieldbus (option)

Fieldbus card is option to buy addition

More information refer to extra manual of fieldbus

- **51.01 Fieldbus option type**
 - *0: Modbus–RTU ----- Initial value*
 - *1: Profibus–DP*
 - *2: Device–Net*
 - *3: Ethernet series*
 - *4: CC–link option*
- **51.02 Fieldbus station number**
 - *1 ~ 32: Modbus–RTU----- Initial value*
 - *1 ~ 63: Device–Net*
 - *1 ~ 125: Profibus–DP*
 - *1 ~ 64: CC–link option*
- **51.03 Fieldbus byte swap**
 - *0: Normal*
 - *1: Swap ----- Initial value*
- **51.08 ~ 51.19 Fieldbus input data 1~12**
 - *0x0000 ~ 0xFFFF*
- **51.20 ~ 51.31 Fieldbus output data 1~12**
 - *0x0000 ~ 0xFFFF*
- **51.32 Fieldbus status**
 - *0x0000 ~ 0xFFFF*
- **51.33 Fieldbus version**
 - *0x0000 ~ 0xFFFF*
- **51.34 CC–link option baudrate selection**
 - *Range: 0 ~ 4*
 - *0 : 156 Kbps ----- Initial value*
 - *1 : 625 Kbps*
 - *2 : 2.5 Mbps*
 - *3 : 5 Mbps*
 - *4 : 10 Mbps*

8.2.27 User parameters

- **96.01 User parameter selection**

- *0: Disable ----- Initial value*
- *1: Enable*

If set 1, it will display only user parameter that has registered
So when user parameter adds or changes, it has to be set 0

- **96.02 ~ 96.33 User parameter configuration 1~32**

- *Range: '01.01'~'99.99'*

It can register maximum 32ea

8.2.28 System

● 97.01 Initialization mode

- 0: Clear trip history ----- Initial value
- 1: Clear all parameters

If set 0, all parameters will reset to initial value except '99.02' (Motor rated voltage)

● 97.02 Parameter lock mode

- 0: All parameters are locked except '97.02', '97.03' by '97.03' ----- Initial value
- 1: All parameters are locked except '97.02', '97.03', '22.01' by '97.03'
- 2: All parameters are locked except '97.02', '97.03'
- 3: All parameters are locked except '97.02', '97.03', '22.01'
- 4: All parameters are locked except '97.02', '97.03', '22.01', '23.04', '23.05'
- ❖ Related Parameters: '97.03'

This parameter used to protect that changes parameter by other person

● 97.03 Software lock source

- 0: Not selected ----- Initial value
- 1: Selected
- 2: DI1
- 3: DI2
- 4: DI3
- 5: DI4
- 6: DI5
- 7: DI6
- 8: DI7
- 9: DI8

Selects the source of software lock

- **Set 0: Not selected**
Always off
- **Set 1: selected**
Always on
- **Set 2~9 : DI1~ DI8**
It works by digital input which is selected

*Caution: If the '97.02' code set 0 or 1, please be careful as the parameter prohibition setting is forcibly activated when the '97.03' code 1 is set.

- **97.04 Current time setting (Year)**

- *Range: 2000 ~ 2099*
- *Initial value: 2016*

Put the value of current year

- **97.05 Current time setting (Month, Day)**

- *Range: 101 ~ 1231*
- *Initial value: 224*

Put the value of current month and day

- **97.06 Current time setting (Hour, Minute)**

- *Range: 0 ~ 2359*
- *Initial value: 0*

Put the value of current hour and minute

- **97.07 Current time setting (Second)**

- *Range: 0 ~ 59*
- *Initial value: 0*

Put the value of current second

8.2.29 Motor control

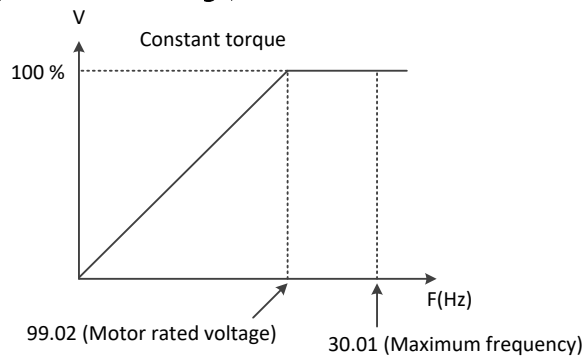
● 98.01 Motor control mode

- 0: CT (V/f) ----- Initial value
- 1: VT (V/f)
- 2: SLV
- 3 : VECTOR(Encoder Option)

▪ Set 0: CT(V/f) – Constant Torque

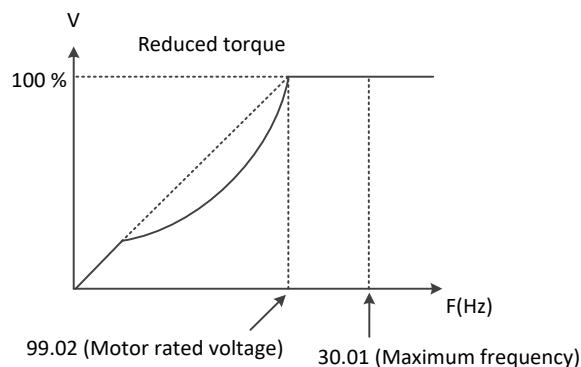
Frequency and voltage are controlled proportionately

Frequency rises until '**30.01**' (**Maximum frequency**) and voltage never rises above '**99.02**' (**Motor rated voltage**)



▪ Set 1: VT(V/f) – Variable Torque

Reduced torque is effective for fan or pump application which do not require high torque at low frequency. By reducing the output voltage, increased efficiency, lower noise, and lower vibration.



▪ Set 2: SLV – Sensorless Vector

For Sensorless Vector method, per specified output voltage, current, motor parameters, motor rpm, the corresponding torque value is calculated. At very low frequency up to 0.5 Hz, high torque operation is possible

▪ Set 3: Vector – Encoder Option

You can control the motor speed and instantaneous torque by using the encoder option. The encoder option is mandatory.

● 98.02 HD/ND (torque type) select

- 0: Heavy duty (HD) ----- Initial value
- 1: Normal duty (ND)

Depending on this parameter, VFD rated current, PWM carrier frequency and Stall level will be changed

- **Set 0: Heavy duty (HD)**
Hoists, conveyors, pump process; select HD
- **Set 1: Normal duty (ND)**
Fans, or centrifugal pump applications; select ND
❖ Related Parameters: '31.18', '98.03',

● 98.03 PWM carrier frequency

- Range: 1.0 ~ 10.0 kHz in 0.1 kHz
- Initial value: 3.0 kHz

Select Heavy Duty or Normal Duty factory setting per VFD model and loading type
If the value is high, noise of motor is decreased and noise and temperature of VFD is increased

Model	HD ('98.02' = 0)	HD ('98.02' = 1)	Range
A1-032A-2 A1-045A-2 A1-064A-2 A1-076A-2 A1-090A-2 A1-114A-2	5.0 kHz	3.0 kHz	1.0 ~ 16.0 kHz
A1-140A-2 A1-170A-2 A1-205A-2 A1-261A-2 A1-310A-2	5.0 kHz	3.0 kHz	1.0 ~ 10.0 kHz
A1-016A-4 A1-023A-4 A1-032A-4 A1-038A-4 A1-045A-4 A1-058A-4	5.0 kHz	3.0 kHz	1.0 ~ 16.0 kHz
A1-075A-4 A1-090A-4 A1-110A-4 A1-149A-4 A1-176A-4 A1-217A-4 A1-260A-4 A1-296A-4	5.0 kHz	3.0 kHz	1.0 ~ 10.0 kHz

● 98.04 PWM carrier mode

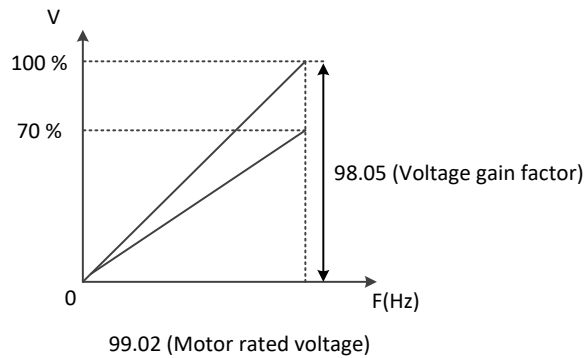
- 0: Normal ----- Initial value
- 1: Swing PWM1

Swing PWM1 is used to decrease noise of motor
It changes the PWM carrier frequency in between 2.25 kHz and 2.75 kHz

● 98.05 Voltage gain factor

- *Range: 20.0 ~ 110.0 % in 0.1 %*
- *Initial value: 100.0 %*

The output voltage cannot exceed the input voltage



● 98.06 Flux braking function

- *0: Disable*
- *1: Enable ----- Initial value*

It can select to use Flux braking Function

❖ Related Parameters: '**42.10**', '**98.07**'

