

SmartGen

MAKING CONTROL SMARTER

HGM9520N GENSET PARALLELED (WITH MAINS) CONTROLLER USER MANUAL



郑州众智科技股份有限公司
SMARTGEN(ZHENGZHOU)TECHNOLOGY CO.,LTD.

SmartGenRegistered trademark

No.28 Xuemei Street, Zhengzhou, Henan, China

Tel: +86-371-67988888/67981888/67992951

+86-371-67981000(overseas)

Fax: +86-371-67992952

Email: sales@smartgen.cn

Web: www.smartgen.com.cn
www.smartgen.cn

All rights reserved. No part of this publication may be reproduced in any material form (including photocopying or storing in any medium by electronic means or other) without the written permission of the copyright holder.




SmartGen reserves the right to change the contents of this document without prior notice.

Table 1 Software Version

| Date | Version | Note |
|------------|---------|--|
| 2020-02-22 | 1.0 | Original release. |
| 2021-03-30 | 1.1 | Modify the parameter error and other translation problems. |
| 2023-05-15 | 1.2 | Update the logo of SmartGen; Modify the flowchart descriptions of island output mode. |
| | | |

This manual is only suits for HGM9520N genset paralleled unit.

Table 2 Symbol Instruction

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

SmartGen

CONTENTS

| | | |
|-------|--|----|
| 1 | OVERVIEW..... | 6 |
| 2 | PERFORMANCE AND CHARACTERISTICS..... | 7 |
| 3 | SPECIFICATION | 9 |
| 4 | OPERATION..... | 11 |
| 4.1 | INDICATOR LAMP | 11 |
| 4.2 | PUSHBUTTONS | 12 |
| 4.3 | LCD DISPLAY | 13 |
| 4.3.1 | MAIN DISPLAY..... | 13 |
| 4.3.2 | USER MENU AND PARAMETER SETTING..... | 14 |
| 4.4 | AUTO START/STOP OPERATION | 15 |
| 4.5 | MANUAL START/STOP OPERATION..... | 16 |
| 4.6 | GENSET SWITCH CONTROL PROCEDURES..... | 16 |
| 4.6.1 | MANUAL CONTROL PROCEDURE | 16 |
| 4.6.2 | AUTOMATIC CONTROL PROCEDURE | 17 |
| 5 | PROTECTIONS..... | 17 |
| 5.1 | WARNING ALARMS..... | 18 |
| 5.2 | BLOCK ALARMS | 24 |
| 5.3 | SAFETY TRIP..... | 29 |
| 5.4 | SAFETY TRIP AND STOP ALARMS..... | 33 |
| 5.5 | TRIP ALARMS..... | 38 |
| 5.6 | TRIP AND STOP ALARM..... | 43 |
| 5.7 | SHUTDOWN ALARMS | 48 |
| 6 | WIRING CONNECTION..... | 54 |
| 7 | SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS..... | 57 |
| 7.1 | CONTENTS AND SCOPES OF PARAMETERS..... | 57 |
| 7.2 | ENABLE DEFINITION OF DIGITAL OUTPUT PORTS..... | 77 |
| 7.2.1 | DEFINITION OF DIGITAL OUTPUT PORTS | 77 |
| 7.2.2 | DEFINED PERIOD OUTPUT..... | 84 |
| 7.2.3 | DEFINED COMBINATION OUTPUT | 84 |
| 7.3 | DEFINED CONTENTS OF DIGITAL INPUT PORTS | 85 |
| 7.4 | SELECTION OF SENSORS | 88 |
| 7.5 | CONDITIONS OF CRANK DISCONNECT SELECTION..... | 89 |
| 8 | PARAMETERS SETTING..... | 89 |
| 9 | SENSOR SETTING..... | 90 |
| 10 | COMMISSIONING | 91 |
| 10.1 | STEP 1: SINGLE UNIT DEBUGGING | 91 |
| 10.2 | STEP 2: MANUAL PARALLEL OPERATION OFF-LOAD | 91 |
| 10.3 | STEP 3: MANUAL PARALLEL OPERATION ON-LOAD | 91 |
| 10.4 | STEP 4: AUTOMATIC PARALLEL OPERATION | 91 |
| 11 | MAINS PARALLEL MODE..... | 92 |

| | | |
|-------|---|-----|
| 11.1 | GEN CONTROL MODE..... | 92 |
| 11.2 | MAINS CONTROL MODE..... | 93 |
| 11.3 | LOAD RECEIPT MODE..... | 94 |
| 11.4 | AMF CONTROL MODE..... | 95 |
| 11.5 | ISLAND START MODE..... | 96 |
| 12 | TYPICAL APPLICATION..... | 97 |
| 13 | POWER MANAGEMENT MODE..... | 99 |
| 14 | NEL TRIP DESCRIPTION..... | 100 |
| 15 | DUMMY LOAD CONNECTION..... | 101 |
| 16 | INSTALLATION..... | 102 |
| 17 | CONNECTIONS OF CONTROLLER AND J1939 ENGINE..... | 103 |
| 17.1 | CUMMINS ISB/ISBE..... | 103 |
| 17.2 | CUMMINS QSL9..... | 103 |
| 17.3 | CUMMINS QSM11 (IMPORT)..... | 104 |
| 17.4 | CUMMINS QSX15-CM570..... | 104 |
| 17.5 | CUMMINS GCS-MOVBUS..... | 104 |
| 17.6 | CUMMINS QSM11..... | 105 |
| 17.7 | CUMMINS QSZ13..... | 105 |
| 17.8 | DETROIT DIESEL DDEC III/IV..... | 106 |
| 17.9 | DEUTZ EMR2..... | 106 |
| 17.10 | JOHN DEERE..... | 106 |
| 17.11 | MTU ADEC (SMART MODULE)..... | 107 |
| 17.12 | MTU ADEC (SAM MODULE)..... | 107 |
| 17.13 | PERKINS..... | 108 |
| 17.14 | SCANIA..... | 108 |
| 17.15 | VOLVO EDC3..... | 108 |
| 17.16 | VOLVO EDC4..... | 109 |
| 17.17 | VOLVO-EMS2..... | 109 |
| 17.18 | YUCHAI..... | 110 |
| 17.19 | WEICHAI..... | 110 |
| 18 | FAULT FINDING..... | 111 |

1 OVERVIEW

HGM9520N genset paralleled (with Mains) controller is suitable for manual/auto parallel system of single genset and Mains, to realize automatic start/stop, parallel running, data measurement, alarm protection as well as “3 remotes” functions. It fits with large LCD display, optional Chinese, English and other languages interface, and it is reliable and easy to use.

HGM9520N genset paralleled (with Mains) controller has GOV and AVR control function, providing various modes of running in parallel with Mains. For example, genset constant active power and inactive power/power factor outputs, Mains peak clipping function, which can recover to Mains supply function continuously. Controller can precisely monitor all running status of genset, and when abnormal occasions occur, genset can parallel off, and stop the genset, in which process, fault status will be displayed on the LCD. Controller has SAE J1939 port, and can communicate with various ECU (Engine Control Unit) with J1939.

HGM9520N genset paralleled (with Mains) controller applies 32-bit micro-processor technology, which realizes precise measurement of many parameters, value adjusting and timing, threshold setting functions etc. Majority of parameters can be adjusted from controller front panel, and all parameters can be set by USB port on PC, moreover they can be adjusted and monitored by RS485 or ETHERNET on PC. It can be widely used in various types of automatic gen-set parallel system with compact structure, simple connections and high reliability.

2 PERFORMANCE AND CHARACTERISTICS

Main characteristics are as bellow:

- With ARM-based 32-bit SCM, high integration of hardware and more reliable;
- 240x128 LCD with backlight, multilingual interface (including English, Chinese or other languages) which can be chosen on site, making commissioning convenient for factory personnel;
- Improved LCD wear-resistance and scratch resistance due to hard screen acrylic;
- Silicon panel and pushbuttons for better operation in high/low temperature environment;
- Two RS485 communication ports enable remote control, remote measuring, remote communication via MODBUS protocol;
- Fitted with CANBUS port and can communicate with ECU equipped with J1939. Not only can you monitor frequently-used data (such as water temperature, oil pressure, engine speed, fuel consumption and so on) of ECU machine, but also control start, stop, raising speed and speed droop via CANBUS port;
- Suitable for 3-phase 4-wire, 3-phase 3-wire, single phase 2-wire, and 2-phase 3-wire systems with voltage 120/240V and frequency 50/60Hz;
- Collects and shows 3-phase voltage of Mains/Gen, Mains/Gen frequency, Gen 3-phase current, Gen power and Gen voltage harmonic parameters;
- For Mains, controller has over voltage, under voltage, over frequency, under frequency, loss of phase and phase sequence wrong detection functions; For generator, controller has over voltage, under voltage, over frequency, under frequency, high unbalanced voltage, high total harmonic distortion, over current, earth fault, high unbalanced current, low power factor, over power, reverse power, loss of excitation, loss of phase, phase sequence wrong detection functions;
- Synchronization parameters: voltage difference between mains and gen, frequency difference between mains and gen, phase angle difference between mains and gen;
- Multiple running modes in auto state: with load running, off load running, island running, parallel running on demand;
- Soft load transfer function in paralleling/splitting;
- 3 fixed analogue sensor inputs (temperature, oil pressure and fuel level);
- 2 configurable analogue sensor inputs can be set as sensors of temperature, oil pressure or level;
- Oil pressure sensor and configurable sensor input 1 can directly connect with resistive/current/voltage sensors, while other sensor inputs can directly connect with resistive sensors, and for connecting voltage/current sensors, please make it clear before the order;
- More kinds of curves of temperature, oil pressure, level sensors can be used directly and users can define the sensor curves by themselves;
- Precisely collect various engine parameters, including temperature, engine oil pressure, fuel level, speed, battery voltage, charger voltage, total running time and total start times etc.;

- Control and protection function: automatic start/stop of the diesel genset, ATS (Auto Transfer Switch) control and perfect 2-class fault indication and protection function etc. various Mains parallel off protections;
- Parameter setting function: parameters can be modified by users and stored in internal EEPROM memory, and cannot be lost even in case of power outage; most of them can be adjusted from the front panel of the controller and all of them can be modified on PC by USB port or RS485 port.
- Multiple crank disconnect conditions (speed, engine oil pressure, generator frequency) are optional;
- Wide power supply range DC(8~35)V, suitable for different starting battery voltage environments;
- Event log, real-time clock, scheduled start & stop function (allowing to start the genset once a day/week/month with load or not);
- Alarm data record function, which allows to record the genset data of 5 alarms;
- Accumulative total run time of A and B and total electric energy of A and B; Users can reset them and start afresh, providing convenience for users;
- Heater, cooler and fuel pump control functions;
- Maintenance function; maintenance time due actions can be set;
- All parameters apply digital adjustment, getting rid of conventional analogue modulation with normal potentiometer, and improving genset reliability and stability;
- IP65 waterproof level is achieved with the help of rubber-ring gasket between shell and control panel;
- Metal fixing clips employed to fix the controller and make it perform better under high temperature environment;
- Modular structure design, self-extinguishing ABS plastic shell, pluggable terminal, built-in mounting, compact structure with easy installation.

3 SPECIFICATION

Table 3 Technical Specification

| Parameter | Details |
|---------------------|--|
| Working Voltage | Range: DC8V - DC35V continuous, DC reverse connection protection Resolution: 0.1V Accuracy: 1% |
| Overall Consumption | <7W (Standby mode: ≤2.5W) |
| AC Voltage | Phase voltage Range: AC15V - AC360V (ph-N) Resolution: 0.1V Accuracy: 0.5% |
| | Wire voltage Range: AC30V - AC620V (ph- ph) Resolution: 0.1V Accuracy: 0.5% |
| AC Frequency | Range: 5Hz -75Hz Resolution: 0.01Hz Accuracy: 0.1Hz |
| AC Current | Rated: 5A Range: 0A - 10A Resolution: 0.1A Accuracy: 1% |
| Speed Sensor | Voltage Range: 1. 0V - 24V (RMS) Frequency Range: 5Hz - 10000Hz |
| Charger(D+) Voltage | Range: DC0V - DC60V continuous Resolution: 0.1V Accuracy: 1% |
| Analog Sensor | Resistor Input Range: 0Ω - 6000Ω Resolution: 0.1 Accuracy: 1Ω (below 300Ω) |
| | Voltage Input Range: 0V - 5V Resolution: 0.001V Accuracy: 1% |
| | Current Input Range: 0mA - 20mA Resolution: 0.01mA Accuracy: 1% |
| Fuel Output | 16A DC24V DC power supply output (relay output) |
| Crank Output | 16A DC24V DC power supply output (relay output) |

| Parameter | Details |
|-----------------------|--|
| Digital Output 1 | 5A DC30V DC power supply output (relay output) |
| Digital Output 2 | 5A DC30V DC power supply output (relay output) |
| Digital Output 3 | 5A DC30V DC power supply output (relay output) |
| Digital Output 4 | 8A AC250V volt-free output (relay output) |
| Digital Output 5 | 8A AC250V volt-free output (relay output) |
| Digital Output 6 | 8A AC250V volt-free output (relay output) |
| Digital Output 7 | 1A DC30V DC power supply output (transistor output) |
| Digital Output 8 | 1A DC30V DC power supply output (transistor output) |
| Digital Input 1-10 | Low limit voltage is 1.2V; high limit voltage is 60V; |
| RS485 | Isolated, half-duplex, 9600 baud rate, maximum communication length 1000m |
| Ethernet | Self-adapting 10/100Mbit |
| MSC CAN | Isolated, maximum communication length 250m; applying Belden 9841 cable or the equivalence |
| EMC/CE Certification | EN 61326-1:2013 |
| Vibration Test | 5 - 8 Hz: ± 7.5 mm 8 - 500 Hz: 2 g IEC 60068-2-6 |
| Shock Test | 50g, 11ms, half-sine, complete shock test from three directions, and 18 times shock for each test IEC 60068-2-27 |
| Bump Test | 25g, 16ms, half-sine IEC 60255-21-2 |
| Production Compliance | According to EN 61010-1 installation category (over voltage category) III, 300V, pollution class 2, altitude 3000m |
| Case Dimensions | 242mm x 186mm x 49mm |
| Panel Cutout | 214mm x 160mm |
| Working Conditions | Temperature: (-25~+70) $^{\circ}$ C Relative Humidity: (20~93)%RH |
| Storage Conditions | Temperature:(-30~+80) $^{\circ}$ C |
| Protection Level | Front Enclosure: IP65 when rubber-ring gasket is installed between the enclosure and the control panel Rear Enclosure: IP20 |
| Insulation Intensity | Apply AC2.2kV voltage between high voltage terminal and low voltage terminal and the leakage current is not more than 3mA within 1min. |
| Weight | 1.1kg |

4 OPERATION

4.1 INDICATOR LAMP



Fig.1 HGM9520N Indicators

NOTE: Description for parts of indicators:

Table 4 Alarm indicator Description

| Alarm Type | Alarm Indicator |
|----------------------|------------------------------------|
| Warning | Slow flashing (1 time per second) |
| Block | Slow flashing (1 time per second) |
| Safety Trip | Fast flashing (5 times per second) |
| Safety Trip and Stop | Fast flashing (5 times per second) |
| Trip | Fast flashing (5 times per second) |
| Trip and Stop | Fast flashing (5 times per second) |
| Shutdown | Fast flashing (5 times per second) |
| No Alarm | Extinguished |






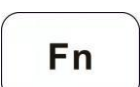

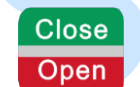






Running indicator: is normally illuminated after crank disconnection and before ETS stop and extinguished for other periods;



Gen normal indicator: is normally illuminated when the generator is normal; flashing when generator state is abnormal; extinguished when there is no generating power.

