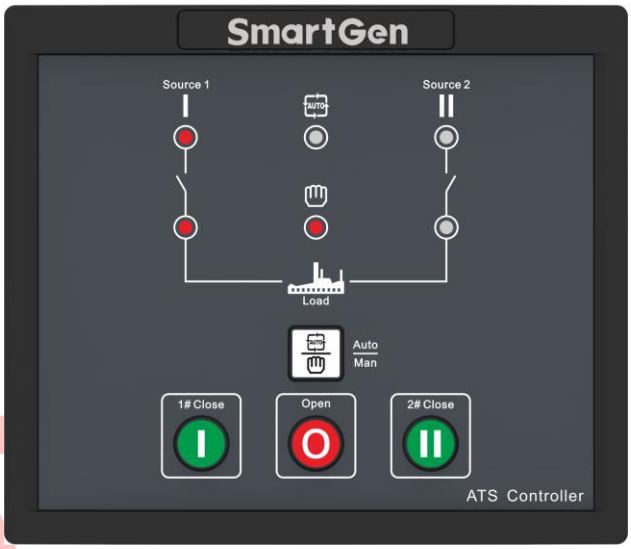
HAT530P/HAT530PC SERIES
ATS CONTROLLER
USER MANUAL



SMARTGEN (ZHENGZHOU) TECHNOLOGY CO., LTD.

Chinese trademark

SmartGen English trademark

SmartGen — make your generator ***smart***

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Table 1 - Software Version

Date	Version	Note
2021-02-07	1.0	Original release.

CONTENT

1 OVERVIEW

HAT530P/HAT530PC series dual power ATS controller consists of microprocessor as the core, can precisely detect voltage (2-way 3-phase/single phase), make accurate judgement on abnormal voltage (power lost, over/under voltage, over/under frequency, loss of phase, reverse phase sequence) and control ATS to transfer after the delay has expired. The controller is applicable for two-stage ATS and three-stage ATS with controlling the start of genset. “Four remotes” (remote control, remote measurement, remote communication and remote adjustment) functions can be realized via RS485 communication port.

2 PERFORMANCE AND CHARACTERISTICS

Its performance and characteristics are shown as below:

— Measure and display 2-way 3-phase voltage and frequency:

1#	2#
Line voltage (Uab, Ubc, Uca)	Line voltage (Uab, Ubc, Uca)
Phase voltage (Ua, Ub, Uc)	Phase voltage (Ua, Ub, Uc)
Frequency Hz	Frequency Hz

— Over/under voltage, loss of phase, reverse phase sequence, over/under frequency detection functions. As default, reverse phase sequence detection and over/under frequency detection are disabled; however, users can set the function as you need;
— Parameters can be set via PC software using SG72 module (USB to RS485);
— The voltage normal delay of S1 or S2 can be set in (0~60) seconds and the Genset start delay can be set in (0~3600) seconds;
— The voltage abnormal delay of S1or S2 can be set in (0~60) seconds and the Genset stop delay can be set in (0~3600) seconds;
— “S1 Master”, “S2 Master”, “Each Backup” and “Auto/Manual” can be set via controller front panel to realize power supply of S1 Master, S2 Master or Backup method for each other;
— Closing output signal can be set as pulse or as continuous output;
— 2-way N wire isolated design;
— Auto/Manual mode. In manual mode, ATS transfer can be implemented via panel pushbutton;
— LEDs mounted on front panel can clearly show ATS running status;
— Forced Open input port is designed; When the input port is active, the switch will be Center Position forcedly (only works for the ATS with Center Position);
— Provide power supply for ATS with LO and NO output functions;
— S1 and S2 power supply transfer relay (S1 CLOSE, S2 CLOSE, OPEN), the output contact capacity of close relay is 16A AC250V and of open relay is 10A AC250V, both of them are volts free contact and can be directly used in driving switch to transfer;
— The output contact capacity of Genset start relay (GENS START) is 7A AC250V/DC28V, volts free N/C contact;
— Suitable for various AC systems (3-phase 4-wire, single phase 2-wire, 2-phase 3-wire and 3-phase 3-wire). The 3-phase 3-wire needs special wiring and is only applicable for the line voltage of 220V system;
— Modular design, flame retardant ABS plastic shell, pluggable terminal, built-in mounting，compact structure with easy installation.

3 SPECIFICATION

Table 2 – Product Specification

Items	Contents
Operating Voltage	AC supply L1N1/L2N2, voltage range AC (170~277)V.
Power Consumption	<3W (Standby mode: <1W)
AC Voltage Input 3P4W 1P2W 2P3W 3P3W	 AC170V~AC277V(ph-N) AC170V~AC277V (ph-N) AC170V~AC277V(ph-N) AC170V~AC277V(ph-ph) (Refer to 3P3W wiring diagram)
Rated Frequency	50/60Hz
S1 Close Relay Output	16A AC250V Volts free output
S2 Close Relay Output	10A AC250V Volts free output
Open Relay Output	10A AC250V Volts free output
LO Relay Output	16A AC250V Volts free output
NO Relay Output	16A AC250V Volts free output
Gen Start Relay	7A AC250V Volts free output
Communication	RS485 interface, MODBUS Protocol
Case Dimensions	139mmx120mmx50mm
Panel Cutout	130mmx111mm
Working Conditions	Temperature: (-25~+70)°C; Relative humidity: (20~93)%RH
Storage Condition	Temperature: (-30~+80)°C
Protection Level	IP65: when waterproof gasket is installed between controller and control screen.
Insulation Strength	Apply AC1.5kV voltage between high voltage terminal and low voltage terminal and the leakage current is not more than 3mA within 1min.
Weight	0.62kg