● 98.07 Flux braking reference

- *Range: 100 ~ 140 % in 1*
- *Initial value: 110 %*

It can program a Flux braking reference

● 98.09 Manual torque boost voltage reference

- *Range: 0.00 ~ 50.00 % in 0.01 %*
- *Initial value: 1.0 %*

For Manual Torque Boost mode, program the value in % of an output voltage

It not works in auto torque mode or sensorless mode

❖ Related Parameters: '**21.01**', '**98.01**', '**98.10**'

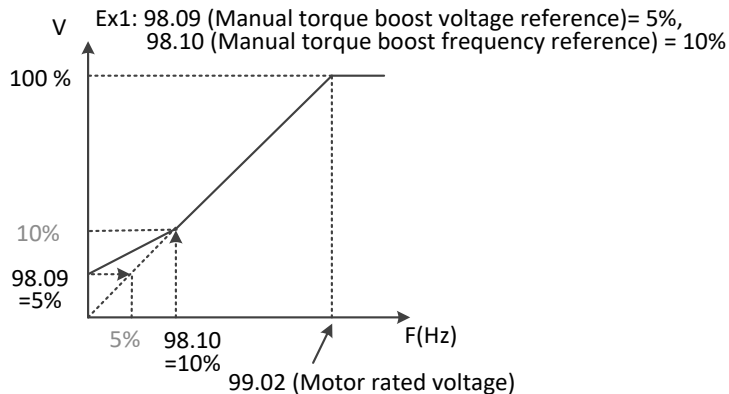
- **98.10 Manual torque boost frequency reference**

- *Range: 0.0 ~ 100.0 % in 0.1 %*
- *Initial value: 100.0 %*

Program the frequency breakpoint

It not works in auto torque mode or sensorless mode

❖ Related Parameters: **'21.01', '98.01', '98.09'**



- **98.11 Backward slip compensation**

- *Range: 0.0 ~ 200.0 % in 0.1 %*
- *Initial value: 100.0 %*

- **98.12 Regeneration slip compensation**

- *Range: 0.0 ~ 200.0 % in 0.1 %*
- *Initial value: 100.0 %*

- **98.13 Motor Type**

- *0: IM ----- Initial value*
- *1: PM SLV(progressing)*
- *2: IM SLV(progressing)*
- *3 : PM VECTOR(progressing)*

- **98.14 Vector control speed controller P-gain**

- *Range: 0 ~ 1000 in 1*
- *Initial value: 100*

Set the proportional controller gain required for speed control when using vector control.

If it is set too high, it may diverge, so be careful when setting it.

The encoder option is mandatory. Please refer to the manual attached to the encoder option box and use it after correct installation.

- **98.15 Vector control speed controller I-gain**

- *Range: 0 ~ 1000.0% in 0.1%*
- *Initial value: 100.0%*

Set the integral controller gain required for speed control when using vector control.
If it is set too high, it may diverge, so be careful when setting it.

The encoder option is mandatory. Please refer to the manual attached to the encoder option box and use it after correct installation.

- **98.16 Forward torque limit**

- *Range: 0 ~ 200.0% in 0.1%*
- *Initial value: 150.0%*

- **98.17 Forward regeneration torque limit**

- *Range: 0 ~ 200.0% in 0.1%*
- *Initial value: 150.0%*

- **98.18 Reverse torque limit**

- *Range: 0 ~ 200.0% in 0.1%*
- *Initial value: 150.0%*

- **98.19 Reverse regeneration torque limit**

- *Range: 0 ~ 200.0% in 0.1%*
- *Initial value: 150.0%*

- **98.20 Zero speed torque limit**

- *Range: 0 ~ 200.0% in 0.1%*
- *Initial value: 150.0%*

- **98.21 Zero speed regeneration torque limit**

- *Range: 0 ~ 200.0% in 0.1%*
- *Initial value: 150.0%*

- **98.22 Torque limit Setting method**

- *0: AI1 (O)*
 - *0 ~ 10V -> 0.0% ~ 200.0% torque limit configuration*
 - *98.16 ~ 98.21 code value is changed equally*
- *1: AI2 (OI)*
 - *4 ~ 20mA -> 0.0% ~ 200.0% torque limit configuration*
 - *98.16 ~ 98.21 code value is changed equally*
- *2: Keypad ----- Initial value*
- *3 : Modbus*
- *4 : Feildbus*
- *5 : UP/DOWN function*

- **98.23 Speed controller output low pass filter time constant**

- *Range: 0 ~ 100 ms in 1ms*
- *Initial value: 0 ms*

During vector control operation, a low-pass filter is applied to the output of the speed controller to smooth the torque change. Excessive filter application destroys vector control, so it is recommended to set it to 0 msec as much as possible. Also, when it is set to torque mode, it operates with the filter time constant of the torque reference.

- **98.24 Zero speed command source select**

- *0: Disable----- Initial value*
- *1: Activate(Be careful with force activation)*
- *2 ~ 9: DI1 ~ DI8*

- **98.30 Speed/Torque Mode select**

- *0: Speed control mode----- Initial value*
- *1: Torque control mode*

Speed control mode – A general encoder uses the actual motor speed to control the desired command speed. At this time, the output of the speed controller is a torque reference to follow the command speed and is used to control the torque in the current controller.

Torque control mode – Torque command can be set as a torque limit of 98.16 ~ 98.21, and only torque is controlled. At this time, if the torque is controlled constant, the motor can continue to accelerate in the direction of the applied torque. To prevent this, the command speed acts as a speed limit, and the torque is reduced so as not to accelerate beyond the speed limit. 98.37 (Speed Limit Bias) makes the torque decrease in the vicinity of the speed limit, so that the torque shock is alleviated.

- **98.31 Torque rise time in torque mode**

- *Range: 0.0 ~ 3000.0 s in 0.1s*
- *Initial value: 0.0 s*

When the inverter run command is applied in the torque mode setting, the torque is gradually increased to alleviate the torque shock.

- **98.32 Torque fall time in torque mode**

- *Range: 0.0 ~ 3000.0 s in 0.1s*
- *Initial value: 0.0 s*

When the inverter stop command is applied in the torque mode setting, the torque is gradually reduced to alleviate the torque shock.

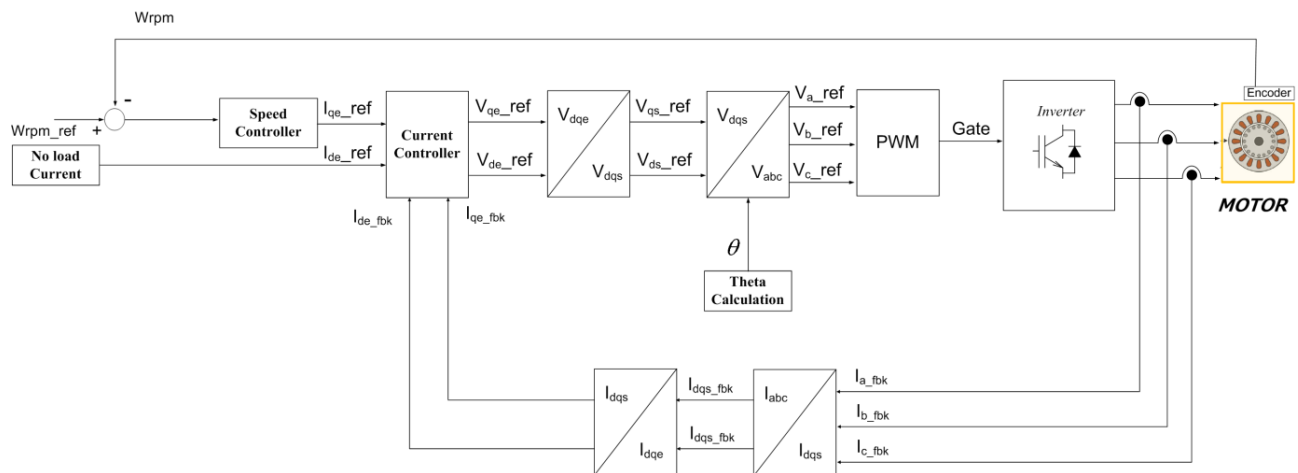
- **98.37 Speed limit bias in torque mode**

- *Range: 0.01 ~ 10.00 Hz in 0.01 Hz*
- *Initial value: 1.0 Hz*

In the torque control mode, if a torque command greater than the load torque is applied, the motor can continue to accelerate. To prevent this, the torque is linearly reduced from near the speed limit to the speed limit bias to prevent the motor from continuing to accelerate. If the speed limit bias is too small, the torque may change rapidly and torque shock may occur.

