

DC Power Modular

High-frequency switching power supply

HuaHeng Electronics

User Manual

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Chapter 1 Overview

1.1 Preface

The series intelligent high-frequency switch power supply modules are specially developed to meet the demands of modern DC system. The charger rectifiers are designed with world leading patent technology “resonant voltage type soft switching power supply technology”. They feature high efficiency and stability, intelligent control, small size and light weight.

Two ranges available: 220V and 110V series with a variety of options separately. RS-485 interface, easy to connect with automation system for various transformer substations, power plant, hydraulic power plant and other DC power supply applications.

The modules are improved by LED display on front panel. Here are the options and specifications as below:

Model	Output voltage (V)	output current (A)	cooling type	Dimensions (D×H×W mm)
HA230D05Z	220	5	natural cooling	260×179×109
HA230D07Z	220	7	natural cooling	325×230×130
HA230D10Z	220	10	natural cooling	325×230×130
HA230D20Z	220	20	natural cooling	400×323×146
HA230D20N	220	20	fan cooling	357×218×118
HA230D30N	220	30	fan cooling	410×303×136
HA230D40N	220	40	fan cooling	410×303×136
HA110D10Z	110	10	natural cooling	260×179×109
HA110D20Z	110	20	natural cooling	325×230×130
HA110D40Z	110	40	natural cooling	400×323×146

1.2 Main characteristic of the Modules

- Modular design, N+1 pc(s) backup;
- The friendly man-machine interface. LED screen
- RS-485 communication interface, achieves “4 remote control” function

- High efficiency, up to 95%-96%;
- Light weight, Small size
- After the full bridge rectifying circuit rectifies 3-phase AC to DC, then adjusted by reactive PFC, power factor > 0.94;
- Unequal current ratio of parallel connection < $\pm 3\%$, can ensure twenty modules work well by parallel connection.
- Function against reverse connection
- LED digital screen
- **Output overvoltage protection**

To prevent the disastrous accident caused by output overvoltage, there is overvoltage protection circuit in the module. Once the output voltage is higher than the threshold, the module locks up automatically and fault indication light is on, the faulty module quits work automatically and doesn't affect the normal operation of the entire system. The overvoltage protection threshold is set in the factory, $320V \pm 5\%$ for 220V series, $160V \pm 5\%$ for 110V series.

- **Output current limiting protect**

The output current cannot increase infinitely. The maximum output current of is limited to 105% of the rated output current.

- **Output short-circuit protection**

When short circuit, the output voltage drops to 0 immediately. Limit the short circuit current under 15% of rated output current. The module will not be damaged under short circuit state for a time, and resumes to work automatically after debugging.

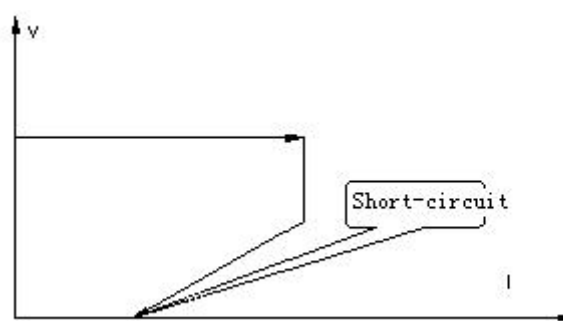


Fig.1-1 Output Characteristic

● **Module parallel protection**

There is parallel protection circuit in each module to ensure that when the fault module quits the system, the normal work of other modules and the system won't be effect.

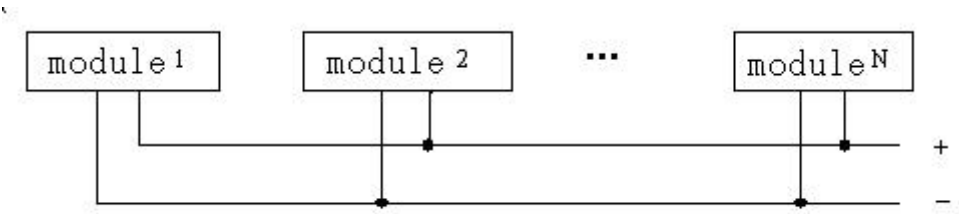


Fig.1-2 output of module parallel

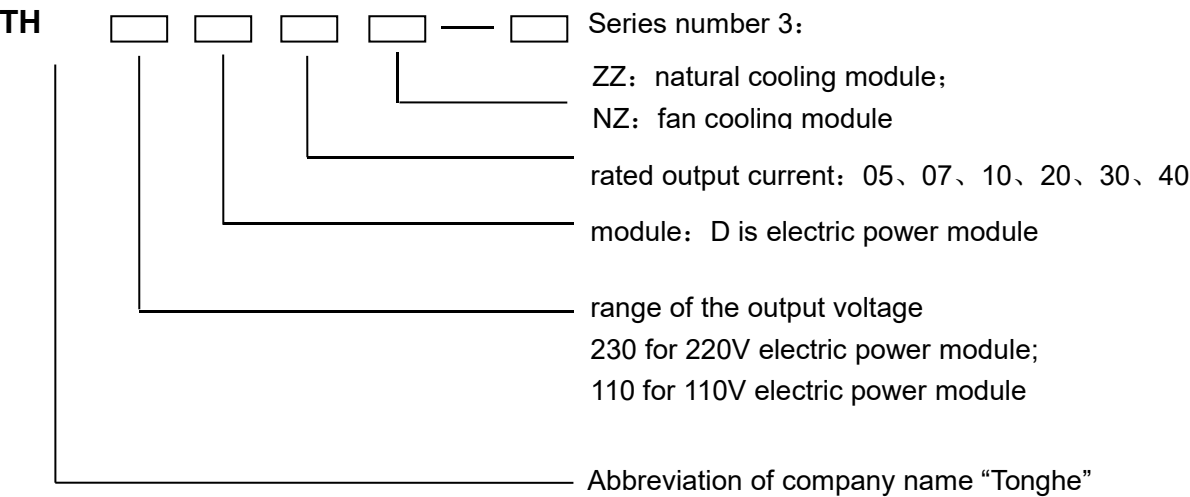
● **Over-temperature protection:**

Over-temperature protection is mainly for protecting large power components. In particular case, when the temperature of the radiator is over the threshold 85℃, the charger module shuts down automatically to protect itself and resume to work after the temperature comes lower.

● **Output over-current protection**

The output current cannot increase infinitely. If overloaded, the output voltage decreases automatically to protect the power components. The over current protection can be resumed automatically.

