Preface

Thanks for using PH380 series solar pump inverter.

This manual tells you how to use it perfectly. Please read this manual carefully and fully, understanding the safety requirement and cautions before using (installation, wiring, operation, maintain, checking, and etc...).

Inside the manual includes all the required parameter settings and program features specific to the PH380 solar pump inverter.

The main features of PH380 series solar pump inverters:

1- Automatically run and stop function (set P0-02=1)

2- Max. input DC up to 1000VDC(Optional with PH380-5T model)

3- Could drive for 220V single phase pump

4- Stable running and low frequency fluctuation

5- All-round protection and inverter no burn

6- Easy for installation: wiring and operating.

7- GPRS for remote monitoring and control function (Available in both PC and mobile platform)

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Chapter1.Before use

READ AND FOLLOW ALL INSTRUCTIONS!
When installing and using this electrical equipment, basic safety precautions should always be followed, including the following:

 **WARNING** – To reduce the risk of injury, do not permit children to use this product unless they are closely supervised at all times.

 **WARNING** – To reduce the risk of electric shock, replace damaged cord immediately.

 **WARNING** – It must be assured that all grounding connections are properly made and that the resistances do meet local codes or requirements

Safety and Caution

1.1 General Warnings

The manual contains basic instructions which must be observed during installation, operation and maintenance. The manual should be carefully read before installation and start-up by the person in charge of the installation. The manual should also be read by all other technical personnel/ operators and should be available at the installation site at all times.
Personnel Qualification and Training – All personnel for the operation, maintenance, inspection and installation must be fully qualified to perform that type of job. Responsibility, competence and the supervision of such personnel must be strictly regulated by the user.
Should the available personnel be lacking the necessary qualification, they must be trained and instructed accordingly. If necessary, the operator may require the manufacturer/supplier to provide such training.
Furthermore the operator/user must make sure that the personnel fully understand the contents of the manual.
Dangers of Ignoring the Safety Symbols – Ignoring the safety directions and symbols may pose a danger to humans as well as to the environment and the equipment itself. Non-observance may void any warranties.
Non-observance of safety directions and symbols may for example entail the following: Failure of important functions of the equipment/plant; failure of prescribed methods for maintenance and repair; endangerment of persons through electrical, mechanical and chemical effects; danger to the environment because of leakage of hazardous material; danger of damage to equipment and buildings.

Safety-oriented Operation – The safety directions contained in the manual, existing national regulations for the prevention of accidents as well as internal guidelines and safety-regulations for the operator and user must be observed at all times.
General Safety Directions for the Operator/User– If hot or cold equipment parts pose a danger then they must be protected by the operator/user against contact with people. Protective covers for moving parts (e.g. couplings) must not be removed when the equipment is running. Leaks (e.g. at

the shaft seal) of hazardous pumping media (e.g. explosive, toxic, hot liquids) must be disposed of in such a way that any danger to personnel and the environment is removed. All government and local regulations must be observed at all times. Any danger to persons from electrical energy must be excluded by using good installation practices and working to local regulations.

Safety Directions for Maintenance, Inspection and Assembly Work– It is the user's responsibility to make sure that all maintenance, inspection and assembly work is performed exclusively by authorized and qualified experts sufficiently informed through careful perusal of the Operating Instructions. The accident prevention regulations must be observed. All work on the equipment should be done when it is not operational and ideally electrically isolated. The sequence for shutting the equipment down is described in the manual and must be strictly observed. Pumps or pump units handling hazardous liquids must be decontaminated. Immediately upon completion of the work, all safety and protective equipment must be restored and activated.

Before restarting the equipment, all points contained in chapter "Initial Start-up" must be observed.

Unauthorized Changes and Manufacturing of Spare Parts– Any conversion or changes of the equipment may only be undertaken after consulting the manufacturer. Original spare parts and accessories authorized by the manufacturer guarantee operational safety. Using non-authorized parts may void any liability on the part of the manufacturer.

Unauthorized Operation– The operational safety of the equipment delivered is only guaranteed if the equipment is used in accordance with the directions contained in this manual. Limits stated in the data sheets may not be exceeded under any circumstances.

Transportation and Intermediate Storage– Prolonged intermediate storage in an environment of high humidity and fluctuating temperatures must be avoided. Moisture and condensation may damage windings and metal parts. Non-compliance will void any warranty.

1.2 Purchase Inspection

 CAUTION: Properly check the delivery before installation. Never install the drive when you find it damaged or lack a component. Incomplete or defective installation might cause accidents.

 CAUTION: The submersible motor is a water filled AC machine. Always observe the instructions delivered together with the motor according to its water filling. These instructions can be found in the motor manual or on the motor body itself. Ignoring these instructions will shorten the product lifetime and damage the motor permanently.

1.3 Installation

 CAUTION: To ensure effective cooling, the drive must be installed vertically with at least 10 cm space above and below the casing.

 CAUTION: When installed in an indoor location sufficient ventilation must be ensured by a vent or ventilator or similar device. Do not install in a place which is exposed to direct sunlight.

 CAUTION: Do not let the drilling chips fall into the drive fin or fan during installation. This might affect the heat dissipation.

1.4 Connection

 WARNING: The connection of the drive must be carried out by qualified personnel only. Unqualified handling might lead to shock, burn, or death.

 WARNING: Please double-check that input power has been disconnected before connecting the device, otherwise electrocution or fire can be caused.

 WARNING: The earth terminal must be reliably grounded, otherwise touching the drive shell might lead to a shock.

 WARNING: Selection of PV module type, motor load and drive must be adequate, or the equipment might get damaged.

 WARNING: Grounding of this electrical equipment is mandatory. Never run the pump system when the ground wire is not connected to proper ground. Ignoring this instruction can lead to electrocution.

1.5 Operation

 WARNING: The drive should only connected to power after correct wiring, or the drive might get damaged.

 WARNING: Do not modify the connection while the system is connected to power, or touching any part of it might cause electrocution

 CAUTION: Adjust partial control parameters according to the steps indicated by the manual before the first operation. Do not change the control parameters of the drive by random, or it might damage the equipment.

 CAUTION: The heat sink gets hot during operation. Do not touch it until it has cooled down again, or you might get burned.

 CAUTION: At altitudes of more than 1,000 m above sea level, the drive should be derated for use. Output current should be derated by 10% for every 1,500 m increment of altitude.

 CAUTION: Never run the pump when it is not fully submerged in water. When the pump is installed the correct running direction can be determined by measuring the flow rates.

Chapter2.Solar pumping system introduction

2.1. Solar Pumping System overview

Solar pumping systems can be applied to all forms of daily use, water pumping for drinking water supply for remote villages and farms without connection to the water grid, for agricultural use such as livestock watering, agricultural irrigation, forestry irrigation, pond management, desert control, and industrial use such as waste water treatment etc.

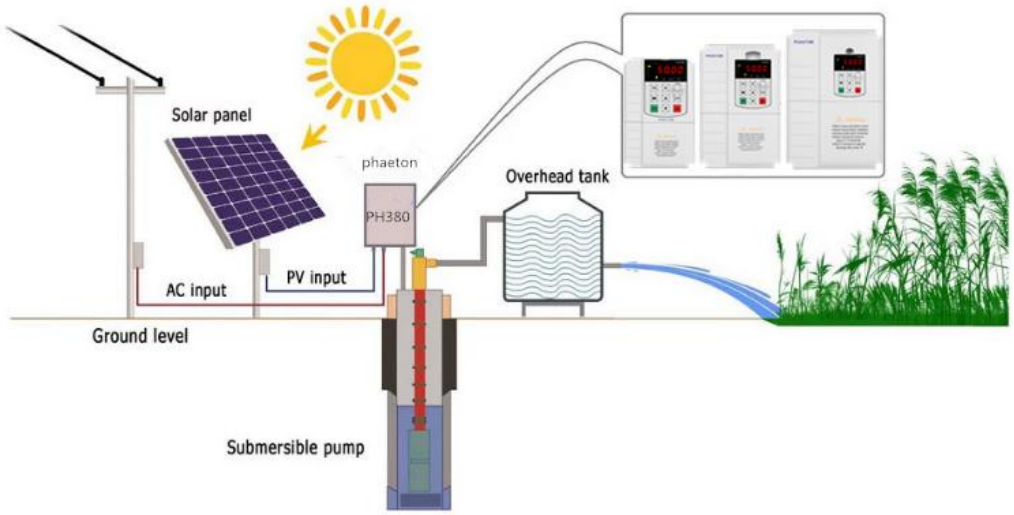
In recent years, with the promotion of the utilization of renewable energy resources, solar pumping systems are more and more used in municipal engineering, city center squares, parks, tourist sites, resorts and hotels, and fountain systems in residential areas.

The system is composed of a PV generator, a pump and a solar pump inverter. Based on the design philosophy that it is more efficient to store water rather than electricity, there is no energy storing device such as storage battery in the system. The system is prepared to be combined with a elevated water storage, e.g. water tower or an uphill tank installation.

The PV generator, an aggregation of PV modules connected in series and in parallel, absorbs solar irradiation and converts it into electrical energy, providing power for the whole system. The pump drive controls and adjusts the system operation and converts the DC produced by the PV module into AC to drive the pump, and adjusts the output frequency in real-time according to the variation of sunlight intensity to realize the maximum power point tracking (MPPT). The pump, driven by 1/3-phase AC motor, can draw water from deep wells, rivers and lakes and pour it into storage tanks or reservoirs, or be connected directly to the irrigation system, fountain system, etc.

According to the actual system demand and installation condition, different types of pumps such as centrifugal pump, axial flow pump, mixed flow pump or deep well pump can be used.

Solar pump system constitution. It includes solar panels arrays, solar pump inverter and AC pumps.



System constitute diagram

2.2. Solar pump system features:

Save energy costs and maximize productivity.

Solar pump inverters ensure reliable power supply throughout the day with on and off-grid compatibility.

Save environment

Harnessing the power of sun provides an environmentally friendly pumping without producing any CO2 emissions

Easy install and operation and little parameters Configuring. end user ,who never used inverter before, can Install and operation it very well.

Reduce maintenance costs

The drives can be equipped with remote monitoring options, reducing maintenance trips to the site.

Reduce operational risk

Embedded pump-specific features such as dry run detection, minimum power input protection, maximum current protection, stop frequency running protection.

Chapter3. Solar pump inverter overview

The PH380 series solar pump inverter is a low voltage AC drive of 0.3 to 110KW above rating designed to operate with energy drawn from solar panel or photovoltaic cells (PV).

The inverter is customized to operate in dual supply mode, so the grid connected supply is used in the absence of energy from PV cells. This drive functions with the latest in technology maximum power point tracking (MPPT) algorithm to derive maximum power from the PV cells at any instant.

The inverter is specifically designed to meet the requirements of pump manufacturers and the original equipment manufacturers (OEM).

3.1. Product Features

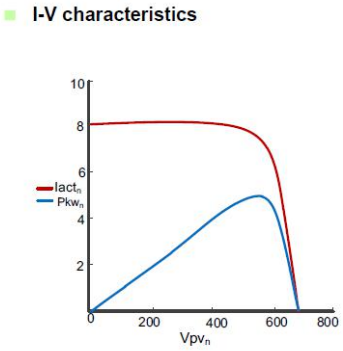
- Maximum power point tracking (MPPT) with fast response speed and stable operation efficiency> 99%
- Suits for most 3 phase AC pumps and AC PMSM high efficiency pumps
- The working voltage of solar panel can set by manual or MPPT automatically tracking
- Compatible with dual power input, AC grid and DC power supply input
- Built in automatic sleep-wake up function,
- Dry run (under load) protection
- Motor maximum current protection
- Low input power protection
- Lowest stop frequency protection
- The PQ (power/flow) performance curve enables calculating the flow output from the pump
- Digital control for fully automatic operation, data storage and protective functions
- Intelligent power module (IPM) for the main circuit
- LED display operating panel and support remote control
- Low water probe sensor, and water level control function
- Strong lightning protection
- Ambient temperature for using: -10 to +50˚C.

3.2. Solar pump inverter operation theory

The solar pump inverter uses the maximum power point tracking (MPPT) control program to improve the efficiency of solar energy systems. The output of the photovoltaic (PV) cell is proportional to its area and intensity, while the output voltage is limited by p-n junction from 0.6 to 0.7 V. Therefore when the output voltage is constant, output power is proportional to intensity and surface area. The current and voltage at which the PV cell generates maximum power is known as the maximum power point.

The MPPT controller follows different strategies to derive the maximum power from the PV array. The internal MPPT algorithm is used to derive maximum power from the PV cell at any instant. This is achieved by modifying the operating voltage or current in the PV cell until the maximum power is obtained.

When the output voltage is zero, the PV cells create short circuit current. If the PV cells are not connected to any load, the output voltage is equal to the open circuit voltage. The maximum power point is obtained at the knee of the I-V curve. See the I-V characteristics shown below.

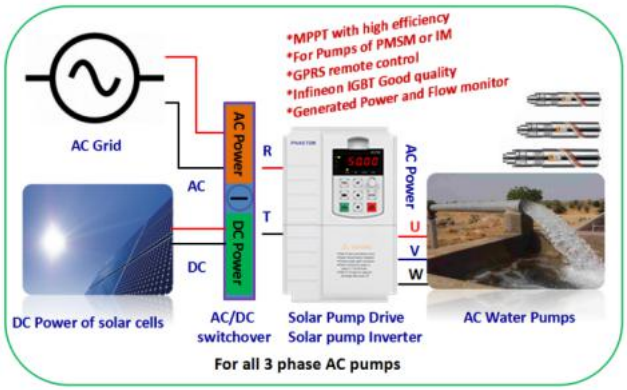


The I-V curve is not constant since intensity and temperature changes during day time. Under constant temperature, current changes linearly with intensity and voltage changes logarithmically with intensity. Since the voltage variation is small with respect to intensity changes, maximum power varies proportionally with intensity

3.3. PH380 series solar pump inverter compatible with dual supply mode

The solar pump inverter operates in dual power supply mode either with AC power grid supply or DC voltage from solar panels arrays.

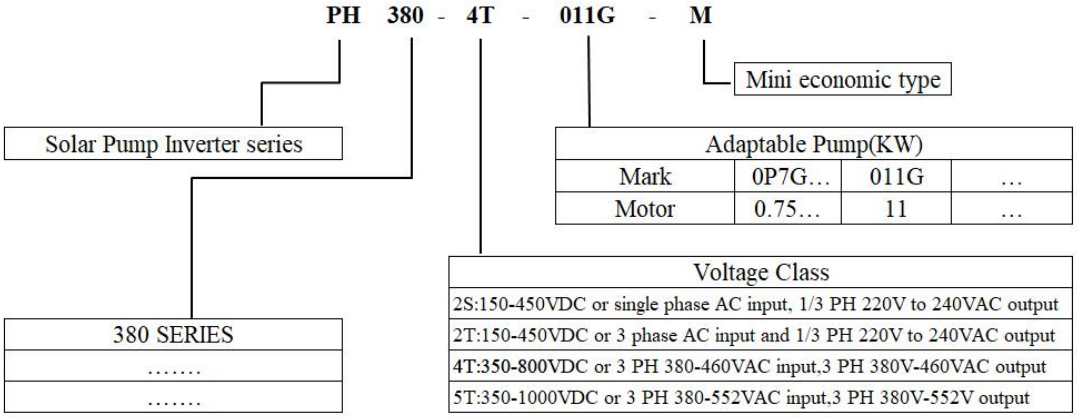
A four-pole changeover switch enables switching between the two supply modes. At a given time only one supply (PV cell or grid) will be connected to the inverter.



Note: Please note that polarity connecting for DC power input to P and N terminals.

3.4. PH380 series solar pump inverter model description

The nameplate of solar pump inverter



PH380 solar pump inverter voltage range

Model	Applicable for pumps	Input DC voltage	Over voltage point	Under voltage point	Suggest Vmp	Suggest Voc
PH380-2S	For 220V AC	150V – 450V	450V	100V	310VDC	380VDC
PH380-4T	For 380V AC	250V– 800V	800V	200V	520VDC	650VDC
PH380-5T	For 380/480V AC	250V– 1000V	1000V	200V	520/680 VDC	650/850 VDC

Power, current and voltage specification (2S /2T 220VAC voltage, and 4T/380VAC voltage)

Rated power/kw	2S 220V range Rated current /A	4T 380V range Rated current /A
0.4	2.3	None
0.7	3.8	2.3
1.5	5.1	3.8
2.2	9	5.1
3.7	13	10
5.5	25	13
7.5	32	17
11	45	25
15	60	32
18.5	75	37
22	91	45
30	110	60
37	152	75
45	176	91

3.5. Models and specification

SN	Model No.	Rate current	Output voltage (3PH AC)	Applicable for pumps	External of drive size(mm)	MPPT voltage (VDC)	Weight (kg)
Economic type 2S series: Input 150-450V DC or 200 to 240V AC, VOC 350V DC							
1	PH380-2S-0P7G-M	4A	0-220VAC	0.75KW	132*85*123.5	260 to 375	1.2
2	PH380-2S-1P5G-M	7A	0-220VAC	1.5KW	132*85*123.5	260 to 375	1.2
3	PH380-2S-2P2G-M	10A	0-220VAC	2.2KW	151*100*127	260 to 375	1.4
Economic type 4T series: Input 350 to 800V DC or 380 to 460V AC, VOC 620V DC							
1	PH380-4T-0P7G-M	2.5A	380V-440V	0.75KW	132*85*123.5	486 to 750	1.2
2	PH380-4T-1P5G-M	3.7A	380V-440V	1.5KW	132*85*123.5	486 to 750	1.2
3	PH380-4T-2P2G-M	5A	380V-440V	2.2KW	132*85*123.5	486 to 750	1.2
4	PH380-4T-004G-M	10A	380V-440V	4KW	151*100*127	486 to 750	1.4
General type 2S series : Input 150 to 450V DC or 200 to 240V AC, VOC 350 VDC							
1	PH380-2S-0P7G	4A	220V/240V	0.75KW	252*195*230	260 to 375	2
2	PH380-2S-1P5G	7A	220V/240V	1.5KW	252*195*230	260 to 375	2
3	PH380-2S-2P2G	10A	220V/240V	2.2KW	252*195*230	260 to 375	2.5
4	PH380-2S-004G	16A	220V/240V	4.0KW	315*235*253	260 to 375	4.3
General type 4T series : Input 350 to 800V DC or 380 to 460V AC, VOC 620V DC							
1	PH380-4T-0P7G	2.5A	380V-440V	0.75KW	252*195*230	486 to 750	2
2	PH380-4T-1P5G	3.7A	380V-440V	1.5KW	252*195*230	486 to 750	3
3	PH380-4T-2P2G	5A	380V-440V	2.2KW	252*195*230	486 to 750	3
4	PH380-4T-004G	10A	380V-440V	4KW	252*195*230	486 to 750	3
5	PH380-4T-5P5G	13A	380V-440V	5.5KW	315*235*253	486 to 750	4.2
6	PH380-4T-7P5G	17A	380V-440V	7.5KW	315*235*253	486 to 750	4.3
7	PH380-4T-011G	22A	380V-440V	11KW	315*235*253	486 to 750	4.5
8	PH380-4T-015G	30A	380V-440V	15KW	395*295*275	486 to 750	7.3
9	PH380-4T-018G	37A	380V-440V	18KW	395*295*275	486 to 750	7.5
10	PH380-4T-022G	45A	380V-440V	22KW	395*295*275	486 to 750	12
11	PH380-4T-030G	60A	380V-440V	30KW	640*410*390	486 to 750	17
12	PH380-4T-037G	75A	380V-440V	37KW	640*410*390	486 to 750	17.5
13	PH380-4T-045G	91A	380V-440V	45KW	700*410*460	486 to 750	35
14	PH380-4T-055G	110A	380V-440V	55KW	700*410*460	486 to 750	36
15	PH380-4T-075G	150A	380V-440V	75KW	680*485*415	486 to 750	45
16	PH380-4T-093G	180A	380V-440V	93KW	680*485*415	486 to 750	51
17	PH380-4T-110G	220A	380V-440V	110KW	680*485*415	486 to 750	54
18	PH380-4T-132G	250A	380V-440V	132KW	885*535*370	486 to 750	55
19	PH380-4T-160G	310A	380V-440V	160KW	885*535*370	486 to 750	86
22	PH380-4T-***G	***	380V-440V	185-400KW	*******	486 to 750	***

3.6.PH380 series solar pump inverter technical specification

**Solar pump inverter specification when PE-00=1&2	
Recommended MPPT voltage range	Vmp 131 to 350 VDC for 1S model (80V to 350VDC input, 3PH 110 to 220VAC output) Vmp 260 to 355VDC for 2S/ 2T model (150V to 350VDC input, 3PH 220 to 240VAC output) Vmp 486 to 650 VDC for 4T model (250V to 800VDC input, 3PH 380 to 460VAC output)
Recommended input Voc and Vmpp voltage	Voc 180(VDC), Vmpp 155(VDC) for 1S model or 110V AC pumps Voc 380(VDC), Vmpp 310(VDC) for 2S model or 220V AC pumps Voc 650(VDC), Vmpp 520(VDC) for 4T model or 380V AC pumps
Motor type	Control for permanent magnet synchronous motor(PMSM) and asynchronous motor pumps.
Rated output voltage	1/3-Phase,110V/160V/220V. 3-phase, 220V/380V/480V
Output frequency range	0~maximum frequency 320Hz.
MPPT efficiency	99.7%,
Ambient temperature range	G-type for submersible pumps,150% rated current for 60s, 180% rated current for 2s. P type for general pumps,120% rated current for 60s,150% rated current for 2s.
Solar pump control special performance	MPPT (maximum power point tracking), CVT (constant voltage tracking), auto/manual operation, dry run protection, low stop frequency protection, minimum power input, motor maximum current protection, flow calculating, energy generated calculating and water tank level detected
Protection function	Phase loss protection, phase short circuit protection, ground to phase circuit protection, input and output short circuit protection. Stall protection, lightning protection
Protection degree	IP20, Air force cooling
Running mode	MPPT or CVT
Altitude	Below 1000m; above 1000m,derate 1% for every additional 100m
Enhanced version of AC drive	CE, Design based on vector control motor AC drive, more specification please refer to PH100 vector control drive operation manual
**Technical specification of variable frequency inverter when PE00=0 (solar pump disable)	
voltage, frequency	1 phase 220V, 3 phase, 220V,380V, 660V, 0-50/60Hz
Control mode	0: VF control ; 1: Open loop vector control mode 2: Close loop vector control mode
Maximum frequency	0-320Hz in vector control mode, 0~3200Hz in VF control mode
Multiple-functions	PID Control, Carrier Frequency Adjustable, Current Limiter, Speed Search, Momentary Power Loss Restart,16 Step Speed (Max), 3-Wire connection, Slip Compensation, Frequency Jump, DC braking, Upper/Lower Frequency, Torque control, Compatible for PMSM and IM, built in RS485, counting, fault information checking, fully fault protection function, frequency combination reference.

