

## 3 Phase Power Regulator User Manual

(PEACO-TS Series)



Dear customer,

Thanks for purchasing Peaco Support SCR Power regulator. Please read the user manual before using so that you could make a full acknowledge of our product and operate it correctly. We will not inform you especially if there is any modification made.

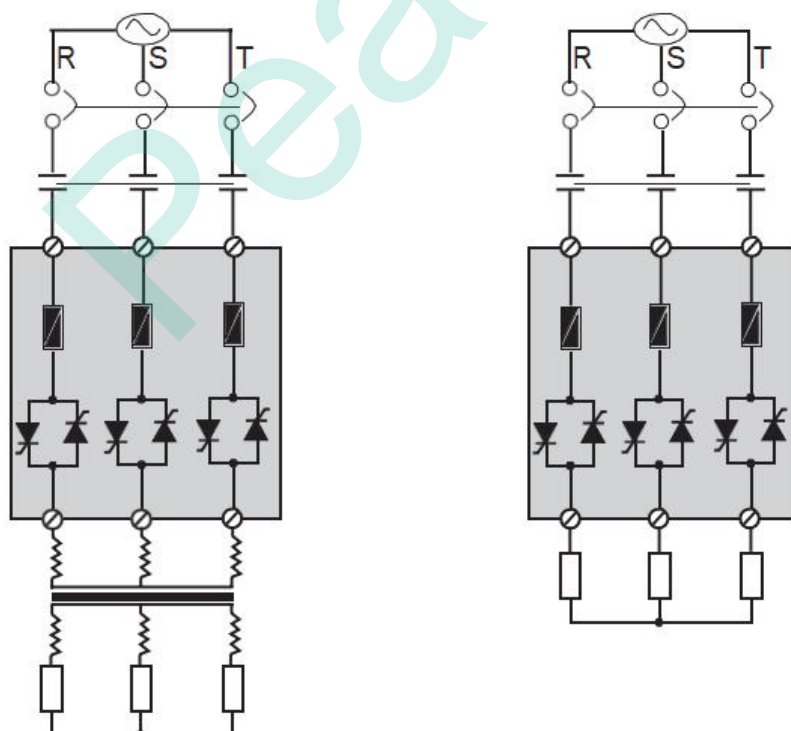
### ◆ 3 Phase SCR Power Regulator Features

1. MCU 32-bit single-chip microcomputer dual-core control, built-in PID closed-loop control, 100% linear output.
2. Double row digital display, input, output, voltage, current, power, five parameters display custom.
3. Double channel signal input design, current and voltage signal input available.
4. A variety of control methods: constant pressure, constant current, constant power, open loop, cycle control.
5. Multiple protection functions: phase loss, over-current, over-temperature, line break protection.
6. After debugging the parameter saving function, restore the factory setting function with one key.
7. MODBUS RTU communication, the upper computer can directly control the output size.

### ◆ Warning and Precautions

1. Main circuit: Power line - Air circuit breaker - Contactor - Load.
2. All connecting nuts must be locking to avoid arcing burned connector.
3. Air Switch can cut off the power to protect the power regulator and personal safety during repair and maintenance.
4. Contactor can cut off power supply automatically to protect the regulator and avoid accidents when it fails.
5. Power regulator will produce internal heat during operation. Please install it vertically and both sides of the gap to be set aside to avoid the rapid aging and damage of power module caused by adverse thermal.
6. Air flow vents are required to control cabinet. Please follow the principle of hot air from bottom to top to install exhaust vents or install convection fan. Cabinet air-conditioning cooling can be considered if conditions allow.
7. Do not install it in high-temperature environments and poorly ventilated situations, otherwise use it less than 70% of rated capacity.
8. Avoid installing it in the steam or acid, alkali, corrosive gases situations.
9. Humidity: 90% RH or less (No condensation).
10. Ambient temperature: 0°C-+40°C.

### ◆ Main Circuit Power Distribution



NFB → Cut off power supply.

