SLANVERT

SBH Series High Voltage Inverter

USER'S MANUAL

Hope SenLan Science & Technology Holding Corp., Ltd

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Preface

Thank you for purchasing Senlan SBH series high voltage inverters.

SBH series high voltage inverters, a new generation of high-performance high voltage inverters featuring multiple functional units in series independently developed by Hope Senlan Science and Technology Holding Corp., Ltd., deliver high power factor, high reliability, high efficiency, low harmonic content, low loss, easy maintenance and small footprint. As "high-high" high voltage inverters with high voltage direct input and inverter high voltage direct output, SBH series, applicable to conventional three-phase high voltage asynchronous induction motors, can be widely used in metallurgy, electric power, machinery, paper making, building materials, chemicals, petroleum, pharmaceuticals, mining and other fields.

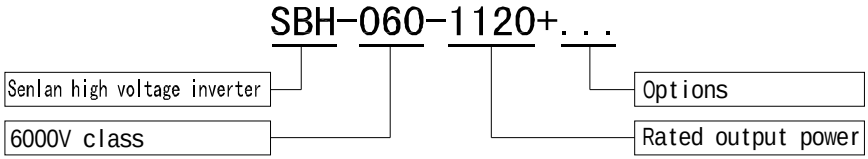
This manual provides for guidance on installation and wiring, parameter setting, routine maintenance, fault diagnosis and troubleshooting. Please read the manual carefully and memorize relevant know-how and safety precautions before any attempt of inverter installation, setting, operation and maintenance to enable proper use of the inverter and full leverage of its superior performance. The technical specifications applicable to this product are subject to change without notice. This manual shall be properly kept until the end of the service life of the inverter.

Check after unpacking

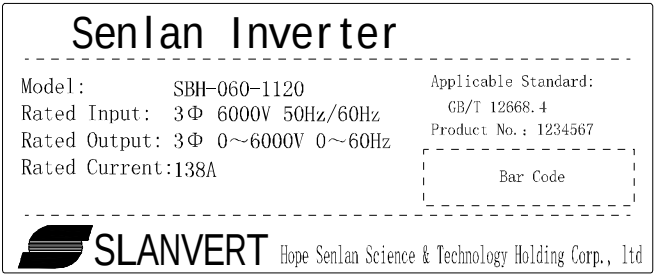
Please check the following items after unpacking. If you have any problem, please contact us or your supplier directly.

What to confirm	How to confirm
Is this exactly what you have ordered?	Check whether the data on the nameplate are consistent with those in your order form.
Is there any damage to the product?	Check the external appearance of the product to see if there is any damage from the transportation process.

Inverter model description



Inverter nameplate description: (SBH-060-1120)



Definition of safety signs

For safety-related content in this manual, the following safety signs apply. The contents with the safety signs must be observed.

DANGER: Any improper use or noncompliant operation may cause inverter damage or casualties.

CAUTION: Any noncompliant operation may cause abnormal system operation which, in serious cases, may lead to inverter damage or mechanical damage.

Some terms and abbreviations are given below:

Name	Description
AI	Analog Input, see Page 78
AO	Analog Output, see Page 81
AVR	Automatic Voltage Regulation, see Page 65
EMC	Electric Magnetic Compatibility
EMI	Electric Magnetic Interference
LED	Light Emitting Diode
PFI	Pulse Frequency Input, see Page 82
PFO	Pulse Frequency Output, see Page 83
PID	Proportional-Integral-Derivative, see Page 84
PG	Pulse Generator, see Page 101
PWM	Pulse Width Modulate
UP/DOWN value	A percentage value adjusted via terminal; can be used as the frequency reference (max. frequency = 100%) and PID reference. See Page 72
n (digital input)	The nth internal switch signal listed in the table of digital input functions on Page 67. It can be used as the input of the X, FWD and REV terminals.
n (digital output)	The nth internal switch signal listed in the table of digital output functions on Page 75. It can be used as the output of the Y terminals and relays.

1 Precautions

1.1 Safety precautions

(1) Installation

- **n** The following installation related contents must be well read and understood before high voltage inverter installation.
- **n** Do not install the inverter in a place with or near combustibles; otherwise there may be a risk of fire.
- **n** Do not install the inverter in an environment exposed to combustible gases; otherwise there may be a risk of explosion.

(2) Wiring

- **n** Wiring must be carried out by qualified personnel; otherwise there may be a risk of electric shock.
- **n** Make sure that the high voltage indicator is thoroughly off; otherwise there may be a risk of electric shock.
- **n** Make sure the input power is completely disconnected and conspicuous operation signs are put in place before the wiring is conducted; otherwise there may be a risk of electric shock.
- **n** The installation of external wiring shall comply with standard and local safety rules. Isolation must be provisioned between high and low voltage cables and any other CE safety standard compliant cables.
- **n** The power supply side of the high-voltage inverter must be equipped with a high-voltage circuit breaker for circuit protection.
- **n** The earth terminal (PE) of the inverter must be properly and reliably connected to earth (resistance to earth≤0.5Ω); otherwise there may be a risk of electric shock.
- **n** The output terminals (U, V, W) must not be connected to the AC power supply.

(3) Check before power-on

- **n** Close the cover of the inverter before power-on; otherwise there may be a risk of electric shock or explosion.
- **n** Before trying to run the motor at a frequency over the rated motor frequency, make sure that the motor and the mechanical devices can endure such a high speed.

(4) Power-on and operation

- **n** The variable frequency speed regulating system poses high voltage hazard. Any operator must strictly observe the operating procedures.
- **n** Any untrained personnel on duty shall not carry out any operation on the touch screen.

- **n** The input power terminal voltage must not exceed the rated voltage range; otherwise there may be a risk of inverter damage.
- **n** Check whether parameters are properly set prior to commissioning.
- **n** The cabinet cover must not be opened when the input power is switched on, because the high voltage inside may cause an electrical shock.
- **n** Do not try to operate the inverter with wet hands; otherwise an electrical shock may occur.
- **n** Do not control the run and stop of the inverter by switching on and off the input power.
- **n** Related parameters shall be reset after parameter initialization.
- **n** If the function of restart has been set (such as auto-reset or restart after momentary power failure), do not approach the motor or mechanical load while the inverter is waiting to restart.
- **n** Even after the high voltage circuit breaker is disconnected and the control power switch is off, dangerous voltage may still exist inside the inverter cabinet (e.g. stored energy inside the unit).
- **n** When the circuit breaker is switched on (disconnection) and the power supply is cut off, dangerous voltage may still exist inside the inverter cabinet.
- **n** Fencing (with high voltage danger signs) must be mounted at necessary locations and must not be removed during equipment operation.

(5) Transportation and packaging

- **n** Do not put any heavy object on the inverter.
- **n** Do not apply any force on the HMI and the cover board while handling the inverter; otherwise there may be a risk of injury to people or damage to equipment.
- **n** In-cabinet equipment is not weatherproof and must be properly protected. When the inverter must be temporarily stored outdoors, a heater must be used within the cabinet to prevent condensation. A protective cover such as plastic or canvas must be placed over the inverter. These measures are particularly important when the inverter has to be placed for a long time.

(6) Disposal

- **n** The inverter shall be disposed of as industrial waste.
- **n** When the electrolytic capacitor inside the inverter is burned, an explosion may occur.
- **n** Toxic gases may be emitted when the plastic parts of the inverter are burnt.

1.2 Other precautions

(1) Motor and mechanical load

- **n** Constant-torque low-speed operation

When a conventional motor driven by an inverter runs at low speed for a long time, the motor temperature will rise due to the weakening cooling effect of the motor. So if a motor is required to operate at low speed and constant torque for a long term, an inverter or the forced air cooling method must be used.

n Motor overload protection

When an adaptation motor is used, the inverter can provide overload protection to the motor. If the rated capacity of the motor does not match that of the inverter, regulate the overload protection level or adopt other protective measures so that the motor can operate safely.

n Running above 50Hz

When the motor runs above 50Hz, be aware that the vibration and noise will increase and make sure that the motor bearings and mechanical devices can withstand such a high speed.

n Lubrication of mechanical devices

While running at low speed for a long period, such mechanical devices as gearbox and gears may be damaged due to worsening lubricating effect. Before you run them, check the lubrication conditions.

n Load of regerative torque

Regerative torque often occurs while a load is hoisted, and the inverter often stops due to overvoltage protection. In this case, an appropriate braking unit shall be selected and installed.

n Mechanical resonant point

Certain output frequencies of the inverter may be the mechanical resonant points. To avoid these points, place anti-vibration rubber under the base of the motor or setting the jump frequencies.

n Motor insulation check before connected to the inverter

When the motor is used for the first time or reused after it has not been used for a long period, the motor insulation must be inspected to prevent the damage to the inverter caused by the failed insulation of the motor windings. Use a 2500V voltage-type megaohm meter to measure the insulation resistance, which shall not be less than 5MΩ.

(2) Inverter

n Capacitor or voltage-dependent resistor for improving power factor

As the inverter output is of PWM voltage type, the capacitor or voltage-dependent resistor (for improving the power factor) installed on the output side of the inverter will lead to inverter trip or damage to components. Do remove the capacitor or the voltage-dependent resistor before using the inverter.

n Installation of switching devices (e.g. contactor) on inverter output side

If a switching device like contactor is required to be installed between the inverter and the motor, make sure the on/off operation is performed while the inverter has no output, otherwise the inverter may be damaged.

n Frequent start and stop

For applications where frequent start and stop are needed, terminals are recommended for the control of the start/stop of the inverter. Using the switching device (such as contactor) on the inverter input side to start or stop the inverter frequently is prohibited. That may destroy the inverter.

n Using the inverter beyond the rated value

It is not advisable to operate the inverter beyond the range of the allowable input voltage. If necessary, please contact the manufacturer.

n Lightning protection

With the built-in protection of overvoltage from lightning, the inverter has certain self-protection ability against the lightning strike.

n Derating of inverter

a) If the ambient temperature exceeds 40℃, the inverter shall be derated by 5% for every 1℃ increase, and external forced cooling shall be provided.

b) In areas where the altitude goes beyond 1000m, the thinner air will deteriorate the cooling effect of the inverter. Therefore, the inverter must be derated by 1% for every 100m rise.

2 Specifications

2.1 General specifications for SBH series high voltage inverters

Item		Description
Input	Rated voltage, frequency	3-phase: 3kV/3.3kV/6kV/6.6kV/10kV/11kV, 50Hz/60Hz
	Allowable range	Voltage: －20%～＋15%; instantaneous: -30%; frequency: ±5%
Output	Output voltage	3-phase, 0V～input voltage; deviation< 5%
	Output frequency range	0.00～120.00Hz
Basic specifications	Motor control mode	V/F control without PG, V/F control with PG, vector control without PG, vector control with PG
	Overload capacity	120% 120s, 150% 5s, 200% immediately protection
	Frequency resolution	Digital reference: 0.01Hz; analog reference: 0.1% of max. frequency
	Run command channel	HMI, terminal and communication. They can be switched over by terminals.
	Frequency reference channel	HMI, communication, UP/DOWN value, AI1, AI2, AI3, PFI
	Auxiliary frequency reference	Flexible auxiliary frequency fine tuning, reference frequency synthesis
	Torque boost	Auto or manual torque boost
	V/F curve	User-defined V/F, linear V/F and 5 reduced-torque curves
	Accel/decel	Linear or S-curve acceleration/deceleration
	Jog	Jog frequency: 0.10～50.00Hz; Jog accel/decel time: 0.1～600.0s
	Auto energy saving operation	V/F curve is optimized automatically based on the load condition, achieving auto energy-saving operation
	Automatic voltage regulation (AVR)	Keeps the output voltage constant automatically when the voltage of power grid fluctuates
	Momentary power failure	Ensures uninterrupted operation by controlling the busbar voltage
	DC braking	Braking time: 0.0～60.0s; braking current: 0.0～100.0% of rated current
	PFI	Max input frequency: 50kHz
	PFO	Open-collector pulse (square wave) output of 0～50kHz, programmable
	Analog input	3 channels of analog input, voltage or current type, positive or negative
	Analog output	4 channels of analog output, 0/4～20mA or 0/2～10V, programmable
	Digital input	8 channels of optional multi-function digital input
	Digital output	2 channels of multi-function digital output; 3 channels of multi-function relay output
	Communication	Built-in RS485 communication interface, supporting Modbus-RTU protocol and Profibus-DP (Optional)
Features	Process PID	Two sets of PID parameters; multiple correction modes
	Multiple PLC modes	The user can set 2 PLC run modes, with each having up to 32 stages. The mode can be selected by terminals. PLC status can be saved at power failure.
	Multi-speed selection	Binary code mode, direct selection mode, sum mode and number mode
Protection		Protection is available for overcurrent, overvoltage, undervoltage, input/output phase loss, output short-circuit, overheat, motor overload, external fault, analog input disconnection, stall prevention, motor PTC or Pt100 overheating, etc.
Options		Manual one-to-one bypass cabinet, manual one-to-two bypass cabinet, automatic one-to-one bypass cabinet, automatic one-to-two bypass cabinet, communication module, SHE-PU01 HMI, Profibus-DP
Environment	Premise	An elevation below 1,000m, indoors, no exposure to direct sunlight, dust, corrosive gases, combustible gases, oil mist, water vapor, drippings and saline mist
	Ambient temperature/humidity	-10 to +40℃/ 20-90% RH, no dew condensation
	Vibration	Below 5.9m/s2 (0.6g)
Structure	IP rating	Above IP30
	Cooling mode	Forced air cooling with fan control

2.2 Specifications of SBH Series

The ratings of SBH series high voltage inverters are shown in the table below:

3kV class:

Model	Rated capacity (kVA)	Rated output current (A)	Applicable motor (kW)	Model	Rated capacity (kVA)	Rated output current (A)	Applicable motor (kW)
SBH-030-160	200	39	160	SBH-030-800	1000	192	800
SBH-030-200	250	49	200	SBH-030-900	1125	216	900
SBH-030-220	275	54	220	SBH-030-1000	1250	240	1000
SBH-030-250	315	61	250	SBH-030-1120	1400	276	1120
SBH-030-280	350	68	280	SBH-030-1250	1563	308	1250
SBH-030-315	400	77	315	SBH-030-1400	1750	345	1400
SBH-030-355	450	86	355	SBH-030-1600	2000	395	1600
SBH-030-400	500	96	400	SBH-030-1800	2250	443	1800
SBH-030-450	560	108	450	SBH-030-2000	2500	493	2000
SBH-030-500	630	120	500	SBH-030-2240	2800	552	2240
SBH-030-560	700	135	560	SBH-030-2500	3150	616	2500
SBH-030-630	800	154	630	SBH-030-2800	3500	690	2800
SBH-030-710	900	171	710	SBH-030-3150	4000	778	3150

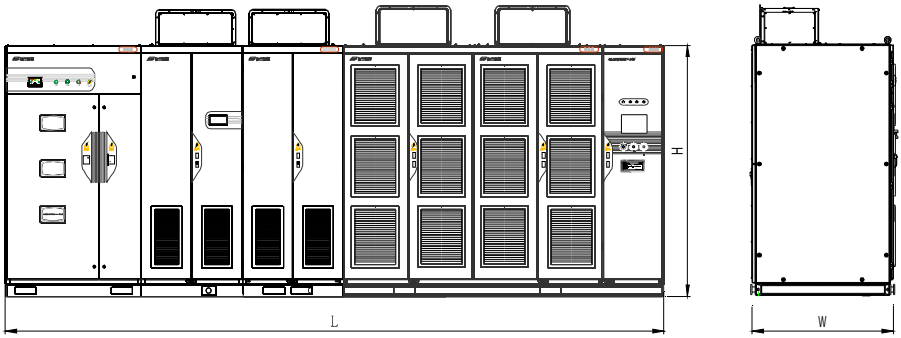
6kV class:

Model	Rated capacity (kVA)	Rated output current (A)	Applicable motor (kW)	Model	Rated capacity (kVA)	Rated output current (A)	Applicable motor (kW)
SBH-060-160	200	20	160	SBH-060-1120	1400	138	1120
SBH-060-200	250	25	200	SBH-060-1250	1600	154	1250
SBH-060-220	275	28	220	SBH-060-1400	1750	173	1400
SBH-060-250	315	31	250	SBH-060-1600	2000	198	1600
SBH-060-280	350	35	280	SBH-060-1800	2250	222	1800
SBH-060-315	400	39	315	SBH-060-2000	2500	247	2000
SBH-060-355	450	44	355	SBH-060-2240	2800	277	2240
SBH-060-400	500	50	400	SBH-060-2500	3150	309	2500
SBH-060-450	560	56	450	SBH-060-2800	3500	346	2800
SBH-060-500	630	62	500	SBH-060-3150	4000	384	3150
SBH-060-560	700	69	560	SBH-060-3550	4500	439	3550
SBH-060-630	800	78	630	SBH-060-4000	5000	495	4000
SBH-060-710	900	88	710	SBH-060-4500	5600	557	4500
SBH-060-800	1000	99	800	SBH-060-5000	6300	619	5000
SBH-060-900	1125	111	900	SBH-060-5600	7000	693	5600
SBH-060-1000	1250	123	1000	SBH-060-6300	7900	780	6300

10kV class:

Model	Rated capacity (kVA)	Rated output current (A)	Applicable motor (kW)	Model	Rated capacity (kVA)	Rated output current (A)	Applicable motor (kW)
SBH-100-200	250	15	200	SBH-100-1600	2000	115	1600
SBH-100-250	315	19	250	SBH-100-1800	2250	130	1800
SBH-100-280	350	21	280	SBH-100-2000	2500	144	2000
SBH-100-315	400	24	315	SBH-100-2240	2800	162	2240
SBH-100-355	450	27	355	SBH-100-2500	3150	182	2500
SBH-100-400	500	30	400	SBH-100-2800	3500	205	2800
SBH-100-450	560	34	450	SBH-100-3150	4000	230	3150
SBH-100-500	630	38	500	SBH-100-3550	4500	260	3550
SBH-100-560	700	42	560	SBH-100-4000	5000	290	4000
SBH-100-630	800	47	630	SBH-100-4500	5600	324	4500
SBH-100-710	900	53	710	SBH-100-5000	6300	360	5000
SBH-100-800	1000	60	800	SBH-100-5600	7000	403	5600
SBH-100-900	1125	68	900	SBH-100-6300	7900	454	6300
SBH-100-1000	1250	75	1000	SBH-100-7100	8900	510	7100
SBH-100-1120	1400	84	1120	SBH-100-8000	10000	580	8000
SBH-100-1250	1600	94	1250	SBH-100-9000	11250	653	9000
SBH-100-1400	1750	105	1400	SBH-100-10000	12500	725	10000

The outline drawing of SBH series inverters is as follows:



SBH dimensions and weight: (following dimension without AC bypass cabinet, generally add 300mm width for power connection,please contact SLANVERT for more information.)

3kV class:

Model	L	W	H	Weight (kg)	Model	L	W	H	Weight (kg)
SBH-030-160	3200	1000	2200	2500	SBH-030-800	4200	1300	2300	4100
SBH-030-200	3200	1000	2200	2550	SBH-030-900	4200	1300	2300	4300
SBH-030-220	3200	1000	2200	2600	SBH-030-1000	4200	1300	2300	4400
SBH-030-250	3200	1000	2200	2680	SBH-030-1120	4200	1300	2300	4550
SBH-030-280	3200	1000	2200	2750	SBH-030-1250	4600	1300	2300	4700
SBH-030-315	3200	1000	2200	2830	SBH-030-1400	4600	1300	2300	4950
SBH-030-355	3500	1000	2200	3000	SBH-030-1600	4600	1300	2300	5200
SBH-030-400	3500	1000	2200	3200	SBH-030-1800	4600	1300	2300	5500

Model	L	W	H	Weight (kg)	Model	L	W	H	Weight (kg)
SBH-030-450	3500	1200	2200	3300	SBH-030-2000	4900	1300	2300	5800
SBH-030-500	3500	1200	2200	3500	SBH-030-2240	4900	1300	2300	6200
SBH-030-560	3500	1200	2200	3650	SBH-030-2500	4900	1400	2300	6500
SBH-030-630	3900	1200	2200	3750	SBH-030-2800	4900	1400	2300	7000
SBH-030-710	3900	1200	2300	3950	SBH-030-3150	4900	1400	2300	7500

6kV class:

Model	L	W	H	Weight (kg)	Model	L	W	H	Weight (kg)
SBH-060-160	3805	1200	2200	2800	SBH-060-1120	3955	1200	2200	4850
SBH-060-200	3805	1200	2200	2900	SBH-060-1250	3955	1200	2200	5100
SBH-060-220	3805	1200	2200	3000	SBH-060-1400	4740	1500	2300	5500
SBH-060-250	3805	1200	2200	3150	SBH-060-1600	4740	1500	2300	6000
SBH-060-280	3805	1200	2200	3250	SBH-060-1800	4740	1500	2300	6500
SBH-060-315	3805	1200	2200	3350	SBH-060-2000	4740	1500	2300	7000
SBH-060-355	3805	1200	2200	3400	SBH-060-2240	4740	1500	2300	7200
SBH-060-400	3805	1200	2200	3500	SBH-060-2500	4740	1500	2300	7600
SBH-060-450	3805	1200	2200	3550	SBH-060-2800	5640	1500	2400	8000
SBH-060-500	3805	1200	2200	3650	SBH-060-3150	5640	1500	2400	8500
SBH-060-560	3805	1200	2200	3750	SBH-060-3550	5640	1500	2400	9000
SBH-060-630	3955	1200	2200	3900	SBH-060-4000	5640	1500	2400	9800
SBH-060-710	3955	1200	2200	4000	SBH-060-4500	5930	1800	2500	10300
SBH-060-800	3955	1200	2200	4200	SBH-060-5000	5930	1800	2500	11000
SBH-060-900	3955	1200	2200	4450	SBH-060-5600	5930	1800	2500	11500
SBH-060-1000	3955	1200	2200	4600	SBH-060-6300	5930	1800	2500	11500

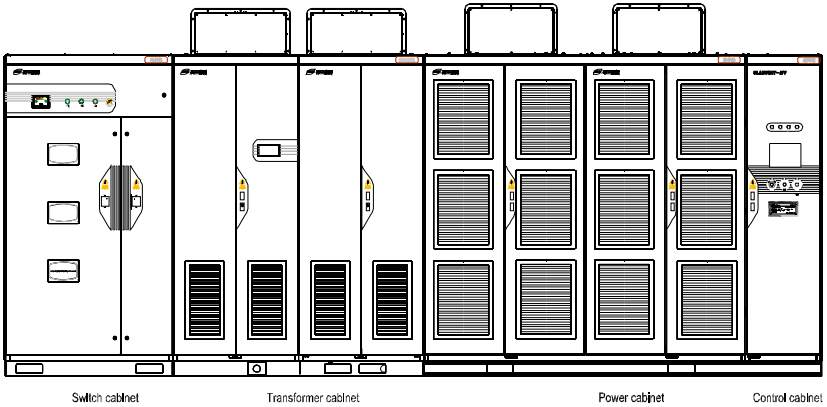
10kV class:

Model	L	W	H	Weight (kg)	Model	L	W	H	Weight (kg)
SBH-100-200	4640	1200	2200	3000	SBH-100-1600	5190	1200	2200	6500
SBH-100-250	4640	1200	2200	3150	SBH-100-1800	5190	1200	2200	6900
SBH-100-280	4640	1200	2200	3250	SBH-100-2000	5190	1200	2200	7200
SBH-100-315	4640	1200	2200	3350	SBH-100-2240	5870	1500	2300	7500
SBH-100-355	4640	1200	2200	3450	SBH-100-2500	5870	1500	2300	8000
SBH-100-400	4640	1200	2200	3500	SBH-100-2800	5870	1500	2300	8500
SBH-100-450	4640	1200	2200	3600	SBH-100-3150	6170	1500	2300	9000
SBH-100-500	4640	1200	2200	3650	SBH-100-3550	6170	1500	2300	9500
SBH-100-560	4640	1200	2200	3750	SBH-100-4000	6170	1500	2300	10800
SBH-100-630	4640	1200	2200	4000	SBH-100-4500	6910	1500	2500	11000
SBH-100-710	4640	1200	2200	4200	SBH-100-5000	7610	1800	2500	11800
SBH-100-800	4640	1200	2200	4400	SBH-100-5600	7610	1800	2500	12500
SBH-100-900	4640	1200	2200	4500	SBH-100-6300	7610	1800	2500	13000
SBH-100-1000	4640	1200	2200	4950	SBH-100-7100	7610	1800	2500	15000
SBH-100-1120	4890	1200	2200	5100	SBH-100-8000	7780	1800	2500	16000
SBH-100-1250	4890	1200	2200	5500	SBH-100-9000	7780	1800	2500	17800
SBH-100-1400	5190	1200	2200	6000	SBH-100-10000	7780	1800	2500	19500

NOTE: Please confirm the overall dimensions and weight with the manufacturer before order placement.

2.3 System composition and working principle

2.3.1 Inverter components



◆Switch cabinet

Lead grid side voltage to inverter; inverter output to motor via high voltage vacuum switch or isolation switch; a variety of specifications of power frequency bypass cabinets for user's choice; standard setting: manual bypass cabinet; user is allowed to perform power frequency bypass operation.

◆ Transformer cabinet

With dry-type phase shifting transformer, provide low-voltage power supply for the power unit; maintain the current harmonics THD on the grid input side below 3% at over 70% load based on the phase shifting technology.

◆ Power cabinet

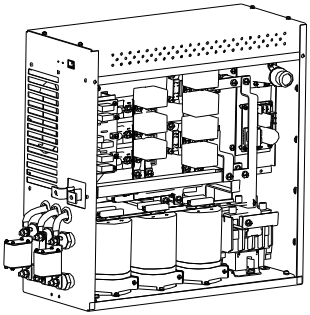
The core power part of inverter, with multiple built-in H-bridge power units; the inverter's per phase output is obtained through a number of power units in series; perform variable frequency speed control of the motor based on the three-phase output of VVVF obtained through the coordination and control of the PWM waveforms emitted by each power unit.

◆ Control cabinet

The core control part of inverter, provide coordination and control of the overall electrical system; control and monitor power units via optical fiber; provide communication between various components; support remote monitoring; feature operation buttons and LCD HMI.

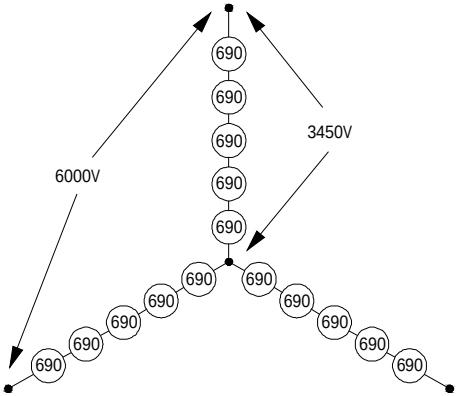
◆ Power unit

The core component of the inverter part, three-phase AC 690V input, single-phase PWM inverter output; supports fault detection, protection and status reporting. The outline drawing of the power unit is as follows:



2.3.2 Principle for series connection of units

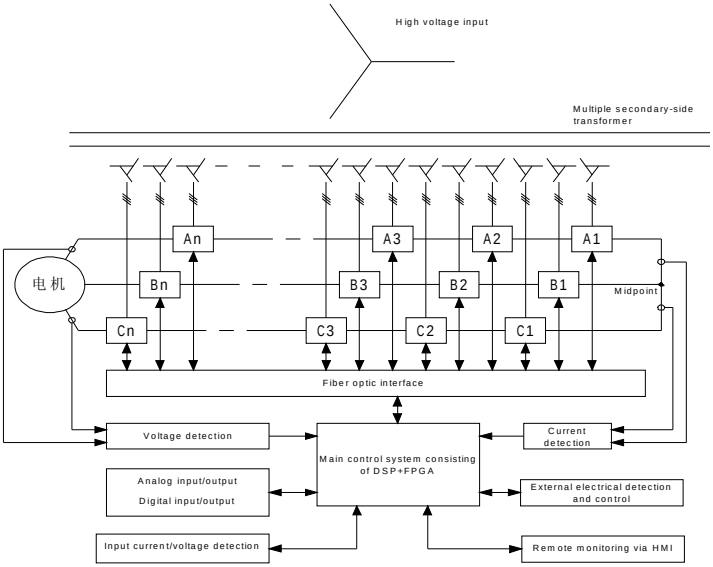
Per phase output of SBH series high-voltage inverters (6kV) is obtained through series connection of five units. The voltage superposition principle is as shown in the diagram below.



Voltage superposition principle diagram

Each unit features three-phase input and single-phase inverter output. When the system works at 50Hz, the output voltage RMS of each unit is 690V. The output superposition of five units leads to phase voltage of 3450V. Three-phase output leads to line voltage of 6000V.

Below is the schematic circuit diagram of unit series high voltage inverters.

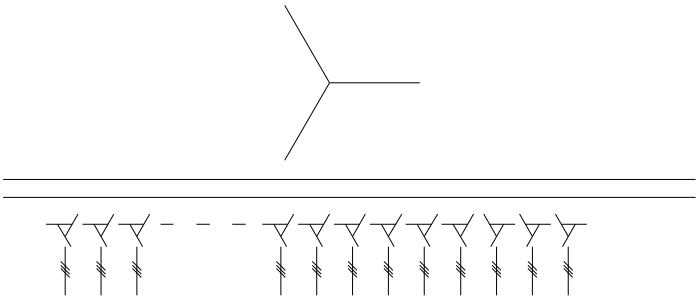


Schematic circuit diagram of unit series high voltage inverters

The grid input provides multiple sets of secondary side output via multiple secondary-side transformers to supply power to power units respectively. Then multiple power units are connected in series to form three-phase output by way of one-phase output. The main control system controls the frequency and amplitude of the inverter output voltage through the control of PWM output of each power unit so as to control the motor speed. The communication between the main control system and units are enabled via optical fiber, which can guarantee reliable signal transmission and insulation of the main control part and the high voltage part.

2.3.3 Phase-shifting transformer

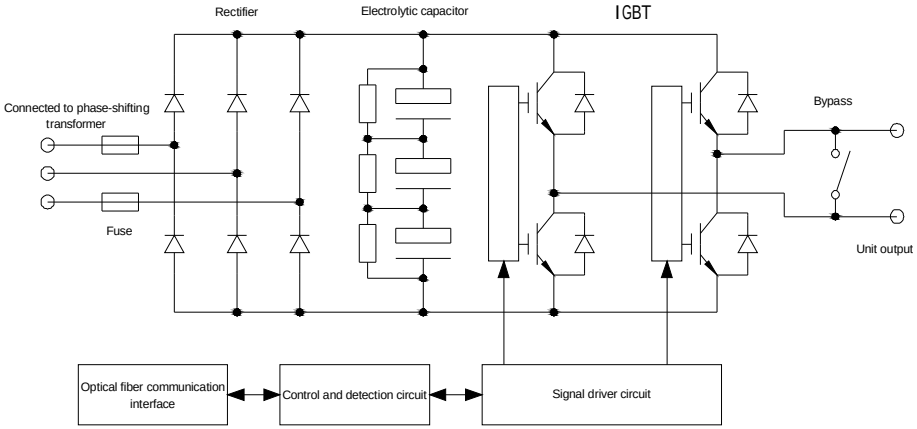
Dry-type multi-secondary-side transformers are used for input isolation transformers in SBH series high voltage inverters. The schematic circuit diagram is as follows:



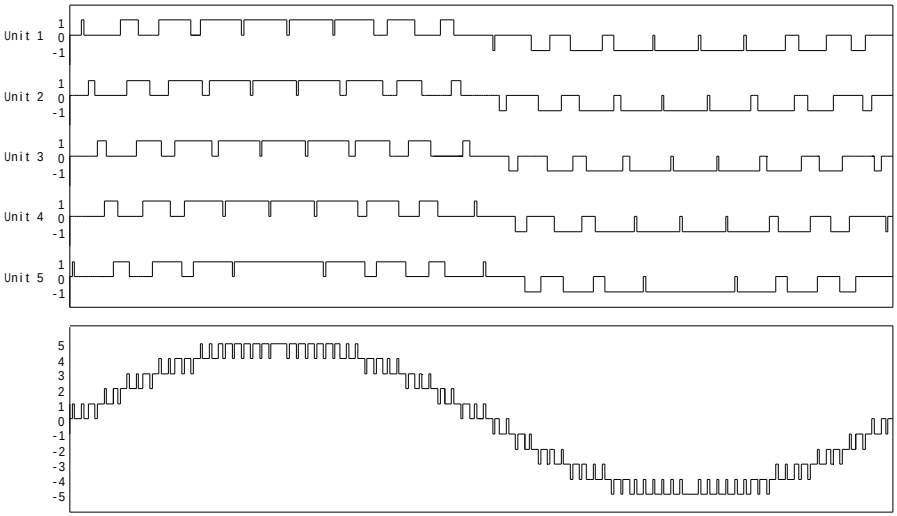
The rated input voltage can be arbitrary, while the secondary-side output voltage is 690V. There are a total of 15 sets of secondary windings (6kV). Each set of winding realizes a certain phase shift through extended delta connection. $Phaseshift\ ingangle = \frac{60°}{perphaseun\ itnumber}$. The power supply to the power unit through phase shifting transformer step-down can enable rectifier input current phase shifting multilevel, which plus the leakage reactance effect of the transformer, can eliminate network-side input current harmonics. The use of the multi-secondary-side phase shifting transformer can control the input current THD below 3%.

2.3.4 Electrical principles of power unit

A power unit is equivalent to a single-phase inverter. Its electrical schematic diagram is as shown below. It consists of three-phase bridge rectifier circuit, capacitor bank and IGBT (or IPM) inverter circuit as well as control circuit for optical fiber communication, PWM control, fault detection and protection.

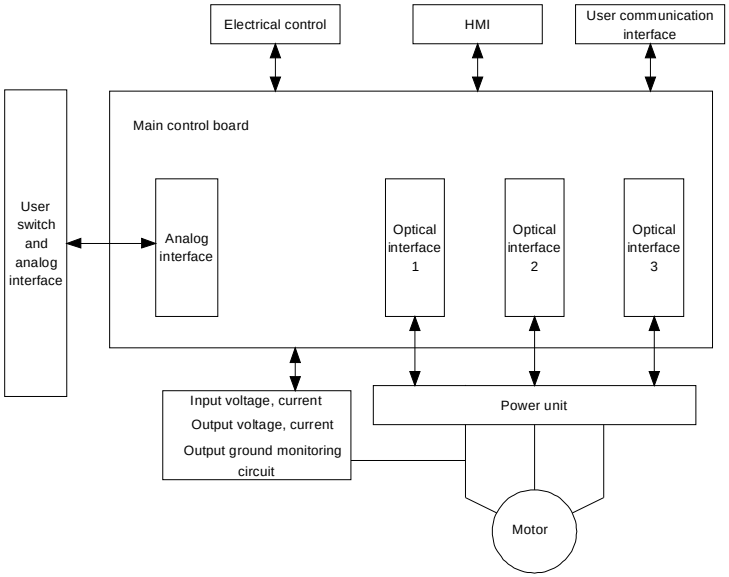


In SBH series high-voltage inverter, all units can be mutually replaced. Each phase obtains multiple phase voltage output by series connection of multiple units. The diagram below shows the phase voltage output waveform obtained by series connection of five units.



Phase voltage can generate 2×5+1=11 steps in total. Output voltage harmonic can be controlled below 5%.

2.3.5 Main control system



Block diagram of the main control system

The above block diagram shows that the main control system is mainly composed of the main control board, external interfaces, and some detection circuits. The electrical control interface is for the control of electrical switches and the receiving of user operation commands. The main control board consists of the main control circuit, monitoring circuit, LCD HMI communication interface, voltage and current detection circuit, and fiber optic communication circuit. The main control circuit supports PWM pulse calculation and sends through the optical fiber communication circuit to the power unit. The LCD HMI supports parameter setting and status indication.

The main control system of SBH series high voltage inverter, composed of DSP and FPGA chips, features high reliability and fast computing speed, delivering a significant edge compared to the main control system composed of MCU.

2.3.6 Bypass function

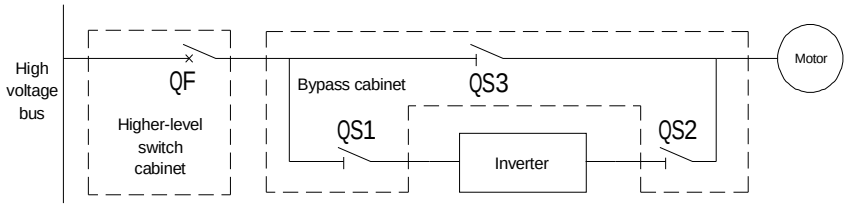
The high voltage circuit breaker with integrated relay protection is adopted for QF.