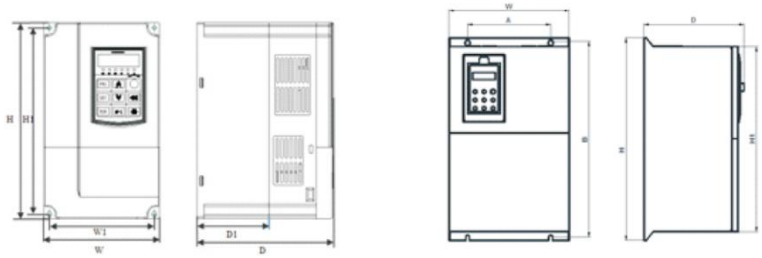
3.7.PH380 series solar pump inverter dimensions

3.7.1 Mini type inverter

Mini type Fig 1

Power/Model	H	H1	W	W1	D	D1	Hole
0.4~1.5KW	130	132	85	74	123.5	74	4.5
2.2kw	151	142	100	88	127	789	5.4

3.7.2 General type inverter



0.75kw-110kw inverter Dimension

Model	Hole location (mm)			Inverter dimension (mm)			Hole D (mm)	N.W
	A	B	H1	H	W	D		(kg)
Single phase 220V input，50/60Hz								
PH380-2S-0P7G	106.5	175	/	185	118	153.8	4.5	2.1
PH380-2S-1P5G								
PH380-2S-2P2G								
PH380-2S-004G	148	235.5	/	247	160	175	5.5	4
3 phase 380V input，50/60Hz								
PH380-4T-0P7G	106.5	175	/	185	118	153.8	4.5	2.1
PH380-4T-1P5G								
PH380-4T-2P2G								
PH380-4T-004G								

PH380-4T-5P5G	148	235.5	/	247	160	175	5.5	4
PH380-4T-7P5G								
PH380-4T-011G								
PH380-4T-015G*	205	305	/	320	220	197.3	6.5	8
PH380-4T-018G*								
PH380-4T-022G*								
PH380-4T-015G	170	400	/	415	230	205	6.5	10
PH380-4T-018G								
PH380-4T-022G								
PH380-4T-030G	200	465	/	480	260	215	8	23
PH380-4T-037G								
PH380-4T-045G	180	550	/	575	320	310	8	30
PH380-4T-055G								
PH380-4T-075G	240	595	/	620	380	310	10	41
PH380-4T-090G								
PH380-4T-110G								

Note: 15kw, 18kw and 22kw have 2 cover, * mean in plastic and without * mean in metal.

Chapter4.Operation control panel description

4.1 Press function key description

Key symbol	Name	Function description
	Menu key	Enter menu
	Confirm key	Enter to menu step by step or confirm the setting value
	UP increase key	Data and function code increase
	Down decrease key	Data and function code reduce
	SHIFT	In the monitor status, press this key can select display monitoring parameter in circulation. Current output frequency/voltage/current,DC bus voltage value ,DC bus current ,input power
	Running key	Use to run motor in keyboard control mode
	Multiple function key	The function of MF.K can be set P7.01 setting. Default setting is no function to program
	Stop and reset	In running status, this key can use to stop motor running (P0-02). Reset malfunction in alarm mode.

4.2. Working status indicating

Symbol	Indicator description
Hz	Unit of frequency（Hz）
A	Unit of current (Amp)
V	Unit of voltage（V）
RUN	Forward run indicator
DIR	Inverter runs in terminal control mode, when P0-02=1 setting
LOCAL	Inverter runs in keyboard control mode, when P0-02=0 setting
TRIP	Fault indicator, inverter will be trip when any alarm happens

4.3. Digital display area

5 digits LED display, it can use to display frequency reference, output frequency and kinds of monitoring data and fault alarm code.

4.4. Function code operation

There are 3 level menu in respectively.

1. Function code parameters（First level menu）
2. Function code name（The second level menu）
3. Setting value of function code (the third level menu ）

Note: If in the third level menu, you can press PRG or ENTER key to return second menu.

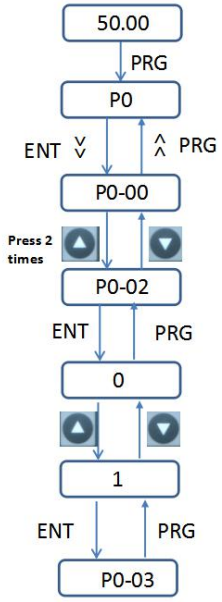
The difference is that press ENTER key will keep setting parameter in CPU board of inverter and then return to second menu, press PRG key to return second menu and without parameters store.

Example of keypad operation

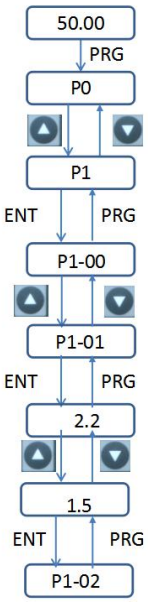
1. Modify command source for terminals control

Modify command source for terminals control, the pump will be start once DI1 and GND switch ON. If DI1 and GND keep turn on status, the inverter will start automatically at morning and turn off automatically at evening.

2, Modify motor rated power in P1-01. If your rated power of inverter is much bigger than rated motor, please set P1-01 per motor nameplate for better motor protection.



Set P0-02=1 guiding



Set P1-02=1.5 kw guiding

4.5. Monitor parameters inquiry.

There have two ways to inquiry monitoring parameters.

Press “  ”to inquiry inverter working status parameters such as output frequency, output current, output voltage, DC voltage and so on.

User also can go to U group parameters (page 70) to inquiry relative parameters.

Example: Press PRG to return monitoring display window and find to U group, user can get running frequency with U0-00, DC bus voltage from U0-02...

4.6. Fault reset

Solar pump inverter will display relative fault information if there are any alarm occurs.

User can reset it by “STOP/RESET” or external terminals (P4-02=9, fault reset by DI3 terminals turn on). Once reset, drive place on standby status.

If inverter place in fault reset and without any reset, it will keep going with protection status and will not working.

Chapter 5. PH380 series solar pump inverter installation

5.1 About this chapter

This chapter includes the basic information about the mechanical and electrical installation of solar pump inverter and also provides steps to quickly operate the inverter.

For general instructions about installation and maintenance of PH100 frequency inverter, please refer to PH100 operation manual.

Safety instructions

WARNING! All electrical installation and maintenance work on the drive must be carried out by qualified electricians only. Follow the safety instructions listed below.

• Never work on the inverter, the braking chopper circuit, the motor cable or the motor when input power is applied to the inverter.

• After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge. Always ensure by measuring that no voltage is actually present.

• A rotating permanent magnet motor generates a dangerous voltage. Always ensure to lock the motor shaft mechanically before connecting a permanent magnet motor to the inverter, and before doing any work on a drive system connected to a permanent magnet motor.

5.2 Mechanical installation

In back mounting, fasten the drive to the wall with screws using four mounting holes.

Note: Installation Environment Requirements

1. Ambient temperature-the surrounding environment temperature take great effect for service life span of solar pump inverter, don't allow surrounding temperature over than allowable temperature above (-10°C to +50°C)

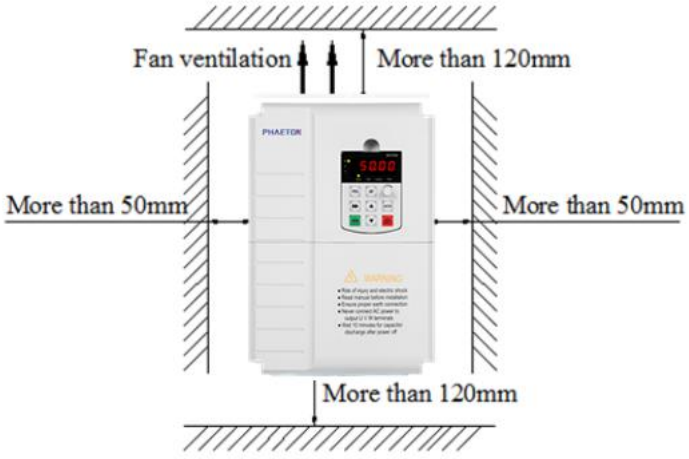
2. Heat dissipation-Install the solar drive on the surface of an incombustible object, and ensure that there is sufficient space around for heat dissipation. Install the solar pump inverter vertically on the support using screws.

3. Vibration-it should be less than 0.6G and far away from the punching machine or the like.

4. Free from direct sunlight, high humidity and condensation

5. Free from corrosive, explosive and combustible gas

6. Free from oil dirt, dust and metal powder



Solar pump inverter installation space requirement.

5.3. Installation and wiring

5.3.1. Diagram of single phase 220V input main circuit loop connection

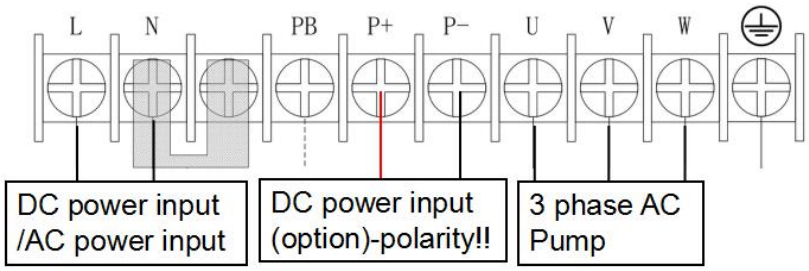


Fig 5.3-1. 1 phase AC power input 220V main circuit loop connection

5.3.2. Diagram 3 phase 380V main circuit loop connection for below 30kw inverter

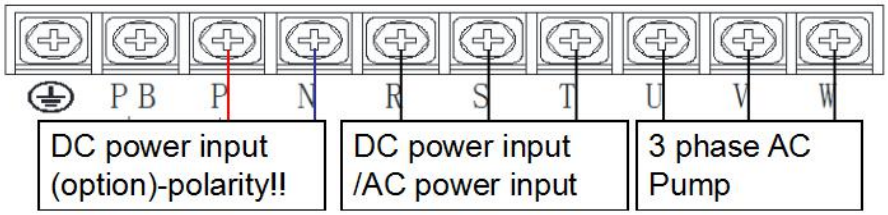


Fig 5.3-2. 3 phase AC power input for below 30 kw inverter

5.3.3. Diagram 3 phase 380V main circuit loop connection for above 30kw inverter.

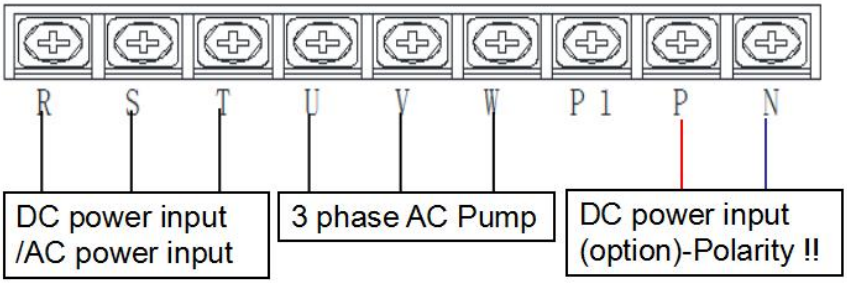


Fig 5.3-3. 3 phase AC power input for above 30 kw inverter

Note: R and T (L and N) terminals of inverter are used to connect DC power from solar panels. It is no request to distinguish polarity of DC power when connect R and T terminals.

But please take great attention to polarity distinguishing when connecting DC power to P and N terminals. P+ must to connect to positive of power , N-must to connect negative of power. Otherwise inverter will be damaged.

• Do not use an asymmetrically constructed motor cable.

• Route the motor cable, input power cable and control cables separately.

• Make sure that the maximum cable lengths are not exceeded. For detailed information, see the user's manual.

• Noted the polarity connection when connecting from P+ and N

5.4. Main circuit terminals description

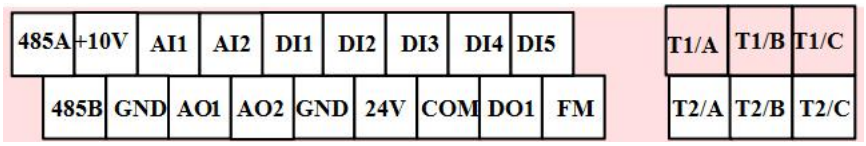
Terminals symbol	Function description
L, N	Single phase AC or DC power input terminals.
R,S,T	3 phase AC input terminals, R, T for DC power input terminals
U, V, W	Power output terminals for 3 phase AC pumps connection.
P, N	DC bus terminals, also can use to connect DC power if need, but please polarity distinguish.
P, PB	Braking resistor connection terminals
P1, P	DC chock connecting terminals.
⏚	Grounding terminals

5.5. Connection procedure

1. Strip the input power cable. Ground the bare shield of the cable (if any) 360 degrees under the grounding clamp. Fasten the grounding conductor (E) of the input power cable under the screw of the grounding clamp. Connect power cable to the R,T terminals from PV solar panel.
2. Strip the motor cable. Ground the bare shield of the cable 360 degrees under the grounding clamp. Twist the shield to form as short a pigtail as possible and fasten it under the screw of the grounding clamp. Connect the phase conductors to the U, V and W terminals.
4. Secure the cables outside the drive mechanically.

5.6 .Control circuit terminals

5.6.1 Control circuit terminals diagram



5.6.2. Control circuit terminals functions description

Type	symbol	Name of terminals	Specification and explanation
Communication	485A	485+	RS485 communication port，compatible with Modbus
	485B	485-	
Digital input and output	DI1～DI4	Digital input	Sink or source input option set by jumper, input resistance is 2.5K,Optocoupler isolation input, jumper J9
	DI5	Digital input or high speed pulse trains input terminals	General digital input terminal characteristics Pulse trains input maximum frequency: 100KHz
	DO1	Digital output 1	Open collector output Maximum drive capability is 50mA

	FM	Digital output 2	Open collector output, maximum drive capability is 50mA, Can be selected as a pulse train output, up to 100KHz
Analog input and output	AI1	Analog input 1	Input voltage range: 0V ~ 10V Input resistance: 22K
	AI2	Analog input 2	Input voltage range: 0 ~ 10V or 4 ~ 20mA Input resistance: 22K, jumper J8
	AO1	Analog output 1	Output range: 0 ~ 10V or 0 ~ 20mA,select by jumper J5
	AO2	Analog output 2	Output range: 0 ~ 10V or 0 ~ 20mA,select by jumperJ5
power supply Reference ground	10V	Analog power supply	Output current: 20mA; Accuracy: 2%
	GND	Analog Ground	Analog reference ground
	24V	User power supply	Accuracy：±15%
	COM	Digital ground	Digital reference ground
Status relay output	T1/A，T1/B，T1/C	Relay 1	TA/TB normal close、TA/TC normal open； Driving capability: 25VAc，3A，COSØ=0.4； 30Vdc，1A
	T2/A，T2/B，T2/C	Relay 2	TA/TB normal close、TA/TC normal open； Driving capability: 25VAc，3A，COSØ=0.4； 30Vdc，1A

Note: There is a short connection between DI1 and COM before factory leaving.

If main circuit breaker is switch on, and inverter is keep power up status, it will be start and stop automatically. This inverter will be started and operated according to steps below:

The power switch of this inverter is on, DC circuit breaker is connected and the switch over to DC power supply of solar panels side.

2)The solar panels arrays generate power once sunrise, and power supply to inverter.

3) The inverter will detect Voc of solar panels and try to start pump, if the voltage is lower than sleep voltage, the inverter will go to sleep again. And inverter will be wake up after some time once the voltage increased to awake up voltage.

In a time,the pump will run in low speed, if the speed goes to reach lowest speed, inverter will stop to run and waiting to run.

Chapter6. Operation and monitoring

Wiring as below attached pictures. It is accepted dual power AC/DC mode connecting input. User can able to install a power switchover to selection which mode power input as conditions.

(1) Wiring P+ and P- of DC solar power to R, T terminals, or 1/3 phase cables of AC power supply to R, T (R, S, T) of inverter.(1 phase 220VAC AC input connect to L, N of inverter).

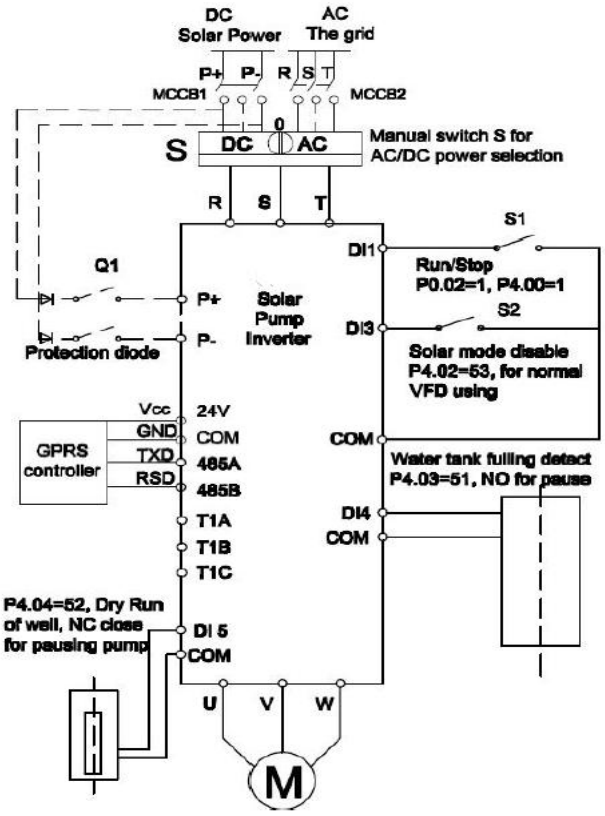
(2) Built a Run/Stop switch S1 to start pumping when setting P0-02=1,that inverter works in terminals control mode.This inverter can achieve auto start at morning when sun light radiation is good, auto stop when sun set when sunlight radiation is low.

(3) Built a switch S2 to disable solar pump control mode when connecting AC grid input.

(4) The inverter can be used fora variable speed drive (VFD) for pumps speed adjusting as need The output frequency can be adjusted by P0-03 frequency reference mode setting. The MPPT function is closed when turn off switch 2 and set P4-02=53. The solar pump control mode function also can be disable by parameters setting PE-00=0.

(5) Connect 2 wires of float ball sensor to DI4 and COM for water tank level fulling detecting, and set P4-03=51(float ball NO relay alarm). When water level reached to sensor detecting, the normal open (NO) relay point will be activated, invereter will stop pumping, and sent a A.FuL alarm.

