Mar./2018-19/L6/5000 | VC : 2344 | SAP NO. 2900000902

India : Toll Free No. 1800 103 5555 **Other Countries : +91-7292 410500**

SHAKTI PUMPS (INDIA) LTD.

Sector - 3, Pithampur - 454774, Dist.- Dhar (M.P.) - INDIA
Fax: +91-7292 410645, E-mail: info@shaktipumps.com, sales@shaktipumps.com,
Visit us at : www.shaktipumps.com

SHAKTI
PUMPING LIFE

INSTALLATION & OPERATING INSTRUCTIONS

SOLAR PUMP CONTROLLER

SHAKTI
PUMPING LIFE

CONTENTS **PAGE NO.**

1: Safety Requirement and Cautions

To ensure safety of your health, equipment and property, please read this chapter carefully before using Controller and act in compliance with the instructions when installing, debugging, running and overhauling the Controller.

1.1 Safety Definition
Danger:
It will cause danger of serious injuries and even death while operating against the rules.

Caution:
It will cause danger of light injuries or equipment destruction while operating against the rules.
Note: some information is useful while operating and use Controller.

1.2 Safety Requirements and Cautions
Before Installation

Danger
1. Only qualified personnel can operate the equipment. Before operating, be sure to carefully read the manual about safety, installation, operation and maintenance. The safe operation depends on the proper processes of choosing models, carrying, installation, operation and maintenance.

Danger
1. Don't use the damaged or incomplete Controllers; Otherwise, there is risk of injury.

2: Installation
Danger
1. Please install Controller on metal or other nonflammable material, and keep it away from the combustible material. Otherwise there is danger of fire;
2. No unauthorized modification to Controller; Otherwise there is danger of damaged.
3. Normal Controller, which is not explosion-proof, cannot install where with explosive gas or dust; Otherwise there is danger of explosion.

Attention
1. When two Controllers are installed in the same control cabinet, pleas pay attention to the installing place to guarantee the effective heat dissipation.
2. When carrying Controller, ease supports its bottom.

Wiring
Danger
1. Wire is connected only when the main circuit is cutoff, otherwise there is a danger of shock.
2. Wire is connected by professional person only. Otherwise there is a danger of shock.
3. Earth must be reliable. Otherwise there is a danger of shock.
4. AC power supply should not be connected with output ports U, V, W, otherwise there is a danger of damage Controller.
5. No drop of bolt, spacer, metal stick, conducting wire or other things into the inner of Controller; Otherwise there is a danger of fire or damage to Controller.

Attention
1. If the damage to Controller or other equipment is caused by improper wiring and utilization or unauthorized alteration, the user should shoulder all responsibilities.
2. Please make sure all wirings meet EMC requirement and satisfy safety standard in the local area; Please refer to recommendations in this manual or national standards of wire diameter to avoid accidents.
3. Static electricity on human body would seriously damage internal MOS transistor, etc. No touch the printed circuit boards, IGBT or other internal devices without anti-static measure; otherwise it will cause the malfunction of Controller.
4. Please don't connect phase shifter capacitance or LC/RC noise filter to the output circuit of Controller; Otherwise it will damage the Controller.
5. Please don't connect the magnetic switch or magnetic contactor to the output circuit of Controller; When Controller is in the operation with load, magnetic switch or magnetic contactor can make Controller over-current protection function act. It will damage Controller seriously.
6. Please don't disassemble the panel cover, it only needs to disassemble the terminal cover when wiring.
7. It is forbidden to do any pressure test on Controller; otherwise it will damage the Controller.

Before Electrification

Danger

1. Please make sure that voltage grade of power supply is consistent with Controller's voltage and then check whether the wiring is correct and firm, and whether there is short circuit in peripheral equipment's circuit. Otherwise it will damage Controller and other equipment.
2. Before the Controller is connected to the input power supply, make sure that the cover has been fixed well. Otherwise it will cause electric shock.
3. For the Controllers whose storage time is over 1 year, when electrification, the voltage should be raised by booster from low to high. Otherwise it will damage the Controller.

Attention

1. Check if all periphery fittings are wired properly according to the handbook; Otherwise it will cause accidents.

After Electrification

Danger

1. After electrified, it is forbidden to open the cover, make wiring, and check up; Otherwise, it will cause the danger of electric shock.
2. After electrified, it is forbidden to contact internal wiring board and its parts. Otherwise it will cause the danger of electric shock.
3. Do not operate or touch Controller with wet hand. Otherwise there is danger of damage to Controller and electric shock.

Attention

1. Please set the parameter of Controller cautiously; Otherwise it will damage equipment.

Operation

Danger

1. Before running, please check and confirm the application range of the machine and equipment once more; Otherwise it will cause accidents.
2. Please don't touch the cooling fan and braking resistance to check the temperature; Otherwise there is a danger of getting burn.
3. Unprofessional workers are banned to check the signals in the running stage; Otherwise it will cause injuries and damage the equipment.