When manual isolation switches are adopted for QS1, QS2 and QS3, the motor supports manual bypass.

When QS1 and QS2 are connected while QS3 is disconnected, the motor supports inverter controlled speed control operation.

When QS1 and QS2 are disconnected while QS3 is connected, the motor can be directly started and stopped via QF for protection. The inverter can be completely off the grid for easy maintenance and repair.

When electrical switches are adopted for QS1, QS2 and QS3, motor automatic bypass or soft start can be realized.



NOTE: Power frequency direct start/stop has great impact on mechanical load and shall be used with caution.

3 Handling, installation and wiring

3.1 Inverter handling and installation

DANGER	**1) Inverter installation shall only be carried out by trained professionals.** **2) When the inverter is damaged or incomplete, installation shall be prohibited. Otherwise, fire or personal injury may be caused.** **3) The inverter shall only be installed in a location where its weight can be supported. Otherwise, the inverter may fall off to cause personal injury or damage to properties.**

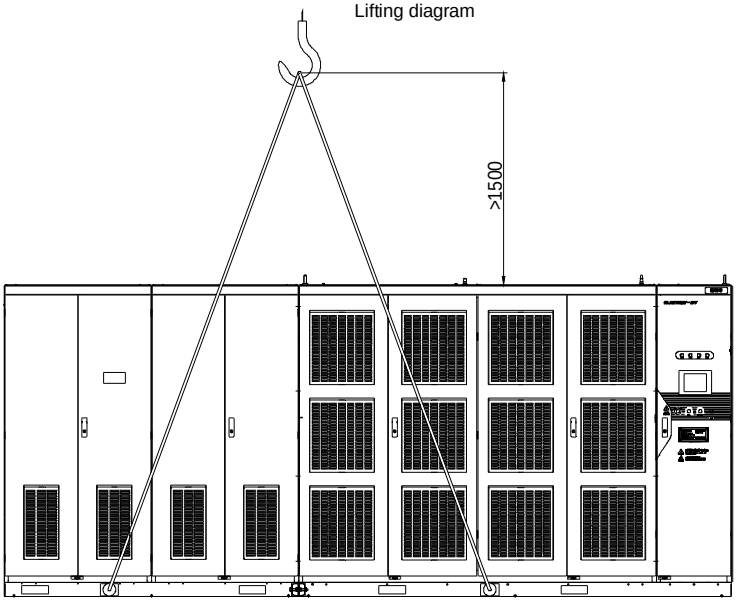
The electrical cabinets of SBH series high-voltage inverter are assembled, tested, packaged and delivered in whole piece, and the cabinets must be transported in whole in the process of transportation. To improve the reliability of the variable frequency speed control system and avoid damage to the system during transportation, this chapter defines basic requirements for transportation and storage. The environmental requirements for transportation and storage described in the chapter must be followed strictly. Any violation to relevant requirements in the chapter will compromise the service life of the high voltage variable frequency speed control system.

3.1.1 Transportation of high voltage inverter

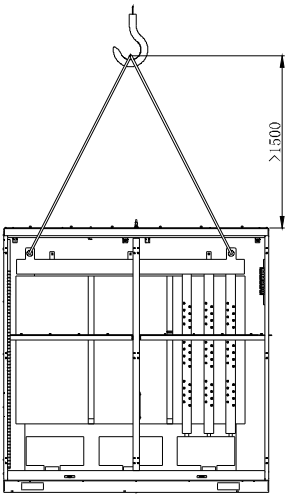
The outer package of SBH series high-voltage inverter can withstand external impact from transportation by sea, land or air, but proper protective measures must be taken to prevent water soaking and dust pollution. Plus, during transportation by sea, air and land, external mechanical forces and rough handling must be prevented. For proper handling, disassembly and storage, please note all relevant precautions and instructions marked on the packing container. It's advisable to commission well-reputed logistics companies to perform lifting and transportation of high voltage inverters.

Transportation: SBH series high voltage inverter can be transported by any transportation means, such as vehicle, train, airplane, and ship. During the transportation process, products must be handled with care, rain and sunlight exposure is strictly forbidden, and severe vibration, knock and putting upside down shall be prevented.

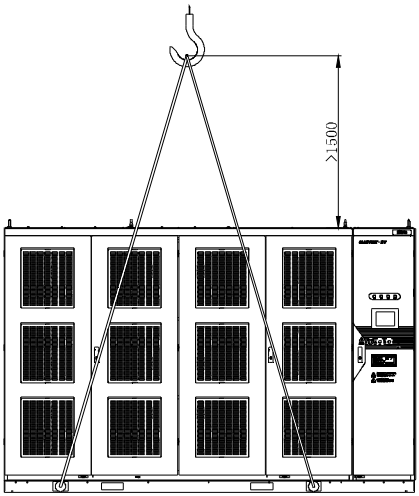
Lifting diagram



Transformer cabinet lifting diagram



Power cabinet lifting diagram



Handling: In the process of handling, the inverter shall be protected from striking and vibration, all cabinets cannot be put upside down, and the angle of inclination shall not exceed 30°. As the phase-shifting transformer is too heavy, and the transformer and transformer cabinet have been fixed as a whole before hoisting, it's not allowed to use the lifting ring on the cabinet for hoisting. Instead,

the hoisting hole on the cabinet can be directly used. To prevent the deformation of cabinets, the included angle between the lifting rope and cabinets shall not be smaller than 60°, as shown in the diagram above. Take special care at the time of hoisting to avoid damaging or scratching the cabinets.

The inverter shall always be placed vertically during handling.

⚠ NOTE: As the fan casing will pose interference, remove it before hoisting. Put the fan casing back in place after hoisting is ready.

In addition, the forklift position must be provided for all cabinets for easy handling by forklift.

3.1.2 Storage and installation conditions of high voltage inverter

Improper storage of electric and electronic equipment may compromise and even terminate the service life of the equipment.

Storage environment: no exposure to direct sunshine, dust, corrosive gas, combustible gas, oil mist, steam, and water dripping;

Relative humidity: 5～95%, storage temperature:－40～＋70℃; avoid places where sudden temperature changes may occur to result in condensation and freezing.

Place the equipment on a proper support rather than directly on the ground. Add a proper amount of desiccant in the case of presence of moisture. In the case of long-term storage, the inverter shall be placed in a ventilated environment.

High voltage electrical equipment shall not be stored in open air and shall be protected from rain.

Regular inspection: during the storage period, inspect the storage and package conditions of the equipment on a monthly basis, and pay special attention to mechanical damages as well as to impact of humidity, temperature or fire. In the case that the package is damaged or the equipment is found damaged, please immediately check the damages to the equipment, and then store the repaired equipment as per the above requirements.

The inverter shall be installed indoor with good ventilation. The installation environment shall meet the following requirements:

(1) The ambient temperature shall stay in the range of －10～40℃. Since the service life of the inverter is greatly influenced by the ambient temperature, the ambient temperature shall not go beyond the permissible range. When the ambient temperature exceeds 40℃, the inverter shall be derated by 5% for every increment of 1℃. Also, forced external heat dissipation must be provided.

(2) In areas where the altitude goes beyond 1000m, the thinner air will deteriorate the heat dissipation effect of the inverter. Therefore, the inverter must be derated by 1% for every increment of 100m.

(3) The humidity must be lower than 90% RH, without water condensation.

(4) The inverter must be installed at a place where the vibration is less than 5.9m/s2 (0.6g).

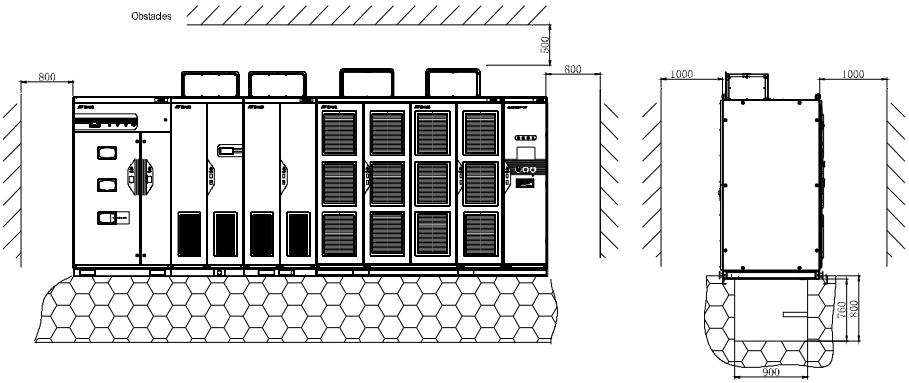
(5) Avoid an installation location with exposure to direct sunlight.

(6) Avoid an installation location with exposure to heavy dust and metal powder.

(7) The inverter must not be installed in a location exposure to corrosive or combustible gases.

(8) The efficiency of the high-voltage inverter is above 96% and all losses can be turned into thermal energy. To reduce the ambient temperature, the user can rely on the centralized ventilation duct to lead hot air outdoor via the centrifugal fan (outdoor pipelines shall be rain resistant). It's advisable that the exhaust volume per 100kW inverter capacity is greater than 1800m3/h, and the configuration of air conditioning per 100kW inverter capacity is greater than 2Hp when air conditioning refrigeration is adopted.

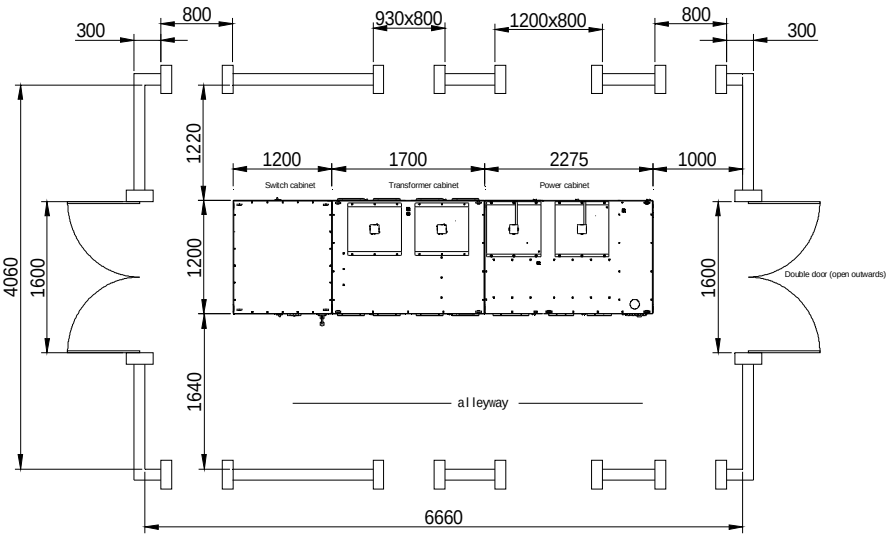
(9) The inverter installation spacing and distance requirements are as shown in the diagram below.



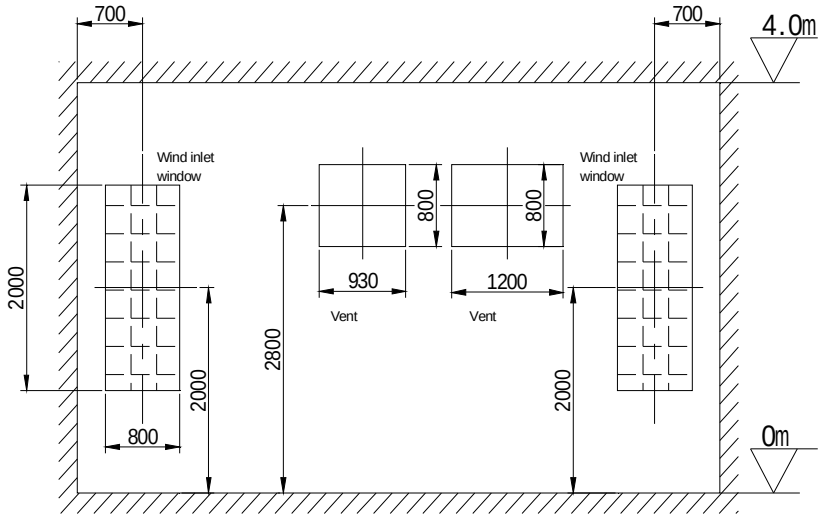
(10) Civil engineering and cabinet installation:

The cabinets of high voltage inverter must be vertically installed on the concrete casting flat steel channel foundation frame, and the overall unevenness of the surface shall be less than 5mm. The foundation must be made of non-combustible materials, smooth and moisture-proof, without worn-out surface, and can withstand the weight of the variable-frequency speed control system. The cable pipelines must be made of non-combustible materials, without worn-out surface, damp-proof and dust proof, and effective measures shall be taken to prevent the entry of animals. All cabinets shall be welded on the base securely and connected with the ground of the facility reliably, and the grounding resistance shall not exceed 0.5Ω. In addition, the welding position shall be rust-proof.

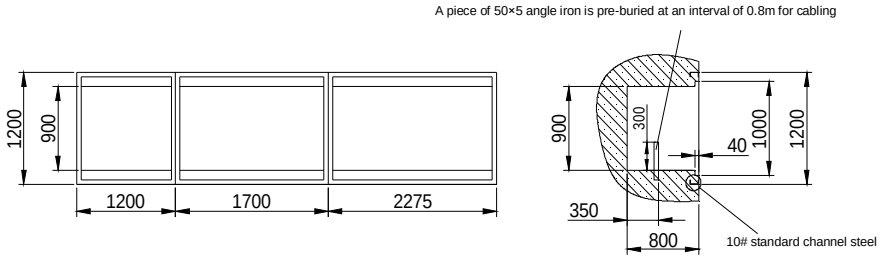
The equipment installation civil engineering layout (e.g. SBH-060-1120):



Civil engineering layout (plane)



Civil engineering layout (elevation view)



Cable channel and channel steel foundation drawing

Reserve one side of the walls as an opening for civil construction of the facility, and build the wall after the inverter is put in place.

NOTE: ■There may be differences by project. The actual project drawings shall apply. The above information is for reference only.

■The installation location shall be kept away from water pipes or other liquid pipes to prevent severe damage to the inverter when such pipes are broken.

3.2 Inverter wiring

DANGER

(1) Inverter wiring shall only be carried out by trained professionals.

(2) The inverter must be grounded reliably; otherwise, electric shock or fire accident may be caused.

(3) Power lines shall not be connected to U, V and W; otherwise, inverter explosion will be caused.

(4) Before power-on, please check whether the rated input voltage of the inverter is consistent with the voltage class of AC power supply. Otherwise, personal casualty and damages to equipment may be caused.

(5) The main circuit terminal must be securely connected to the cold-pressed terminal of the conductor.

(6) The input R, S, T and output U, V, W terminals must be wired in strict phase order.

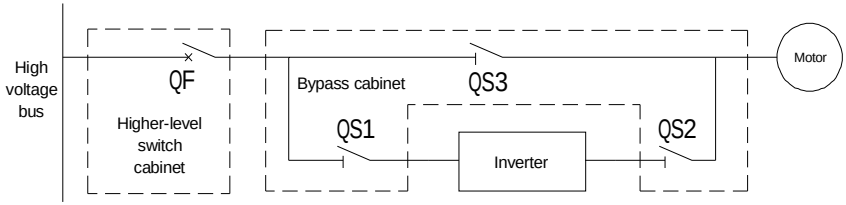
(7) It is strictly forbidden to connect the surge absorbing capacitor to the output of the inverter.

3.2.1 Wiring and configuration of main circuit terminals

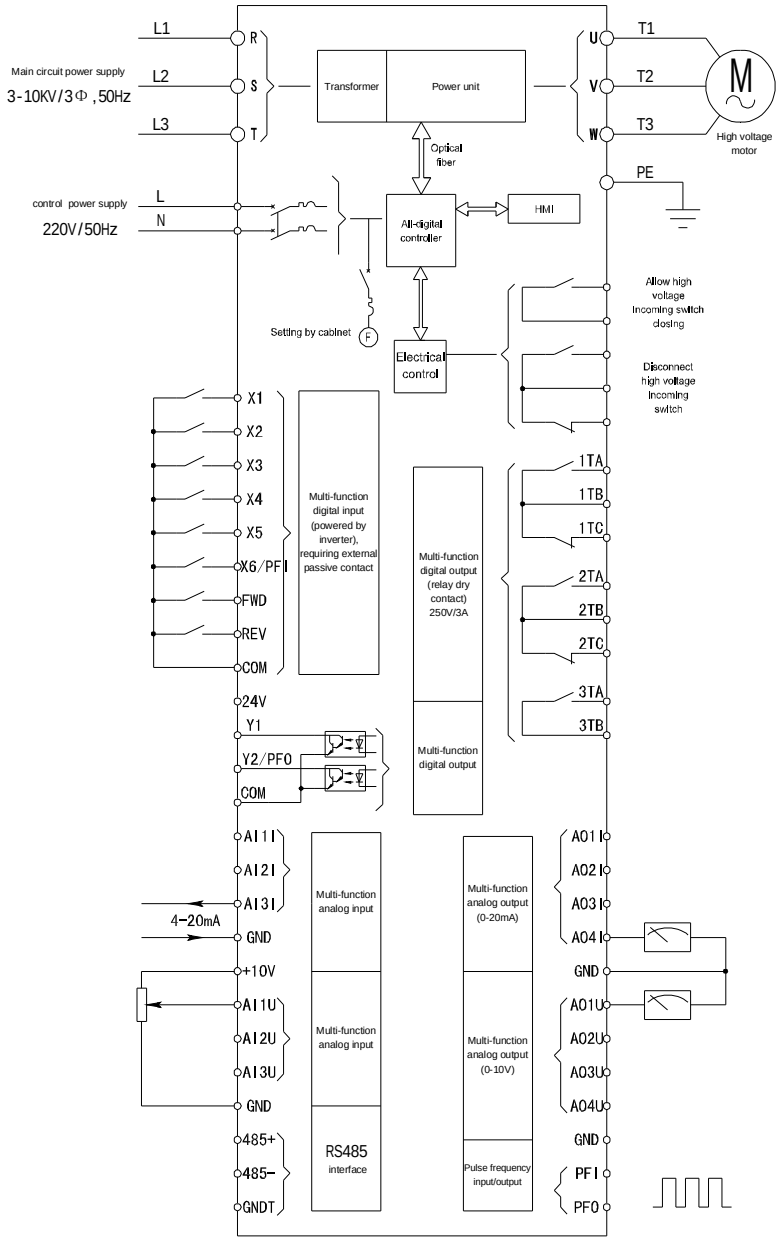
High voltage power supply need to be connected to the high voltage inverter via the main circuit breaker. Only after the high voltage switch-on allowed signal from the inverter is received, can the main circuit breaker be switched on.

The main circuit breaker may be a vacuum or gas insulated circuit breaker. It must feature overcurrent and short circuit protection and be able to withstand the transformer switch-on impact current (about 7 to 8 times the rated current of the inverter).

The typical main circuit diagram:



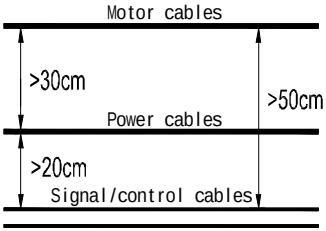
The basic operation wiring is as shown below:

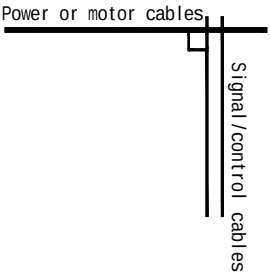


Main circuit terminal function description:

Terminal code	Terminal name	Description
R, S, T	Power input terminal	Connected to the 3-phase power supply
U, V, W	Inverter output terminal	Connected to the 3-phase motor
PE	Earth terminal	The earth terminal on the inverter enclosure must be earthed.

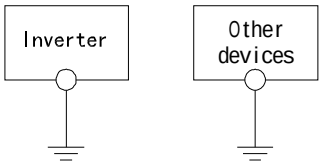
The control cable, power cable and motor cable must be kept apart in order to prevent intercoupling interference. The three types of cable must be spaced at a sufficiently wide distance, especially when they are installed parallel to each other and run for a relatively long distance. Whenever the signal cable has to cross over the power cable, they must be vertical to each other, as shown in the diagram below.



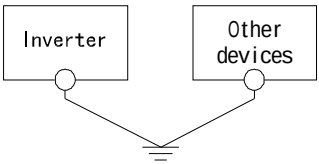


The bigger the length and the cross section of the motor cable, the bigger the capacitance to earth and the interference caused by intercoupling. Therefore, cables of a specified cross section and of an appropriately minimized length are recommended.

The diagram below gives the earthing modes recommended for wiring:

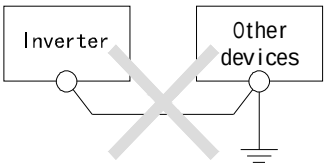


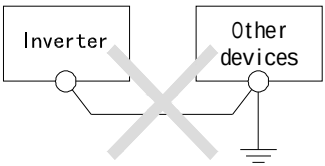
Special ground (best)



Common ground (good)

The following earthing modes are not allowed:





3.2.2 Control terminal and wiring

The user terminal functions of SBH series high voltage inverter are as shown in the table below:

Terminal code	Terminal name	Terminal function and description	Technical specifications
485＋	Positive terminal of 485 differential signal	RS485 communication interface	Connect 1~32 RS485 station(s) Input impedance: >10kΩ
485－	Negative terminal of 485 differential signal		
GNDT	Earth terminal of 485 differential signal	Communication interface earth terminal	GNDT inside is isolated from GND, COM
GND	Ground	Grounding terminal for analog input/output, +10V power supply	GND inside is isolated from COM, GNDT
＋10V	+10V reference power supply	+10V power supply offered to the user	+10V: max output current of 100mA and voltage accuracy above 2%
Y2/PFO	Pulse frequency output	Refer to the description of F6-40 for output function PFO and Y2 terminals for shared use	0-50 kHz, collector open-circuit output Specification: 24V/50mA
X6/PFI	Pulse frequency input	Refer to the description of Parameters F6-37～39. PFI and X6 terminals for shared use	0 ～ 50kHz, input impedance of 1.5kΩ High level: >6V; Low level: <3V Max. input voltage: 30V
AO1I	Multifunctional analog output 1	Function options: Refer to the description of Parameters F6-21, F6-25, F6-29 and F6-33.	Current mode: 0 ～ 20mA; load: ≤500Ω
AO2I	Multifunctional analog output 2		
AO3I	Multifunctional analog output 3		
AO4I	Multifunctional analog output 4		
AO1U	Multifunctional analog output 1		Voltage mode: 0 ～ 10V; output: ≤10mA
AO2U	Multifunctional analog output 2		
AO3U	Multifunctional analog output 3		
AO4U	Multifunctional analog output 4		
AI1I	Analog input 1	Function options: Refer to the description of Parameters F6-00, F6-07 and F6-14. NOTE: I and U of the same analog input shall not be used simultaneously.	Input current range: － 20 ～ ＋ 20mA Input impedance: current input: 250Ω
AI2I	Analog input 2		
AI3I	Analog input 3		
AI1U	Analog input 1		Input voltage range: －10～＋10V Input impedance: voltage input: 110kΩ
AI2U	Analog input 2		
AI3U	Analog input 3		
24V	24V power supply terminal	24V power supply offered to the user	Max. output current: 100mA
X1	Digital input terminal	Refer to the F4 menu for function options and settings X6 and PFI terminals for shared use	Optocoupler isolation One-way input Input impedance: ≥3kΩ Input voltage range: <30V Sampling period: 1ms High level: differential pressure with COM>10V
X2	Digital input terminal X2		
X3	Digital input terminal		
X4	Digital input terminal		
X5	Digital input terminal		

Terminal code	Terminal name	Terminal function and description	Technical specifications
X6/PFI	Digital input terminal X6		Low level: differential pressure with COM<3V
REV	Digital input terminal REV		
FWD	Digital input terminal FWD		
COM	Digital common port	Common ports of X1-X6, FWD, REV, Y1, Y2 and 24V power supply terminals	The inside is isolated from GND, GNDT
Y1	Digital output terminal Y1	Refer to the F5 menu for function options and settings Y2 and PFO terminals for shared use	Optocoupler isolation OC output Specification: 24VDC/50mA
Y2/PFO	Digital output terminal Y2		
1TA	Output terminal of Relay 1	Refer to the F5 menu for function options and settings	TA-TB: Constantly open TB-TC: Constantly closed Contact specification: 250V AC/3A 24V DC/5A
ITB			
ITC			
2TA	Output terminal of Relay 2		
2TB			
2TC			
3TA	Output terminal of Relay 3		
3TB			

NOTE: All terminals shall not be used beyond the scope. **The signal points above are for reference only. The actual project drawings shall apply.**

(1) Wiring of analog input terminal

In a remote operation supported by voltage analog signals, the control cable between the operation device and the inverter shall be less than 30m. As analog signals are very vulnerable to interference, the analog control cables must be separately installed away from the strong current loop, relay loop and contactor loop. The wiring must have a sufficiently short distance and the connecting wires must be STP (shielded twisted pair) with one end connected to the GND terminal of the inverter.

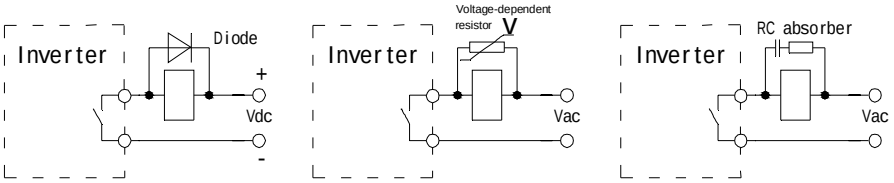
(2) Wiring of multifunctional input terminals X1-X6/PFI, FWD and REV terminals, and multifunctional output terminals Y1, Y2/PFO

The wiring of multifunctional input and output terminals shall be kept from the wiring of analog input, output terminals as well as power lines as far as possible. When shielded wires are used, the shield layer shall be securely earthed. When necessary, signal lines can be enclosed by metal pipes and then connected to the equipment. The metal pipes must be earthed to minimize interference. The wiring of multifunctional input, output terminals shall not exceed 50m in length. When Y1, Y2/PFO drive inductive loads, a freewheeling diode shall be additionally installed.

(3) Wiring of relay output terminals TA, TB and TC

If the inverter is used to drive inductive loads (e.g. electromagnetic relays, contactors and electromagnetic brakes), a surge voltage absorption circuit, pressure-sensitive resistor or freewheeling diode (used for a DC electromagnetic loop; pay attention to polarity in the course of

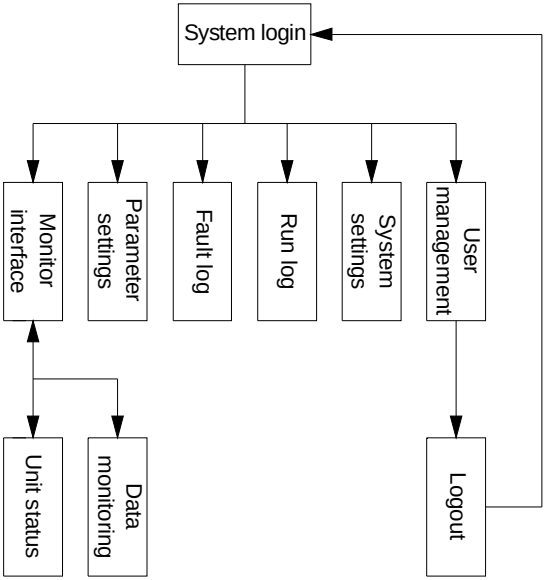
installation) shall be additionally installed. The elements of the absorption circuit must be installed close by (at the two ends of the coil of the relay or the contactor), as shown in the diagram below:



4. Inverter operation

4.1 HMI operation

The block diagram of Senlan's variable frequency high voltage systems:



System login window:

User level: There are three user levels for the touch screen: User, Admin and Master. The default User and Admin passwords are set to 1111 and 2222 respectively.

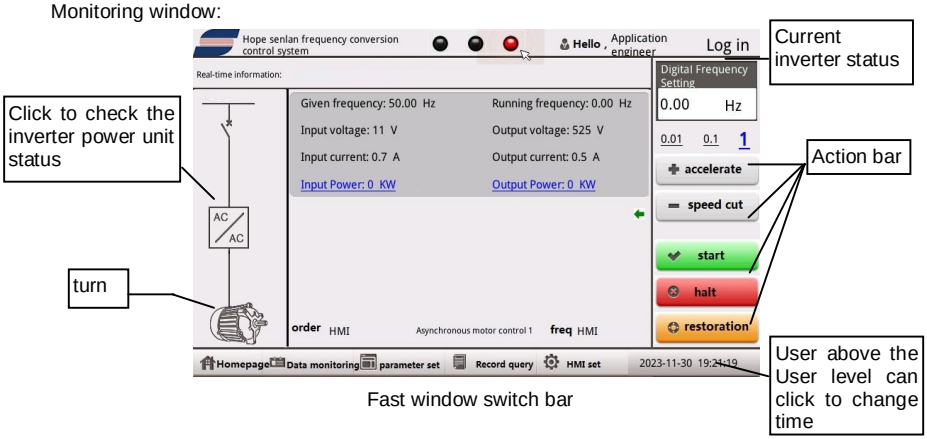
The User level is allowed to perform simple operation, but is not allowed to modify the function parameters of the inverter.

The Admin level is allowed to modify the function parameters of the inverter as well as the password for the User level.

The Master level is allowed to modify the function parameters of the inverter as well as the password for the User level and the Admin level.

For easy login of the User level, the user is allowed to set whether to indicate the "User" button in the "System Settings" window. If the "User" button is not indicated, then the login of the User level requires the user to enter the password.

Monitoring window:



Fast window switch bar

Accel: When the inverter frequency is set via the touch screen, the set inverter frequency can be modified based on the currently selected accel and decel step.

Start: Start the inverter.

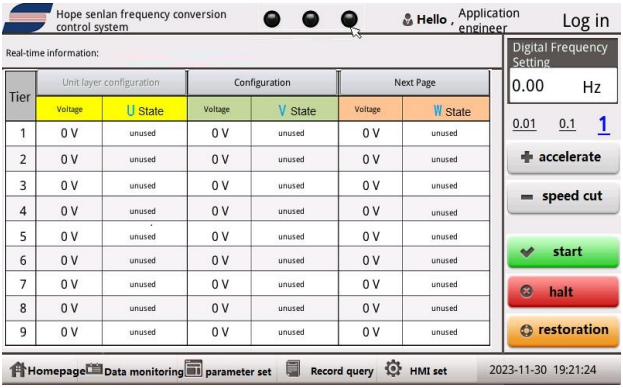
Stop: Stop the running inverter.

Reset: When a fault occurs to the inverter, the Reset button is shown in the position of the Stop button.

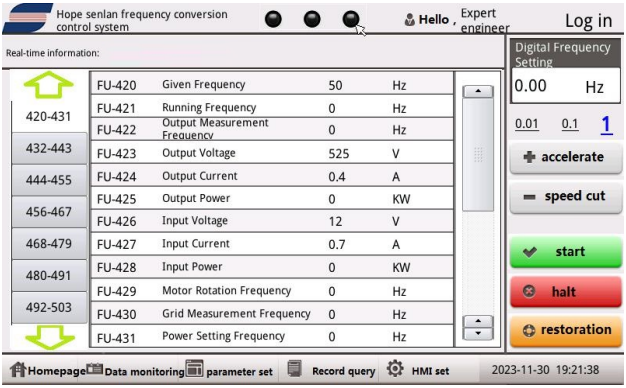
Re-select: re-select the items to be monitored.

NOTE: "Parameter Settings", "System Settings" and "Time" in the fast switching bar of the window can only be modified by the User level and above.

Unit Status Window: The user can observe the real-time unit status and the status of the main control board terminal via the window, and observe the status of other data via the "Data Monitor" button.

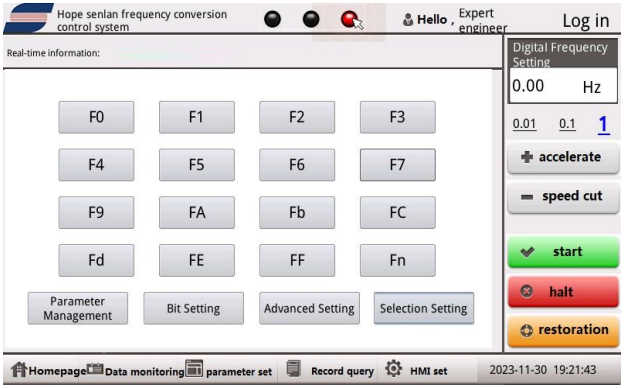


Data Monitor Window: The user is allowed to switch different monitor data via the left-side tags.



Parameter Settings:

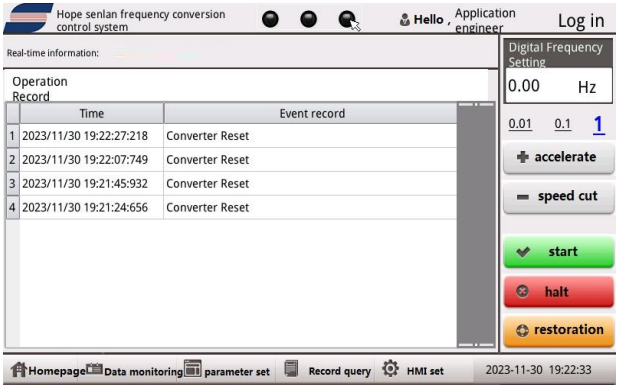
Only the user above the User level is allowed to enter the Parameter Settings window and modify inverter parameters.



After modifying drop-down parameters, click the OK button to save the settings.

Fault Log:

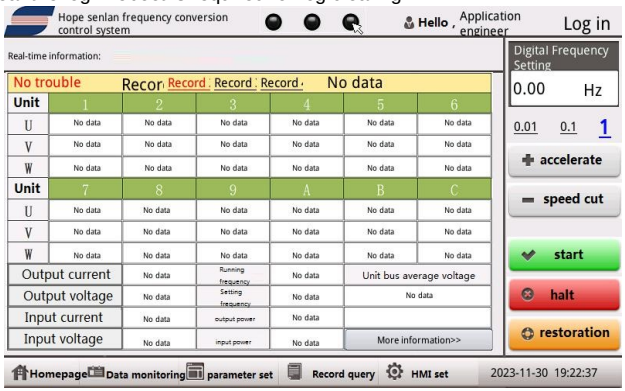
Record the occurrence time and individual run time of last fault, 2nd last fault, 3rd last fault, 4th last fault and 5th last fault, as well as the unit status, working frequency, reference frequency, output current, output voltage, output power, input current, input voltage, DC bus voltage and terminal status at the time of above faults.



The user above the User level is allowed to clear the log.

Run Log:

The inverter fault, running and stopping time is recorded in details. The user above the User level is allowed to clear the log. Reboot is required for log clearing.



System Settings:

The user is allowed to perform the following settings in the System Settings interface:

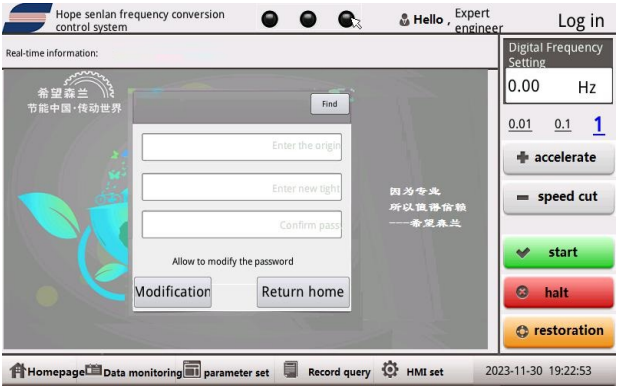
Backlight Time: set the duration of no touch screen operation before the backlight is off;

Date, Time: modify the system time of the touch screen;

Buzzer: After the item is checked, effective touch screen operations will lead to beeps.

Fast User Login: After the item is checked, the User button will be shown in the login window.

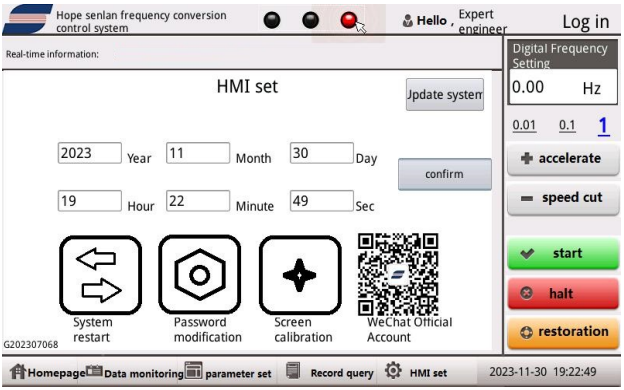
Brightness: adjust the brightness of the touch screen backlight.