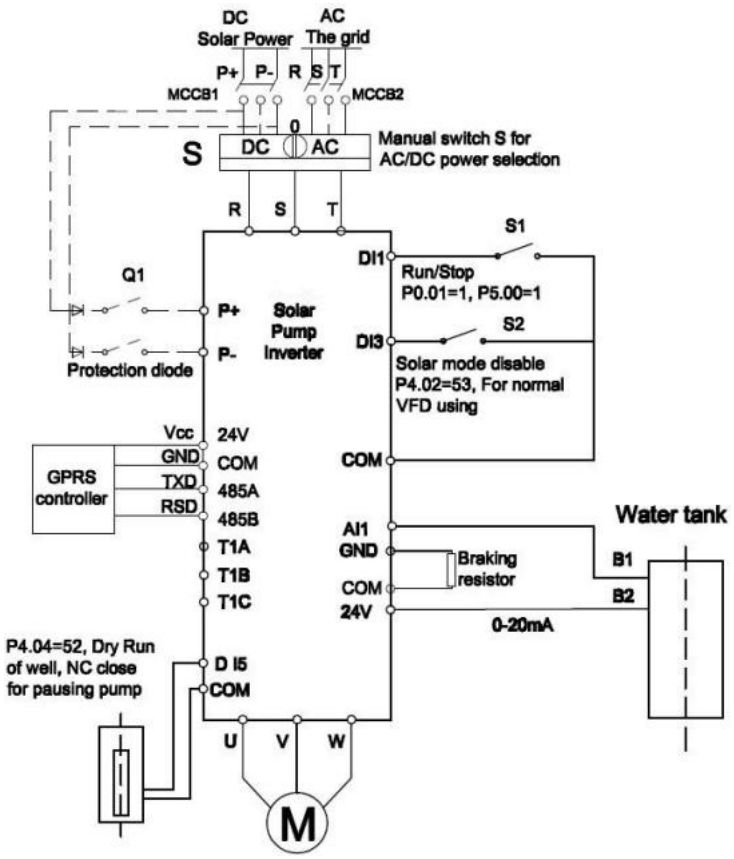
(6) Connect 2 wires of sensor of dry run sensor of well to DI5 and GND, and set P4-04=52 (dry run NC relay alarm).It will sent alarm A.LLd and stop pumping when lack of water in well for dry run protection.



solar pump wiring 1, digital switch for water tank fulling

(7) It is also enable to connect analog (0-10VDC, or 0/4-20mA) water level sensor for water tank leveling detecting:

(8) Connecting 2 wires of 0/4-20mA analog sensor to AI1 and 24VDC terminals of inverter,and short connect COM and GND terminals for constructing a loop circuit.

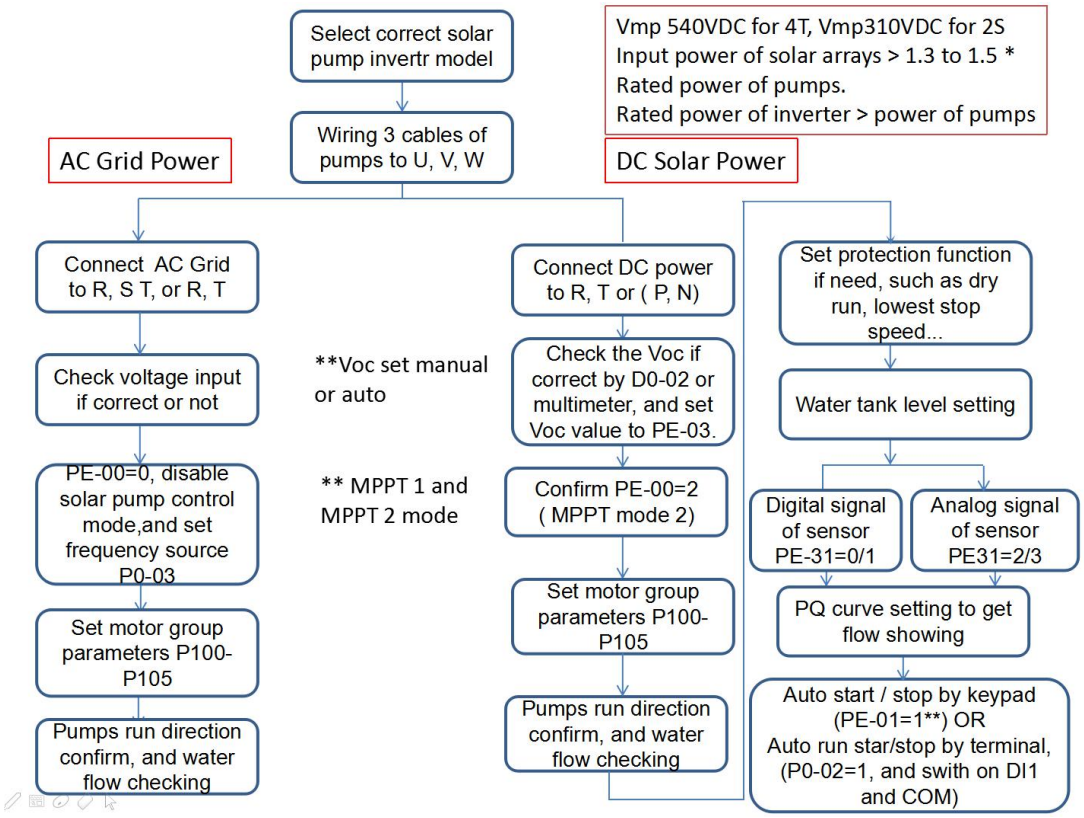


PH380 solar pump wiring 2, digital switch for water tank fulling

Note:

- It is also available to connect DC solar power supply to P+(positive), P- (negative) to inveter, but please make sure to confirmed the polarity connection. Positive of DC power supply to P+ terminal, and negative of DC power supply to P- terminal. It will cause inverter serious damage seriously when wrong polarity connection.
- It is forbidden to connect power supply to output terminals U, V, W of inverter, otherwise it will damage inverter seriously.
- Confirm the running direction of motor if corrector not. If not correct, please change the any two phase order of U, V, W wiring.
- The total power of solar arrays input should be large than 1.3 to 1.5 times of rated of pumps.and the rated power of inverter must be large than rated power of pumps.
- It must to perform motor auto tuning for PMSM high speed and high efficiency pumps. Regarding for driving PMSM, the motor auto tuning is very important. The user can check parameters of P1-20, after auto tuning if has been modification, if these parameters is not correct for pumps, please modify it according to pumps specification.

A. Commission and operation flow chat



PH380 solar pump inverter operation flow chat

Note:

1) User can take this solar pump inverter for variable frequency inverter using. It can use to speed and torque control for AC motor. And all of function of variable frequency inverter is available for FE-00=0.
2) Set Voc value of PV to PE-03 (PE-03=Voc) by U0-02 detect value or measured by multimeter.
3) Set P1-00 to P1-05 motor group parameters for getting better pumps protection
4) Set dry run function with PE-22 to PE-24 parameters for pumps protection if not enough water in well.
5) Set lowest stop frequency function for pumps not allow to run in low speed protection with PE-19 to PE-21.
6) Set pumps over current protection with PE-25 and PE-26.
7) Set Min power input function to avoid solar pump system working in low power input. (PE-28 to PE-30).
8) Compatible with both digital and analog signal of transmitter for water tank full detection. (PE-31 to PE-35).
9) User can get flow, day flow, generating energy and day generating energy information from inverter with PQ curve setting(PE-38 to PE-39), and get monitor form U0-13 to U0-19.

10) Provide GPRS remote control module for remote monitoring, remote control, history data record, parameters remote setting function.

6.7. 10.1) GPRS introduction and connection

User can option to buy a GPRS remote control module to monitor, control and modify inverter parameters by website. It has several function as below mentioned:

(1) Working status monitoring and locating in google map.

(2) Inverter control, start, stop, reset and command control mode.

(3) Parameters read and write.

(4) History data reading and export to excel file.

VCC connect to 24V
GND connect to GND
TXD/A connect to Rs485A
RXD/B connecto to Rs485B

Wiring and commissioning of GPRS

1) Connect Vcc of GPRS to 24V of inverter, GND to GND, TXD/A to Rs485A, TXD/B to Rs485B.

2) Check if power indicator turn now or not after connecting.

3) Install SIM which can able to access to internet to GPRS module.

4) Set APN, APN user and APN password to GPRS as SIM service provider.

5) If NET and DAT will be flash, means communication between inverter ans GPRS is successfully. 5). Login http://120.25.236.230:8010 to with user name and password to website control platform.

6) User can review inverter working status, such as output frequency, output current, Dc voltage, flow... in monitor area, start/stop inverter in control panel area,and parameters read/write in parameters area, to export history working data.

Note: User can modify APN with message as follow command.

1. Read APN message: sent “AT+WXAPN?” to SIM number,

Change APN message: set “ :AT+WXAPN=***T”to SIM number, *** stands for APN value.

Chapter 7.Simple parameter list

Table Symbol Description:

"√" - indicates that the parameter can be changed in the process of stopping and running.

"×" - indicates that the parameter can be changed in stop mode, can not be changed during running;

"●" - Indicates that the initial parameters related to the drives model.

Below list all parameters for AC drives, not only for solar pump control but also for motor speed and torque control. Blue and bold words stands for parameters which may relative to solar pump control function.

"*" Factory setting, it is not allow to set by user.

The parameters related to the PV control function are shown in blue bold.

Function code	Name	Setting range	Factory setting	Modification
P0 Basic function parameters				
P0-00	G/P model display	1: G type（ Heavy duty） 2: P type（pumps, fans load duty）	Per model	●
P0-01	The first motor control mode	0:VF control 1:Sensorless vector control without PG card feedback 2: Sensor vector control with PG card feedback 3: 2 wires output for 1 phase pump 4: 3 wires output for 1 phase pump (if remove starting capacitor and running capacitor, please select 4. If only remove starting capacitor or difficult to remove starting and running capacitors. Please select 3).	0	×
P0-02	Command mode	0: Keypad (LED OFF) 1:Terminal command (LED ON) 2: RS485 communication (LED flash)	0	√
P0-03	Main frequency reference source X	0: Set by P0-08 of keypad, UP/DOWN setting not saved after power down. 1: Set by P0-08 of keypad, UP/DOWN setting memorized power down. 2: Analog AI1 3: Analog AI2 4: Keypad potentiometer 5: PULSE trains frequency reference (DI5) 6: Multiple step command reference 7: Simple PLC	0	×

		8. PID 9: RS485 communication		
P0-04	Auxiliary frequency reference source Y	As same as P0-03 (main frequency reference source X)	0	×
P0-05	The auxiliary frequency source Y range basic reference when superposition	0:Relative to the maximum frequency 1:Relative to frequency source X	0	√
P0-06	The auxiliary frequency source Y range when superposition	0%～150%	100%	√
P0-07	Frequency source selection when superposition	Unit's digit： frequency source selection 0: main frequency source 1:Arithmetic result of main and auxiliary operation (arithmetic relationship operation depends on ten's digit) 2: Switchover between main frequency X source and auxiliary source Y 3: Switchover between main source X and arithmetic operation between of main source X and auxiliary source Y. 4: Switchover between auxiliary source Y and arithmetic operation between of main source X and auxiliary source Y Ten's digit : The arithmetic operation relationship between main and auxiliary. 0: main + auxiliary 1: main – auxiliary 2: Maximum of X and Y 3: Minimum of X and Y	00	√
P0-08	Preset frequency	0.00Hz～Maximum（P0-10）	50.00Hz	√
P0-09	Running direction	0: the same direction 1: the opposite direction	0	√
P0-10	Maximum frequency	50.00Hz～600.00Hz	50.00Hz	×
P0-11	Upper limit frequency source	0：P0-12 1：AI1 2：AI2 3：Potentiometer of keypad 4：PULSE trains 5：Rs485 communication	3	×
P0-12	Upper limit frequency source	Lower limit frequency P0-14～Maximum frequency P0-10	50.00Hz	√

P0-13	Upper limit frequency offset	0.00Hz～Maximum frequency P0-10	0.00Hz	√
P0-14	Lower limit frequency	0.00Hz～Maximum frequency P0-12	0.00Hz	√
P0-15	Carrier frequency	0.5kHz～16.0kHz	Per model	√
P0-16	Carrier frequency auto adjusting with temperature	0: Not 1: Yes	1	√
P0-17	Acceleration time 1	0.00s～650.00s(P0-19=2) 0.0s～6500.0s(P0-19=1) 0s～65000s(P0-19=0)	Per model	√
P0-18	Deceleration time 1	0.00s～650.00s(P0-19=2) 0.0s～6500.0s(P0-19=1) 0s～65000s(P0-19=0)	Per model	√
P0-19	Unit of acceleration /deceleration time	0：1s 1：0.1s 2：0.01s	1	×
P0-20	The balance factory for 1 phase pump driving (3 phase output)	0.00 ～2.00	1.0	×
P0-21	The offset of auxiliary frequency source when perform superposition	0.00Hz～Maximum frequency F0-10	0.00Hz	√
P0-22	Frequency resolution	1：0.1Hz 2：0.01Hz	2	×
P0-23	Memory selection when frequency reference is set by digital	0：Not save 1：save	0	√
P0-24	Motor parameter group	0：Motor parameters group 1 1：Motor parameters group 2	0	×
P0-25	The reference frequency of Acceleration/ deceleration time	0：Maximum frequency (P0-10) 1: setting frequency 2：100Hz	0	×
P0-26	UP/DOWN of reference	0: Running frequency 1: Set frequency	0	×
P0-27	Frequency source and command binding	Unit digit: Frequency source is bound by keypad command 0: No bonding 1: frequency is set by digital 2：AI1 3：AI2	0000	√

		4：potentiometer of keypad 5：PULSE train（DI5） 6：multi-step frequency 7：Simple PLC 8：PID 9：Communication Ten digit: Frequency source is bound by terminals Hundreds digit: Frequency source is bound by communication Thousands of digit: Automatic run Binding frequency source selection		
P0-28	Serial communication protocol selection	0：Modbus protocol	0	√
P1 First motor parameters group				
P1-00	Motor type	0:General asynchronous motor 1:Variable frequency asynchronous motor 2. Permanent magnet synchronous motor	0	×
P1-01	Rated power of motor	0.1KW～1000.0KW	Per model	×
P1-02	Rated voltage of motor	1V～2000V	Per model	×
P1-03	Rated current of motor	Inverter power <= 55KW：0.01A～655.35A Inverter power > 55KW：0.1A～6553.5A	Per model	×
P1-04	Rated frequency of motor	0.01Hz～Maximum frequency	Per model	×
P1-05	Rated speed of motor	1rpm～65535rpm	Per model	×
P1-06	Asyn. Motor Stator resistance	Inverter power <= 55KW：0.001Ω～65.535Ω Inverter power > 55KW: 0.0001Ω～6.5535Ω	Auto tuning	×
P1-07	Asyn. motor rotor resistance	Inverter power <= 55KW：0.001Ω～65.535Ω Inverter power > 55KW : 0.0001Ω～6.5535Ω	Auto tuning	×
P1-08	Asyn. motor leakage inductance	Inverter power <= 55KW：0.01mH～655.35mH Inverter power > 55KW：0.001mH～65.535mH	Auto tuning	×

P1-09	Asyn. motor mutual inductance	Inverter power <= 55KW：0.1mH～6553.5mH Inverter power > 55KW：0.01mH～655.35mH	Auto tuning	×
P1-10	Asyn. motor no-load current	Inverter power <= 55KW: 0.01A～F1-03 Inverter power > 55KW：0.1A～F1-03	Auto tuning	×
P1-16	Synchronous motor stator resistance	Inverter power <= 55KW：0.001Ω～65.535Ω Inverter power > 55KW：0.0001Ω～6.5535Ω	Auto tuning	×
P1-17	Synchronous motor D-axis inductance	Inverter power <= 55KW0.01mH～655.35mH Inverter power > 55KW : 0.001mH～65.535mH	Auto tuning	×
P1-18	Synchronous motor Q axis inductance	Inverter power <= 55KW：0.01mH～655.35mH Inverter power > 55KW : 0.001mH～65.535mH	Auto tuning	×
P1-20	Synchronous motor back electromotive force	0.1V～6553.5V	Auto tuning	×
P1-27	Number of encoder lines	1～65535	1024	×
P1-28	Encoder type	0：ABZ incremental encoder 1：UVW incremental encode 2：Rotary transformer 3：Sine and cosine encoders 4：Provincial line UVW encoder	0	×
P1-30	ABZ incremental encoder phase sequence	0：Forward 1：Reverse	0	×
P1-31	Encoder installation angle	0.0～359.9°	0.0°	×
P1-32	Reserve	0	0	×
P1-33	Reserve	0	0	×
P1-34	Number of pole pairs of rotary transformers	1～65535	1	×
P1-36	Speed feedback PG disconnection Detection time	0.0：on operation 0.1s～10.0s	0.0	×
P1-37	Auto tuning mode selection	0: no operation 1: Asynchronous motor still tunes 2: Asynchronous motor complete tuning 11: Synchronous motor tuning with load 12: Synchronous motor with no-load tuning	0	×

P2 group The first motor vector control parameters				
P2-00	Speed loop proportional gain 1	1～100	30	√
P2-01	Speed loop integral time 1	0.01s～10.00s	0.50s	√
P2-02	Switching frequency 1	0.00～P2-05	5.00Hz	√
P2-03	Speed loop proportional gain 2	1～100	20	√
P2-04	Speed loop integral time 2	0.01s～10.00s	1.00s	√
P2-05	Switching frequency 2	P2-02～Maximum frequency	10.00Hz	√
P2-06	Slip compensation coefficient	50%～200%	100%	√
P2-07	Speed loop filter time constant	0.000s～0.100s	0.000s	√
P2-08	Vector control over excitation gain	0～200	64	√
P2-09	Upper limit of torque source selection in speed control mode	0：set by P2-10 1：AI1 2：AI2 3：Potentiometer of keypad 4：PULSE train 5：communication 6：MIN(AI1,AI2) 7：MAX(AI1,AI2) The full range of 1-7 option is correspond to P2-10	0	√
P2-10	Upper limit of torque digital setting in speed control mode	0.0%～200.0%	150.0%	√
P2-13	Excitation adjustment proportional gain	0～60000	2000	√
P2-14	Excitation adjustment integral gain	0～60000	1300	√
P2-15	Torque adjustment proportional gain	0～60000	2000	√
P2-16	Torque adjustment integral gain	0～60000	1300	√
P2-17	Observer Gain	0.1% - 999.9%	30.0%	√
P2-18	Observer Filter Time	0.1 - 100.0ms	4.0ms	√
P2-19	AM motor pre-Flux time	0 - 9999ms	300ms	√

P2-20	PM sensorless start mode	0:Start directly 1: Detect flux before start 2: Dc-injectbefore start	2	×
P2-21	Dc-inject current	0.0% - 200.0%	30.0%	√
P2-22	MTPA gain	0.0% - 999.9%	80.0%	√
P2-23	MTPA filter time	1ms - 9999ms	100ms	√
P2-24	PM Flux weak current	0.1% - 200.0%	0	√
P2-25	Flux weak forward Gain	0.1% - 999.9%	0	√
P2-26	Flux weak feedback Gain	0 - 9999	1000	√
P2-27	Flux weak integral gain	0 - 9999	1000	√
P2-30	PM stability Gain	0.1% - 100.0%	10.0%	√
P2-31	PM current Gain	0.1 - 20.0	3.0	√
P2-32	PM magnetic depth	0.1% - 500.0%	60.0%	√
P2-33	PM magnetic Gain	0 - 5000	1000	√
P2-34	PM magnetic integral	0 - 5000	1000	√
P2-35	Dc-inject time	0 - 9999	500	√
P2-36	Dc-inject low freq.	0.0 - 100.0%	10.0%	√
P2-37	Dc-inject high freq.	0.0 - 100.0%	20.0%	√
P3 group V/F control parameters				
P3-00	VF curve setting	0: Linear V / F curve 1: Multi-point V / F curve 2: Square V / F curve 3: 1.2 power V / F 4: 1.4 power V / F 6: 1.6 power V/F 8: 1.8 power V/f 10: VF completely separation mode 1 11:VF Semi-separated separation mode 2	0	×
P3-01	Torque booster	0.0%：（Automatic torque boost） 0.1%～30.0%	Per model	√
P3-02	Torque boost cut-off frequency	0.00Hz～Maximum frequency	50.00Hz	×
P3-03	Multipoint VF frequency point 1	0.00Hz～P3-05	0.00Hz	×
P3-04	Multipoint VF voltage point 1	0.0%～100.0%	0.0%	×
P3-05	Multipoint VF frequency point 2	P3-03～P3-07	0.00Hz	×