Mains normal indicator: is normally illuminated when Mains is normal; flashing when Mains status is abnormal; extinguished when Mains is off.

4.2 PUSHBUTTONS

Table 5 Button Function Description

| Icons | Buttons | Description |
|---|------------------|--|
|  | Stop | Stop the running generator in Auto/Manual mode; Reset alarm in stop mode; Press for over 3s, and it can test whether panel indicators are normal (lamp test); During stopping process, press again to stop the generator immediately. |
|  | Start | Start the genset in Manual mode. |
|  | Manual Mode | Press this key and the controller goes in Manual mode. |
|  | Auto Mode | Press this key and controller goes in Auto mode. |
|  | Mute/Reset Alarm | Remove the alarm sound; Remove the alarm by pressing for over 3s. |
|  | Fn | Shortcut button by making groups with other buttons; or other function button (power button, stop button etc.) by setting. |
|  | Mains Close/Open | Control Mains close/open in manual mode. |
|  | Gen Close/Open | Control Gen close/open in manual mode. |
|  | Up/Increase | 1) Screen scroll; 2) Move up the cursor and increase value in setting menu. |
|  | Down/Decrease | 1) Screen scroll; 2) Move down the cursor and decrease value in setting menu. |
|  | Left | 1) Page scroll; 2) Left move the cursor in setting menu. |
|  | Right | 1) Page scroll; 2) Right move the cursor in setting menu. |
|  | Set/Confirm | 1) Enter setting screen; 2) Enter next menu or confirm the settings. |
|  | Exit | 1) Return to main menu; 2) Return to previous menu in setting menu. |





NOTE: Press  and  simultaneously in manual mode and it can force the generator to crank. At this time the controller shall not judge whether the genset start is successful or not according to the starting conditions. It is controlled by the operator. When operator observes that the engine has started, he/she should release the button and the start output will be deactivated. Safety on delay will be initiated.

NOTE: Regarding ECU genset, in Stop/Auto mode, Press  button and it shall power on the ECU (fuel output and ECU power output are active.).

CAUTION: Factory default password is "00318", and users can change it in case others change the advanced parameter settings. Please clearly remember the password after changing. If you forget it, please contact SmartGen services and send the PD information in the controller page of "ABOUT" to the service personnel.

4.3 LCD DISPLAY

4.3.1 MAIN DISPLAY

Paging is applied for the main screen;   is used for page scroll and   for screen scroll.

Main Screen includes the following contents:

Gen: voltage, frequency, current, active power, reactive power;

Mains: voltage, frequency;

Engine: speed, temperature, engine oil pressure, battery voltage;

Part of status displays;

Status page includes the following contents:

Genset status, Mains status and ATS status;

Engine page includes the following contents:

Engine speed, engine temperature, engine oil pressure, fuel level, configurable analog 1, configurable analog 2, battery voltage, charger voltage, accumulated running time, accumulated start times.

NOTE: If CAN BUS is connected and engine information is from J1939, this page also includes: coolant pressure, coolant level, fuel temperature, fuel pressure, inlet temperature, exhaust temperature, turbo pressure, fuel consumption, total fuel consumption and so on. (Different engines have different parameters.)

Generator page includes the following contents:

Phase voltage, wire voltage, frequency, phase sequence, current, active power of different phases, total active power and percentage, reactive power of different phases, total reactive power and percentage, apparent power of different phases, total apparent power, power factor of different phases, average power factor, accumulated electric power, total power of multi-genset; ground current and percentage, unbalance current and percentage, unbalance voltage and percentage.

NOTE:

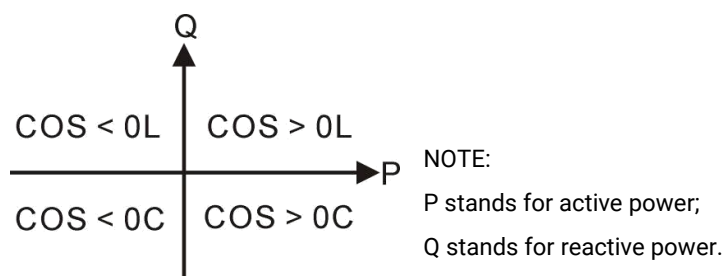


Fig. 2 Power Factor Display Description

Table 6 Power Factor Display Description

| Power Factor | Conditions | Active Power | Reactive Power | Remark |
|--------------|------------|--------------|----------------|--|
| COS>0L | P>0,Q>0 | Input | Input | Load is resistive induction. |
| COS>0C | P>0,Q<0 | Input | Output | Load is resistive capacitance. |
| COS<0L | P<0,Q>0 | Output | Input | Load equals an under excitation generator. |
| COS<0C | P<0,Q<0 | Output | Output | Load equals an over excitation generator. |

▲NOTES:

1. Input active power, and generator sends active power to load.
2. Output active power, and load supplies electricity to generator.
3. Input reactive power, and generator sends reactive power to load.
4. Output reactive power, and load sends reactive power to generator.

Mains page includes the following contents:

Phase voltage, wire voltage, frequency, phase sequence; current, and power.

Snyc. page includes the following contents:

Voltage difference, frequency difference, phase difference, gen active power output and percentage, gen reactive power output and percentage, GOV output percentage, AVR output percentage and MSC status.

Alarm page:

▲NOTE: For ECU alarms and shutdown alarms, if the alarm information is displayed, check the engine according to it. Otherwise, please check the generator manual according to SPN alarm code.

Event log page:

Make records about all start/stop events (alarm events except warnings, manual start/stop events) and the real time when events occur;

Expansion page:

Sensor value of expansion analogue module.

▲NOTE: AIN24 expansion module or AIN8 expansion module needs to be enabled.


Others page includes the following contents:

Time and date, maintenance due (if configured), input/output port status, communication indication and Ethernet configuration (if configured).

About page includes the following contents:

Release software version, hardware version, and product PD number.

4.3.2 USER MENU AND PARAMETER SETTING

Press  key for more than 1s and it enters user menu.

- Parameter Setting

After inputting the correct password (factory default password is 00318) you can enter the parameter setting screen.

- Language

Optional Simplified Chinese, English and others.


- Commissioning

On load, off load and users-defined commissioning are optional. Defined commissioning can be configured regarding load on or load off, commissioning time, and which mode it shall return after commissioning (manual mode, auto mode and stop mode).

- Clear users' accumulation

It can clear total running time A and B, total electric energy A and B.

4.4 AUTO START/STOP OPERATION

Press the  button and the indicator beside is illuminated, which means the genset is at Auto Start Mode.

Automatic Start Sequence:

- 1) When "remote start" (on-load) is active or Mains is abnormal, "start delay" timer is initiated;
- 2) "Start Delay" countdown will be displayed on genset status page;
- 3) When start delay is over, preheating relay is energized (if configured), "preheat delay XX s" information will be displayed on genset status page;
- 4) After the above delay, the fuel relay is energized, and then one second later, the start relay is engaged. During the "start time", if the genset does not start, then fuel relay and start relay stop outputting, and enter "crank rest time", waiting for next crank;
- 5) Should the start continues beyond the set attempts, the controller issues "start failure" and stops the genset and at the same time alarm page on LCD displays "start failure" alarm;
- 6) If it starts during the attempts, it enters "safety on time", and during this period Low Oil Pressure, High Temperature, Under speed and Charge Alternator Failure alarms are all inactive; After "safety on time", it enters "start idle delay" (if configured);
- 7) During "start idle delay", under speed, under frequency, under voltage alarms are inhibited. When this delay is over, "warming up delay" is initiated (if configured);
- 8) When one genset is running and "warming up delay" is over, if generator status is normal, its indicator will be illuminated. If generator voltage and frequency have reached on-load requirements, then the generator close relay will be energized; the genset will take load and generator power indicator will be illuminated, and generator will enter normal running status. If voltage or frequency is abnormal, the controller will initiate alarm (alarm information will be displayed on LCD);





▲NOTE: When Remote Start is applied to start (Off Load), the procedure is the same as the above. But generator close relay is deactivated, and moreover, genset is off load.

Automatic Stop Sequence:

- 1) When Mains normal delay is over, Mains close relay outputs, and Mains supply indicator is illuminated. When the Remote Start signal is removed and Mains is normal, the "stop delay" is initiated;
- 2) Once this "stop delay" has expired, gen close relay is deactivated. Gen supply indicator is extinguished. "cooling delay" timer is initiated;
- 3) During "stop idle delay" (if configured), the idling speed relay is energized;
- 4) "ETS solenoid hold" begins, ETS relay is energized while fuel relay is de-energized, and complete stop is detected automatically;
- 5) "Fail to stop delay" begins, and complete stop is detected automatically;
- 6) When generator is stopped completely, "after stop delay" will be initiated. Otherwise, "fail to stop" alarm is initiated and the corresponding alarm information is issued. (If generator stops successfully after "fail to stop" alarm has initiated, "after stop delay" will be initiated and the alarm will be removed.);

7) Generator is placed into its standby mode after its “after stop delay”;

4.5 MANUAL START/STOP OPERATION


1. MANUAL START: Manual mode is selected by pressing the  button; a LED beside the button will be illuminated to confirm the operation; then press  button to start the gen-set; it can detect crank disconnect condition automatically and generator accelerates to high-speed running automatically. With high temperature, low oil pressure, over speed and abnormal voltage during generator running, controller can protect genset to stop quickly. Press  to control switch close/open. (please refer to No.3~8 of **Automatic Start Sequence** for detailed procedures, the only difference is switch close and open way.)
2. MANUAL STOP: Press  and it can shut down the running generators. (Please refer to No.2~7 of **Automatic Stop Sequence** for detailed procedures).

▲NOTE: In “manual mode”, for the procedures of ATS please refer to **Genset Switch Control Procedures** in this manual.

4.6 GENSET SWITCH CONTROL PROCEDURES

4.6.1 MANUAL CONTROL PROCEDURE

When controller is in **Manual** mode, the switch control procedures will start through manual control procedure. Users can control the loading transfer of ATS via pressing button to switch on or off.

Gen Breaker Close Operation: During genset normal running, press gen close key  if generator voltage and frequency have reached on-load requirements.

- When Mains is not closed, it directly issues Gen close signal;
- When Mains is closed, controller will control GOV and AVR to synchronize genset and Mains; when synchronization conditions are met, it issues gen close signal and parallel genset with Mains.

Gen Breaker Open Operation: Press gen open button ,

- When Mains is not closed, controller issues gen open signal directly;
- When Mains is closed, controller first transfers the load to Mains, and then issues gen open signal;

Mains Breaker Close Operation: Press Mains close button ,

- When Gen is not closed, it issues Mains close signal directly;
- When Gen is closed, controller will control GOV and AVR to synchronize genset and Mains; when synchronization conditions are met, it issues Mains close signal and parallel genset with Mains.

Mains Breaker Open Operation: Press Mains open button ,

- When Gen is not closed, it issues Mains open signal directly;
- When Gen is closed, controller will first transfer the load to Gen, then issues Mains open signal.

4.6.2 AUTOMATIC CONTROL PROCEDURE

When controller is in Auto mode, the switch control procedure is automatic control procedure.

▲NOTE: The auxiliary close input should be configured necessarily and make sure the connection is correct.

5 PROTECTIONS

Table 7 Controller Alarm Types

| Alarm Type/Action | Open Directly | Open After Soft Unloading | Stop Directly | Stop After Cooling | Reset Alarm |
|----------------------|---------------|---------------------------|---------------|--------------------|-------------|
| Warning | - | - | - | - | Auto |
| Block | - | - | - | - | Manual |
| Safety Trip | - | ● | - | - | Manual |
| Safety Trip and Stop | - | ● | - | ● | Manual |
| Trip | ● | - | - | - | Manual |
| Trip and Stop | ● | - | - | ● | Manual |
| Alarm Shutdown | ● | - | ● | - | Manual |

5.1 WARNING ALARMS

When controller detects the warning alarm, it only issues warning, and the genset does not open and shutdown. When the warning signal disappears, alarm is removed automatically.

Table 8 Warning Alarms

| No | Type | Description |
|----|---------------------------|--|
| 1 | Over Speed | When this is enabled, and the controller detects that the genset speed is above the pre-set limit, it will initiate a warning. It is always detected. |
| 2 | Under Speed | When this is enabled and the controller detects that the genset speed is below the pre-set limit, it will initiate a warning. It is detected after "warming up" and before "stop idle". |
| 3 | Loss of Speed Signal | When the controller detects the genset speed is 0, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold". |
| 4 | Gen Over Frequency | When this is enabled, and the controller detects the frequency is above the preset limit, it shall issue a warning. It is detected always. |
| 5 | Gen Under Frequency | When this is enabled, and the controller detects the frequency is below the preset limit, it shall issue a warning. It is detected after "warming up time" before "stop idle time". |
| 6 | Gen Over Voltage | When this is enabled, and the controller detects the voltage is above the preset limit, it shall issue a warning. It is always detected. |
| 7 | Gen Under Voltage | When this is enabled, and the controller detects the voltage is below the preset limit, it shall issue a warning. It is detected after "warming up time" before "stop idle time". |
| 8 | Gen Over Current | When this is enabled, and the controller detects the current is above the preset limit, it shall issue a warning. It is always detected. |
| 9 | Negative Sequence Current | When this is enabled, and the controller detects the value is above the preset limit, it shall issue a warning. It is always detected. |
| 10 | Earth Fault | When this is enabled, and the controller detects the earth current is above the preset limit, it shall issue a warning. It is always detected. |
| 11 | Reverse Power | When this is enabled, and the controller detects the reverse power (negative) is above the preset limit, it shall issue a warning. It is always detected. |
| 12 | Over Power | When this is enabled, and the controller detects the genset power (positive) is above the preset limit, it shall issue a warning. It is always detected. |
| 13 | Loss Excitation | When this is enabled, and the controller detects the genset reactive |

| No | Type | Description |
|----|---------------------------|---|
| | | power (negative) is above the preset limit, it shall issue a warning. It is always detected. |
| 14 | ECU Alarm | When the controller receives the engine alarm signal from J1939, it shall issue a warning. It is always detected. |
| 15 | Temp. Sensor Open | When the controller detects the sensor circuit is open, it shall issue a warning. It is always detected. |
| 16 | Engine Temp High | When this is enabled, and the controller detects the temp. is above the preset limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold". |
| 17 | Engine Temp Low | When this is enabled, and the controller detects the temp. is below the preset limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold". |
| 18 | Oil Pressure Sensor Open | When the controller detects the sensor circuit is open, it shall issue a warning. It is always detected. |
| 19 | Oil Pressure Low | When this is enabled, and the controller detects the pressure is below the preset limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold". |
| 20 | Oil Pressure Sensor Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue a warning, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 21 | Fuel Level Sensor Open | When the controller detects the sensor circuit is open, it shall issue a warning. It is always detected. |
| 22 | Fuel Level Low | When this is enabled, and the controller detects the level is below the preset limit, it shall issue a warning. It is always detected. |
| 23 | Flex. Sensor 1 Open | When the controller detects the sensor circuit is open, it shall issue a warning. It is always detected. |
| 24 | Flex. Sensor 1 High | When over high warning is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 25 | Flex. Sensor 1 Low | When over low warning is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; |

