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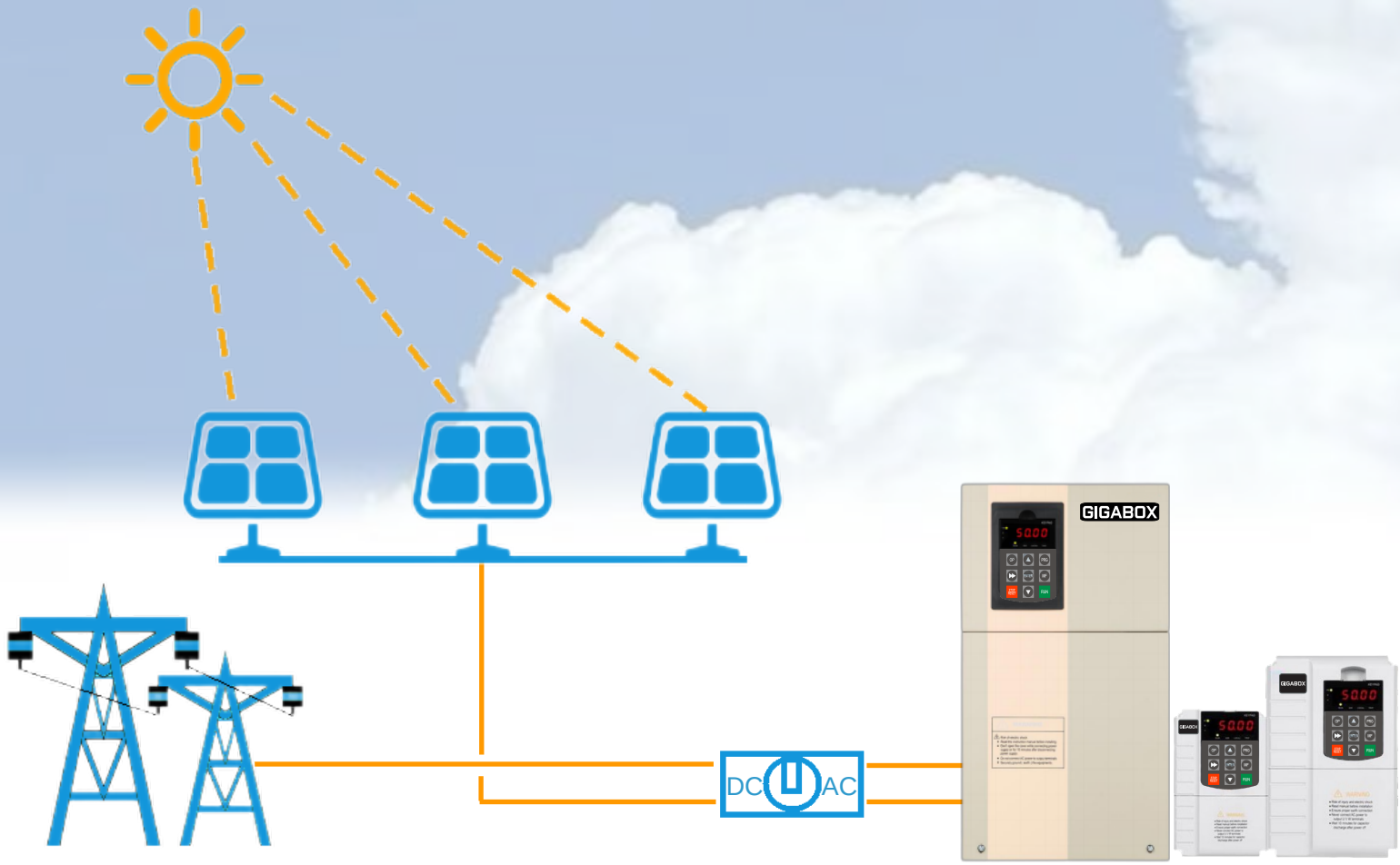


GW20 Solar Pump Inverter Operation Manual V3

Low carbon economy
In-built MPPT with high efficiency
Pump specific protection
Remote monitoring
Best off grid solution
Perfect stable frequency output

Contents

Chapter 1. About this manual

This chapter provides an overview of the contents, purpose, compatibility, and the intended audience of this manual.

The GW20series solar pump inverters is a low voltage pumps inverter of 0.3 to 400KW above rating designed to operate with energy drawn from solar panel or photovoltaic cells (PV).

The inverters is customized to operate in dual supply mode (Ac and DC), 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.

This supplement manual intends to serve as a quick start guide for installing, commissioning and operating the GW20solar pump inverter.

This manual includes all the required parameters settings and program features specific to the solar pump inverters.

READ AND FOLLOW ALL INSTRUCTIONS BEFORE INSTALLATION DURING USING.

When installing and using this electrical equipment, basic safety precautions should always be followed, including the following:


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


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


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


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

Chapter 2. Solar pumping system and inverter features.

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 live stock watering, agricultural irrigation, forestry irrigation, pond management, desert control, and industrial use such as waste water treatment etc.
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 inverter 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).

GW20solar pump inverter (drive) is customized to operate in dual supply mode (AC and DC), so the grid connected supply is used in the absence of energy from PV cells. This inverters functions with the latest in technology maximum power point tracking (MPPT) algorithm to derive maximum power from the PV cells at any instant.