4 PANEL INSTRUCTION

4.1 OPERATION PANEL

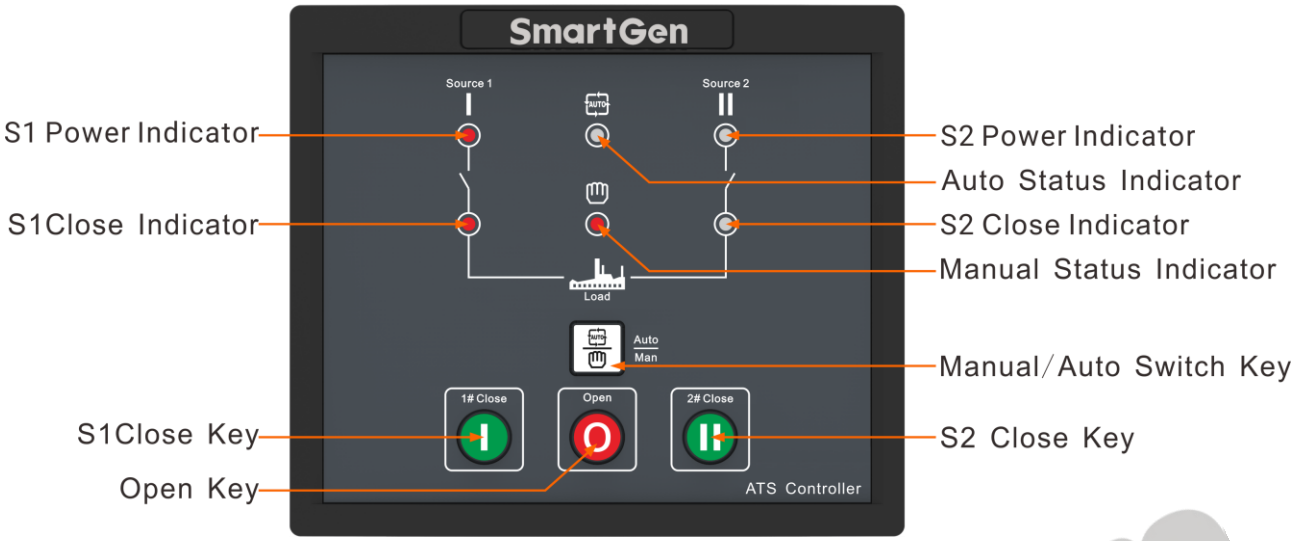

Fig.1 – Panel Drawing

4.2 INDICATORS DESCRIPTION

Table 3 – Indicator Function Description in Normal Testing Mode

Items	Description
S1 Power Indicator	It is illuminated when S1 power is normal; flashing when S1 power state is abnormal; extinguished when there is no S1 power.
S2 Power Indicator	It is illuminated when S2 power is normal; flashing when S2 power state is abnormal; extinguished when there is no S2 power.
S1 Close Indicator	It is illuminated when S1 power auxiliary contactor is active while extinguished when it is deactivated.
S2 Close Indicator	It is illuminated when S2 power auxiliary contact is active while extinguished when it is deactivated.
Auto Status Indicator	It is illuminated when the controller is in auto mode while extinguished the controller is in manual mode.
Manual Status Indicator	It is illuminated when the controller is in manual mode while extinguished the controller is in auto mode.

NOTE: More details of indicators, please refer to the following description of “Panel Button Operation”.

5 PARAMETER SETTING OF PANEL OPERATION

5.1 PANEL OPERATION SETTING

Pressing and holding the button for more than 3s, all LEDs are illuminated to enter into lamp test mode; Pressing and holding the button for more than 7s, all LEDs are flashing (500ms per time) to enter into parameter setting status, and release button; If you are not trying to set parameters, press button and all LEDs flash quickly for 5 times (once per 200ms) and return to normal test mode. At lamp test state, release button, and controller will return to normal test mode. After entering parameter setting mode, if parameters are not set, controller will automatically return back to normal test mode after about 1 minute and 30 seconds.

5.2 MASTER SETTING

Firstly, make controller enter parameter setting status and then conduct the setting.

Procedures of setting "S1 Master", "S2 Master" and "Each Backup":

a) Press , and at the same time, when S1/S2 power indicator and Auto indicator are illuminated; release the three buttons, then the auto indicator and S2 power indicators extinguish, S1power indicator illuminates, which means controller master status can be set.

b) Pressing can circularly set 3 conditions of power supply:

- **S1 Master:** S1 power indicator illuminates and S2 power indicator extinguishes;
- **S2 Master:** S2 power indicator illuminates and S1 power indicator extinguishes;
- **Each Backup:** S1 power and S2 power indicators are illuminated at the same time.

c) After adjusting, press , when S1 power indicator, Auto indicator and S2 power indicator are illuminated, the adjusted power master has been saved. The controller will go back to normal status automatically after all LEDs are flashing 5 times rapidly and controller will work as the master status.

Once the controller is power on, its master status can be judged by the following three conditions.

— If S1 power supply indicator flashes rapidly for three times, indicating S1 power supply for master.

— If S2 power supply indicator flashes rapidly for three times, indicating S2 power supply for master.

— If S1 and S2 power supply indicators flash simultaneously for three times, indicating it is Each Backup.

5.3 AC SYSTEM SETTING

Firstly, make controller enter parameter setting status and then conduct the setting.

Procedures of setting "Single-phase 2-wire", "3-phase 4-wire", "2-phase 3-wire" and "3-phase 3-wire":

a) Press , and at the same time, when S1/S2 power indicator and auto indicator are illuminated; release the three buttons, then the auto indicator and S2 power indicators extinguish, S1 power indicator illuminates.

b) Press , when S1/S2 power indicator and auto indicator are illuminated; release the button, then the auto indicator and S1/S2 power indicators are extinguished simultaneously, which means controller AC system can be set.

c) Pressing can circularly set four AC systems.

- **Single phase 2-wire:** S1 close indicator illuminates;
- **3-phase 4-wire:** S1 close indicator, S2 close indicator and manual mode indicator illuminate simultaneously;
- **2-phase 3-wire:** S1 close indicator and manual mode indicator illuminate simultaneously;
- **3-phase 3-wire:** S2 close indicator and manual mode indicator illuminate simultaneously.

d) After adjusting, press , when S1 power indicator, auto indicator and S2 power indicator are illuminating, the adjusted AC system has been saved. The controller will go back to normal status automatically after all LEDs are flashing 5 times rapidly and controller will work according to the set AC system.