Attention

1. Please don't turn off the equipment by switching off power; Please cut off the power supply after the electric machine stops running; Otherwise it will damage the Controller.
2. Please avoid anything dropping into the equipment when the Controller is running; Otherwise it will cause electric shock.

INSTALLATION AND OPERATING INSTRUCTIONS

Maintenance

Danger

1. Please don't maintain and repair the equipment with electric; Otherwise it will cause electric shock.
2. Before maintaining and repairing the Controller, please make sure the indicator lights of power supply have completely turned off; Otherwise it may cause electric shock and damage the Controller.
3. Persons who have not passed specialized train are not allowed to conduct the Controller maintenance; Otherwise it may cause electric shock and damage the Controller.

1.3 Cautions in Using

1. In application of this series Controller, you have to confirm all machine insulation to prevent damage to the equipment. Moreover, when the motor working in tough environment, please periodic inspect the electrical insulation to ensure the safety of the system work.
2. If the motor adapter is not consistent with Controller's rating current (The rating current of the motor is far smaller than that of Controller), please adjust the protective value to ensure safe running.
3. In occasions such as load raises, usually there is negative torque and Controller breaks off for over-current or over-voltage. In this case, you should consider choosing the matching brake unit.
4. Controller, in a certain output frequency range, can meet the mechanical resonance of the load equipment. To avoid it, you can set up jumping frequency.
5. As output voltage of the Controller is pulse-wave type, if there is capacity which can improve power factor or pressure-sensitive resistance which used for thunder-proof in the voltage output side, the Controller will break off or its parts will be damaged, so it is necessary to dismantle them. Moreover, it is proposed not install switch parts like air switch and contactor (if it is necessary to install switch on output side, please make sure the output electricity of Controller is zero when the switch is working)
6. At over 1,000 meters altitude, the Controller's heat dissipation function worsened due to the thin air, it is necessary to use less.
7. The Controller output voltage is pulse wave type. If using digital multi-meter measurement, deviation of the reading will be great. And the deviation is different by using different type of digital multi-meter. Under normal circumstances, while PWM 380V, digital multi-meter reading is around 450V.

MODEL	MAX. DC VOLTAGE (Vdc)	RANGE OF MPPT(Vdc)	CONTROLLER CURRENT (Amp)
DCSHAKTI-01P-10A	450	180-380	10
DCSHAKTI-03P-13A	780	320-700	13
DCSHAKTI-03P-17A	780	320-700	17
DCSHAKTI-03P-25A	780	320-700	25
DCSHAKTI-03P-32A	780	320-700	32
DCSHAKTI-03P-38A	780	320-700	38
DCSHAKTI-03P-45A	780	320-700	45
DCSHAKTI-03P-60A	780	320-700	60
DCSHAKTI-03P-75A	780	320-700	75
DCSHAKTI-03P-90A	780	320-700	90

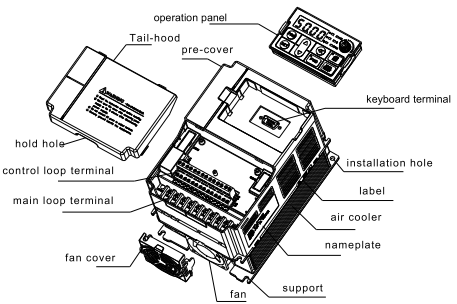
1.4 Cautions in Disposal

When you dispose Controller, please pay attention to:

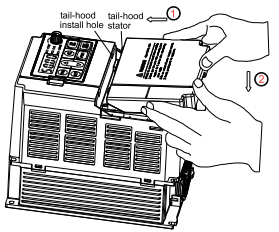
1. Electrolytic capacitor: the electrolytic capacitor of main circuit or the printing plate may explode when they are burned.
2. Plastic: plastic incineration may generate toxic gases.
3. Dispose method: please dispose as industrial waste.

2: Installation and Wiring

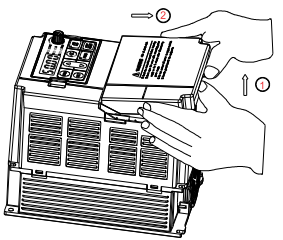
2.1 Products Appearance and Component Names



2.2 Dismantlement and Installation of Tail-hood



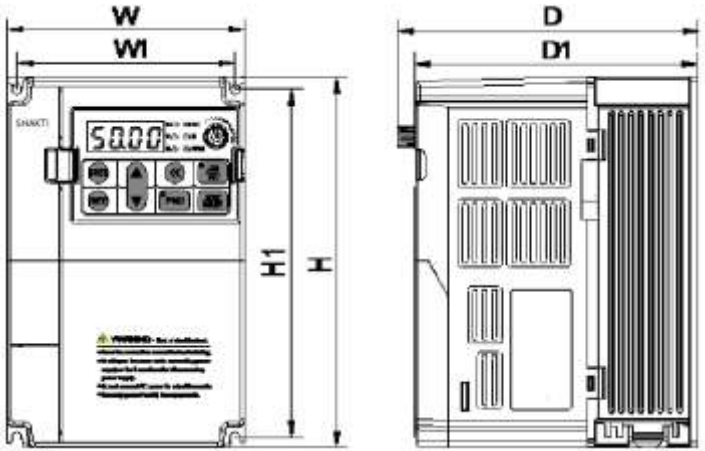
Installation: First the tail-hood upwardly inclines around 15 degrees and inserts the top fixed flat into the fixed hole in the front cover. Then slightly press the tail-hood downward. While your hear "Ka", it means that the tail-hood is into the place



