

**POWER DATA D20 Smart Pro
PIPPOHYDRO Pump Drive
User Manual**

Version code: POWERDATA 20-EN-60200257-1712



Preface

Thank you for using POWER DATA 2.0 series products. This manual provides you with relevant operation instructions and detailed description of parameters. Please read this manual carefully before installation, running, maintenance or inspection.

Make sure the wiring and the pump's rotation direction is correct before using.


This manual is only used in the pump drive of which software version is V3.0 and above; please check the value of your machine parameters F0.17 before using.


Content

Preface	- 1 -
Notes for Safe Operation	- 4 -
Chapter 1 Operation Panel Instruction	- 7 -
1.1 Operation Panel Diagram	- 7 -
1.2 Indicator Light Instruction	- 8 -
1.3 Key Operating Instruction	- 8 -
1.4 Pressure Setting Instruction	- 9 -
Chapter 2 Model, Appearance and Wiring	- 10 -
2.1 Model Instruction	- 10 -
2.2 Outline & Installation Dimensions	- 10 -
2.3 Installation Diagram	- 12 -
2.4 Wiring steps and precautions	- 12 -
2.5 Wiring Diagram of Main Circuit and Control Terminals	- 14 -
2.6 Control Terminal Instruction	- 15 -
2.7 Wiring of Sensors	- 16 -
2.8 Control panel jumper	- 18 -
2.9 Expansion card	- 19 -
Chapter 3 Quick Setting	- 20 -
Chapter 4 Datasheet of Power Data20	- 23 -
4.1 Parameters Displayed at Running Status	- 23 -
4.2 Parameters Displayed at Stopped Status	- 23 -
4.3 Common Parameter Sets of Single-drive	- 24 -
4.4 Common Parameter Groups of Multi-drive Mode	- 27 -
4.5 Debugging Parameter Groups	- 29 -
4.6 PID and Standby Parameter Sets	- 31 -

4.7 Parameter Sets of Pump Protection	- 35 -
4.8 Parameter Sets of Motor	- 38 -
4.9 Parameter Sets of Protections and Faults	- 39 -
4.10 Parameter Sets of Terminals	- 41 -
4.11 Communication Parameter Sets	- 43 -
4.12 Monitoring Parameter Sets	- 46 -
4.13 Agent Parameter Sets	- 46 -
4.14 Factory Parameter Sets	- 47 -
4.15 Details of Some Parameters	- 48 -
Chapter 5 Fault Information and Troubleshooting	- 60 -
5.1 Fault Codes Description	- 60 -
5.2 Common Faults and Handling	- 63 -
Chapter 6 Communication Protocol	- 65 -
6.1 Command Codes and Communication Data Description	- 65 -
Chapter 7 Typical Application Cases	- 71 -
7.1 Single Pump Control Case 1	- 71 -
7.2 Single Pump Control Case 2	- 72 -
7.3 Two driven by one control case	- 74 -
7.4 Multi-pump control case	- 75 -

Notes for Safe Operation

 Warning: Indicate a potentially dangerous situation in which could result in death or serious physical injuries.

 Caution: Indicate a potentially dangerous situation in which could result in minor or moderate physical injuries and damage to equipments. Meanwhile, this sign can be also used for indicating errors or unsafe operation.

SPD: Abbreviation of smart pump drive.

■ Inspection



⊙Do not install or operate the SPD if it is damaged or has missing parts. Otherwise it may result in equipment damage or physical injuries.

■ Installation



⊙Please hold the bottom of SPD when installing or moving it. In case that the SPD is broken or damaged; only holding the shell is not allowed.

⊙Keep the SPD away from heat, inflammable and explosive goods; Install SPD on the metal or other nonflammable objects.

⊙If the SPD is mounted in an electric cabinet or other enclosed objects, fans or other cooling device should be installed inside the cabinet; Setting ventilation opening to ensure ambient temperature is below 40°C. Otherwise it may be damaged because of high temperature.

■ Wiring



WARNING

- ◎ Wiring must be completed by qualified electrical engineers. Otherwise it can cause an electrical shock or SPD damage.
- ◎ Before wiring, make sure the power supply is de-energized. Otherwise it will cause an electrical shock or a fire.
- ◎ Make sure the ground terminal (⊕) is grounded safely and correctly. Otherwise there will be a risk of electrical shock on the shell of SPD.
- ◎ Do not touch the main circuit terminal, and the main circuit terminals of the SPD are not allowed to contact the shell. Otherwise it may cause an electrical shock.



CAUTION

- ◎ Before connecting, make sure the voltage rating and phase number of SPD is conformed to the input power voltage, phase number; Otherwise it may cause a fire or physical injuries.
- ◎ Never connect the AC input power supply to the output terminals V, U, W of SPD; Otherwise it will cause damage to the SPD and you are not guaranteed to enjoy the warranty services.
- ◎ Never conduct a pressure test on SPD; Otherwise it will cause damage to the SPD.
- ◎ The main circuit wiring of the SPD and the control loop wiring should be separated or vertical crossed, otherwise the control signal will be interfered.
- ◎ The cable connected to the main circuit terminals should be use lugs with isolated casing
- ◎ If the length of cable between the SPD and the motor is over 50 meters, an output reactor is recommended so as to protect the SPD and motor.

■ Running



WARNING

- ◎ Turn on the input AC power after the wiring of SPD is completed and the front cover is installed. Do not dismantle the front cover when operating; otherwise it will lead to an electric shock.
- ◎ When SPD is set with the function of fault automatic reset or auto-restart after power

failure, protection measures for equipment system should be taken in advance. Otherwise it will cause physical injuries.

◎The key “RUN/STOP” may be lose efficacy because some function had been set, a separate emergency power switch can be installed in the SPD control system; Otherwise it may cause damage or physical injuries.

◎Though the SPD terminal is in stop state, the terminal is electrified after power on. Do not touch; otherwise there will be a risk of electric shock.

■ Maintenance and Inspection



WARNING

◎When power on, do not touch the connection terminals. Otherwise it may cause an electrical shock.

◎Only qualified electrical engineering personnel can maintain, replace and inspect the SPD.

◎Wait at least 10 minutes after the power failure, or make sure that is no residual voltage before carry out maintenance and inspection, otherwise it may cause damage.



CAUTION

◎PCB board has CMOS integrated circuit, do not touch, otherwise the static electricity may damage PCB board.

■ Others

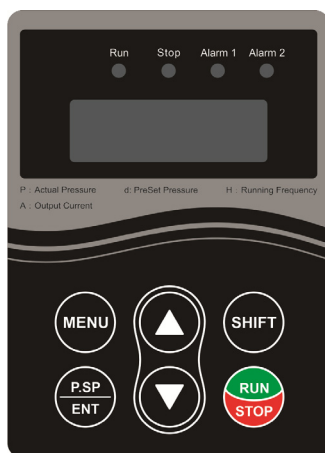


WARNING

◎It is strictly forbidden to transform the SPD, otherwise it may cause casualties. After arbitrarily changing SPD, will no longer enjoy the warranty service.

Chapter 1 Operation Panel Instruction

1.1 Operation Panel Diagram



Operation panel diagram

- (1) **MENU**: used to switch from fixed model to modification model.
- (2) **P.SP/ENT**: shortcut key of water pressure setting and “confirmation” key of parameter setting.
- (3) **SHIFT**: used to shift display and move cursors in parameter modification .In running status, pressing “shift” can switch back and forth among running frequency, output current, pressure setting and feedback pressure. Press “shift” to modify parameters. Flicker bit is the current bit which can be modified.
- (4) **▲ ▼ keys**: used to modify parameter values.
- (5) **RUN**: start button when using keyboard as starting mode.
- (6) **STOP**: stop button and fault reset button when using keyboard as start mode.

1.2 Indicator Light Instruction

- (1) **Run:** (Always on) Running instruction; (Flicker): Sleep or stop instruction
- (2) **Stop:** Stop or standby instruction
- (3) **Alarm 1:** SPD fault alarm
- (4) **Alarm 2:** Pipe network abnormal alarm

1.3 Key Operating Instruction

Three-class menus are:

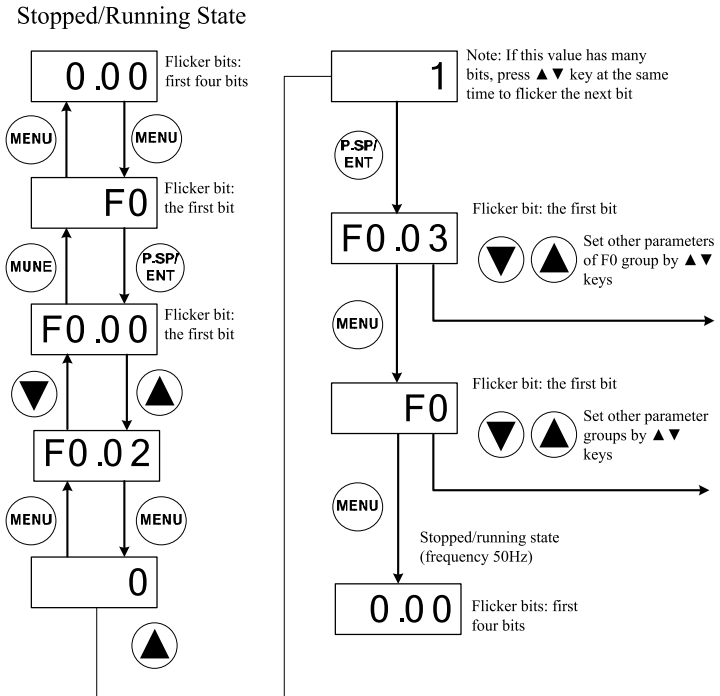
- ① Function code group (first class)
- ② Function code (second class)
- ③ Function code (third class)

Instruction: In the third class menu, pressing “MENU” or “P.SP/ENT” can return to the second class menu. Pressing “P.SP /ENT” first saves parameters to control board, and then returns to the second class menu and shifts to next function code automatically; pressing “MENU” returns to the second class menu directly without saving parameters and keeps staying at current function code.

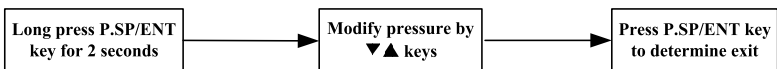
Under the third class menu, only flicker bit can be modified. Press “shift” to select flicker bit.

Note: For parameters marked with “●”, please modify them in stopped state. Parameters marked with “◎” are actual detected and recorded values which can't be modified.

Example: Modify F0.02 from 0 to 1; pressing the menu key for two seconds can access to parameter set.



