

# SmartGen

MAKING CONTROL SMARTER

## HAT860 SERIES

### HAT860/HAT860S

## MEDIUM VOLTAGE ATS CONTROLLER

## USER MANUAL



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**Table 1 – Software Version**

Date	Version	Content
2021-11-18	1.0	Original release.
2021-12-24	1.1	Modify some errors.
2025-06-27	1.2	Modify "Load Switch Trip Fault" to "Warning"; Added parallel transfer mode, modified the description of "Stepwise Switch Quantity" to "Switch Priority Quantity"; Added redundancy control function, local mode, and model comparison, etc.

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## 1 OVERVIEW

**HAT860 Series Medium Voltage ATS Controller** is a module that integrates programmable function, automatic measurement, PT break detection, load stepwise switch, LCD display and digital communication. It combines digital, intelligent and network technology, realizes automation of measurement and control process, thus reducing manual operation error, which is an ideal product for medium voltage dual power transfer.

**HAT860 Series Medium Voltage ATS 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 the electric automatic control system of electric power, telecom, petrochemical industry, mining, railways, municipal administration, data center, intelligent building and other industries.

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## 2 MODEL DESCRIPTIONS

Table 2 – Model Comparison

Items	HAT860	HAT860S
DC Supply	•	•
AC Supply (LN~305)V	•	•
Current Monitoring	•	•
Synchronized Switching		•
Expand I/O Port	•	•
Stepwise Switch	•	•
Input Port No.	12	12
Output Port No.	13	13
Genset Control	•	•
RS485	2	2
USB	•	•

## 3 PERFORMANCE AND CHARACTERISTICS

- System type can set as: Mains-Mains, Mains-Gen, Gen-Mains, Gen-Gen;
- 4.3-inch single color 240x128 LCD display with white backlight, multilingual interface (Simplified Chinese, English, other), push-button operation;
- Collect and display 2-way 3-phase voltage, frequency and phase sequence;
- Collect and display load active power, reactive power, apparent power, power factor and 2-way current;
- PT break detection function, whether PT wire is broken can be judged by measured voltage and current data and PT break status can be obtained by digital input ports;
- Load stepwise switch function, can realize current unit and external stepwise switch control. With current unit stepwise switch control, stepwise switch control of 24 load breakers can be realized, the priority of each load breaker can be flexibly set, close feedback status, work position status, test position status and trip status of each load breaker can be detected;
- Six 16-way digital input modules and three 16-way digital output modules can be expanded via RS485 interface;
- Bustie control function, suitable for 4-incoming 2-bustie application scheme (realize by two HAT860 modules);
- Earth fault protection function;
- S1/S2 independent overcurrent warning or fault alarm function;

- Forced open, PT break, communication failure, earth fault alarm functions;
- NEL trip function;
- Display of S1/S2 accumulated active energy, reactive energy, close times, automatic transfer times, mains failure transfer times;
- Display of current continuous supply time, S1/S2 accumulated supply time, accumulated auto transfer running time;
- For energy storage breaker, it can close after PF (close is ready) signal is active;
- Over/under voltage, over/under frequency, overcurrent, loss of phase, reverse phase sequence function;
- Support Auto and Manual synchronized switching, and displaying voltage difference, frequency difference, and phase difference (HAT860S only);
- Load/Auto/manual transfer, manually control breaker close/open in manual mode;
- Redundancy control function;
- All parameters can be configured on site. Passwords authentication ensures authorized staff operation only;
- Manual commissioning to achieve genset start/stop operation;
- Breaker re-closing function;
- Closing output signal can be set as pulse or continuous output;
- 2-way N-wire isolated design;
- Real-time clock (RTC); event log function (event log can record 200 items circularly);
- With black box function, can record 5 groups of events in ATS auto transfer circularly, 60 detailed data of 50s before each event record, and 10s after each event record;
- Scheduled routing run & scheduled not run (can be set as genset start daily/weekly/monthly whether with load or not, also can be set some time not run daily/weekly/monthly);
- Can control two gensets to work as cycle run mode, master-slave run mode and balanced time run mode;
- Wide DC power supply range DC(8~60)V allows the controller can bear instantaneous DC 80V input, genset starting battery also can supply power;
- Supply power can be connected with AC(90~305)V or DC110V, DC220V;
- Maximum AC 625V voltage input can be accepted;
- With Dual-RS485 isolated communication interface. With “four remote” (remote control, remote measurement, remote communication, remote adjusting) function by the ModBus-RTU communication protocol. Genset start/stop and breaker close/open can be controlled remotely;
- Suitable for various AC systems (3-phase 4-wire, 3-phase 3-wire, single-phase 2-wire, and 2-phase 3-wire methods);
- Modular design, anti-flaming ABS plastic shell, pluggable terminal, embedded mounting, compact structure with easy installation.

4 SPECIFICATION

Table 3 – Performance Parameters

Items	Contents	
Working Voltage	1. B+, B- terminal: DC12V/24V/48V; 2. PA, PN terminal: AC(90~305)V or DC110V/DC220V; Either or both.	
Overall Consumption	<6W (Standby mode: ≤2W)	
AC Voltage Input (PT or PT secondary side not used)	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	16A AC250V Volts free output	
Aux. Output 5~7, 9, 11~13	8A AC250V Volts free output	
Digital Input 1~12	GND(B-) connected is active, low on threshold voltage ≤1.6VDC, max. input voltage is 60VDC.	
RS485 Interface	Isolated, half-duplex, 2400/4800/9600/19200bps baud rate can be set, Modbus-RTU communication protocol, max. communication distance can reach 1000m.	
USB Interface	D-type USB interface	
EMC Test Standard	Meet 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

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5 MEASURE AND DISPLAY DATA

Table 4 – 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	Load 3-phase Current
6	Load 3-phase Active Power kW
7	Load Total Active Power kW
8	Load 3-phase Reactive Power kvar
9	Load Total Reactive Power kvar
10	Load 3-phase Apparent Power kVA
11	Load Total Apparent Power kVA
12	Load 3-phase Power Factor PF
13	Load Average Power Factor PF
14	Current Continuous Supply Time
15	Last Continuous Supply Time
16	S1 Accumulated Supply Time
17	S2 Accumulated Supply Time
18	Accumulated Auto Transfer Running Time
19	S1 Accumulated Active Energy kWh
20	S2 Accumulated Active Energy kWh
21	S1 Accumulated Reactive Energy kvarh
22	S2 Accumulated Reactive Energy kvarh
23	QS1 Accumulated Close Times
24	QS2 Accumulated Close Times
25	Accumulated Auto Transfer Times
26	Mains Failure Transfer Times
27	Digital Input/Output Port Status
28	Real Time Clock
29	Event Log
30	Black Box Records
31	Alarm Information
32	Communication Status
33	Expand Input/Output Port Status
34	Synchronization Information (HAT860S)



Fig.1 – Panel Indication Drawing

6.1 INDICATORS

Table 4 – Indicators Description

Indicator Name	Description
Alarm	Slow flashing (1 time per sec) when warn alarm occurs; Fast flashing (5 times per sec) when fault alarm occurs.
Auto Trans./Restore	Green light on when it is in auto transfer/restore mode.
Auto Trans. Non-restore	Red light on when it is in auto transfer, non-restore mode.
S1 Power	Light on when S1 AC power supply is normal, flashes when it is abnormal, light off when there is no power.
S1 Close Status	Light on when QS1 auxiliary contact is active, light off when it is inactive. Flashes while switching to current status.
S2 Close Status	Light on when QS2 auxiliary contact is active, light off when it is inactive. Flashes while switching to current status.
S2 Power	Light on when S2 AC power supply is normal, flashes when it is abnormal, light off when there is no power.
Manual Mode	Light on when current mode is Manual mode, flashes when current mode is Local mode.
Auto Mode	Light on when current mode is Auto mode.
Genset	Light on when the controller sends genset start signal.

6.2 KEY FUNCTION DESCRIPTION

Table 6– Key Function Description

Icon	Keys	Function Description
	Manual	Switch to Manual mode.
	Auto	Switch to Auto mode.
	S1 Close	Active in Manual mode; QS1 close and S1 supplies power after pressing this key.
	Open	Active in Manual mode; Load disconnect after pressing this key.
	S2 Close	Active in Manual mode; QS2 close and S2 supplies power after pressing this key.
	Genset Test	Press this key can directly enter genset manual start/stop operation screen.
	Restore	Auto Trans./Restore mode and Auto Trans./Non-restore mode switching.
	Alarm Reset	Press this key to remove fault alarm.
	Return/Homepage	When setting parameters, it is return key, press it can return previous menu; In main screen, press this key to return to homepage; in other screen, press this key to return to homepage.
	Set/Confirm	In main screen, press this key to enter menu; In menu screen, press this key can move cursor and confirm setting information.
	Up/Alarm Mute	In main screen, press this key to scroll up screen; In menu interface, press this key to up cursor or increase value in setting menu; Long press this key for muting, which can turn off the alarm sounds.
	Down/Lamp Test	In main screen, press this key to scroll down screen; In menu interface, press this key to down cursor or decrease value in setting menu; In main screen, long press this key for testing lamps, LCD backlight illuminates, LCD displays all black, all LEDs illuminate in this mode.

7 LCD DISPLAY

7.1 MAIN SCREEN

Table 7 – Screen Display

Items	Display Contents
Homepage	S1 status, S2 status, genset start status, breaker status, load breaker switch status; Supply system diagram, QS1 is S1 power side breaker, QS2 is S2 power side breaker; S1/S2 voltage and frequency; S1/S2 master set; Auto trans./restore status; Load related parameters.
S1 Power S2 Power	S1 line voltage, phase voltage, phase angle, frequency; S2 line voltage, phase voltage, phase angle, frequency.
Load 	Load 3-phase current A (I1, I2, I3); Load 3-phase reactive power kW (P1, P2, P3); Load 3-phase reactive power kvar (Q1, Q2, Q3); Load 3-phase apparent power kVA (S1, S2, S3); Load total active power kW (sum of P1, P2, P3); Load total reactive power kvar (sum of Q1, Q2, Q3); Load total apparent power kVA (sum of S1, S2, S3); Earth current In (display after earth fault detection is enabled); Load 3-phase power factor PF (PF1, PF2, PF3); Load average power factor PF (average value of PF1, PF2, PF3); S1 accumulated active energy; S2 accumulated active energy; S1 accumulated reactive energy; S2 accumulated reactive energy; S1 accumulated supply time; S2 accumulated supply time.
Time 	Current continuous supply time; Last continuous supply time; Accumulated auto transfer running time.
QF 	QS1 accumulated close times; QS2 accumulated close times; Accumulated auto transfer times; Mains failure transfer times.
I/O Coil 	Digital input ports status; Digital output ports status.
Comm. 	RS485 communication address; RS485-1 comm. status and baud rate; RS485-2 comm. status and baud rate; USB communication status.
Alarms	Current alarm information (warn alarm and fault alarm).

Items	Display Contents
	
Expand Input/Output Ports Status	Expand 16-way digital input status of DIN16A-2 module 1-6; Expand 16-way digital output status of DOUT16B-2 module 1-3.
Status	Alarm status/working status; Real-time clock; Status line is showed below in every main screen pages.
Synchronization Status 	Sync. Voltage Difference (Difference in three-phase voltage averages); Sync. Frequency Difference; Sync. Phase Difference; HAT860S only.

## 7.2 STATUS DESCRIPTION

**Table 8 – S1 Voltage Status**

No.	Item	Description
1	S1 Available	S1 Normal Delay.
2	S1 Unavailable	S1 Abnormal Delay.
3	S1 Volt. Normal	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 is lower than the set value.
7	S1 Over Freq.	Frequency is higher than the set value.
8	S1 Under Freq.	Frequency is lower than the set value.
9	S1 Loss of Phase	Loss of 1-phase or 2-phase of A, B and C.
10	S1 Reverse Phase Seq.	A-B-C phase sequence is wrong.

**Table 9 – S2 Voltage Status**

No.	Item	Description
1	S2 Available	S2 Normal Delay.
2	S2 Unavailable	S2 Abnormal Delay.
3	S2 Volt. Normal	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 is lower than the set value.
7	S2 Over Freq.	Frequency is higher than the set value.
8	S2 Under Freq.	Frequency is lower than the set value.
9	S2 Loss of Phase	Loss of 1-phase or 2-phase of A, B and C.
10	S2 Reverse Phase Seq.	A-B-C phase sequence is wrong.

**Table 10 – Genset Status**

No.	Item	Description
1	Start Delay	Delay time before genset start.
2	Stop Delay	Delay time before genset stop.
3	Scheduled Not Run	When scheduled not run is active, its duration time will be displayed.
4	Scheduled Run	When scheduled run is active, its duration time will be displayed.
5	S1 Cycle Run	S1 cycle run countdown will begin when cycle start is active.
6	S2 Cycle Run	S2 cycle run countdown will begin when cycle start is active.
7	S1 Genset Working	Active only when system has 2 gensets and S1 is generating.
8	S2 Genset Working	Active only when system has 2 gensets and S2 is generating.
9	Genset Working	Genset start signal output.
10	Genset Standby	There is no genset start signal output.

**Table 11 – ATS Status**

No.	Item	Description
1	Ready to Transfer	ATS transfer begins.
2	QS1 Closing	QS1 closing delay is in progress.
3	QS1 Opening	QS1 opening delay is in progress.
4	QS2 Closing	QS1 closing delay is in progress.
5	QS2 Opening	QS2 opening delay is in progress.
6	Transfer Rest	Transfer rest time.
7	Closing QS1 Again	If “Closing Again Delay” is not 0, when the QS1 “Fails to Open” condition occurs, it’s the again close time.
8	Opening QS1 Again	If “Opening Again Delay” is not 0, when the QS1 “Fails to Close” condition occurs, it’s the again open time.
9	Closing QS2 Again	If “Closing Again Delay” is not 0, when the QS2 “Fails to Open” condition occurs, it’s the again close time.
10	Opening QS2 Again	If “Opening Again Delay” is not 0, when the QS2 “Fails to Close” condition occurs, it’s the again open time.
11	Wait for Synchronization	Configurable delay timer for awaiting synchronization between S1 and S2 after voltage difference, frequency difference, and phase difference meet set thresholds (HAT860S only).
12	QS1 Sync. Close	QS1 synchronized closing output upon synchronization conditions are satisfied (HAT860S only).
13	QS2 Sync. Close	QS2 synchronized closing output upon synchronization conditions are satisfied (HAT860S only).
14	Wait QS1 PF Input	QS1 ready PF input is active before QS1 closing.
15	Wait QS2 PF Input	QS2 ready PF input is active before QS2 closing.
16	Elevator Delay	Delay time before ATS transfer, elevator control outputs.
17	S1 On-load	QS1 was already closed and S1 is taking load.
18	S2 On-load	QS2 was already closed and S1 is taking load.
19	Off-load	Breaker is opened, load is disconnected.
20	QTIE Closing	After QTIE control is enabled, QTIE is closing delay.
21	QTIE Opening	After QTIE control is enabled, QTIE is opening delay.

