SCR VOLTAGE REGULATOR
HGW9 SERIES

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03

1.Appearance and Product Features

Product Features:

- Three rows of digital display, respectively showing three-phase voltage, current, and power;
- It supports two industrial standard communication protocols: MODBUS RTU and MODBUS TCP.
- Single-channel universal input design, which can accept both current and voltage signal inputs;
- True RMS sampling method, completely isolated control circuit and power circuit;
- Optional high-sensitivity touch screen panel provides an intuitive human-machine interaction experience;
- Achieve precise control in constant voltage, constant current, constant power, and open-loop modes, with a control accuracy of up to ±0.5%;
- Adopts imported 32-bit single-chip microcomputer (MCU) with dual-core control, built-in PID closed-loop control, and 100% linear output;

Appearance:

2.Pays attention to item

⚠ Dangerous

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 equipment and personal safety in the repair and maintenance.
4.Contactor: Can cut of power supply automatically to protect the equipment and avoid accidents,when the power regulator fails.

⚠ Admonition

1.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.
2.Air flow vents is 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.
3.Do not install it in high-temperature environments and poorly ventilated situations,otherwise use it less than 70% of rated capacity.
4.Avoid installing It in a steam or acid, alkali, corrosive gases and so on situations.
5.Humidity: 90% RH or less. (No condensation)
6.Ambient temperature:0°C~+40°C.

3.Panel Function Description

Name	Function Description
Upper row digital tube	Current input percentage display / A-phase output voltage, current, power /Parameter name display / Fault light code
Middle row digital tube	Current output voltage / B-phase output voltage, current, power / parameter value
Lower row digital tube	Current output current / C-phase output voltage, current, power
RUN indicator light	Green. This light is on when the power regulator is working.
FAULT indicator light	Red. This light is on when the power regulator issues an abnormal alarm.
COM indicator light	Yellow. This light flashes when the communication is online.

- In the display parameter layer, the ENT button can switch to display the input percentage and cycle through the display of output voltage, current, and power.

input percentage output voltage output current | Phase A, Phase B, Phase C Output voltage | Phase A, Phase B, and Phase C Output current | Phase A, Phase B, and Phase C Output power | Main interface

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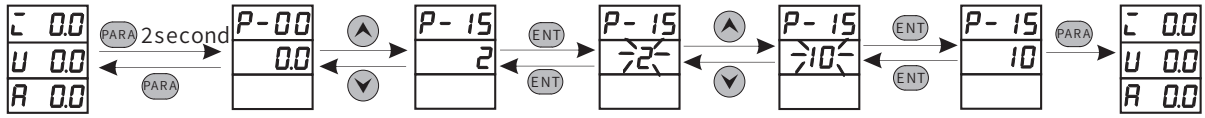
・Function setting parameter layer

Operation instructions for parameter modification (for example, changing the P-15 soft start time parameter from 2 seconds to 10 seconds, and the modification steps for other parameters are similar)



Main display screen | Enter the function setting parameter layer. | Select the parameter code that needs to be set. | The original set value starts to flash. | Change to the new value, and the screen flashes. | Confirm the modification, and the set value stops flashing. | Return to the parameter layer.

4.Function description of control terminals

P+	AI1	AI2	GND	SW1	SW2	GND	A	B	NO	COM	NC	L	N
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Serial number	Symbol	Function description
1	P+	Reference power supply +5V: The given reference for external potentiometers.
2	AI1	Analog input port 1: DC 0–20mA/DC 4–20mA (input impedance 250Ω)/DC 0–5V/DC 0–10V/DC 1–5V/DC 2–10V, forming an input circuit with terminal 4 GND.
3	AI2	Potentiometer input port 2: The middle tap of the potentiometer forms an input circuit with GND.
4	GND	Signal common ground: Negative pole of analog signals, common terminal of digital signals.
5	SW1	External start/stop control terminal: SW1 and terminal GND form the start/stop function. When the two terminals are closed, the regulator operates; otherwise, it stops.
6	SW2	Fault reset: When a fault alarm occurs (except for phase loss alarm and radiator overheating alarm), close the 、terminal SW2 to reset the alarm.
7	GND	Signal common ground: The negative pole of analog signals and the common terminal of digital signals.
8	A	RS485 communication port, RS485+.
9	B	RS485 Communication port, RS485-
10	NC	Output relay: Can be used as an operation output signal or an alarm output signal according to the function selection of P-49 in the menu. Load capacity: AC240V/5A, DC24V/5A. NO: Normally open contact; NC: Normally closed contact.
11	COM	
12	NO	
13	L	Control board power supply: AC160~240V
14	N	

⚠ Terminals 5 (start) and 7 are factory-connected for default power-on startup. If a start switch needs to be installed on the control cabinet, terminals 5 and 7 can be used for the switch connection.

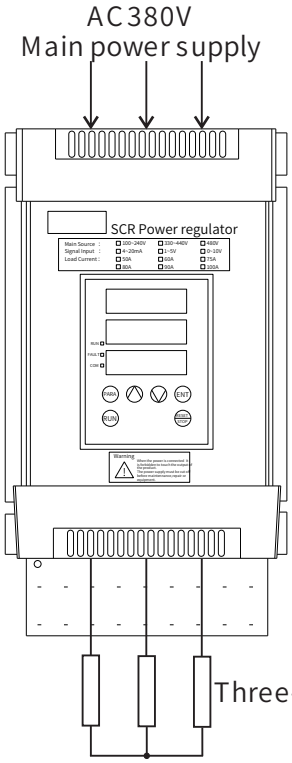
⚠ Safety Reminder: It is recommended to use the alarm output function of the power regulator when designing electrical circuits. The power regulator has complete alarm functions for loads and power supplies, which can output an alarm immediately in case of any abnormalities.

5.Quick Use Guide

1.Main power supply and control board wiring

After unpacking the regulator, first remove the protective cover and baffle, then the green control board will be visible. The wiring of the control board can be divided into three types according to different input signals. Regardless of the input signal type, the main circuit wiring is the same:

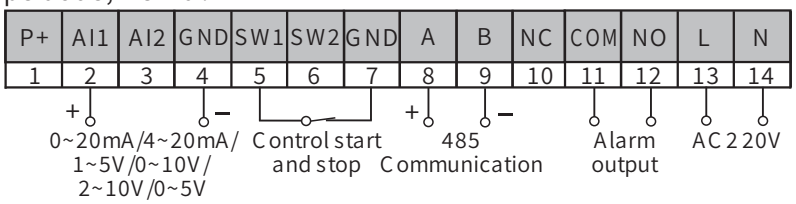
Main circuit wiring:



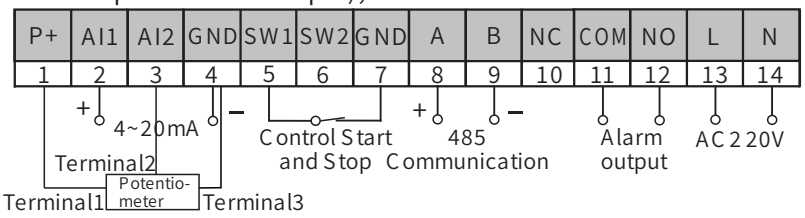
The load can be connected in a star configuration or a delta configuration.
The load can be connected to the neutral wire, but not to the ground wire.

Control board wiring:

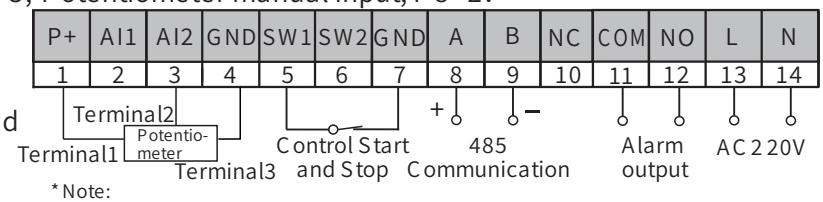
1. Analog current and voltage signal input, P7 = corresponding input type code, P8 = 0:



2, Analog input, potentiometer amplitude limiting, P7=2 (taking 4-20mA input as an example), P8=1:



3, Potentiometer manual input, P8=2:



*Note:
The Potentiometer has three terminals, here the middle terminal and either of the two side terminals are used, to AI2 and GND terminals respectively.
With three terminals facing up, select the terminal on the right, turn clockwise to increase; select the terminal on the, turn counterclockwise to increase.

2.Selection of control signal input mode

The regulator's input signals support analog input and digital input modes.
The default input of this product is 4~20mA. The analog input modes include 4–20mA, 0–10V, 0–5V, 0–20mA, 2–10V, 1–5V, potentiometer manual input, restricted other signals, etc. For the wiring of each input mode, please refer to the control board wiring described above.
If analog signals are not used during debugging, digital input signals can also be used. The digital signals are divided into panel-set percentage and communication-set percentage, with the operations as follows:

1. Panel-set signal
First, modify the parameters: set P7=0 and P9=0. Return to the main interface, then press the panel keys: the ↑key increases the numerical input, and the ↓key decreases the numerical input. The regulator will then output accordingly.

2. Communication-set input percentage
For the communication-set input percentage, the parameters need to be adjusted as P7=0 and P9=1. Writing a value to the decimal address 11 serves as the input signal.

3.Selection of control output mode

The control output modes of the regulator are divided into phase and zero position.
Phase is divided into phase-shift open loop and phase-shift closed loop, phase-shift closed loop is divided into constant voltage, constant current, constant power zero position control mode is divided into wave zero, fixed period zero, fixed period zero period adjustable. The common control modes are constant voltage and constant current.
Constant voltage control (P24=0) is the default control mode, regulated by PID. The output voltage = input signal × rated voltage. Constant voltage control can be used for resistive loads such as resistance wires, heaters, and infrared heating tubes.
Constant current control (P24=1), regulated by PID, with the output current = input signal × rated current. Therefore, the rated current (P-42) should be set as the maximum actual output current of the load. The constant current control mode is often used for loads with large resistance changes, such as transformers, silicon molybdenum rods, silicon carbide rods, and graphite.
Constant power control (P24=2), regulated by PID, with the total output power = input signal × rated current × rated voltage × 1732. After setting the rated current as the maximum output current of the load, calculate the rated voltage based on the load power and set it in the P-41 parameter. It is generally used for PTC loads.
Phase-shifting open-loop control (P24=3) is not controlled by PID and is greatly affected by the power grid. The output voltage is directly proportional to the conduction angle, with no soft start or soft shutdown.
Cycle zero-crossing control (P24=4) is a zero-crossing control mode where the period is automatically adjusted to the minimum proportional period according to the input percentage, featuring fast switching speed.
Fixed-cycle zero-crossing with adjustable period (P24=5) is a fixed-cycle zero-crossing control mode where the period can be set. The average power of the load is controlled by triggering the circuit to adjust the ratio of the number of conducting cycles to the number of off cycles, with long on/off times. P28 parameter setting cycle time.

