SmartGen

MAKING CONTROL SMARTER

HAT821SI

DUAL POWER BUS TIE CONTROLLER

USER MANUAL

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Table 1 – Software Version

Date	Version	Note
2022-11-24	1.0	Original release.
2023-03-03	1.1	Add descriptions of loop closing mode and reverse power detection.
2023-08-02	1.2	Modify sync. voltage difference enabled by default, and modify default function of Aux. input 4-8.
2024-06-18	1.3	Relay output ports 7,8,9 are modified as “Electrical Interlock Release, Normally Open Ouput”.
2025-02-12	1.4	Add functions of over power lock and current detection for loss of phase.

Table 2 – Symbol Instruction

Symbol	Instruction
NOTE	Highlights an essential element of a procedure to ensure correctness.
CAUTION	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
WARNING	Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.

CONTENT

1 OVERVIEW

HAT821SI Dual Power Bus Tie Controller is a medium voltage ATS module that integrates configurable function, automatic measurement, PT break detection, load stepwise transfer, LCD display and digital communication. It combines digitization, intelligence and networking, the automatic measurement and control process can reduce incorrect operation, which is an ideal option for dual power bus-tie transfer.

HAT821SI Dual Power Bus Tie Controller is composed of microprocessor as the core, which can precisely detect 2-way 3-phase incoming voltage, make accurate judgment for voltage abnormal situations (over/under voltage, over/under frequency, loss of phase, reverse phase sequence) and output passive control coil. With compact structure, advanced circuits, simple wiring and high reliability, it can be widely used in electrical automatic control system of electric power, telecom, petrochemical industry, mining, railways, municipal administration, data center, intelligent building and other industries.

2 PERFORMANCE AND CHARACTERISTICS

——System type can be set as: Mains - Mains, Mains - Gen, Gen - Mains;

——4.3-inch single color 240x128 LCD display with white backlight, multilingual display (including Simplified Chinese, English and others), push-button operation;

——Collect and display 2-way 3-phase voltage, current, phase sequence, frequency and voltage imbalance;

——Display 2-way active power, reactive power, apparent power, power factor and earth current;

——PT break detection function, whether PT wire is broken can be judged by measured voltage and current data, or PT break status can be obtained by digital input ports;

——Load switch stepwise transfer can realize the control of local and external. Up to 12 load switches of each way can be realized by local stepwise transfer control. The priority of each load switches can be set flexibly and the closing feedback status, operating position status, test position status and switch tripping status can be detected;

——Real-time detection of the load rate for 2 power supplies, intelligent loading and unloading can be performed according to the settings;

——6 16-way digital input modules and 4 16-way digital output modules can be extended by RS485 interface;

——Display S1/S2 total power supply time; display current duration and total duration of power supply for Load 1 & Load 2;

——Display total close times of QS1, QS2 and QTIE;

——Detection functions of over/under voltage, over/under frequency, loss of phase, reverse phase sequence;

——Earth fault protection function;

——S1/S2 overcurrent warning or fault independent alarm function;

——NEL trip function;

——Manual commissioning to achieve genset start/stop operation;

——Scheduled routing run & scheduled not run (can be set as genset start daily/weekly/monthly whether with load or not);

——Real-time clock (RTC);

——Event log function (event log can record 200 items circularly);

——With black box function, can record 5 events circularly, 60 detailed data of 50s before each event record, and 10s after each event record;

——Suitable for various AC systems (3-phase 4-wire, 3-phase 3-wire, single-phase 2-wire, and 2-phase 3-wire methods);

——Simultaneously control the closing and opening of the 2-way CB switch and the bus-tie CB switch to simplify the control system;

——For stored-energy type ATS, its can close after the PF input is active;

——Auto/Manual transfer, manually control the switch close or open in manual mode;

——Loop closing mode (sync. closing and parallel continuous running), and the reverse power detection function can realize the trip protection when reverse power occurs;

——Local mode. When it is active, controller only displays data parameters, switch transfer needs to be realized by external operation;

——Electric interlock release function, which is used for releasing electric interlock in switch parallel transfer;

——6 kinds of buttons on the panel to manually control switch easily;

——Breaker re-closing function;

——Closing output signal can be set as pulse or continuous output, which is suitable for CB breaker or CC contactor;

——All parameters can be set on site. Passwords authentication ensures authorized staff operation only;

——2-way N-wire isolated design;

——Wide DC power supply range allows the controller can bear instantaneous 80V DC input;

——Large terminal space allows the controller can bear maximum 625V AC voltage input;

——With Dual-RS485 isolated communication interface. With “remote control, remote communication, remote measurement, remote adjusting” functions by the ModBus-RTU Communication protocol. Genset start/stop and ATS close/open can be controlled remotely;

——USB is convenient to debug parameters and upgrade program locally;

——Modular design, self extinguishing ABS shell, silicone panel, pluggable terminal, built-in mounting, compact structure with easy installation.

3 SPECIFICATION

Table 3 – Performance Parameters

Items	Contents	
Operating Voltage	1. B+, B-: DC12V/24V/48V; 2. PA, PN: AC(90~305)V or DC110V/DC220V; Either or both.	
Power Consumption	<6W (Standby mode: ≤2W)	
AC Voltage Input (PT is not used or PT secondary side)	AC system	
	3P4W (L-L)	(80~625)V
	3P3W (L-L)	(80~625)V
	1P2W (L-N)	(50~360)V
	2P3W (L-L)	(80~625)V
	Voltage Resolution: 1V Accuracy: 1%	
AC Frequency	Rated: 50/60Hz Range: 15Hz~75Hz Resolution: 0.1Hz Accuracy: 0.1Hz	
AC Current	Rated: 5A Resolution: 0.1A Accuracy: 1%	
Aux. Output 1~4, 8, 10 Relay Capacity	16A 250VAC Volts free output	
Aux. Output 5~7, 9, 11~13 Relay Capacity	8A 250VAC Volts free output	
Digital Input 1~12	GND (B-) connected is active, low on threshold voltage ≤1.6VDC, input voltage 60VDC.	
RS485	Isolated, half-duplex, 2400/4800/9600/19200 baud rate can be set, Modbus-RTU communication protocol, max. communication distance can reach 1000m.	
USB	D-type USB interface.	
EMC Test Standard	Meets GB/T14048.11-2016 and IEC/EN 60947-6-1.	
Vibration	5Hz~8Hz: displacement=±7.5mm 8Hz~500Hz: a=±2g IEC 60068-2-6	
Shock	a=50g, Pulse continuous time: 11ms, Pulse waveform: half-sine, three consecutive shocks are applied in each of the three mutually perpendicular directions, i.e. a total of 18 times. IEC 60068-2-27.	
Bump	a=25g, Pulse continuous time: 16ms, Pulse waveform: half-sine. IEC 60255-21-2	

Items	Contents
Case Dimensions	260mmx180mmx54mm
Panel Cutout	242mmx161mm
Working Temperature	(-25~+70)°C
Working Humidity	(20~93)%RH
Storage Temperature	(-30~+80)°C
Protection Level	Front Panel IP65: when water proof rubber ring inserted between controller and panel. Back Panel IP20.
Insulation Strength	Apply AC1.5kV voltage between high voltage terminal and low voltage terminal; The leakage current is not more than 3mA within 1min.
Weight	1.2kg

4 MEASURE AND DISPLAY

Table 4 – Measure and Display Parameters

No.	Measure & Display Data Items
1	S1/S2 Power Phase Voltage
2	S1/S2 Power Line Voltage
3	S1/S2 Power Voltage Phase
4	S1/S2 Power Frequency
5	S1/S2 Power Phase Current
6	S1/S2 Power Max. Voltage Imbalance
7	S1/S2 Power Earth Current
8	S1/S2 Total Power Supply Time
9	S1/S2 Total Active Power Supply
10	S1/S2 Total Reactive Power Supply
11	S1/S2 Active Power of Each Phase
12	S1/S2 Reactive Power of Each Phase
13	S1/S2 Apparent Power of Each Phase
14	S1/S2 Total Active Power
15	S1/S2 Total Reactive Power
16	S1/S2 Total Apparent Power
17	Load 1/Load 2 Continuous Power Supply Time (Present)
18	Load 1/Load 2 Continuous Power Supply Time (Last Time)
19	Load 1/Load 2 Total Power Supply Time
20	QS1 Total Close Times
21	QS2 Total Close Times
22	QTIE Total Close Times
23	Input/Output Port Status
24	RTC (Real Time Clock)
25	Event Log & Black Box Records
26	Communication Status
27	Sync Information
28	Digital Status of Exp. Input/Output Module

Table 5 – Identification & Abbreviations Explanation

No.	Identification & Abbreviations	Explanation
1	S1	S1 power
2	S2	S2 power
3	QS1	S1 power side switch
4	QS2	S2 power side switch
5	QTIE	Bus-tie switch
6	PF	Ready for close signal
7	CB	Circuit breaker
8	LOAD1	Load 1
9	LOAD2	Load 2
10	Sync.	Synchronization
11	L1-n n=(1~12)	Bus 1 stepwise transfer load No.
12	L2-n n=(1~12)	Bus 2 stepwise transfer load No.

5 OPERATION

5.1 INDICATORS

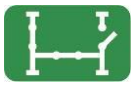
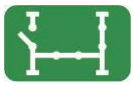
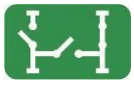
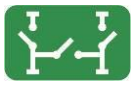
Fig.1 – Panel Indication Drawing

Table 6 – Indicators Description

Indicator Type	Description
Alarm	Red, slow flashing (1 time per sec) when warn alarm occurs. Fast flashing (5 times per sec) when fault alarm occurs.
Man	Red, Light on when the module is in Manual mode.
Auto	Green, Light on when the module is in Auto mode.
IOI	Red Illuminated: QS1 closed, QS2 closed, LOAD1 powered by S1, LOAD2 powered by S2. Red Flashing: status switching.
IIO	Red Illuminated: QS1 closed, QTIE closed, LOAD1 and LOAD2 powered by S1. Red Flashing: status switching.
OII	Red Illuminated: QTIE closed, QS2 closed, LOAD1 and LOAD2 powered by S2. Red Flashing: status switching.
IOO	Red Illuminated: QS1 closed, LOAD1 powered by S1, LOAD2 is disconnected. Flashing: status switching.
OOI	Red Illuminated: QS2 closed, LOAD2 powered by S2, LOAD1 is disconnected. Red Flashing: status switching.
OOO	Red Illuminated: QS1, QS2, QTIE are all open, LOAD1 and LOAD2 are disconnected. Red Flashing: status switching.

5.2 KEY FUNCTION DESCRIPTION

Table 7 – Keys Function Description

Icon	Keys	Function Description
	IOI	Active in Manual mode. After pressing this key, QS1 will close, QTIE will open and QS2 will close, which means LOAD1 powered by S1 and LOAD2 powered by S2.
	IIO	Active in Manual mode. After pressing this key, QS1 will close, QTIE will close and QS2 will open, which means LOAD1 and LOAD2 powered by S1.
	OII	Active in Manual mode. After pressing this key, QS1 will open, QTIE will close and QS2 will close, which means LOAD1 and LOAD2 powered by S2.
	IOO	Active in Manual mode. After pressing this key, QS1 will close, QTIE will open and QS2 will open, which means LOAD1 powered by S1 and LOAD2 disconnect.
	OOI	Active in Manual mode. After pressing this key, QS1 will open, QTIE will open and QS2 will close, which means LOAD2 powered by S2 and LOAD1 disconnect.
	OOO	Active in Manual mode. After pressing this key, QS1 will open, QTIE will open and QS2 will open, which means LOAD1 and LOAD2 disconnect.
	Man/Auto	Manual mode and Auto mode switching.
	Alarm Reset	Pressing this key can reset fault alarm.
	Return/Homepage	When setting parameters, press the key to return back. In main screen, press the key to return to the first screen; in other screen, hold and press the key to return to main screen.
	Set/Confirm	In main screen, press the key to enter to menu. In menu screen, press this key can move cursor and confirm setting information.
	Up/Alarm Mute	In main screen, press the key to scroll up screen. In menu interface, press this key to up cursor or increase value in setting menu. Mute the alarm.
	Down/Lamp Test	In main screen, press the key to scroll down screen. In menu interface, press this key to down cursor or decrease value in setting menu. In main screen, press the key for seconds to enter lamp test mode, LCD backlit and all LED lamps are lit and LCD screen displays black.

6 LCD DISPLAY

6.1 MAIN SCREEN

Table 8 – Main Screen Display

Items	Display Contents
Homepage	S1 status, S2 status, switch status, load transfer status, genset start status; Supply system diagram, QS1 is switch for S1 power side, QS2 is switch for S2 power side, QTIE is bus-tie switch; S1/S2 voltage, current and frequency; S1/S2 priority status; Parallel mode; Auto trans/restore status.
S1 S2	S1 line voltage, phase voltage, phase angle, frequency and voltage imbalance; S2 line voltage, phase voltage, phase angle, frequency and voltage imbalance;
S1	Three-phase current A (I1, I2, I3); Three-phase active power kW (P1, P2, P3); Three-phase reactive power kvar (Q1, Q2, Q3); Three-phase apparent power kVA (S1, S2, S3); Three-phase power factor PF (PF1, PF2, PF3); Average power factor (Average value of PF1, PF2 and PF3); Total active power kW (Sum of P1, P2 and P3); Total reactive power kvar (Sum of Q1, Q2 and Q3); Total apparent power Kva (Sum of S1, S2 and S3); Earth current Im (Display after earth fault detection is enabled).
S2	Three-phase current A (I1, I2, I3); Three-phase active power kW (P1, P2, P3); Three-phase reactive power kvar (Q1, Q2, Q3); Three-phase apparent power kVA (S1, S2, S3); Three-phase power factor PF (PF1, PF2, PF3); Average power factor (Average value of PF1, PF2 and PF3); Total active power kW (Sum of P1, P2 and P3); Total reactive power kvar (Sum of Q1, Q2 and Q3); Total apparent power Kva (Sum of three-phase S1, S2 and S3); Earth current Im (Display after earth fault detection is enabled).
S1 S2	S1 total supply time, toal active energy, total reactive energy; S2 total supply time, toal active energy, total reactive energy.
LOAD1 	LOAD1 continuous power supply time (present); LOAD1 continuous power supply time (last time); LOAD1 total power supply time.
LOAD2 	LOAD2 continuous power supply time (present); LOAD2 continuous power supply time (last time); LOAD2 total power supply time.
QF	QS1 total close times; QS2 total close times;

Items	Display Contents
	QTIE total close times.
I/O 	Programmable digital input status; Programmable digital output status.
Comm. 	RS485 communication address; RS485-1 communication status and communication parameter; RS485-2 communication status and communication parameter; USB communication status.
Alarms 	Present alarm information (warn alarm and fault alarm).
Sync. 	Voltage difference; Frequency difference; Phase difference;
Status	Alarm status/working status; Real-time clock; Statusline is showed below in every main screen page.
Expansion Input Status	Expand the 16-way programmable digital input status of DIN16A-2 module 1-6.
Expansion Output Status	Expand the 16-way programmable digital output status of DOUT16B-2 module 1-4.