–Vector Control

- 1) Controls the motor speed and instantaneous torque using an encoder.
- 2) Vector control block diagram



- 3) Vector control related parameters

code	Function	Min	Max	default
98.01	Control mode	0 (V/f)	3 (VECTOR)	0 (V/f)
98.13	Motor type	0 (IM)	3(PM SLV)	0 (IM)
98.14	Speed Controller Kp	0	1000	100
98.15	Speed controller Ki	0.0	1000.0	100.0
98.16	Forward torque limit	0.0 %	200.0 %	150.0 %
98.17	Forward regeneration torque limit	0.0 %	200.0 %	150.0 %
98.18	Reverse torque limit	0.0 %	200.0 %	150.0 %
98.19	Reverse regeneration torque limit	0.0 %	200.0 %	150.0 %
98.20	Zero speed torque limit	0.0 %	200.0 %	150.0 %
98.21	Zero speed regeneration torque limit	0.0 %	200.0 %	150.0 %
98.22	Torque limit setting method	0	5	2
98.23	Speed controller output LPF tow	0.0 msec	100.0 msec	0.0 msec
98.24	Zero speed command source	0	9	0
98.30	Speed/Torque Mode select	0	1	0
98.31	Torque rise time in torque mode	0.0 s	3000.0 s	0.0 s
98.32	Torque fall time in torque mode	0.0 s	3000.0 s	0.0 s
98.37	Speed limit bias	0.01 Hz	10.00 Hz	1.00 Hz
99.15	Encoder PPR	0	9999	1024

► Speed Controller

98.14 P–Gain

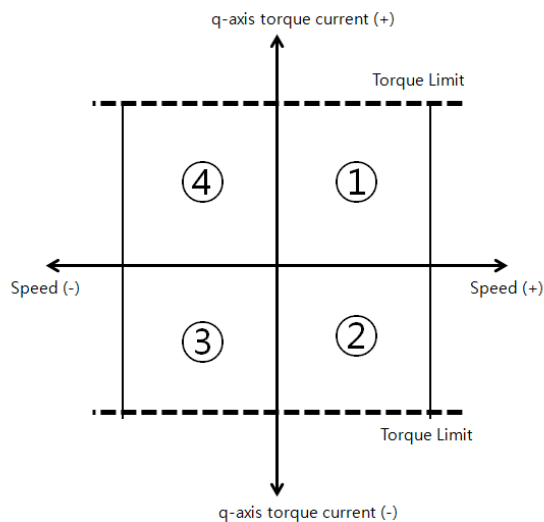
- The larger the P gain value, the faster the response speed.
- Be careful because too high P–gain value may cause vibration or overshoot.

98.15 I-Gain

- The larger the I gain value, the faster the response speed.
- Be careful because too high I-gain value may cause vibration or overshoot.

► Torque Limit

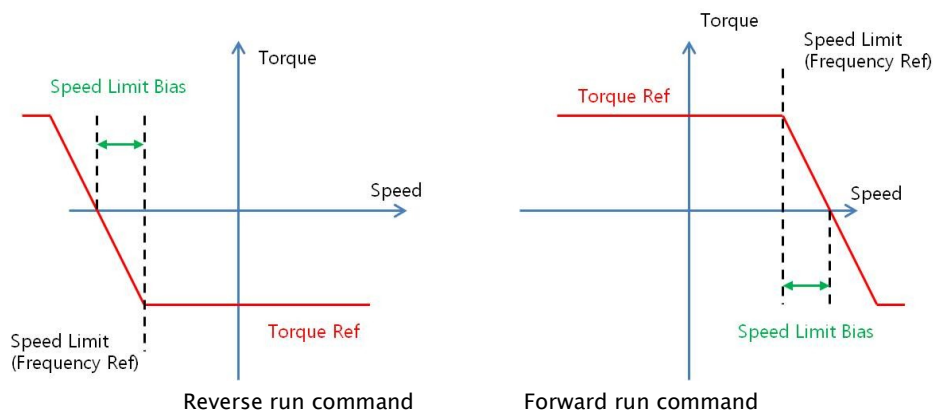
- As shown in the figure below, when the motor is driven in the forward or reverse direction, you can set the motoring and regenerative torque limits.



- Forward Motoring Torque limit : $\sqrt{i} \times \text{motor rated current} \times 98.16 \%$
- Forward Regeneration Torque limit : $\sqrt{2} \times \text{motor rated current} \times 98.17 \%$
- Reverse Motoring Torque limit : $\sqrt{2} \times \text{motor rated current} \times 98.18 \%$
- Reverse Regeneration Torque limit : $\sqrt{2} \times \text{motor rated current} \times 98.19 \%$
- Zero Speed Motoring Torque limit : $\sqrt{2} \times \text{motor rated current} \times 98.20 \%$
- Zero Speed Regeneration Torque limit : $\sqrt{2} \times \text{motor rated current} \times 98.21 \%$

► Torque Mode Operation

- In case torque control mode is set using 98.30 code, torque limit(98.16~98.21) is set as torque reference and speed reference is set as speed limit. The speed limit bias set in code 98.37 reduces the torque command near the speed limit to prevent infinite acceleration of the motor. Please note that if the speed limit bias is small, system failure may occur due to sudden torque change.



8.2.30 Motor data

- **99.01 Motor capacity**

- *2.2kW, 3.7kW, 5.5kW, 7.5kW, 11kW, 15kW, 18.5kW, 22kW, 30kW, 37kW, 45kW, 55kW, 75kW, 90kW, 110kW, 132kW, 160kW, 200kW, 220kW, 250kW, 280kW, 320kW, 350kW*
- *Initial value: depend on VFD models*

Program a capacity of motor
Ex) 30L: 30kW–200V, 30H: 30kW–400V

- **99.02 Motor rated voltage**

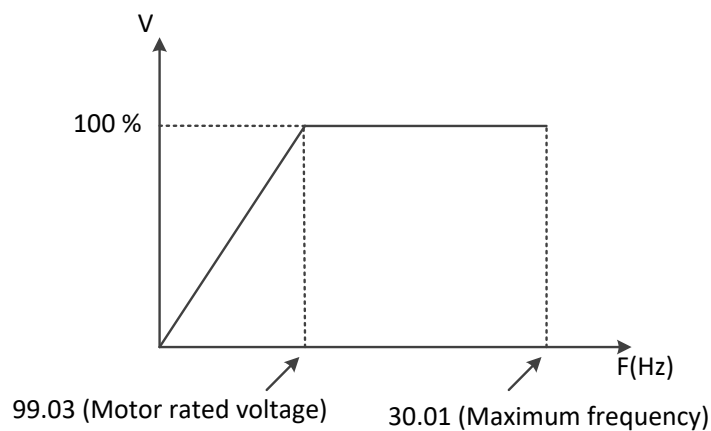
- *200V Class setting: 200/220/230/240*
400V Class setting: 380/400/415/440/460/480
- *Initial value: depend on VFD models*

Program a rated voltage of the motor nameplate

- **99.03 Motor rated frequency**

- *Range: 0.00 ~ 400Hz in 0.01 Hz*
- *Initial value: 60.00 Hz*

Program a rated frequency of the motor nameplate



- **99.04 Motor rated current**

- *Range: 0.1 ~ 800.0 A in 0.1 A*
- *Initial value: depend on VFD models*

Program a rated current of the motor nameplate

● **99.05 Motor flux current**

- *Range: 0.1 ~ 400.0 A in 0.1 A*
- *Initial value: depend on VFD models*

Program the no load (flux) current value

Not all motors will have this information on the nameplate

✧ The value is approximately 30% of rate current

● **99.06 Motor rated slip**

- *Range: 0.01 ~ 10.0 % in 0.1 %*
- *Initial value: depend on VFD models*

Program the slip percent of the motor rated nameplate rpm

Rated slip frequency: [(rated speed – speed of nameplate) / rated speed] x 100

Ex) [(1800rpm – 1750rpm) / 1800rpm] X 100 = 2.78%

● **99.07 Motor Pole setting**

- *2: 2 Poles*
- *4: 4 Poles ----- Initial value*
- *6: 6 Poles*
- *8: 8 Poles*

Program a number of poles to the corresponding motor used with the VFD

Ex1) 2 Poles for 3600rpm (60Hz), 3000rpm (50Hz)

Ex2) 4 Poles for 1800rpm (60Hz), 1500rpm (50Hz)

Ex3) 6 Poles for 1200rpm (60Hz), 1000rpm (50Hz)

Ex4) 8 Poles for 900rpm (60Hz), 750rpm (50Hz)

● **99.08 Auto tuning**

- *0: Disable ----- Initial value*
- *1: Enable*

Program to enable auto tuning function

Motor parameters are calculated using the internal auto tuning algorithm and automatically set for sensorless vector control design

Auto tuning process

1. Put the data at '**99.01' (Motor capacity) ~ '99.07' (Motor Pole setting)**
2. Set 1 at '**99.08' (Auto tuning)**
3. Push the Run button on the keypad

- Complete successful: 

- Occurred error: 

