

Thank you for purchasing the APR3H series SCR power regulator. Before operation, please read this manual to fully understand how to use this product. Please keep this manual for your reference at all times.

1. Product Characteristics

- ◇ Using MCU 32-bit single-chip microcomputer dual-core control, built-in PID closed-loop control, 100% linear output.
- ◇ Four-line liquid crystal display, input, output, voltage, current, power five parameter display customization.
- ◇ Dual-channel signal input design, current and voltage signal input are available.
- ◇ Multiple control modes: constant voltage, constant current, constant power, open-loop and weekly wave control.
- ◇ Multiple protection functions: phase failure, over-current, over-temperature, disconnection protection; module breakdown alarm;
- ◇ Parameter saving function after debugging and one-key factory setting restoration function.
- ◇ MODBUS RTU communication, the upper computer can directly control the output size.
- ◇ Output relay function, customizable

2. Safety, Warnings and Precautions

Safety

- ◇ Please read the safety precautions carefully before use. These precautions are important for safety.
- ◇ If this product is to be used on equipment that may cause injury to personnel or significant property damage, it must be used with double or triple protection.
- ◇ When the SCR is not output, it is not considered to be fully isolated, and it is recommended that a tap changer (NFB) be installed.
- ◇ In equipment maintenance, to isolate the main power supply, such as only operating the SCR off is not enough, because its output is still charged, there will be a risk of electric shock.
- ◇ It is recommended to use the alarm output function of the power regulator, when there is any abnormality, it can be the first alarm output.

Warning

- ◇ In order to maintain the long-term use of this product, please use the standard input voltage correctly.
- ◇ Please do not disassemble, process, modify or repair this product at will, it will be dangerous such as electric shock and fire.

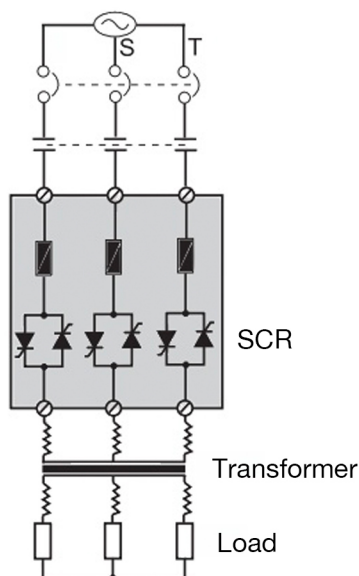
Attention

- ◇ Please make sure that the product is not damaged during transportation and then use it.
- ◇ Environmental settings have a great impact on the performance and life of this product, so please avoid the following environments: high temperature air is not easy to circulate the environment.

- ◇ Please avoid corrosive gases, hazardous gases and other places (such occasions need to be effectively isolated from the control box or control room).
- ◇ When installed in the control box, punch holes in the upper part of the box and install an exhaust fan.
- ◇ Humidity around the use: 90% RH or less (no frost).
- ◇ Operating temperature: 0°C~+40°C MAX60°C (when the weekly temperature is between +40°C~+60°C, every increase of 1°C, the rated current must be attenuated by 1.2%).
- ◇ Input and output wiring must be fastened, SCR is a high-current products, such as terminals are not fastened will cause arc welding phenomenon, the current increased several times, resulting in parts burned.
- ◇ The high temperature of the heat sink prohibit contact with the body.
- ◇ Input and output terminals have the danger of electric shock, please avoid direct contact with the conductor.
- ◇ Unused terminals are not allowed to be connected.
- ◇ Installation should follow the principle of gas heat, please install the product in the vertical direction.
- ◇ This product, including components, is guaranteed for 1 year under normal use.
- ◇ The SCR cannot be tested properly if the load is not connected or the current is less than 0.6A (please make sure the load is greater than 0.6A).

3. Main Circuit Wirings

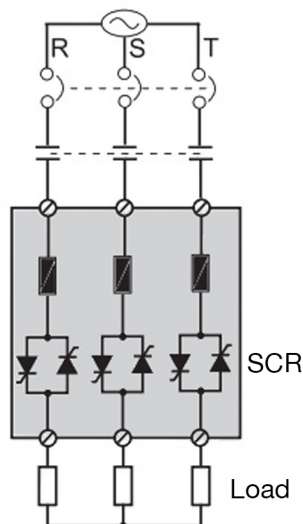
Transformer primary control



SCR

Adjust the output current according to the size of the control signal to achieve the effect of temperature control.