6.2 STATUS DESCRIPTION

Table 9 – S1 Voltage Status

No.	Item	Description
1	S1 Available	S1 Normal Delay
2	S1 Unavailable	S1 Abnormal Delay
3	S1 Available	Power supply voltage is within the setting range
4	S1 Blackout	Voltage is 0
5	S1 Over Volt	Voltage is higher than the set value
6	S1 Under Volt	Voltage has fallen below the set value
7	S1 Over Freq	Frequency is higher than the set value
8	S1 Under Freq	Frequency has fallen below the set value
9	S1 Loss of Phase	Loss of any phase of A, B and C
10	S1 Phase Seq Wrong	A-B-C phase sequence is wrong
11	S1 Reverse Power	Power is negative and absolute value exceeds set upper limit

Table 10 – S2 Voltage Status

No.	Item	Description
1	S2 Available	S2 Normal Delay
2	S2 Unavailable	S2 Abnormal Delay
3	S2 Available	Power supply voltage is within the setting range
4	S2 Blackout	Voltage is 0
5	S2 Over Volt	Voltage is higher than the set value
6	S2 Under Volt	Voltage has fallen below the set value
7	S2 Over Freq	Frequency is higher than the set value
8	S2 Under Freq	Frequency has fallen below the set value
9	S2 Loss of Phase	Loss of any phase of A, B and C
10	S2 Phase Seq Wrong	A-B-C phase sequence is wrong
11	S2 Reverse Power	Power is negative and absolute value exceeds set upper limit

Table 11 – Switch Status

No.	Item	Description
1	Ready to Transfer	Switch transfer begins.
2	QS1 Closing	QS1 closing delay is in progress.
3	QS1 Opening	QS1 opening delay is in progress.
4	QS2 Closing	QS2 closing delay is in progress.
5	QS2 Opening	QS2 opening delay is in progress.
6	Transfer Rest	Interval time between switch transfer.
7	Waiting for Sync.	Waiting for S1 and S2 sync. conditions (voltage difference, frequency difference, phase difference) to meet the setting value delay.
8	QS1 Sync. Closing	QS1 sync. closing outputs when sync. conditions are ready.
9	QS2 Sync. Closing	QS2 sync. closing outputs when sync. conditions are ready.
10	QTIE Sync. Closing	QTIE sync. closing outputs when sync. conditions are ready.
11	Waiting QS1 PF	Before QS1 is closed, it's the delay time to confirm "QS1 PF Input" signal is active.
12	Waiting QS2 PF	Before QS2 is closed, it's the delay time to confirm "QS2 PF Input" signal is active.
13	Waiting QTIE PF	Before QTIE is closed, it's the delay time to confirm "QTIE PF Input" signal is active.
14	Elevator Delay	Elevator control outputs before ATS transfer delay.
15	QS1 On Load	QS1 was already closed and S1 is taking load1.
16	QS2 On Load	QS2 was already closed and S2 is taking load2.
17	Offload	Switch was already opened and load is disconnected.
18	QTIE Closing	QTIE closing delay is in progress.
19	QTIE Opening	QTIE opening delay is in progress.
20	QS1 & QTIE Closed	QS1 and QTIE were already closed and S1 is taking load1 and load2.
21	QS2 & QTIE Closed	QS2 and QTIE were already closed and S2 is taking load1 and load2.
22	QS1 & QS2 Closed	QS1 and QS2 were already closed. S1 is taking load1 and S2 is

No.	Item	Description
		taking load2.
23	QTIE Closed	QTIE bus-tie switch was already closed.
24	L1 Load Stepwise Closing	Bus 1 load stepwise transfer loading.
25	L1 Load Stepwise Opening	Bus 1 load stepwise transfer unloading.
26	L2 Load Stepwise Closing	Bus 2 load stepwise transfer loading.
27	L1 Load Stepwise Opening	Bus 2 load stepwise transfer unloading.
28	Loop Closing Running	S1 and S2 are in parallel continuous running.

Table 12 – Genset Status

No.	Item	Description
1	Start Dealy	The delay time before genset start.
2	Stop Delay	The delay time before genset stop.
3	Scheduled Not Run	When it is active , it displays the duration of scheduled not run.
4	Scheduled Run	When it is active, it displays the duration of scheduled run.
5	Genset Start	The genset start signal outputs.
6	Genset At Rest	There is no genset start signal outputs.

Warning alarms are active when controller detects the alarm signals, and alarm indicator will flash slowly (1 time per sec). When alarm is reset, indicator is extinguished, which means warn alarms are not latched.

Table 13 – Warning Alarms

No.	Item	Description
1	S1 Load Overcurrent	Set overcurrent act as warning, the current of S1 is over the set value.
2	S2 Load Overcurrent	Set overcurrent act as warning, the current of S2 is over the set value.
3	Forced Open Warn	Set forced open (cut off non-fire supply) act as warning, when the input is active, it will initiate a warning alarm.
4	Over Load Alarm	When it is active or the alarm reset is within the alarm release delay.
5	Sync. Failure Warn	Set sync. failure act as warning, it will alarm when sync. wait is timeout.
6	S1 PT Break	It alarms when PT secondary circuit is disconnected.
7	S2 PT Break	It alarms when PT secondary circuit is disconnected.
8	Earth Fault Warn	Set the alarm act as warning. It alarms when earth current detection is enabled and the earth current is over the set value.
9	Load Switch Transfer Fail	During the load switch stepwise transfer, close or open fails and alarms, set the load transfer failure action as warn and display the failure switch number of the min priority.
10	Load Switch Tripping	Load switch trips and displays the tripping switch number of the

No.	Item	Description
	Alarm	mini priority.
11	Input 1-6 Comm Fail Warn	Extension input module 1-6 communication fails and the alarms when the action is set to warn.
12	Output 1-4 Comm Fail Warn	Extension output module 1-4 communication fails and the alarms when the action is set to warn.
13	Volt. Sampling BW	When current detection for loss of phase is enabled, an alarm is sent if there is phase current but no phase voltage.

Fault alarms are active when controller detects the alarm signals. Alarm indicator will flash rapidly (5 times per sec), fault alarms are latched and it will be removed after manually reset.

Table 14 – Fault Alarms

No.	Item	Description
1	QS1 Fails to Close	QS1 fails to close.
2	QS1 Fails to Open	QS1 fails to open.
3	QS2 Fails to Close	QS2 fails to close.
4	QS2 Fails to Open	QS2 fails to open.
5	S1 Load Over Curent Fault	Set overcurrent act as fault, the current of S1 is over the set value.
6	S2 Load Over Curent Fault	Set overcurrent act as fault, the current of S2 is over the set value.
7	QTIE Fails to Close	QTIE fails to close.
8	QTIE Fails to Open	QTIE fails to open.
9	Forced Open Fault	Set forced open (cut off non-fire supply) act as fault, when the input is active, it will initiate a fault alarm.
10	Genset Fault	Genset fault input is active.
11	Earth Fault	Set the alarm act as fault. It alarms when earth current detection is enabled and the earth current is over the set value.
12	Switch Trip Alarm	It will initiate a fault alarm when the input is active.
13	QS1 Switch Trip Alarm	It will initiate a fault alarm when the input is active.
14	QS2 Switch Trip Alarm	It will initiate a fault alarm when the input is active.
15	QTIE Switch Trip Alarm	It will initiate an alarm when the input is active.
16	QS1 Earth&Overcurrent Fault	It will initiate a fault alarm when the input is active.
17	QS2 Earth&Overcurrent Fault	It will initiate a fault alarm when the input is active.
18	Sync. Failure Fault	Set sync. failure act as fault, it alarms when sync. wait is timeout.
19	Switch Parallel Alarm	It will initiate a fault alarm when three switches parallel abnormally.
20	Load Switch Transfer Fail	During the load switch stepwise transfer, close or open fails and alarms, set the load transfer failure action as fault and display the failure switch number of the min priority.
21	Input 1-6 Comm Fault	Extension input module 1-6 communication fails and the alarms when the action is set as fault.
22	Output 1-4 Comm Fault	Extension output module 1-4 communication fails and the alarms when the action is set as fault.

No.	Item	Description
23	S1 Reverse Power Fault	When reverse power fault of S1 power side occurs.
24	S2 Reverse Power Fault	When reverse power fault of S2 power side occurs.

The indication information will continuously display for 2s when it is active.

Table 15 – Indication Information

No.	Item	Description
1	Please Reset The Alarm	When there is fault alarm occurs, the indication will be displayed when change the genset mode to Auto Mode manually.
2	Panel Locked	The information displays when panel lock is active and keys are pressed (except for UP/Down, Confirm and Return Buttons).
3	Stepwise Transferring	When the load switch is stepwise transferring, the message when pressing the switch transfer key on the panel.
4	S1 Over Power Lock	Before bus tie closing, the potential overload of S1 power supply is detected and the controller issues a warning signal.
5	S2 Over Power Lock	Before bus tie closing, the potential overload of S2 power supply is detected and the controller issues a warning signal.

Table 16 – Other Status Information

No.	Item	Description
1	QS1 Close Inhibit	QS1 close inhibit is active.
2	QS2 Close Inhibit	QS2 close inhibit is active.
3	QTIE Close Inhibit	QTIE close inhibit is active.
4	Auto Mode	Current mode is Auto mode.
5	Manual Mode	Current mode is Manual mode.
6	Local Mode	Current mode is Local mode.
7	Start Inhibit	Genset start inhibit input is active.
8	Remote Control Inhibit	Remote control inhibit input is active.
9	S1 Supply QTIE Close Inhibit	S1 supplies power and QITE close inhibit is active.
10	S2 Supply QTIE Close Inhibit	S2 supplies power and QITE close inhibt is active.
11	Remote Start On-load	Remote start on-load is active.
12	Remote Start Off-load	Remote start off-load is active.
13	Mains Abnormal Start	Genset starts when mains supply is abnormal.
14	NEL1 Trip	NEL1 is off-load and outputs.
15	NEL2 Trip	NEL2 is off-load and outputs.
16	NEL3 Trip	NEL3 is off-load and outputs.
17	S1 Smart Unloading	S1 is on-load, the smart unloading is being performed and the unloading switch number is displayed.
18	S2 Smart Unloading	S2 is on-load, the smart unloading is being performed and the unloading switch number is displayed.
19	S1 Smart Loading	S1 is on-load, the smart loading is being performed and the loading switch number is displayed.
20	S2 Smart Loading	S2 is on-load, the smart loading is being performed and the loading

No.	Item	Description
		switch number is displayed.
21	Loop Closing Mode	Current status is loop closing mode.

6.3 MAIN MENU

In main screen, press ⚙/OK key will enter into the menu interface.

1. Configuration **2. Data Calibration** **3. Historical Records** **4. Black Box Records** **5. Auto Trans/Restore** **6. Parallel Mode** **7. Genset Start/Stop** **8. Language** **9. About**	Press **Up/Down** key to choose parameters (the current line was highlighted with black) and then press **Confirm** key to enter into the corresponding display screen.

NOTE1: Default password is 01234, user can change it in case of others change the parameters setting. Please clearly remember the password after changing. If you forget it, please contact SmartGen services.

NOTE2: Data Calibration is for factory use only and correct passwords must be input before entered.

7 START/STOP OPERATION

7.1 MANUAL START/STOP

7.1.1 PANEL START/SOP

In the main screen, press /OK key to select the option of “Start/Stop”, press /OK key to reconfirm, then enter into the “Manual Start/Stop” interface.

Start/Stop	Press “Up/Down” key to choose parameters (the current line was highlighted with black) and then press “Confirm” key to confirm.
Return Genset Stop Genset Start	

Genset Stop：Disconnect the start signal, i.e. stop the running genset.
Genset Start：Output the start signal, i.e. start the genset.

7.1.2 REMOTE START/STOP

Send remote start/stop signals using MODBUS protocol via RS485 port.
Remote Stop: Disconnect the start signal, i.e. stop the running genset.
Remote Start: Output the start signal, i.e. start the genset.

7.2 AUTO START/SOP

7.2.1 START CONDITIONS

INPUT START

Set input port as “Remote Start On Load” or “Remote Start Off Load”, both could not be set simultaneously.

Remote Start on Load：When the input is active, genset close relay will be active after genset is normal; when the input is inactive, genset will stop automatically.

Remote Start off Load：When the input is active, mains close relay will be active after mains is normal; when the input is inactive, genset will stop automatically.

MAINS ABNORMAL START

When mains power is abnormal and the input is active, gens close relay will be active after gens is normal.

7.2.2 SCHEDULED RUN

Once “Scheduled Run” enables, users can set the scheduled start time. Controller will send start signal at preset start time. Start signal will be disconnected after the start delay has expired. “Scheduled Run On Load” or “Scheduled Run Off Load” can be set.

Scheduled Run On Load: When the input is active, genset close relay will be active after genset is normal.

Scheduled Run Off Load: When the input is active, mains close relay will be active after mains is normal.

Cycle time of *Scheduled Run* can be set as start monthly, weekly and daily.

Run Monthly: month, date and time can be set.

Run Weekly: the same time in couple of days can be set. Eg. Start the genset at 8:00 a.m. from

Monday to Friday and keep 10 hours.

Run Daily: the same time everyday can be set.

7.2.3 SCHEDULED NOT RUN

When ”Scheduled Not Run” enables, users can set the “Scheduled Not Start” time. Start signal will be deactivated at preset time and it will be inhibited before the delay has expired.

Cycle time of “Scheduled Not Run” can be set as monthly, weekly and daily.

Not Run Monthly: month, date and time can be set.

Not Run Weekly: the same time in couple of days can be set. Eg. Not start the genset at 19:00 p.m. from Monday to Friday and keep 12 hours.

Not Run Daily: at same time everyday can be set.

NOTE3: “Scheduled Not Run” operation is prior to “Scheduled Run” operation.

8 PARAMETERS CONFIGURATION

8.1 ILLUSTRATION

In the main interface, press /OK key, choose **Configuration** and press /OK again to enter into password confirmation interface. If password is correct, enter into parameter setting interface, otherwise, exit to main interface directly. Factory default password is ***01234***. In parameters configuration interface, pressing /⌂ key to return the prior menu.

8.2 PARAMETERS TABLE

Table 17 – Parameters Configuration Form

No.	Item	Range	Default	Description
AC Setting				
1	S1 Volt Normal	(0~3600) s	10	The delay from S1 voltage abnormal to normal.
2	S1 Volt Abnormal	(0~3600)s	5	The delay from S1 voltage normal to abnormal.
3	S2 Volt Normal	(0~3600)s	10	The delay from S2 voltage abnormal to normal.
4	S2 Volt Abnormal	(0~3600)s	5	The delay from S2 voltage normal to abnormal.
5	Master Set	(0~2)	0	0: S1Master S2Master 1: S1Master S2Backup 2: S1Backup S2Master
6	System Type	(0~2)	2	0: S1M S2G 1: S1G S2M 2: S1M S2M
7	AC System	(0~3)	1	0: 3 Phase,4 Wire (3P4W) 1: 3 Phase,3 Wire (3P3W) 2: 2 Phase,3 Wire (2P3W) 3: Single Phase,2 Wire (1P2W)
8	PT Fitted	(0~1)	1	0: Disable ; 1: Enable
9	PT Primary	(30~30000)V	100	Primary voltage of voltage transformer
10	PT Secondary	(30~1000)V	100	Secondary voltage of voltage transformer
11	Rated Voltage	(0-30000)V	220	Rated voltage of AC system
12	Over Volt Warn	(0~1)	1	0: Disable; 1: Enable
13	Set Value	(0~200)%	120	Upper limit value of voltage; it is abnormal if the value has exceeded the set value.
14	Return	(0~200)%	115	Upper limit return value of voltage; it is normal only when the value has fallen below the set value.
15	Under voltage Warn	(0~1)	1	0: Disable; 1: Enable
16	Set Value	(0~200)%	80	Lower limit value of voltage; it is

No.	Item	Range	Default	Description
				abnormal if the value has fallen below the set value.
17	Return Value	(0~200)%	85	Lower limit return value of voltage; it is normal only when the value has exceeded the set value.
18	Rated Frequency	(10.0~75.0)Hz	50.0	Rated frequency of AC system
19	Over Frequency Warn	(0~1)	1	0: Disable; 1: Enable
20	Set Value	(0~200)%	110	Upper limit value of frequency; it is abnormal if the value has exceeded the set value.
21	Return Value	(0~200)%	104	Upper limit return value of frequency; it is normal only when the value has fallen below the set value.
22	Under Frequency Warn	(0~1)	1	0: Disable; 1: Enable
23	Set Value	(0~200)%	90	Lower limit value of frequency; it is abnormal if the value has fallen below the set value.
24	Return Value	(0~200)%	96	Lower limit return value of frequency; it is normal only when the value has exceeded the set value.
25	Phase Sequence Wrong	(0~1)	1	0: Disable; 1: Enable
26	Current Detection for Loss of Phase	(0~1)	0	0: Disable; 1: Enable
27	Currentless Threshold Value	(0.0~100.0)%	1..0	Current lower limit. If below the limit, it is judged as no current.
28	Currentless Return Value	(0.0~100.0)%	5.0	Return value of current lower limit. If above the limit, the current is detected.
Switch Setting				
1	Auto Trans./ Restore Time	(0~1)	1	0: Auto Trans. Non-restore; 1: Auto Trans. /Restore
2	Auto Restore Delay	(0~30000)m	0	When the power supply is restored to normal, auto restore will be performed after the delay time is set.
3	Auto Restore Start Time (h)	(0~23)	0	The start time for auto restore is allowed.
4	Auto Restore Start Time (min)	(0~59)	0	
5	Auto Restore Stop Time (h)	(0~23)	0	The stop time for auto restore is allowed.
6	Auto Restore Stop Time (min)	(0~59)	0	
7	Overload Alarm	(0~30000)m	90	After the overload alarm input signal is