| No | Type | Description |
|----|---------------------------|---|
| | | It is always detected when the sensor is selected as fuel level sensor. |
| 26 | Flex. Sensor 1 Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue a warning, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 27 | Flex. Sensor 2 Open | When the controller detects the sensor circuit is open, it shall issue a warning. It is always detected. |
| 28 | Flex. Sensor 2 High | When over high warning is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 29 | Flex. Sensor 2 Low | When over low warning is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 30 | Fail to Stop | After 'fail to stop delay' is over, if the genset does not stop completely, it will initiate a warning alarm. It is detected when the genset is normally running. |
| 31 | Charge Alternator Failure | When this is enabled and the controller detects that charger voltage is below the pre-set limit, it will initiate a warning alarm. It is detected when the genset is normally running. |
| 32 | Battery Over Volt | When this is enabled, and the controller detects the battery voltage is above the preset limit, it shall issue a warning signal. It is always detected. |
| 33 | Battery Under Volt | When this is enabled, and the controller detects the battery voltage is below the preset limit, it shall issue a warning signal. It is always detected. |
| 34 | Fail to Sync. | If the controller doesn't detect sync. signal within the pre-set time, it will initiate a warning alarm. It is detected when GCB closes. |
| 35 | GOV Reach Limit | When the controller's GOV output reaches the upper limit or lower limit, it will initiate a warning alarm. It is detected when the genset is running. |
| 36 | AVR Reach Limit | When the controller's AVR output reaches the high limit or low limit, it will initiate a warning alarm. It is detected when the genset is running. |
| 37 | Gen Breaker Alarm | When "Gen Closed Aux" is not set for the controller input port, the controller will initiate a warning alarm. It is always detected. |

| No | Type | Description |
|----|---------------------|--|
| 38 | Mains Over Freq | When the controller detects that the mains frequency is above the pre-set value, it will initiate a warning alarm. It is detected after "Mains Parallel Mode" is active and after "Gen closed". |
| 39 | Mains Under Freq | When the controller detects the mains frequency has fallen below the pre-set value, it will initiate a warning alarm. It is detected after "Mains Parallel Mode" is active and after "Gen closed". |
| 40 | Mains Over Voltage | When the controller detects that the mains voltage has exceeded the pre-set value, it will initiate a warning alarm. It is detected after "Mains Parallel Mode" is active and after "Gen closed". |
| 41 | Mains Under Voltage | When the controller detects that the mains voltage has fallen below the pre-set value, it will initiate a warning alarm. It is detected after "Mains Parallel Mode" is active and after "Gen closed". |
| 42 | Mains ROCOF | When the controller detects mains ROCOF is above the pre-set value, it will initiate a warning alarm. It is detected after "Mains Parallel Mode" is active and after "Gen closed". |
| 43 | Mains Vector Shift | When the controller detects mains voltage vector shift is above the pre-set value, it will initiate a warning alarm. It is detected after "Mains Parallel Mode" is active and after "Gen closed". |
| 44 | Freq Error Too High | When the controller detects the generator frequency and busbar frequency is above 8Hz, it will initiate a warning alarm. It is detected during synchronous close. |
| 45 | Maintenance Due | When this is enabled and countdown time is 0, it will initiate a warning alarm. It is detected when the genset is running. |
| 46 | Digital Input Alarm | When the digital input port is set users-defined and if it is active, the controller will initiate a warning for the input port. It is detected in the detection range set for the input port. |
| 47 | PLC Functions Alarm | When PLC function is set users-defined and if it is active, the controller will initiate a warning. It is detected in the detection range set by the PLC function. |
| 48 | DIN16 Comm. Fail | When DIN16 communication is enabled and the controller cannot receive the communication data, it will initiate a warning. It is always detected. |
| 49 | DIN16 Input Alarm | When DIN16 input is set users-defined and if it is active, the controller will initiate a warning. It is detected in the detection range set in the input. |
| 50 | DOUT16 Comm. Fail | When DOUT16 communication is enabled and the controller cannot |

| No | Type | Description |
|----|--------------------------------------|---|
| | | receive the communication data, it will initiate a warning. It is always detected. |
| 51 | AIN24 Comm. Fail | When AIN24 communication is enabled and the controller cannot receive the communication data, it will initiate a warning. It is always detected. |
| 52 | AIN24 Cylinder Temp. High | When this is enabled and the controller detects cylinder temperature has exceeded the pre-set value, it will initiate a warning alarm. It is detected after "safety on time" before "ETS solenoid hold". |
| 53 | AIN24 Exhaust Temp. High | When this is enabled and the controller detects exhaust temperature has exceeded the pre-set value, it will initiate a warning alarm. It is detected after "safety on time" before "ETS solenoid hold". |
| 54 | AIN24 Cylinder Temp. Difference High | When this is enabled and the controller detects cylinder temp. difference has exceeded the pre-set value, it will initiate a warning alarm. It is detected after "safety on time" before "ETS solenoid hold". |
| 55 | AIN24 Sensor Open | When the controller detects the sensor circuit is open, it shall issue a warning. It is always detected. |
| 56 | AIN24 Sensor High | When over high warning is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 57 | AIN24 Sensor Low | When over low warning is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 58 | AIN8 Comm. Fail | When AIN8 communication is enabled and the controller cannot receive the communication data, it will initiate a warning. It is always detected. |
| 59 | AIN8 Sensor Open | When the controller detects the sensor circuit is open, it shall issue a warning. It is always detected. |
| 60 | AIN8 Sensor High | When over high warning is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 61 | AIN8 Sensor Low | When over low warning is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue a warning. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; |

| No | Type | Description |
|----|--------------------|---|
| | | It is always detected when the sensor is selected as fuel level sensor. |
| 62 | Power Factor Low | When this is enabled and the controller detects that the generator power factor has fallen below the pre-set value, it will initiate a warning alarm. It is always detected. |
| 63 | THD High | When this is enabled and the controller detects that the THD has exceeded the pre-set value, it will initiate a warning alarm. It is always detected. |
| 64 | Gen Volt Unbalance | When this is enabled and the controller detects that the voltage unbalanced value has exceeded the pre-set value, it will initiate a warning alarm. It is always detected. |

SmartGen

5.2 BLOCK ALARMS

When the controller detects block signals, it only issues warning and the genset does not shut down and not open. Users need to reset alarms manually.

Table 9 Block Alarms

| No | Type | Description |
|----|---------------------------|--|
| 1 | Over Speed | When this is enabled, and the controller detects that the genset speed is above the pre-set limit, it will initiate a block alarm. It is always detected. |
| 2 | Under Speed | When this is enabled and the controller detects that the genset speed is below the pre-set limit, it will initiate a block alarm. It is detected after "warming up" and before "stop idle". |
| 3 | Loss of Speed Signal | When the controller detects the genset speed is 0, it shall issue a block alarm. It is detected after "safety on time" and before "ETS solenoid hold". |
| 4 | Gen Over Frequency | When this is enabled, and the controller detects the genset frequency is above preset limit, it shall issue a block alarm. It is detected always. |
| 5 | Gen Under Frequency | When this is enabled, and the controller detects the frequency is below the preset limit, it shall issue a block alarm. It is detected after "warming up" and before "stop idle". |
| 6 | Gen Over Voltage | When this is enabled, and the controller detects the genset voltage is above preset limit, it shall issue a block alarm. It is detected always. |
| 7 | Gen Under Voltage | When this is enabled, and the controller detects the voltage is below the preset limit, it shall issue a block alarm. It is detected after "warming up" and before "stop idle". |
| 8 | Gen Over Current | When this is enabled, and the controller detects the genset current is above preset limit, it shall issue a block alarm. It is detected always. |
| 9 | Negative Sequence Current | When this is enabled, and the controller detects the unbalanced current is above preset limit, it shall issue a block alarm. It is detected always. |
| 10 | Earth Fault | When this is enabled, and the controller detects the earth current is above the preset limit, it shall issue a block alarm. It is always detected. |
| 11 | Reverse Power | When this is enabled, and the controller detects the reverse power (negative) is above the preset limit, it shall issue a block alarm. It is always detected. |
| 12 | Over Power | When this is enabled, and the controller detects the genset power (positive) is above the preset limit, it shall issue a block alarm. It is always detected. |
| 13 | Loss Excitation | When this is enabled, and the controller detects the genset reactive |

| No | Type | Description |
|----|---------------------------|---|
| | | power (negative) is above the preset limit, it shall issue a block alarm. It is always detected. |
| 14 | ECU Alarm | When the controller receives the engine alarm signal from J1939, it shall issue a block alarm. It is always detected. |
| 15 | Temp. Sensor Open | When the controller detects the sensor circuit is open, it shall issue a block alarm. It is always detected. |
| 16 | Engine Temp High | When this is enabled, and the controller detects the temp. is above the preset limit, it shall issue a block alarm. It is detected after "safety on time" before "ETS solenoid hold". |
| 17 | Engine Temp Low | When this is enabled, and the controller detects the temp. is below the preset limit, it shall issue a block alarm. It is detected after "safety on time" before "ETS solenoid hold". |
| 18 | Oil Pressure Sensor Open | When the controller detects the sensor circuit is open, it shall issue a block alarm. It is always detected. |
| 19 | Oil Pressure Low | When this is enabled, and the controller detects the pressure is below the preset limit, it shall issue a block alarm. It is detected after "safety on time" before "ETS solenoid hold". |
| 20 | Oil Pressure Sensor Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue a block alarm, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 21 | Fuel Level Sensor Open | When the controller detects the sensor circuit is open, it shall issue a block alarm. It is always detected. |
| 22 | Fuel Level Low | When this is enabled, and the controller detects the level is below the preset limit, it shall issue a block alarm. It is always detected. |
| 23 | Flex. Sensor 1 Open | When the controller detects the sensor circuit is open, it shall issue a block alarm. It is always detected. |
| 24 | Flex. Sensor 1 High | When over high block alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue a block alarm. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 25 | Flex. Sensor 1 Low | When over low block alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue a block alarm. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; |

| No | Type | Description |
|----|---------------------------|---|
| | | It is always detected when the sensor is selected as fuel level sensor. |
| 26 | Flex. Sensor 1 Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue a block alarm, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 27 | Flex. Sensor 2 Open | When the controller detects the sensor circuit is open, it shall issue a block alarm. It is always detected. |
| 28 | Flex. Sensor 2 High | When over high block alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue a block alarm. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 29 | Flex. Sensor 2 Low | When over low block alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue a block alarm. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 30 | Charge Alternator Failure | When this is enabled, and the controller detects the charger voltage value is below the preset limit, it shall issue a block alarm. It is detected when the genset is normally running. |
| 31 | Battery Over Volt | When this is enabled, and the controller detects the battery voltage is above the preset limit, it shall issue a block signal. It is always detected. |
| 32 | Battery Under Volt | When this is enabled, and the controller detects the battery voltage is below the preset limit, it shall issue a block signal. It is always detected. |
| 33 | Fail to Sync. | If the controller doesn't detect sync. signal within the pre-set time, it will initiate a block alarm. It is detected when breaker closes. |
| 34 | Maintenance Due | When this is enabled and countdown time is 0, it will initiate a block alarm. It is detected when the genset is running. |
| 35 | Digital Input Alarm | When the digital input port is set users-defined and if it is active, the controller will initiate a block signal for the input port. It is detected in the detection range set for the input port. |
| 36 | PLC Functions Alarm | When PLC function is set users-defined and if it is active, the controller will initiate a block signal. It is detected in the detection range set by the PLC function. |
| 37 | DIN16 Comm. Fail | When DIN16 communication is enabled and the controller cannot receive the communication data, it will initiate a block signal. It is always detected. |

| No | Type | Description |
|----|--------------------------------------|---|
| 38 | DIN16 Input Alarm | When DIN16 input is set users-defined and if it is active, the controller will initiate a block signal. It is detected in the detection range set in the input. |
| 39 | DOUT16 Comm. Fail | When DOUT16 communication is enabled and the controller cannot receive the communication data, it will initiate a block signal. It is always detected. |
| 40 | AIN24 Comm. Fail | When AIN24 communication is enabled and the controller cannot receive the communication data, it will initiate a block signal. It is always detected. |
| 41 | AIN24 Cylinder Temp. High | When this is enabled and the controller detects cylinder temperature has exceeded the pre-set value, it will initiate a block alarm. It is detected after "safety on time" before "ETS solenoid hold". |
| 42 | AIN24 Exhaust Temp. High | When this is enabled and the controller detects exhaust temperature has exceeded the pre-set value, it will initiate a block alarm. It is detected after "safety on time" before "ETS solenoid hold". |
| 43 | AIN24 Cylinder Temp. Difference High | When this is enabled and the controller detects cylinder temp. difference has exceeded the pre-set value, it will initiate a block alarm. It is detected after "safety on time" before "ETS solenoid hold". |
| 44 | AIN24 Sensor Open | When the controller detects the sensor circuit is open, it shall issue a block alarm. It is always detected. |
| 45 | AIN24 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue a block alarm. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 46 | AIN24 Sensor Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue a block alarm. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 47 | AIN8 Comm. Fail | When AIN8 communication is enabled and the controller cannot receive the communication data, it will initiate a block signal. It is always detected. |
| 48 | AIN8 Sensor Open | When the controller detects the sensor circuit is open, it shall issue a block alarm. It is always detected. |
| 49 | AIN8 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue a block alarm. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 50 | AIN8 Sensor Low | When over low alarm is enabled, and the controller detects the sensor |

| No | Type | Description |
|----|--------------------|---|
| | | <p>value is below the preset lower limit, it shall issue a block alarm.</p> <p>It is detected after “safety on time” before “ETS solenoid hold” when the sensor is selected as temperature sensor and pressure sensor;</p> <p>It is always detected when the sensor is selected as fuel level sensor.</p> |
| 51 | Power Factor Low | <p>When this is enabled and the controller detects that the generator power factor has fallen below the pre-set limit, it will initiate a block alarm.</p> <p>It is always detected.</p> |
| 52 | THD High | <p>When this is enabled and the controller detects that the THD has exceeded the pre-set limit, it will initiate a block alarm.</p> <p>It is always detected.</p> |
| 53 | Gen Volt Unbalance | <p>When this is enabled and the controller detects that the voltage unbalanced value has exceeded the pre-set limit, it will initiate a block alarm.</p> <p>It is always detected.</p> |

SmartGen

5.3 SAFETY TRIP

When controller detects safety trip signals, it will open breaker after soft unloading but not stop the genset. Users need to reset alarms manually.