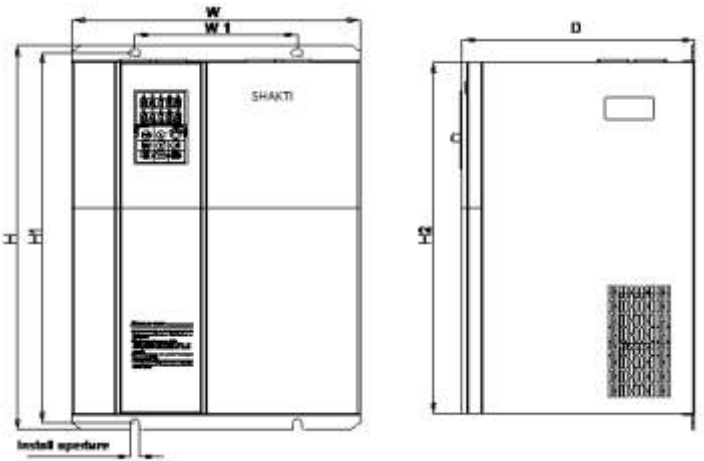
Dismantlement:

At the tail of the Controller, there is a special dismantlement hole design. Put your fingers into the hole, upwardly pull the cover with a little force until the buckle between the tail-hood and the crust tear off, and then removed tail-hood down.

2.3 Dimension of Controller and Keyboard



Controller	W	H	D	D1	W1	H1	Install aperture
DCSHAKTI-01P-10A	159	246	157.5	148	147.2	236	Φ 5.5
DCSHAKTI-03P-13A	159	246	157.5	148	147.2	236	Φ 5.5
DCSHAKTI-03P-17A	195	291	167.5	158	179	275	Φ 7
DCSHAKTI-03P-25A							



Controller model	Controller size			Install size			Install
	W	H	D	H2	W1	H1	aperture
DCSHAKTI-03P-32A	235	345	200	311	160	331.5	Φ7
DCSHAKTI-03P-38A							
DCSHAKTI-03P-45A	255	410	225	370	180	395	Φ7
DCSHAKTI-03P-60A							
DCSHAKTI-03P-75A	305	570	260	522	180	550	Φ9
DCSHAKTI-03P-90A							

2.4 Control terminals menu

Category	Terminal	name	Function
Control signal	COM	Common terminal	
	FWD	Forward turn command	Short connect with (COM)is workable
	REV	Reverse turn command	Short connect with (COM)is workable
	X1	Multifunction input terminalsX1	Short connect with (COM) is workable Multifunction input terminals, please refer to parameters[F-01 ~ F-06]to set the definitions by program.
	X2	Multifunction input terminalsX2	
	X3	Multifunction input terminalsX3	
	X4	Multifunction input terminalsX4	
	X5	Multifunction input terminalsX5	
	X6	Multifunction input terminalsX6	
	PUL	Pulse frequency input signal	0KHz-50KHz， Amplitude 8～24V.
Output signal	TA,TB,TC	Output signal 1	(TA-TC)Normally open, (TB-TC) Normally close (programmable setting motion targets).
	Y1	Output signal 2	Open collector output, programmable setting motion targets. Max output DC24V/50mA.
	Y2	Output signal 3	Open collector output, programmable setting motion targets. Max output DC24V/50mA.
Analog output& input signal	GND	Output common terminal 3	

Analog output& input signal	GND	Output common terminal 3	
	+10V	Signal power	Maximum output +10V/50mA.
	-10V	Signal power	Maximum output -10V/50mA.
	VS2	Voltage input signal	(VS2) terminal -10V ~ 10V.
	AS	Voltage input signal	(AS) terminal 4 ~ 20 mA .
	A01	Analog output signal 1	(A01) terminal 0V ~ 10V.
	A02	Output signal 2	0V ~ 10V, 0V ~ 20mA, 4 ~ 20mA, frequency pulse output, By choices of [F-62] and the terminal jumper J1, J2 and J3.
Auxiliary Power	+24	Power anode terminals	Maximum output 24V/200mA.
	COM	Common terminal	
Communication	A+	Communication Interface	RS485 Communication Interface.
	B-	Communication Interface	

