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BACM2420A
BATTERY CHARGER
USER MANUAL

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Table 1 Software Version

Date	Version	Note
2021-03-29	1.0	Original Release
2022-04-22	1.1	Modify the parameter of wiring connections.
2025-03-28	1.2	Add requirements for parallel current sharing, derating curve and auxiliary output port.

CONTENT

1 OVERVIEW

BACM2420A battery charger is an intelligent and multi-function charger, which is specially designed to meet the charging characteristics of the lead-acid engine starter batteries. It is suitable for 24V or 12V battery pack and the maximum output current is 20A.

2 PERFORMANCE AND CHARACTERISTICS

It has the following characteristics:
  a) Switch power supply structure, wide AC voltage input range, small size, light weight, high efficiency;
  b) Users can select automatic two-stage charging process or automatic three-stage charging process according to needs. Both two charging processes are carried out according to storage battery charging characteristics, which can prevent overcharging and significantly prolong battery lifetime;
  c) Built-in PFC circuit, which allows to calibrate the power factor up to 0.99;
  d) Battery voltage detection ports, which can detect the battery voltage at real time.
  e) Battery under voltage output port; it will output low level immediately after the battery voltage has fallen below the set value after preset delay.
  f) Temperature sensor port, which allows monitoring the battery temperature at real time; and temperature compensation function, which can prevent too high battery temperature effectively;
  g) Mains failure alarm port; It will output low level when the AC input is interrupted;
  h) Standard RS485 serial communication port.
  i) Default suitable for 24V battery pack; it can be changed to 12V battery pack by changing configuration information; rated charging current is 20A;
  j) External LED status display: Full charged indication (Green light) and charging indication (Red light).
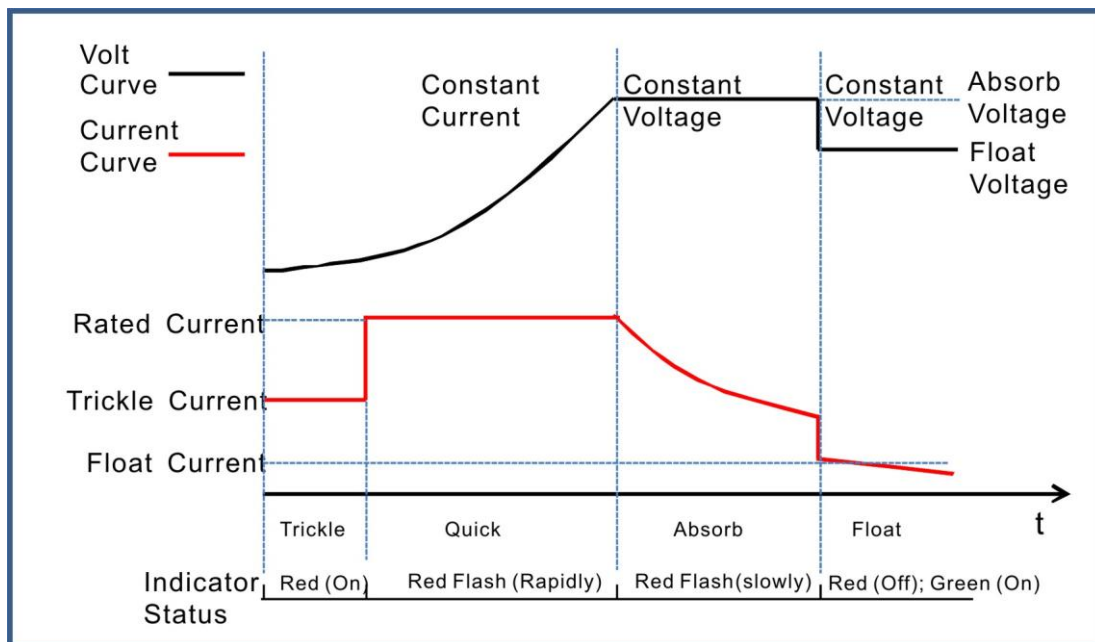
3 CHARGING PRINCIPLE

Fig. 1 Three-stage Charging Curve

Three-stage charging method is used according to the battery charging characteristics.