No.	Item	Description
22	S1 Load Stepwise Close	After load stepwise switch is enabled, S1 load is closing is noted in S1 load stepwise closing process.
23	S1 Load Stepwise Open	After load stepwise switch is enabled, S1 load is opening is noted in S1 load stepwise opening process.
24	S2 Load Stepwise Close	After load stepwise switch is enabled, S2 load is closing is noted in S2 load stepwise closing process.
25	S2 Load Stepwise Open	After load stepwise switch is enabled, S2 load is opening is noted in S2 load stepwise opening process.

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 warning alarms are not latched.

**Table 12 – Warning Alarms**

No.	Item	Description
1	S1 Load Overcurrent	When overcurrent action is set as warning, S1 takes load, current is greater than the set value.
2	S2 Load Overcurrent	When overcurrent action is set as warning, S2 takes load, current is greater than the set value.
3	Forced Open	Forced open (non-fire cutoff) action is set as warning, when this input is active, forced open warning alarm occurs.
4	Synchronization Failure	Synchronization failure action is set as warning, timeout during sync waiting triggers a warning alarm (HAT860S only).
5	S1 PT Break	Alarm is initiated when PT secondary circuit is broken.
6	S2 PT Break	Alarm is initiated when PT secondary circuit is broken.
7	Input 1-6 Comm. Failure	Alarm is initiated when expand input module 1-6 communication fails and alarm action is set as warning,
8	Output 1-3 Comm. Failure	Alarm is initiated when expand output module 1-3 communication fails and alarm action is set as warning,
9	Load Switching Failure	In load stepwise switching process, close or open failure alarm occurs and switching failure action is set as warning.
10	Earth Fault	When earth current detection is enabled and the current is greater than the set value, warning alarm will be initiated when the action is selected.
11	Load Switch Trip	Load switch trip alarm input is active.
12	Redundant Communication Failure	When redundant communication is enabled, main and backup controllers fail to communicate within 2 seconds.

Fault alarms are active when controller detects the alarm signals. Alarm indicator will flash rapidly (5 times per sec) and the alarm will last until it was removed manually. Fault alarms are latched.

**Table 13 – Fault Alarms**

No.	Item	Description
1	QS1 Close Failure	QS1 fails to close.
2	QS1 Open Failure	QS1 fails to open.
3	QS2 Close Failure	QS2 fails to close.
4	QS2 Open Failure	QS2 fails to open.
5	S1 Load Overcurrent Fault	Overcurrent action is set as fault, the current value is greater than the set value when S1 takes load.
6	S2 Load Overcurrent Fault	Overcurrent action is set as fault, the current value is greater than the set value when S2 takes load.
7	Forced Open	Forced open (non-fire cutoff) action is set as fault, when this input is active, forced open fault alarm occurs.
8	S1 Genset Fault	Only when system has 2 gensets and S1 is generating, S1 fails to start.
9	S2 Genset Fault	Only when system has 2 gensets and S2 is generating, S2 fails to start.
10	S1 Breaker Trip Alarm	This input is active.
11	S1 Breaker Trip Alarm	This input is active.
12	Synchronization Failure Fault	Synchronization failure action is set as fault, fault alarm will be initiated when timeout during sync waiting (HAT860S only).
13	Input 1-6 Comm. Failure Fault	Fault alarm will be initiated when expand input port 1-6 communication fails and alarm action is set as fault.
14	Output 1-3 Comm. Failure Fault	Fault alarm will be initiated when expand output port 1-3 communication fails and alarm action is set as fault.
15	Load Switching Fail	In load stepwise switching process, close or open failure alarm occurs and switching failure action is set as fault.
16	Earth Fault	When earth current detection is enabled and the current is greater than the set value, fault alarm will be initiated when the action is selected.
17	QTIE Close Failure	In auto mode, if QTIE close signal can't be detected after close output delay, QTIE close failure alarm will be initiated.
18	QTIE Open Failure	In auto mode, if there is still a close signal after open output delay, QTIE open failure alarm will be initiated.
19	QTIE Breaker Trip	This input is active.
20	Power Supply Detection Abnormal Fault	When redundancy control is enabled, an alarm activates upon detection of abnormal local power supply conditions while the other controller maintains normal power detection status.
21	Breaker Closing Detection Abnormal	When redundancy control is enabled, an alarm is triggered if the closing status of the two controllers is inconsistent, or when current

No.	Item	Description
	Fault	is detected despite no closing status.

The prompt information will disappear after displaying for 2s when it is active.

**Table 14 – Prompt Information**

No.	Item	Description
1	Please Reset the Alarm	When there is fault alarm occurs and alarm is not removed, the indication will be displayed when manually transfers to Auto Mode.
2	S1 Closed	The prompt information after pressing “S1 Close” key when S1 closed.
3	S2 Closed	The prompt information after pressing “S2 Close” key when S2 closed.
4	Opened	The prompt information after pressing “Open” key when the load is disconnected.
5	Panel Locked	The prompt information when panel lock is active and keys are pressed (Manual, Auto, S1 Close, S2 Close, Open, Genset Test keys).
6	QTIE Closed	The prompt information after pressing “S1 Close” or “S2 Close” key when QTIE is closed.
7	Stepwise Switching	The prompt information after pressing “S1 Close” or “S2 Close” key when load breaker is stepwise switching.

**Table 15 – Other Status Information**

No.	Item	Description
1	Start Inhibit	Genset start Inhibit is active.
2	QTIE Close Inhibit	QTIE close inhibit is active.
3	S1 Load Inhibit	S1 Load Inhibit input is active.
4	S2 Load Inhibit	S2 Load Inhibit input is active.
5	NEL1 Trip	NEL1 offload output.
6	NEL2 Trip	NEL2 offload output.
7	NEL3 Trip	NEL3 offload output.
8	Remote Start On-load	Remote start (on load) input is active.
9	Remote Start Off-load	Remote start (off load) input is active.
10	Gen Start Mains NG	Start genset when mains is abnormal.
11	Cycle Run Mode	Active when S1 and S2 are both generating.
12	Balanced Run Mode	Active when S1 and S2 are both generating.
13	Master-Slave Run Mode	Active when S1 and S2 are both generating.
14	Auto Mode	Current mode is Auto mode.
15	Manual Mode	Current mode is Manual mode.
16	Local Mode	Current mode is local mode.
17	Remote Inhibit	Remote inhibit input is active.

## 7.3 MAIN MENU

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

<ul style="list-style-type: none"><li>1. Configuration</li><li>2. Data Calibration</li><li>3. Event Log</li><li>4. Black Box Records</li><li>5. Auto Trans. Auto Restore</li><li>6. Parallel Mode</li><li>7. Language</li><li>8. About</li></ul>	<p>Press <b>Up/Down</b> key to choose parameter line (the current line was highlighted with black) and then press <b>Confirm</b> key to enter into the corresponding display screen.</p> <p>HAT860S doesn't have a parallel mode setting option.</p>
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**▲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.

**▲NOTE3:** HAT860S doesn't have a parallel mode setting option.

SmartGen

## 8 START/STOP OPERATION

### 8.1 MANUAL START/STOP

#### 8.1.1 PANEL START/STOP

In the main screen, press  key, when system type is "S1 Mains S2 Gen, S1 Gen S2 Mains, S1 Mains S2 Mains", it will enter manual start operation interface.

Manual Genset Test	Press "Up/Down" key to choose parameter line (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.

When system type is "S1 Gen S2 Gen", manual start/stop menu interface is as follows:

Manual Genset Test	Press "Up/Down" key to choose parameter line (the current line was highlighted with black) and then press "Confirm" key to confirm.
Return	
S1 Genset Stop	
S1 Genset Start	
S2 Genset Stop	
S2 Genset Start	

**S1 Genset Stop:** Disconnect the S1 start signal, i.e. stop the running S1 genset.

**S1 Genset Start:** Output the S1 start signal, i.e. start the S1 genset.

**S2 Genset Stop:** Disconnect the S2 start signal, i.e. stop the running S2 genset.

**S2 Genset Start:** Output the S2 start signal, i.e. start the S2 genset.

#### 8.1.2 REMOTE COMMUNICATION START/STOP

Send remote start/stop signals using MODBUS protocol via RS485 port.

**Remote Communication Stop:** Disconnect the start signal, i.e. stop the running genset.

**Remote Communication Start:** Output the start signal, i.e. start the genset.

## 8.2 AUTO START/STOP

### 8.2.1 START CONDITIONS

#### 8.2.1.1 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 genset start output, gen close relay will active after gen is normal; when the input inactive, genset will stop automatically.

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

#### 8.2.1.2 GEN START MAINS NG

When mains is abnormal, genset start outputs, gen close relay will active after gen is normal.

### 8.2.2 TWO GENSETS START/STOP

When system is "S1 Gen S2 Gen", input port setting is as follows:

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

**Remote Start on Load:** Detect S1 or S2 start output according to start mode. Gen close relay will active after gen is normal.

**Remote Start off Load:** Detect S1 or S2 start output according to start mode. Both gen S1 close relay and S2 close relay are deactivated after genset start.

**Start Mode:** Cycle Run, Master-Slave Run, Balanced Time Run, None.

#### **Cycle Run**

When remote start is active, S1 and S2 cycle start will according to the cycle run time. When firstly start the genset, choose "S1 Start" or "S2 Start" depends on "Priority". e.g. S1 start firstly if "S1" has higher priority. Then S1 cycle run countdown is started according to the preset delay. At the same time, genset fault identification will be initiated. If S1 gen is normal before the fault identification has expired, S1 will take load; S2 start after the preset S1 cycle run delay has expired and the S2 loading process is same as S1. S1 will stop after the S2 takes load successfully. S1 and S2 will cycle run in this way alternately until the remote start signal deactivated.

During the start process, if there is genset fault (fault identification overtime or genset fault input is active), fail to close or load inhibit alarm occurs, the starting genset will stop immediately and the additional genset will start automatically.

During the cycle run process, if "Manual Mode" is selected, the current status will be hold and the "cycle run countdown" will be suspended.

## Master-Slave Run

Master genset will start when remote start signal is active. During the start process, if there is genset fault alarm (genset supply delay overtime or genset fault input is active), fail to close or load inhibit alarm occurs, the starting genset will stop immediately and the additional genset will start automatically. Otherwise, the master genset will run continuously until the remote start signal is deactivated.

## Balanced Time Run

The genset which has the shortest running time will start when remote start signal is active. During the start process, if there is genset fault alarm (genset supply delay overtime or genset fault input is active), fail to close or load inhibit alarm occurs, the starting genset will stop immediately and the additional genset will start automatically. Otherwise, the current genset will run continuously until the remote start signal is deactivated.

In system of “S1 Gen S2 gen” to start/stop genset should meet following several conditions:

- 1) It is active in Auto mode;
- 2) System type set as “S1 Gen S2 Gen”;
- 3) Output should be set as “S1 Genset Start” and “S2 Genset Start”;
- 4) Input should be set as “S1 Genset Fault Input”, “S2 Genset Fault Input” and “Remote Start On Load” or “Remote Start Off Load”;
- 5) Should set the system as “Two Gensets Start Mode”;
- 6) Should configure “Genset Supply Delay”, If start mode is cycle run, also should set “S1 Cycle Run Time”, “S2 Cycle Run Time”.

Among input ports, “S1 Genset Fault Input” and “S2 Genset Fault Input” are selective setting, genset fault can be judged by “Genset Supply Delay” and there no need to inquire the fault alarm via input port.

When two gensets start mode configured as “None”, there is no genset start signals output.

For example:

**Table 16 – Genset Start**

System Type	Start Conditions	Result
S1 Gen S2 Gen	Input Active (Remote Start On Load/Remote Start Off Load)	S1 Genset Start Output
	Priority: S1	

### 8.2.3 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 deactivated after the start delay has expired. “Scheduled Run On Load” or “Scheduled Run Off Load” can be set.

**Scheduled Run On Load:** When genset start output, gen close relay will active after gen is

normal.

**Scheduled Run Off Load:** When genset start output, mains close relay will active after mains is normal.

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

**Run Monthly:** Which month to start, start date and time can be set.

**Run Weekly:** Can start the genset at the same time in couple days of a week. eg. Start the genset at 8:00 a.m. from Monday to Friday and keep 10 hours.

**Run Daily:** Can start the genset at same time every day.

## 8.2.4 SCHEDULED NOT RUN

Once “Scheduled Not Run” enables, users can set the “Scheduled Not Run” 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:** Which month not start, not start date and time can be set.

**Not Run Weekly:** Can't start the genset at the same time in couple days of a week. eg. Not Start the genset at 19:00 p.m. from Monday to Friday and keep 12 hours.

**Not Run Daily:** Can't start the genset at same time every day.

**▲NOTE4:** “Scheduled Not Run” operation is prior to “Scheduled Run” operation.

9 PARAMETERS CONFIGURATION

9.1 ILLUSTRATION

In the main interface, press  key, choose **Configuration** and press  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 previous menu.

9.2 PARAMETERS CONFIGURATION

Table 17 – Parameters Configuration

No.	Item	Range	Default	Description
<b>AC Setting</b>				
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	(0~1)	0	0: S1 Master 1: S2 Master
6	System Type	(0~3)	0	0: S1 Mains S2 Gen; 1: S1 Gen S2 Mains; 2: S1 Mains S2 Mains; 3: S1 Gen S2 Gen.
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 Volt	(30~30000)V	10000	Primary voltage of voltage transformer ratio.
10	PT Secondary Volt	(30~1000)V	100	Secondary voltage of voltage transformer ratio.
11	Rated Voltage	(0~30000)V	10500	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 Value	(0~200)%	115	Upper limit return value of voltage; it is normal only when the value has fallen below the set value.

No.	Item	Range	Default	Description
15	Under voltage Warn	(0~1)	1	0: Disable 1: Enable
16	Set Value	(0~200)%	80	Lower limit value of voltage; it is 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	Reverse Phase Seq.	(0~1)	1	0: Disable 1: Enable
<b>Breaker Setting</b>				
1	Auto Transfer/Restore	(0~1)	1	0: Auto Transfer Non-restore; 1: Auto Transfer/Restore.
2	Fixed C/O Time	(0~1)	0	0: Disable 1: Enable Disable: The output time is depended on the close status; the longest output time is the set c/o time. Enable: The output time lasts for the preset time.
3	Close Delay	(0.1~20.0)s	5.0	Pulse time of close relay.
4	Open Delay	(0.1~20.0)s	5.0	Pulse time of open relay.
5	Transfer Rest	(0~9999)s	1	Delay time from S1 open to S2 close or from S2 open to S1 close.
6	Again Close Delay	(0~20.0)s	0.0	When the breaker fails to open for the first time, then the module will close for the second time and the Again Close Delay begins, after the delay has expired, if it still fails to open for the second time, the module will send out fail to open alarm.