- **99.09 Motor data selection**

- *0: Standard motor data ----- Initial value*
- *1: Auto tuning data*

Program to select between standard motor data and auto tuned data

- **99.10 Motor resistance R1**

- *Range: 0.1 ~ 30.0 Ohm in 0.001 Ohm*
- *Initial value: depend on VFD models*

The initial value is Hyundai motor data

- **99.11 Transient inductance**

- *Range: 0.01 ~ 100.0 mH in 0.01 mH*
- *Initial value: depend on VFD models*

The initial value is Hyundai motor data

- **99.12 Motor resistance R1 (Auto tuned data)**

- *Range: 0.1 ~ 30.0 Ohm in 0.001 Ohm*
- *Initial value: depend on VFD models*

Value determined during auto tuning process

- **99.13 Transient inductance (Auto tuned data)**

- *Range: 0.01 ~ 100.0 mH in 0.01 mH*
- *Initial value: depend on VFD models*

Value determined during auto tuning process

- **99.15 Encoder PPR(Pulsea per revolution)**

- *Range: 0 ~ 9999*
- *Initial value: 1024*
- *Encoder option required*

- **99.16 Encoder direction setting**

- *0: Counterclockwise ----- Initial value*
- *1: Clockwise*
- *Encoder option required*

- **99.17 Encoder low pass filter time constant**

- *Range: 0 ~ 10000 ms*
- *Initial value: 0 ms*
- *Encoder option required*

A low-pass filter can be applied to the motor speed measured by the encoder. To prevent speed hunting due to noise, set the filter time constant. In vector control, feedback speed delay may cause controller divergence, so set it to 0msec as much as possible

- **99.18 Encoder frequency deviation error frequency**

- *Range: 0.00 ~ 10.00 Hz*
- *Initial value: 3.00 Hz*
- *Encoder option required*

- **99.19 Encoder frequency deviation error detection time**

- *Range: 0.0 ~ 10.0 sec*
- *Initial value: 0.0 sec*
- *Encoder option required*

During vector control operation, if the difference between the speed reference and the actual motor speed measured by the encoder is greater than the value set in code 99.18 and maintained for the time set in code 99.19, the inverter stops and displays an error.

- **99.20 Over speed error detection level**

- *Range: 100.0 ~ 120.0 %*
- *Initial value: 110.0 %*
- *Encoder option required*

- **99.21 Over speed error detection time**

- *Range: 0.0 ~ 3.0 sec*
- *Initial value: 0.0 sec*
- *Encoder option required*

During vector control operation, if the actual motor speed measured by the encoder is higher than [Speed reference * "99.20"] and maintained for the set time "99.21", the inverter stops and an error is displayed.

- **99.22 Encoder pulse error detection method select**

- *0: Disable detection ----- Initial value*
- *1: Detection all encoder pulse error*
- *2: A and B all pulse error*
- *3: A or B pulse error*
- *Encoder option required*

- **99.23 Encoder pulse error detection time**
 - *Range: 0.0 ~ 60.0 sec*
 - *Initial value: 3.0 sec*
 - *Encoder option required*

9. Checking and Trouble shooting

9.1 Error code

9.1.1 Error code list

Name	Cause(s)	Error Code
Over Current	When the VFD output current exceeds the rated current by more than approximately 200% during the motor locked or reduced in speed. Protection circuit activates, halting VFD output.	oC
Short Circuit	The VFD output was short-circuited. This condition causes excessive current for the VFD, so the VFD output is turned off.	oC or SC
Motor Overload	When the VFD output current causes the motor to overload, the electronic thermal trip in the VFD cuts off the VFD output.	EtH
VFD Overload	The power IGBT is protected from over heat. The operating time of VFD is 1 minute with 150% load of HD or 120% load of ND. The operating time is changed depending on carrier frequency, load, ambient temperature and power rating.	IoLt
DC link Over Voltage	If regenerative energy from the motor or the main power supply voltage is high, the protective circuit activates to cut off the VFD output when the voltage of DC link exceeds the specification	ov
DC link Under Voltage	When input voltage drops below the low-voltage detection level, the control circuit does not function normally. So when the input voltage is below the specification, the VFD output is cut off.	Lv
EEPROM Error	The VFD output is cut off when EEPROM in the VFD has an error due to external noise, excessive temperature rise, or other factor	E2PE
Communication Error	Communication error between VFD and its operator. If the Reset signal persists for more than 4 seconds, it will occur.	CE
IGBT Over Temperature	When the temperature in the main circuit increases due to cooling fan stop, the VFD output is cut off. (only for the model type with cooling fan)	ot

Name	Cause(s)	Error Code
Input Phase Loss	A function that detects phase loss in the input AC source. Detection is performed using the fluctuation in the main circuit's DC voltage. Also, in the case of degradation of main capacitors it could be occurred.	PF
Ground Fault	When ground fault is detected on running condition, the output is cut off.	GF
Fan Fault	The Fan fault is indicated when the fan is not rotated	FF
OVS control fail	The OVS output frequency is higher than maximum OVS output frequency during the setting time when the OVS function is enabled	ovSF
External Event	When the external equipment or unit has an error, the VFD receives the corresponding signal and cuts off the output.	EE1~EE5
Safety input trip	When the terminal of safety has opened	SAFE
System Overload Detection Fault	The output current of the drive is greater than the detection level set for this feature when it enabled	oLdt
System Underload Detection Fault	The output current of the drive is less than the detection level set for this feature when it enabled	uLdt
Braking Resistor Overload Trip	When DBR exceeds the duty cycle of the braking resistor this fault will occur. The circuit is designed to calculate and protect the braking resistor from thermally overheating	brot
Running Time Out Trip	When using the inverter beyond the set maximum operating time	dL
CC-Link Communication Trip	In case communication error is detected for 2 seconds when CC-Link option card is used	FE3
Encoder Frequency Deviation Trip	When using the encoder option card, if it exceeds the set speed deviation and is maintained for as long as the detection time	dEv
Encoder Overspeed Trip	When the encoder option card is used, if it exceeds the set overspeed level and is maintained for as long as the detection time	oS
Encoder Pulse Error1 Trip	When using an encoder option card, if both A and B pulses of the encoder or encoder option card remain uninput for the detection time	EnC1
Encoder Pulse Error2 Trip	When using an encoder option card, if only one of the A or B pulses is input and maintained for as long as the detection time	EnC2