1) The first stage is named "constant current". a): Trickle Charge: when the battery terminal voltage is relatively low, the charging current is low likewise, which effectively prevents battery damage from too high temperature. The charging indicator (Red color) status is illuminated.   b): Quick Charge: When the battery terminal voltage is relatively high, the charging current will rise to rated value. Large current charging operation leads to a rapid increase in the electrical quantity of the battery. The charging indicator (Red color) status is flashing rapidly (0.2s/per).

2) The second stage is named "absorption charge". After the first stage, the battery voltage rises to absorption charge value rapidly, and the charger voltage will keep constant. The battery terminal voltage will stabilize in the absorption charge value with the decreasing of charging current. The charging indicator (Red color) status is flashing slowly (1s/per).

3) The third stage is named "float charge": After the above two stages, the charging is basically completed and charger output voltage changes to float voltage automatically. Charging current decreases to floating charging current. Red charging indication is extinguished. Green full charging indication is illuminated. Afterwards charging current neutralizes self-discharge of the battery. Even long-term charging doesn't do harm to the battery. That is, charger not only can keep the battery fully charged but also guarantee long lifetime of the battery.
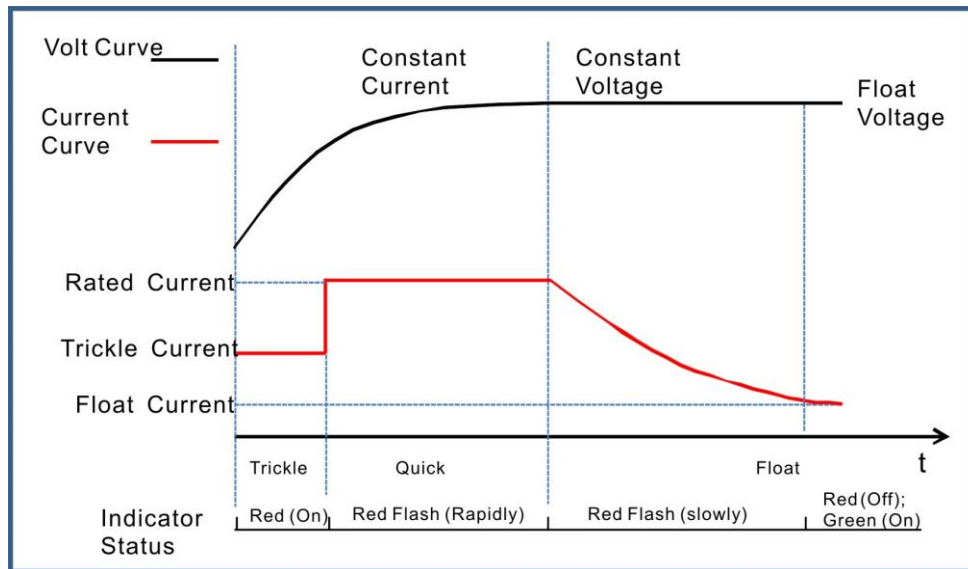
Fig. 2 Two-stage Charging Curve

Two-stage charging method is performed according to the battery charging characteristics.

1) The first stage is named "constant current". a): Trickle Charge: when the battery terminal voltage is relatively low, the charging current is low likewise, which can prevent battery damage from too high temperature. The charging indicator (Red color) status is illuminated. b): Quick Charge: When the battery terminal voltage is relatively high, the charging current will rise to rated value. Large current charging operation leads to a rapid increase in the electrical quantity of the battery. The charging indicator (Red color) status is flashing rapidly (0.2s/per).

2) The second stage is named "float charge". The charging current will decrease with the rising of battery electricity. The charging indicator (Red color) status is flashing slowly (1s/per). As soon as charging current value falls below 0.3A, the battery is basically fully charged (Red indicator will extinguish and the green indicator will be illuminated). After that charging current will only neutralize the battery self-discharge. Even long-term charging cannot harm the battery, as charger can keep the battery fully charged and also guarantee long lifetime of the battery.