No.	Item	Range	Default	Description
	Remove Delay			inactive, the alarm will be removed when the setting time is delayed.
8	Switch Reclose Enable	(0~1)	1	0: Disable 1: Enable
9	Fixed Close/Open Time	(0~1)	0	0: Disable; 1: Enable Disable: The output time depends on the close relay; the longest output time is up to the set delay. Enable: The output time lasts for the preset time.
10	Close Time	(0.1~20.0)s	5.0	The pulse time of closing relay outputs.
11	Open Time	(0.1~20.0)s	5.0	The pulse time of opening relay outputs.
12	Transfer Interval	(0~9999)s	1	The delay time from S1 open to S2 close, or from S2 open to S1close
13	Forced Open Action	(0~1)	0	0: Warn Alarm 1: Fault Alarm
14	Continually Close	(0~1)	0	0: Disable; 1: Enable If “Enable” is selected, “Close Time” and “Open Time” are deactivated.
15	Parallel Mode	(0~3)	0	0: Non-parallel 1: Manual/Auto Parallel 2: Auto Parallel 3: Manual Parallel
16	Sync. Voltage Difference Enable	(0~1)	1	0: Disable 1: Enable
17	Sync. Voltage Difference	(0~50)V	5	The max. voltage difference when synchronization success.
18	Sync. Frequency Difference	(0~0.50)Hz	0.20	The max. frequence difference when synchronization success.
19	Sync. Phase Difference	(0~20) °	5	The max. phase difference when synchronization success.
20	Sync. Failure Alarm Action	(0~1)	0	0: Warning Alarm 1: Fault Alarm After sync. failure, it continues to wait for a synchronization until the switch is closed. Warning alarms, the alarm will be cleared when synchronization is finished or exited. Fault alarms, press alarm reset key to clear the alarm.
21	Sync. Failure Forced Transfer	(0~1)	0	0: Disable 1: Enable After sync. failure, it will perform nonsynchronous closing and will not initiate a nonsynchronous. failure alarm.
22	Sync. Failure Delay	(0~9999)s	120	Time to wait for sync. success, it fails to synchronize when the time exceeds the

No.	Item	Range	Default	Description
				pre-set value.
23	Dection Time for Sync. C/O	(0.1~1.0)s	0.6	Sync. closing or opening output starts to delay when sync. switching, it will stop the closing/opening pulse output when it detects the correct closing status during the delay process. If it still can not detect the correct closing status when the delay ends, it will initiate a closing failure alarm or opening failure alarm.
24	Sync Hold Time	(0.0~100.0)s	10.0	Sync holding time for sync transfer of loop closing time. (The parameter is invalid for non-loop closing mode.)
Genset Setting				
1	Start Delay	(0~9999)s	1	When the genset is ready to start, start delay begins, after the start delay has expired, start signal will be initiated.
2	Stop Delay	(0~9999)s	5	When the genset is ready to stop, stop delay begins, after the stop delay has expired, stop signal will be initiated.
Scheduled Setting				
1	Schedule Run	(0~1)	0	0: Disable ; 1: Enable
2	Run Mode	(0~1)	0	0: Off Load 1: On Load
3	Cycle Selection	(0~2)	0	0: Monthly 1: Weekly 2: Daily
4	Time (Month)	(1~12)	Each Month	☑ Jan. ☑ Feb. ☑ Mar. ☑ Apr. ☑ May ☑ June ☑ July ☑ Aug. ☑ Sep. ☑ Oct. ☑ Nov. ☑ Dec.
5	Time (Day)	(1~31)	1	The date of start the genset.
6	Time (Week)	Monday~Sunday	Sunday	☑ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday

No.	Item	Range	Default	Description
				☐ Friday ☐ Saturday
7	Time (Hour)	(0~23)h	0	The time of start the genset.
8	Time (Minute)	(0~59)min	0	
9	Duration	(0~30000)min	30	The duration time of genset running.
10	Scheduled Not Run	(0~1)	0	0: Disable 1: Enable
11	Cycle Selection	(0~2)	0	0: Monthly 1: Weekly 2: Daily
12	Time (Month)	(1~12)	Each Month	☑ Jan. ☑ Feb. ☑ Mar. ☑ Apr. ☑ May ☑ June ☑ July ☑ Aug. ☑ Sep. ☑ Oct. ☑ Nov. ☑ Dec.
13	Time (Day)	(1~31)	1	The date of *NOT* start the genset.
14	Time (Week)	(Monday~Sunday)	1	☑ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday
15	Time (Hour)	(0~23)h	0	The time of *NOT* start the genset.
16	Time (Minute)	(0~59)min	0	
17	Duration	(0~30000)min	30	The duration time of genset *NOT* running.
Load Setting				
1	Elevator Enable	(0~1)	0	0: Disable; 1: Enable
2	Elevator Delay	(0~300)s	300	It's the delay time before the switch transfer. Used to control the running elevator stop at the nearest floor until the switch transfer is terminated.
3	Current CT Enable	(0~1)	1	0: Disable; 1: Enable
4	CT Primary/5	(5~9000)A	500	The primary current of CT.
5	S1 Full Load Rating	(5~9000)A	500	The current of S1 taking full load
6	S2 Full Load Rating	(5~9000)A	500	The current of S2 taking full load

No.	Item	Range	Default	Description
7	S1 Max kW Rating	(1~20000)kW	200	The maximum active power of S1 taking load
8	S2 Max kW Rating	(1~20000)kW	200	The maximum active power of S2 taking load
9	Over Current Enable	(0~1)	1	0: Disable; 1: Enable
10	Over Load Current	(0~200)%	120	Over current set value
11	Action	(0~1)	0	0: Warn 1: Fault
12	QTIE Trip	(0~1)	0	0: Disable; 1: Enable
13	Type	(0~1)	0	0：Definite Time 1：IDMT(Inverse Definite MMinimum Time)
14	Delay	(0~3600)s	10	It's the over current delay time when "Definite Time" is selected.
15	Multiply	(1~36)	36	It's the over current multiply when "IDMT" is selected.
16	NEL Trip	(0~1)	0	0: Disable ; 1: Enable
17	NEL1 Set Value	(0~200)%	90	Off load output will be active if the load power has exceeded the set value and the delay time has expired.
18	NEL1 Delay	(0~3600)s	5	
19	NEL2 Set Value	(0~200)%	100	Off load output will be active if the load power has exceeded the set value and the delay time has expired.
20	NEL2 Delay	(0~3600)s	1	
21	NEL Return Enable	(0~1)	0	0: Disable ; 1: Enable
22	Set Value	(0~200)%	50	NEL control will be deactivated if the load power has fallen below the set value and the delay time has expired.
23	Delay	(0~3600)s	5	
24	NEL Num	(1~3)	3	NEL number
25	Earth Fault Detection Enable	(0~1)	0	0: Disable ; 1: Enable
26	Over Current Value	(0~200)%	20	If the earth current is over the pencentage of rated current, the earth fault alarm will be initiated after delay. If set the alarm act as warn, when the earth current is less than the set return value, the alarm will be removed.
27	Over Current Return Value	(0~200)%	18	
28	Delay Value	(0~3600)s	5	
29	Act Setting	(0~2)	0	0: No Alarm 1: Warn 2: Fault Alarm

No.	Item	Range	Default	Description
30	S1 Smart Unloading Enable	(0~1)	0	0: Disable ; 1: Enable
31	S1 Smart Unloading Threshold Value	(0~200)%	100	The percentage of S1 load current and rated current. When the percentage of S1 load current is greater than the setting value, the smart unloading function will be performed. The loweset priority load will be unloaded firstly until the load ratio is lower than the setting value or all of them will be unloaded completely.
32	S1 Smart Unloading Delay	(0~100)s	5	The interval of S1 smart unloading.
33	S2 Smart Unloading Enable	(0~1)	0	0: Disable ; 1: Enable
34	S2 Smart Unloading Threshold Value	(0~200)%	100	The percentage of S2 load current and rated current. When the percentage of S2 load current is greater than the setting value, the smart unloading function will be performed. The loweset priority load will be unloaded firstly until the load ratio is lower than the setting value or all of them will be unloaded completely.
35	S2 Smart Unloading Delay	(0~100)s	5	The interval of S2 smart unloading.
36	S1 Load Recovery Enable	(0~1)	0	0: Disable; 1: Enable
37	S1 Load Recovery Threshold Value	(0~100)%	50	The percentage of S1 load current and the rated current. When the S1 load current percentage is lower than the setting value, the load recovery function will be performed. The highest priority load will be loaded until the load rate is greater than the setting value or all of them will be loaded completely.
38	S1 Load Recovery Delay	(0~100)s	5	The interval of S1 load recovery.
39	S2 Load Recovery Enable	(0~1)	0	0: Disable; 1: Enable
40	S2 Load Recovery Threshold Value	(0~100)%	50	The percentage of S2 load current and the rated current. When the S2 load current percentage is lower than the setting value, the load

No.	Item	Range	Default	Description
				recovery function will be performed. The highest priority load will be loaded until the load rate is greater than the setting value or all of them will be loaded completely.
41	S2 Load Recovery Delay	(0~100)s	5	The interval of S2 load recovery.
42	Reverse Power Detection	(0~1)	0	0: Disable; 1: Enable
43	Reverse Power Dection Threshold	(0~200)%	20	When S1/S2 power is negative and the ratio of its absolute value and rated power is greater than the set value, it will issue a fault alarm.
44	Reverse Power Detection Return Value	(0~200)%	18	When S1/S2 power is negative and the ratio of its absolute value and rated power is less than the set value, it will release the reverse power status.
45	Reverse Power Dectection Delay Value	(0~3600)s	5	The delay time of reverse power detection.
46	Over Power Lock	(0~1)	0	0: Disable; 1: Enable
Digit Inputs Setting				
1	Digital Input 1	(0~169)	30	QS1 Closing Input.
2	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
3	Digital Input 2	(0~169)	31	QS2 Cosing Input.
4	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
5	Digital Input 3	(0~169)	32	QTIE Closing Input.
6	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
7	Digital Input 4	(0~169)	46	QS1 Trip Fault.
8	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
9	Digital Input 5	(0~169)	47	QS2 Trip Fault.
10	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
11	Digital Input 6	(0~169)	48	QTIE Trip Fault.
12	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
13	Digital Input 7	(0~169)	14	Local Mode.
14	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate

No.	Item	Range	Default	Description
15	Digital Input 8	(0~169)	1	Forced Open.
16	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
17	Digital Input 9	(0~169)	0	Not Used.
18	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
19	Digital Input 10	(0~169)	0	Not Used.
20	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
21	Digital Input 11	(0~169)	0	Not Used.
22	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
23	Digital Input 12	(0~169)	0	Not Used.
24	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate
Relay Outputs Setting				
1	Relay Output 1	(0~1)	0	0: Output (NO) 1: Output (NC)
2	Contents Setting	(0~159)	34	QS1 Close Control.
3	Relay Output 2	(0~1)	0	0: Output (NO) 1: Output (NC)
4	Contents Setting	(0~159)	35	QS1 Open Control.
5	Relay Output 3	(0~1)	0	0: Output (NO) 1: Output (NC)
6	Contents Setting	(0~159)	36	QS2 Close Control.
7	Relay Output 4	(0~1)	0	0: Output (NO) 1: Output (NC)
8	Contents Setting	(0~159)	37	QS2 Open Control.
9	Relay Output 5	(0~1)	0	0: Output (NO) 1: Output (NC)
10	Contents Setting	(0~159)	94	QITE Close Control.
11	Relay Output 6	(0~1)	0	0: Output (NO) 1: Output (NC)
12	Contents Setting	(0~159)	95	QITE Open Control.
13	Relay Output 7	(0~1)	0	0: Output (NO) 1: Output (NC)
14	Contents Setting	(0~159)	16	Electrical interlock release.
15	Relay Output 8	(0~1)	1	0: Output (NO) 1: Output (NC)
16	Contents Setting	(0~159)	16	Electrical interlock release.
17	Relay Output 9	(0~1)	0	0: Output (NO) 1: Output (NC)

No.	Item	Range	Default	Description
18	Contents Setting	(0~159)	16	Electrical interlock release.
19	Relay Output 10	(0~1)	0	0: Output (NO) 1: Output (NC)
20	Contents Setting	(0~95)	0	Not Used.
21	Relay Output 11	(0~1)	0	0: Output (NO) 1: Output (NC)
22	Contents Setting	(0~159)	0	Not Used.
23	Relay Output 12	(0~1)	0	0: Output (NO) 1: Output (NC)
24	Contents Setting	(0~159)	0	Not Used.
25	Relay Output 13	(0~1)	0	0: Output (NO) 1: Output (NC)
26	Contents Setting	(0~159)	0	Not Used.
Defined Combination Output Setting				
1	Combined 1 Or Output 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
2	Combined 1 Or Output 1 Contents Setting	(0~159)	23	S1 Available.
3	Combined 1 Or Output 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
4	Combined 1 Or Output 2 Contents Setting	(0~159)	25	S2 Available.
5	Combined 1 And Output Active Type	(0~1)	1	0: Output (NO) 1: Output (NC)
6	Combined 1 And Output Contents Setting	(0~159)	0	Not Used.
7	Combined 2 Or Output 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
8	Combined 2 Or Output 1 Contents Setting	(0~159)	0	Not Used.
9	Combined 2 Or Out 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
10	Combined 2 Or Output 2 Contents Setting	(0~159)	0	Not Used.
11	Combined 2 And Output Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)

No.	Item	Range	Default	Description
12	Combined 2 And Output Contents Setting	(0~159)	0	Not Used.
13	Combined 3 Or Output 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
14	Combined 3 Or Output 1 Contents Setting	(0~159)	0	Not Used.
15	Combined 3 Or Output 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
16	Combined 3 Or Output 2 Contents Setting	(0~159)	0	Not Used.
17	Combined 3 And Output Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
18	Combined 3 And Output Contents Setting	(0~159)	0	Not Used.
19	Combined 4 Or Output 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
20	Combined 4 Or Output 1 Contents Setting	(0~159)	0	Not Used.
21	Combined 4 Or Output 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
22	Combined 4 Or Output 2 Contents Setting	(0~159)	0	Not Used.
23	Combined 4 And Output Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
24	Combined 4 And Output Contents Setting	(0~159)	0	Not Used.
25	Combined 5 Or Output 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
26	Combined 5 Or Output 1 Contents Setting	(0~159)	0	Not Used.
27	Combined 5 Or Output 2 Active	(0~1)	0	0: Output (NO) 1: Output (NC)

No.	Item	Range	Default	Description
	Type			
28	Combined 5 Or Output 2 Contents Setting	(0~159)	0	Not Used.
29	Combined 5 And Output Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
30	Combined 5 And Output Contents Setting	(0~159)	0	Not Used.
31	Combined 6 Or Output 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
32	Combined 6 Or Output 1 Contents Setting	(0~159)	0	Not Used.
33	Combined 6 Or Output 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
34	Combined 6 Or Output 2 Contents Setting	(0~159)	0	Not Used.
35	Combined 6 And Output Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
36	Combined 6 And Output Contents Setting	(0~159)	0	Not Used.
Module Setting				
1	Language	(0~2)	0	0: Chinese 1: English 2: Other (Language can be set via PC software, Default: Traditional Chinese)
2	Password	(00000~65534)	01234	For entering parameters setting.
3	Power On Mode	(0~2)	0	0: Last Mode (Keep the working mode last time running) 1: Manual Mode 2: Auto Mode
4	Module Address	(1~254)	1	RS485 communication address
5	RS485-1 Baud	(0~3)	2	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps
6	RS485-1 Stop Bit	(1~2)	1	2 stop bits or 1 stop bit can be set.
7	RS485-1 Parity Bit	(0~2)	0	0: None 1: Odd 2: Even

No.	Item	Range	Default	Description
8	RS485-1 Comm.	(0~3)	0	0: Remote Ajusting/Control Enable 1: Remote Control Disable 2: Remote Adjusting Disable 3: Remote Ajusting/Control Disable
9	RS485-2 Baud	(0~3)	2	0: 2400 bps 1: 4800 bps 2: 9600 bps 3:19200 bps
10	RS485-2 Stop Bit	(1~2)	1	2 stop bits or 1 stop bit can be set.
11	RS485-2 Parity Bit	(0~2)	0	0: None 1: Odd 2: Even
12	RS485-2 Comm.	(0~3)	0	0: Remote Ajusting/Control Enable 1: Remote Control Disable 2: Remote Adjusting Disable 3: Remote Ajusting/Control Disable
13	Date and Time			
14	Controller Description 1	(0~20) characters		"About" information is displayed. Any characters can be inputted via PC software (letter occupies 1 character, Chinese character occupies 2.).
15	Controller Description 2	(0~20) characters		
PT Break Comm. Detection Setting				
1	Comm. Detection Enable	(0~1)	0	0: Disable; 1: Enable Whether PT is disconnected according to the AC sampling voltage and current.
2	PT Break Delay	(0~60)s	3	PT disconnection warning will be initiated after the set delay when the mark of disconnection is detected.
3	Max. Line Volt. Multiple	(0-1.00)	0.20	Multiples of max. line voltage determined by PT disconnection to the rated voltage.
4	Max. Current Multiple	(0~1.00)	0.02	Multiples of max. current determined by PT disconnection to the rated current.
5	Amplitude Difference of Line Volt.	(0~1.00)	0.20	Multiples of amplitude difference of line voltage determined by PT disconnection to the rated voltage.
6	BW Reset Volt. Multiple	(0~1.00)	0.90	Multiples of reset voltage set value determined by PT disconnection to the rated voltage.
PT Break Comm. Detection Setting				
1	Detection Enable	(0~1)	0	0: Disable; 1: Enable When it is enabled, PT break can be judged according to AC sampling voltage, current.
2	PT Break Delay	(0-60)s	3	When detection is enabled, PT break sign is detected, after setting delay, PT break