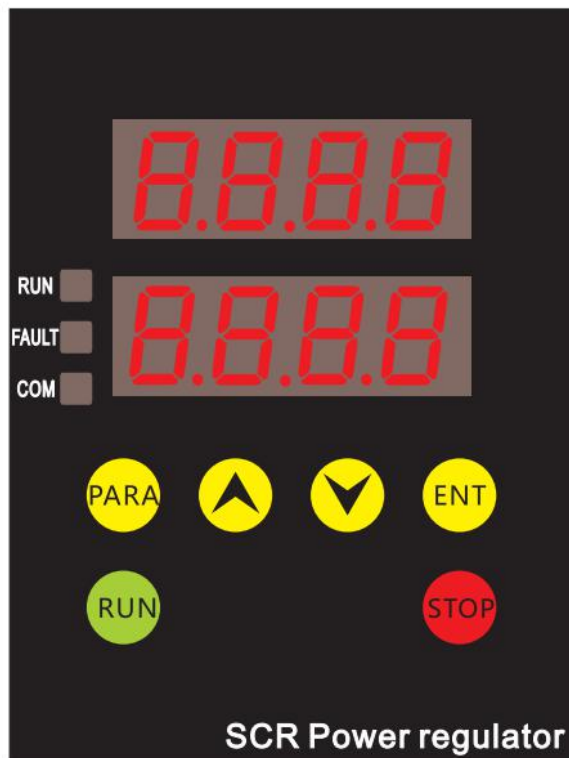
MC → Protective contactor.

SCR → According to the control signal to adjust the output current to achieve constant temperature control.

LOAD → The load can be resistive or inductive and the center point can be connected to the zero line.

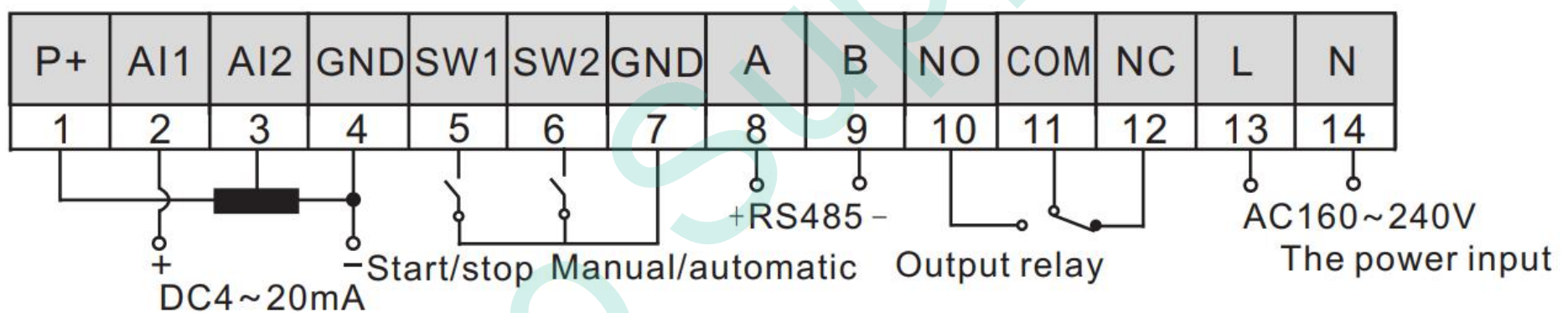


◆ Panel Function Description



The name of the	Functional specifications
Upper digital tube	Current input percentage display/parameter name display
Lower digital tube	Current input, output, voltage, current, power display/parameter value display
The RUN light	Green, this light is on when the power regulator is working
The FAULT light	Red, when the power regulator abnormal alarm, this light on
COM indicator light	Yellow, this light flashes when the communication is online
PARA key	Press 2 seconds to enter the parameter setting menu
▲ key	Parameter back switch/data increase key
▼ key	Parameter forward switch/data reduction key
ENT key	Modify the confirmation key; In the initial screen can be switched to view I,O,U,A,P
RUN key	Keyboard starting
STOP key	Keyboard stop, reset in case of failure

◆ Function Description of Control Terminal



NO.	symbol	Functional specifications
1	P+	Reference power supply +5V: a given reference for use by an external potentiometer
2	AI1	Current analog input port 1: DC0 ~ 20 ma/DC4 ~ 20 ma (125 $\Omega$ input impedance), and 4 terminals GND input circuits
3	AI2	Voltage analog input port 2:0-5v input/potentiometer input (middle tap)/ dc0-10v, and GND constitute the input loop
4	GND	Signal common ground: analog signal negative, switching signal common end
5	SW1	External start/stop control end :SW1 and GND constitute start/stop. When the terminals are closed, the regulator works
6	SW2	Analog input port selection: SW2 and 7-terminal GND, close analog input port 2; Disconnect select input port 1
7	GND	Signal common ground: analog signal negative, switching signal common end
8	A	Rs485 communication port,RS485+
9	B	Rs485 communication port,RS485-
10	NO	Output relay: it can be selected as operation output signal or alarm output signal according to p-49 function in the menu. Load capacity AC240V/5A,DC24V/5A, NO: normally open point; NC: normally closed
11	COM	
12	NC	
13	L	Power supply of control board: AC160~240V
14	N	