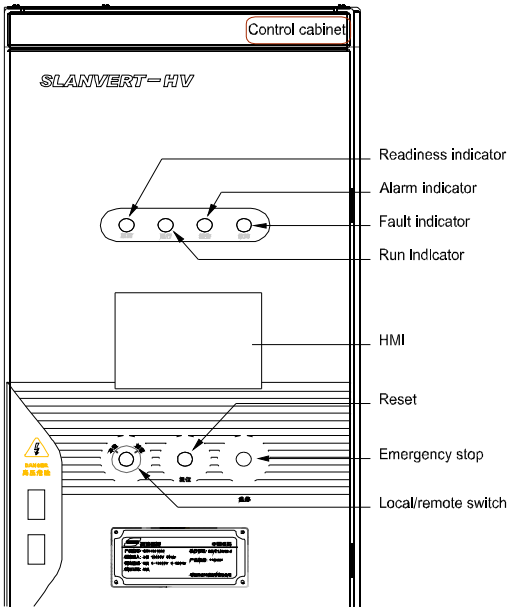
User Management:

In the User Management interface, the user is allowed to modify the password below the current user level and enter the password to switch the current user level.

Logout: After logout, the current user level will be changed into User and the login interface will be shown.



4.2 Introduction to control cabinet



Fault Indicator: indicates whether the variable frequency speed control system is in a fault condition. When a fault occurs, the indicator lights up and a beep is generated.

Alarm Indicator: indicates whether the variable frequency speed control system is in the alarm state. If it's in the alarm state, then the indicator lights up.

Operation Indicator: indicates whether the variable frequency speed control system is in the operation state. If it's running, then the indicator lights up.

Readiness Indicator: indicates whether the variable frequency speed control system is in the standby readiness or normal operation state. When a fault is detected, the indicator goes off.

HMI: The HMI supports parameter setting and viewing, operation control and fault information indication.

Reset: When the inverter detects fault signals, i.e. in the fault state, the fault indicator lights up. Fault reset can be done by entering the reset command (HMI, control terminal, control cabinet reset button or communication command). If the fault still exists, fault indication will still be present.

Emergency Stop: If the button is pressed during inverter operation, the output will be blocked immediately and the motor will stop in a freewheeling mode.

Local/Remote Switch: run the command to switch to the HMI or terminal.

5. List of function parameters

NOTE: In the “Change” column of the table below, “O” indicates the parameter can be changed in either the standby state or the running state, “×” indicates the parameter is only changeable in the running state, while “△” indicates the parameter is read only.

F0: Basic Parameters

No.	Name	Setting range and description	Default	Change	Page
F0-00	Digital reference frequency	0.00Hz~±F0-06 “Max. frequency”	50.00Hz	○	56
F0-01	Main reference channel for normal operation	0: F0-00 digital reference 1: Communication reference 2: UP/DOWN value 3: AI1 4：AI2 5：AI3 6: PFI	3	○	56
F0-02	Run command channel	0: HMI 1: Terminal 2: Communication control	0	×	56
F0-03	Reserved	-	-	-	-
F0-04	Auxiliary reference channel	0: None 1: F0-00 2: UP/DOWN value 3: AI1 4：AI2 5：AI3 6: PFI	0	○	57
F0-05	Auxiliary channel gain	－1.000~1.000	1.000	○	57
F0-06	Max. frequency	F0-07~120.00Hz	50.00Hz	×	57
F0-07	Upper limit frequency	F0-08 “Lower limit frequency”~F0-06 “Max. frequency”	50.00Hz	×	57
F0-08	Lower limit frequency	0.00Hz~F0-07 “Upper limit frequency”	0.00 Hz	×	57
F0-09	Running direction	0: in the same direction 1: in the opposite direction	0	○	57
F0-10	Parameter write-in protection	0: Inapplicable 1: Applicable to all parameters but F0-00 and F7-04 2: Applicable to all parameters	0	○	57
F0-11	Parameter initialization	11: Enabled 22: Enabled (except communication parameters) 33: Fault log clear (FP only)	00	×	57
F0-12	Motor control mode	0: V/F control without PG 1: V/F control with PG 2: Vector control without PG 3: Vector control with PG	0	×	57
F0-13	Power grid frequency setting	40.00~70.00Hz	50.00Hz	×	58

F1: Accel/decel, start, stop and jog parameters

No.	Name	Setting range and description	Default	Change	Page
F1-00	Accel time 1	0.1~3600.0s Accel time: time period over which the frequency rises by 50Hz. Decel time: time period over which the frequency drops by 50Hz.	Depends on model	○	58
F1-01	Decel time 1				58
F1-02	Accel time 2				58
F1-03	Decel time 2				58
F1-04	Accel time 3				58

No.	Name	Setting range and description	Default	Change	Page
F1-05	Decel time 3	NOTE: The factory setting is 50.0s for models of 1120kW and below and 80.0s for models above 1120kW.			58
F1-06	Accel time 4				58
F1-07	Decel time 4				58
F1-08	Accel/decel time auto switching point	0.00~120.00Hz(switched to accel/ 4 below this point)	0.00Hz	×	59
F1-09	Decel time for fast stop	decel time 0.1~3600.0s	100.0s	○	59
F1-10	Starting mode	0: Start from starting frequency 1: Start from starting frequency after DC braking 2: Start from searched speed	0	×	59
F1-11	Starting frequency	0.00~120.00Hz	0.50Hz	○	59
F1-12	Starting frequency duration	0.0~60.0s (only valid for V/F control without PG)	0.0s	○	59
F1-13	Starting delay time	0.0~1000.0s	0.0s	×	59
F1-14	Voltage soft start	0: Disabled; 1: Enabled	1	×	59
F1-15	DC braking time (at start)	0.0~60.0s	0.0s	○	59
F1-16	DC braking current (at start)	0.0~100.0%(rated current of inverter as 100%)	0.0%	○	60
F1-17	Stop mode	0: Slowdown stop 1: Coast stop 2: Slowdown+DC braking 3: Slowdown+holding brake delay	0	○	61
F1-18	DC braking frequency (at stop)	0.00~120.00Hz	0.50Hz	○	61
F1-19	DC braking waiting time (at stop)	0.00~10.00s	0.00s	○	61
F1-20	DC braking time (at stop)	0.0~60.0s, also as the holding brake delay time	0.0s	○	61
F1-21	DC braking current (at stop)	0.0~100.0%; rated current of inverter as 100%	0.0%	○	61
F1-22	Zero-speed delay time	0.0~60.0s	0.0s	○	61
F1-23	Accel/decel mode	0: Linear 1: S-curve	0	×	62
F1-24	S-curve accel start-stage time	0.01~50.00s	0.20s	×	62
F1-25	S-curve accel end-stage time	0.01~50.00s	0.20s	×	62
F1-26	S-curve decel start-stage time	0.01~50.00s	0.20s	×	62
F1-27	S-curve decel end-stage time	0.01~50.00s	0.20s	×	62
F1-28	FWD/REV deadband time	0.0~3600.0s	0.0s	×	63
F1-29	Jog Frequency	0.10~50.00Hz	5.00Hz	○	63
F1-30	Jog accel time	0.1~600.0s	Depends on model	○	63
F1-31	Jog decel time	0.1~600.0s	Depends on model	○	63

F2: V/F control parameters

No.	Name	Setting range and description	Default	Change	Page
F2-00	V/F curve	0: User-defined 1: Linear 2: Reduced-torque V/F curve 1 3: Reduced-torque V/F curve 2 4: Reduced-torque V/F curve 3 5: Reduced-torque V/F curve 4 6: Reduced-torque V/F curve 5	1	×	63
F2-01	Torque boost	0: No boost 1: Manual 2: Auto 3: Maunal+auto	1	×	64
F2-02	Manual torque boost level	0.0%~maximum value depending on the model; minimum unit is 0.1%	Depends on model	○	64
F2-03	Manual torque boost cut-off point	0.0~100.0%; FA-04 as 100%	10.0%	○	64
F2-04	Auto torque boost level	0.0~100.0%	60.0%	×	64
F2-05	Slip compensation gain	0.0~300.0%	0.0%	○	65
F2-06	Slip compensation filtering time	0.1~25.0s	1.0s	×	65
F2-07	Electromotive slip compensation limit	0~250%; rated slip frequency of motor as 100%	200%	×	65
F2-08	Regenerative slip compensation limit	0~250%; rated slip frequency of motor as 100%	200%	×	65
F2-09	Vibration damping	0~200	0	○	65
F2-10	AVR	0: Invalid 1: Always valid 2: Only valid during decel	1	×	65
F2-11	Auto energy-saving operation	0: Invalid 1: Valid	0	○	66
F2-12	Max. output voltage	1600~20000V	Depends on model	×	66
F2-13	V/F frequency F4	F2-15~FA-04	0.00Hz	×	66
F2-14	V/F voltage V4	F2-16~100.0%; F1-12 as 100%	0.0%	×	66
F2-15	V/F frequency F3	F2-17~F2-13	0.00Hz	×	66
F2-16	V/F voltage V3	F2-18~F2-14; F1-12 as 100%	0.0%	×	66
F2-17	V/F frequency F2	F2-19~F2-15	0.00Hz	×	67
F2-18	V/F voltage V2	F2-20~F2-16; F1-12 as 100%	0.0%	×	67
F2-19	V/F frequency F1	0.00Hz~F2-17	0.00Hz	×	67
F2-20	V/F voltage V1	0.0%~F2-18; F1-12 as 100%	0.0%	×	67

F4: Digital input terminals and multistep speed

No.	Name	Setting range and description	Default	Change	Page
F4-00	Functions of digital input terminal X1	0: No signal 1: Multistep frequency 1 2: Multistep frequency 2 3: Multistep frequency 3 4: Multistep frequency 4 5: Multistep frequency 5 6: Multistep frequency 6 7: Multistep frequency 7 8: Multistep frequency 8 9: Accel/decel time 1 10: Accel/decel time 2 11: External fault input (NC) 12: External fault input (NO) 13: Fault reset 14. Jog forward 15. Jog reverse 16. Fast stop (OFF3)	1	×	67
F4-01	Functions of digital input terminal X2		2		
F4-02	Functions of digital input terminal X3		3		

No.	Name	Setting range and description	Default	Change	Page
F4-03	Functions of digital input terminal X4	17. Inverter run disabled 18: Coast stop 19: UP/DOWN increase 20: UP/DOWN decrease 21: UP/DOWN clear 22: PLC control disabled 23: PLC operation pause 24: PLC standby state reset 25: PLC mode 1 26: Analog input disconnection forced frequency terminated 27: Auxiliary reference channel disabled 28: External alarm input 29: Reserved 30: Process PID disabled 31: PID Parameter 2 32: PID sleep disabled 33: Multi-PID select 1 34: Multi-PID select 2 35: Multi-PID select 3 36: Accel/decel disabled 37: 3-wire stop command 38: Internal virtual FWD terminal 39: Internal virtual REV terminal 40: Run command channel switching 41: Reference frequency switched to AI1 42: Analog reference frequency hold 43: Motor thermal protection input 44: Reference frequency channel switching 45: Reserved 46: Reserved 47: Reserved 48: Motor overspeed input 49: Reserved NOTE: When F4-05 is not 0, PFI is automatically invalid.	41		
F4-04	Functions of digital input terminal X5		13		
F4-05	Functions of digital input terminal X6		4		
F4-06	Functions of FWD Terminal		38		
F4-07	Functions of REV Terminal		39		
F4-08	FWD/REV run mode	0: 1-wire mode (start/stop) 1: 2-wire mode 1 (FWD, REV) 2: 2-wire mode 2 (start/stop, direction) 3: 2-wire mode 3 (start, stop) 4: 3-wire mode 1 (FWD, REV, stop) 5: 3-wore mode 2 (run, direction, stop) 6: 2-wire mode 4 (start/stop)	3	×	70
F4-09	Input terminal logic (positive & negative)	REV/ FWD/ X6~X1	0	×	72
F4-10	Digital input terminal anti-jittering time	0~2000ms	10ms	○	72
F4-11	UP/DOWN value	0: Level type (terminal) 1: Pulse type (terminal)	0	○	72
F4-12	UP/DOWN speed/step	0.01~100.00; unit: %/s or %	1.00	○	72
F4-13	UP/DOWN memory	0: Stored on power loss 1: Cleared on power loss 2: Cleared at stop and on power loss	0	○	72
F4-14	UP/DOWN upper limit	F4-15~100.0%	100.0%	○	72
F4-15	UP/DOWN lower limit	－100.0%~F4-14	0.0%	○	72
F4-16	Multi-speed select mode	0: Binary code 1: Direct select 2: Sum 3: Number	0	×	73
F4-17 ～ F4-48	Multistep frequencies 1~32	－60.00~120.00Hz The default values of multistep frequencies 1~32 are their respective frequency codes, for example, the default value of the multistep frequency 3 is 3.00Hz. Negative means reverse.	n.00Hz (n=1~32)	○	73

The parameters for multistep frequencies 1~32 are as shown below.

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Multi-step frequency n	F4-17	F4-18	F4-19	F4-20	F4-21	F4-22	F4-23	F4-24	F4-25	F4-26	F4-27	F4-28	F4-29	F4-30	F4-31	F4-32
n	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Multi-step frequency n	F4-33	F4-34	F4-35	F4-36	F4-37	F4-38	F4-39	F4-40	F4-41	F4-42	F4-43	F4-44	F4-45	F4-46	F4-47	F4-48

F5: Digital and relay outputs

No.	Name	Setting range and description	Default	Change	Page
F5-00	Functions of digital output terminal Y1	0: Inverter ready for operation 1: Inverter running 2: Reverse running 3: Forward running 4: Frequency reach 5: Frequency detection signal 1 6: Frequency detection signal 2 7: Fault output 8: Holding brake signal 9: Motor load overweight 10: Motor overload 11: Undervoltage lockout 12: External fault trip 13: Reserved 14: Restart after momentary power failure 15: Alarm output 16: Stopping 17: In-operation same layer bypass indication 18: Torque limit 19: Frequency upper limit 20: Frequency lower limit 21: Running in generating 22: Emergency stop 23: Phase locking finished 24: PLC operation 25: PLC operation pause 26: PLC stage finished 27: PLC cycle finished 28: PLC mode 0 indication 29: PLC mode 1 indication 30: Process PID in sleep 31: Power frequency bypass 32: Cabinet not closed indication 33: Fan fault indication 34: Local control indication 35: Terminal control indication 36: Communication control indication 37: Reserved 38: Reserved 39: High voltage indication 40: Reserved 41: Channel A of encoder 42: Channel B of encoder 43: Virtual revolution-counting pulse 44: Overspeed fault 45: Fan life reach 46: Status of circuit breaker KM1 47: Status of circuit breaker KM2 48: Status of circuit breaker KM3 49: Status of circuit breaker KM4 50: Status of circuit breaker KM5 51: Status of circuit breaker KM6 52: PID feedback below lower limit 53: PID feedback above upper limit	1		74
F5-01	Functions of digital output terminal Y2		2	×	
F5-02	Output functions of relay T1		33		
F5-03	Output functions of relay T2		32	×	
F5-04	Output functions of relay T3		31	×	
F5-05	Y terminal output logic (positive & negative)	bit1：Y2 bit0：Y1	00	×	77
F5-06	Frequency reach detection band	0.00～120.00Hz	2.50Hz	○	77
F5-07	Frequency reach detection level 1	0.00～120.00Hz	50.00Hz	○	77
F5-08	Frequency reach detection hysteresis 1	0.00～120.00Hz	1.00Hz	○	77
F5-09	Frequency reach detection level 2	0.00～120.00Hz	25.00Hz	○	77
F5-10	Frequency reach detection hysteresis 2	0.00～120.00Hz	1.00Hz	○	77
F5-11	Y1 terminal closing delay	0.00～650.00s	0.00s	○	78
F5-12	Y1 terminal opening delay		0.00s		
F5-13	Y2 terminal closing delay		0.00s		
F5-14	Y2 terminal opening delay		0.00s		
F5-15	T1 terminal closing delay	0.00～650.00s	0.00s	○	78
F5-16	T1 terminal opening delay		0.00s		

No.	Name	Setting range and description	Default	Change	Page
F5-17	T2 terminal closing delay	0.00～650.00s	0.00s	○	78
F5-18	T2 terminal opening delay		0.00s		
F5-19	T3 terminal closing delay	0.00～650.00s	0.00s	○	78
F5-20	T3 terminal opening delay		0.00s		
F5-21	Alarm output select 1	0～65535	65535	○	78
F5-22	Alarm output select 2	0～65535	65535	○	78

F6: Analog and pulse frequency terminals

No.	Name	Setting range and description	Default	Change	Page
F6-00	AI1 input type	0: 0~10V or 0~20mA, corresponding to 0~100% 1: 10~0V or 20~0mA, corresponding to 0~100% 2: 2~10V or 4~20mA, corresponding to 0~100% 3: 10~2V or 20~4mA, corresponding to 0~100% 4: -10~10V or -20~20mA, corresponding to -100-100% 5: 10~-10V or 20~-20mA, corresponding to -100-100% 6: 0~10V or 0~20mA, corresponding to -100~100% 7: 10~0V or 20~0mA, corresponding to -100~100%	2	○	78
F6-01	AI1 gain	0.0～1000.0%	100.0%	○	79
F6-02	AI1 bias	-100.00~100.00%; 10V or 20mA as 100%	0.00%	○	79
F6-03	AI1 filtering time	0.000～10.000s	0.100s	○	79
F6-04	AI1 zero-point threshold	0.00～50.00%	1.00%	○	79
F6-05	AI1 zero-point hysteresis error	0.00～50.00%	0.00%	○	79
F6-06	AI1 disconnection threshold	0.00~20.00%; 10V or 20mA as 100% NOTE: For 2～10V or 4～20mA and 10～2V or 20～4mA, the internal disconnection threshold is fixed at 10%; For －10～10V or －20～20mA and 10～－10V or 20 ～ － 20mA, the disconnection detection is not performed.	0.00%	○	79
F6-07	AI2 input type	Same as F6-00 AI1 input type	2	○	79
F6-08	AI2 gain	0.0～1000.0%	100.0%	○	79
F6-09	AI2 bias	－100.00～100.00%	0.00%	○	79
F6-10	AI2 filtering time	0.000～10.000s	0.100s	○	79
F6-11	AI2 zero-point threshold	0.00～50.00%	1.00%	○	79
F6-12	AI2 zero-point hysteresis error	0.00～50.00%	0.00%	○	79
F6-13	AI2 disconnection threshold	0.00～20.00%	0.00%	○	79
F6-14	AI3 input type	Same as F6-00 AI1 input type	2	○	79
F6-15	AI3 gain	0.0～1000.0%	100.0%	○	79
F6-16	AI3 bias	－100.00～100.00%	0.00%	○	79
F6-17	AI3 filtering time	0.000～10.000s	0.100s	○	79
F6-18	AI3 zero-point threshold	0.00～50.00%	1.00%	○	79

No.	Name	Setting range and description	Default	Change	Page
F6-19	AI3 zero-point hysteresis error	0.00～50.00%	0.00%	○	79
F6-20	AI3 disconnection threshold	0.00～20.00%	0.00%	○	79
F6-21	AO1 function	Select to use FU parameters	0	○	81
F6-22	AO1 type	0: 0～10V or 0～20mA 1: 2～10V or 4～20mA 2: 5V or 10mA at the center	1	○	81
F6-23	AO1 gain	0.0～1000.0%	100.0%	○	81
F6-24	AO1 bias	-100.00~100.00%; 10V or 20mA as 100%	0.00%	○	81
F6-25	AO2 function	Same as F6-21 AO1 function	19	○	81
F6-26	AO2 type	Same as F6-22 AO1 type	1	○	81
F6-27	AO2 gain	0.0～1000.0%	100.0%	○	81
F6-28	AO2 bias	-100.00~100.00%; 10V or 20mA as 100%	0.00%	○	81
F6-29	AO3 function	Same as F6-21 AO1 function	0	○	82
F6-30	AO3 type	Same as F6-22 AO1 type	1	○	82
F6-31	AO3 gain	0.0～1000.0%	100.0%	○	82
F6-32	AO3 bias	-100.00~100.00%; 10V or 20mA as 100%	0.00%	○	82
F6-33	AO4 function	Same as F6-21 AO1 function	0	○	82
F6-34	AO4 type	Same as F6-22 AO1 type	1	○	82
F6-35	AO4 gain	0.0～1000.0%	100.0%	○	82
F6-36	AO4 bias	-100.00~100.00%; 10V or 20mA as 100%	0.00%	○	82
F6-37	PFI frequency corresponding to 100%	0～50000Hz; When F4-05=0, PFI is valid.	10000Hz	○	82
F6-38	PFI frequency corresponding to 0%	0～50000Hz	0Hz	○	82
F6-39	PFI filtering time	0.000～10.000s	0.100s	○	82
F6-40	PFO function	Same as F6-21 AO1 function, shared with Y2	0	○	83
F6-41	PFO output pulse modulation method	0: Frequency modulation 1: Duty ratio modulation 2: Y2 is applicable	0	○	83
F6-42	PFO frequency corresponding to 100%	0～50000Hz; also as the duty-ratio modulation frequency	10000Hz	○	83
F6-43	PFO frequency corresponding to 0%	0～50000Hz	0Hz	○	83
F6-44	PFO duty ratio corresponding to 100%	0.0～100.0%	100.0%	○	83
F6-45	PFO duty ratio corresponding to 0%	0.0～100.0%	0.0%	○	83
F6-46	Constant current output	0.0～20.0mA	1.6mA	○	83

F7: Process PID parameters

No.	Name	Setting range and description	Default	Change	Page
F7-00	PID control function	0: PID control disabled 1: PID control enabled 2: PID corrects reference frequency prior to accel/decel 3: PID corrects reference frequency after accel/decel	0	×	84

No.	Name	Setting range and description	Default	Change	Page
F7-01	PID reference channel	0: F7-04 1: UP/DOWN value 2：AI1　3：AI2　4：AI3　5：PFI 6: PC analog 1 7: PC analog 2	0	×	84
F7-02	PID feedback channel	0：AI1　1：AI2　2：AI3　3：PFI 4：AI1－AI2　5：AI1＋AI2 6：$\sqrt{\lvert AI1\rvert}$　7：$\sqrt{\lvert AI2\rvert}$ 8：$\sqrt{\lvert AI1-AI2\rvert}$　9：$\sqrt{\lvert AI1\rvert}+\sqrt{\lvert AI2\rvert}$ 10: PC analog 1 11: PC analog 2	0	×	84
F7-03	PID display coefficient	0.010～10.000, affecting the monitoring menu only	1.000	○	84
F7-04	PID digital reference	－100.00～100.00%	0.00%	○	84
F7-05	Proportional gain 1	0.00～100.00	0.20	○	85
F7-06	Integral time 1	0.01～100.00s	20.00s	○	85
F7-07	Differential time 1	0.00～10.00s	0.00s	○	85
F7-08	Proportional gain 2	0.00～100.00	0.20	○	85
F7-09	Integral time 2	0.01～100.00s	20.00s	○	85
F7-10	Differential time 2	0.00～10.00s	0.00s	○	85
F7-11	PID parameter switching	0: By digital input 31 "PID parameter 2" 1: According to operating frequency 2: PC analog 1 3: PC analog 2	0	×	85
F7-12	Sampling period	0.001～10.000s	0.010s	○	86
F7-13	Error limit	0.00～20.00%; PID setpoint as 100%	0.00%	○	86
F7-14	Setpoint up/down time	0.00～20.00s	0.00s	○	86
F7-15	PID regulation characteristic	0: Positive 1: Negative	0	×	86
F7-16	Integral regulation	0: Disabled 1: Enabled	1	×	87
F7-17	PID upper limit	F7-18 “PID lower limit”～100.00%	100.00%	○	87
F7-18	PID lower limit	－100.00%～F7-17 "PID upper limit"	0.00%	○	87
F7-19	PID differential limit	0.0～100.0%; limits the max. and min. value of differential component	5.00%	○	87
F7-20	PID preset	F7-18～F7-17	0.00%	○	87
F7-21	PID preset holding time	0.0～3600.0s	0.0s	×	87
F7-22 ～ F7-28	Multi-PID setpoint 1 ～ Multi-PID setpoint 7	－100.00～100.00%	1.00% ～ 7.00%	○	87
F7-29	Sleep frequency	0.00～120.	40.00Hz	○	88
F7-30	Sleep latency	00Hz 0.0～	60.0s	○	88
F7-31	Wakeup deviation	0.00～100.00%; NOTE: When it's 100.00%, the sleep function is not applicable.	100.00%	○	88
F7-32	Wakeup delay time	0.000～60.000s	0.500s	○	88
F7-33	PID feedback upper limit detection point	F7-34 "PID feedback lower limit detection point" ～100.00%	100.00%	○	89
F7-34	PID feedback lower limit detection point	－100.00%～F7-33 “PID feedback upper limit detection point”	0.00%	○	89
F7-35	PID feedback overrun detection hysteresis	0.00～50.00%	5.00%	○	89
F7-36	PID feedback overrun detection time	0.0～600.0s	10.0s	○	89

No.	Name	Setting range and description	Default	Change	Page
F7-37	PID feedback overrun action	0: No action 1: Alarm 2: Coast to a stop due to fault	0	○	89

F8: Simple PLC

No.	Name	Setting range and description	Default	Change	Page
F8-00	PLC operation mode	0: PLC operation disabled 1: N cycles (n set by F8-06) + stop 2: N cycles + final stage speed (n set by F8-06) 3: Continuous cycle	0	×	90
F8-01	PLC restart mode	0: Restart from the first stage 1: Restart from the frequency of the interrupted stage 2: Restart from the operating frequency at the moment of interruption	0	×	90
F8-02	PLC saving on power loss	0: Don't save 1: Save	0	×	90
F8-03	Unit of time for each stage	0: Second 1: Minute	0	×	90
F8-04	PLC mode/stage number	0: 1×32, 1 mode, 32 stages 1: 2×16, 2 modes, 16 stages for each	0	×	90
F8-05	PLC operation mode	0: Terminal select 1: Mode 0 2: Mode 1	0	×	90
F8-06	PLC cycle number	1～65535	1	×	90
F8-07 ～ F8-69	Stage 1～32 setting Accel/decel time	0: Accel/decel time 1: Accel/decel time 2 2: Accel/decel time 3: Accel/decel time 4	0	○	91
F8-08 ～ F8-70	Stage 1~32 time	0.0～6,500.0 (in second or minute) The unit is set by F8-03 "Unit of time for each stage"	0.0	○	91

FA: Motor parameters

No.	Name	Setting range and description	Default	Change	Page
FA-01	Rated power of motor	110～50000kW	Depends on model	×	94
FA-02	Number of poles	2～48	4	×	94
FA-03	Rated current of motor	0.5～1200.0A	Depends on model	×	94
FA-04	Rated frequency of motor	1.00～120.00Hz	50.00Hz	×	94
FA-05	Rated speed of motor	125～40000r/min	Depends on model	×	94
FA-06	Rated voltage of motor	380～20000V	Depends on model	×	94
FA-07	No-load current of motor	0.1A~FA-03 “Rated current of motor”	Depends on model	×	94

Fb: Protection functions and advanced inverter settings

No.	Name	Setting range and description	Default	Change	Page
Fb-00	Motor cooling condition	0: Common motor 1: Inverter-controlled motor or common motor with separate cooling fan	0	○	94
Fb-01	Motor overload protection level	50.0~150.0%, rated current of motor as 100%	110.0%	○	94

No.	Name	Setting range and description	Default	Change	Page
Fb-02	Motor overload action	0: No action 1: Alarm 2: Coast to a stop due to fault	1	×	94
Fb-03	Motor load overweight detection	0: Always detect 1: Detect only in constant-speed operation	0	×	95
Fb-04	Motor load overweight detection level	20.0~200.0%, rated current of motor as 100%	130.0%	×	95
Fb-05	Motor load overweight detection time	0.0～30.0s	5.0s	×	95
Fb-06	Motor load overweight action	0: No action 1: Alarm 2: Coast to a stop due to fault	2	×	95
Fb-07	Motor temperature sensor type	0：1×Pt100 1：2×Pt100 2：3×Pt100 3：1×PTC 4：2×PTC 5：3×PTC	0	×	95
Fb-08	Motor overheating protection input source	0: Digit input 43 "Motor thermal protection input" 1：AI1 2：AI2 3：AI3	0	×	95
Fb-09	Motor overheating protection alarm point	40.0~200.0℃; when Fb-07 is set to Pt100, the unit will be 0.1℃; when PTC is selected, the unit will be 1Ω.	90.0℃	×	95
Fb-10	Motor overheating protection fault point		110.0℃	×	95
Fb-11	Motor overheating action	0: No action 1: Alarm 2: Coast to a stop due to fault	0	×	96
Fb-12	Inverter underload protection	0: No action 1: Alarm 2: Coast to a stop due to fault	0	×	96
Fb-13	Inverter underload protection level	0.0～100.0%; rated inverter current as 100%	30.0%	×	96
Fb-14	Underload protection detection time	0.0～100.0s	1.0s	×	96
Fb-16	High voltage disconnect on fault	0: No action 1. High voltage disconnect	1	×	96
Fb-17	Cabinet cover protection enable when high voltage is present	0: Alarm 1: Coast to a stop due to fault + alarm	0	×	96
Fb-18	Frequency bypass action on fault	0: Manual 1: Auto	0	×	96
Fb-19	Allowed number of unit bypass levels	0: Unit bypass disabled 1~3: 1~3 level(s)	1	×	96
Fb-20	Analog input disconnection action	0: No action 1: Alarm; run at the average frequency within 10s before disconnection 2: Alarm; run at F0-00 3: Coast to a stop due to fault	1	×	97
Fb-21	Operating frequency below lower limit action	0: Run at the lower frequency limit 1: Coast stop after running at the lower frequency limit for a period of time	0	×	97
Fb-22	Lower frequency limit running time	0.0～6000.0s	10.0s	○	97
Fb-23	Grid overvoltage detection point	3300～14300V	Depends on model	×	97
Fb-25	Inverter input phase loss protection	0: No action 1: Alarm 2: Coast to a stop due to fault	1	×	97
Fb-26	Inverter output phase loss protection	0: No action 1: Alarm 2: Coast to a stop due to fault	2	×	97
Fb-27	HMI communication failure action	0: No action 1: Alarm 2: Coast to a stop due to fault	1	×	98

No.	Name	Setting range and description	Default	Change	Page
Fb-28	Analog input disconnection detection enable	0: Disabled 1: Enabled bit0：AI1 bit1：AI2 bit2：AI3	111	×	98
Fb-29	Motor overspeed action	o action 1: Alarm 2: Coast to a stop due to fault	1	×	98
Fb-30	Motor overspeed detection level	0.0-120.0%, rated frequency of motor as 100%	110.0%	×	98
Fb-31	Motor overspeed detection time	0.0～2.0s	0.1s	×	98
Fb-32	Accel overcurrent stall prevention	0: Invalid; 1: Valid; time limit of 1min; 2: Valid, no time limit	1	×	98
Fb-33	Accel overcurrent stall point	10.0～150.0%; rated current of inverter as 100%	115.0%	×	98
Fb-34	Constant-speed overcurrent stall prevention	0: Invalid; 1: Valid; time limit of 1min; 2: Valid, no time limit	1	×	98
Fb-35	Constant-speed overcurrent stall point	10.0～150.0%; rated current of inverter as 100%	115.0%	×	98
Fb-36	Overvoltage stall prevention	0: Invalid 1: Valid	1	×	98
Fb-38	Input power supply power-off action	0: Coast to a stop and report the undervoltage fault 1: Coast to a stop, and restart if the voltage resumes within the time set	0	×	99
Fb-40	Allowable time for momentary power failure	0.0～30.0s	3.0s	×	99
Fb-43	Auto reset times	0～10; auto reset is not available for module protection and external fault	0	×	99
Fb-44	Auto reset interval	1.0～30.0s	5.0s	×	99
Fb-45	Fault output during auto reset	0: No output 1: Output	0	×	100
Fb-46	Restart after momentary stop	0: Startup in the startup mode 1: Tracking startup	1	×	100
Fb-48	Modulation mode	0: Discontinuous modulation 1: Continuous modulation	1	○	100
Fb-49	Carrier frequency	500～2000Hz	600	×	100
Fb-52	Overmodulation	0: Disabled 1: Enabled	1	×	100
Fb-53	Cooling fan control	0: Standby time delay disable 1: Constant operation	0	○	101
Fb-54	Jump frequency 1	0.00～120.00Hz	0.00Hz	○	101
Fb-55	Jumping width 1	0.00～20.00Hz	0.00Hz	○	101
Fb-56	Jump frequency 2	0.00～120.00Hz	0.00Hz	○	101
Fb-57	Jumping width 2	0.00～20.00Hz	0.00Hz	○	101
Fb-58	Jump frequency 3	0.00～120.00Hz	0.00Hz	○	101
Fb-59	Jumping width 3	0.00～20.00Hz	0.00Hz	○	101
Fb-60	Grounding protection action	0: No action 1: Alarm 2: Coast to a stop due to fault	2	×	101

Fd: Expansion options and functions

No.	Name	Setting range and description	Default	Change	Page
Fd-00	PG pulse number per revolution	1～8192	1024	×	101
Fd-01	PG type	0: Quadrature encoder 1: Single-channel encoder	0	×	101
Fd-02	PG direction	0: Positive 1: Negative	0	×	102
Fd-03	PG disconnection action	0: No action 1: Alarm 2: Coast to a stop due to fault	2	×	102
Fd-04	PG disconnection detection time	0.1～10.0s	1.0s	×	102
Fd-05	PG speed ratio denominator	1～1000	1	×	102
Fd-06	PG speed ratio numerator	1～1000	1	×	102
Fd-07	PG speed test filtering time	0.000～2.000s	0.005s	○	102
Fd-08	Fan life expectancy	1～65000h	40000 h	○	103

FF: Communication parameters

No.	Name	Setting range and description	Default	Change	Page
FF-00	Communication protocol	0：Modbus-RTU 1：Profibus-DP	0	×	103
FF-01	Communication data format	0：8,N,1 1：8,E,1 2：8,O,1 3：8,N,2	0	×	103
FF-02	Baud rate	0：1200bps 1：2400bps 2：4800bps 3：9600bps 4：19200bps 5：38400bps	3	×	103
FF-03	Local address	0～247	1	×	103
FF-04	Communication overtime detection time	0.1～600.0s	10.0s	○	103
FF-05	Local response delay	0～1000ms	5ms	○	103
FF-06	Communication overtime action	0: No action 1: Alarm; run at the current setting 2: Alarm; run at F0-00 3: Coast to a stop due to fault	0	×	103
FF-07	Communication reference magnification	0.001～30.000	1.000	○	103
FF-08	Profibus data type	0～4：PPO1～PPO5	4	×	103
FF-09	Actual value	Select the contents in the FU menu for output	0	○	104
FF-10	Process word 1	Select the contents in the FU menu for output	39	○	104
FF-11	Process word 2		21	○	104
FF-12	Process word 3		32	○	104
FF-13	Process word 4		19	○	104
FF-14	Process word 5		40	○	104
FF-15	Process word 6		30	○	104
FF-16	Process word 7		2	○	104
FF-17	Process word 8		4	○	104