No.	Item	Range	Default	Description
7	Again Open Delay	(0~20.0)s	0.0	When the breaker fails to close for the first time, then the module will open for the second time and the Again Open Delay begins, after the delay has expired, if it still fails to close for the second time, the module will send out fail to close alarm.
8	Type Setting	(0~1)	0	0: 2-breaking 1: 1-breaking
9	Forced Open Action	(0~1)	0	0: Warning Alarm 1: Fault Alarm
10	Continuous Close	(0~1)	0	0: Disable 1: Enable When continuous close is active, it needs to be enabled, and close time and open time are inactive.
11	QTIE Enable	(0~1)	0	0: Disable 1: Enable When bustie breaker control is required, it needs to be enabled.
12	Parallel Mode	(0~3)	1	0: Non-parallel 1: Manual/Auto Parallel 2: Manual/Parallel 3: Auto Parallel (HAT860S only).
13	Sync. Volt. Difference Enable	(0~1)	0	0: Disable; 1: Enable
14	Sync. Volt. Difference	(0~50)V	5	Max. voltage difference during successful synchronization.
15	Sync. Freq. Difference	(0~0.50)Hz	0.20	Max. frequency difference during successful synchronization.
16	Sync. Phase Difference	(0~20) °	5	Max. phase difference during successful synchronization.
17	Sync. Failure Alarm Action	(0~1)	0	0: Warning Alarm 1: Fault Alarm After synchronization failure, it continues waiting for synchronization until closing is realized following successful synchronization. Warning alarms are cleared when synchronization completes or upon exiting the synchronization process. Fault alarms must be cleared by pressing the alarm reset button.
18	Sync. Failure Forced Transfer	(0~1)	0	0: Disable; 1: Enable After synchronization failure, asynchronous closing will be executed,

No.	Item	Range	Default	Description
				and no synchronization failure alarm will be issued.
19	Sync. Failure Delay	(0~9999)s	120	The waiting time for successful synchronization, if times out, it will be considered a synchronization failure.
20	Sync. Close/Open Detection	(0.1~1.0)s	0.6	During synchronization switching, the closing or opening output begins a time delay. If the correct closing status is detected during the delay period, the closing/opening pulse output will stop. If the correct closing status remains undetected upon timeout, a closing failure alarm or opening failure alarm will be issued.
<b>Genset Setting</b>				
1	Start Delay	(0-9999)s	1	When the genset is ready to start, start delay begins, after the 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 delay has expired, start signal will be disconnected.
3	Two Gensets Start Mode	(0~3)	0	0: Cycle Run; 1: Master-Slave Run; 2: Balanced Time Run; 3: None.
4	S1 Cycle Run Time	(0~9999)min	720	Gens cycle start S1 running time.
5	S2 Cycle Run Time	(0~9999)min	720	Gens cycle start S2 running time.
6	Supply Delay	(0~9999)s	120	When the start signal is active, the start delay will be initiated. If the gen voltage lasts abnormal after the delay has expired, genset fault alarm will be initiated.
<b>Scheduled Run/Not Run Setting</b>				
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	Run Time (Month)	(1~12)month	monthly	<input checked="" type="checkbox"/> Jan. <input checked="" type="checkbox"/> Feb. <input checked="" type="checkbox"/> Mar.

No.	Item	Range	Default	Description
				<input checked="" type="checkbox"/> Apr. <input checked="" type="checkbox"/> May <input checked="" type="checkbox"/> June <input checked="" type="checkbox"/> July <input checked="" type="checkbox"/> Aug. <input checked="" type="checkbox"/> Sep. <input checked="" type="checkbox"/> Oct. <input checked="" type="checkbox"/> Nov. <input checked="" type="checkbox"/> Dec.
5	Run Time (Date)	(1~31)	1	The date of start the genset monthly.
6	Run Time (Week)	Mon ~ Sun	Sunday	<input checked="" type="checkbox"/> Sunday <input type="checkbox"/> Monday <input type="checkbox"/> Tuesday <input type="checkbox"/> Wednesday <input type="checkbox"/> Thursday <input type="checkbox"/> Friday <input type="checkbox"/> Saturday
7	Run Time (Hour)	(0~23)h	0	The time of genset start.
8	Run 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	Not Run Time (Month)	(1~12)month	monthly	<input checked="" type="checkbox"/> Jan. <input checked="" type="checkbox"/> Feb. <input checked="" type="checkbox"/> Mar. <input checked="" type="checkbox"/> Apr. <input checked="" type="checkbox"/> May <input checked="" type="checkbox"/> June <input checked="" type="checkbox"/> July <input checked="" type="checkbox"/> Aug. <input checked="" type="checkbox"/> Sep. <input checked="" type="checkbox"/> Oct. <input checked="" type="checkbox"/> Nov. <input checked="" type="checkbox"/> Dec.
13	Not Run Time (Date)	(1~31)	1	The date of genset not start monthly.
14	Not Run Time (Week)	Mon ~ Sun	Sunday	<input checked="" type="checkbox"/> Sunday <input type="checkbox"/> Monday <input type="checkbox"/> Tuesday <input type="checkbox"/> Wednesday <input type="checkbox"/> Thursday <input type="checkbox"/> Friday <input type="checkbox"/> Saturday

No.	Item	Range	Default	Description
15	Not Run Time (Hour)	(0~23)h	0	The time of genset not start.
16	Not Run Time (Minute)	(0~59)min	0	
17	Not Run Duration	(0~30000)min	30	The duration time of genset <i>NOT</i> running.
<b>Load Setting</b>				
1	Elevator Enable	(0~1)	0	0: Disable 1: Enable
2	Elevator Delay	(0~300)s	300	It's the delay time before the load disconnect or switch transfer. Used for control the running elevator stop at the nearest floor until the switch transfer is terminated.
3	Current Monitoring	(0~1)	1	0: Disable 1: Enable
4	CT Ratio/5	(5~6000)A	500	CT primary current.
5	S1 Full-load Current	(5~6000)A	500	Current of S1 full-loading.
6	S2 Full-load Current	(5~6000)A	500	Current of S2 full-loading.
7	S1 Max. Active Power	(1~20000)kW	8000	Max. S1 loading active power.
8	S2 Max. Active Power	(1~20000)kW	8000	Max. S2 loading active power.
9	Overcurrent Protect	(0~1)	1	0: Disable 1: Enable
10	Overload Current	(0~200)%	120	Load overcurrent threshold.
11	Protect Action	(0~1)	0	0: Warning 1: Fault
12	Delay Type	(0~1)	0	0: DMT Delay 1: IDMT Delay
13	DMT Delay Value	(0~3600)s	10	Overcurrent delay value of DMT delay.
14	IDMT Delay Rate	(1~36)	36	Overcurrent delay rate of IDMT delay.
15	NEL Trip	(0~1)	0	0: Disable 1: Enable
16	NEL Over Power Trip 1 Set Value	(0~200)%	90	When load power is greater than the set value and delay is over, it will take off load.
17	NEL Over Power Trip 1 Delay	(0~3600)s	5	
18	NEL Over Power Trip 2 Set Value	(0~200)%	100	When load power is greater than the set value and delay is over, it will take off load.
19	NEL Over Power Trip 2 Delay	(0~3600)s	1	
20	NEL Over Power Return	(0~1)	0	0: Disable 1: Enable
21	NEL Over Power Return Set Value	(0~200)%	50	When load power is lower than the set value and delay is over, trip will disconnect..
22	NEL Over Power Return Delay	(0~3600)s	5	
23	NEL Numbers	(1~3)	3	Set NEL numbers.

No.	Item	Range	Default	Description
24	Mains Loading NEL	(0~1)	0	0: Disable 1: Enable
25	Earth Fault Detect	(0~1)	0	0: Disable 1: Enable
26	Earth Fault Detect Overcurrent Value	(0~200)%	20	When the earth current is greater than set rated current percentage and delay is over, earth fault alarm will be initiated. If alarm action is set as warning, when earth current is lower than set return value, the alarm will be removed.
27	Earth Fault Detect Overcurrent Return Value	(0~200)%	18	
28	Earth Fault Detect Delay Value	(0~3600)s	5	
29	Earth Fault Action	(0~2)	0	0: No Action 1: Warning Alarm 2: Fault Alarm
<b>Digit Inputs Setting</b>				
1	Digital Input 1	(0~159)	42	S1 Closed.
2	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
3	Digital Input 2	(0~159)	43	S2 Closed.
4	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
5	Digital Input 3	(0~159)	1	Forced Open.
6	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
7	Digital Input 4	(0~159)	8	S1 Breaker Trip.
8	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
9	Digital Input 5	(0~159)	9	S2 Breaker Trip.
10	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
11	Digital Input 6	(0~159)	0	Not Used.
12	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
13	Digital Input 7	(0~159)	0	Not Used.
14	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
15	Digital Input 8	(0~159)	0	Not Used.
16	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
17	Digital Input 9	(0~159)	0	Not Used.
18	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
19	Digital Input 10	(0~159)	0	Not Used.
20	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
21	Digital Input 11	(0~159)	0	Not Used.

No.	Item	Range	Default	Description
22	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
23	Digital Input 12	(0~159)	0	Not Used.
24	Active Type	(0~1)	0	0: Close to activate; 1: Open to activate.
<b>Relay Outputs Setting</b>				
1	Relay Output 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
2	Contents Setting	(0~159)	34	QS1 Close.
3	Relay Output 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
4	Contents Setting	(0~159)	35	QS1 Open.
5	Relay Output 3 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
6	Contents Setting	(0~159)	36	QS2 Close.
7	Relay Output 4 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
8	Contents Setting	(0~159)	37	QS2 Open.
9	Relay Output 5 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
10	Contents Setting	(0~159)	0	Not Used.
11	Relay Output 6 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
12	Contents Setting	(0~159)	0	Not Used.
13	Relay Output 7 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
14	Contents Setting	(0~159)	0	Not Used.
15	Relay Output 8 Active Type	(0~1)	1	0: Output (NO) 1: Output (NC)
16	Contents Setting	(0~159)	32	Genset Start.
17	Relay Output 9 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
18	Contents Setting	(0~159)	0	Not Used.
19	Relay Output 10 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
20	Contents Setting	(0~159)	0	Not Used.
21	Relay Output 11 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
22	Contents Setting	(0~159)	0	Not Used.
23	Relay Output 12 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
24	Contents Setting	(0~159)	0	Not Used.

No.	Item	Range	Default	Description
25	Relay Output 13 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
26	Contents Setting	(0~159)	0	Not Used.
27	Combined 1 or Out 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
28	Combined 1 or Out 1 Contents Setting	(0~159)	23	S1 Voltage Normal.
29	Combined 1 or Out 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
30	Combined 1 or Out 2 Contents	(0~159)	25	S2 Voltage Normal.
31	Combined 1 and Out Active Type	(0~1)	1	0: Output (NO) 1: Output (NC)
32	Combined 1 and Out Contents	(0~159)	0	Not Used.
33	Combined 2 or Out 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
34	Combined 2 or Out 1 Contents Setting	(0~159)	0	Not Used.
35	Combined 2 or Out 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
36	Combined 2 or Out 2 Contents	(0~159)	0	Not Used.
37	Combined 2 and Out Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
38	Combined 2 and Out Contents	(0~159)	0	Not Used.
39	Combined 3 or Out 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
40	Combined 3 or Out 1 Contents	(0~159)	0	Not Used.
41	Combined 3 or Out 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
42	Combined 3 or Out 2 Contents	(0~159)	0	Not Used.
43	Combined 3 and Out Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
44	Combined 3 and Out Contents	(0~159)	0	Not Used.
45	Combined 4 or Out 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
46	Combined 4 or Out 1 Contents	(0~159)	0	Not Used.
47	Combined 4 or Out	(0~1)	0	0: Output (NO) 1: Output (NC)

No.	Item	Range	Default	Description
	2 Active Type			
48	Combined 4 or Out 2 Contents	(0~159)	0	Not Used.
49	Combined 4 and Out Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
50	Combined 4 and Out Contents	(0~159)	0	Not Used.
51	Combined 5 or Out 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
52	Combined 5 or Out 1 Contents	(0~159)	0	Not Used.
53	Combined 5 or Out 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
54	Combined 5 or Out 2 Contents	(0~159)	0	Not Used.
55	Combined 5 and Out Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
56	Combined 5 and Out Contents	(0~159)	0	Not Used.
57	Combined 6 or Out 1 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
58	Combined 6 or Out 1 Contents	(0~159)	0	Not Used.
59	Combined 6 or Out 2 Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
60	Combined 6 or Out 2 Contents Setting	(0~159)	0	Not Used.
61	Combined 6 and Out Active Type	(0~1)	0	0: Output (NO) 1: Output (NC)
62	Combined 6 and Out Contents	(0~159)	0	Not Used.
<b>Module Setting</b>				
1	Language	(0~2)	0	0: Simplified Chinese; 1: English; 2: Other (This must be set via upper computer software, Default: Traditional Chinese).
2	Password	(00000~65534)	01234	Password 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.