9.2 Trouble Shooting

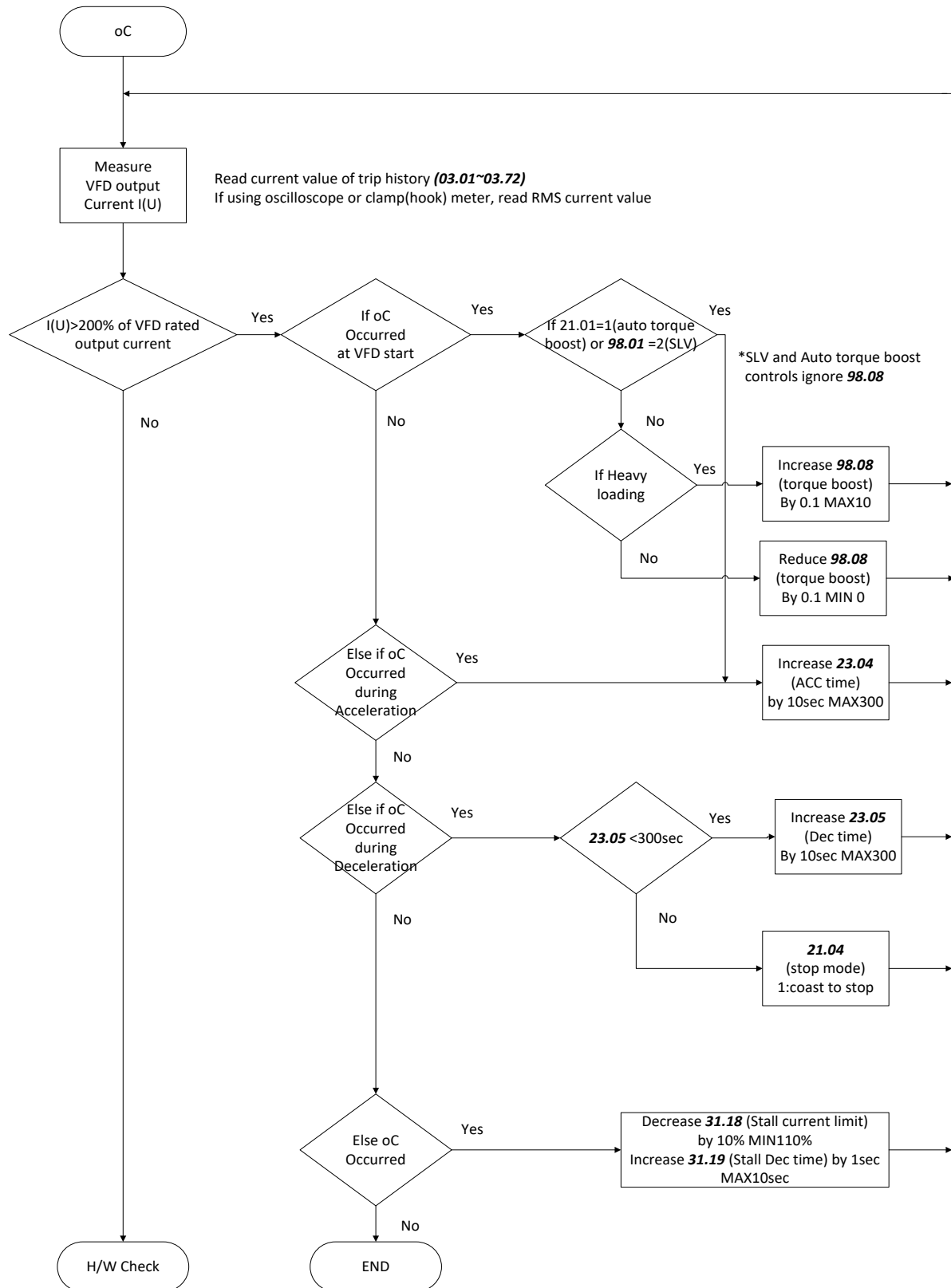
9.2.1 Trip monitor display

- Display the trip source and operation status when occurred the trip
- Display until the previous five trip event in *'03.13' ~ '03.72'*
- Each trip contents are displayed below flow
 - 1) Source of trip
 - 2) Frequency at trip
 - 3) Current at trip
 - 4) Vdc at trip
 - 5) Running status at trip
 - 6) DI status at trip
 - 7) DO status at trip
 - 8) Temperature at trip
 - 9) Torque at trip

Trip event	Contents	Description
Trip monitor 1	<i>'03.13' ~ '03.24'</i>	Source, Frequency, Current, Vdc, Running status, DI status, DO status, Temperature, Torque
Trip monitor 2	<i>'03.25' ~ '03.36'</i>	Same with the Trip monitor 1
Trip monitor 3	<i>'03.37' ~ '03.48'</i>	Same with the Trip monitor 1
Trip monitor 4	<i>'03.49' ~ '03.60'</i>	Same with the Trip monitor 1
Trip monitor 5	<i>'03.61' ~ '03.72'</i>	Same with the Trip monitor 1
Trip counter	<i>'03.73'</i>	Displays the trip accumulation count

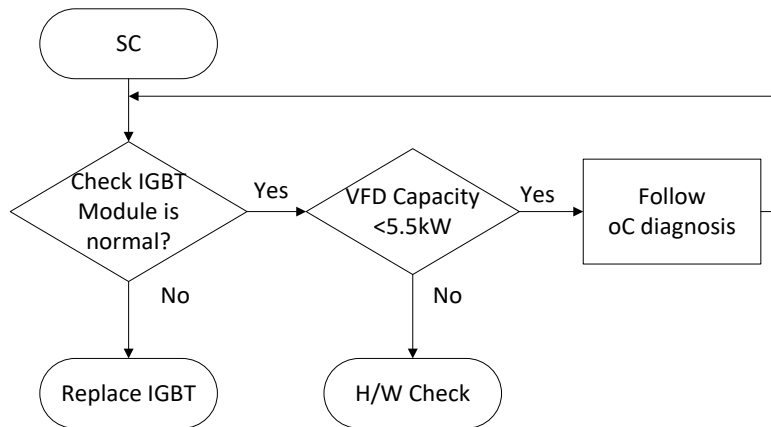
9.2.2 oC (Over Current)

1) Diagnostic flow chart



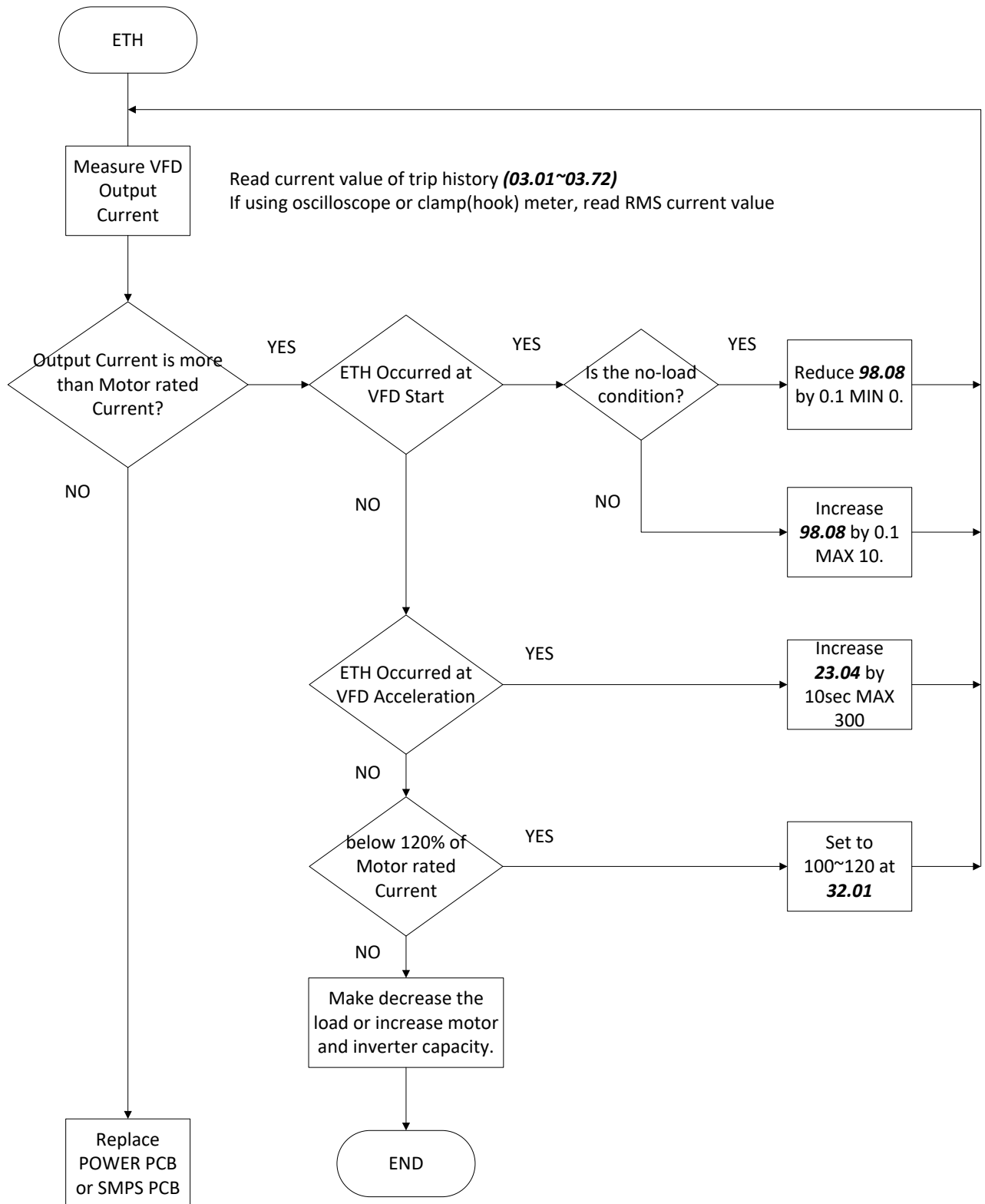
9.2.3 SC (Short Circuit)