3: Basic Operation and Trial Run

3.1 Keyboard Layout and Function Specification.

● Keyboard Appearance

SHAKTI PUMPING LIFE

Key Function

Key	Name	Function
PRG	Menu key	Enter menu while standby or running. Press this key to return while modify parameter. While standby or running, press for 1 sec to enter condition monitoring interface.
SET	Confirm/modify key	Press to modify parameter while in menu interface. Press again to confirm after modifying. While standby or running, press to change LED monitoring items at stop.
▲ ▼	Up/down key	Select parameter group in menu interface. Modify parameter while in modify interface. Modify given frequency?PID? given torque or magnetic powder clutch given torque while at standby or condition monitoring state.
≪	Shift key	Select digit of function no modified by up/down key? Select parameter digits modified by up/down key. Change LED monitoring items while standby or running.
FWO	Forward run key	While run/stop is controlled by keyboard, press this key, the Controller forward rotate and the indicator is always on. While reverse, the indicator sparks.
JOG RAV	Jog/reverse key	This key function can be defined by parameter [E-08]. Press it, machine reverses and indicator is off if this key is defined as REVERSE. Machine will jog and indicator is on ifthis key is defined as JOG.
STOP RESET	Stop/reset key	Machine stops if press it while run/stop is controlled by keyboard. Its efficiency range is defined via function no [F-07]. Controller resets if press it in fault state (no reset if fault is not solved).
	Keyboard potentiometer	Can be used as input channel for given frequency, upper frequency limit, given torque, given PID or PID feedback setting.

Indicator Light Meanings

Name		State	Meaning
Unit indicator light	Hz	Spark	Digital display given frequency.
	Hz	On	Digital display output frequency.
	A	On	Digital display actual output current.
	V	On	Digital display input voltage.
	V	Spark	Digital display output voltage.
	S	On	Time unit is second.
	S	Spark	Time unit is ms, min, or h.
	RPM	On	Digital display motor speed.
	%	Spark	Digital display given PID.
	%	On	Digital display PID feedback.
State indicator light	FWD	On	Controller is forward rotating.
	FWD	Spark	Controller is reverse rotating.
	FWD	Off	Controller stops.
Function indocator light	REV/JOG	On	Jog.
	REV/JOG	Off	Reverse.

4: Fault Diagnosis and Solution

This chapter describes the Controller fault, alerts, and operation of the failure on the Controller, the display information on Controller and countermeasures. In addition, the poor condition of the Controller and motor failures will be briefly described in this chapter.

4.1 Fault Type

Type	Solar Controller action when fault happen
Solar Controller Fault	If any fault has been detected, it will occur following states. • Fault information will be show in keypad • The output of solar Controller will be cut off, and motor coast to stop. • When Function code [F2.29] set to 3 (fault output), the Y collector terminals output is ON. • When the [F2.30\F2.31] set to 3 (fault output), TA1~TC1?TA2~TC2 terminals output ON passive digital output, TB1~TC1,TB2~TC2 output OFF passive digital output • If there are over load (OLO, over current (OC), system abnormal (SC), over voltage (OU), under voltage during running, and if [FA.22] is not set to 0, the solar Controller will restart after [FA.23] time.

External fault	In some application case, introduce the external fault to solar Controller system as for monitoring, protecting, switching purpose. If one multiple programmable terminals set for external fault input. When external input signal is valid, the solar Controller will be trip and sent out fault alarm.

4.2 Fault Information and Description in Detail

Keypad display	Fault code	Fault type	Possibility reason	Troubleshooting
	E.LU 2	Under voltage at runs	•Power voltage too low •DC main contactor don't close	•Check input power to solve • Ask support
	E.oU 1	Over voltage at acceleration	•Power voltage fluctuation over limit •Too start rotating motor	• Check power grid • Restart until motor is stop completely, or set [F1.00] set for 1 or 2
	E.oU 2	Over voltage during deceleration	•Deceleration time too small •The driving load too heavy •Power voltage fluctuation over limit	•Prolong deceleration time •Reduce the load, or select bigger capacitor Controller, or connect braking unit • Check input power
	E.oU 3	Overvoltage at constant speed	•The input voltage is too high. •An external force Controllers the motor during deceleration	•Adjust the voltage to normal range. •Cancel the external force or install the braking resistor.
	E.oU 4	Over voltage at stop	•Voltage fluctuate above limit	• Check the input voltage
	E.oC 1	Over current during acceleration	•Acceleration time is too short •To start rotating motor •V/F setting not	•Prolong acceleration time •Restart motor when it on still, or set f1.00 for 1 or 2.