No.	Item	Range	Default	Description
				warning is issued.
3	Max. Line Volt Multiple	(0-1.00)	0.20	Multiple of max. line voltage set value accounting for rated voltage.
4	Max. Current Multiple	(0-1.00)	0.02	Multiple of max. current set value accounting for rated current.
5	Multiple of Line Volt Amplitude Difference	(0-1.00)	0.20	Multiple of line voltage amplitude difference accounting for rated voltage.
6	Reset Volt Multiple	(0-1.00)	0.90	Multiple of reset voltage set value accounting for rated voltage.
Load Stepwise Transfer Setting				
1	Stepwise Transfer Control Enable	(0~1)	0	0: Disable; 1: Enable
2	Control Mode	(0~1)	0	0: Unit stepwise transfer control. 1: External stepwise transfer control. Unit stepwise transfer control: by expanding the input/output port mode to realize the close/open control and the state detection of each load switch. External stepwise transfer control: by sending the close/open output signal to realized the stepwise transfer of the load switch.
3	L1 Load Priority Number	(0~12)	12	The number of stepwise transfer priorities allowed for close/open control.
4	L2 Load Priority Number	(0~12)	12	The number of stepwise transfer priorities allowed for close/open control.
5	Switch Position Dectection Enable	(0~1)	1	0: Disable; 1: Enable When switch position detection is set as “Disable”: not detect switch position status, stepwise transfer will be performed according to the setting priority order. When switch position detection is set as “Enable”: only when it detects that the switch is on the operating position, the load switch will be allowed to close/open control.
6	Close/Open Fixed Time Enable	(0~1)	0	0: Disable; 1: Enable When the close/open fixed time is set as “Disable”: When the close/open pulse outputs, it will judge the output time according to the closing status, the longest the time is the setting close/open time. During the closing time, if the closing

No.	Item	Range	Default	Description
				status is not detected, the load stepwise transfer is failure. During the opening time, if the closing status is not disconnected, the load stepwise transfer is failure. Set the close/open fixed time as "Enable": not detect the closing status of the load switch, the close/open pulse output time is the setting fixed time.
7	Switch Close Time	(0.1~20.0)s	5.0	The pulse time when the closing relay outputs.
8	Switch Open Time	(0.1~20.0)s	5.0	The pulse time when the opening relay outputs.
9	Switch Transfer Interval	(0~9999)s	1	0: Disable; 1: Enable The interval between the ending of the current load switch closing or opening and the beginning of the next load switch closing or opening.
10	Open Control Enable	(0~1)	1	0: Disable; 1: Enable When it is enabled, it can control the stepwise opening of the load switch.
11	Stepwise Transfer Failure Act	(0~2)	0	0: No Action 1: Warning Alarm 2: Fault Alarm During the load switch stepwise transfer, if the closing/opening of one load switch fails, it will send an alarm signal of load stepwise transfer failure.
12	L1 Stepwise Transfer Priority Set	(1~12)	1-12	It can set whether each load switch (up to 12) of 1 section bus is allowed to close when S1/S2 is loaded, and the priority of closing and opening. When the priorities are the same, the corresponding switches act simultaneously.
13	L2 Stepwise Transfer Priority Set	(1~12)	1-12	It can set whether each load switch (up to 12) of 2 section bus is allowed to close when S1/S2 is loaded, and the priority of closing and opening. When the priorities are the same, the corresponding switches act simultaneously.
14	Manual Mode Stepwise Transfer Selection	(0~2)	2	0: No Action 1: Automatic Stepwise Transfer 2: Confirmation Prompt Act

No.	Item	Range	Default	Description
				No action: after manually closing the main switch, the load switch will not stepwisely transfer; Automatically stepwise transfer: after manually closing the main switch, the automatic cascade closing/opening of load switch will control; Confirmation prompt act: after manually closing the main switch, the prompt box of "Confirm load stepwise transfer" will pop up. Press the up/down keys to select "Confirm" "Cancel", press the set key to confirm the operation and exit the prompt box. If no operation is selected and confirmed within 10s, the prompt box will automatically exit and cancel the stepwise transfer. If "Confirm" is selected, the stepwise transfer will be performed, if "Cancel" is selected, the stepwise transfer will not performed.
Expansion Input Module (1~6) Set				
1	Enable Set	(0~1)	0	0: Disable; 1: Enable Set as "Enable", it can communicate with DIN16A-2 module.
2	Comm. Failure Act	(0~1)	0	0: Warning Alarm 1: Fault Alarm
3	Comm. Module Address	(1~254)	100	The communication address of RS485 network communication.
4	Expansion Input Port Set	(1~16)	1	It can set the functions and active types of the 16 digital input ports of the DIN16A-2 module.
Expansion Output Module (1~4) Set				
1	Enable Set	(0~1)	0	0: Disable; 1: Enable Set as "Enable", it can communicate with DOUT16B-2 module.
2	Comm. Failure Act	(0~1)	0	0: Warning Alarm 1: Fault Alarm
3	Comm. Module Address	(1~254)	106	The communication address of RS485 network communication.
4	Expansion Output Port Set	(1~16)	1	It can set the functions and active types of the 16 digital output ports of the DOUT16B-2 module.

8.3 DIGITAL INPUT/OUTPUT FUNCTION DESCRIPTION

8.3.1 INPUT PORTS FUNCTION

Table 18 – Input Ports Function Description

No.	Item	Description
0	Not Used	Invalid
1	Forced Open	No matter the genset is in manual mode or auto mode, when the input is active, this will force the breaker to transfer the ATS to OFF position. LOAD1 and LOAD2 are disconnected.
2	Remote Start On-load	Genset starts output, the genset close relay will be active when mains is normal.
3	Remote Start Off-load	Genset starts output, the mains close relay will be active when mains is normal.
4	Lamp Test	When it is active, all LED lamps on the front panel are illuminated and the backlight of the LCD is illuminated while the LCD screen is black in color.
5	Geset Fault	External outputs when it is active.
6	Reserved	
7	Start Inhibit Input	In Auto mode, start signal will be deactivated after the stop delay has expired. In Manual mode, if the genset is running, users should stop it manually; then the manual start signal will be deactivated.
8	Breaker Trip Input	Trip failure input, if input is active, controller will initiate “Breaker Trip Fault” alarm, and forced enter into manual mode at the same time; if input is inactive, alarm can be reset manually.
9	QS1 Close Inhibit	In Manual mode, QS1 manual close is inhibited; if breaker has already closed, users should open it manually. In Auto mode, if breaker has already closed, then QS1 disconnect.
10	QS2 Close Inhibit	In Manual mode, QS2 manual close is inhibited; if breaker has already closed, users should open it manually. In Auto mode, if breaker has already closed, then QS2 disconnect.
11	QS1 PF Input	QS1 PF signal input, it needs to wait QS1 PF active before it closes.
12	QS2 PF Input	QS2 PF signal input, it needs to wait QS2 PF active before it closes.
13	Over Load Alarm Input	When external over load alarm input is active, the controller will initiate warning, when the alarm input is inactive and needs to wait for the alarm release delay, the controller will stop warning.
14	Local Mode	Forced to set the controller mode as local mode, the controller only displays Not Control in this mode.
15	Alarm Reset	Reset the current alarm.
16	Alarm Mute	Silence the audible alarm.
17	Manual NEL Trip	Please select self-reset key to manually control NEL offload.
18	Manual NEL	Please select self-reset key to manually control NEL on-load

No.	Item	Description
	Reconnection	again.
19	S1 Master Input	Forced to set S1 as master use.
20	S2 Master Input	Forced to set S2 as master use.
21	Forced Manual Mode	Foced to set the controller in Manual mode.
22	Forced Auto Mode	Forced to set the controller in Auto mode.
23	Panel Lock	Panel button operations are inhibited (Except Up, Down, Confirm, and Return keys)
24	Sync. Transfer Inhibit	Synch. transfer function is invalid (HMAT821S)
25	Scheduled Run/Not Run Inhibit	Scheduled Run or Not Run is inactive.
26	Simulate S1 OK	Simulate S1 is normal; the S1 voltage abnormal delay is deactivated.
27	Simulate S2 OK	Simulate S2 is normal; the S2 voltage abnormal delay is deactivated.
28	QS1 Earth & Over Current Fault	When input is active, QS1 won't close.
29	QS2 Earth & Over Current Fault	When input is active, QS2 won't close.
30	QS1 Close Input	QS1 current closing status.
31	QS2 Close Input	QS2 current closing status.
32	QTIE Close Input	QTIE current closing status.
33	Auto Trans/Restore	If this item is configured but without auto trans.non restore, then auto trans./restore status is mainly based on input port status. Auto trans./restore when the input active, auto transfer, non-restore when invalid. If both of them are configured, the signal becomes momentary pulse with auto trans./ restore mode remaining adjustable via controller.
34	Manual/Auto Input	Manual mode when input is active; Auto mode when input is inactive.
35	QTIE Close Inhibit	In Manual mode, QTIE manual close is inhibited; if breaker already closed, users should open it manually. In Auto mode, if breaker already closed, then QTIE disconnect.
36	QTIE PF Input	When the QTIE PF input is active, QTIE close relay will be activated.
37	Simulate OOO Key	Same function with Panel OOO Key. Please use reset key to control ATS to transfer to OOO.
38	Simulate OOI Key	Same function with Panel OOI Key. Please use reset key to control ATS to transfer to OOI.
39	Simulate IOO Key	Same function with Panel IOO Key. Please use reset key to control ATS to transfer to IOO.
40	Simulate OII Key	Same function with Panel OII Key. Please use reset key to control ATS to transfer to OII.
41	Simulate IIO Key	Same function with Panel IIO Key. Please use reset key to control ATS to transfer to IIO.

No.	Item	Description
42	Simulate IOI Key	Same function with Panel IOI Key. Please use reset key to control ATS to transfer to IOI.
43	Auto Trans./Non Restore	If this item is configured but without auto trans./restore, then auto trans./restore status is mainly based on input port status. Auto trans./non restore when the input active, auto transfer/restore when invalid. If both of them are configured, the signal becomes momentary pulse with auto trans./ restore mode remaining adjustable via controller.
44	Simulate Manual/Auto Key	Same as Manual/Auto key on panel. Please use reset key to control.
45	Remote Control Inhibit	When it is active, the remote control will be inactive.
46	QS1 Trip Fault	QS1 trip fault input.
47	QS2 Trip Fault	QS2 trip fault input.
48	QTIE Trip Fault	QTIE trip fault input.
49	S1 Supply QTIE Open	When S1 supplies with load, QTIE close is inhibited.
50	S2 Supply QTIE Open	When S2 supplies with load, QTIE close is inhibited.
51	Non Parallel	Forced set parallel mdoe as non-parallel mode.
52	Manual Parallel	Forced set parallel mdoe as non-parallel mode.
53	Auto Parallel	Forced set parallel mdoe as non-parallel mode.
54	Manual/Auto Parallel	Forced set parallel mdoe as non-parallel mode.
55	S1 PT BW	The PT secondary circuit broken wire input of S1.
56	S2 PT BW	The PT secondary circuit broken wire input of S2.
57	Reserved	
58	External Device 1 Closing Status	When the stepwise transfer mode selects the external device control, the Bus 1 transfer device is closing.
59	External Device 2 Closing Status	When the stepwise transfer mode selects the external device control, the Bus 2 transfer device is closing.
60	L1-1 Closing Status	Closing status input of Bus 1 load switch 1.
61	L1-1 Operating Position Status	Operating position status input of Bus 1 load switch 1.
62	L1-1 Testing Position Status	Testing position status input of Bus 1 load switch 1.
63	L1-1 Switch Tripping	Tripping fault input of Bus 1 load switch 1.
64	L1-2 Closing Status	Closing status input of Bus 1 load switch 2.
65	L1-2 Operating Position Status	Operating position status input of Bus 1 load switch 2.
66	L1-2 Testing Position Status	Testing position status input of Bus 1 load switch 2.
67	L1-2 Switch Tripping	Tripping fault input of Bus 1 load switch 2.
68	L1-3 Closing Status	Closing status input of Bus 1 load switch 3.
69	L1-3 Operating Position Status	Operating position status input of Bus 1 load switch 3.
70	L1-3 Testing Position Status	Testing position status input of Bus 1 load switch 3.

No.	Item	Description
71	L1-3 Switch Tripping	Tripping fault input of Bus 1 load switch 3.
72	L1-4 Closing Status	Closing status input of Bus 1 load switch 4.
73	L1-4 Operating Position Status	Operating position status input of Bus 1 load switch 4.
74	L1-4 Testing Position Status	Testing position status input of Bus 1 load switch 4.
75	L1-4 Switch Tripping	Tripping fault input of Bus 1 load switch 4.
76	L1-5 Closing Status	Closing status input of Bus 1 load switch 5.
77	L1-5 Operating Position Status	Operating position status input of Bus 1 load switch 5.
78	L1-5 Testing Position Status	Testing position status input of Bus 1 load switch 5.
79	L1-5 Switch Tripping	Tripping fault input of Bus 1 load switch 5.
80	L1-6 Closing Status	Closing status input of Bus 1 load switch 6.
81	L1-6 Operating Position Status	Operating position status input of Bus 1 load switch 6.
82	L1-6 Testing Position Status	Testing position status input of Bus 1 load switch 6.
83	L1-6 Switch Tripping	Tripping fault input of Bus 1 load switch 6.
84	L1-7 Closing Status	Closing status input of Bus 1 load switch 7.
85	L1-7 Operating Position Status	Operating position status input of Bus 1 load switch 7.
86	L1-7 Testing Position Status	Testing position status input of Bus 1 load switch 7.
87	L1-7 Switch Tripping	Tripping fault input of Bus 1 load switch 7.
88	L1-8 Closing Status	Closing status input of Bus 1 load switch 8.
89	L1-8 Operating Position Status	Operating position status input of Bus 1 load switch 8.
90	L1-8 Testing Position Status	Testing position status input of Bus 1 load switch 8.
91	L1-8 Switch Tripping	Tripping fault input of Bus 1 load switch 8.
92	L1-9 Closing Status	Closing status input of Bus 1 load switch 9.
93	L1-9 Operating Position Status	Operating position status input of Bus 1 load switch 9.
94	L1-9 Testing Position Status	Testing position status input of Bus 1 load switch 9.
95	L1-9 Switch Tripping	Tripping fault input of Bus 1 load switch 9.
96	L1-10 Closing Status	Closing status input of Bus 1 load switch 10.
97	L1-10 Operating Position Status	Operating position status input of Bus 1 load switch 10.
98	L1-10 Testing Position Status	Testing position status input of Bus 1 load switch 10.
99	L1-10 Switch Tripping	Tripping fault input of Bus 1 load switch 10.
100	L1-11 Closing Status	Closing status input of Bus 1 load switch 11.