1.4 Pressure Setting Instruction

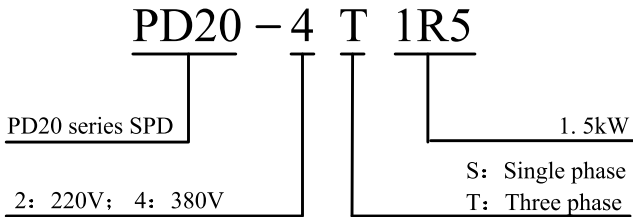


Remarks--Pressure Measure:

$$0.1\text{MPa} = 100\text{kPa} = 1\text{bar} = 1\text{kgf} / \text{cm}^2$$

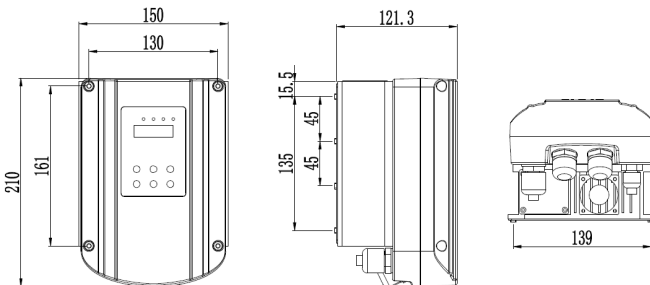
Chapter 2 Model, Appearance and Wiring

2.1 Model Instruction

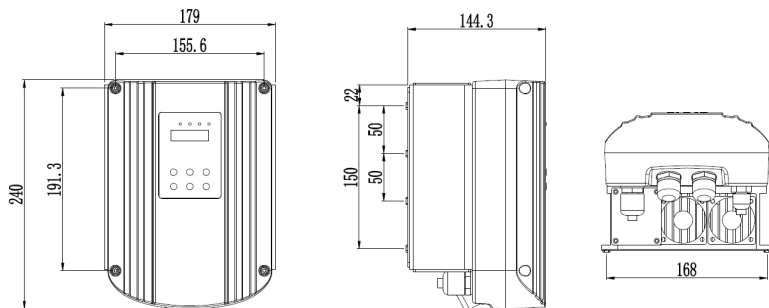


2.2 Outline & Installation Dimensions

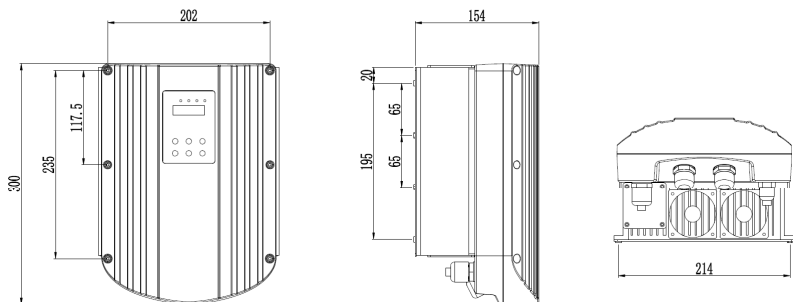
(Unit: mm)



0.75-2.2kW Outline dimensions



4-7.5kW Outline dimensions



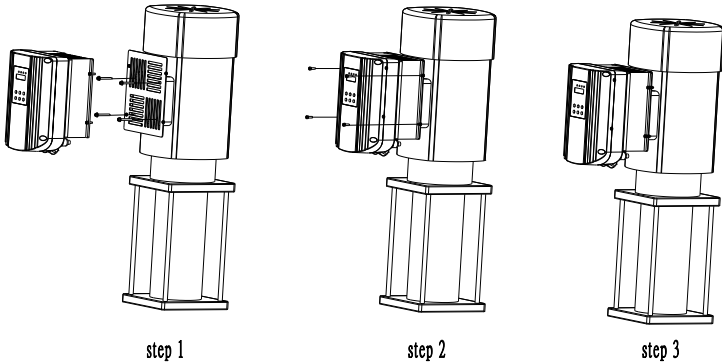
11-18.5kW Outline dimensions

2.3 Installation Diagram

Step 1: Fix the baseplate with 4 screws on the electrical box of motor.

Step 2: Install the SPD on the baseplate and fix with 4 screws.

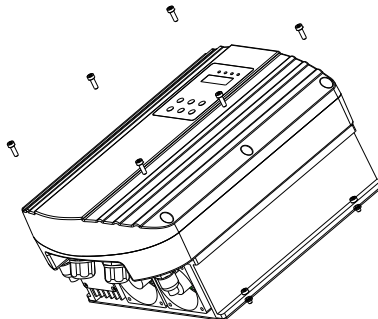
Step 3: Finish installation.



2.4 Wiring steps and precautions

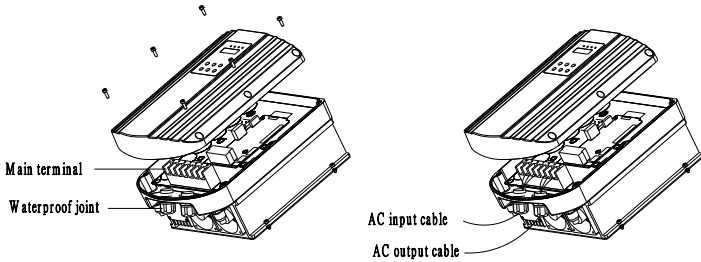
2.4.1 Wiring steps

(1) Dismantle the screws on operation panel, unplug the keyboard cable, and remove the cover. (Caution: do not break the keyboard cable)



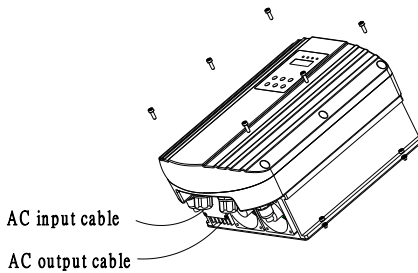
Remove the six screws of cover

(2) Each cable is connected to the terminals correctly through waterproof joint on the bottom.



Take the cover and connect the input and output cable
 (Note: Do not break the keyboard line when take the cover)

(3) Connect the keyboard cable, install the cover and fix with screws

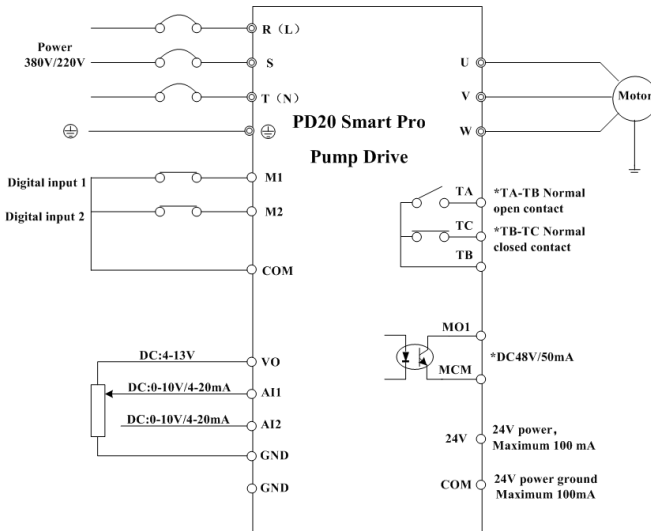


Connect the keyboard line, fix the cover

2.4.2 Special notes

- ① Do not pull the keyboard cable apart when dismantling the cover.
- ② Make sure all the cables are connected correctly.
- ③ Make sure the keyboard cable is reconnected before putting the cover back.

2.5 Wiring Diagram of Main Circuit and Control Terminals



Note:

- ① Terminals: ◎ refers to main circuit terminals; ○ control loop terminals .
- ② Main circuit terminals are L, N when the SPD voltage is selected as single phase 220V.
- ③ Do not pull the keyboard cable apart when unplugging.

2.6 Control Terminal Instruction

2.6.1 Control terminals —— signal terminals:

M1	M2	COM	COM	24V	S+	S-
----	----	-----	-----	-----	----	----

MO1	MCM	AI1	AI2	VO	GND	GND
-----	-----	-----	-----	----	-----	-----

Control terminals —— relay terminals:

TA	TB	TC
----	----	----

2.6.2 Control terminal instruction

Terminal symbol	Terminal name	Technical specification
M1~M2	Multi-function digital input terminal	1. Optical couplers isolation one-way input 2. Enabled when connected to GND. Disabled when open 3. Input voltage range: 9~36 VDC 4. Input impedance: 3.3 K Ω
AI1	Analog input terminal 1	1. Input voltage range: DC 0~10VDC or 0/4~20mA, determined by parameters.
AI2	Analog input terminal 2	2. Input impedance: 20K Ω when voltage input; 500 Ω when current input
VO	Analog reference voltage	4~13V (can be set), $\pm 5\%$ maximum output current 50mA
GND	Analog ground terminal	VO reference zero potential
TA/TB/TC	Relay output	TA~TB: normally open terminals TB~TC: normally closed terminals Contact capacity: AC 250V / 3A / normally open terminals AC 250V / 3A / normally closed terminals

Terminal symbol	Terminal name	Technical specification
+24V	+24V power for external devices	Provide +24V power to external devices. Maximum output current 100 mA. Commonly used as digital input working power and external sensor power
COM	+24V power public terminal	Provide +24V power public terminal to external devices
S+	Standard RS485 communication terminal	Standard isolated 485 communication interface. Please use twisted pair or shielded wire
S-		

2.7 Wiring of Sensors

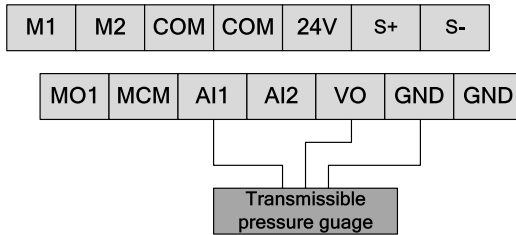
2.7.1 Terminal instruction

- ① VO ---Supply terminal of transmissible pressure gauge(adjustable output voltage)
- ② 24V ---Supply terminal of pressure transmitter
- ④ AI1, AI2 --- 0~10V or 4~20mA analog signal input terminal
- ⑤ GND --- VO power ground
- ⑤ COM --- 24V power ground

2.7.2 Wiring diagram

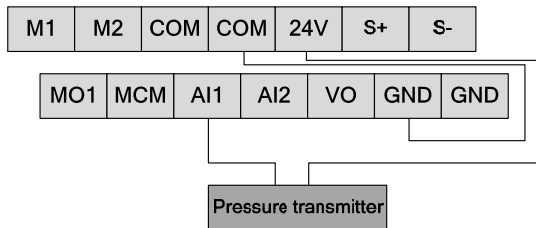
The SPD can be connected to transmissible pressure gauge and pressure transmitter. Please connect wire according to below diagrams.

- ① Transmissible pressure gauge: working voltage 4~13VDC, output 0~10VDC.
Wiring method is shown as below.

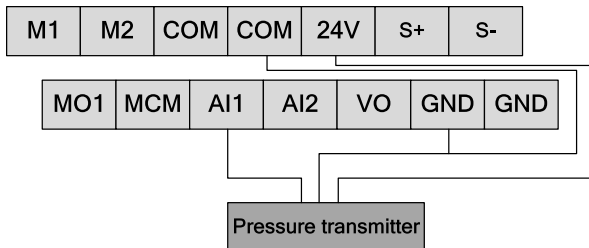


Wiring diagram of Transmissible pressure gauge

- ② 24V pressure transmitter: working voltage range 10~30VDC, output 4~20mA.

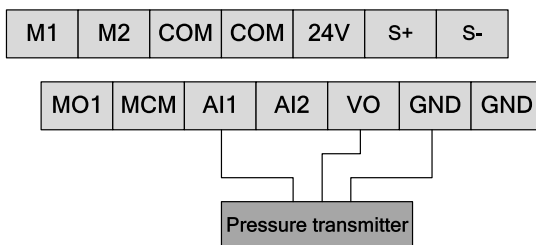


Wiring diagram of two-wire pressure transmitter



Wiring diagram of three-wire pressure transmitter

③ 10V pressure transmitter: working voltage range 10DC, output 4~20mA



Wiring diagram of three-wire pressure transmitter

2.8 Control panel jumper

There are 3 sets of jumpers, the selecting instruction of corresponding jumpers are as follows:

Jumper No.	Jumper Position	Function specification	Jumper Position	Function specification
JP1	1-2	RS485 communication is connected to terminal resistor; use terminals in multi-drive	2-3	RS485 communication is not connected to terminal resistor; use intermediate machine in multi-drive
JP2	1-2	GND terminals is connected to the ground capacitance	2-3	GND terminals is not connected to the ground capacitance
JP2	1-2	GND terminals is connected to the ground capacitance	2-3	GND terminals is not connected to the ground capacitance

2.9 Expansion card

This SPD can be equipped with an expansion card. The expansion card is equipped with one RS485 interface. With no effect to each other, the expansion RS485 interface is independent of the standard RS485 interface on the control board. By setting the parameters, standard RS485 interface and expansion RS485 interface can both work as auxiliary at the same time. Also, it can be one host and one auxiliary. Please refer to the application case in the Chapter 7.4.

The instruction for the expansion card terminals are shown in the table below:

Terminal sign	Terminal name	Technical specification
485A/485B	The communication port of expansion RS485	485 communication port. Please use twisted pair or shielded wire.
CGND	RS485 ground terminal	485 connect to the ground. If not, it can hang in the air.

The expansion card is equipped with one jumper. The selecting instruction for the corresponding jumper is as follows:

Jumper No.	Jumper position	Function specification	Jumper position	Function specification
J1	1-2	RS485 communication is connected to terminal resistor and use terminals in multi-drive	2~3	RS485 communication is not connected to the terminal resistor and use the intermediate machine in multi-drive

Notes: In the following chapter, RS1 refers to standard RS485 interface and RS2 refers to expansion RS485 interface.