Table 2 Charging Indicator Status

Mode	Indicator	Charging Status				
		Constant Current		Constant Voltage	Float Charge	Charge Failure
		Trickle Charge	Quick Charge			
Two Stage	Red	On	Flash(Rapidly)	None	Flash(Slowly)→Off	Flash(Rapidly)
	Green	Off	Off	None	Off→On	Flash(Rapidly)
Three Stage	Red	On	Flash(Rapidly)	Flash(Slowly)	Off	Flash(Rapidly)
	Green	Off	Off	Off	On	Flash(Rapidly)

4 PARAMETERS CONFIGURATION

Table 3 Parameter Configuration List

Items	Default		Adjustable Range		Description
	24V	12V	24V	12V	
Battery Type	1		(0~2)		0:12V；1:24V；2:Self-adaption
Charging Stage	3		(2~3)		2: Two Stage; 3: Three Stage
Max. Rated Current	20.0A		Nonadjustable		Maximum charging current
Rated Current	100%		(0~100)%		Maximum charging current percentage
Absorption Charge Voltage	28.2V	14.1V	(20~32)V	(10~16)V	The charging voltage of "Constant Voltage"
Absorption Charge Time	1		(0~1)		0: Disable; 1: Enable
Absorption Charge Time Setting	1.0h		(0.1~100)h		The charging time of "Constant Voltage"
Absorption Charge Complete Current	1		(0~1)		0: Disable; 1: Enable
Complete Current Setting	0.5A		(0.20~3.00)A		The transition current from "Absorption Charge" transfer to "Float Charge".
Float Charge Voltage	27.0V	13.5V	(20~32)V	(10~16)V	The voltage of "Float Charge"
AUTO BOOST Voltage	25.6V	12.8V	(20~32)V	(10~16)V	When the charger is in "Float Mode", it enters into "Quick Charge" if the battery voltage has fallen below the set value.
AUTO BOOST Voltage Delay	20s		(0~3600)s		When the battery voltage drops to the BOOST voltage and after this time delay, it automatically switches to fast charging mode.
Trickle Charge	1		(0~1)		0: Disable; 1: Enable
Trickle Charge Voltage	22.0V	11.0V	(20~32)V	(10~16)V	The voltage of "Trickle Charge"
Trickle Charge Current	50%		(0~100)%		Maximum charging current percentage
Battery Detection	0		(0~1)		0: Disable; 1: Enable
Battery Under Voltage Warn	1		(0~1)		0: Disable; 1: Enable
Under Voltage Set Value	23.0V	11.50V	(16.0~32.0)V	(8.0~16.0)V	"Under voltage" alarm will be initiated if the battery voltage has fallen below the set value.
Under Voltage Delay	120s		(0~3600)s		"Under voltage" alarm will be initiated if the battery voltage has fallen below the set value and the delay timer has expired.
Under Voltage Return Value	24.0V	12.0V	(16.0~32.0)V	(8.0~16.0)V	The transition voltage from "under voltage" transfer to

Items	Default		Adjustable Range		Description
	24V	12V	24V	12V	
					"normal voltage".
Under Voltage Return Delay	10s		(0~3600)s		"Under voltage" alarm will be removed if the battery voltage has exceeded the return value and the delay timer has expired.
Battery Over Voltage Warn	1		(0~1)		0: Disable; 1: Enable
Over Voltage Set Value	30.0V	15.0V	(16.0~32.0)V	(8.0~16.0)V	An overvoltage alarm will be triggered if the battery voltage exceeds this value.
Over Voltage Delay	120s		(0~3600)s		An overvoltage alarm is triggered when the battery voltage reaches the threshold and the time delay expires.
Over Voltage Return Value	27.6V	13.8V	(16.0~32.0)V	(8.0~16.0)V	The voltage threshold at which the battery transitions from over voltage alarm state back to normal operating voltage.
Over Voltage Return Delay	10s		(0~3600)s		The overvoltage alarm automatically deactivates when the battery voltage reaches the release threshold and the preset time delay completes.
Over Voltage Control Enable	0		(0~1)		0: Disable; 1: Enable
Temperature Sensor	1		(0~1)		0: Disable; 1: Enable
Temperature Compensation	1		(0~1)		0: Disable; 1: Enable
Temperature Compensation Set Value	0.036 V/℃	0.018 V/℃	(0.020~0.060) V/℃	(0.010~0.030) V/℃	The Compensation of each 1℃ change on 20℃ basis.
High Temp. Warn	1		(0~1)		0: Disable; 1: Enable
High Temp. Set Value	55℃		(0~80)℃		"High Temp." alarm will be initiated if the battery temperature has exceeded the set value.
High Temp. Delay	0.5s		(0~60.0)s		"High Temp." alarm will be initiated if the battery temperature has exceeded the set value and the delay timer has expired.
High Temp. Return Value	50℃		(0~80)℃		The transition temperature from "High Temp." transfer to "Normal Temp.".
High Temp. Return Delay	1s		(0~60.0)s		"High Temp." alarm will be removed if the battery

