



User Guide

MD380 Solar Pump AC Drive

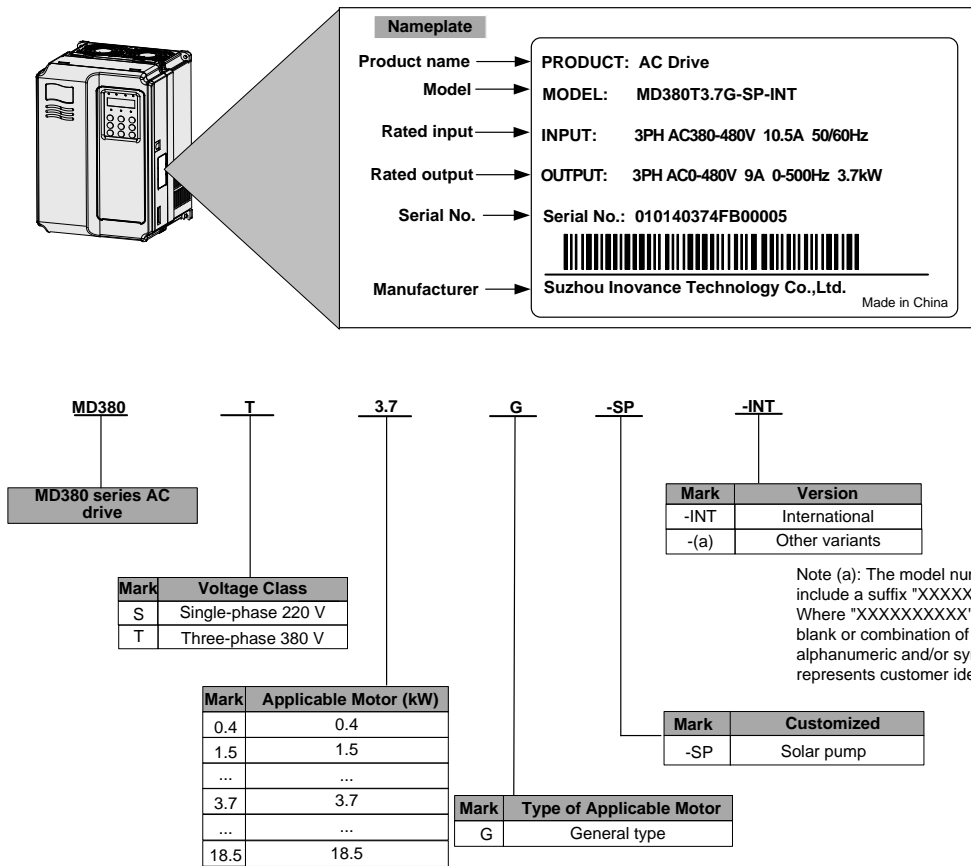


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1 Product Information

1.1 Nameplate and Designation Rule



1.2 General Specifications

Voltage class		Single Phase, 220 VAC					Three Phase, 380 VAC									
Drive model: MD380xxxxG-SP-INT		S0.4	S0.75	S1.5	S2.2	S3.7	T0.7	T1.5	T2.2	T3.7	T5.5	T7.5	T11	T15	T18.5	
Dimension * Height * Width* Depth (mm)		H: 186 W: 125 D: 164			H: 322 W: 208 D: 192		H: 186 W: 125 D: 164			H: 248 W: 160 D: 183			H: 322 W: 208 D: 192		H: 432 W: 285 D: 228	
Mounting Hole (mm)		5				6	5			5			6		6.5	
Drive Input (AC)	Rated input voltage	Single Phase 200~240 VAC, -15%~+10% (170~264VAC)					Three Phase 380~480 VAC, -15%~ +10% (323~528 VAC)									
	Rated input current, [A]	5.4	8.2	14	23	32	3.4	5	5.8	10.5	14.6	20.5	26	35	38.5	
	Power capacity, [kVA]	1	1.5	3	4	7	1.5	3	4	5.9	8.9	11	17	21	24	
	Rated input frequency	50/60 Hz, ±5%														
Drive Input (DC)	DC input voltage range	180~400 VDC					350~800 VDC									
	DC input operating voltage	220~350 VDC					350~750 VDC									
	Recommended DC input power [KW]	0.5	0.9	1.8	2.6	4.5	0.9	1.8	2.6	4.5	6.5	9	13	18	22	
Drive Output	Applicable motor	[kW]	0.4	0.75	1.5	2.2	3.7	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5
		[HP]	0.5	1	2	3	5	1	2	3	5	7.5	10	15	20	25
	Output current [A] ☆	2.3	4	7	9.6	13	2.1	3.8	5.1	9	13	17	25	32	37	
	Max. output voltage	Three Phase 200~240 VAC (Proportional to input voltage)					Three Phase 380~480 VAC (Proportional to input voltage)									
	Max. output frequency	500 Hz														
Enclosure		IP 20														

☆: At 4 kHz carrier frequency without derating.

*: The mounting dimensions are shown below.

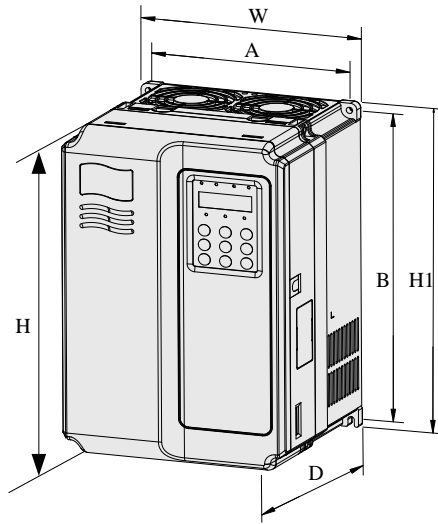


Fig1-1. Physical appearance and overall dimensions of the MD380 (0.4kW~15kW plastic housing)

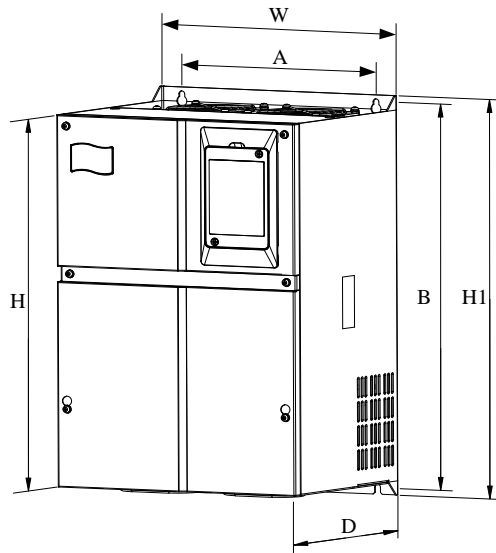


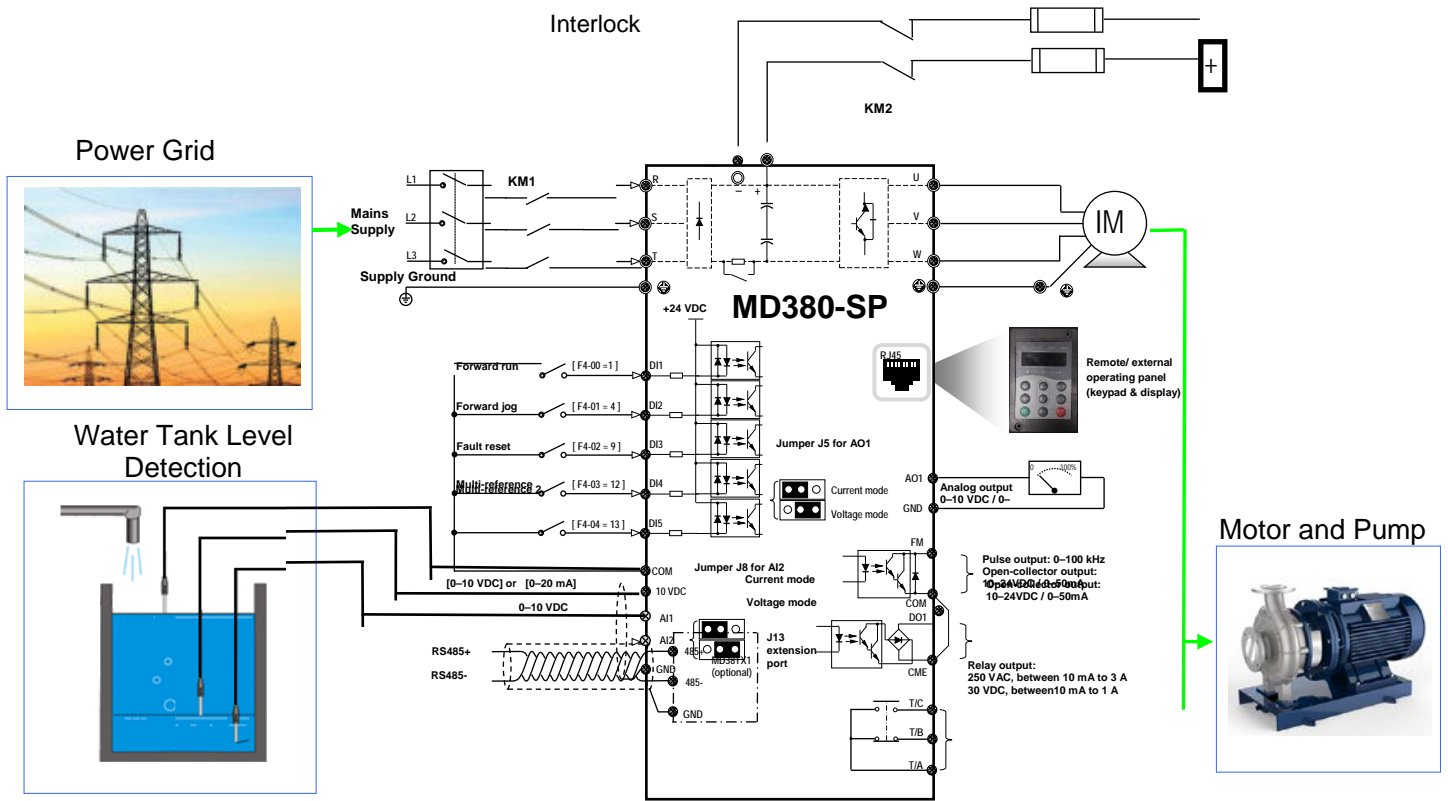
Fig1-2. Physical appearance and overall dimensions of the MD380 (18.5kW sheet metal housing)

Table 1-1 Overall dimensions and mounting hole dimensions

Model	Mounting Hole (mm)		Overall Dimensions (mm)				Mounting Hole Diameter (mm)	Weight (kg)
	A	B	H	H1	W	D		
Single-phase 220 V								
MD380S0.4G-SP-INT	113	172	186	/	125	164	ø5.0	1.1
MD380S0.7G-SP-INT								
MD380S1.5G-SP-INT								
MD380S2.2G-SP-INT								
MD380S3.7G-SP-INT	190	305	322	/	208	192	ø6	6.5
Three-phase 380 V								
MD380T0.7G-SP-INT	113	172	186	/	125	164	ø5.0	1.1
MD380T1.5G-SP-INT								
MD380T2.2G-SP-INT								
MD380T3.7G-SP-INT	148	236	248	/	160	183	ø5.0	2.5
MD380T5.5G-SP-INT								
MD380T7.5G-SP-INT	190	305	322	/	208	192	ø6	6.5
MD380T11G-SP-INT								
MD380T15G-SP-INT								
MD380T18.5G-SP-INT	235	447	432	463	285	228	ø6.5	20
MD380T22G-SP-INT								
MD380T30G-SP-INT								

2 Wiring

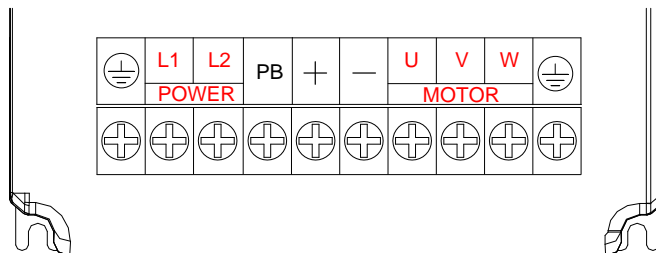
2.1 Typical Wiring



Terminal Description

✓ Terminals of main circuit

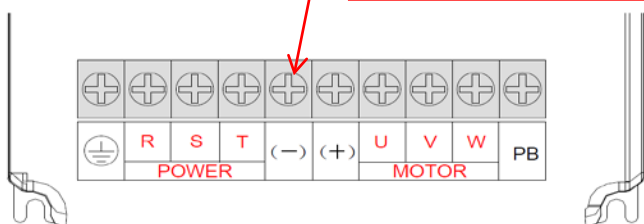
Single phase 220 V



Terminal	Terminal Name	Description
L1, L2	Single-phase power supply input terminals	Connect to the single-phase 220 VAC power supply.
(+), (-)	Positive and negative terminals of DC bus	Connect to solar PV panel.
PB, (+)	Connecting terminals of braking resistor	Connect to a braking resistor.
U, V, W	Output terminals	Connect to a three-phase motor.
⊖	Grounding terminal	Must be grounded.