1.3 Type No. Naming



1.4 Technical characteristics

TH230D series module characteristic of the module technical index

Module Code		230D05Z	230D07Z	230D10Z	230D20Z	230D20F	230D30F	230D40F
project								
rated output current(A)		5	10	10	20	20	30	40
power (KW)		1.5	2.1	3	6	6	9	12
weight(kg)		5.2	9	9	16	10.5	19	19
cooling type		natural cooling				fan cooling		
Internal radiator temperature rise		≤30℃				≤20℃		
range of input voltage AC (VAC)	min	304						
	Typical value	380						
	max	475						
range of the output voltage (VDC)	min	190						
	Typical value	220						
	max	300						
Voltage Stabilizing accuracy		±0.5%						
Current Stabilizing accuracy		±1%						
PFC		≥0.93						
Efficiency		≥95%						
noise (dB)		<50						
Storage temperature (℃)	min	-40						
	Typical value	25						
	max	60						
working temperature (℃)	min	-10						
	Typical value	25						
	max	40						
Unbalance rate of load sharing		≤±3%						
Soft start time (s)		3~8						
Ripple coefficient		≤0.2%						
Load grade		Continuous working with Grade I(100%) rating output current						
Automatic current limiting		The output current does not increase infinitely. When output current is over threshold, there will be limited constant current output. The maximum output current of is limited to 105% of the rated output current.						
Output overvoltage protection		No output, threshold (320±5VDC), self recoverable						
output short circuit protection		When short circuit, the module will protect itself from broken. Self recoverable						

110D series module characteristic of the module technical index

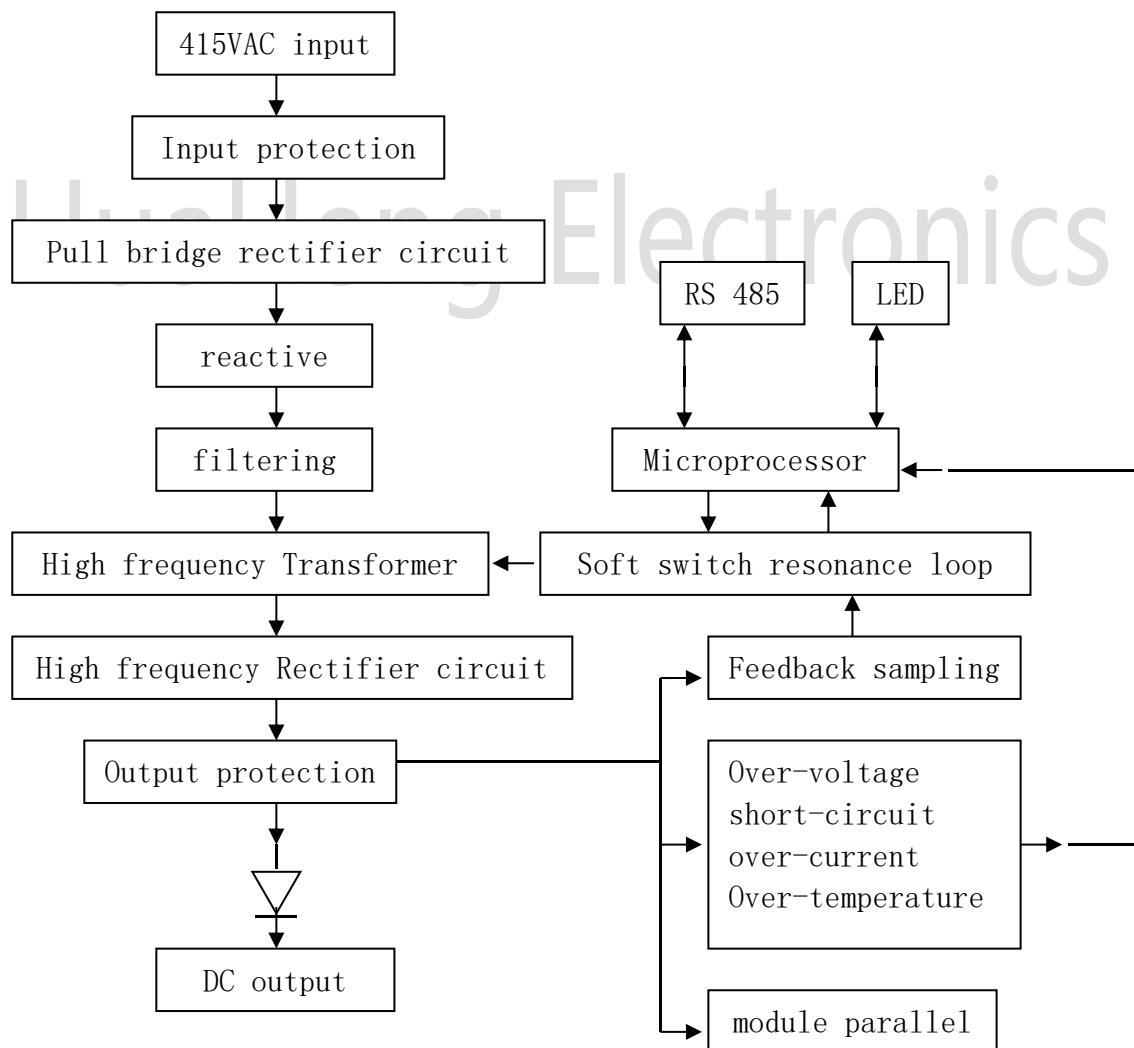
module		110D10Z	110D20Z	110D40Z
project				
rated output current(A)		10	20	40
power (KW)		1.5	3	6
weight(kg)		5.2	9	16
cooling type		natural cooling		
heat sink temperature rise		$\leq 30^{\circ}\text{C}$		
rang of input AC (VAC)	min	304		
	Typical value	380		
	max	475		
rang of the output voltage (VDC)	min	95		
	Typical value	110		
	max	150		
Voltage Stabilizing accuracy		$\pm 0.5\%$		
Current Stabilizing accuracy		$\pm 1\%$		
PFC		≥ 0.93		
Efficiency		$\geq 95\%$		
noise (dB)		50		
Storage temperature ($^{\circ}\text{C}$)	min	-40		
	Typical value	25		
	max	60		
working temperature ($^{\circ}\text{C}$)	min	-10		
	Typical value	25		
	max	40		
Unbalance rate of load sharing		$\leq \pm 3\%$		
Soft start time (s)		3~8		
Ripple		$\leq 0.2\%$		
Load		Continuous working with Grade I(100%) rating output current		
Automatic current limiting		The output current does not increase infinitely. When output current is over threshold, there will be limited constant current output. The maximum output current of is limited to 105% of the rated output current.		
Output overvoltage protection		No output, threshold ($160 \pm 3\text{VDC}$), self recoverable		
output short circuit protection		When short circuit, the module will protect itself from broken. Self recoverable		

Chapter 2 Operating Condition

1. Altitude $\leq 2000\text{m}$;
2. Storage temperature: $-40^{\circ}\text{C} \sim +60^{\circ}\text{C}$; ambient temperature: $-10^{\circ}\text{C} \sim 40^{\circ}\text{C}$;
3. Relative humidity: $\leq 96\%$ (operating temperature 25°C) ;
4. No conductive and explosive dust, no caustic gas;
5. Indoor only;