Items	Default		Adjustable Range		Description
	24V	12V	24V	12V	
					temperature has fallen below the return value and the delay timer has expired.
Aux. Input Port	3		(0~4)		0. Not Used; 1. Shutdown：The battery charger enters into Standby Status if the input is active. 2. Enable Battery Detection; The battery charger enters into Standby Status if the input is active but there is not battery voltage signal. 3. Manual BOOST: The battery charger enters into BOOST if the input is active. 4. 12V system: if input is active, charger will be in 12V system.
Aux. Input Port Delay	2.0s		(0~60.0)s		The corresponding action will be active if the input is active.
Aux. Output Port	1		(0~7)		0: Not Used; 1: Under voltage: Active; 2: Over voltage: Active; 3: Charging Failure; Active; 4: Under/over voltage: Active; 5: Under voltage or charging failure; Active; 6: Over voltage or charging failure: Active; 7: Under/over voltage or charging failure: Active At least one configured condition in modes 4~7 is satisfied (if applicable)
Communication Address	10		1~254		RS485 Communication Address
Baud Rate	0		(0~2)		0: 9600bps; 1: 19200bps; 2: 38400bps

5 PARAMETERS SPECIFICATION

Table 4 Product Parameters

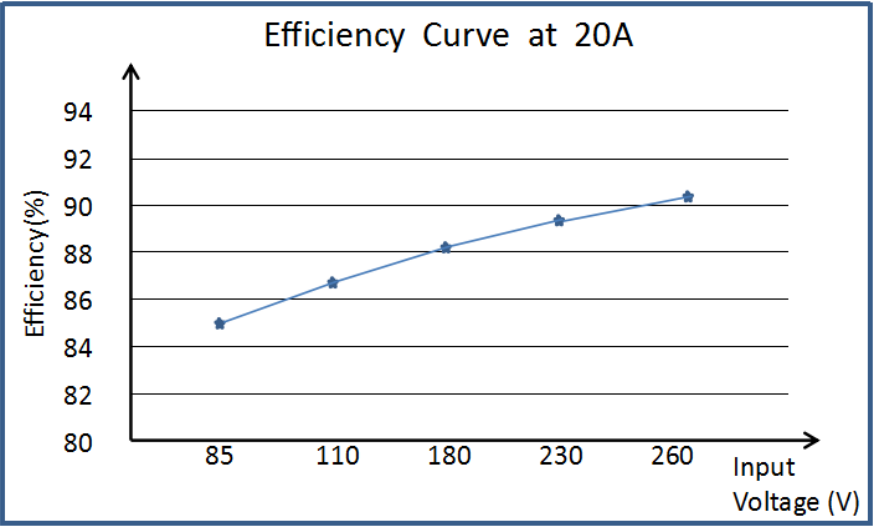| Items	Contents	Parameters			
		24V		12V	
Input Characteristics	Nominal AC Voltage Range	AC (100~277)V			
	Max. AC Voltage Range	AC (90~305)V			
	AC Frequency	50Hz/60Hz			
	Max. Active Power	736W		373W	
	Max. Current	8.2A		4.2A	
	Max. Efficiency	90%		85%	
	Power Factor Calibration	AC 110V	AC 220V	AC 110V	AC 220V
		>0.99	>0.97	>0.99	>0.97
Output Characteristics	No-load Output Voltage	32V，Error±1%		16V, Error±1%	
	Rated Charging Current	20A，Error±2%			
	Max. Output Power	640W		320W	
Insulating Property	Insulation Resistance	Between input and output, input and shell all are DC1000V1min, insulation resistance $R_L \geqq 50M\Omega$			
	Insulation Voltage	Between input and output, input and shell all are: AC3000V 50Hz 1min, leakage current: $I_L \leqq 3mA$ Between output and shell is: AC500V 50Hz 1min leakage current: $I_L \leqq 3mA$			
Working Condition	Working Temperature	(-30~+55)°C			
	Storage Temperature	(-40~+85)°C			
	Working Humidity	20%RH~93%RH(No condensation)			
Shape Structure	Weight	2.2kg			
	Dimension	265mm×156mm×68mm (length*width*height)			