- ✧ Maximum power point tracking (MPPT) with fast response speed and stable operation efficiency > 99.6%;
- ✧ High speed running when sunlight radiation is good, frequency reduce fast when sunlight is become weak, stop running when output frequency lower lower limit frequency setting.
- ✧ Suits for most 1/ 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 simultaneously.
- ✧ Built in automatic sleep-wake up function, start by timer is option.
- ✧ Dry run (under load) protection, Pumps loss phase protection, over current protection...
- ✧ Pumps 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/LCD display operating panel and support remote control
- ✧ Low water probe sensor, and water level control function
- ✧ Strong lightning protection
- ✧ Easy operation and Voc voltage auto detection function
- ✧ GPRS function is option for remote start and stop, remote parameters setting.
- ✧ Clock relay card for timing stop and stop control

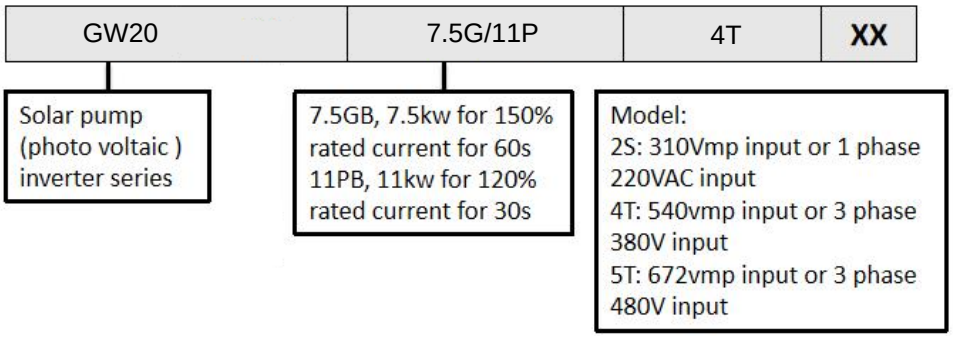
2.1. Solar pump inverters model description

The nameplate of GW20series solar pump inverter

GW20M means mini size models

GW20Smeans for OEM design with steel cover

GW20Imeans for IP55 high protection class, water proof dusty proof, outdoo



2.2. Solar pump inverter models and specification

SN	Models	Rate current	Output voltage (3PH VAC)	Applicable for pumps	MPPT voltage (VDC)
Mini type 2S series : 90/150 to 450 VDC or 220VAC input,Vmp 310V,Voc 380V					
1	GW20-0K7GB-2S-M	3.8A	0-220VAC	0.75KW	260 to 375
2	GW20-1K5GB-2S-M	7A	0-220VAC	1.5KW	260 to 375
3	GW20-2K2GB-2S-M	10A	0-220VAC	2.2kw	260 to 375
4	GW20-4K0GB-2S	17A	0-220VAC	4.0KW	260 to 375
General type: 4T, 250/350 to 800 VDC or 380 input, Vmp520, Voc 650					
1	GW20-0K7GB-4T-M	2.3A	0-380V	0.75KW	486 to 750
2	GW20-1K5GB-4T-M	3.8A	0-380V	1.5KW	486 to 750
3	GW20-2K2GB-4T-M	5.1A	0-380V	2.2KW	486 to 750
4	GW20-0K7GB-4T	2.3A	0-380V	0.75KW	486 to 750
5	GW20-1K5GB-4T	3.8A	0-380V	1.5KW	486 to 750
6	GW20-2K2GB-4T	5.1A	0-380V	2.2KW	486 to 750
7	GW20-4K0GB-4T	10A	0-380V	4.0KW	486 to 750
8	GW20-5K5GB-4T	13A	0-380V	5.5KW	486 to 750
9	GW20-7K5GB-4T	17A	0-380V	7.5KW	486 to 750
10	GW20-011GB-4T	25A	0-380V	11KW	486 to 750
11	GW20-015GB-4T	32A	0-380V	15KW	486 to 750
12	GW20-018GB-4T	37A	0-380V	18KW	486 to 750
13	GW20-022GB-4T	45A	0-380V	22KW	486 to 750
14	GW20-030G-4T	60A	0-380V	30KW	486 to 750
15	GW20-037G-4T	75A	0-380V	37KW	486 to 750
16	GW20-045G-4T	91A	0-380V	45KW	486 to 750
17	GW20-055G-4T	110A	0-380V	55KW	486 to 750
18	GW20-075G-4T	150A	0-380V	75KW	486 to 750

19	GW20-090G-4T	180A	0-380V	90KW	486 to 750
20	GW20-110G-4T	220A	0-380V	110KW	486 to 750
21	GW20-132G-4T	260A	0-380V	132KW	486 to 750
22	GW20-160G-4T	320A	0-380V	160kw	486 to 750
23	GW20-185G-4T	340A	0-380V	185kw	486 to 750
24	GW20-200G-4T	380A	0-380V	200kw	486 to 750
25	GW20-220G-4T	415A	0-380V	220kw	486 to 750
26	GW20-250G-4T	470	0-380V	250kw	486 to 750
27	GW20-280G-4T	520A	0-380V	280kw	486 to 750
28	GW20-315G-4T	585A	0-380V	315kw	486 to 750
29	GW20-355G-4T	650A	0-380V	355kw	486 to 750
30	GW20-400G-4T	725A	0-380V	400kw	486 to 750
IP55 high protection class models up to 220V 7.5kw models are available IP55 high protection class models up to 380V 22kw models are available OEM steel housing design for 0.75kw to 22kw models are option					

2.3 External Diemension

（kW）	H（mm）	W（mm）	D（mm）	G.W（kg）
	External Diemension			
4	290	205	225	3.5
5.5	290	205	225	3.5
7.5	290	205	225	3.5
11	390	295	280	6
15	390	295	280	6
18.5	390	295	280	6
22	590	340	300	10
30	590	340	300	10

2.3.Solar pump inverter technical specification

GW20Solar pump inverter specification when PE-00=1&2	
Recommended MPPT voltage range	Vmp 131 to 350 VDC for 1s 3 phase 110VAC pumps Vmp 260 to 355VDC for 2S 3 phase 220VAc pumps Vmp 486 to 650 VDC for 4T 3 phase 380VAc pums
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 Voc 820(VDC), Vmpp 676(VDC) for 5T model or 480V AC pumps
Motor type	Permanent magnet synchronous motor Asynchronous motor pumps. (surface pumps, submersible pumps...)
Rated output voltage	1/3-Phase,110V/160V/220V. 3-phase, 220V/380V/460V
Output frequency range	0~maximum frequency 600Hz.
MPPT efficiency	Above 99.8%,
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, IP55/PI65 are option
Running mode	MPPT or CVT
Altitude	Below 1000m; above 1000m, derated 1% for every additional 100m.
Enhanced version of AC drive	CE, Design based on vector control motor AC drive, more specification please refer to S600 or S600 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.