P3-06	Multipoint VF voltage point 2	0.0%～100.0%	0.0%	×
P3-07	Multipoint VF frequency point 3	P3-05～Motor rated frequency(F1-04)	0.00Hz	×
P3-08	Multipoint VF voltage point 3	0.0%～100.0%	0.0%	×
P3-09	VF Slip compensation gain coefficient	0.0%～200.0%	100.0%	√
P3-10	VF over excitation gain	0～200	100	√
P3-11	VF oscillation suppression gain	0～100	50	√
P3-13	VF separate voltage source	0: Set by digital（F3-14） 1: AI1 2: AI2 3: Potentiometer of keypad 4: PULSE train（DI5） 5:Multiple speed command 6: Simple PLC 7: PID 8: Communication Note: 100.0% corresponds to the motor rated voltage	0	√
P3-14	VF separate voltage digital setting	0V～Rated motor voltage	0V	√
P3-15	acceleration time of VF separate	0.0s～1000.0s Note: Indicates the deceleration time when 0V changes to the motor rated voltage	0.0s	√
P4 group Input terminals				
P4-00	DI1 terminals function selection	0：no operation 1: Forward running or running command 2: Reverse running REV or forward/reverse running direction selection (note: when set for 1 or 2 parameter, please reference to P4-11 function introduction) 3: 3 line control mode 4: Forward Jog（FJOG） 5: Reverse Jog（RJOG） 6: Terminal UP 7: Terminal DOWN 8: Free stop 9: Fault reset（RESET）	1	×
P4-01	DI2 terminals function selection		4	×
P4-02	DI3 terminals function selection		9	×
P4-03	DI4 terminals function selection		12	×
P4-04	DI5 terminals function selection		13	×
P4-05	Reserve		0	×
P4-06	Reserve		0	×

P4-07	Reserve	10: Run pause 11: External fault normal open input 12: Multiple step terminals 1 13: Multiple step terminals 2 14: Multiple step terminals 3 15: Multiple step terminals 4 16: Acceleration/ deceleration selection terminals 1 17: Acceleration/ deceleration selection terminals 2 18: Frequency source switch 19: UP/DOWN setting reset (terminals or keypad) 20: Running command terminals switch 21: Acceleration/deceleration forbidden 22: PID pause 23：PLC status reset 24: Swing frequency pause 25: Counter input 26: Counter reset 27: length counting input 28: length reset 29: Torque control forbidden 30: PULSE train frequency input (only for DI5 valid) 31: Reserve 32: Starting DC braking 33: External fault normal close input 34: Frequency change enable 35: Change PID direction 36: External parking terminal 1 37: Control command switchover terminal2 38: PID integral pause 39: Switchover between frequency source X and preset frequency 40: Switchover between frequency source Y and preset frequency 41: Motor selection terminals 1 42: Motor selection terminals 2 43: PID parameter switchover 44: User define fault 1 45: User define fault 2 46: Speed control /Torque control switchover	0	×
P4-08	Reserve		0	×
P4-09	Reserve		0	×

		47: Emergency stop 48: External parking terminal 2 49: DC braking in deceleration 50: current running time res 51: Water tank full detect 1/ single point detect 52: Water tank full detect 2/ single point detect 53: MPPT tracking stop/ solar pump control disable.		
P4-10	DI filter time	0.000s～1.000s	0.010s	√
P4-11	Terminals command mode	0: Two line control 1 1: Two line control 2 2: 3 line control 1 3: 3 line control 2	0	×
P4-12	Terminals UP/DOWN Change ratio	0.001Hz/s～65.535Hz/s	1.00Hz/s	√
P4-13	AI curve 1 minimum input	0.00V～P4-15	0.00V	√
P4-14	AI curve 1 minimum input corresponding setting	-100.0%～+100.0%	0.0%	√
P4-15	AI curve 1 Max. input	P4-13～+10.00V	10.00V	√
P4-16	AI curve 1 Max input corresponding setting	-100.0%～+100.0%	100.0%	√
P4-17	AI1 filter time	0.00s～10.00s	0.10s	√
P4-18	AI curve 2 minimum input	0.00V～P4-20	0.00V	√
P4-19	AI curve 2 minimum input corresponding setting	-100.0%～+100.0%	0.0%	√
P4-20	AI curve 2 Max. input	P4-18～+10.00V	10.00V	√
P4-21	AI curve 2 Max input corresponding setting	-100.0%～+100.0%	100.0%	√
P4-22	AI2 filter time	0.00s～10.00s	0.10s	√
P4-23	AI curve 3 minimum input	-10.00V～P4-25	-10.00V	√
P4-24	AI curve 3 minimum input corresponding setting	-100.0%～+100.0%	-100.0%	√
P4-25	AI curve 3 Max. input	P4-23～+10.00V	10.00V	√
P4-26	AI curve 3 Max input corresponding setting	-100.0%～+100.0%	100.0%	√
P4-27	AI3 filter time	0.00s～10.00s	0.10s	√
P4-28	PULSE Min. input	0.00kHz～P4-30	0.00kHz	√

P4-29	PULSE Min. input corresponding setting	-100.0%～100.0%	0.0%	√
P4-30	PULSE Maximum input	P4-28～100.00kHz	50.00kHz	√
P4-31	PULSE Max. Input corresponding setting	-100.0%～100.0%	100.0%	√
P4-32	PULSE filter time	0.00s～10.00s	0.10s	√
P4-33	AI Curve selection	Units' digit：AI1 curve selection 1: Curve 1（2 point, see P4-13～P4-16） 2: Curve 2（2 point, see P4-18～P4-21） 3: Curve 3 (2 point, see P4-23～F4-26) 4: Curve 4（4 point, seeA6-00～A6-07） 5: Curve 5（4 point, see A6-08～A6-15） Ten's digit：AI2 curve selection，as above Hundred's digit: Curve set by potentiometer of keypad, as above	321	√
P4-34	When AI input is less than minimum setting selection	Units' digit: AI 1 is less than minimum input Set selection 0: Corresponds to the minimum input setting 1:0.0% Ten's digit: A2 is less than minimum input Set selection, as above Hundred's digit: Potentiometer less than Min. Input selection, as above	000	√
P4-35	DI1 Relay time	0.0s～3600.0s	0.0s	×
P4-36	DI2 Relay time	0.0s～3600.0s	0.0s	×
P4-37	DI3 Relay time	0.0s～3600.0s	0.0s	×
P4-38	DI terminal effective mode choose 1	0: Enable in High level 1: Enable in low level Digits：DI1 Ten's：DI2 Hundred's: DI3 Thousand's:DI4 Ten thousand's: DI5	00000	×
P4-39	DI terminal effective mode choose 2	0: Enable in High level 1: Enable in low level Digits：DI6 Ten's：DI7 Hundred's: DI8 Thousand's: DI9 Ten thousand's: DI10	00000	×

P5 Group Output terminals				
P5-00	FM terminals output mode selection	0: High speed pulse output (FMP) 1: Digital output (FMR)	0	√
P5-01	FMR output function selection	0: No output 1: Frequency inverter running 2: Fault output (Free stop fault) 3: FDT1 Frequency level detect output 4:Frequency reach 5: Zero speed running (no output when stop) 6: Motor overload pre-alarm 7: Inverter overload pre-alarm 8: Preset counting reach 9: Specify counting reach 10: Length reach 11: PLC cycle running finish 12: Cumulative run time arrives 13: Frequency limit 14: Torque limit 15: Ready to run 16: AI1>AI2 17: Upper limit frequency arrives 18: Lower limit frequency arrives (relative to running) 17: Upper limit frequency arrives 18: Lower limit frequency arrives 19: Under voltage status output 20: Communication setting 21: Positioning finish (reserve) 22: Positioning approach (Reserve) 23: Zero speed running 2(output when in stop as well) 24: Accumulated power up time arrives 25: Frequency level detection FDT2 output 26: Output when frequency 1 reaches 27: Output when frequency 2 reaches 28: Output when current 1 reaches 29: Output when current 2 reaches 30: Output when timing up 31: AI1 input over limit 32: Under loading 33: reverse running 34: Zero current state	0	√
P5-02	Relay 1 function selection		2	√
P5-03	Relay 2 function selection		0	√
P5-04	DO1 output function selection		1	√
P5-05	Extension card DO2 Output selection		4	√

		35: Module temperature arrives 36: Output current is exceeded 37: Lower frequency arrival (output when stop as well) 38: Alarm output (all faults) 39: Motor over temperature warning 40: Current running time arrives 41: Fault output (for free stop failure and under voltage is not output)		
P5-06	FMP output function selection	0: Running frequency 1: Setting frequency 2: Output current 3: Output torque (Absolute value of torque) 4: Output power 5: Output voltage 6: Pulse input (100% corresponds to 100.0Hz) 7: AI1 8: AI2 9: Keyboard potentiometer 10: Length 11: Count value 12: Communication settings 13: Motor speed 14: Output current (100.0% corresponds to 1000.0A) 15: Output voltage (100.0% corresponds to 1000.0V) 16: Output torque (torque actual value)	0	√
P5-07	AO1 output function selection		0	√
P5-08	AO2 output function selection		1	√
P5-09	FMP maximum frequency	0.01kHz～100.00kHz	50.00kHz	√
P5-10	AO1 zero bias coefficient	-100.0%～+100.0%	0.0%	√
P5-11	AO1 gain	-10.00～+10.00	1.00	√
P5-12	AO2 zero bias	-100.0%～+100.0%	0.0%	√
P5-13	AO2 gain	-10.00～+10.00	1.00	√
P5-17	FMR output relay time	0.0s～3600.0s	0.0s	√
P5-18	RELAY1 output relay time	0.0s～3600.0s	0.0s	√
P5-19	RELAY2 output relay time	0.0s～3600.0s	0.0s	√
P5-20	DO1 output relay time	0.0s～3600.0s	0.0s	√
P5-21	DO2 output relay time	0.0s～3600.0s	0.0s	√

P5-22	DO output terminal valid state selection	0: Positive logic 1: Negative logic Bits: FMR Ten's bit: RELAY1 Hundreds's bit: RELAY2 Thousands's bits: DO1 Ten thousands's bit;s: DO2	00000	√
P6 Group start and stop control				
P6-00	Starting mode	0: Directly start 1: start after speed tracking 2: Pre-excitation start (AC asynchronous machine)-	0	√
P6-01	Speed tracking mode	00: starts from stop frequency 1: starts at zero speed 2: Starting from the maximum frequency	0	×
P6-02	The speed of speed tracking	1～100	20	√
P6-03	Starting speed	0.00Hz～10.00Hz	0.00Hz	√
P6-04	Starting speed keeping time	0.0s～100.0s	0.0s	×
P6-05	Start DC braking current / pre-excitation current	0%～100%	0%	×
P6-06	Start DC braking time / pre-excitation time	0.0s～100.0s	0.0s	×
P6-07	Acceleration and deceleration mode	0: Linear acceleration / deceleration 1: S curve acceleration / deceleration A 2: S curve acceleration and deceleration B	0	×
P6-08	S curve starting section time ratio	0.0%～(100.0%-P6-09)	30.0%	×
P6-09	S curve finishing section time ratio	0.0%～(100.0%-P6-08)	30.0%	×
P6-10	Stop mode	0: Deceleration stop 1: free parking	0	√
P6-11	start frequency when in stop with DC braking	0.00Hz～Maximum frequency	0.00Hz	√
P6-12	Waiting time of stop with DC braking	0.0s～100.0s	0.0s	√
P6-13	Braking current when Stop with DC braking	0%～100%	0%	√
P6-14	DC braking time when stop	0.0s～100.0s	0.0s	√
P6-15	Brake usage ratio	0%～100%	100%	√

P7 Group keyboard and display				
P7-01	MF.K function button option	0: MF.K is invalid 1: Switchover between Operation panel command channel and remote command channel (terminal command channel or communication command channel) 2: Forward and reverse switching 3: Forward Jog 4: Reverse Jog	0	×
P7-02	STOP/RESET function	0: STOP/RES button enable only in operation panel control mode 1: STOP/RES button enable in any control mode	1	√
P7-03	LED display parameters 1 in running mode	0000～FFFF Bit00: Running frequency 1(Hz) Bit01: Setting frequency (Hz) Bit02: DC bus voltage (V) Bit03: Output voltage (V) Bit04: Output current (A) Bit05: Output power (KW) Bit06: Output torque (%) Bit07: DI input status Bit08: DO output status Bit09: AI1 voltage (V) Bit10: AI2 voltage (V) Bit11: Voltage of potentiometer(V) Bit12: Counting Bit13: Length Bit14: Load speed display Bit15: PID setting	1F	√
P7-04	LED display parameters 2 in running mode	0000～FFFF Bit00: PID feedback Bit01: PLC stage Bit02: PULSE input pulse train frequency（kHz） Bit03: Running frequency 2（Hz） Bit04: Rest running time Bit05: AI1 before correction voltage (V) Bit06: AI2 before correction voltage (V) Bit07: operation panel potentiometer before correction voltage (V) Bit08: Line speed Bit09: Current power-on time (Hour)	0	√

		Bit10: Current running time (Min) Bit11: PULSE train input pulse frequency (Hz) Bit12: Communication setpoint Bit13: Encoder feedback speed (Hz) Bit14: Main frequency X display (Hz) Bit15: Auxiliary Frequency Y Display (Hz)		
P7-05	LED display in stop mode	0000 ~ FFFF Bit00: Set frequency (Hz) Bit01: Bus voltage (V) Bit02: DI input status Bit03: DO output status Bit04: AI1 voltage (V) Bit05: AI2 voltage (V) Bit06: Operation panelpotentiometer voltage (V) Bit07: Count value Bit08: Length value Bit09: PLC stage Bit10: Load speed Bit11: PID setting Bit12: PULSE train input pulse frequency (kHz)）	33	√
P7-06	Load speed display factor	0.0001～6.5000	1.0000	√
P7-07	Heat sink of Inverter IGBT model temperature	0.0℃～100.0℃	-	●
P7-08	Heat sink of Inverter Rectifier temperature	0.0℃～100.0℃	-	●
P7-09	Cumulative run time	0h～65535h	-	●
P7-10	Products serial No.	-	-	●
P7-11	Software version No.	-	-	●
P7-12	The number of decimal places of load speed Displays	0: 0 decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	1	√
P7-13	Accumulated time since power on	0～65535 hour	-	●
P7-14	Cumulative power consumption	0～65535 KWh	-	●

P8 group Auxiliary function				
P8-00	Jog running frequency	0.00Hz～Maximum frequency	2.00Hz	√
P8-01	Jog acceleration	0.0s～6500.0s	20.0s	√
P8-02	Jog deceleration	0.0s～6500.0s	20.0s	√
P8-03	Acceleration time 2	0.0s～6500.0s	Per model	√
P8-04	Deceleration time 2	0.0s～6500.0s	Per model	√
P8-05	Acceleration time 3	0.0s～6500.0s	Per model	√
P8-06	Deceleration time 3	0.0s～6500.0s	Per model	√
P8-07	Acceleration time 4	0.0s～6500.0s	Per model	√
P8-08	Deceleration time 4	0.0s～6500.0s	Per model	√
P8-09	Jumping frequency 1	0.00Hz～Maximum frequency	0.00Hz	√
P8-10	Jumping frequency 2	0.00Hz～Maximum frequency	0.00Hz	√
P8-11	Jump frequency range	0.00Hz～Maximum frequency	0.01Hz	√
P8-12	Dead zone time of forward to reverse	0.0s～3000.0s	0.0s	√
P8-13	Reverse running enable	0: Allow 1: Forbidden	0	√
P8-14	Running mode when setting frequency is less than the lower limit frequency	0: Run at lower limit frequency 1: stop 2: Zero speed running	0	√
P8-15	Drop control	0.00Hz～10.00Hz	0.00Hz	√
P8-16	Set the cumulative power-up arrival time	0h～65000h	0h	√
P8-17	Set the cumulative running arrival time	0h～65000h	0h	√
P8-18	Start protection selection	0: Disable 1: Enable	0	√
P8-19	Frequency detection value (FDT1)	0.00Hz～Maximum frequency	50.00Hz	√
P8-20	Frequency detection hysteresis (FDT1)	0.0%～100.0%（FDT1 voltage level）	5.0%	√
P8-21	Frequency arrival detection amplitude	0.0%～100.0%（Maximum frequency ）	0.0%	√

P8-22	Whether the jump frequency is valid during acceleration / deceleration	0: Invalid 1: Valid	0	√
P8-25	Switchover point between acceleration time 1 to acceleration time 2	0.00Hz～Maximum frequency	0.00Hz	√
P8-26	Switchover point between deceleration time 1 to deceleration time 2	0.00Hz～Maximum frequency	0.00Hz	√
P8-27	Terminal control prior	0 : Invalid 1: Valid	0	√
P8-28	Frequency detection value (FDT2)	0.00Hz～Maximum frequency	50.00Hz	√
P8-29	Frequency detection hysteresis (FDT2)	0.0%～100.0%（FDT2 voltage level）	5.0%	√
P8-30	Any arrival frequency detection value 1	0.00Hz～Maximum frequency	50.00Hz	√
P8-31	Any arrival frequency detection amplitude 1	0.0%～100.0%（Maximum frequency）	0.0%	√
P8-32	Any arrival frequency detection value 2	0.00Hz～Maximum frequency	50.00Hz	√
P8-33	Any arrival frequency detection amplitude 2	0.0%～100.0%（Maximum frequency）	0.0%	√
P8-34	Zero current detection level	0.0%～300.0% 100.0% corresponds to the motor rated current	5.0%	√
P8-35	Zero current detection delay time	0.01s～600.00s	0.10s	√
P8-36	Output current over limit	0.0%（No detect） 0.1%～300.0%（Rated current）	200.0%	√
P8-37	Output current over limit detect relay time	0.00s～600.00s	0.00s	√
P8-38	Any arrival current 1	0.0%～300.0%(Motor rated current)	100.0%	√
P8-39	Any arrival current 1 detect amplitude	0.0%～300.0% (Motor rated current)	0.0%	√
P8-40	Any arrival current 2	0.0%～300.0% (Motor rated current)	100.0%	√
P8-41	Any arrival current 2 detect amplitude	0.0%～300.0% (Motor rated current)	0.0%	√
P8-42	Timing function selection	0: Invalid 1: Valid	0	√
P8-43	Timing of run time	0: Set by P8-44	0	√

	selection	1: AI1 2: AI2 3: Potentiometer of operation panel The range of analog input corresponds to P8-44		
P8-44	Timing value setting of running time	0.0Min～6500.0Min	0.0Min	√
P8-45	Lower limit of AI1 input voltage protection	0.00V～P8-46	3.10V	√
P8-46	Upper limit of AI1 input voltage protection	P8-45～10.00V	6.80V	√
P8-47	IGBT Module temperature arrives	0℃～100℃	75℃	√
P8-48	Cooling fan control	0: Working in running 1: Working after power up 2:Working by temperature(45℃/40℃) 3:Solar Mode, working if Vpn > PE-16)	3	√
P8-49	Wake up frequency	Sleep frequency (P8-51)～Maximum （P0-10)	0.00Hz	√
P8-50	Wake up delay time	0.0s～6500.0s	0.0s	√
P8-51	Sleep frequency	0.00Hz～Wake up frequency （P8-49)	0.00Hz	√
P8-52	Sleep relay time	0.0s～6500.0s	0.0s	√
P8-53	Current running arrival time setting	0.0～6500.0 min.	0.0Min	√
P9 group Fault and protection				
P9-00	Motor overload protection selection	0: Prohibited 1: Allow	1	√
P9-01	Motor overload protection gain	0.20～10.00	1.00	√
P9-02	Motor overload pre-warning coefficient	50%～100%	80%	√
P9-03	Overvoltage stall gain	0～100	100	√
P9-04	Overvoltage stall protection voltage	120%～150%	135%	√
P9-05	Over-current stall gain	0～100	20	√
P9-06	Overcurrent stall protection current	100%～200%	150%	√
P9-07	Ground short circuit protection options when	0: Invalid 1: Valid	1	√

	power on			
P9-09	Number of automatic reset times	0～20	0	√
P9-10	DO (digital output) when fault alarm auto reset	0: No action 1: Action	0	√
P9-11	Fault auto reset interval time	0.1s～100.0s	1.0s	√
P9-12	Input phase loss/ contactor pull protection selection	Bit: Input phase loss protection selection Ten: Contactor pull protection options 0: Prohibited 1: Allow	11	√
P9-13	Output phase loss protection	0: Prohibited 1: Allow	1	√
P9-14	First failure alarm type	0: No fault 1: Reserved 2: Over current in acceleration 3: Over current in deceleration 4: Over current in constant speed during 5: Over voltage in acceleration 6: Over voltage in deceleration 7: Over voltage in constant speed during 8: Buffer resistance overload 9: Under voltage 10: Inverter overload 11: Motor overload 12: Input phase loss	—	●
P9-15	Second fault alarm type	13: Output phase loss 14: IGBT Module overheating 15: External fault 16: Communication error 17: Contactor is abnormal 18: Current detection is abnormal 19: Motor tuning abnormal 20: Encoder / PG card is abnormal 21: Parameter read and write exception 22: Inverter hardware abnormality 23: Motor to ground short circuit 24: Reserved 25: Reserved	—	●
P9-16	The third (latest one) type of failure	26: Running time arrives 27: User defined fault 1	—	●