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4.Constant power filtering coefficient

When in constant power control, if there is output fluctuation, the P91 parameter can be modified. The larger the value, the smaller the fluctuation.

5.Restricted input signal

The parameter P17 is used to limit the input signal, thereby restricting the output opening degree and serving to limit the output voltage and current. With a unit of %, the default value of 100% indicates no restriction on the output.

If the upper limit of the input signal is set to 80%, the input signal of 0~100% corresponds to the input percentage of 0~80% of the regulator. Under constant voltage control,The output voltage linearly outputs between 0 and 380V×80%.

6.Control modes for starting and stopping the regulator

There are three ways to control the start and stop of the regulator: terminal start/stop, communication-controlled start/stop, and panel button-controlled start/stop. By default, this product uses the terminals SW1 and GND to control the start and stop of the regulator (parameter P12=0), where suction starts the regulator and disconnection stops it. The operations for other methods are as follows:

Communication-controlled start/stop: Set parameter P12=1. Writing "1" to the decimal address 13 starts the regulator, and writing "0" stops it.

Panel button-controlled start/stop: Set parameter P12=2. Press "RUN" on the main interface to start the regulator, and press "STOP" to stop it.

7.Three-phase output voltage unbalance alarm

If an alarm is required when the difference in output voltage between the three phases of the regulator reaches a certain value, the three-phase voltage unbalance alarm function should be used.

First, enable the alarm: set P60=1. For example, if an alarm is required when the difference in three-phase output voltage reaches 20V, simply set P59=20.

To prevent false alarms caused by interference, a function to set the alarm delay time is added: the time set in parameter P-93 is the number of seconds after the alarm is triggered for the relay to output.

8.Three-phase output current unbalance alarm

If the difference between the output currents of the three phases of the regulator is to be alarmed when it reaches a certain value, the three-phase current imbalance is required.

Enable the alarm: P66=1. For example, if an alarm is to be given when the difference between the output currents of the three phases reaches10A, then P65=10 is sufficient.

In order to prevent false alarms due to interference, a function to set the alarm time can be added: time set by the P-94 parameter is the number of seconds after the alarm that the relay output is given.

9.Parameter power-off saving

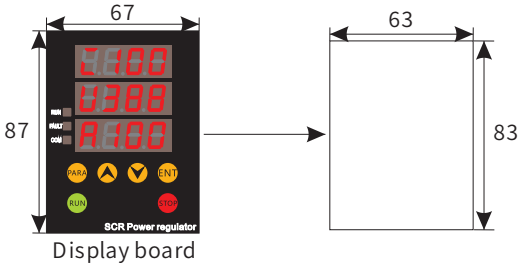
After modifying the parameters, a 5-second saving time is required. If a power-off is needed, please operate after 5 seconds.

10.Restore to default settings

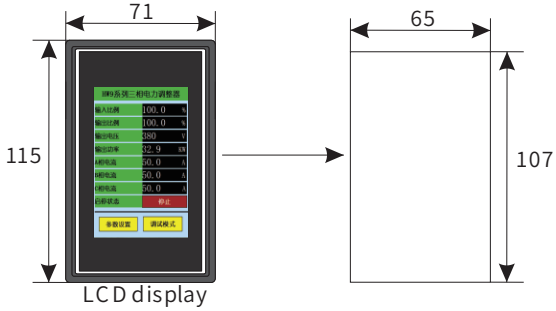
If the parameters are out of order, you can restore the power regulator to its initial settings with one key.
Panel modification: Set parameter P79 to 110;Communication modification: Write 110 to decimal address 79;

11.Expand function

This product can extend the display board to install on the control cabinet door; in addition, a liquid crystal display screen can be matched as a display, and the crystal display screen can also be extended. The following are the appearance size and hole size of the display board and liquid crystal display screen.



Display board



LCD display

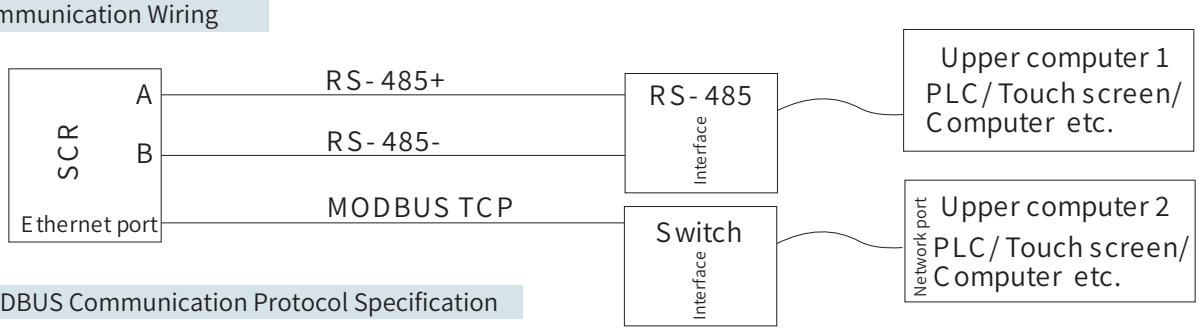
6.Detailed Instructions for Communication

This product supports two communication methods: MODBUS RTU and MODBUS TCP, and can communicate with multiple upper computers simultaneously.

1.Modify communication parameters

RS-485 communication default settings:Device address: P-43, default value is 2.Baud rate: P-44, default value is 1 (9600).Data format: P-45, default value is 0 (no parity, 1 stop bit, 8 data bits).
The default IP address is 192.168.1.100, the default gateway is 192.168.1.1, and the port number is 502.

2.Communication Wiring



3.MODBUS Communication Protocol Specification

1. MODBUS Communication Configuration
The HW9 series three-phase power regulators adopt the standard MODBUS communication protocol, supporting data interaction with devices such as host computers, touch screens, and PLCs. The device is standard-equipped with RS485 communication interface and Ethernet interface, which can simultaneously support two communication modes of MODBUS RTU and TCP, and be compatible with standard function codes such as 03, 04, 06, and 16, providing users with flexible and convenient industrial communication solutions.
2. Communication Data Read/Write
When the attribute of the regulator's function menu is set to read/write, parameters can be modified via the communication function. When the attribute of the regulator's function menu is set to read-only, only reading operations are permitted.
3. MODBUS RTU Communication Protocol
When the communication is set to communicate in RTU mode on the Modbus network, each 8-bit byte in the data contains two 4-bit hexadecimal characters.
1) Code system: 8-bit binary
2) Bits per byte: 1 start bit, 8 data bits (with the least significant bit sent first), 1 parity bit, and 1 stop bit (2 stop bits when there is no parity check).
3) Error detection field: CRC (Cyclic Redundancy Check)
Keyword Explanation:
Frame: A set of commands for implementing possible functional operations, composed of several bytes to achieve a specific operation.
Device address: The communication address defined for a device when performing operations on it.
Register address: The address corresponding to a register when performing operations on a specific register of a device. The address is split into high and low bytes in the frame.
Command word: The operation function code defined by MODBUS. Each command code represents a specific operation process.
Function code 3: Read multiple holding registers, which enables batch reading of multiple consecutive registers.
Function code 4: Read multiple input registers, which enables batch reading of multiple consecutive registers.
Function code 6: Write a single holding register.
Function code 16: Write multiple holding registers, which enables batch writing to multiple consecutive registers.

- **RTU Message Frame Format**

Device Address	Function Code	Data	CRC Check
1 byte	1 byte	N bytes	2 bytes

Data is transmitted in an 8-bit data format and organized in a 16-bit hexadecimal manner.

- **Read Holding Registers**

Read Command Frame Format

0	1	2	3	4	5	6	7
Device Address	03H	Parameter Address H	Parameter Address L	Length H	Length L	CRC H	CRC L

Parameter address: Refers to the starting address of the consecutive read parameter units.
Length: Refers to the number of consecutive parameter units to be read.
Return command frame format

0	1	2	3	4		13	14
Device Address	03H	Number of bytes	Data 1H	Data 1L	. . .	CRC H	CRC L

Number of bytes: The total number of bytes of the returned data.
Command frame format for returning error messages

0	1	2	3	4
Device Address	83H	Error code	CRC H	CRC L

- **Read Input Registers**

Read command frame format

0	1	2	3	4	5	6	7
Device Address	04H	Parameter Address H	Parameter Address L	Length H	Length L	CRC H	CRC L

Parameter address: Refers to the starting address of the consecutive read parameter units.
Length: Refers to the number of consecutive parameter units to be read.
Return command frame format

0	1	2	3	4		13	14
Device Address	04H	Number of bytes	Data 1H	Data 1L	. . .	CRC H	CRC L

Number of bytes: The total number of bytes of the returned data.
The command frame format for returning error messages.

0	1	2	3	4
Device Address	84H	Error code	CRC H	CRC L

- **Write Single Holding Register**

Command frame format

0	1	2	3	4	5	6	7
Device Address	06H	Parameter Address H	Parameter Address L	Data 1H	Data 1L	CRC H	CRC L

The format of the returned command frame.

0	1	2	3	4	5	6	7
Device Address	06H	Parameter Address H	Parameter Address L	Data 1H	Data 1L	CRC H	CRC L

The command frame format for returning error messages.

0	1	2	3	4
Device Address	86H	Error code	CRC H	CRC L

- **Write Multiple Holding Registers**

Command frame format

0	1	2	3	4	5	6	7	8		17	18
Device Address	10H	Parameter Address H	Parameter Address L	Length H	Length L	Number of bytes	Data 1H	Data 1L	. . .	CRC H	CRC L

Parameter address: refers to the starting address of consecutive write parameter units.
Length: refers to the number of consecutive write parameter units.
The format of the returned command frame.

0	1	2	3	4	5	6	7
Device Address	10H	Parameter Address H	Parameter Address L	Length H	Length L	CRC H	CRC L

The command frame format for returning error messages.

0	1	2	3	4
Device Address	90H	Error code	CRC H	CRC L

4.MODBUS TCP Description of Communication Protocol

MODBUS TCP/IP is a MODBUS protocol based on TCP/IP, suitable for Ethernet environments. The following is a format description of MODBUS TCP/IP:

To request reading data from consecutive addresses, this function code can be used to sequentially read data from the current address to 125 consecutive addresses. For each register, the data is divided into two bytes: the first byte contains the high 8 bits, and the second byte contains the low 8 bits.

- **Read Holding Registers**

Read command frame format

0	1	2	3	4	5	6	7	8	9	10	11
Frame header	Frame header	Frame header	Frame header	Frame header	Transmission Byte	Device Address	03H	Parameter Address H	Parameter Address L	Length H	Length L

Parameter address: Refers to the starting address of consecutive read parameter units.
Length: Refers to the number of consecutive read parameter units.
Byte: The basic unit of data.
Number of bytes: The total number of bytes occupied by data during transmission or storage.
Transmitted bytes: The actual number of bytes transmitted.
Returned command frame format

0	1	2	3	4	5	6	7	8	9	10	11	12	13
Frame header	Frame header	Frame header	Frame header	Frame header	Transmission Byte	Device Address	03H	Number of bytes	Data 1H	Data 1L	Data 2H	Data 2L	. . .