No.	Item	Range	Default	Description
5	RS485-1 Baud Rate	(0~3)	2	0: 2400bps; 1: 4800bps; 2: 9600bps; 3: 19200bps.
6	RS485-1 Stop Bit	(1~2)	1	1 stop bit or 2 stop bits can be set.
7	RS485-1 Parity Bit	(0~2)	0	0: None; 1: Odd Parity; 2: Even Parity.
8	RS485-2 Baud Rate	(0~3)	2	0: 2400bps; 1: 4800bps; 2: 9600bps; 3: 19200bps.
9	RS485-2 Stop Bit	(1~2)	1	1 stop bit or 2 stop bits can be set.
10	RS485-2 Parity Bit	(0~2)	0	0: None; 1: Odd Parity; 2: Even Parity.
11	RS485-1 Comm. Set	(0~3)	0	0: Remote Adjusting/Control Enable; 1: Remote Control Disable; 2: Remote Adjusting Disable; 3: Remote Adjusting/Control Disable.
12	RS485-2 Comm. Set	(0~3)	0	0: Remote Adjusting/Control Enable; 1: Remote Control Disable; 2: Remote Adjusting Disable; 3: Remote Adjusting/Control Disable.
13	Date and Time			
14	Controller Description 1	(0~20) characters		Information displayed in "About" interface.
15	Controller Description 2	(0~20) characters		Any characters can be inputted via PC software (letter occupies 1 character, Chinese character occupies 2.).
<b>Load Stepwise Switch Setting</b>				
1	Stepwise Switch	(0~1)	0	0: Disable    1: Enable
2	Control Mode	(0~1)	0	0: Current Unit Stepwise Switch; 1: External Stepwise Switch. Current unit stepwise switch: it can detect c/o control and status of each load breaker via expand input/output ports. External stepwise switch: Load breaker stepwise switch can be realized by close and open output signal of load switching device.
3	Priority Numbers	(0~24)	24	Priority numbers of stepwise switch that allows C/O control.
4	Position Detection	(0~1)	1	0: Disable    1: Enable

No.	Item	Range	Default	Description
				<p>Disable: It does not detect breaker position status and switch according to set priority.</p> <p>Enable: This load breaker can be allowed to control c/o when it is in working position.</p>
5	Fixed C/O Time	(0~1)	0	<p>0: Disable      1: Enable</p> <p>Disable: Output time is detected according to close status when close/open pulse outputs, the max. time is set close/open time.</p> <p>If it keeps closed status during open time, load stepwise switch fails.</p> <p>Enable: It does not detect close status of load breaker, close/open pulse output time is set fixed close/open time.</p>
6	Close Time	(0.1~20.0)s	5.0	Pulse time of close relay output.
7	Open Time	(0.1~20.0)s	5.0	Pulse time of open relay output.
8	Transfer Rest	(0~9999)s	1	Interval time from current load breaker close/open to next load breaker close/open.
9	Open Control	(0~1)	1	<p>0: Disable      1: Enable</p> <p>When it is enabled, it can control the stepwise open of load breaker.</p>
10	Stepwise Switch Failure Action	(0~2)	0	<p>0: No Action;</p> <p>1: Warning Alarm;</p> <p>2: Fault Alarm.</p> <p>During the load stepwise switching process, if some load breaker close/open fails, switch failure alarm signal will be initiated.</p>
11	Priority Set	(1~24)	1-24	<p>It can set the priority in S1/S2 c/o of 24 loading breaker.</p> <p>When the priority is same, corresponding breaker will be active.</p>
12	Manual Switch Mode	(0~2)	2	<p>0: No Action;</p> <p>1: Auto Stepwise Switch;</p> <p>2: Action after Prompt Confirm.</p> <p>No action: When the main breaker is manually closed/opened, load breaker is not stepwise switched;</p> <p>Auto stepwise switch: When the main breaker is manually closed/opened, load breaker will automatically control stepwise close/open;</p>

No.	Item	Range	Default	Description
				Action after prompt confirm: When the main breaker is manually closed/opened, prompt box "Confirm to stepwise switch load?" will be popped out. Press Up/Down key to select "Confirm", "Cancel", then press Set key to confirm operation, and exit prompt box. If no action over 10s, it will exit automatically and stepwise switch will be cancelled. If select "Confirm", it will enter stepwise switch; if select "Cancel", there is no switch action.
<b>Expand Input Modules (1-6) Setting</b>				
1	Enable	(0~1)	0	0: Disable 1: Enable When it is enabled, it can communicate with DIN16A-2 module.
2	Comm. Fail Action	(0~1)	0	0: Warning Alarm 1: Fault Alarm
3	Comm. Module Address	(1~254)	100	RS485 network communication address.
4	Expand Input Ports	(1~16)	1	It can set 16 input ports function and active type of DIN16A-2 module.
<b>Expand Output Modules (1-3) Setting</b>				
1	Enable	(0~1)	0	0: Disable 1: Enable When it is enabled, it can communicate with DOUT16B-2 module.
2	Comm. Fail Action	(0~1)	0	0: Warning Alarm 1: Fault Alarm
3	Comm. Module Address	(1~254)	106	RS485 network communication address.
4	Expand Output Ports	(1~16)	1	It can set 16 output ports function and active type of DOUT16B-2 module.
<b>PT Break Communication Detection Setting</b>				
1	PT Break Comm. Detection	(0~1)	0	0: Disable 1: Enable When it is enabled, PT break is judged according to AC sampling voltage, current.
2	PT Break Delay	(0~60)s	3	When the communication detection is enabled, PT break sign is detected, PT break warning is triggered after set delay time.
3	Max. Line Volt Multiple	(0~1.00)	0.20	It is the multiple that max. line voltage set value of PT break judgment accounts for rated voltage.
4	Max. Current Multiple	(0~1.00)	0.02	It is the multiple that max. current set value of PT break judgment accounts for rated current.

No.	Item	Range	Default	Description
5	Line Volt Amplitude Difference Multiple	(0~1.00)	0.20	It is the multiple that line voltage amplitude difference set value of PT break judgment accounts for rated voltage.
6	Break Reset Volt Multiple	(0~1.00)	0.90	It is the multiple that PT break reset voltage set value accounts for rated voltage.
<b>Redundancy Control Setting</b>				
1	Redundancy Control	(0~1)	0	0: Disable 1: Enable
2	Controller Type	(0~1)	0	0: Main 1: Slave
3	Exit Control on Abnormality	(0~1)	1	0: Disable 1: Enable



9.3 DIGITAL INPUT/OUTPUT FUNCTION DESCRIPTION

9.3.1 INPUT PORTS FUNCTION DESCRIPTION

Table 18 – Input Ports Function Description

No.	Item	Description
0	Not Used	Input port is invalid.
1	Forced Open	Forced open (non-fire cutoff) only suits for breaker with open control. When it is active, breaker will transfer to 0 position whether in manual or auto mode.
2	Remote Start On Load	Genset start output, when mains is normal, genset will close the breaker.
3	Remote Start Off Load	Genset start output, when mains is normal, mains will close the breaker.
4	Lamp Test	All LED lights on the panel are illuminated and the backlight of the LCD is illuminated while the LCD screen is all black.
5	Gen1 Fault Input	In cycle start, if the input is active, S1 Gens start will be inhibited.
6	Gen2 Fault Input	In cycle start, if the input is active, S2 Gens start will be inhibited.
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	S1 Breaker Trip	S1 breaker trip fault input.
9	S2 Breaker Trip	S2 breaker trip fault input.
10	S1 Load Inhibit	In Manual mode, S1 manual close is inhibited; if breaker is already closed, users should open it manually. In Auto mode, if breaker is already closed, then load will disconnect or S2 takes load.
11	S2 Load Inhibit	In Manual mode, S2 manual close is inhibited; if breaker is already closed, users should open it manually. In Auto mode, if breaker is already closed, then load will disconnect or S1 takes load.
12	QS1 Ready PF	When S1 close ready signal inputs, it needs to wait S1 PF input active before closing.
13	QS2 Ready PF	When S2 close ready signal inputs, it needs to wait S2 PF input active before closing.
14	S1 Close Key Input	Same as S1 close key, the self-reset key is used to control S1 close.
15	S2 Close Key Input	Same as S2 close key, the self-reset key is used to control S2 close.
16	Open Input	Same as open key, the self-reset key is used to control breaker open.
17	Alarm Reset	Reset the current alarm.
18	Alarm Mute	Silence the audible alarm.
19	Manual NEL Trip Input	Please select self-reset key to manually control NEL offload.
20	Manual NEL Re-connect Input	Please select self-reset key to manually control NEL on-load again.
21	S1 Master Input	Set S1 master use compulsively.
22	S2 Master Input	Set S2 master use compulsively.
23	Forced Manual Mode	Set the controller in Manual mode compulsively.
24	Forced Auto Mode	Set the controller in Auto mode compulsively.

No.	Item	Description
25	Panel Lock	Panel key operations are inhibited (Except Up, Down, Confirm, Return and Alarm Reset and Alarm Mute keys).
26	Synchronization Transfer Inhibit	Synchronization transfer is inhibited. HAT860S only.
27	Scheduled Start/Stop Inhibit	Schedule start and stop function are deactivated.
28	Simulate S1 OK	Simulate S1 voltage is normal; the S1 voltage abnormal delay is deactivated.
29	Simulate S2 OK	Simulate S2 voltage is normal; the S2 voltage abnormal delay is deactivated.
30	Auto Transfer/Restore Input	Auto trans. auto restore when active and auto trans. non-restore when inactive.
31	S1 Open Input	QS1 open feedback input.
32	S2 Open Input	QS2 open feedback input.
33	Remote Control Inhibit	Remote control operation is inactive when input is active.
34	S1 PT Break	S1 PT secondary coil break input.
35	S2 PT Break	S2 PT secondary coil break input.
36	QTIE Closed Input	QTIE closed status input.
37	QTIE Trip Fault	QTIE trip fault input.
38	QS1 Closed Status at Contact Side	QS1 closed status of bustie breaker another side in 4-incoming 2-bustie scheme.
39	QS2 Closed Status at Contact Side	QS2 closed status of bustie breaker another side in 4-incoming 2-bustie scheme.
40	External Closed Status	When the external stepwise switch is selected, switch device will close.
41	Reserved	
42	S1 Closed Input	QS1 Closed feedback input.
43	S2 Closed Input	QS2 Closed feedback input.
44	Non-parallel	Parallel switching is inhibited. Parameter settings are inactive when the input port is active (HAT860S only)
45	Manual/Auto Parallel	Parallel switching is allowed in both Manual and Auto modes. Parameter settings are inactive when the input port is active (HAT860S only)
46	Auto Parallel	Parallel switching is allowed only in Auto mode. Parameter settings are inactive when the input port is active (HAT860S only)
47	Manual Parallel	Parallel switching is allowed only in Manul mode. Parameter settings are inactive when the input port is active (HAT860S only)
48	Local Mode	Set the controller to local mode. In this mode, the controller only displays status and does not execute control commands.
49	Reserved	
50	Reserved	
51	Reserved	

No.	Item	Description
52	Load 1 Close Status	Load breaker 1 closed status input.
53	Load 1 Work Position Status	Load breaker 1 work position status input.
54	Load 1 Test Position Status	Load breaker 1 test position status input.
55	Load 1 Breaker Trip	Load breaker 1 trip fault input.
56	Load 2 Close Status	Load breaker 2 closed status input.
57	Load 2 Work Position Status	Load breaker 2 work position status input.
58	Load 2 Test Position Status	Load breaker 2 test position status input.
59	Load 2 Breaker Trip	Load breaker 2 trip fault input.
60	Load 3 Close Status	Load breaker 3 closed status input.
61	Load 3 Work Position Status	Load breaker 3 work position status input.
62	Load 3 Test Position Status	Load breaker 3 test position status input.
63	Load 3 Breaker Trip	Load breaker 3 trip fault input.
64	Load 4 Close Status	Load breaker 4 closed status input.
65	Load 4 Work Position Status	Load breaker 4 work position status input.
66	Load 4 Test Position Status	Load breaker 4 test position status input.
67	Load 4 Breaker Trip	Load breaker 4 trip fault input.
68	Load 5 Close Status	Load breaker 5 closed status input.
69	Load 5 Work Position Status	Load breaker 5 work position status input.
70	Load 5 Test Position Status	Load breaker 5 test position status input.
71	Load 5 Breaker Trip	Load breaker 5 trip fault input.
72	Load 6 Close Status	Load breaker 6 closed status input.
73	Load 6 Work Position Status	Load breaker 6 work position status input.
74	Load 6 Test Position Status	Load breaker 6 test position status input.
75	Load 6 Breaker Trip	Load breaker 6 trip fault input.
76	Load 7 Close Status	Load breaker 7 closed status input.
77	Load 7 Work Position Status	Load breaker 7 work position status input.
78	Load 7 Test Position Status	Load breaker 7 test position status input.
79	Load 7 Breaker Trip	Load breaker 7 trip fault input.
80	Load 8 Close Status	Load breaker 8 closed status input.
81	Load 8 Work Position	Load breaker 8 work position status input.

No.	Item	Description
	Status	
82	Load 8 Test Position Status	Load breaker 8 test position status input.
83	Load 8 Breaker Trip	Load breaker 8 trip fault input.
84	Load 9 Close Status	Load breaker 9 closed status input.
85	Load 9 Work Position Status	Load breaker 9 work position status input.
86	Load 9 Test Position Status	Load breaker 9 test position status input.
87	Load 9 Breaker Trip	Load breaker 9 trip fault input.
88	Load 10 Close Status	Load breaker 10 closed status input.
89	Load 10 Work Position Status	Load breaker 10 work position status input.
90	Load 10 Test Position Status	Load breaker 10 test position status input.
91	Load 10 Breaker Trip	Load breaker 10 trip fault input.
92	Load 11 Close Status	Load breaker 11 closed status input.
93	Load 11 Work Position Status	Load breaker 11 work position status input.
94	Load 11 Test Position Status	Load breaker 11 test position status input.
95	Load 11 Breaker Trip	Load breaker 11 trip fault input.
96	Load 12 Close Status	Load breaker 12 closed status input.
97	Load 12 Work Position Status	Load breaker 12 work position status input.
98	Load 12 Test Position Status	Load breaker 12 test position status input.
99	Load 12 Breaker Trip	Load breaker 12 trip fault input.
100	Load 13 Close Status	Load breaker 13 closed status input.
101	Load 13 Work Position Status	Load breaker 13 work position status input.
102	Load 13 Test Position Status	Load breaker 13 test position status input.
103	Load 13 Breaker Trip	Load breaker 13 trip fault input.
104	Load 14 Close Status	Load breaker 14 closed status input.
105	Load 14 Work Position Status	Load breaker 14 work position status input.
106	Load 14 Test Position Status	Load breaker 14 test position status input.
107	Load 14 Breaker Trip	Load breaker 14 trip fault input.
108	Load 15 Close Status	Load breaker 15 closed status input.
109	Load 15 Work Position Status	Load breaker 15 work position status input.
110	Load 15 Test Position	Load breaker 15 test position status input.

No.	Item	Description
	Status	
111	Load 15 Breaker Trip	Load breaker 15 trip fault input.
112	Load 16 Close Status	Load breaker 16 closed status input.
113	Load 16 Work Position Status	Load breaker 16 work position status input.
114	Load 16 Test Position Status	Load breaker 16 test position status input.
115	Load 16 Breaker Trip	Load breaker 16 trip fault input.
116	Load 17 Close Status	Load breaker 17 closed status input.
117	Load 17 Work Position Status	Load breaker 17 work position status input.
118	Load 17 Test Position Status	Load breaker 17 test position status input.
119	Load 17 Breaker Trip	Load breaker 17 trip fault input.
120	Load 18 Close Status	Load breaker 18 closed status input.
121	Load 18 Work Position Status	Load breaker 18 work position status input.
122	Load 18 Test Position Status	Load breaker 18 test position status input.
123	Load 18 Breaker Trip	Load breaker 18 trip fault input.
124	Load 19 Close Status	Load breaker 19 closed status input.
125	Load 19 Work Position Status	Load breaker 19 work position status input.
126	Load 19 Test Position Status	Load breaker 19 test position status input.
127	Load 19 Breaker Trip	Load breaker 19 trip fault input.
128	Load 20 Close Status	Load breaker 20 closed status input.
129	Load 20 Work Position Status	Load breaker 20 work position status input.
130	Load 20 Test Position Status	Load breaker 20 test position status input.
131	Load 20 Breaker Trip	Load breaker 20 trip fault input.
132	Load 21 Close Status	Load breaker 21 closed status input.
133	Load 21 Work Position Status	Load breaker 21 work position status input.
134	Load 21 Test Position Status	Load breaker 21 test position status input.
135	Load 21 Breaker Trip	Load breaker 21 trip fault input.
136	Load 22 Close Status	Load breaker 22 closed status input.
137	Load 22 Work Position Status	Load breaker 22 work position status input.
138	Load 22 Test Position Status	Load breaker 22 test position status input.
139	Load 22 Breaker Trip	Load breaker 22 trip fault input.