Purely resistive loads



NFB

It can cut off the power supply to avoid personnel electric shock during repair or maintenance.

MC

It can cut off the power supplied to the load, and cut off the power supply when the power regulator fails or the temperature is higher than the setting too much, so as to avoid the high temperature burning equipment or accidents.

Load

Depending on the control mode, the loads can be resistive, inductive, variable resistive, e.g. voltage regulators, silicon carbon rods, silicon molybdenum rods, etc. The loads can be connected to zero wire.

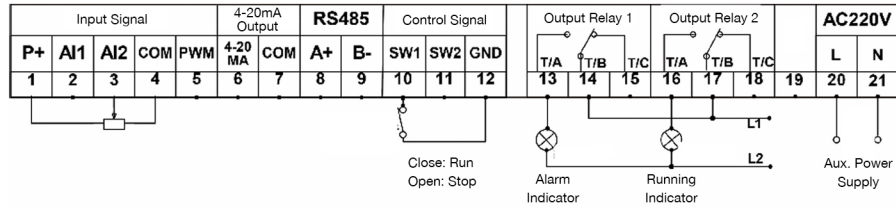
4. Control Terminal Functions



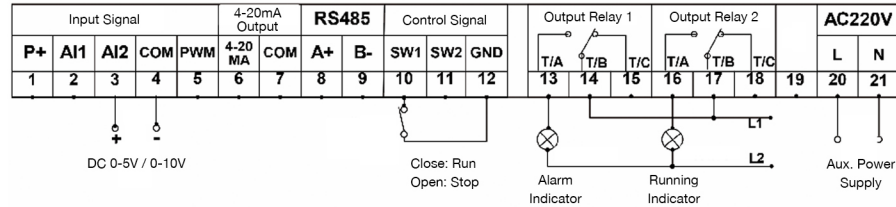
No.	Mark	Functional Description
1	P+	Reference power supply +5V: Feed reference for external potentiometers
2	AI1	Current analog input port: 0/4-20mA (Input impedance 1252)
3	AI2	Voltage analog input port: potentiometer (center tap); DC 0~5/10V, no need to connect P+
4	GND	Signal common ground: analog signal negative terminal, switch signal common terminal
5	PWM	Signal analog, PWM input port
6	4-20mA Output	4-20mA output+
7	COM	4-20mA output-
8	A	RS485 communication port, RS485+
9	B	RS485 communication port, RS485-
10	SW1	External start/stop control terminal: SW1 and 12 terminal GND constitute the start/stop; when the two terminals are closed, the SCR regulator work
11	SW2	Analog input port selection: SW2 and terminal 12 GND, closed to select AI2, disconnected to select AI1
12	GND	Signal common ground: analog signal negative terminal, switch signal common terminal
13	NO	Output relay 1: according to the menu A basic parameters A07 function selection can used as an output signal, or fault alarm output signal; load capabecity, AC 240V/5A, DC 24V/5A (NO: Normally open; NC: Normally closed)
14	COM	
15	NC	
16	NO	Output relay 2: according to the menu A basic parameters A07 function selection can used as an output signal, or fault alarm output signal; load capabecity, AC 240V/5A, DC 24V/5A (NO: Normally open; NC: Normally closed)
17	COM	
18	NC	
19	*null	
20	L	External AC 220V as auxiliary power supply
21	N	

- ⚠ Basic application wiring: 4~20mA control signal input positive to terminal 2 AI1, negative to terminal 4 GND. Start terminals 10 and 12 have been factory connected, default power on start. If you need to install a starting switch on the control cabinet, you can make 10 and 12 as a switch.
- ⚠ Safety reminder: it is recommended to use the alarm output function of the power conditioner when designing the electrical wiring, the power conditioner for the load and power supply has a perfect alarm function, when there is any abnormality, it can be the first time alarm output.