1) Diagnostic flowchart



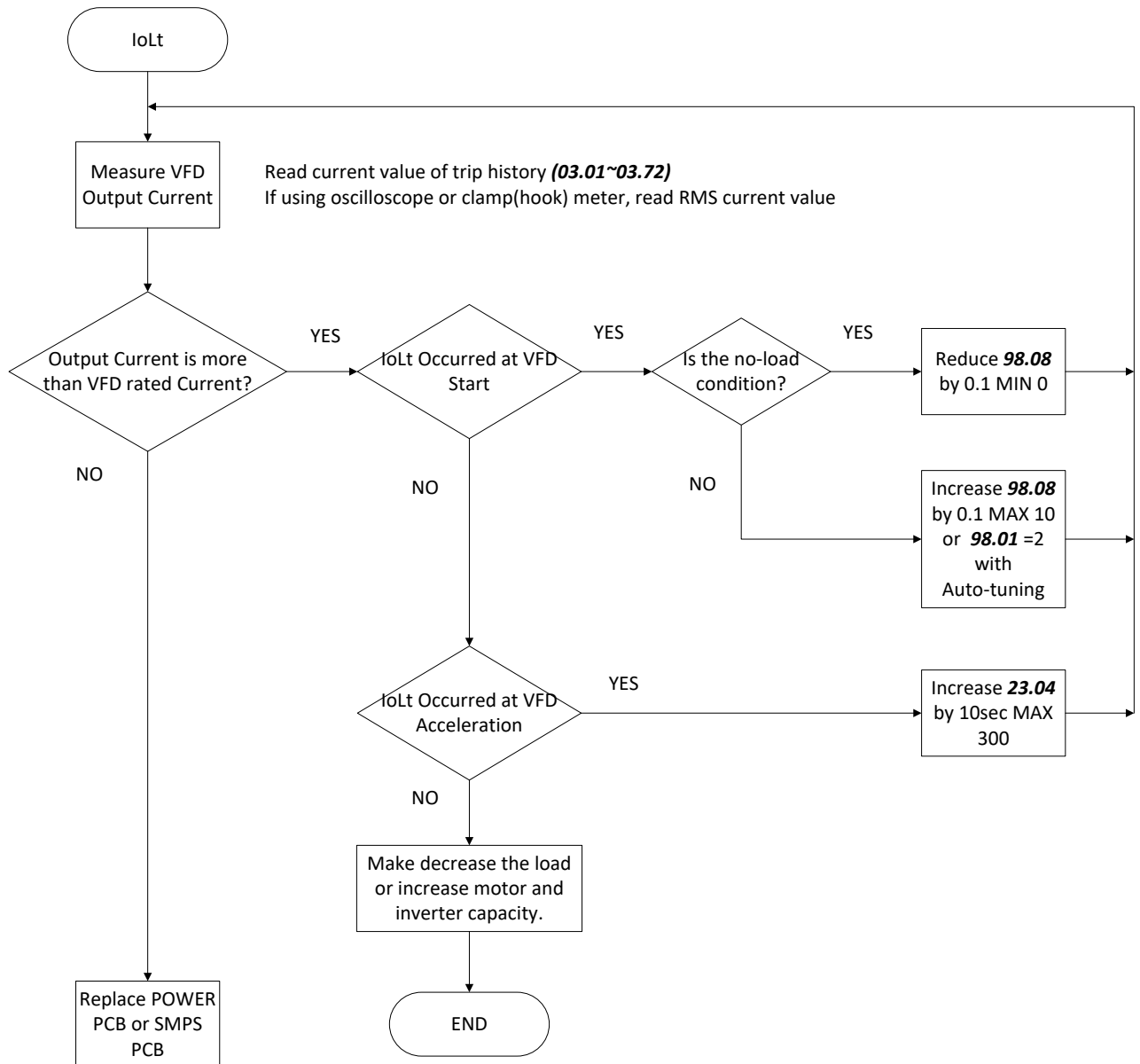
9.2.4 ETH (Motor Overload)

1) Diagnostic flowchart



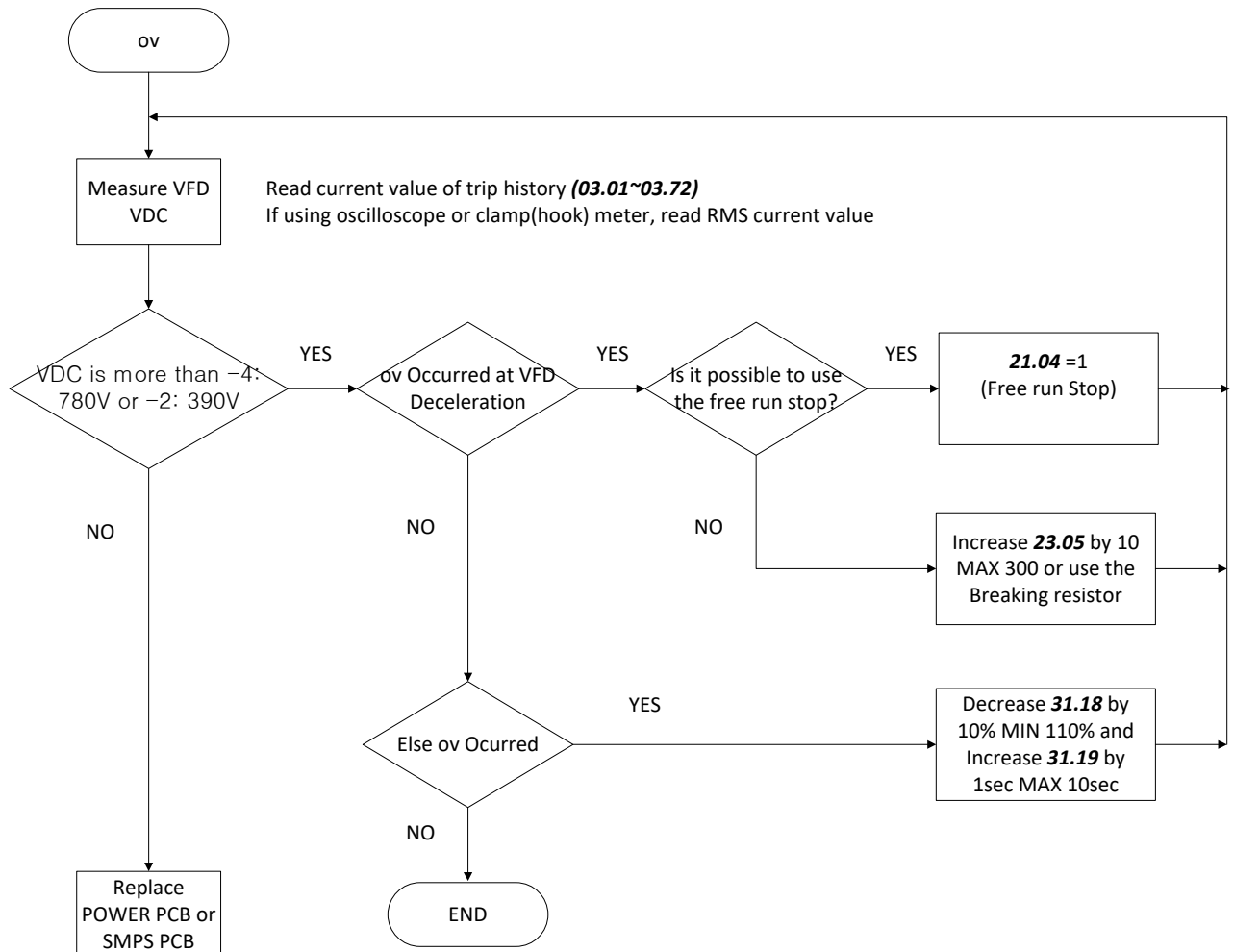
9.2.5 IoLt (VFD Overload)

1) Diagnostic flowchart



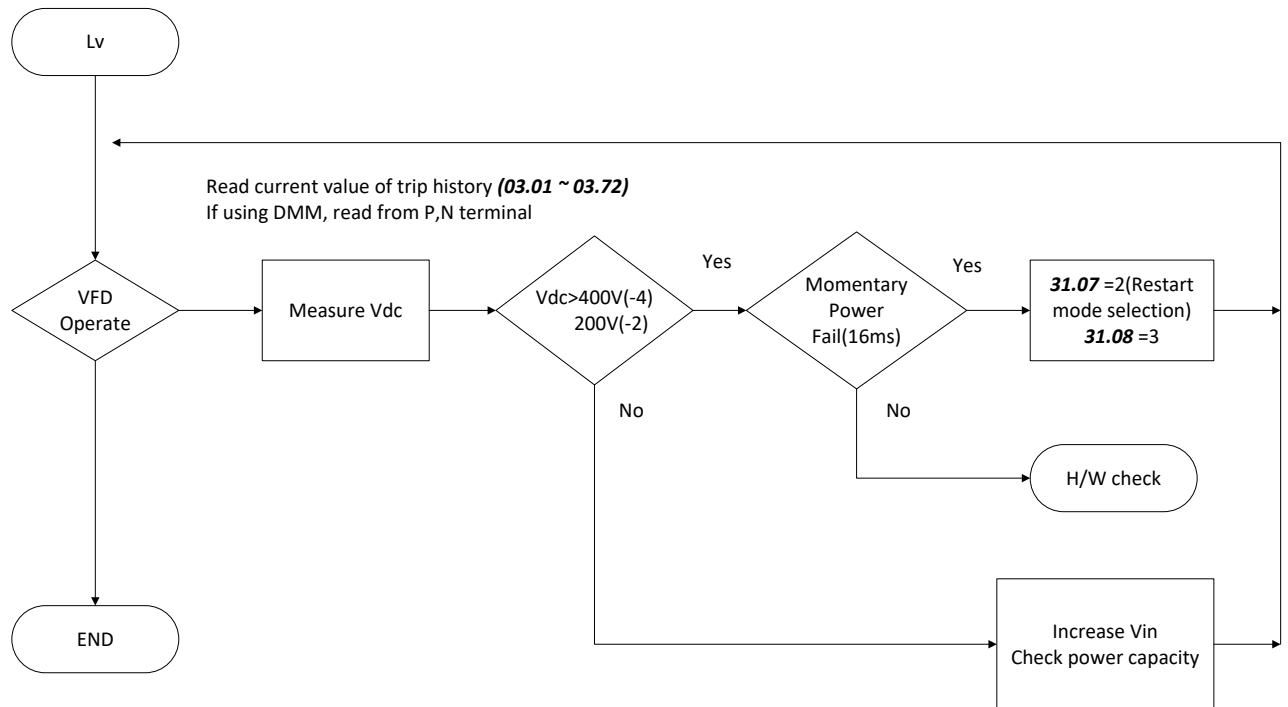
9.2.6 ov (DC link Over Voltage)