FP: Fault log

No.	Name	Description	Page
FP-00	Type of last fault	0: No fault 1: Momentary overcurrent at start 2: Overcurrent in accel 3: Overcurrent in decel 4: Overcurrent in constant-speed run 5: Overvoltage in accel 6: Overvoltage in decel 7: Overvoltage in constant-speed run 8: Overvoltage in standby state 9: Undervoltage in run 10: Input phase loss 11: Inverter overheating 12: Inverter overload 13: Motor overload 14: Motor overheating 15: External fault 16: Motor load overweight 17: Inverter underload 18: Input voltage detection fault 19: Output voltage detection fault 20: Input current detection fault 21: Output current detection fault 22: Feeder circuit breaker abnormality 23: Charging circuit breaker abnormality 24: Bypass circuit breaker abnormality 25: Output circuit breaker abnormality 26: Phase-shifting transformer overheating 27: Reserved 28: Parameter saving failed 29: Communication abnormality 30: Analog input disconnection 31: Cabinet overheating fault 32: Cabinet cover interlock switch not in place 33: Abnormal stop fault 34: Controller communication fault 35: HMI communication fault 36: Power-on failure for unclosed cabinet cover 37: Grid overvoltage fault 38: Output ground fault 39: Charge fault (beyond the expected time) 40: Motor overspeed fault 41: Motor temperature detection open circuit and short circuit 42: PG disconnection 43: Power unit fault 44: Unit bypass contactor fault 45: Input phase loss fault 46: Fan contactor fault 47: PID feedback above upper limit fault 48: PID feedback below lower limit fault 49: Reserved 50: Reserved 51: Reserved 52: Reserved 53：IO1 54：IO2 55: Emergency stop	110
FP-01	Last fault time (month day year)	Year: bits 9-15; Month: bits 5-8; Day: bits 0-4 Year + 2000 = the current year	110
FP-02	Last fault time (hour minute second)	Hour: bits 11-15; minute: bits 5-10; second: bits 0-4 Second x 2 = the current second value	110
FP-03	Operating frequency at last fault	Min. unit: ±0.01Hz	110
FP-04	Reference frequency at last fault	Min. unit: ±0.01Hz	111
FP-05	Output current at Last Fault	Min. unit: 0.1A	111
FP-06	Output voltage at last fault	Min. unit: 1V	111
FP-07	Output power at last fault	Min. unit: 1kW	111
FP-08	Input current at last fault	Min. unit: 0.1A	111
FP-09	Input voltage at last fault	Min. unit: 1V	111
FP-10	DC busbar voltage at last fault	Min. unit: 1V	111
FP-11	Terminal status at last fault	T3-T1, Y2, Y1, REV, FWD, X6 ~ X1 are arranged bit by bit	111
FP-12	Unit U4U3U2U1 state at last fault	U1 state: bits 0-3 U2 state: bits 4-7 U3 state: bits 8-11 U4 state: bits 12-15	111

No.	Name	Description	Page
FP-13	Unit U8U7U6U5 state at last fault	U5 state: bits 0-3 U6 state: bits 4-7 U7 state: bits 8-11 U8 state: bits 12-15	111
FP-14	Unit V4V3V2V1 state at last fault	V1 state: bits 0-3 V2 state: bits 4-7 V3 state: bits 8-11 V4 state: bits 12-15	112
FP-15	Unit V8V7V6V5 state at last fault	V5 state: bits 0-3 V6 state: bits 4-7 V7 state: bits 8-11 V8 state: bits 12-15	112
FP-16	Unit W4W3W2W1 state at last fault	W1 state: bits 0-3 W2 state: bits 4-7 W3 state: bits 8-11 W4 state: bits 12-15	112
FP-17	Unit W8W7W6W5 state at last fault	W5 state: bits 0-3 W6 state: bits 4-7 W7 state: bits 8-11 W8 state: bits 12-15	112
FP-18	System and unit W9V9U9 state at last fault	U9 state: bits 0-3 V9 state: bits 4-7 W9 state: bits 8-11 System state: bits 12-15	112
FP-19	Single-time run time at last fault	Min. unit: 0.1h	112
FP-20	Type of second last fault	Same as FP-00	112
FP-21	Second last fault time (month day year)	Year: bits 9-15; Month: bits 5-8; Day: bits 0-4 Year + 2000 = the current year	112
FP-22	Second last fault time (hour minute second)	Hour: bits 11-15; minute: bits 5-10; second: bits 0-4 Second x 2 = the current second value	112
FP-23	Operating frequency at 2nd last fault	Min. unit: ±0.01Hz	112
FP-24	Reference frequency at 2nd last fault	Min. unit: ±0.01Hz	112
FP-25	Output current at 2nd last fault	Min. unit: 0.1A	113
FP-26	Output voltage at 2nd last fault	Min. unit: 1V	113
FP-27	Output power at 2nd last fault	Min. unit: 1kW	113
FP-28	Input current at 2nd last fault	Min. unit: 0.1A	113
FP-29	Input voltage at 2nd last fault	Min. unit: 1V	113
FP-30	DC busbar voltage at 2nd last fault	Min. unit: 1V	113
FP-31	Terminal state at 2nd last fault	T3-T1, Y2, Y1, REV, FWD, X6 ~ X1 are arranged bit by bit	113
FP-32	Unit U4U3U2U1 state at 2nd last fault	U1 state: bits 0-3 U2 state: bits 4-7 U3 state: bits 8-11 U4 state: bits 12-15	113
FP-33	Unit U8U7U6U5 state at 2nd last fault	U5 state: bits 0-3 U6 state: bits 4-7 U7 state: bits 8-11 U8 state: bits 12-15	113
FP-34	Unit V4V3V2V1 state at 2nd last fault	V1 state: bits 0-3 V2 state: bits 4-7 V3 state: bits 8-11 V4 state: bits 12-15	113
FP-35	Unit V8V7V6V5 state at 2nd last fault	V5 state: bits 0-3 V6 state: bits 4-7 V7 state: bits 8-11 V8 state: bits 12-15	114
FP-36	Unit W4W3W2W1 state at 2nd last fault	W1 state: bits 0-3 W2 state: bits 4-7 W3 state: bits 8-11 W4 state: bits 12-15	114
FP-37	Unit W8W7W6W5 state at 2nd last fault	W5 state: bits 0-3 W6 state: bits 4-7 W7 state: bits 8-11 W8 state: bits 12-15	114
FP-38	System and unit W9V9U9 state at 2nd last fault	U9 state: bits 0-3 V9 state: bits 4-7 W9 state: bits 8-11 System state: bits 12-15	114
FP-39	Single-time run time at 2nd last fault	Min. unit: 0.1h	114
FP-40	Type of 3rd last fault	Same as FP-00	114
FP-41	3rd last fault time (month day year)	Year: bits 9-15; Month: bits 5-8; Day: bits 0-4 Year + 2000 = the current year	114
FP-42	3rd last fault time (hour minute second)	Hour: bits 11-15; minute: bits 5-10; second: bits 0-4 Second x 2 = the current second value	114
FP-43	Operating frequency at 3rd last fault	Min. unit: ±0.01Hz	114
FP-44	Reference frequency at 3rd last fault	Min. unit: ±0.01Hz	114
FP-45	Output current at 3rd last fault	Min. unit: 0.1A	114

No.	Name	Description	Page
FP-46	Output voltage at 3rd last fault	Min. unit: 1V	115
FP-47	Output power at 3rd last fault	Min. unit: 1kW	115
FP-48	Input current at 3rd last fault	Min. unit: 0.1A	115
FP-49	Input voltage at 3rd last fault	Min. unit: 1V	115
FP-50	DC busbar voltage at 3rd last fault	Min. unit: 1V	115
FP-51	Terminal state at 3rd last fault	T3-T1, Y2, Y1, REV, FWD, X6 ~ X1 are arranged bit by bit	115
FP-52	Unit U4U3U2U1 state at 3rd last fault	U1 state: bits 0-3 U2 state: bits 4-7 U3 state: bits 8-11 U4 state: bits 12-15	115
FP-53	Unit U8U7U6U5 state at 3rd last fault	U5 state: bits 0-3 U6 state: bits 4-7 U7 state: bits 8-11 U8 state: bits 12-15	115
FP-54	Unit V4V3V2V1 state at 3rd last fault	V1 state: bits 0-3 V2 state: bits 4-7 V3 state: bits 8-11 V4 state: bits 12-15	115
FP-55	Unit V8V7V6V5 state at 3rd last fault	V5 state: bits 0-3 V6 state: bits 4-7 V7 state: bits 8-11 V8 state: bits 12-15	115
FP-56	Unit W4W3W2W1 state at 3rd last fault	W1 state: bits 0-3 W2 state: bits 4-7 W3 state: bits 8-11 W4 state: bits 12-15	116
FP-57	Unit W8W7W6W5 state at 3rd last fault	W5 state: bits 0-3 W6 state: bits 4-7 W7 state: bits 8-11 W8 state: bits 12-15	116
FP-58	System and unit W9V9U9 state at 3rd last fault	U9 state: bits 0-3 V9 state: bits 4-7 W9 state: bits 8-11 System state: bits 12-15	116
FP-59	Single-time run time at 3rd last fault	Min. unit: 0.1h	116
FP-60	Type of 4th last fault	Same as FP-00	116
FP-61	4th last fault time (month day year)	Year: bits 9-15; Month: bits 5-8; Day: bits 0-4 Year + 2000 = the current year	116
FP-62	4th last fault time (hour minute second)	Hour: bits 11-15; minute: bits 5-10; second: bits 0-4 Second x 2 = the current second value	116
FP-63	Operating frequency at 4th last fault	Min. unit: ±0.01Hz	116
FP-64	Reference frequency at 4th last fault	Min. unit: ±0.01Hz	116
FP-65	Output current at 4th last fault	Min. unit: 0.1A	116
FP-66	Output voltage at 4th last fault	Min. unit: 1V	116
FP-67	Output power at 4th last fault	Min. unit: 1kW	117
FP-68	Input current at 4th last fault	Min. unit: 0.1A	117
FP-69	Input voltage at 4th last fault	Min. unit: 1V	117
FP-70	DC busbar voltage at 4th last fault	Min. unit: 1V	117
FP-71	Terminal state at 4th last fault	T3-T1, Y2, Y1, REV, FWD, X6 ~ X1 are arranged bit by bit	117
FP-72	Unit U4U3U2U1 state at 4th last fault	U1 state: bits 0-3 U2 state: bits 4-7 U3 state: bits 8-11 U4 state: bits 12-15	117
FP-73	Unit U8U7U6U5 state at 4th last fault	U5 state: bits 0-3 U6 state: bits 4-7 U7 state: bits 8-11 U8 state: bits 12-15	117
FP-74	Unit V4V3V2V1 state at 4th last fault	V1 state: bits 0-3 V2 state: bits 4-7 V3 state: bits 8-11 V4 state: bits 12-15	117
FP-75	Unit V8V7V6V5 state at 4th last fault	V5 state: bits 0-3 V6 state: bits 4-7 V7 state: bits 8-11 V8 state: bits 12-15	117
FP-76	Unit W4W3W2W1 state at 4th last fault	W1 state: bits 0-3 W2 state: bits 4-7 W3 state: bits 8-11 W4 state: bits 12-15	117
FP-77	Unit W8W7W6W5 state at 4th last fault	W5 state: bits 0-3 W6 state: bits 4-7 W7 state: bits 8-11 W8 state: bits 12-15	118
FP-78	System and unit W9V9U9 state at 4th last fault	U9 state: bits 0-3 V9 state: bits 4-7 W9 state: bits 8-11 System state: bits 12-15	118
FP-79	Single-time run time at 4th last fault	Min. unit: 0.1h	118

No.	Name	Description	Page
FP-80	Type of 5th last fault	Same as FP-00	118
FP-81	5th last fault time (month day year)	Year: bits 9-15; Month: bits 5-8; Day: bits 0-4 Year + 2000 = the current year	118
FP-82	5th last fault time (hour minute second)	Hour: bits 11-15; minute: bits 5-10; second: bits 0-4 Second x 2 = the current second value	118
FP-83	Operating frequency at 5th last fault	Min. unit: ±0.01Hz	118
FP-84	Reference frequency at 5th last fault	Min. unit: ±0.01Hz	118
FP-85	Output current at 5th last fault	Min. unit: 0.1A	118
FP-86	Output voltage at 5th last fault	Min. unit: 1V	118
FP-87	Output power at 5th last fault	Min. unit: 1kW	118
FP-88	Input current at 5th last fault	Min. unit: 0.1A	119
FP-89	Input voltage at 5th last fault	Min. unit: 1V	119
FP-90	DC busbar voltage at 5th last fault	Min. unit: 1V	119
FP-91	Terminal state at 5th last fault	T3-T1, Y2, Y1, REV, FWD, X6 ~ X1 are arranged bit by bit	119
FP-92	Unit U4U3U2U1 state at 5th last fault	U1 state: bits 0-3 U2 state: bits 4-7 U3 state: bits 8-11 U4 state: bits 12-15	119
FP-93	Unit U8U7U6U5 state at 5th last fault	U5 state: bits 0-3 U6 state: bits 4-7 U7 state: bits 8-11 U8 state: bits 12-15	119
FP-94	Unit V4V3V2V1 state at 5th last fault	V1 state: bits 0-3 V2 state: bits 4-7 V3 state: bits 8-11 V4 state: bits 12-15	119
FP-95	Unit V8V7V6V5 state at 5th last fault	V5 state: bits 0-3 V6 state: bits 4-7 V7 state: bits 8-11 V8 state: bits 12-15	119
FP-96	Unit W4W3W2W1 state at 5th last fault	W1 state: bits 0-3 W2 state: bits 4-7 W3 state: bits 8-11 W4 state: bits 12-15	119
FP-97	Unit W8W7W6W5 state at 5th last fault	W5 state: bits 0-3 W6 state: bits 4-7 W7 state: bits 8-11 W8 state: bits 12-15	119
FP-98	Unit W9V9U9 state at 5th last fault	U9 state: bits 0-3 V9 state: bits 4-7 W9 state: bits 8-11	120
FP-99	Single-time run time at 5th last fault	Min. unit: 0.1h	120

Description of power unit states

State	Content	State	Content	State	Content	State	Content
0	Contactor bypass fault	4	Overtemperature fault	8	Uplink communication fault	12	Power unit not ready
1	Contactor pull-in fault	5	Undervoltage fault	9	Reserved	13	Unit not used
2	Module fault	6	Input phase loss fault	10	Reserved	14	Same layer bypass
3	Overvoltage fault	7	Downlink communication fault	11	NTC disconnection fault	15	Normal

FU: Data monitoring

No.	Name	Description	Page
FU-00	Operating frequency	Frequency reflecting the motor speed; min. unit: ±0.01Hz	120
FU-01	Operating frequency percentage	Rated max. frequency of inverter as 100%; min. unit: ±0.01%	120
FU-02	Reference frequency	Min. unit: ±0.01Hz	120
FU-03	PLC current mode and stage	Example: 1.02 indicates the 2nd stage of mode 1.	120
FU-04	Output power factor	Min. unit: 0.01	120

No.	Name	Description	Page
FU-05	PG detection frequency	Min. unit: 0.01Hz	120
FU-06	Output torque	Rated torque as 100%; min. unit: 0.01%	120
FU-07	Reference torque	Rated torque as 100%; min. unit: 0.01%	121
FU-08	PID feedback	Min. unit: 0.01%	121
FU-09	PID reference	Min. unit: 0.01%	121
FU-10	PID output	Min. unit: 0.01%	121
FU-11	UP/DOWN value	Min. unit: 0.01%	121
FU-12	AI1	Min. unit: 0.01%	121
FU-13	AI2	Min. unit: 0.01%	121
FU-14	AI3	Min. unit: 0.01%	121
FU-15	PFI	Min. unit: 0.01%	121
FU-16	Input watt-hour meter timer	Min. unit: 0.01h	121
FU-17	Output watt-hour meter timer	Min. unit: 0.01h	122
FU-18	Remaining time of PLC current stage	Min. unit: 0.1s or 0.1min	122
FU-19	Output current	Min. unit: 0.1A	122
FU-20	Load current percentage	Rated inverter current as 100%; min. unit: 0.1%	122
FU-21	Input current	Min. unit: 0.1A	122
FU-22	R-phase input current	Min. unit: 0.1A, instantaneous value	122
FU-23	S-phase input current	Min. unit: 0.1A, instantaneous value	122
FU-24	T-phase input current	Min. unit: 0.1A, instantaneous value	122
FU-25	U-phase output current	Min. unit: 0.1A, instantaneous value	122
FU-26	V-phase output current	Min. unit: 0.1A, instantaneous value	122
FU-27	W-phase output current	Min. unit: 0.1A, instantaneous value	123
FU-28	Constant current output	Min. unit: 0.1A, for motor temperature detection for AO, AI	123
FU-29	Motor temperature	Min. unit: 0.1℃, only valid for Pt100	123
FU-30	Input watt-hour meter kWh	Min. unit: 1kWh, cleared via HMI	123
FU-31	Output watt-hour meter kWh	Min. unit: 1kWh, cleared via HMI	123
FU-32	Output voltage	Min. unit: 1V	123
FU-33	Operating speed	Min. unit: 1r/min	123
FU-34	Reference speed	Min. unit: 1r/min	123
FU-35	DC bus voltage	Min. unit: 1V	123
FU-36	Output power	Min. unit: 1kW	123
FU-37	Operating line speed	Min. unit: 1m/s	124
FU-38	Reference line speed	Min. unit: 1m/s	124
FU-39	Input voltage	Min. unit: 1V	124
FU-40	Input power	Min. unit: 1kW	124
FU-41	Input RS line voltage	Min. unit: 1V, instantaneous value	124
FU-42	Input ST line voltage	Min. unit: 1V, instantaneous value	124
FU-43	Input TR line voltage	Min. unit: 1V, instantaneous value	124
FU-44	Output UV line voltage	Min. unit: 1V, instantaneous value	124
FU-45	Output VW line voltage	Min. unit: 1V, instantaneous value	124
FU-46	Output WU line voltage	Min. unit: 1V, instantaneous value	124
FU-47	Communication poll cycle	Min. unit: 1ms	125

No.	Name	Description	Page
FU-48	Communication error times	0～60000	125
FU-49	PLC cycled number	Min. unit: 1	125
FU-50	Cumulative fan run time	Min. unit: 1h	125
FU-51	Digital input/output terminal state	T3-T1, Y2, Y1, REV, FWD, X6-X1 are arranged based on the binary system 0: Disconnected 1: Connected	125
FU-52	Grounding current/voltage	Min. unit: 0.1A/V	125
FU-53	Unit U4U3U2U1 state	U1 state: bits 0-3 U2 state: bits 4-7 U3 state: bits 8-11 U4 state: bits 12-15	125
FU-54	Unit U8U7U6U5 state	U5 state: bits 0-3 U6 state: bits 4-7 U7 state: bits 8-11 U8 state: bits 12-15	125
FU-55	Unit V4V3V2V1 state	V1 state: bits 0-3 V2 state: bits 4-7 V3 state: bits 8-11 V4 state: bits 12-15	125
FU-56	Unit V8V7V6V5 state	V5 state: bits 0-3 V6 state: bits 4-7 V7 state: bits 8-11 V8 state: bits 12-15	125
FU-57	Unit W4W3W2W1 state	W1 state: bits 0-3 W2 state: bits 4-7 W3 state: bits 8-11 W4 state: bits 12-15	126
FU-58	Unit W8W7W6W5 state	W5 state: bits 0-3 W6 state: bits 4-7 W7 state: bits 8-11 W8 state: bits 12-15	126
FU-59	Unit W9V9U9 state	U9 state: bits 0-3 V9 state: bits 4-7 W9 state: bits 8-11	126
FU-60	System fault code	Same as FP-00	125
FU-61	Max. current holding	Min. unit: 0.1A, cleared via HMI	125
FU-62 ～ FU-72	Reserved		
FU-73	System time (month day year)		126
FU-74	System time (hour minute second)		126
FU-75	Rated inverter power	Min. unit: 1kW	126
FU-76	DSP software version	0.00～99.99	126
FU-77	FPGA software version	0.00～99.99	127
FU-78	CPLD software version	0.00～99.99	127
FU-79	Controller software version	0.00～99.99	127
FU-80	HMI software version	0.00～99.99	127
FU-81	Main control board hardware version	0.00～99.99	127
FU-82	Unit board hardware version	0.00～99.99	127
FU-83	HMI hardware version	0.00～99.99	127
FU-84	Current frequency reference channel	0:HMI 1:MODBUS communication 2:UP/DOWN 3:AI1 4：AI2 5：AI3 6：PFI 7～8: Reserved 9: Multi-speed 10: Jog 11～12: Reserved 13:PID	127
FU-85	Current command channel	0:HMI 1: Terminal 2:MODBUS communication	128
FU-86	Input watt-hour meter upper 16 bits	0～65535	128
FU-87	Output watt-hour meter upper 16 bits	0～65535	128

No.	Name	Description	Page
FU-88	Switch cabinet switch state	Depending on the switch cabinet model	128
FU-89	Cumulative operation time (hour)	0～65535 hours	128
FU-90	Cumulative operation time (minute)	0～59 minutes	128
FU-91	Single-time run time (hour)	0.0～6553.5 hours	128

NOTE: When the current signals in FU parameters are used as analog output, the full amplitude shall be twice the rated inverter current.

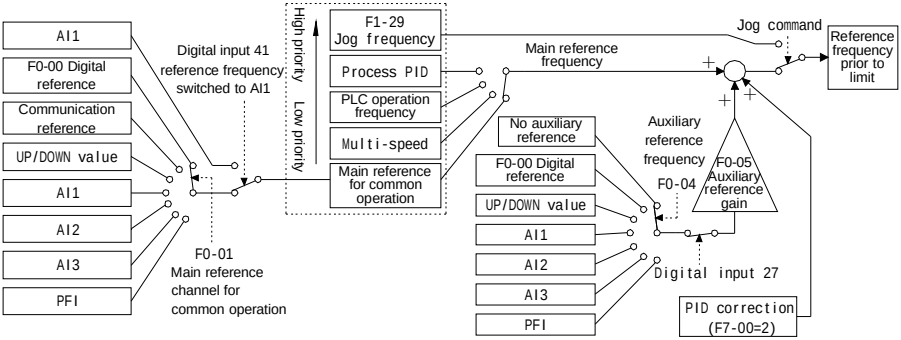
When the voltage signals in FU parameters are used as analog output, the full amplitude shall be 1.5 times the rated inverter voltage.

6 Details about function parameters

6.1 F0: Basic parameters

F0-00	Digital reference frequency	Default	50.00Hz	Change	○
Setting range	0.00Hz~±F0-06 "Max. frequency"				
F0-01	**Main reference channel for common operation**	**Default**	**3**	**Change**	**○**
Setting range	0: F0-00 digital setting, via HMI 1: Communication setting, F0-00 as the initial value 2: UP/DOWN value 3：AI1 4：AI2 5：AI3 6：PFI				

The reference frequency channels are shown in the following diagram:



The inverter has 5 operation modes and their priorities are: jog>process PID>PLC>multi-speed> common operation. For example, if multi-speed operation is valid when the inverter is in common operation, the main reference frequency will be determined by the multistep frequency.

- **&** In common operation, the main reference frequency can be selected by F0-01 "Main reference channel for common operation", and the frequency reference channel can be compulsively switched to AI1 by digital input 41 "Reference frequency switched to AI1". See Page 69.
- **&** Auxiliary reference channel is selected by F0-04 "Auxiliary reference channel" and it can be disabled by digital input 27 "Auxiliary channel disabled".
- **&** Setting F7-00 "PID control function" to 2 can correct the reference frequency before acceleration/deceleration.
- **&** When PFI is selected as reference, F4-05 shall be set to 0.
- **&** A jog command means that digit input 14 "Jog forward" or 15 "Jog reverse" is valid in the terminal control mode.
- **&** The final reference frequency is restricted by F0-07 "Upper limit frequency" and F0-08 "Lower limit frequency". When the reference frequency is negative, the motor needs to run reverse.

F0-02	Run command channel	Default	0	Change	×
Setting range	0: HMI 1: Terminal 2: Communication control				

- **&** Digital input 40 "Run command channel switching" can compulsively switch the run command

channel. See Page 69.

F0-04	Auxiliary reference channel	Default	0	Change	○
Setting range	0: None 1: F0-00 "Digital reference frequency" 2: UP/DOWN value 3: AI1 4：AI2 5：AI3 6: PFI				
F0-05	**Auxiliary channel gain**	Default	1.000	Change	○
Setting range	－1.000～1.000				

& See the description of F0-00 and F0-01 on Page 56.

F0-06	Max. frequency	Default	50.00Hz	Change	×
Setting range	F0-07 "Upper limit frequency" ～120.				
F0-07	**Upper limit frequency**	Default	50.00Hz	Change	×
Setting range	F0-08 "Lower limit frequency"~F0-06 "Max. frequency"				
F0-08	**Lower limit frequency**	Default	0.00Hz	Change	×
Setting range	0.00Hz~F0-07 "Upper limit frequency"				

& F0-06 "Max. frequency": the frequency corresponding to a frequency setting of 100%, used for calibration for a frequency setting by analog input or PFI.

& F0-07 "Upper limit frequency", F0-08 "Lower limit frequency": limit the final reference frequency

F0-09	Running direction	Default	0	Change	○
Setting range	0: in the same direction 1: in the opposite direction				

& Adjust the motor rotation direction.

F0-10	Parameter write-in protection	Default	0	Change	○
Setting range	0: All parameters can be changed except read-only ones 1: All parameters can't be changed except F0-00 "Digital reference frequency", F7-04 "PID digital reference" and this parameter 2: All parameters can't be changed except this parameter				

& This function is used to prevent parameters from being modified unexpectedly.

F0-11	Parameter initialization	Default	00	Change	×
Setting range	11: Enabled 22: Enabled (except communication parameters) 33: Fault log clear (FP only)				

& Parameter initialization restores a parameter to the default value and the fault logs are not restored.

F0-12	Motor control mode	Default	0	Change	×
Setting range	0: V/F control without PG 1: V/F control with PG 2: Vector control without PG 3: Vector control with PG				

& Motor control mode:

F0-12＝0 "V/F control without PG": Open-loop V/F control. The torque output capacity can be improved by torque boost, and the mechanical characteristics and speed control accuracy can be improved by slip compensation.

F0-12＝1 "V/F control with PG": Closed-loop V/F control. This mode has a high steady-state speed accuracy, and is especially suited for applications where the encoder is not directly installed on the motor shaft and the accurate speed control is needed.

F0-12＝2 "Vector control without PG": Speed sensor-less vector control. This mode enables decoupling control of flux and torque through rotor field orientation and speed closed-loop control based on identified speed. It has good mechanical characteristics and can be used for applications where there is a high demand for driving performance and it is not convenient to install an encoder. Torque control can be achieved under this mode.

F0-12＝3 "Vector control with PG": Speed sensor vector control. This mode enables decoupling control of flux and torque through rotor field orientation and speed closed-loop control based on identified speed. It has the highest dynamic performance and steady-state accuracy. It is mainly used for high-performance control such as high-accuracy speed control and simple servo control. Torque control can be achieved under this mode, with high control accuracy both at low speeds and in generating state.

⚠ DANGER: In the control mode with PG, the PG parameters must be set correctly (refer to the description of encoder parameters on Page 101), otherwise injury to people or damage to equipment may occur. The direction setting of the encoder must be rechecked after the rewiring of the motor cables.

F0-13	**Power grid frequency setting**	Default	50.00Hz	Change	×
Setting range	40.00～70.00Hz				

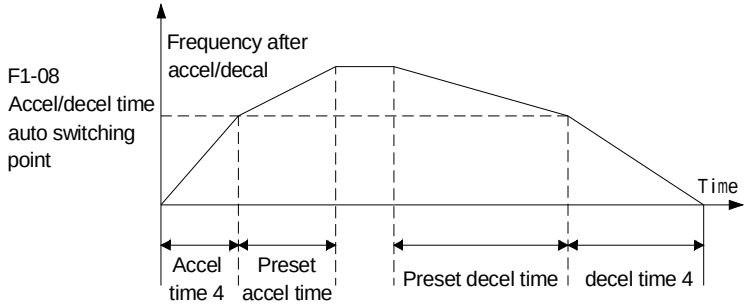
6.2 F1: Accel/decel, start, stop and jog parameters

F1-00	**Accel time 1**	Default	Depends on model	Change	○
F1-01	**Decel time 1**	Default	Depends on model	Change	○
F1-02	**Accel time 2**	Default	Depends on model	Change	○
F1-03	**Decel time 2**	Default	Depends on model	Change	○
F1-04	**Accel time 3**	Default	Depends on model	Change	○
F1-05	**Decel time 3**	Default	Depends on model	Change	○
F1-06	**Accel time 4**	Default	Depends on model	Change	○
F1-07	**Decel time 4**	Default	Depends on model	Change	○
Setting range	0.1～3600.0s. The default value is 50.0s for models of 1120 kW or less, and 80.0s for models above 1120 kW. Accel time: the time period over which the frequency rises by 50Hz. Decel time: the time period over which the frequency drops by 50Hz.				

F1-08	Accel/decel time auto switching point	Default	0.00Hz	Change	×
Setting range	0.00～120.00Hz. Accel/decel time is compulsively switched to Accel/decel time 4 (i. e. F1-06 and F1-07) when the frequency drops below this point.				
F1-09	**Decel time for fast stop**	Default	100.0s	Change	○
Setting range	0.1～3600.0s				

& F1-00～F1-07 offer four sets of accel/decel time, which can be selected by digital inputs 9 and 10 (See Page 57).

& F1-08 "Accel/decel time auto switching point" is illustrated as below. If automatic segmented accel/decel is not required, the parameter may be set to 0. The accel/decel time automatic switching function is invalid in the case of jog operation, emergency stop and stall prevention.



& F1-09 "Decel time for fast stop": In the case of digit input 16 "Fast stop" or the communication port sends a fast stop command, the inverter will shut down according to the "Decel time for fast stop".

F1-10	Starting mode	Default	0	Change	×
Setting range	0: Start from starting frequency 1: Start from starting frequency after DC braking 2: Start from searched speed				
F1-11	**Starting frequency**	Default	0.50Hz	Change	○
Setting range	0.00～120.00Hz				
F1-12	**Starting frequency duration**	Default	0.0s	Change	○
Setting range	0.1～60.0s, only valid for V/F control without PG				
F1-13	**Starting delay time**	Default	0.0s	Change	×
Setting range	0.0～1000.0s				
F1-14	**Voltage soft start**	Default	1	Change	×
Setting range	0: Disabled. Start from the voltage corresponding to the starting frequency. 1: Enabled. The voltage rises smoothly within F1-21 "Starting frequency duration".				
F1-15	**DC braking time (at start)**	Default	0.0s	Change	○
Setting range	0.0～60.0s				

F1-16	DC braking current (at start)	Default	0.0%	Change	○
Setting range	0.0~100.0%; rated inverter current as 100%				

& The inverter has the following starting modes:

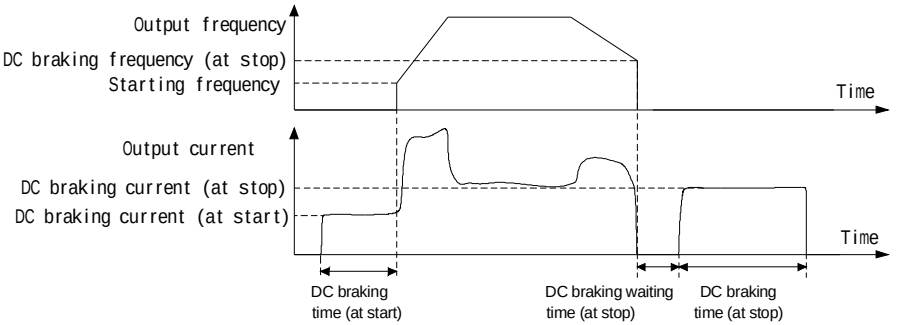
F1-10＝0 "Start from starting frequency": The motor first runs at F1-11 "Starting frequency" for a period of time set by F1-12 "Starting frequency duration" and then begins accelerating. This mode can reduce the current impact at the start.

F1-10＝1 "Start from starting frequency after DC braking": The motor sometimes is in rotation before it starts (for example, the fan motor may run reverse because of the wind). In such a case, the motor can be stopped by DC braking and then restarts, thus preventing the overcurrent impact at the start. The related parameters may be set via F1-15 "DC braking time" and F1-16 "DC braking current".

F1-10＝2 "Start from searched speed": The speed and the direction of the motor are searched automatically before the motor starts, then the motor starts smoothly from the searched speed. It is not necessary to wait until the running motor stops thoroughly before enforcing a restart. This starting mode shortens the starting time and reduces the impact at the start.

& For restarts following the momentary stop, auto reset or operation interruption, parameter Fb-46 "Restart after momentary stop" can make the motor start from the searched speed compulsively. If V/F control with PG is selected, restart from the searched speed is not needed.

& DC braking at start and stop is illustrated as below.



⚠ CAUTION: For high-speed or large-inertia loads, it is recommended to adopt "starts from searched speed" instead of "starts from starting frequency after DC braking".

⚠ CAUTION: Starting from the starting frequency immediately after a coast stop will cause overcurrent. Therefore if an immediate start is needed when the motor doesn't stop turning after the coast stop, it is recommended to adopt "starts from searched speed".

& F1-14 "Voltage soft start": If F1-14=1 when the starting mode is "starts from starting frequency" and F1-12 "Starting frequency duration" is not equal to 0, the output voltage will rise gradually from zero to the value which corresponds to the starting frequency within the time period set by F1-12. This helps reduce the impact at the start and prevent undirectional rotation due to voltage surge. The function is only valid for V/F control without PG.

F1-17	Stop mode	Default	0	Change	○
Setting range	0: Slowdown stop 1: Coast stop 2: Slowdown+DC braking 3: Slowdown+holding brake delay				
F1-18	DC braking frequency (at stop)	Default	0.50Hz	Change	○
Setting range	0.00～120.00Hz				
F1-19	DC braking waiting time (at stop)	Default	0.00s	Change	○
Setting range	0.00～10.00s				
F1-20	DC braking time (at stop)	Default	0.0s	Change	○
Setting range	0.0~60.0s, also as the holding brake delay time				
F1-21	DC braking current (at stop)	Default	0.0%	Change	○
Setting range	0.0~100.0%; rated inverter current as 100%				
F1-22	Zero-speed delay time	Default	0.0s	Change	○
Setting range	0.0～60.0s				

& The inverter has the following stop modes:

F1-17＝0 "slowdown stop": The inverter decelerates until its operating frequency drops to F1-18 "DC braking frequency (at stop)" and then enters the standby state.

F1-17＝1 "Coast stop": The inverter blocks the output and the motor coasts to a stop. But for jog stop or emergency stop, the stop mode remains to be slowdown stop. Coast stop is not recommended for a water pump, for the water pump has a short stop time ant its sudden stop may result in water hammer.

F1-17＝2 "Slowdown+DC braking": The inverter slows down after receiving the stop command and blocks the output when its operating frequency drops to F1-18 "DC braking frequency (at stop)". After a period of time set by F1-19 "DC braking waiting time (at stop)", the inverter applies the DC current set by F1-21 "DC braking current (at stop)" to the motor, which stops following another period of time set by F1-20 "DC braking time (at stop)". See the diagram of DC braking at start and stop on Page 51.

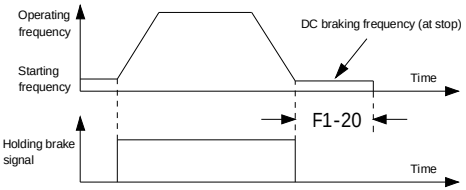
⚠ CAUTION: DC braking is recommended only for low-speed operation (below 10Hz) or small motors.

⚠ CAUTION: Long-time or frequent DC braking can easily cause motor overheating, for the load mechanical energy is consumed in the motor rotor.

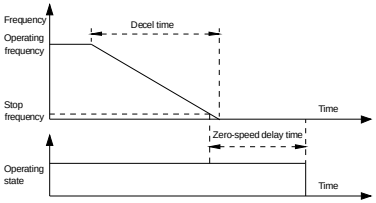
F1-17＝3 "Slowdown+holding brake delay": The inverter slows down after receiving the stop command until its operating frequency drops to F1-18 "DC braking frequency (at stop)". Then after a period of time set by F1-20 "DC braking time (at stop)", the inverter enters the standby state. Digital input 8 "Holding brake signal" can be used to control the electromagnetic holding brake, as shown in the diagram below.

& F1-22 "Zero-speed delay time": In the slowdown stop mode, when the frequency drops to F1-18

"DC braking frequency (at stop)", the motor continues decelerating to zero within the time period set by F1-22 and keeps running at the zero frequency. The motor remains excited so that it can start quickly at any time without pre-excitation. Zero-speed delay is invalid when the parameter is set to 0. The zero-speed delay stop process is as shown below.



Holding brake delay

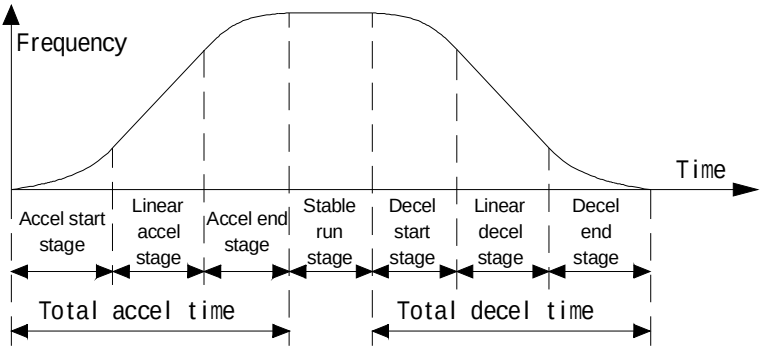


Zero-speed delay

F1-23	Accel/decel mode	Default	0	Change	×
Setting range	0: Linear 1: S-curve				
F1-24	**S-curve accel start-stage time**	Default	0.20s	Change	×
F1-25	**S-curve accel end-stage time**	Default	0.20s	Change	×
F1-26	**S-curve decel start-stage time**	Default	0.20s	Change	×
F1-27	**S-curve decel end-stage time**	Default	0.20s	Change	×
Setting range	0.01～50.00s				

& In S-curve accel/decel mode, the acceleration and speed change gradually and smoothly, which can enable more smooth elevator operation, prevent the falling of objects on conveyors, or reduce the impact to equipment at the start/stop.