Chapter 3 Module Configuration

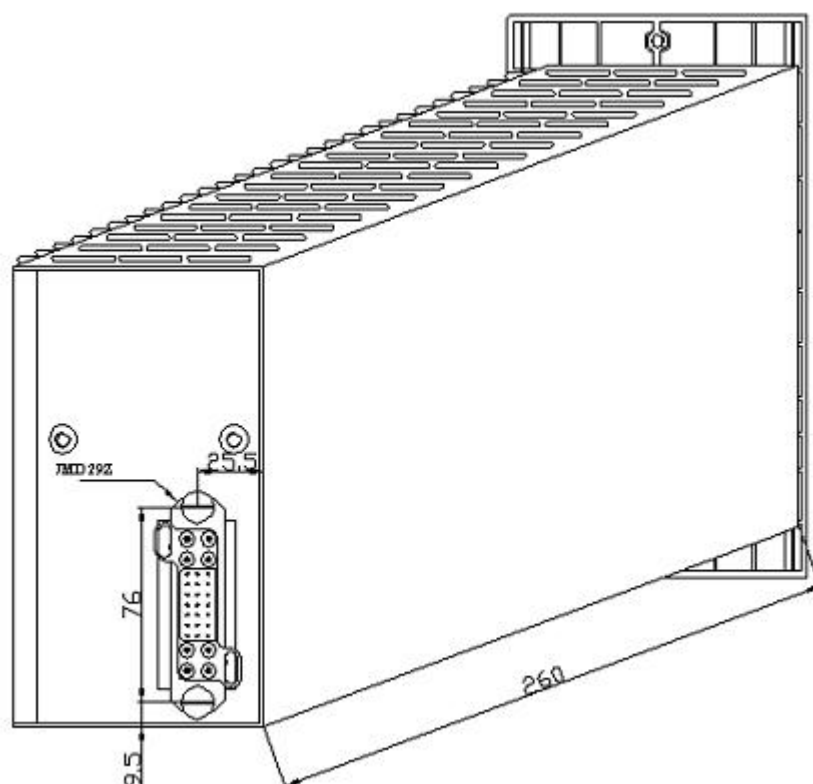
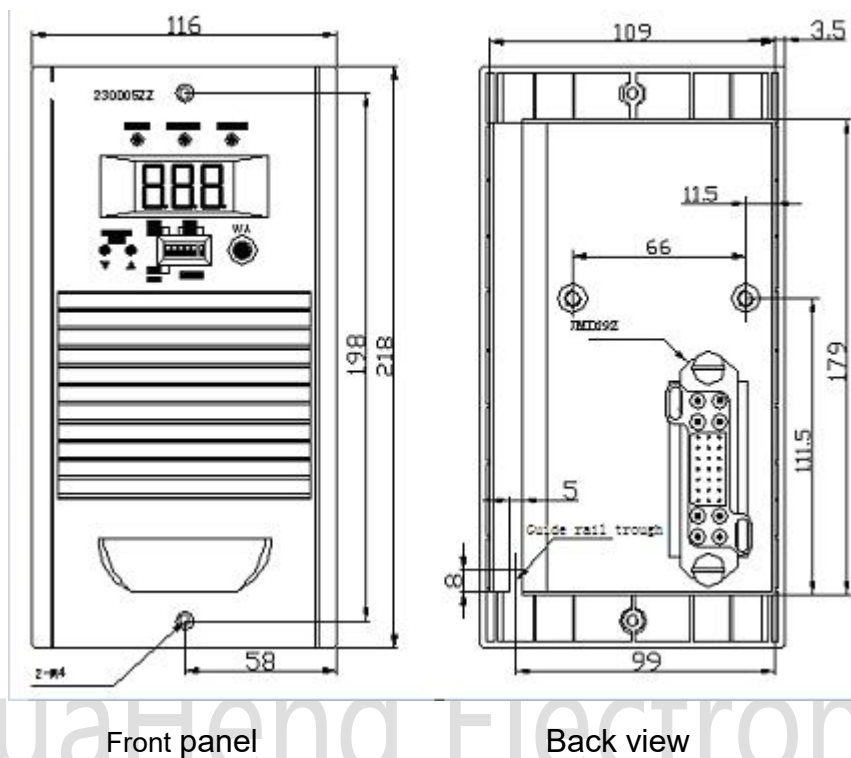
3.1 Working flow of the charging module



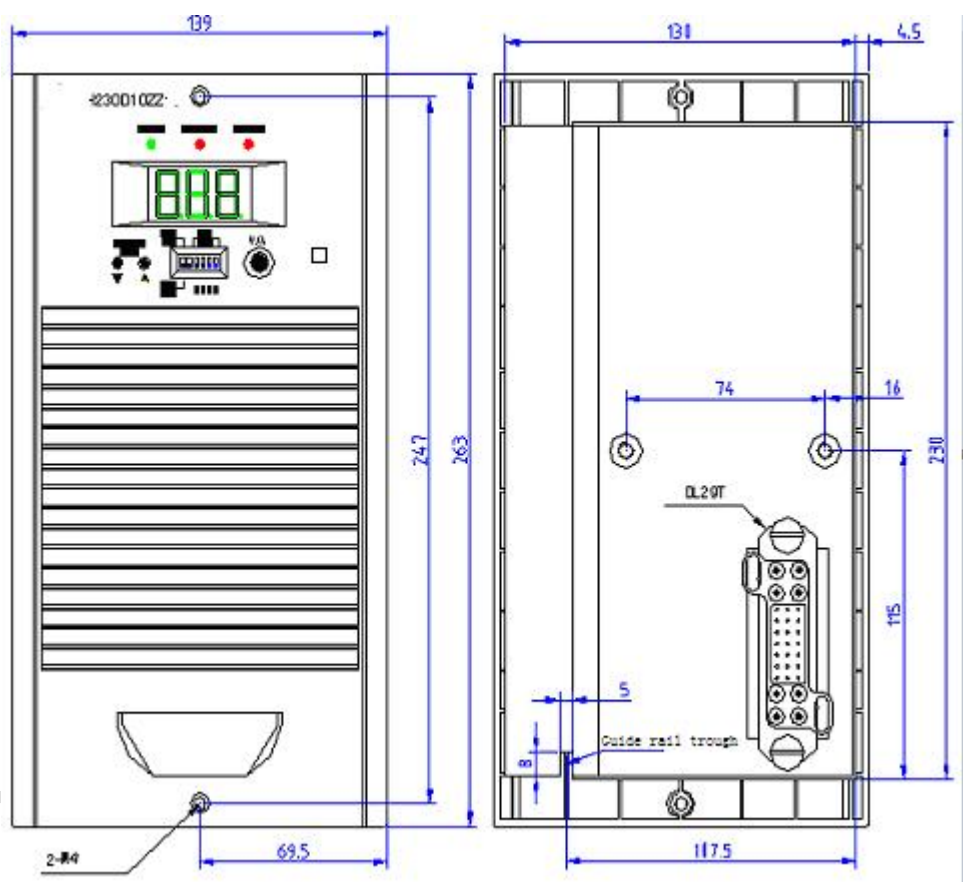
Functional diagram

3.2 Dimension

HA230D05Z、HA110D10Z natural cooling module dimension sketch map:

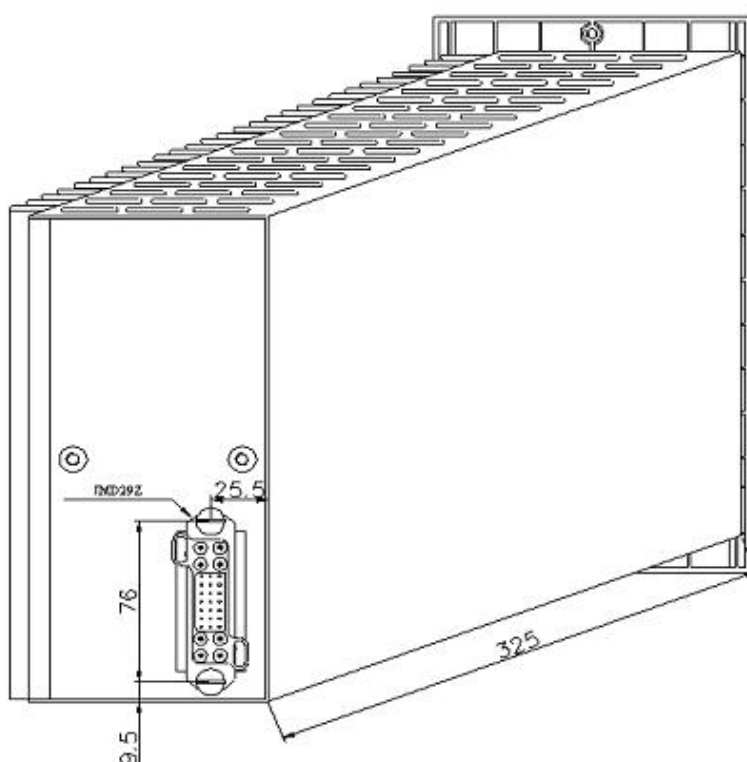


outline drawing of the module

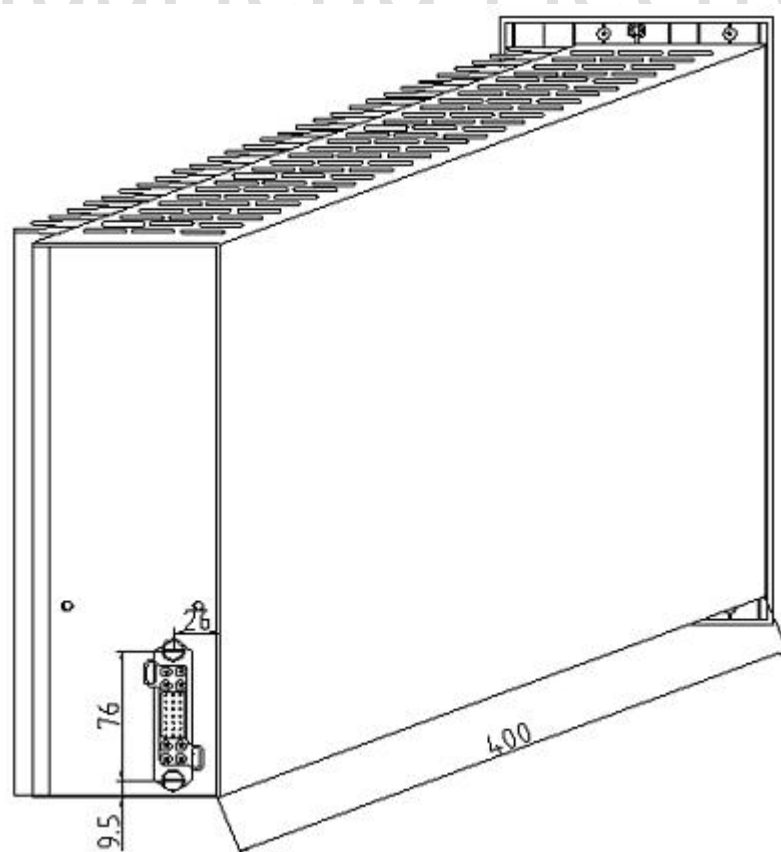
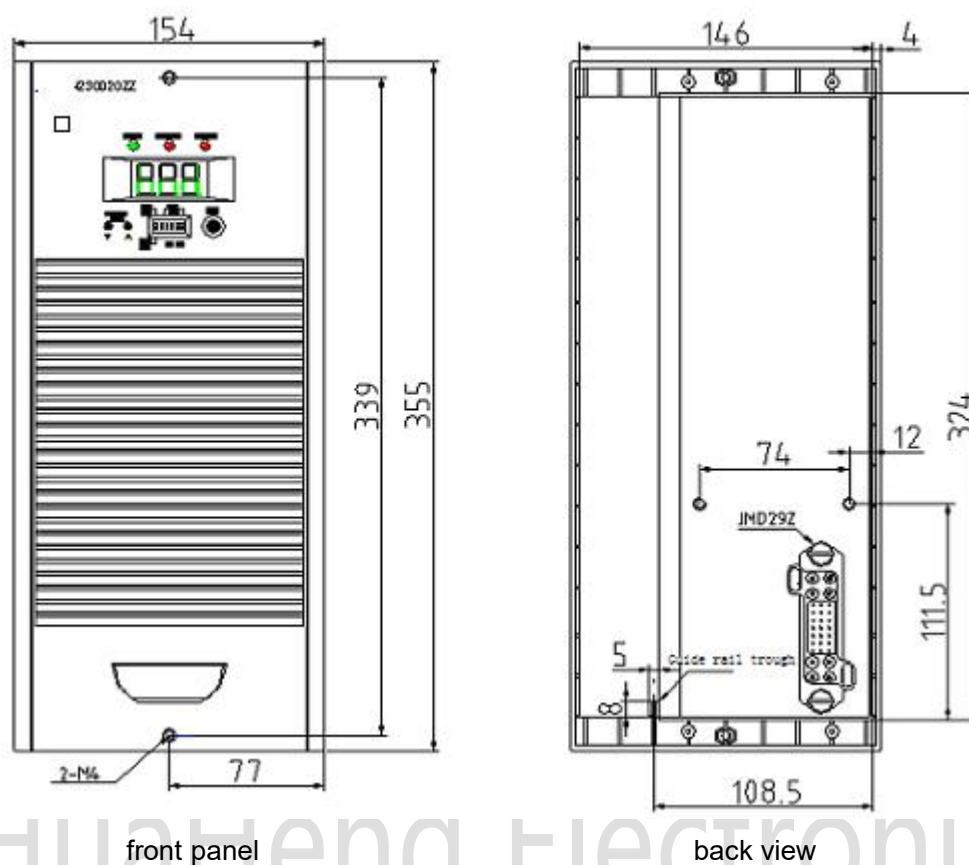
HA230D10Z、HA110D20Z **natural cooling module dimension sketch map:**