- **Write Multiple Holding Registers**

Command frame format

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Frame header	Frame header	Frame header	Frame header	Frame header	Transmission Byte	Device Address	10H	Parameter Address H	Parameter Address H	Length H	Length L	Number of bytes	Data 1H	Data 1L	Data 2H	Data 2L

Parameter address: Refers to the starting address of consecutive write parameter units.
Length: Refers to the number of consecutive write parameter units.
Byte: The basic unit of data.
Number of bytes: The total number of bytes occupied by data during transmission or storage.
Transmitted bytes: The actual number of bytes transmitted.
Returned command frame format

0	1	2	3	4	5	6	7	8	9	10	11
Frame header	Frame header	Frame header	Frame header	Frame header	Transmission Byte	Device Address	10H	Parameter Address H	Parameter Address L	Length H	Length L

5.Description of Communication Address

The parameter code of the regulator is the communication decimal address:
For example, the rated load voltage is P-41, so the communication address is decimal 41. When reading with a PLC, the address for some PLCs may be 40042.

6.Communication Example

- **Modbus RTU**

1. Read the display value of the current output voltage (P-02)
The communication address of the regulator is set to 1, 10#02 = 16#02, send the command frame:

Communication Address	Function code	Starting address of the read register	Number of registers	CRC Check
01	03	0002	0001	

2. Write the soft start rise time (P-15 is 5 seconds)
The regulator communication address is set to 1, 10#15 = 16#0F, 10#5 = 16#05, send the command frame:

Communication Address	Function code	Starting address of the read register	Data	CRC Check
01	06	000F	0005	

• **Modbus TCP**

1, Read the following three consecutive variables from the input percentage (P000) to the output voltage (P002). Referring to the address table in the communication protocol, start reading these three consecutive variables from address 0000 (0x0000) using function code 0x03.

0	1	2	3	4	5	6	7	8	9	10
Frame header	Frame header	Frame header	Frame header	Transmission Byte	Device Address	03H	Parameter Address H	Parameter Address L	Length H	Length L
00	00	00	00	06	02	03	00	00	00	03

Communication return value

0	1	2	3	4	5	6	7	8	9	10	11	12	13
Frame header	Frame header	Frame header	Frame header	Transmission Byte	Device Address	03H	Number of bytes	Data 1H	Data 1L	Data 2H	Data 2L	Data 3H	Data 3L
00	00	00	00	09	02	03	06	03	E8	03	E8	01	7C

Data 1 = Data 1H + Data 1L, 16#03E8 = 10#1000, meaning the return value of Data 1 is 1000.
Data 2 = Data 2H + Data 2L, 16#03E8 = 10#1000, meaning the return value of Data 2 is 1000.
Data 3 = Data 3H + Data 3L, 16#017C = 10#380, meaning the return value of Data 3 is 380.

2, Set the values of rated voltage (P041) and rated current (P042) to 500 and 100. According to the address in the communication protocol table, start writing 2 consecutive variables from 0041 (0x0029).

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Frame header	Frame header	Frame header	Frame header	Frame header	Transmission Byte	Device Address	10H	Parameter Address H	Parameter Address H	Length H	Length L	Number of bytes	Data 1H	Data 1L	Data 2H	Data 2L
00	00	00	00	00	0B	02	10	00	29	00	02	04	01	F4	00	64

Communication return value

0	1	2	3	4	5	6	7	8	9	10
Frame header	Frame header	Frame header	Frame header	Transmission Byte	Device Address	10H	Parameter Address H	Parameter Address L	Length H	Length L
00	00	00	00	06	02	10	00	29	00	02

7.Parameter Description

The parameter serial number is the decimal address. For example, the serial number of P-0 input percentage is 0, which is address 0.

P-0	Effective input percentage display	Range	0.0~100.0%, onedecimal place	Factory value	—	Attribute	R
P-1	Effective output percentage display	Range	0.0~100.0%, onedecimal place	Factory value	—	Attribute	R
P-2	Display of three-phase average output voltage value	Range	Measured voltage value, one decimal place	Factory value	—	Attribute	R
P-3	Display of three-phase average output current value	Range	Measured current value, one decimal place	Factory value	—	Attribute	R
P-4	Display of three-phase total output power	Range	Measured total power value, one decimal place	Factory value	—	Attribute	R
P-5	Display of current grid frequency	Range	The actual detected grid frequency value	Factory value	—	Attribute	R
P-6	Display of the current regulator start-stop status	Range	0: Stop; 1: Run	Factory value	—	Attribute	R
P-7	Input Signal Selection	Range	0: Digital quantity, 1: 0~20mA, 2: 4~20mA, 3: 1~5V, 4: 0~10V, 5: 2~10V, 6: 0~5V	Factory value	1	Attribute	R/W

By selecting parameters through the input signal, the input signals can be divided into two categories:
Digital quantity, including two types: panel button input or communication input. After setting P-7 to 0, the P-9 parameter can be configured.
Analog quantity, which is selected according to options 1-6 based on the type of the AI1 and GND input ports.

P-8	Potentiometer input selection	Range	0:Off 1:Limit analog input 2:Manual output	Factory value	0	Attribute	R/W

If you use the potentiometer function, whether it is used to limit the first analog Input or as a manual input via the potentiometer, you need to set P-7 to a non-digital given mode (i.e., P-7≠0); otherwise, the potentiometer function will be invalid.
If P8=1, connecting a potentiometer to the second channel will limit the first analog input.
If P8=2, the potentiometer will serve as a manual given input.

P-9	Digital input signal type selection	Range	0: Panel button 1: Communication given	Factory value	1	Attribute	R/W

0: Panel button. Directly press the up or down key on the main interface to set the input percentage. The set value remains valid after power-off and restart.
1: Communication given. Set the input percentage through parameter P-11, which is the communication parameter address 11.

P-10	Panel set percentage	Range	0.0~100.0%	Factory value	0.0	Attribute	R/W

This parameter only displays the input percentage set by the panel. When the input percentage is set via the panel, the set value will not be lost after a power failure and subsequent power-up, and is stored in this parameter. A range of 0~1000 corresponds to 0.0%~100.0%.

P-11	Communication set percentage	Range	0.0~100.0%	Factory value	0.0	Attribute	R/W

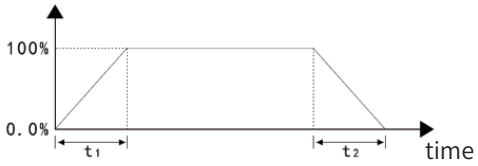
When setting the input percentage for communication given, the host computer writes data to this address, where 0~1000 corresponds to 0.0~100.0%.

P-12	Start-stop mode selection	Range	0:Externalswitch,1:Communication, 2:Keyboard	Factory value	0	Attribute	R/W

0: External switch. When the SW1 switch is closed, the regulator starts running; when the SW1 switch is opened, the regulator stops working.
1: Communication start. The host computer writes data to P-13 (address 13), where 1 indicates start and 0 indicates stop.
2: Keyboard start. Press the RUN button on the regulator panel to start the regulator, and press the STOP button to stop the regulator.

P-13	Communication control start-stop input	Range	0:Stop,1:Start	Factory value	0	Attribute	R/W
P-15	Soft start time setting	Range	0~300S	Factory value	2	Attribute	R/W
P-16	Soft shutdown time setting	Range	0~300S	Factory value	2	Attribute	R/W

The soft start time refers to the time required for the regulator's output to rise from 0% to 100% (as shown in t1 below); the soft shutdown time refers to the time required for the regulator's output to drop from 100% to 0% (as shown in t2 below).



P-17	Input limit	Range	0~100%	Factory value	100	Attribute	R/W
P-18	Input lower limit setting	Range	0~100%	Factory value	0	Attribute	R/W

The upper limit of input is the limit of the input signal, which changes linearly from 0 to "the value set in P-17" corresponding to0 to 100%; the lower limit of output is the lowest output percentage. For specific usage, please refer to the "5. Input Upper Limit" description in theQuick Operation Guide".

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P-19	Maximum voltage limit	Range	0~500V	Factory value	380	Attribute	R/W

The maximum voltage limit is related to the rated voltage and will not exceed the rated voltage. The factory default value is the rated voltage, which is used to limit the maximum output voltage.

P-20	Maximum current limit	Range	0~800A	Factory value	100	Attribute	R/W

The maximum current limit is related to the rated current and cannot exceed the rated current. The factory default value is the rated current, which is used to limit the maximum output current.

P-21	Proportional coefficient	Range	0~9999	Factory value	1000	Attribute	R/W

The proportional gain of the PID regulator. The proportional gain is multiplied by the error to obtain the correction value. Increasing this parameter increases the damping of the system and speeds up the dynamic response of the system. For a certain load, if this parameter is too large, it will cause the system to become unstable. The optimal setting value is the maximum possible value at which the system begins to become unstable.

P-22	Integral coefficient	Range	0~9999	Factory value	200	Attribute	R/W

The integral gain of the PID regulator. The integral gain is multiplied by the error to obtain the correction value. This correction value ensures that the system has no error. Increasing this parameter increases the recovery rate of the system after being disturbed. If the parameter is too large, the system tends to oscillate rather than recover quickly.

P-23	Differential coefficient	Range	0~9999	Factory value	10	Attribute	R/W

The differential gain of the PID regulator. The correction value is obtained by multiplying the differential gain by the error, which has a damping effect. The optimal performance is achieved through the best coordination of the three PID parameters.

P-24	Control mode	Range	0, 1, 2, 3, 4, 5	Factory value	0	Attribute	R/W

1:Constant current;2: Constant power;3: Open loop;4: Cycle zero-crossing;5:Adjustable cycle zero-crossing control
For specific descriptions of the control modes, please refer to the "Control Mode Selection" instructions on Page 3.

P-28	Fixed cycle zero-crossing adjustable cycle setting	Range	2~60S	Factory value	2	Attribute	R/W

When P24=5 (adjustable zero-crossing control with adjustable cycle), the time set in P-28 is one cycle time.

P-29	Input signal (AI1) calibration	Range	0. 50~1. 50	Factory value	1.00	Attribute	R/W

Zero and full-scale calibration can be performed for the signal input by AI1.

P-34	Current fault code	Range	0~8	Factory value	—	Attribute	R

Displays the current operating status of the power regulator;
0: No fault; 1: Overcurrent; 2: Power phase loss; 3: Load disconnection; 4: Radiator overtemperature; 5: Load short circuit; 6: Thyristor breakdown; 7: Output voltage imbalance; 8: Output current imbalance.