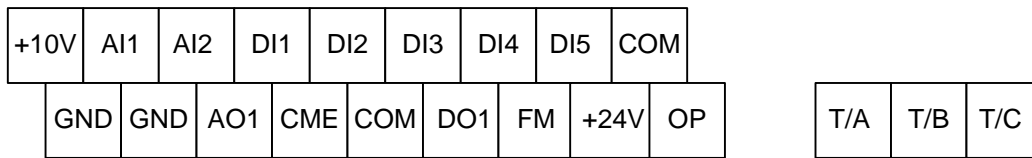
Three phase 380V

Warning: Do not use terminal (-) for braking resistor, otherwise AC drive would be damaged.



Terminal	Terminal Name	Description
R, S, T	Three-phase power supply input terminals	Connect to the three-phase AC power supply.
(-), (+)	Positive and negative terminals of DC bus	Connect to solar PV panel.
PB, (+)	Connecting terminals of braking resistor	Connect to a braking resistor.
U, V, W	Output terminals	Connect to a three-phase motor.
⊖	Grounding terminal	Must be grounded.

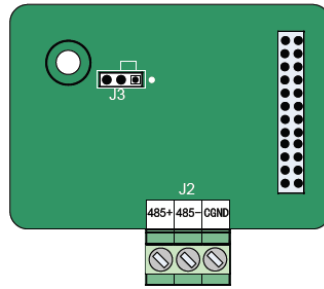
✓ **Terminals of main control board**



Terminal	Terminal Name	Description
+10 V-GND	+10 VDC power supply	Provide +10 VDC power supply externally. Usually, it provides power supply to the external potentiometer with resistance range of 1 to 5 kΩ. Max. output current: 10 mA.
+24V-COM	+24 VDC power supply	Provide +24 VDC power supply externally. Usually, it provides power supply to DI/DO terminals and external sensors. Max. output current: 200 mA.
OP	Input terminal of external power supply	Connect to +24 VDC by default. Whether it connects to +24 V or COM is decided by jumper J7. When DI1 to DI5 need to be driven by the external signal, OP needs to be connected to the external power supply and be disconnected from +24 VDC.
AI1-GND	Analog input 1	AI1 input voltage range: 0 to 10 VDC. Impedance: 22 kΩ.
AI2-GND	Analog input 2	AI2 can be used as voltage input or current input, which is chosen by jumper J8 on main control card. Input range: 0 to 10 VDC or 4 to 20 mA. Impedance: 22 kΩ if voltage input, 500 Ω if current input.
DI1-COM	Digital input 1	Optical coupling isolation, compatible with dual-polarity input. Impedance: 2.4 kΩ. Input voltage range: 9 to 30 VDC.
DI2-COM	Digital input 2	
DI3-COM	Digital input 3	
DI4-COM	Digital input 4	
DI5-COM	High-speed pulse input	Besides features of DI1 to DI4, it can be used for high-speed pulse input. Max. input frequency: 100 kHz.
AO1-GND	Analog output 1	Voltage or current output, determined by jumper J5 on main control board. Output voltage range: 0 to 10 VDC. Output current range: 0 to 20 mA.
DO1-CME	Digital output 1	Open-collector, dual polarity output, optical coupling isolated. Voltage range: 0 to 24 VDC. Current range: 0 to 50 mA.
FM-COM	High-speed pulse output	It is restricted by F5-00 (FM terminal output mode selection). As a high-speed pulse output, the maximum frequency is 100 kHz. As an open-collector output, its specification is the same as that of DO1: Voltage range: 0 to 24 VDC. Current range: 0 to 50 mA.
T/A-T/B	Normally closed terminal	Contact driving capacity: 250 VAC, 3 A; 30 VDC, 1 A.
T/A-T/C	Normally open terminal	

NOTE: Default Drive comes with jumper between +24V → OP and CME → COM.

Extension RS-485 Modbus-RTU Communication Card MD38TX1



✓ Terminals

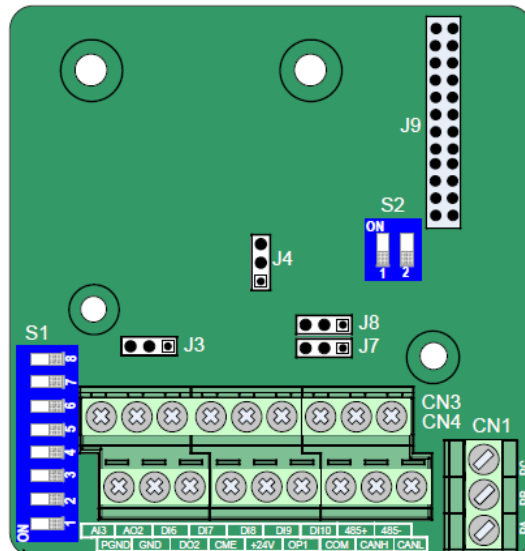
Terminal	Terminal Name	Description
485+	RS485 positive input	RS485 communication terminal with isolation input
485-	RS485 negative input	RS485 communication terminal with isolation input
CGND	RS485 grounding	RS485 power grounding

NOTE: see below configuration of jumper

Jumper	Description	Meaning	Setting
J3	RS485 terminal resistor matching selection	Matching	
		Not matching	

2.2 Extension I/O Card MD38IO1

NOTE: MD38IO1 applies to the drive 3.7 kW and above only.



✓ IO resource

Item	Listing	Description
Inputs	5 digital inputs; 1 analog input	AI range: -10 to 10 VDC, it can be used as AI, PT100 and PT1000 input (thermal sensor, 0 to 200°C).
Outputs	1 relay; 1 digital output; 1 analog output	
Communication	RS485 interface;	RS485 supports MODBUS-RTU protocol.



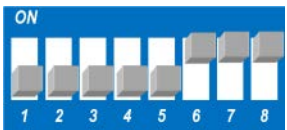
✓ Terminals

Terminal	Terminal Name	Description
+24V-COM	+24 VDC power supply	Provide +24 VDC power supply externally. Usually, it provides power supply to DI/DO terminals and external sensors. Max. output current: 200 mA.
OP1	Input terminal of external power supply	Connect to +24 VDC by default. Whether it connects to +24 V is decided by jumper J8. When DI6 to DI10 need to be driven by the external signal, OP1 needs to be connected to the external power supply and be disconnected from +24 VDC.
AI3-PGND	Analog input 3	Optical coupling isolation, compatible with differential signal and PT100/PT1000 temperature sensor input (0 to 200°C). Input voltage range: -10 to 10 VDC. Use dial switch S1 to select different input mode: Analog, or PT1000 or PT100, must not select more than one mode at one time.
DI6-COM	Digital input 6	
DI7-COM	Digital input 7	
DI8-COM	Digital input 8	Optical coupling isolation, compatible with dual-polarity input. Impedance: 2.4 kΩ.
DI9-COM	Digital input 9	Input voltage range: 9 to 30 VDC.
DI10-COM	Digital input 10	
AO2-GND	Analog output 2	Voltage or current output, determined by jumper J3 on extension I/O card. Output voltage range: 0 to 10 VDC. Output current range: 0 to 20 mA. Impedance range: for current output, 0 to 500 Ω
DO2-CME1	Digital output 2	Multi-function and dual-polarity and open-collector output. Voltage range: 0 to 24 VDC. Current range: 0 to 50 mA.
485+-485-	MODBUS communication terminal	MODBUS protocol. Baud rate: 300 to 115200 bps. Max. nodes: 32. Terminal resistance dial switch: S2.
PA-PB	Normally closed terminal	Contact driving capacity: 250 VAC, 3 A;
PA-PC	Normally open terminal	30 VDC, 1 A.
CANH-CANL	CANlink communication terminal	CANlink communication.

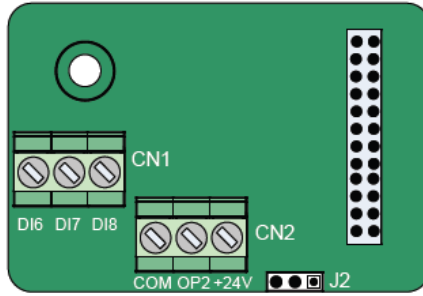
NOTE: see below configuration of jumpers

Jumper	Description
J3	AO2 output mode selection: voltage or current.
J4	CAN terminal resistance selection
J7	CME1 connection mode selection: connected to COM or not.
J8	OP1 connection mode selection: connected to internal +24V or not.
S1	AI input mode selection: analog input (voltage) or PT100 or PT1000 input (both 0 to 200°C).
S2	RS485 terminal resistance selection (RTU).

NOTE: see below configuration methods for dial switch S1:

S1 Configuration	AI Input Mode
	Analog input (voltage).
	PT1000 thermal sensor (0 to 200°C).
	PT100 thermal sensor (0 to 200°C).

Extension Mini I/O Card MD38IO2



✓ Terminals

Terminal	Terminal Name	Description
+24V-COM	+24 VDC power supply	Provide +24 VDC power supply externally. Usually, it provides power supply to DI/DO terminals and external sensors. Max. output current: 170 mA.
OP2	Input terminal of external power supply	Connect to +24 VDC by default. Whether it connects to +24 V is decided by jumper J2. When DI6 to DI8 need to be driven by the external signal, OP2 needs to be connected to the external power supply and be disconnected from +24 VDC.
DI6-COM	Digital input 6	Optical coupling isolation, compatible with dual-polarity input. Impedance: 2.4 kΩ. Input voltage range: 9 to 30 VDC.
DI7-COM	Digital input 7	
DI8-COM	Digital input 8	

NOTE: see below configuration of jumper

Jumper	Description	Meaning	Setting
J2	OP2 connecting mode selection	If DI connected in SINK mode, OP2 connected to +24V	
		If DI connected in SOURCE mode, OP2 connected to COM	

3 Operation Panel

3.1 Get Familiar With Operation Panel










✓ Overview



✓ Parameter unit indicator

Indicator Appearance	Meaning
	Hz for frequency
	A for current
	V for voltage
	% for anything relevant