Once the controller is power on, its AC system can be judged by the following four conditions.

— If S1 close indicator illuminates, it means **Single-phase 2-wire** system is selected.
— If S1 close indicator, manual mode indicator and S2 close indicator illuminate simultaneously, it means **3-phase 4-wire** system is selected.
— If S1 close indicator and manual mode indicator illuminate simultaneously, it means **2-phase 3-wire** system is selected.
— If S2 close indicator and manual mode indicator illuminate simultaneously, it means **3-phase 3-wire** system is selected.

5.4 DELAY ADJUSTMENT

Adjusting "S1 power normal delay" potentiometer (located nearby the back panel terminal) can set output delay after S1power supply is normal.

Adjusting "S2 power normal delay" potentiometer (located nearby the back panel terminal) can set output delay after S2 power supply is normal.

Firstly, make controller enter parameter setting status, and then conduct the setting.

Setting Procedures of "S1 power abnormal delay" and "S2 power abnormal delay":

a) Press and at the same time, when S1/S2 power indicator and auto indicator are illuminated; release the two buttons, then the auto indicator and S1/S2 power indicators are extinguished simultaneously which means the delay timer of the controller can be set.

- S1 power abnormal delay: adjust "S1 Power Normal Delay" potentiometer;
- S2 power abnormal delay: adjust "S2Power Normal Delay" potentiometer;

b) After adjusting the delays, press . When S1/S2 power indicator and automatic indicator are illuminated simultaneously, the adjusted values has been saved. The controller will go back to normal status automatically after all LEDs are flashing 5 times rapidly and controller will work according to the set delay values.

NOTE：1# Normal Delay set value must be no less than 1# Abnormal Delay, otherwise, 1# Normal Delay set value will be forced to set as 1# Abnormal Delay set value. S2 Normal Delay set value must be no less than S2 Abnormal Delay, otherwise, S2 Normal Delay set value will be forced to set as S2 Abnormal Delay set value.

5.5 FACTORY RESET DELAY VALUE

Firstly, make controller enter parameter setting status and then conduct the setting.

a) Press and at the same time, when S1/S2 power indicator and auto indicator are illuminated simultaneously; release the two buttons, then the auto indicator and S1/S2 power indicators are extinguished simultaneously which means the delay timer of the controller can be set.

b) press , when S1/S2 power indicator and automatic indicator are illuminated simultaneously, then reset the factory default. The controller will to back to normal status automatically after all LEDs are flashing 5 times rapidly and controller will work according to the set delay values.

NOTE：The factory settings are S1/S2 abnormal delay of 5s and genset shutdown delay of 90s.

5.6 AUTO TRANS. AUTO RESTORE SETTING

Firstly, make controller enter parameter setting status and then conduct the setting.
Set “Auto Trans. Auto Restore/Auto Trans. Non-Restore” Steps:

a) Press and at the same time, when S1/S2 power indicator and auto indicator are illuminated simultaneously, release the two buttons, then the auto indicator and S2 power indicator is extinguished, S1power indicator and S1 close indicator are illuminated, which means the auto trans. auto restore of the controller can be set.

b) Press can circularly set two states:

Auto trans. non-restore when S1 power indicator and S1close indicator are illuminated, S2 power indicator and S2 close indicator are extinguished.
Auto trans. auto restore when S2 power indicator and S2 close indicator are illuminated, S1 power indicator and S1 close indicator are extinguished.

c) After adjustment, press . When S1/S2 power indicator and auto indicator are illuminated simultaneously, it indicates that the set parameter value has been saved successfully; all indicators on the panel flash 5 times rapidly and controller will work according to the set state of auto trans. auto-restore/auto trans. non-restore.

NOTE: Turn on the power supply of the controller, auto trans. auto-restore/auto trans. non-restore set by the controller can be judged by the following two situations:

If S1 power indicator and S1close indicator flash rapidly three times at the same time, it is auto trans. non-restore.

If S2 power indicator and S2 close indicator flash quickly three times at the same time, it is auto trans. auto restore.

6 PARAMETER CONFIGERATION

6.1 PARAMETERS TABLE

Table 4 – Parameters Setting Table

No.	Item	Range	Default	Description
01	1# Normal Delay	(0-60)s	Can be set via controller potentiometer	It is the delay of #1 power from voltage abnormal to voltage normal. Generally, it is 10s.
02	1# Abnormal Delay	(0-60)s	5	It is the delay of #1 power from voltage normal to voltage abnormal.
03	2# Normal Delay	(0-60)s	Can be set via controller potentiometer	It is the delay of #2 power from voltage abnormal to voltage normal. Generally, it is 10s.
04	2# Abnormal Delay	(0-60)s	5	It is the delay of #2 power from voltage normal to voltage abnormal.
05	Close Delay	(0-20)s	5	Closing relay output pulse. If set as zero, it is continuous output.
06	Open Delay	(1-20)s	5	Open relay output pulse.
07	Transfer Interval	(0-60)s	1	It is the delay from 1# power open to 2# power close or from 2# power open to 1# power close.
08	Exceed Transfer	(0-20.0)s	0.0	It is the extra output delay of the closing relay after the closing signal has received.
09	Start Delay	(0-3600)s	1	When voltage is abnormal, start delay begins; start signal is initiated after the delay has expired.
10	Stop Delay	(0-3600)s	90	When starting, if the mains voltage is normal, stop delay begins; stop signal is initiated after the delay has expired.
11	AC System	(0-3)	0	0. 3-phase 4-wire 1. 2-phase 3-wire 2. Single phase 3. 3-phase 3-wire
12	Rated Volt	(100-240)V	230	AC system rated voltage.
13	Rated Frequency	(50.0-60.0) Hz	50.0	To offer standards for detecting of over/under frequency.
14	Over Volt Enable	(0-1)	1	0: Disable；1: Enable
15	Over Voltage	(100-120)%	115	Voltage upper limit; it is abnormal when the voltage has exceed the set value.
16	Over Volt Return	(100-120)%	113	Voltage upper limit return value; it is normal only when the voltage is below