No.	Item	Description
101	L1-11 Operating Position Status	Operating position status input of Bus 1 load switch 11.
102	L1-11 Testing Position Status	Testing position status input of Bus 1 load switch 11.
103	L1-11 Switch Tripping	Tripping fault input of Bus 1 load switch 11.
104	L1-12 Closing Status	Closing status input of Bus 1 load switch 12.
105	L1-12 Operating Position Status	Operating position status input of Bus 1 load switch 12.
106	L1-12 Testing Position Status	Testing position status input of Bus 1 load switch 12.
107	L1-12 Switch Tripping	Tripping fault input of Bus 1 load switch 12.
108	L2-1 Closing Status	Closing status input of Bus 2 load switch 1.
109	L2-1 Operating Position Status	Operating position status input of Bus 2 load switch 1.
110	L2-1 Testing Position Status	Testing position status input of Bus 2 load switch 1.
111	L2-1 Switch Tripping	Tripping fault input of Bus 2 load switch 1.
112	L2-2 Closing Status	Closing status input of Bus 2 load switch 2.
113	L2-2 Operating Position Status	Operating position status input of Bus 2 load switch 21.
114	L2-2 Testing Position Status	Testing position status input of Bus 2 load switch 2.
115	L2-2 Switch Tripping	Tripping fault input of Bus 2 load switch 2.
116	L2-3 Closing Status	Closing status input of Bus 2 load switch 3.
117	L2-3 Operating Position Status	Operating position status input of Bus 2 load switch 3.
118	L2-3 Testing Position Status	Testing position status input of Bus 2 load switch 3.
119	L2-3 Switch Tripping	Tripping fault input of Bus 2 load switch 3.
120	L2-4 Closing Status	Closing status input of Bus 2 load switch 4.
121	L2-4 Operating Position Status	Operating position status input of Bus 2 load switch 4.
122	L2-4 Testing Position Status	Testing position status input of Bus 2 load switch 4.
123	L2-4 Switch Tripping	Tripping fault input of Bus 2 load switch 4.
124	L2-5 Closing Status	Closing status input of Bus 2 load switch 5.
125	L2-5 Operating Position Status	Operating position status input of Bus 2 load switch 5.
126	L2-5 Testing Position Status	Testing position status input of Bus 2 load switch 5.
127	L2-5 Switch Tripping	Tripping fault input of Bus 2 load switch 5.
128	L2-6 Closing Status	Closing status input of Bus 2 load switch 6.
129	L2-6 Operating Position Status	Operating position status input of Bus 2 load switch 6.

No.	Item	Description
130	L2-6 Testing Position Status	Testing position status input of Bus 2 load switch 6.
131	L2-6 Switch Tripping	Tripping fault input of Bus 2 load switch 6.
132	L2-7 Closing Status	Closing status input of Bus 2 load switch 7.
133	L2-7 Operating Position Status	Operating position status input of Bus 2 load switch 7.
134	L2-7 Testing Position Status	Testing position status input of Bus 2 load switch 7.
135	L2-7 Switch Tripping	Tripping fault input of Bus 2 load switch 7.
136	L2-8 Closing Status	Closing status input of Bus 2 load switch 8.
137	L2-8 Operating Position Status	Operating position status input of Bus 2 load switch 8.
138	L2-8 Testing Position Status	Testing position status input of Bus 2 load switch 8.
139	L2-8 Switch Tripping	Tripping fault input of Bus 2 load switch 8.
140	L2-9 Closing Status	Closing status input of Bus 2 load switch 9.
141	L2-9 Operating Position Status	Operating position status input of Bus 2 load switch 9.
142	L2-9 Testing Position Status	Testing position status input of Bus 2 load switch 9.
143	L2-9 Switch Tripping	Tripping fault input of Bus 2 load switch 9.
144	L2-10 Closing Status	Closing status input of Bus 2 load switch 10.
145	L2-10 Operating Position Status	Operating position status input of Bus 2 load switch 10.
146	L2-10 Testing Position Status	Testing position status input of Bus 2 load switch 10.
147	L2-10 Switch Tripping	Tripping fault input of Bus 2 load switch 10.
148	L2-11 Closing Status	Closing status input of Bus 2 load switch 11.
149	L2-11 Operating Position Status	Operating position status input of Bus 2 load switch 11.
150	L2-11 Testing Position Status	Testing position status input of Bus 2 load switch 11.
151	L2-11 Switch Tripping	Tripping fault input of Bus 2 load switch 11.
152	L2-12 Closing Status	Closing status input of Bus 2 load switch 12.
153	L2-12 Operating Position Status	Operating position status input of Bus 2 load switch 12.
154	L2-12 Testing Position Status	Testing position status input of Bus 2 load switch 12.
155	L2-12 Switch Tripping	Tripping fault input of Bus 2 load switch 12.
156	Loop Closing Mode	Enable controller enter the loop closing mode.
157	Remote Control Mode	The PC remote control mode is available when input is active.
158	S1 Power Abnormal Input	Power abnormal status of external input.
159	S2 Power Abnormal	Power abnormal status of external input.

No.	Item	Description
	Input	
160	Auto Control Input	The auto mode can be performed when this function is configured and active.
161-169	Reserved	

8.3.2 OUTPUT PORTS FUNCTION

Table 19 – Output Ports Function Description

No.	Items	Description
0	Not Used	Invalid
1	Custom Combined 1	Output status please to see corresponding custom combination.
2	Custom Combined 2	
3	Custom Combined 3	
4	Custom Combined 4	
5	Custom Combined 5	
6	Custom Combined 6	
7	Auto Trans./Restore	Output in auto trans./restore mode.
8	Auto Trans./Non Restore	Output in auto trans./non restore mode.
9	S1&S2 Abnormal	Both S1 and S2 are abnormal.
10	Running Output	Output as soon as it is powered up.
11	Common Alarm	It includes fault alarm and warn alarm.
12	Common Fault Alarm	It includes “Transfer Fault” alarm, “Forced Open Fault” alarm and “Tripping” alarm.
13	Common Warn Alarm	It includes “Forced Open” warning alarm.
14	Transfer Fault	It includes “QS1 Fail to Close” alarm, “QS1 Fail to Open” alarm, “QS2 Fail to Close” alarm, “QS2 Fail to Open” alarm, “QTIE Fail to Close” alarm, “QTIE Fail to Open” alarm.
15	Audible Alarm	Action when common alarm occurs. Can be connected annunciator externally. When “alarm mute” input is active or 60s delay has expired, it can remove the alarm.
16	Electric Interlock Release	Electric interlock release signal outputs when ATS is synchronously parallel transferring.
17	Genset Start Delay	Output when genset start is delay.
18	Genset Stop Delay	Output when genset stop is delay.
19	Elevator Control	Output before the load disconnect or switch transfer. Used to control the running elevator stop at the nearest floor until the switch transfer is terminated.
20	S1 Unload Output	Output when QS1 is not closed.
21	S2 Unload Output	Output when QS2 is not closed.
22	Reserved	
23	S1 Available	Output when S1 power is normal.
24	S1 Unavailable	Output when S1 power is abnormal.
25	S2 Available	Output when S2 power is normal.
26	S2 Unavailable	Output when S2 power is abnormal.
27	S1 Overcurrent	Output when S1 is over current.
28	S2 Overcurrent	Output when S2 is over current.
29	Local Mode	Output when the genset is in Local mode.
30	Auto Mode	Output when the genset is in Auto mode.
31	Manual Mode	Output when the genset is in Manual mode.
32	Genset Start	Control the genset to start.

No.	Items	Description
33	Reserved	
34	QS1 Close Control	Control the QS1 switch closing.
35	QS1 Open Control	Control the QS1 switch opening.
36	QS2 Close Control	Control the QS2 switch closing.
37	QS2 Open Control	Control the QS2 switch opening.
38	S1 PT BW	Output when S1 PT secondary circuit broken.
39	S2 PT BW	Output when S2 PT secondary circuit broken.
40	NEL1 Off-load Control	Control NEL unloading when output is active and return (onload) after unloading while output is inactive.
41	NEL2 Off-load Control	
42	NEL3 Off-load Control	
43	QTIE Closed Input	The close status of QTIE switch.
44	Reserved	
45	QS1 Closed Input	The close status of S1 switch.
46	QS2 Closed Input	The close status of S2 switch.
47	Reserved	
48	Reserved	
49	Remote Control	Remote control the output via communication command.
50	Input 1 Status	Aux. Input status.
51	Input 2 Status	
52	Input 3 Status	
53	Input 4 Status	
54	Input 5 Status	
55	Input 6 Status	
56	Input 7 Status	
57	Input 8 Status	
58	Input 9 Status	
59	Input 10 Status	
60	Input 11 Status	
61	Input 12 Status	
62	Reerved	
63	Reserved	
64	S1 Blackout	S1 power supply status
65	S1 Over Volt	
66	S1 Under Volt	
67	S1 Over Freq	
68	S1 Under Freq	
69	S1 Loss of Phase	
70	S1 Phase Seq Wrong	
71	Reserved	
72	Reserved	
73	S2 Blackout	S2 power supply status
74	S2 Over Volt	
75	S2 Under Volt	
76	S2 Over Freq	

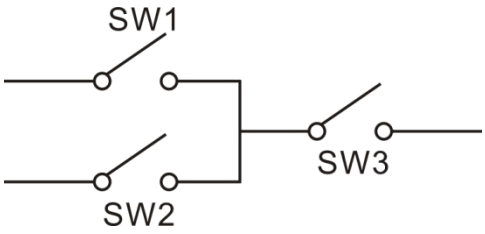
No.	Items	Description
77	S2 Under Freq	
78	S2 Loss of Phase	
79	S2 Phase Seq Wrong	
80	Reserved	
81	Reserved	
82	Sync. Failure	
83	Waiting for Sync.	
84	Transferring	Output during the switch transfer process.
85	Reserved	
86	Switch Parallel	Output when the switch abnormal parallel alarms.
87	Scheduled Not Run	Output when in scheduled not run duration.
88	Scheduled Run	Output when in scheduled run duration.
89	Breaker Trip Fault	Output when QS1, QS2 or QTIE trip fault.
90	QS1 Trip Fault	Output when QS1 trip fault.
91	QS2 Trip Fault	Output when QS2 trip fault.
92	Reserved	
93	QTIE Trip Fault	Output when QTIE trip fault.
94	QTIE Close Control	Control QTIE closeing.
95	QTIE Open Control	Control QTIE opening.
96	L1 External Device Closing	When the load stepwise transfer mode is the external control, the Bus 1 load switch closing outputs.
97	L1 External Device Opening	When the load stepwise transfer mode is the external control, the Bus 1 load switch opening outputs.
98	L2 External Device Closing	When the load stepwise transfer mode is the external control, the Bus 2 load switch closing outputs.
99	L2 External Device Opening	When the load stepwise transfer mode is the external control, the Bus 2 load switch opening outputs.
100	L1-1 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 1 closing outputs.
101	L1-1 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 1 opening outputs.
102	L1-2 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 2 closing outputs.
103	L1-2 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 2 opening outputs.
104	L1-3 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 3 closing outputs.
105	L1-3 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 3 opening outputs.
106	L1-4 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 4 closing outputs.
107	L1-4 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 4 opening outputs.
108	L1-5 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 5 closing

No.	Items	Description
		outputs.
109	L1-5 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 5 opening outputs.
110	L1-6 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 6 closing outputs.
111	L1-6 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 6 opening outputs.
112	L1-7 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 7 closing outputs.
113	L1-7 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 7 opening outputs.
114	L1-8 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 8 closing outputs.
115	L1-8 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 8 opening outputs.
116	L1-9 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 9 closing outputs.
117	L1-9 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 9 opening outputs.
118	L1-10 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 10 closing outputs.
119	L1-10 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 10 opening outputs.
120	L1-11 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 11 closing outputs.
121	L1-11 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 11 opening outputs.
122	L1-12 Closing Output	Unit stepwise transfer controls, Bus 1 load switch 12 closing outputs.
123	L1-12 Opening Output	Unit stepwise transfer controls, Bus 1 load switch 12 opening outputs.
124	L2-1 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 1 closing outputs.
125	L2-1 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 1 opening outputs.
126	L2-2 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 2 closing outputs.
127	L2-2 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 2 opening outputs.
128	L2-3 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 3 closing outputs.
129	L2-3 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 3 opening outputs.
130	L2-4 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 4 closing

No.	Items	Description
		outputs.
131	L2-4 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 4 opening outputs.
132	L2-5 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 5 closing outputs.
133	L2-5 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 5 opening outputs.
134	L2-6 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 6 closing outputs.
135	L2-6 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 6 opening outputs.
136	L2-7 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 7 closing outputs.
137	L2-7 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 7 opening outputs.
138	L2-8 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 8 closing outputs.
139	L2-8 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 8 opening outputs.
140	L2-9 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 9 closing outputs.
141	L2-9 Opening Output	Unit cascade transfer controls, Bus 2 load switch 9 opening outputs.
142	L2-10 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 10 closing outputs.
143	L2-10 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 10 opening outputs.
144	L2-11 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 11 closing outputs.
145	L2-11 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 11 opening outputs.
146	L2-12 Closing Output	Unit stepwise transfer controls, Bus 2 load switch 12 closing outputs.
147	L2-12 Opening Output	Unit stepwise transfer controls, Bus 2 load switch 12 opening outputs.
148 – 159	Reserved	

8.3.3 CUSTOM COMBINED

Defined combination output is composed by 3 parts, OR condition output SW1, OR condition output SW2, AND condition output SW3.



SW1 or SW2 is **TRUE**, while SW3 is **TRUE**, Defined combination output is active;

SW1 and SW2 are **FALSE**, or SW3 is **FALSE**, Defined combination output is deactivated.

NOTE1: SW1, SW2, SW3 can be set as any contents except for "defined combination output" in the output setting.

NOTE2: 3 parts of defined combination output (SW1, SW2, SW3) couldn't include or recursively include themselves.

Example,

Contents of OR condition output SW1: input port 1 is active;

Active type of OR condition output SW1: normally open output (disconnect when inactive);

Contents of OR condition output SW2, input port 2 is active;

Active type of OR condition output SW2: normally open output (disconnect when inactive);

Contents of AND condition output SW3: input port 3 is active;

Active type of OR condition output SW3: normally open output (disconnect when inactive);

When input port 1 active or input port 2 active, if input port 3 is active, Defined combination output is outputting; If input port 3 inactive, Defined combination output is not outputting;

When input port 1 inactive and input port 2 inactive, whatever input port 3 is active or not, defined combination output is not outputting.

8.3.4 ELECTRIC INTERLOCK RELEASE

When controller is in synchronous parallel mode, relay automatically closes, electric interlock releases; when controller is in non-parallel mode or local mode, relay not output, electric interlock is active.

8.4 DEFINITE TIME DELAY AND INVERSE DEFINITE MINIMUM TIME SETTING

Definite Time: overcurrent delay is definite time delay. Different overcurrent value has corresponding delay.

Inverse Definite Minimum Time(IDMT): overcurrent delay decrease with the increase of overcurrent. Different overcurrent value has corresponding delay.

IDMT formula:

$T = t / ((IA/IT)-1)^2$

T: Overcurrent delay (second)

t: Timing multiplier ratio

IA: Current max. load current (L1/L2/L3)

IT: Overcurrent setting value

Example：

t = 36

IA = 550A

IT =500A

Conclusion: T = 3600s(1 hour)

9 HISTORICAL RECORDS

On the main screen press ⚙/OK key and select **Historical Records**, and then press ⚙/OK key again, the screen will show the historical records interface.

Each record includes:

Record date and time

Record type

Event log

S1 power supply status

S2 power supply status

S1 3-phase voltage

S2 3-phase voltage

S1 frequency

S2 frequency

S1 3-phase Current

S2 3-phase Current

S1 total active power

S2 total active power

S1 power factor

S2 power factor

Maximum pieces of historical record are 200. The first record is latest, and users could check every record by dredge up/down. The latest record will cover the oldest one when records amount exceeds 200.

Event log type includes: Action Event, Operation Event, Warn Event and Fault Event. All fault event actions are fault alarm while all warn event actions are warning alarms.

Table 20 – Action Events List

No.	Action Events	Description
1.	Closing QS1	Record when QS1 close relay is activated.
2.	Closing QS2	Record when QS2 close relay is activated.
3.	Opening QS1	Record when QS1 open relay is activated.
4.	Opening QS2	Record when QS2 open relay is activated.
5.	Closing QTIE	Record when QTIE close outputs.
6.	Opening QTIE	Record when QTIE open outputs.
7.	QS1 Synchronous Closing	Record when QS1 synchronously close.
8.	QS2 Synchronous Closing	Record when QS2 synchronously close.
9.	QTIE Synchronous Closing	Record when QTIE synchronously close.
10.	Auto Mode	Record when genset is transferred to auto mode.
11.	Manual Mode	Record when genset is transferred to manual mode.
12.	Local Mode	Record when genset is transferred to local mode.

No.	Action Events	Description
13.	NEL1 Trip	Record when NEL1 unloading control outputs.
14.	NEL2 Trip	Record when NEL2 unloading control outputs.
15.	NEL3 Trip	Record when NEL3 unloading control outputs.
16.	Genset Start	Record when genset start signal outputs.
17.	Genset Stop	Record when genset start signal disconnect outputs.
18.	L1-1~L1-12 Smart Unloading	Record when Bus 1 load switch 1~12 is smart unloading.
19.	L2-1~L2-12 Smart Unloading	Record when Bus 2 load switch 1~12 is smart unloading.