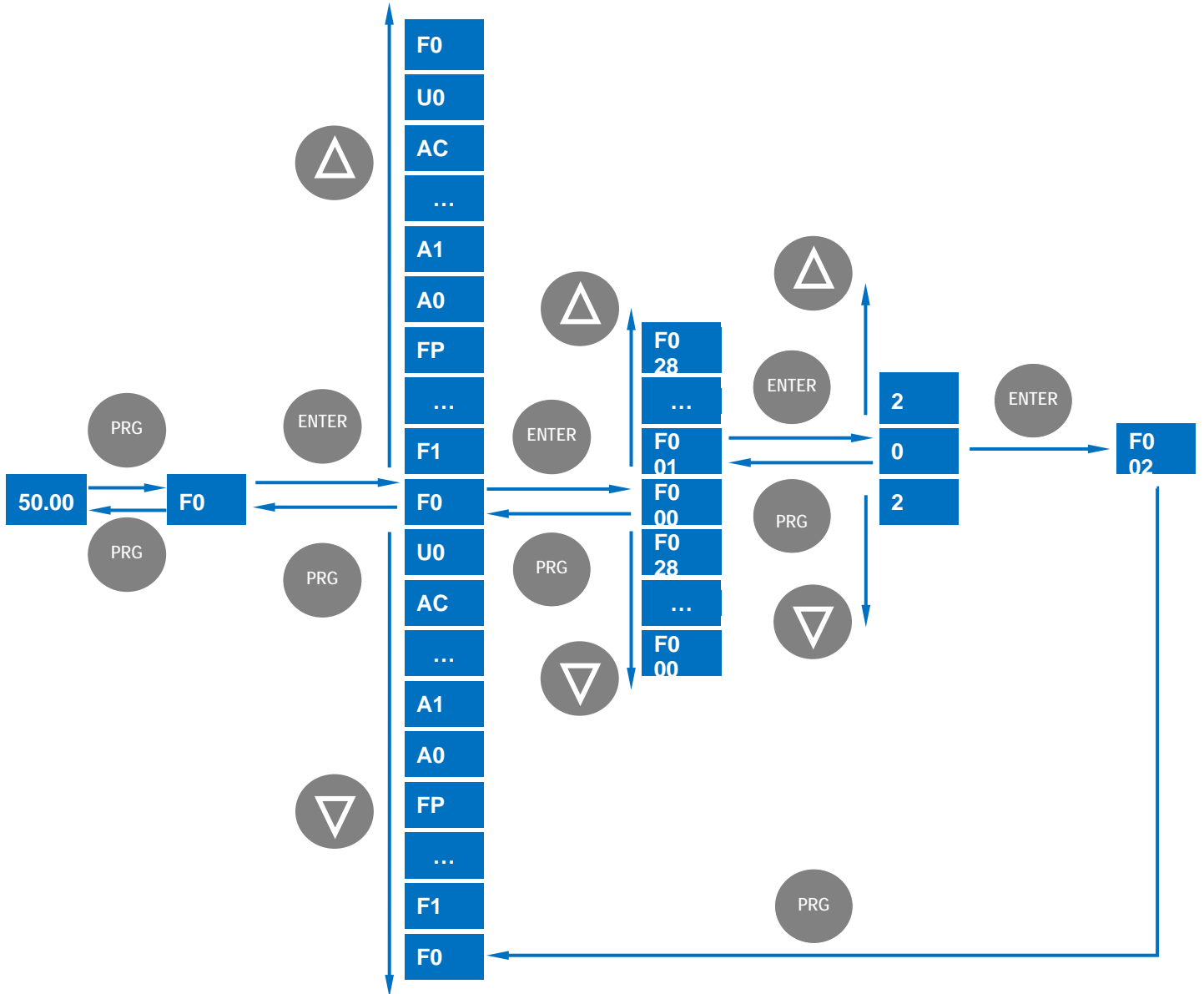
✓ **Keys on operation panel**

Key	Key Name	Function
	Programming	Enter or exit Level I menu.
	Confirm	Enter the menu interfaces level by level, and confirm the parameter setting.
	Increment	Increase data or function code.
	Decrement	Decrease data or function code.
	Shift	Select the displayed parameters in turn in the stop or running state, and select the digit to be modified when modifying parameters.
	RUN	Start the AC drive in the keypad operation mode.
	Stop/Reset	Stop the AC drive when it is in the running state and perform the reset operation when it is in the faulty state. The functions of this key are restricted by F7-02
	Multifunction	Perform function switchover (such as quick switchover of command source or direction) according to the setting of F7-01 .
	Menu mode selection	Perform switchover between menu modes according to the setting of FP-03 .

✓ **Relevant parameters for operation panel setting**

Function Code	Parameter Name	Setting Range	Unit	Default	Commission
F7-01	MF.K key function selection	0: MF.K key disabled 1: Switchover from remote control (terminal or communication) to keypad control 2: Switchover between forward rotation and reverse rotation 3: Forward jog 4: Reverse jog 5: Individualized parameter display	N.A.	0	0
F7-02	STOP/RESET key function	0: STOP/RESET key enabled only in keypad control 1: STOP/RESET key enabled in any operation mode	N.A.	1	1
FP-03	Parameter display property	For user defined and user modified parameters 00: non of them will display 01: user defined parameters will display 10: user modified parameters will display 11: both of them will display	N.A.	00	

✓ Operations of parameters

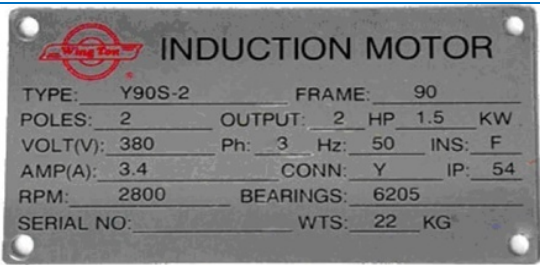




✓ Parameter arrangement

Function Code Group	Description	Remark
F0 to FF	Standard function code group	Standard function parameters
A0 to AC	Advanced function code group	Special parameters for solar pump application
U0	Running state function code group	Display of state-monitoring parameters

4 Quick Setup

4.1 Setup Flowchart

START	Para	Parameter Name	Default	Commissioning
Ahead of setup		Default values are elicited from enormous real elevator applications, so users can rely on them usually, only some adjustments are necessary. If parameter restoration is prohibited due to some reasons, then the following steps have to be followed one by one.		
Remove DI wirings		Usually if any DI is set as Forward or Reverse run and if signal is active, then some operations cannot succeed, such as restoring parameters, changing command source, which are necessary steps for quick setup. So it's seriously recommended to remove DI wirings at the beginning of commissioning.		
Restore parameters	FP-01	Parameter operation	0	1
		0: No operation 1: Restore default settings except motor parameters 2: Clear records including errors 4: Restore user's backup parameters 501: Backup parameters NOTE: Usually people have no idea what parameters have been changed, so it's seriously recommended to restore parameters to default at the beginning of commissioning.		
Set motor parameters		Motor Nameplate		
				
	F1-01	Rated motor power	model dependent	
		Unit: kW		
	F1-02	Rated motor voltage	380	
		Unit: V		
	F1-03	Rated motor current	model dependent	
		Unit: A		
	F1-04	Rated motor frequency	50.00	
		Unit: Hz		
	F1-05	Rated motor speed	1460	
		Unit: rpm		
CONTINUE	Para	Parameter Name	Default	Commissioning

CONTINUE	Para	Parameter Name	Default	Commissioning
Select command source	F0-02	Command source selection	1	0
↓		0: Operation panel control (indicator 'LOCAL/REMOT' OFF) 1: Terminal control (indicator 'LOCAL/REMOT' ON) 2: Communication control (indicator 'LOCAL/REMOT' blinking) 3 : Water tank level detection control		
Perform motor auto tuning	F1-37	Auto-tuning selection	0	3
↓		0: No auto-tuning 2: Asynchronous motor dynamic auto-tuning 3: Asynchronous motor static auto-tuning (NEW) NOTE: Motor won't rotate at this stage. Steps of auto-tuning: 1. Make sure the UVW connection between inverter and motor is not cut off by output contactor; if it is cut off, then manually handle with the output contactor; 3. Set F1-37=3, press  , then LED on panel will display letters 'TUNE'; 4. Press the key  on panel, then motor starts auto-tuning, it usually takes about 30 seconds to finish this auto-tuning, wait until LED stops displaying 'TUNE';		
Select Control mode	F0-01	Control mode selection	2	0 or 2
↓		0: SVC control 2: VF control		
Select frequency reference source	F0-03	Main frequency source X selection	8	8
↓		0: Digital setting F0-08 1: Digital setting F0-08 2: AI1 3: AI2 4: AI3 5: Pulse setting (DI5) 6: Multi-reference setting 7: Simple PLC 8: MPPT control mode for solar pump 9: Communication setting		
Set start-up voltage	A9-09	Start-up voltage	220 V: 300.0; 380 V: 550.0	
↓		Note: The minimum voltage that allows the system start-up		
Set shutdown voltage	A9-10	Shutdown voltage	220 V: 200.0; 380 V: 300.0	
↓		Note: When the DC bus voltage of AC drive is below A9-10, the drive will freely stop.		
Set output power upper limit	A9-08	System output power upper limit	1.0KW	
↓		Note: The purpose of setting A9-08 is to limit the system output power to prevent the pump overload and burned down. When A9-08 = 0.0, it means no protection for pump overload.		
OVER				

4.2 MPPT Fine-Tuning

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
A9-00	The minimum value of PID proportional coefficient	0.1 to 900.0	N.A	40.0	0xA900
A9-02	The maximum value of PID proportional coefficient	0.1 to 900.0	N.A	200.0	0xA902

Proportional Gain P: Decide the adjustment strength of entire PID regulator, the larger P value is, the larger the adjust intensity is. When the parameter is 10,000, that is to say when the deviation between the amount of feedback and the amount of given is 100 %, the output frequency can be up to the maximum amplitude value adjusted by PID regulator. The rule of PID proportional coefficient varies from the minimum value (A9-00) to the maximum value (A9-02) as follows:

Proportional coefficient of PID

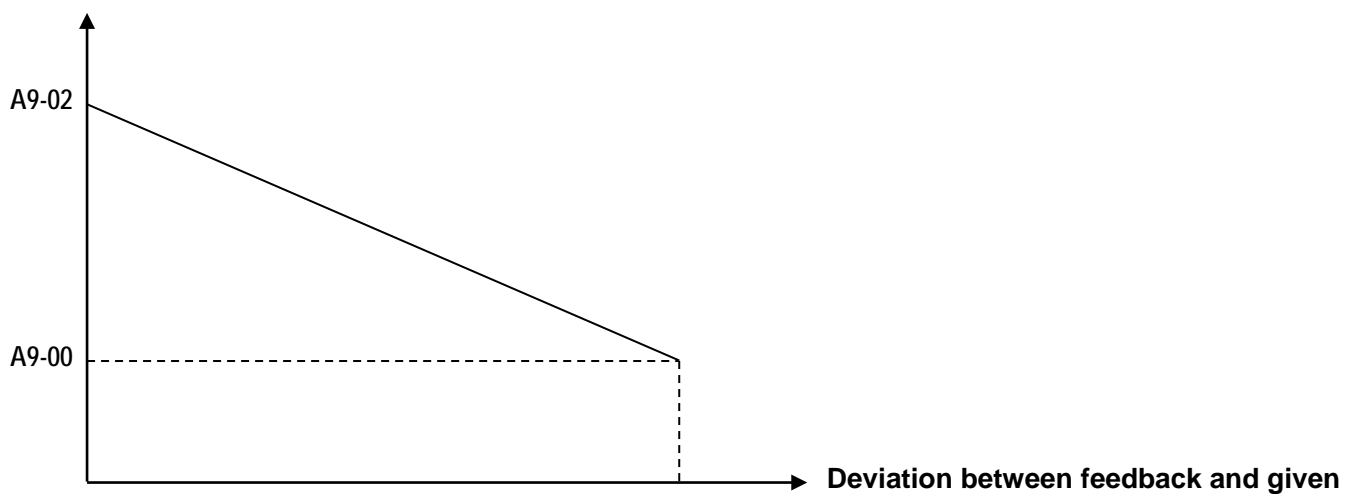


Figure 4-1 PID scale factor changing relationships

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
A9-01	The maximum value of PID integral time	0.01 to 90.00	N.A	2.00	0xA901
A9-03	The minimum value of PID integral time	0.01 to 90.00	N.A	0.12	0xA903

Both of above parameters are used for deciding integral adjusting speed of PID regulator to overcome the deviation between the amount of feedback and the amount of given. When the deviation between the amount of feedback and the amount of given is 100 %, the adjusting amount of integral regulator (Ignore proportional and differential role) will be up to the maximum frequency (F0-10) after the integral time. The shorter the integral time is, the stronger the regulation intensity is.