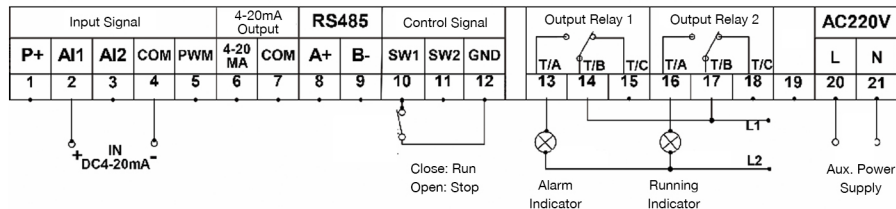
Common Wirings and Parameter Settings



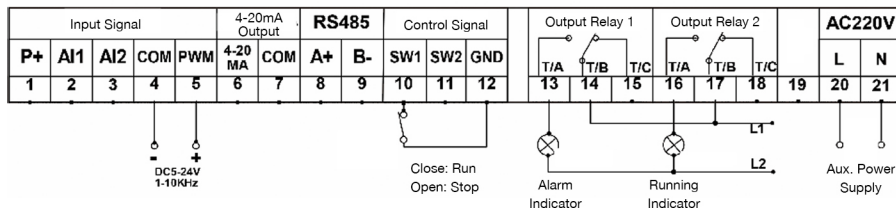
- Potentiometer Control
A02=2, select AI2 as the input signal



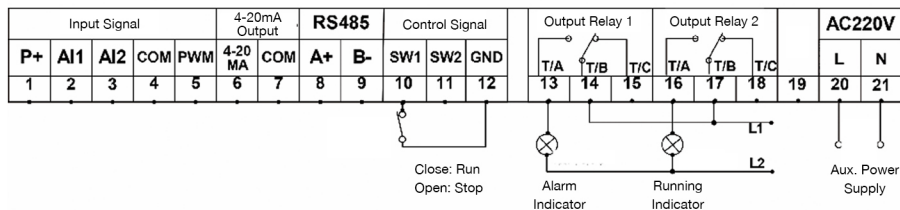
- Voltage Control
A02=2, select AI2 as the input signal
A06=0, DC 0-5V input
A06=1, DC 0-10V input



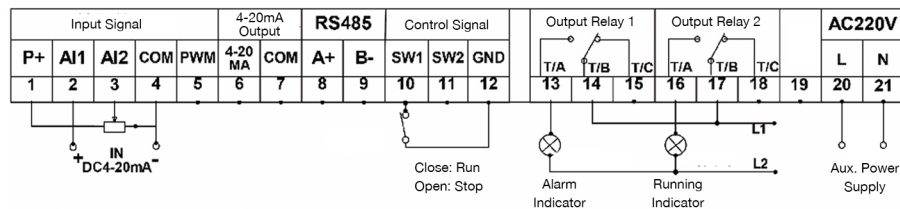
- 4-20mA Control
A02=1, select AI1 as the input signal



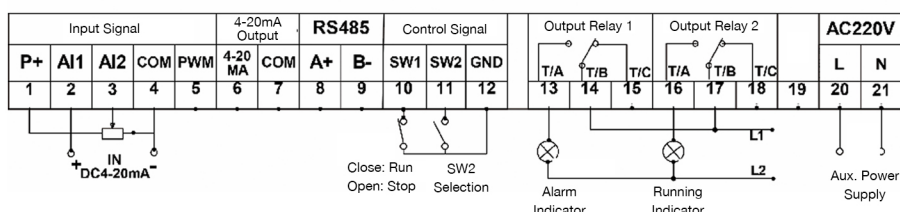
- PWM Signal Switching
A02=3, select PWM as the input signal



- Digital Switching
A02=0, select digital as the input signal



- Second Limit Control
A02=1, AI1 as the input signal
A03=1, AI2 as the limit signal



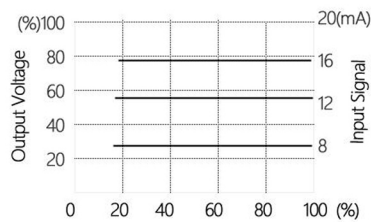
- Dual-signal Control
A02=3, input signal chosen by SW2
SW2 open, AI1 as the input signal
SW2 closed, AI2 as the input signal