No.	Item	Description
140	Load 23 Close Status	Load breaker 23 closed status input.
141	Load 23 Work Position Status	Load breaker 23 work position status input.
142	Load 23 Test Position Status	Load breaker 23 test position status input.
143	Load 23 Breaker Trip	Load breaker 23 trip fault input.
144	Load 24 Close Status	Load breaker 24 closed status input.
145	Load 24 Work Position Status	Load breaker 24 work position status input.
146	Load 24 Test Position Status	Load breaker 24 test position status input.
147	Load 24 Breaker Trip	Load breaker 24 trip fault input.
148	Reserved	
149	Reserved	
150	QTIE Inhibit Close	Inhibit QTIE breaker close.
151	Reserved	
152	QTIE Close Key Input	When bustie control is enabled, it controls QTIE breaker close in manual mode.
153	QTIE Open Key Input	When bustie control is enabled, it controls QTIE breaker open in manual mode.
154	Reserved	
155	Reserved	
156	Reserved	
157	Reserved	
158	Reserved	
159	Reserved	

### 9.3.2 OUTPUT PORTS FUNCTION DESCRIPTION

**Table 19 – Output Ports Function Description**

No.	Items	Description
0	Not Used	Output port is invalid.
1	Custom Combined 1	
2	Custom Combined 2	
3	Custom Combined 3	
4	Custom Combined 4	
5	Custom Combined 5	
6	Custom Combined 6	
7	Reserved	
8	Reserved	
9	Local Mode	Output when controller is in local mode.
10	Reserved	
11	Common Alarm	It includes fault alarm and warn alarm.
12	Common Fault Alarm	It includes “Transfer Failure”, “Overcurrent Trip” alarm.

No.	Items	Description
13	Common Warn Alarm	It includes "S1 Reverse Phase Sequence", "S2 Reverse Phase Sequence", "Load Overcurrent", "Forced Open" warning.
14	Transfer Failure	It includes "QS1 Close failure", "QS1 Open Failure", "QS2 Close Failure", "QS2 Open Failure".
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	Reserved	
17	Genset Start Delay	Output when start signal is initiated.
18	Genset Stop Delay	Output when stop signal is initiated.
19	Elevator Control	Output before the load disconnect or switch transfer. Used for control the running elevator stop at the nearest floor until the switch transfer is terminated.
20	Reserved	
21	Reserved	
22	Reserved	
23	S1 Voltage Normal	Output when S1 power is normal.
24	S1 Voltage Abnormal	Output when S1 power is abnormal.
25	S2 Voltage Normal	Output when S2 power is normal.
26	S2 Voltage Abnormal	Output when S2 power is abnormal.
27	S1 Overcurrent Output	Output when S1 overcurrent loading.
28	S2 Overcurrent Output	Output when S2 overcurrent loading.
29	Reserved	
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.
33	Reserved	
34	QS1 Close Control	Control the QS1 to close.
35	QS1 Open Control	Control the QS1 to open.
36	QS2 Close Control	Control the QS2 to close.
37	QS2 Open Control	Control the QS2 to open.
38	S1 PT Break	Output when S1 PT secondary coil is broken.
39	S2 PT Break	Output when S2 PT secondary coil is broken.
40	NEL1 Trip	When it is active, it controls NEL offload; when it is inactive, it can be used for NEL on-load again.
41	NEL2 Trip	
42	NEL3 Trip	
43	Reserved	
44	Reserved	
45	QS1 Closed Input	The close status of S1 breaker.
46	QS2 Closed Input	The close status of S2 breaker.
47	S1 Genset Start	When the system type is "S1 Gen S2 Gen", it controls the S1 genset start.
48	S2 Genset Start	When the system type is "S1 Gen S2 Gen", it controls the S2 genset start.

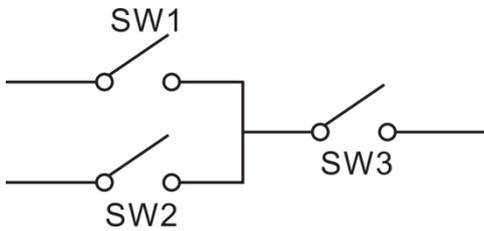
No.	Items	Description
49	ATS Power L1	ATS power supply.
50	ATS Power L2	
51	ATS Power L3	
52	ATS Power N	
53	Remote Control	Control the output via RS485 communication command.
54	Aux. Input 1 Status	Aux. Input port status.
55	Aux. Input 2 Status	
56	Aux. Input 3 Status	
57	Aux. Input 4 Status	
58	Aux. Input 5 Status	
59	Aux. Input 6 Status	
60	Aux. Input 7 Status	
61	Aux. Input 8 Status	
62	Aux. Input 9 Status	
63	Aux. Input 10 Status	
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 Reverse Phase Sequence	
71	Reserved	
72	Reserved	
73	S2 Blackout	S2 power supply status.
74	S2 Over Volt	
75	S2 Under Volt	
76	S2 Over Freq	
77	S2 Under Freq	
78	S2 Loss of Phase	
79	S2 Reverse Phase Sequence	
80	Reserved	
81	Reserved	
82	Synchronization Failure	Synchronization status was not successfully detected after the synchronization wait delay. (HAT860S only)
83	Wait for Synchronization	Output during synchronization wait delay. (HAT860S only)
84	Transferring	Output during the breaker transfer process, stop after transfer is over.
85	Reserved	
86	Reserved	
87	Scheduled Not Run	Output during the Scheduled Not Run process.
88	Scheduled Run	Output during the Scheduled Run process.
89	Reserved	

No.	Items	Description
90	Reserved	
91	Reserved	
92	Reserved	
93	QTIE Breaker Trip Fault	QTIE breaker trip fault output.
94	QTIE Breaker Close	Control QTIE to close.
95	QTIE Breaker Open	Control QTIE to open.
96	Aux. Input 11 Status	Aux. Input port status.
97	Aux. Input 12 Status	
98	Reserved	
99	Reserved	
100	External Close Control	When load stepwise switch selects external way, load breaker close output.
101	External Open Control	When load stepwise switch selects external way, load breaker open output.
102	Reserved	
103	Reserved	
104	Load 1 Close Output	Expand output control way, load breaker 1 close output.
105	Load 1 Open Output	Expand output control way, load breaker 1 open output.
106	Load 2 Close Output	Expand output control way, load breaker 2 close output.
107	Load 2 Open Output	Expand output control way, load breaker 2 open output.
108	Load 3 Close Output	Expand output control way, load breaker 3 close output.
109	Load 3 Open Output	Expand output control way, load breaker 3 open output.
110	Load 4 Close Output	Expand output control way, load breaker 4 close output.
111	Load 4 Open Output	Expand output control way, load breaker 4 open output.
112	Load 5 Close Output	Expand output control way, load breaker 5 close output.
113	Load 5 Open Output	Expand output control way, load breaker 5 open output.
114	Load 6 Close Output	Expand output control way, load breaker 6 close output.
115	Load 6 Open Output	Expand output control way, load breaker 6 open output.
116	Load 7 Close Output	Expand output control way, load breaker 7 close output.
117	Load 7 Open Output	Expand output control way, load breaker 7 open output.
118	Load 8 Close Output	Expand output control way, load breaker 8 close output.
119	Load 8 Open Output	Expand output control way, load breaker 8 open output.
120	Load 9 Close Output	Expand output control way, load breaker 9 close output.
121	Load 9 Open Output	Expand output control way, load breaker 9 open output.
122	Load 10 Close Output	Expand output control way, load breaker 10 close output.
123	Load 10 Open Output	Expand output control way, load breaker 10 open output.
124	Load 11 Close Output	Expand output control way, load breaker 11 close output.
125	Load 11 Open Output	Expand output control way, load breaker 11 open output.
126	Load 12 Close Output	Expand output control way, load breaker 12 close output.
127	Load 12 Open Output	Expand output control way, load breaker 12 open output.
128	Load 13 Close Output	Expand output control way, load breaker 13 close output.
129	Load 13 Open Output	Expand output control way, load breaker 13 open output.
130	Load 14 Close Output	Expand output control way, load breaker 14 close output.
131	Load 14 Open Output	Expand output control way, load breaker 14 open output.

No.	Items	Description
132	Load 15 Close Output	Expand output control way, load breaker 15 close output.
133	Load 15 Open Output	Expand output control way, load breaker 15 open output.
134	Load 16 Close Output	Expand output control way, load breaker 16 close output.
135	Load 16 Open Output	Expand output control way, load breaker 16 open output.
136	Load 17 Close Output	Expand output control way, load breaker 17 close output.
137	Load 17 Open Output	Expand output control way, load breaker 17 open output.
138	Load 18 Close Output	Expand output control way, load breaker 18 close output.
139	Load 18 Open Output	Expand output control way, load breaker 18 open output.
140	Load 19 Close Output	Expand output control way, load breaker 19 close output.
141	Load 19 Open Output	Expand output control way, load breaker 19 open output.
142	Load 20 Close Output	Expand output control way, load breaker 20 close output.
143	Load 20 Open Output	Expand output control way, load breaker 20 open output.
144	Load 21 Close Output	Expand output control way, load breaker 21 close output.
145	Load 21 Open Output	Expand output control way, load breaker 21 open output.
146	Load 22 Close Output	Expand output control way, load breaker 22 close output.
147	Load 22 Open Output	Expand output control way, load breaker 22 open output.
148	Load 23 Close Output	Expand output control way, load breaker 23 close output.
149	Load 23 Open Output	Expand output control way, load breaker 23 open output.
150	Load 24 Close Output	Expand output control way, load breaker 24 close output.
151	Load 24 Open Output	Expand output control way, load breaker 24 open output.
152	Power Supply Detection Abnormal	Output upon detection of abnormal power supply fault.
153	Closing Detection Abnormal	Output upon detection of abnormal closing fault.
154	Controller Detection Fault	Output upon detection of abnormal power supply fault or abnormal closing fault.
155	Backup Takeover Control	Output when the controller gains control authority.
156	Reserved	
157	Reserved	
158	Reserved	
159	Reserved	

### 9.3.3 CUSTOM COMBINED OUTPUT

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**, and SW3 is **TRUE**, defined combination output is active;

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

**NOTE5:** SW1, SW2, SW3 can be set as any contents except for "defined combination output" in the output setting.

**NOTE6:** 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 AND 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 is 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.

### 9.4 OVERCURRENT DMT AND IDMT SETTING

**DMT:** Overcurrent delay is definite, different overcurrent values have same pre-set delay;

**IDMT:** Overcurrent delay decrease with the increase of current, different overcurrent values have different delay time.

IDMT overload current delay formula is as follows:

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

T: Overload current delay value (s)

t: Timing multiplier rate

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

IT: Overload current set value

$$t = 36$$

$$IA = 550A$$

$$IT = 500A$$

Then  $T = 3600s$  (1h)

## 10 EVENT LOG

On the main screen press  key and select **Event Log**, and then press  key again, the screen will show the event log interface.

Each event log includes:

- Log date and time
- Log type
- Event
- S1 power status
- S2 power status
- S1 3-phase voltage
- S2 3-phase voltage
- S1 frequency
- S2 frequency
- S1 current IA, IB, IC
- S2 current IA, IB, IC
- Active power
- Power factor

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

Event log type includes: Action Event, Warn Event and Fault Event. Fault events are all fault alarms while warn events are all warn alarms.

**Table 20– Action Events List**

No.	Action Events	Description
1	QS1 Close	Record when the QS1 close relay outputs.
2	QS2 Close	Record when the QS2 close relay outputs.
3	QS1 Open	Record when the QS1 open relay outputs.
4	QS2 Open	Record when the QS2 open relay outputs.
5	NEL1 Trip	Record when NEL1 offload outputs.
6	NEL2 Trip	Record when NEL2 offload outputs.
7	NEL3 Trip	Record when NEL3 offload outputs.
8	Genset Start	Record when the genset start signal outputs.
9	S1 Genset Start	Record when the S1 genset start signal output.
10	S2 Genset Start	Record when the S2 genset start signal output.
11	Genset Stop	Record when the genset start signal deactivated.
12	S1 Genset Stop	Record when the S1 genset start signal deactivated.
13	S2 Genset Stop	Record when the S2 genset start signal deactivated.
14	Auto Mode	Record when the genset transfers to Auto Mode.
15	Manual Mode	Record when the genset transfers to Manual Mode.
16	Manual Open Key	Record when manually operate key open.

No.	Action Events	Description
17	Manual S1 Close Key	Record when manually operate S1 close key.
18	Manual S2 Close Key	Record when manually operate S2 close key.
19	Remote Open Key	Record when remotely operate key open via communication.
20	Remote S1 Close Key	Record when remotely operate S1 close key via communication.
21	Remote S2 Close Key	Record when remotely operate S2 close key via communication.

## 11 BLACK BOX RECORDS

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

Each record includes:

- Record date and time
- Record type
- Event
- S1 power status
- S2 power status
- S1 3-phase voltage
- S2 3-phase voltage
- S1 frequency
- S2 frequency
- S1 current IA, IB, IC
- S2 current IA, IB, IC
- Active power
- Power factor

Maximum pieces of black box record are 5. Every event records total 60s (before and after) data information of this event, and record once per second. The latest record will cover the oldest one when records amount exceeds 5. The first record is latest. Users could check details by pressing Confirm Key, and could check the 60 data by up/down keys.

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

**Table 21 – Action Events List**

No.	Action Events	Description
1	Auto Open	Open in auto mode.
2	Auto S1 Close	QS1 close in auto mode.
3	Auto S2 Close	QS2 close in auto mode.

## 12 ATS OPERATION

### 12.1 MANUAL OPERATION

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

ATS will start to transfer immediately after pressing the corresponding key. During the process, corresponding indicators will flash, and then the indicator will be normally illuminated when transfer is done.

**Table 22 – Manual Transfer Keys**

Icon	Key Name	Description
	S1 Close	After pressing this key, if load is disconnected, QS1 will close, load breaker will stepwise switch and S1 will supply power.
	S2 Close	After pressing this key, if load is disconnected, QS2 will close, load breaker will stepwise switch and S2 will supply power.
	Open	After pressing this key, load breaker stepwise switches, after open is over, QS1 or QS2 will open and load will disconnect.