The rule of PID integral time varies from the maximum value (A9-01) to the minimum value (A9-03) as follows:

PID integral time

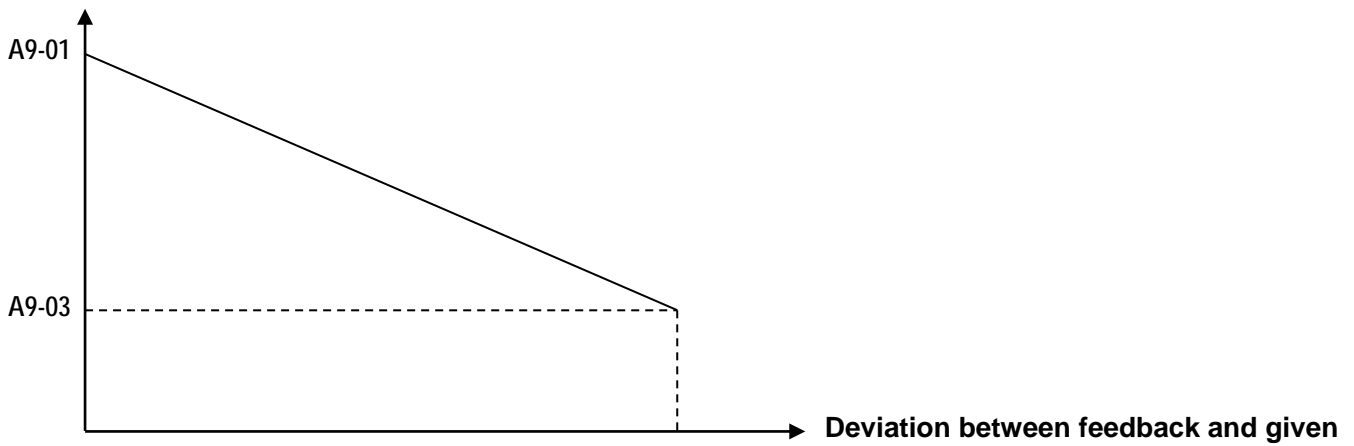


Figure 4-2 PID integral time variation rule

For the first time while the system is being used, the factory default parameters may not be able to adapt to on-site use, when the following situations occur, you can refer the solution as below. Based on actual use on-site, once successfully operates, the system has fully automatic and unattended features, there is no need to adjust any more.

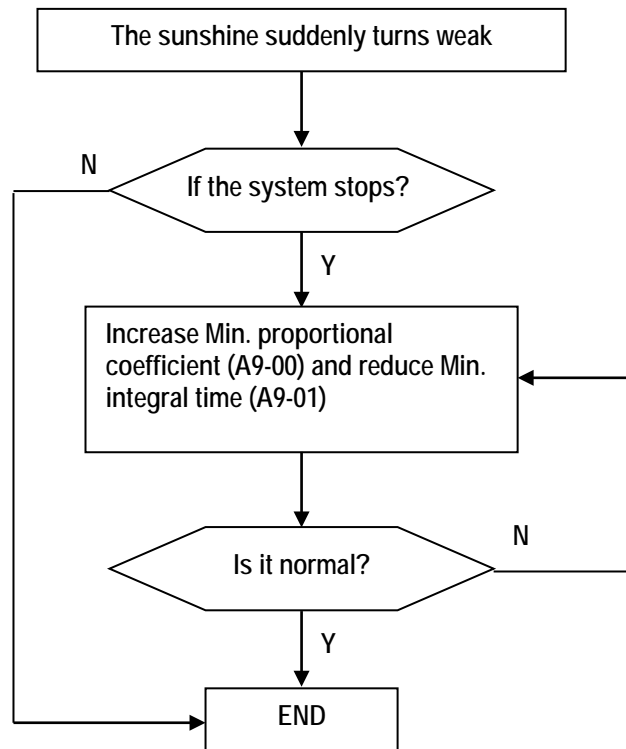


Figure 4-3 The sunshine suddenly turns weak and the system stops

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
A9-04	Right MPPT tracking step	0.0 to 10.0	V	0.6	0xA904
A9-05	Left MPPT tracking step	0.0 to 10.0	V	1.5	0xA905
A9-06	MPPT tracking time	0 to 60,000	ms	200	0xA906

By setting A9-04, A9-05, A9-06, it can adjust MPPT tracking speed.

MPPT tracking step: Used to set increase (decrease) voltage amplitude of each time left (right) side searching the best DC bus voltage for tracking the Maximum Output Power. The larger the value is, the faster the searching speed is. When the parameter setting is too large, it is easy to cause oscillation near the maximum power point.

MPPT tracking time: Used to set up the interval time of each tracking step. The shorter the tracking time is, the faster the tracking speed is, too short, may also cause oscillations.

Note: When the system is at oscillating state, it will significantly reduce solar energy utilization efficiency.

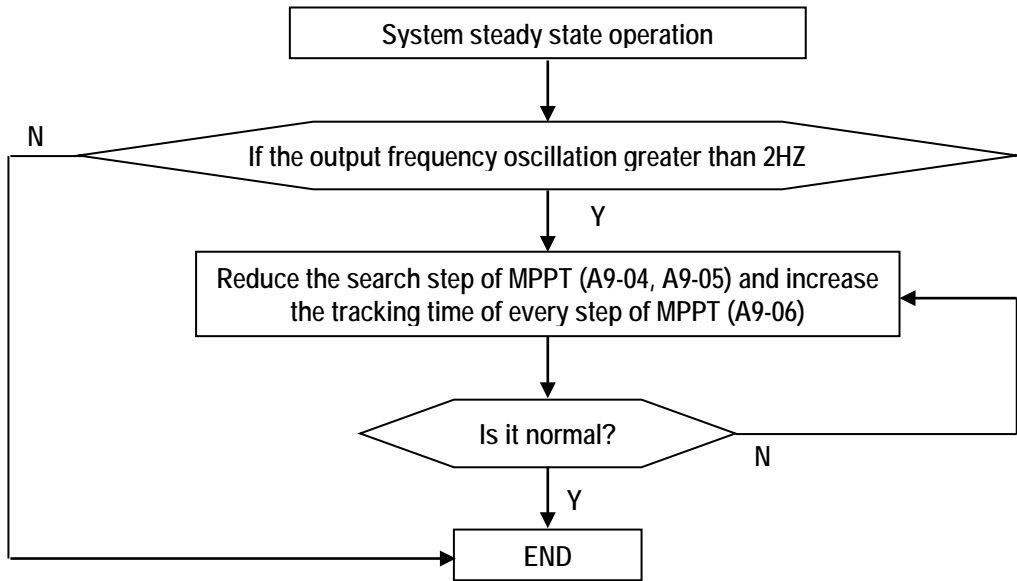


Figure 4-4 The output frequency oscillates when steady state operation

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
A9-07	The minimum value of DC bus voltage for MPPT	100.0 to 800.0	V	220 V: 240.0 380 V: 440.0	0xA907

By setting A9-07 to prevent the case: When the cloudy or evening (morning), the solar panels output voltage is low, thus the DC bus voltage will be too low by the normal MPPT tracking method and it may cause the system under-voltage shutdown.

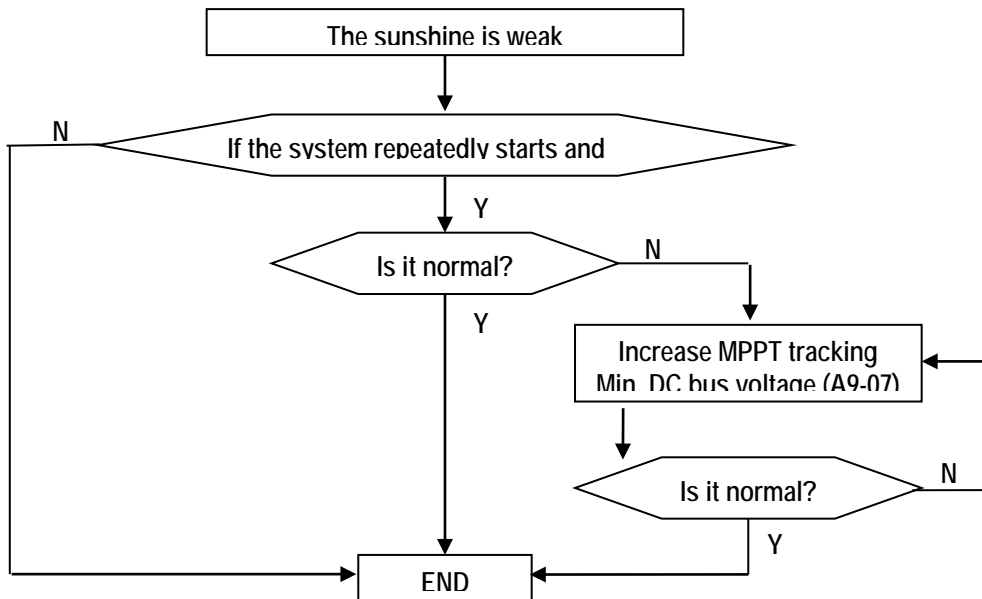


Figure 4-5 The sunshine is weak, the system repeatedly starts and stops

✓ **Auto-Start/Stop Based on Water Tank Level Detection**

Function Code	Parameter Name	Setting Range	Unit	Default	Commissioning
F0-02	Command source selection	0 : Operation panel control (LED off) 1 : Terminal control (LED on) 2 : Communication control (LED flashing) 3 : Water tank level detection control	N.A	0	3
A9-11	Water tank level detection threshold	0.00 to 10.00	V	8.00	8.00

This system has high and low water level detection function with 3-Electrode stick to access the AI1, AI2 and GND. A9-11 is the threshold value judging full water of tank. When the command source (F0-02=3, controlled by water level), the system can start or stop by judging water level.

The specific rules are as follows:

- When AI1 and AI2 more than A9-11 at the same time, the drive will stop;
- When AI1 and AI2 less than A9-11 at the same time, the drive will re-start;

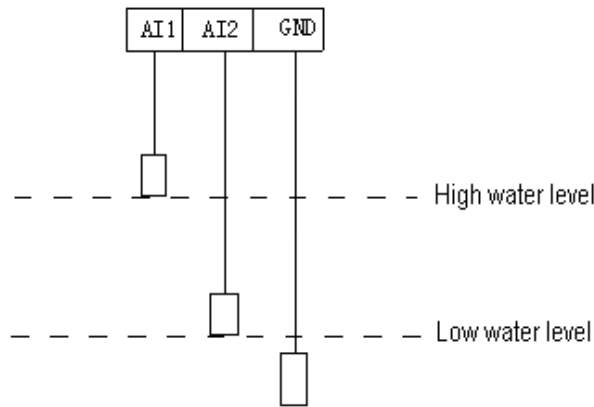


Figure 4-6 Water tank level detection schematic

4.3 Hibernating and Wake-up

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
F8-49	Wakeup frequency	Hibernating frequency (F8-51) to maximum frequency (F0-10)	Hz	0.00	0xF831
F8-50	Wakeup delay time	0.0–6500.0	s	0.0	0xF832
F8-51	Hibernating frequency	0.00 Hz to wakeup frequency (F8-49)	Hz	0.00	0xF833
F8-52	Hibernating delay time	0.0–6500.0	s	0.0	0xF834

This feature can achieve hibernating and wake-up function.

After giving the start command, and if it is in a sleep state, when the setting frequency more than F8-49 (wake-up frequency), and the time duration exceeds more than F8-50 (wake-up delay time), the system will wake up to run. When the system at running state, if the setting frequency less than F8-51 (hibernating frequency), and the time duration exceeds F8-52 (hibernating delay time), the system will go into hibernating state (shut down). If set F8-49 (wake-up frequency) and F8-51 (hibernating frequency) to 0, the hibernating and wake-up functions will be invalid.

4.4 Dry Run Protection

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
A9-22	Under load detection current threshold	0.0 to 100.0	%	30.0	0xA916
A9-23	Under load judgment delay time	0.0 to 6553.5	s	1.0	0xA917
A9-24	Auto reset time in case of under load fault	0.0 to 6553.5	s	5.0	0xA918

The solar pump inverter trips to an Err64 fault---DRY RUN when the water flow is not available at the pump inlet or when a blockage occurs in the pump. During these conditions the inverter consumes less current than the A9-22 value and sustains longer time than A9-23, the inverter will report Err64 fault, and then it can automatically reset after A9-24 defined time.

Note: The dry run protection function is disabled during the initial start up time.