			correct or torque boost setting too big •Solar Controller capacitor is too small	• Reset V/f curve or torque boost setting
	E.oC 2	Over current during deceleration	• The output circuit is grounded or short circuited. • Motor auto-tuning is not performed. • The acceleration time is too short. Manual torque boost or V/F curve is not appropriate. • The voltage is too low. • The startup operation is performed on the rotating motor. • A sudden load is added during acceleration. • Controller model is of too small power class.	• Eliminate external faults. •Perform the motor auto tuning. • Increase the acceleration time. • Adjust the manual torque boost or V/F curve. • Adjust the voltage to normal range. • Select rotational speed tracking restart or start the motor after it stops. • Remove the added load. • Select a Controller of higher power class.
	E.oC 3	Over current at constant speed	• The output circuit is grounded or short circuited. • Motor auto-tuning is not performed. • The voltage is too low. • A sudden load is added during operation. • Controller model is of too small power class	• Eliminate external faults. •Perform the motor auto tuning. •Adjust the voltage to normal range. • Remove the added load. 5: Select an
	E.oL1	Motor overload	Boost torque is too big under VF control ACC. and DEC.	Reduce boost torque Increase the

			time is too short •Motor parameters setting is improperly •Restart motor which in counter rotate •The grid voltage is too lower •Load is too big or motor block load •Controller selected is too load	ACC./DEC. time • Reset motor parameters •Reduce current limit and adopt speed tracking • Check grid voltage • Check load condition •Change bigger power Controller
	E.oL2	Controller overload	•Boost torque is too big under VF control •ACC. and DEC. time is too short •Motor parameters setting is improperly •Restart motor which in counter rotate •The grid voltage is too lower •Load is too big or motor block load •Controller selected is too load	•Reduce boost torque increase the •ACC./DEC. time reset motor parameters •Reduce current limit and adopt speed tracking • Too check grid voltage •Too check load change bigger power Controller
	E. SC	System abnormal	•Deceleration is too short •Short circuit of solar •Controller output or phase output short circuit to ground • Module damage • EMC interface	Prolong acceleration time • To check peripheral equipment Ask to support • Check the wiring layout, cable ground
	E.oH 1	Controller over-heat	•Temperature is too high. • Air channel is blocked. • Fan connection parts is loose. Fan is damaged. •Temperature detection circuit fault	Make the environment meet the requirement. • Clear the air channel. • Check and reconnect the wire • Change the same new fan.

				Seek support from factory.
	E.oH2	Rectifier over-heat	• Temperature is too high. • Air channel is blocked. • Fan connection parts are loose. Fan is damaged. • Temperature detection circuit fault	•Make the environment meeting the requirement. • Clear the air channel. • Check and reconnect the wire. • Change the same new fan. • Seek support from factory.
	E.TE1	Motor static detection fault	• Detection overtime • Start static detection while motor is running. • Capacitance difference is too big between motor and • Controller. • Motor parameter setting mistake.	• Check motor connection wire. • Detect after motor stopping totally. • Change Controller model. • Reset parameter according to nameplate.
	E.TE2	Motor rotation detection fault	• Detect while motor is running. • Detect with load. • Detection overtime • Capacitance difference is too big between motor and • Controller. • Motor parameter setting mistake.	• Detect after motor stop totally. • Re-detect without load. • Check motor connection wire. • Change Controller model. • Reset parameter according to nameplate.
	E.EEP	Memory fault	•Electromagnetic disturb in memory period. •EEPROM damage.	• Resume load and save. • Seek support from factory.
	LIFE	Reserved		
	E.ILF	Input phase	•3-phase input power	• Check 3-phase

		loss	open phase.	power supply and the phase. •Check 3-phase power supply wiring.
	E.oLF	Output phase loss	•3-phase output power open phase	• Check 3-phase output voltage and current. • Check wiring.
	E.Gnd	Output earth terminal short circuit.	•Check wiring and insulation.	•Output earth
	E.HAL	Current detection fault	•Detect circuit fault. Phase imbalance	•Seek support from factory • Check motor and wiring.
	E.PAn	Keyboard connect fault	•Keyboard wire fault. •Keyboard component damage.	• Check keyboard wire. •Seek support from factory.
	Rs485communication fault	Unsuitable baud rate setting. Communication wire breaks. Communication format does not match upper machine.	•Set suitable baud rate setting. •Check communication wire. •Make sure right communication format.	•RS485communication fault
	E.CPE	Parameter copy fault	•Parameter copy communication is fault. •Copy keyboard does not match the •Controller.	• Check wire. •Select the specified external keyboard model.

*Basic Function Parameter

"●" Stands for parameters can modify during running.
"○" Stands for parameters can't modify during running
"×" Stands for parameter read only, can't modify
"▁" Stands for factory parameters, only for factory
"※" Stands for relative with Controller models.