5. Functions of Control Mode

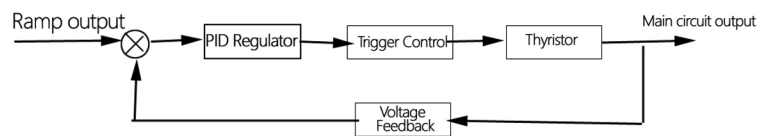
• Constant Voltage Control Mode

☐ Control mode setting: Parameter A01=0

☐ A control method that keeps the voltage output value constant at the voltage set value. When the grid voltage fluctuates or the load impedance changes, the regulator Applicable to inductive, resistive and capacitive loads.



Constant voltage output
characteristic diagram

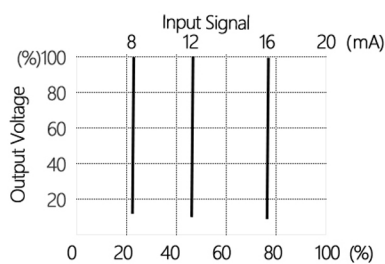


Constant voltage logic
control block diagram

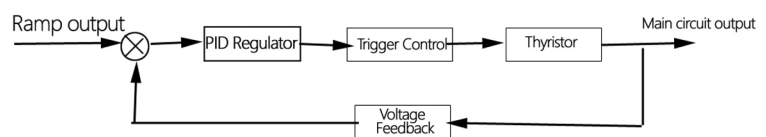
• Constant Current Control Mode

☐ Control mode setting: Parameter A01=1

☐ A control method that keeps the current output value constant at the current given value. When the grid voltage fluctuates or the load impedance changes, The regulator is regulated according to PID rules. It is suitable for inductive, resistive and capacitive loads.