P-35	Power phase loss protection enable	Range	0:Off,1:On	Factory value	1	Attribute	R/W

When the load power supply is phase-loss, the power regulator will alarm; when the load power supply is reconnected, the fault will be automatically eliminated.

P-36	Load overcurrent protection enable	Range	0:Off,1:On	Factory	1	Attri-	R/W
P-37	Load overcurrent protection percentage setting	Range	50~200%	Factory value	150	Attribute	R/W

When the overcurrent protection enable is turned on, P-37 can set the overcurrent range, which can be adjusted from 50% to 200% of the rated current.

P-40	Radiator overheating protection enable	Range	0:Off,1:On	Factory value	1	Attribute	R/W

When the radiator overheating protection is enabled, if the temperature of the radiator exceeds 80°C, the power regulator will automatically stop output and restart output automatically after cooling.

P-41	Load rated voltage	Range	50~500V	Factory value	—	Attribute	R/W
P-42	Load rated current	Range	5~800A	Factory value	—	Attribute	R/W

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

P-43	Communication address	Range	1~247	Factory value	2	Attribute	R/W
P-44	Baud rate	Range	0, 1, 2, 3	Factory value	1	Attribute	R/W

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

P-45	Data format	Range	0:8N1;1:8E1;2:8O1	Factory value	0	Attribute	R/W

Data format: 0: 8 data bits, 1 stop bit, no parity; 1: 8 data bits, 1 stop bit, even parity;
2 : 8 data bits, 1 stop bit, odd parity.

P-46	Internal current transformer ratio	Range	200~800	Factory	200	Attri-	R/W

The ratio of the current transformer is factory-set and should not be changed.

P-47	Wiring mode of the internal current transformer	Range	0~1	Factory value	0	Attribute	R/W

Wiring mode: The factory settings should not be changed.

P-49	Output relay function selection	Range	0~5	Factory value	0	Attribute	R/W

Function selection for the relay output ports of terminals 10 and 11: 0: Normally open output without alarm;
1: Normally closed output without alarm; 2: Closed during operation; 3: Closed during stop; 4: Normally closed when powered – the relay remains normally closed once the 220V control power is connected, independent of the alarm and output status; 5: Normally open when powered – the relay remains normally open once the 220V control power is connected, independent of the alarm and output status.

P-54	Retain parameters	Range	0~3999	Factory value	850	Attribute	R/W

It is factory-set and should not be modified.

P-59	Three-phase output voltage unbalance threshold	Range	2~400	Factory value	20	Attribute	R/W
P-60	Three-phase output voltage unbalance alarm	Range	0:Off,1:On	Factory value	0	Attribute	R/W

When P60=1, the three-phase output voltage unbalance alarm function is enabled. The factory default setting for P-59 is 20. When the maximum voltage difference between any two phases of the output voltage reaches 20, an alarm will be triggered and the relay will output.
The alarm relay output time can be set through the P-93 parameter, with the unit being seconds.

P-61	Phase A current	Range	Measured phase A current value: 0.0~800.0	Factory value	—	Attribute	R
P-62	Phase B current	Range	Measured phase B current value: 0.0~800.0	Factory value	—	Attribute	R
P-63	Phase C current	Range	Measured phase C current value: 0.0~800.0	Factory value	—	Attribute	R
P-65	Three-phase output current unbalance threshold	Range	2~400	Factory value	20	Attribute	R/W
P-66	Three-phase output current unbalance alarm	Range	0:Off,1:On	Factory value	0	Attribute	R/W

Setting P66=1 activates the three-phase output current imbalance alarm function. The factory default value for P-65 is 20. When the maximum current difference among the three-phase output currents reaches 20, an alarm is triggered, and the relay outputs a signal.
The relay output duration can be configured via parameter P-94, with the unit in seconds.

P-70	IP 1	Range	Device network port parameter address 1	Factory value	192	Attribute	R/W
P-71	IP 2	Range	Device network port parameter address 2	Factory value	168	Attribute	R/W
P-72	IP 3	Range	Device network port parameter address 3	Factory value	1	Attribute	R/W
P-73	IP 4	Range	Device network port parameter address 4	Factory value	100	Attribute	R/W
P-74	WG 1	Range	Device network port gateway address 1	Factory value	192	Attribute	R/W
P-75	WG 2	Range	Device network port gateway address 2	Factory value	168	Attribute	R/W
P-76	WG 3	Range	Device network port gateway address 3	Factory value	1	Attribute	R/W
P-77	WG 4	Range	Device network port gateway address 4	Factory value	1	Attribute	R/W
P-79	Restore to default settings	Range	—	Factory value	0	Attribute	R/W

When the regulator parameters have been adjusted in a chaotic manner and cannot be used normally, you can choose to restore the factory settings. On the main interface, press the ↓ key + ENT key + STOP key together for 2 seconds, or write 110 to P-79. After the interface displays "LoAd ----", the parameters will be restored to the factory values.

P-81	Actual value of the input signal	Range	Analoginputsignalvalue	Factory value	—	Attribute	R
P-83	Communication status	Range	0~9999	Factory value	—	Attribute	R

When the communication between the upper computer and the power regulator is successful, this parameter will increment by 1. The communication status can be determined to be good by the change in the numerical value.

P-84	Parameter saving	Range	—	Factory value	0	Attribute	R/W

Before leaving the factory, after setting the parameters according to the corresponding model and function, change P-84 to 16, then press the ENT key to confirm. When the digital tube displays **SAvE**, the saving of the parameter settings is completed. In this way, after restoring the factory values, the parameters will be the ones just saved.
If users set different parameters during use, they can also save the parameter settings by writing 16. In this case, when restoring the factory values again, the parameter settings will be the ones saved by the users themselves, and it will be impossible to restore the original factory default settings.

P-90	Thyristor breakdown alarm	Range	0:Off,1:On	Factory value	1	Attribute	R/W
P-91	Constant power control filter coefficient	Range	0~999	Factory value	10	Attribute	R/W

When in constant power control, if the output fluctuates, this parameter can be set. The larger the value, the smaller the fluctuation.

P-93	Three-phase voltage unbalance alarm time	Range	1~200S	Factory value	5	Attribute	R/W
P-94	Three-phase current unbalance alarm time	Range	1~200S	Factory value	5	Attribute	R/W
P-112	Phase AB voltage	Range	Measured Phase AB voltage 0.0~500.0	Factory value	——	Attribute	R
P-113	Phase AC voltage	Range	Measured Phase AC voltage 0.0~500.0	Factory value	——	Attribute	R
P-114	Phase BC voltage	Range	Measured Phase BC voltage 0.0~500.0	Factory value	——	Attribute	R

8. Explanation of Fault Codes

The power regulator has multiple fault protection functions. When a fault occurs, the regulator will automatically activate protection and display the corresponding fault code in the display window. Users can determine the fault scope based on the displayed fault code and take corresponding fault handling measures.

Fault phenomenon	Fault name	Fault causes and handling solutions
No display	No power supply to the control board.	1. Check the control power supply; 2. Check the connection between the control board and the display board.
Output out of control	The output cannot be controlled.	1. Check whether the parameter settings are correct.

Unstable output	The output cannot be stabilized.	1. Check the PID parameter settings.
E--1	Overcurrent in the load	1. Check whether the load has any problems.
E--2 (E-A2) (E-B2) (E-C2)	Phase loss in the load power supply	1. Check whether the load power supply is energized; 2. Check if any contactors or fuse tubes are damaged. When there is a single-phase power supply phase loss, the display code will be E-A2, E-B2, or E-C2, which respectively indicate phase loss in phase A, B, or C. When the display code is E--2, it indicates that at least two phases of the power supply are missing. 3. When the fault is eliminated, the alarm will automatically be cleared.
E--3	Load disconnection fault	Check whether the load is balanced and whether there is any disconnection.
E--4	Radiator overheating fault	The power regulator is overheated. When the radiator temperature is detected to be higher than 80°C, the alarm is activated. When the temperature drops below 80°C, the alarm will automatically clear. Possible causes of overheating include: 1. Ambient temperature higher than 45°C; 2. Faulty cooling fan; 3. Dust accumulation in the air duct.
E--5	Load short-circuit alarm	1. Check whether the load is short-circuited.
E--6	Thyristor module breakdown	1. Measure the resistance of each phase's incoming and outgoing lines. A very low resistance indicates module breakdown.
E--7	Unbalanced output voltage	1. Check whether the load is balanced and whether there is any disconnection.
E--8	Unbalanced output current	1. Check whether the load is balanced and whether there is any disconnection.

9.Specification and Model Table

HGW9 — □ — □ — □□□ — □ — □

Specification	Code
Three-phase	4

Main power supply	Code
110~220V	2
380~440V	4
480~520V	8

Current	Code	Current	Code	Current	Code	Current	Code
30A	030	80A	080	175A	175	400A	400
40A	040	90A	090	200A	200	450A	450
50A	050	100A	100	250A	250	500A	500
60A	060	125A	125	300A	300	600A	600
75A	075	150A	150	350A	350	800A	800

Control mode setting	Code
Constant voltage control	P
Constant current control	C
Constant power control	CV
Cycle zero-crossing control	Z
Fixed-cycle zero-crossing control	ZV

Optional Content	Code
No configuration	None
30/40 blower	F
Touch screen external lead * meters	H
Display panel external lead * meters	Y

For example:HGW9-4-4-300-P-H3 is a 3-meter lead;
Note: The maximum length the lead outside the display board is 3 meters, and the maximum length of the lead outside the touch screen is 20 meters.