Chapter 3. Keypad operation control panel description

3.1. Press function key description

Key symbol	Name	Function description
	Menu key	Enter menu or
	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,Current output voltage,Current output current,DC bus voltage value ,DC bus current ,Input power
	Running key	Us 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 RESET	Stop and reset	In running status, this key can use to stop motor running (P0-02). Reset malfunction in alarm mode.

3.2. 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

keypad Digital display

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

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 ）

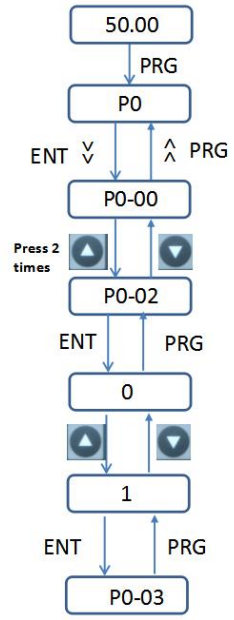
Note: If in the third level menu, you can press PRG or ENTER key to return second menu.
The difference is that press ENTER key will keep setting parameter in CPU board of inverter and then return to second menu, press PRG key an return second menu directly without parameters store.

Example of keypad operation

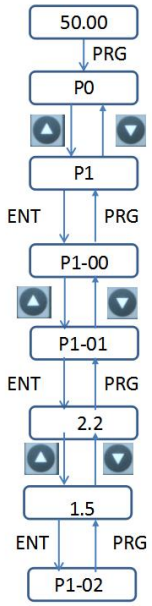
1. Modify command source for terminals control

Modify command source for terminals control, the pump will be start once X1 and GND switch ON. If X1 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 guiding

Monitor parameters inquiry.

There two ways to inquiry monitoring parameters.

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

User also can go to U group parameters 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...

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 (P402=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 located in protection status and can’t working.

4.3.Control circuit terminals loop.

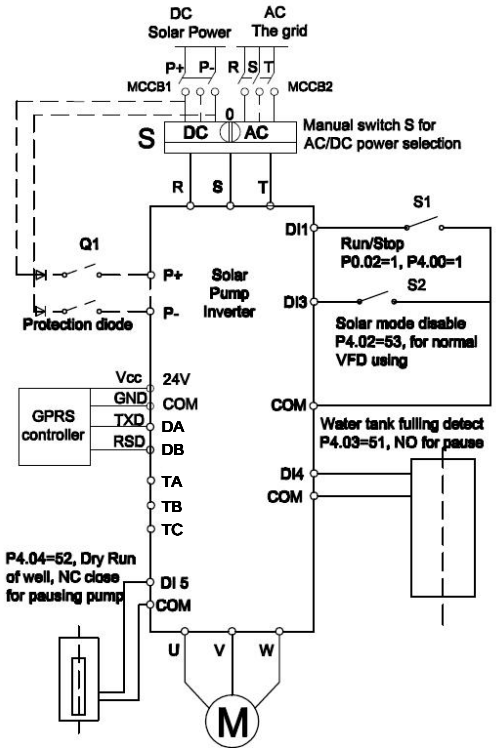
Blow attached terminals used to input/output communication with inverters ,which can install switch to start/stop inveter, and inverter status by LED device...

Type	symbol	Name of terminals	Specification and explanation
Communication	DA	485+	RS485 communication port， compatible with Modbus
	DB	485-	
Digital input and output	DI1～DI6	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
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
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	TA，TB, TC	Relay 1	TA/TB normal close、TA/TC normal open； Driving capability: 25VAc，3A，COSØ=0.4；30Vdc，1A
	RA,RB	Relay 2	RA/RC normal open； Driving capability: 25VAc，3A，COSØ=0.4；30Vdc，1A

Chapter 5. Solar pump inverter wiring steps.

It is accepted dual power AC/DC mode connecting input. If connect AC and DC simultaneously, please install a anti-direction diode (protection diode) between inverter and soalr panels which used to protection solar panels safety.

User can able to install a power switchover to selection which mode power input as conditions.



GW20solar pump wiring 1, digital type sensor for water tank fulling

6.1. 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 inuptconnect to L, N of inverter).

6.2. Built a Run/Stop switch S1 to start pumping when setting **P0.02** for 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.

6.3. Built a switch 2 to disable solar pump control mode when connecting AC grid input.

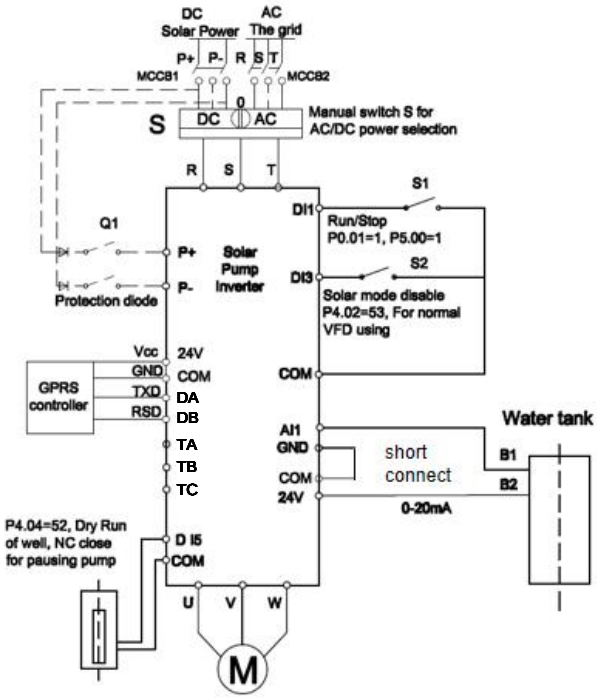
The inverter can be used for a variable speed drive (VFD) for pumps speed adjusting as need. The output frequency can be adjusted byP0-03 frequency reference mode setting. The MPPT function is closed when turn off switch 2 and set P4.02=53. The solar pump control mode function also can be disable by parameters setting PE00=0.