**NOTE7:** If manual mode switch is set as “Action after Prompt Confirm”, prompt box will be popped out after manually close/open main breaker, you need to select if stepwise witch load breaker according to the box content.

### 12.2 AUTO OPERATION

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

In auto mode, controller automatically transfer breaker according S1, S2 status, transfer priority and auto transfer/restore status, so that ensuring the load supply. The example is as follows:

**Table 23 – Auto Transfer Logic**

Power Status	ATS&Load Status	S1 Master	S2 Master
S1 Normal S2 Normal Auto Trans./Restore	ATS Status	QS1 Close QS2 Open	QS2 Close QS1 Open
	Load Status	S1 supplies power for load.	S2 supplies power for load.
S1 Normal S2 Abnormal Auto Trans./Restore	ATS Status	QS1 Close QS2 Open	QS1 Close QS2 Open
	Load Status	S1 supplies power for load.	S1 supplies power for load.
S1 Abnormal S2 Normal Auto Trans./Restore	ATS Status	QS2 Close QS1 Open	QS2 Close QS1 Open
	Load Status	S2 supplies power for load.	S2 supplies power for load.
S1 Abnormal S2 Abnormal (ATS has undervolt trip function or ATS supply normal)	ATS Status	QS1 Open QS2 Open	
	Load Status	Load blackout.	

If close failure or close inhibit occurs during transferring, corresponding ATS will not close, other ATS can control close supplies power for load. If open fails, ATS has no action.

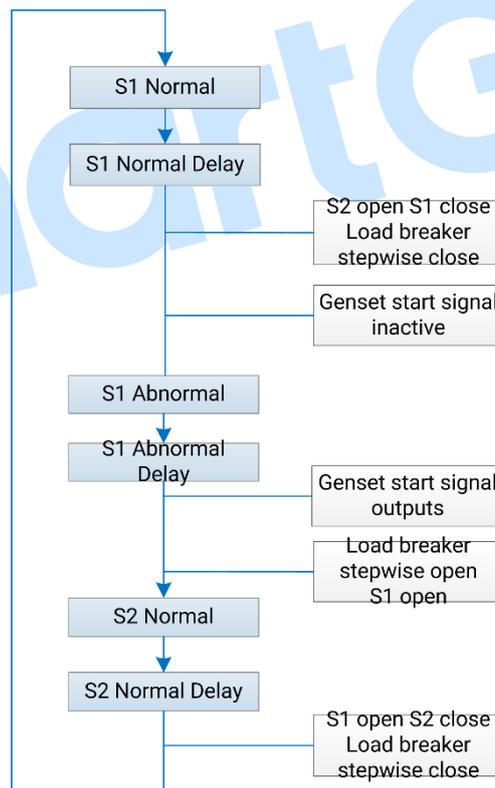
**12.2.1 AUTO TRANSFER AUTO RESTORE**

Set S1 Mains S2 Gen, auto transfer/restore, S1 master and load stepwise switch control is enabled.

If S1 is normal, S1 breaker will close, after close if over, genset start signal is inactive; Load breaker close/open status is detected, load breaker closes step by step according to set close sequence and interval time, main power supplies power for load.

If S1 is abnormal, it will enter S1 abnormal delay, after the delay is over, genset start signal outputs, load breaker opens step by step according to set open sequence and interval time (open control is enabled), after the load side open is over, open S1 breaker and wait for S2 normal. After S2 normal delay, S2 breaker closes. After standby S2 is closed, load breaker close/open status is detected, load breaker closes step by step according to set close sequence and interval time, standby power supplies power for load.

If main power recovers, transfer load to its side to realize auto transfer, auto restore.



**Fig.2 – Auto Trans./Restore Flowchart**

**12.2.2 AUTO TRANSFER NON-RESTORE**

Set S1 Mains S2 Mains, auto transfer, non-restore, S1 master and load stepwise switch control is enabled.

If S1 is normal, S1 breaker will close, after close if over, load breaker close/open status is detected, load breaker closes step by step according to set close sequence and interval time, main power supplies power for load.

If S1 is abnormal, it will enter S1 abnormal delay, after the delay is over, load breaker opens step by step according to set open sequence and interval time (open control is enabled), after the load side open is over, open S1 breaker and wait for S2 normal. After S2 normal delay, S2 breaker closes. After standby S2 is closed, load breaker close/open status is detected, load breaker closes step by step according to set close sequence and interval time, standby power supplies power for load.

If main power recovers, S2 keeps closed, breaker has no action. When S2 is abnormal, transfer load to main power side.

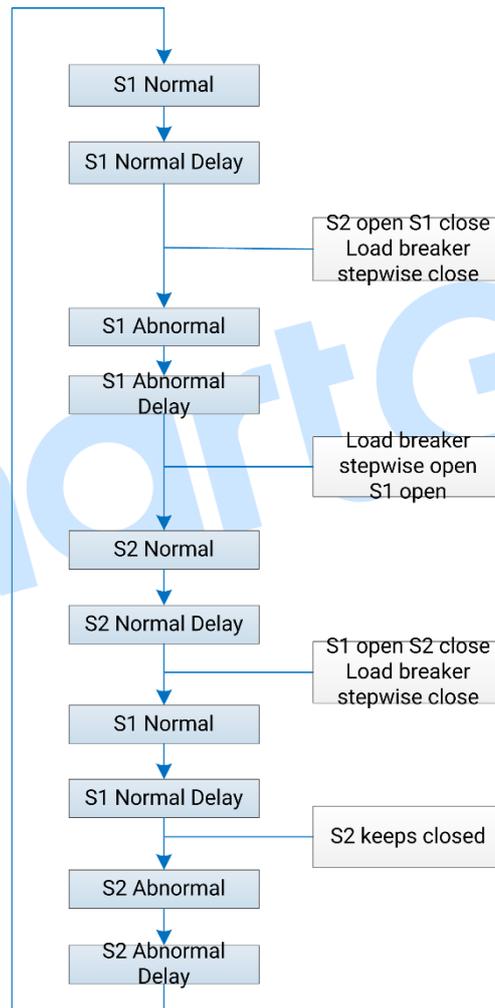
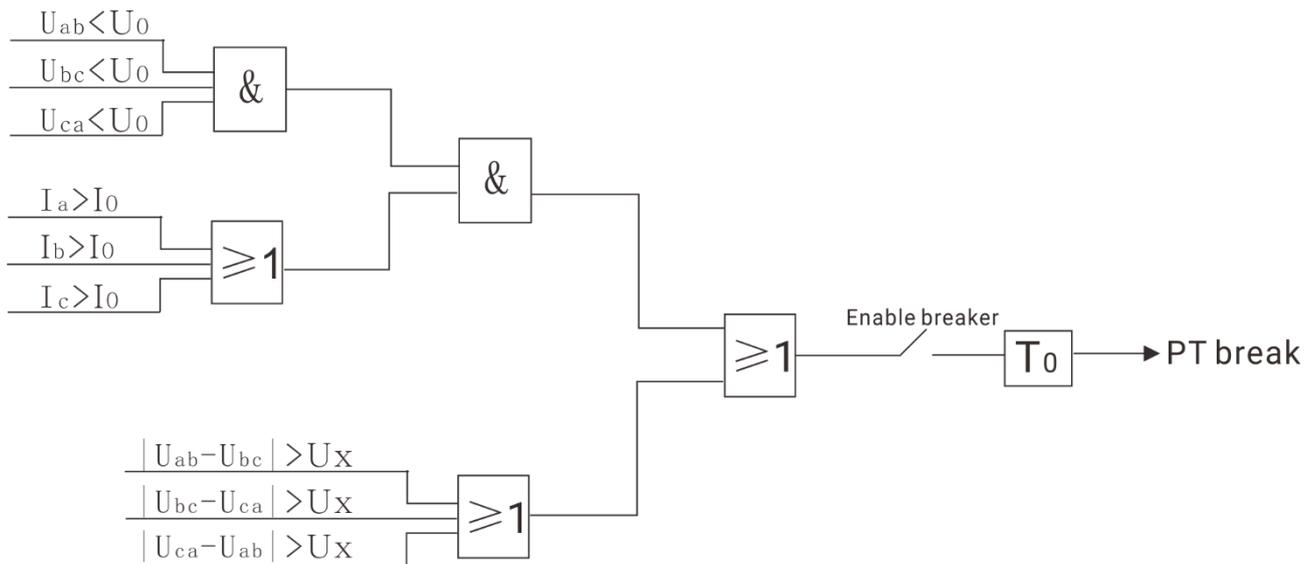


Fig.3 – Auto Trans. Non-restore Flowchart

## 13 PT BREAK DETECTION



**Fig.4 – PT Break Detection Logic**

**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.

14 NEL CONTROL

14.1 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.

14.2 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

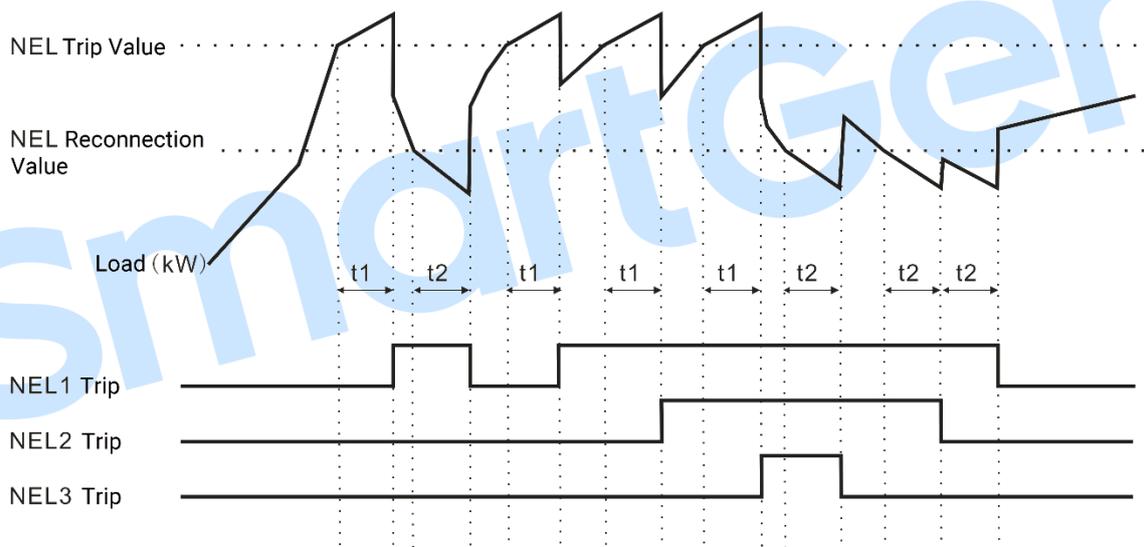


Fig.5 – NEL Trip

14.3 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.

**NOTE7:** When auto trip and reconnection are enabled, manual operation is still active.

## 15 COMMUNICATION CONFIGURATION AND CONNECTION

### 15.1 ILLUSTRATION

HAT860 Series Medium Voltage ATS controller equips with RS485, USB communication interfaces. RS485 communication interface 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 *HAT860 Communication Protocol*.

### 15.2 RS485 COMMUNICATION

HAT860 Medium Voltage ATS controller has two isolated RS485 communication interfaces, one for RS485 LAN monitoring, the other for CMM366 series communication module connection to realize cloud monitoring.

When redundancy control is enabled, the main and slave controllers communicate via RS485-1 for data exchange. During this operation, communication with PC through this interface is unavailable.

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 EXPAND INPUT/OUTPUT MODULE COMMUNICATION DESCRIPTION

RS485-2 of HAT860 Series Medium Voltage ATS controller can communicate with input/output module to realize the expansion function of input/output ports.

After HAT860 expansion module is enabled, dial switch of input/output module is set as same with HAT860 expansion communication module address, which enables to configure input/output module function via HAT860 and read input module status via RS485 communication, relay that controls output module will output.

Matched with DIN16A-2 and DOUT26B-2, HAT860 can realize stepwise switch of 24-way load breakers in the most. When the baud rate is 9600bps, it can realize the expansion application of no more than 1km theoretically.

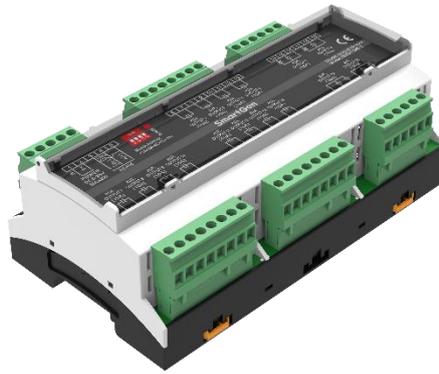


Fig.6 – DOUT16B-2 Module



Fig.7 – DIN16A-2 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.