Chapter 3 Quick Setting

Please follow the steps below to finish setting

Step 1: Set the sensor range, the sensor type

F0.08 = 10.0 Sensor's range

F0.09 = 0 Sensor feedback channel selection (0: AI1 channel 1: AI2 channel; 2: Max (AI1, AI2))

F2.00 = 10.0 Sensor operating voltage

F2.01 = 11 Sensor type(AI1、 AI2 default to current feedback)

Step2: Confirm the motor's rotation direction

Run the pump shortly, monitor if the direction is correct. You can change the rotation direction by 2 ways below:

- ① Disconnect the input power and make sure the display is OFF, the exchange two line of any of U\W\W.
- ② Stop the SPD, Modify to F0.02.

Step 3: Adjust the display pressure

There is two ways to adjust the display pressure and actual pressure:

- ① When the pressure is stable, adjust F2.06 within each range of 0.5 bar.
- ② If the SPD pressure is a little higher, make the sensor range lower(F0.08); And vice versa.
- ③ Adjust parameters: F2.02~F2.05, refer to the manual for details.

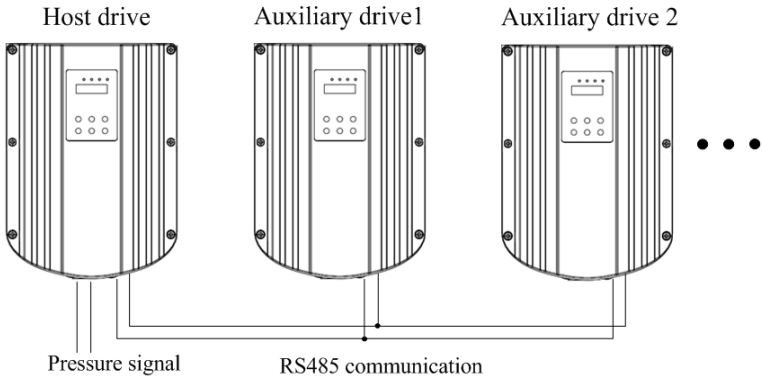
Step4: Macro Settings

Please reference to the table below, to set your system quickly.

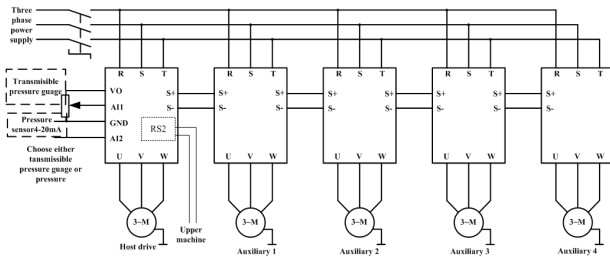
System Type	Parameter	Details of parameters changed automatically	Description
Solo Pump setting	F0.20=1	F0.06=1;F1.02=0; F1.03=0;F2.07=8; F8.00=3	Auto-Reset, Auto- Start enable, As Rs485 Slave
Two SPDs, as Master	F0.20=2	F0.06=1;F1.02=1; F1.03=1;F2.07=8; F8.00=6	Auto-Reset, Auto- Start enable, As Rs485 Slave
Three SPDs, as Master	F0.20=3	F0.06=1;F1.02=1; F1.03 = 2;F2.07=8; F8.00=6	Auto-Reset, Auto- Start enable, As Rs485 Slave
Four SPDs , as Master	F0.20=4	F0.06=1;F1.02=1; F1.03=3;F2.07=8; F8.00=6	Auto-Reset, Auto- Start enable, As Rs485 Slave
Five SPDs , as Master	F0.20=5	F0.06=1;F1.02=1; F1.03=4;F2.07=8; F8.00=6	Auto-Reset, Auto- Start enable, As Rs485 Slave
Six SPDs, as Master	F0.20=6	F0.06=1;F1.02=1; F8.00=6 F1.03=5;F2.07=8;	Auto-Reset, Auto- Start enable, As Rs485 Slave
One SPD, one grid	F0.20=7	F0.06=1;F1.02=0;F1.03=0; F2.07=8;F7.07=2; F8.00=3	Auto- Start, Use RO1 control a Pump
Emergent Mode	F0.20=9	F2.07=5; F0.06=1; F8.00=3	Frequency source changed
SPD network, Slave No.1	F0.20=11	F0.05=2; F0.06=1; F1.00=1; F1.04=1; F2.07=9; F8.00=6	SPD commu address set to 1, You need to pick up the sensor, and it's short for M1 and COM
SPD network, Slave No.2	F0.20=12	F0.05=2; F0.06=1; F1.00=2; F1.04=1; F2.07=9; F8.00=6	Para locked, SPD commu address set to 2 , You need to pick up the sensor, and it's short for M1 and COM
SPD network, Slave No.3	F0.20=13	F0.05=2; F0.06=1; F1.00=3; F1.04=1; F2.07=9; F8.00=6	Para locked, SPD commu address set to 3 , You need to pick up the sensor, and it's short for M1 and COM
SPD network, Slave No.4	F0.20=14	F0.05=2; F0.06=1; F1.00=4; F1.04=1; F2.07=9; F8.00=6	Para locked, SPD commu address set to 4 , You need to pick up the sensor, and it's short for M1 and COM

SPD network, Slave No.5	F0.20=15	F0.05=2; F0.06=1; F1.00=5; F1.04=1; F2.07=9; F8.00=6	Para locked, SPD commu address set to 5, You need to pick up the sensor, and it's short for M1 and COM
Settings	F0.20=0	F0.06=0; F5.12=0;	Para unlocked, Auto-reset & auto-start disable.

Step5: Press Key “P.SP” 2 second, set the pressure you need. Then press RUN.



Outline



Terminal wiring diagram (5 auxiliaries at most)

Chapter 4 Datasheet of Power Data 2.0

Note: “○”: The parameter can be modified in both standby and operating state.

“●”: The parameter can't be modified in operating state.

“◎”:The parameter is the actual detected and recorded value which can't be modified.

When the SPD is power on, it only displayed the parameter which is less than or equal to the Grade 1. Set F0.15=2, confirm by pressing “P.SP/ENT” key to confirm and parameters of other levels can be shown.

4.1 Parameters Displayed at Running Status

Note: Press “SHIFT” key to switch

Display	Name	Description	Unit	Remarks
P	Current pressure	Pressure value of actual operation	bar	◎
H	Running frequency	Current running frequency	Hz	◎
d	Set pressure/temperature	Set pressure/temperature	bar/°C	◎
A	Running current	Actual output current of the SPD	A	◎

4.2 Parameters Displayed at Stopped Status

Note: Press “SHIFT” key to switch

Display	Name	Description	Unit	Remarks
P	Current pressure	Pressure value of actual operation	Bar	◎
d	Set pressure/temperature	Set pressure/temperature	bar/°C	◎
	DC Bus voltage	Pressure value of DC bus	V	◎

4.3 Common Parameter Sets of Single-drive

Function code	Description	Set range	Unit	Default	Display level	Modification level	Remarks
F0.00	Pre-set pressure	0.0~F0.08	bar	3.0	0	○	In multi-drive mode, users only need to set parameters of the host drive.
F0.01	Startup pressure derivation	0.0~F0.00	bar	0.3	0	○	Wakeup from standby mode when the pressure is lower than pre-set pressure
F0.02	Motor rotation direction	0: Forward 1: Reverse	\	0	0	●	Rotation direction can be changed by modifying this parameter
F0.03	Antifreeze	0:Disabled 1:Enabled (in seconds) 2: Enabled (in minutes)	\	0	0	○	Antifreeze and rust-proof function of the pump itself. For details, please refer to F4.09~F4.11. The antifreeze function for each SPD need to be set separately in multi-pump.
F0.04	Water leakage coefficient	0.0~100.0	\	5.0	0	○	The bigger the water leakage, the bigger the coefficient.
F0.05	Start/stop signal option	0~3	\	0	0	●	0:Keyboard start/stop 1:Terminal start/stop 2:Start/stop by communication control 3: Start/stop according to the pressure of water inlet. Notes: This parameter of auxiliary drives must be set to 2 in multi-drive mode
F0.06	Auto-starting option	0~1	\	0	0	○	0:Disabled 1:Enabled (Note: The function is valid when F0.05 = 0)
F0.07	Auto-starting delay time	0.0~100.0	s	5.0	0	○	Delay time while auto-starting at power on

F0.08	Sensor range	0.0~200.0	bar	10.0	0	○	The maximum range of sensor
F0.09	The selection of sensor feedback channel	0:AI1 1:AI2 2: Max (AI1,AI2) 3:Min(AI1,AI2) 4: communication feedback	\	2	0	○	AI1 and AI2 can be connected to the default sensor randomly. (AI1 and AI2 is current feedback mode in factory default state; please set F2.01 when using voltage feedback.)
F0.10	Set value of high pressure alarm	0.00~F0.08	bar	8.0	0	○	When feedback pressure is bigger than this set pressure, it alarms and stops after 0.1s delay. When the pressure returns to normal, after the reset delay time, the fault is solved automatically.
F0.11	Set value of low pressure alarm	0.0~F4.01	bar	0.0	0	○	When the feedback pressure is less than this set pressure, it alarms and stops after alarm delay set by F4.09. This function is invalid when this parameter is set as 0. When the pressure returns to normal, the fault is solved automatically after the reset delay
F0.12	Pressure point to stop at inlet	F0.13~F0.08	bar	3.2	0	○	It is valid when F0.05=3. The SPD starts when pressure feedback of water inlet is less than F0.13. The SPD stops when pressure feedback of water inlet is bigger than or equals to F0.12.
F0.13	Pressure point to start at inlet	0.0~F0.12	bar	3.0	0	○	

F0.14	Displayed parameters at user level	0000~FFFF	\	0000	0	○	This parameter is a 16-bit binary number. Bit 0-bit 15 corresponds to F0-FF 16 group of parameters respectively. When the bit is set as 1, the corresponding group of parameters is hidden; when the bit is set as 0, the corresponding group of parameters is displayed. However, F0, FD and FE group of parameters will always be displayed no matter corresponding bits are set as 0 or 1. For more details, please refer to parameter instruction.
F0.15	Parameter display level setting	0~FD.05	\	1	0	○	3:Parameters of SPD manufacturer 2: Parameters of Pump manufacturer 1:Agent parameters 0:User parameters
F0.16	Product number		\		0	◎	Product predefined by manufacturer
F0.17	Software version	3.00~3.99	\		0	◎	This instruction is only applicable to the software in this version.
F0.18	Acceleration time	0.1~800.0	s	5.0	0	○	Differentiating from the power range
F0.19	Deceleration time	0.1~800.0	s	4.0	0	○	Differentiating from the power range
F0.20	Macro function	0~15	\	0	0	●	Refer to quick settings (Chapter 3)

4.4 Common Parameter Groups of Multi-drive Mode

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F1.00	Local SPD communication address	1~247	\	1	1	○	1-5 is the address of auxiliary drives. The address of host drive can be any other values.
F1.01	The sensor line detects the start function of the backup host	0~1	\	0		○	0:Disabled 1:Enabled
F1.02	The selection of communication network mode	0~2	\	0	1	○	0: RS1,RS2 serve as the common mod-bus slave station 1: RS1 serve as the host SPD for multi-pump, while RS2 serve as slave station 2: RS2 serve as the host SPD for multi-pump, while RS1 serve as slave station
F1.03	Auxiliary number	0~5	Set	0	1	○	0: Cancel the control function of the host drive over the auxiliaries. Note: This parameter only serves as PID frequency source and is only set in RS485 host drive. It needs to set the parameter in advance when the auxiliary is used as backup host drive.

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F1.04	Backup settings of the host drive	Ones: backup host drive Tens: rotation timekeeping mode Hundreds: uniform speed mode of multi-pump Thousands: the delay selection of adding pumps	\	0001	1	○	Ones: (Only support standard RS485 as backup host drive) 0: turn off this function 1: backup host drive enabled, refer to the instruction Tens: timekeeping mode of rotation 0: Rotation with power on time interval 1: Rotation with running time interval(excluding standby) Hundreds :online running mode 0: Overflow mode 1: Dividing the running frequency of each pump equally Thousands: The delay selection of adding pump 0: the delay of adding pump is valid 1: no delay function
F1.05	Alternating time	0~3600	min	120	1	○	The alternating time of host SPD and auxiliary SPD. 0: Cancel the alternating function of host SPD and the auxiliary SPD.
F1.06	Address setting of small pump	0~10	\	6	1	○	It is invalid when this address is bigger than the number of auxiliary drives. 0 means that the host drive is the small pump.
F1.07	Delay time of adding pumps	0.0~100.0	s	5.0	1	○	It means the delay time of adding pumps when the pressure is not enough.