- **Current calculation formula**

$$\text{Three-phase: SCR amperage} = 1.2 * \frac{\text{Load(KW)} * 1000}{\text{Line voltage(V)} \times \sqrt{3}}$$

- **Specification and Model Table**

Specification and Model	Current	Load Power (KW)		Appearance Dimensions (mm)			Fixed Dimensions (mm)		Weight (KG)	Screws and tightening torque		Cooling method	Illustration
		220V	380V	Length	Width	Height	Length	Width					
HGW9-4-4-030-P	30A	9.5	16.5	250	140	195	162	135	3.5	M6	50kgfcm	Air	Figure 1
HGW9-4-4-040-P	40A	12.5	20	250	140	195	162	135	3.5	M6	50kgfcm	Air	
HGW9-4-4-030-PF	30A	9.5	16.5	250	140	195	162	135	3.5	M6	50kgfcm	Fan	Figure 2
HGW9-4-4-040-PF	40A	12.5	20	250	140	195	162	135	3.5	M6	50kgfcm	Fan	
HGW9-4-4-050-P	50A	15.5	27	250	140	195	162	135	3.5	M6	50kgfcm	Fan	
HGW9-4-4-060-P	60A	19	33	250	140	195	162	135	3.5	M6	50kgfcm	Fan	
HGW9-4-4-075-P	75A	23.5	41	250	140	195	162	135	3.5	M6	70kgfcm	Fan	
HGW9-4-4-080-P	80A	25.5	44	250	140	195	162	135	3.5	M6	75kgfcm	Fan	
HGW9-4-4-090-P	90A	28.5	49	250	140	205	162	135	3.5	M6	85kgfcm	Fan	Figure 3
HGW9-4-4-100-P	100A	32	55	250	140	205	162	135	3.5	M6	85kgfcm	Fan	
HGW9-4-4-125-P	125A	40	68.5	290	140	205	202	135	4.4	M8	95kgfcm	Fan	Figure 4
HGW9-4-4-150-P	150A	45.5	75	340	140	205	252	135	5.5	M8	170kgfcm	Fan	Figure 5
HGW9-4-4-175-P	175A	53	88	390	140	205	302	135	6	M8	200kgfcm	Fan	Figure 6
HGW9-4-4-200-P	200A	60	100	379	185	225	272	170	13	M8	220kgfcm	Fan	Figure 7
HGW9-4-4-250-P	250A	73	125	420	244	236	401	160	13	M10	220kgfcm	Fan	Figure 8
HGW9-4-4-300-P	300A	87	150	435	263	248	416	160	15	M10	250kgfcm	Fan	Figure 9
HGW9-4-4-350-P	350A	100	177	435	263	248	416	160	18	M10	250kgfcm	Fan	
HGW9-4-4-400-P	400A	115	200	435	263	290	416	160	22	M10	250kgfcm	Fan	Figure 10
HGW9-4-4-450-P	450A	130	220	435	263	290	416	160	25	M10	250kgfcm	Fan	
HGW9-4-4-500-P	500A	150	240	435	263	290	416	160	25	M10	250kgfcm	Fan	
HGW9-4-4-600-P	600A	175	300	525	388	330	495*3	140*2	37	M12	300kgfcm	Fan	Figure 11
HGW9-4-4-800-P	800A	235	410	525	388	330	495*3	140*2	37	M12	300kgfcm	Fan	

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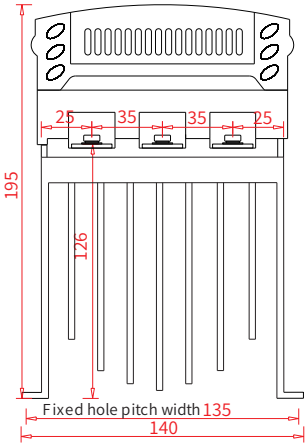
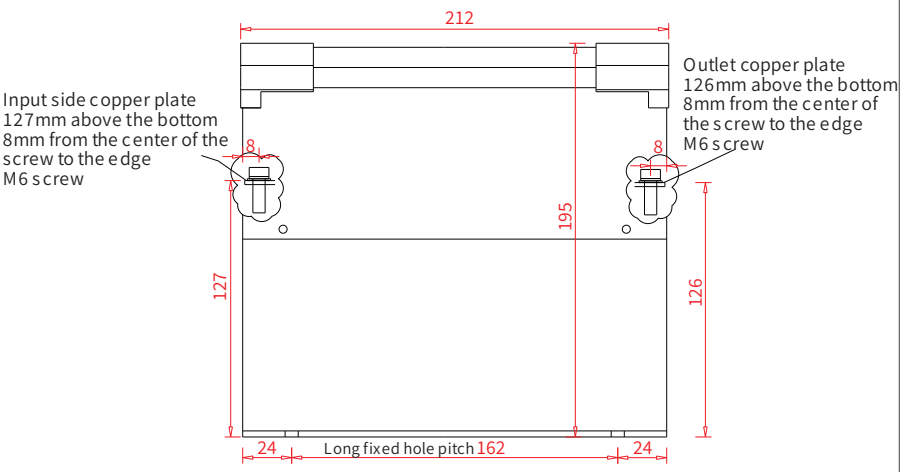




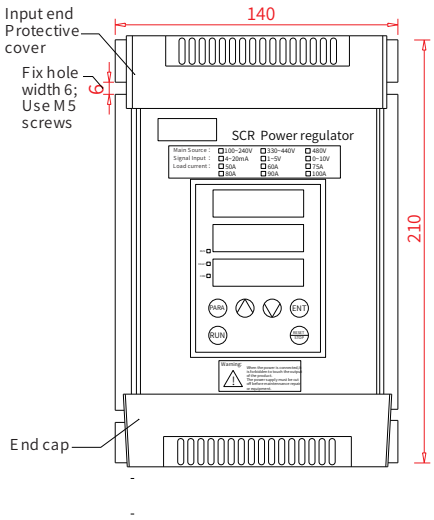
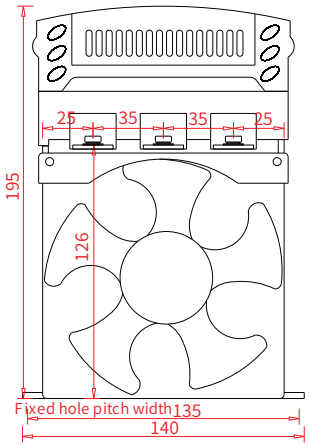
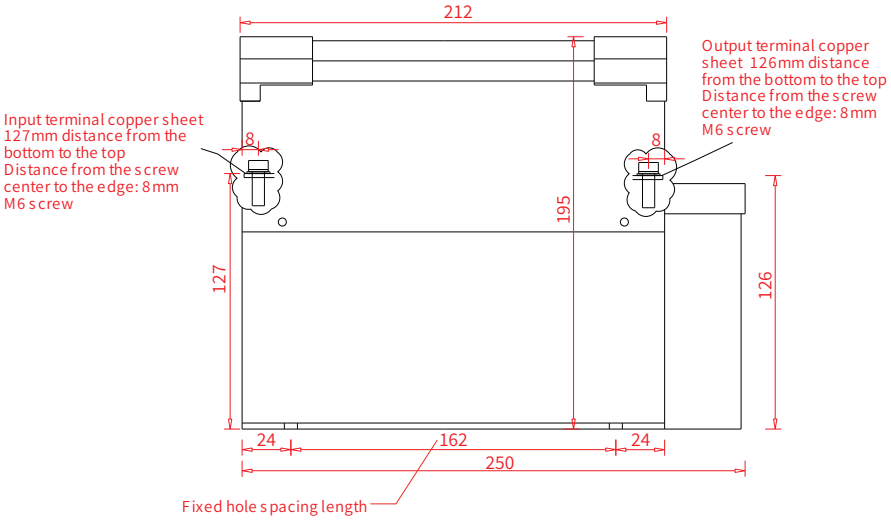


Figure 1
HGW9-4-4-030-P
HGW9-4-4-040-P





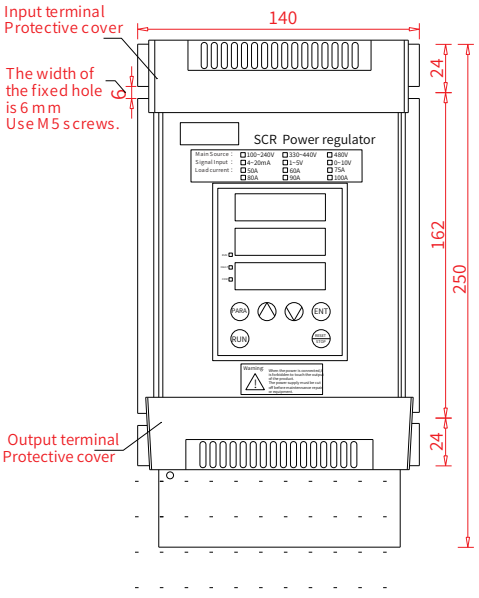


Figure 2
HGW9-4-4-030-PF
HGW9-4-4-040-PF
HGW9-4-4-050-P
HGW9-4-4-060-P
HGW9-4-4-075-P
HGW9-4-4-080-P

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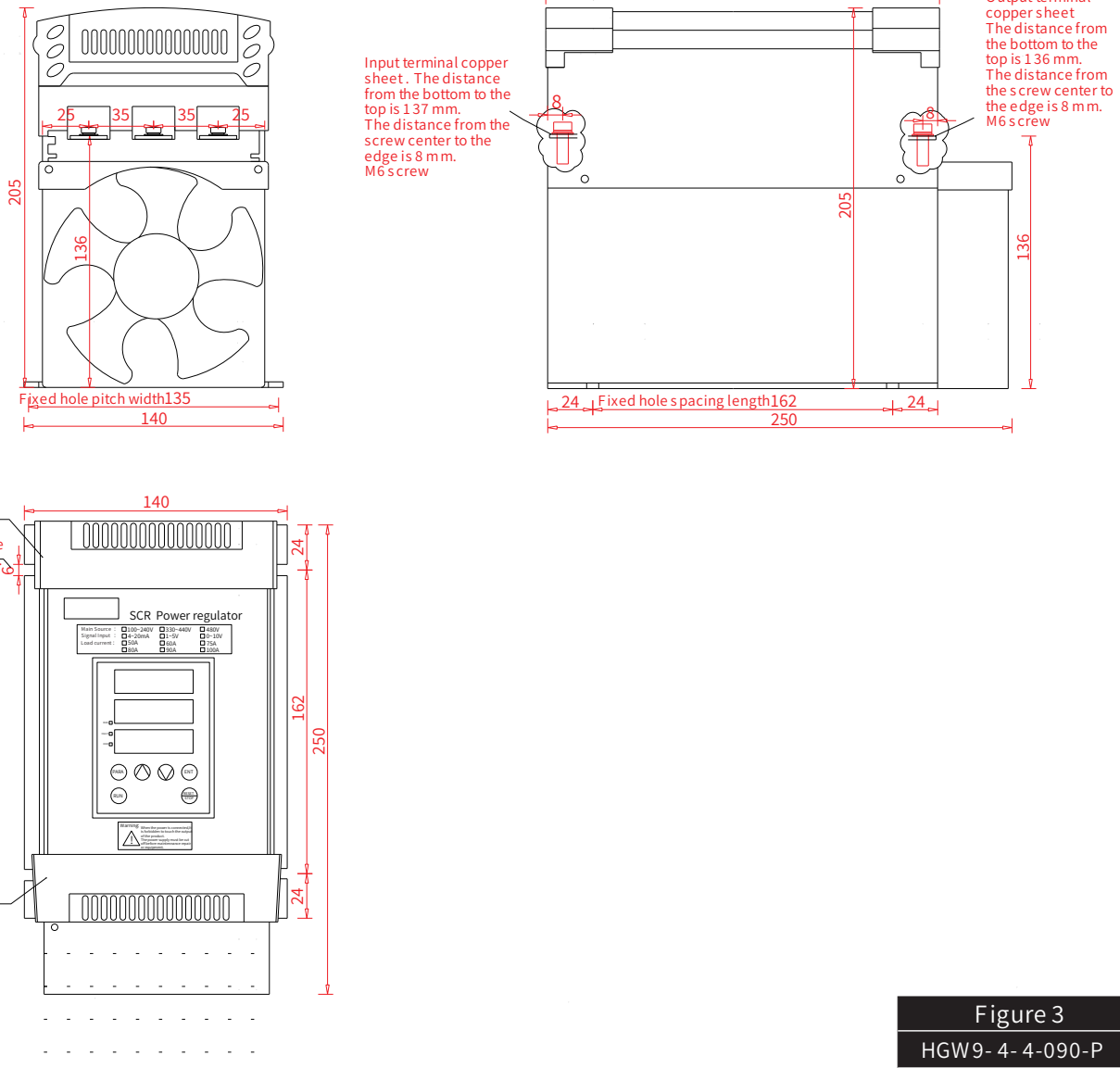