Basic application wiring: 4~20mA control signal input positive terminal to terminal 2 AI1, negative terminal to terminal 4 GND. Control power 220V connected to 13, 14 terminals, zero. The line of fire does not divide. Starting terminals 5 and 7 has been connected in factory and it starts by default. If you need to install a starting switch in the control cabinet, you can switch 5 and 7.

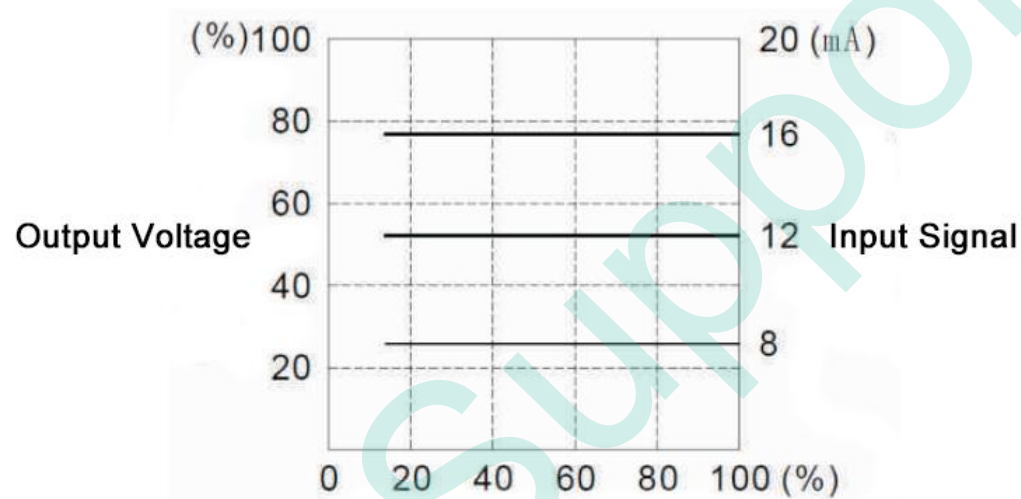


It is recommended to use the alarm output function of the power regulator when designing the electrical circuit. The power regulator is perfect for load and power supply alarm function, when there is any abnormal, there will be alarm output timely.

### ◆ Control Mode Function Description

#### ● Constant Voltage Control Mode

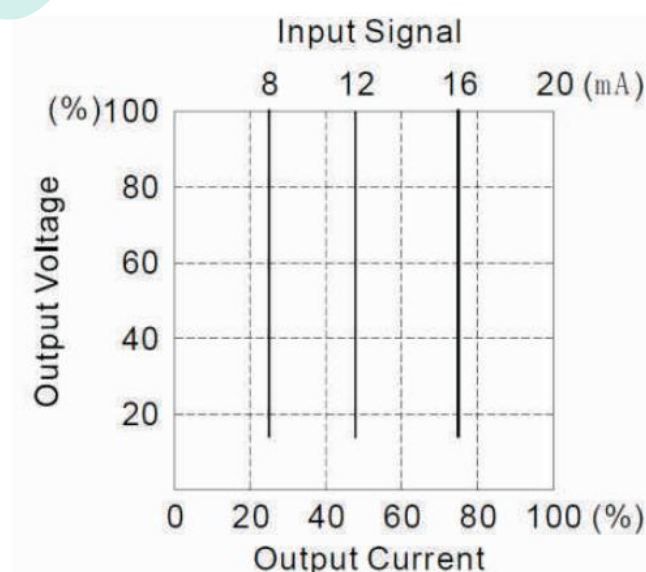
- Control mode setting: p-24 parameter =0.
- In a control system, the output value of a voltage is kept constant at a given voltage. When the network voltage fluctuations or load impedance changes, the regulator to adjust the PID law, suitable for inductive, resistive and capacitive loads.



Constant Voltage Output Diagram

#### ● Constant Current Control Mode

- Control mode setting: p-24 parameter=1.
- A control system that keeps the current output constant at a given current value. When the network voltage fluctuates or load impedance changes, the regulator adjusts the PID law. Suitable for inductive, resistive and capacitive loads.