Fig. 3 Efficiency Curve
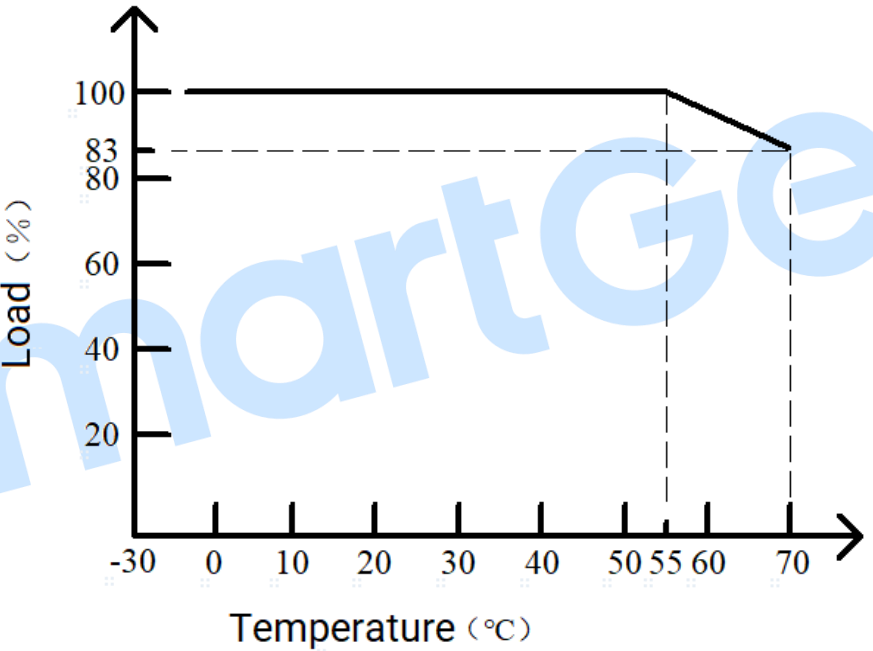
Fig. 4 Derating Curve

6 OPERATION

Fig. 5 BACM2420A Mask

Table 5 Wiring Connections

Terminal	Function	Description
L	AC Input Terminals	Connect terminals L and N to AC (100~277)V; Bigger than BVR 2.0mm^2 multi-strand copper line is recommended.
N		
PE	GND Terminals	Connect to shell internally.
A(+)	RS485 Communication Port	Standard RS485 serial communication interface
B(-)		
MF	Mains Failure Output Port	It will output low level immediately when the AC input is interrupted.
IN	Auxiliary input port	Low level is active.
BV	Battery Voltage Port	Connect to battery positive.
COM	Common Port	COM port of BV and temperature acquisition terminal. Connect to battery negative.
BT	Temperature Sensor Port	Connect to PT1000 sensor
BLV	Auxiliary output port	Under/Over voltage and charging failure conditions can be enabled. By default, under voltage detection is enabled with active-low logic.
B-	Battery Negative	Connect to battery negative; Bigger than BVR 4mm^2 multi-strand copper line is recommended.
B+	Battery Positive	Connect to battery positive; Bigger than BVR 4mm^2 multi-strand copper line is recommended.
FULL CHARGED	Green LED Indicator	Full charged indicator.
CHARGING	Red LED Indicator	Charging status indicator.

⚠ **NOTE**:

1) Because there is diode and current-limiting circuit inner the charger, it can be used together with charging generator, and there is no need to disconnect the charger when cranking.

2) During genset is running, high current will cause voltage drop in charging line, so recommend separately connecting to battery terminal to avoid disturbance on sampling precision.

7 PARALLE CURRENT SHARING

1. The wiring method for parallel operation is shown as below.
2. The output voltage difference between each charger should be less than 0.2V (calibration is realized via host computer).
3. The max. total output current is the total rated current, which equals to the sum of the rated currents of all individual chargers.
4. The output terminals of chargers should be connected to the DC busbar, using the cables of same length. Please refer to the table below for cable specifications.