Figure 3
HGW9-4-4-090-P
HGW9-4-4-100-P

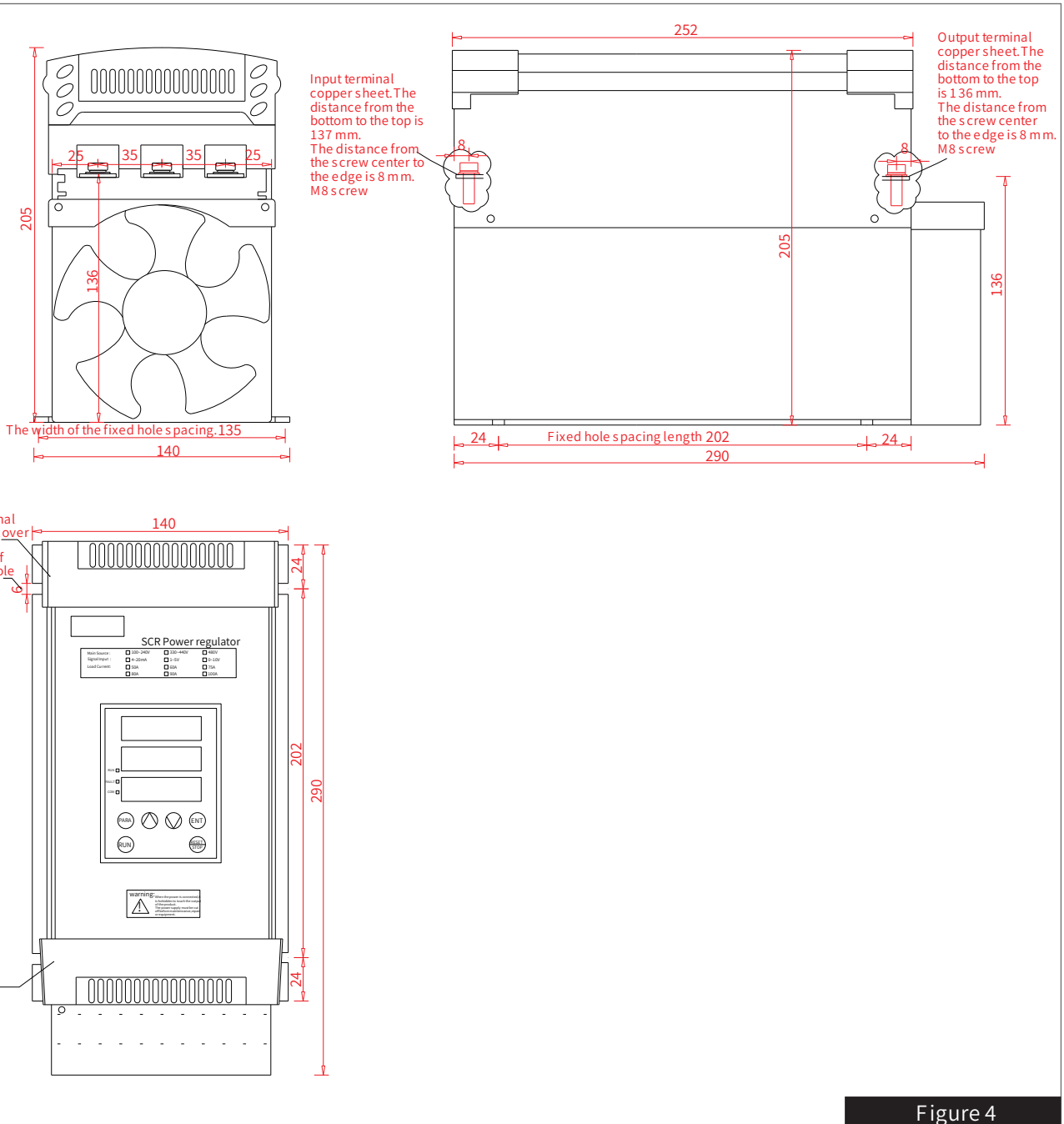

Figure 4
HGW9-4-4-125-P

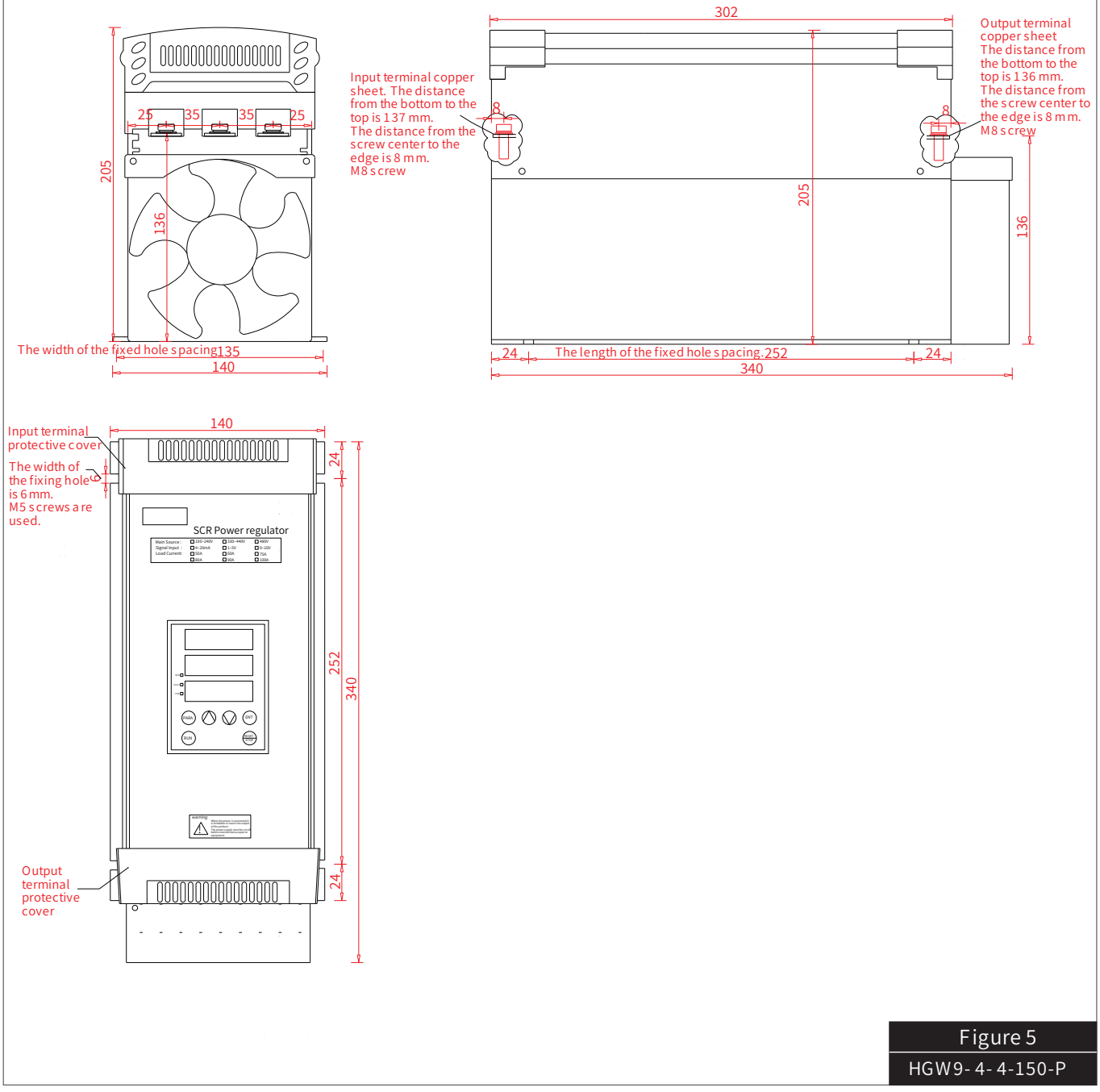

Figure 5
HGW9-4-4-150-P

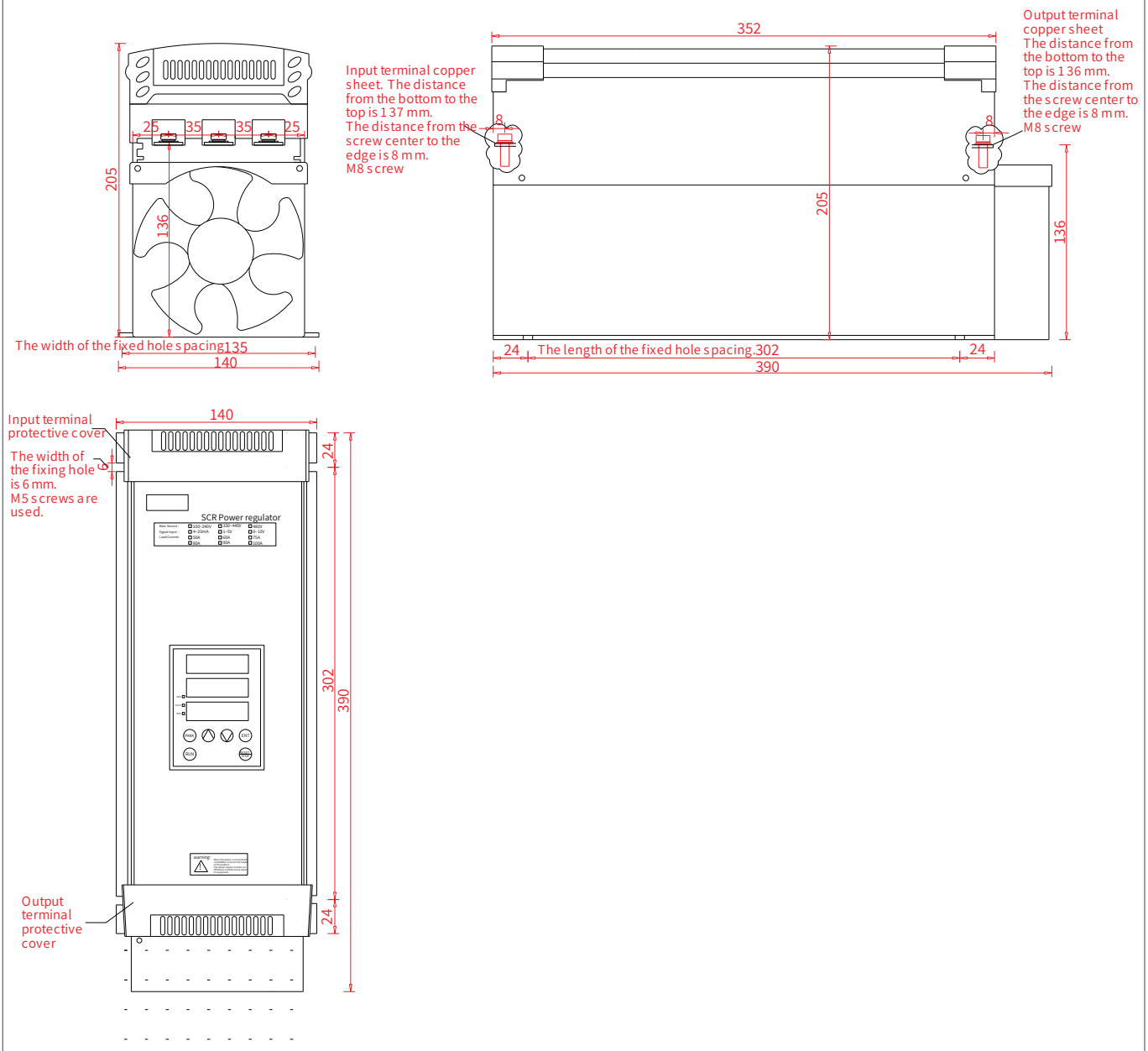

Figure 6
HGW9- 4- 4-175-P

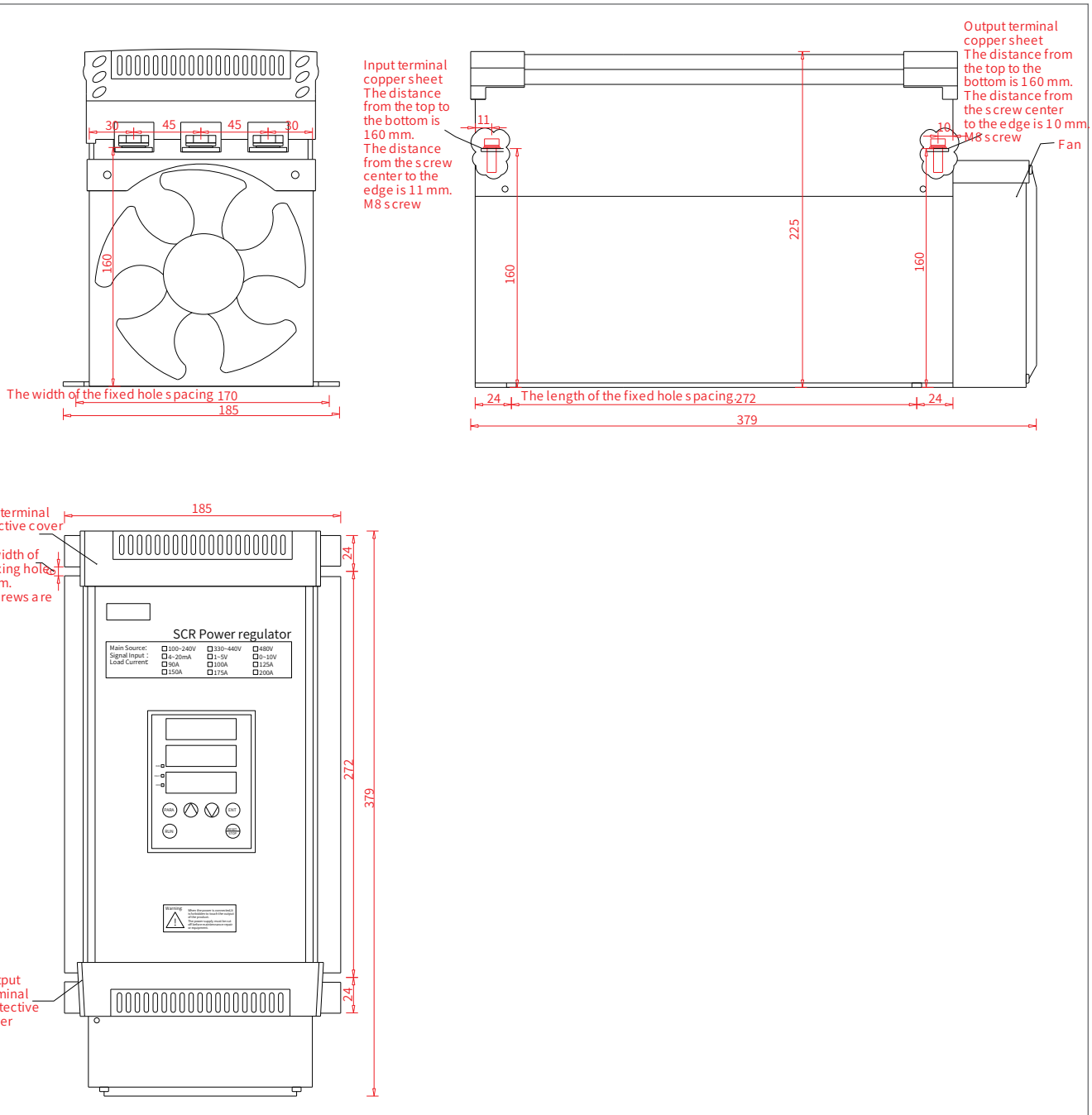

Figure 7
HGW9-4-4-200-P

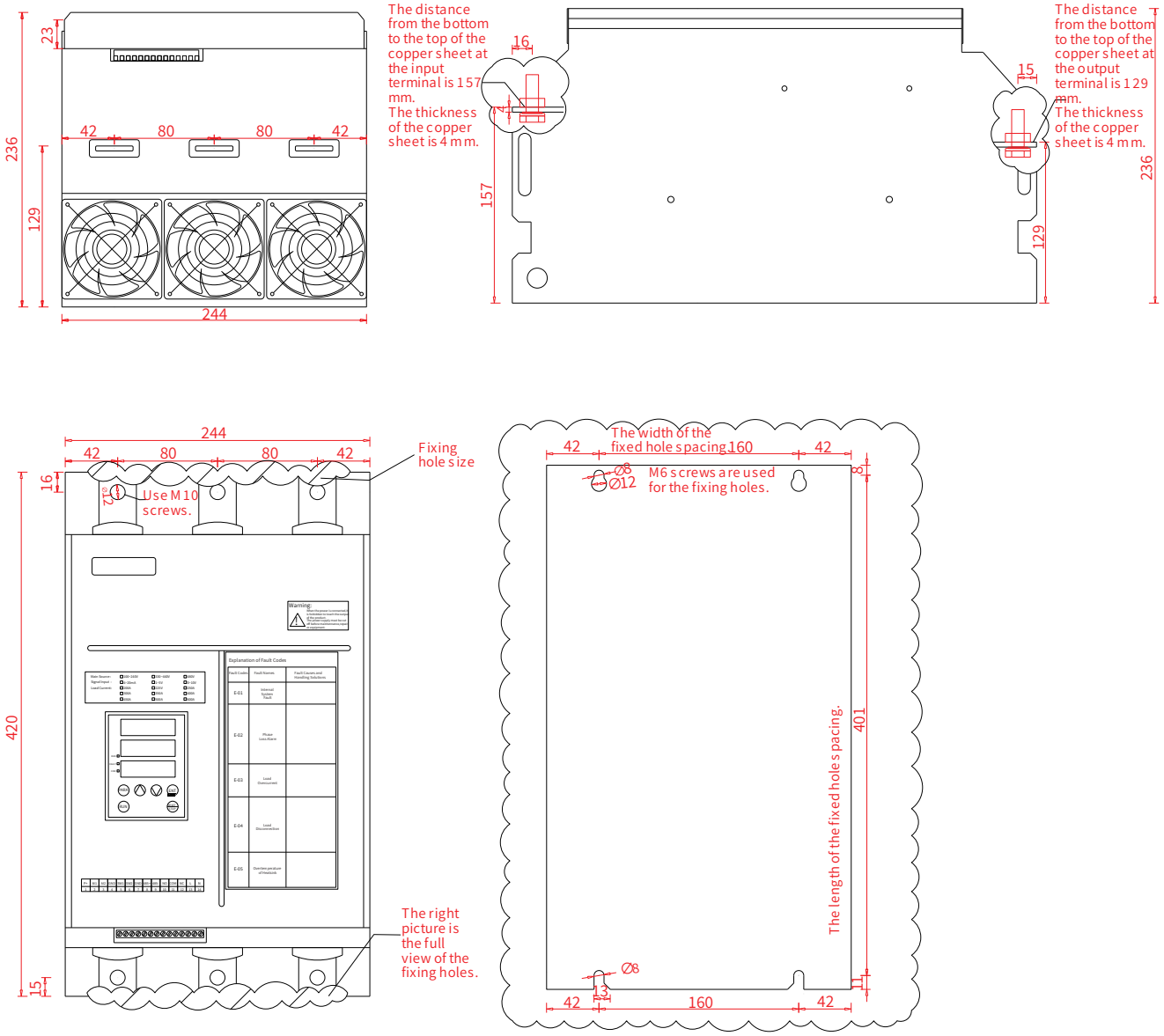

Figure 8
HGW9- 4- 4-250-P