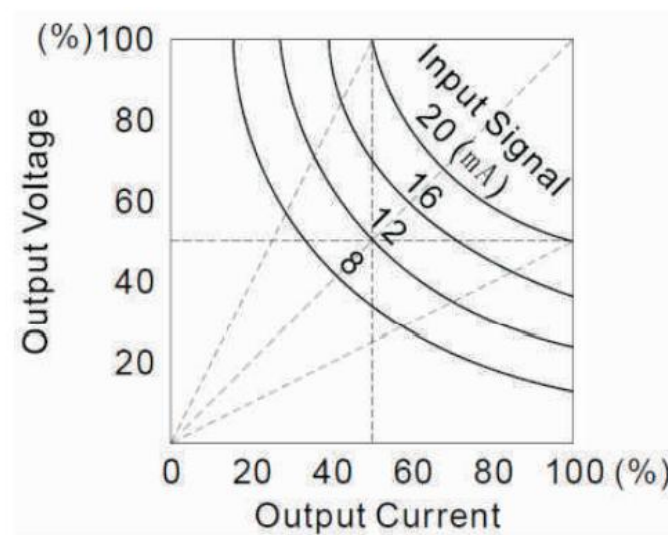


Constant Current Output Diagram

#### ● Constant Power Control Mode

- Control mode setting: p-24 parameter=2.
- A control system that keeps the power output constant at a given power value. When the network voltage fluctuates or load impedance changes, the regulator adjusts the PID law. Suitable for inductive, resistive and capacitive loads.





Constant Power Output Diagram

### ● Open Loop Control Mode

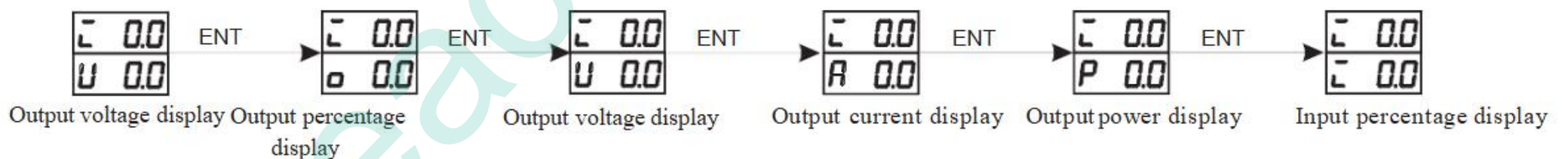
1. Control mode setting: p-24 parameter=3.
2. The control method of controlling the amount of thyristor opening directly by input value. When the network voltage fluctuates or the load impedance changes, the voltage or current cannot remain constant. Suitable for inductive, resistive and capacitive loads.

### ● Circumferential Zero Control Mode

1. Control mode setting: p-24 parameter=4 (cycle crossing zero), 5 (cycle crossing zero).
2. The control mode without harmonic pollution to power grid. The cycle number of the thyristor in 100 cycles is determined by the input value, which is suitable for the pure resistive load.
3. Cycle zero crossing is a kind of variable cycle zero crossing control method with fast on and off speed. Fixed period zero crossing is a cycle of 2 seconds according to the duty cycle on and off time zero crossing mode.

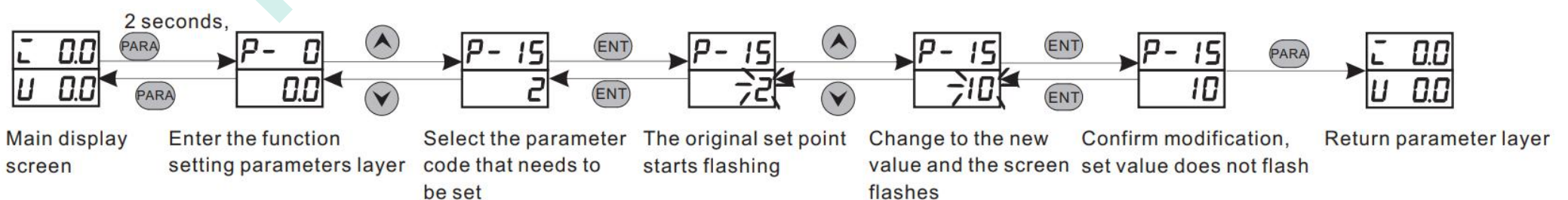
## ◆ Technical Parameters

1. Display parameter layer. ENT button can switch the lower row to display input, output, voltage, current and power cycle.