Table 21 – Operation Events List

No.	Operation Events	Description
1	Manual OOO Key	Press this key to execute OOO action in manual mode.
2	Manual OOI Key	Press this key to execute OOI action in manual mode.
3	Manual IOO Key	Press this key to execute IOO action in manual mode.
4	Manual IIO Key	Press this key to execute IIO action in manual mode.
5	Manual OII Key	Press this key to execute OII action in manual mode.
6	Manual IOI Key	Press this key to execute IOI action in manual mode.
7	Remote OOO Key	Using remote communication command to execute OOO action in manual mode.
8	Remote OOI Key	Using remote communication command to execute OOI action in manual mode.
9	Remote IOO Key	Using remote communication command to execute IOO action in manual mode.
10	Remote IIO Key	Using remote communication command to execute IIO action in manual mode.
11	Remote OII Key	Using remote communication command to execute OII action in manual mode.
12	Remote IOI Key	Using remote communication command to execute IOI action in manual mode.

10 BLACK BOX RECORDS

On the main screen press ⚙/OK key and select **Black Box Records**, and then press ⚙/OK key again, the screen will show the black box records interface.

Maximum pieces of black box record are 5. Every event records total 60s (before 50s and after 10s) data information of this event, and record once per second. There are total 60 groups of data.

Each record includes:

Record date and time

Record type

Event log

S1 power supply status

S2 power supply status

S1 3-phase voltage

S2 3-phase voltage

S1 frequency

S2 frequency

S1 3-phase current

S2 3-phase current

S1 total active power

S2 total active power

S1 power factor

S2 power factor

Black box is loop recorded, the latest record will cover the oldest one when records amount exceeds 5. The first record is latest. Users could switch to the next record by pressing set button, and check details by pressing up/down button.

Record type: the action event of close/open switching in auto mode.

Table 22 – Action Events List

No.	Action Events	Description
1	Auto Action OOO	In auto mode, breaker transfers to OOO based on the present status and settings.
2	Auto Action OOI	In auto mode, breaker transfers to OOI based on the present status and settings.
3	Auto Action IOO	In auto mode, breaker transfers to IOO based on the present status and settings.
4	Auto Action IIO	In auto mode, breaker transfers to IIO based on the present status and settings.
5	Auto Action OII	In auto mode, breaker transfers to OII based on the present status and settings.
6	Auto Action IOI	In auto mode, breaker transfers to IOI based on the present status and settings.
7	Auto Action OIO	In auto mode, breaker transfers to OIO based on the present status and settings.

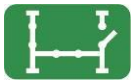
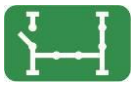
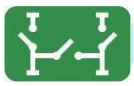
11 SWITCH OPERATION

11.1 MANUAL OPERATION

Manual mode is selected by pressing the  key; a LED beside it will illuminate to confirm the operation.

It will start to transfer immediately after pressing “Switch Key”. During the process, corresponding lamps will flash, and then the lamp will be normally illuminated when transfer is done. If fail to close or fail to open occurs in the process, the controller will alarm (Transfer key is still active and the operation can be done again).

Table 23 – Manual Transfer Keys

Icon	Key Name	Description
	IOI	After pressing this key, QS1 will close, QTIE will open, and QS2 will close, which means LOAD1 will be powered by S1 and LOAD2 will be powered by S2.
	IIO	After pressing this key, QS1 will close, QTIE will close, and QS2 will open, which means LOAD1 and LOAD2 will be powered by S1.
	OII	After pressing this key, QS1 will open, QTIE will close, and QS2 will close, which means LOAD1 and LOAD2 will be powered by S2.
	IOO	After pressing this key, QS1 will close, QTIE will open, and QS2 will open, which means LOAD1 will be powered by S1 and LOAD2 will be disconnected.
	OOI	After pressing this key, QS1 will open, QTIE will open, and QS2 will close, which means LOAD2 will be powered by S2 and LOAD1 will be disconnected.
	OOO	After pressing this key, QS1 will open, QTIE will open, and QS2 will open, which means LOAD1 and LOAD2 will be disconnected.

11.2 AUTOMATIC OPERATION

Auto mode is selected by pressing the  key; a LED beside it will illuminate to confirm the operation.

In auto mode, the controller will transfer automatically to ensure power supply for LOAD1 and LOAD2 according to S1/S2 status, master status and Auto Trans/Restore status.

Table 24 – Auto Transfer Logic

Power Status	Switch and Load Status	S1&S2 Master	S1 Master	S2 Master
S1 Normal S2 Normal	Switch Status	Status IOI QS1 Close QTIE Open QS2 Close	Status IIO QS1 Close QTIE Close QS2 Open	Status OII QS1 Open QTIE Close QS2 Close
	Load Status	LOAD1 powered by S1 LOAD2 powered by S2	LOAD1 and LOAD2 powered by S1	LOAD1 and LOAD2 powered by S2
S1 Normal S2 Abnormal	Switch Status	Status IIO QS1 Close QTIE Close QS2 Open		
	Load Status	LOAD1 and LOAD2 powered by S1		
S1 Abnormal S2 Normal	Switch Status	Status OII QS1 Open QTIE Close QS2 Close		
	Load Status	LOAD1 and LOAD2 powered by S2		
S1 Abnormal S2 Abnormal (With under volt trip function)	Switch Status	Status OOO QS1 Open QTIE Open QS2 Open		
	Load Status	LOAD1 and LOAD2 power off		

During the transferring process, if fail to close or close inhibit occurs, the corresponding switch will not close, and other switches that can execute close action will supply power to LOAD1/LOAD2 in prior.

11.3 LOCAL MODE OPERATION

Local mode can be controlled by digital input ports (external knob). When it is active, controller only display without control, electric interlock release output port is inactive, electric interlock is active (inhibit parallel).

11.4 LOOP CLOSING MODE OPERATION

The loop closing mode is controlled via programmable input port. The controller detects that S1 and S2 supplies at the same time and keeps the set value of sync holding time, and then performs the synchronous parallel closing to maintain the continuous running. The reverse power will be detected during operation in real-time and the closing switch will be cut off when the reverse power occurs.

12 PT BREAK DETECTION

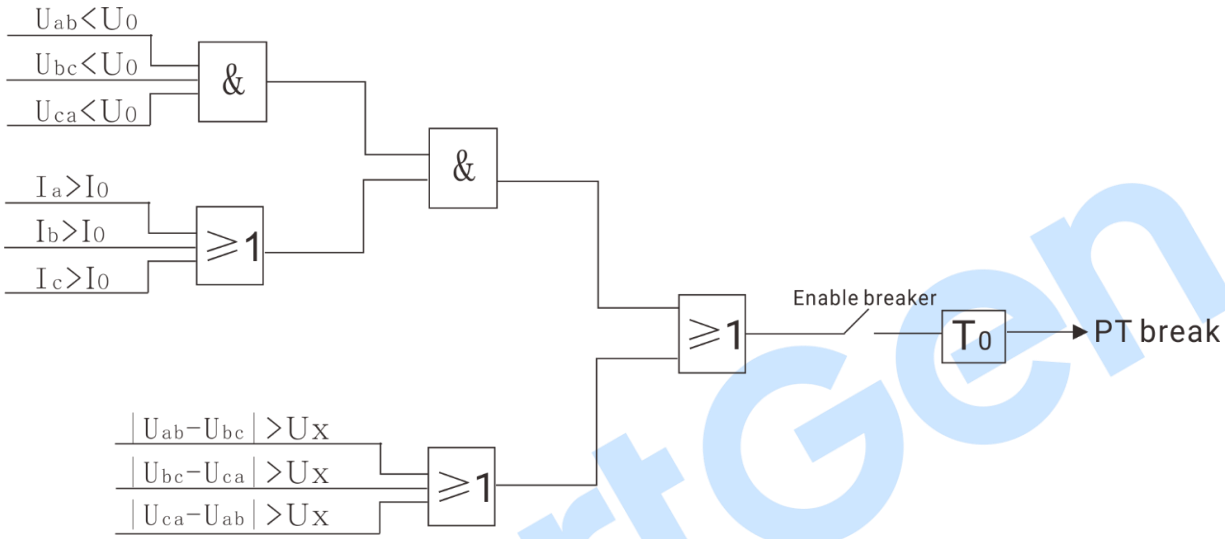


Fig.2 – Logic Diagram for PT Break Detection

Illustration:

U_0 is set line voltage value (max. line voltage multiple*rated voltage);

I_0 is set current value (max. current multiple*rated current);

U_x is set line voltage amplitude difference (line voltage amplitude difference multiple*rated voltage);

T_0 is PT break detection delay;

U_r is set PT break reset voltage value (break reset voltage multiple*rated voltage).

For example: 3P3W system, rated voltage is 10500V, rated current is 500A.

U_0 = 0.2 *10500 = 2100V

I_0 = 0.02 * 500 = 10A

U_x = 0.2 *10500 = 2100V

T_0 = 3s

U_r = 0.9 *10500 = 9450V

When the current max. line voltage is less than U_0 (2100V), and min. current is higher than I_0 (10A), after delay T_0 (3s), PT break warning occurs and voltage protection is inactive.

When line voltage difference of any two lines is higher than U_x (2100V), after delay T_0 (3s), PT break warning occurs and voltage protection is inactive.

If PT line is broken, when the current min. line voltage is higher than U_r (9450V), PT break warning disappears.

13 NEL CONTROL

13.1 ILLUSTRATION

Non-essential Load----NEL is the abbreviation, which refers to the load can be unloaded first when genset power is insufficient.

The controller can control the NEL1, NEL2 and NEL3 to trip separately. The order of the essentiality is: NEL3 > NEL2 > NEL1.

13.2 AUTO OPERATION

NEL trip enable: If the genset power has exceeded the NEL trip value, after the trip delay, NEL1 will trip earliest, and then is NEL2, NEL3;

NEL auto reconnection enable: If the genset power has fallen below the reconnection set value, after the reconnection delay, NEL3 will reconnect earliest, and then is NEL2, NEL1.

t1: NEL Trip Delay
t2: NEL Reconnection Delay

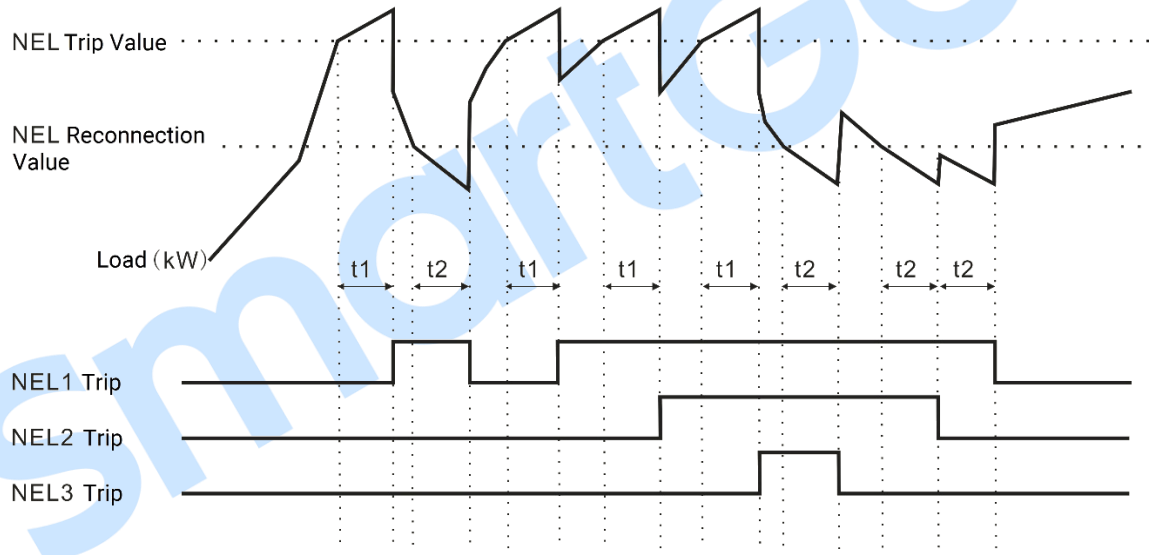


Fig.3 – NEL Trip

13.3 MANUAL OPERATION

If NEL manual trip input is active (earthed falling edge is active), NEL1 will trip without delay; If this input is active again, NEL2 will trip; If this input is active for the third time, NEL3 will trip;

If NEL manual reconnection input is active (earthed falling edge is active), NEL3 will reconnect without delay; If this input is active again, NEL2 will reconnect; If this input is active for the third time, NEL1 will reconnect. During this process, whether genset power is lower than NEL reconnection value is detected. If the genset power has fallen below the value, then this input is active; if it doesn't, this input is deactivated.

NOTE4: When auto trip and reconnection are enabled, manual operation is still active.

14 LOAD STEPWISE TRANSFER AND SMART UNLOADING

14.1 LOAD STEPWISE TRANSFER

Load stepwise transfer: when load transfers the on-load power supply, the stepwise unloading will take the priority in order, and the stepwise loading will be performed after the power supply conversion is done. Our controller will divide the load into two parts by bus, and each part of load can set up to 12 load switches. Each load can be independently controlled according to the power supply conversion.

The priority of stepwise transfer: the different load switches of each load can be set as the same priority, the smaller number the higher priority, and the same priority will act at the same time during loading/unloading.

For example: when ATS switches from 101 to 110, the stepwise transfer will perform the load switch unloading with the highest priority of Bus 2 until all load switches unloading are finished of the Bus 2. After ATS conversion, the switch loading of Bus 2 with the highest priority will be performed until all the switches loading of Bus 2 are finished, and then exit the stepwise transfer process.

NOTE5: Ther is no stepwise transfer act during sync. transfer.

14.2 SMART UNLOADING

Smart unloading: during the controller operating, it will monitor the current load rate of two buses, when any current load rate is greater than the set smart unloading threshold value, the unloading will be performed firstly with the lowest priority. After the unloading delay, if the load rate is still greater than the setting value, the unloading will be performed with the lower priority until all the unloadings are finished of the bus or the load rate is less than the setting unloading threshold value. When QTIE closes and the unloading of the two buses with the same priority will be performed at the same time.

Load restores to loading: during the controller operating, it will monitor the current load rate of two buses, when any current load rate is greater than the set loading threshold value, the reloading of the unloaded ones with the highest priority will be performed. After the loading delay, if the load rate is still less than the loading threshold value, the loading will be performed with the lower priority until all the loadings are finished or the load rate is greater than the setting loading threshold value. When QTIE closes and the loading of the two buses with the same priority will be performed at the same time.

15 COMMUNICATION CONFIGURATION AND CONNECTION

15.1 ILLUSTRATION

HAT821SI Dual Power Bus Tie Controller equips with 2 RS485 communication ports, 1 USB device port. RS485 communication port enables the connection of open structure LAN. It uses Modbus protocol via PC or software operated on data acquisition system, which can provide a simple and practical management plan of dual power ATS transfer for factories, telecom, industrial and civil buildings, and achieve “remote control, remote measuring, remote communication” functions.

More information of Communication Protocol, please refer to *HAT821SI Communication Protocol*.

15.2 RS485 COMMUNICATION

Communication protocol: ModBus-RTU.

Communication parameters:

Module address	1 (range: 1~254)
Baud rate	9600bps (2400/4800/9600/19200bps)
Data bit	8-bit
Parity bit	No (No parity, odd parity, even parity)
Stop bit	2 bits (1-bit or 2-bit)

15.3 EXPANSION INPUT/OUTPUT MODULE COMMUNICATION

The RS485-2 of HAT821SI Dual Power Bus Tie Controller can communicate with input/output module to realize the extended function of the input/output port.

When HAT821SI expansion module enables, the dip switch of input/output port is set as the same address of expanded communication module of HAT821SI, i.e the function of the input/output module can be configured through HAT821SI, the status of the input module can be obtained via RS485 communication, and the relay output of the output module will be controlled.

Combined with DIN16A-2 and DOUT16B-2, HAT821SI can realize up to 24 load switches stepwise transfer. At the baud rate of 9600bps, the application of no more than 1km can be realized theoretically.

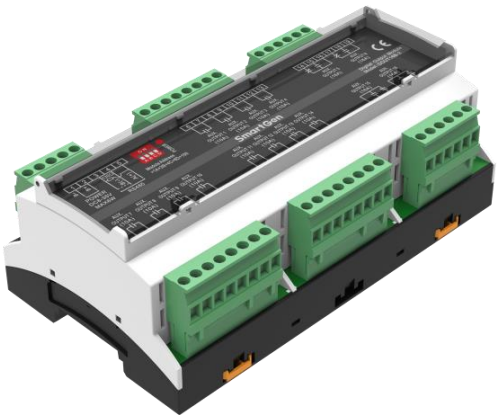


Fig.4 – DOUT16B-2 Digital Output Module

Fig.5 – DIN16A-2 Digital Input Module

15.4 TERMINAL RESISTOR

At both ends of the linear network (on the two communication ports furthest apart), it is necessary to connect 120Ω terminal resistor in parallel on a pair of communication lines. According to the transmission line theory, the terminal resistor can absorb reflected waves on the network, effectively enhancing the signal strength. The value of two terminal resistors in parallel should be approximately equal to the characteristic impedance of the transmission line at the communication frequency.