& The total accel/decel time is extended after the S-curve accel/decel time is set, as shown below.



The calculation formula for the total accel/decel time is:

Total accel/decel time=accel/decel time for non S-curve+ (accel/decel start-stage time＋accel/decel end-stage time)÷2

If the total accel/decel time obtained from the above formula is less than the sum of accel/decel start-stage time and accel/decel end-stage time, then:

Total accel/decel time= accel/decel start-stage time+accel/decel end-stage time

& The S-curve function automatically becomes invalid when the accel/decel time auto switching function is valid (i.e. F1-08 "Accel/decel time auto switching point" ≠0).

F1-28	FWD/REV deadband time	Default	0.0s	Change	×
Setting range	0.0～3600.0s				

& F1-28 "FWD/REV deadband time": the waiting time during which the motor switches from forward run to reverse run or vice versa. It is used to reduce the impact to equipment during the forward-reverse switching.

F1-29	Jog frequency	Default	5.00Hz	Change	○
Setting range	0.10~50.00Hz				
F1-30	Jog accel time	Default	Depends on model	Change	○
F1-31	Jog decel time	Default	Depends on model	Change	○
Setting range	0.1~600.0s NOTE: The default value of jog accel/decel time is set to 30.0s for models of 1,120 kW or less, and 50.0s for models above 1,120 kW.				

& In jog operation, the functions of "auxiliary reference" and "PID frequency correction" are invalid.

& The start/stop mode for jog operation is fixed as "starts from starting frequency" and "slowdown stop".

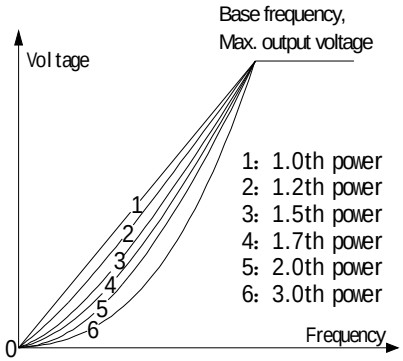
6.3 F2: V/F control parameters

F2-00	V/F curve	Default	1	Change	×
Setting range	0: User-defined (see F2-13 ~ F2-20) 1: Linear V/F curve (1.0-th power) 2: Reduced-torque V/F curve 1 (1.2-th power) 3: Reduced-torque V/F curve 2 (1.5-th power) 4: Reduced-torque V/F curve 3 (1.7-th power) 5: Reduced-torque V/F curve 4 (2.0-th power) 6: Reduced-torque V/F curve 5 (3.0-th power)				

& A V/F curve can be a user-defined multi-segment line, linear line or reduced-torque curve.

& A reduced-torque V/F curve can improve the efficiency of the motor of a reduced-torque load (such as a fan or pump) in light-load operation. The auto energy-saving operation (see the description of F2-11 on Page 55) also improves the motor efficiency.

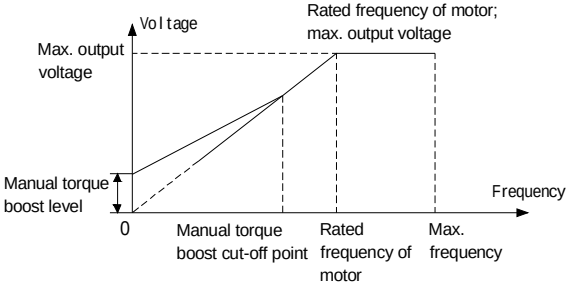
& Apart from improving the motor efficiency, the reduced-torque V/F curve and auto energy-saving operation can decrease the noise. The linear and reduced-torque V/F curves are as shown below:



F2-01	Torque boost	Default	1	Change	×
Setting range	0: No boost 2: Auto	1: Manual 3: Manual+Auto			
F2-02	**Manual torque boost level**	Default	Depends on model	Change	○
Setting range	1120kW or less: 0.0～15.0%, Above 1120kW: 0.0~10.0% F2-12 "Max. output voltage" as 100%				
F2-03	**Manual torque boost cut-off point**	Default	10.0%	Change	○
Setting range	0.0～100.0%; FA-04 "Rated frequency of motor" as 100%				
F2-04	**Auto torque boost level**	Default	60.0%	Change	×
Setting range	0.0～100.0%				

& Manual torque boost increases the motor's torque at the start or at low speeds. Tune up F2-02 "Manual torque boost level" until the startup requirements are met. The parameter must not be too great; otherwise there will be the risk of motor overheating or overcurrent.

& The relation curve of output voltage (V) and frequency (F) consists of a setup V/F curve, manual torque boost and auto torque boost. The relation between F2-02 "Manual torque boost level", F2-03 "Manual torque boost cut-off point", FA-04 "Rated frequency of motor" and F2-12 "Max. output voltage" are as shown below.



& Auto torque boost can change the voltage in a real-time manner according to the load current,

compensate the voltage loss of the stator impedance, automatically adapt to different loads and output appropriate voltage. This function can ensure larger output torque under heavy loads and smaller output currents under zero load.

& In V/F control mode, tracking startup, auto torque boost and slip compensation involve some motor parameters.

F2-05	Slip compensation gain	Default	0.0%	Change	○
Setting range	0.0～300.0%				
F2-06	**Slip compensation filtering time**	Default	1.0s	Change	×
Setting range	0.1~25.0s				
F2-07	**Electromotive slip compensation limit**	Default	200%	Change	×
F2-08	**Regenerative slip compensation limit**	Default	200%	Change	×
Setting range	0~250%; the rated slip frequency of the motor as 100%				

& Slip compensation: If the output frequency remains unchanged, the load change may cause a slip change and the rotation speed will drop. Slip compensation supports online adjustment of the inverter's output frequency according to load torque, minimizes change in rotation speed with load and improves speed control accuracy.

& Slip compensation is effective when auto torque boost is enabled (F2-01=2 or 3).

& Slip compensation may be adjusted by F2-05 "Slip compensation gain". It is recommended that the adjustment be done according to the drop of the rotation speed when the motor temperature is relatively stable under load operation. If the slip compensation gain is 100%, it means that the compensation value at the rated torque is the rated slip frequency.

The formula for rated slip frequency: Rated slip frequency = Rated frequency — (Rated rotation speed × Number of poles ÷ 120)

& If the motor oscillates in the course of slip compensation, tune up F2-06 "Slip compensation filtering time".

F2-09	Vibration damping	Default	0	Change	○
Setting range	0～200				

& The oscillation of a motor under a zero or light load may be controlled by adjusting this parameter. Tune up the value to eliminate oscillation.

F2-10	AVR	Default	1	Change	×
Setting range	0: Invalid 1: Always valid 2: Only valid during decel				

& AVR means auto voltage regulation. This function ensures that the output voltage is stable when the input voltage or the DC busbar voltage oscillates, thus securing the production process and product quality.

& When the input voltage exceeds the rated value, enable AVR to prevent the motor from

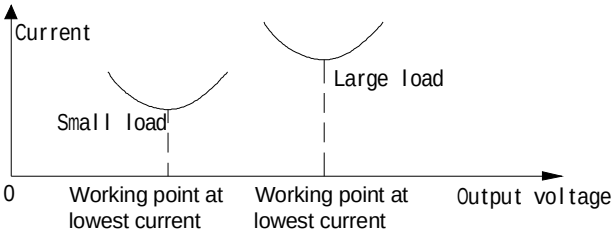
operating under a too high voltage.

& Compared with the "always valid" mode, the "only valid during decel" mode allows faster deceleration, but requires a larger deceleration current. This is because a deceleration causes the DC busbar voltage to rise. If the dead output voltage of AVR also increases, the loss of the motor also increases and the mechanical energy feedback is reduced. Therefore, the deceleration time is shorter.

⚠ CAUTION: If the load has a very large rotary inertia, AVR must be set to "always valid" to prevent motor overheating caused by overvoltage during deceleration.

F2-11	Auto energy-saving operation	Default	0	Change	○
Setting range	0: Disabled	1: Enabled			

& Auto energy-saving operation: The output voltage is automatically adjusted to minimize the load current and motor loss at a constant rotation speed. This function is especially effective for such loads as fans and pumps with torque lowering characteristics. See the diagram below.

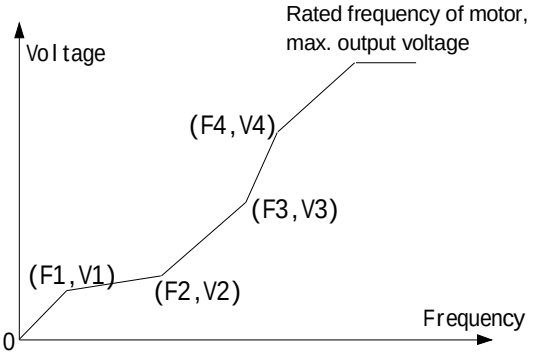


& Auto energy-saving operation requires the use of auto torque boost and slip compensation at the same time.

F2-12	Max. output voltage			Default	Depends on model	Change	×
Setting range	3kV	1600~4000V	Default: 3000V	3.3kV	1600~4000V	Default: 3300V	
	6kV	3500~9000V	Default: 6000V	6.6kV	3500~9900V	Default: 6600V	
	10kV	6000~20000V	Default: 10000V	11kV	7000~20000V	Default: 11000V	
F2-13	**V/F frequency F4**			Default	0.00Hz	Change	×
Setting range	F2-15 "V/F frequency F3" ～ FA-04 "Rated frequency of motor"						
F2-14	**V/F voltage V4**			Default	0.0%	Change	×
Setting range	F2-16 "V/F voltage V3" ～100.0%; F2-12 "Max. output voltage" as 100%						
F2-15	**V/F frequency F3**			Default	0.00Hz	Change	×
Setting range	F2-17 "V/F frequency F2" ~ F2-13 " V/F frequency F4"						
F2-16	**V/F voltage V3**			Default	0.0%	Change	×
Setting range	F2-18 "V/F frequency V2" ~ F2-14 "V/F frequency V4"; F2-12 "Max. output voltage" as 100%						

F2-17	V/F frequency F2	Default	0.00Hz	Change	×
Setting range	F2-19 "V/F frequency F1" ~ F2-15 "V/F frequency F3"				
F2-18	V/F voltage V2	Default	0.0%	Change	×
Setting range	F2-20 "V/F frequency V1" ~ F2-16 "V/F frequency V3"; F2-12 "Max. output voltage" as 100%				
F2-19	V/F frequency F1	Default	0.00Hz	Change	×
Setting range	0.00Hz ～ F2-17 "V/F frequency F2"				
F2-20	V/F voltage V1	Default	0.0%	Change	×
Setting range	0.0%～F2-18 "V/F voltage V2" ; F2-12 "Max. output voltage" as 100%				

& The user-defined V/F curve setting of the V/F curve is as shown below.



6.4 F4: Digital input terminals and multistep speed

F4-00	Functions of digital input terminal X1	Default	1	Change	×
F4-01	Functions of digital input terminal X2	Default	2	Change	×
F4-02	Functions of digital input terminal X3	Default	3	Change	×
F4-03	Functions of digital input terminal X4	Default	41	Change	×
F4-04	Functions of digital input terminal X5	Default	13	Change	×
F4-05	Functions of digital input terminal X6	Default	4	Change	×
F4-06	Functions of FWD terminal	Default	38	Change	×
F4-07	Functions of REV terminal	Default	39	Change	×
Setting range	The table of digital input functions is given below. NOTE: When F4-05 is not 0, PFI is automatically disabled.				

& Table of digital input functions (a same function must not be selected for any two digital input terminals at the same time).

0: No signal	1: Multistep frequency 1	27: Auxiliary reference channel disabled
2: Multistep frequency 2	3: Multistep frequency 3	28: External alarm input 29: Reserved
4: Multistep frequency 4	5: Multistep frequency 5	30: Process PID disabled 31: PID parameter 2
6: Multistep frequency 6	7: Multistep frequency 7	32: PID sleep disabled 33: Multi-PID select 1
8: Multistep frequency 8	9: Accel/decel time 1	34: Multi-PID select 2 35: Multi-PID select 3
10: Accel/decel time 2	11: External fault input (NC)	36: Accel/decel disabled 37: 3-wire stop command
12: External fault input (NO)		38: Internal virtual FWD terminal
13: Fault reset	14. Jog forward	39: Internal virtual REV terminal
15. Jog reverse	16. Fast stop (OFF3)	40: Run command channel switching
17. Inverter run disabled	18: Coast stop	41: Reference frequency switched to AI1
19: UP/DOWN increase	20: UP/DOWN decrease	42: Analog reference frequency hold
21: UP/DOWN clear	22: PLC control disabled	43: Motor thermal protection input
23: PLC operation pause	24: PLC standby state reset	44: Reference frequency channel switching
25: PLC mode 1	26: Analog input disconnection forced frequency terminated	45: Reserved 46: Reserved 47: Reserved 48: Motor overspeed input 49: Reserved

& Related monitored parameters: FU-51 "Digital input/output terminal status".

& Description of digital input functions:

1～8: Multistep frequency. See the description of F4-16 "Multispeed select mode" on Page 73.

9～10: Accel/decel time. For coding, select accel/decel time 1～4.

See the table below, where "0" means invalid and "1" means valid:

Accel/decel time select 2	Accel/decel time select 1	Selected accel/decel time
0	0	Accel/decel time 1 (F1-00, F1-01)
0	1	Accel/decel time 2 (F1-02, F1-03)
1	0	Accel/decel time 3 (F1-04, F1-05)
1	1	Accel/decel time 4 (F1-06, F1-07)

NOTE: The function of accel/decel time options is disabled in the case of simple PLC, jog operation or emergency stop.

11: External fault input (NC), 12: External fault input (NO): This signal sends the abnormality or fault information about the peripherals into the inverter, causing the inverter to stop and giving the external fault alarm. This fault cannot be reset automatically; it must be reset manually. Digit input 11 is Normally Off, while digit input 12 is Normally On. The external fault can be indicated by digital output 12 "External fault trip".

13: Fault reset: The rising edge of this signal resets the fault.

14～15: Jog forward, jog reverse: Refer to the description of jog functions on Page 63.

16: Fast stop: When this signal is valid, the inverter will stop according to F1-09 "Decel time for fast stop".

17. Inverter operation disabled. When this signal is valid, the inverter is prohibited to run or coasts to a stop if it is running.

18: Coast stop. If this signal is valid when the inverter is running, the inverter will block the output and the motor will coast to a stop.

19～21: UP/DOWN increase, decrease and clear: See the description of UP/DOWN on Page 60.

22～24: PLC disable, pause and reset: See the section of F8 on Page 90.

25: PLC mode 1 valid: See the section of F8 on Page 90.

26: Analog input disconnection forced frequency terminated: Terminate the frequency locking state caused by analog input

27: Auxiliary reference channel disabled. When this signal is effective, the auxiliary reference function will be disabled.

28: External alarm input. High level is valid.

30: Process PID disabled. When this signal is effective, PID will be disabled. PID will not be enabled until this signal is ineffective and there isn't any operation mode with a higher priority.

31: PID parameter 2. If this signal is valid when F7-11 "PID parameter switching" =0, choose PID parameter 2 (F7-08～F7-10); If this signal is ineffective, choose PID parameter 1 (F7-05～F7-07).

32: PID sleep disabled. Disable or enable PID sleep.

33～35: Multi-PID selects 1～3: The three terminals are used to select the present PID settings via coding.

Multi-PID select 3	Multi-PID select 2	Multi-PID select 1	Selected PID reference
0	0	0	Depending on F7-01 "PID reference channel"
0	0	1	F7-22 "Multi-PID setpoint 1"
0	1	0	F7-23 "Multi-PID setpoint 2"
0	1	1	F7-24 "Multi-PID setpoint 3"
1	0	0	F7- 25 "Multi-PID setpoint 4"
1	0	1	F7- 26 "Multi-PID setpoint 5"
1	1	0	F7- 27 "Multi-PID setpoint 6"
1	1	1	F7- 28 "Multi-PID setpoint 7"

36: Accel/decel disabled When this signal is effective, the accel/decel process of the inverter is stopped; when this signal is ineffective, the inverter will return to normal accel/decel operations.

37～39: 3-wire stop command, internal virtual FWD terminal and internal virtual REV terminal: Refer to the description of the FWD/REV run mode on Page 70.

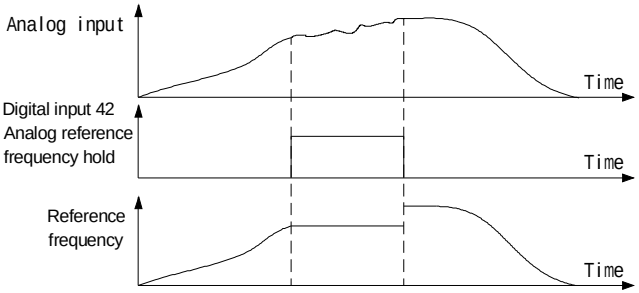
40: Run command channel switching. The command channel may be switched with this signal according to F0-02. See the table below.

F0-02 Run command channel	Status of digital input 40	Run command channel after switching
0: HMI	Invalid	HMI
	Valid	Terminal
1: Terminal	Invalid	Terminal
	Valid	HMI
2: Communication	Invalid	Communication
	Valid	HMI

41: Reference frequency switched to AI1. When the signal is effective, the normal working frequency reference channel will be forced to switch to AI1 analog voltage/current setting. After the signal becomes ineffective, the frequency reference channel will be restored.

42: Analog reference frequency hold. If this signal is valid when the reference frequency comes from the analog input, then the reference frequency will not change by the analog input;

otherwise it will. This function is quite useful in applications where the analog input is vulnerable to the electromagnetic disturbance. See the diagram below.



43: Motor thermal protection input. As the digital input of motor thermal protection, when the signal is valid, motor overheating is indicated. Thermal protection is enabled according to Fb-11 "Motor overheating action". See Page 96.

44: Frequency settings channel switching. When the signal is effective, the normal working frequency reference channel changes as follows. After the signal becomes ineffective, the frequency reference channel will be restored.

F0-01 "Main reference channel for common operation"	Status of digital input 44	Reference frequency channel after switching
F0-01=0: F0-00 digital reference	Invalid	F0-00 digital reference
	Valid	AI3
F0-01= 1: communication reference	Invalid	Communication reference
	Valid	F0-00 digital reference
F0-01= 2: UP/DOWN value	Invalid	UP/DOWN value
	Valid	F0-00 Digital reference
F0-01=3：AI1	Invalid	AI1
	Valid	F0-00 Digital reference
F0-01=4：AI2	Invalid	AI2
	Valid	F0-00 Digital reference
F0-01=5：AI3	Invalid	AI3
	Valid	Communication reference
F0-01=6：PFI	Invalid	PFI
	Valid	F0-00 Digital reference

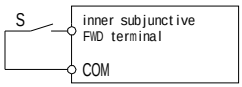
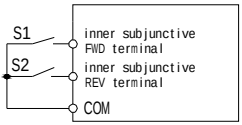
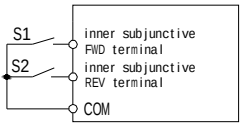
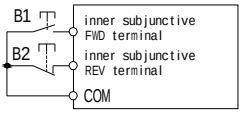
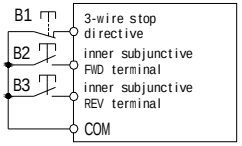
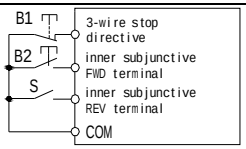
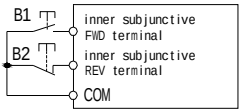
48: Motor overspeed input: See Page 98**.**

F4-08	FWD/REV run mode	Default	3	Change	×
Setting range	0: 1-wire mode (start/stop) 2: 2-wire mode 2 (start/stop, direction) 4: 3-wire mode 1 (FWD, REV, stop) 6: 2-wire mode 4 (start/stop)	1: 2-wire mode 1 (FWD, REV) 3: 2-wire mode 3 (start, stop) 5: 3-wore mode 2 (run, direction, stop)			

& Digital input commands: 37 "3-wire stop command", 38 "Internal virtual FWD terminal" and 39 "Internal virtual REV terminal".

& The following table lists the logics and diagrams of different operation modes. In this table, S

means "level valid" and B means "edge valid":

<table>
<tr><th>F4-08</th><th>Mode</th><th>Logic</th><th>Diagram</th></tr>
<tr><td>0</td><td>1-wire mode (start/stop)</td><td>S: Run switch. When it is valid, the motor runs.
Note: The run direction depends on the direction of the reference frequency.</td><td> 
</td></tr>
<tr><td>1</td><td>2-wire mode 1 (FWD, REV)</td><td><table><tr><th>S2 (REV)</th><th>S1 (FWD)</th><th>Result</th></tr><tr><td>Invalid</td><td>Invalid</td><td>Stop</td></tr><tr><td>Invalid</td><td>Valid</td><td>FWD</td></tr><tr><td>Valid</td><td>Invalid</td><td>REV</td></tr><tr><td>Valid</td><td>Valid</td><td>Stop</td></tr></table></td><td> 
</td></tr>
<tr><td>2</td><td>2-wire mode 2 (start/stop, direction)</td><td><table><tr><th>S2 (direction)</th><th>S1 (start/stop)</th><th>Result</th></tr><tr><td>Invalid</td><td>Invalid</td><td>Stop</td></tr><tr><td>Invalid</td><td>Valid</td><td>FWD</td></tr><tr><td>Valid</td><td>Invalid</td><td>Stop</td></tr><tr><td>Valid</td><td>Valid</td><td>REV</td></tr></table></td><td> 
</td></tr>
<tr><td>3</td><td>2-wire mode 3 (start, stop)</td><td>B1: Run button (constantly on)
B2: Stop button (constantly off)
Note: The run direction depends on the direction of the reference frequency.</td><td> 
</td></tr>
<tr><td>4</td><td>3-wire mode 1 (FWD, REV, stop) Digital input 37 "3-wire stop command" needed</td><td>B1: Stop button (constantly off)
B2: FWD button (constantly on)
B3: REV button (constantly on)</td><td> 
</td></tr>
<tr><td>5</td><td>3-wire mode 2 (Run, direction, stop) Digital input 37 "3-wire stop command" needed</td><td>B1: Stop button (constantly off)
B2: Run button (constantly on)
S: Direction switch. When it is valid, the motor runs reverse.</td><td> 
</td></tr>
<tr><td>6</td><td>2-wire mode 4 (start/stop)</td><td>B1: FWD run/stop button (constantly on)
B2: REV run/stop button (constantly on)</td><td> 
</td></tr>
</table>

& For 1-wire mode or 2-wire mode 1 and 2 under the terminal control mode, although they are both level-effective, if the stop command comes from other sources and causes the inverter to stop, then the stop command must be given before the run command in order to restart the inverter.

& For 2-wire mode 3 and 3-wire mode, the run button is invalid if the constantly off stop button is switched off.

& For 2-wire mode 4, in the standby state, press FWD to enable inverter FWD operation and press FWD again to stop the inverter. It's the same for REV.

& Even if the operation mode defines the operation direction, the direction lock still overrides.

& If the terminal command doesn't contain the direction information, the run direction will be determined by the polarity of the reference frequency channel.

F4-09	Input terminal logic (positive & negative)	Default	0	Change	×
Setting range	For REV/FWD/X6 ~ X1, binary representation is adopted 0: Positive logic, valid when circuit is closed and invalid when circuit is open. 1: Negative logic, invalid when circuit is closed and valid when circuit is open.				
F4-10	Digital input terminal anti-jittering time	Default	10ms	Change	○
Setting range	0~2000ms				

& Digital input terminal anti-jittering time: This parameter determines the anti-jittering time for the digital input signal. Those signals with their duration less than the anti-jittering time will be ignored.

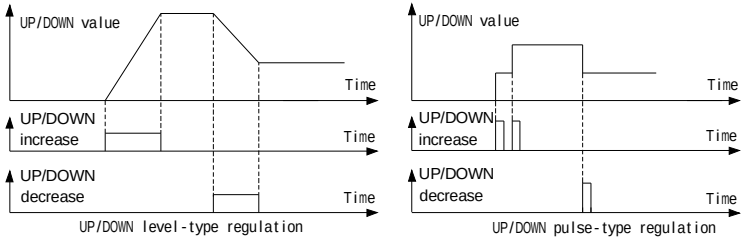
F4-11	UP/DOWN regulation mode	Default	0	Change	○
Setting range	0: Level type (terminal) 1: Pulse type (terminal)				
F4-12	UP/DOWN speed/step	Default	1.00	Change	○
Setting range	0.01～100.00; Minimum unit: 0.01%/s (level type), 0.01% (pulse type)				
F4-13	UP/DOWN memory	Default	0	Change	○
Setting range	0: Stored on power loss 1: Cleared on power loss 2: Cleared at stop or on power loss				
F4-14	UP/DOWN upper limit	Default	100.0%	Change	○
Setting range	F4-15～100.0%				
F4-15	UP/DOWN lower limit	Default	0.0%	Change	○
Setting range	－100.0～F4-14				

& The UP/DOWN function allows the continuous regulation in the switching mode. The regulated value can be used as the frequency reference or PID reference.

& **F4-11＝0 "Level type (terminal)":** When the digital input 19 "UP/DOWN: increase" or 20 "UP/DOWN: decrease" is valid, FU-11 "UP/DOWN value" increases or decreases at the speed set by F4-12. When the digital inputs 19 and 20 are valid or invalid at the same time, FU-11 remains unchanged.

F4-11＝1 "Pulse type (terminal)": For per effective impulse to the digital input 19 "UP/DOWN: increase" or 20 "UP/DOWN: decrease", FU-11 "UP/DOWN value" increases or decreases by the step length set by F4-12.

& The two control modes for UP/DOWN are as shown in the diagram below:



Digital Input 21 "UP/DOWN Clear": The rising edge of the signal clears FU-11 "UP/DOWN value".

F4-16	Multi-speed select mode	Default	0	Change	×
Setting range	0: Binary code 1: Direct select 2: Sum 3: Number				
F4-17 ～ F4-48	Multistep frequency 1~32	Default	n.00Hz (n=1～32)	Change	○
Setting range	－60.00～120.00Hz; NOTE: Multistep frequency 32 is only used for simple PLC operation. The default values of multistep frequency 1 to multistep frequency 32 are their respective multistep frequency numbers. For example, the default value of multistep frequency 3 is 3.00Hz.				

F4-16＝0 "Binary code": The multistep frequency selects 1～31 are selected based on the binary codes for the multistep frequency selects 1~5. E.g. if X1~X5 are set to multistep frequency selects 1~5 respectively, then the frequency selection table will be as follows, where "0" means invalid and "1" means valid.

X5	X4	X3	X2	X1	Result of selection	X5	X4	X3	X2	X1	Result of selection
0	0	0	0	0	Reference frequency for common operation	1	0	0	0	0	F4-32 Multistep frequency 16
0	0	0	0	1	F4-17 Multistep frequency 1	1	0	0	0	1	F4-33 Multistep frequency 17
0	0	0	1	0	F4-18 Multistep frequency 2	1	0	0	1	0	F4-34 Multistep frequency 18
0	0	0	1	1	F4-19 Multistep frequency 3	1	0	0	1	1	F4-35 Multistep frequency 19
0	0	1	0	0	F4-20 Multistep frequency 4	1	0	1	0	0	F4-36 Multistep frequency 20
0	0	1	0	1	F4-21 Multistep frequency 5	1	0	1	0	1	F4-37 Multistep frequency 21
0	0	1	1	0	F4-22 Multistep frequency 6	1	0	1	1	0	F4-38 Multistep frequency 22
0	0	1	1	1	F4-23 Multistep frequency 7	1	0	1	1	1	F4-39 Multistep frequency 23
0	1	0	0	0	F4-24 Multistep frequency 8	1	1	0	0	0	F4-40 Multistep frequency 24
0	1	0	0	1	F4-25 Multistep frequency 9	1	1	0	0	1	F4-41 Multistep frequency 25
0	1	0	1	0	F4-26 Multistep frequency 10	1	1	0	1	0	F4-42 Multistep frequency 26
0	1	0	1	1	F4-27 Multistep frequency 11	1	1	0	1	1	F4-43 Multistep frequency 27
0	1	1	0	0	F4-28 Multistep frequency 12	1	1	1	0	0	F4-44 Multistep frequency 28
0	1	1	0	1	F4- 29 Multistep frequency 13	1	1	1	0	1	F4-45 Multistep frequency 29
0	1	1	1	0	F4-30 Multistep frequency 14	1	1	1	1	0	F4-46 Multistep frequency 30
0	1	1	1	1	F4-31 Multistep frequency 15	1	1	1	1	1	F4-47 Multistep frequency 31

F4-16＝1 "Direct select": The multistep frequency selects 1~8 directly correspond to the multistep frequencies 1~8 respectively. When multiple signal options are valid, the one of the minimum number shall apply. E.g. if X1~REV are set to multistep frequency selects 1~8 respectively, the mapping relation is as shown in the diagram below, where "0" indicates invalid, "1" indicates valid and "—" indicates any state.

REV	FWD	X6	X5	X4	X3	X2	X1	Result of selection
0	0	0	0	0	0	0	0	Reference frequency for common operation
—	—	—	—	—	—	—	1	F4-17 Multistep frequency 1
—	—	—	—	—	—	1	0	F4-18 Multistep frequency 2
—	—	—	—	—	1	0	0	F4-19 Multistep frequency 3
—	—	—	—	1	0	0	0	F4-20 Multistep frequency 4
—	—	—	1	0	0	0	0	F4-21 Multistep frequency 5
—	—	1	0	0	0	0	0	F4-22 Multistep frequency 6
—	1	0	0	0	0	0	0	F4-23 Multistep frequency 7
1	0	0	0	0	0	0	0	F4-24 Multistep frequency 8

F4-16＝2 "Sum": The reference frequency equals the sum of all multistep frequencies selected (restricted by the upper- and lower-limit frequencies).

E.g. if only "multistep frequency select 1", "multistep frequency select 3" and "multistep frequency select 4" are valid, then

Reference frequency= multistep frequency 1+ multistep frequency 3+multistep frequency 4

F4-16＝3 "Number": The number of the valid signal(s) among multistep frequency selects 1~8 determines which multistep frequency is used as the reference. E.g. if any three of them are valid, then reference frequency=multistep frequency 3.

6.5 F5: Digital and relay outputs

F5-00	Functions of digital output terminal Y1	Default	1	Change	×
F5-01	Functions of digital output terminal Y2	Default	2	Change	×
F5-02	Output functions of relay T1	Default	33	Change	×
F5-03	Output functions of relay T2	Default	32	Change	×
F5-04	Output functions of relay T3	Default	31	Change	×
Setting range	0～53; See the table of digital output functions below. NOTE: Terminal Y2 is only valid in the case of F6-41=2.				

& Related monitored parameter: FU-51 "Digital input/output terminal status".

& Table of digital output functions

0: Inverter ready	1: Inverter running	33: Fan fault indication
2: Reverse running	3: Forward running	34: Local control indication
4: Frequency reach		35: Terminal control indication
5: Frequency reach detection signal 1		36: Communication control indication
6: Frequency reach detection signal 2		37: Reserved
7: Fault output	8: Holding brake signal	38: Reserved
9: Motor load overweight		39: High voltage indication
10: Motor overload	11: Undervoltage lockout	40: Reserved
12: External fault trip	13: Reserved	41: Channel A of encoder
14: Restart after momentary power failure		42: Channel B of encoder
15: Alarm output	16: Shutdown in process	43: Virtual revolution-counting pulse
17: In-operation same layer bypass indication		44: Overspeed fault
18: Torque limit enabled		45: Fan life reach
19: Upper frequency limit enabled		46: Status of circuit breaker KM1
20: Lower frequency limit enabled		47: Status of circuit breaker KM2
21: Running in generating state		48: Status of circuit breaker KM3
22: Emergency stop	23: Phase locking finished	49: Status of circuit breaker KM4
24: PLC operation	25: PLC operation pause	50: Status of circuit breaker KM5
26: PLC stage finished	27: PLC cycle finished	51: Status of circuit breaker KM6
28: PLC mode 0 indication	29: PLC mode 1 indication	52: PID feedback below lower limit
30: PID in dormancy	31: Power frequency bypass	53: PID feedback above upper limit
32: Cabinet not closed indication		

& Detailed description of digital output functions:

0: Inverter ready. The energized contactor has been closed. There is no fault.

1: Inverter running. The inverter is in operation.

2: Reverse running. This signal is valid when the inverter is running reverse.

3: Forward running. This signal is valid when the inverter is running forward.

4: Frequency reach. This signal is valid when the inverter operating frequency falls in the range between reference frequency minus and reference frequency plus. See F5-06 on Page 77.

5～6: Frequency reach detection signals 1, 2. Refer to F5-07～F5-10 on Page 77.

7: Fault output. An effective signal will be output if the inverter is in the fault state.

8: Holding brake signal. See the description of F1-17 "Stop mode" on Page 61.

9: Motor load overweight. The signal will be effective when the inverter detects a motor load overweight. Refer to Page 95 for details.

10: Motor overload. The signal will be effective when the motor is overloaded. Refer to Page 94 for details.

11: Undervoltage lockout. This signal is valid when DC bus undervoltage causes trip.

12: External fault trip. This signal is valid when an external fault causes trip and becomes invalid after fault reset.

14: Restart after momentary power failure. The signal will be effective after the main loop has an undervoltage and is waiting for restart. See Page 99.

15: Alarm output. This signal is valid when the inverter gives an alarm.

16: Stopping. This signal is valid when the inverter is in the process of slowdown stop.

17: In-operation same layer bypass indication. This signal is valid when bypass occurs to the inverter unit.

18: Torque limit. This signal is valid when the torque reaches the limit value.

19: Frequency upper limit. This signal is valid when reference frequency ≥ upper-limit frequency and the operating frequency rises to the upper-limit frequency.

20: Frequency lower limit. This signal is valid when reference frequency ≤ lower-limit frequency and the operating frequency falls to the lower-limit frequency.

21: Running in generating state. This signal is valid when the inverter is running in the generating state.

22: Emergency stop. This signal is valid in the case of emergency stop

23: Phase locking finished. Used for grid phase frequency detection; can be used for variable frequency to work frequency switching.

24: PLC operation. This signal is valid when the inverter is in the simple PLC operation mode.

25: PLC operation pause. This signal is valid when the digital input 23 "PLC operation pause" is valid.

26: PLC stage finished. A 500ms pulse is sent out each time a stage of PLC operation is completed.

27: PLC cycle finished. A 500ms pulse is sent out each time a cycle of PLC operation is completed.

28, 29: PLC mode 0 indication, PLC mode 1 indication. Used to indicate the serial number of current PLC mode

30: PID in dormancy. Indicates that the inverter is in a sleep state, without output. See Page 88.

31: Power frequency bypass. Determine based on the state of the switch cabinet detected by the controller whether the system is in the power frequency bypass state.

32: Cabinet not closed indication. This signal is valid when the cabinet cover interlock switch is not in place.

33: Fan fault indication. The fan contactor is not closed.

34: Local control indication, 35: Terminal control indication, 36: communication control indication. Used to indicate the current control mode for easy switching of control modes.

39: High voltage indication. This signal is valid after the main power supply of the inverter is put into use.

41, 42: Channel A, B of encoder. Used to detect the status of the encoder channel and judge whether the wiring is correct.

43: Virtual revolution-counting pulse. A pulse signal with a duty ratio of 50%; can simulate the motor speed signal for per revolution output.

44: Overspeed fault. See Page 98.

45: Fan life reach. Used to indicate the fan's service life comes to end. See Page 103.

46 ～51: Status of circuit breakers KM1～6. The working state of the circuit breaker in the

system detected by the controller

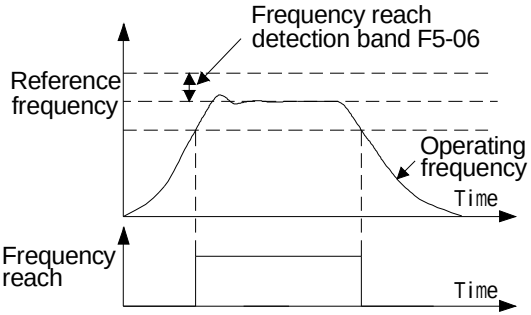
52: PID feedback below lower limit; 53: PID feedback above upper limit. See Page 89.