Table 10 Safety Trip

| No | Type | Description |
|----|---------------------------|--|
| 1 | Over Speed | When this is enabled, and the controller detects that the genset speed is above the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 2 | Under Speed | When this is enabled and the controller detects that the genset speed is below the pre-set limit, it will initiate an alarm signal. It is detected after "warming up" and before "stop idle". |
| 3 | Loss of Speed Signal | When the controller detects the genset speed is 0, it shall issue an alarm signal. It is detected after "safety on time" and before "ETS solenoid hold". |
| 4 | Gen Over Frequency | When this is enabled, and the controller detects the genset frequency is above preset limit, it shall issue an alarm signal. It is detected always. |
| 5 | Gen Under Frequency | When this is enabled, and the controller detects the frequency is below the preset limit, it shall issue an alarm signal. It is detected after "warming up" and before "stop idle". |
| 6 | Gen Over Voltage | When this is enabled, and the controller detects the genset voltage is above preset limit, it shall issue an alarm signal. It is detected always. |
| 7 | Gen Under Voltage | When this is enabled, and the controller detects the voltage is below the preset limit, it shall issue an alarm signal. It is detected after "warming up" and before "stop idle". |
| 8 | Gen Over Current | When this is enabled, and the controller detects the genset current is above preset limit, it shall issue an alarm signal. It is detected always. |
| 9 | Negative Sequence Current | When this is enabled, and the controller detects the unbalanced current is above preset limit, it shall issue an alarm signal. It is detected always. |
| 10 | Earth Fault | When this is enabled, and the controller detects the earth current is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 11 | Reverse Power | When this is enabled, and the controller detects the reverse power (negative) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 12 | Over Power | When this is enabled, and the controller detects the genset power (positive) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 13 | Loss Excitation | When this is enabled, and the controller detects the genset reactive |

| No | Type | Description |
|----|---------------------------|---|
| | | power (negative) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 14 | ECU Alarm | When the controller receives the engine alarm signal from J1939, it shall issue an alarm signal. It is always detected. |
| 15 | Temp. Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 16 | Engine Temp High | When this is enabled, and the controller detects the temp. is above the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 17 | Engine Temp Low | When this is enabled, and the controller detects the temp. is below the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 18 | Oil Pressure Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 19 | Oil Pressure Low | When this is enabled, and the controller detects the pressure is below the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 20 | Oil Pressure Sensor Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue an alarm signal, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 21 | Fuel Level Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 22 | Fuel Level Low | When this is enabled, and the controller detects the level is below the preset limit, it shall issue an alarm signal. It is always detected. |
| 23 | Flex. Sensor 1 Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 24 | Flex. Sensor 1 High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 25 | Flex. Sensor 1 Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; |

| No | Type | Description |
|----|---------------------------|---|
| | | It is always detected when the sensor is selected as fuel level sensor. |
| 26 | Flex. Sensor 1 Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue an alarm signal, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 27 | Flex. Sensor 2 Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 28 | Flex. Sensor 2 High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 29 | Flex. Sensor 2 Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 30 | Charge Alternator Failure | When this is enabled, and the controller detects the charger voltage value is below the preset limit, it shall issue an alarm signal. It is detected when the genset is normally running. |
| 31 | Battery Over Volt | When this is enabled, and the controller detects the battery voltage is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 32 | Battery Under Volt | When this is enabled, and the controller detects the battery voltage is below the preset limit, it shall issue an alarm signal. It is always detected. |
| 33 | Fail to Sync. | If the controller doesn't detect sync. signal within the pre-set time, it will initiate an alarm signal. It is detected when GCB closes. |
| 34 | Maintenance Due | When this is enabled and countdown time is 0, it will initiate an alarm signal. It is detected when the genset is running. |
| 35 | Digital Input Alarm | When the digital input port is set users-defined and if it is active, the controller will initiate an alarm signal for the input port. It is detected in the detection range set for the input port. |
| 36 | PLC Functions Alarm | When PLC function is set users-defined and if it is active, the controller will initiate an alarm signal. It is detected in the detection range set by the PLC function. |
| 37 | DIN16 Comm. Fail | When DIN16 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |

| No | Type | Description |
|----|--------------------------------------|---|
| 38 | DIN16 Input Alarm | When DIN16 input is set users-defined and if it is active, the controller will initiate an alarm signal. It is detected in the detection range set in the input. |
| 39 | DOUT16 Comm. Fail | When DOUT16 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 40 | AIN24 Comm. Fail | When AIN24 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 41 | AIN24 Cylinder Temp. High | When this is enabled and the controller detects cylinder temperature has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 42 | AIN24 Exhaust Temp. High | When this is enabled and the controller detects exhaust temperature has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 43 | AIN24 Cylinder Temp. Difference High | When this is enabled and the controller detects cylinder temp. difference has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 44 | AIN24 Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 45 | AIN24 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 46 | AIN24 Sensor Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 47 | AIN8 Comm. Fail | When AIN8 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 48 | AIN8 Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 49 | AIN8 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 50 | AIN8 Sensor Low | When over low alarm is enabled, and the controller detects the sensor |

| No | Type | Description |
|----|--------------------|--|
| | | value is below the preset lower limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 51 | Power Factor Low | When this is enabled and the controller detects that the generator power factor has fallen below the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 52 | THD High | When this is enabled and the controller detects that the THD has exceeded the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 53 | Gen Volt Unbalance | When this is enabled and the controller detects that the voltage unbalanced value has exceeded the pre-set limit, it will initiate an alarm signal. It is always detected. |

5.4 SAFETY TRIP AND STOP ALARMS

When controller detects safety stop signals, it will open breaker after soft unloading and genset stops after cooling. Users need to reset alarms manually.

Table 11 Safety Trip and Stop Alarms

| No | Type | Description |
|----|----------------------|--|
| 1 | Over Speed | When this is enabled, and the controller detects that the genset speed is above the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 2 | Under Speed | When this is enabled and the controller detects that the genset speed is below the pre-set limit, it will initiate an alarm signal. It is detected after "warming up" and before "stop idle". |
| 3 | Loss of Speed Signal | When the controller detects the genset speed is 0, it shall issue an alarm signal. It is detected after "safety on time" and before "ETS solenoid hold". |
| 4 | Gen Over Frequency | When this is enabled, and the controller detects the genset frequency is above preset limit, it shall issue an alarm signal. It is detected always. |
| 5 | Gen Under Frequency | When this is enabled, and the controller detects the frequency is below the preset limit, it shall issue an alarm signal. It is detected after "warming up" and before "stop idle". |
| 6 | Gen Over Voltage | When this is enabled, and the controller detects the genset voltage is above preset limit, it shall issue an alarm signal. It is detected always. |
| 7 | Gen Under Voltage | When this is enabled, and the controller detects the voltage is below the preset limit, it shall issue an alarm signal. It is detected after "warming up" and before "stop idle". |

| No | Type | Description |
|----|---------------------------|--|
| 8 | Gen Over Current | When this is enabled, and the controller detects the genset current is above preset limit, it shall issue an alarm signal. It is detected always. |
| 9 | Negative Sequence Current | When this is enabled, and the controller detects the unbalanced current is above preset limit, it shall issue an alarm signal. It is detected always. |
| 10 | Earth Fault | When this is enabled, and the controller detects the earth current is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 11 | Reverse Power | When this is enabled, and the controller detects the reverse power (negative) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 12 | Over Power | When this is enabled, and the controller detects the genset power (positive) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 13 | Loss Excitation | When this is enabled, and the controller detects the genset reactive power (negative) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 14 | ECU Alarm | When the controller receives the engine alarm signal from J1939, it shall issue an alarm signal. It is always detected. |
| 15 | Temp. Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 16 | Engine Temp High | When this is enabled, and the controller detects the temp. is above the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 17 | Engine Temp Low | When this is enabled, and the controller detects the temp. is below the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 18 | Oil Pressure Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 19 | Oil Pressure Low | When this is enabled, and the controller detects the pressure is below the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 20 | Oil Pressure Sensor Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue an alarm signal, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 21 | Fuel Level Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. |

| No | Type | Description |
|----|---------------------------|---|
| | | It is always detected. |
| 22 | Fuel Level Low | When this is enabled, and the controller detects the level is below the preset limit, it shall issue an alarm signal. It is always detected. |
| 23 | Flex. Sensor 1 Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 24 | Flex. Sensor 1 High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 25 | Flex. Sensor 1 Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 26 | Flex. Sensor 1 Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue an alarm signal, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 27 | Flex. Sensor 2 Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 28 | Flex. Sensor 2 High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 29 | Flex. Sensor 2 Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 30 | Charge Alternator Failure | When this is enabled, and the controller detects the charger voltage value is below the preset limit, it shall issue an alarm signal. It is detected when the genset is normally running. |
| 31 | Battery Over Volt | When this is enabled, and the controller detects the battery voltage is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 32 | Battery Under Volt | When this is enabled, and the controller detects the battery voltage is below the preset limit, it shall issue an alarm signal. |

| No | Type | Description |
|----|--------------------------------------|---|
| | | It is always detected. |
| 33 | Fail to Sync. | If the controller doesn't detect sync. signal within the pre-set time, it will initiate an alarm signal. It is detected when GCB closes. |
| 34 | Maintenance Due | When this is enabled and countdown time is 0, it will initiate an alarm signal. It is detected when the genset is running. |
| 35 | Digital Input Alarm | When the digital input port is set users-defined and if it is active, the controller will initiate an alarm signal for the input port. It is detected in the detection range set for the input port. |
| 36 | PLC Functions Alarm | When PLC function is set users-defined and if it is active, the controller will initiate an alarm signal. It is detected in the detection range set by the PLC function. |
| 37 | DIN16 Comm. Fail | When DIN16 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 38 | DIN16 Input Alarm | When DIN16 input is set users-defined and if it is active, the controller will initiate an alarm signal. It is detected in the detection range set in the input. |
| 39 | DOUT16 Comm. Fail | When DOUT16 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 40 | AIN24 Comm. Fail | When AIN24 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 41 | AIN24 Cylinder Temp. High | When this is enabled and the controller detects cylinder temperature has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 42 | AIN24 Exhaust Temp. High | When this is enabled and the controller detects exhaust temperature has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 43 | AIN24 Cylinder Temp. Difference High | When this is enabled and the controller detects cylinder temp. difference has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 44 | AIN24 Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 45 | AIN24 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 46 | AIN24 Sensor Low | When over low alarm is enabled, and the controller detects the sensor |

| No | Type | Description |
|----|--------------------|---|
| | | value is below the preset lower limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 47 | AIN8 Comm. Fail | When AIN8 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 48 | AIN8 Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 49 | AIN8Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 50 | AIN8 Sensor Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 51 | Power Factor Low | When this is enabled and the controller detects that the generator power factor has fallen below the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 52 | THD High | When this is enabled and the controller detects that the THD has exceeded the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 53 | Gen Volt Unbalance | When this is enabled and the controller detects that the voltage unbalanced value has exceeded the pre-set limit, it will initiate an alarm signal. It is always detected. |

5.5 TRIP ALARMS

When controller detects trip alarms, it will open breaker directly but not stop the genset. Users need to reset alarms manually.

Table 12 Trip Alarms

| No | Type | Description |
|----|---------------------------|--|
| 1 | Over Speed | When this is enabled, and the controller detects that the genset speed is above the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 2 | Under Speed | When this is enabled and the controller detects that the genset speed is below the pre-set limit, it will initiate an alarm signal. It is detected after "warming up" and before "stop idle". |
| 3 | Loss of Speed Signal | When the controller detects the genset speed is 0, it shall issue an alarm signal. It is detected after "safety on time" and before "ETS solenoid hold". |
| 4 | Gen Over Frequency | When this is enabled, and the controller detects the genset frequency is above preset limit, it shall issue an alarm signal. It is detected always. |
| 5 | Gen Under Frequency | When this is enabled, and the controller detects the frequency is below the preset limit, it shall issue an alarm signal. It is detected after "warming up" and before "stop idle". |
| 6 | Gen Over Voltage | When this is enabled, and the controller detects the genset voltage is above preset limit, it shall issue an alarm signal. It is detected always. |
| 7 | Gen Under Voltage | When this is enabled, and the controller detects the voltage is below the preset limit, it shall issue an alarm signal. It is detected after "warming up" and before "stop idle". |
| 8 | Gen Over Current | When this is enabled, and the controller detects the genset current is above preset limit, it shall issue an alarm signal. It is detected always. |
| 9 | Negative Sequence Current | When this is enabled, and the controller detects the unbalanced current is above preset limit, it shall issue an alarm signal. It is detected always. |
| 10 | Earth Fault | When this is enabled, and the controller detects the earth current is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 11 | Reverse Power | When this is enabled, and the controller detects the reverse power (negative) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 12 | Over Power | When this is enabled, and the controller detects the genset power (positive) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 13 | Loss Excitation | When this is enabled, and the controller detects the genset reactive |

| No | Type | Description |
|----|---------------------------|---|
| | | power (negative) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 14 | ECU Alarm | When the controller receives the engine alarm signal from J1939, it shall issue an alarm signal. It is always detected. |
| 15 | Temp. Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 16 | Engine Temp High | When this is enabled, and the controller detects the temp. is above the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 17 | Engine Temp Low | When this is enabled, and the controller detects the temp. is below the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 18 | Oil Pressure Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 19 | Oil Pressure Low | When this is enabled, and the controller detects the pressure is below the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 20 | Oil Pressure Sensor Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue an alarm signal, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 21 | Fuel Level Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 22 | Fuel Level Low | When this is enabled, and the controller detects the level is below the preset limit, it shall issue an alarm signal. It is always detected. |
| 23 | Flex. Sensor 1 Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 24 | Flex. Sensor 1 High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 25 | Flex. Sensor 1 Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; |

| No | Type | Description |
|----|---------------------------|---|
| | | It is always detected when the sensor is selected as fuel level sensor. |
| 26 | Flex. Sensor 1 Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue an alarm signal, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 27 | Flex. Sensor 2 Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 28 | Flex. Sensor 2 High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 29 | Flex. Sensor 2 Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 30 | Charge Alternator Failure | When this is enabled, and the controller detects the charger voltage value is below the preset limit, it shall issue an alarm signal. It is detected when the genset is normally running. |
| 31 | Battery Over Volt | When this is enabled, and the controller detects the battery voltage is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 32 | Battery Under Volt | When this is enabled, and the controller detects the battery voltage is below the preset limit, it shall issue an alarm signal. It is always detected. |
| 33 | Fail to Sync. | If the controller doesn't detect sync. signal within the pre-set time, it will initiate an alarm signal. It is detected when GCB closes. |
| 34 | Volt Asynchrony | After GCB is closed, the voltage difference between busbar and generator is above the preset synchronous voltage, the controller shall issue an alarm signal. It is detected after GCB is closed. |
| 35 | Freq Asynchrony | After GCB is closed, the frequency difference between busbar and generator is above the preset synchronous frequency, the controller shall issue an alarm signal. It is detected after GCB is closed. |
| 36 | Phase Asynchrony | After GCB is closed, the voltage phase difference between busbar and generator is above the preset synchronous phase, the controller shall issue an alarm signal. It is detected after GCB is closed. |

| No | Type | Description |
|----|--------------------------------------|--|
| 37 | Gen Close Failure | When the controller detects GCB close fails, that is, after close output the close status input is inactive, it will initiate an alarm signal. It is detected after GCB is closed. |
| 38 | Gen Open Failure | When the controller detects GOB open fails, that is, after open output the close status input is active, it will initiate an alarm signal. It is detected after GCB is closed. |
| 39 | Maintenance Due | When this is enabled and countdown time is 0, it will initiate an alarm signal. It is detected when the genset is running. |
| 40 | Digital Input Alarm | When the digital input port is set users-defined and if it is active, the controller will initiate an alarm signal for the input port. It is detected in the detection range set for the input port. |
| 41 | PLC Functions Alarm | When PLC function is set users-defined and if it is active, the controller will initiate an alarm signal. It is detected in the detection range set by the PLC function. |
| 42 | DIN16 Comm. Fail | When DIN16 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 43 | DIN16 Input Alarm | When DIN16 input is set users-defined and if it is active, the controller will initiate an alarm signal. It is detected in the detection range set in the input. |
| 44 | DOUT16 Comm. Fail | When DOUT16 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 45 | AIN24 Comm. Fail | When AIN24 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 46 | AIN24 Cylinder Temp. High | When this is enabled and the controller detects cylinder temperature has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 47 | AIN24 Exhaust Temp. High | When this is enabled and the controller detects exhaust temperature has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 48 | AIN24 Cylinder Temp. Difference High | When this is enabled and the controller detects cylinder temp. difference has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 49 | AIN24 Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 50 | AIN24 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; |

| No | Type | Description |
|----|--------------------|---|
| | | It is always detected when the sensor is selected as fuel level sensor. |
| 51 | AIN24 Sensor Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 52 | AIN8 Comm. Fail | When AIN8 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 53 | AIN8 Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 54 | AIN8 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 55 | AIN8 Sensor Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 56 | Power Factor Low | When this is enabled and the controller detects that the generator power factor has fallen below the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 57 | THD High | When this is enabled and the controller detects that the THD has exceeded the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 58 | Gen Volt Unbalance | When this is enabled and the controller detects that the voltage unbalanced value has exceeded the pre-set limit, it will initiate an alarm signal. It is always detected. |

5.6 TRIP AND STOP ALARM

When the controller detects trip and stop signals, it will open breaker directly and stop the genset after cooling. Users need to reset alarms manually.