A regular RS485 network usually uses terminal resistor. It can also be not used in the case of network connection line is very short, temporary or laboratory test.

15.5 USB COMMUNICATION

There is a D-type USB interface which can be used to connect PC for software parameter setting and program upgrading.

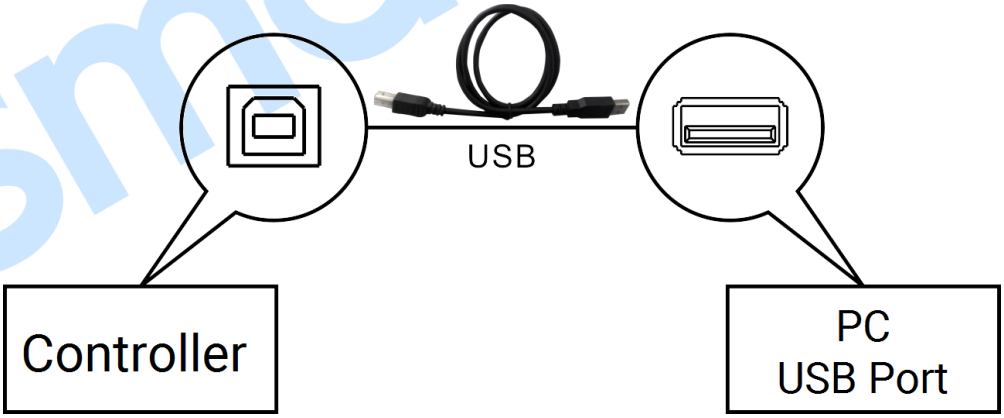


Fig.6 – USB Connection Diagram

16 TERMINALS

16.1 TERMINAL DESCRIPTION

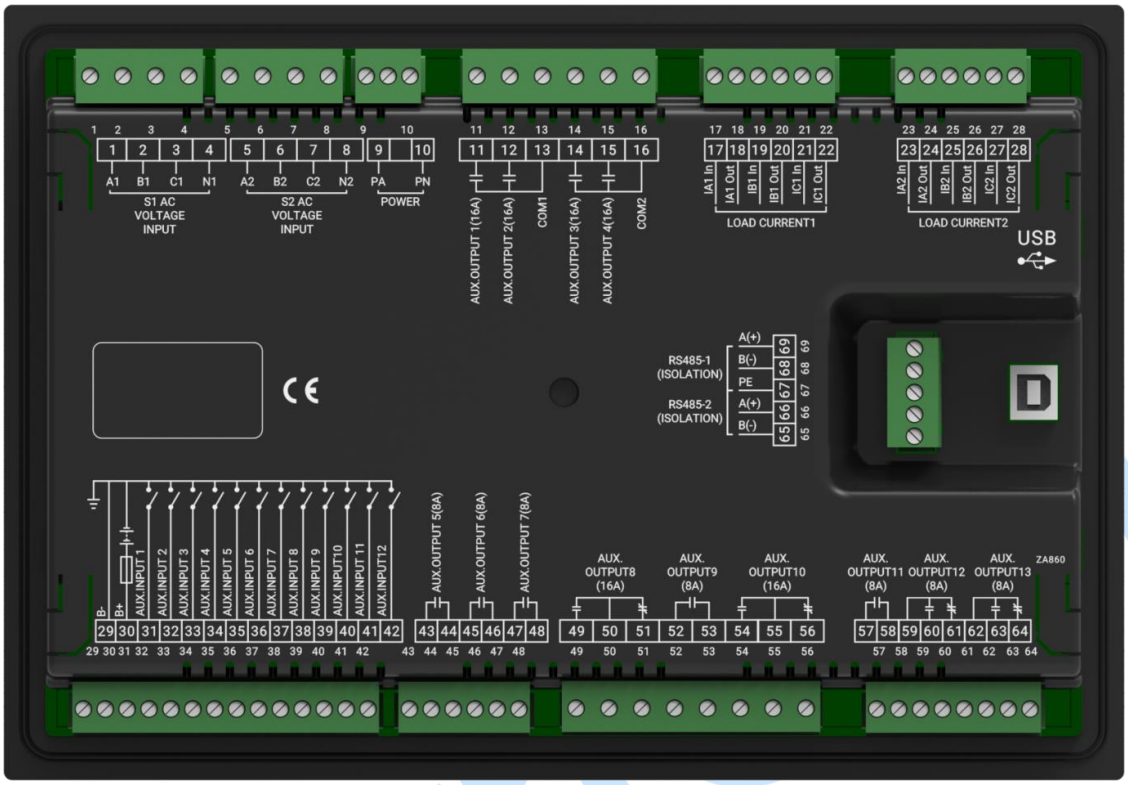


Fig.7 – Controller Rear Panel Drawing

Table 25 – Inputs/Outputs Function Description

No.	Items	Description	Remark
1	A1	S1 AC 3P4W Voltage Input	For single phase, only connects A1, N1.
2	B1		
3	C1		
4	N1		
5	A2	S2 AC 3P4W Voltage Input	For single phase, only connects A2, N2.
6	B2		
7	C2		
8	N2		
9	PA	POWER Supply	Supply power can be connected to AC(90~305)V or DC110V, DC220V.
10	PN		
11	AUX. OUTPUT1	Aux. Output Port 1	Default: QS1 Close Control. Volts free relay; Normally open output. Capacity: 16A AC250V.
12	AUX. OUTPUT2	Aux. Output Port 2	Default: QS1 Open Control. Volts free relay; Normally open output. Capacity: 16A AC250V.
13	COM	Common port	Common port of AUX. OUTPUT1, 2.

No.	Items	Description	Remark
14	AUX. OUTPUT3	Aux. Output Port 3	Default: QS2 Close Control. Volts free relay Normally open/close output. Capacity: 16A AC250V.
15	AUX. OUTPUT4	Aux. Output Port 4	Default: QS2 Open Control. Volts free relay; Normally open/close output. Capacity: 16A AC250V.
16	COM	Common port	Common port of AUX. OUTPUT3, 4.
17	IA1 In	1# CT secondary A phase current connected	1# current.
18	IA1 Out		
19	IB1 In	1# CT secondary B phase current connected	
20	IB1 Out		
21	IC1 In	1# CT secondary C phase current connected	
22	IC1 Out		
23	IA2 In	2# CT secondary A phase current connected	2# current.
24	IA2 Out		
25	IB2 In	2# CT secondary B phase current connected	
26	IB2 Out		
27	IC2 In	2# CT secondary C phase current connected	
28	IC2 Out		
29	B-	Connects genset starting battery negative	Module ground terminal.
30	B+	When needs to starting genset, this terminal is connected to genset starting battery positive	DC(8~60)V, controller power supply.
31	AUX. INPUT 1	Aux. Input Port 1	Default: S1 Closed Input. Grounding active.
32	AUX. INPUT 2	Aux. Input Port 2	Default: S2 Closed Input. Grounding active.
33	AUX. INPUT 3	Aux. Input Port 3	Default: QTIE Close Input. Grounding active.
34	AUX. INPUT 4	Aux. Input Port 4	Default: Forced Open. Grounding active.
35	AUX. INPUT 5	Aux. Input Port 5	Default: Not Used. Grounding active.
36	AUX. INPUT 6	Aux. Input Port 6	Default: Not Used. Grounding active.
37	AUX. INPUT 7	Aux. Input Port 7	Default: Not Used. Grounding active.
38	AUX. INPUT 8	Aux. Input Port 8	Default: Not Used. Grounding active.
39	AUX. INPUT 9	Aux. Input Port 9	Default: Not Used. Grounding active.
40	AUX. INPUT 10	Aux. Input Port 10	Default: Not Used. Grounding active.
41	AUX. INPUT 11	Aux. Input Port 11	Default: Not Used. Grounding active.
42	AUX. INPUT 12	Aux. Input Port 12	Default: Not Used. Grounding active.
43	AUX. OUTPUT 5	Aux. Output Port 5	Default: QTIE Close Control. Volts free relay; Normally Open output. Capacity: 8A 250V.
44			

No.	Items	Description		Remark
45	AUX. OUTPUT 6	Aux. Output Port 6		Default: QTIE Open Control. Volts free relay; Normally Open output. Capacity: 8A 250V.
46				
47	AUX. OUTPUT 7	Aux. Output Port 7		Default: Electrical interlock release.. Volts free relay; Normally Open output. Capacity: 8A 250V.
48				
49	AUX. OUTPUT 8	N/O	Aux. Output Port 8	Default: Electrical interlock release. Volts free relay; Normally Open/Close output. Capacity: 16A 250V.
50		COM		
51		N/C		
52	AUX. OUTPUT 9	Aux. Output Port 9		Default: Electrical interlock release. Volts free relay; Normally Open output. Capacity: 8A 250V.
53				
54	AUX. OUTPUT 10	N/O	Aux. Output Port 10	Default: Not Used. Volts free relay; Normally Open/Close output. Capacity: 16A 250V.
55		COM		
56		N/C		
57	AUX. OUTPUT 11	Aux. Output Port 11		Default: Not Used. Volts free relay; Normally Open output. Capacity: 8A 250V.
58				
59	AUX. OUTPUT 12	COM	Aux. Output Port 12	Default: Not Used. Volts free relay; Normally Open output. Capacity: 8A 250V.
60		N/O		
61		N/C		
62	AUX. OUTPUT 13	COM	Aux. Output Port 13	Default: Not Used. Volts free relay; Normally Open output. Capacity: 8A 250V.
63		N/O		
64		N/C		
65	RS485-2 B(-)	RS485-2 Communication Port		120Ω impedance matched resistor should be connected externally according to network situation.
66	RS485-2 A(+)			
67	PE	Ground terminal of communication port		
68	RS485-1 B(-)	RS485-1 Communication Port		120Ω impedance matched resistor should be connected externally according to network situation.
69	RS485-1 A(+)			
USB	USB	D-type USB Communication Port		Parameters setting and program upgrading via PC.

NOTE6: When the external line of digital input exceeds 5m, it is recommended to extend the input line through the external relay.

16.2 CONTROLLER AC/DC SUPPLY DESCRIPTION

16.2.1 POWER SUPPLY

Controller has independent power supply port. Power supply can be connected to AC(90~305)V or DC110V, DC220V.

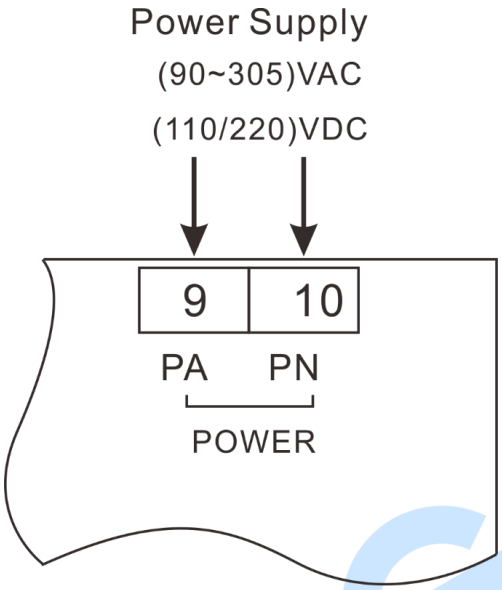


Fig.8 – Power Supply Diagram

16.2.2 DC SUPPLY

Controller has DC supply function, supply range is (8~60)VDC.

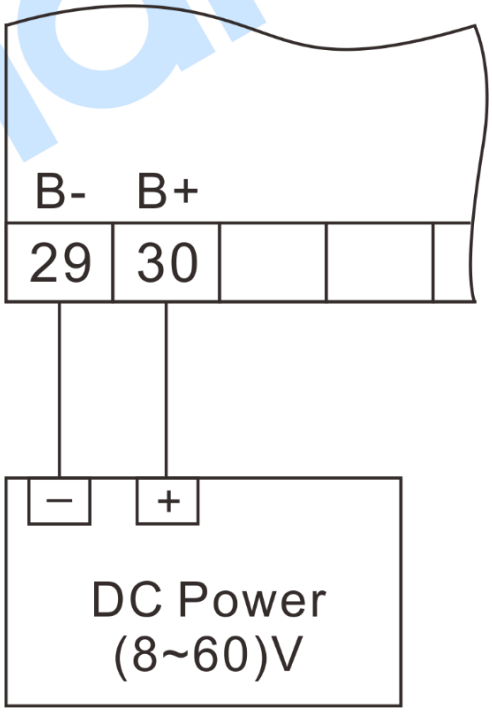


Fig.9 – DC Supply Diagram

17 TYPICAL APPLICATION DIAGRAM

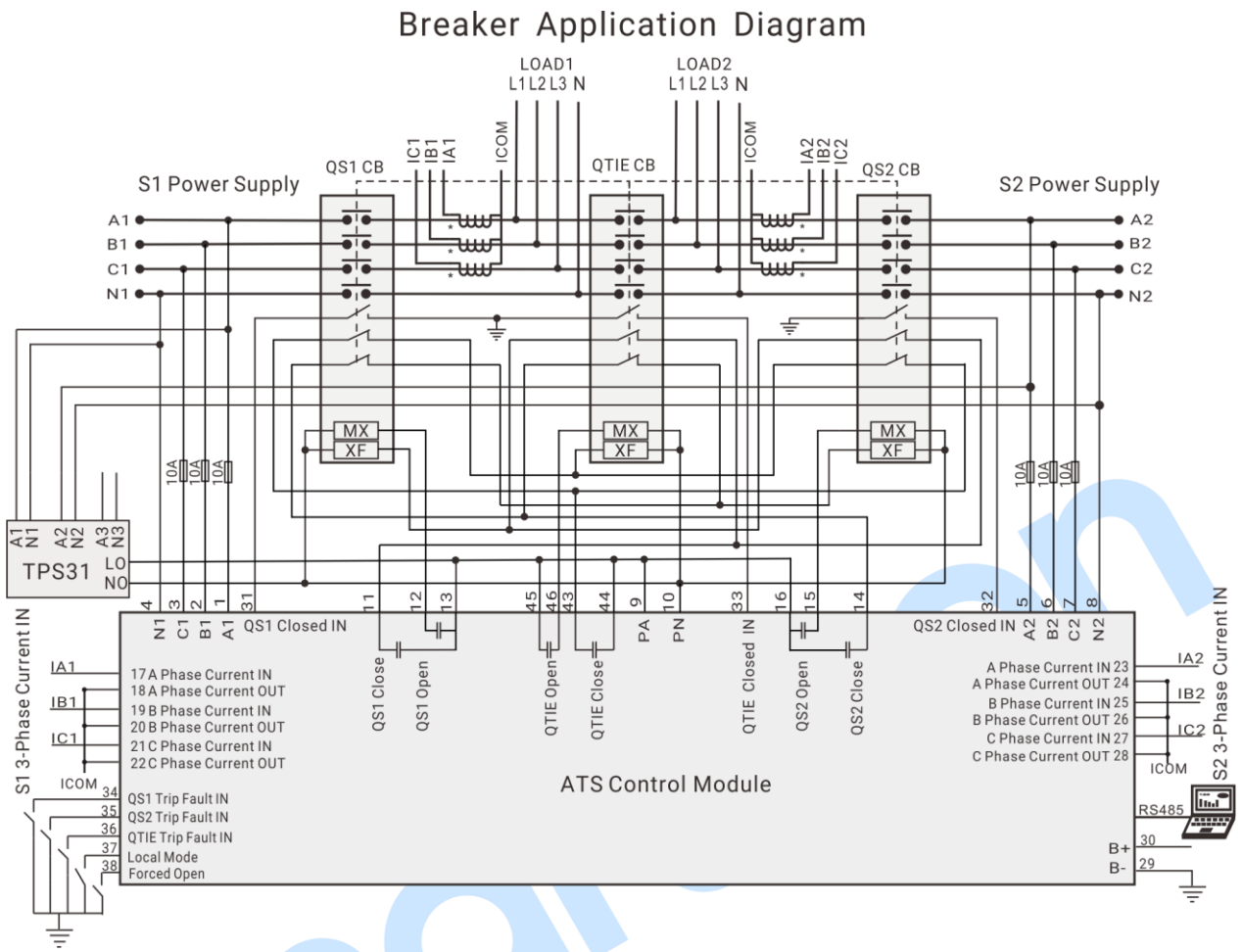


Fig.10 – Breaker Application Diagram

MX: Open Relay; XF: Close Relay.