F5-05	Y terminal output logic (positive & negative)	Default	00	Change	×
Setting range	bit1：Y2 bit0：Y1 0: Positive logic, valid when closed and invalid when open 1: Negative logic, valid when open and invalid when closed				

& This parameter can negate the Y1 and Y2 signals and output them.

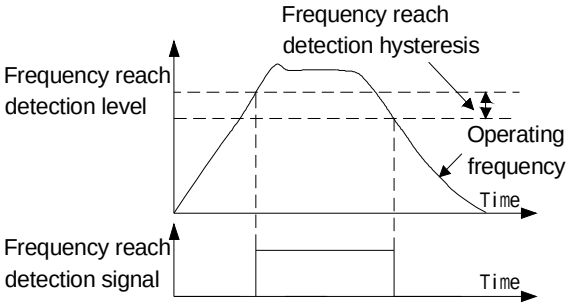
F5-06	Frequency reach detection band	Default	2.50Hz	Change	○
Setting range	0.00～120.00Hz				

& The frequency reach signal is sent out when the inverter operating frequency is in the range between reference frequency minus and reference frequency plus, as shown below.



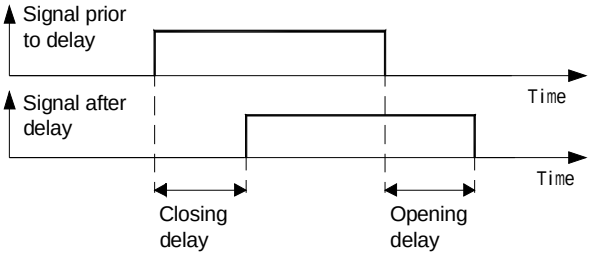
F5-07	Frequency reach detection level 1	Default	50.00Hz	Change	○
F5-08	Frequency reach detection hysteresis 1	Default	1.00Hz	Change	○
F5-09	Frequency reach detection level 2	Default	25.00Hz	Change	○
F5-10	Frequency reach detection hysteresis 2	Default	1.00Hz	Change	○
Setting range	0.00～120.00Hz				

& The digital output "frequency reach detection signal" is valid when the operating frequency is greater than "Frequency reach detection level". It becomes invalid when the operating frequency is less than "frequency reach detection level — frequency reach detection hysteresis". Refer to the diagram below.



F5-11	**Y1 terminal closing delay**	Default	0.00s	Change	○
F5-12	**Y1 terminal opening delay**	Default	0.00s	Change	○
F5-13	**Y2 terminal closing delay**	Default	0.00s	Change	○
F5-14	**Y2 terminal opening delay**	Default	0.00s	Change	○
F5-15	**T1 terminal closing delay**	Default	0.00s	Change	○
F5-16	**T1 terminal opening delay**	Default	0.00s	Change	○
F5-17	**T2 terminal closing delay**	Default	0.00s	Change	○
F5-18	**T2 terminal opening delay**	Default	0.00s	Change	○
F5-19	**T3 terminal closing delay**	Default	0.00s	Change	○
F5-20	**T3 terminal opening delay**	Default	0.00s	Change	○
Setting range	0.00~650.00s				

& The digital output delay is illustrated as follows.



F5-21	**Alarm output select 1**	Default	65535	Change	○
F5-22	**Alarm output select 2**	Default	65535	Change	○
Setting range	0～65535				

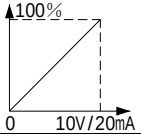
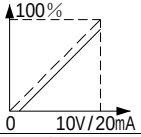
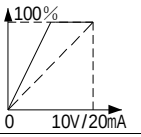
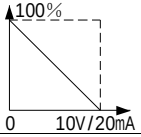
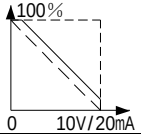
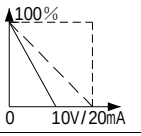
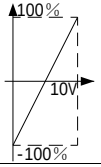
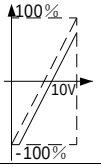
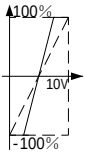
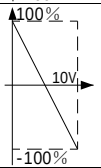
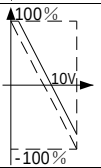
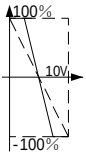
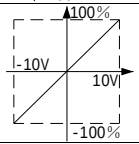
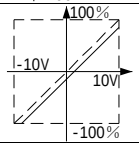
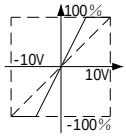
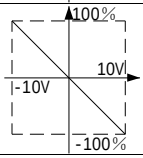
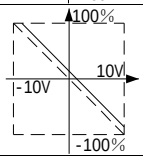
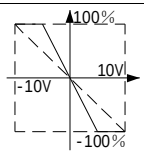
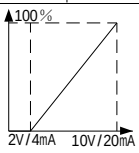
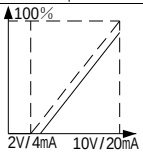
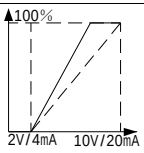
& Used to select alarm information to be monitored. The corresponding bit (binary) set to 1 enables output of the alarm via digital output terminal; otherwise the alarm is ignored.

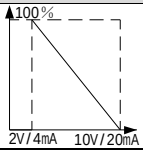
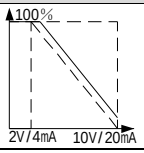
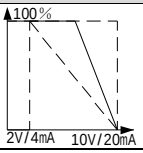
6.6 F6: Analog and pulse frequency terminals

F6-00	**AI1 input type**	Default	2	Change	○

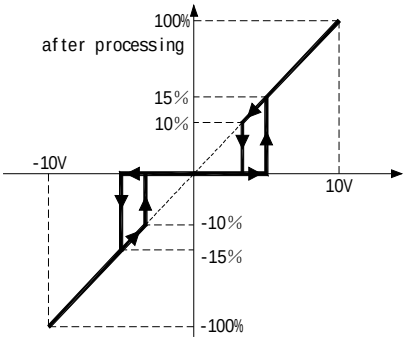
Setting range	0: 0～10V or 0～20mA (corresponding to 0～100%) 1: 10～0V or 20～0mA (corresponding to 0～100%) 2: 2～10V or 4～20mA (corresponding to 0～100%) 3: 10～2V or 20～4mA (corresponding to 0～100%) 4: -10～10V or -20～20mA (corresponding to -100～100%) 5: 10～-10V or 20～-20mA (corresponding to -100～100% 6: 0～10V or 0～20mA(corresponding to -100～100%, with 5V or 10mA at the center) 7: 10～0V or 20～0mA (corresponding to -100～100%, with 5V or 10mA at the center)				
F6-01	**AI1 gain**	Default	100.0%	Change	○
Setting range	0.0～1000.0%				
F6-02	**AI1 bias**	Default	0.00%	Change	○
Setting range	-100.00~100.00%; 10V or 20mA as 100%				
F6-03	**AI1 filtering time**	Default	0.100s	Change	○
Setting range	0.000~10.000s				
F6-04	**AI1 zero-point threshold**	Default	1.00%	Change	○
Setting range	0.00～50.00%				
F6-05	**AI1 zero-point hysteresis error**	Default	0.00%	Change	○
Setting range	0.00～50.00%				
F6-06	**AI1 disconnection threshold**	Default	0.00%	Change	○
Setting range	0.00~20.00%; 10V or 20mA as 100% For 2～10V/ 4～20mA or 10～2V/20～4mA, the internal disconnection threshold is fixed at 10%; For -10～10V/-20～20mA or 10～-10V/20～-20mA, the disconnection test is not performed.				
F6-07	**AI2 input type**	Default	2	Change	○
F6-08	**AI2 gain**	Default	100.0%	Change	○
F6-09	**AI2 bias**	Default	0.00%	Change	○
F6-10	**AI2 filtering time**	Default	0.100s	Change	○
F6-11	**AI2 zero-point threshold**	Default	1.00%	Change	○
F6-12	**AI2 zero-point hysteresis error**	Default	0.00%	Change	○
F6-13	**AI2 disconnection threshold**	Default	0.00%	Change	○
F6-14	**AI3 input type**	Default	2	Change	○
F6-15	**AI3 gain**	Default	100.0%	Change	○
F6-16	**AI3 bias**	Default	0.00%	Change	○
F6-17	**AI3 filtering time**	Default	0.100s	Change	○
F6-18	**AI3 zero-point threshold**	Default	1.00%	Change	○
F6-19	**AI3 zero-point hysteresis error**	Default	0.00%	Change	○
F6-20	**AI3 disconnection threshold**	Default	0.00%	Change	○
Setting range	All settings for AI2, AI3 are the same as those for AI1.				

& The table below lists the calculation formulas, characteristic curves and regulation diagrams for analog inputs (dotted lines represent factory settings while solid ones represent regulated settings).

Input	Calculation formula for output	Basic curve	Bias=10.00%	gain=200.0%
0~10V or 0~20mA (corresponding to 0~100%)	Output=gain×(input-bias) (result confined to 0~100%)			
10~0V or 20~0mA (corresponding to 0~100%)	Output=gain× [-(input-bias)] +100% (result confined to 0~100%)			
0~10V (corresponding to -100~100%, with 5V at the center)	Output=gain×2 ×[(input-bias) -50%] (result confined to -100~100%)			
10~0V (corresponding to -100~100%, with 5V at the center)	Output=gain×(-2) ×[(input-bias) -50%] (result confined to -100~100%)			
-10~10V or -20~20mA (corresponding to -100~100%,	Output=gain×(input-bias) (result confined to －100～100%)			
10～－10V or 20～－20mA (corresponding to -100~100%,	Output=gain ×[-(input-bias)] (result confined to -100~100%)			
2～10V or 4～20mA (corresponding to 0~100%)	Output=gain×[5/4 ×(input-bias) - 25%] (result confined to 0~100%)			

Input	Calculation formula for output	Basic curve	Bias＝10.00%	gain＝200.0%
10～2V or 20～4mA (corresponding to 0~100%)	Output=gain×[-5/4 ×(input-bias)+125%] (result confined to 0~100%)			

& "Zero-point threshold" and "zero-point hysteresis error" prevent the analog input signal fluctuating around the zero point. For example, setting the former to 10.0% and the latter to 5.0% can bring the hysteresis effect shown in the following diagram.



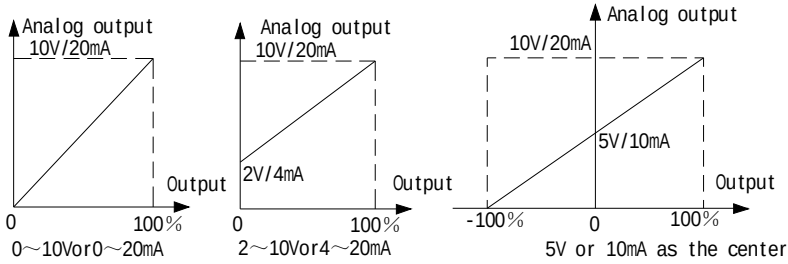
& "Filtering time": Increasing the filtering time slows down the response, but strengthens the immunity to the disturbance. Reducing the filtering time speeds up the response, but weakens the immunity.

& "Disconnection threshold": Analog input is considered to be disconnected if it is lower than the disconnection threshold. The action after the disconnection is determined by Fb-20 "Analog input disconnection action".

F6-21	AO1 function	Default	0	Change	○
Setting range	Use parameters in FU				
F6-22	**AO1 type**	Default	1	Change	○
Setting range	0: 0～10V or 0～20mA 1: 2～10V or 4～20mA 2: 5V or 10mA at the center				
F6-23	**AO1 gain**	Default	100.0%	Change	○
Setting range	0.0～1000.0%				
F6-24	**AO1 bias**	Default	0.00%	Change	○
Setting range	-100.00~100.00%; 10V or 20mA as 100%				
F6-25	**AO2 function**	Default	19	Change	○
F6-26	**AO2 type**	Default	1	Change	○
F6-27	**AO2 gain**	Default	100.0%	Change	○
F6-28	**AO2 bias**	Default	0.00%	Change	○

F6-29	**AO3 function**	Default	0	Change	○
F6-30	**AO3 type**	Default	1	Change	○
F6-31	**AO3 gain**	Default	100.0%	Change	○
F6-32	**AO3 bias**	Default	0.00%	Change	○
F6-33	**AO4 function**	Default	0	Change	○
F6-34	**AO4 type**	Default	1	Change	○
F6-35	**AO4 gain**	Default	100.0%	Change	○
F6-36	**AO4 bias**	Default	0.00%	Change	○
Setting range	All settings for AO2, AO3 and AO4 are the same as those for AO1.				

& The three types of analog output are as shown in the diagram below.



& Adjusting the gain and bias can change the measuring range and correct the zero point.

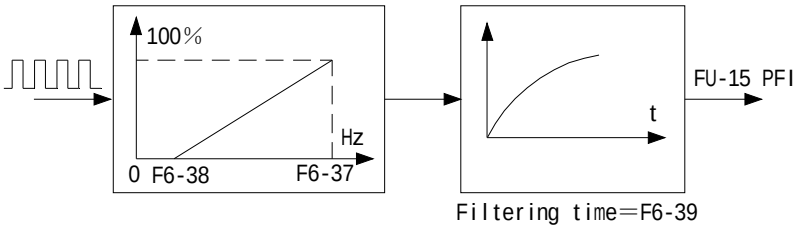
The calculation formula is: 0～10V $output = \left(\left| \frac{output}{\max .valueofselectedsignal} \right| \times gain + bias \right) \times 10V$ 。

2～10V $output = \left(\left| \frac{output}{\max .valueofselectedsignal} \right| \times gain \times \frac{4}{5} + \frac{1}{5} + bias \right) \times 10V$ 。

with 5V at the center

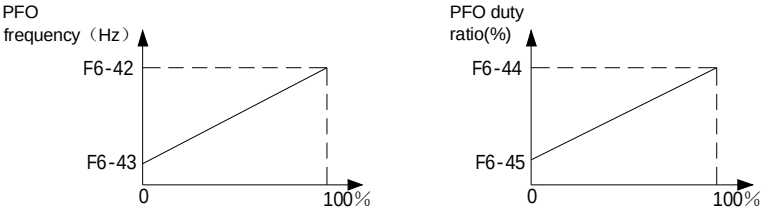
F6-37	**PFI frequency corresponding to 100%**	Default	10000Hz	Change	○
F6-38	**PFI frequency corresponding to 0%**	Default	0Hz	Change	○
Setting range	0～50000Hz (The PFI function is valid when F4-05 is set to 0.)				
F6-39	**PFI filtering time**	Default	0.100s	Change	○
Setting range	0.000～10.000s				

& The PFI function converts the input pulse frequency to a percentage value and filters it, which can be monitored via FU-15 "PFI", as shown below. PFI can be used as the frequency reference for cascade synchronous control, or as the PID feedback for constant line speed control.



F6-40	PFO function	Default	0	Change	○
Setting range	Select to use FU parameters; shared by PFO and Y2 terminals				
F6-41	**PFO output pulse modulation method**	Default	0	Change	○
Setting range	0: Frequency modulation 1: Duty ratio modulation 2: Y2 is applicable				
F6-42	**PFO frequency corresponding to 100%**	Default	10000Hz	Change	○
Setting range	0～50000Hz (also used as the duty-ratio modulation frequency)				
F6-43	**PFO frequency corresponding to 0%**	Default	0Hz	Change	○
Setting range	0～50000Hz				
F6-44	**PFO duty ratio corresponding to 100%**	Default	100.0%	Change	○
F6-45	**PFO duty ratio corresponding to 0%**	Default	0.0%	Change	○
Setting range	0.0～100.0%				

& PFO function: outputs the internal percentage signal in the format of pulse frequency or duty ratio, as shown below.



& In frequency modulation, the duty ratio is fixed at 50%. In duty-ratio modulation, the pulse frequency is fixed at F6-42.

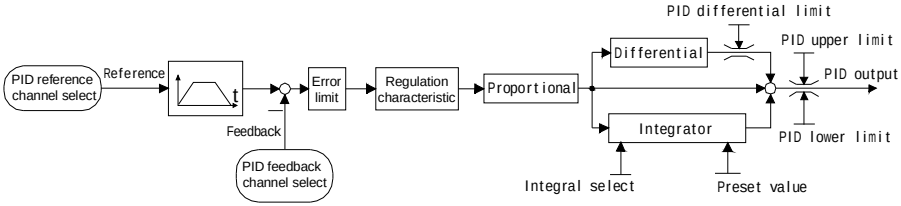
F6-46	Constant current output	Default	1.6mA	Change	○
Setting range	0.0~20.0mA				

& The parameter, together with analog input, is used for temperature measurement of motor winding or bearing; a constant current source is provided.

6.7 F7: PID Parameters

F7-00	PID control function	Default	0	Change	×
Setting range	0: PID control disabled 1: PID control enabled (PID output: max. frequency=100%) 2: PID corrects reference frequency prior to accel/decel (PID output: max. frequency=100%) 3: PID corrects reference frequency after accel/decel (PID output: max. frequency=100%)				

& Process PID can be used for the control of process variables such as tension, pressure, flowrate, liquid level and temperature. The proportional element can generate deviation proportional control to reduce the deviation. The integral element can eliminate the static error. The longer the integral time, the weaker the integral action; the shorter the integral time, the stronger the integral action. The differential element predicts the change of deviational signals by analyzing the trend of deviational changes. It also inhibits the control signals prior to deviational increase so as to improve the response speed of the control. The structure of process PID is as follows.



& Process PID has two types of correction modes: reference frequency correction prior to accel/decel, and reference frequency correction after accel/decel.

Reference frequency correction prior to accel/decel: PID output is added to the reference frequency prior to accel/decel.

Reference frequency correction after accel/decel: PID output is added to the reference frequency after accel/decel. Unlike the previous correction mode, this mode can also perform the correction during accel/decel.

F7-01	PID reference channel	Default	0	Change	×
Setting range	0: F7-04 1: UP/DOWN value 2: AI1 3: AI2 4: AI3 5: PFI 6: PC analog 1 7: PC analog 2				
F7-02	**PID feedback channel**	Default	0	Change	×
Setting range	0: AI1 1: AI2 2: AI3 3: PFI 4: AI1-AI2 5: AI1+AI2 6: $\sqrt{\lvert AI1 \rvert}$ 7: $\sqrt{\lvert AI2 \rvert}$ 8: $\sqrt{\lvert AI1-AI2 \rvert}$ 9: $\sqrt{\lvert AI1 \rvert}+\sqrt{\lvert AI2 \rvert}$ 10: PC analog 1 11: PC analog 2				
F7-03	**PID display coefficient**	Default	1.000	Change	○
Setting range	0.010～10.000, only affecting FU-08 "PID feedback" and FU-09 "PID reference"				
F7-04	**PID digital reference**	Default	0.00%	Change	○

Setting range	－100.00～100.00%

& PID adopts normalized input and output, that is, both the input and output range are between -100%~+100%. The input scaling is related to feedback channel, sensor characteristics and analog input setting. The output scaling takes the maximum frequency as 100% for frequency control.

& There is a filtering section for the PID reference channel and feedback channel, for example, the filtering time for AI1 is F6-03. These filtering sections have influence on the control performance and can be set according to the actual needs.

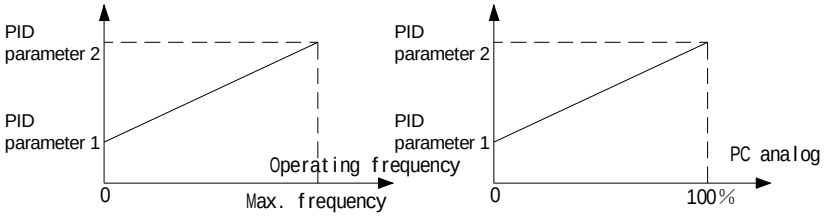
& In some machines (such as centrifuges), the square root of the inlet pressure has a linear relationship with the flowrate, therefore, the square root feedback can be used to control the flowrate.

& F7-03 "PID display coefficient" is used to scale FU-09 "PID reference" and FU-08 "PID feedback", making them match the real physical units. It has no influence on the control.

& When PFI is used as PID reference or feedback, F4-05 must be set to 0.

F7-05	**Proportional gain 1**	Default	0.20	Change	○
Setting range	0.00～100.00				
F7-06	**Integral time 1**	Default	20.00s	Change	○
Setting range	0.01～100.00s				
F7-07	**Differential time 1**	Default	0.00s	Change	○
Setting range	0.00～10.00s				
F7-08	**Proportional gain 2**	Default	0.20	Change	○
Setting range	0.00～100.00				
F7-09	**Integral time 2**	Default	20.00s	Change	○
Setting range	0.01～100.00s				
F7-10	**Differential time 2**	Default	0.00s	Change	○
Setting range	0.00～10.00s				
F7-11	**PID parameter switching**	Default	0	Change	×
Setting range	0: By digital input 31 "PID parameter 2" 1: According to operating frequency 2: PC analog 1 3: PC analog 2				

& SBH high voltage inverter series has two sets of PID parameters: PID parameter 1 (F7-05, F7-06, F7-07) and PID parameter 2 (F7-08, F7-09, F7-10). They can be switched mutually by the digital input 36. They can be switched by digital input 31 "PID parameter 2", operating frequency or PC analog.



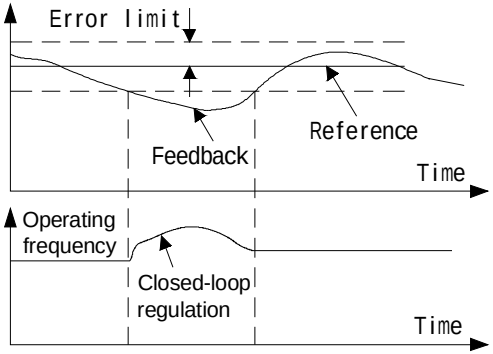
& PID parameter adjustment principle: first increase the proportional gain from a smaller value (e.g. 0.20) until the feedback signal starts to oscillate, and then lower it by 40%-60% to stabilize the feedback signal; reduce the integral time from a larger value (e.g. 20.00s) until the feedback signal starts to oscillate, and then increase it by 10%-50% to stabilize the feedback signal. Differential action can be introduced if there is a high requirement for overshoot and dynamic error.

F7-12	Sampling period	Default	0.010s	Change	○
Setting range	0.001～10.000s				

& PID sampling period: It shall generally be set to a value five to ten times smaller than the response time of the controlled object.

F7-13	Error limit	Default	0.00%	Change	○
Setting range	0.0～20.0%, PID setpoint as 100%				

& When the error of the setpoint and feedback is less than the error limit, PID stops its regulation and the output remains constant. This function eliminates frequent actions during the control. See the diagram below.



F7-14	Setpoint up/down time	Default	0.00s	Change	○
Setting range	0.00～20.00s				

& Setpoint up/down time: This parameter enables the setpoint to increase and decrease smoothly, thus reducing the impact generated at the moment PID is introduced.

F7-15	PID regulation characteristics	Default	0	Change	×

Setting range	0: Positive 1: Negative

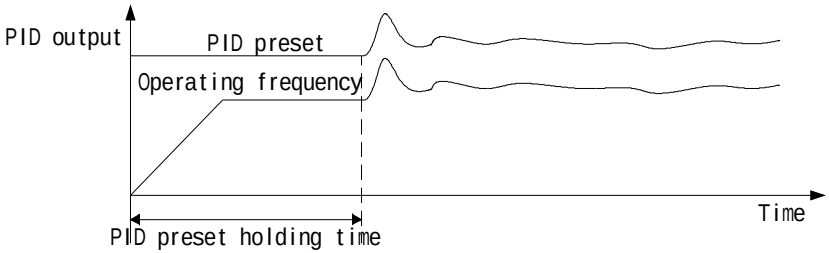
& PID regulation characteristics: Positive means under stable working conditions when the setpoint is increased the speed is required to be increased, for example, in heating control; while Negative means when the setpoint is increased the speed is required to be lowered, for example, in cooling control.

F7-16	**Integral regulation**	Default	1	Change	×
Setting range	0: Disabled 1: Enabled				
F7-17	**PID upper limit**	Default	100.00%	Change	○
Setting range	F7-18 "PID lower limit"～100.00%				
F7-18	**PID lower limit**	Default	0.00%	Change	○
Setting range	－100.00%～F7-17 "PID upper limit"				
F7-19	**PID differential limit**	Default	5.00%	Change	○
Setting range	0.00～100.00% (limits the max. and min. value of differential component)				

& Moderate limitation of PID can reduce overshoot. Excessive limitation shall be avoided.

F7-20	**PID preset**	Default	0.00%	Change	○
Setting range	F7-18 "PID lower limit"～F7-17 "PID upper limit"				
F7-21	**PID preset holding time**	Default	0.0s	Change	×
Setting range	0.0～3600.0s				

& PID preset: the PID output remains as the preset value within the preset holding time; this is equivalent to an open-loop control. At the end of the preset, the initial value of the PID integrator is assigned as the preset value and the PID closed-loop control begins. In the case of F7-00=1, see the diagram below.



& If the preset holding time is set to 0, PID control is performed with the preset value being the integrator initial value. This can speed up the response at the start.

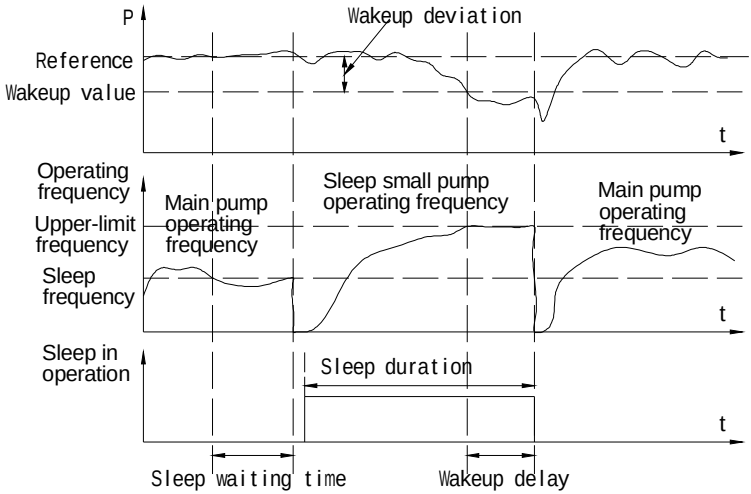
F7-22	**Multi-PID setpoint 1**	Default	1.00%	Change	○
F7-23	**Multi-PID setpoint 2**	Default	2.00%	Change	○

F7-24	**Multi-PID setpoint 3**	Default	3.00%	Change	○
F7-25	**Multi-PID setpoint 4**	Default	4.00%	Change	○
F7-26	**Multi-PID setpoint 5**	Default	5.00%	Change	○
F7-27	**Multi-PID setpoint 6**	Default	6.00%	Change	○
F7-28	**Multi-PID setpoint 7**	Default	7.00%	Change	○
Setting range	－100.00～100.00%				

& Used for multi-PID control. Refer to the description of digital inputs 33, 34 and 35 "Multi-PID selects 1-3" on Page 58.

F7-29	**Sleep frequency**	Default	40.00Hz	Change	○
Setting range	0.00～120.00Hz				
F7-30	**Sleep latency**	Default	60.0s	Change	○
Setting range	0.0～3600.0s				
F7-31	**Wakeup deviation**	Default	100.00%	Change	○
Setting range	0.00-100.00%; NOTE: When it's 100.00%, the sleeping function is disabled.				
F7-32	**Wakeup delay time**	Default	0.500s	Change	○
Setting range	0.000～60.000s				

& When PID is used, for example, in constant pressure water supply occasions, the sleeping function can be enabled. When water consumption drops, the operating frequency is lower than F7-29 "Sleep frequency" and the duration exceeds F7-30 "Sleep latency", PID enters the state of dormancy and enables digit output 30 "PID in dormancy". When the feedback is less than PID reference minus F7-31 "Wakeup bias" and the duration exceeds F7-32 "Wakeup latency", PID wakes up and enters the normal working state. When the digital input 32 "PID sleep disabled" is valid, if the system is currently in a dormant state, then PID is forced to wake up and enter the normal operation state; if the system does not enter the dormant state yet, then the sleep function is invalid. See the diagram below.



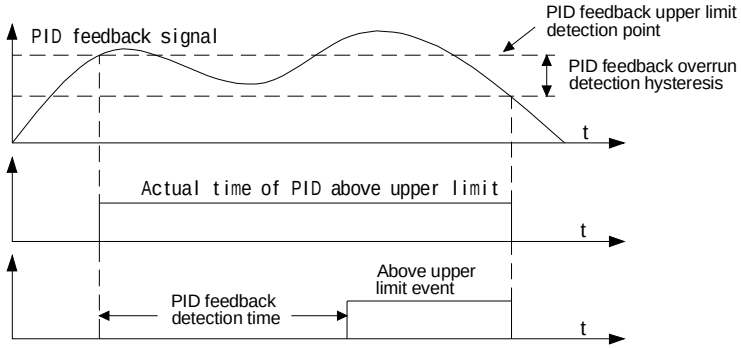
& The start mode after PID wakeup from sleep is determined by Fb-46 "Restart after momentary stop" and F1-10 "Starting mode". It's advisable to start from the starting frequency on occasions where reverse running is not allowed.

& The related digital output function 30 "PID in dormancy" can be used to start other small power pumps at the time of sleep.

F7-33	**PID feedback upper limit detection point**	Default	100.00%	Change	○
Setting range	F7-34 "PID feedback lower limit detection point" ～ 100.00%				
F7-34	**PID feedback lower limit detection point**	Default	0.00%	Change	○
Setting range	-100.00%～F7-33 "PID feedback upper limit detection point"				
F7-35	**PID feedback overrun detection hysteresis**	Default	5.00%	Change	○
Setting range	0.00～50.00%				
F7-36	**PID feedback overrun detection time**	Default	10.0s	Change	○
Setting range	0.0~600.0s				
F7-37	**PID feedback overrun action**	Default	0	Change	○
Setting range	0: No action 1: Alarm 2: Coast to a stop due to fault				

& When the inverter PID (F7-00 not set to 0) is used, PID provides a digital comparator for feedback signal detection. The comparator can detect PID feedback signals in a real-time manner so as to avoid prolonged duration of load in a unpermitted working state caused by PID misadjustment. The user can set F7-33, F7-34 PID feedback upper and lower limit detection points and F7-35

Detection hysteresis according to the actual situation, and block overrun caused by momentary overcharge during the PID regulation process via F7-36. When the comparator detects that the duration of feedback signals going beyond the upper and lower limits is greater than the detection time set by F7-36, the inverter will generate an event of "PID feedback below lower limit" or "PID feedback above higher limit". The user can select to output the event via the digital output terminal. When the above event occurs, the user can also select via F7-37 to output the alarm by inverter or respond the event by the actions such as fault trip. See the diagram below.



6.8 F8: Simple PLC

F8-00	PLC operation mode	Default	0	Change	×
Setting range	0: PLC operation disabled 1: N cycles (cycle number decided by F8-06) + stop 2: N cycles (cycle number decided by F8-06) + final stage speed 3: Continuous cycle				
F8-01	**PLC restart after operation interruption**	Default	0	Change	×
Setting range	0: Restart from the first stage 1: Restart from the frequency of the interrupted stage 2: Restart from the operating frequency at the moment of interruption				
F8-02	**PLC saving on power loss**	Default	0	Change	×
Setting range	0: Don't save 1: Save				
F8-03	**Unit of time for each stage**	Default	0	Change	×
Setting range	0: Second 1: Minute				
F8-04	**PLC mode/stage number**	Default	0	Change	×
Setting range	0: 1×32, 1 mode, 32 stages 1: 2×16, 2 modes, 16 stages for each				
F8-05	**PLC operation mode**	Default	0	Change	×
Setting range	0: Terminal select 1: Mode 0 2: Mode 1				
F8-06	**PLC cycle number**	Default	1	Change	×
Setting range	1～65535				

F8-07 ～ F8-69	Stage(1~32) accel/decel time	Default	0	Change	○
Setting range	0: Accel/decel time 1; 1: Accel/decel time 2; 2: Accel/decel time 3; 3: Accel/decel time 4				
F8-08 ～ F8-70	Stage (1～32) operation time	Default	0.0	Change	○
Setting range	0.0～6500.0 (second or minute); The time unit is determined by F8-03 Unit of time for each stage				

& The settings for stages 2~32 are similar to that for stage 1. The default value of the multistep frequency n equals its respective stage number. The table of parameters by stage is given below.

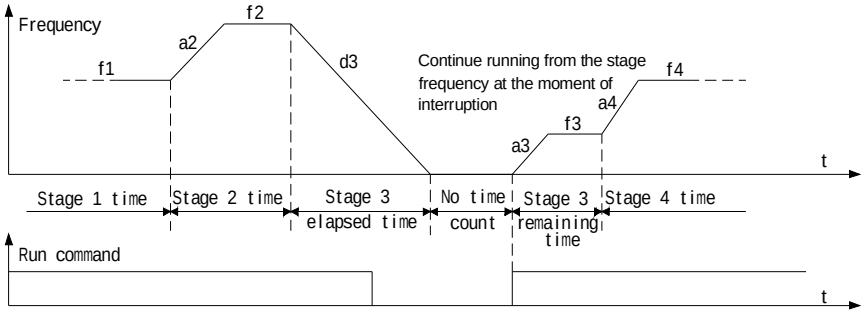
n	1	2	3	4	5	6	7	8
Stage n setting	F8-07	F8-09	F8-11	F8-13	F8-15	F8-17	F8-19	F8-21
Stage n time	F8-08	F8-10	F8-12	F8-14	F8-16	F8-18	F8-10	F8-22
Multistep frequency n	F4-17	F4-18	F4-19	F4-20	F4-21	F4-22	F4-23	F4-24
n	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Stage n setting	F8-23	F8-25	F8-27	F8-29	F8-31	F8-33	F8-35	F8-37
Stage n time	F8-24	F8-26	F8-28	F8-30	F8-32	F8-34	F8-36	F8-38
Multistep frequency n	F4-25	F4-26	F4-27	F4-28	F4-29	F4-30	F4-31	F4-32
n	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Stage n setting	F8-39	F8-41	F8-43	F8-45	F8-47	F8-49	F8-51	F8-53
Stage n time	F8-40	F8-42	F8-44	F8-46	F8-48	F8-50	F8-52	F8-54
Multistep frequency n	F4-33	F4-34	F4-35	F4-36	F4-37	F4-38	F4-39	F4-40
n	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
Stage n setting	F8-55	F8-57	F8-59	F8-61	F8-63	F8-65	F8-67	F8-69
Stage n time	F8-56	F8-58	F8-60	F8-62	F8-64	F8-66	F8-68	F8-70
Multistep frequency n	F4-41	F4-42	F4-43	F4-44	F4-45	F4-46	F4-47	F4-48

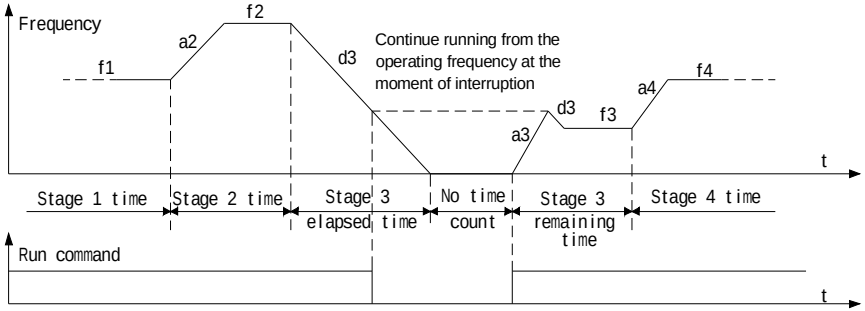
& Simple PLC operation: allows the automatic switching of reference frequencies according to the preset run time, thus realizing the automation of the production process.

& PLC restart mode after operation interruption: determined by F8-01 PLC restart mode after operation interruption. When PLC operation is interrupted (failure or stop), it can restart from the first stage, from the frequency of the interrupted stage, or from the operating frequency at the moment of interruption. The start mode is determined by F1-10. See the diagram below.

& In all diagrams in this section, fn represents stage n's multistep frequency n, an and dn

represent stage n's accel and decel time respectively, and Tn stands for stage n's time. n=1~32.





& PLC status can be stored when power is off, so that it can continue running from the stop status. For example, the unfinished operation of the previous day can be continued when you turn on the power the next day.

& PLC status will be automatically reset when F8-00～F8-06 are modified.

& Switching PLC modes during running will take effect after the stop.