2. Function setting parameter layer.

Operating instructions for parameter modification. (for example, changing p-15 slow start time parameter from 2 seconds to 10 seconds, other parameter modification steps are similar.)



Note: 1. When the display is in the parameter setting window, if there is no operation for 2 minutes, it will automatically return to the basic display state. At this point, parameters that have been modified but not saved will be invalid.

- **P-0 to p-6 are read-only parameters that show the basic information for normal operation of the regulator.**

P-0	Valid input percentage display	range	0.0~100.0%,one decimal place	default	—	attribute	read
P-1	Valid output percentage display	range	0.0~100.0%,one decimal place	default	—	attribute	read
P-2	Output voltage value display	range	The actual measured voltage	default	—	attribute	read
P-3	Output current value display	range	The actual measured current size	default	—	attribute	read
P-4	Output power display	range	Actual detected power size	default	—	attribute	read
P-5	Grid frequency display	range	The actual measured power grid frequency	default	—	attribute	read
P-6	Start stop state of regulator	range	Zero: stop, 1: run	default	—	attribute	read

- **P-7 to p-14 are input signals and start-stop mode parameters, and change the functional parameters to make the regulator achieve the required functions.**

P-7	Input signal selection	range	0: digital quantity, 1: analog quantity	default	1	attribute	Read/write
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Input signals have two categories by selecting parameters through input signals: 0: digital quantity, including panel key input mode or communication input mode. The specific mode shall be set with p-9 parameters as follows. 1: analog quantity, including the current analog quantity at AI1 port and the voltage analog quantity at AI2 port, which way to choose, please refer to the switch state of SW2, and select the current analog quantity at AI1 port in the open state. The voltage analog input of AI2 port is selected in the closed state.

P-8	The second analog input limiter	range	0:close, 1:open	default	0	attribute	Read/write
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When p-7 =1 and SW2 switch is in the open state, if p-8 =1 is set, then the second analog input is used as the limiter input function, usually connected to the potentiometer and used as the maximum limiter of the first analog input.

P-9	Digital input signal type selection	range	0: panel keys, 1: communication given	default	1	attribute	Read/write
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0: panel key, in the main interface, directly press the increase key or decrease key to set the input percentage. The set value is still valid after power failure and restart. 1: given communication, set the input percentage by setting the parameter p-11, namely address 11 of communication parameter 0.0~100.0.

P-10	Panel setting percentage	range	0.0~100.0%	default	0.0	attribute	Read
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This parameter only shows the input percentage set by the panel. When setting the input percentage by the panel, the value set will not be lost and will be saved in this parameter.

P-11	Communication set percentage	range	0.0~100.0%	default	0.0	attribute	Read/write
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When setting the communication given input percentage, the upper computer writes data to the address (11) from 0.0~100.0 corresponding to 0.0~100.0% of the input signal.

P-12	Start and stop mode selection	range	0: external switch, 1: communication, 2: keyboard	default	0	attribute	Read/write
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0: external switch, SW1 switch closes, the regulator starts to run, SW1 switch opens, the regulator stops working.

1: communication starting, the upper computer writes data to p-50, namely address 50, write 1 as starting, write 0 as stop.

2: keyboard start; press the RUN button on the regulator panel to start the regulator; press the STOP button to STOP the regulator.

P-13	Current input analog type	range	0: 0~20mA, 1: 4~20mA	default	1	attribute	Read/write
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When p-7 =1, the SW2 switch is in the open state, then the current analog signal input by AI1 will select the type through this parameter. 0: 0~20mA input, 1: 4~20mA input.

P-14	Voltage input analog type	range	0: 0~5V, 1: 0~10V	default	0	attribute	Read/write
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When p-7 =1, SW2 switch is closed, then the input voltage analog signal of AI2 port is selected by this parameter. 0:0~5V input, 1:0~10V input.

- **P-15 to p-26 set parameters for limiting parameters and output functions, which can be changed to achieve the desired functions of the regulator.**

P-15	Slow start time setting	range	0~300seconds	default	2	attribute	Read/write
P-16	Delay shutdown time setting	range	0~300seconds	default	2	attribute	Read/write

Slow start time refers to the time required for the output of the regulator to rise from 0% to 100% (as shown in figure t1 below). The delay time is the time required for the regulator output to drop from 100% to 0% (figure t2 below).



P-17	Output ceiling setting	range	0~100%	default	100	attribute	Read/write
P-18	Output lower limit setting	range	0~100%	default	0	attribute	Read/write

Output upper limit (maximum) set, output lower limit (minimum) set.