4.5 Debugging Parameter Groups

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F2.00	The setting of sensor voltage	4.0~13.5	V	10.0	0	○	Applicable for setting VO output of the sensor's supply voltage
F2.01	The selection setting of AI1,AI2 current and voltage	Ones:AI1 setting 0:voltage feedback 1:current feedback Tens: AI2 setting 0: voltage feedback 1: current feedback	\	11	0	○	AI1 and AI2 default to current feedback type
F2.02	Lower limit of AI1 input	0.00~F2.03	V/mA	4.00	0	○	Be used for correcting the upper/lower limit of AI1(The parameter will be modified automatically when altering F2.00 or F2.01)
F2.03	Upper limit of AI1 input	F2.02~22.00	V/mA	20.00	0	○	
F2.04	Lower limit of AI2 input	0.0~F2.05	V/mA	4.00	0	○	Be used for correcting the upper/lower limit of AI2(The parameter will be modified automatically when changing F2.00 or F2.01)
F2.05	Upper limit of AI2 input	F2.04~22.00	V/mA	20.00	0	○	
F2.06	Pressure correction value	0.1~F0.08	bar	-	0	○	This is used for SPD to correct the displayed pressure and corresponds to the data in pressure gauge. Please refer to the instruction.
F2.07	Frequency source choice	0: Up/Down is digital set 1:Reserved 2: AI1 3: AI2 5: Emergent water supply 8: PID 9: Setting by communication	\	8	1	●	Choose 8 for the host drive Choose 9 for auxiliary drives Choose 5 for emergent water supply.

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F2.08	Upper limit of running frequency	F2.10~F2.09	Hz	50.00	1	●	The upper limit of SPD's running frequency
F2.09	Maximum output frequency	10.00~600.0	Hz	50.00		●	
F2.10	Lower limit of running frequency	0.00~F2.08	Hz	0.00		●	
F2.11	Options when it reaches the lower limit frequency	0: Running according to the lower limit frequency 1: stop 2: standby	\	2		●	
F2.12	Setting of carrier frequency	1.0~15.0	kHz	Set according to the machine type		○	Noise of the motor can be adjusted by modifying this value
F2.13	Fan running mode	0: Running constantly when power on 1: Automatically running	\	1		○	Fan is controlled by temperature; automatically running
F2.14	Selection of the halt mode	0: Stop by deceleration 1: Stop automatically	\	0		●	The selection for the halt mode of SPD

4.6 PID and Standby Parameter Sets

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F3.00	Proportional gain	0.00~200.0	%	5.00	1	○	The bigger this parameter is, the quicker the response speed of water pressure system will be. However, if the value is too big, the system will oscillate. The value should be adjusted according to different water supply system.
F3.01	Integral time	0.01~90.00	s	0.50	1	○	
F3.02	Derivative time	0.00~10.00	s	0.02	2	○	
F3.03	Sampling period	0.00~10.00	s	0.00	1	○	
F3.04	Deviation limit of PID control	0.0~100.0	%	0.3	1	○	
F3.05	PID source setting choice	0~4	\	0	1	○	0: setting by keyboard 1: setting by AI1 2: setting by AI2 3: setting by LCD 4: setting by communication

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F3.06	PID output characteristic choice	Ones 0: Positive 1:Negative Tens: 0: Displayed pressure “d” 1:Displayed temperature “c” Hundreds: 0:turn on the sampling of standby frequency 1:turn off the sampling of standby frequency	\	000	1	○	Ones: 1. Positive control: When the feedback signal is bigger than the PID setting signal, the output frequency decreases; when the feedback signal is smaller than the PID setting signal, the output frequency increases. 2. Negative control: When the feedback signal is bigger than the PID setting signal, the output frequency increases; when the feedback signal is smaller than the PID setting signal, the output frequency decreases.
F3.07	Broken-line fault detection time of PID feedback	0.0~100.0	s	5.0	1	○	When the running frequency reaches upper limit set by F2.06, after this detection period, if the PID feedback value is still 0, feedback broken-line fault is reported. This function is invalid when this parameter is set as 0. Either machine reaching the maximum running frequency, the host drive will report fault, no matter the host drive reaches the maximum running frequency or not.

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F3.08	PID standby function option	0:Disabled 1:Standby Mode 1 2:Standby Mode 2 3:Standby Mode 3 4:Standby Mode 4	\	4	1	○	Standby mode 1: Judging pressure, frequency, standby treatment of time, the function of standby frequency and time validity. Standby mode 2: By setting F3.17 , it can deal with the standby function automatically. Standby mode 3: It is the treatment of forced standby function after the pressure and frequency meet the condition of standby. Standby mode 4: Self-adaptive standby, it requires 10-20 times standby learning process.
F3.09	PID wakeup detection delay	0.0~120.0	s	3.0	1	○	PID wakeup detection delay
F3.10	PID standby detection delay	0.0~120.0	s	5.0	1	○	If the standby is slow or it can't enter standby in small water demand, decrease this value. If it enters standby in advance or it is started and stopped frequently, increase this value.
F3.11	PID standby deviation pressure	0.0~F0.01	bar	0.1	1	○	When the feedback pressure is within standby deviation range, it starts standby
F3.12	PID standby hold frequency	0.00~F3.13	Hz	20.00	1	○	PID runs at standby hold frequency. After the standby duration, PID enters standby status.

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F3.13	Standby detection frequency	F3.12~F2.08	Hz	20.00	1	○	The system will judge whether the condition of standby function, meet the frequency
F3.14	The feedback of disconnected detection value	0~1.00	V	0.03	1	○	Sampling minimum value in the system. It is judged by the voltage.
F3.15	Increment set by standby mode 3:	0.0~12.0	%	1.0	1	○	By referring to the range, the fixed increment of pressure is set when using standby mode 3.
F3.16	The frequency for half pump flow (The pumping flow ratio between small pump and large pump)	5.00~100.00	Hz (%)	30.00	1	○	Used in the mode of average dividing frequency. It is the frequency value that the pump reach half pump flow (notes: the parameter is reused in the small pump, serving as the flow percentage for small pumps and large pumps)
F3.17	SPD Sleep Ratio	1~100	\	3	1	○	Set bigger make sleep quicker
F3.19	Proportional gain 2	0.00~200.0	%	5.00	2	○	Use F3.19 and F3.20 when the deviation of setting and feedback is greater than 60%. Use F3.00 and F3.01 when is less than 30%. If the deviation is between 30%-60%, please use linear section.
F3.20	Integral time 2	0.01~90.00	s	1.00	2	○	

4.7 Parameter Sets of Pump Protection

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F4.00	Water shortage protection	0~3	\	2	0	○	0: Disabled 1: Enabled. Judge by frequency, pressure and current 2: Enabled. Judge by outlet pressure 3: Enabled. Judge by inlet pressure(a sensor needs to be installed at inlet)
F4.01	Threshold of water shortage detection	0.0~F0.08	bar	0.5	0	○	When feedback pressure is smaller than this value, water shortage judgement is made
F4.02	Detection frequency of water shortage protection	0~50.00	Hz	48.00	0	○	It is valid only when F4.00 = 1. Comparison frequency to judge whether water shortage occurs. When running frequency is bigger than this frequency, it is judged as water shortage.
F4.03	Detection time of water shortage protection	0.0~200.0	s	60.0	0	○	When it meets the condition of water shortage, water shortage fault will be reported after this time.
F4.04	Current percentage of water shortage protection detection	0~100.0	\	40.0	0	○	It is valid only when F4.00 = 1. The percentage of motor rated current. When running current is less than this current, it is judged as water shortage.
F4.05	Automatic restart delay of water shortage protection	0~9999	min	15	0	○	Set 0: use F4.07 and F4.08 to reset water shortage faults. If it is not the "Set 0"

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F4.06	Automatic reset times of water shortage protection	0~9999	\	3	0	○	When water shortage fault is reported, after the period set by F4.05, the SPD resets and runs automatically. Reset times are limited by F4.05. When it reaches reset times, water shortage fault can't be cleared automatically. Press REST manually to reset the fault. 9999 can reset the fault unlimitedly
F4.07	Input water recover pressure	0~F0.00	bar	1.0	0	○	If the system reported the water shortage fault (E027); When the SPD detection pressure is greater or equal to detection pressure of setting input water, and the time is greater than the detection time of input water, the system will reset to E027. This is applicable to pressurization system .of water inlet This is pressure value of output water
F4.08	Input water recover detect time	0~100.0	s	20.0	0	○	
F4.09	The delay time of abnormal pressure alarm	0.0~120.0	s	3.0	0	○	The delay time of water pressure alarm and failure alarm
F4.10	Antifreeze running frequency	0.0~30.00	Hz	10.00	0	○	The time unit of antifreeze and antirust function can be second or minute, refer to The set of F0.03. When the interval setting is 0, it always runs with
F4.11	Antifreeze running time	0~65500	s/min	60	0	○	

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F4.12	Antifreeze running interval	0~65500	s/min	300	0	○	antifreeze running frequency.
F4.13	The wakeup setting of pressure change rate	0~80.0	%	0	1	○	PID wake up when the pressure is less than the setting pressure and the decreasing change rate is greater than the setting value, No less than the wakeup value.
F4.14	Water shortage setting of pressure increment	0.1~80.0	%	50.0	1	○	Pressure acceleration, namely restart the water shortage counter when the change rate is greater than the setting value. This function can delay the time of reporting the water shortage faults.
F4.15	Detection time of burst pipes	0~1000	s	0	1	○	The running frequency of all drives in system is greater or equal than F4.02, and the pressure is less than the starting pressure. It will report E030 fault after the time of F4.15. Set“0”: The detection of burst pipes is invalid.

4.8 Parameter Sets of Motor

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F5.00	Motor rated power	0.4~18.5	kW	Default value of corresponding motor	0	●	Set according to motor nameplate.
F5.01	Motor rated frequency	0.01~F2.08	Hz	50.00Hz	0	●	Set according to motor nameplate.
F5.02	Motor rated speed	0~36000	rpm	Default value of corresponding motor	0	●	Set according to motor nameplate.
F5.03	Motor rated voltage	0~480	V	Default value of corresponding motor	0	●	Set according to motor nameplate.
F5.04	Motor rated current	0.1~200.0	A	0	0	●	Set according to motor nameplate.
F5.12	Fault/ Warning automatic reset option	0: Disabled 1: Enabled	\	1	0	○	Choose 1 to enable the function of fault automatic reset. If there is fault in running, it resets the fault automatically after ten seconds. (Notes: When water shortage faults and disconnection faults meet the reset conditions, it will start to calculate the time.(10s)

4.9 Parameter Sets of Protections and Faults

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F6.00	Motor overload protection choices	0~2	\	1	1	●	0: Unprotected 1: common motor(with low speed compensation) 2: variable frequency motor(without low speed compensation)
F6.01	Overload protection current of the motor	20.0~120.0	%	100.0	1	○	The percentage relative to motor rated current
F6.02	Automatic current limiting choices	0~1	\	1	1	○	0: Always enabled 1:Disabled at constant speed
F6.03	Input phase loss protection choices	0:Disabled 1:Enabled	\	1	1	○	Motor protection parameter
F6.04	Output phase loss protection choices		\	1	1	○	
F6.05	Over voltage stalling protection		\	0	1	○	
F6.06	Over voltage stalling protection voltage	110~150	%	130	1	○	The percentage relative to motor's standard bus voltage
F6.07	Automatic current-limiting level	50~200	%	140	1	○	
F6.08	Display choices of stopped status	0x0000 ~ 0x3FFF	\	0xFC20	1	○	0 ~ 0xFFFF BIT0:Set frequency BIT1:Bus voltage BIT2:Input terminals state BIT3: Output terminals state BIT4:PID set value BIT5:PID feedback value BIT6:analog AI1 value BIT7:analog AI2value