		28: user defined fault 2 29: Power-up time arrives 30: Under load 31: PID feedback is missing in running 40: Fast current limit timeout 41:Motor switch in running 42: The speed deviation is too big 43: Motor over speed 45: Motor over temperature 51: Initial position error		
P9-17	Frequency at when the third (last) failure frequency	—	—	●
P9-18	Current at when the third (last) failure frequency	—	—	●
P9-19	DC bus voltage at when the third (last) failure frequency	—	—	●
P9-20	Input terminals status at when the third (last) failure frequency	—	—	●
P9-21	Output terminals status at when the third (last) failure frequency	—	—	●
P9-22	Inverter status when the third (last) failure frequency	—	—	●
P9-23	Power up time when the third (last) failure frequency	—	—	●
P9-24	Running time when the third (last) failure frequency	—	—	●
P9-27	Frequency at when the second failure	—	—	●
P9-28	Current at when the second failure	—	—	●
P9-29	DC bus voltage at when the second failure	—	—	●
P9-30	Input terminals status at when the second failure	—	—	●
P9-31	Output terminals status at when the second failure	—	—	●
P9-32	Inverter status at when the second failure	—	—	●

P9-33	Power up time when the second failure	—	—	●
P9-34	Running time when the second failure	—	—	●
P9-37	Frequency at when the third failure	—	—	●
P9-38	Current at when the third failure	—	—	●
P9-39	DC bus voltage at when the third failure	—	—	●
P9-40	Input terminals status at when the third failure	—	—	●
P9-41	Output terminals status at when the third failure	—	—	●
P9-42	Inverter status at when the third failure	—	—	●
P9-43	Power up time when the third failure	—	—	●
P9-44	Running time when the third failure	—	—	●
P9-47	Fault protection action selection 1	Bit: Motor overload (11) 0: Free stop 1: Stop by stop mode setting 2: Continue to run Ten: Input missing (12) Hundreds: Output phase loss (13) Thousands of bits: external failure (15) Million: communication anomaly (16)	00000	√
P9-48	Fault protection action selection 3	Bit: Encoder / PG card exception (20) 0: Free stop Ten: Function code read and write exception (21) 0: Free stop 1: Stop by stop mode setting Hundred places: reserved Thousands: Motor overheating (25) Million: run time arrival (26)	00000	√
P9-49	Fault protection action selection 3	Bit: User defined fault 1 (27) 0: Free stop 1: Stop by stop mode 2: Continue to run	00000	√

		Ten: User Defined Fault 2 (28) 0: Free Stop 1: Stop by stop mode 2: Continue to run Hundreds: Power-up time arrives (29) 0: Free stop 1: Stop by stop mode 2: Continue to run Thousands of bits: (30) 0: Free stop 1: Deceleration stop 2:Skip to 7% of the rated motor frequency to continue running, restore to run with setting frequency after no missing load Million: PID feedback lost in running (31) 0: Free parking 1: Stop by stop mode 2: Continue to run		
P9-50	Fault protection action selection 4	Bit: the speed deviation is too large (42) 0: Free stop 1: Stop by stop mode 2: Continue to run Ten: Motor over speed (43) Hundred places: initial position error (51)	00000	√
P9-54	Running frequency of continue running when fault alarm	0: Run at the current operating frequency 1: Run at set frequency 2: Run at the upper limit frequency 3: Run at the lower limit frequency 4: Run at an abnormal standby frequency	0	√
P9-55	An abnormal standby frequency	0.0%～100.0% (100.0% corresponds to the maximum frequency P0-10)	100.0%	√
P9-56	Motor temperature sensor type	0: No temperature sensor 1：PT100 2：PT1000	0	√
P9-57	Motor overheat protection threshold	0℃～200℃	110℃	√
P9-58	Motor overheat pre-warning threshold	0℃～200℃	90℃	√
P9-59	Working action of Instantaneous power fail selection	0: Invalid 1: Deceleration 2: Deceleration stop	0	√

P9-60	Judgment voltage of instantaneous power fail pause	80.0%～100.0%	90.0%	√
P9-61	Voltage recovery judgment time when instantaneous power fail	0.00s～100.00s	0.50s	√
P9-62	Judgment voltage of instantaneous power failure action	60.0%～100.0%(Standard bus voltage)	80.0%	√
P9-63	Load miss protection	0: Disable 1: Enable	0	√
P9-64	Load miss detection level	0.0～100.0%	10.0%	√
P9-65	Load miss detection time	0.0～60.0s	1.0s	√
P9-67	Over speed detection	0.0%～50.0%(Max frequency)	20.0%	√
P9-68	Over speed detection time	0.0s: No detect 0.1～60.0s	1.0s	√
P9-69	Detection value of the speed deviation is too big	0.0%～50.0%(Max frequency)	20.0%	√
P9-70	Detection time of speed deviation is too big.	0.0s: No detect 0.1～60.0s	5.0s	√
PA Group PID function				
PA-00	PID reference source	0: PA-01 1: AI1 2: AI2 3: Keyboard potentiometer 4: PULSE train setting (DI5) 5: Communication reference 6: Multi-step instructions reference	0	√
PA-01	PID value setting	0.0%～100.0%	50.0%	√
PA-02	PID feedback source	0：AI1 1: AI2 2: Keyboard potentiometer 3: AI1-AI2 4: PULSE setting (DI5) 5: Communication reference 6: AI1 + AI2 7: MAX (| AI1 |, | AI2 |) 8: MIN (| AI1 |, | AI2 |)	0	√
PA-03	PID working direction	0: Positive effect 1: Reverse effect	0	√
PA-04	PID reference feedback	0～65535	1000	√

	range			
PA-05	Proportional gain Kp1	0.0～100.0	20.0	√
PA-06	Integral time Ti1	0.01s～10.00s	2.00s	√
PA-07	Differential time Td1	0.000s～10.000s	0.000s	√
PA-08	PID reversal cutoff frequency	0.00～Maximum frequency	2.00Hz	√
PA-09	PID deviation limit	0.0%～100.0%	0.0%	√
PA-10	PID differential limiting	0.00%～100.00%	0.10%	√
PA-11	PID reference given change time	0.00～650.00s	0.00s	√
PA-12	PID feedback filter time	0.00～60.00s	0.00s	√
PA-13	PID output filter time	0.00～60.00s	0.00s	√
PA-14	Reserve	-	-	√
PA-15	Proportional gain Kp2	0.0～100.0	20.0	√
PA-16	Integral time Ti2	0.01s～10.00s	2.00s	√
PA-17	Derivative time Td2	0.000s～10.000s	0.000s	√
PA-18	PID parameter switching condition	0: Do not switch 1: Switch via DI terminal 2: Automatic switching according to the deviation	0	√
PA-19	PID parameter switching deviation 1	0.0%～PA-20	20.0%	√
PA-20	PID parameter switching deviation 2	FA-19～100.0%	80.0%	√
PA-21	PID initial value	0.0%～100.0%	0.0%	√
PA-22	PID initial value hold time	0.00～650.00s	0.00s	√
PA-23	The maximum value of positive deviations for two output	0.00%～100.00%	1.00%	√
PA-24	The maximum value of reverse deviations for two output	0.00%～100.00%	1.00%	√
PA-25	PID integral property	Bit: Integral separation 0: Invalid 1: Valid Ten:Whether to stop the integral working after outputting to the limit 0: Continue integral working	00	√

		1: Stop integral working		
PA-26	PID feedback loss detection value	0.0%:Do not judge feedback loss 0.1%～100.0%	0.0%	√
PA-27	PID Feedback loss detection time	0.0s～20.0s	0.0s	√
PA-28	PID calculating when stop	0：Don't execute calculating when stop 1: Execute PID calculating when stop	0	√
PB Group Wobble, Length and Count				
PB-00	Wobble setting mode	0: Relative to center frequency 1: Relative to maximum frequency	0	√
PB-01	Wobble amplitude	0.0%～100.0%	0.0%	√
PB-02	Sudden jump frequency range	0.0%～50.0%	0.0%	√
PB-03	Wobble cycle	0.1s～3000.0s	10.0s	√
PB-04	Wobble of the triangular wave rise time	0.1%～100.0%	50.0%	√
PB-05	Set length	0m～65535m	1000m	√
PB-06	Actual length	0m～65535m	0m	√
PB-07	Number of pulses per meter	0.1～6553.5	100.0	√
PB-08	Set the count value	1～65535	1000	√
PB-09	Specify the count value	1～65535	1000	√
PC Group multi-step instructions, simple PLC				
PC-00	Multi - step instructions 0	-100.0%～100.0%	0.0%	√
PC-01	Multi - step instructions 1	-100.0%～100.0%	0.0%	√
PC-02	Multi - step instructions 2	-100.0%～100.0%	0.0%	√
PC-03	Multi - step instructions 3	-100.0%～100.0%	0.0%	√
PC-04	Multi - step instructions 4	-100.0%～100.0%	0.0%	√
PC-05	Multi - step instructions 5	-100.0%～100.0%	0.0%	√
PC-06	Multi - step instructions 6	-100.0%～100.0%	0.0%	√
PC-07	Multi - step instructions 7	-100.0%～100.0%	0.0%	√
PC-08	Multi - step instructions 8	-100.0%～100.0%	0.0%	√
PC-09	Multi - step instructions 9	-100.0%～100.0%	0.0%	√
PC-10	Multi - step instructions 10	-100.0%～100.0%	0.0%	√
PC-11	Multi - step instructions 11	-100.0%～100.0%	0.0%	√
PC-12	Multi - step instructions 12	-100.0%～100.0%	0.0%	√
PC-13	Multi - step instructions 13	-100.0%～100.0%	0.0%	√

PC-14	Multi - step instructions 14	-100.0%～100.0%	0.0%	√
PC-15	Multi - step instructions 15	-100.0%～100.0%	0.0%	√
PC-16	Simple PLC running mode	0: Single run to end and stop 1: Single run to end and keep final value 2: Continue to run in loop	0	√
PC-17	Simple PLC power loss memory selection	Bit: Power off memory options 0: No memory power-off 1: Power off memory Ten: Stop memory selection 0: Stop no memory 1: Stop memory	00	√
PC-18	Simple PLC 0 step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-19	Accel/Decel time selection of 0 step of simple PLC	0～3	0	√
PC-20	Simple PLC 1st step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-21	Accel/Decel time selection of 1st step of simple PLC	0～3	0	√
PC-22	Simple PLC 2nd step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-23	Accel/Decel time selection of 2nd step of simple PLC	0～3	0	√
PC-24	Simple PLC 3rd step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-25	Accel/Decel time selection of 3rd step of simple PLC	0～3	0	√
PC-26	Simple PLC 4th step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-27	Accel/Decel time selection of 4th step of simple PLC	0～3	0	√
PC-28	Simple PLC 5th step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-29	Accel/Decel time selection of 5th step of simple PLC	0～3	0	√
PC-30	Simple PLC 6th step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-31	Accel/Decel time selection of 6th step of simple PLC	0～3	0	√
PC-32	Simple PLC 7th step	0.0s(h)～6553.5s(h)	0.0s/h	√

	running time			
PC-33	Accel/Decel time selection of 7th step of simple PLC	0～3	0	√
PC-34	Simple PLC 8th step running time	0.0s(h)～6553.5s(h)	0.0s(h)	√
PC-35	Accel/Decel time selection of 8th step of simple PLC	0～3	0	√
PC-36	Simple PLC 9th step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-37	Accel/Decel time selection of 9th step of simple PLC	0～3	0	√
PC-38	Simple PLC 10th step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-39	Accel/Decel time selection of 10th step of simple PLC	0～3	0	√
PC-40	Simple PLC 11th step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-41	Accel/Decel time selection of 11th step of simple PLC	0～3	0	√
PC-42	Simple PLC 12th step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-43	Accel/Decel time selection of 12th step of simple PLC	0～3	0	√
PC-44	Simple PLC 13th step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-45	Accel/Decel time selection of 13th step of simple PLC	0～3	0	√
PC-46	Simple PLC 14th step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-47	Accel/Decel time selection of 14th step of simple PLC	0～3	0	√
PC-48	Simple PLC 15th step running time	0.0s(h)～6553.5s(h)	0.0s/h	√
PC-49	Accel/Decel time selection of 15th step of simple	0～3	0	√

	PLC			
PC-50	Simple PLC run time unit	0：s（2） 1：h（hour）	0	√
PC-51	Multi-step instruction 0 step given mode	0: set by FC-00 1：AI1 2：AI2 3: Keyboard potentiometer 4: PULSE train 5: PID 6: Preset frequency (F0-08) is given, UP / DOWN can be modified	0	√
PD Group communication				
PD-00	Communication baud rate	bit：MODBUS 0：300BPS 1：600BPS 2：1200BPS 3：2400BPS 4：4800BPS 5：9600BPS 6：19200BPS 7：38400BPS 8：57600BPS 9：115200BPS Ten: Profibus-DP 0：115200BPs 1：208300BPs 2：256000BPs 3：512000Bps Hundred places: reserved	6005	√
PD-01	MODBUS data format	0: No parity (8-N-2) 1: Even check (8-E-1) 2: Odd parity (8-O-1) 3: No parity (8-N-1) (MODBUS active)	0	√
PD-02	Local address	0：Broadcast address 1～249 (MODBUS、Profibus-DP、CANlink enable)	1	√
PD-03	MODBUS respond relay	0～20ms (MODBUS enable)	2	√

PD-04	Serial communication timeout	0.0：Disable 0.1～60.0s (MODBUS, Profibus-DP, CANopen enable)	0.0	√
PE group Solar Pump inverter control parameters				
PE-00	Solar pump control mode	0:Disable of solar pump control 1: Enable (Algorithm-1, High efficiency) 2: Enable (Algorithm-2, High stability) User can use terminal to disable solar pump control mode, make inverter work for motor variable speed control. See Digital terminal definition 53: MPPT/Solar control disable. (set P4-02=53, switch on DI3 and COM) Terminal control is prior.	2	X
PE-01	Solar pump control mode option	1 Bit: Vmpp mode selecting 0: Vmp set by PE-02 manually (CVT) 1: MPPT automatically Ten: Voc (open loop voltage of PV) detect mode 0: Voc set by PE-03 manually 1: Voc detect automatically Hundred: Auto running by keypad 0: Disable 1: Auto start/stop in keypad control mode. Inverter will automatically start when power on after 5 seconds only on keypad control mode.	H001	√
PE-02	CVT voltage set by manual	0 -100%	80%	√
PE-03	Voc (open loop voltage) set manually	0.0V-1000.0V	650V/ 380V	V
PE-04	DC bus voltage stability Proportional gain	0.0% - 999.9%	100.0%	√
PE-05	DC bus voltage stability Integral gain	0.0% - 999.9%	100.0%	√
PE-06	DC bus voltage stability differential gain	0.0% - 999.9%	5%	√
PE-07	Initial point of fast frequency drop	0.0 - 100.0%	5.0%	√
PE-08	Stop point of fast frequency drop	0.0 - 100.0%	50.0%	

PE-09	Weak magnetic limit multiples	0.0- 9.9	1.2	
PE-10	Mppt search upper limit voltage	0.0% - 100.0%	90%	√
PE-11	Mppt search lower limit voltage	0.0% - 100.0%	75%	√
PE-12	MPPT search gain	0% - 500%	100%	√
PE-13	MPPT search interval	0.0 - 10.0sec	2.0sec	√
PE-14	Stabilizer filtering time (solar pump control mode2)	0-1000ms	50ms	
PE-15	Reserve	0	0	
PE-16	Sleep voltage threshold	0.0 - 1000.0V	250.0V/ 150.0V	√
PE-17	Wake up voltage threshold	0.0 - 1000.0V	350.0V/250 .0V	√
PE-18	Awake waiting time	0 - 30000sec	60sec	√
PE-19	Stop frequency setting when low speed	0.00Hz ～300.00Hz	10.00Hz	√
PE-20	Detecting time of low frequency protection	0 - 30000sec	20sec	√
PE-21	Low speed protection auto reset delay time	0 - 30000sec	60sec	√
PE-22	Dry run protection detecting current	0.0 - 999.9A	0.0A	√
PE-23	Dry run protection detecting time	0 - 30000sec	10sec	√
PE-24	Dry run protection auto reset relay time	0 - 30000sec	60sec	√
PE-25	Detecting current of over current protection	0.0 - 999.9A	0.0A	√
PE-26	Detecting time of over current protection	0 - 30000sec	10sec	√
PE-27	Over current auto reset delay time	0 - 30000sec	60sec	√
PE-28	Minimum power protection value	0.00kw - 650.00kw	0.00kw	√
PE-29	Detecting time of minimum power protection	0 - 30000sec	10sec	√
PE-30	Minimum power protection auto reset delay time	0 - 30000sec	60sec	√
PE-31	Water tank full level detecting method	Digit: Water full detect mode 0: Single point detect 1: 2 points detect	H0.0.0	√

		2: AI1 analog 3: AI2 analog Ten: Single point detect 51# function logic detection selecting Hundred: Single point detect 52# function logic detection selecting. 0: Normal Open, work when open, stop when switch on 1: Normal close, work when close, stop when open.		
PE-32	Water full level detecting threshold of analog	0 - 100.0%	25.0%	√
PE-33	Water full level reach protection detecting time	0 - 30000sec	10sec	√
PE-34	Water full level protection exit relay time	0 - 30000sec	10 sec	√
PE-35	Water level sensor probe damage threshold	0 - 100.0%	0.0%	√
PE-36	DC current correction factor	0.0 - 200.0%	100.00%	√
PE-37	DC current correction bias	-100.00A - 100.00A	0.00A	√
PE-38	Power point 0 of PQ Current	0.0kw - 999.9kw	0.5kw	√
PE-39	Power point 1 of PQ Current	0.0kw - 999.9kw	1.0kw	√
PE-40	Power point 2 of PQ Current	0.0kw - 999.9kw	1.5kw	√
PE-41	Power point 3 of PQ Current	0.0kw - 999.9kw	2.0kw	√
PE-42	Power point 4 of PQ Current	0.0kw - 999.9kw	2.5kw	√
PE-43	Flow point 0 of PQ curve	0.0 - 999.9m^3/h	0.0 m^3/h	√
PE-44	Flow point 1 of PQ curve	0.0 - 999.9m^3/h	5.0 m^3/h	√
PE-45	Flow point 2 of PQ curve	0.0 - 999.9m^3/h	10.0m^3/h	√
PE-46	Flow point 3 of PQ curve	0.0 - 999.9m^3/h	15.0m^3/h	√
PE-47	Flow point 4 of PQ curve	0.0 - 999.9m^3/h	20.0m^3/h	√
PE-48	Initiating frequency of dry run protection	0.00 - 320.00Hz	0.0Hr	√
PE-49	Sleep power setting	0.0% - 100.0%	0.0%	√
PE-50	Detecting time of sleep power	0 - 30000sec	60sec	√

PE-51	Sleep frequency	0.00Hz ～300.00Hz	10.00Hz	√
PP Group Function code management				
PP-00	User password	0～65535	0	√
PP-01	Parameter initialization	0: On operation 1: Restore parameters to factory setting except motor parameters 2: Clear record information	0	√
PP-02	Function parameter group display selection	Bit: U group monitoring parameters 0: Not displayed 1: Display Ten: Advanced parameters 0: Not displayed 1: display	01	×
PP-03	Personality parameter group show selection	Bit: User custom parameter group display selection 0: Not displayed 1: Display Ten: User Change Parameter Group Display Selection 0: Not displayed 1: Display	00	√
PP-04	Function code modification attribute	0： Enable modification 1: Not allow to modify	0	√
PP-05	Distributor unlock password	0 - 65535		
PP-06	Factory unlock password	0 - 65535		
PF Distributor password setting				
PF-06	Distributor password setting	0 - 65535		
PF-07	Distributor allow total running time	0 - 65535Hr	Maximum 7.4 Year	

Chapter 8. Solar pump control parameters description

Some parameters description which may relative with solar pump control.