Constant current output
characteristic diagram

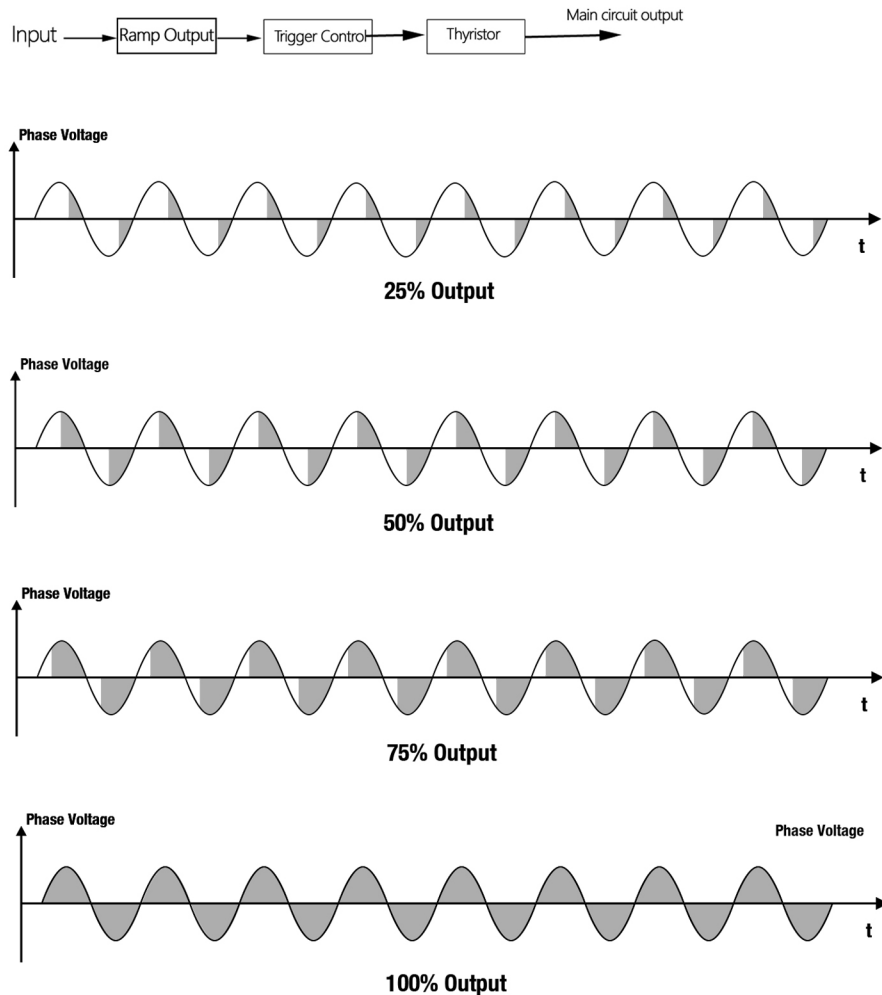


Constant current logic
control block diagram

• Phase-angle Control Mode

☐ Control mode setting: Parameter A01=3

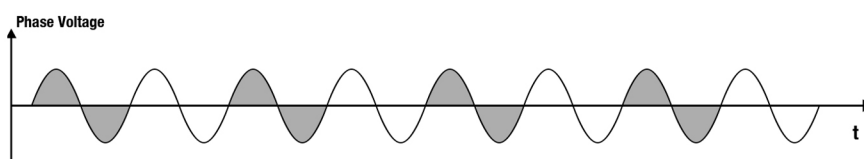
☐ Directly control the thyristor opening amount by input value based on phase-angle firing. When the grid voltage fluctuates or the load impedance changes, The voltage or current cannot be kept constant.



• Alternate Zero-Crossing Mode

☐ Control mode setting: Parameter A01=4

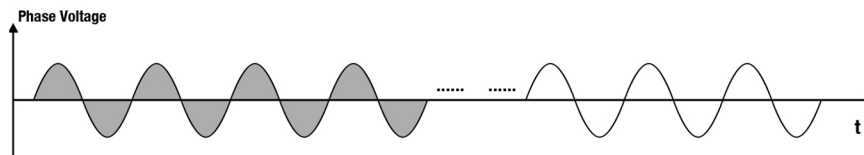
☐ A control method that does not pollute the power grid with harmonics. The number of cycles that are turned on in 100 cycles is determined by the input value.



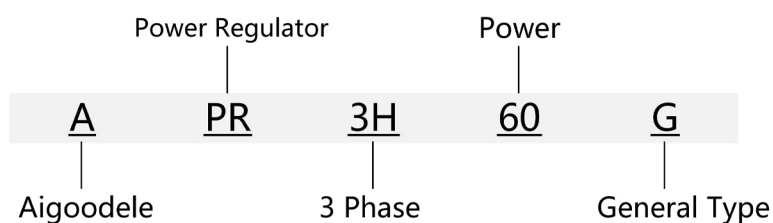
• Continuous Zero-Crossing Mode

☐ Control mode setting: Parameter A01=5

☐ A control method that does not pollute the power grid with harmonics. The thyristor is determined by the input value. A fixed-cycle zero crossing with a period of 2 seconds and a duty cycle.



6. Model Definition



• Overall and Mounting Dimensions

Power	Overall dimensions			Mounting Dimensions		Weight(KG)
	H	W	D	H1	W1	
30-60kw	255	160	195	240	142	3.7
70-100kw	320	167	190	280	85	8.6
110-250kw	400	210	225	335	150	12.2
280-350kw	450	260	280	355	195	17
400-450kw	460	390	270	380	330	23.5
500-630kw	640	480	295	530	335	36.25
800-1000kw	820	650	350	620	395	70