front panel

back view

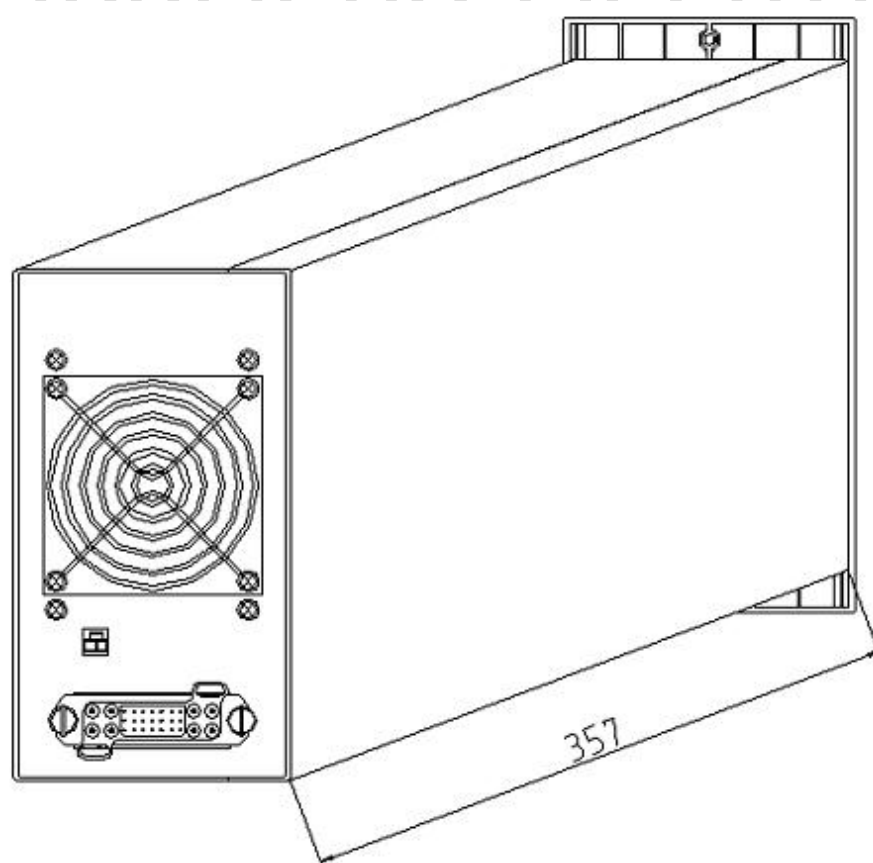
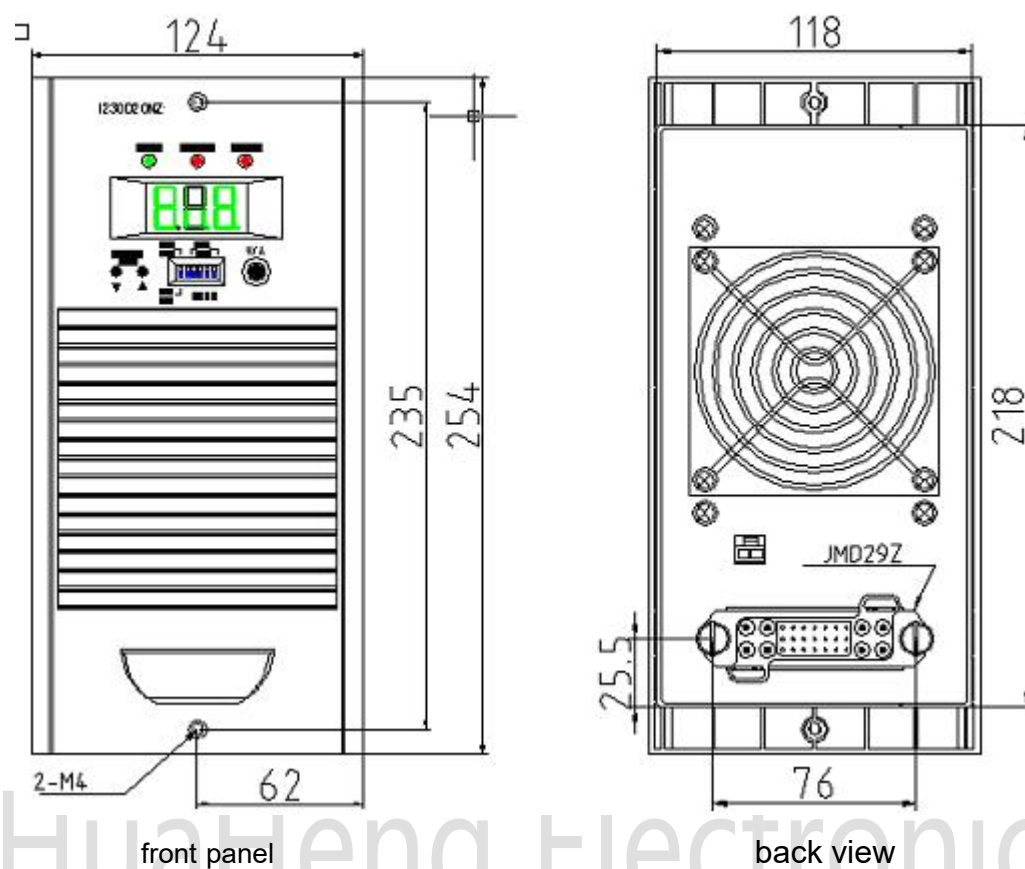