6.4. 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, inverterr will stop pumping, and sent a A.FuL alarm.

6.5. Connect 2 wires of sensor of dry run sensor of well to DI5 and GND, and set F4.04=52 (dry run NC relay alarm).

It will sent alarm A.LL dand stop pumping when lack of water in wellfor dry run protection.

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

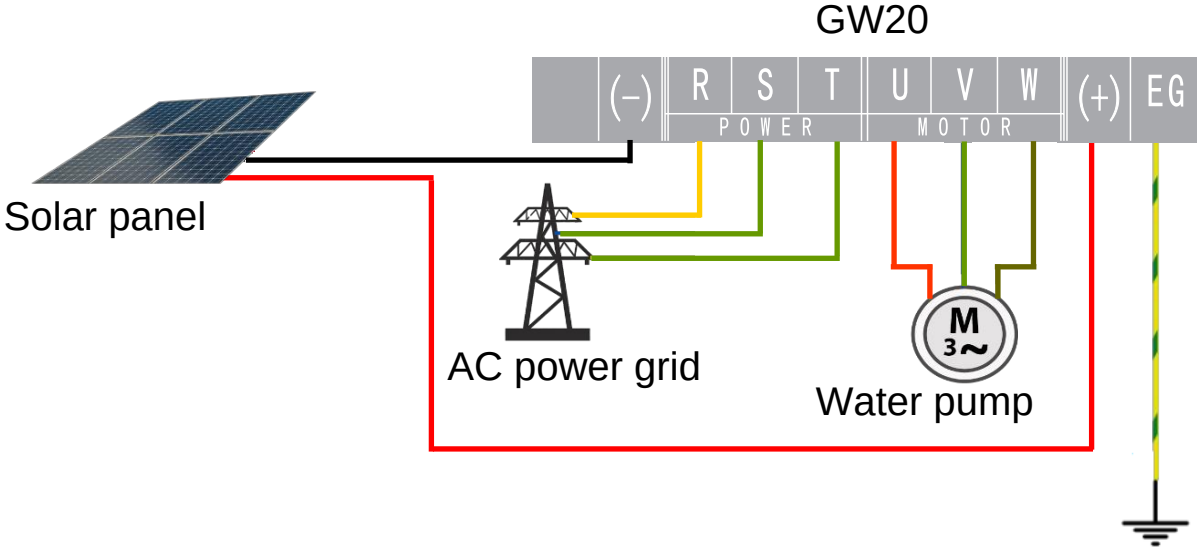


GW20solar pump wiring 2, analog type sensor for water tank fulling

PS Note:

1. 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.

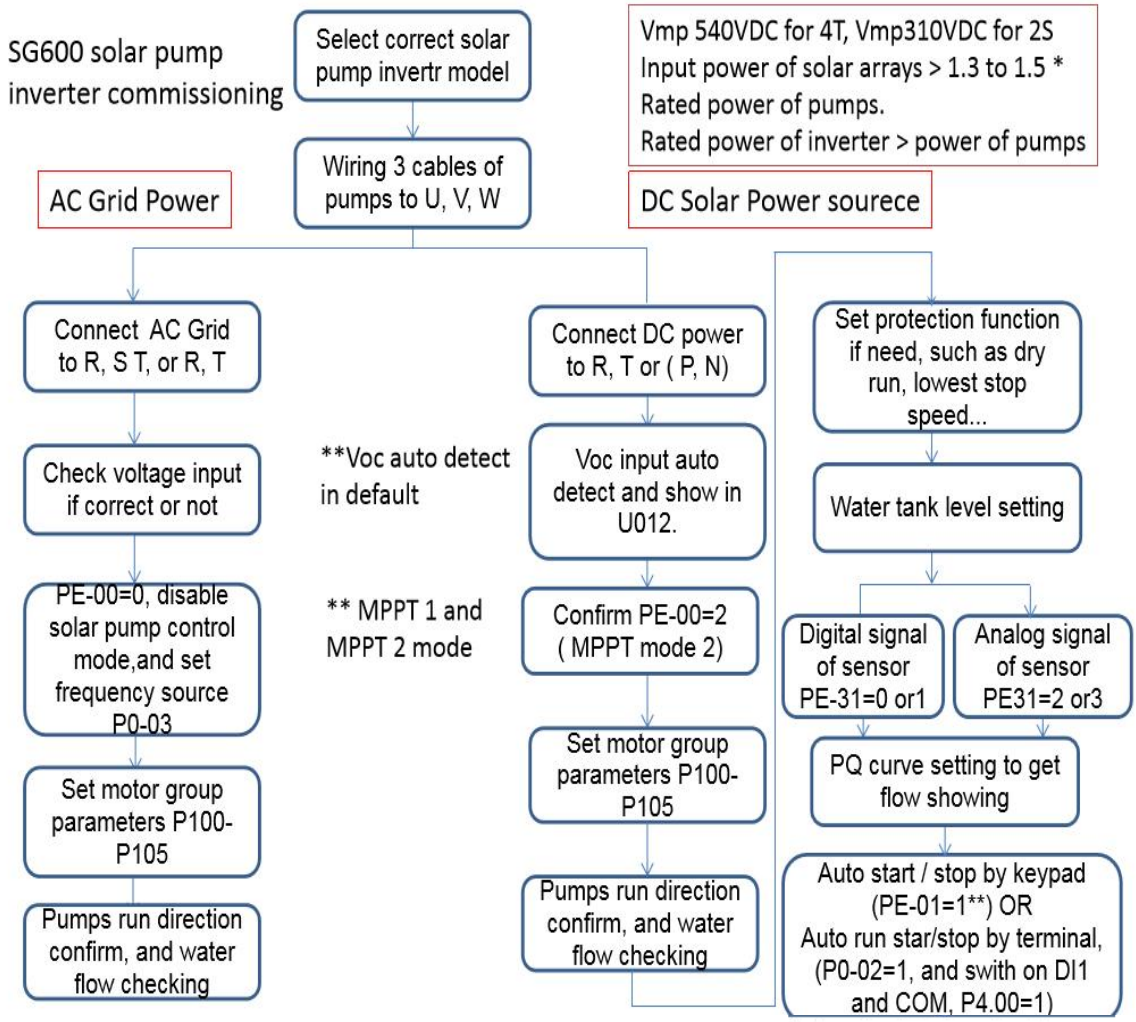
2.Installation Diagram



Chapter 6. Solar pump inverter installation guiding.