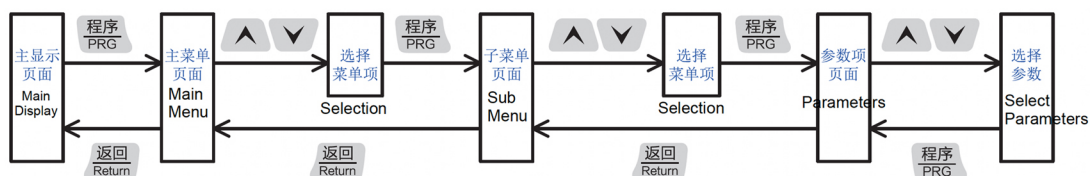
• Model Selection

SCR Power Controller Selection	220V Heater Power (kW)	380V Heater Power (kW)	440V Heater Power (kW)
APR3H16G	$0 < P \leq 7.41$	$0 < P \leq 12.8$	$0 < P \leq 14.82$
APR3H22G	$7.41 < P \leq 10.19$	$12.8 < P \leq 17.6$	$14.82 < P \leq 20.38$
APR3H30G	$10.19 < P \leq 13.89$	$17.6 < P \leq 24$	$20.38 < P \leq 27.79$
APR3H40G	$13.89 < P \leq 18.53$	$24 < P \leq 32$	$27.79 < P \leq 37.05$
APR3H50G	$18.53 < P \leq 23.16$	$32 < P \leq 40$	$37.05 < P \leq 46.32$
APR3H60G	$23.16 < P \leq 27.79$	$40 < P \leq 48$	$46.32 < P \leq 55.58$

APR3H70G	$27.79 < P \leq 32.42$	$48 < P \leq 56$	$55.58 < P \leq 64.84$
APR3H80G	$32.42 < P \leq 37.05$	$56 < P \leq 64$	$64.84 < P \leq 74.11$
APR3H90G	$37.05 < P \leq 41.68$	$64 < P \leq 72$	$74.11 < P \leq 83.37$
APR3H100G	$41.68 < P \leq 46.32$	$72 < P \leq 80$	$83.37 < P \leq 92.63$
APR3H110G	$46.32 < P \leq 50.95$	$80 < P \leq 88$	$92.63 < P \leq 101.89$
APR3H132G	$50.95 < P \leq 61.14$	$88 < P \leq 105.6$	$101.89 < P \leq 122.27$
APR3H150G	$61.14 < P \leq 69.47$	$105.6 < P \leq 120$	$122.27 < P \leq 138.95$
APR3H160G	$69.47 < P \leq 74.11$	$120 < P \leq 128$	$138.95 < P \leq 148.21$
APR3H175G	$74.11 < P \leq 81.05$	$128 < P \leq 140$	$148.21 < P \leq 162.11$
APR3H200G	$81.05 < P \leq 92.63$	$140 < P \leq 160$	$162.11 < P \leq 185.26$
APR3H220G	$92.63 < P \leq 101.89$	$160 < P \leq 176$	$185.26 < P \leq 203.79$
APR3H250G	$101.89 < P \leq 115.79$	$176 < P \leq 200$	$203.79 < P \leq 231.58$
APR3H280G	$115.79 < P \leq 129.68$	$200 < P \leq 224$	$231.58 < P \leq 259.37$
APR3H300G	$129.68 < P \leq 138.95$	$224 < P \leq 240$	$259.37 < P \leq 277.89$
APR3H320G	$138.95 < P \leq 148.21$	$240 < P \leq 256$	$277.89 < P \leq 296.42$
APR3H350G	$148.21 < P \leq 162.11$	$256 < P \leq 280$	$296.42 < P \leq 324.21$
APR3H400G	$162.11 < P \leq 185.26$	$280 < P \leq 320$	$324.21 < P \leq 370.53$
APR3H450G	$185.26 < P \leq 208.42$	$320 < P \leq 360$	$370.53 < P \leq 416.84$
APR3H500G	$208.42 < P \leq 231.58$	$360 < P \leq 400$	$416.84 < P \leq 463.16$
APR3H600G	$231.58 < P \leq 254.74$	$400 < P \leq 440$	$463.16 < P \leq 509.47$
APR3H600G	$254.74 < P \leq 277.89$	$440 < P \leq 480$	$509.47 < P \leq 555.79$
APR3H630G	$277.89 < P \leq 291.79$	$480 < P \leq 504$	$555.79 < P \leq 583.58$

7. Parameter Description

• Keypad Operation



*Display parameter layer, ENT button can display input, output, voltage, current and power in cycle.