Table 13 Trip and Stop Alarms

| No | Type | Description |
|----|---------------------------|--|
| 1 | Over Speed | When this is enabled, and the controller detects that the genset speed is above the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 2 | Under Speed | When this is enabled and the controller detects that the genset speed is below the pre-set limit, it will initiate an alarm signal. It is detected after "warming up" and before "stop idle". |
| 3 | Loss of Speed Signal | When the controller detects the genset speed is 0, it shall issue an alarm signal. It is detected after "safety on time" and before "ETS solenoid hold". |
| 4 | Gen Over Frequency | When this is enabled, and the controller detects the genset frequency is above preset limit, it shall issue an alarm signal. It is detected always. |
| 5 | Gen Under Frequency | When this is enabled, and the controller detects the frequency is below the preset limit, it shall issue an alarm signal. It is detected after "warming up" and before "stop idle". |
| 6 | Gen Over Voltage | When this is enabled, and the controller detects the genset voltage is above preset limit, it shall issue an alarm signal. It is detected always. |
| 7 | Gen Under Voltage | When this is enabled, and the controller detects the voltage is below the preset limit, it shall issue an alarm signal. It is detected after "warming up" and before "stop idle". |
| 8 | Gen Over Current | When this is enabled, and the controller detects the genset current is above preset limit, it shall issue an alarm signal. It is detected always. |
| 9 | Negative Sequence Current | When this is enabled, and the controller detects the unbalanced current is above preset limit, it shall issue an alarm signal. It is detected always. |
| 10 | Earth Fault | When this is enabled, and the controller detects the earth current is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 11 | Reverse Power | When this is enabled, and the controller detects the reverse power (negative) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 12 | Over Power | When this is enabled, and the controller detects the genset power (positive) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 13 | Loss Excitation | When this is enabled, and the controller detects the genset reactive |

| No | Type | Description |
|----|---------------------------|---|
| | | power (negative) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 14 | ECU Alarm | When the controller receives the engine alarm signal from J1939, it shall issue an alarm signal. It is always detected. |
| 15 | Temp. Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 16 | Engine Temp High | When this is enabled, and the controller detects the temp. is above the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 17 | Engine Temp Low | When this is enabled, and the controller detects the temp. is below the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 18 | Oil Pressure Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 19 | Oil Pressure Low | When this is enabled, and the controller detects the pressure is below the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 20 | Oil Pressure Sensor Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue an alarm signal, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 21 | Fuel Level Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 22 | Fuel Level Low | When this is enabled, and the controller detects the level is below the preset limit, it shall issue an alarm signal. It is always detected. |
| 23 | Flex. Sensor 1 Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 24 | Flex. Sensor 1 High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 25 | Flex. Sensor 1 Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; |

| No | Type | Description |
|----|---------------------------|---|
| | | It is always detected when the sensor is selected as fuel level sensor. |
| 26 | Flex. Sensor 1 Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue an alarm signal, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 27 | Flex. Sensor 2 Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 28 | Flex. Sensor 2 High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 29 | Flex. Sensor 2 Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 30 | Charge Alternator Failure | When this is enabled, and the controller detects the charger voltage value is below the preset limit, it shall issue an alarm signal. It is detected when the genset is normally running. |
| 31 | Battery Over Volt | When this is enabled, and the controller detects the battery voltage is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 32 | Battery Under Volt | When this is enabled, and the controller detects the battery voltage is below the preset limit, it shall issue an alarm signal. It is always detected. |
| 33 | Fail to Sync. | If the controller doesn't detect sync. signal within the pre-set time, it will initiate an alarm signal. It is detected when GCB closes. |
| 34 | Mains Over Freq | When the controller detects mains frequency is above the set limit, it shall issue an alarm signal. It is detected after mains parallel mode is active and GCB is closed. |
| 35 | Mains Under Freq | When the controller detects mains frequency is below the set limit, it shall issue an alarm signal. It is detected after mains parallel mode is active and GCB is closed. |
| 36 | Mains Over Voltage | When the controller detects mains voltage is above the set limit, it shall issue an alarm signal. It is detected after mains parallel mode is active and GCB is closed. |
| 37 | Mains Under Voltage | When the controller detects mains voltage is below the set limit, it shall issue an alarm signal. It is detected after mains parallel mode is active and GCB is closed. |

| No | Type | Description |
|----|--------------------------------------|--|
| 38 | Mains ROCOF | When the controller detects mains ROCOF is above the set limit, it shall issue an alarm signal. It is detected after mains parallel mode is active and GCB is closed. |
| 39 | Mains Vector Shift | When the controller detects mains voltage vector change is above the set limit, it shall issue an alarm signal. It is detected after mains parallel mode is active and GCB is closed. |
| 40 | Maintenance Due | When this is enabled and countdown time is 0, it will initiate an alarm signal. It is detected when the genset is running. |
| 41 | Digital Input Alarm | When the digital input port is set users-defined and if it is active, the controller will initiate an alarm signal for the input port. It is detected in the detection range set for the input port. |
| 42 | PLC Functions Alarm | When PLC function is set users-defined and if it is active, the controller will initiate an alarm signal. It is detected in the detection range set by the PLC function. |
| 43 | DIN16 Comm. Fail | When DIN16 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 44 | DIN16 Input Alarm | When DIN16 input is set users-defined and if it is active, the controller will initiate an alarm signal. It is detected in the detection range set in the input. |
| 45 | DOUT16 Comm. Fail | When DOUT16 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 46 | AIN24 Comm. Fail | When AIN24 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 47 | AIN24 Cylinder Temp. High | When this is enabled and the controller detects cylinder temperature has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 48 | AIN24 Exhaust Temp. High | When this is enabled and the controller detects exhaust temperature has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 49 | AIN24 Cylinder Temp. Difference High | When this is enabled and the controller detects cylinder temp. difference has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 50 | AIN24 Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 51 | AIN24 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; |

| No | Type | Description |
|----|----------------------|---|
| | | It is always detected when the sensor is selected as fuel level sensor. |
| 52 | AIN24 Sensor Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue an alarm signal. It is detected after “safety on time” before “ETS solenoid hold” when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 53 | AIN8 Comm. Fail | When AIN8 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 54 | AIN8 Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 55 | AIN8 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after “safety on time” before “ETS solenoid hold” when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 56 | AIN8 Sensor Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue an alarm signal. It is detected after “safety on time” before “ETS solenoid hold” when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 57 | Power Factor Low | When this is enabled and the controller detects that the generator power factor has fallen below the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 58 | THD High | When this is enabled and the controller detects that the THD has exceeded the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 59 | Gen Volt Unbalance | When this is enabled and the controller detects that the voltage unbalanced value has exceeded the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 60 | MSC Mains Decoupling | When the controller receives “MSC Mains Decoupling” alarm, it shall issue an alarm signal. It is always detected. |

5.7 SHUTDOWN ALARMS

When controller detects shutdown alarms, it will send signal to open breaker and shut down the generator. Users need to reset alarms manually.

Table 14 Shutdown Alarms

| No | Type | Description |
|----|---------------------------|--|
| 1 | Emergency Stop | When the controller detects emergency stop signals, it will initiate a shutdown alarm. It is always detected. |
| 2 | Over Speed | When this is enabled, and the controller detects that the genset speed is above the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 3 | Under Speed | When this is enabled and the controller detects that the genset speed is below the pre-set limit, it will initiate an alarm signal. It is detected after "warming up" and before "stop idle". |
| 4 | Loss of Speed Signal | When the controller detects the genset speed is 0, it shall issue an alarm signal. It is detected after "safety on time" and before "ETS solenoid hold". |
| 5 | Gen Over Frequency | When this is enabled, and the controller detects the genset frequency is above preset limit, it shall issue an alarm signal. It is detected always. |
| 6 | Gen Under Frequency | When this is enabled, and the controller detects the frequency is below the preset limit, it shall issue an alarm signal. It is detected after "warming up" and before "stop idle". |
| 7 | Gen Over Voltage | When this is enabled, and the controller detects the genset voltage is above preset limit, it shall issue an alarm signal. It is detected always. |
| 8 | Gen Under Voltage | When this is enabled, and the controller detects the voltage is below the preset limit, it shall issue an alarm signal. It is detected after "warming up" and before "stop idle". |
| 9 | Fail to Start | If the genset doesn't start during the start attempts, the controller shall issue an alarm signal. |
| 10 | Gen Over Current | When this is enabled, and the controller detects the genset current is above preset limit, it shall issue an alarm signal. It is detected always. |
| 11 | Negative Sequence Current | When this is enabled, and the controller detects the unbalanced current is above preset limit, it shall issue an alarm signal. It is detected always. |
| 12 | Earth Fault | When this is enabled, and the controller detects the earth current is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 13 | Reverse Power | When this is enabled, and the controller detects the reverse power (negative) is above the preset limit, it shall issue an alarm signal. |

| No | Type | Description |
|----|--------------------------|--|
| | | It is always detected. |
| 14 | Over Power | When this is enabled, and the controller detects the genset power (positive) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 15 | Loss Excitation | When this is enabled, and the controller detects the genset reactive power (negative) is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 16 | ECU Comm. Fail | When the controller doesn't receive the engine alarm signal from J1939, it shall issue an alarm signal. It is always detected. |
| 17 | ECU Alarm | When the controller receives the engine alarm signal from J1939, it shall issue an alarm signal. It is always detected. |
| 18 | Aux High Temp Alarm | When the controller detects that this alarm in the input port is active, it shall issue an alarm signal. It is detected after "safety on time" and before "ETS solenoid hold". |
| 19 | Aux Low OP Alarm | When the controller detects that this alarm in the input port is active, it shall issue an alarm signal. It is detected after "safety on time" and before "ETS solenoid hold". |
| 20 | MSC ID Error | When the controller detects MSC bus has the same IDs, it shall issue shutdown alarm signal. It is always detected. |
| 21 | Volt Bus Error | When the controller detects other genset GCBs are closed, but busbar voltage is below the uncharged busbar voltage, it shall issue an alarm signal. It is detected when GCB is closed. |
| 22 | Gen Phase Seq Wrong | When the controller detects phase sequence error, it shall issue an alarm signal. It is always detected. |
| 23 | Bus Phase Seq Wrong | When the controller detects busbar sequence error, it shall issue an alarm signal. It is detected always. |
| 24 | Temp. Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 25 | Engine Temp High | When this is enabled, and the controller detects the temp. is above the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 26 | Engine Temp Low | When this is enabled, and the controller detects the temp. is below the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 27 | Oil Pressure Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. |

| No | Type | Description |
|----|---------------------------|---|
| | | It is always detected. |
| 28 | Oil Pressure Low | When this is enabled, and the controller detects the pressure is below the preset limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 29 | Oil Pressure Sensor Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue an alarm signal, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 30 | Fuel Level Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 31 | Fuel Level Low | When this is enabled, and the controller detects the level is below the preset limit, it shall issue an alarm signal. It is always detected. |
| 32 | Flex. Sensor 1 Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 33 | Flex. Sensor 1 High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 34 | Flex. Sensor 1 Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 35 | Flex. Sensor 1 Wrong | When voltage or current input is selected for the curve type of the controller, and the controller detects input signal is abnormal, it shall issue an alarm signal, and meanwhile the curve is transferred to resistor type to prevent damaging the controller. It is detected always. |
| 36 | Flex. Sensor 2 Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 37 | Flex. Sensor 2 High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 38 | Flex. Sensor 2 Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset low limit, it shall issue an alarm signal. |

| No | Type | Description |
|----|---------------------------|--|
| | | It is detected after “safety on time” before “ETS solenoid hold” when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 39 | Charge Alternator Failure | When this is enabled, and the controller detects the charger voltage value is below the preset limit, it shall issue an alarm signal. It is detected when the genset is normally running. |
| 40 | Battery Over Volt | When this is enabled, and the controller detects the battery voltage is above the preset limit, it shall issue an alarm signal. It is always detected. |
| 41 | Battery Under Volt | When this is enabled, and the controller detects the battery voltage is below the preset limit, it shall issue an alarm signal. It is always detected. |
| 42 | Fail to Sync. | If the controller doesn’t detect sync. signal within the pre-set time, it will initiate an alarm signal. It is detected when GCB closes. |
| 43 | Maintenance Due | When this is enabled and countdown time is 0, it will initiate an alarm signal. It is detected when the genset is running. |
| 44 | Low Coolant Level | When the controller detects Low Coolant Level alarm in the input port is active, it shall issue an alarm signal. It is always detected. |
| 45 | Detonation Alarm | When the controller detects Detonation Alarm in the input port is active, it shall issue an alarm signal. It is always detected. |
| 46 | Gas Leak Alarm | When the controller detects Gas Leak Alarm in the input port is active, it shall issue an alarm signal. It is always detected. |
| 47 | Digital Input Alarm | When the digital input port is set users-defined and if it is active, the controller will initiate an alarm signal for the input port. It is detected in the detection range set for the input port. |
| 48 | PLC Functions Alarm | When PLC function is set users-defined and if it is active, the controller will initiate an alarm signal. It is detected in the detection range set by the PLC function. |
| 49 | DIN16 Comm. Fail | When DIN16 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 50 | DIN16 Input Alarm | When DIN16 input is set users-defined and if it is active, the controller will initiate an alarm signal. It is detected in the detection range set in the input. |
| 51 | DOUT16 Comm. Fail | When DOUT16 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 52 | AIN24 Comm. Fail | When AIN24 communication is enabled and the controller cannot |

| No | Type | Description |
|----|--------------------------------------|---|
| | | receive the communication data, it will initiate an alarm signal. It is always detected. |
| 53 | AIN24 Cylinder Temp. High | When this is enabled and the controller detects cylinder temperature has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 54 | AIN24 Exhaust Temp. High | When this is enabled and the controller detects exhaust temperature has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 55 | AIN24 Cylinder Temp. Difference High | When this is enabled and the controller detects cylinder temp. difference has exceeded the pre-set value, it will initiate an alarm signal. It is detected after "safety on time" before "ETS solenoid hold". |
| 56 | AIN24 Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 57 | AIN24 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 58 | AIN24 Sensor Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 59 | AIN8 Comm. Fail | When AIN8 communication is enabled and the controller cannot receive the communication data, it will initiate an alarm signal. It is always detected. |
| 60 | AIN8 Sensor Open | When the controller detects the sensor circuit is open, it shall issue an alarm signal. It is always detected. |
| 61 | AIN8 Sensor High | When over high alarm is enabled, and the controller detects the sensor value is above the preset upper limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 62 | AIN8 Sensor Low | When over low alarm is enabled, and the controller detects the sensor value is below the preset lower limit, it shall issue an alarm signal. It is detected after "safety on time" before "ETS solenoid hold" when the sensor is selected as temperature sensor and pressure sensor; It is always detected when the sensor is selected as fuel level sensor. |
| 63 | Power Factor Low | When this is enabled and the controller detects that the generator power factor has fallen below the pre-set limit, it will initiate an alarm signal. |

| No | Type | Description |
|----|--------------------|---|
| | | It is always detected. |
| 64 | THD High | When this is enabled and the controller detects that the THD has exceeded the pre-set limit, it will initiate an alarm signal. It is always detected. |
| 65 | Gen Volt Unbalance | When this is enabled and the controller detects that the voltage unbalanced value has exceeded the pre-set limit, it will initiate an alarm signal. It is always detected. |