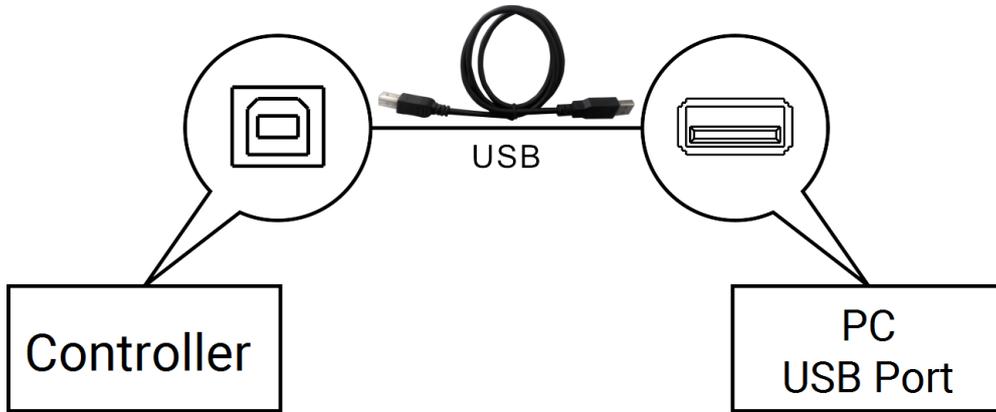


Fig.8 – USB Connection Diagram

16 TERMINALS

16.1 TERMINAL DESCRIPTION

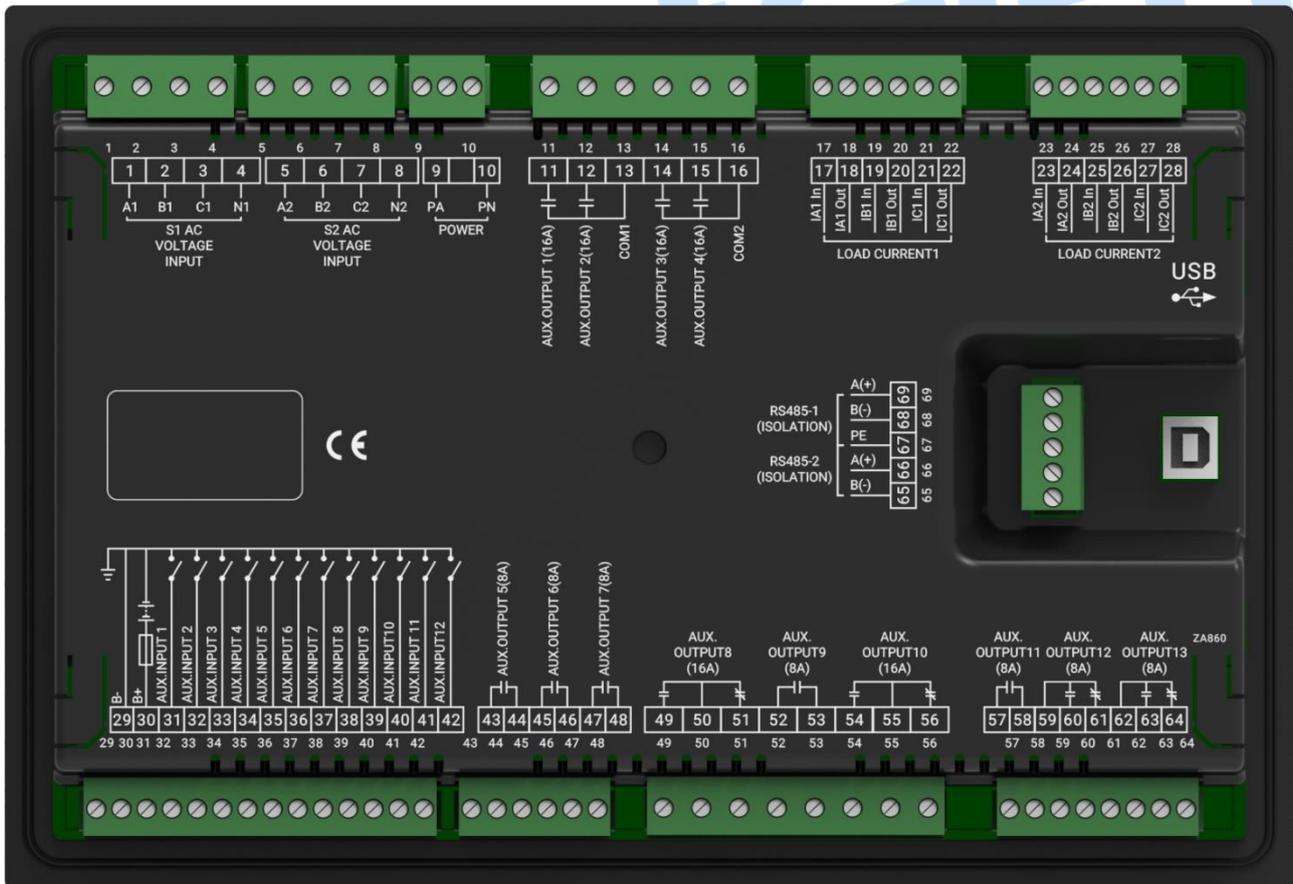


Fig.9 – Controller Rear Panel Drawing

**Table 24 – 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.
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		
20	IB1 Out		
21	IC1 In	1# CT secondary C phase current connected	1# current.
22	IC1 Out		
23	IA2 In		
24	IA2 Out		
25	IB2 In	2# CT secondary B phase current connected	2# current.
26	IB2 Out		
27	IC2 In		
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.

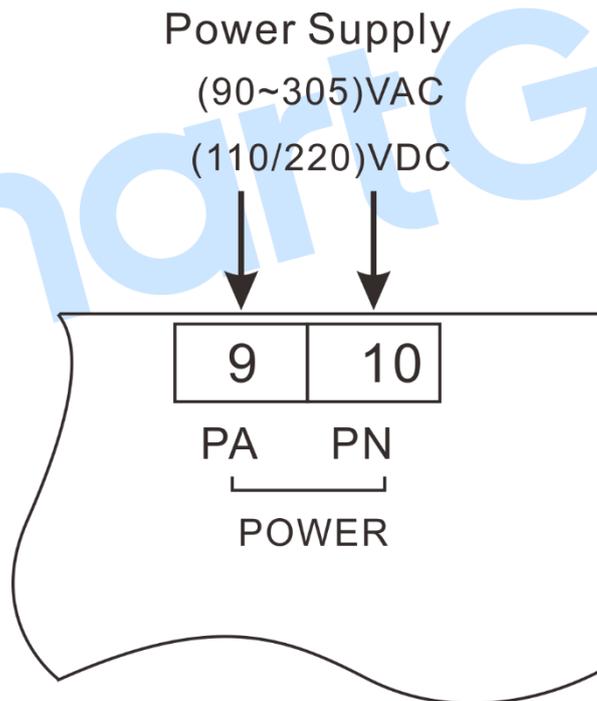
No.	Items	Description		Remark
				Grounding active.
32	AUX. INPUT 2	Aux. Input Port 2		Default: S2 Closed Input. Grounding active.
33	AUX. INPUT 3	Aux. Input Port 3		Default: Forced Open. Grounding active.
34	AUX. INPUT 4	Aux. Input Port 4		Default: S1 Breaker Trip. Grounding active.
35	AUX. INPUT 5	Aux. Input Port 5		Default: S2 Breaker Trip. 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				Default: Not Used.
44	AUX. OUTPUT 5	Aux. Output Port 5		Volts free relay; Normally Open output. Capacity: 8A 250V.
45				Default: Not Used.
46	AUX. OUTPUT 6	Aux. Output Port 6		Volts free relay; Normally Open output. Capacity: 8A 250V.
47				Default: Not Used.
48	AUX. OUTPUT 7	Aux. Output Port 7		Volts free relay; Normally Open output. Capacity: 8A 250V.
49		N/O	Aux. Output Port 8	Default: Genset Start (N/C). Volts free relay; Normally Open/Close output. Capacity: 16A 250V.
50	AUX. OUTPUT 8	COM		
51		N/C		
52				Default: Not Used.
53	AUX. OUTPUT 9	Aux. Output Port 9		Volts free relay; Normally Open output. Capacity: 8A 250V.
54		N/O	Aux. Output Port 10	Default: Not Used. Volts free relay; Normally Open/Close output. Capacity: 16A 250V.
55	AUX. OUTPUT 10	COM		
56		N/C		
57				Default: Not Used.
58	AUX. OUTPUT 11	Aux. Output Port 11		Volts free relay; Normally Open output. Capacity: 8A 250V.
59		COM	Aux. Output Port 12	Default: Not Used. Volts free relay; Normally Open output. Capacity: 8A 250V.
60	AUX. OUTPUT 12	N/O		
61		N/C		
62		COM	Aux. Output Port 13	Default: Not Used. Volts free relay; Normally Open output. Capacity: 8A 250V.
63	AUX. OUTPUT 13	N/O		
64		N/C		
65	RS485-2 B(-)	RS485-2	Communication	120Ω impedance matched resistor

No.	Items	Description	Remark
66	RS485-2 A(+)	Port	should be connected externally according to network situation. (If expand input/output module is enabled, it can only connect control module communication.)
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

## 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.10 – Power Supply Diagram**

16.2.2 DC SUPPLY

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

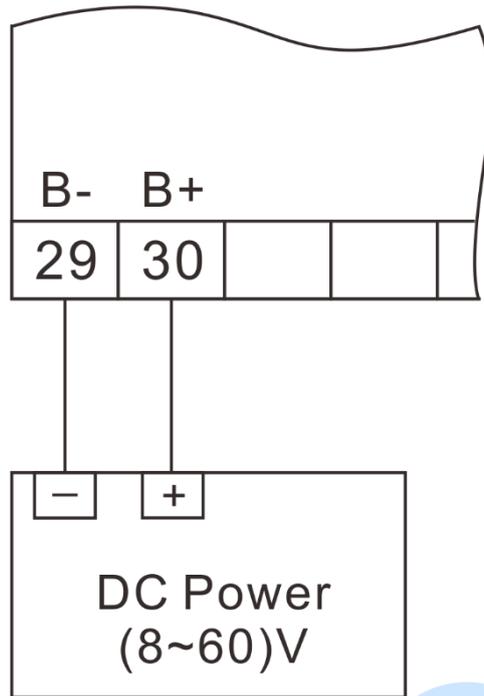


Fig.11 – DC Supply Diagram

17 4-INCOMING 2-BUSTIE APPLICATION

17.1 SLD OF 4-INCOMING 2-BUSTIE SCHEME

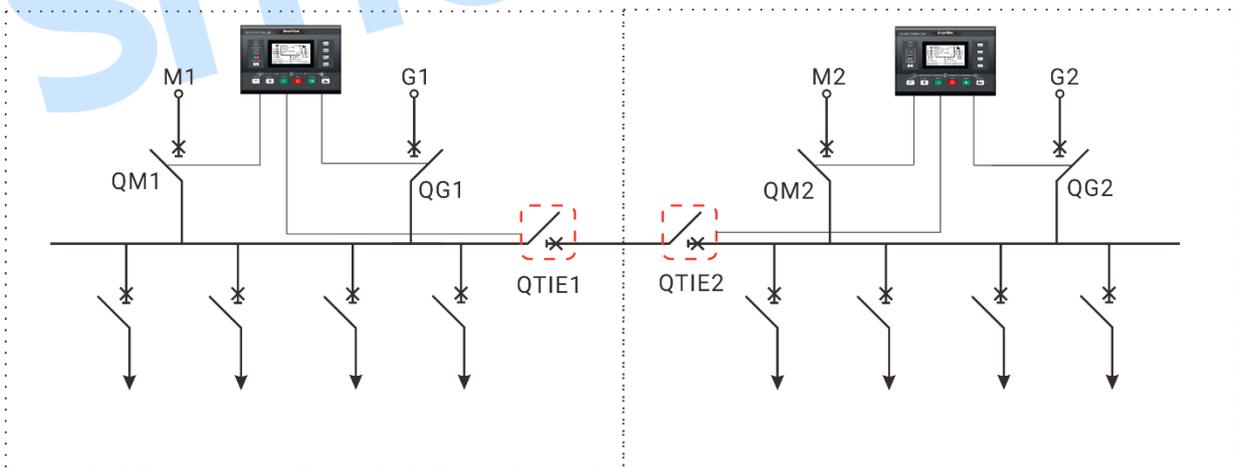


Fig.12 – SLD of 4-incoming 2-bustie Scheme

17.2 SYSTEM APPLICATION REQUIREMENTS

Set 2-way mains, 2-way gens, 2-way mains as master, 2-way gens as slave.

If 2-way mains are normal, bustie breaker will open and 2-way mains take load separately; If one mains abnormal, two bustie breaker will close, mains normal side takes load and supplies power; If both mains abnormal, bustie breaker will open, 2-way gens take load separately.

17.3 CONTROLLER APPLICATION

It requires 2 HAT860 modules.

Table 24 – Corresponding Setting

Some Parameters Setting	
Breaker Type Setting	Two-breaking
Aux. Input 1	S1 closed input
Aux. Input 2	S2 closed input
Aux. Input 3	QTIE closed input
Aux. Input 4	QS1 closed input at contact side
Aux. Input 5	QS2 closed input at contact side
Aux. Input 6	S1 breaker trip input
Aux. Input 7	S2 breaker trip input
Aux. Input 8	QTIE trip fault input
Aux. Output 1	QS1 close output
Aux. Output 2	QS1 open output
Aux. Output 3	QS2 close output
Aux. Output 4	QS2 open output
Aux. Output 5	QTIE close control
Aux. Output 6	QTIE open control
Aux. Output 8	Genset start

**NOTE9:** The above application diagram and parameter setting are only examples, user should connect wire according to actual situation.

**NOTE10:** The start signal of each bustie is “Genset Start Mains NG”, the total start signal is provided by two controllers start signal in series, that is start when 2-way mains abnormal simultaneously.

18 TYPICAL APPLICATION DIAGRAM

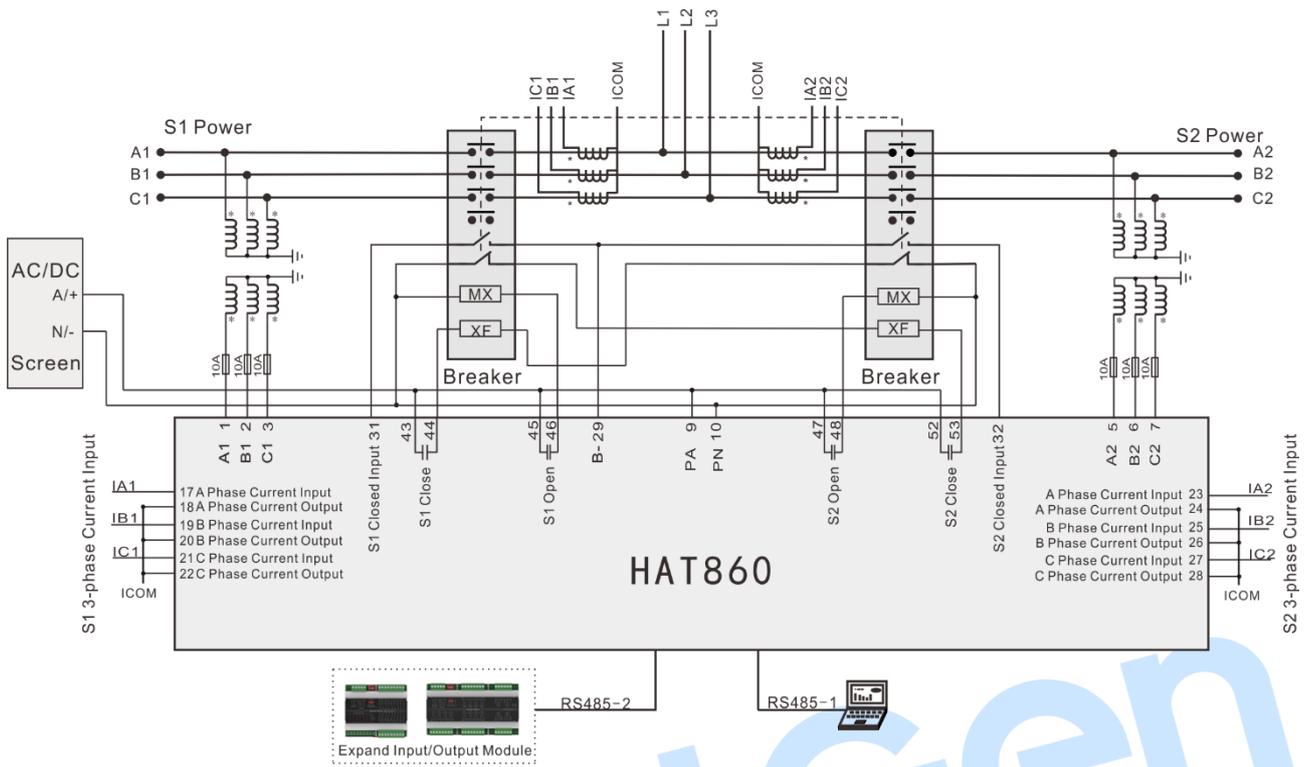


Fig.13 – Breaker Application Diagram

MX: Open coil; XF: Close coil.