outline drawing of the module

HA230D20Z、HA110D40Z **natural cooling module dimension sketch map:**

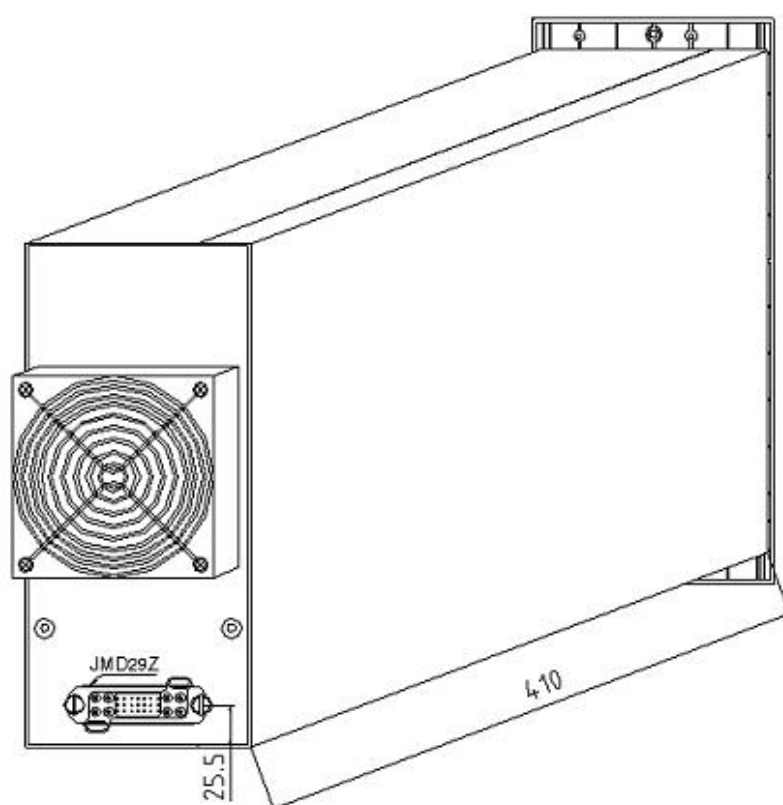
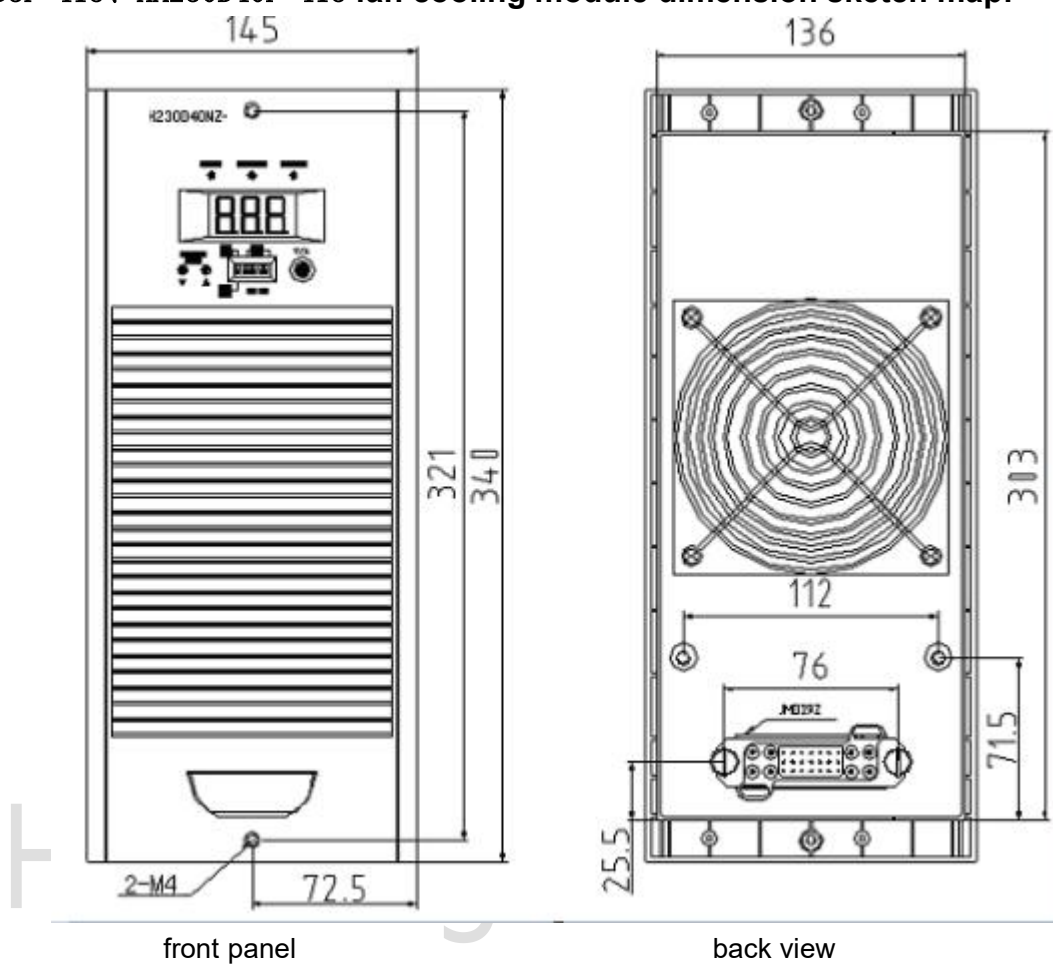
outline drawing of the module

HA230D20F fan cooling module dimension sketch map:



outline drawing of the module

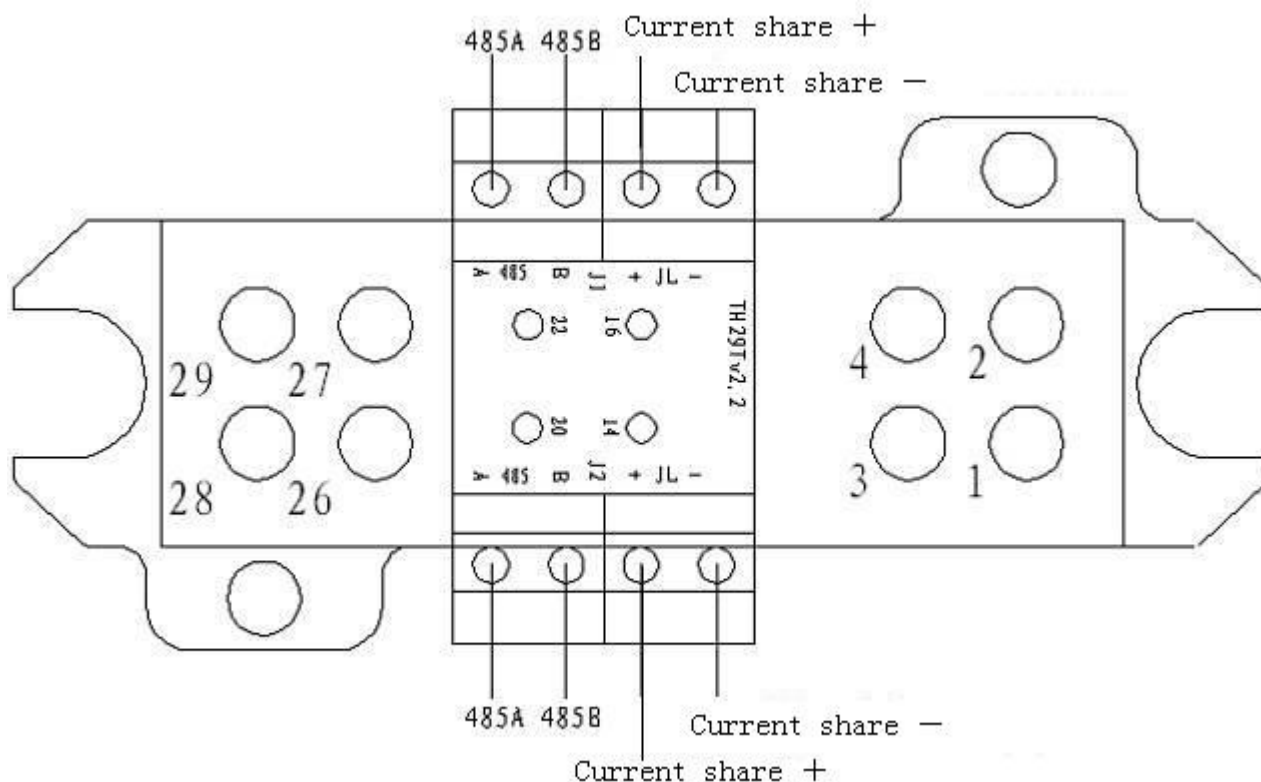
HA230D3F-415、HA230D40F-415 fan cooling module dimension sketch map:



outline drawing of the module

3.3 Installation

1. HA230D05Z、HA230D07Z、HA230D10Z、HA230D20Z、HA110D10Z、HA110D20Z、HA230D20F,
Definition of the connector assembly(JMD29T)



2.