No.	Item	Range	Default	Description
				the set value.
17	Under voltage	(70-100)%	75	Voltage lower limit; it is abnormal when the voltage is below the set value.
18	Under Volt Return	(70-100)%	77	Voltage lower limit return value; it is normal only when the voltage is over the set value.
19	Over Freq. Enable	(0-1)	0	0: Disable；1: Enable
20	Over Frequency	(100-120)%	110	Frequency upper limit; it is abnormal when the frequency is over the set value.
21	Over Freq. Return	(100-120)%	104	Frequency upper limit return value; it is normal only when the frequency is below the set value.
22	Under Freq. Enable	(0-1)	0	0: Disable；1: Enable
23	Under Frequency	(80-100)%	90	Frequency lower limit; it is abnormal when the frequency is below the set value.
24	Under Freq. Return	(80-100)%	96	Frequency lower limit return value; it is normal only when the frequency is over the set value.
25	Loss of Phase	(0-1)	1	0: Disable；1: Enable
26	Reverse Phase Sequence	(0-1)	0	0: Disable；1: Enable
27	Master-Slave Set	(0-2)	0	0. 1# Master; 1. 2# Master; 2. Each Backup
28	Auto Trans. Auto Restore Set	(0-1)	1	0: Auto Trans. Non Restore 1: Auto Trans. Auto Restore
29	Neutral Position	(0-1)	0	0. With Breaking; 1. Without Breaking
30	Module Address	(1-254)	1	Communication address for module.
31	Stop Bit Setting	(0-1)	0	0: 1 stop bit; 1: 2 stop bits.

NOTE 1: Parameters above are configured via PC software of SmartGen. The PC programming connection is to use RS485 interface of SG72 module connecting with RS485 interface of controller.

NOTE 2: "1# Voltage Normal Delay" and "2# Voltage Normal Delay" can be set only via the potentiometer which locates nearby the back panel terminal. "1# Voltage Abnormal Delay" and "2# Voltage Abnormal Delay" can be set via the PC software or potentiometer which locates nearby the back panel terminal. AC system setting and master selection priority can be set via panel button or PC software while other parameters can be set via PC software only.

NOTE 3: S1 Normal Delay set value must be no less than S1 Abnormal Delay, otherwise, S1 Normal Delay set value will be forced to set as S1 Abnormal Delay set value. S2 Normal Delay set value must be no less than S2 Abnormal Delay, otherwise, S2 Normal Delay set value will be forced to set as S2 Abnormal Delay set value.

7 OPERATION CONTROL

When controller is running, pressing  key can set the controller as Auto mode or Manual mode (indicated by automatic and manual indicators).

In Auto mode, controller can automatically transfer the load to S1 or S2 power.

When it is set to Auto Trans. Auto Restore, master power is normal, and controller will transfer to master power end in priority.

When it is set to Auto Trans. Non Restore, controller only transfers to backup power, and master power transfer can only be controlled manually.

Each Backup is for two powers to be backup; when S1 power is abnormal, S2 is normal, then switch will transfer to S2 power supply, and vice versa. When it is set to Each Backup, controller will not detect Auto Trans. Auto Restore setting.

In Manual mode, press  , load will be transferred to S1 power supply; press  to disconnect load supply; press  , load will be transferred to S2 power supply.