P-19	Maximum voltage limit	range	0~500V	default	380	attribute	Read/write
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The maximum voltage limit is related to the rated voltage and shall not be greater than the rated voltage. The factory value is the rated voltage and is used to limit the maximum output voltage. When the rated voltage is changed, please remember to modify this parameter. For example, after the rated voltage is changed from the factory 220V to 380V, this parameter should also be changed to 380V. Otherwise, the maximum output cannot be 380V, because the maximum limit is 220V.

P-20	Maximum current limit	range	0~500A	default	100	attribute	Read/write
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The maximum current limit is related to the rated current and can not be greater than the rated current. The factory value is the rated current and is used to limit the maximum output current.

P-21	ratio	range	0~9999	default	500	attribute	Read/write
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The proportional gain of the PID regulator is multiplied by the error to obtain the modified value. If this parameter is added, the damping of the system will be increased and the dynamic response speed of the system will be accelerated. For a certain load, this parameter will cause system instability. The optimal setting value is the maximum possible value for the system to enter into instability.

P-22	Integral coefficient	range	0~9999	default	200	attribute	Read/write
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The integral gain of the PDI regulator is multiplied by the error to obtain the modified value. The modified value ensures that the system has no error. If the parameter is increased, the recovery rate of the system after disturbance will be increased. If the parameter is too large, the system tends to oscillate rather than recover quickly.

P-23	Differential coefficient	range	0~9999	default	10	attribute	Read/write
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The differential gain of PID regulator is modified by the error, which has damping effect. The optimal performance is obtained by the best combination of three PID parameters.

P-24	Control mode	range	0~5	default	0	attribute	Read/write
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Zero: constant pressure; 1: constant current; 2: constant power; 3: open loop; 4: cycle passing zero; 5: Constant period crossing zero

P-25	Top row digital tube display content selection	range	0~4	default	0	attribute	Read
P-26	Lower digital tube display content selection	range	0~4	default	0	attribute	Read

After the power regulator is powered on, the upper and lower rows of digital tubes will display different parameters according to different control modes: constant voltage mode upper input percentage, lower output voltage; Constant current mode upper input percentage, lower output current; In constant power mode, the upper row shows the output voltage and the lower row shows the output current. In open-loop mode, the upper row shows the input percentage, and the lower row shows the output percentage. The top row of the cycle mode shows the input percentage, and the bottom row shows the output percentage. The top and bottom row can also be customized display content: 0, input percentage; 1. Output percentage; 2. Output current; 3. Output voltage; 4. Output power.

- P-27 to p-33 are the calibration parameters of input signals and output current and voltage values.**

P-27	Input voltage signal (AI2) calibration	range	0.500~1.500	default	1.000	attribute	Read/write
P-29	Calibration of input current signal (AI1)	range	0.500~1.500	default	1.000	attribute	Read/write

The zero and full degree of the input voltage signal of AI2 can be calibrated, and the zero and full degree of the input current signal of AI1 can be calibrated.

P-31	Output voltage calibration	range	0.500~1.500	default	1.000	attribute	Read/write
P-33	Output current calibration	range	0.500~1.500	default	1.000	attribute	Read/write

The output voltage and current values can be calibrated.

- P-34 to p-40 are the protection function parameters, change the setting parameters of each function, and you can change the setting of each protection function of the regulator to meet the expected demand.**

P- 34	Current fault code	range	0~6	default	/	attribute	Read
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Display the current state of the power regulator; 0: no fault; 1. Over-current; 2: power supply phase loss; 3: load disconnection; 4: excessive temperature of radiator; 5: load short circuit; 6: thyristor breakdown; 7: unbalanced output voltage; 8: unbalanced output current.

P- 35	Power lack phase protection allowed	range	0:close,1:open	default	1	attribute	Read/write
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When the load power supply is out of phase, the power regulator will give an alarm. When the load power supply is connected, the fault will be eliminated automatically.



P-36	Load over-current protection is allowed	range	0:close,1:open	default	1	attribute	Read/write
P-37	Load over-current protection percentage setting	range	50~200%	default	150	attribute	Read/write

When the over-current protection is enabled, the p-37 can set the over-current range from 50 to 200% of the rated current.