6.1. Inverter installation guiding flow chat

User can perform solar pump inverter installation as below attached chat.
There are two models input AC and DC. It can provide soft tarter function and output speed adjusting function when AC grid input (PE00=0).
The MPPT function and frequency fast drop function will be activated when DC solar power supply input. (PE00=1 or 2), the output frequency is auto change by MPPT as sunlight radiation.



GW20**solar pump inverter commissioning flow chat**

6.2. Solar panels and pumps selection.

Select correct modes of solar pump inverter (voltage, power and current) as pumps nameplate and field requirement, such as water head, water flow, distance from pump to inverter, pumps voltage, pumps rated current, maximum current of pumps, and working conditions.
The selecting rated current of inveter must be equal or bigger than rated of using AC pumps.
The bigger power of inverter should be selected for long distance from pumps to inverter.
Suggested to select bigger rated current power inverter for submersible pumps.

6.2. Solar panels and pumps selection.

Select correct modes of solar pump inverter (voltage, power and current) as pumps nameplate and field requirement, such as water head, water flow, distance from pump to inverter, pumps voltage, pumps rated current, maximum current of pumps, and working conditions.
The selecting rated current of inveter must be equal or bigger than rated of using AC pumps.
The bigger power of inverter should be selected for long distance from pumps to inverter.
Suggested to select bigger rated current power inverter for submersible pumps.

6.3. Input DC solar power supply selectoin

Input voltage, power solar arrays selection				
Pumps model	Inverte models	Vmp	Voc	Total Power of solar arrays
110VAC pumps	1S	110*1.41=130VDC	156VDC	≧ (1.3 to 2.0) rated power of pumps It is also depend on the quality of solar panels. The more power input, the better performance.
220VAC pumps	2S	220*1.41=310VDC	372VDC	
380VAC pumps	4T (Max 800VDC)	380*1.41=540VDC	648VDC	
480VAC pumps	4T (Max 900VDC)	480*1.41=677VDC	812VDC	

Although GW20inverter built in high efficiency MPPT tracking arithmetic, up to 99.6% MPPT efficiency, but also need to consider many factors of solar radiation. It is no certain rules to determine exactly how many piece solar panels exactly input for system. If the output frequency can't get to 50Hz/60Hz, please consider to connect more solar panels.

6.4 Solar arrays selection tables for AC pumps.

Connecting solar panels in series to get enough voltage input, and then calculating how much strings for getting enough power.

Take a solar panels Voc38VDC, Vmp 31VDC, 265W for exampling.

Please check if enough DC voltage input for system, Voc and Vmp. 2S (310vmp), 380V (540vmp).

If the output frequency is not high, lower than 50/60Hz even in good sunlight radiation, please check if enough solar panels have been connected. The total power should be at least bigger 1.3 times than of rated power of pumps.

Solar panel spec.:265w, 38Voc (Open circuit voltage), 31Vmp (Voltage at Pmax)				
Inverter models	Power of pump	Connection in series (PCS) (Vmp)	Connect in parallel (Strings) Power	Total (PCS)
1S (110VAC)	0.75kw to 1.0kw	4 or 5 PCS	1* strings	5*1=5
2S (220VAC)	0.75kw to 1.5kw	10PCS	1* strings	10*1=10
2S (220VAC), Max 450vdc	2.2kw	11PCS	1* strings	11*1=11
4T(380VAC)	0.75kw to 2.2kw	18PCS	1* strings	18*1=18
4T(380VAC) Max 900VDC	3.7kw	20PCS	1* strings	20*1=20
4T(380VAC)	5.5kw	18PCS	2* strings	18*2=36
4T(380VAC) Max 900VDC	7.5kw	20pcs	2* strings	20*2=40
4T(380VAC)	11kw	18pcs	3* strings	18*3=54
4T(380VAC) Max900VDC	15kw	20pcs	4* strings	20*4=80

6.5. Solar pump inverters installation steps.

1. Wiring DC power supply to R, T terminals of inverter. (also can able to connect DC power supply to P+ and P-,but please take great attention for polarity connecting. Positive to P+,Negative to P-.)

2.Voc auto detect and show in U012. If set Voc set by manual, please set PE01=001, and set actual onsite value to PE 003.

3.Confirmed PE-00 if set for 1or 2 for MPPT working in solar pump control model.

4. Set P1-00 to P1-05 motor group parameters for getting better pumps protection.

5. Press the RUN button to start inverter (keypad control mode is in default setting, P0-02=0),to check output frequency, output voltage if good or not. The output frequency should be increase from 0 to 50/60hz, and output voltage should be balanced when frequency reach to rated frequency of pumps.

6.If output frequency and output voltage is normal, please stop inverter, and then switch off power, after that connect pump to U, V, W of inverter. (connect U, W for 1 phase pumps).

7. Press the RUN to start inverter to check water flow if correct, if water flow is small when reach to high speed, please check the pump running direction if correct or not. Please rewire any two phase order of U, V, W if pump running direction is not correct.

PS： If the output frequency is not stable, the PE04 and PE05 or PE12, PE13 PE14 parameters can used to adjust the MPPT gain.

Options operation if need.