4.5 Output Power and Accumulative Electricity Consumption Display

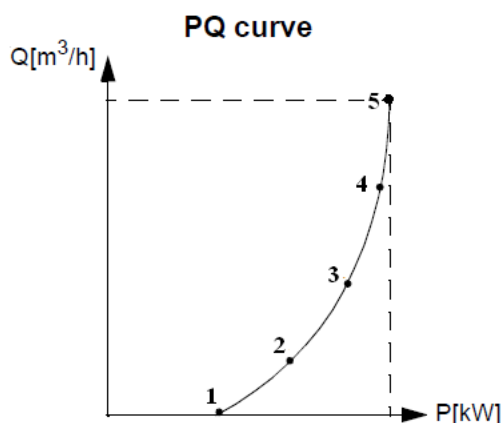
Function Code	Parameter Name	Setting Range	Unit	Default	Remark
F7-14	Accumulative electricity consumption	0 to 65535	kW.h	0	display
U0-05	Output power	0.0~6553.5	kW	N.A.	display
FP-01	Parameter initialization	0: No operation 01: Restore factory settings except motor parameters 02: Clear records (Including accumulative total electricity consumption) 04: Restore user backup parameters 501: Back up current user parameters	N.A.	0	

Above 3 parameters are provided for monitoring accumulative total electricity consumption and output power.

4.6 Flow Calculation and Display

The flow calculation function provides a reasonably accurate calculation of the flow without the installation of a separate flow meter, it defines the flow estimate by using the pump performance curve and drive actual load. The PQ (power/flow) performance curve enables calculating the pump flow per hour, thus it needs user to save five operating points (P1~5, Q1~5) of the performance curve into A9-25~A9-34 parameters. After finishing it, the solar pump inverter will record and store the flow rate on each hour, each day and each year in A9-35~A9-37 parameters.

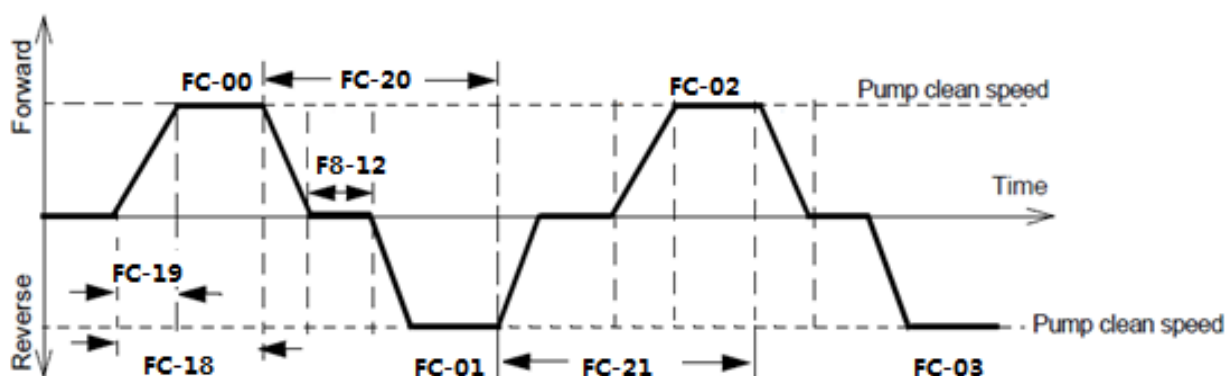
Note: This performance curve generally is provided by the pump manufacturer.



Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
A9-25	PQ curve P1	0.0 to 6553.5	kW	0.0	0xA919
A9-26	PQ curve Q1	0.0 to 6553.5	m ³ /h	0.0	0xA91A
A9-27	PQ curve P2	0.0 to 6553.5	kW	0.0	0xA91B
A9-28	PQ curve Q2	0.0 to 6553.5	m ³ /h	0.0	0xA91C
A9-29	PQ curve P3	0.0 to 6553.5	kW	0.0	0xA91D
A9-30	PQ curve Q3	0.0 to 6553.5	m ³ /h	0.0	0xA91E
A9-31	PQ curve P4	0.0 to 6553.5	kW	0.0	0xA91F
A9-32	PQ curve Q4	0.0 to 6553.5	m ³ /h	0.0	0xA920
A9-33	PQ curve P5	0.0 to 6553.5	kW	0.0	0xA921
A9-34	PQ curve Q5	0.0 to 6553.5	m ³ /h	0.0	0xA922
A9-35	Hourly flow of pump	Display rang: 0.0 to 6553.5	m ³	0.0	0xA923
A9-36	Daily flow of pump	Display rang: 0.0 to 6553.5	m ³	0.0	0xA924
A9-37	Yearly flow of pump	Display rang: 0.0 to 6553.5	m ³	0.0	0xA925

4.7 Pump Automatic Cleaning

The solar pump inverter provides the pump cleaning function to prevent solids from building up on pump impellers or piping. The function consists of a programmable sequence of forward and reverse runs of the pump to shake off any residue on the impeller or piping.



The pump cleaning function actually is realized by simple PLC running function. Set A9-38 to 1, and start up, the inverter will enter pump cleaning mode: the pump will carry out three cycles (6 segments) of positive and reverse alternate rotation and stop. After finishing cleaning, please set A9-38 to 0 to exit pump cleaning mode.

In this mode, each segment running speed and running time are defined by FC group parameters, and the acceleration / deceleration time are defined by F8-03 / F8-04 parameters.

Notes: By default, the hibernating function is effective (the hibernating frequency F8-51=15 Hz; wake up frequency F8-49=25 Hz). When the simple PLC running frequency FC-00~FC-05 is less than F8-51, the inverter will enter

hibernating state, so when you need the pump to run at the frequency less than 25 Hz, don't forget to reduce or shut off the hibernating frequency and wake up frequency.

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
A9-38	Pump cleaning mode enable	0: Disable 1: Enable	N.A	0	0xA926
F8-03	Acceleration time 2	0.0 to 6500.0	s	2.0	0xF803
F8-04	Deceleration time 2	0.0 to 6500.0	s	2.0	0xF804
F8-12	Forward/Reverse rotation dead-zone time	0.0–3000.0s	s	2.0	0xF80C
FC-00	Reference 0	-100.0 to 100.0	%	50.0%	0xFC00
FC-01	Reference 1	-100.0 to 100.0	%	-50.0%	0xFC01
FC-02	Reference 2	-100.0 to 100.0	%	50.0%	0xFC02
FC-03	Reference 3	-100.0 to 100.0	%	-50.0%	0xFC03
FC-04	Reference 4	-100.0 to 100.0	%	50.0%	0xFC04
FC-05	Reference 5	-100.0 to 100.0	%	-50.0%	0xFC05
FC-18	Running time of simple PLC reference 0	0.0 to 6500.0	s	5	0xFC12
FC-19	Acceleration/deceleration time selection of simple PLC reference 0	0: Acceleration/deceleration time 1 (F0-17/F0-18) 1: Acceleration/deceleration time 2 (F8-03/F8-04) 2: Acceleration/deceleration time 3 (F8-05/F8-06) 3: Acceleration/deceleration time 4 (F8-07/F8-08)	N.A.	1	0xFC13
FC-20	Running time of simple PLC reference 1	0.0 to 6500.0	s	5	0xFC14
FC-21	Acceleration/deceleration time selection of simple PLC reference 1	0~3 (refer to FC-19)	N.A.	1	0xFC15
FC-22	Running time of simple PLC reference 2	0.0 to 6500.0	s	5	0xFC16
FC-23	Acceleration/deceleration time selection of simple PLC reference 2	0~3 (refer to FC-19)	N.A.	1	0xFC17
FC-24	Running time of simple PLC reference 3	0.0 to 6500.0	s	5	0xFC18
FC-25	Acceleration/deceleration time selection of simple PLC reference 3	0~3 (refer to FC-19)	N.A.	1	0xFC19
FC-26	Running time of simple PLC reference 4	0.0 to 6500.0	s	5	0xFC1A
FC-27	Acceleration/deceleration time selection of simple PLC reference 4	0~3 (refer to FC-19)	N.A.	1	0xFC1B
FC-28	Running time of simple PLC reference 5	0.0 to 6500.0	s	5	0xFC1C
FC-29	Acceleration/deceleration time selection of simple PLC reference 5	0~3 (refer to FC-19)	N.A.	1	0xFC1D

NOTE: Not all parameters are listed, here below are relevant to solar pump applications. Any parameter which is not mentioned, please refer MD380 User Guide.

5 Parameter Table

5.1 Group F0: Fundamental

Function Code	Parameter name	Setting Range	Unit	Default	Modbus Address
F0-01	Motor 1 control mode	0 : Sensor-less vector control (SVC) 2 : V/F control	N.A	2	0xF001
F0-02	Command source selection	0 : Operation panel control (LED off) 1 : Terminal control (LED on) 2 : Communication control (LED flashing) 3 : Water tank level detection control	N.A	0	0xF002
F0-03	Main frequency source X selection	0: Digital setting (set by F0-08, non-retentive at power failure) 1: Digital setting (set by F0-08, retentive at power failure) 2 : AI1 3 : AI2 4 : AI3 5: Pulse setting (DI5) 6: Multi-reference 7: Simple PLC 8: MPPT control mode for solar pump 9: Communication setting	N.A	8	0xF003
F0-07	Frequency source selection	0 : Main frequency source X	N.A	0	0xF007
F0-08	Preset frequency	0.00 to maximum frequency (valid when frequency source is digital setting)	Hz	50.00	0xF008
F0-09	Rotation direction	0: Same direction 1: Reverse direction	N.A	0	0xF009
F0-10	Maximum frequency	50.00 to 100.00	Hz	50.00	0xF00A
F0-15	Carrier frequency	0.5–16.0 kHz	kHz	Model dependant	0xF00F
F0-17	Acceleration time 1	0.00 to 650.00 (F0-19 = 2) 0.0 to 6500.0 (F0-19 = 1) 0 to 65000 (F0-19 = 0)	Sec	2.0	0xF011
F0-18	Deceleration time 1	0.00 to 650.00 (F0-19 = 2) 0.0 to 6500.0 (F0-19 = 1) 0 to 65000 (F0-19 = 0)	Sec	2.0	0xF012
F0-19	Acceleration/Deceleration time unit	0 : 1 1 : 0.1 2 : 0.01	Sec	1	0xF013
F0-28	Communication card type	0: Modbus communication card	N.A	0	0xF01C

5.2 Group F1: Motor 1 Parameters

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
F1-00	Motor type selection	0 : Common asynchronous motor 1 : Variable frequency asynchronous motor	N.A	0	0xF100
F1-01	Motor rated power	0.1 to 1000.0	kW	Model dependent	0xF101
F1-02	Motor rated voltage	1 to 2000	V	380	0xF102
F1-03	Motor rated current	0.01 to 655.35 (For AC drive power ≤ 55 kW) 0.1 to 6553.5 (For AC drive power > 55 kW)	A	Model dependent	0xF103
F1-04	Motor rated frequency	0.01 Hz to maximum frequency	Hz	50	0xF104
F1-05	Motor rated rotational speed	1 to 65535	RPM	1460	0xF105
F1-06	Stator resistance (asynchronous motor)	0.001 to 65.535 (AC drive power ≤ 55 kW) 0.0001 to 6.5535 (AC drive power > 55 kW)	Ω	0	0xF106
F1-07	Rotor resistance (asynchronous motor)	0.001 to 65.535 (AC drive power ≤ 55 kW) 0.0001 to 6.5535 (AC drive power > 55kW)	Ω	0.000	0xF107
F1-08	Leakage inductive reactance (asynchronous motor)	0.01 to 655.35mH (AC drive power ≤ 55 kW) 0.001 to 65.535 (AC drive power > 55 kW)	mH	0.00	0xF108
F1-09	Mutual inductive reactance (asynchronous motor)	0.01 to 655.35 (AC drive power ≤ 55 kW) 0.001 to 65.535 (AC drive power > 55 kW)	mH	0.00	0xF109
F1-10	No-load current (asynchronous motor)	0.01 to F1-03 (AC drive power ≤ 55 kW) 0.1 to F1-03 (AC drive power > 55 kW)	A	0.00	0xF10A
F1-37	Auto tuning selection	0 : No auto-tuning 2: Asynchronous motor dynamic auto-tuning 3 : Asynchronous motor static auto-tuning (NEW)	N.A	0	0xF125