1) Diagnostic flow chart



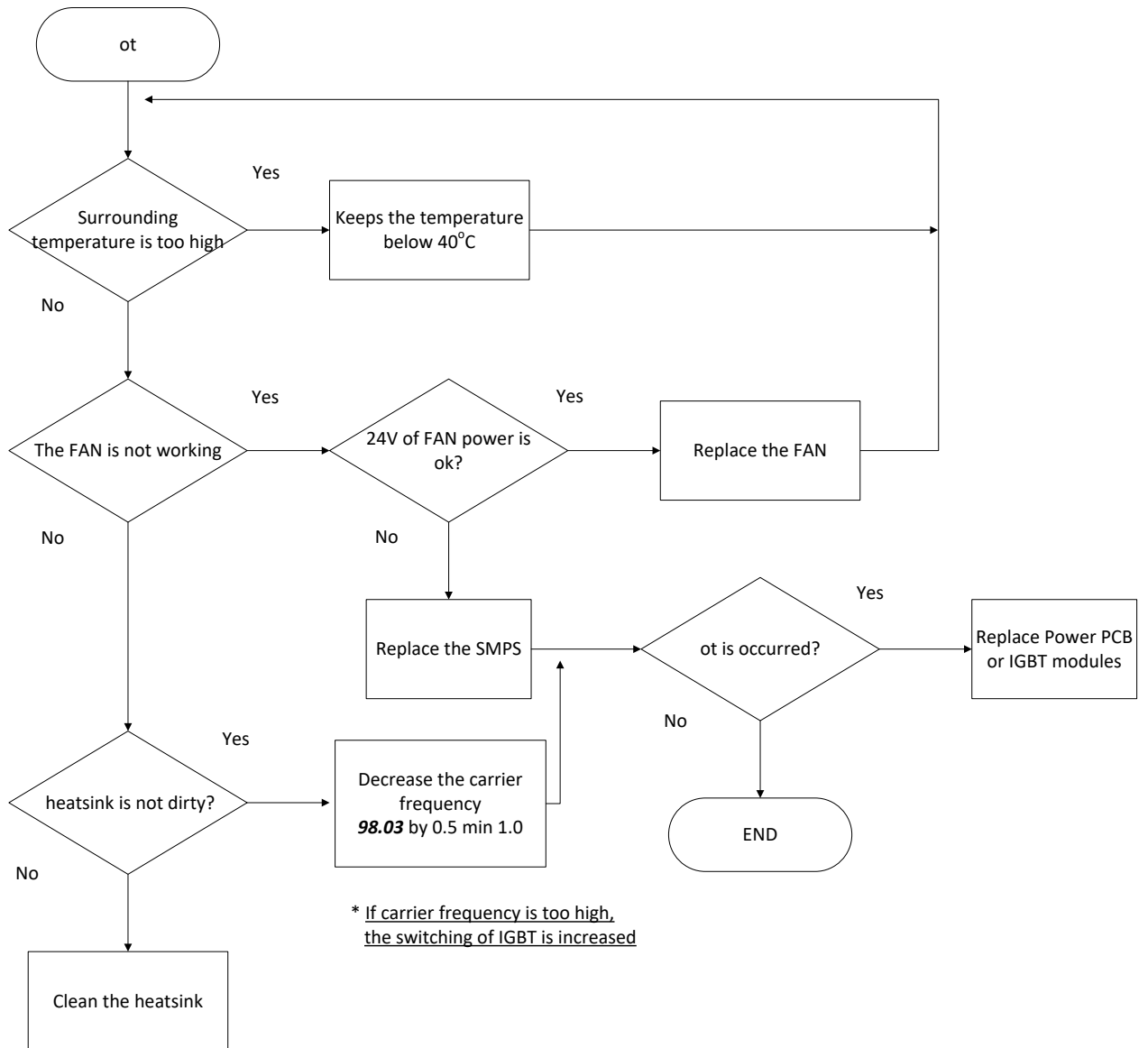
9.2.7 Lv (DC link Under Voltage)

1) Diagnostic flow chart



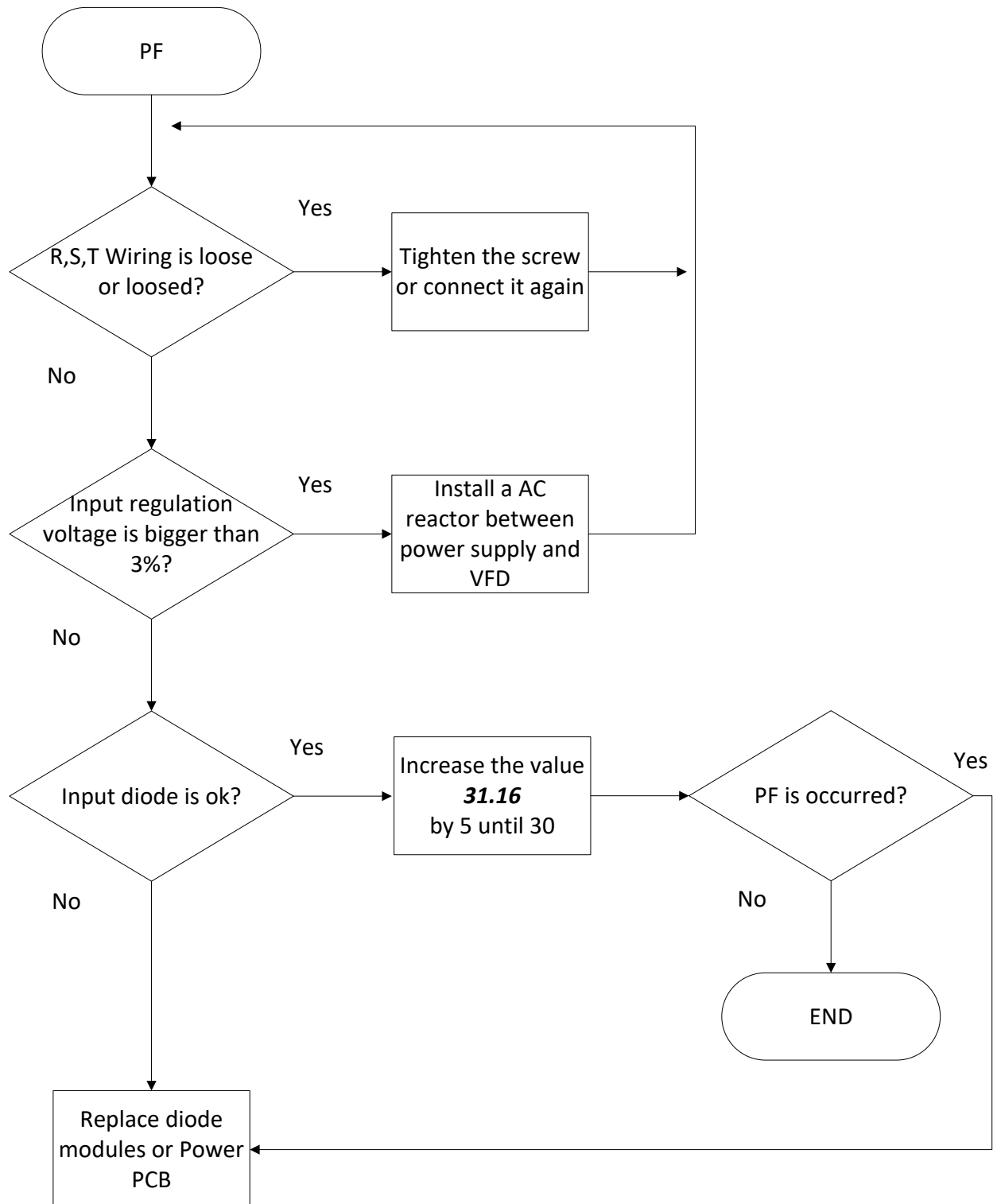
9.2.8 ot (Over Temperature)

1) Diagnostic flow chart



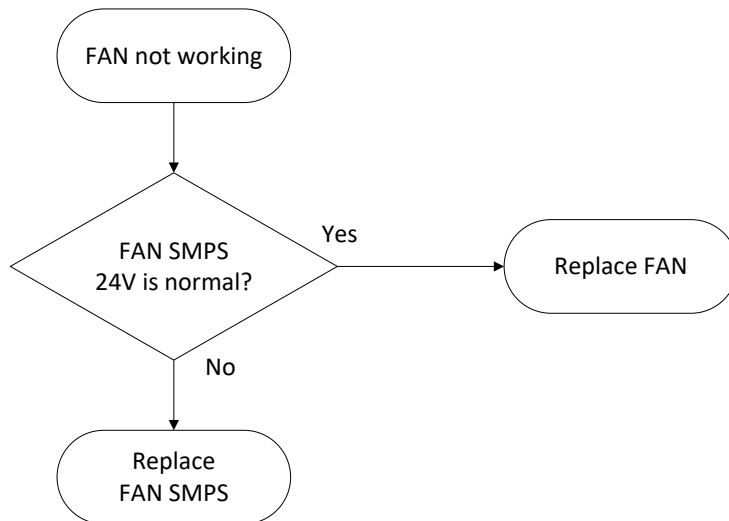
9.2.9 PF (Input Power Loss)