SmartGen

6 WIRING CONNECTION

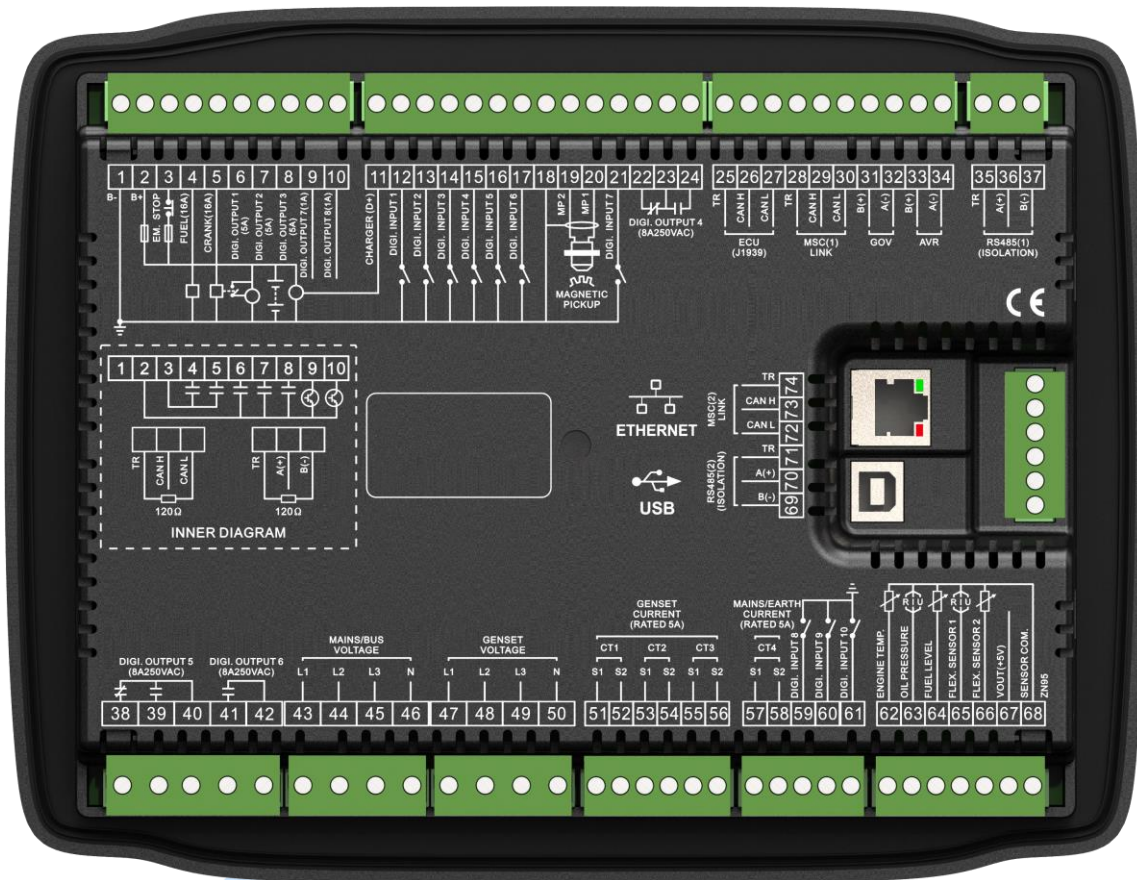


Fig. 3 HGM9520N Controller Rear Panel Drawing

Table 15 Terminal Connection Description

| No. | Functions | Cable Size | Remark |
|-----|----------------|--------------------|---|
| 1 | B- | 2.5mm ² | Connect with starter battery negative. |
| 2 | B+ | 2.5mm ² | Connect with starter battery positive. If wire length is over 30m, it's better to double wires in parallel. Max. 20A fuse is recommended. |
| 3 | Emergency stop | 2.5mm ² | Connect with B+ via emergency stop button. |
| 4 | Fuel relay | 1.5mm ² | B+ is supplied by 3 points, rated 16A. |
| 5 | Crank relay | 1.5mm ² | B+ is supplied by 3 points, rated 16A. Connect to starter coil. |
| 6 | Digi. output 1 | 1.5mm ² | B+ is supplied by 2 points, rated 5A. |
| 7 | Digi. output 2 | 1.5mm ² | B+ is supplied by 2 points, rated 5A. |
| 8 | Digi. output 3 | 1.5mm ² | B+ is supplied by 2 points, rated 5A. |
| 9 | Digi. output 7 | 1.5mm ² | B+ is supplied by 2 points, rated 1A. |
| 10 | Digi. output 8 | 1.5mm ² | B+ is supplied by 2 points, rated 1A. |
| 11 | Charger (D+) | 1.0mm ² | Connect with Charger D+ (WL) terminal. If this terminal doesn't exist, hang it in the air. |
| 12 | Digi. input 1 | 1.0mm ² | Ground connected is active (B-). |

| No. | Functions | Cable Size | Remark |
|-----|-------------------------------|--------------------|--|
| 13 | Digi. input 2 | 1.0mm ² | Ground connected is active (B-). |
| 14 | Digi. input 3 | 1.0mm ² | Ground connected is active (B-). |
| 15 | Digi. input 4 | 1.0mm ² | Ground connected is active (B-). |
| 16 | Digi. input 5 | 1.0mm ² | Ground connected is active (B-). |
| 17 | Digi. input 6 | 1.0mm ² | Ground connected is active (B-). |
| 18 | Magnetic pickup shield | 0.5mm ² | Connect with speed sensor, and shielding line is recommended. B- is already connected with speed sensor input 2 in the inside controller. |
| 19 | MP2 | | |
| 20 | MP1 | | |
| 21 | Digi. input 7 | 1.0mm ² | Ground connected is active (B-). |
| 22 | Digi. output 4 | 1.5mm ² | Normally close output, rated 8A. |
| 23 | | | Public points of relay. |
| 24 | | | Normally open output, rated 8A. |
| 25 | ECU TR | / | Connect ECU and expansion module; Impedance-120Ω shielding wire is recommended, and the single-end shall be earth connected. Short connect TR with H and then connect to 120Ω terminal resistor. |
| 26 | ECU CAN H | 0.5mm ² | |
| 27 | ECU CAN L | 0.5mm ² | |
| 28 | MSC(1) TR | / | Reserved for HGM9520N. |
| 29 | MSC(1) CAN H | 0.5mm ² | |
| 30 | MSC(1) CAN L | 0.5mm ² | |
| 31 | GOV B(+) | 0.5mm ² | Shielding wire is recommended. Shielding layer shall be earth connected at GOV end. |
| 32 | GOV A(-) | 0.5mm ² | |
| 33 | AVR B(+) | 0.5mm ² | Shielding wire is recommended. Shielding layer shall be earth connected at AVR end. |
| 34 | AVR A(-) | 0.5mm ² | |
| 35 | RS485(1) TR | / | Impedance-120Ω shielding wire is recommended, and the single-end shall be earth connected. Short connect TR with A(+) and then connect to 120Ω terminal resistor. |
| 36 | RS485(1) A(+) | 0.5mm ² | |
| 37 | RS485(1) B(-) | 0.5mm ² | |
| 38 | Digi. output 5 | 2.5mm ² | Normally close output, rated 8A. |
| 39 | | 2.5mm ² | Normally open output, rated 8A. |
| 40 | | 2.5mm ² | Public points of relay. |
| 41 | Digi. output 6 | 2.5mm ² | Normally open output, rated 8A. |
| 42 | | 2.5mm ² | Public points of relay. |
| 43 | Mains A-phase voltage input | 1.0mm ² | Connect to A-phase of Mains (2A fuse is recommended). |
| 44 | Mains B-phase voltage input | 1.0mm ² | Connect to B-phase of Mains (2A fuse is recommended). |
| 45 | Mains C-phase voltage input | 1.0mm ² | Connect to C-phase of Mains (2A fuse is recommended). |
| 46 | Mains N-wire input | 1.0mm ² | Connect to N-wire of Mains. |
| 47 | Gen-set A-phase voltage input | 1.0mm ² | Connect to A-phase of gen-set (2A fuse is recommended). |
| 48 | Gen-set B-phase voltage input | 1.0mm ² | Connect to B-phase of gen-set (2A fuse is recommended). |

| No. | Functions | Cable Size | Remark |
|-----|------------------------------|--------------------|---|
| 49 | Genset C-phase voltage input | 1.0mm ² | Connect to C-phase of gen-set (2A fuse is recommended). |
| 50 | Genset N-wire input | 1.0mm ² | Connect to N-wire of genset. |
| 51 | CT A-phase input | 1.5mm ² | Outside connect to secondary coil of current transformer (rated 5A). |
| 52 | | 1.5mm ² | |
| 53 | CT B-phase input | 1.5mm ² | Outside connect to secondary coil of current transformer (rated 5A). |
| 54 | | 1.5mm ² | |
| 55 | CT C-phase input | 1.5mm ² | Outside connect to secondary coil of current transformer (rated 5A). |
| 56 | | 1.5mm ² | |
| 57 | Earth CT input | 1.5mm ² | Outside connect to secondary coil of current transformer (rated 5A). |
| 58 | | 1.5mm ² | |
| 59 | Digi. input 8 | 1.0mm ² | Ground connected is active (B-). |
| 60 | Digi. input 9 | 1.0mm ² | Ground connected is active (B-). |
| 61 | Digi. input 10 | 1.0mm ² | Ground connected is active (B-). |
| 62 | Engine Temperature | 1.0mm ² | Connect to temperature resistance sensor. |
| 63 | Oil pressure | 1.0mm ² | Connect to engine oil pressure sensor. Voltage type (0V-5V), current type (4mA-20mA) and resistance sensor can be chosen. |
| 64 | Fuel level | 1.0mm ² | Connect to fuel level resistance sensor. |
| 65 | Flex. sensor 1 | 1.0mm ² | Connect to temp. /fuel level/pressure type sensor. Voltage type (0V-5V), current type (4mA-20mA) and resistance sensor can be chosen. |
| 66 | Flex. sensor 2 | 1.0mm ² | Connect to temp./fuel level/pressure type sensor. |
| 67 | VOUT(+5V) | 1.0mm ² | Provide +5V voltage for voltage type sensor, and current is below 50mA. |
| 68 | Sensor COM. | / | Public sensor terminal, and B- is already connected in the controller. |
| 69 | RS485(2) B(-) | 0.5mm ² | Impedance-120Ω shielding wire is recommended, and the single-end shall be earth connected. Short connect TR with A(+) and then connect to 120Ω terminal resistor. |
| 70 | RS485(2) A(+) | 0.5mm ² | |
| 71 | RS485(2) TR | / | |
| 72 | MSC(2) CAN L | / | |
| 73 | MSC(2) CAN H | / | Reserved for HGM9520N. |
| 74 | MSC(2) TR | / | |

NOTE: USB ports on the controller rear panel are configurable parameter ports, and users can directly program the controller on PC.

NOTE: ETHERNET port on the controller rear panel is parameter programming and monitoring port, and it can be programmed and monitored on PC.

7 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

7.1 CONTENTS AND SCOPES OF PARAMETERS

Table 16 Parameter Configuration

| No. | Items | Parameters | Defaults | Description |
|-----------------------|------------------------|------------|----------|---|
| Module Setting | | | | |
| 1. | Power On Mode | (0~2) | 0 | 0: Stop Mode 1: Manual Mode 2: Auto Mode |
| 2. | Communication Address | (1~254) | 1 | Controller address for remote monitoring. |
| 3. | Communication Stop Bit | (0~1) | 0 | 0: 2-Bit Stop Bit 1: 1-Bit Stop Bit This cannot be set on the front panel. |
| 4. | Language | (0~2) | 0 | 0: Simplified Chinese 1: English 2: Other |
| 5. | Password | (0~65535) | 00318 | It is used to enter advanced parameter setting. |
| 6. | Daylight Saving Time | (0~1) | 0 | 0: Disable 1: Enable Start and end time for this can be set. |
| 7. | Date and Time | | | It is used for date and time settings. |
| 8. | Temperature Unit | (0~1) | 0 | 0: °C; 1: °F |
| 9. | Pressure Unit | (0~2) | 0 | 0: kPa; 1: psi; 2: bar |
| 10. | Backlight Time | (0~3600)s | 300 | |
| 11. | Non-parallel Mode | (0~1) | 0 | 0: Disable 1: Enable |
| 12. | Network | (0~1) | 1 | 0: Disable 1: Enable |
| 13. | J1939-75 | (0~1) | 0 | 0: Disable 1: Enable |
| 14. | Alarm Data Interval | (0~60.0)s | 0.1 | |
| 15. | MSC2 | (0~1) | 0 | 0: Disable 1: Enable When it is enabled, MSC1 works with MSC2 in parallel. (Not available for HGM9520N) |
| 16. | Mains/Redundant | (0~2) | 0 | 0: Sole Module 1: Main Module 2: Redundant Module (Not available for HGM9520N) |
| 17. | Fn Function | (0~6) | 0 | 0: Fn Button 1: Stop Button 2: Start Button 3: Manual Button 4: Auto Button |

| No. | Items | Parameters | Defaults | Description |
|----------------------|--------------------|------------|----------|--|
| | | | | 5: Mains Close/Open Button (C) 6: Gen Close/Open Button (O) |
| Timer Setting | | | | |
| 1. | Start Delay | (0~3600)s | 5 | Time from mains abnormal or remote start signal is active to genset is starting. |
| 2. | Stop Delay | (0~3600)s | 30 | Time from mains normal or remote start signal is inactive to genset is stopping. |
| 3. | Preheat Delay | (0~3600)s | 0 | Time for pre-powering the heat plug before starter is powered up. |
| 4. | Cranking Time | (3~60)s | 8 | Time for starter power on each time. |
| 5. | Crank Rest Time | (3~60)s | 10 | The waiting time before second power up when engine start fails. |
| 6. | Safety On Delay | (0~3600)s | 10 | Alarms for low oil pressure, high temperature, under speed, under frequency /voltage, charge fail are inactive. |
| 7. | Start Idle Time | (0~3600)s | 10 | Running time for genset idling speed when the genset is starting. |
| 8. | Warming Up Time | (0~3600)s | 30 | Warming up time between genset switch on and high speed running. |
| 9. | Cooling Time | (0~3600)s | 60 | Radiating time before genset stop, after it unloads. |
| 10. | Stop Idle Time | (0~3600)s | 10 | Running time for genset idling speed when the genset is stopping. |
| 11. | ETS Solenoid Hold | (0~3600)s | 20 | Time for the stop electromagnet energization as the genset is stopping. |
| 12. | Fail to Stop Delay | (0~3600)s | 0 | Time after "idle delay" is over before the complete stop when "ETS Solenoid Hold" is set "0"; time after "ETS Solenoid Hold" delay is over before the complete stop when it is set other than "0". |
| 13. | After Stop Time | (0~3600)s | 0 | Time between a complete stop and standby. |
| 14. | Gas Engine Timers | (0~1) | 0 | 0: Disable 1: Enable When gas engine timer is enabled, fuel oil output is used for controlling gas valve. |
| 15. | Choke On Time | (0~60)s | 0 | Output time for gas thickening after the engine starts. |
| 16. | Gas On Delay | (0~60)s | 0 | After this period, gas valve control outputs after the engine starts. |
| 17. | Ignition Off Delay | (0~60)s | 0 | After this period, gas ignition control stops outputting after the gas valve is closed. |
| 18. | Smart Pre-heat | (0~1) | 0 | 0: Disable 1: Enable When it is enabled, the controller will stop |