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F6.09	Frequency decrease rate in current limiting	0.00~50.00	Hz/s	10.00	1	○	
F6.10-F6.11	Reserved	\	\	\	1	○	
F6.12	Under-clocking point of instant power off	70.0~110.0	%	80.0	1	○	The percentage relative to motor's standard bus voltage
F6.13	Frequency reduction of instant power off	0.00~F2.08	Hz	0	1	○	
F6.14	Previous two fault types	\	\	0	0	◎	Please refer to fault code and treatment
F6.15	Last fault type	\	\	0		◎	
F6.16	Current fault type	\		0		◎	
F6.17	Current fault running frequency	\	Hz	0		◎	Fault recording value: including the fault current frequency, fault voltage frequency and pressure.
F6.18	Current fault output current	\	A	0		◎	
F6.19	Bus voltage of current fault	\	V	0		◎	
F6.20	Fault-input terminal state	\	\	0		◎	
F6.21	Fault- pressure fault records	\	bar	0		◎	

4.10 Parameter Sets of Terminals

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F7.00	M1 input terminal function choices	0,1,7,9,37	NO	1	0	●	0:No function 1: Forward running (FWD) 7:Fault reset 9:Water shortage protection is normally open 37:Output delay of terminal input Note: Parameters not listed in this list mustn't be set.
F7.01	M2 input terminal function choices			9		●	
F7.02	VDI terminal function choices			2		●	
F7.03	The min percentage of sensorless	0.0~100.0	%	0.0	1	○	The max and min frequency output for adjusting the sensorless mode
F7.04	The max percentage of sensorless	F7.03~100.0	%	100.0		○	
F7.05	The max input value of sensorless	0.0~150.0	%	125.0		○	
F7.06	MO1 output terminal function choices	0,1,2,3	\	1	1	○	0: no output 1: motor in operation 2: Two driven by one RO1 function 3: Fault output It is forbidden to set unlisted function codes.
F7.07	Relay output function choices		\	3		○	
F7.08	Terminal running protection choices at power on	0:Terminal running command is invalid at power on 1: Terminal running command is valid at power on	\	1			○

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes	
F7.09	Relay output detection time	0.5~100.0	s	5.0		○	The correspondence of A11 linear output and filter time	
F7.13	A11 lower limit setting	0.0~100.0	%	0.0		○		
F7.14	A11 upper limit setting	0.0~100.0	%	100.0		○		
F7.15	A11 input filter time	0.00~10.00	s	0.01		○		
F7.16	A12 lower limit setting	0.0~100.0	%	0.0		2	○	The correspondence of A12 linear output and filter time
F7.17	A12 upper limit setting	0.0~100.0	%	100.0			○	
F7.18	A12 input filter time	0.00~10.00	s	0.01			○	
F7.19	M11 closed function delay	0~6000.0	s	0.1		2	○	The detection time of M1 terminal closed and disconnection function(used as the filter anti-shake for liquid level sensor)
F7.20	M11 disconnection function delay	0~6000.0	s	0.1	○			
F7.21	M12 closed function delay	0~6000.0	s	0.1	○		The detection time of M2 terminal closed and disconnection function(used as the filter anti-shake for liquid level sensor)	
F7.22	M12 disconnection function delay	0~6000.0	s	0.1	○			

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F7.26	Choose Max input terminal is normally open or closed	0x0~0x7	\	0x0	2	●	Setting corresponding bit of each terminal as 0 refers to the input is normally open and 1 normally closed. BIT0: M1 input terminal BIT1: M2 input terminal;

4.11 Communication Parameter Sets

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F8.00	RS1 Baud rate setting of communication	0:1200 1:2400 2:4800 3:9600 4:19200 5:38400 6:57.6k 7:115.2k	\	3	1	○	When the host drive is connected to the auxiliary drives, the baud rate of communication is modified as“6”(57600BPS)
F8.01	RS1 Data bit check setting	0: No check 1: Even check 2: Odd check 3: No check 4: Even check 5: Odd check	\	0		○	(N,8,1) for RTU (E,8,1) for RTU (O,8,1) for RTU (N,8,2) for RTU (E,8,2) for RTU (O,8,2) for RTU
F8.02	RS1 Response delay	2~200	ms	3		○	

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F8.03	RS1 Time out fault time	0.0~100.0	s	0.0	1	○	0.0: The function is disabled. When multi-drive function is used, set this parameter of the auxiliary to a nonzero value after connecting the communication line between the host and the auxiliary drives.
F8.04	RS1 Communication fault handling	0~3	\	10		○	0: Alarm and stop 1: No alarm and keep running 2: No alarm and stop according to stop mode(only in communication control mode) 3: No alarm and stop according to stop mode(in all control modes) In multi-drive mode, the host drive doesn't have this function
F8.05	The selection of RS1 data transfer format	0:non-standard mode 1:standard mode	\	1		○	The returned format setting of reading data
F8.07	RS2 Baud rate setting of communication	0:1200 1:2400 2:4800 3:9600 4:19200 5:38400 6:57.6k 7:115.2k	\	3		○	The Baud rate setting of expansion communication card

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F8.08	RS2 Data bit check setting	0:No check 1:Even check 2:Odd check 3:No check 4:Even check 5:Odd check	\	0	1	○	(N,8,1) for RTU (E,8,1) for RTU (O,8,1) for RTU (N,8,2) for RTU (E,8,2) for RTU (O,8,2) for RTU
F8.09	RS2 Response delay	2~200	ms	5		○	
F8.10	RS2 fault time of communication timeout	0.0~ 100.0	s	0.0		○	0.0: The function is disabled. When multi-drive function is used, set this parameter of the auxiliary to a nonzero value after connecting the communication line between the host and the auxiliary drives.
F8.11	RS2Communication fault handling	0~3	\	0		○	0: Alarm and stop 1: No alarm and keep running 2: No alarm and stop according to stop mode(only in communication control mode) 3: No alarm and stop according to stop mode(in all control modes) In multi-drive mode, the host drive doesn't have this function.
F8.12	The selection of RS2 data transfer format	0:non-standard mode 1:standard mode	\	1		○	The returned format setting of reading data

4.12 Monitoring Parameter Sets

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
F9.00	Temperature of radiator	0~100	℃	0	0	☉	Temperature of SPD
F9.01	Running time of this machine	0~9000	min	0	1	○	Running time of this machine(this is the statistical time)
F9.05~F9.11	Test monitoring parameter	reserved	\	\	2	☉	reserved
F9.12	Running time of this machine	0~9999	min	The time is decided by the host and auxiliary drive	1	☉	RS485 will count the running time of each machine and conduct the rotation.
F9.13	Running time of No. 1 auxiliary	0~9999	min			☉	
F9.14	Running time of No. 2 auxiliary	0~9999	min			☉	
F9.15	Running time of No. 3 auxiliary	0~9999	min			☉	
F9.16	Running time of No. 4 auxiliary	0~9999	min			☉	
F9.17	Running time of No. 5 auxiliary	0~9999	min			☉	

4.13 Agent Parameter Sets

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
FD.00	Password of the agent	0000~9999	\	0000	0	☉	Password to enter group FD
FD.01	Restore factory defaults	0~2	\	0	1	●	0:No operation 1: Restore factory defaults 2:Clear fault records
FD.02	Parameter	0~1	\	0		○	0:unlocked 1:locked

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
	Locked						
FD.03	Reserved						
FD.04	Parameter sets display setting of the agent level	0000~FFFF	\	0000		○	Please refer to description of F0.14.
FD.05	Display level of the agent	0~FE.09	\	1		○	

4.14 Factory Parameter Sets

Function code	Description	Set range	Unit	Default	Display level	Modification level	Notes
FE.00	Password	0000~9999		0000	1	◎	The password to enter group FE
FE.01	Running time setting	0000~65535	h	0000		○	No time limit
FE.02	Action choices when it reaches the running time	0~1		0		○	0:Keep running 1:Breakdown
FE.03	Accumulated running time of this machine	0~65535	h	0		◎	Total running time of this machine
FE.04~FE.07	Reserved			\		○	
FE.08	Display level of factory	0000~FFFF		0000	2	○	Please refer to the description of F0.14
FE.09	Manufacture display level	0~FF.01		2		○	

4.15 Details of Some Parameters

F0.00	Pressure setting	0.0~F0.08	bar	3.0	In multi-drive mode, only the parameter of the host drive needs to be set.
F0.08	Sensor range	0.0~200.0	bar	10.0	The maximum range of corresponding sensor

F0.08 is the range of the sensor. The common range is 1MPa, namely 10.0 bar.

F0.00 is the pressure set by the pump network. If F0.00 = 3.0Bar, the pressure of the pump network is constant 3.0 bar.

Note: In multi-pump system, users only need to set the pressure parameter of the host drive and the auxiliary doesn't need to be set. (Backup host drive need to set the pressure parameter)

F0.01	Start pressure deviation	0.0~F0.00	bar	0.3	The standby is woken up when the pressure is lower than the PID set pressure.
F3.09	PID wakeup detection delay	0.0~120.0	s	3.0	PID wakeup detection delay

When the feedback value is equivalent to set pressure minus PID start pressure (F0.00-F0.01) and holds for the time set by F3.09, PID adjustment will restart. For example, when F0.00=3, F0.01=0.3, F3.09=5.0 and the feedback pressure is less than or equivalent to 2.7 and holds for more than 5 seconds, PID adjustment will restart. Once the value is larger than 2.7, time will be recounted

F0.02	Motor rotation direction	0:Forward 1:Reverse	\	0	Change the rotation direction by modifying this parameter
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In first use, please confirm the rotation direction of the motor. Exchange any two of the output power line U, V, W or modify the parameter F0.02 to change the rotation direction of the motor.

F0.03	Antifreeze and anti rust function	0:Off 1:On, counting as second	\	0	Self-antifreeze and self antirust function of the pump
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		2:On, counting as minute			
F4.10	Antifreeze running frequency	0.0~30.00	Hz	10.00	
F4.11	Antifreeze running time	0~65500	s/min	60	
F4.12	Antifreeze running interval	0~65500	s/min	300	0: Keep running at antifreeze running frequency

F0.03=1/2: Enable anti-freeze function. The running frequency of the pump is adjusted automatically according to the current state after the SPD is started.

Note:

- (1) If anti-freeze function is in need, the parameters F0.03, F4.09, F4.10, and F4.11 of both the host and the auxiliary drives need to be set.
- (2) Pump's self-adjustment of the given frequency is prior to anti-freeze frequency.
- (3) The anti-freeze frequency cannot be set too large. It should be set as the output frequency which can just make the pump run but can't provide the pressure.

F0.04	Leakage coefficient	0.0~100.0		5.0	The bigger the leakage, the bigger this coefficient.
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In no water use condition, the leakage of the pump network prevents the SPD from stopping, as a result, the SPD starts and stops frequently. To solve the leakage problem of the pump network, modify the value of F0.04 according to the leakage degree. The bigger the leakage is, the bigger this coefficient will be.

F0.05	Start/stop signal choices	0:By keyboard 1: By terminals 2:By communication control 3:By inlet pressure		0	Note: In multi-drive mode, the parameter of the auxiliary needs to be set as 2.
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F2.07	Frequency source choices	0: Digital set by up/down keys 1: Panel potentiometer 2: AVI 3: ACI 5: Emergent Mode 8: PID 9: Set by communication		8	Choose 8 for the host drive Choose 9 for auxiliary drives Choose 5 for emergency water supply(sensorless water supply mode)
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Different start/stop modes and frequency source modes can be chosen for every SPD

Note: These parameters can be completed by using micro function

- (1) In multi-pump system, F2.05 of auxiliary drives needs to be modified as
- (2) If communication start/stop is chosen for the host drive, auxiliary drives can't be connected in the system and F1.02 needs to be set as 0.
- (3) In multi-pump system, F2.07 of the host drive can be only set as 8 and F2.07 of auxiliary drives 9.
- (4) When it is in emergent water supply(sensorless water supply mode), F4.02 (protection frequency of water shortage) needs to be set; When water isn't needed in the system, the min value of running frequency is protection frequency of water shortage.

F0.06	Auto-start option	0~1	\	0	0:Disabled 1:Enabled Note: The function is valid when F0.05= 3
F0.07	Self-starting delay	0.0~100.0	s	5.0	The delay time before self-starting at power on

If you hope that the power-on SPD will conduct the self-start function (or fault automatic reset), after the delay set by F0.07 and completing all the parameters setting, you need to set F0.06 as 1 to enable SPD self-starting function. It will self-start every time it is power-on.