Table 26 – Corresponding Setting

Some Parameters Setting	
Breaker Type Setting	Two-breaking
Aux. Input 1	S1 Closed Input
Aux. Input 2	S2 Closed Input
Aux. Output 5	QS1 Close Output
Aux. Output 6	QS1 Open Output
Aux. Output 7	QS2 Open Output
Aux. Output 9	QS2 Close Output

**NOTE10:** The above application diagram is only an example, user should connect wire according to actual situation.

19 STEPWISE SWITCH SYSTEM APPLICATION DIAGRAM

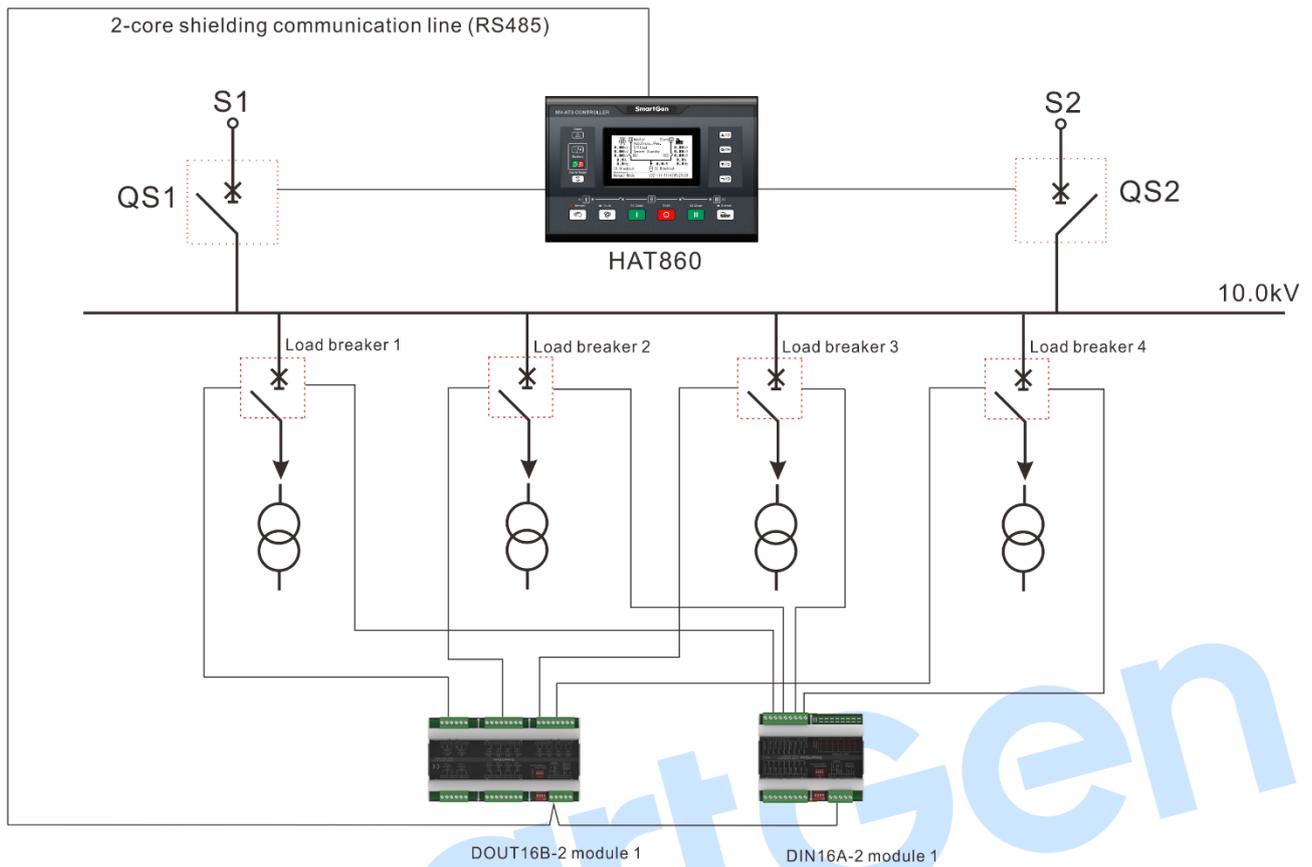
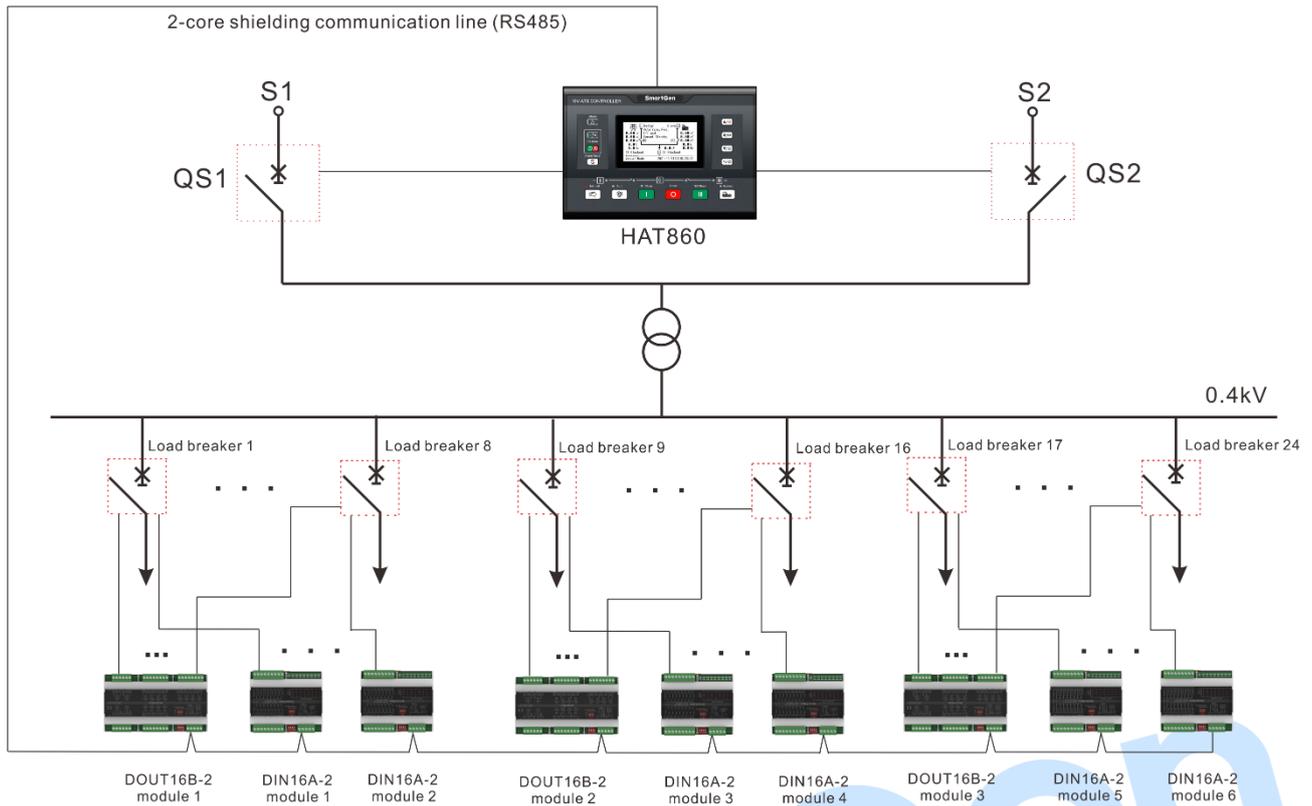


Fig.14 – Medium Voltage Load Breaker Stepwise Switch Application Diagram

Table 27 – Corresponding Setting

Some Parameters Setting	
Stepwise Switch Control Mode	Expand Output Control
Load Breaker Numbers	4
Expand Input Module 1 Setting	Enable
Expand Output Module 1 Setting	Enable
Expand Input Port Function Setting	Load (1-4) Close Status
Expand Input Port Function Setting	Load (1-4) Work Position Status
Expand Input Port Function Setting	Load (1-4) Test Position Status
Expand Input Port Function Setting	Load (1-4) Trip Status
Expand Output Port Function Setting	Load (1-4) Close Output
Expand Output Port Function Setting	Load (1-4) Open Output

**NOTE12:** The above application diagram and configuration are only examples, user should select expansion module numbers, wiring and configuration according to actual situation.



**Fig.15 – Low Voltage Load Breaker Stepwise Switch Application Diagram**

**Table 28 – Corresponding Setting**

Some Parameters Setting	
Stepwise Switch Control Mode	Expand Output Control
Load Breaker Numbers	24
Expand Input Module (1-3) Setting	Enable
Expand Output Module (1-3) Setting	Enable
Expand Input Port Function Setting	Load (1-24) Close Status
Expand Input Port Function Setting	Load (1-24) Work Position Status
Expand Input Port Function Setting	Load (1-24) Test Position Status
Expand Input Port Function Setting	Load (1-24) Trip Status
Expand Output Port Function Setting	Load (1-24) Close Output
Expand Output Port Function Setting	Load (1-24) Open Output

**NOTE13:** The above application diagram and configuration are only examples, user should select expansion module numbers, wiring and configuration according to actual situation.

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

Unit: mm

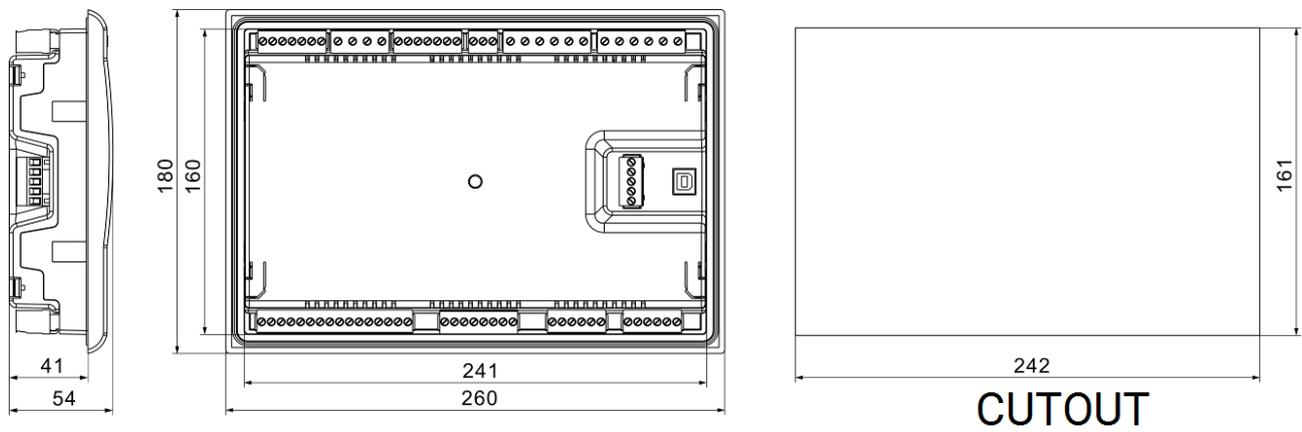


Fig.16 – Overall & Cutout Dimensions

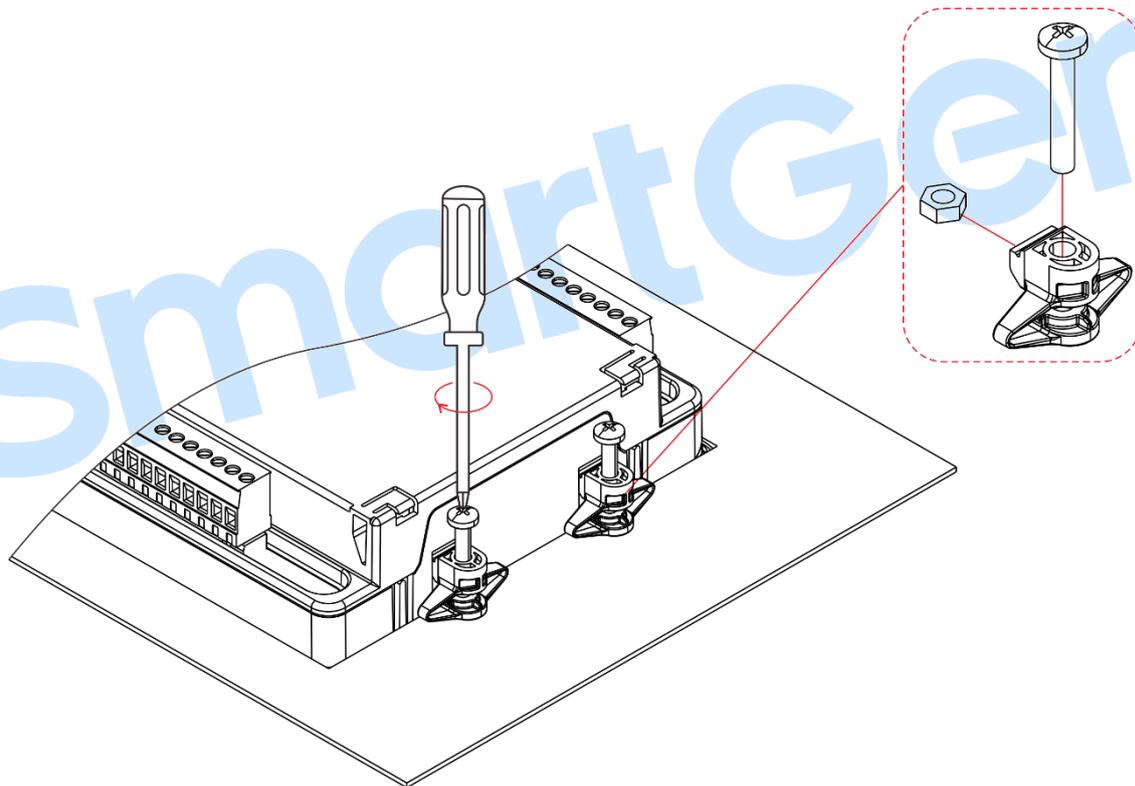


Fig.17 – Clips Installation

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 port connections, pay attention to normally open contact and normally close contact; Check the output port function settings and output types in parameters configuration.
Auxiliary Input Abnormal	Check whether the auxiliary input is soundly connected to GND when it is active, while hung up when it is inactive ( <b>NOTE:</b> 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.