P-38	Load break protection is allowed	range	0:close,1:open	default	0	attribute	Read/write
P-39	Load break protection threshold	range	1~70%	default	70	attribute	Read/write

If you want to use load break protection, first set the maximum current value when the load is full to the rated current p-42, so that the break protection function can be effectively used. Then change p-38 to 1 to open the protection, and set the p-39 protection threshold as a percentage of the rated current. Note: the calculation formula for the threshold current of load disconnection protection is as follows: input percentage (p-01) \* rated current \* threshold percentage of disconnection protection (p-39) = threshold current.

P-40	Radiator overheat protection allowed	range	0:close,1:open	default	1	attribute	Read/write
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When the radiator overheat protection is allowed, when the temperature of the radiator exceeds 80℃, the power regulator automatically stops the output, and automatically starts the output after cooling.

### ● P-41 to p-45 are regulator rated parameter settings and communication settings.

P-41	Load rated voltage	range	50~500V	default	/	attribute	Read/write
P-42	Load rated current	range	5~200A	default	/	attribute	Read/write

The rated voltage and rated current are set to the nominal values of the regulator, which are set according to the model.

P-43	Correspondence address	range	1~247	default	1	attribute	No read/write
P-44	Baud rate	range	0,1,2,3	default	1	attribute	No read/write

For the selection of communication baud rate, 0:4800, 1:9600,2:19200, 3:38400.

P-45	The data format	range	0:8N1;1:8E1;2:8O1	default	0	attribute	No read/write
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Data format: 0:8-bit data bit, 1-bit stop bit, no check; 1:8 data bits, 1 stop bit, even check; 2:8 data bits, 1 stop bit, odd check.

The power regulator supports MODBUS communication protocol and supports 4 functions including 3, 4, 6 and 16. The parameter value is a 16-bit unsigned register, which does not support the decimal point. If you want to write 56.7, you need to adjust it to the integer 567 before writing. Parameter address is the parameter number, such as write delay start time, as long as the parameter address 15 write data.

### ● P-46 through p-63 are the Settings for other higher-order functions of the regulator.

P-46	Internal current transformer ratio	range	100~1000	default	200	attribute	Read/write
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Do not change the ratio of current transformer and the factory setting.

P-47	Internal current transformer connection mode	range	0~1	default	1	attribute	Read/write
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Wiring mode, factory settings are the same.

P-49	Output relay function selection	range	0~5	default	0	attribute	Read/write
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Select the function of relay outlet of terminal 10, 11.

0: normally open output without alarm.

1: normally closed output without alarm.

2: run-time closure.

3: Closure at stop.

4: the relay is normally closed only when 220V control power is connected, which has nothing to do with alarm and output state.

5: the power is normally on. As long as the 220V control power is connected, the relay is normally on, which has nothing to do with alarm and output state.

P-50	Communication control start stop input	range	0, 1	default	0	attribute	Read/write
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Write 1 to start the power regulator and 0 to stop the p-50 by means of communication.

P-51	Three phase voltage unbalance alarm enable	range	0: close, 1: open	default	0	attribute	Read/write
P-52	Three phase voltage unbalance alarm deviation	range	1~500V	default	20	attribute	Read/write

Set whether p-51 enables three-phase voltage unbalance alarm, set the voltage value of p-52 three-phase deviation, when the set deviation value is reached, the alarm output.

P-53	Three phase current unbalance alarm enable	range	0:close, 1:open	default	0	attribute	Read/write
P-54	Three phase current unbalance alarm deviation	range	1~500A	default	20	attribute	Read/write

Set whether p-53 enables three-phase current unbalance alarm, set the current value of p-54 three-phase deviation, when the set deviation value is reached, the alarm output.

P-55	AB phase output voltage	range	0~500V	default	—	attribute	Read
P-56	BC phase output voltage	range	0~500V	default	—	attribute	Read
P-57	CA phase output voltage	range	0~500V	default	—	attribute	Read

Displays the actual output voltage between the three phases.

P-58	A phase output current value	range	0~500A	default	—	attribute	Read
P-59	B phase output current value	range	0~500A	default	—	attribute	Read
P-60	C phase output current value	range	0~500A	default	—	attribute	Read

Shows the actual output current value of three phases.

P-61	Factory value recovery	range	—	default	0	attribute	No read/write
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When the parameters of the regulator have been adjusted and cannot be used normally, you can choose to restore the factory value. In the main operating interface, press **ENT** + **✓** + **STOP** three keys together for 2 seconds. When the tube displays **LOAD**, the parameters will restore to the factory value.