Function code	Function name	Setting range and definition	Default setting	property	Com. Add
F0.00	Control mode	1：AM linear VF control without PG 6：Without PG for HES motor	1	○	0x000
F0.02	Running control mode	0：Key board control 1：Terminal control	0	○	0x002
F0.03	Main frequency source X reference	0：digital reference of keyboard 1：Potentiometer of key board 8：PID control reference	0	○	0x003
F0.08	Digital frequency reference	0.00～maximum frequency	100.00Hz	.	0x008
F0.09	Maximum frequency	0.00～320.00Hz	100.00Hz	○	0x009
F0.11	Upper limit frequency	Lower limit frequency～Maximum frequency	100.00Hz	●	0x00B
F0.12	Lower limit frequency	Upper limit frequency	0.00Hz	●	0x00C
F0.14	Acceleration time 1	0.01～650.00s	Per model	●	0x00E
F0.15	Deceleration time 1	0.01～650.00s	Per model	●	0x00F
F0.16	Rotation direction	0：As same as forward 1：Runs in reverse 2：Forbidden reverse	0	●	0x010
F0.17	Carrier frequency	0.6～15.0kHz	Per model	●	0x011
F0.19	Factory setting	0：No operation 1：Restore to default(motor parameters don't restore) 2：Clear fault record 3：Restore to default(motor parameters restore)	0	○	0x013

SHAKTI PUMPING LIFE

*Motor Parameter

Function code	Function name	Setting range and definition	Default setting	property	Comm. Add
F5.00	Motor type	0：AC Motor（AM） 1：Permanent magnet motor (HES)	1	.	0x500
F5.01	Poles of motor	2-48	4	○	0x501
F5.02	Rated power of motor	0.4-1000.0kW	Per model	○	0x502
F5.03	Rated frequency of motor	0.01-maximum	Per model	○	0x503
F5.04	Rated speed of motor	0-65000rpm	Per model	○	0x504
F5.05	Rated voltage of motor	0-1500V	Per model	○	0x505
F5.06	rated current of motor	0.1-2000.0A	Per model	○	0x506
F5.07	Motor no load current	0.01-650.0A	Per model	○	0x507
F5.08	Stator resistance (motor)	0.001-65.000	Per model	○	0x508
F5.09	Rotor resistance (motor)	0.001～65.000	Per model	○	0x509
F5.10	Leakage inductive inductance (motor)	0.1-6500.0mH	Per model	○	0x50A
F5.11	Mutual inductive inductance (motor)	0.1-6500.0mH	Per model	○	0x50B
F5.12	Motor auto tuning	0：No operation 1：Rotation auto tuning 2：Stationary auto tuning	0	○	0x50C
F5.21	Stator resistance Of HES motor	0.001-65.000	Per model	○	0x515
F5.22	Shaft D inductance of HES motor	0.01mH-655.35mH	Per model	○	0x516
F5.23	Shaft Q inductance of (HES motor	0.01mH-655.35mH	Per model	○	0x517
F5.24	Back EMF of HES motor of	0.1V-1000.0V	Per model	○	0x518

*** Fault and Protection Parameters**

Function code	Function name	Setting range and definition	Default setting	property	Comm. Add
FA.10	DC bus under voltage protection point	50.0% ~ 100.0%	70.0 %	●	0xA0A

*** Communication Control Function Parameters**

Function code	Function name	Setting range and definition	Default setting	property	Comm. Add
Fd.00	Master-slave selecting (485 Can)	LED 1 digit：485 communication mast to slave： LED 10 digit：Can selection： 0：Master 1：Slave	0	○	0xD00
Fd.02	Communication baud selection	LED 1 digit：485 communication： 0：1200 bps 1：2400 bps 2：4800 bps 3：9600 bps 4：19200 bps LED 10 digit：Can communication 0：20 kbps 1：50 kbps 2：100kbps 3：125kbps 4：250kbps	43	○	0xD02
Fd.10	RS485 communication protocol	0：Modbus protocol 1：Virtual oscilloscope 2：Reserve	0	○	0xD0A

Note: If you need a detailed description of parameters, please contact to Shakti Pumps(I) Ltd.

*** Solar Pump Special Parameters**

Function code	Function name	Setting range and definition	Default setting	property	Comm. Add
FE.00	Solar pump Controller control mode	0：Variable frequency control mode 1：CVT mode for solar 2：MPPT mode for solar	2	○	0xE00
FE.01	Running control mode	0：Stop 1：Running 2：Sleep 3：Low speed protection 4：Dry run protection 5：Over current protection 6：Minimum power protection	Read only		0xE01
FE.02	VOC voltage(display)	0.0 ~ 999.9V	Read only		0xE02
FE.03	CVT target voltage	70.0 ~ 95.0%	81.0%	●	0xE03
FE.04	MPPT upper limit voltage	20.0 ~ 200.0%	100.0%	●	0xE04
FE.05	MPPT lower limit voltage	20.0 ~ 200.0%	50.0%	●	0xE05
FE.06	Frequency adjusting gain	0.1 ~ 500.0%	10.0% (AM) 40.0% (HES)	●	0xE06
FE.07	MPPT search interval	0.1 ~ 100.0	1.0s	●	0xE07
FE.08	MPPT regulating gain	0 ~ 9999	100	●	0xE08
FE.09	Quick-drop frequency gain	0 ~ 20	2	●	0xE09
FE.10	Frequency adjusting filter time	0.001 ~ 2.000 s	0.001	●	0xE0A
FE.11	Go to sleep mode voltage	0 ~ 1000V	0V	●	0xE0B
FE.12	Wake up restore voltage	0 ~ 1000V	400V	●	0xE0C
FE.13	Sleeping stop restore waiting time	0.0 ~ 3000.0s	10.0s	●	0xE0D