P0-01	Motor control mode		Factory setting	0
	Setting range	0	VF control	
		1	Open loop sensorless vector control	
		2	Close loop sensor vector control with PG card	
		3	2 wires output for single phase pump	
		4	3 wires output for single phase pump	

0: V/F control

No need install encoder, good compatibility and stable running. Suits for the applications, which no high request for loads, and one drive for more than one motors, and motor auto-tuning cannot be performed or the motor's parameters can be acquired through other methods, such as fans, pumps load.

Always select VF control for solar pump control application for asynchronous motor.

1: Open loop sensorless vector control

Open loop sensorless vector control mode suits for high performance general purpose application without encoder, such as machine, centrifugal machine, drawbench, injection mold machine, etc. one AC drive only allow to service one motor.

2: Close loop sensor vector control with PG card

That is vector control running mode with speed sensor, which is mainly used in the cases such as high accuracy speed control, torque control and simple servo control which have high requirements for control performance. When the control mode is selected, generally, PG should be installed on the motor's terminal, and the PG's parameters should be set up correctly.

3: 2 wires output for single phase pumps when capacitors can’t removed.

4: 3 wires output for single phase pumps when starting capacitors

P0-02	Running command source		Factory setting	0
	Setting	0	Keyboard/ keypad/ operation panel（LED turn off）	
		1	Terminals control （LED turn ON）	
		2	Communication （LED Flash）	

Solar pump inverter running command source selection.

User can start inverter by keyboard, terminals control or communication.

0: Keypad (operation panel); The running command is given by RUN, STOP, JOG ...by keypad.

1: External terminals; The running command controlled by multiple function terminals. It can achieved to forward, reverse, Jog, reverse running with two lines or three lines control. Refer to P4 input terminals command group. When DI1 and COM is short circuit connection and P4-00 set to 1 (set for forwarder running), the solar pump inverter can start in morning once received enough power from solar arrays automatically and stop at the evening when less of sunshine.

2: communication command

The running command is given by communication, see the communication protocol Pd group description. User must set it for 2 communication mode when GPRS remote controller using.

P0-03	Main frequency reference source		Factory setting	0
	Setting range	0	P0-08，UP/DOWN no memory when power fail	
		1	P0-08，UP/DOWN memory when power up	
		2	AI1	
		3	AI2	
		4	Potentiometer of keypad	
		5	Pulse train (DI5)	
		6	Multiple speed step	
		7	PLC	
		8	PID	
		9	Communication	

When PE-00=0 solar pump control is disable, this parameters will be activated. User can select main frequency reference source by this parameters.

P0-09	Running direction		Factory setting	0
	Setting range	0	In the same direction	
		1	In the opposite direction	

By this parameter setting, User can change the motor running direction without wiring change.

P0-15	Carrier frequency	Factory setting	Per model
	Setting range	0.5kHz～16.0kHz	

It uses to adjust the carrier frequency. By adjusting the carrier frequency can reduce the motor noise, to avoid the resonance point of the mechanical system, to reduce the line to ground leakage current and reduce the interference generated by the inverter

When the carrier frequency is low, the output current harmonic component increases, the motor loss increases, the motor temperature rise.

When the carrier frequency is high, the motor loss decreases, the motor temperature decreases, but the inverter loss increases, the inverter temperature increases, interference increases.

Adjusting the carrier frequency affects the following performance:

Carrier frequency	Low → High
Motor noise	Big → Small
Output current waveform	Low → Good
Motor temperature rise	High → Low
Inverter temperature rise	Low → High
Leakage current	Small → Big
External radiation interference	Small → Big

P1-00	Motor type		Factory setting	0
	Setting range	0	General asynchronous motor	
		1	Variable frequency asynchronous motor	

		2	Permanent magnet synchronous motor (PMSM)	
P1-01	Rated power		Factory setting	As per model
	Setting range		0.1KW～1000.0KW	
P1-02	Rated voltage		Factory setting	As per model
	Setting range		1V～2000V	
P1-03	Rated current		Factory setting	As per model
	Setting range		Power of inverter <= 55KW：0.01A～655.35A Power of inverter ＞55KW ：0.1A～6553.5A	
P1-04	Rated power		Factory setting	As per model
	Setting range		0.01Hz～Max power of inverter	
P1-05	Rated speed		Factory setting	As per model
	Setting range		1rpm～65535rpm	

User need to set above motor parameters code according to motor nameplate in VF control or vector control mode. To get a better vector control. In order to obtain better vector control performance, it is necessary to motor parameters auto tuning, and the accuracy of the adjustment results is closely related to the correct setting of the motor nameplate parameters.

Configure below permanent magnet synchronous motor parameters for perform motor auto tuning.

P1-16	Synchronous motor stator resistance	Factory setting	As per model
	Setting range	Frequency inverter power <= 55KW：0.001Ω～65.535Ω Frequency inverter power > 55KW : 0.0001Ω～6.5535Ω	
P1-17	Synchronous motor D-axis inductance	Factory setting	As per model
	Setting range	Frequency inverter power <= 55KW：0.01mH～655.35mH Frequency inverter power > 55KW: 0.001mH～65.535mH	
P1-18	Synchronous motor Q axis inductance	Factory setting	As per model
	Setting range	Frequency inverter power <= 55KW：0.01mH～655.35mH Frequency inverter power > 55KW: 0.001mH～65.535mH	
P1-20	Synchronous motor back electromotive force	Factory setting	As per model
	Setting range	0.1V～6553.5V	

P1-16 ~ P1-20 is the parameter of the synchronous motor. Some parameters on the nameplate of the synchronous motor will be provided. However, most motor name plates do not provide the above parameters, need to be tuned automatically by the inverter, and must select "synchronous machine no-load tuning " Because "synchronous motor no-load tuning" can get P1-16, P1-17, P1-18, P1-19 these four motor parameters, and "synchronous motor with a load tuning" can only get synchronous encoder phase sequence, Installation angle and other parameters.

When the motor rated power (P1-01) or the motor rated voltage (P1-02) is changed, the inverter will automatically modify the value of P1-16 ~ P1-20.
The above synchronization machine parameter, can also be based on the manufacturer to provide data directly set the corresponding function code.

P1-37	Motor auto tuning		Factory setting	0
	Setting range	0	No operation	
		1	Asynchronous motor static tuning	
		2	Asynchronous motor complete tuning	
		11	Synchronous motor with load tuning	
		12	Synchronous motor with no load tuning	

0: No operation, not allow to do motor auto tuning
1: Asynchronous motor static tuning, suitable for asynchronous motor and load is not easy to disconnect, and can’t carry out a complete tuning of the occasion.
Please set motor group parameters P1-00～P1-05 as motor nameplate correctly before asynchronous motor static tuning.P1-06～P1-08 these 3 parameters will be catch after auto tuning.
Auto tuning action: SET P1-37 to 1, and then press RUN keypad, inverter will perform autotuning
2: Asynchronous motor complete tuning
To ensure the dynamic control performance of the frequency converter, select the complete tuning, the motor must be disconnected from the load to keep the motor empty.
During the complete tuning process, the inverter first performs the static tuning and then accelerates to 80% of the rated frequency of the motor according to the acceleration time P0-17. After a period of time, the inverter stops as P0-18 deceleration time and finish auto tuning.
12: if it is difficult to get nameplate of PMSM, please select PMSM no load tuning to get P1-16, P1-17, P1-18, P1-19 parameters, and check if P1-20 if correct as motor nameplate after motor auto tuning.

P7-06	Load speed display factor		Factory setting	1.0000
	Setting range		0.0001～6.5000	
P8-18	Start protection selection		Factory setting	0
	Setting range	0	No protection	
		1	Protection	

This parameter relates to the safety protection function of the inverter.
If the parameter is set to 1, if the inverter is running at the power-on time command (for example, the terminal running command is closed before power-on), the inverter does not respond to the

running command. The run command must be removed once. After the run command is valid again The inverter responds.

In addition, if the parameter is set to 1, if the inverter fails to run the command at the time of the fault reset, the inverter does not respond to the run command. The run command must be removed to eliminate the running protection status.

Setting this parameter to 1 prevents the motor from responding to the risk of running commands when the power is turned on or when a fault is reset.

For the solar pump inverter, please set P8-18=0 to activated pumps run automatically.

P9-09	Number of automatic reset times		Factory setting	20
	Setting range	0～20		

When the inverter is selected to automatically reset the fault, it is used to set the number of automatic reset. After this number of times, the inverter remains faulty.

P9-09 set to 20 for solar pump control inverter.

P4 Group input terminals				
P4-00	DI1 digital input function	0: No function 1: Forward run FWD or run command 2: Reverse run REV or forward and reverse run direction 8: Free stop 9: Fault reset (RESET) 10: Run pause 51:Water tank full detect 1 52:Water tank full detect 2 53:MPPT tracking stop/ solar pump control disable	1	×
P4-01	DI2 digital input function		53	×
P4-02	DI3 digital input function		9	×
P4-03	DI4 digital input function		51	×
P4-04	DI5 digital input function		52	×

51 and 52 two digital input for water level full function activating.

Install a height place aside from water full leveling to form a water full detection hysteresis.

52: User can use to this function to disable solar pump control function by terminals.

When this function is activated, inverter will work variable frequency mode and exit of solar pump control mode.

PE group solar pump control parameters group explanation:

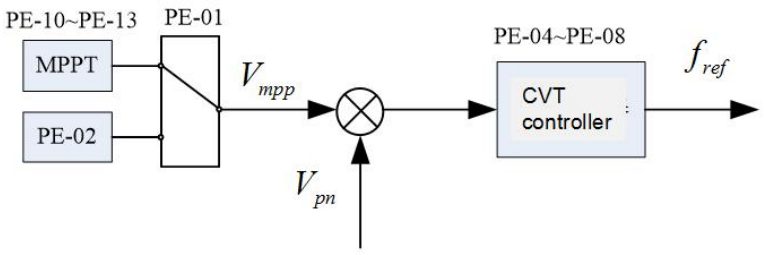
PE-00	Solar pump control mode	0: Disable 1: Enable (Algorithm-1, High efficiency) 2: Enable (Algorithm-2, High stability)	2

This parameters use to enable or disable solar pump control mode, When it set to 1 or 2, the solar pump control function will be activated, when it set to 0, the inverter work as general variable frequency without solar control function. The output frequency can be set but not vary with sunshine radiation.

There’re two type Solar Pump control algorithmembed , and one (PE-00=1) is emphasized on efficiency, the other one(PE-00=2) is emphasized on stability;

PE-01	Vmpp voltage reference mode	Bit: Vmpp mode selecting 0: CVT set by PE-02 manually 1: MPPT auto mode Ten: Voc (open loop voltage of PV) detect mode 0: Voc set by PE-03 manually 1: Voc automatically detect Hundred: Auto running by keypad 0: Disable 1: Auto start/stop even in keypad control mode. Inverter will automatically start when power on after 5 seconds under keypad control mode (P0-02=0)	H0.0.1.
PE-02	CVT voltage setting value	0 -100%	80%
PE-03	Voc (open loop voltage) setting	0.0V-1000.0V	650V/ 380V

There are CVT and MPPT for solar pump control, user can set CVT or MPPT by PE-01 value.
If user set PE-01=***0, please set CVT value to PE-02.
If user set PE-01=***1, inverter carry out MPPT mode.
PE-01=**0*, if the ten digit set for 0, User need to set Voc value of PV to PE-03, the default setting 650VDC for 380VAC pumps, 350VDC for 220VAC pumps. Voc value is show by d0-02, so please set d0-02 value to FE-03.
PE-01=**1*, when the ten digit of PE-01 set for 1, the Voc will be detected automatically, and PE-03 is lower limit of auto detect value.
the inverter will detect Voc (open loop voltage of PV) automatically.
PE-01=*1**, the inverter can be able to start/stop automatically even in keypad control mode.



PE-04	DC bus voltage stability Proportional gain	0.0% - 999.9%	100.0%
PE-05	DC bus voltage stability Integral gain	0.0% - 999.9%	100.0%
PE-06	DC bus voltage stability differential gain	0.0% - 999.9%	0.0%

PE-04 to PE-06 use to adjust MPPT tracking ratio, and keep DC bus voltage in stability.
The more PI, the more stable of DC bus voltage.

PE-07	Initial point of fast frequency drop	0.0 - 100.0%	5.00%
PE-08	Stop point of fast frequency drop	0.0 - 100.0%	50.00%

In some cloudy case, the inverter can't get enough solar energy from PV arrays, so we program inverter drop frequency quickly, make pump in generating mode, feedback energy to inveter to maintain DC bus voltage.
PE-07=0, frequency quick drop function is disable.

PE-09	Weak magnetic limit multiples	0.0- 9.9	1.2
PE-10	Mppt search upper limit voltage	0.0% - 100.0%	90%
PE-11	Mppt search lower limit voltage	0.0% - 100.0%	75%
PE-12	MPPT search gain	0% - 500%	100%
PE-13	MPPT search interval	0.0 - 10.0sec	2.0sec
PE-14	Stabilizer filtering time (sold pump control mode 2)	0-1000ms	50ms

PE-10/PE-11 use to set Vmpp range, and PE-12 is used to set MPPT searching gain, and PE-13 is used to set MPPT searching interval time. When the output frequency is fluctuating after activated MPPT searching,the performance can be improved by reducing PE-12 MPPT searching gain value and increase PE-13 the MPPT searching interval

PE-16	Sleep voltage threshold	0.0 - 1000.0V	250V/150V
PE-17	Wake up voltage threshold	0.0 - 1000.0V	350V/250V
PE-18	Awake waiting time	0 - 30000sec	60sec

PE-16 to FE-18 use to set solar pump inverter if go to sleep mode when input DC voltage is too low, and wake up automatically when DC bus voltage recovery again.
When the DC voltage is lower than FE-16 setting value for a system default time, it will go to sleep and sent out A.SLP alarm code. When DC bus voltage raises again and higher than PE-17 value for a FE-18 setting time, the inverter will be wake up to work again.

PE-19	Stop frequency setting when low speed	0.00Hz ～300.00Hz	10.00Hz
PE-20	Detecting time of low frequency protection	0 - 30000sec	20sec
PE-21	Low speed protection auto reset delay time	0 - 30000sec	60sec

If the output frequency is lower than PE-19 for a low speed detecting time PE-20,the solar pump inverter will stop to running and sent out A.LFr alarm.
Once the output frequency is greater than PE-19 for PE-21(automatic recover time), the inverter will restore to working.

PE-22	Dry run protection current threshold (under-load protection)	0.0 - 999.9A	0.0A

PE-23	Dry run detect delay time	0 - 30000sec	10sec
PE-24	Automatic recover time in dry run protection mode	0 - 30000sec	60sec

If the output current is lower than PE-22 (Dry run current) for PE-23(dry run detect delay time), the inverter will go to dry run protection mode and sent out A.LLd alarm.

Once the current is bigger than PE-22 again for PE-24 (recover time of dry run), the inverter will restore to working.

PE-25	Motor over current protection threshold	0.0 - 999.9A	0.0A
PE-26	Over current detect delay time	0 - 30000sec	10sec
PE-27	Automatic recovery time in over current protection mode	0 - 30000sec	60sec

PE-25,PE-26, PE-27parameters are used to set motor over current protection.

If the over current is bigger than PE-25 for PE-26time, the drive will go to stop mode for providing motor protection and sent out A.OLd alarm.

Once the current is lower than PE-25 for PE-27 recover time, the inverter will recover to work again.

PE-28	Minimum power input protection threshold	0.00kw - 650.00kw	0.00kw
PE-29	Minimum power input detect delay time	0 - 30000sec	10sec
PE-30	Automatic recovery time in minimum power input protection mode	0 - 30000sec	60sec

PE-28,PE-29,PE30 parameters are used to set minimum power input power protection.

When the input power from solar panel is lower than PE-28 (minimum power input) for PE-29 time, the inverter will be stop to working and sent out A.LPr alarm.

Once the input power larger than PE-28 for PE-30 time, the inverter will start to working again automatically.

PE-31	Water tank full level detecting method	Digit: Water full detect mode 0: 1 point detect 1: 2 points detect 2: AI1 analog 3: AI2 analog Ten: Single point detect 51# function logic detection selecting Hundred: Single point detect 52# function logic detection selecting. 0: Normal Open, work when open, stop when switch on 1: Normal close, work when	H0.00

		close, stop when open.	
PE-32	Water full level detecting threshold of analog	0 - 100.0%	25.0%
PE-33	Water full level reach protection detecting time	0 - 30000sec	10sec
PE-34	Water full level protection exit relay time	0 - 30000sec	60sec
PE-35	Water level sensor probe damage threshold	0 - 100.0%	0.0%

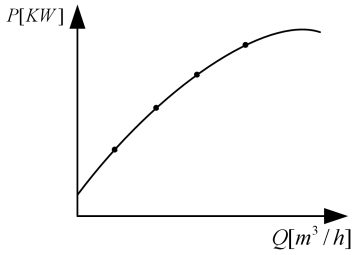
PE-31 parameter is used to set detecting method of water tank leveling.
point digital terminal water tank full detecting is default setting. There are normal open and normal close for selection.
For water well dry run detection, we can select normal close of digital function.
For water tank full detection, we can select normal open of digital function.
If select 2 points digital terminals full detect, please see below explanation:
Any 2 terminals (DI4 and DI5 are in default setting) can use to set for terminals digital detecting, the function code is 51/or 52. If both terminals are valid, it can able to activate water tank fulling protection, if both terminals are invalid, the water tank full is disable, only one terminals is valid, keep no changing of current working status.
PE-33/PE-34 are used to set water full detecting time and protection exit relay time.
PE-35 is used to set analog sensor damage detection threshold, when PE-31 is set for analog detecting, and feedback analog value larger than PE-35 setting threshold, and will judge the sensor is broken, submit A.Prb alarm as well, and inverter stop to working; The sensor probe detecting is disable when PE-31 set for 0.

PE-36	DC current correction factor	0.0 - 200.0%	100.00%
PE-37	DC current correction bias	-100.00A - 100.00A	0.00A

It us used to correct DC current showing of software calculated. U0-06 is DC current showing after corrected. The correction formula: U0-06= (estimated value* PE-36) + PE-37.

PE-38	Power point 0 of PQ Current	0.0kw - 999.9kw	0.5kw
PE-39	Power point 1 of PQ Current	0.0kw - 999.9kw	1.0kw
PE-40	Power point 2 of PQ Current	0.0kw - 999.9kw	1.5kw
PE-41	Power point 3 of PQ Current	0.0kw - 999.9kw	2.0kw
PE-42	Power point 4 of PQ Current	0.0kw - 999.9kw	2.5kw
PE-43	Flow point 0 of PQ curve	0.0 - 999.9m^3/h	0.0 m^3/h
PE-44	Flow point 1 of PQ curve	0.0 - 999.9m^3/h	5.0 m^3/h
PE-45	Flow point 2 of PQ curve	0.0 - 999.9m^3/h	10.0m^3/h
PE-46	Flow point 3 of PQ curve	0.0 - 999.9m^3/h	15.0m^3/h
PE-47	Flow point 4 of PQ curve	0.0 - 999.9m^3/h	20.0m^3/h

The set of parameters calculates the output flow rate (U0-13) based on the output power (U0-05),user can program PE-38 ~ PE-47 according to P-Q curve of pumps, and U0-13 flow rated can be calculated by software.



PE-48	Initiating frequency of dry run protection	0.00 - 320.00Hz	0.0Hz	√
PE-49	Sleep power setting	0.0% - 100.0%	0.0%	√
PE-50	Detecting time of sleep power	0 - 30000sec	60sec	√
PE-51	Sleep frequency	0.00Hz ～300.00Hz	10.00Hz	√

PE-48 parameters use to select dry run function starting frequency. Only the output frequency is higher than this setting, the dry run is activated.

The inverter if enter to sleep mode can able to detect sleep voltage and sleep power.

PE-49, PE-50 and PE-51 for power judge sleep mode.

When PE-49=0.0%, the inverter if enter sleep mode by judging sleep voltage PE-17.

When PE-49 is none 0.0%, the inverter if go to sleep by judging sleep power.

If the power less than PE-49 and output frequency is lower than PE-51 for PE-50 relay time , inverter will go to sleep mode.

Note:

Solar pump inverter has following difference compare to general variable frequency inverter.

* Torque booster value is 1.0% in default(F3.01)；
* Over excitation function is disable in default (P3-01 as 0)；
* Input/ output phase missing is disable（P9-12,P9-13 both parameters set to 0）；
* Over current , over voltage suppression function is disable in default（P9-03, P9-05=0）；
* Digital terminals programmable function are set for forward running, fault reset, solar pump control disable, water tank fulling detect 1, water tank fulling detect 2.
* Automatic fault reset is activated in default，when P9-09=20, automatically reset times is infinite
* Auto start when power on with terminal control for forwarding , (P0-02=1), DI1 short circuit connect to COM .
* Below parameters setting in default are difference for 400VAC output voltage and 200VAC output voltage.