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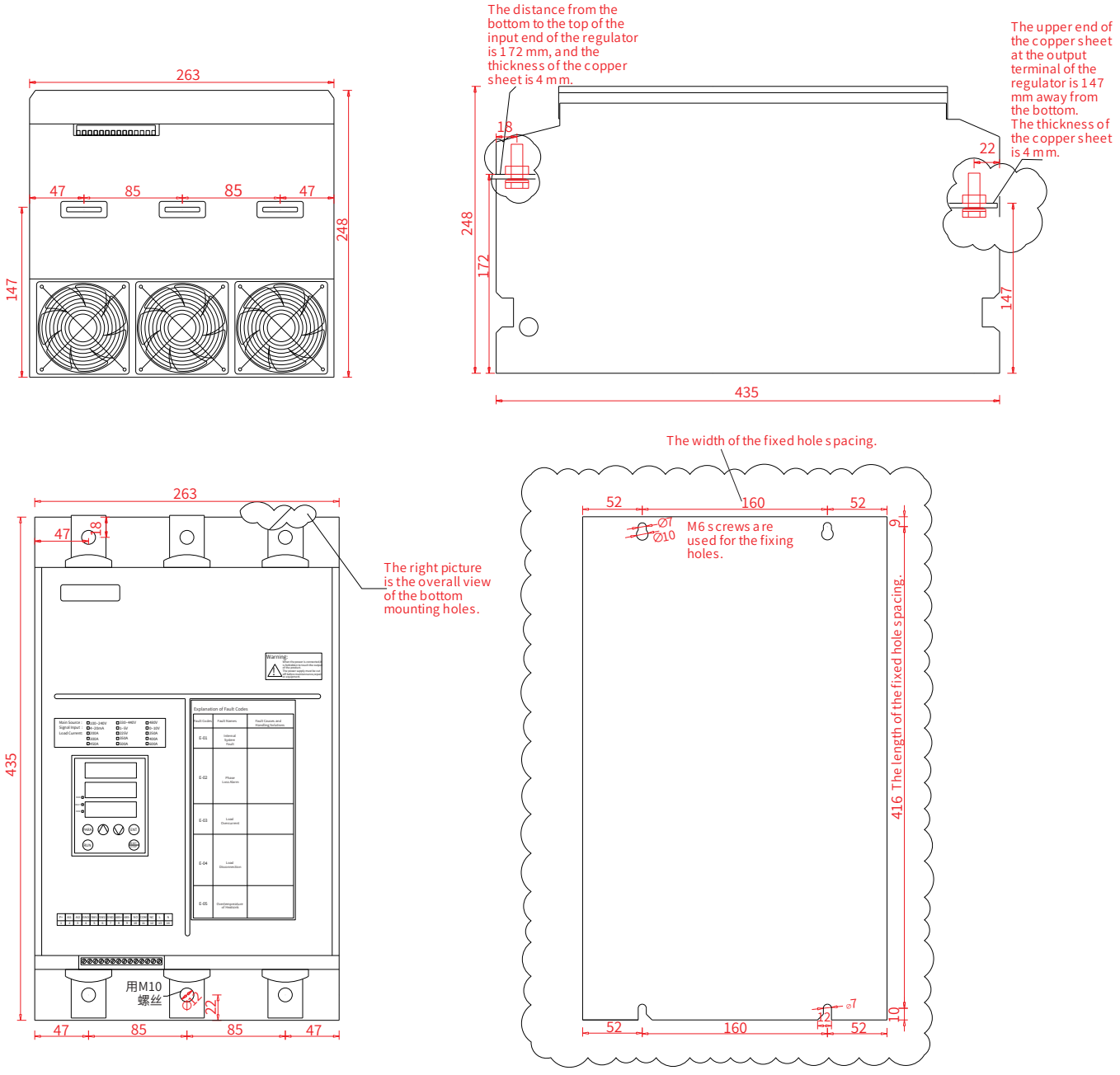

Figure 9
HGW9-4-4-300-P
HGW9-4-4-350-P

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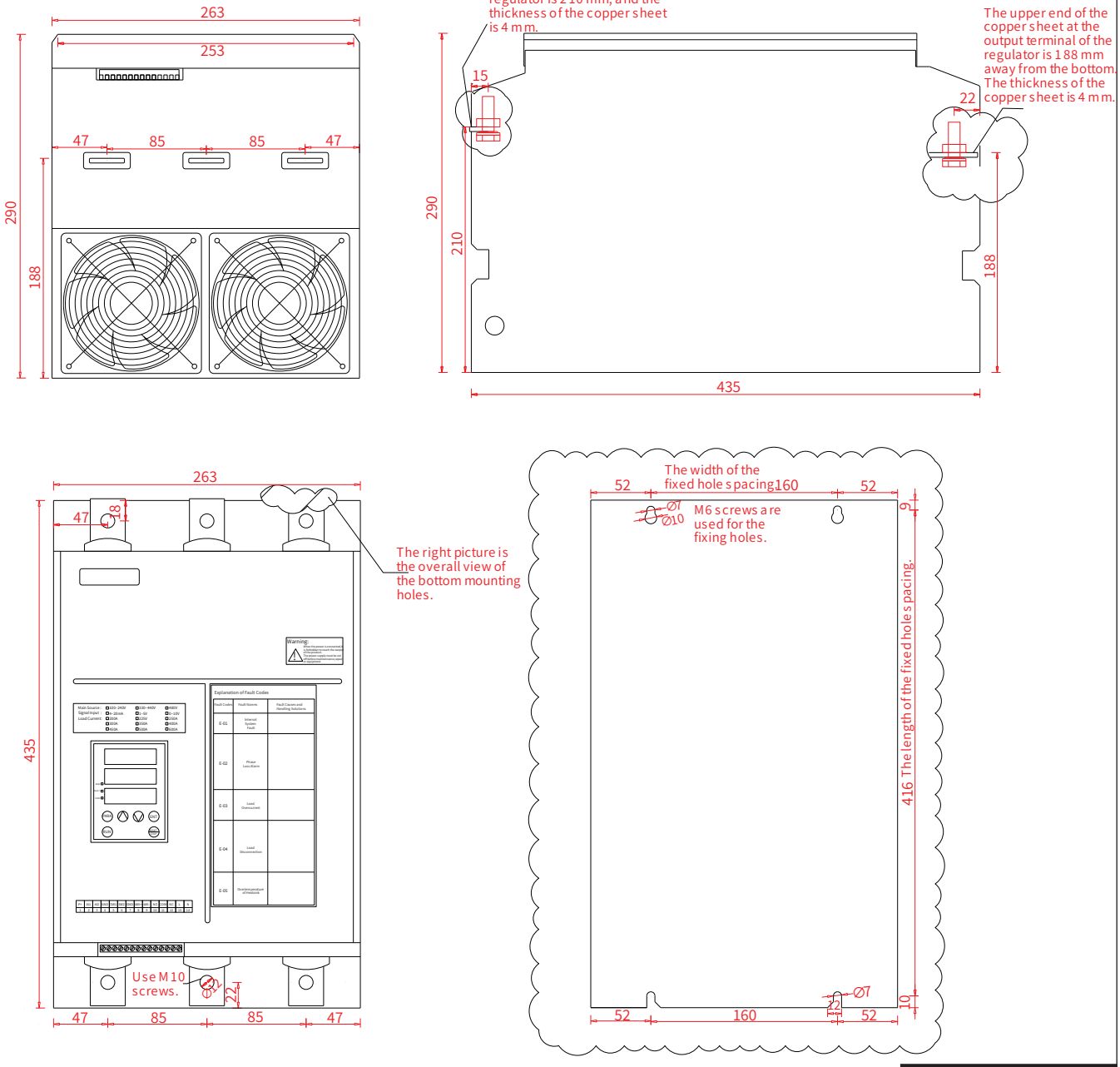

Figure 10

HGW9-4-4-400-P

HGW9-4-4-450-P

HGW9-4-4-500-P

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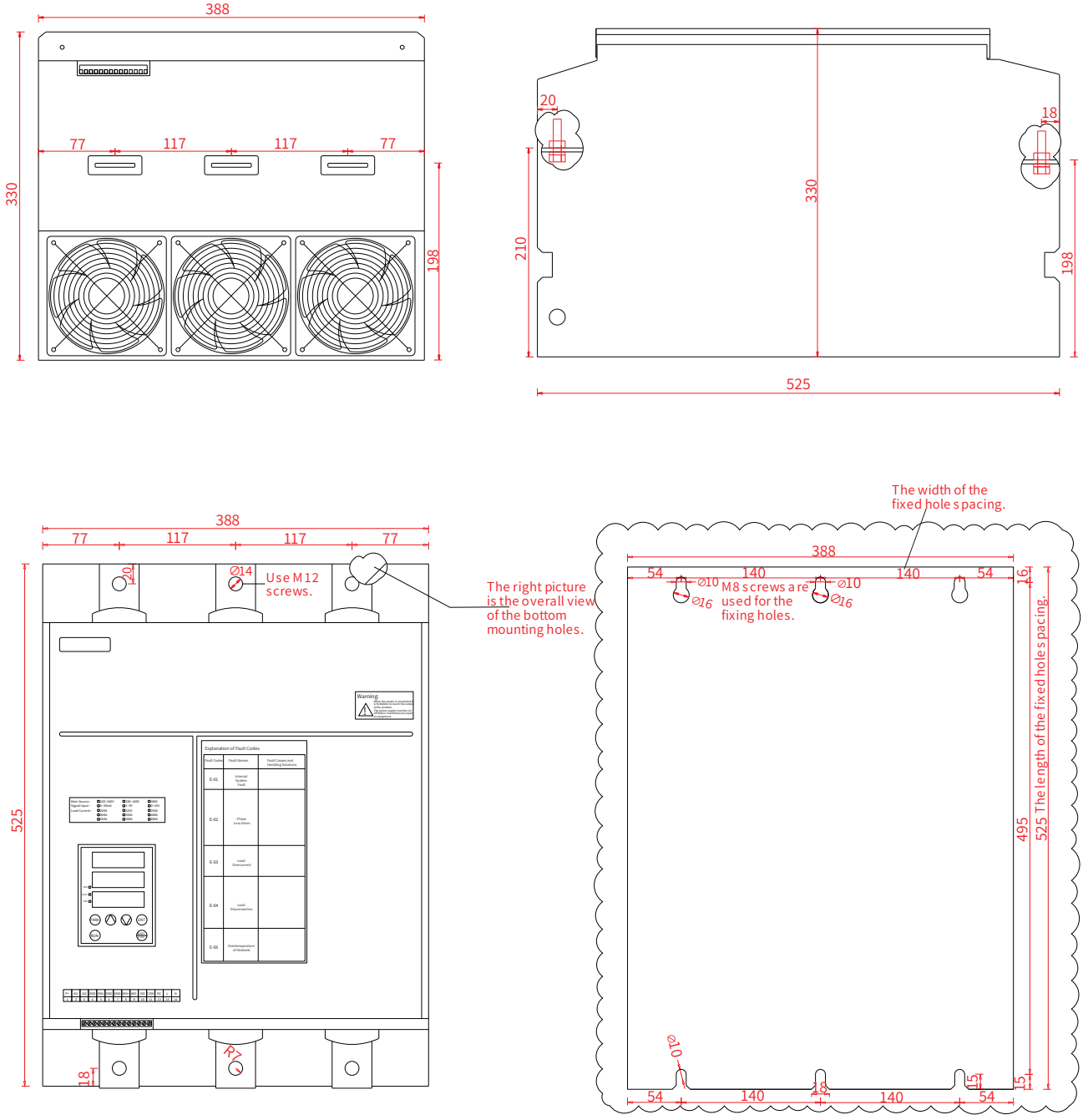

Figure 11

HGW9-4-4-600-P

HGW9-4-4-800-P

Thank you for purchasing the HGW9 series SCR power regulator. This instruction manual mainly describes some precautions for installation and wiring. Before operation, please read this manual first to fully understand the usage method of this product. Please keep this manual for future reference at any time.