Notes: The SPD will not start after user stop

F0.09	The selection of sensor feedback channel	0: AI1 1: AI2 2: Max(AI1,AI2) 3:Min(AI1,AI2) 4: communication feedback	\	2	Default sensor can be connected to AI1 or AI2 randomly
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Two channels are current feedback type; it needs to modify F2.01 when using voltage sensor.

F0.10	High pressure alarm value setting	F0.00~F0.08	bar	8.0	When the feedback pressure is greater than or equal to this value, it alarms and stops after 0.1 second alarm delay.
F0.11	Low pressure alarm value setting	0.0~F4.01	bar	0.0	When the feedback pressure is less than this value, it alarms and stops after alarm delay set by F4.09. This function is invalid when the parameter is set as 0. The fault is removed automatically after the same delay when the pressure returns to normal
F4.09	The delay time of abnormal water voltage alarm	0.0~120.0	s	3.0	The delay time of water voltage faults alarm

The SPD will compare F0.10 and F0.11 automatically according to pump network pressure fed back by the sensor. If the pressure is abnormal, it stops and alarms to protect the pump network system.

F0.12	Stop pressure of the inlet	F0.13~F0.08	bar	3.2	It is valid when F0.05 = 3. The SPD starts when the pressure feedback of the inlet is less than F0.13. The SPD stops when the pressure feedback of the inlet is no less than F0.12. Only AI1 can be used as signal detection for the inlet pressure sensor.
F0.13	Start pressure of the inlet	0.0~F0.12	bar	3.0	

Notes: When using this function, the inlet pressure sensor must be connected to the AI1.

F0.14	Parameter sets display setting at user level	0000~FFFF	\	0000	This parameter is a binary number with 16 bits, corresponding to F0-FF 16 sets of parameters respectively. When a bit is set as 0, corresponding set of parameter is hidden. When a bit is set as 1, corresponding set of parameter is displayed. However, F0, FD, FE groups of parameters will always be displayed no matter corresponding bits are set as 0 or 1. For more details, please refer to parameter description.
FD.04	Parameter sets display setting at agent level	0000~FFFF	\	0000	Please refer to description of F0.14.
FE.08	Parameter sets display setting at pump factory level	0000~FFFF	\	0000	

F0.14, FD.04, FE.08 can set the parameters to be displayed or hidden in the unit of parameter set. The parameter is a binary number with 16 bits. Bit 0 to bit 15 corresponds to F0-FF 16 sets of parameters respectively. When a bit is set as 1, corresponding set of parameter is hidden. When a bit is set as 0, corresponding set of parameter is displayed. The bitwise value of four 16-bit binary numbers of F0.14, FD.04, FE.08 parameters decides the parameter set is displayed or hidden. However, F0, FD, FE groups of parameters will always be displayed no matter corresponding bits are set as 0 or 1.

F0.15	Parameter display level setting	0~FD.05	\	0	3: SPD manufacturer parameters 2: pump manufacturer parameters 1: Agent parameters 0: User parameters
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F0.15 (parameter display level setting) is used to set parameters to be displayed or hidden according to the display level. Please pay attention to the difference between F0.15 and F0.14 (display setting of parameter sets). To display a parameter, you must first set the parameter group by F0.14 and then set the level needed by the parameter by F0.15

F0.18	Acceleration time	0.1~800.0	s	5.0	Each power rate with different model
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F0.19	Deceleration time	0.1~800.0	s	4.0	
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The acceleration & deceleration time setting of pump motor will be automatically set with power rate.

F1.00	Communication address of this machine	1~247	\	1	1-5 is the address of auxiliary drives. The address of the host drive can be set by arbitrary values.
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In multi-pump system, auxiliary drives need to be set as different addresses with range of 1-5. The address of the host drive can be set at random.

F1.02	The selection of communication network	0~2	\	0	0:RS1 and RS2 serve as slave station 1:RS1 serve as RS485 master station, RS2 serve as slave station 2:RS2 serve as RS485 master station, RS1 serve as slave station
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When it is in multi-drive mode (multiple PD20 is controlled by single PD20), F1.02 needs to be set as non-zero value. With micro set-up, RS1 acts as the master station.

F1.03	Number of the auxiliary drives	0~5	set	0	Choose 0 to cancel the control of the host drive over auxiliary drives
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In multi-pump system, you should set F1.03 in the host drive; the number of auxiliaries (this parameter is automatically set by micro function

F1.04	Backup host and other options	Ones: backup host Tens : rotation timekeeping mode Hundreds: uniform velocity mode Thousands: the delay selection of adding pumps		0001	
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Ones: backup host function (this function only support the standard 485, and the slave station needs to be connected to the sensor.) After setting the auxiliary by micro function, it will be automatically set as “1”. In order to ensure the water supply system, the auxiliary will switch to host when the auxiliary fails to receive the data package from the host and the auxiliary is enabled.

Notes:

1. The host fails to send command data to the auxiliary when it is disconnected, overheated, short-circuit and default phase.

2. After the auxiliary becomes into the host, the parameters that is automatically changed will not be saved. It means that the original host is not changed after power-on.

Tens: Rotation timekeeping mode

0: Keep recording the rotation time after the machine starts. The time of standby is included in the rotation time.

1: Calculating the rotation time when the machine is in running. The time of standby is not included in the rotation time.

Hundreds: uniform velocity mode of multi-drive

0: Overflow mode; only one drive adjust the output frequency, while the others keep a full output frequency.

1: Distributed the running frequency of each pump averagely; multi drive runs at the same frequency.

Thousands: the selection of adding pump delay

0: valid

1: invalid

F1.05	Interval of rotation	0~3600	min	120	When the interval of rotation among the host and the auxiliary drives is set as 0, the rotation function will be disabled.
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Note: The minimum unit is 1 minute. This function is disabled when the parameter is set as 0.

F1.07	The delay time of adding pump	0~100	s	5.0	
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In the multi-drive system, start the delay time of next pump when the pressure is insufficient.

F2.02	Lower limit of AI1 input signal	0.00~F2.03	V/mA	4.00	Used to correct the lower limit of AI1 signal
F2.03	Upper limit of AI1 input signal	F2.02~22.00	V/mA	20.00	Used to correct the upper limit of AI1 signal
F2.04	Lower limit of AI2 input signal	0.00~F2.05	V/mA	4.00	Used to correct the lower limit of AI2 signal
F2.05	Upper limit of AI2 input signal	F2.04~22.00	V/mA	20.00	Used to correct the lower limit of AI2 signal

If you find that there is deviation between feedback pressure of the sensor and the feedback pressure displayed by the SPD, adjust the above parameters to correct the sensor.

F2.06	Input value of pressure correction	0.0~F0.08	bar		
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F2.06 is used for correcting the displayed pressure in order to correspond to the data on the pressure gauge. When accessing to the parameters, the data it displayed is the current pressure. For example, 3.0 bar. If the data on the pressure gauge is 3.5 bars, the value would be modified as 3.5. The system would modify the displayed pressure by F2.03 or F2.05 and corresponds to the pressure gauge after confirmed.
Notes: The correction will be valid only when the pressure value exceed 1/4 range. The input correction range for each time is -0.5bar~+0.5bar (current pressure).

F3.00	Proportional gain	0.00~200.0	%	3.00	
F3.01	Integral time	0.01~90.00	s	0.50	

The bigger F3.00 is set, the faster the response speed of the pressure system will be. However, if the parameter is set too large, the system will vibrate. The parameter needs to be adjusted by different water supply system.

F3.08	PID standby option	0:Invalid 1:Mode 1 2:Mode 2 3:Mode 3 4:Mode 4		4	
F3.09	PID wakeup detection delay	0.0~120.0	s	3.0	PID wakeup detection delay

F3.10	PID standby detection delay	0.0~120.0	s	5.0	If the standby is slow or it can't enter standby in small water demand, decrease this value. If it enters standby in advance or it is started/stopped frequently, increase this value.
F3.11	PID standby deviation pressure	0.0~120.0	bar	0.1	When the feedback pressure is in standby deviation range, it starts standby.
F3.12	PID standby hold frequency	0.00~F3.13	Hz	20.00	PID runs at standby hold frequency. After the standby duration, PID enters standby status
F3.13	Standby detection frequency	F3.12~F2.08	Hz	20.00	

When the standby is enabled by F3.08, the SPD will detect whether the feedback pressure is bigger than set pressure. If yes, the SPD will start standby detection. After the PID standby detection delay period set by F3.10, if the feedback pressure is still bigger than set pressure, the SPD will decrease the output frequency to low hold frequency of the standby detection set by F3.12. After low hold frequency of the standby detection waits for the set period, if the feedback pressure is still bigger than set pressure, the SPD will decrease the output frequency to 0Hz and enters standby. In above process, if the feedback pressure is less than set pressure, the SPD will judge that standby detection is invalid and will return to PID adjustment state.

When the SPD enters standby status, if the feedback pressure is lower than wakeup pressure threshold value, wakeup will be successful and the SPD will return to PID adjustment state. Else, the wakeup will be failed. Too high wakeup threshold value will lead the SPD to start and stop frequently. Too low wakeup threshold value will lead to shortage of pressure.

Note: The standby hold frequency of different water supply system is different. If there is no water use and the tap is turned off but the pump is still running, F3.12 standby hold frequency needs to be increased manually.

Mode 2 is automatic standby mode. Modify F3.17 to change the speed to standby.

Mode 3 is Enforce standby mode.

Mode 4 is Self-adaptive standby

F4.00	Water shortage protection	0~3		2	0:Disabled 1: Enabled. Judge by frequency, pressure and current 2: Enabled. Judge by outlet pressure 3: Enabled. Judge by inlet pressure(a sensor needs to be installed at inlet)
F4.01	Threshold of water shortage detection	0.0~F0.08	bar	0.5	When feedback pressure is smaller than this value, water shortage judgement is made.
F4.02	Water shortage protection detection frequency	0~50.00	Hz	48.00	
F4.03	Current percentage of water shortage protection detection	0~200.0	s	15.0	
F4.04	Automatic restart delay of water shortage protection	0~100.0	%	40.0	It is valid only when F4.00 = 1. The percentage of motor rated current
F4.05	Automatic reset times of water shortage protection	0~9999	min	15	When water shortage fault is reported, after the period set by F4.05, the SPD resets and runs automatically. Reset times are limited by F4.06. When it reaches reset times, water shortage fault can't be cleared automatically. Press REST manually to reset the fault
F4.06	Input water recover pressure	0~9999		3	

The following methods can realize water shortage protection:

- (1) Add water level sensor to inlet. Report E015 fault by the terminal's closing and opening function.
- (2) Add water voltage type pressure sensor to inlet and connect it to the AVI terminal of the SPD to judge water shortage. Make F4.00=3.
- (3) Judge by pressure feedback of the outlet sensor. Make F4.00=2(Some risks exist)
- (4) Judge by the pressure of the inlet and the frequency current of the motor. Make F4.00=1. (Some risks exist)

Note: It is recommended to choose method 1 and method 2 to judge water shortage or fault.

When F4.00 is set as 2 and the feedback pressure is less than the set value of F4.01, water shortage fault is reported after abnormal pressure alarm delay set by F4.03.

When F4.00 is set as 1, the conditions to report water shortage are as follows:

- (1) The switch of water shortage protection is turned on (F4.00=1) ;
- (2) The feedback pressure is less than allowed threshold value of water shortage detection (feedback pressure<F4.01);
- (3) The current running frequency is no less than water shortage protection detection frequency (running frequency>=F4.02);
- (4) The current output current is no bigger than the current percentage of water shortage detection. (output current=<F4.04)
- (5) When it meets the condition of (1) - (4) , it will report water shortage faults.

When F4.05 is not "0", the SPD will automatically reset and restart after the water shortage faults is reported and the time set by F4.05. When automatic reset times reach to the value set by F4.06, it won't restart automatically and will access to the judgement of input water. When F4.06 is set as 9999 , the system can reset the water shortage faults unlimitedly. When F4.05 is set as 0, it will use feedback pressure to detect input water and reset the water shortage faults. When F4.05 is bigger than the value of F4.07 and holds for the time set by F4.08, it will reset and

restart.

Notes: Because every SPD is in different working condition, like lift and load size, F4.04 should be set properly according to real situation. This can make an accurate judgement whether it is short of water or not.