PE-16: sleep voltage：250V for 4T /150V for 2S

PE-17: awake up voltage：350V/ for 4T / 250V for 2S

* Under voltage of 400VAC (4T)　models is 250VDC, 200VAC (2S) model under voltage is 100VDC.

*When PE-01 is set to ***0, the inverter working CVT (constant voltage tracking) mode, work

with MPPT (maximum power point tracking) with PE-01 not 0 setting. The greater the periodic disturbance of the DC bus voltage (0.5V*PE-01), the bigger PE-01 value setting.

*If the MPPT tracking is not stable, or can't find the maximum power point, we can try to select CVT working mode with PE-01=0 setting, and set DC bus working voltage to PE-02.

* The day flow and day generated energy period setting is 8hour per day.

Total flow=(U0-16 high bit)*1000+(U0-15)

Total generated energy=(U0-19 high bit)*1000+(U0-18)

Monitor parameters of solar pump control

Monitor parameters	Monitoring contents	Unit	Address
U0-00	Output frequency	0.01Hz	7000H
U0-01	Preset frequency	0.01Hz	7001H
U0-02	DC voltage of PV arrays	0.1V	7002H
U0-03	Output voltage	1V	7003H
U0-04	Output current	0.01A	7004H
U0-05	Power of PV arrays	0.1KW	7005H
U0-06	Current of PV arrays	0.01A	7006H
U0-07	DI input status	1	7007H
U0-08	DO output status	1	7008H
U0-09	AI1	0.01V	7009H
U0-10	AI2	0.01V	700AH
U0-11	Motor (pump) speed	1rpm	700BH
U0-12	PV open loop circuit voltage (Voc)	0.1V	700CH
U0-13	Flow rate of pump	0.1m^3/hr	700DH
U0-14	Day flow	0.1m^3	700EH
U0-15	Flow accumulation （low-order digit)	0.1m^3	700FH
U0-16	flow accumulation（low-order digit)	0.1Km^3	7010H
U0-17	Day generated power	0.1kwh	7011H
U0-18	Generated accumulation （low-order digit)	0.1kwh	7012H
U0-19	Generated accumulation （high-order digit)	0.1Mwh	7013H
U0-20	The rest running time	0.1Min	7014H
U0-24	Pump running speed	r/min	7018H
U0-25	Current power up time	1min	7019H
U0-26	Current running time	0.1min	701AH
U0-45	Fault information	1	702DH
U0-61	Inverter working status	1	703DH

Related alarm code

Alarm showing	Alarm description	Alarm code
A.SLP	Sleep mode	81
A.LFr	Low frequency protection	82
A.LLd	Dry run/under load protection	83
A.OLd	Over current/ over load protection	84
A.LPr	Minimum power	85
A.FuL	Water tank full	86
A.Prb	Analog sensor problem failure	87
Err.98	Distributor running time reach	98
Err.99	Factory running time reach	99

Chapter9 Troubleshooting and Countermeasures

The below table listed PH380 series solar pump inverter all types of faults possibly occurs. Before contacting manufacturer for technical support, you can first determine the fault type through following table description and records your done treating process and phenomena. if the fault can not be resolved, please seek for the manufacturer service support.

Troubleshooting table

Fault code	Fault description	Possible reason	Countermeasures
Inverter unit protection	Err01	1, The inverter output circuit short circuit 2, the motor and inverter wiring is too long 3, the module overheating 4. The inverter wiring is loose 5, The circuit board abnormal 6, inverter module exception	1, Excluding the external fault 2, Install the reactor or output filter 3, Check the air duct is blocked; 4, Plug all the cable 5, Seek technical support
Over current in acceleration	Err02	1, Motor to ground short circuit 2, Not perform auto tuning 3, The acceleration time is too short 4, Torque boost is not appropriate 5, The grid voltage is low 6, Loading suddenly in acceleration 7, The using Inverter capacity (rated power is small	1, Excluding the external fault 2, Perform motor ID auto tuning 3, Increase the acceleration time 4, Adjust the torque boost or V / F curve 5, Adjust voltage of power supply to normal 6, Adjust the load 7, Select big power inverter instead
Over current in deceleration	Err03	1, Output short circuit or output to ground 2, No performance ID auto tuning for carrying vector control 3, The deceleration time is too short 4, The voltage is low 5, Loading suddenly when deceleration 6, No installing of brake unit and brake resistor	1, Excluding the external fault 2, Perform motor ID auto tuning 3, Increase the acceleration time 4, Adjust voltage of power supply to normal 5, Cancel the suddenly adding load 6, Install braking unit or braking resistor
Over current in constant speed running	Err04	1, The inverter output short circuit or phase to ground 2, No performance ID auto tuning for carrying vector control 3, The voltage of grid is low 4, Whether there is a sudden load in running	1, Excluding the external fault 2, Perform motor ID auto tuning 3, Cancel the sudden loading 4, Cancel the suddenly adding load 5. Select big power inverter instead

		5, The using Inverter capacity (rated power is small	
Over voltage in acceleration	Err05	1, The input voltage is high 2, The acceleration process there is an external drag motor running 3, The acceleration time is too short 4, No brake unit and brake resistor	1, Adjust voltage to the normal range Cancel the additional force or install braking resistor 3, Increase the acceleration time 4, Install the braking unit or braking resistor
Deceleration overvoltage	Err06	1, The input voltage is high 2, The process of deceleration there is an external drag motor running 3, Deceleration time is too short 4, No brake unit and brake resistor	1, Adjust voltage to normal range 2, Cancel the additional force or install braking resistor 3, Increase acceleration time 4, Install the braking unit or braking resistor
Over voltage in constant speed	Err07	1, Input voltage is high 2. ,The process of deceleration there is an external drag motor running	1. Increase voltage go normal range 2. Cancel external force or install braking resistor
Fault of control section power supply	Err08	1. Input voltage is out of limit	Adjust voltage to normal range
Under voltage fault	Err09	1, Instantaneous power failure 2, Input voltage is out of limit DC bus voltage is abnormal 4, rectifier bridge and buffer resistance is not normal	1, Reset the fault 2, Adjust the voltage to the normal range 3, seek technical support
Inverter over load	Err10	1.. If load is too big, or motor is blocked or not 2. Using inverter capacity is too small	1. Reduce the load and check the motor and machine condition 2. Select bigger one capacity of motor
Motor overload	Err11	1, The motor protection parameter P9-01 set is appropriate 2, The load is too large or motor is blocked 3, Using the power of inverter too small	Set correct parameter Reduce load or check motor and driving machine Select bigger power inverter
Input phase loss	Err12	1, Three-phase input power is not normal 2, The driving board exception 3, Lightning board abnormalities 4, The main control board exception	1, Check and eliminate the problems in the external lines 2, Seek technical support

Output phase loss	Err13	1, The inverter wiring is damaged 2, 3 phase output is not balance of inverter when motor running 3, Driving board is abnormal 4, IGBTmodel is abnormal	1, Excluding the external fault 2, Check the motor three-phase winding is normal and troubleshooting 3, seek technical support
IGBT module is over heat	Err14	1, The ambient temperature is too high 2, Air duct blockage 3, The fan is damaged 4, IIGBT module thermistor is damage 5, The inverter module is damaged	1, Reduce the ambient temperature 2, Clean up the duct 3, Replace the fan 4, Replace the thermistor 5, Replace the inverter module
External device fault	Err15	1, Through the multi-function terminal DI input external fault signal 2, Through the virtual IO function input external fault signal	1, Reset 2, Reset
communication fail	Err16	1, The host computer is not working properly 2, The communication line is not normal 3, Communication parameters PD group settings are not correct	1, Check the host computer wiring 2, Check the communication cable 3, Set the communication parameters correctly
Contactor failure	Err17	1, The driving board and power supply is not normal 2, Contactor is not normal	1, Replace the drive board or power board 2, Replace the contactor
Current detection failure	Err18	1, Check the Hall device exception 2, The driving board exception	1, Replace the Hall device 2, Replace the driver board
Motor tuning fault	Err19	1, The motor parameters are not set by nameplate 2, Parameter identification process timeout	Set motor parameters according to motor nameplate
Encoder fault	Err20	1, The encoder model does not match 2, The encoder connection error 3, The encoder is damaged 4, PG card exception	1, Check the encoder parameters 2, Excluding line wiring failure 3, Replace the encoder 4, Replace the PG card
EEPROM read and write failures	Err21	1, EEPROM IC broken	1, Replace the controller board
Inverter hardware failure	Err22	1, there is overvoltage 2, there is overcurrent	1, Troubleshooting as over voltage 2, Troubleshooting as over current
Short to ground	Err23	1, Motor to ground short circuit	1, Change motor cable or motor
The cumulative	Err26	1, The cumulative run time is	1, Clear the record with parameters

run time arrives		over the set the value	initialization
User Defined Fault 1	Err27	1, User define fault signal 1 with multi-function terminals. 2, User define fault signal 1 with virtual IO function	1, Reset 2, Reset
User Defined Fault 2	Err28	1 , User define fault signal 2 with multi-function terminals. 2, User define fault signal 2 with virtual IO function	Reset Reset
The cumulative power up time arrives	Err26	1, The cumulative power up is over the set the value	1, Clear the record with parameters initialization
Load missing	Err30	1,The running current of inverter less than P9-64	Check the load condition
PID feedback loss	Err31	1, PID feedback value less than PA-26	Check the PID feedback signal or set PA-26 value correct
wave by wave current limit fault	Err40	1, The load is too large 2, The inverter selection is too small	1, Check the load 2, Zoom in the inverter power level;
Motor switchover fault	Err41	1. Change the current motor selection through the terminal during the inverter operation	Switch motor in stop mode of inverter
The speed deviation is too large	Err42	1, The encoder parameter setting is not correct 2, No perform motor auto tuning 3, The speed deviation is too large , P9-69, P9-60 setting is unreasonable	1, Correct set encoder parameters 2, Motor auto tuning 3, Set correct value for P9-69, P9-60 per filed condition

Note:

The PH380 solar pump inverter can able to record the three latest three fault code, fault information such as output frequency, current, voltage, DC voltage, input terminals status and output terminals status with P9-14 to P9-44.These information can help user resolve problem.

Charter 10 Routine Inspection and Maintenance

Affected by ambient temperature, humidity, dust, vibration and internal device aging of the controller, problems might occur during operation. To make the inverter run stably, a periodic inspection must be performed every year.

Requirement of Inspection and Maintenance

1. The inspection must be performed by professional technical personnel.
2. Before working on the controller, always cut off the power supply and wait, until the display turns off.
3. Avoid leaving any metal components in the controller, or else they might cause damage to the equipment.
4. An electric insulation test has been made on the controller before it has left factory. A withstand-voltage test is not necessary.
5. It is forbidden to use the megohmmeter to test in the control circuit.
6. When conducting insulation test on the motor, you have to disconnect the connection between motor and controller.

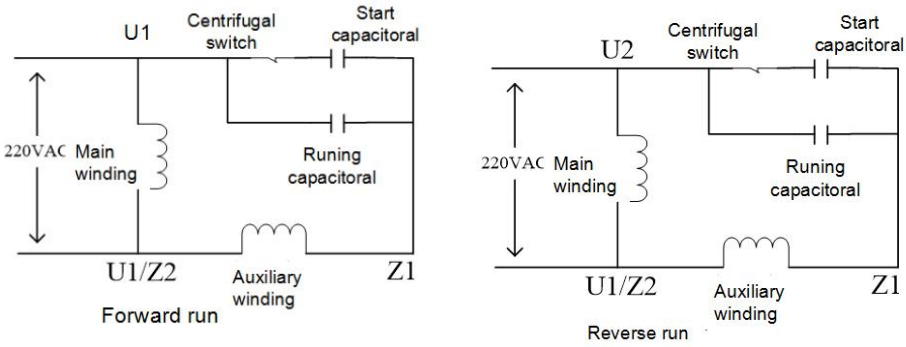
Warranty card

User name	
Company name and address	
Contact telephone	
Products mode	
Products series number	
Fault code	
Fault occurs time	
Fault description in detail	
Suggestion if you have	

Appendix 1.PH380 Solar Pump Inverter For Driving 1 Phase 220V Pumps

(Version 12.13 and his above version can use to drive 1 phase 220V pumps, check P7-11 software version value)

1. Working principle of 1 phase motor (pumps)



Single-phase motor is mainly composed of main winding (U1 / U2), auxiliary winding (Z1 / Z2), running capacitor, starting capacitor, centrifugal switch;

Single-phase (220VAC) power supply needs to be reversed, the need to exchange U1, U2 (or Z1 / Z2) wiring to achieve;

3. Start capacitor capacitance value is generally larger than the running capacitor, can improve the starting torque;

The start capacitors will be disconnect when motor rotation speed reaches a certain value via a centrifugal switch, and there are no build starting capacitor for some light load starting motor.

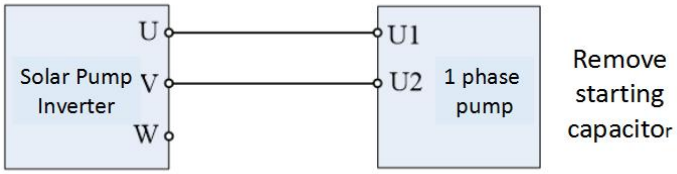
2. PH380 drive single-phase motor:

P0-01	1st motor control mode	0: VF control 1: Sensorless vector control (SVC) 2: PG sensor vector control (FVC) 3: 2 wires output for single phase pumps 4: 3 Wires for single phase pumps	0
P0-20	Single - phase motor balance coefficient (Three-phase output)	0.0 - 2.0	1.0

There are 2 driving modes for using inverter to drive 1 phase motor. It is select by P0-01 parameters, for 1 phase output mode or 3 phase output mode. It can able to adjust the output voltage ratio through P0-20 when working on 3 phase output mode.

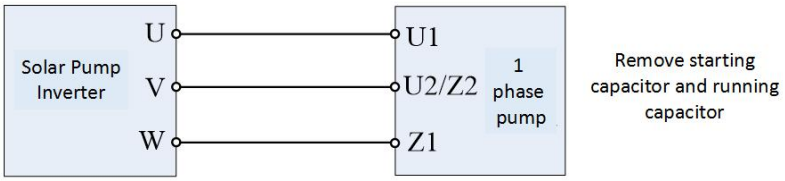
It is also request to set motor group parameters(P1 group) when driving 1 phase motor or pumps. And also can adjust the output torque capacity with P3-01 parameters.

2.1. 2 wire output mode (P0-01 = 3): The mode wiring as follows:



In this control mode, the start capacitor is removed. Connect the 2 wires cable of 1 phase pump to U and V, V and
W or U and W. It can get large adjusting speed range due to starting capacitor have been remove. Through increase the value of P3-01 can increase the start torque and improve the starting capacity.
It is not allow to change running direction in this control mode. Please change the cable wiring to change running direction if need.

2.2. 3 wires output mode (P0-01 = 4): This mode wiring as shown below



When selecting this mode, the starting and running capacitor must be remove. Adjusting the P0-20 value can able to change the UV/ WV voltage ratio (the bigger P0-20, the bigger WV, and smaller UV).

Because the output voltage phase is difference 90°, so the output voltage can't reaches $Udc/\sqrt{2}$, only can reaches $Udc/2$ (P0-20=1.0).
The load driving capacity is not too strong compare to drive 3 phase AC pumps, and running current will be higher.
Please select one more rated power inverter for drive 1 phase pumps.
It is able to change running direction in this control mode by setting parameters.

Appendix 2 PH380 Solar pump inverter for PMSM pumps supplementary instructions.

The documentation needs to be used in together with the operation manual of PH380, it is supplementary for manual.

PH380 has two motor control algorithms for driving permanent magnet synchronous motor, which set by P1-00 and P0-01 both parameters.

	P0-01=0 (VF scalar control)	P0-01=1 (Sensorless vector control)
P1-00=0/1 (IM)	Asynchronous motor VF control	Asynchronous motor vector control
P1-00=2 (PMSM)	Permanent magnet motor scalar V/F control	Permanent Magnet Motor Vector Control

The vector control is superior to the scalar (V/f) control in terms of motor control performance such as low frequency torque, stability, current waveform and so on. However, the scalar control is not sensitive to the motor back EMF parameter (P1-20). The vector control requires accurate setting or identification of the motor back electromotive force; Both control algorithms need to obtain accurate stator resistance, inductance parameters (P1-16 ~ P1-18);

It is recommended sensorless vector control for driving solar PMSM pumps.

PH380 permanent magnet synchronous motor control need to set the following motor nameplate parameters:

P1-00	Motor type selection	0: General induction motor (AM) 1：Variable speed induction motor（AM） 2: Permanent magnet synchronous motor（PM）
P1-01	Rated motor power	0.1kW～1000.0kW
P1-02	Rated motor voltage	0V～2000V
P1-03	Rated motor current	0.01A～655.35A(Rated power of inverter <= 55kW) 0.1A～6553.5A(Rated power of inverter > 55kW)
P1-04	Rated motor frequency	0.00Hz～Maximum（P0-10）
P1-05	Rated motor speed	0rpm ～ 65535rpm

Permanent magnet motor model parameters are as follows: (obtained by parameter identification of motor auto tuning)

P1-16	Stator resistance	0.001Ω～65.535Ω(Rated power of inverter<=55kW) 0.0001Ω～6.5535Ω(Rated power of inverter>55kW)
P1-17	D-axis inductance	0.01mH～655.35mH(Rated power of inverter<=55kW) 0.001mH～65.535mH(Rated power of inverter>55kW)
P1-18	Q-axis inductance	
P1-20	Back Electromotive Force	0.1V～6553.5V

Synchronous motor parameter identification: P1-16 ~ P1-20 motor model parameters can be obtained through parameter identification, the following steps:

P1-37 set to 11: permanent magnet motor static auto tuning if load is unable to disconnect (back EMF by nameplate parameters automatically calculated)

P1-37 set to 12: permanent magnet motor without load completely auto tuning, it request to remove the load first, and then take motor auto tuning.

If the control algorithm for the scalar control (P0-01 = 0), carry the static auto tuning is okay, do not need to remove the load; vector control need to obtain accurate back EMF parameters, if the application site is not easy to disconnect the load,user can set Back electromotive force by manual.

(Note: When the P1-37 set to 1,2 for the asynchronous motor auto tuning; parameters from the learning, especially dynamic self-learning need to stabilize the power supply, the best use of AC electricity supply. Means we can do motor auto tuning with AC power input first before using in solar system.)

Notes :

Vector control related parameters: it is no need to adjust vector control related parameters in generally. Please see the below list.

P2-00 ~ P2-05 for the speed loop PI parameters, vector control is effective; adjust the PI parameters can get better speed control effect;

P2-13 ~ P2-16 for the axis current loop PI parameters, vector effective; adjust the parameters of the group can improve the stability, current response;

P2-17 ~ P2-18 for the vector control observer (observer) parameters, adjust the observer gain can improve the stability;

P2-21: Start pull into the current size settings, vector / scalar algorithm is valid; increase the pull-in current can improve the low-frequency start torque;

P2-30 ~ P2-34 for the scalar control parameters: P2-30 oscillation suppression used to improve the stability; P2-32 excitation depth for the search to obtain the minimum current;

P2-00	Speed loop proportional gain 1	1～100	
P2-01	Speed loop integral time 1	0.01s～10.00s	
P2-02	Switching frequency 1	0.00～P2-05	
P2-03	Speed loop proportional gain 2	1～100	
P2-04	Speed loop integral time 2	0.01s～10.00s	
P2-05	Switching frequency 2	P2-02～Maximum frequency	
P2-06	Slip compensation coefficient	50%～200%	
P2-07	Speed loop filter time constant	0.000s～0.100s	
P2-08	Vector control over excitation gain	0～200	
P2-10	Current upper limit / torque upper limit	0.0%～200.0%	
P2-13	M-axis current loop	0～20000	

	proportional gain		
P2-14	M-axis current loop integral gain	0～20000	
P2-15	T-axis current loop proportional gain	0～20000	
P2-16	T-axis current loop integral gain	0～20000	
P2-17	Observer gain	0.1% - 999.9%	
P2-18	Observe the filter time	0.1 - 100.0ms	
P2-19	AM pre-excitation gain	0 - 9999ms	
P2-20	PM open loop start mode	0: direct start; 1: position detection start 2: DC pull-in start	
P2-21	Pull in current	0.0% - 200.0%	
P2-22	MTPA gain	0.0% - 999.9%	
P2-23	MTPA filter	1ms - 9999ms	
P2-24	PMSM weak current limit	0.1% - 200.0%	
P2-25	PMSM Weak Magnetic Feedforward Gain	0.1% - 999.9%	
P2-26	PMSM weakening ratio gain	0 - 9999	
P2-27	PMSM weak Magnetic Integral Gain	0 - 9999	
P2-30	Oscillation suppression gain	0.1% - 100.0%	
P2-31	Current loop gain	0.1 - 20.0	
P2-32	Excitation depth	0.1% - 500.0%	
P2-33	Excitation control proportional gain	0 - 5000	
P2-34	Excitation control integral gain	0 - 5000	
P2-35	DC pull time	0 - 9999	
P2-36	DC pull-in transition frequency	0.0 - 100.0%	
P2-37	DC pull-in cut-off frequency	0.0 - 100.0%	

The Procedure of operation for PMSM driving.