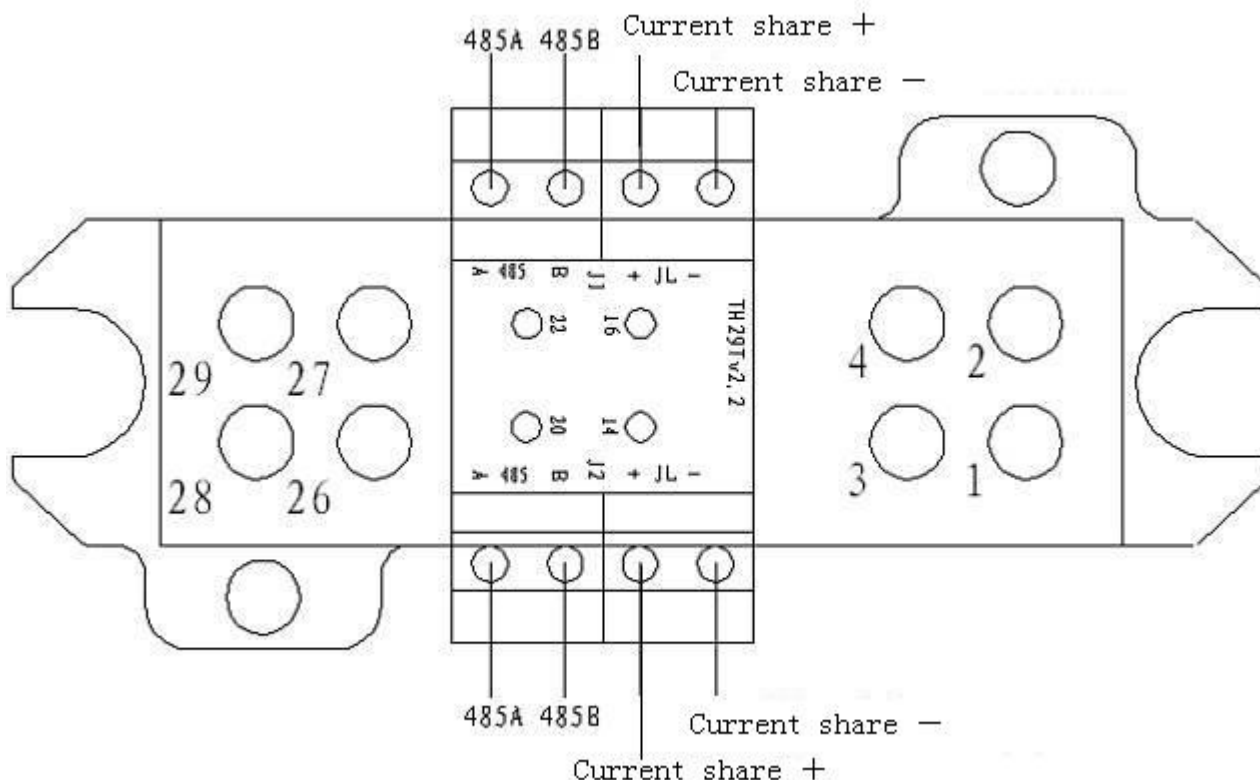
port	Standard pins	Definition	Function
1	12#	DC+	DC output+
2	12#	DC-	DC output-
26	12#	G	EARTH
27	12#	A	Input 380V
28	12#	B	Input 380V
29	12#	C	Input 380V

Note:

- ① Undefined port is empty
- ② Keep a good natural ventilation around the charger module.
- ② Keep a good ventilation around the fan cooling modules
- ③ Connect according to the indication “current share +”, “current share -” to achieve the automatic current share.
- ④ Wire terminal A and terminal B separately and connect with the host monitor (such as THJK002G-3 monitor) through terminal A & terminal B of RS485 A, which achieve communication between the module and monitor

3. HA230D40F、HA110D40Z、HA230D30F:

Definition of connector (JMD29T)



port	Standard pins	definition	function
1、3	12#	DC+	DC output+
2、4	12#	DC-	DC output-
26	12#	G	EARTH
27	12#	A	Input380V
28	12#	B	Inptu380V
29	12#	C	Input 380V

- ③ Undefined port is empty
- ④ Keep a good natural ventilation around the charger module.
- ⑤ Keep a good ventilation around the fan cooling modules
- ⑥ Connect according to the indication “current share +”, “current share -” to achieve the automatic current share.
- ⑦ Wire terminal A and terminal B separately and connect with the host monitor (such as THJK002G-3 monitor) through terminal A & terminal B of RS485 A, which achieve communication between the module and monitor

For installation, there are brackets for option, installation drawing is in the appendix

3.4 Operation Introduction

Take HA230D10Z as the example

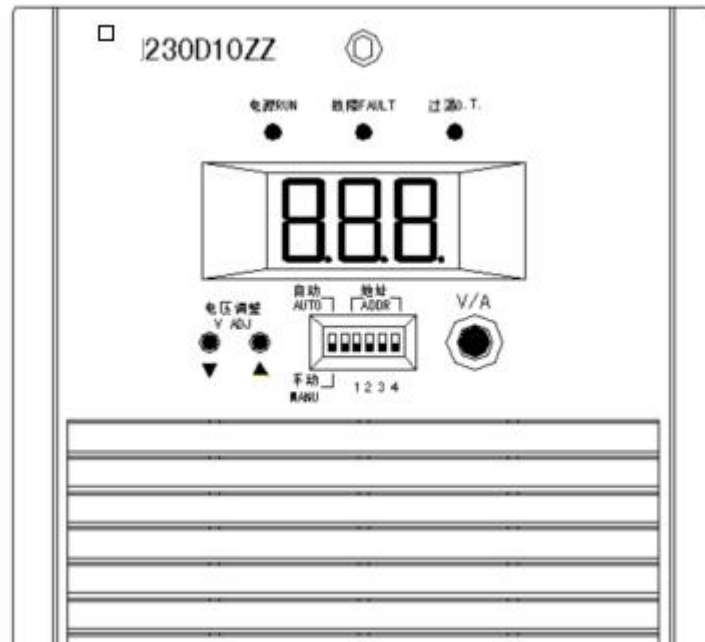
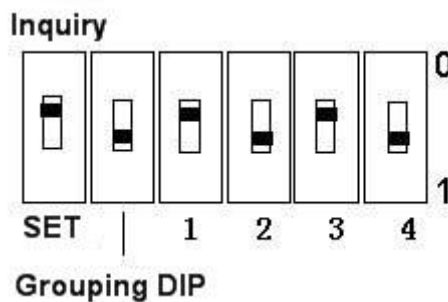


Figure 4-1 Front panel of charging module

3.4.1 DIP OPERATION INSTRUCTION

Two options: **Information Inquiry** and **Parameter Set**, choose via the “Auto”&”Manual” DIP Switch. It is “Information Inquiry” when the DIP on top side and is “Parameter Set” when at the bottom side.



1. Information Inquiry:

The DIP switch (the most left DIP) is on the top side. The following functions available:

- i , Indicate the voltage, current and fault information
- ii , Define the charger address via the grouping DIP and address DIP
- LCD screen

Indicate the voltage, current, alarms of the charger. Switch over by the button **V/A**

Table 1 Fault code and identification

Code	E01	E02	E04	E05	E06	E20
Identification	Under voltage	Over voltage	Over voltage/current protection	Over temperature	Input fault	Setting over range

- Grouping DIP switch

The second code button from left is grouping DIP switch (broadcast address identification code) and used for identifying packets groups (Broadcasting Data packet.)