FE.14	Low speed protection detect frequency	0.00 ~ 300.00Hz	10.00Hz	●	0xE0E
FE.15	Low speed protection detect time	0.0 ~ 3000.0s	10.0s	●	0xE0F
FE.16	Low speed protection restore working time	0.0 ~ 3000.0s	10.0s	●	0xE10
FE.17	Dry run protection detect current	0.0 ~ 999.9A	0.0A	●	0xE11
FE.18	Dry run protection detect time	0.0 ~ 3000.0s	10.0s	●	0xE12
FE.19	Dry run auto restore working time	0.0 ~ 3000.0s	10.0s	●	0xE13
FE.20	Over current point setting	0.0 ~ 999.9A	0.0A	●	0xE14
FE.21	Over current protection detect time	0.0 ~ 3000.0s	10.0s	●	0xE15
FE.22	Over current protection auto restore working time	0.0 ~ 3000.0s	10.0s	●	0xE16
FE.23	Input minimum power protection power point setting	0.00 ~ 650.00kw	0.00kw	●	0xE17
FE.24	Minimum power protection detect time	0.0 ~ 3000.0s	10.0s	●	0xE18
FE.25	Minimum power protection auto restore working time	0.0 ~ 3000.0s	10.0s	●	0xE19
FE.26	Fault alarm restore mode	0：Auto reset;1 ：Reset by manual LED0：Low speed protection LED1：Dry run LED2：Over current protection LED3: Minimum power protection	0000	●	0xE1A
FE.27	Water fulfilled detect time	0.0s ~ 3000.0s	10.0s	●	0xE1B

FE.28	Water fulfilled restore time	0.0s ~ 3000.0s	10.0s	●	0xE1C
FE.29	reserve			●	0xE1D
FE.30	DC current revise offset	0.00 ~ 99.99A	0.01A	●	0xE1E
FE.31	DC current revise proportion gain	0.0 ~ 999.9%	100.0%	●	0xE1F
FE.32	Power curve point 0	0.00 ~ 99.99kw	0.50kw	●	0xE20
FE.33	Power curve point 1	0.00 ~ 99.99kw	1.00kw	●	0xE21
FE.34	Power curve point 2	0.00 ~ 99.99kw	1.50kw	●	0xE22
FE.35	Power curve point 3	0.00 ~ 99.99kw	2.00kw	●	0xE23
FE.36	Power curve point 4	0.00 ~ 99.99kw	2.50kw	●	0xE24
FE.37	Flow curve point 0	0.0 ~ 999.9m3/h	0.0 m3/h	●	0xE25
FE.38	Flow curve point 1	0.0 ~ 999.9m3/h	5.0 m3/h	●	0xE26
FE.39	Flow curve point 2	0.0 ~ 999.9m3/h	10.0 m3/h	●	0xE27
FE.40	Flow curve point 3	0.0 ~ 999.9m3/h	15.0 m3/h	●	0xE28
FE.41	Flow curve point 4	0.0 ~ 999.9m3/h	20.0 m3/h	●	0xE29
FE.42	Flow calculating revise offset	0.0 ~ 999.9m3	0.0m3	●	0xE30
FE.43	Flow calculating revise gain	0.0 ~ 999.9%	100.0%	●	0xE31
FE.44	Power per day/ generated power per day reset period	0.0 ~ 24.0h	**7.0h**	●	0xE32
FE.45	Reserved			●	0xE33

FE.46	Solar pump function selection 1	LED0：Constant torque frequency limit selection 0：Invalid 1：Valid LED1：Reserved LED2：Voltage rising update Voc voltage LED3: Fast frequency falling function	1100H	●	0xE34
FE.47	Fast frequency falling threshold	3.0%～15.0%	5.0%	●	0xE35
FE.48	Constant torque frequency limit coefficient	80.0%～150.0%	100.0%	●	0xE36
FE.49	Sudden voltage increase threshold	0.0%～20.0%	5.0%	●	0xE37
FE.50	Reserved			●	0xE38

*** Solar Pump Sets Monitoring Parameters**

Function code	Function name	Setting range and definition	Default setting	property	Comm. Add
C-00	Frequency reference	0.01Hz	Read only		2100H
C-01	Output frequency	0.01Hz	Read only		2101H
C-02	Output current	0.1A	Read only		2102H
C-04	Output voltage	0.1V	Read only		2104H
C-10	Output power	0.01kw	Read only		210AH
C-11	DC bus voltage	0.1V	Read only		210BH
C-30	DC current	0.01A	Read only		211EH
C-31	Flow speed	0.1 m3/h	Read only		211FH
C-32	Voc voltage	0.1 V	Read only		2120H
C-33	Flow per day	0.1 m3	Read only		2121H
C-34	Cumulative total flow(low position)	0.1m3	Read only		2122H
C-35	Cumulative total flow(high position)	0.1km3	Read only		2123H
C-36	Generated power per day	0.1kwh	Read only		2124H
C-37	Cumulative total generated power (low position)	0.1kwh	Read only		2125H
C-38	Cumulative total generated power (high position)	0.1Mwh	Read only		2126H

5. Operation Guidance

5.1 Solar AC motor pump Controller operation guidance

1) Wiring:
a. Confirmed the solar pump Controller if mating with motor.
b. Connecting "+""-" of solar panel to corresponding "+""-" of Controller or R, T wiring terminals. Otherwise it will cause Controller damage.
c. Connect motor wire and ground wire to corresponding U, V, W, E terminals.