1, Set P0-01=1 and P1-00=2 parameters for starting PMSM running.

Set PMSM motor parameters. P1-01 to P1-05, P1-16 to P1-20.(if the load is difficult to disconnect from motor, please set P1-20 BEF (Back Electromotive Force) accuracy from motor nameplate.

Set P1-37=12 to perform motor completely auto tuning if load is able to discount from motor, set P1-37=2 to perform motor static auto tuning if load is can't remove from the load.

If the performance is not good, please adjust some related parameter from P2-00 to P2-37.

Appendix 3 Communication protocol

PH380 series solar pump inverter can select the RS485 communication interface. The international standard ModBus communication protocol is adopted for master-slave communication. The consumer can carry out centralized control by PC/PLC, upper machine, main station solar pump inverter etc (Setting of the solar pump inverter control command, running frequency, relative function parameters modification, solar pump inverter working state and malfunction information monitoring etc.. to adapt to the special application requirements.

2. Protocol content

This ModBus protocol defines the information content and format of asynchronous transmission in series communication. It includes: host machine polling, broadcast and the format of slave machine response. Host machine data frame includes: slave machine address (or broadcast address), ask action code, data and fault check. Slave machine response is same structure: action check, back data and fault check. If slave machine meet fault while accept frame, or can't compete the action asked, fault information will be feed back to host machine.

3. Application mode

PH380 series solar pump inverter has control network for "single host machine and many slave machines" with R2S32/RS485.

Remote RS485 communication needs shield cable and shield grounding.

For long distance communication, we suggest to open J6 and add 120Ωresistance to prevent signal reflection.

4. Main line structure

1, Port mode: RS485 port

2, Transmission mode: Asynchronous series, half duplex transmission mode. At same time, one of the host machine and slave machine sends data, anther receives data. Data is sent one by one frame as report form in asynchronous series communication.

3, Topological structure: One host machine with several slave machines. Range of slave machine address is 1 to 247. O is broadcast address. Every slave machine address is only one. It is the base of ModBus series communication.

5. Protocol explain

PH380 series solar pump inverter communication protocol is main-slave ModBus communication protocol of asynchronous series. In the net, only the host machine can set up protocol "inquire/ order". Slave machines can only respond to host machine. Host machine means PC, main solar pump inverter, industrial control equipment or PLC…

Slave machines are PH380 solar pump inverters and other control equipments with same communication protocol. Host machine can communicate with only one slave machine or broadcast to all slave machines. Slave machine need feedback every "inquire/order" of host machine, but no need feedback broadcast.

5.1 Communication frame structure

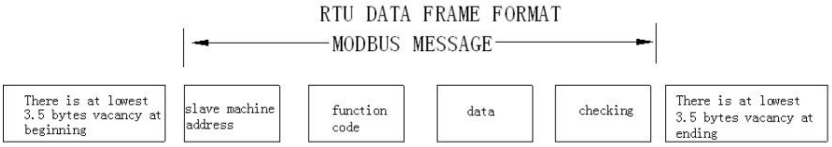
The ModBus protocol communication data format of PH380 series solar pump inverter is RTU (remote terminal unit) mode. Communication data format is as follows:

The byte composition: Include initiation bit, 8 data bit, check bit and stop bit.

Initiatio	Bit	Bit	Bit	Bi4	Bit	Bit	Bit	Bit	No check bit	stop

n bit	1	2	3	T	5	6	7	8	Even check bit Odd check	bit

In RTU mode, it always starts after at least 3.5 byte transmission time which is easy realized under Baud rate. And next data is: slave machine address, operation order code, data and CRC check. Every domain transmission is hexadecimal 0...9， A...F. Network equipment detects the network bus unceasingly, including the interval time. While receiving the first domain (address information, each network equipments carry out decoding to judge whether the byte is for itself. While the final byte transmission is completed, there will be at least 3.5 bytes transmission time interval to indicate that this frame is over. Then a new information' transmission can begin



One frame message must be transmitted as a continued data flow. If there is a pause over 1.5 byte before the end, the receiving equipment will clear the half-baked information. And the next byte will be considered as the address domain of a new frame. Similarly, if the interval between a new frame start-up and the former frame is smaller than 3.5 byte time, the receiving equipment will think that it is the former one frame continuation. Because of the jumbled frame, finally CRC checking value is incorrect, what leads to the communication mistake.

RTU frame's standard structure

Frame start	The transmission time of 3.5 bytes in silent
Slave address ADDR	0~247(0 broadcast address)
Executive command MD	03H：Read slave parameters
Function code H	Inverter inside parameters, divided into functional code and non-functional patterns (such as operating status parameters, run the command, etc.) parameters, see the address definition. When transmitting, the high byte is preceded by the low byte
Function code L	
Function code H	The number of function codes read by this frame, if 1 is to read a function code. When transmitting, the high byte is preceded by the low byte in the post. This protocol can only rewrite a function code at once,
Function code L	
Data H	The data to be answered, or the data to be written, is transmitted when the high byte is preceded by the low byte in
Date L	
CRC CHK high byte	Detection value: CRC16 check value. When transmitting, the high byte is preceded by the low byte in the post. The calculation method is described in the CRC check in this
CRC CHK low byte	
END	3.5 characters

CRC check mode --- CRC (Cyclical Redundancy Check)

Use RTU format, frame include Framing Error detection domain calculation method based on CRC. CRC field checks the contents of the entire frame. CRC field is two bytes, containing a 16-bit binary. After it is calculated by the transmission equipment is added to the frame. The receiving device receiving the frame recalculate the CRC, and compared with the value received in the CRC field, if not equal, then the transmission errors.

CRC is first stored in 0XFFFF, then calls a procedure in the frame byte and the value of the current register for processing. Only 8Bit data for each byte CRC is valid, the start and stop bits and the parity bits are invalid.

CRC generation process, each 8 bytes are separate and distinct register contents or (XOR), the result moves to the least significant bit direction, the most significant bits padded with 0s. LSB is extracted detect if LSB is 1, the preset value register individually and XOR, if LSB is 0, no. The whole process is repeated eight times. After the last (eight), the next 8-bit byte is exclusive content dissimilar or register. The final value of the register is CRC value of the frame in all bytes after the execution.

CRC This calculation method using the international standard CRC check rules, the user when editing CRC algorithm, can refer to the relevant standard CRC algorithm to write a CRC calculation program really meet the requirements.

CRC now offers a simple function to calculate the user's reference (C programming language):

```
unsigned int crc_cal_value(unsigned char *data_value, unsigned char data_length)
#define uint      unsigned int
#define uchar     unsigned char uint crc_chk_value(uchar *data_value , uchar length)
{
uint crc_value ;
int    i ;

      crc_value = 0xFFFF
while(length --)
      {
            crc_value ^= *data_value ++ ;
for(i=0;i<8;i++)
            {
if(crc_value & 0x0001)
                  {
                        crc_value = (crc_value >> 1) ^ 0xA001 ;
}else
                  {
                        crc_value = crc_value >>1 ;
                  }
            }
      }
return crc_value ;
}
```

Function Code Parameter Addressing Rules:

With the function code group number and label for the parameter address that rules:

High byte: P0 ~ PF (group F), 70 (U group); low byte: 00 ~ FF

For example, if the range function code P3-12 is to be used, the access address of the function code is represented as 0xF30C;

Note: PF group parameters: neither read nor change; U group: only read, can not change the parameters.

Some parameters can not be changed when the inverter is running. Some parameters can not be changed regardless of the state of the inverter. Change the function code parameters and pay attention to the range, unit and description of the parameters.

Function code	Communication access address	Communication Modifies the function code address in RAM
P0～PE group	0xF000～0xFEFF	0x0000～0x0EFF
U0 group	0x7000～0x70FF	Can't modify

Note: Because EEPROM is frequently stored, will reduce the EEPROM's life, so some function code in the communication mode, no need to store, just change the value of RAM on it. If the P group parameters, to achieve this function, as long as the function code address high F to 0 can be achieved.

The corresponding function code address is as follows:

High byte: 00 ~ 0F (group F); low byte: 00 ~ PF

For example: Function code P3-12 is not stored in the EEPROM, the address is expressed as 030C; the address that can only write RAM, can not read the action, read, for the invalid address.

For all parameters, you can also use the command code 07H to achieve this function.

Shutdown / Run Parameters Section:

Monitor parameters	Monitoring contents	Unit	Address
U0-00	Output frequency	0.01Hz	7000H
U0-01	Preset frequency	0.01Hz	7001H
U0-02	Input DC voltage of PV arrays	0.1V	7002H
U0-03	Output voltage	1V	7003H
U0-04	Output current	0.01A	7004H
U0-05	Input power of PV arrays	0.1KW	7005H
U0-06	Current of PV arrays	0.01A	7006H
U0-07	DI input status	1	7007H
U0-08	DO output status	1	7008H
U0-09	AI1 of terminal	0.01V	7009H
U0-10	AI2 of terminal	0.01V	700AH
U0-11	Motor (Pump) speed	1rpm	700BH
U0-12	PV open loop circuit voltage (Voc)	0.1V	700CH
U0-13	Flow rate of pump	0.1m^3/hr	700DH
U0-14	Day flow (8H/day)	0.1m^3	700EH

U0-15	Flow accumulation（low-order digit)	0.1m^3	700FH
U0-16	flow accumulation（low-order digit)	0.1Km^3	7010H
U0-17	Day generated power (8H/day)	0.1kwh	7011H
U0-18	Generated accumulation （low-order digit)	0.1kwh	7012H
U0-19	Generated accumulation （high-order digit)	0.1Mwh	7013H
U0-20	The rest running time	0.1Min	7014H
U0-24	Pumps speed	1 r/min	7018H
U0-25	Current power on time	1min	7019H
U0-26	Current running on time	0.1min	701AH
U0-45	Fault information	1	702DH
U0-61	Inverter working status	1	703DH

Inverter working status: 0: stop, 1: Forward running; 2: reverse running

3. For the data of the torque dimension, the percentage is P2-10 (torque upper limit digital setting).

Control command input to Invert: (write only)

Read the Inverter status: (read only)

Address of command	Command function
2000H	0001: Forward
	0002: Reverse
	0003: Jog forward
	0004: Jog Reverse
	0005: Free stop
	0006: Deceleration
	0007：Fault reset

Status word address	Status word function
3000H	0001: Forward run
	0002: Reverse run
	0003: Stop

Parameter lock password verification: (if returned to 8888H, that means that password verification)

Password address	Enter the contents of the password
1F00H	*****

Digital output terminal control: (write only)

Command address	Command contents
2001H	BIT0: DO1 output control BIT1: DO2 output control BIT2: RELAY1 output control BIT3: RELAY2 output control

	BIT4: FMR output control

Analog output AO1 control: (write only)

Command address	Command contents
2002H	0 ~ 7FFF means 0% ~ 100%

Analog output AO2 control: (write only)

Command address	Command contents
2003H	0 ~ 7FFF means 0% ~ 100%

Pulse (PULSE) Output Control: (write only)

Command address	Command contents
2004H	0 ~ 7FFF means 0% ~ 100%

Inverter fault description:

Inverter fault address	Inverter fault information	
8000H	0000: No fault 0001: Reserved 0002: Accelerated overcurrent 0003: Deceleration overcurrent 0004: constant speed overcurrent 0005: Accelerated overvoltage 0006: Deceleration overvoltage 0007: constant speed overvoltage 0008: Buffer resistance overload fault 0009: Undervoltage fault 000A: Inverter overload 000B: motor overload 000C: Input phase loss 000D: Output phase loss 000E: module overheat 000F: External fault 0010: communication error 0011: contactor is abnormal 0012: Current detection fault 0013: Motor tuning fault 0014: Encoder / PG card fault	0015: Parameter read and write exception 0016: Drive hardware failure 0017: Motor to ground short circuit fault 0018: Reserved 0019: Reserved 001A: Run time arrives 001B: user defined fault 1 001C: User Defined Fault 2 001D: Power-up time arrives 001E: Drop 001F: Runtime PID feedback lost 0028: Fast current limit timeout 0029: Motor is switched at runtime 002A: The speed deviation is too large 002B: motor speed 002D: motor overtemperature 005A: Encoder line setting error 005B: Missed encoder 005C: initial position error 005E: Speed feedback error

Information description data (fault code):

Communication fault address	Fault function description	
8001H	0000: No fault 0001: Password is incorrect	0005: invalid parameter 0006: parameter change is

	0002: Command code error 0003: CRC check error 0004: Invalid address	invalid 0007: The system is locked 0008: operating in EEPROM

PD group communication parameter description

Pd-00	Baud rate	Factory default	6005
	Set range	Bit: MODBUS baud rate	
		0：300BPS 1：600BPS 2：1200BPS 3：2400BPS 4：4800BPS	5：9600BPS 6：19200BPS 7：38400BPS 8：57600BPS 9：115200BPS

Pd-01	Data Format	Factory default	0
	Set range	0: No parity: Data format <8, N, 2> 1: Even test: Data format <8, E, 1> 2: Odd parity: data format <8, O, 1> 3: No parity: Data format <8-N-1>	

Pd-02	Local address	Factory default	1
	Set range	1～247，0 is the broadcast address	

When the local address is set to 0, that is, broadcast address, to achieve the host computer broadcast function.

The local address is unique (except for the broadcast address), which is to achieve the host computer and the inverter point to point communication basis.

Pd-03	Response delay	Factory default	2ms
	Predetermined area	0～20ms	

Pd-04	Communication timeout	Factory default	0.0 s
	Set range	0.0 s（ invalid ） 0.1～60.0s	

Whe n the function code is set to 0.0 s, the communication timeout parameter is invalid.

When the function code is set to a valid value, the system will report a communication error (Err16) if the interval between the next communication and the next communication exceeds the communication timeout period. Normally, it is set to invalid. If you set the secondary parameter in a continuous communication system, you can monitor the communication status.

Pd-05	Communication protocol selection	Factory default	0

	Set range	0: non-standard Modbus protocol 1: Standard Modbus protocol

PD-05 = 1: Select the standard Modbus protocol.

PD-05 = 0: When reading a command, the number of bytes returned by the slave is one byte more than the standard Modbus protocol.

Pd-05	Communication read current resolution	Factory default	0
	Set range	0：0.01A 1：0.1A	

Used to determine the output unit of the current value when the communication reads the output current.

Example：forward running reverse running stop, and reset operation command word as following:

Button name:	RUN	Send instruction:	01 06 20 00 00 01 43 CA	Return instruction:	01 06 20 00 00 01 43 CA
Button name:	REV	Send instruction:	01 06 20 00 00 02 03 CB	Return instruction:	01 06 20 00 00 02 03 CB
Button name:	STOP	Send instruction:	01 06 20 00 00 05 42 09	Return instruction:	01 06 20 00 00 05 42 09
Button name:	RESET	Send instruction:	01 06 20 00 00 07 C3 C8	Return instruction:	01 06 20 00 00 07 C3 C8

Appendix 4 Selection of Peripheral Electrical Devices of PH380

1. Selection of peripheral electrical devices

Inverter Model	MCCB	Contactor	Cable of Input Side Main Circuit	Cable of Output Side Main Circuit	Cable of Control Circuit
	(A)	(A)	(mm2)	(mm2)	(mm2)
Single-phase 220 V					
PH380-2S-0P7G	10	12	0.75	0.75	0.5
PH380-2S-1P5G	16	18	1.5	1.5	0.5
PH380-2S-2P2G	25	25	2.5	2.5	0.5
PH380-2S-004G	32	32	4	4	0.75
Three-phase 380 V					
PH380-4T-0P7G	4	9	0.75	0.75	0.5
PH380-4T-1P5G	6	9	0.75	0.75	0.5
PH380-4T-2P2G	10	12	0.75	0.75	0.5
PH380-4T-004G	16	18	1.5	1.5	0.5
PH380-4T-5P5G	20	25	2.5	2.5	0.75
PH380-4T-7P5G	25	25	4	4	0.75
PH380-4T-011G	32	32	6	6	0.75
PH380-4T-015G	40	40	6	6	0.75
PH380-4T-018G	50	50	10	10	1
PH380-4T-022G	50	50	10	10	1
PH380-4T-030G	63	63	10	10	1
PH380-4T-037G	80	80	25	25	1
PH380-4T-045G	100	115	35	35	1
PH380-4T-055G	125	125	50	50	1
PH380-4T-075G	160	185	70	70	1
PH380-4T-090G	200	225	95	95	1
PH380-4T-110G	225	225	120	120	1
PH380-4T-132G	315	330	120	120	1

2. Out put reactor (OCR)

This reactor is used for suppress the capacitive charging current of connection cable between inverter and motor, and passivate the voltage rising rated of PWM as well. It is mounted at the output side of frequency inverter. When the distance of cable between inverter and motor over a value, suggest installed output rector to compensate recharge current of line capacitive.
Product application
1. Limit DV/DT to 500V/us
2. Limit the overvoltage of motor .
3. Reduce the leakage current of motor
4. Reduce the interference generated by contactor which mount between filter and motor.
5. If the distance from pump to inverter over than 150M, less than 300M, suggest install output reactor.

3. DV/dT filters with VFDs Introduction

A dV/dT filter is a device that controls the voltage spikes generated by variable frequency drives (VFDs) and long motor lead lengths. This voltage spike event is generally known as the reflected wave phenomenon . This resulting reflected wave can cause very high voltages on the motor leads, which can lead to damage and premature failure of the motor winding insulation (even with inverter duty rated motors), particularly within the first few turns.
Taking these factors into account will assist in the performance of the dV/dT filter in the application and the protection of the motor from dangerous reflected wave voltages up to 1000 feet from the VFD. (VFD means inverter)

4.Sine Wave Filter (SFR)

Sine Wave Filter are designed to provide a Sine Wave output voltage when driven from Variable Frequency Drives or other types of PWM inverters with switching frequencies from 2kHz to 8kHz.
For Variable Frequency Drive (VFD) applications, Sine Wave Filters eliminate the problem of motor/cable insulation failures, heating, and audible noise. Sine Wave Filters also reduce electromagnetic interference (EMI) by eliminating the high dV/dt associated with inverter output waveforms. Bearing currents are also reduced, especially in larger motors above 50 kW.
The perfect solution for:
•he perfect solution for: ve (VFD
•he perfect solution for:
•he perfect solution for: ve (VFD) ap
•he perfect solution for: ve (VFD) applications, Sine W
•he perfect solution between 350 and 3000 meters

Above reactor and filter can improve the inverter performance especial long distance from pump to inverter. If need more details and help, please feel free to contact us.

Appendix 5 : Solar Panel Selection Description

Required DC(VOC) and power from Solar Panels

Ac pumps,PH380 solar pump inverter and Solar panels				
Pump type	Inverter model	Vmp from Solar array	Voc from Solar array	Total power from Solar array
220v Ac pump	PH380-2S-XXX	310VDC	372VDC	More than 1.3times of the Pump power. More power input, better performance. (Also it ups to your solar panel quality)
380v Ac pump	PH380-4T-XXX	540VDC	648VDC	

Vmp: Max. Power Voltage Voc: Open Circuit Voltage

Recommend Solar Array selection table

For example: Solar Panel Specification: 265W, 38 Voc , 31 Vmp				
PH380 Solar Pump Inverter	Power of the Ac Pump	Connection in series(pcs) (Vmp)	Connection in parallel (Strings) Power	Total solar panel (pcs)
2S(220v model)	0.75-1.5kw	10pcs	1 string	10*1=10pcs
2S(220v model)	2.2kw	11pcs	1 string	11*1=11pcs
4T(380v model)	0.75-2.2kw	18pcs	1 string	18*1=18pcs
4T(380v model)	3.7kw	19pcs	1 string	19*1=19pcs
4T(380v model)	5.5kw	18pcs	2 strings	18*2=36pcs
4T(380v model)	7.5kw	19pcs	2 strings	19*2=38pcs
4T(380v model)	11kw	18pcs	3 strings	18*3=54pcs
4T(380v model)	15kw	19pcs	4 strings	19*4=76pcs