5.3 Group F2: Vector Control

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
F2-00	Speed loop proportional gain 1	0 to 100	N.A	30	0xF200
F2-01	Speed loop integral time 1	0.01 to 10.00	Sec	0.50	0xF201
F2-02	Switchover frequency 1	0.00 to F2-05	Hz	5.00	0xF202
F2-03	Speed loop proportional gain 2	0 to 100	N.A	20	0xF203
F2-04	Speed loop integral time 2	0.01 to 10.00	Sec	1.0	0xF204
F2-05	Switchover frequency 2	F2-02 to maximum output frequency	Hz	10.00	0xF205
F2-06	SVC slip gain	50 to 200	%	100	0xF206
F2-10	Torque upper limit (for SVC)	0.0 to 200.0 (% inverter rated current)	%	150.0	0xF20A
F2-13	Excitation adjustment proportional gain	0 to 20000	N.A	2000	0xF20D
F2-14	Excitation adjustment integral gain	0 to 20000	N.A	1300	0xF20E
F2-15	Torque adjustment proportional gain	0 to 20000	N.A	2000	0xF20F
F2-16	Torque adjustment integral gain	0 to 20000	N.A	1300	0xF210

5.4 Group F3: VF Control

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
F3-00	V/F curve setting	0: Linear V/F 1: Multi-point V/F 2: Square V/F 3 to 11: not relevant settings	N.A.	0	0xF300
F3-01	Torque boost	0.0 to 30.0 (if it is 0, then auto torque boost is activated)	%	0	0xF301
F3-02	Cut-off frequency of torque boost	0.00 to max output frequency	Hz	50	0xF302
F3-03	Multi-point V/F frequency 1	0.00 to F3-05	Hz	0	0xF303
F3-04	Multi-point V/F voltage 1	0.0 to 100.0	%	0	0xF304
F3-05	Multi-point V/F frequency 2	F3-03 to F3-07	Hz	0	0xF305
F3-06	Multi-point V/F voltage 2	0.0 to 100.0	%	0	0xF306
F3-07	Multi-point V/F frequency 3	F3-05 to rated motor frequency (F1-04)	Hz	0	0xF307

F3-08	Multi-point V/F voltage 3	0.0 to 100.0	%	0	0xF308
F3-09	V/F slip compensation gain	0 to 200.0	%	0	0xF309
F3-10	V/F over-excitation gain	0 to 200	%	64	0xF30A
F3-11	V/F oscillation suppression gain	0 to 100	%	40	0xF30B
F3-13	Voltage source for V/F separation	0 to 8	N.A.	0	0xF30D
F3-14	Voltage digital setting for V/F separation	0 to rated motor voltage	V	0	0xF30E
F3-15	Voltage rise time of V/F separation	0.0 to 1000.0	s	0.0	0xF30F
F3-18	Overcurrent stall prevention current limit (for VF mode)	100 to 200 (% inverter rated current)	%	150	0xF312
F3-19	Overcurrent stall prevention enable (for VF mode)	0: Disable; 1: Enable	N.A.	1	0xF313
F3-20	Overcurrent stall prevention gain (for VF mode)	0 to 100	N.A.	20	0xF314
F3-22	Overvoltage stall prevention voltage limit (for VF/SVC)	650 to 800	V	760	0xF316
F3-23	Overvoltage stall prevention enable (for VF/SVC)	0: Disable; 1: Enable	N.A.	1	0xF317
F3-24	Overvoltage stall prevention frequency gain (for VF/SVC)	0 to 100	N.A.	30	0xF318
F3-25	Overvoltage stall prevention voltage gain (for VF/SVC)	0 to 100	N.A.	30	0xF319

5.5 Group F4: Input Terminals

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
F4-00	DI 1 function selection (Standard on-board)	0 : No function 1 : Forward RUN (FWD)	N.A	1	0xF400
F4-01	DI 2 function selection (Standard on-board)	2 : Reverse RUN (REV) 3 : Three-line Control	N.A	4	0xF401
F4-02	DI 3 function selection (Standard on-board)	4 : Jog Forward (FJOG) 5 : Jog Reverse (RJOG)	N.A	9	0xF402
F4-03	DI 4 function selection (Standard on-board)	6 : Terminal UP 7 : Terminal DOWN	N.A	12	0xF403
F4-04	DI 5 function selection (Standard on-board)	8 : Coast to stop 9 : Fault reset (RESET)	N.A	13	0xF404
F4-05	DI 6 function selection (On-board expansion card)	10: RUN Pause 11: Normally open (NO) input of external fault	N.A	0	0xF405
F4-06	DI 7 function selection (On-board expansion card)	12: Multi-reference terminal 1 13: Multi-reference terminal 2	N.A	0	0xF406
F4-07	DI 8 function selection (On-board expansion card)	14: Multi-reference terminal 3 15: Multi-reference terminal 4	N.A	0	0xF407
F4-08	DI 9 function selection (On-board expansion card)	16: Terminal 1 for acceleration/ deceleration time selection	N.A	0	0xF408
F4-09	DI 10 function selection (On-board expansion card)	17: Terminal 2 for acceleration/ deceleration time selection 18: Frequency source switchover 19: UP and DOWN setting clear (terminal, operation panel) 20: Command source switchover terminal 1 (switch to keypad operation mode) 21: Acceleration/Deceleration prohibited 22: PID pause 23: PLC status reset 24: Swing pause 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control prohibited 30: Pulse input (enabled only for DI5) 31: Reserved 32: Immediate DC braking 33: Normally closed (NC) input of external fault 34: Frequency modification forbidden 35: Reverse PID action direction 36: External STOP terminal 1 (for keypad operation mode) 37: Command source switchover terminal 2 (switchover between	N.A	0	0xF409

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
		terminal and communication command)			
		38: PID integral pause			
		39: Switchover between main frequency source X and preset frequency			
		40: Switchover between auxiliary frequency source Y and preset frequency			
		41: Motor selection terminal 1			
		42: Motor selection terminal 2			
		43: PID parameter switchover			
		44: User defined fault 1 (Err27)			
		45: User defined fault 2 (Err28)			
		46: Speed control/Torque control switchover			
		47: Emergency stop			
		48: External STOP terminal 2 (for any kind of command, deceleration time 4)			
		49: Deceleration DC braking			
		50: Clear the current running time			
		51: Switchover between two-line mode and three line mode			
		52 to 59 : Reserved			
F4-10	DI filter time	0.000 to 1.000	Sec	0.010	0xF40A
F4-11	Terminal command mode	0 : Two-line mode 1 1 : Two-line mode 2 2 : Three-line mode 1 3 : Three-line mode 2	N.A	0	0xF40B
F4-12	Terminal UP/DOWN rate	0.01 to 65.535	Hz/s	1.00	0xF40C
F4-13	AI curve 1 minimum input	0.00 to F4-15	V	0.00	0xF40D
F4-14	Corresponding setting of AI curve 1 minimum input	-100.00 to 100.00	%	0.0	0xF40E
F4-15	AI curve 1 maximum input	F4-13 to 10.00 V	Volt	10.00	0xF40F
F4-16	Corresponding setting of AI curve 1 maximum input	-100.00 to 100.00	%	100.0	0xF410
F4-17	AI 1 filter time	0.00 to 10.00	Sec	0.10	0xF411
F4-18	AI curve 2 minimum input	0.00 to F4-20	V	0.00	0xF412
F4-19	Corresponding setting of AI curve 2 minimum input	-100.00 to 100.00	%	0.0	0xF413
F4-20	AI curve 2 maximum input	F4-18 to 10.00 V	Volt	10.00	0xF414
F4-21	Corresponding setting of AI curve 2 maximum input	-100.00 to 100.00	%	100.0	0xF415
F4-22	AI 2 filter time	0.00 to 10.00	Sec	0.10	0xF416
F4-38	DI valid mode selection (for DI1 to DI5)	00000 to 11111 (binary)	N.A	00000	0xF426
F4-39	DI valid mode selection 2 (for DI6 to DI10)	00000 to 11111 (binary)	N.A	00000	0xF427

5.6 Group F5: Output Terminals

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
F5-00	FM terminal output mode	0 : High-speed pulse output (FMP) 1 : ON/OFF output (FMR)	N.A	0	0xF500
F5-01	FMR function (open-collector output terminal)	0 : No output 1 : AC Drive running 2 : Fault output (stop) 3 : Frequency-level detection FDT1 output	N.A	0	0xF501
F5-02	Relay function (T/A-T/BT/C)	4 : Frequency reached 5 : Zero-speed running (no output at stop) 6 : Motor overload pre-warning 7 : AC Drive overload pre-warning 8 : Set count value reached 9 : Designated count value reached	N.A	2	0xF502
F5-03	Extension card relay function (P/A-P/B-P/C)	10 : Length reached 11 : PLC cycle complete 12 : Accumulated running time reached 13 : Frequency limited 14 : Torque limited 15 : Ready for RUN 16 : AI-1 larger than AI-2	N.A	0	0xF503
F5-04	DO-1 function selection (open-collector output terminal)	17 : Frequency upper limit reached 18 : Frequency lower limit reached (no output at stop) 19 : Under-voltage state output 20 : Communication setting 21-22 : Reserved 23 : Zero-speed running 2 (having output at stop) 24 : Cumulative power-on time reached	N.A	1	0xF504
F5-05	Extension card DO-2 function	25 : Frequency-level detection FDT2 output 26 : Frequency 1 reached 27 : Frequency 2 reached 28 : Current 1 reached 29 : Current 2 reached 30 : Timing reached 31 : AI-1 input limit exceeded 32 : Load becoming 0 33 : Reverse running 34 : Zero current state 35 : Module temperature reached 36 : Software current limit exceeded 37 : Frequency lower limit reached (having output at stop) 38 : Alarm output 39 : Motor overheat warning 40 : Current running time reached 41 : Fault output(There is no output if it is the coast-to-stop fault and under-voltage occurs)	N.A	4	0xF505

F5-07	AO1 function selection	0 : Running frequency 1 : Set frequency 2 : Output current 3 : Output torque (absolute value) 4 : Output power 5 : Output voltage 6 : Pulse input 7 : AI1 8 : AI2 9 : AI3 14: Output current 15: Output voltage	N.A	0	0xF507
F5-10	AO1 offset coefficient	-100.0%–100.0%		0.0%	0xF50A
F5-11	AO1 gain	-10.00–10.00		1.00	0xF50B
F5-12	AO2 offset coefficient	-100.0%–100.0%		0.00%	0xF50C
F5-13	AO2 gain	-10.00–10.00		1.00	0xF50D

5.7 Group F6: Start and Stop Control

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
F6-00	Start mode	0 : Direct start 1 : Rotational speed tracking restart 2 : Pre-excited start (asynchronous motor)	N.A	0	0xF600
F6-03	Startup frequency	0.00 to 10.00	Hz	0	0xF603
F6-04	Startup frequency active set time	0.0 to 100.0	Sec	0	0xF604
F6-05	DC injection 1 level	0 to 150	%	0	0xF605
F6-06	DC injection 1 active set time	0.0 to 5.0	Sec	0	0xF606
F6-07	Acceleration/Deceleration mode	0 : Linear acceleration/ deceleration	N.A	0	0xF607
F6-08	Time proportion of S-curve at Accel start	0.0% to Min[(100.0%- F6-09), 80%]	%	30.0	0xF608
F6-09	Time proportion of S-curve at Accel end	0.0% to Min[(100.0%- F6-08), 80%]	%	30.0	0xF609
F6-10	Stop mode	0 : Decelerate to stop 1 : Coast to stop	N.A	0	0xF60A
F6-11	DC injection 2 frequency threshold	0.00 Hz to maximum frequency	Hz	0.0	0xF60B
F6-12	DC Injection 2 delay ON set time	0.0 to 36.0	Sec	0.0	0xF60C
F6-13	DC injection 2 level	0 to 150	%	0	0xF60D
F6-14	DC injection 2 active set time	0.0 to 5.0	Sec	0.0	0xF60E

5.8 Group F7: Product and Software Version Checking

Function Code	Parameter Name	Setting Range	Unit	Default	Remark
F7-08	Product number	N.A.	N.A.	380.00	display
F7-09	Accumulative running time	0 to 65535	h	-	display
F7-10	Performance software version	N.A.	N.A.		display
F7-11	Functional software version	N.A.	N.A.		display
F7-13	Accumulative power-on time	0 to 65535	h	0	display
F7-14	Accumulative electricity consumption	0 to 65535	kW.h	0	display