Table 26 – Corresponding Settings

Partial Parameters Setting	
Aux. Output 1	QS1 Close
Aux. Output 2	QS1 Open
Aux. Output 3	QS2 Close
Aux. Output 4	QS2 Open
Aux. Output 5	QTIE Close
Aux. Output 6	QTIE Open
Aux. Input 1	QS1 Closed Input
Aux. Input 2	QS2 Closed Input
Aux. Input 3	QTIE Closed Input
Aux. Input 4	QS1 Trip Fault
Aux. Input 5	QS2 Trip Fault
Aux. Input 6	QTIE Trip Fault
Aux. Input 7	Local Mode
Aux. Input 8	Forced Open

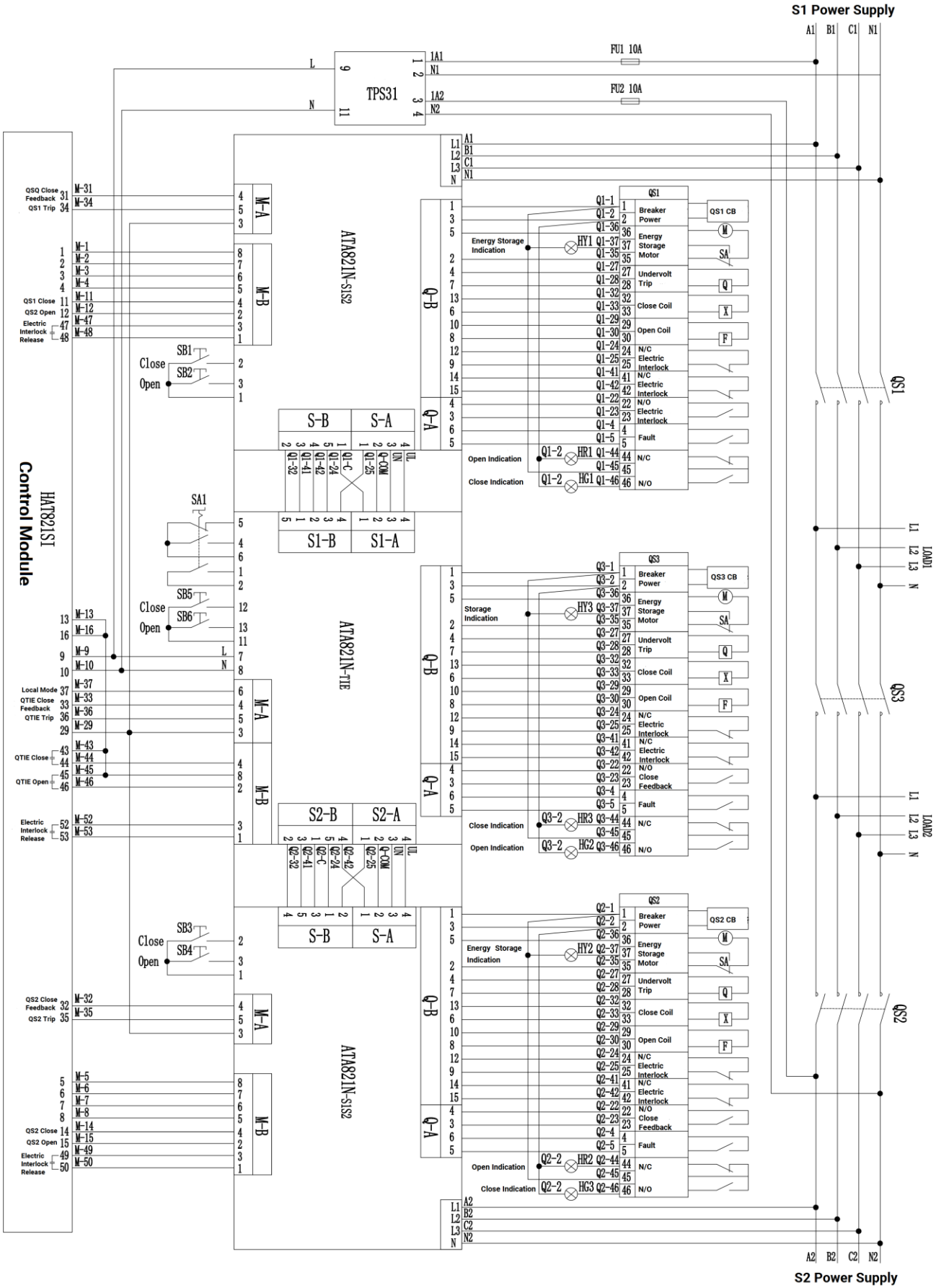


Fig.11– Application Diagram of Electric Interlock Release

Table 27 – Corresponding Settings

Partial Parameters Setting	
Aux. Output 1	QS1 Close
Aux. Output 2	QS1 Open
Aux. Output 3	QS2 Close
Aux. Output 4	QS2 Open
Aux. Output 5	QTIE Close
Aux. Output 6	QTIE Open
Aux. Output 7	Electric Interlock Release
Aux. Output 8	Electric Interlock Release
Aux. Output 9	Electric Interlock Release
Aux. Input 1	QS1 Closed Input
Aux. Input 2	QS2 Closed Input
Aux. Input 3	QTIE Closed Input
Aux. Input 4	QS1 Trip Fault
Aux. Input 5	QS2 Trip Fault
Aux. Input 6	QTIE Trip Fault
Aux. Input 7	Local Mode

NOTE7: The application diagram above is only an example, users should do connect wirings according to the actual situation.

18 STEPWISE TRANSFER SYSTEM APPLICATION

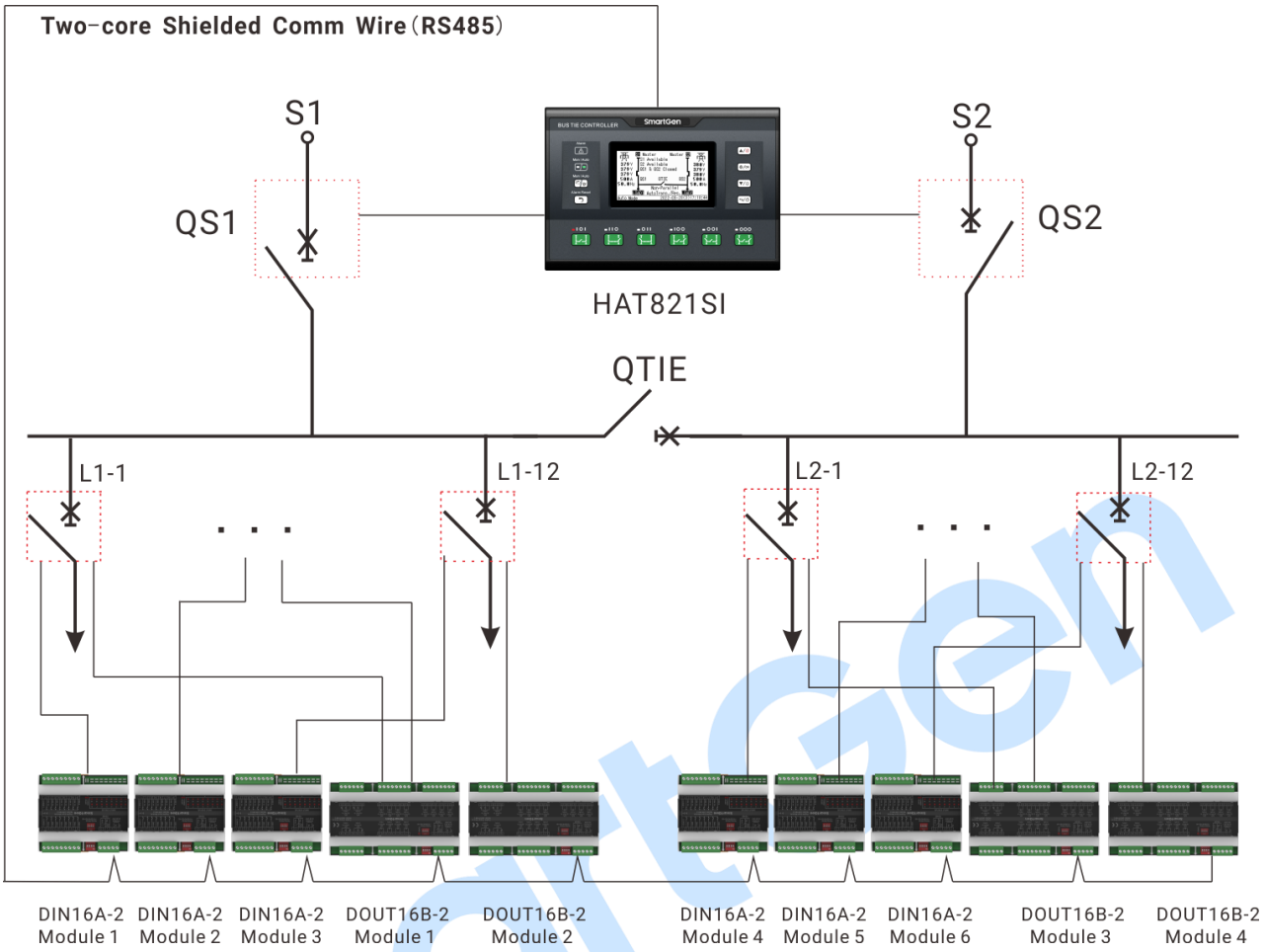


Fig.12 – Application Diagram of Load Switch Stepwise Transfer Control System

Table 28 – Corresponding Settings

Partial Parameters Setting	
Stepwise Transfer Control Mode	Unit stepwise transfer control.
Load Switch Number	12 load switches of Bus 1, 12 load switches of Bus 2.
Expanded Input Module (1-6) Set	Enable
Expanded Output Module (1-3) Set	Enable
Expanded Input Port Function Set	L1-(1~12) closing status, L2-(1~12) closing status.
Expanded Input Port Function Set	L1-(1~12) operating position status, L2-(1~12) operating position status.
Expanded Input Port Function Set	L1-(1~12) testing position status, L2-(1~12) testing position status.
Expanded Input Port Function Set	L1-(1~12) tripping status, L2-(1~12) tripping status.
Expanded Output Port Function Set	L1-(1~12) closing output, L2-(1~12) closing output.
Expanded Output Port Function Set	L1-(1~12) opening output, L2-(1~12) opening output.

NOTE8: The application diagram and configuration above are only examples, users should select expansion module, connection wires and configuration according to the actual situation.

19 CASE DIMENSIONS

Controller is panel built-in design; it is fixed by clips when installed.

Unit:mm

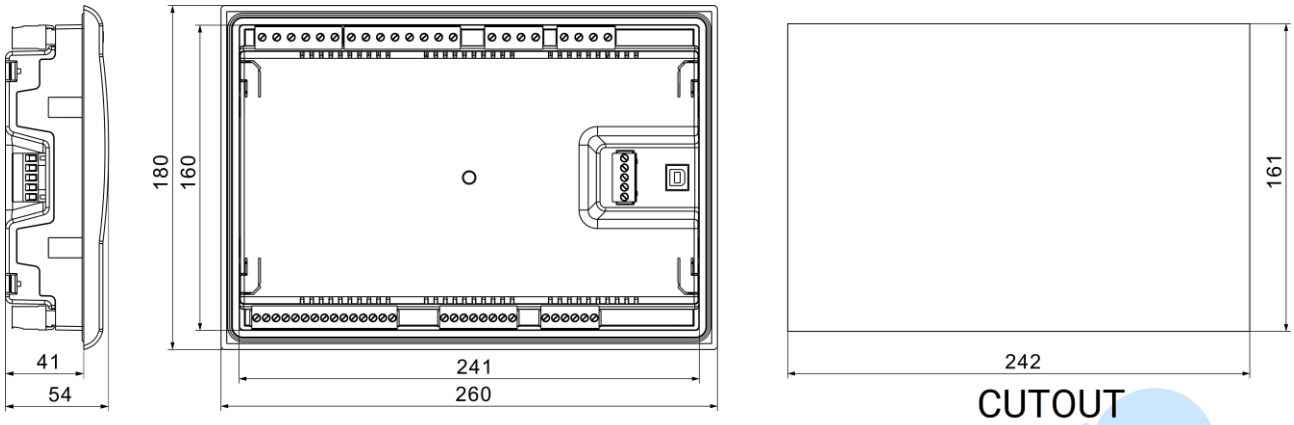


Fig.13 – Overall & Cutout Dimensions

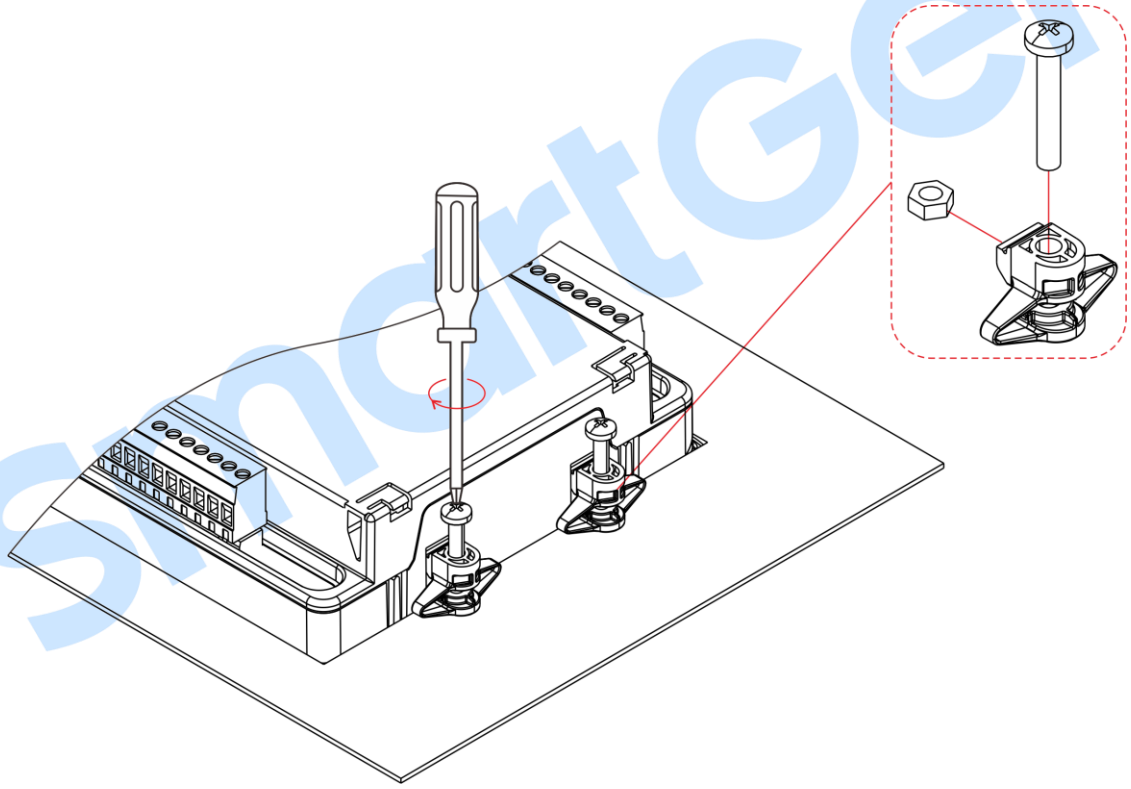


Fig.14 – Clips Installation Drawing

20 TROUBLESHOOTING

Table 29 – Troubleshooting

Symptoms	Possible Solutions
Controller No Response	Check DC voltage. Check DC fuse. Check AC Power supply.
RS485 Communication Abnormal	Check RS485's positive and negative are correctly connected or not; Check RS485 converter is normal or not; Check communication parameter setting in parameters configuration is correct or not; If above methods can't solve the problem, parallel connect 120Ω resistor between RS485 A terminal and B terminal is recommended.
Auxiliary output error	Check auxiliary output connections, pay attention to normally open contact and normally close contact. Check the output settings in parameters settings.
Auxiliary Input Abnormal	Check whether the auxiliary input is soundly connected to GND when it is active, while hung up when it is inactive (**NOTE:** The input port will be possibly damaged when connected with high voltage.); Check the input port function settings and active types in parameters configuration.
ATS Transfer Abnormal	Check ATS; Check the connection wirings between controller and ATS; Check ATS related parameter setting.
Genset Start Abnormal	Check system type setting; Check the output port function settings and output types; Check all Start/Stop settings.