8 WIRING CONNECTION

8.1 DESCRIPTION OF CONNECTING TERMINALS

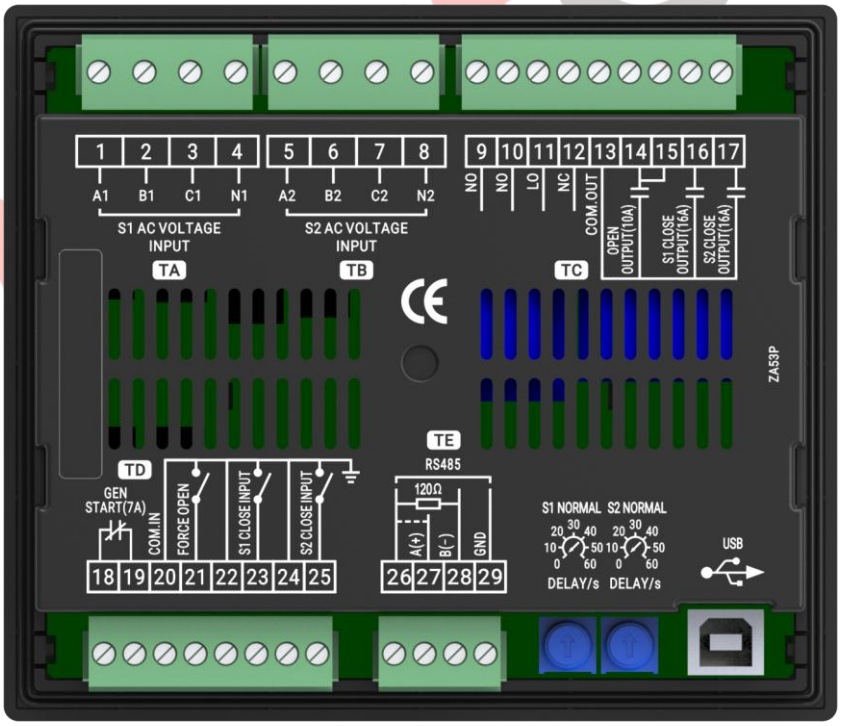

Fig. 2 – HAT530P/HAT530PC Rear Panel Drawing

Table 5 - Terminal Function Table

Terminal No.		Item	Description	Remark
1	TA	A1	1# AC 3P4W voltage input	If it is single phase input, only connect with A1, N1.
2		B1		
3		C1		
4		N1		
5	TB	A2	2# AC 3P4W voltage input	If it is single phase input, only connect with A2, N2.
6		B2		
7		C2		
8		N2		
9	TC	NO	ATS power supply N	Provide power supply for ATS.
10		NO		
11		LO	ATS power supply L	
12		NC	Null	
13		COM.OUT	Common port of close/open output	
14		OPEN OUTPUT	Open output	Volts free N/C output, capacity is AC250V10A
15				
16		S1 CLOSE OUTPUT	1# close output	Volts free N/C output, capacity is AC250V16A
17		S2 CLOSE OUTPUT	2# close output	Volts free N/C output, capacity is AC250V16A
18	TD	GEN START	Genset start output	Volts free N/C output, capacity is AC250V7A
19				
20		COM.IN	Input common port	
21		FORCE OPEN	Forced open input	When it is active, set ATS as breaking position and connect with COMM.IN.
22		COM.IN	Input common port	
23		S1 CLOSE INPUT	1# close input	Detect 1# switch close status, the auxiliary contact input.
24		COM.IN	Input common port	
25		S2 CLOSE INPUT	2# close input	Detect 2# switch close status, the auxiliary contact input.
26	TE	120Ω RESISTANCE	RS485 impedance resistance	Users need to connect the terminal with Terminal 27 A(+) according to the on-site networking for accessing to the 120Ω impedance resistance built in the controller.
27		A(+)	RS485 communication Port	The interior has been connected to the 120Ω impedance resistance.
28		B(-)		
29		GND		Connect to RS485 communication shielding wire.

8.2 RS485 CONNECTION

The connection between RS485 and adaptor is shown below:

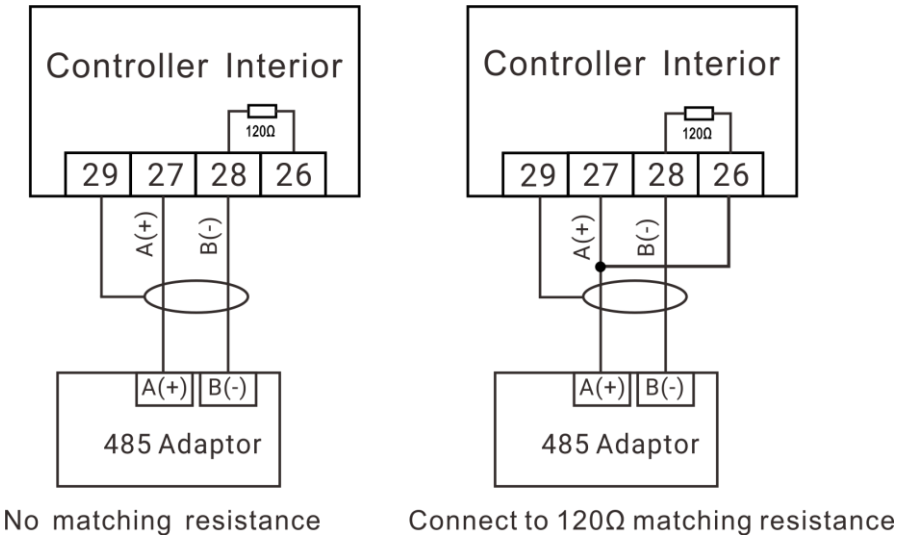

Fig. 3 – RS485 Connection Diagram

9 ATS POWER SUPPLY

The controller has built-in ATS power supply automatic switching function. If the voltage between S1and S2 is normal, this can ensure ATS power supply normally by transferring between N/O contact output and N/C contact output of the intermediate relay 1/2.

The output is LO and NO, the output value is LN voltage of S1 or LN voltage of S2. The internal wiring connection is shown as below:

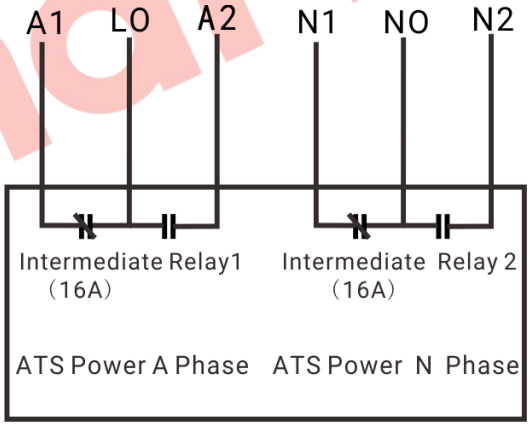

Fig. 4 – The Internal Wiring Diagram of LO and NO Power Supply

10 TYPICAL WIRING DIAGRAM

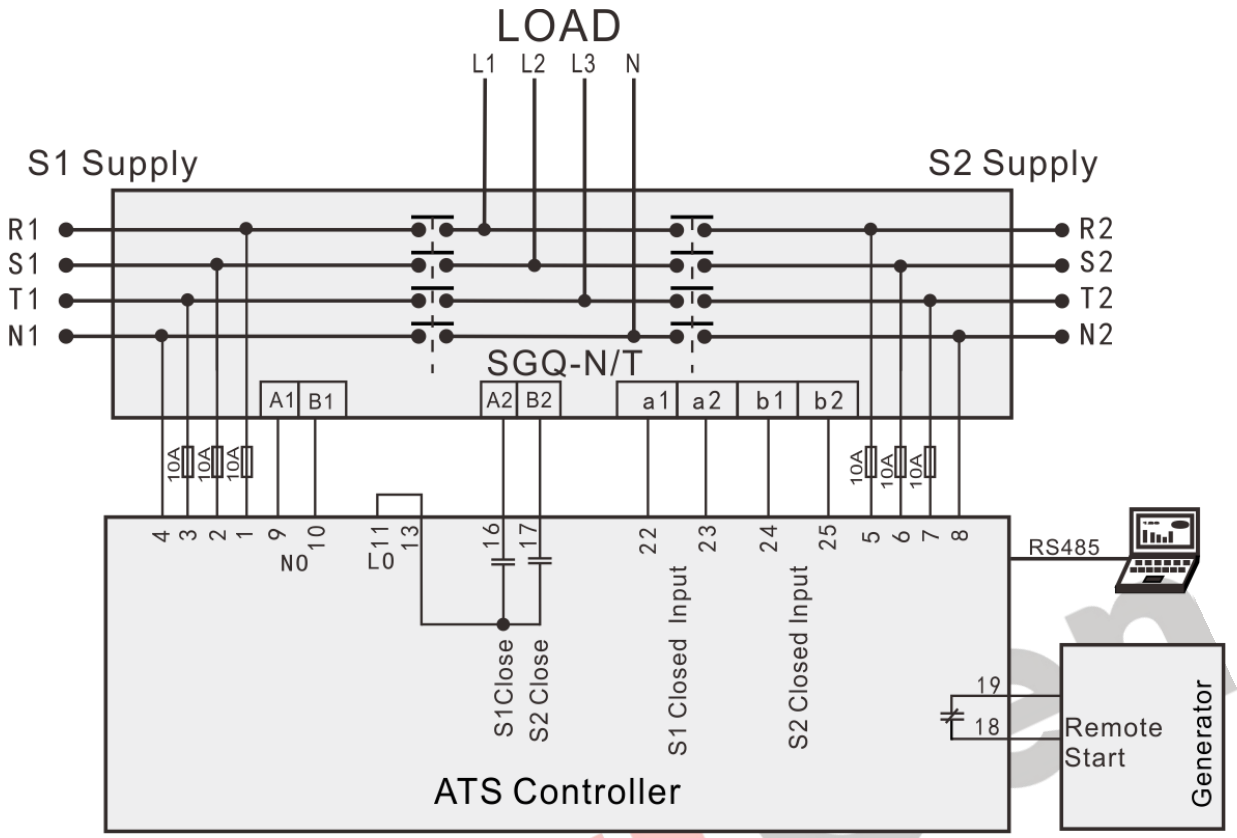

Fig. 5 - SGQ-N/T Application Diagram

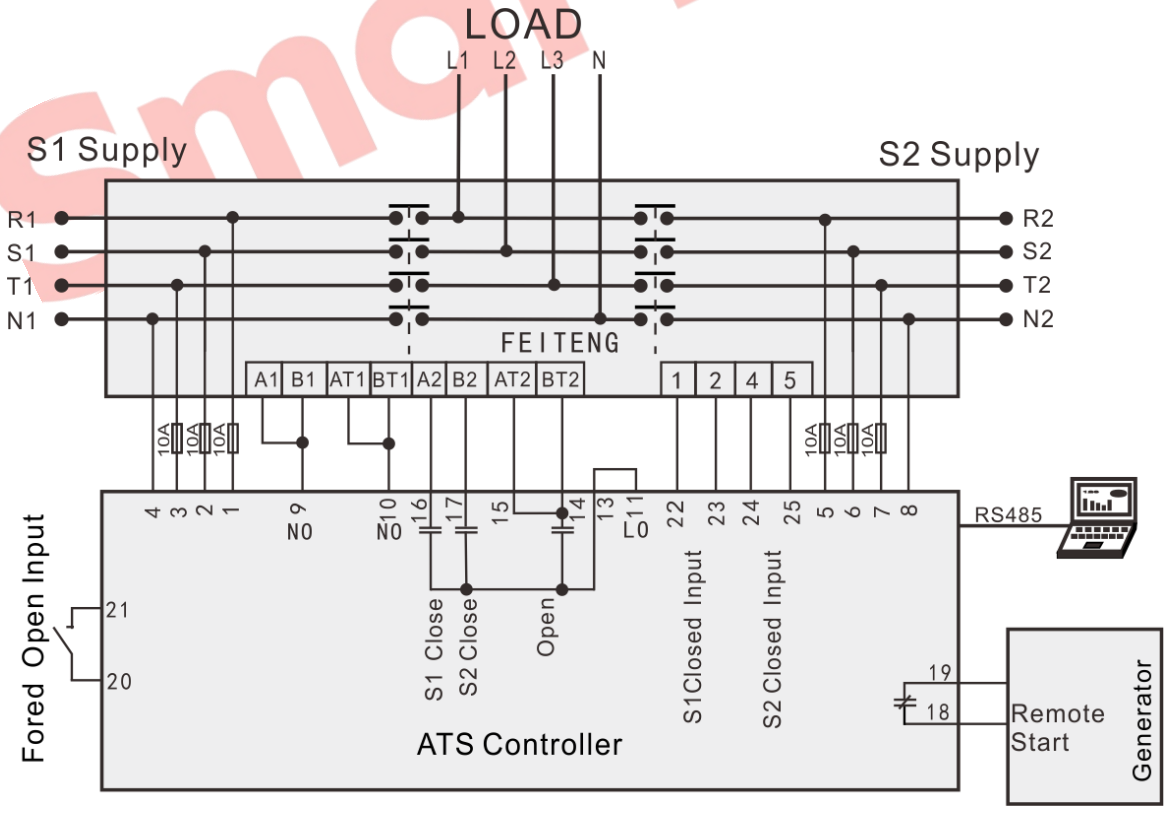

Fig. 6 – FEITENG Application Diagram

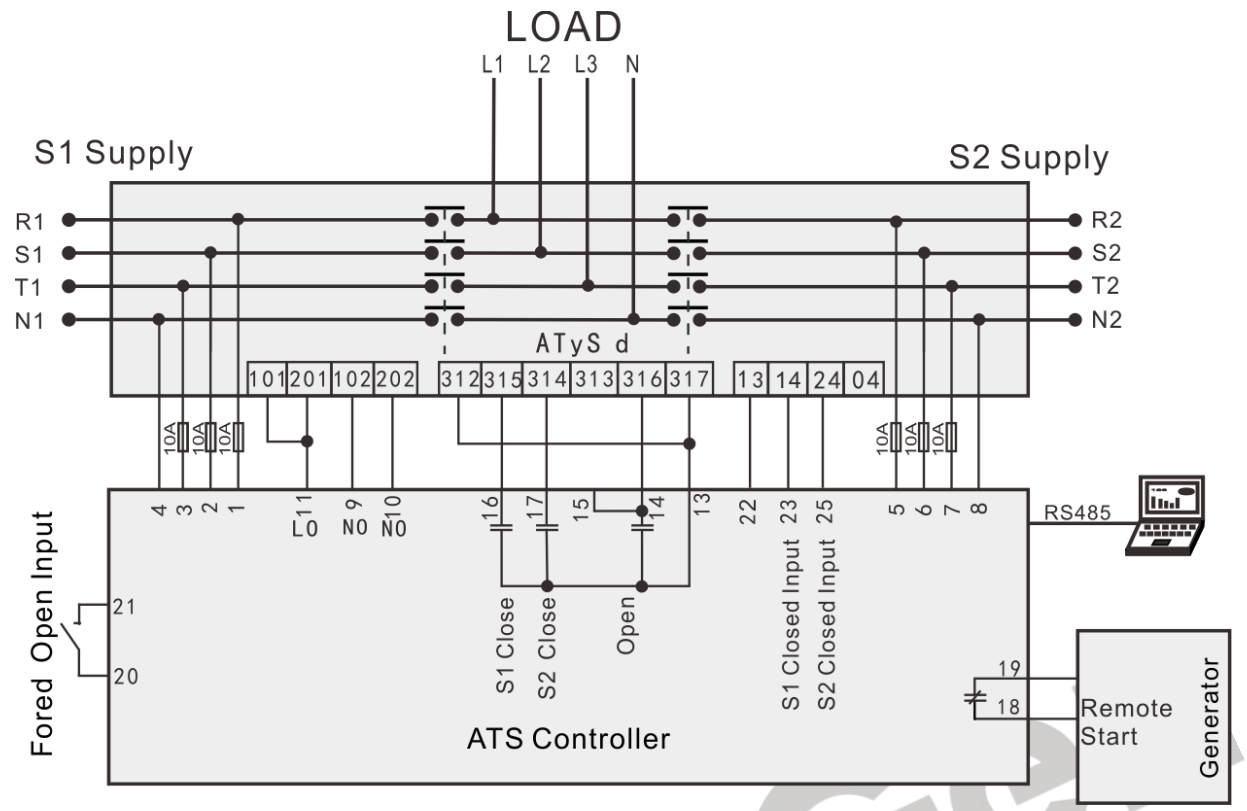