P-62	Keyboard modifies parameter permissions	range	0: modifiable, 1: not modifiable	default	0	attribute	No read/write
P-63	Factory Settings are saved	range	—	default	0	attribute	Read/write

Before leaving the factory, after setting the parameters according to the corresponding model and functions, change p-63 to 16, then press **ENT** to confirm and **SAVE** the parameters after the digital tube appears **SAVE**. Once the factory value is restored, the parameters are the Settings just saved. If the user sets different parameters in the process of use, he can also save the parameters after writing 16 and then restore the factory value. The parameter setting is the parameter setting saved by the user, which cannot be restored to the factory initial setting.

## ◆ Troubleshooting

The power regulator has a variety of fault protection functions. When a fault occurs, the regulator will automatically protect and display the corresponding fault code in the display window. Users can determine the fault range according to the displayed fault code and make corresponding countermeasures.

Phenomenon	Cause	Troubleshooting
No display	No power to control panel	1. Check the control power supply. 2. Check the connection between the control board and the display board.
The output is out of control	Out of control	1. Check whether the parameter setting is correct.
The output instability	Output is not stable	1. Check the PID parameter setting.
E -- 1	The load flow	1. Check whether there is any problem with the load.
E -- 2 (E - A2) (E - B2) (E - C2)	Load power out of phase	1. Check whether the load power supply is transmitted. 2. Check whether the contactor or fuse is broken. When there is A phase power shortage, the display code or e-a2, e-b2, e-c2 appear, respectively can represent A or B or C phase power shortage, when the display code is E--2 represents at least two phase power shortage. 3. Eliminate the fault and automatically remove the alarm.
E -- 3	Disconnection of load	Load disconnection, disconnection current = given percentage * rated current * load threshold, the difference between the given current value and the actual detected value is greater than disconnection current, the alarm is activated, which may be: 1. Load is disconnected. 2. The load current is too small and the rated current is set too large. 3. Load door limit (p-39) is set too small.
E -- 4	Radiator overheating fault	The power regulator overheats, and the temperature of the radiator is detected to be greater than 80°C, and the alarm is activated. When the temperature is less than 80°C, the alarm is automatically eliminated. The possible cause of the over-temperature is: 1. The ambient temperature is higher than 45°C. 2. The cooling fan is damaged. 3. Dust accumulation in air duct
E -- 5	Load short circuit alarm	1. Check whether the load is short circuit.
E -- 6	Thyristor module breakdown	1. Measure the resistance of incoming and outgoing lines. Small resistance means breakdown.
E -- 7	The output voltage is unbalanced	1. Check whether the load is balanced and whether there is broken line.
E -- 8	The output current is unbalanced	1. Check whether the load is balanced and whether there is broken line.

## ◆ Current calculation

$$\text{Three phase current} = 1.2 \times \frac{\text{load (KW)} \times 1000}{\text{voltage (V)} \times \sqrt{3}}$$

## ◆ Specification and Model List

Mode	current (A)	load (kW)		Size (mm)			Fixed size		Weight (kg)	Screw torque (kgfcm)		Cooling
		220V	380V	Length	Width	Height	Length	Width				
PEACO-TS-4-4-030-P	30	9.50	16.50	200	110	160	130	105	2.2	M6	40	Natural
PEACO-TS-4-4-040-P	40	12.50	20.00	200	110	160	130	105	2.5	M6	40	Natural
PEACO-TS-4-4-050-P	50	15.50	27.00	250	140	205	162	135	3.5	M6	50	Fan
PEACO-TS-4-4-060-P	60	19.00	33.00	250	140	205	162	135	3.5	M6	50	Fan
PEACO-TS-4-4-075-P	75	23.50	41.00	250	140	205	162	135	3.5	M6	70	Fan
PEACO-TS-4-4-080-P	80	25.50	44.00	250	140	205	162	135	3.5	M6	75	Fan
PEACO-TS-4-4-090-P	90	28.50	49.00	250	140	205	162	135	3.5	M6	85	Fan
PEACO-TS-4-4-100-P	100	32.00	55.00	250	140	205	162	135	3.5	M6	85	Fan
PEACO-TS-4-4-125-P	125	40.00	68.50	290	140	205	202	135	4.4	M8	95	Fan
PEACO-TS-4-4-150-P	150	45.00	75.00	340	140	205	252	135	5.5	M8	170	Fan
PEACO-TS-4-4-175-P	175	53.00	88.00	390	140	205	252	135	6.0	M8	200	Fan