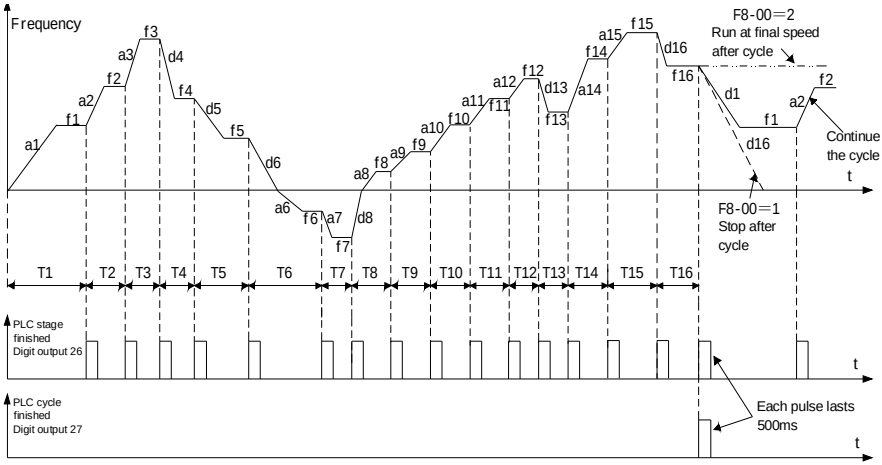
& The PLC modes and the stage number for each mode are listed in the table below.

1 mode×32 stages	**Mode 0**	
Stages contained in each mode	1～32	
2 modes × 16 stages	**Mode 0**	**Mode 1**
Stages contained in each mode	1~16	17~32

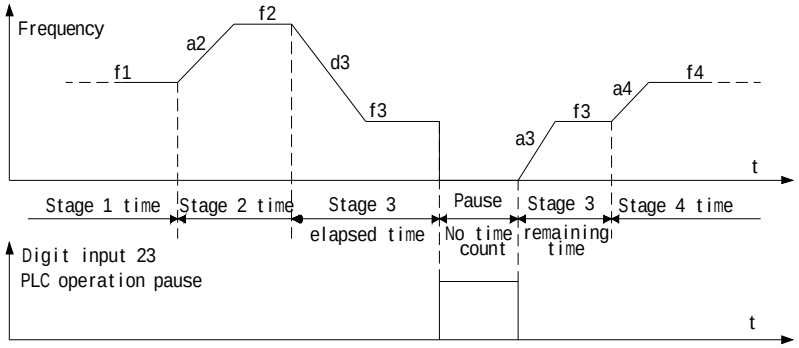
& When digital input 25 is valid, the PLC mode changes.

& Each stage of PLC operation has its own multistep frequency (acting as the reference), run time and accel/decel time. If you don't want a certain stage, set the run time of that stage to 0.

& The following diagram illustrates the operation process of mode 1 (F8-04＝1).



& When digital input 23 "PLC operation pause" is valid, PLC operation pauses; when it is invalid, PLC operation restarts from the stage before the pause (start mode is determined by F1-10), as shown below.



& When digital input 22 "PLC control disabled" is valid, the inverter enters the running mode with a lower priority (see F0-01 on Page 48); when it is invalid, PLC operation resumes.

& If digital input 24 "PLC standby state reset" is valid in the standby state, then parameters concerning the PLC run stage, cycled number and run timing are reset.

& Related digital outputs: 24 "PLC in operation", 25 "PLC operation pause", 26 "PLC stage finished", 27 "PLC cycle finished", 28 "PLC mode 0 indication" and 29 "PLC mode 1 indication". Digit outputs 26, 27: 500ms pulses

& Related monitored parameters: FU-03 "PLC current mode and stage", FU-49 "PLC cycled number" and FU-18 "Remaining time of PLC current stage".

6.9 FA: Motor parameters

FA-01	Rated power of motor	Default	Depends on model	Change	×
Setting range	110～50000kW				
FA-02	**Number of poles**	Default	4	Change	×
Setting range	2～48				
FA-03	**Rated current of motor**	Default	Depends on model	Change	×
Setting range	0.5～1200.0A				
FA-04	**Rated frequency of motor**	Default	50.00Hz	Change	×
Setting range	1.00～120.00Hz				
FA-05	**Rated speed of motor**	Default	Depends on model	Change	×
Setting range	125～40000r/min				
FA-06	**Rated voltage of motor**	Default	Depends on model	Change	×
Setting range	380～20000V				

& Make sure to input the motor nameplate parameters FA-01~FA-06 before running the inverter.

FA-07	No-load current of motor	Default	Depends on model	Change	×
Setting range	0.1A～FA-03 “Rated current of motor”				

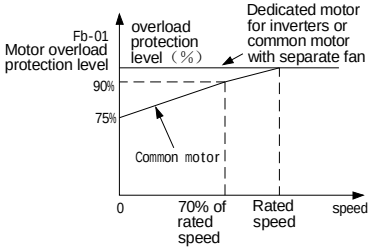
6.10 Fb: Protection functions and advanced inverter settings

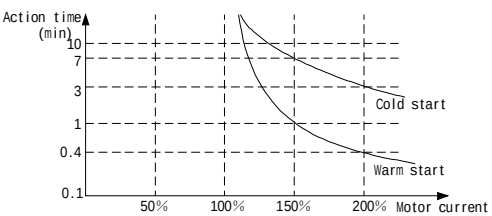
Fb-00	Motor cooling condition	Default	0	Change	○
Setting range	0: Common motor 1: Inverter-controlled motor or common motor with separate cooling fan				
Fb-01	**Motor overload protection level**	Default	110.0%	Change	○
Setting range	50.0～150.0%, rated current of motor as 100%				
Fb-02	**Motor overload action**	Default	1	Change	×
Setting range	0: No action 1: Continue running with an alarm 2: Coast to a stop due to fault				

& Fb-00 "Motor cooling condition": depends on the type of the motor connected to the inverter. When a common motor runs at low speeds, the cooling effect of the self-cooling fan becomes poorer and the inverter overload protection level becomes lower accordingly. See the diagram below.

& Fb-01 "Motor overload protection level": used to adjust the motor overload protection curve. Suppose the motor is running at the rated

speed and Fb-01=100%, if the motor suddenly runs at 150% of its rated current, then the overload protection function will take effect one minute later, as shown in the following diagrams.





& When the motor overload protection takes effect, the motor can continue to run only after it is cooled.

⚠ CAUTION: The motor overload protection function is only applicable to applications where one inverter drives one motor. For applications where one inverter controls more than one motor, please install a thermal protection unit on each motor.

Fb-03	**Motor load overweight detection**	Default	0	Change	×
Setting range	0: Always detect 1: Detect only in constant-speed operation				
Fb-04	**Motor load overweight detection level**	Default	130.0%	Change	×
Setting range	20.0～200.0%, rated current of motor as 100%				
Fb-05	**Motor load overweight detection time**	Default	5.0s	Change	×
Setting range	0.0～30.0s				
Fb-06	**Motor load overweight action**	Default	2	Change	×
Setting range	0: No action 1: Continue running with an alarm 2: Coast to a stop due to fault				

& Motor load overweight: When the motor current exceeds Fb-04 and lasts for a period of time longer than Fb-05, the motor acts according to the setting of Fb-06. This function is used to detect whether the mechanical load is abnormal and causes an excessively large current.

Fb-07	**Motor temperature sensor type**	Default	0	Change	×
Setting range	0：1×Pt100 1：2×Pt100 2：3×Pt100 3：1×PTC 4：2×PTC 5：3×PTC				
Fb-08	**Motor overheating protection input source**	Default	0	Change	×
Setting range	0: Digit input 43 "Motor thermal protection input" 1：AI1 2：AI2 3：AI3				
Fb-09	**Motor overheating protection alarm point**	Default	90℃	Change	×
Setting range	40.0～200.0℃; when Fb-07 is set to Pt100, the unit will be 0.1℃; when PTC is selected, the unit will be 1Ω.				
Fb-10	**Motor overheating protection fault point**	Default	110℃	Change	×
Setting range	40.0~200.0℃; when Fb-07 is set to Pt100, the unit will be 0.1℃; when PTC is selected, the unit will be 1Ω.				

Fb-11	Motor overheating action	Default	0	Change	×
Setting range	0: No action 1: Alarm 2: Coast to a stop due to fault				

& When thermal protection for motor is necessary, connect motor temperature signals via the mode set by Fb-08. If AI input is selected, and also select the temperature sensor model via Fb-07. Then select the protection mode via Fb-11. When alarm or fault protection is selected, the temperature point by action can be adjusted via Fb-09 and Fb-10.

Fb-12	Inverter underload protection	Default	0	Change	×
Setting range	0: No action 1: Continue running with an alarm 2: Coast to a stop due to fault				
Fb-13	**Inverter underload protection level**	Default	30.0%	Change	×
Setting range	0.0～100.0%, against rated current of inverter				
Fb-14	**Underload protection detection time**	Default	1.0s	Change	×
Setting range	0.0～100.0s				

& Inverter underload protection: When the output current is lower than Fb-13 and lasts for a period of time longer than Fb-14, the inverter acts according to the setting of Fb-12. This function can timely detect such faults as no-load turning of water pump, breaking of conveying belt and opening of contactor on the motor side.

& Do not enable this protection function during the inverter no-load test.

Fb-16	High voltage disconnect on fault	Default	1	Change	×
Setting range	0: No action 1. High voltage disconnect				
Fb-17	**Cabinet cover protection enable when high voltage is present**	Default	0	Change	×
Setting range	0: Alarm 1: Coast to a stop due to fault + alarm				
Fb-18	**Frequency bypass action on fault**	Default	0	Change	×
Setting range	0: Manual 1: Auto				
Fb-19	**Allowed number of unit bypass levels**	Default	1	Change	×
Setting range	0: Unit bypass disabled 1～3: 1～3 level(s)				

& Fb-16 is used to set whether to disconnect the high voltage power supply on the input side when a fault occurs to the inverter. If "high voltage disconnect" is selected, then the inverter outputs the "high voltage disconnect signal" to the main circuit breaker at the time of stop. After receiving the signal, the main circuit breaker disconnects the inverter input power supply.

Faults subject to "high voltage disconnect on fault" include: transformer overheating protection, PLC reconnect after disconnection, too high input main voltage, electric leakage action, emergency stop command, input overcurrent (150% a minute), and input phase sequence error.

& To protect the safety of users and prevent electric shock caused by open or improperly closed

cabinet cover when the inverter is connected to a high voltage power supply, Fb-17 is used to set the inverter action for open or improperly closed cabinet cover.

& Set Fb-18 according to the switch cabinet type needed by the user. Only when an automatic bypass cabinet is used, will this parameter be set to "automatic".

& When the inverter detects fault of one or more power unit(s), it allows the layer(s) where the faulty power unit(s) is/are to be bypassed and other units to continue operating. The more bypass levels there are, the greater the output voltage decrease is. Set the max. allowed bypass levels via Fb-19.

Fb-20	**Analog input disconnection action**	Default	1	Change	×
Setting range	0: No action 1: Alarm; run at the average frequency within 10s before disconnection 2: Alarm; run at F0-00 3: Coast to a stop due to fault				

& Analog input disconnection action: The analog input is considered to be disconnected when the inverter detects that the analog input signal is lower than the disconnection threshold.

& Related parameters: F6-06 "AI1 disconnection threshold", F6-13 "AI2 disconnection threshold" and F6-20 "AI3 disconnection threshold".

Fb-21	**Operating frequency below lower limit action**	Default	0	Change	×
Setting range	0: Run at the lower frequency limit 1: Coast stop after running at the lower frequency limit for a period of time				
Fb-22	**Lower frequency limit running time**	Default	10.0s	Change	○
Setting range	0.0～6000.0s				

& Fb-21 and Fb-22 are mainly set for fans and pumps that cannot operate at a too low load working frequency. Fb-21 is used to set the inverter action when the working frequency reaches the minimum frequency allowed by load (i.e. the lower frequency limit of inverter).

& When Fb-21 is set to 1, the inverter will proceed to coast stop after running for a period of time set by Fb-22.

Fb-23	**Grid overvoltage detection point**		Default	Depends on model	Change	×
Setting range	3kV	3300～4500V Default: 3900V	3.3kV	3600～4900V Default: 4300V		
	6kV	6600～9000V Default: 7800V	6.6kV	7250～9900V Default: 8600V		
	10kV	11000~15000V Default: 13000V	11kV	12000～16500V Default: 14300V		
Fb-25	**Inverter input phase loss protection**		Default	1	Change	×
Setting range	0: No action 1: Alarm 2: Coast to a stop due to fault					
Fb-26	**Inverter output phase loss protection**		Default	2	Change	×
Setting range	0: No action 1: Alarm 2: Coast to a stop due to fault					

Fb-27	HMI communication failure action	Default	1	Change	×
Setting range	0: No action 1: Alarm 2: Coast to a stop due to fault				
Fb-28	**Analog input disconnection detection enabled**	Default	**111**	Change	×
Setting range	0: Disconnection detection disabled 1: Disconnection detection enabled bit0：AI1 bit1：AI2 bit2：AI3				
Fb-29	**Motor overspeed action**	Default	1	Change	×
Setting range	0: No action 1: Alarm 2: Coast to a stop due to fault				
Fb-30	**Motor overspeed detection level**	Default	110.0%	Change	×
Setting range	0.0-120.0%, rated frequency of motor as 100%				
Fb-31	**Motor overspeed detection time**	Default	0.1s	Change	×
Setting range	0.0～2.0s				

& Inverter output phase loss protection: When the inverter has the fault of output phase loss, the motor will run in single phase, which will lead to both a greater current and torque pulsation. Output phase loss protection prevents the motor and its mechanical load being damaged.

& When the output frequency or current is very low, the output phase loss protection will be invalid.

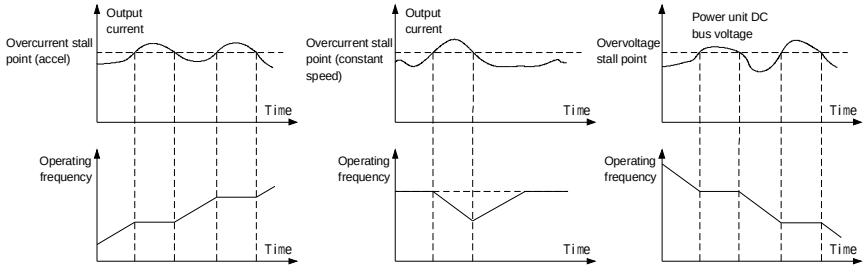
Fb-32	Accel overcurrent stall prevention	Default	1	Change	×
Setting range	0: Invalid 1: Valid; time limit of 1min 2: Valid, no time limit				
Fb-33	**Accel overcurrent stall point**	Default	115.0%	Change	×
Setting range	10.0-150.0%; rated current of inverter as 100%				
Fb-34	**Constant-speed overcurrent stall prevention**	Default	1	Change	×
Setting range	0: Invalid 1: Valid; time limit of 1min 2: Valid, no time limit				
Fb-35	**Constant-speed overcurrent stall point**	Default	115.0%	Change	×
Setting range	10.0-150.0%; rated current of inverter as 100%				
Fb-36	**Overvoltage stall prevention**	Default	1	Change	×
Setting range	0: Invalid 1: Valid				

& During acceleration, when Fb-32 "Accel overcurrent stall prevention" is valid and the output current is greater than Fb-33 "Accel overcurrent stall point", the acceleration stops temporarily. After the current drops, the motor continues to accelerate. See diagram (a) below.

& During constant-speed running, when Fb-34 "Constant-speed overcurrent stall prevention" is valid and the output current is greater than Fb-35 "Constant-speed overcurrent stall point", the motor decelerates. After the current drops, the motor reaccelerates to the original operating

frequency. See diagram(b) below.

& During deceleration, when Fb-36 "Overvoltage stall prevention" is valid and the DC bus voltage of the power unit is greater than "overvoltage stall point", the deceleration stops temporarily. After the DC bus voltage drops to the normal level, the motor continues to decelerate. See diagram (c) below.



（a） （b） （c）

Fb-38	Input power supply power-off action	Default	0	Change	×
Setting range	0: Coast to a stop and report the undervoltage fault 1: Coast to a stop, and restart if the voltage resumes within the time set				
Fb-40	**Allowable time for momentary power failure**	Default	3.0s	Change	×
Setting range	0.0～30.0s				

& When the input voltage is too low:

Fb-38＝0: An undervoltage is deemed a fault. Coast stop will follow and an undervoltage fault will be reported.

Fb-38＝1: In this case, the output will be locked and the drop in DC bus voltage slows down. If the voltage is restored within Fb-40 “Allowable time for momentary power failure”, a restart (depending on Fb-46 “Restart after momentary stop”) will follow and the undervoltage timeout fault will be reported.

& Fb-38＝1: This solution is intended for large-inertia loads, such as fans and centrifuges, to prevent undervoltage shutdown caused by instantaneous power failure.

& Fb-40 “Allowable time for momentary power failure”: The parameter only applies to cases where Fb-38=1.

& A free shutdown will follow and an undervoltage fault will be reported in the case of an undervoltage in operation. In the case of an undervoltage in standby mode, only an alarm will be generated.

Fb-43	Auto reset times	Default	0	Change	×
Setting range	0～10				
Fb-44	**Auto reset interval**	Default	5.0s	Change	×
Setting range	1.0～30.0s				

Fb-45	Fault output during auto reset	Default	0	Change	×
Setting range	0: No output 1: Output				
Fb-46	**Restart after momentary stop**	Default	1	Change	×
Setting range	0: Startup in the startup mode 1: Tracking startup				

& Auto reset function: when a fault occurs during running, the fault is reset automatically according to the settings of Fb-44 "Auto reset interval" and Fb-43 "Auto reset times", thus avoiding trip due to misoperation, instantaneous power supply overvoltage and external non-repeated impact.

& Auto reset process: when a fault occurs during running, it is reset automatically after the auto reset interval. If the fault disappears, the motor restarts according to the mode set by Fb-46 "Restart after momentary stop"; if the fault still exists and the reset times is not greater than Fb-43, the attempt of auto reset will continue; otherwise an alarm is reported and the motor stops.

& Auto reset times is cleared in any of the following cases: no fault occurs within the ten minutes after the fault reset; fault is manually reset after it is detected; power supply resumes after the momentary power failure.

& Fb-45 "Fault output during auto reset": used to select whether digital output 7 "Fault output" is valid during auto reset.

& Faults of power device protection, external fault and emergency stop are not reset automatically.

⚠ DANGER: Auto reset must be used with care. It may cause injury to people or damage to equipment.

Fb-48	Modulation mode	Default	1	Change	○
Setting range	0: Discontinuous modulation 1: Continuous modulation				

& The discontinuous modulation in the auto mode has a lower switching loss but greater harmonics compared with the continuous one.

Fb-49	Carrier frequency	Default	600	Change	×
Setting range	500～2000Hz				

& Fb-49 "Carrier frequency": Increasing the carrier frequency can lower the motor noise, harmonic current and the heat generated by the motor, but raise the common-mode current, disturbance and the heat generated by the inverter, while decreasing the carrier frequency will lead to the opposite. Therefore, when a silent run is required, you can moderately raise the carrier frequency. If the set carrier frequency is higher than the default value, then the inverter shall be derated by 5% for every increment of 1kHz.

Fb-52	Overmodulation	Default	1	Change	×
Setting range	0: Disabled 1: Enabled				

& Overmodulation enables the inverter to have a high output voltage which can be near or greater than the power supply voltage, but also causes high torque ripples of the motor. Disabling

overmodulation can eliminate the torque ripples and improve the control of such load as grinding machines.

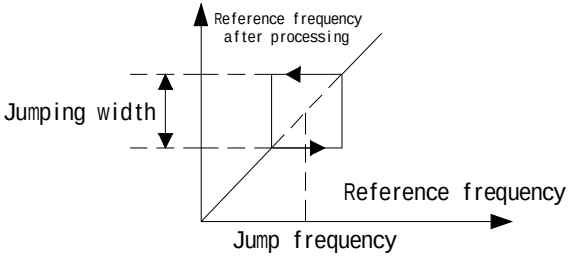
Fb-53	Cooling fan control	Default	0	Change	○
Setting range	0: Standby time delay disable 1: Constant operation				

& In applications where the motor starts/stops frequently, it's preferably to set the parameter to 1 to prevent frequent start/stop of the cooling fan.

Fb-54	Jump frequency 1	Default	0.00Hz	Change	○
Setting range	0.00～120.00Hz				
Fb-55	Jumping width 1	Default	0.00Hz	Change	○
Setting range	0.00～20.00Hz				
Fb-56	Jump frequency 2	Default	0.00Hz	Change	○
Setting range	0.00～120.00Hz				
Fb-57	Jumping width 2	Default	0.00Hz	Change	○
Setting range	0.00～20.00Hz				
Fb-58	Jump frequency 3	Default	0.00Hz	Change	○
Setting range	0.00～120.00Hz				
Fb-59	Jumping width 3	Default	0.00Hz	Change	○
Setting range	0.00～20.00Hz				
Fb-60	Grounding protection action	Default	2	Change	×
Setting range	0: No action 1: Alarm 2: Coast to a stop due to fault				

& The jump frequency function prevents the inverter running at the mechanical resonant points.

& During acceleration or deceleration, the inverter can run through the jump frequency smoothly, but cannot keep steady-state operation within the jumping width.



6.11 Fd: Expansion options and functions

Fd-00	PG pulse number per revolution	Default	1024	Change	×
Setting range	1～8192				
Fd-01	PG type	Default	0	Change	×
Setting range	0: Quadrature encoder 1: Single-channel encoder				

Fd-02	PG direction	Default	0	Change	×
Setting range	0: Positive (direction is positive if phase A of quadrature encoder leads phase B) 1: Negative (direction is positive if phase B of quadrature encoder leads phase A)				
Fd-03	PG disconnection action	Default	2	Change	×
Setting range	0: No action 1: Alarm 2: Coast to a stop due to fault				
Fd-04	PG disconnection detection time	Default	1.0s	Change	×
Setting range	0.1～10.0s				
Fd-05	PG speed ratio denominator	Default	1	Change	×
Fd-06	PG speed ratio numerator	Default	1	Change	×
Setting range	1～1000				
Fd-07	PG speed test filtering time	Default	0.005s	Change	○
Setting range	0.000～2.000s				

& Fd-01 "PG type": If single-channel encoder is selected, the signal must enter from channel A. Single-channel encoder is not applicable to low-speed operations and operations with both forward and reverse directions.

& Fd-02 "PG direction": For a single-channel encoder, if positive direction is selected, then the encoder speed value (FU-05 "PG detection frequency") is always positive, otherwise always negative.

& PG disconnection: PG is regarded to be disconnected if the reference frequency of the speed regulator is greater than 0.5Hz and the encoder fails to generate a pulse within the time set by Fd-04 "PG disconnection detection time". The motor act according to the setting of Fd-03 "PG disconnection action". PG disconnection detection is performed only for V/F control with PG.

& In applications where the encoder is connected to the motor shaft via speed changing devices such as gears, Fd-05 and Fd-06 must be correctly set. The relationship between the encoder speed and motor speed is:

Motor speed=encoder speed×Fd-06 "PG speed ratio numerator" ÷ Fd-05 "PG speed ratio denominator"

& Fd-07 "PG speed test filtering time": Fd-07 shall not be too large if a high dynamic performance is required.

& Related monitored parameter: FU-05 "PG detection frequency"

& **Encoder setting verification method:** Adopt V/F control without PG and run the motor in the direction and at the frequency which are allowed by the load. Observe whether the direction of FU-05 "PG detection frequency" is consistent with the direction displayed on the HMI, and if the value of FU-05 is close to the reference frequency.

⚠ **DANGER: PG parameters must be set correctly in control modes with PG; otherwise injury to people and damage to equipment may occur. The setting of the encoder direction must be rechecked after the motor cables are rewired.**

Fd-08	Fan life expectancy	Default	40000h	Change	○
Setting range	1～65000h				

& When the accumulated running time of a fan reaches the preset fan life expectancy, the digital input terminal function 45 "Fan life expectancy reach" becomes valid. It's advisable to replace with a fan of the same model. After fan replacement, the user can use the reset button next to the monitored parameter FU-50 on the HMI to clear the cumulative fan run time. The digital output 45 "Fan life expectancy reach" becomes invalid at the same time.

& Related parameter: the digital output terminal function 45 "Fan life expectancy reach".

Monitored parameter: FU-50 "Cumulative fan run time"

6.12 FF: Communication parameters

FF-00	Communication protocol	Default	0	Change	×
Setting range	0: Modbus-RTU protocol 1：Profibus-DP				
FF-01	Communication data format	Default	0	Change	×
Setting range	0: 8,N,1 (1 start bit, 8 data bits, no parity check, 1 stop bit) 1: 8,E,1 (1 start bit, 8 data bits, even check, 1 stop bit) 2: 8,O,1 (1 start bit, 8 data bits, odd check, 1 stop bit) 3: 8,N,2 (1 start bit, 8 data bits, no parity check, 2 stop bits)				
FF-02	Baud rate	Default	3	Change	×
Setting range	0：1200bps　1：2400bps　2：4800bps 3：9600bps　4：19200bps　5：38400bps				
FF-03	Local address	Default	1	Change	×
Setting range	0～247 NOTE: 1~247 for Modbus, 0~127 for Profibus				
FF-04	Communication overtime detection time	Default	10.0s	Change	○
Setting range	0.1~600.0s				
FF-05	Local response delay	Default	5ms	Change	○
Setting range	0～1000ms				
FF-06	Communication overtime action	Default	0	Change	×
Setting range	0: No action 1: Alarm 2: Alarm and run according to F0-00 2: Alarm and coast to a stop				
FF-07	Communication reference magnification	Default	1.000	Change	○
Setting range	0.001～30.000. Frequency reference = FF-07×communication reference frequency				
FF-08	PROFIBUS data type	Default	4	Change	×
Setting range	0～4：PPO1～PPO5				

FF-09	Actual value	Default	0	Change	○
Setting range	Select the contents in the FU menu for output				
FF-10	**Process word 1**	Default	39	Change	○
FF-11	**Process word 2**	Default	21	Change	○
FF-12	**Process word 3**	Default	32	Change	○
FF-13	**Process word 4**	Default	19	Change	○
FF-14	**Process word 5**	Default	40	Change	○
FF-15	**Process word 6**	Default	30	Change	○
FF-16	**Process word 7**	Default	2	Change	○
FF-17	**Process word 8**	Default	4	Change	○
Setting range	Select the contents in the FU menu for output				

& Senlan inverter's RS485 Modbus-RTU protocol comprises three layers: Physical layer, Data Link layer and Application layer. The former two layers employ the RS485-based Modbus protocol. The application layer controls inverter run/stop, parameter reading and writing, etc.

& Modbus-RTU is a master-slave protocol. The communication between the master and slave falls into two types: master requests, slave responds; master broadcasts, slave doesn't respond. At any time, the bus can have only one sending device. The master polls the slaves. Any slave can't send messages without receiving the command from the master. The master may resend the command when the communication is not correct. If the master doesn't get a response within given time, the slave polled is considered to be lost. The slave sends a piece of error information to the master if it cannot implement a message.

& Communication only changes RAM values. If a parameter in RAM is to be written into EEPROM, the communication variable "EEP write command" (Modbus address is 3209H) needs to be changed to 1 by communication.

& Method of addressing the inverter parameters: among the 16 bits of the Modbus parameter address, the upper 8 bits represent the group number of a parameter, and the lower 8 bits represent the serial number of the same parameter in the group. Addressing is based on the hexadecimal system. For example, the address of the parameter F4-17 is 0411H. The group number is 50(32H) for communication variables (control word, status word, etc.). NOTE: Communication variables include inverter parameters which can be accessed to by communication, as well as communication dedicated command variables and status variables. The menu codes correspond to the group numbers of parameters according to table below.

Menu code	Parameter group No.	Menu code	Parameter group No.	Menu code	Parameter group No.	Menu code	Parameter group No.
F0	0（00H）	F5	5（05H）	FA	10（0AH）	FF	15（0FH）
F1	1（01H）	F6	6（06H）	Fb	11（0BH）	Fn	16（10H）
F2	2（02H）	F7	7（07H）	Fc	12（0CH）	FP	17（11H）
—	—	F8	8（08H）	Fd	13（0DH）	FU	18（12H）
F4	4（04H）	F9	9（09H）	—	—	—	—

& Data types in communication: The data transmitted in communication are 16-bit integers. The minimum unit is indicated by the place of the decimal point. For example, the minimum unit of F0-00 "Digital reference frequency" is 0.01Hz, therefore, for the Modubus-RTU protocol, data 5000 transmitted in communication represents 50.00Hz.

& Table of communication command variables:

Name	Modbus address	Change	Description
Main control word	3200H	○	Bit 0: ON/OFF1 (run on rising edge. 0: stop) Bit 1: OFF2 (0: coast stop) Bit 2: OFF3 (0: emergency stop) Bit 3: Driving lockout (0: driving lockout) Bit 4: Accel/decel enabled (0: accel/decel disabled) Bit 5: Reserved Bit 6: Reserved Bit 7: Fault reset (on rising edge) Bit 8: Jog forward Bit 9: Jog reverse Bit 10: Reserved Bit 11: Reference reversion (1: reference frequency reversed, 0: not reversed) Bit 12: Reserved Bit 13: UP Bit 14: DOWN Bit 15: Reserved
Communication reference frequency	3201H	○	Non-negatives (unit: 0.01Hz), used as the frequency reference after multiplied by FF-07.
PC analog 1	3202H	○	Range: －100.00%～100.00%
PC analog 2	3203H	○	
Extended control word 1	3204H	○	Bits 0～15 correspond to digital inputs 1～16
Extended control word 2	3205H	○	Bits 0~15 correspond to digital inputs 17～32
Extended control word 3	3206H	○	Bits 0~15 correspond to digital inputs 33～48
Extended control word 4	3207H	○	Bit 0 corresponds to digital input 49, other bits are reserved.
Extended control word 5	3208H	○	Reserved
EEPROM write-in	3209H	○	When “1” is written to this address, the parameters in the inverter RAM will be written in EEPROM.

NOTE: Digital inputs 37 "3-wire stop command", 38 "Internal virtual FWD terminal" and 39 "Internal virtual REV terminal" are only used for terminal control. They are invalid in communication control.

& Table of communication status variables

Name	Modbus address	Change	Description
Main status word	3210H	Δ	Bit 0: Ready Bit 1: Ready for run Bit 2: Running Bit 3: Fault Bit 4: OFF2 valid (0: valid) Bit 5: OFF3 stopping (0: valid) Bit 6: Charging contactor open Bit 7: Alarm Bit 8: Reserved Bit 9: Reserved Bit 10: Frequency reach detection signal 1 Bit 11: Reserved Bit 12: Reserved Bit 13: Reserved Bit 14: Running forward Bit 15: Reserved
Actual Value	3211H	Δ	Corresponding to FF-09
Process word 1 select output	3212H	Δ	Corresponding to FF-10
Process word 2 select output	3213H	Δ	Corresponding to FF-11
Process word 3 select output	3214H	Δ	Corresponding to FF-12
Process word 4 select output	3215H	Δ	Corresponding to FF-13
Process word 5 select output	3216H	Δ	Corresponding to FF-14
Process word 6 select output	3217H	Δ	Corresponding to FF-15
Process word 7 select output	3218H	Δ	Corresponding to FF-16
Process word 8 select output	3219H	Δ	Corresponding to FF-17

Name	Modbus address	Change	Description
Alarm word 1	321AH	△	See the table of alarms and remedies on Page 98.
Alarm word 2	321BH	△	See the table of alarms and remedies on Page 98.
Extended status word 1	321CH	△	Bits 0～15 correspond to digital outputs 0～15
Extended status word 2	321DH	△	Bits 0~15 correspond to digital outputs 16～31
Extended status word 3	321EH	△	Bits 0~15 correspond to digital outputs 32～47
Extended status word 4	321FH	△	Bits 0～5 correspond to digital outputs 48～53, other bits are reserved.
Extended status word 5	3220H	△	Reserved

& SBH high voltage inverter supports the Modbus protocol using RTU (Remote Terminal Unit) mode. The functions it supports include: Function 3 (read multiple parameters, with max. word number of 50), Function 16 (write multiple parameters, with max. word number of 10) and Function 8 (read-back test). Among them, Function 16 supports broadcast (broadcast message address is 0). In RTU mode, both the starting and ending of the message frame are marked by an interval of at least 3.5 character times (but 2ms for baud rates of 19200bit/s and 38400bit/s). A typical RTU message frame is shown below.

Slave address (1 byte)	Modbus function code (1 byte)	Data (multiple bytes)	CRC16 (2 bytes)

& Function 3: read multiple parameters. Word number read ranges from 1 to 50. Refer to the following example for its message format.

Example: read the main status word, operating frequency and process word 1 output (three words with their addresses beginning with 3210H) from the #1 slave.

Query from master:

Slave address	01H
Modbus function code	03H
Start address (MSB)	32H
Start address (LSB)	10H
Word number read (MSB)	00H
Word number read (LSB)	03H
CRC (LSB)	0AH
CRC (MSB)	B6H

Response from slave:

Slave address	01H
Modbus function code	03H
Byte number returned	06H
MSB of 3210H	44H
LSB of 3210H	37H
MSB of 3211H	13H
LSB of 3211H	88H
MSB of 3212H	00H
LSB of 3212H	00H
CRC (LSB)	5FH
CRC (MSB)	5BH

& Function 16: write multiple parameters. Word number written ranges from 1 to 10. Refer to the following example for its message format.

Example: to make the #1 slave runs forward at 50.00Hz, you can rewrite the two words with their addresses beginning with 3200H into 003FH and 1388H.

Query from master:

Slave address	01H
Modbus function code	10H
Start address (MSB)	32H
Start address (LSB)	00H
Word number written (MSB)	00H
Word number written (LSB)	02H
Byte number written	04H
MSB of 1st data	00H
LSB of 1st data	3FH
MSB of 2nd data	13H
LSB of 2nd data	88H
CRC (LSB)	83H
CRC (MSB)	94H

Response from slave:

Slave address	01H
Modbus function code	10H
Start address (MSB)	32H
Start address (LSB)	00H
Word number written (MSB)	00H
Word number written (LSB)	02H
CRC (LSB)	4FH
CRC (MSB)	70H

Example: to make the #1 slave stop (forward run at 50.00Hz), you can rewrite the two words with their addresses beginning with 3200H into 003EH and 1388H.

Query from master:

Slave address	01H
Modbus function code	10H

Response from slave:

Start address (MSB)	32H
Start address (LSB)	00H
Word number written (MSB)	00H
Word number written (LSB)	02H
Byte number written	04H
MSB of 1st data	00H
LSB of 1st data	3EH
MSB of 2nd data	13H
LSB of 2nd data	88H
CRC (LSB)	D2H
CRC (MSB)	54H

Slave address	01H
Modbus function code	10H
Start address (MSB)	32H
Start address (LSB)	00H
Word number written (MSB)	00H
Word number written (LSB)	02H
CRC (LSB)	4FH
CRC (MSB)	70H

& Function 8: read-back test. The test code is 0000H. The original frame is required to return, as shown below.

& Exception response: if the slave fails to implement the request from the master, it will return an exception response message.