Setting method: SPD operation; Turn off the water inlet when the running frequency reaches to the maximum value and record the output current displayed on the SPD. Dividing the current value by F5.04 motor rated current to get a percentage. The set value of F4.04 is 5%-10% higher than the percentage. When F4.04 is too high, it may report the water shortage faults mistakenly in a normal operation. If it is too low, it cannot protect the machine effectively when it is in water shortage.

Other function

1: Emergent water supply (F2.07=5)

Emergent water supply (without sensor) , can be used in the situation that needs high capacity but small demand for the pressure. The SPD will conduct the calculation according to the operation status. Without using water, it will run automatically at low frequency. Instead, it will be at high frequency if the water is in use.

It will judge the water shortage by comparing that whether the running frequency is less than the detection frequency of water shortage, so it needs to set the detection frequency F4.02 correctly; Without using water, the min value of SPD running frequency can be regarded as the set of water shortage frequency (F4.02).The emergent water supply is not influenced by the switch of water shortage. Set F4.02=0, if the water shortage protection of emergent water supply needs to be closed.

Chapter 5 Fault Information and Troubleshooting

5.1 Fault Codes Description

Fault code	Fault type	Possible fault reasons	Solution
E001	Invert cells fault	<ol style="list-style-type: none"> 1. Too fast acceleration 2. IGBT inside broken 3. Malfunction caused by interference 4. Sound grounding or not 	<ol style="list-style-type: none"> 1. Increase acceleration time 2. Seek for support 3. Check whether peripheral equipments have strong interference source 4. Check grounding line
E002	Over current in accelerated running	<ol style="list-style-type: none"> 1. Too fast acceleration 2. Too low grid voltage 3. The power of the SPD is too low 	<ol style="list-style-type: none"> 1. Increase acceleration time 2. Check input power 3. Use bigger power SPD
E003	Over current in decelerated running	<ol style="list-style-type: none"> 1. Too fast deceleration 2. The inertia torque of load is too big. 3. The power of the SPD is too low 	<ol style="list-style-type: none"> 1. Increase deceleration time 2. Add proper dynamic braking modules 3. Increase power of the SPD
E004	Over current in constant speed running	<ol style="list-style-type: none"> 1. Saltation or abnormality happens to load 2. The grid voltage is too low 3. The power of the SPD is too low 	<ol style="list-style-type: none"> 1. Check the load or decrease the saltation of the load 2. Check input power supply 3. Use bigger power SPD
E005	Over voltage in accelerated running	<ol style="list-style-type: none"> 1. The input voltage is abnormal 2. Restart rotating motor after momentary outages 	<ol style="list-style-type: none"> 1. Check input power supply 2. Avoid restarting after it is stopped
E006	Over voltage in decelerated running	<ol style="list-style-type: none"> 1. Too fast deceleration 2. The inertia of load is too big 3. The input voltage is abnormal 	<ol style="list-style-type: none"> 1. Increase acceleration time 2. Increase dynamic braking modules 3. Check input power
E007	Over voltage in constant speed running	<ol style="list-style-type: none"> 1. Abnormal changes happen to input voltage 2. The inertia of load is too big 	<ol style="list-style-type: none"> 1. Install input reactor 2. Add proper dynamic braking modules
E008	Hardware over voltage	<ol style="list-style-type: none"> 1. The input voltage is abnormal. 2. Too fast deceleration 3. The inertia of load is too big. 	<ol style="list-style-type: none"> 1. Check input power supply 2. Increase deceleration time 3. Increase dynamic braking modules
E009	Bus undervoltage	<ol style="list-style-type: none"> 1. The grid voltage is too low. 	<ol style="list-style-type: none"> 1. Check grid input power supply

E010	SPD overload	<ol style="list-style-type: none"> 1. Too fast acceleration 2. Restart rotating motor 3. The grid voltage is too low. 4. Overload 	<ol style="list-style-type: none"> 1. Increase acceleration time 2. Avoid restarting after it is stopped 3. Check grid voltage 4. Use bigger power SPD
E011	Motor overload	<ol style="list-style-type: none"> 1. The grid voltage is too low. 2. Wrong setting to motor rated current 3. Motor stall or big changes to load 4. Motor is too small 	<ol style="list-style-type: none"> 1. Check grid voltage 2. Reset motor rated current 3. Check the load and adjust torque lifting capacity 4. Use proper motor
E012	Input phase loss	Phase loss of input R,S,T	<ol style="list-style-type: none"> 1. Check input power 2. Check wiring installation
E013	Output phase loss	U,V,W phase loss output(or the three phases of load is not symmetrical)	<ol style="list-style-type: none"> 1. Check output wiring 2. Check motor and cable
E014	Module overheating	<ol style="list-style-type: none"> 1. Instant over current of SPD 2. Output three phases have interphase or ground is short circuit 3. Air passage block or fan broken 4. The environmental temperature is too high 5. Control panel wire or plugins loose 6. Power circuit irregularity 8. Control board exception 	<ol style="list-style-type: none"> 1. Refer to over current solutions 2. Re-wiring 3. Dredge air passage or change fan 4. Decrease environmental temperature 5. Check and re-connect 6. Seek for service
E015	External faults	External input terminals faults	<ol style="list-style-type: none"> 1. Check input of external equipment
E016	Communication faults	<ol style="list-style-type: none"> 1. Baud rate is set improperly 2. Communication faults of adopting serial communication 3. Communication is interrupted for a long time 	<ol style="list-style-type: none"> 1. Set proper baud rate 2. Press RUN/STOP key to reset; seek for service 3. Check wiring of communication interface
E018	Fault of current detection circuits	<ol style="list-style-type: none"> 1. Poor contact of control board connector 2. Power circuit irregularity 3. Damage to hall devices 4. Exception of amplifying circuit 	<ol style="list-style-type: none"> 1. Check connector and re-plug 2. Seek for service
E022	EEPROM read write faults	<ol style="list-style-type: none"> 1. Read write of control parameter goes wrong 2. EEPROM broken 	<ol style="list-style-type: none"> 1. Press RUN/STOP key to reset 2. Seek for service

E023	Torque rich	<ol style="list-style-type: none"> 1. Too fast acceleration 2. Restart rotating motor 3. Grid voltage is too low 4. Load is too heavy 	<ol style="list-style-type: none"> 1. Increase acceleration time 2. Avoid restart rotation motor. 3. Check grid voltage 4. Use big power SPD
E024	Feedback broken line fault	<ol style="list-style-type: none"> 1. Sensor broken line or poor contact 2. Broken line detection time is too short 3. The sensor is broken or the system has no feedback signal. 	<ol style="list-style-type: none"> 1. Check the installation and wiring of sensor 2. Increase broken line detection time 3. Change sensor
E025	Running time reaches set time	<ol style="list-style-type: none"> 1. Running time reaches set time 	<ol style="list-style-type: none"> 1. Seek for service
E027	Water shortage alarm	<ol style="list-style-type: none"> 1. Water pressure/level exception 2. Sensor broken line or poor contact. System has no feedback signal 3. Water shortage alarm detection time is too short (F4.03) 4. Water shortage protection frequency is too low(F4.02) 5. Water shortage protection detection current is too low (F4.04) 	<ol style="list-style-type: none"> 1. Check whether the pressure of inlet is abnormal or not 2. Check the installation and wiring of sensor 3. Check relevant parameter settings
E028	High pressure alarm	<ol style="list-style-type: none"> 1. Feedback signal of sensor exception 2. High pressure alarm value adjustment is too low (F0.10) 3. Alarm detection time adjustment is too short (F4.09) 	<ol style="list-style-type: none"> 1. Check the wiring of sensor 2. Check relative parameter settings
E029	Low pressure alarm	<ol style="list-style-type: none"> 1. Low pressure alarm value is set too high (F0.11) 2. Sensor broken line or poor contact. System has no feedback signal 3. Sensor type is inconsistent with actual situation 	<ol style="list-style-type: none"> 1. Modify parameters 2. Check the sensor
E030	Burst pipes alarm	The detection time of burst pipe is too short (F4.15)	Pipe detection (Notes: This fault is only for manual reset)
E050	Multi-drive communication error	Abnormal multi-drive communication	<ol style="list-style-type: none"> 1. Be power on again 2. The host is connected to termination resistor (refer to Chapter 2.8) 3. Seek for services

5.2 Common Faults and Handling

The following faults may happen in use. For brief fault analysis, please refer to the following methods.

5.2.1 No display at power on

- (1) Check whether the input power is consistent with the nominal voltage of the drive with multimeter.
- (2) Check whether the three-phase rectifier bridge is intact. If the rectifier bridge is broken down, please request service.

5.2.2 The power air switch trips off at power on.

- (1) Check whether there is short circuit or ground connection between input power. If yes, please eliminate it.
- (2) Check whether the rectifier bridge has been broken down. If yes, please request service.

5.2.3 The motor doesn't rotate after the SPD runs.

- (1) Check whether there is balanced three-phase output among U, V, W. If yes, check whether the motor is broken or blocked. If no, please confirm whether the motor parameters are set correctly.
- (2) If there is output but the three-phase power is not balanced, please request service.
- (3) If there is no output voltage, please request service.- 61 - 8200B Series

5.2.4 SPD shows normally at power on but the power air switch trips off after running.

- (1) Check whether short circuit occurs between output modules interval. If yes, please request service.

(2) Check if there is short circuit or ground connection between motor leads. If yes, please eliminate it.

(3) If switch tripping off occurs occasionally and the distance between motor and inverter is far, consider to add output AC reactor.

5.2.5 It doesn't stop in no water use.

(1) Check whether the feedback pressure displayed on the SPD board is no less than set pressure. If the feedback pressure is less than set pressure, please check whether the range of the pressure sensor is set correctly, whether the pump rotates reversely, whether there is air and whether the inlet is blocked by sundries.

(2) If the feedback value change back and forth around the set value, stop the SPD manually and check whether the pressure keep declining or not. If yes, it needs to change the check valve.

(3) Under the condition that the system is able to maintain the pressure, decrease F3.00 properly and observe whether it is in a normal standby function.

5.2.6 It can't sleep in small amount of water use or leakage

If it can't sleep or the sleep time is too long, please change F3.08 as standby mode 3 and then increase F3.15 properly.

If it starts and stops frequently, please change F3.08 as standby mode 3 and then increase F0.04 properly.

5.2.7 It can't stop to make protection in water shortage.

(1) Water shortage protection switch F4.00 is not enabled.

(2) The threshold value of water shortage detection F4.01 is set too low.

(3) The current percentage of water shortage detection F4.04 is set too low.