If TonHe protocol: if switch to the top side, the charger is in packet group 1, the data packets addressed 253 and 255 are broadcast data packet. If switch to the bottom, the charger is in packet group 2, and the data packets addressed 254 and 255 are broadcast data packet.

If MODBUS protocol: switch to the top side, the charger is in packet group 1, the data packet addressed 255 is broadcast data packet. If switch to the bottom, the charger is in packet group 2 and the data packet addressed 254 is broadcast data packet.

- Address set DIP

The right 4 communication addresses set DIP and the broadcast address identification code are composed of communication address set DIP switch, which is used for setting the communication address of the module. The address is binary number, and means 0 if the DIP is on the top and means 1 if at the bottom. The rightmost code among is the lowest digit and the leftmost code is the highest digit. The address DIP of power supply module are 5 digits, so the set range of communication address is 0~31. That is to say, maximally 32 modules could be connected to one serial port of the host controller. The address is the only sign the controller could identify each module and the address of each module must be different in one system. For one module, the communication address setting must be same as the address setting of the host controller module. Otherwise abnormal communication occurs. The address in controller is decimal digit and the relation table is as follows.

Table 2 relation between binary and decimal digit

二进制	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111
十进制	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
二进制	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110	11111
十进制	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

For example: the DIP set above highlighted in black is binary digit 10101, corresponding decimal address is 21. This charger is in Group 2.

2. Parameter set

Come to parameter setting when switch the left most DIP to the bottom (read 1). Use the Grouping DIP and right 4 address bits to make different set. The DIP switch and identifications are as follows.

Table 3 DIP identification (220V/110V)

拨码	Grouping DIP	1	2	3	4	Function	Setting range	Default
	0	0	0	0	0	Working mode	0-IND., 1-MANU, 2-AUTO	2
	0	0	0	0	1	Communication protocol	0-Modbus, 1-TonHe	1
	0	0	0	1	0	Over voltage alarm set	220V Under voltage threshold -300V 110V Under voltage threshold-150V	260V 130V
	0	0	0	1	1	Under voltage alarm set	220V 190V-over voltage threshold 110V 95V-over voltage threshold	190V 95V
	0	0	1	0	0	Charging state set	0-float charge, 1-boost charge	0
	0	0	1	0	1	Float charge voltage	220V 190V-300V 110V 95V-150V	242V 121V
	0	0	1	1	0	Boost charge voltage set	220V 176V-300V 110V 88V-150V	253V 126V
	0	0	1	1	1	Charging current limit set	10%-105% rated current	105%
	0	1	0	0	0	Current threshold from float to boost charge	Current threshold from boost to float charge-105%	80%
	0	1	0	0	1	Current threshold from boost to float charge	0.5-current threshold from float to boost	20%
	0	1	0	1	0	Tail current charging time	0-10 hours	3
	0	1	0	1	1	Max boost charge time	0-99 hours	10
	0	1	1	0	0	Boost charge cycle	0-999 days	180
	0	1	1	0	1	Fault output node set	0-normally open 1-normally close	0

NOTE: you need to power on the charger again if you change the communication protocol on line

When the DIP setting is over the range in the table above, will indicate E20.

If -3G and -5 series products, the low end of voltage range is 176V/88V, the under voltage alarm default is 176V/88V. The current set range is 10-110% and the highest current from float to boost charge is 110% rated output current.

The setting operation instruction:

- 1) Switch the DIP to "MANU" i.e. "1" position, otherwise cannot enter the setting

interface;

- 2) Follow the tables above to enter setting interface required;
- 3) Push the button “V/A” once, then the leftmost letter flashes. Now you can adjust the data;
- 4) Use the “V ADJ” button “▼,▲” to adjust the value. Push “▼” once, the value decrease a unit. Push “▲”, increase a unit.
- 5) Then push “V/A” button again to make sure the leftmost letter stop flash. Then the set finishes and setting is saved successfully.

The working mode of the charger is optional. Three modes optional, Independent, Automatic, Manual and two communication protocol optional, TH and MODBUS. The RS485 interface available between charger and controller/ charger and charger:

- Independent “IND.”: the charger will work independently when set working mode “0”. The DIP switch position “00000”. Then the communication protocol “00001”-“1” (“TH” protocol) will be advised. Under this working mode, the charger cannot communicate with the upper controller, but the automatic float and boost charge is available. The charger can manage the charging process automatically. The same time, it is capable to send charging voltage and current command to control other chargers if several chargers work in parallel.

This mode is suitable for the conditions without upper controller and several chargers work in parallel. One charger will be “IND.” mode as master module to send command to other chargers. The other chargers will be set “AUTO” mode and “TH” protocol.

- Manual “MANU”: set working mode “00000”-“1”, the charger will be Manual mode. Communication protocol is “TonHe” when the DIP setting “00001”-“1”, is “MODBUS” when set “00001”-“0”. The user can set accordingly to the upper controller. Under this working mode, the charger can communicate with the controller and send data back to the controller. Automatic float and boost charge function is available but the charger can not send command to other chargers.

This mode is suitable for that the additional controller does not have automatic float and boost charge function but the controller need to know the working status of chargers. Normally for system one charger and one battery bank.

- Automatic “AUTO”: corresponding DIP set is “00000”-“2”. Communication protocol is “TonHe” when the DIP setting “00001”-“1”, is “MODBUS” when set “00001”-“0”. If choose “AUTO” mode, the setting indication in the tables above is null. The charger will work following the setting of the controller. In this mode, the controller is able to realize “four remotes”, remote signaling, remote measure, remote control and remote regulating. The charging voltage and current are controlled by the upper controller.

This mode is suitable for that the upper controller is of automatic float and boost charge management function and can control the chargers remotely.

Charger set		Communication protocol of upper controller		Automatic float and boost charge function	Remarks
Working mode	Protocol	TonHe	Modbus		
IND.	TonHe			YES	If choose Modbus protocol, the master charger cannot control the charging current of other slave chargers. So advise "TonHe"
	Modbus				
MANU	TonHe	YES			Remote signaling and measure available Remote control and regulating unavailable
	Modbus		YES		
AUTO	TonHe	YES			Remote signaling, remote measure, remote control, remote regulating
	Modbus		YES		

NOTE: When the charger work in "AUTO" mode, the output voltage will come to 234V/117V/48V/24V, the current limit threshold will be the max 105% rated current. Pay attention to the RS485 A&B correspondingly when wiring.

3.4.6 Fault Display

Alarm information are displayed in the table of fault code in the LED. Then LED displays the fault code. The voltage will be shown by pushing the switching button. Fault code as shown in Table 4-3.

Table 4-3

fault code	E01	E02	E03	E04	E05	E06
Definition	Output Under voltage	Output over voltage	Output Overflow protection	Output over voltage protection	Overheat protection	Ac input Abnormal

3.4.7 Communication Function

The module can communicate with PC mode in RS485 interface. It can send the output voltage and current, the module protection and alarm information to a host computer, accepting and implementing the control orders issued by the host computer.

Note : When the charging module is in automatic mode, if there is not any communication in 4 minutes . The output voltage will be adjusted to 234V automatically. Current limiting points will be open all to 105% of rated current value