1) Diagnostic flow chart



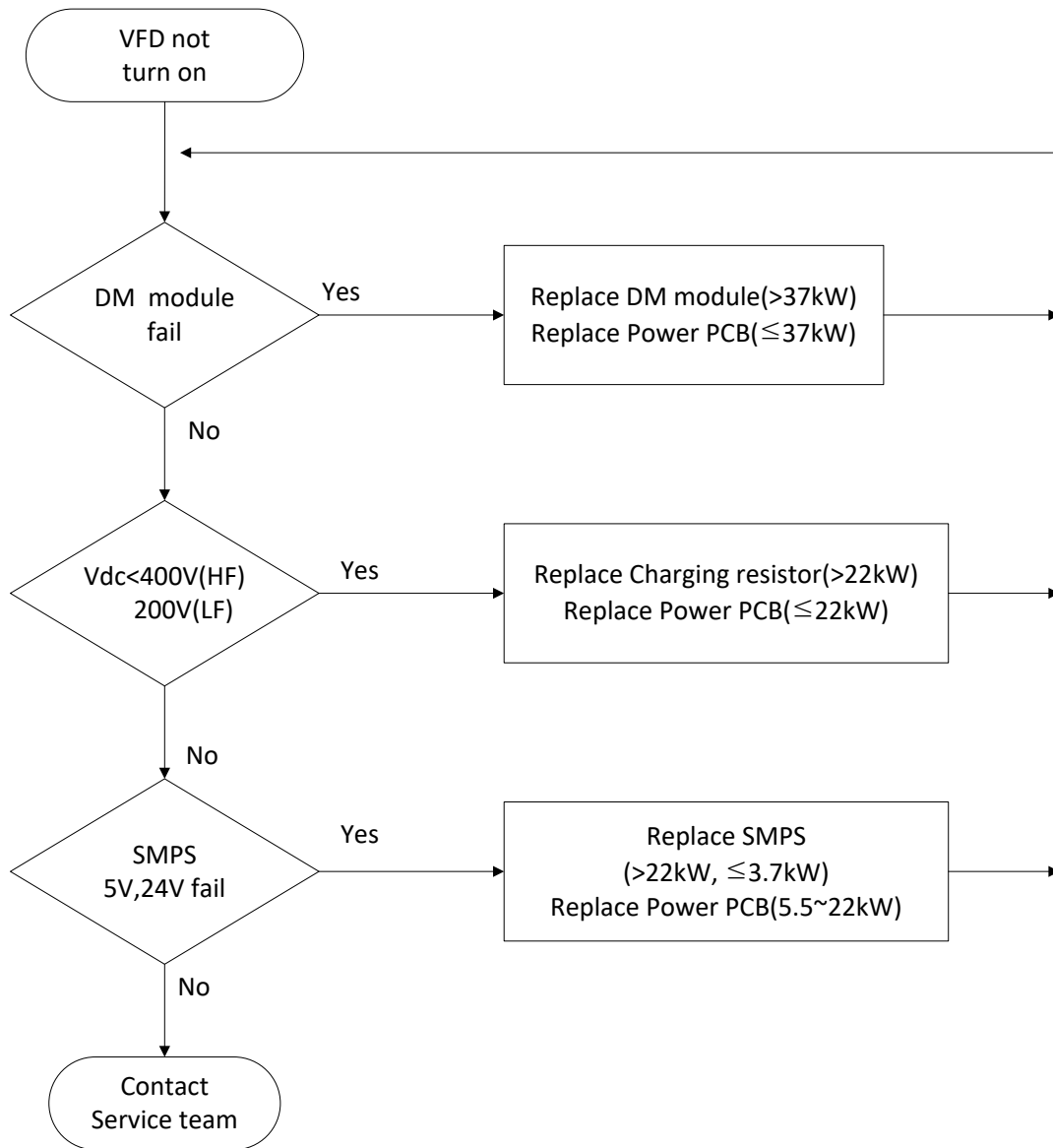
9.2.10 FF (Fan Fault)

1) Diagnostic flow chart



9.2.11 VFD doesn't turn on

1) Diagnostic flow chart



10. Functional Safety

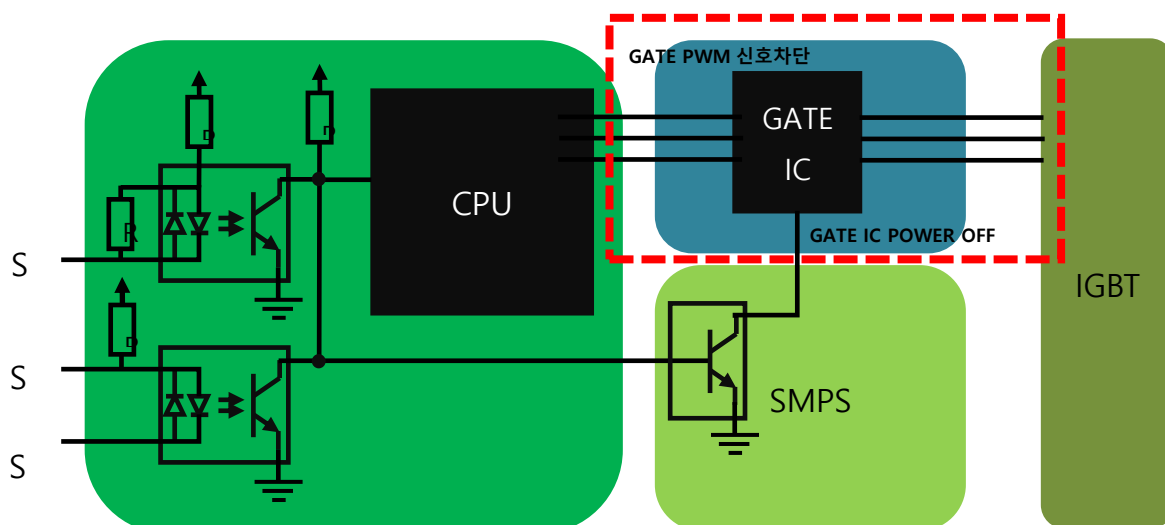
10.1 Functional Safety

10.1.1 Safety standard product

- A1 offers safety option to reduce the risk of an emergency situation by off the VFD output to protect the operator when using the machine. Performance level of safety features are as follows
 - EN 61508: SIL 2
- When using the safety function, make sure that the system of risk assessment need to be carried out and if it meets the safety requirements
- Operating wiring or maintenance, VFD must be turned off
Safety function is not electrically isolated or completely blocks the power of motor

10.1.2 Safety function description and wiring diagram

- Safety function is STO function to cut off power supply from motor (Cutting off VFD output current) by impeding gate with hard-wired and not to cause a torque
- VFD cut off output when SA input closed or SB input open
- STO function has 2 channels (SA, SB) the input signal is connected to independently. The signal cut off the output of the VFD control circuit drive signal and power module. During operation, safety function is activated, the VFD cut off the output and the status of motor is "Free run" and message is displayed on the keypad ("Safety Opt Err" message) to turn off the trip, when VFD of state is normal, press the reset key





Maker	Advanced Drive Technology	Installation Date	
Model No.	imaster – A1	Warranty Period	
Customer Information	Name		
	Address		
	Tel.		
Sales Office (Distributor)	Name		
	Address		
	Tel.		

- Warranty period is 12 months after installation or 18 months after manufactured when the installation date is unidentified. However, the guarantee term may vary on the sales term

IN-WARRANTY service information

- If the defective part has been identified under normal and proper use within the guarantee term, contact your local authorized ADT distributor or Service center

OUT-WARRANTY service information

- The guarantee will not apply in the following cases, even if the guarantee term has not expired
 - Damage was caused by misuse, negligence or accident
 - Damage was caused by abnormal voltage and peripheral device' malfunction (failure)
 - Damage was caused by an earthquake, fire, flooding, lightning, or other natural calamities
 - When ADT nameplate is not attached
 - When the warranty period has expired

Revision History

No	Date	Edition	Changes
1	2016.06	First Edition	–
2	2016.12	2 nd Edition	Add 5.5~22kW(HD) Specification, DBR Duty cycle
3	2017.05	3 rd Edition	Add Quick start guide
4	2020.04	4 th Edition	Add PID Function, KEB Function
5	2021.01	5 th Edition	Add LCD KEYPAD MAP, Motor Control Method(VECTOR)
6	2022.10	6 th Edition	Add LV Trip level, CC-link, Encoder, ETH Trip Off, Vector Control, Emergency Dec Stop mode, Modify Reset Terminal Detect, Modify Stall Level, Add Start Frequency, DI input Filter Constant initial value set 10ms
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