5.9 Group F8: Auxiliary Functions

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
F8-00	JOG running frequency	0.00 to maximum frequency	Hz	2.00	0xF800
F8-01	JOG acceleration time	0.0 to 6500.0	s	20.0	0xF801
F8-02	JOG deceleration time	0.0 to 6500.0	s	20.0	0xF802
F8-03	Acceleration time 2	0.0 to 6500.0	s	2.0	0xF803
F8-04	Deceleration time 2	0.0 to 6500.0	s	2.0	0xF804
F8-05	Acceleration time 3	0.0 to 6500.0	s	0.0	0xF805
F8-06	Deceleration time 3	0.0 to 6500.0	s	0.0	0xF806
F8-07	Acceleration time 4	0.0 to 6500.0	s	0.0	0xF807
F8-08	Deceleration time 4	0.0 to 6500.0	s	0.0	0xF808
F8-12	Forward/Reverse rotation dead-zone time	0.0–3000.0s	s	2.0	0xF80C
F8-16	Accumulative power-on time reach threshold	0–65000 h	h	0	0xF810
F8-17	Accumulative running time reach threshold	0–65000 h	h	0	0xF811
F8-18	Start-up protection	0: No 1: Yes	N.A.	0	0xF812
F8-49	Wakeup frequency	Hibernating frequency (F8-51) to maximum frequency (F0-10)	Hz	0.00	0xF831
F8-50	Wakeup delay time	0.0–6500.0	s	0.0	0xF832
F8-51	Hibernating frequency	0.00 Hz to wakeup frequency (F8-49)	Hz	0.00	0xF833
F8-52	Hibernating delay time	0.0–6500.0	s	0.0	0xF834
F8-54	Output power correction coefficient	0.00%–200.0%	N.A.	100.0%	0xF836

5.10 Group F9: Fault and Protection

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
F9-00	Motor thermal protection enable selection	0: disable motor thermal protection; 1: enable motor thermal protection	N.A.	1	0xF900
F9-01	Motor thermal protection coefficient	0.1 to 10.00	N.A.	1.00	0xF901
F9-02	Motor thermal protection pre-warning coefficient	50 to 99	%	80	0xF902
F9-07	Ground fault detection Enable	0: Disable; 1: Enable detection upon power on;	N.A.	1	0xF907
F9-08	Braking trigger DC bus voltage level	220 V input: 320 to 390 380 V input: 620 to 730	V	220 V input: 350 380 V input: 670	0xF908
F9-09	Fault auto reset times	0 to 20	N.A.	0	0xF909
F9-11	Time interval of fault auto reset	0.1 to 100.0	Sec	1.0	0xF90B
F9-13	Drive output phase loss detection Enable	0: Disable; 1: Enable;	N.A.	1	0xF90D
F9-14	1st fault type	0 to 51	N.A.	N.A.	0xF90E
F9-15	2nd fault type	0 to 51	N.A.	N.A.	0xF90F
F9-16	3rd (latest) fault type	0 to 51	N.A.	N.A.	0xF910
F9-17	Frequency upon 3rd fault	N.A.	Hz	N.A.	0xF911
F9-18	Current upon 3rd fault	N.A.	A	N.A.	0xF912
F9-19	Bus voltage upon 3rd fault	N.A.	V	N.A.	0xF913
F9-20	Input terminal status upon 3rd fault	N.A.	N.A.	N.A.	0xF914
F9-21	Output terminal status upon 3rd fault	N.A.	N.A.	N.A.	0xF915
F9-22	AC drive status upon 3rd fault	N.A.	N.A.	N.A.	0xF916
F9-23	Power-on time upon 3rd fault	N.A.	N.A.	N.A.	0xF917

5.11 Group FC: Simple PLC Multi-Reference

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
FC-00	Reference 0	-100.0 to 100.0	%	50.0%	0xFC00
FC-01	Reference 1	-100.0 to 100.0	%	-50.0%	0xFC01
FC-02	Reference 2	-100.0 to 100.0	%	50.0%	0xFC02
FC-03	Reference 3	-100.0 to 100.0	%	-50.0%	0xFC03
FC-04	Reference 4	-100.0 to 100.0	%	50.0%	0xFC04
FC-05	Reference 5	-100.0 to 100.0	%	-50.0%	0xFC05
FC-18	Running time of simple PLC reference 0	0.0 to 6500.0	s	5	0xFC12
FC-19	Acceleration/deceleration time selection of simple PLC reference 0	0: Acceleration/deceleration time 1 (F0-17/F0-18) 1: Acceleration/deceleration time 2 (F8-03/F8-04) 2: Acceleration/deceleration time 3 (F8-05/F8-06) 3: Acceleration/deceleration time 4 (F8-07/F8-08)	N.A.	1	0xFC13
FC-20	Running time of simple PLC reference 1	0.0 to 6500.0	s	5	0xFC14
FC-21	Acceleration/deceleration time selection of simple PLC reference 1	0~3 (refer to FC-19)	N.A.	1	0xFC15
FC-22	Running time of simple PLC reference 2	0.0 to 6500.0	s	5	0xFC16
FC-23	Acceleration/deceleration time selection of simple PLC reference 2	0~3 (refer to FC-19)	N.A.	1	0xFC17
FC-24	Running time of simple PLC reference 3	0.0 to 6500.0	s	5	0xFC18
FC-25	Acceleration/deceleration time selection of simple PLC reference 3	0~3 (refer to FC-19)	N.A.	1	0xFC19
FC-26	Running time of simple PLC reference 4	0.0 to 6500.0	s	5	0xFC1A
FC-27	Acceleration/deceleration time selection of simple PLC reference 4	0~3 (refer to FC-19)	N.A.	1	0xFC1B
FC-28	Running time of simple PLC reference 5	0.0 to 6500.0	s	5	0xFC1C
FC-29	Acceleration/deceleration time selection of simple PLC reference 5	0~3 (refer to FC-19)	N.A.	1	0xFC1D

5.12 Group FD: Communication Parameters

Function Code	Parameter Name	Setting Range	Unit	Default	Commissioning
FD-00	Baud rate	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	N.A.	6005	6005
FD-01	Data format	0: No check, data format <8,N,2> 1: Even parity check, data format <8,E,1> 2: Odd Parity check, data format <8,O,1> 3: No check, data format <8,N,1> Valid for Modbus	N.A.	Model dependent	0
FD-02	Local address	0: Broadcast address 1–247	N.A.	1	1
FD-03	Response delay	0–20 ms Valid for Modbus	ms	2	2
FD-04	Communication timeout	0.0s (invalid) 0.1–60.0s	s	0.0	0.0
FD-05	Modbus protocol selection	Unit's digit: Modbus protocol 0: Non-standard Modbus protocol 1: Standard Modbus protocol Ten's digit: PROFIBUS-DP data format 0: PPO1 format 1: PPO2 format 2: PPO3 format 3: PPO5 format	N.A.	30	31
FD-06	Communication reading current resolution	0: 0.01A 1: 0.1A	A	0	0

5.13 Group FF: AC Drive Parameters

Function Code	Parameter Name	Setting Range	Unit	Default	Remark
FF-00	Factory password	0 to 65535	N.A.	0	
FF-01	Drive code	1 to 537	N.A.	Model dependent	
FF-02	G/P type selection	1: G type ; 2: P type	N.A.	1	
FF-03	Drive rated power	0 to 6553.5	N.A.	Model dependent	display

5.14 Group FP: Function Code Management

Function Code	Parameter Name	Setting Range		Unit	Default	Remark
FP-00	User password	0 to 65535		N.A.	0	
FP-01	Parameter initialization	0: No operation 01: Restore factory settings except motor parameters 02: Clear records (Including accumulative total electricity consumption) 04: Restore user backup parameters 501: Back up current user parameters		N.A.	0	
FP-03	Parameter display selection	0 or 1	0 or 1	N.A.	00	
		Modified parameters: 0: No display 1: Display	Customized parameters: 0: No display 1: Display			

5.15 Group A9: Special Parameters for Solar Pump Application

Function Code	Parameter Name	Setting Range	Unit	Default	Modbus Address
A9-00	The minimum value of PID proportional coefficient	0.1 to 900.0	N.A	40.0	0xA900
A9-01	The maximum value of PID integral time	0.01 to 90.00	N.A	2.00	0xA901
A9-02	The maximum value of PID proportional coefficient	0.1 to 900.0	N.A	200.0	0xA902
A9-03	The minimum value of PID integral time	0.01 to 90.00	N.A	0.12	0xA903
A9-04	Right MPPT tracking step	0.0 to 10.0	V	0.6	0xA904
A9-05	Left MPPT tracking step	0.0 to 10.0	V	1.5	0xA905
A9-06	MPPT tracking time	0 to 60,000	ms	200	0xA906
A9-07	The minimum value of DC bus voltage for MPPT	100.0 to 800.0	V	440.0	0xA907
A9-08	System Output Power Upper Limit	0.0 to 100.0	kW	1.0	0xA908
A9-09	Start-up voltage threshold	100.0 to 800.0	V	380 V: 550.0 220 V: 320.0	0xA909
A9-10	Shutdown voltage threshold	0.0 to 800.0	V	380 V: 300.0 220 V: 170.0	0xA90A
A9-11	Water tank level detection threshold	0.00 to 10.00	V	8.00	0xA90B
A9-22	Under load detection current threshold	0.0 to 100.0	%	30.0	0xA916
A9-23	Under load judgment delay time	0.0 to 6553.5	s	1.0	0xA917
A9-24	Auto reset time in case of under load fault	0.0 to 6553.5	s	5.0	0xA918
A9-25	PQ curve P1	0.0 to 6553.5	kW	0.0	0xA919
A9-26	PQ curve Q1	0.0 to 6553.5	m ³ /h	0.0	0xA91A
A9-27	PQ curve P2	0.0 to 6553.5	kW	0.0	0xA91B
A9-28	PQ curve Q2	0.0 to 6553.5	m ³ /h	0.0	0xA91C
A9-29	PQ curve P3	0.0 to 6553.5	kW	0.0	0xA91D
A9-30	PQ curve Q3	0.0 to 6553.5	m ³ /h	0.0	0xA91E
A9-31	PQ curve P4	0.0 to 6553.5	kW	0.0	0xA91F
A9-32	PQ curve Q4	0.0 to 6553.5	m ³ /h	0.0	0xA920
A9-33	PQ curve P5	0.0 to 6553.5	kW	0.0	0xA921
A9-34	PQ curve Q5	0.0 to 6553.5	m ³ /h	0.0	0xA922
A9-35	Hourly flow of pump	Display rang: 0.0 to 6553.5	m ³	0.0	0xA923
A9-36	Daily flow of pump	Display rang: 0.0 to 6553.5	m ³	0.0	0xA924
A9-37	Yearly flow of pump	Display rang: 0.0 to 6553.5	m ³	0.0	0xA925
A9-38	Pump cleaning mode enable	0: Disable 1: Enable	N.A	0	0xA926

5.16 Group U0: Monitoring

Function Code	Parameter Name	Display Range	Unit	Default	Modbus Address
U0-00	Running frequency	0.00~500.00	Hz	N.A.	0x7000
U0-01	Set frequency	0.00~500.00	Hz	N.A.	0x7001
U0-02	Bus voltage	0.0~800.0	V	N.A.	0x7002
U0-03	Output voltage	0~380	V	N.A.	0x7003
U0-04	Output current	0.00~655.35	A	N.A.	0x7004
U0-05	Output power	0.0~6553.5	kW	N.A.	0x7005
U0-06	Output torque	-200.0~200.0	%	N.A.	0x7006
U0-07	DI state	0~32767	N.A.	N.A.	0x7007
U0-08	DO state	0~1023	N.A.	N.A.	0x7008
U0-09	AI1 voltage	0.00~10.57	V	N.A.	0x7009
U0-10	AI2 voltage	0.00~10.57	V	N.A.	0x700A
U0-11	AI3 voltage	0.00~10.57	V	N.A.	0x700B

NOTE: DI/DO State description.