8. Set lowest stop frequency PE-19 for pumps low speed running protection if need.

9. Set PE-22, PE-23, PE-24and PE-48parameters to active dry run function.

10. Set pump over current protection function if need by PE-26 and PE-27 setting

11. Set PE-36 to PE-47 curve parameters as pumps PQ curve for getting accuracy flow indicating.

12.Water tank fulling detecting with digital switch of ball float sensor or analog signal senor.

A.Set PE-31=0,and connect 2 wires to DI4 and COM, and set F4.03=51. when water level reach to setting to activate normal open (NO) switch turn on, it will stop pumping and sent water full alarm.

B, Set PE-31=AI1 and connect2 wires of analog sensor (0/4-20mA) to 24VDC and AI1 terminals, and short circuit GND and COM for loop. Set the parameters PE-32 to PE35.

13. If need auto restart function please set P0-02=1to make inverter control by terminals, and switch on DI1 and COM, also need confirm P4-00=1 (terminal function for Forward)

Note: 1). If the input Voc, Vmp DC voltage is too low, it will cause inverter can't work properly due to there are no built any voltage booster circuits or transformer parts inside of inverter.

2). The output AC voltage is related to DC voltage input, the output AC voltage range is 0 ~DC voltage/1.41, also is limited by motor rated voltage setting P1-02 parameter value.

3). Please select one bigger power inverter for driving single phase pumps, because the running current of 1 phase pumps is much bigger than 3 phase pumps.For example, take 1.5kw inverter for 1 phase 220AV, 0.75kw pump, 0.75kw inverter for 1 phase 220VAC, 0.4kw pump.

4). Please consider to install output reactor, Dv/dt reactor, sine wave reactor when long distance from pump inveter.

5). PE-04, PE-05 and PE-05 parameters can use to increase the MPPT function gain, the bigger setting, the stronger MPPT, but it also can cause output frequency a little fluctuation.

6). Please refer Appendix 2for getting more information for driving PMSM high speed pumps.

Chapter 7. Function 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 setting by user.

Function code	Name	Setting range	Factory setting	Modification
P0 Basic function parameters				
P0-00	GP 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	√
P0-08	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 keyboard 4：PULSE trains 5：Rs485 communication	3	╳

Function code	Name	Setting range	Factory setting	Modification
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	√
P0-20	The balance factory for 1 phase pump driving (3 phase output)	0.00 ～2.00	1.0	×
P0-22	Frequency resolution	1：0.1Hz 2：0.01Hz	2	×

Function code	Name	Setting range	Factory setting	Modification
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 Motor	Inverter power <= 55KW：0.01mH～	Auto	×
	leakage inductance	655.35mH Inverter power > 55KW：0.001mH～65.535mH	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. otor 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 tunin	×
P1-17	Synchronous motor D-axis inductance	Inverter power <= 55KW0.01mH～655.35mH Inverter power > 55KW : 0.001mH～65.535mH	Auto tuning	×

Function code	Name	Setting range	Factory setting	Modification
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	×
P1-37	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	×

Function code	Name	Setting range	Factory setting	Modification
P4-00	DI1 terminals function selection	0: N: 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 8: Free stop 9: Fault reset（RESET） 10: Run pause 47: Emergency stop 50: Current running time rest 51: Water tank fulling detect 1/ single point detect 52: Water tank fulling detect 2/ single point detect 53: MPPT tracking stop/ solar pump control disable.	1	×
P4-01	DI2 terminals function selection		2	×
P4-02	DI3 terminals function selection			
P4-03	DI4 terminals function selection			
P4-04	DI5 terminals function selection			
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	√

P5 Group Output terminals				
P5-02	Relay 1 function selection	0: No output 1: Frequency inverter working 2: Fault output (Free stop fault) 4:Frequency reach 6: Motor overload pre-alarm 7: Inverter overload pre-alarm 12: Cumulative run time arrives 19: Under voltage status output	0	√
			2	√
P5-04	Relay 2 function selection		0	√
P5-18	RELAY1 output relay time	0.0s～3600.0s	0.0s	√
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 2: Forward and reverse switching	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) Bit14: Load speed display	1F	√
P7-04	LED display parameters 2 in running mode	0000～FFFF Bit03: Running frequency 2（Hz） Bit04: Rest running time Bit08: Line speed Bit09: Current power-on time (Hour) Bit10: Current running time (Min))	0	√

P7-05	LED display in stop mode	0000 ~ FFFF Bit00: Set frequency (Hz) Bit01: Bus voltage (V) Bit10: Load speed	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	-	●
P8-13	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	√
P9 Protection function code				
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%	√
P9-07	Ground short circuit protection options when power on	0: Invalid 1: Valid	1	√
P9-09	Number of automatic reset times	0～20	0	√
P9-11	Fault auto reset interval time	0.1s～100.0s	1.0s	√
P9-12	Input phase loss/ contactor pull	Bit: Input phase loss protection selection Ten: Contactor pull protection options	11	√

	protection selection	0: Prohibited 1: Allow		
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 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 abnormall 21: Parameter read and write exception 22: Inverter hardware abnormality 23: Motor to ground short circuit	—	●
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 40: Fast current limit timeout 41:Motor switch in running 42: The speed deviation is too big 43: Motor over speed 45: Motor overtemperature 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	—	—	●
P9-55	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	√
P9-63	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	√

PE Solar control purpose parameters.				
PE-00	Solar pump control mod`e	0:Disable of solar pump control 1: Enable (Algorithm-1, High fficiency) 2: Enable (Algorithm-2, High stability) User can use terminal to disable solar pump control mode, make inverter work as motor variable speed control. See Digital terminal definition 53: MPPT/Solar control disable. (set F4-02=53, switch on DI3 and COM) Terminal control is prior.	1	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.	H.011	√
PE-02	CVT voltage set by manual	0 -100%	80%	√
PE-03	Voc (open loop voltage) set manually/Automatic detection lower limit	0.0V-1000.0V	650V/ 380V	V
PE-04	**CVT proportional gain**	**0.0% - 999.9%**	**100.0%**	**√**
PE-05	**CVT integral gain**	**0.0% - 999.9%**	**100.0%**	**√**
PE-06	CVT differential gain	0.0% - 999.9%	0%	√