Table 6 Cable Requirements

	Parallel Cable Length＜3m	3m≤Parallel Cable Length＜4.5m
Specifications	BVR 4mm² Multi-strand Copper Wire	BVR6mm² Multi-strand Copper Wire

5. During parallel operation under light-load conditions, current sharing imbalance may occur due to voltage and cable diameter differences. This is normal and will not affect charging function.
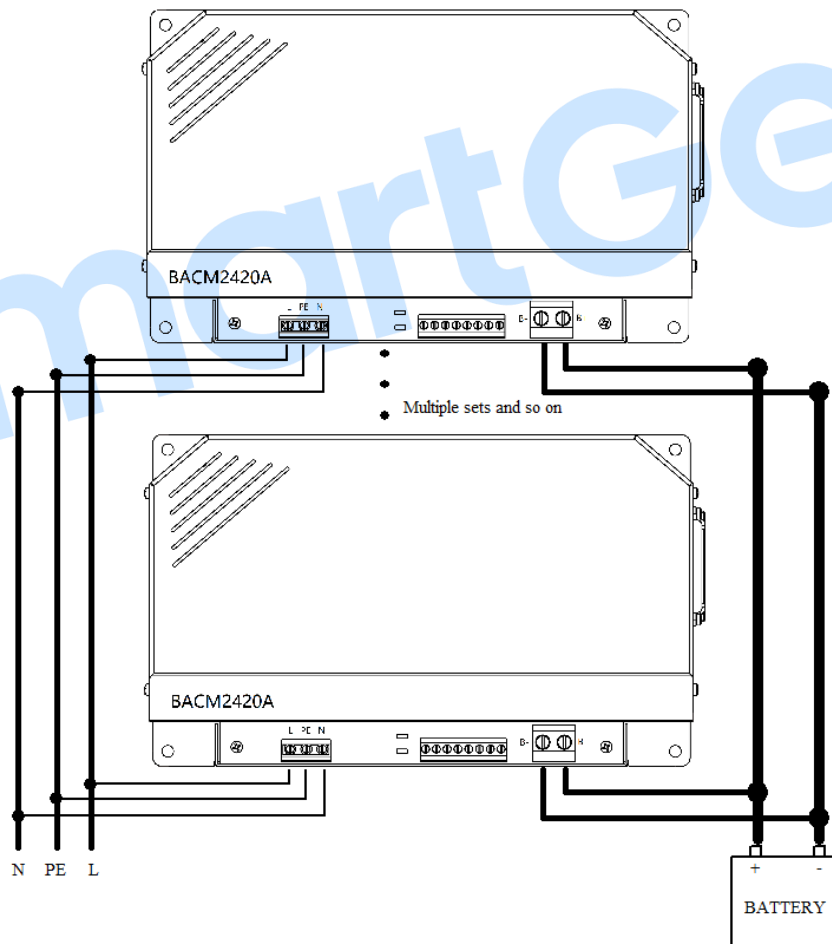