| No. | Items | Parameters | Defaults | Description |
|-----------------------|-----------------------------|---|-------------------------------|--|
| | | | | pre-heating earlier according to the set conditions. Sensors are available, and when it is above the set value, it shall end the pre-heating. |
| 19. | Smart Start Idle | (0~1) | 0 | 0: Disable 1: Enable When it is enabled, the controller will stop pre-heating earlier according to the set conditions. Sensor is available, and when it is above the set value, it shall end the start idle period. |
| Engine Setting | | | | |
| 1. | Engine Type | (0~39) | 0 | Default: conventional engine (not ECU) When the controller is connected to J1939 engine, choose the corresponding type. |
| 2. | Flywheel Teeth | (10~300) | 118 | Tooth number of the engine, for judging of starter separation conditions and inspecting of engine speed. See the installation instructions. |
| 3. | Rated Speed | (0~6000)r/min | 1500 | Offer standard to judge over/under/loading speed. |
| 4. | Loading Speed | (0~100.0)% | 90.0 | Set value is percentage of rated speed. Controller detects when it is ready to load. It won't switch on when speed is under loading speed. |
| 5. | Loss of Speed Signal Delay | (0~3600)s | 5 | Time from detecting 0 speed to action confirm. |
| 6. | Loss of Speed Signal Action | (0~7) | 7 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. |
| 7. | Over Speed 1 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 114.0 112.0 2 7 | 0: Disable 1: Enable Setting value is rated speed percentage. Return value is rated speed percentage. Delay value Action |
| 8. | Over Speed 2 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 110.0 108.0 5 1 | 0: Disable 1: Enable Setting value is rated speed percentage. Return value is rated speed percentage. Delay value Action |
| 9. | Under Speed 1 Set | (0~1) (0~200.0)% (0~200.0)% | 1 80.0 82.0 | 0: Disable 1: Enable Setting value is rated speed percentage. Return value is rated speed percentage. |

| No. | Items | Parameters | Defaults | Description |
|-----|-----------------------|---|--------------------------------|--|
| | | (0~3600)s (0~7) | 3 7 | Delay value Action |
| 10. | Under Speed 2 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 86.0 90.0 5 1 | 0: Disable 1: Enable Setting value is rated speed percentage. Return value is rated speed percentage. Delay value Action |
| 11. | Battery Rated Voltage | (0~60.0)V | 24.0 | Standard for detecting of over/under voltage of battery. |
| 12. | Battery Over Volt 1 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 120.0 115.0 60 1 | 0: Disable 1: Enable Set value is batt. rated volt percentage. Return value is batt. rated volt percentage. Delay value Action |
| 13. | Battery Over Volt 2 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 0 120.0 115.0 60 0 | 0: Disable 1: Enable Set value is batt. rated volt percentage. Return value is batt. rated volt percentage. Delay value Action |
| 14. | Battery Under Volt 1 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 85.0 90.0 60 1 | 0: Disable 1: Enable Set value is batt. rated volt percentage. Return value is batt. rated volt percentage. Delay value Action |
| 15. | Battery Under Volt 2 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 0 85.0 90.0 60 0 | 0: Disable 1: Enable Set value is batt. rated volt percentage. Return value is batt. rated volt percentage. Delay value Action |
| 16. | Charge Alt Fail | (0~1) (0~60.0)V (0~60.0)V (0~3600)s (0~7) | 1 8.0 10.0 10 1 | 0: Disable 1: Enable Setting value Return value Delay value Action |
| 17. | Start Attempts | (1~10) times | 3 | Maximum crank times for start failures; when it reaches this, controller will send start failure signal. |
| 18. | Crank Disconnect | (0~6) | 2 | There are 3 conditions of disconnecting starter with engine. Each condition can be used alone and simultaneously to separate the start motor and engine as soon as possible. |
| 19. | Disconnect | (0~200.0)% | 24.0 | Percentage of the generating rated |

| No. | Items | Parameters | Defaults | Description |
|--------------------------|-------------------------|---------------|----------|---|
| | Generator Freq | | | frequency; when generator frequency is higher than the set value, starter will be disconnected. See the below installation instruction. |
| 20. | Disconnect Engine Speed | (0~200.0)% | 24.0 | Percentage of the rated speed; when generator speed is higher than the set value, starter will be disconnected. See the installation instruction. |
| 21. | Disconnect Oil Pressure | (0~1000)kPa | 200 | When generator oil pressure is higher than the set value, starter will be disconnected. See the installation instruction. |
| 22. | ECU Malfunc. Lamp | (0~7) | 1 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. |
| 23. | ECU Stop Lamp | (0~7) | 7 | |
| 24. | ECU Warning Lamp | (0~7) | 1 | |
| 25. | ECU Protect Lamp | (0~7) | 1 | |
| Generator Setting | | | | |
| 1. | AC System | (0~3) | 0 | 0: 3P4W; 1: 3P3W; 2: 2P3W; 3: 1P2W. |
| 2. | Poles | (2~64) | 4 | Numbers of generator pole, used for calculating engine speed when there is not speed sensor. |
| 3. | Rated Voltage | (30~30000)V | 230 | To offer standards for detecting of gens' over/under voltage and loading voltage. (It is primary voltage when voltage transformer is used; it is line voltage when AC system is 3P3W while it is phase voltage when other AC system is used). |
| 4. | Loading Voltage | (0~200.0)% | 90.0 | Percentage of generator rated voltage; it is detected when the controller prepares to load; when the generating voltage is below the load voltage. It won't enter normally running period. |
| 5. | Gen Rated Frequency | (10.0~75.0)Hz | 50.0 | Offer standards for detecting over/under/load frequency. |
| 6. | Loading Frequency | (0~200.0)% | 90 | Percentage of generator rated frequency; detected when controller prepares to take load; when generator frequency is under load frequency, it won't enter normal running. |
| 7. | Volt. Trans.(PT) | (0~1) | 0 | 0: Disable; 1:Enable |
| 8. | Gen Over Volt 1 Set | (0~1) | 1 | 0: Disable 1: Enable |
| | | (0~200.0)% | 120.0 | Set value is gen rated volt percentage. |
| | | (0~200.0)% | 118.0 | Return value is gen rated volt percentage. |

| No. | Items | Parameters | Defaults | Description |
|-----|-----------------------|--|-------------------------------|--|
| | | (0~3600)s (0~7) | 3 7 | Delay value Action |
| 9. | Gen Over Volt 2 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 110.0 108.0 5 1 | 0: Disable 1: Enable Set value is gen rated volt percentage. Return value is gen rated volt percentage. Delay value Action |
| 10. | Gen Under Volt 1 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 80.0 82.0 3 7 | 0: Disable 1: Enable Set value is gen rated volt percentage. Return value is gen rated volt percentage. Delay value Action |
| 11. | Gen Under Volt 2 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 84.0 86.0 5 1 | 0: Disable 1: Enable Set value is gen rated volt percentage. Return value is gen rated volt percentage. Delay value Action |
| 12. | Gen Over Freq. 1 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 114.0 112.0 2 7 | 0: Disable 1: Enable Set value is gen rated freq. percentage. Return value is gen rated freq. percentage. Delay value Action |
| 13. | Gen Over Freq. 2 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 110.0 108.0 5 1 | 0: Disable 1: Enable Set value is gen rated freq. percentage. Return value is gen rated freq. percentage. Delay value Action |
| 14. | Gen Under Freq. 1 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 80.0 82.0 3 7 | 0: Disable 1: Enable Set value is gen rated freq. percentage. Return value is gen rated freq. percentage. Delay value Action |
| 15. | Gen Under Freq. 2 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 84.0 86.0 5 1 | 0: Disable 1: Enable Set value is gen rated freq. percentage. Return value is gen rated freq. percentage. Delay value Action |
| 16. | Harmonic Display | (0~1) | 0 | 0: Disable 1: Enable |
| 17. | Volt Unbalance 1 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7)(0~1) | 1 10.0 5.0 5 1 | 0: Disable 1: Enable Set value is gen degree of unbalance. Return value is gen degree of unbalance. Delay value Action |

| No. | Items | Parameters | Defaults | Description |
|-----|------------------|---|-------------------------------|--|
| 18. | Volt Unbalance 2 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 0 10.0 5.0 5 0 | 0: Disable 1: Enable Set value is gen degree of unbalance. Return value is gen degree of unbalance. Delay value Action |
| 19. | THD Alarm 1 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 0 10.0 5.0 5 0 | 0: Disable 1: Enable Set value is gen degree of distortion. Return value is gen degree of distortion. Delay value Action |
| 20. | THD Alarm 2 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 0 10.0 5.0 5 0 | 0: Disable 1: Enable Set value is gen degree of distortion. Return value is gen degree of distortion. Delay value Action |
| 21. | CT | (5~6000)/5 | 500 | Ratio of external connected current transformer. |
| 22. | Rated Current | (5~6000)A | 500 | It is rated current of generator and used for loading current standard. |
| 23. | Over Current 1 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 120.0 118.0 3 6 | 0: Disable 1: Enable Set value is percentage of rated current. Return value is percentage of rated current. Delay value Action |
| 24. | Over Current 2 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 110.0 108.0 5 1 | 0: Disable 1: Enable Set value is percentage of rated current. Return value is percentage of rated current. Delay value Action |
| 25. | NegSeq Current 1 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 20.0 18.0 5 1 | 0: Disable 1: Enable Set value is percentage of rated current. Return value is percentage of rated current. Delay value Action |
| 26. | NegSeq Current 2 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 0 20.0 18.0 5 0 | 0: Disable 1: Enable Set value is percentage of rated current. Return value is percentage of rated current. Delay value Action |
| 27. | Earth Fault 1 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s | 1 20.0 18.0 5 | 0: Disable 1: Enable Set value is percentage of rated current. Return value is percentage of rated current. Delay value |

| No. | Items | Parameters | Defaults | Description |
|-----|---------------------|---|-------------------------------|--|
| | | (0~7) | 1 | Action |
| 28. | Earth Fault 2 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 0 20.0 18.0 5 0 | 0: Disable 1: Enable Set value is percentage of rated current. Return value is percentage of rated current. Delay value Action |
| 29. | Rated Power(W) | (0~6000)kW | 276 | Genset rated active power, which is standard of loading active power. |
| 30. | Rated Power(var) | (0~6000)kvar | 210 | Genset rated reactive power, which is standard of loading reactive power. |
| 31. | Load Ramp Rate | (0.1~100.0)%/s | 3.0 | For each time of genset loads the set ramp point power, after the set ramp delay time, it will upload to the target power by the set ramp rate. |
| 32. | Load Ramp Point | (0.1~40.0)% | 10.0 | |
| 33. | Load Ramp Delay | (0~30)s | 0 | |
| 34. | Unload Ramp Rate | (0.1~100.0)%/s | 3.0 | Genset unloading speed |
| 35. | Over Power 1 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 120.0 118.0 3 6 | 0: Disable 1: Enable Set value is percentage of gen rated active power. Return value is percentage of gen rated active power. Delay value Action |
| 36. | Over Power 2 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 110.0 108.0 5 1 | 0: Disable 1: Enable Set value is percentage of gen rated active power. Return value is percentage of gen rated active power. Delay value Action |
| 37. | Reverse Power 1 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 10.0 8.0 3 7 | 0: Disable 1: Enable Set value is percentage of gen rated active power. Return value is percentage of gen rated active power. Delay value Action |
| 38. | Reverse Power 2 Set | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 5.0 3.0 5 1 | 0: Disable 1: Enable Set value is percentage of gen rated active power. Return value is percentage of gen rated active power. Delay value Action |

| No. | Items | Parameters | Defaults | Description |
|------------------------------|------------------------|---|-----------------------------|--|
| 39. | Loss Excitation 1 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 20.0 18.0 5 1 | 0: Disable 1: Enable Set value is percentage of gen rated reactive power. Return value is percentage of gen rated reactive power. Delay value Action |
| 40. | Loss Excitation 2 | (0~1) (0~200.0)% (0~200.0)% (0~3600)s (0~7) | 1 20.0 18.0 5 0 | 0: Disable 1: Enable Set value is percentage of gen rated reactive power. Return value is percentage of gen rated reactive power. Delay value Action |
| 41. | Power Factor Low 1 | (0~1) (0~1.00) (0~1.00) (0~3600)s (0~7) | 1 0.70 0.75 5 1 | 0: Disable 1: Enable Set value is gen power factor. Set value is gen power factor. Delay value Action |
| 42. | Power Factor Low 2 | (0~1) (0~1.00) (0~1.00) (0~3600)s (0~7) | 0 0.70 0.75 5 0 | 0: Disable 1: Enable Set value is gen power factor. Set value is gen power factor. Delay value Action |
| Switch Setting | | | | |
| 1. | Close Time | (0~20.0)s | 5.0 | Pulse width of switch on. When it is 0, it means output constantly. |
| 2. | Open Time | (0~20.0)s | 3.0 | Pulse width of switch off. When it is 0, it means output constantly. |
| 3. | Check Time | (0~20.0)s | 5.0 | Feedback and check time of breaker close status input. |
| Analog Sensor Setting | | | | |
| Temperature Sensor | | | | |
| 1. | Curve Type | (0~15) | 8 | SGD |
| 2. | Open Circuit Action | (0~7) | 1 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. |
| 3. | High Temp. Alarm 1 Set | (0~1) ((-50)~300)°C ((-50)~300)°C (0~3600)s (0~7) | 1 98 96 3 7 | 0: Disable 1: Enable Set value is engine temperature value. Set value is engine temperature value. Delay value Action |
| 4. | High Temp. Alarm | (0~1) | 1 | 0: Disable 1: Enable |

| No. | Items | Parameters | Defaults | Description |
|-----------------------------|---------------------------|---|---------------------------|---|
| | 2 Set | ((-50)~300)°C ((-50)~300)°C (0~3600)s (0~7) | 95 93 5 1 | Set value is engine temperature value. Set value is engine temperature value. Delay value Action |
| 5. | Low Temp. Alarm Set | (0~1) ((-50)~300)°C ((-50)~300)°C (0~3600)s (0~7) | 0 70 75 5 1 | 0: Disable 1: Enable Set value is engine temperature value. Set value is engine temperature value. Delay value Action |
| Oil Pressure Sensor | | | | |
| 1. | Curve Type | (0~15) | 8 | SGD |
| 2. | Open Circuit Action | (0~7) | 1 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. |
| 3. | Low OP Alarm 1 Set | (0~1) (0~1000)kPa (0~1000)kPa (0~3600)s (0~7) | 1 103 117 2 7 | 0: Disable 1: Enable Set value is engine oil pressure value. Set value is engine oil pressure value. Delay value Action |
| 4. | Low OP Alarm 2 Set | (0~1) (0~1000)kPa (0~1000)kPa (0~3600)s (0~7) | 1 124 138 5 1 | 0: Disable 1: Enable Set value is engine oil pressure value. Set value is engine oil pressure value. Delay value Action |
| Fuel Level Sensor | | | | |
| 1. | Curve Type | (0~15) | 0 | Not used. |
| Flexible Sensor 1 | | | | |
| 1. | Flexible Sensor 1 Setting | (0~1) | 0 | 0: Disable 1: Enable; Temperature/pressure/fuel level sensors are optional. |
| Flexible Sensor 2 | | | | |
| 1. | Flexible Sensor 2 Setting | (0~1) | 0 | 0: Disable; 1: Enable; Temperature/pressure/fuel level sensors are optional. |
| Digital Input Ports | | | | |
| Digital Input Port 1 | | | | |
| 1. | Contents Setting | (0~70) | 31 | Remote start (on demand). |
| 2. | Active Type | (0~1) | 0 | 0: Close 1: Open |
| Digital Input Port 2 | | | | |
| 1. | Contents Setting | (0~70) | 27 | Low oil pressure shutdown input |
| 2. | Active Type | (0~1) | 0 | 0: Close 1: Open |
| Digital Input Port 3 | | | | |