DI State:

If **U0-07** display **124**, the corresponding binary value is **1111100**, as the follow table,

Bit1	Bit1	Bit1	Bit1	Bit1	Bit1	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
5	4	3	2	1	0	DI10	DI9	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1
-	VDI 5	VDI 4	VDI 3	VDI 2	VDI 1	0	0	0	1	1	1	1	1	0	0
-	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	OFF	OFF

DO State:

If **U0-08** display **14**, the corresponding binary value is **1110**, as the follow table,

Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
VDO5	VDO4	VDO3	VDO2	VDO1	DO2	DO1	Relay2	Relay1	DO3
0	0	0	0	0	0	1	1	1	0
OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF

6 Troubleshooting

6.1 AC Drive Fault Codes

Display	Fault Name	Possible Causes	Solutions
Err02	Overcurrent during acceleration	<ol style="list-style-type: none"> 1. The output circuit is short circuited. 2. The acceleration time is too short. 3. Manual torque boost or V/F curve is not appropriate. 4. The power supply is too low. 5. The startup operation is performed on the rotating motor. 6. A sudden load is added during acceleration. 7. The AC drive model is of too small power class. 	<ol style="list-style-type: none"> 1: Eliminate short circuit. 2: Increase the acceleration time F0-17. 3: Adjust the manual torque boost or V/F curve. 4: Check that the power supply is normal. 5: Select speed tracking restart or start the motor after it stops. 6: Remove the added load. 7: Select a drive of higher power class.
Err03	Overcurrent during deceleration	<ol style="list-style-type: none"> 1. The output circuit is short circuited. 2. The deceleration time is too short. 3. The power supply is too low. 4. A sudden load is added during deceleration. 5. The braking resistor is not installed. 	<ol style="list-style-type: none"> 1: Eliminate short circuit. 2: Increase the deceleration time F0-18. 3: Check the power supply, and ensure it is normal. 4: Remove the added load. 5: Install the braking resistor.
Err04	Overcurrent at constant speed	<ol style="list-style-type: none"> 1. The output circuit is short circuited. 2. The power supply is too low. 3. A sudden load is added during operation. 4. The AC drive model is of too small power class. 	<ol style="list-style-type: none"> 1: Eliminate short circuit. 2: Adjust power supply to normal range. 3: Remove the added load. 4: Select a drive of higher power class.
Err05	Overvoltage during acceleration	<ol style="list-style-type: none"> 1. The DC bus voltage is too high[*]. 2. An external force drives the motor during acceleration. 3. The acceleration time is too short. 4. The braking resistor is not installed. 	<ol style="list-style-type: none"> 1: Replace with a proper braking resistor. 2: Cancel the external force or install braking resistor. 3: Increase the acceleration time. 4: Install a braking resistor.
Err06	Overvoltage during deceleration	<ol style="list-style-type: none"> 1. The DC bus voltage is too high[*]. 2. An external force drives the motor during deceleration. 3. The deceleration time is too short. 4. The braking resistor is not installed. 	<ol style="list-style-type: none"> 1: Replace with a proper braking resistor. 2: Cancel the external force or install braking resistor. 3: Increase the deceleration time. 4: Install the braking resistor.
Err07	Overvoltage at constant speed	<ol style="list-style-type: none"> 1. The DC bus voltage is too high[*]. 2. An external force drives the motor during deceleration. 	<ol style="list-style-type: none"> 1: Replace with a proper braking resistor. 2: Cancel the external force.
* : Voltage thresholds			
Voltage Class		DC Bus Overvoltage Threshold A5-09	DC Bus Undervoltage Threshold A5-06 (Default Value : 100%)
Three-phase 220 V		400 VDC	200 VDC
Three-phase 380 V		810 VDC	350 VDC
Err08	Control power fault	The input voltage exceeds the allowed range.	Adjust the input voltage to within the allowed range.

Display	Fault Name	Possible Causes	Solutions
Err09	Undervoltage	<ol style="list-style-type: none"> 1. Instantaneous power failure occurs. 2. The input voltage exceeds the allowed range 3. The DC bus voltage is too low[*]. 4. The rectifier bridge and buffer resistor are faulty. 5. The drive board is faulty. 6. The control board is faulty. 	<ol style="list-style-type: none"> 1: Reset the fault. 2: Adjust the input voltage to within the allowed range. 3 to 6: Seek for maintenance.
Err10	Drive overload	<ol style="list-style-type: none"> 1. The load is too heavy or the rotor is locked. 2. The drive is of too small power class. 	<ol style="list-style-type: none"> 1: Reduce the load, or check the motor, or check the machine whether it is locking the rotor. 2: Select a drive of higher power class.
Err11	Motor overload	<ol style="list-style-type: none"> 1. F9-01 is too small. 2. The load is too heavy or the rotor is locked. 3. The drive is of too small power class. 	<ol style="list-style-type: none"> 1: Set F9-01 correctly. 2: Reduce load, or check motor, or check the machine whether it is locking the rotor. 3: Select a drive of larger power class.
Err12	Power input phase loss	<ol style="list-style-type: none"> 1. The three-phase power supply is abnormal. 2. The drive board is faulty. 3. The lightning protection board is faulty. 4. The control board is faulty. 	<ol style="list-style-type: none"> 1: Check the power supply. 2 to 4: Seek for maintenance.
Err13	One drive output phase loss	<ol style="list-style-type: none"> 1. The cable between drive and motor is faulty. 2. The drive's three-phase output is unbalanced when the motor is running. 3. The drive board is faulty 4. The IGBT is faulty. 	<ol style="list-style-type: none"> 1: Check the cable. 2: Check the motor windings. 3 to 4: Seek for maintenance.
Err14	IGBT overheat	<ol style="list-style-type: none"> 1. The ambient temperature is too high. 2. The air filter is blocked. 3. The cooling fan is damaged. 4. The thermal sensor of IGBT is damaged. 5. The IGBT is damaged. 	<ol style="list-style-type: none"> 1: Reduce the ambient temperature. 2: Clean the air filter. 3 to 5: Seek for maintenance.
Err15	External equipment fault	<ol style="list-style-type: none"> 1. External fault signal is input via DI. 2. External fault signal is input via VDI. 	Reset the fault.
Err16	Communication fault	<ol style="list-style-type: none"> 1. The host computer is abnormal. 2. The communication cable is faulty. 3. The extension card type set in F0-28 is incorrect. 4. The communication parameters in group FD are set improperly. 	<ol style="list-style-type: none"> 1: Check cabling of the host computer. 2: Check the communication cabling. 3: Set F0-28 correctly. 4: Set the communication parameters properly.
Err18	Current detection fault	The drive board is faulty.	Replace the drive board.
Err19	Motor tuning fault	<ol style="list-style-type: none"> 1. Motor parameters are wrong. 2. Motor tuning overtime. 	<ol style="list-style-type: none"> 1. Check motor parameters F1-00 to F1-05. 2. Check the wiring between drive and motor.
Err21	EEPROM read-write fault	The EEPROM chip is damaged.	Replace the main control board.

Display	Fault Name	Possible Causes	Solutions
Err23	Short circuit to ground	The motor is short-circuited to ground.	Replace the cables or motor.
Err26	Accumulative running time reached	The accumulative running time reaches the setting of F8-17.	Clear the record by performing parameter initialization (set FP-01 to 2).
Err27	User-defined fault 1	1. The user-defined fault 1 signal is input via DI. 2. User-defined fault 1 signal is input via VDI.	Reset the fault.
Err28	User-defined fault 2	1. The user-defined fault 2 signal is input via DI 2. The user-defined fault 2 signal is input via VDI.	Reset the fault.
Err29	Accumulative power-on time reached	The accumulative power-on time reaches the setting of F8-16.	Clear the record by performing parameter initialization (set FP-01 to 2).
Err30	Off load fault	Offload when it's running.	Check the connection between motor and load. Check if output current is less than F9-64
Err31	PID feedback lost during running	The PID feedback is lower than FA-26.	Check the PID feedback signal or set FA-26 to a proper value.
Err40	Quick current limit	1. The load is too heavy or the rotor is locked. 2. The drive is of too small power class.	1: Reduce the load, or check the motor, or check the machine whether it is locking the rotor. 2: Select a drive of higher power class.
Err41	Motor switchover fault during running	The current motor is switched over via a terminal during running of the AC drive.	Switch over the motor only after the AC drive stops.
Err61	Two or three drive output phases loss	1. The drive output connections get loose; 2. The output contactor gets wrongly operated or malfunctions.	1. Check drive output connections; 2. Check drive output contactor.
Err64	Solar pum dry run protection	1. The water flow is not available at the inlet of pump; 2. There is a blockage in the pump; 3. Unreasonable setting of A9-22 and A9-23	1. Check water supply; 2. Check the pump and water pipe; 3. Check A9-22~A9-24 setting;

6.2 AC Drive Common Symptoms and Diagnostics

Fault Name	Possible Causes	Solutions
There is no display at power-on.	<ol style="list-style-type: none"> 1. There is no power supply or the power supply is too low. 2. The switching power supply on the drive board is faulty. 3. The rectifier bridge is damaged. 4. The buffer resistor of the drive is damaged. 5. The control board or the keypad is faulty. 6. The cable between the control board and the drive board or keypad breaks. 	<ol style="list-style-type: none"> 1: Check the power supply. 2 to 5: Seek for maintenance. 6: Re-connect the 4-core and 28-core flat cables, or seek for maintenance.
"HC" is displayed at power-on.	<ol style="list-style-type: none"> 1. The cable between the drive board and the control board is in poor contact. 2. The control board is damaged. 3. The motor winding or the motor cable is short-circuited to the ground. 4. The power supply is too low. 	<ol style="list-style-type: none"> 1: Re-connect the 4-core and 28-core flat cables, or seek for maintenance. 2: Seek for maintenance. 3: Check the motor or replace it, and check the motor cable. 4. Check the power supply according to chapter 1.3.
The display is normal upon power-on, but "HC" is displayed after start and the motor stops immediately.	<ol style="list-style-type: none"> 1. The cooling fan is damaged or the rotor is locked. 2. A certain terminal is short-circuited. 	<ol style="list-style-type: none"> 1: Replace cooling fan, or check the machine whether it is locking the rotor. 2: Eliminate short circuit.
Err14 is reported frequently.	<ol style="list-style-type: none"> 1. The carrier frequency is set too high. 2. The cooling fan is damaged, or the air filter is blocked. 3. Components (thermal coupler or others) inside the drive are damaged. 	<ol style="list-style-type: none"> 1: Reduce F0-15. 2: Replace the fan and clean the air filter. 3: Seek for maintenance.
The motor does not rotate after the AC drive outputs a non-zero reference.	<ol style="list-style-type: none"> 1. The motor or motor cable is damaged. 2. The motor parameters are set improperly. 3. The cable between the drive board and the control board is in poor contact. 4. The drive board is faulty. 5. The rotor is locked. 	<ol style="list-style-type: none"> 1: Check the motor, or check the cable between the drive and the motor. 2: Check and re-set motor parameters. 3: Re-connect the 4-core and 28-core flat cables, or seek for maintenance. 4: Seek for maintenance. 5: Check the machine whether it is locking the rotor.
The DI terminals are disabled.	<ol style="list-style-type: none"> 1. The DI parameters are set incorrectly. 2. The input signal is incorrect. 3. The wire jumper between OP and +24V is in poor contact. 4. The control board is faulty. 	<ol style="list-style-type: none"> 1: Check and reset DI parameters in group F4. 2: Check the input signals, or check the input cable. 3: Check the jumper between OP and +24 V. 4: Seek for maintenance.
The drive reports overcurrent and overvoltage frequently.	<ol style="list-style-type: none"> 1. The motor parameters are set improperly. 2. The acceleration/deceleration time is too small. 3. The load fluctuates. 	<ol style="list-style-type: none"> 1: Reset motor parameters. 2: Set proper acceleration/deceleration time. 3: Check the machine, or seek for maintenance.

Revision History

Date	Version	Change Description
Dec 2016	A00	Related firmware version: F7-10=L71.03 and F7-11=L312 The version of the program: F7-15=312.11 and F7-16=605.05
April 2019	A01	Updated the cover.

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