PE-07	Initial point of fast frequency drop function	0.0 - 100.0% Set to 0, which means to turn off the fast frequency reduction	5.0%	√
PE-08	Cut -off point of fast frequency drop function	0.0 - 100.0%	50.0%	
PE-09	Weak magnetic limit multiples	0.0- 9.9, 0 means turn off the weak magnetic limit function	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 filter time (MPP2)	0-1000ms	50ms	√
PE-15	Reserve	0	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	0 – 30000sec	20sec	√

	frequency protection			
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	DC bus voltage drop	0.0% - 100.0%	90.0%	√
PE-29	Detecting frequency when DC voltage drop	0.0% - 100.0%	15.0%	√
PE-30	Minimum power protection automatic recovery time	0 – 30000sec	3000sec	√
PE-31	Water tank fulling level detecting method	Digit: Water fulling detect mode 0: Single 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 close, stop when open. Note:Single point detecting,when DI4 setfor 51(in default setting),adopt 5sec hysteresis detecting. 2 points detecting,DI4 set for 51,DI5 set for 52, both points should be activated at the same time to make water fulling function useful.	H0.0.0	√

PE-32	Water fulling level detecting threshold of analog type,	0 – 100.0%	25.0%	√
PE-33	Water fulling level reach protection detecting time	0 – 30000sec	10sec	√
PE-34	Water fulling 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	0.0Hz	√
PE-49	Sleep power detecting selection When PE-49=0, the sleep mode activating as voltage, When PE-49 not set for 0, inveter if go to sleep	0.0% - 100.0%	0.0%	√

	mode as sleep power detecting.			
PE-50	Detecting time of sleep power	0 – 30000sec	60sec	√
PE-51	Sleep frequency	0.00Hz ～300.00Hz	10.00 Hz	√
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-04	Function code modification attribute	0： Enable modification 1: Not allow to modify	0	√
PP-05	Unlock parameter for agent	0 - 65535		
PP-06	Unlock parameters for vendor	0 - 65535		

Chapter 8. PE solar control purpose code explanation

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

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 are two type Solar Pump control algorithm embed.

PE-00=1 MPPT mode 1 for high effiency (PE04 and PE05 and PE06 can be used to adjust the MPP again.)

PE-00=2 MPP mode 2 for high stability (PE12 and PE13 and PE14 can be used to adjust the MPPT gain).

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.(It good for driving single phase pumps)

PE-04	CVT Proportional gain	0.0% - 999.9%	100.0%
PE-05	CVT Integral gain	0.0% - 999.9%	100.0%
PE-06	CVT differential gain	0.0% - 999.9%	0.0%

When the PE00=1, the PE04, PE05, PE06 are working for MPPT again. Which used to keep output frequency stable and increase the frequency response.

PE-04 to PE-05 use to adjust MPPT tracking gain ratio, and keep DC bus voltage in stability. The bigger value setting of PE-04 to PE-05, the stronger MPPT calculating. But it can cause output frequency a little fluctuation.

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

When the PE00=2, PE12 and PE13 are working for MPPT again.

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 ca 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 Fb-04,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
PE-48	Initiating frequency of dry run protection	0.00 - 320.00Hz	0.0Hz

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

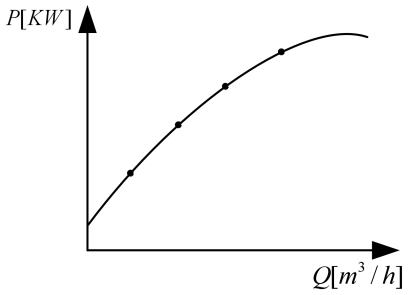
PE-31	Water tank fulling level detecting method	Digit: Water fulling detect mode 0: 1 point detect 1: 2 points detect 2: AI1 analog 3: AI2 analog Ten: Single point detect 51# function logic detection selecting Hundred: Single point detect 52# function logic detection selecting. 0: Normal Open, work when open, stop when switch on 1: Normal close, work when close, stop when open.	H0.00
PE-32	Water fulling level	0 - 100.0%	25.0%

	detecting threshold of analog		
PE-33	Water fulling level reach protection detecting time	0 - 30000sec	10sec
PE-34	Water fulling 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 fulling 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 fulling detection, we can select normal open of digital function.
If select 2 points digital terminals fulling 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 fulling is disable, only one terminals is valid, keep no changing of current working status.
PE-33/PE-34 are used to set water fulling 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-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-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	√

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 (P3-1=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 P909=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 .
* Under voltage of 400VAC (4T) models is 250VDC, 200VAC (2S) model under voltage is 100VDC.
* 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)

Chapter 9. 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 （High-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

Chapter10 .Troubleshooting and Counter measures

The below table listed GW20series 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

Related alarm code of when working solar pump control mode.

Alarm showing	Alarm code	Alarm description	Countermeasures
A.SLP	81	Sleep mode	To check if enough total solar power input, the total power of solar arrays should bigger 1.3 times of rated power of pumps. 2.To check if enough DC Vmp, recommend 1.41 times DC voltage ofAC pumps voltage 3. Increase the PE-04 and PE-05MPPT gain value 4.To check PE-16sleep voltage if correct to set.
A.LFr	82	Low frequency protection	If the output frequency is lower PE-19 setting,this alarm will be activated for pumpsprotection, please set PE-19 for low value if need.
A.LLd	83	Dry run/under load protection	Set PE-22 for lower value to disable this alarm.
A.OLd	84	Over current/ over load protection	Set over current PE-25 for low or set for 0.
A.LPr	85	Minimum power	Set PE-28minimum power input protection for lower
A.FuL	86	Water tank fulling	To check if water is fulling
A.Prb	87	Analog sensor problem failure	To check if the sensor is broken or set PE-35for lower
Err.98	98	Distributor running time reach	Contact distributor
Err.99	99	Factory running time reach	Contact manufacturer