• Parameter Description

Group A: Basic Parameters

Group C: Other Parameters

Group B: Protection Parameters

Group D: Status Parameters

No.		Function Name	Function Acronyms	Setting range	Setting Acronyms	Default Value	MODBUS Address
0	A00	Start-stop control mode	Control Mode	0: Terminal control 1: Keypad control 2: Communication control 3: Keypad communication control	0: Terminal 1: Keypad 2: Communication 3: Key+Comm	0: Terminal control	0000/1000
1	A01	Operation Mode	Run Mode	0: constant voltage 1: constant current 2: constant power 3: open loop 4: Weekly wave over-zero 5: Constant period over-zero	0: Volt CL 1: Curr CL 2: Power CL 3: Open Loop 4: Zero Point 5: Const ZP	3: Open loop	0001/1001
2	A02	Input signal selection	Input Signal	0: Digital 1: Analog AI1 2: Analog AI2 3: SW select analog 4: PWM	0: Digital 1: AI 1 2: AI 2 3: AI by T-Sel 4: PWM	1: Analog AI1	0002
3	A03	Second analog input limit	AI2 Limit	0: Close 1: Open	0: Disable 1: Enable	0: Off	0003
4	A04	Digital Setting	Digital Given	0.0~100.0%		100.0%	0004
5	A05	Current input analog type	Curr AI Type	0: 0~20mA 1: 4~20mA		1: 4~20mA	0005
6	A06	Voltage input analog type	Volt AI Type	0: 0~5V 1: 0~10V		0: 0~5V	0006
7	A07	Output relay 1 function selection	Relay 1 Func	0: Fault closed 1: Fault disconnected 2: Closed when running 3: Closed when stopping 4: Energized closed 5: Energized disconnection 6: Thyristor breakdown closure	0: Fault-NO 1: Fault-NC 2: Run Close 3: Stop Close 4: Poweron-NO 5: Poweron-NC 6: Scr SC Close	0: Fault closed	0007
8	A08	Output relay 2 function selection	Relay 2 Func	0: Fault closed 1: Fault disconnection 2: Closed during operation 3: Closed when stopping 4: Energized closed 5: Energized disconnection 6: Thyristor breakdown closure		2: Closed during operation	0008
9	A09	Slow start time setting	Soft Start Time	0~300s		2s	0009
10	A10	Slow off time setting	Soft Stop Time	0~300s		2s	000A
11	A11	Input upper limit setting	In Up Limit	0~100.0%		100%	000B
12	A12	Input lower limit setting	In Low Limit	0~100.0%		0%	000C
13	A13	Maximum output current limit	Out Curr Limit	0~100.0% 0~100.0% 0~100.0% 0~100.0% 0~100.0		100%	000D
14	A14	Maximum output voltage limit	Out Volt Limit	0~100.0% 0~100.0% 0~100.0% 0~100.0% 0~100.0		100%	000E