Example of read-back test:

Slave address	01H
Modbus function code	08H
MSB of test function code	00H
LSB of test function code	00H
MSB of test data	37H
LSB of test data	DAH
CRC (LSB)	77H
CRC (MSB)	A0H

Example of exception response:

Slave address	1 byte
Response code	1 byte (Modbus function code＋80H)
Exception code	1 byte, with following meanings: 1: Modbus function codes that can't be handled 2: illegal data address 3: data value beyond the range 4: operation failed（such as attempting to write a read-only parameter, modifying an unchangeable parameter during running, etc.）
CRC (LSB)	—
CRC (MSB)	—

6.13 FP: Fault history

FP-00	Type of Last Fault	Min. unit	1	Change	▵
Description	See the list of faults below				

0: No fault
1: Momentary overcurrent at start
2: Overcurrent in accel
3: Overcurrent in decel
4: Overcurrent in constant-speed run
5: Overvoltage in accel
6: Overvoltage in decel
7: Overvoltage in constant-speed run
8: Overvoltage in standby state
9: Undervoltage in run
10: Input phase loss
11: Inverter overheating
12: Inverter overload
13: Motor overload
14: Motor overheating
15: External fault
16: Motor load overweight
17: Inverter underload
18: Input voltage detection fault
19: Output voltage detection fault
20: Input current detection fault
21: Output current detection fault
22: Feeder circuit breaker abnormality
23: Charging circuit breaker abnormality
24: Bypass circuit breaker abnormality
25: Output circuit breaker abnormality
26: Phase-shifting transformer overheating
27: Reserved
28: Parameter saving failed
29: Communication abnormality
30: Analog input disconnection
31: Cabinet overheating fault
32: Cabinet cover interlock switch not in place
33: Abnormal stop fault
34: Controller communication fault
35: HMI communication fault
36: Power-on failure for unclosed cabinet cover
37: Grid overvoltage fault
38: Output ground fault
39: Charge fault (beyond the expected time)
40: Motor overspeed fault
41: Motor temperature detection open circuit and short circuit
42: PG disconnection
43: Power unit fault
44: Unit bypass contactor fault
45: Input phase loss fault
46: Fan contactor fault
47: PID above upper limit fault
48: PID below lower limit fault
49: Reserved
50: Reserved
51: Reserved
52: Reserved
53: IO1 54: IO2
55: Emergency stop

FP-01	Last fault time (month day year)	Min. unit	—	Change	▵
FP-02	Last fault time (hour minute second)	Min. unit	—	Change	▵
FP-03	Operating frequency at last fault	Min. unit	0.01Hz	Change	▵

FP-04	**Reference frequency at last fault**	Min. unit	0.01Hz	Change	▵
FP-05	**Output current at Last Fault**	Min. unit	0.1A	Change	▵
FP-06	**Output voltage at last fault**	Min. unit	1V	Change	▵
FP-07	**Output power at last fault**	Min. unit	1kW	Change	▵
FP-08	**Input current at last fault**	Min. unit	0.1A	Change	▵
FP-09	**Input voltage at last fault**	Min. unit	1V	Change	▵
FP-10	**DC busbar voltage at last fault**	Min. unit	1V	Change	▵
FP-11	**Terminal input status at last fault**	Min. unit	1	Change	▵
Description	T3-T1, Y2, Y1, REV, FWD, X6 ~ X1 are arranged bit by bit.				
FP-12	**Unit U4U3U2U1 state at last fault**	Min. unit	—	Change	▵
FP-13	**Unit U8U7U6U5 state at last fault**	Min. unit	—	Change	▵

FP-14	**Unit V4V3V2V1 state at last fault**	Min. unit	—	Change	Δ
FP-15	**Unit V8V7V6V5 state at last fault**	Min. unit	—	Change	Δ
FP-16	**Unit W4W3W2W1 state at last fault**	Min. unit	—	Change	Δ
FP-17	**Unit W8W7W6W5 state at last fault**	Min. unit	—	Change	Δ
FP-18	**Unit W9V9U9 state at last fault**	Min. unit	—	Change	Δ
FP-19	**Single-time run time at last fault**	Min. unit	0.1h	Change	Δ
FP-20	**Type of second last fault**	Same as FP-00	—	Change	Δ
FP-21	**Second last fault time (month day year)**	Min. unit	—	Change	Δ
FP-22	**Second last fault time (hour minute second)**	Min. unit	—	Change	Δ
FP-23	**Operating frequency at 2nd last fault**	Min. unit	0.01Hz	Change	Δ
FP-24	**Reference frequency at 2nd last fault**	Min. unit	0.01Hz	Change	Δ

FP-25	**Output current at 2nd last fault**	Min. unit	0.1A	Change	▵
FP-26	**Output voltage at 2nd last fault**	Min. unit	1V	Change	▵
FP-27	**Output power at 2nd last fault**	Min. unit	1kW	Change	▵
FP-28	**Input current at 2nd last fault**	Min. unit	0.1A	Change	▵
FP-29	**Input voltage at 2nd last fault**	Min. unit	1V	Change	▵
FP-30	**DC busbar voltage at 2nd last fault**	Min. unit	1V	Change	▵
FP-31	**Terminal input state at 2nd last fault**	Min. unit	—	Change	▵
Description	T3-T1, Y2, Y1, REV, FWD, X6 ~ X1 are arranged bit by bit.				
FP-32	**Unit U4U3U2U1 state at 2nd last fault**	Min. unit	—	Change	▵
FP-33	**Unit U8U7U6U5 state at 2nd last fault**	Min. unit	—	Change	▵
FP-34	**Unit V4V3V2V1 state at 2nd last fault**	Min. unit	—	Change	▵

FP-35	**Unit V8V7V6V5 state at 2nd last fault**	Min. unit	—	Change	△
FP-36	**Unit W4W3W2W1 state at 2nd last fault**	Min. unit	—	Change	△
FP-37	**Unit W8W7W6W5 state at 2nd last fault**	Min. unit	—	Change	△
FP-38	**Unit W9V9U9 state at 2nd last fault**	Min. unit	—	Change	△
FP-39	**Single-time run time at 2nd last fault**	Min. unit	0.1h	Change	△
FP-40	**Type of 3rd last fault**	Same as FP-00	—	Change	△
FP-41	**3rd last fault time (month day year)**	Min. unit	—	Change	△
FP-42	**3rd last fault time (hour minute second)**	Min. unit	—	Change	△
FP-43	**Operating frequency at 3rd last fault**	Min. unit	0.01Hz	Change	△
FP-44	**Reference frequency at 3rd last fault**	Min. unit	0.01Hz	Change	△
FP-45	**Output current at 3rd last fault**	Min. unit	0.1A	Change	△

FP-46	**Output voltage at 3rd last fault**	Min. unit	1V	Change	▵
FP-47	**Output power at 3rd last fault**	Min. unit	1kW	Change	▵
FP-48	**Input current at 3rd last fault**	Min. unit	0.1A	Change	▵
FP-49	**Input voltage at 3rd last fault**	Min. unit	1V	Change	▵
FP-50	**DC busbar voltage at 3rd last fault**	Min. unit	1V	Change	▵
FP-51	**Terminal input state at 3rd last fault**	Min. unit	—	Change	▵
Description	T3-T1, Y2, Y1, REV, FWD, X6 ~ X1 are arranged bit by bit				
FP-52	**Unit U4U3U2U1 state at 3rd last fault**	Min. unit	—	Change	▵
FP-53	**Unit U8U7U6U5 state at 3rd last fault**	Min. unit	—	Change	▵
FP-54	**Unit V4V3V2V1 state at 3rd last fault**	Min. unit	—	Change	▵
FP-55	**Unit V8V7V6V5 state at 3rd last fault**	Min. unit	—	Change	▵

FP-56	**Unit W4W3W2W1 state at 3rd last fault**	Min. unit	—	Change	△
FP-57	**Unit W8W7W6W5 state at 3rd last fault**	Min. unit	—	Change	△
FP-58	**Unit W9V9U9 state at 3rd last fault**	Min. unit	—	Change	△
FP-59	**Single-time run time at 3rd last fault**	Min. unit	0.1h	Change	△
FP-60	**Type of 4th last fault**	Same as FP-00	—	Change	△
FP-61	**4th last fault time (month day year)**	Min. unit	—	Change	△
FP-62	**4th last fault time (hour minute second)**	Min. unit	—	Change	△
FP-63	**Operating frequency at 4th last fault**	Min. unit	0.01Hz	Change	△
FP-64	**Reference frequency at 4th last fault**	Min. unit	0.01Hz	Change	△
FP-65	**Output current at 4th last fault**	Min. unit	0.1A	Change	△
FP-66	**Output voltage at 4th last fault**	Min. unit	1V	Change	△

FP-67	**Output power at 4th last fault**	Min. unit	1kW	Change	△
FP-68	**Input current at 4th last fault**	Min. unit	0.1A	Change	△
FP-69	**Input voltage at 4th last fault**	Min. unit	1V	Change	△
FP-70	**DC busbar voltage at 4th last fault**	Min. unit	1V	Change	△
FP-71	**Terminal input state at 4th last fault**	Min. unit	—	Change	△
Description	T3-T1, Y2, Y1, REV, FWD, X6 ~ X1 are arranged bit by bit				
FP-72	**Unit U4U3U2U1 state at 4th last fault**	Min. unit	—	Change	△
FP-73	**Unit U8U7U6U5 state at 4th last fault**	Min. unit	—	Change	△
FP-74	**Unit V4V3V2V1 state at 4th last fault**	Min. unit	—	Change	△
FP-75	**Unit V8V7V6V5 state at 4th last fault**	Min. unit	—	Change	△
FP-76	**Unit W4W3W2W1 state at 4th last fault**	Min. unit	—	Change	△

FP-77	**Unit W8W7W6W5 state at 4th last fault**	Min. unit	—	Change	Δ
FP-78	**Unit W9V9U9 state at 4th last fault**	Min. unit	—	Change	Δ
FP-79	**Single-time run time at 4th last fault**	Min. unit	0.1h	Change	Δ
FP-80	**Type of 5th last fault**	Same as FP-00	—	Change	Δ
FP-81	**5th last fault time (month day year)**	Min. unit	—	Change	Δ
FP-82	**5th last fault time (hour minute second)**	Min. unit	—	Change	Δ
FP-83	**Operating frequency at 5th last fault**	Min. unit	0.01Hz	Change	Δ
FP-84	**Reference frequency at 5th last fault**	Min. unit	0.01Hz	Change	Δ
FP-85	**Output current at 5th last fault**	Min. unit	0.1A	Change	Δ
FP-86	**Output voltage at 5th last fault**	Min. unit	1V	Change	Δ
FP-87	**Output power at 5th last fault**	Min. unit	1kW	Change	Δ

FP-88	**Input current at 5th last fault**	Min. unit	0.1A	Change	▵
FP-89	**Input voltage at 5th last fault**	Min. unit	1V	Change	▵
FP-90	**DC busbar voltage at 5th last fault**	Min. unit	1V	Change	▵
FP-91	**Terminal input state at 5th last fault**	Min. unit	—	Change	▵
Description	T3-T1, Y2, Y1, REV, FWD, X6 ~ X1 are arranged bit by bit				
FP-92	**Unit U4U3U2U1 state at 5th last fault**	Min. unit	—	Change	▵
FP-93	**Unit U8U7U6U5 state at 5th last fault**	Min. unit	—	Change	▵
FP-94	**Unit V4V3V2V1 state at 5th last fault**	Min. unit	—	Change	▵
FP-95	**Unit V8V7V6V5 state at 5th last fault**	Min. unit	—	Change	▵
FP-96	**Unit W4W3W2W1 state at 5th last fault**	Min. unit	—	Change	▵
FP-97	**Unit W8W7W6W5 state at 5th last fault**	Min. unit	—	Change	▵

FP-98	**Unit W9V9U9 state at 5th last fault**	Min. unit	—	Change	△
FP-99	**Single-time run time at 5th last fault**	Min. unit	0.1h	Change	△

6.14 FU: Data monitoring

FU-00	**Operating frequency**	Min. unit	0.01Hz	Change	△
Description	Frequency reflecting the motor speed				
FU-01	**Operating frequency percentage**	Min. unit	0.01%	Change	△
Description	Rated max. frequency of inverter as 100%				
FU-02	**Reference frequency**	Min. unit	0.01Hz	Change	△
FU-03	**PLC current mode and stage**	Min. unit	—	Change	△
Description	Example: 1.02 indicates the 2nd stage of mode 1.				
FU-04	**Output power factor**	Min. unit	0.01	Change	△
FU-05	**PG detection frequency**	Min. unit	0.01Hz	Change	△
FU-06	**Output torque**	Min. unit	0.01%	Change	△

FU-07	**Reference torque**	Min. unit	0.01%	Change	Δ
Description	Rated torque as 100%				
FU-08	**PID feedback**	Min. unit	0.01%	Change	Δ
Description	FU-08 "PID feedback" = PID feedback channel × F7-03 "PID display coefficient"				
FU-09	**PID reference**	Min. unit	0.01%	Change	Δ
Description	FU-09 "PID reference" = PID reference channel × F7-03 "PID display coefficient"				
FU-10	**PID Output Value**	Min. unit	0.01%	Change	Δ
FU-11	**UP/DOWN value**	Min. unit	0.01%	Change	Δ
FU-12	**AI1**	Min. unit	0.01%	Change	Δ
FU-13	**AI2**	Min. unit	0.01%	Change	Δ
FU-14	**AI3**	Min. unit	0.01%	Change	Δ
FU-15	**PFI**	Min. unit	0.01%	Change	Δ
FU-16	**Input watt-hour meter timer**	Min. unit	1h	Change	Δ

Description	Cleared via HMI				
FU-17	**Output watt-hour meter timer**	Min. unit	1h	Change	∆
Description	Cleared via HMI				
FU-18	**Remaining time of PLC current stage**	Min. unit	0.1s/min	Change	∆
FU-19	**Output current**	Min. unit	0.1A	Change	∆
FU-20	**Load current percentage**	Min. unit	0.1%	Change	∆
Description	Rated inverter current as 100%				
FU-21	**Input current**	Min. unit	0.1A	Change	∆
FU-22	**R-phase input current (instantaneous)**	Min. unit	0.1A	Change	∆
FU-23	**S-phase input current (instantaneous)**	Min. unit	0.1A	Change	∆
FU-24	**T-phase input current (instantaneous)**	Min. unit	0.1A	Change	∆
FU-25	**U-phase output current (instantaneous)**	Min. unit	0.1A	Change	∆
FU-26	**V-phase output current (instantaneous)**	Min. unit	0.1A	Change	∆

FU-27	**W-phase output current (instantaneous)**	Min. unit	0.1A	Change	Δ
FU-28	**Constant current output**	Min. unit	0.1mA	Change	Δ
Description	Used for motor temperature detection by AO, AI				
FU-29	**Motor temperature**	Min. unit	0.1°C	Change	Δ
Description	Only valid in the case of Pt100				
FU-30	**Input watt-hour meter kWh**	Min. unit	1kWh	Change	Δ
FU-31	**Output watt-hour meter kWh**	Min. unit	1kWh	Change	Δ
Description	Cleared via HMI (FU-30 can be extended into 32-bit count via FU-86 and FU-31 can be extended to 32-bit count via FU-87)				
FU-32	**Output voltage**	Min. unit	1V	Change	Δ
FU-33	**Operating speed**	Min. unit	1r/min	Change	Δ
FU-34	**Reference speed**	Min. unit	1r/min	Change	Δ
FU-35	**DC bus voltage**	Min. unit	1V	Change	Δ
FU-36	**Output power**	Min. unit	1kW	Change	Δ

FU-37	**Operating line speed**	Min. unit	1m/s	Change	▵
Description	FU-37 "Operating line speed" = operating frequency × FC-06 "Line speed display coefficient"				
FU-38	**Reference line speed**	Min. unit	1m/s	Change	▵
Description	FU-38 "Reference line speed" = reference frequency× FC-06 "Line speed display coefficient"				
FU-39	**Input voltage**	Min. unit	1V	Change	▵
FU-40	**Input power**	Min. unit	1kW	Change	▵
FU-41	**Input RS line voltage (instantaneous)**	Min. unit	1V	Change	▵
FU-42	**Input ST line voltage (instantaneous)**	Min. unit	1V	Change	▵
FU-43	**Input TR line voltage (instantaneous)**	Min. unit	1V	Change	▵
FU-44	**Output UV line voltage (instantaneous)**	Min. unit	1V	Change	▵
FU-45	**Output VW line voltage (instantaneous)**	Min. unit	1V	Change	▵
FU-46	**Output WU line voltage (instantaneous)**	Min. unit	1V	Change	▵

FU-47	**Communication poll cycle**	Min. unit	1ms	Change	Δ
FU-48	**Communication error times**	Min. unit	1	Change	Δ
Description	0～60000				
FU-49	**PLC cycled number**	Min. unit	1	Change	Δ
FU-50	**Cumulative fan run time**	Min. unit	1h	Change	Δ
FU-51	**Digital input/output terminal state**	Min. unit	1	Change	Δ
Setting range	T3-T1, Y2, Y1, REV, FWD, X6-X1 are arranged based on the binary system (0: disconnection 1: connection)				
FU-52	**Grounding current/voltage**	Min. unit	0.1A/V	Change	Δ
FU-53	**Unit U4U3U2U1 state**	Min. unit	—	Change	Δ
FU-54	**Unit U8U7U6U5 state**	Min. unit	—	Change	Δ
FU-55	**Unit V4V3V2V1 state**	Min. unit	—	Change	Δ
FU-56	**Unit V8V7V6V5 state**	Min. unit	—	Change	Δ

FU-57	**Unit W4W3W2W1 state**	Min. unit	—	Change	△
FU-58	**Unit W8W7W6W5 state**	Min. unit	—	Change	△
FU-59	**System and unit W9V9U9 state**	Min. unit	—	Change	△
Description	Occupy the lower 12 bits; the upper 4 bits are DSP, FPGA, controller and HMI state				
FU-60	**System fault code**	Min. unit	—	Change	△
Description	Same as FP-00				
FU-61	**Max. current holding**	Min. unit	0.1A	Change	△
FU-62 ～ FU-72	**Reserved**				
FU-73	**System time (month day year)**	Min. unit	—	Change	△
FU-74	**System time (hour minute second)**	Min. unit	—	Change	△
FU-75	**Rated inverter power**	Min. unit	1kW	Change	△
FU-76	**DSP software version**	Min. unit	0.01	Change	△
Description	0.00～99.99				

FU-77	**FPGA software version**	Min. unit	0.01	Change	△
Description	0.00～99.99				
FU-78	**CPLD software version**	Min. unit	0.01	Change	△
Description	0.00～99.99				
FU-79	**Controller software version**	Min. unit	0.01	Change	△
Description	0.00～99.99				
FU-80	**HMI software version**	Min. unit	0.01	Change	△
Description	0.00～99.99				
FU-81	**Main control board hardware version**	Min. unit	0.01	Change	△
Description	0.00～99.99				
FU-82	**Unit board hardware version**	Min. unit	0.01	Change	△
Description	0.00～99.99				

FU-83	**HMI hardware version**	Min. unit	0.01	Change	△
Description	0.00～99.99				
FU-84	**Current frequency reference channel**	Min. unit	1	Change	△
Description	0：HMI 1: MODBUS communication 2：UP/DOWN 3：AI1 4：AI2 5：AI3 6：PFI 7-8: Reserved 9: Multi-speed 10: Jog 11 -12: Reserved 13:PID				

FU-85	**Current command channel**	Min. unit	1	Change	△
Description	0:HMI 1: Terminal 2:MODBUS communication				
FU-86	**Input watt-hour meter higher 16 bits**	Min. unit	1	Change	△
Description	0～65535 Used together with FU-30				
FU-87	**Output watt-hour meter upper 16 bits**	Min. unit	1	Change	△
Description	0～65535 Used together with FU-31				
FU-88	**Switch cabinet switch state value**	Min. unit	1	Change	△
Description	Depending on the switch cabinet model				
FU-89	**Cumulative operation time (hour)**	Min. unit	1h	Change	△
Description	0～65535				
FU-90	**Cumulative operation time (minute)**	Min. unit	1min	Change	△
Description	0～59				
FU-91	**Single-time run time (hour)**	Min. unit	0.1h	Change	△
Description	0～6553.5				

7 Troubleshooting

7.1 Inverter faults and remedies

Fault description and remedies

Fault code	Fault type	Possible causes	Remedies
1	Momentary overcurrent at start	Inter-phase or grounding short-circuit inside the motor or between wirings	Check the motor and wiring
		Inverting module failed	Seek for assistance
		Overhigh voltage at start	Check the setting of torque boost
2	Overcurrent during acceleration	Accel time too short	Increase the accel time
		V/F curve improper	Regulate V/F curve or the setting of torque boost
		Running motor restarts	Set the start mode to smooth start; Restart the motor after it stops completely
		Low power grid voltage	Check the input power
		Inverter capacity too small	Use an inverter with larger capacity
3	Overcurrent during deceleration	Decel time too short	Increase the decel time
		There is potential energy load or inertial torque of the load is large	Install an external dynamic braking unit
		Inverter capacity too small	Use an inverter with larger capacity
4	Overcurrent during constant-speed operation	Sudden change of load	Reduce the sudden change of the load
		load error	Check the load
		Low power grid voltage	Check the input power
		Inverter capacity too small	Use an inverter with larger capacity
5	Overvoltage during acceleration	Input voltage abnormal	Check the input power
		Running motor restarts	Set the start mode to smooth start; Restart the motor after it stops completely
6	Overvoltage during deceleration	Decel time too short	Increase the decel time
		There is potential energy load or inertial torque of the load is large	Install an external dynamic braking unit
		Input voltage abnormal	Check the input power
		Improper motor running, with oscillation	Adjust F2-09 to reduce oscillation
7	Overvoltage during constant-speed operation	Input voltage abnormal	Check the input power
		Accel/decel time too short	Increase the accel/decel time
		Input voltage changes irregularly	Install an input reactor
		Large load inertia	Employ a dynamic braking unit

Fault code	Fault type	Possible causes	Remedies
8	Overvoltage in standby state	Input voltage overhigh	Check the input power
		Voltage detection circuit fault	Seek for assistance
9	Undervoltage during running	Input voltage abnormal or power loss during running	Check input power and wiring
		There is heavy-load impact	Check the load
		Input phase loss	Check input power and wiring
10	Output phase loss	Loss of output (U, V or W)	Check the output wiring; check the motor and cables
11	Inverter overheating	Ambient temperature overhigh	Lower the ambient temperature
		Air path blocked or fan failed	Clean air path or replace the fan
		Too large load	Check the load or select an high-capacity inverter
12	Inverter overload	Too large load	Check the load or select an high-capacity inverter
		Inverter temperature too high	Check the fan, air path and ambient temperature
		Accel time too short	Increase the accel time
		Carrier frequency too high	Lower the carrier frequency or select an inverter with a higher capacity
		V/F curve improper	Regulate V/F curve and torque boost level
		Running motor restarts	Set the start mode to smooth start or restart the motor after it stops completely
		Input voltage too low	Check the input voltage
13	Motor overload	V/F curve improper	Correctly set the V/F curve and torque boost level
		Input voltage too low	Check the input voltage
		The common motor runs with heavy load at low speed for a long time	Install a separate cooling fan or select a motor designed for inverter
		Improper setting of nameplate parameters or overload protection	Set FA-03, Fb-00 and Fb-01 correctly
		Motor stalls or load changes suddenly and greatly	Check the load
14	Motor overheating	The common motor runs with heavy load at low speed for a long time	Install a separate cooling fan or select a motor designed for inverter
		Motor stalls or load changes suddenly and greatly	Check the load
15	External fault	External fault terminal closed	Deal with the external fault
16	Motor load overweight	Motor current exceeds the load overweight detection level, and the detection time is exceeded	Check the load Check the setting of load overweight protection

Fault code	Fault type	Possible causes	Remedies
17	Inverter underload	Inverter output current is less than the underload protection level, and the detection time is exceeded	Check the load Check the setting of underload protection
18	Input voltage fault detection	Inverter input voltage beyond range detected	Check the input power or detection circuit
19	Output voltage fault detection	Inverter output voltage beyond range detected	Check the detection circuit
20	Input current fault detection	Inverter input current beyond range detected	Check the input power or detection circuit
21	Output current fault detection	Inverter output current beyond range detected	Check the detection circuit
22	Feeder circuit breaker abnormality	Feeder circuit breaker logic error	Check the feeder circuit breaker
23	Charging circuit breaker abnormality	Charging circuit breaker logic error	Check the charging circuit breaker
24	Bypass circuit breaker abnormality	Bypass circuit breaker logic error	Check the bypass circuit breaker
25	Output circuit breaker abnormality	Output circuit breaker logic error	Check the output circuit breaker
26	Phase-shifting transformer overheating	Ambient temperature overhigh	Lower the ambient temperature
		Air path blocked or fan failed	Clean air path or replace the fan
		Too large load	Check the load or select an high-capacity inverter
27	Reserved	——	——
28	Parameter saving failed	Failure in writing parameters	Retry after reset. Seek for assistance if the problem still exists.
29	Communication error	Improper setting of communication parameters	Check the settings of the FF menu
		Serious communication interference	Check the wiring and grounding of the communication circuit
		PC does not work	Check PC and wiring
30	Analog input disconnection	Wires broken or peripheral devices failed	Check external wires and peripheral devices
		Disconnection threshold not set properly	Check the settings of F6-06, F6-13 and F6-20
31	Cabinet overheating	Cabinet inlet blocked	Clean the air inlet filter screen
		Cooling fan failed	Replace the cooling fan
		Temperature probe damaged or	Replace the temperature probe or
32	Cabinet cover interlock switch not in place	Cabinet cover not properly closed or travel switch damaged	Check whether the cabinet cover is properly closed; check the travel switch and its contact

Fault code	Fault type	Possible causes	Remedies
33	Abnormal stop	Stall state lasts one minute	Set the operating parameters correctly
		Overspeed due to reverse connection of PG	Check the connection of PG
34	Controller communication failure	Communication line broken or parameter error	Check the communication lines or seek for assistance
35	HMI communication failure	Communication line broken or parameter error	Check the communication lines or seek for assistance
36	Power-on failure for unclosed cabinet cover	Cabinet not properly closed	Put the cabinet cover in place and re-poweron or seek for assistance
37	Grid overvoltage fault	The grid voltage is greater than 20% of the rated voltage	Reduce the power grid voltage
38	Output ground fault	Output cable or load grounding leakage or short circuit	Check the output cable or load
39	Charge fault (beyond the expected time)	Charging contactor fault or control connection fault	Check the charging contactor or wiring
40	Motor overspeed fault	Output frequency greater than rated motor frequency	Reduce the operating frequency
41	Motor temperature detection open circuit and short circuit		Check the motor temperature detection resistance and connection
42	PG disconnection	Error of connecting wires for encoder interface board	Check the wires
		Encoder interface board jumper not set properly	Check the jumper as shown in 10.3
		Fd-05 "PG disconnection detection time" too short	Increase it moderately
		Encoder failed	Check and replace the damaged encoder
43	Power unit fault	Input power supply overvoltage or undervoltage, output overcurrent, too high internal temperature, damaged internal component, etc.	Check the power unit status on HMI, get fault information, and eliminate the power unit failure thereby
44	Unit bypass contactor fault	The bypass contactor of the power unit is damaged	Replace the damaged power unit or seek for assistance
45	Input phase loss fault	Power supply contactor fault	Check the power supply and power supply circuit
46	Fan contactor fault	Damaged contactor of control fan or circuit failure	Replace the damaged contactor or check the fan control circuit

Fault code	Fault type	Possible causes	Remedies
47	PID feedback above upper limit fault	Improper PID upper/lower limit setting, causing PID misadjustment	Set the PID upper/lower limit properly
		Improper PID feedback upper limit setting	Set the PID feedback upper limit properly
		The PID feedback overrun detection time is too short, causing misaction during the normal adjustment process	Set the PID overrun detection time properly
		PID feedback signal acquisition or line fault	Replace the signal acquisition device or check the wiring
48	PID feedback below lower limit fault	Improper PID upper/lower limit setting, causing PID misadjustment	Set the PID upper/lower limit properly
		Improper PID feedback lower limit setting	Set the PID feedback lower limit properly
		The PID feedback overrun detection time is too short, causing misaction during the normal adjustment process	Set the PID overrun detection time properly
		PID feedback signal acquisition or line fault	Replace the signal acquisition device or check the wiring
49～52	Reserved		
53, 54	IO1, IO2	Reserved	Power off and reset
55	Emergency stop	External fault input	Check peripheral devices

7.2 Alarms and remedies

The table of alarms and remedies is given below:

Alarm name	Description	Remedies	Alarm word Bit
Motor overload	Motor thermal model detects the motor temperature rise is overhigh	Refer to the remedies to the corresponding fault	Word 1 Bit 0
Motor load overweight	Motor current exceeds the load overweight detection level, and the detection time is exceeded	Refer to the remedies to the corresponding fault	Word 1 Bit 1
Inverter underload	Inverter output current is less than the underload protection level, the detection time is exceeded	Refer to the remedies to the corresponding fault	Word 1 Bit 2
Analog input disconnection	Analog input signal is lower than the disconnection threshold	Refer to the remedies to the corresponding fault	Word 1 Bit 5
Input phase loss	Lack of input phase or imbalance among three phases	Refer to the remedies to the corresponding fault	Word 1 Bit 6
Output phase loss	Output phase loss	Refer to the remedies to the corresponding fault	Word 1 Bit 7
Communication error	Communication timeout	Refer to the remedies to the corresponding fault	Word 1 Bit 8

Alarm name	Description	Remedies	Alarm word Bit
Parameter saving failed	Parameter saving failed	Refer to the remedies to the corresponding fault	Word 1 Bit 9
Undervoltage	The input voltage is lower than the undervoltage point	It is normal for this alarm to be displayed when the power is off	Word 1 Bit 11
HMI communication alarm	Communication line broken or parameter error	Refer to the remedies to the corresponding fault	Word 1 Bit 12
Controller communication alarm	Communication line broken or parameter error	Refer to the remedies to the corresponding fault	Word 1 Bit 13
PG disconnection	No PG signal	Refer to the remedies to the corresponding fault	Word 1 Bit 14
Overspeed alarm			Word 2 Bit 0
Parameter detection error	Parameter not in the range	Data initialization via F0-11	Word 2 Bit 1
Fan fault			Word 2 Bit 2
Switchgear ID incompatibility		Check whether the switchgear ID matches	Word 2 Bit 3
Temperature controller failure			Word 2 Bit 4
Motor overheating	Poor motor cooling; improper inverter V/F curve setting; too high output voltage	Refer to the remedies to the corresponding fault	Word 2 Bit 5
Cabinet cover interlock switch not in place	Cabinet cover not closed; detection switch damaged	Refer to the remedies to the corresponding fault	Word 2 Bit 6
Transformer overheating	Transformer cabinet inlet blocked; transformer cabinet cooling fan damaged; output overload	Refer to the remedies to the corresponding fault	Word 2 Bit 7
Unit fault and bypass	A power unit fails and is bypassed by the inverter to operate at lower voltage	Record the fault information of the faulty unit, and deal with it promptly after the inverter stops.	Word 2 Bit 8
PID feedback above upper limit	Improper PID upper/lower limit setting, causing PID misadjustment; PID feedback upper/lower limit not reasonable; The PID feedback overrun detection time is too short, causing misaction during the normal adjustment process; PID feedback signal acquisition or line fault	Refer to the remedies to the corresponding fault	Word 2 Bit 9
PID feedback below lower limit		Refer to the remedies to the corresponding fault	Word 2 Bit 10
Control power supply error	One of the control power supplies has no output, or detection failure	Check the control power supply wiring	Word 2 Bit 11
PLC communication incompatibility	PLC program version does not match	Contact the manufacturer	Word 2 Bit 12

Alarm name	Description	Remedies	Alarm word Bit
Output grounding alarm	Inverter output grounding short circuit	Check the inverter output line and motor insulation	Word 2 Bit 13
External fault	External fault signal valid		Word 2 Bit 14

7.3 Inverter operation abnormalities and remedies

The table of operation abnormalities and remedies is given below:

Abnormality	Description	Possible causes	Remedies
No response from the HMI	A key has or all keys have no response to key pressing	Poor contact of the HMI connecting wire	Check the connecting wire; seek for assistance from the manufacturer when it's found abnormal
		No operation permission granted	
		The HMI is damaged	Replace the HMI
Parameter correction failed	Some parameters cannot be modified	F0-10 is set to 1 or 2	Set F0-10 to 0
		The parameters are read-only	Read-only parameters cannot be modified by users
	Parameters cannot be modified in running state	Some parameters are unchangeable during running	Modify them in standby state
Unexpected stop during running	Inverter stops automatically without receiving stop command	There is fault	Troubleshoot and reset it
		PLC cycle completed	Check the PLC parameter setting
		Command execution channel switching	Check the operation and command execution channel status
	The motor stops automatically without receiving the stop command	During the waiting for the fault auto reset	Check the fault auto reset setting and fault cause
		In PLC pause state	Check the PLC parameter setting
		Run interruption	Check the run interruption setting
		Reference frequency is 0	Check the reference frequency
		PID positive, feedback > reference PID negative, feedback < reference	Check PID reference and feedback

Abnormality	Description	Possible causes	Remedies
Inverter start failed	After receiving the start command, the inverter fails to start	Digital input 18 "Coast stop" is valid	Check the coast stop terminal
		Digital input 17 "Inverter operation disabled" is valid	Check the inverter operation disabled terminal
		The stop button is not closed under 3-wire 1, 3-wire 2 or 2-wire 3 control mode	Check the stop button and its connection
		Run command channel error	Change the run command channel
		Inverter error	Troubleshoot
		Input terminal logic error	Check the setting of F4-09 and F4-10

8 Maintenance and after-sale service

DANGER

(1) Only trained professionals are permitted to dismount, maintain or replace the parts and components;

(2) Prior to inspection and maintenance, make sure that the inverter has been disconnected from the power supply and the high voltage indicator has gone off. Wait for a few minutes until the inverter inside has been fully discharged; otherwise there may be a risk of electric shock.

(3) Do not leave any metal pieces such as screws and washers in the inverter. That may destroy the inverter or cause fire.

(4) Reset related parameters after replacing the control board, otherwise the inverter may be damaged.

8.1. Daily maintenance

A fault may occur to the inverter as a result of ambient conditions (dust, humidity and vibration, etc.) as well as aging or deteriorating devices. Therefore, it is necessary to check the inverter and its operating environment at regular intervals. An effective way to extend the service life of an inverter is to maintain a good operating environment, make daily operation records, and identify abnormalities as early as possible. The daily inverter maintenance shall cover the following items:

(1) If the working environment of the inverter meets the requirement;

(2) If the operating parameters of the inverter are set within the specified ranges.

(3) If there is any unusual vibration or noise;

(4) If there is any unusual odor;

(5) If the fans run properly; and

(6) If the input voltage is within the specified range and voltages of various phases are balanced.

8.2 Regular maintenance

The user may check the inverter on a 3-month or 6-month basis, depending on the operating environment. Generally, the following items must be checked:

(1) If the screws of control terminals are loose;

(2) If the main loop terminal has any poor contact and if the connection of copper bars has marks of overheat;

(3) If the power cables and control cables have any damage, especially scoring marks where the cables are in contact with metal surfaces;

(4) if the insulation bands on the cold-pressed terminals of the power cables have come off;

(5) Remove dust on PCBs and wind path thoroughly. It's better to use a vacuum cleaner; and

(6) When leaving the inverter unused for a long term, place it under a 5-hour energizing test within 2 years. During the energizing test, step up the voltage slowly to the rated value with a voltage regulator. Loads may be dropped.

⚠ DANGER: If an insulation test is required for the motor, the motor must be disconnected from the inverter and be subjected to an independent test; otherwise the inverter may be damaged.

⚠ DANGER: Do not perform the voltage withstand test or insulation test on the control circuit. That may destroy the circuit components on it.

8.3 Replacement of parts

The wearing parts mainly include the electrolytic capacitor and the cooling fan. The service life and the service environment are closely related to the maintenance status. The user can determine whether to change the wearing parts according to the running time.

u Cooling fan

Possible causes of damage: bearing abrasion and blade aging (the fan life is generally 30,000-40,000 hours);

Criteria: crack on fan blades; unusual vibration at the start

NOTE:

(1) The replacement must be a fan of the same specification (rated voltage, current, speed and air volume) as specified by the manufacturer;

(2) While installing the fan, keep the direction marked on the fan to be consistent with the direction in which the fan supplies wind.

(3) Do not forget to install the fan guard.

u Wave-filtering electrolytic capacitor

Possible causes of damage: high ambient temperature; frequent and sudden load change which leads to high pulsating current; aging of electrolyte.

Criteria: liquid leak, bulged safety valve, electrostatic capacity measurement and insulation resistance measurement.

It is advisable to replace the bus electrolytic capacitor once every four or five years.

8.4 Storage of inverter

After inverter purchase, the following cautions on temporary and long-term storage must be followed:

u Avoid storage in high-temperature, high-humidity environments filled with dust and metal power;

u Leaving the inverter unused for a long period would lead to aging of the electrolytic capacitor. So the inverter must be supplied with electricity once every two years for at least five hours, and the input voltage must be tuned up to the rated value with a voltage regulator.

8.5 After-sale service

The warranty is effective for 12 months commencing from the date of purchase. However, in any of the following cases, the repair will be non-gratuitous notwithstanding a warranty period:

(1) Any damage arising from noncompliance with the user's manual;

(2) Any damage arising from unauthorized modification of the product;

(3) Any damage arising from above-norm use;

(4) Any damage caused by falls or in transit;

(5) Any damage arising from fire, flood, abnormal voltage or lighting strike;

In the event of any abnormality arising in operation, check and adjust the inverter as per the user's manual. When any fault occurs, promptly contact the supplier, the local electrical engineering agent of Hope Senlan or our headquarters. We will rectify any fault for free that arises from manufacturing and design within the warranty period. For a rectification beyond the warranty period, we will charge the user as required at a reasonable rate.

The contents of this manual are subject to change without notice

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