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 Er.OC1	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 Er.OC2	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 Er.OC3	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 5, The using Inverter capacity (rated power is small	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

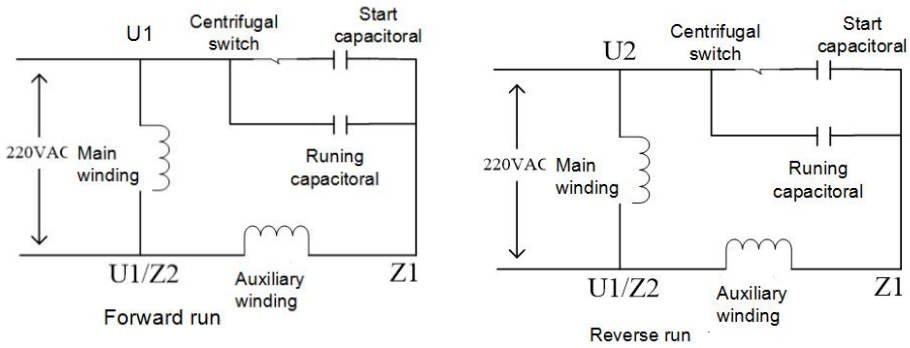
Over voltage in acceleration	Err05 Er.OU1	1, The input voltage is high 2, The acceleration process there is an external drag motor running 3, The acceleration time is too short 4, No brake unit and brake resistor	1, Adjust voltage to the normal range Cancel the additional force or install braking resistor 3, Increase the acceleration time 4, Install the braking unit or braking resistor
Deceleration over voltage	Err06 Er.OU2	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 Er.OU3	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 Er.oHr	1. Input voltage is out of limit	Adjust voltage to normal range
Under voltage fault	Err09 Er.LU1	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 Er.oL1	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 Er.oL2	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 inveter too small	Set correct parameter Reduce load or check motor and driving machine Select bigger power inverter
Input phase loss	Err12 Er.ILF	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 Er.oLF	1, The inverter wiring is damaged 2, 3 phase output is not balance of inverter when motor running 3, Driving board is abnormal 4, Igbt model 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 Er.oH1	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
Current detection failure	Err18 Er.HAL	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 Er.TUn	1, The motor parameters are not set by nameplate 2, Parameter identification process timeout	Set motor parameters according to motor nameplate
Inverter hardware failure	Err22 Er. 22	1, there is overvoltage 2, there is overcurrent	1, trouble shooting as over voltage 2, trouble shooting as over current
Short to ground	Err23 Er.SGd	1, Motor to ground short circuit	1, Change motor cable or motor
The cumulative run time arrives	Err26	1, The cumulative run time is over the set the value	1, Clear the record with parameters initialization
The cumulative power up time arrives	Err26 Er.ort	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 inveter less than P9-64	Check the load condition

Note: The
GW20solar 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.

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

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;

2. 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.

3. S600 inverters for driving 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.

The load driving capacity is not too strong compare to drive 3 phase AC pumps, and running current will be higher.

Please select one bigger rated power inverter for drive 1 phase pumps.

It is able to change running direction in this control mode by setting parameters.

Appendix 2. Solar pump inverter for PMSM pumps testing.

The documentation needs to be used in together with the operation manual of GW20, it is supplementary for manual.

GW20has two motor control algorithms for driving permanent magnet synchronous motor, which set by P(1-00) and P 0-01 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.

GW20permanent 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 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.)

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. Selection of peripheral electrical devices

1. Selection of peripheral electrical devices

Inverer 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					
GW20-0.7GB	10	12	0.75	0.75	0.5
GW20-2S-1.5GB	16	18	1.5	1.5	0.5
GW20-2S-2.2GB	25	25	2.5	2.5	0.5
GW20-2S-4.0GB	32	32	4	4	0.75
Three-phase 380 V					
GW20-0.7GB-4T-4T	4	9	0.75	0.75	0.5
GW20-1.5GB-4T	6	9	0.75	0.75	0.5
GW20-2.2GB-4T	10	12	0.75	0.75	0.5
GW20-4.0G-4T	16	18	1.5	1.5	0.5
GW20-5.5GB-4T	20	25	2.5	2.5	0.75
GW20-7.5G-4T	25	25	4	4	0.75
GW20-11GB-4T	32	32	6	6	0.75
GW20-15GB-4T	40	40	6	6	0.75
GW20-4T-18.5G	50	50	10	10	1
GW20-4T-22G	50	50	10	10	1
GW20-4T-30G	63	63	10	10	1
GW20-4T-37G	80	80	25	25	1
GW20-4T-45G	100	115	35	35	1
GW20-4T-55G	125	125	50	50	1
GW20-4T-75G	160	185	70	70	1
GW20-4T-90G	200	225	95	95	1
GW20-4T-110G	225	225	120	120	1
GW20-4T-132G	315	330	120	120	1
GW20-4T-160G	350	400	150	150	1
GW20-4T-185G	350	400	150	150	1
GW20-4T-200G	400	400	185	185	1
GW20-4T-220G	500	500	240	240	1
GW20-4T-250G	500	500	120 *2	120 *2	1
GW20-4T-280G	630	630	120 *2	120 *2	1
GW20-4T-315G	630	630	150 *2	150 *2	1
GW20-4T-355G	700	800	185*2	185*2	1
GW20-4T-400G	800	800	240*2	240*2	1

2. Out put reactor (OCR)

This reactor is used for suppress the capacitive charging current of connection cable between inverter and motor, and passivating 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 contacter 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 fi lters 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 inveter)

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 waveform. Bearing currents are also reduced, especially in larger motors above 50 kW.

The perfect solution for:

- Applications with older motors
- Aggressive environments
- Applications with frequent braking
- 690 V above applications with general purpose motors
- Motor cable length between 350 and 3000 meters

Above reactor and filter can improve the inveter performance especial long distance from pump to inveter. If need more detail please contact us.

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