15	A15	Proportionality factor	Proportional	0~100.0% 0~100.0% 0~100.0% 0~100.0		500	000F
16	A16	Integral coefficient	Integral	0~100.0% 0~100.0% 0~100.0% 0~100.0		200	0010
17	A17	Differential coefficient	Differential	1~127		10	0011
18	A18	Communication address	MB Address	1~127		1	0012
19	A19	Baud rate	MB Baudrate	0:2400 1:4800 2:9600 3:19200		2: 9600	0013
20	A20	Current multiplication for 20mA output	AO Curr Range	50%~500		100%	0014
21	B00	Power supply phase loss protection allowed	Input PL	0: off 1: On	0: Disable 1: Enable	1: Turn on	0015
22	B01	Thyristor breakdown protection allowed	SCR SC	0: Off 1: On	0: Disable 1: Enable	1: Turn on	0016
23	B02	Load overcurrent protection allowed	Over Curr	0: off 1: On	0: Disable 1: Enable	1: Turn on	0017
24	B03	Load overcurrent protection percentage	OC Percentage	20%~200		150%	0018
25	B04	Load overcurrent protection time	OC Time	0~100s		5s	0019
26	B05	Load Break Protection Allowed	Load Open Cir	0: off 1: On	0: Disable 1: Enable	0: off	001A
27	B06	Load Break Protection Threshold	LOC Percent	5%~70		50%	001B
28	B07	Load disconnect protection time	LOC Time	0~100s		5s	001C
29	B08	Radiator overheat protection allowed	Over Heat	0: off 1: On	0: Disable 1: Enable	1: On	001D
30	B09	Three-phase current imbalance alarm enable	Curr Unbalance	0: off 1: On	0: Disable 1: Enable	1: On	001E
31	B10	Three-phase current unbalance degree	Curr Unb Perc	10%~90%		40%	001F
32	B11	Three-phase current imbalance protection	Curr Unb Time	0~100s		5s	0020
33	C00	Standby display mode	Stanby Disp	0: Mode 0 1: Mode 1	0: Mode 0 1: Mode 1		0021
34	C01	Running display mode	Run Disp	0: Mode 0 1: Mode 1	0: Mode 0 1: Mode 1		0022
35	C02	First line display	Disp Line 1	0: Adjuster status 1: Start-stop control mode 2: Input percentage 3: Output percentage 4: Average output voltage 5: Average output current 6: Output power 7: Running Time	0: Status 1: Control Mode 2: Input Pct 3: Out Pct 4: Ave Out Vlot 5: Ave Out Curr 6: Out Power 7: Run Time	0	0023
36	C03	Second line display	Disp Line 2			1	0024
37	C04	Third line display	Disp Line 3			2	0025
38	C05	Fourth line display	Disp Line 4			3	0026
39	C06	Input current signal (AI1) calibration	In Curr Cali	50.0%~200.0%		100.0%	0027
40	C07	Input voltage signal (AI2) calibration	In Volt Cali	50.0%~200.0%		100.0%	0028
41	C08	Output current	Out Curr Cali	50.0%~200.0%		100.0%	0029
42	C09	Spare	Reserve				002A
43	C10	Spare	Reserve				002B
44	C11	Output Voltage	Out Volt Cali	50.0%~200.0%		100.0%	002C
45	C12	Output 4mA Calibration	Out 4mA Cali	50.0%~200.0%		100.0%	002D

46	C13	Output 20mA	Out 20mA Cali	50.0%~200.0%		100.0%	002E
47	C14	Neutral Point Wiring Method	Neutral Point	0: No zero connection 1: Zero connection	0: Float 1: Connect	0: No zero connection	002F
48	C15	Alternate 2 (factory	Reserve2	0-65535			0030
49		Power Regulator Rated Current	Rated Curr	30~450A			0031
50		Rated Voltage of Power Regulator	Rated Volt	50~500V			0032
51		Internal Current Transformer Ratio	CT Ratio	500~3000			0033
52		Internal current transformer wiring	CT Wire	0: IA 1: IABC		1: IABC	0035? ?
53		Internal Sampling Resistance (Alternate)	Samp Res				
54		Running Time Limit	Run Time Lim				
55		Clear running time	Clear Run Time	6 Clear			
56		Manufacturer's	Fac Password	0-65535			
57	D00	Adjuster rated current	Rated Curr	5~5000A			0100
58	D01	Adjuster Rated Voltage	Rated Volt	50~690V			0101
59	D02	Current Adjuster Status	Status				0102
60	D03	Current Fault Code	Fault				0103
61	D04	Average output current value	Ave Curr				0104
62	D05	A-phase current value	Curr A				0105
63	D06	B-phase current value	Curr B				0106
64	D07	Phase C current value	Curr C				0107
65	D08	Output voltage average value	Ave Volt				0108
66		A-phase voltage value	Volt A				0109
67		B-phase voltage value	Volt B				010A
68		C-phase voltage value	Volt C				010B
69	D09	Effective Input	Input Pct				010C
70	D10	Effective output percentage	Out Pct				010D
71	D11	Current output power	Out kVA	0.0kVA			010E
72	D12	Accumulated running time (hours)	Accu Run Hour				010F
73		Accumulated Running Seconds	Accu Run Sec				0110
74	D13	Software Version	SW Version				0111
		Communication control start/stop input		0x55F0 Start 0x55F1 Stop 0x55F2 Failure Reset			0200
		Fault record display	Fault Rec				
		Restore factory value	Restore Para				
		Clear fault record	Clear Fault Rec				

MO 0xxx power down does
 DBU not save
 S 1xxx power down save