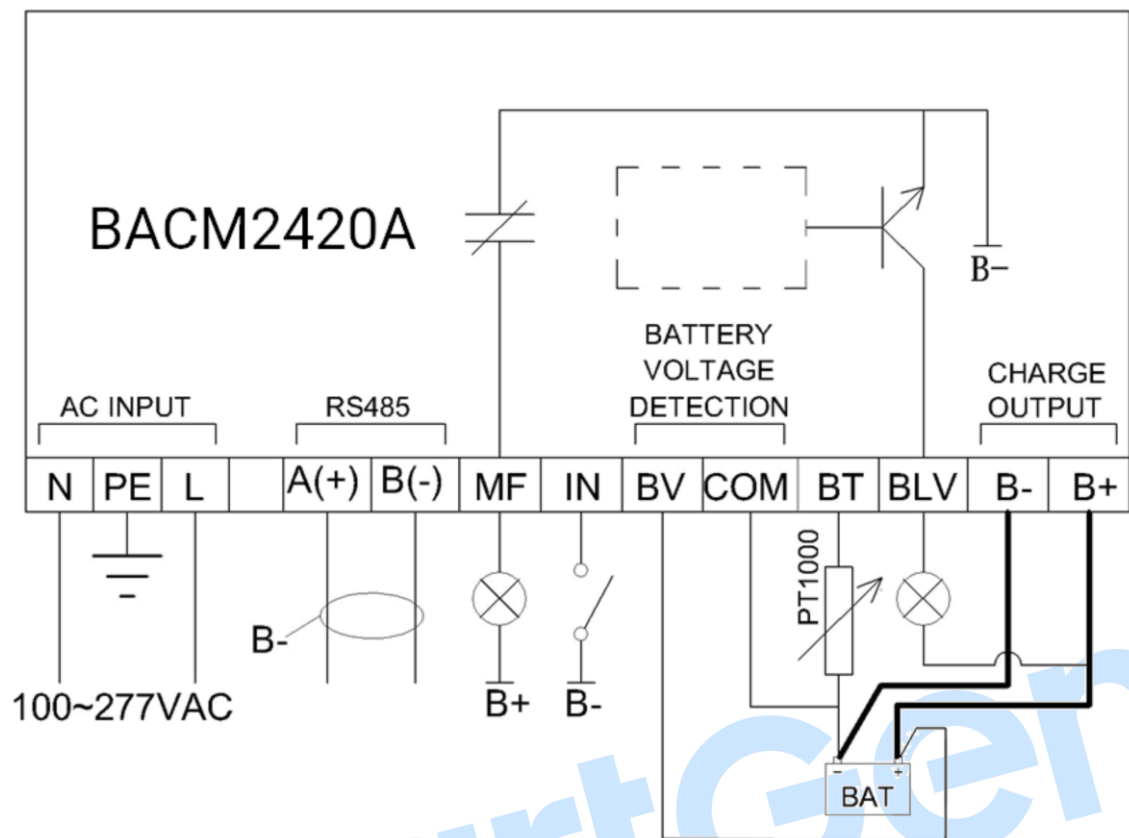**Fig. 6 Parallel Connection Wiring Diagram**
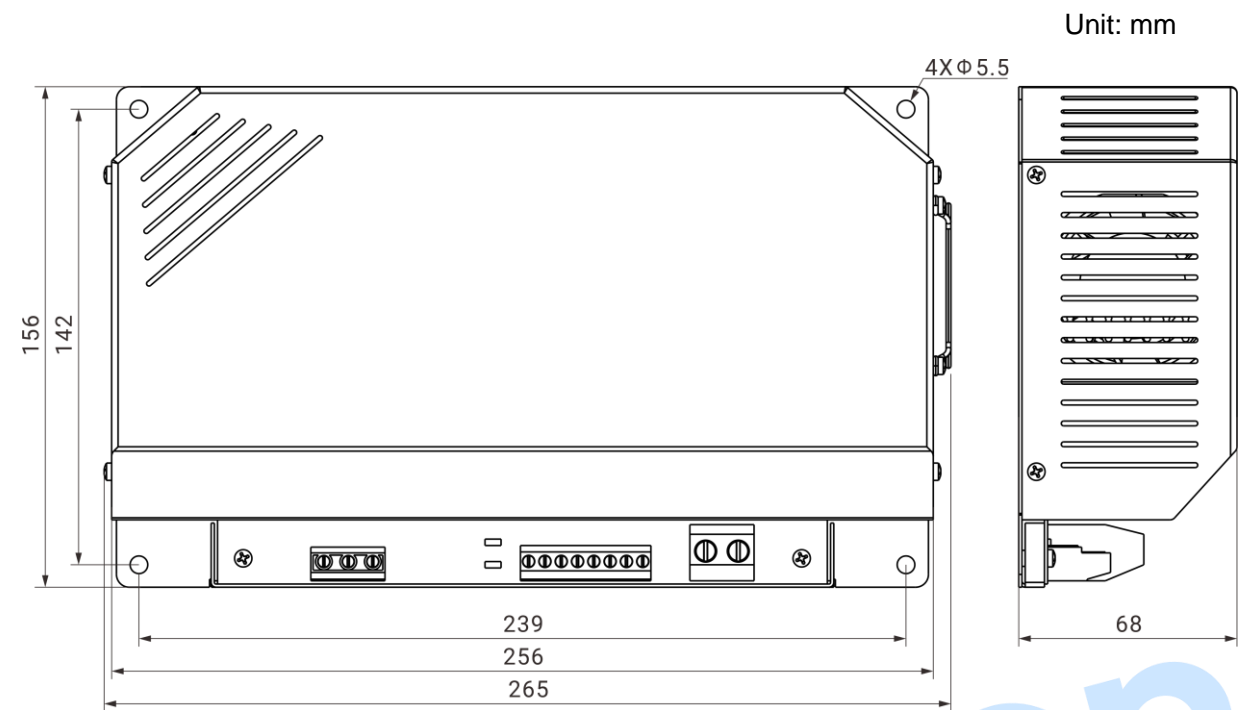
8 CONNECTION

Fig. 7 Wiring Diagram

9 CASE DIMENSIONS

Unit: mm

Fig. 8 BACM2420A Installation Size