Fig. 7 - ATyS d Application Diagram

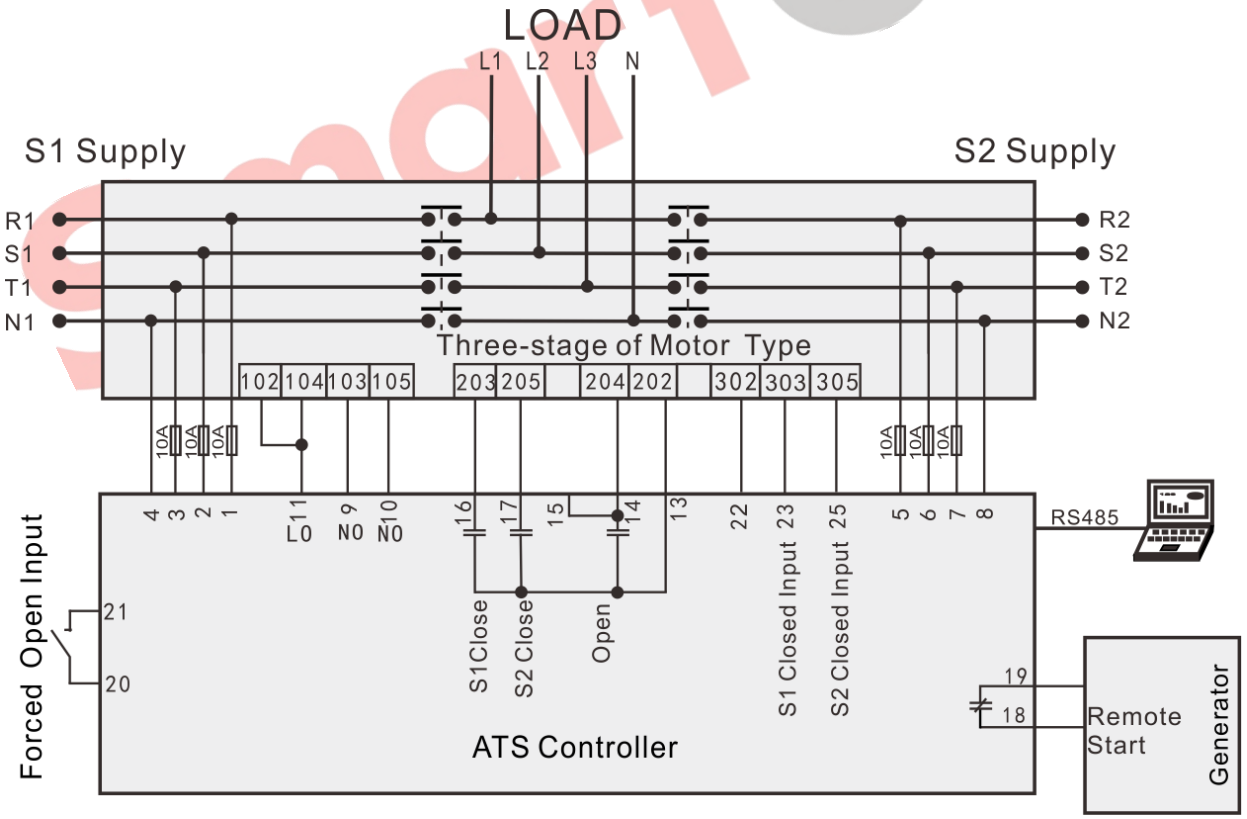

Fig. 8 –Three–stage Application Diagram of Motor Type

NOTE: 1. The diagram is for reference only. The actual wiring shall follow the ATS instruction. Users should choose proper fuse capacity according to the actual power consumption.