2). Parameters setting and trial run:
a. Set F0.00 to 1, F0.02 for 0, and F0.09, F0.11, F0.14, F0.15 parameters setting according to application site.
b. Set motor (pump) parameters according to nameplate of pump
c. Set solar pump MPPT mode FE.001 for 1 or 2
d. Press FWD button for trail running, and confirm the motor running direction.

6.2 Solar HES motor pump Controller operation guidance

1) Wiring:
a. Confirm if the solar pump Controller matches with the motor.
b. Connecting "+""-" of solar panel to corresponding "+""-" of Controller or R, T wiring terminals. Otherwise it will cause Controller damage.
c. Connect motor wire and ground wire to corresponding U, V, W, E terminals.

2) Parameters setting and trial run:
a) Set F0.00 to 6, F0.02 for 0, and F0.09=100.00, F0.11=100.00; F0.14, F0.15 can be set according to demand.
b). Set motor (pump) parameters according to nameplate of pump. Then Set F5.12 for 1, the keypad will show T-00, Press FWD to start motor auto tuning. This process takes about three minutes;

Note:
1. If you can disconnect the motor and load, self-learning would be better;.
2. The self-learning need to be done with enough sunshine and when the solar panels can provide enough energy.

c). Set solar pump MPPT mode FE.001 for 1 or 2
d). Press FWD button for trail running, and confirm the motor running direction.

5.3 PV Water Pump Features

A. Sleep Function
During the Solar pump operation, the Controller will go into sleep state when the DC voltage provided by solar panels is lower than FE.11 (sleep voltage threshold) due to objective factors, while the keyboard warning "A.LPn"; when DC voltage provided by solar panels rises back to FE.12 (sleep recovery voltage) point, start timing and after FE.13 (sleep shutdown waiting time), the Controller starts running;

B. Low-frequency Protection Function
During the operation of the Solar pump, for some reason, the output frequency is lower than FE.14 (low frequency detection frequency), and after FE.15 (under frequency detection time) time, enters into the standby protection state, while the keyboard warning "A.LFr"; after entering into the standby protection state and after FE.16 (frequency protection automatic recovery) time, automatically resume to running state;

C. Dry Run Protection
During the operation of the Solar pump, for some reason, the output current is less than FE.17 (dry protection current detection), and after FE.18 (dry protection detection time) time, enters into standby protection state, while the keyboard warning "A.LuT"; after entering into the standby protection state and after FE.19 (dry protection automatic recovery) time, automatically resume to running state;

D. Over-current Protection
During the operation of the Solar pump, for some reason, the output current is greater than FE.20(over current protect detect current), and after FE.21 (over current protection detect time) time, enters into standby protection state, while the keyboard warning "A.oLd"; after entering into the standby protection state and after FE.22 (over current protection auto restore time), automatically resume to running state;

E. Minimum Power Protection
During the operation of the Solar pump, for some reason, the output power is less than FE.23(minimum power protection value), and after FE.24 (minimum power protection detection time) time, enters into standby protection state, while the keyboard warning "A.LPr"; after entering into the standby protection state and after FE.25 (minimum power automatic recovery)time, automatically resume to running state;

F. Full Water Protection

Detect the water full alarm and low water level through two X terminals, realizing automatic level control. Wherein FE.27 is the water overflow protection detection time and FE.28 is full water protection exit time, and X terminal is defined as 10 (full solar water detection alarm), and when defined as the 11 (full solar water detection alarm reset), the warning signal is shown as "A.Ful"

G. Alarm Recovery Mode: 0: automatic recovery; 1: manual recovery

This option is for low frequency protection, dry protection, over-current protection, minimum power function; you can select the alarm restoration by FE.26. When you select 0 for automatic recovery, during fault warning displaying, you can also press the "RESET" button to stop operation; during fault warning displaying, you can press the "RESET" button to manually clear, you can also press "RESET" button to achieve stop operation.

H. PQ Curve Function

This model provides a self-defined PQ curve for users to set up five groups of PQ corresponding points according to the pump cases, to achieve real-time traffic speed, daily flow, cumulative flow, generating capacity, cumulative electricity consumption; of which by default, daily flow and generating capacity are calculated based on 7h in a day.

I. Status Check

When the Solar pump is running, you can check FE.01 to confirm the current operating status.