Chapter 6 Communication Protocol

PD 20 series provides two RS485 communication interfaces, and adopts international standard Mod-Bus communication protocol to make master and slave communication. Users can realize centralized control by PC/PLC/touch screen and other upper machine to suit for specific application demand. (Setting SPD control command, running frequency, modifying function code parameters, motoring SPD working status and fault information)

6.1 Command Codes and Communication Data Description

(1)Address of functions

Function	Address definition	Data meaning	R/W character
Communication control command	0x1000H	0x0001:Under running	W
		0x0002:Reserved	
		0x0003:Reserved	
		0x0004:Reserved	
		0x0005:Stop	
		0x0006:Free stop (emergency stop)	
		0x0007:Fault reset	
		0x0008:Reserved	
SPD status	0x1001H	0x0001:Running	R
		0x0002:Faults	
		0x0003:Stop without faults	
		0x0004: Reserved	
		0x0005:SPD LU state	
Address of communication	0x2000	Communication setting value range (-10000~10000) Note: Communication set value is the percentage of	W/R

Function	Address definition	Data meaning	R/W character
set value		relative value (-100.00%~100.00%) .Communication write operation can be made. When it serves as frequency source setting, the relative value is the percentage of maximum frequency (F2.09) . When it serves as PID setting or feedback, the relative value is the percentage of PID.	
	0x2001	PID setting, range (0~1000,1000 corresponding to full range) set F3.05=4	W/R
	0x2002	PID feedback, range (0~1000,corresponding to full range) set F0.09=4	W/R
	0x2003	Reserved	
Running/stop parameter address of single drive and multi-drive host	0x3000	Manufacturer reserved the parameters	R
	0x3001	Running frequency(two decimals)	R
	0x3002	Accumulated running time (unit: time, 0 decimal)	R
	0x3003	Bus voltage (one decimal)	R
	0x3004	Output voltage(zero decimal)	R
	0x3005	Output current(one decimal)	R
	0x3006	Running speed(zero decimal)	R
	0x3007	Faults code (The number of fault code and fault type in function code menu is consistent. Here the returned data is hexadecimal, not fault character.)	R
	0x3008	Terminal input mark state (0 decimal)	R
	0x3009	Terminal output mark state (0 decimal)	R
	0x300A	Analog AI1 value(two decimals)	R
	0x300B	Analog AI2 value(two decimals)	R
	0x300C	Set frequency(two decimal)	R
	0x300D	Output power(one decimal)	R
0x300E	Output torque(zero decimal)	R	
0x300F	SPD temperature(one decimal)	R	

Function	Address definition	Data meaning	R/W character
	0x3010	Feedback pressure(one decimal)	R
	0x3011	Given pressure (one decimal)	R
	0x3012	Water inlet pressure (one decimal)	R
	0x3013	Reserved	R
	0x3014	Reserved	R
	0x3015	Reserved	R
	0x3016	Software version number (two decimals)	R
	0x3017	Product number	R

Auxiliary status address of the host storage							
	No.1 auxiliary	No.2 auxiliary	No.3 auxiliary	No.4 auxiliary	No.5 auxiliary	Description	R/W character
The status address of each auxiliary	0x3101	0x3201	0x3301	0x3401	0x3501	Running frequency	R
	0x3102	0x3202	0x3302	0x3402	0x3502	Running time	R
	0x3103	0x3203	0x3303	0x3403	0x3503	Bus voltage	R
	0x3104	0x3204	0x3304	0x3404	0x3504	Out voltage	R
	0x3105	0x3205	0x3305	0x3405	0x3505	Output current	R
	0x3106	0x3206	0x3306	0x3406	0x3506	Running speed	R
	0x3107	0x3207	0x3307	0x3407	0x3507	Faults code	R (0x63)

Notes: The value of 0x63 can be gained by reading 0x3107、0x3207、0x3307、0x3407、0x3507 in the host and it indicates the auxiliary fail to connect to the master.(This address sheet is only for the host of multi-drive)

Note: The read data and the actual fault from 3007H are listed as below:

Data	Fault
0x00	No faults
0x01	Invert cells fault
0x02	Over current in acceleration running
0x03	Over current in deceleration running
0x04	Over current in constant running
0x05	Over voltage in acceleration running
0x06	Over voltage in deceleration running
0x07	Over voltage in constant running
0x08	Hardware over voltage
0x09	Bus undervoltage
0x0A	SPD overload
0x0B	Motor overload
0x0C	Phase loss of input
0x0D	Phase loss of output
0x0E	Module overheating
0x0F	External fault
0x10	Communication fault
0x11	Reserved
0x12	Current detection current fault
0x16	EEPROM read-write fault
0x17	Overload pre-alarm
0x18	PID feedback broken line fault
0x19	Reach running time
0x1A	Reserved
0x1B	Water shortage alarm
0x1C	High water pressure alarm
0x1D	Low water pressure alarm
0x32	Communication faults

Meaning of fault codes

Mod-bus fault codes		
Code	Name	Meaning
0x01	code error	The code written in the code checking address is different from the code set by FD.00 user
0x02	Illegal functions	Function code received from upper machine is not allowed operation. Perhaps the slave unit processes such requests in wrong state
0x03	Check error	In the frame information sent by the upper machine, when RTU format CRC check bit or ASCII format LRC check bit is different with the check number of lower machine, check error will be reported.
0x04	Illegal data address	Request data address of the upper machine is not allowed address. Especially, the combination of register address and transferred byte is invalid.
0x05	Illegal data value	Data field received includes not allowed value. Note: It does not mean that the data item submitted for saving in the register has an unexpected value.
0x06	Parameter modification invalid	In the writing command sent by the upper machine, the data sent is beyond parameter range or the writing address cannot be written currently.
0x07	System is locked	When the upper machine is reading or writing, if user password is set and password lock is not removed, it will report that the system is locked.
0x08	Slave drive is busy	SPD is busy(EPPROM is under saving)
0x09	Setting error	Not in the mode of communication control command source

The example of reading and writing parameters command

	SPD address	Command	High address of parameters	Low address of parameters	High bit of data content	Low bit of data content	Low bit of CPR check	High bit of CRC check
Reading command (F0.12)	01	03	F0	0C	00	02	37	08
Writing command (F0.12)	01	06	F0	0C	00	21	BA	D1
Writing RAM command (F0.12)	01	06	00	0C	00	20	48	11

Notes: Reading parameters address directly. For example, the read address of F3.15 is 0xF30F; the max is 12

Write parameters and save. The address is same as the reading address. For example, the writing address of F3.17 is 0xF311

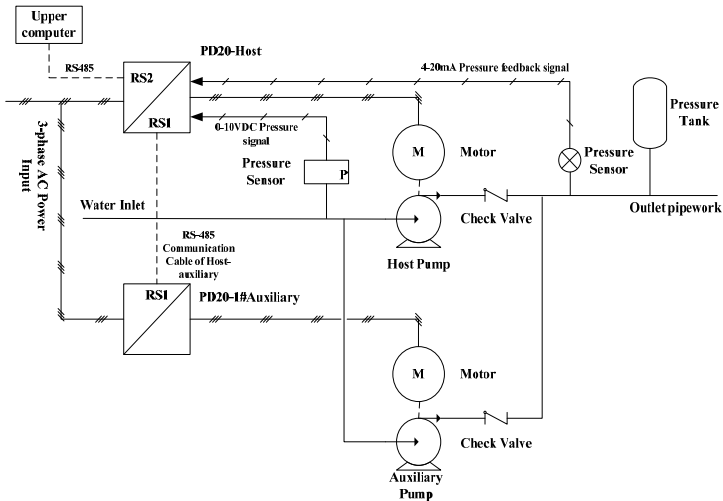
Write parameters without saving. The high bit of address is 0. For example; the writing address of F3.19 is 0x0313.

Chapter 7 Typical Application Cases

7.1 Single Pump Control Case 1

Condition	Requirement	Parameter setting
Pump network pressure	3.0kg	F0.00 = 3.0
Water shortage protection mode	Switching value sensor is installed at inlet.	Input by external terminals. (Please connect to M2 terminal under the default condition)

Please set the parameters F0.08, F0.09, F2.01 according to the pressure sensor type.



7.2 Single Pump Control Case 2

Condition	Requirement	Parameter setting
Pump network pressure	3.5kg	F0.00 = 3.5
Start mode	Keyboard start	F0.05 = 2; F1.02 = 0
Communication address	Address:01	F1.00 = 01
Communication baud rate	9600BPS	F8.00 = 3
Water shortage protection mode	Voltage type sensor is installed at inlet	F4.00 = 3
Threshold value of water shortage protection	Reports faults when it is less than 0.5kg	F4.01 = 0.5

Please set the parameters F0.08, F0.09, F2.01 according to the pressure sensor type.

The upper machine (such as PLC) sends the start command: the data format is hexadecimal.

The example of writing command

	SPD address	Writing command	High address of writing data	Low address of writing data	High bit of data content	Low bit of data content	Low bit of CRC check	High bit of CRC check
Start command	01	06	10	00	00	01	4C	CA
Stop command	01	06	10	00	00	05	4D	09
Faults reset	01	06	10	00	00	07	CC	C8

The example of reading command

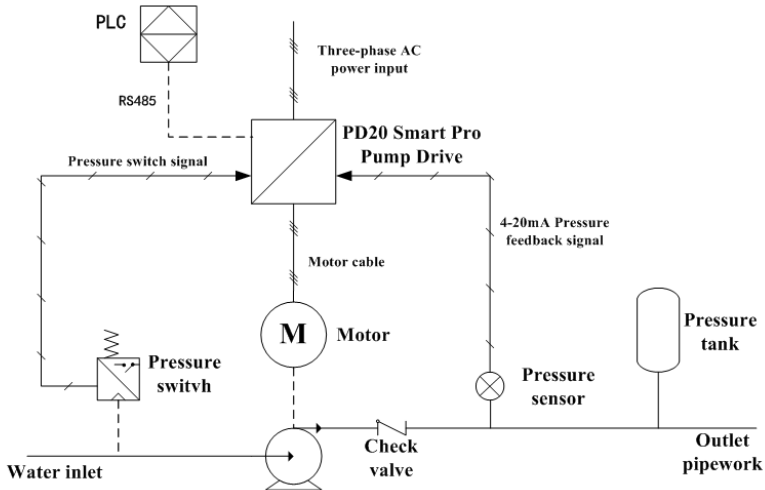
	SPD address	Reading command	High address of reading data	Low address of reading data	High bit of reading data number	Low bit of reading data number	Low bit of CPR check	High bit of CPR check
Reading running frequency	01	03	30	01	00	01	DA	CA

Notes: reading data is 12 at maximum

After the auxiliary drives receive data from the host drive, the following format data is returned. The data returned in this example is 1388H, namely decimal 5000, which means that the current running frequency is 50.00Hz.

Data returned by SPD	SPD address	Reading command	Byte number	Data high bit	Data low bit	Low bit of CRC check	High bit of CRC check
standard	01	03	02	13	88	B5	12

SPD returned	SPD address	Reading command	High bit of byte number	Low bit of byte number	Data high bit	Data low bit	Low bit of CRC check	High bit of CRC check
Non standard	01	03	00	02	13	88	E9	5C

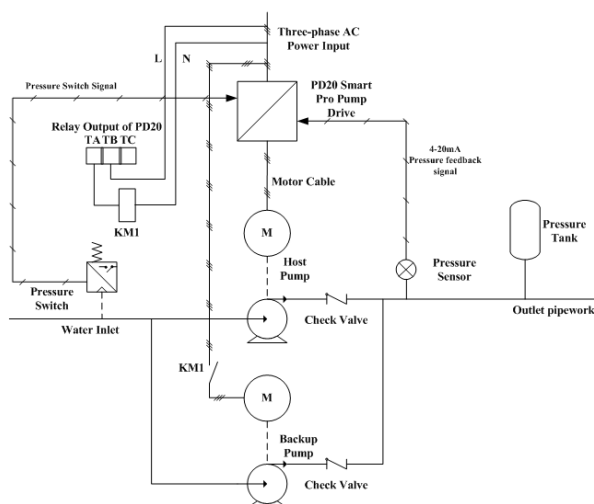


7.3 Two driven by one control case

One driving two means one SPD drives two pumps; one pump which is the host pump works at variable frequency, the other pump which is the auxiliary pump works at power frequency. If the host pump works at full frequency, but the water pressure still cannot meet the demand; the terminal TA will be connected to TB, and then the auxiliary pump will work at power frequency. If the water pressure is adequate, the auxiliary pump will be stopped at first. You can only set F0.20=7, or set F7.07=2 separately to start the one driven two mode.

Condition	Requirement	Parameter setting
Pump network pressure	4.0kg	F0.00 = 4.0
Start mode	Start by keyboard	F0.05 = 0
Water shortage protection mode	Voltage type sensor is installed at inlet	Input by external terminals
Control mode	Two driven by one	F0.20=7 (or F7.07=2; recommended setting F0.20=7)

Please set the parameters F0.08, F0.09, F2.01 according to the pressure sensor type.



7.4 Multi-pump control case

Condition	Requirement	Parameter setting
Pump network pressure	4.0kg	F0.00 = 4.0
Number of auxiliaries	One auxiliary (5 at most)	F1.03 = 1
Pump rotation time	30min	F1.05 = 30
Water shortage protection mode	Voltage type sensor is installed at inlet	F4.00 = 3
Water shortage protection threshold value of inlet	Fault is reported if less than 1.0kg	F4.01 = 1.0
Address setting	Host address>5, Auxiliary address 1-5	
Network setting	Double master-slave network*	Macro setting: host: F0.20=2; auxiliary: F0.20=11

Please set the parameters F0.08, F0.09, F2.01 according to the pressure sensor type.

*: Double master-slave network: One master-slave network is constituted by the RS2 in PD20 and upper machine; the upper machine serves as the master station. The other master-slave network is constituted by the RS1 in the SPDs; the RS1 in the PD20-Host serve as master station. (As shown in the following figure)