2. For two-stage switch, set the breaking position to “no breaking”.

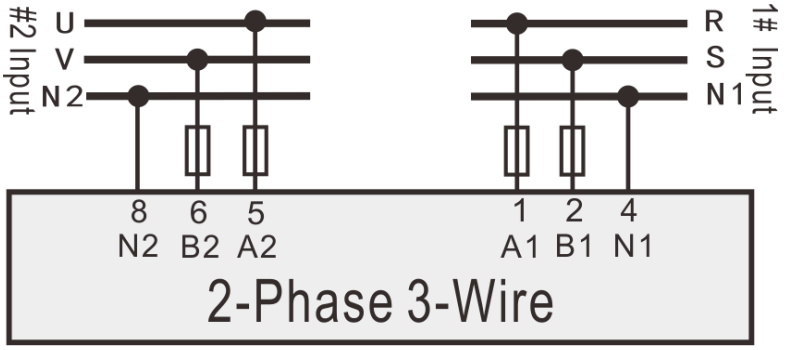

Fig. 9 - 2-phase 3-wire Wiring Diagram

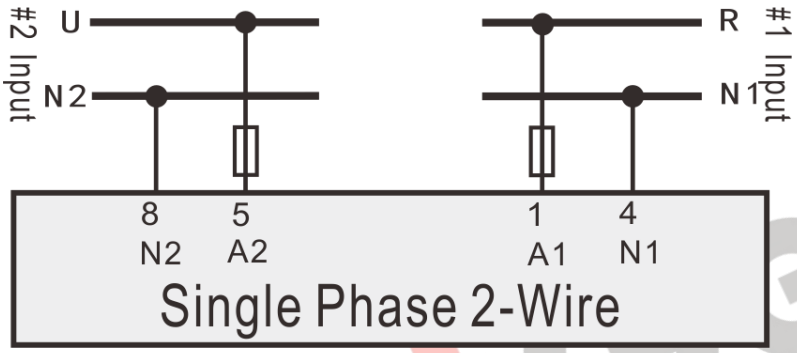

Fig. 10 - Single Phase 2-wire Wiring Diagram

NOTE: The 2P3W and 1P2W wiring diagrams shown in the pictures above are the AC 220V phase voltage.

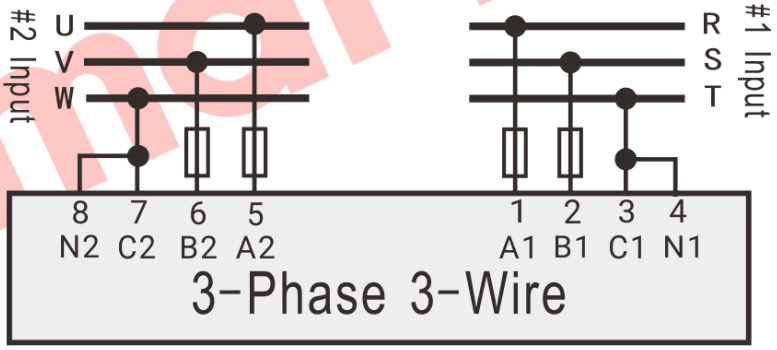

Fig. 11 – 3-phase 3-wire Wiring Diagram

NOTE: The 3P3W wiring diagram shown in the picture above is the AC 220V line voltage. If the actual application is different from it, please contact with SmartGen’s technical staff to get the specific wiring methods.

11 INSTALLATION

Unit: mm

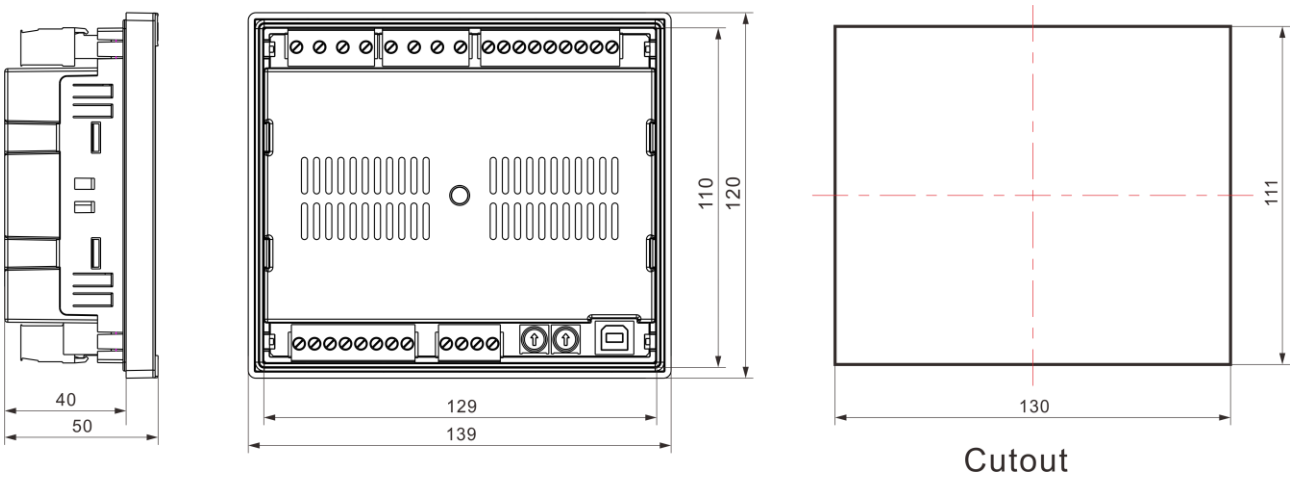

Fig. 12 - Installation Dimensions