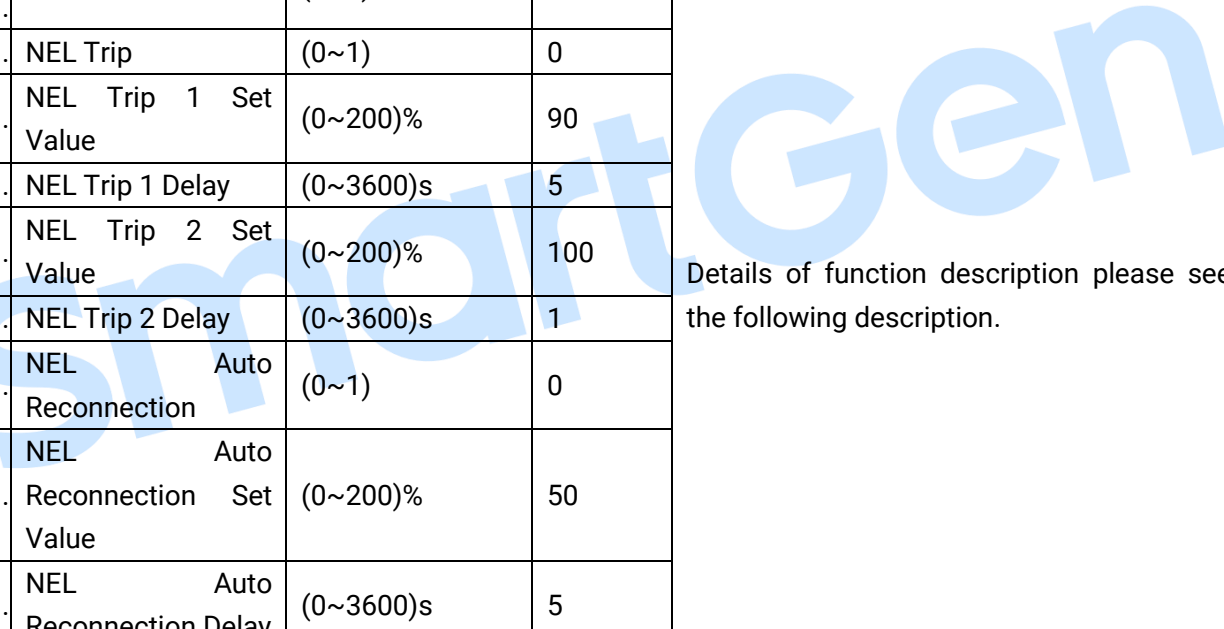
| No. | Items | Parameters | Defaults | Description |
|----------------------|------------------|------------|----------|--|
| 1. | Contents Setting | (0~70) | 26 | High temperature shutdown input |
| 2. | Active Type | (0~1) | 0 | 0: Close 1: Open |
| Digital Input Port 4 | | | | |
| 1. | Contents Setting | (0~70) | 13 | Gen close status input |
| 2. | Active Type | (0~1) | 0 | 0: Close 1: Open |
| Digital Input Port 5 | | | | |
| 1. | Contents Setting | (0~70) | 0 | Users-defined |
| 2. | Active Type | (0~1) | 0 | 0: Closed to active 1: Open to active |
| 3. | Arming | (0~3) | 3 | 0: From safety on 1: From starting 2: Always 3: Never |
| 4. | Active Actions | (0~7) | 4 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. |
| 5. | Active Delay | (0~20.0)s | 2.0 | Time from detecting active to confirm |
| 6. | Description | | | LCD displays detailed contents when the input is active. |
| Digital Input Port 6 | | | | |
| 1. | Contents Setting | (0~70) | 44 | Master choice |
| 2. | Active Type | (0~1) | 0 | 0: Close 1: Open |
| Digital Input Port 7 | | | | |
| 1. | Contents Setting | (0~70) | 0 | Users-defined. |
| 2. | Active Type | (0~1) | 0 | 0: Close 1: Open |
| 3. | Arming | (0~3) | 3 | 0: From safety on 1: From starting 2: Always 3: Never |
| 4. | Active Actions | (0~7) | 4 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. |
| 5. | Active Delay | (0~20.0)s | 2.0 | Time from detecting active to confirm |
| 6. | Description | | | LCD displays detailed contents when the input is active. |
| Digital Input Port 8 | | | | |
| 1. | Contents Setting | (0~70) | 0 | User defined. |
| 2. | Active Type | (0~1) | 0 | 0: Close 1: Open |
| 3. | Arming | (0~3) | 3 | 0: From safety on 1: From starting 2: Always 3: Never |
| 4. | Active Actions | (0~7) | 4 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. |
| 5. | Active Delay | (0~20.0)s | 2.0 | Time from detecting active to confirm |
| 6. | Description | | | LCD displays detailed contents when the input is active. |

| No. | Items | Parameters | Defaults | Description |
|------------------------------|------------------|------------|----------|--|
| Digital Input Port 9 | | | | |
| 1. | Contents Setting | (0~70) | 0 | Users-defined |
| 2. | Active Type | (0~1) | 0 | 0: Close 1: Open |
| 3. | Arming | (0~3) | 3 | 0: From safety on 1: From starting 2: Always 3: Never |
| 4. | Active Actions | (0~7) | 4 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. |
| 5. | Active Delay | (0~20.0)s | 2.0 | Time from detecting active to confirm |
| 6. | Description | | | LCD displays detailed contents when the input is active. |
| Digital Input Port 10 | | | | |
| 1. | Contents Setting | (0~70) | 0 | Users-defined |
| 2. | Active Type | (0~1) | 0 | 0: Close 1: Open |
| 3. | Arming | (0~3) | 3 | 0: From safety on 1: From starting 2: Always 3: Never |
| 4. | Active Actions | (0~7) | 4 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. |
| 5. | Active Delay | (0~20.0)s | 2.0 | Time from detecting active to confirm |
| 6. | Description | | | LCD displays detailed contents when the input is active. |
| Digital Output Ports | | | | |
| Digital Output Port 1 | | | | |
| 1 | Contents Setting | (0~299) | 44 | Normal generating output. |
| 2 | Active Type | (0~1) | 0 | 0: Normally open; 1: Normally close |
| Digital Output Port 2 | | | | |
| 1 | Contents Setting | (0~299) | 48 | Common Alarm. |
| 2 | Active Type | (0~1) | 0 | 0: Normally open; 1: Normally close |
| Digital Output Port 3 | | | | |
| 1 | Contents Setting | (0~299) | 38 | Energize to Stop. |
| 2 | Active Type | (0~1) | 0 | 0: Normally open; 1: Normally close |
| Digital Output Port 4 | | | | |
| 1 | Contents Setting | (0~299) | 35 | Idle Control. |
| 2 | Active Type | (0~1) | 0 | 0: Normally open; 1: Normally close |
| Digital Output Port 5 | | | | |
| 1 | Contents Setting | (0~299) | 30 | Open Gen Output. |
| 2 | Active Type | (0~1) | 0 | 0: Normally open; 1: Normally close |
| Digital Output Port 6 | | | | |
| 1 | Contents Setting | (0~299) | 29 | Close Gen Output. |
| 2 | Active Type | (0~1) | 0 | 0: Normally open; 1: Normally close |
| Digital Output Port 7 | | | | |

| No. | Items | Parameters | Defaults | Description |
|----------------------------------|-------------------|------------|----------|--|
| 1 | Contents Setting | (0~299) | 0 | Not Used. |
| 2 | Active Type | (0~1) | 0 | 0: Normally open; 1: Normally close |
| Digital Output Port 8 | | | | |
| 1 | Contents Setting | (0~299) | 0 | Not Used. |
| 2 | Active Type | (0~1) | 0 | 0: Normally open; 1: Normally close |
| Scheduled Run | | | | |
| 1 | Scheduled Run | (0~1) | 0 | 0: Disable; 1: Enable Circular setting (monthly, weekly, daily), start time setting, continuous time setting and loading or not are available. |
| Scheduled Not Run | | | | |
| 1 | Scheduled Not Run | (0~1) | 0 | 0: Disable; 1: Enable Circular setting (monthly, weekly, daily), non-start time setting, and continuous time setting are available. |
| Maintenance Setting | | | | |
| 1 | Maintenance | (0~1) | 0 | 0: Disable; 1: Enable Maintenance time, alarm action can be set. |
| Alternative Configuration | | | | |
| 1 | Alt. Config. 1 | (0~1) | 0 | 0: Disable; 1: Enable Power supply system, rated voltage, rated frequency, rated speed, rated current, rated active power, rated reactive power, GOV SW1, AVR SW1 can be set. |
| 2 | Alt. Config. 2 | (0~1) | 0 | 0: Disable; 1: Enable |
| 3 | Alt. Config. 3 | (0~1) | 0 | 0: Disable; 1: Enable |
| Sync Setting | | | | |
| Auto Sync | | | | |
| 1 | GOV Output Type | (0~1) | 1 | 0: Internal Relays; 1: Internal Analogue |
| 2 | GOV Reverse | (0~1) | 0 | 0: Disable; 1: Enable |
| 3 | GOV Action | (0~2) | 1 | 0: None; 1: Adjust to Rated; 2: Adjust Center Point |
| 4 | AVR Output | (0~2) | 2 | 0: None 1: Internal Relays; 2: Internal Analogue |
| 5 | AVR Reverse | (0~1) | 0 | 0: Disable; 1: Enable |
| 6 | AVR Action | (0~2) | 1 | 0: None; 1: Adjust to Rated; 2: Adjust Center Point |
| Sync Check | | | | |
| 1 | Dead Bus Volt | (10~50)V | 30 | It is considered Bus no power when Bus voltage is lower than dead Bus voltage. |
| 2 | Check Volt | (0~30)V | 3 | It is considered voltage synchronization when the voltage difference between |

| No. | Items | Parameters | Defaults | Description |
|-------------------|--------------------|---------------|----------|--|
| | | | | Generator and Bus is lower than synchronization voltage difference. |
| 3 | Check Pos Freq | (0~2.00)Hz | 0.20 | It is considered frequency synchronization when the frequency difference between Generator and Bus is less than "Check Pos Freq" but more than "Check Neg Freq". |
| 4 | Check Neg Freq | (0~2.00)Hz | 0.10 | |
| 5 | Check Phase Ang | (0~20)° | 10 | It is considered 'Check Phase Angle' when the initial phase difference is lower than synchronization phase difference. |
| 6 | Phase Angle Offset | (0~360)° | 0 | Gen initial phase will add pre-set phase offset based on the sampling initial phase. |
| 7 | Fail Sync Delay | (5.0~300.0) s | 60.0 | If sync signals are not detected during the set "Fail Sync Delay", controller will initiate corresponding alarms based on the "Fail Sync Act". |
| 8 | Fail Sync Act | (0~7) | 1 | |
| Multi Sync | | | | |
| 1. | Num. On MSC Bus | (1~32) | 2 | It is the minimum MSC number. (Not available for HGM9520N) |
| 2. | MSC Fail Act | (0~7) | 1 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. (Not available for HGM9520N) |
| 3. | MSC Baud Rate | (0~3) | 1 | 0: 500kBit/s; 1: 250kBit/s; 2: 125kBit/s; 3: 50kBit/s. (Not available for HGM9520N) |
| 4. | Starting Option | (0~1) | 1 | 0: Start All; 1: Start Sets on demand (Not available for HGM9520N) |
| 5. | Start All Time | (0~3600)s | 120 | When starting option is set as "start all", controller will stop corresponding gensets as required after "Start All Time" delay. (Not available for HGM9520N) |
| 6. | Balance Enable | (0~1) | 0 | 0: Disable; 1: Enable (Not available for HGM9520N) |
| 7. | Balance Hours | (1~1000)h | 1 | When the input is active, the controller will start/stop the genset automatically according to the running time and the pre-set balanced running time. Balance running gensets should be configured as the same priority. (Not available for HGM9520N) |
| 8. | Sets on Bus | (1~32) | 1 | Set the number of closed gensets on the bus. (Not available for HGM9520N) |

| No. | Items | Parameters | Defaults | Description |
|-----|-------------------------|------------|----------|---|
| 9. | Call Sets Mode | (0~1) | 0 | 0: Gen Power (%); 1: Available Power. (Not available for HGM9520N) |
| 10. | Call More Sets(%) | (0~100)% | 80 | Schedule the load value of other gensets when start the genset on demand. (Not available for HGM9520N) |
| 11. | Call Less Sets(%) | (0~100)% | 50 | Schedule the load value of other genset when start the genset on demand. (Not available for HGM9520N) |
| 12. | Call More Sets(W) | (0~6000)kW | 200 | Schedule the available power value of other genset when start the genset on demand. (Not available for HGM9520N) |
| 13. | Call Less Sets(W) | (0~6000)kW | 400 | Schedule the available power value of other genset when start the genset on demand. (Not available for HGM9520N) |
| 14. | Freq Feedback | (0~200)% | 10 | It is frequency feedback coefficient in configuring active power distribution. (Not available for HGM9520N) |
| 15. | Volt Feedback | (0~200)% | 10 | It is voltage feedback coefficient in configuring active power distribution. (Not available for HGM9520N) |
| 16. | Ground Relay Close Fail | (0~7) | 7 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. (Not available for HGM9520N) |
| 17. | Ground Relay Open Fail | (0~7) | 1 | 0: None; 1: Warning; 2: Block; 3: Safety Trip; 4: Safety Trip and Stop; 5: Trip; 6: Trip and Stop; 7: Shutdown. (Not available for HGM9520N) |
| 18. | Static Parallel Delay | (0~600)s | 60 | If static paralleling is not completed during "Static Parallel Delay", controller will initiate alarm information. (Not available for HGM9520N) |
| 19. | Economy Fuel | (0~1) | 0 | 0: Disable; 1: Enable All gensets should be configured the same economy fuel value. (Not available for HGM9520N) |
| 20. | Economy Fuel (%) | (0~100)% | 60 | It is the economy fuel percentage of genset. (Not available for HGM9520N) |
| 21. | Economy Sawp(W) | (0~6000)kW | 200 | Economy fuel consumption starts exchange if difference value of the total rated power of the exchange gensets and the total power of the current loading gensets is greater than the set exchange |

| No. | Items | Parameters | Defaults | Description |
|---------------------|---------------------------------|------------|----------|--|
| | | | | power, otherwise no exchange is performed. (Not available for HGM9520N) |
| 22. | GOV Droop | (0~1) | 0 | 0: Disable; 1: Enable |
| | | (0~200.0)% | 101.0 | It is the percentage of no-load frequency and rated frequency. |
| | | (0~200.0)% | 100.0 | It is the percentage of full-load frequency and rated frequency. |
| 23. | AVR Droop | (0~1) | 0 | 0: Disable; 1: Enable |
| | | (0~200.0)% | 101.0 | It is the percentage of no-load voltage and rated voltage. |
| | | (0~200.0)% | 100.0 | It is the percentage of full-load voltage and rated voltage. |
| NEL Settings | | | | |
| 1. | NEL Number | (1~3) | 3 |  <p>Details of function description please see the following description.</p> |
| 2. | NEL Trip | (0~1) | 0 | |
| 3. | NEL Trip 1 Set Value | (0~200)% | 90 | |
| 4. | NEL Trip 1 Delay | (0~3600)s | 5 | |
| 5. | NEL Trip 2 Set Value | (0~200)% | 100 | |
| 6. | NEL Trip 2 Delay | (0~3600)s | 1 | |
| 7. | NEL Auto Reconnection | (0~1) | 0 | |
| 8. | NEL Auto Reconnection Set Value | (0~200)% | 50 | |
| 9. | NEL Auto Reconnection Delay | (0~3600)s | 5 | |
| Dummy Load | | | | |
| 1. | DL Number | (1~3) | 3 | <p>Details of function description please see the following description.</p> |
| 2. | DL Connection | (0~1) | 0 | |
| 3. | DL Connection Value 1 | (0~200)% | 20 | |
| 4. | DL Connection Delay 1 | (0~3600)s | 5 | |
| 5. | DL Connection Value 2 | (0~200)% | 10 | |
| 6. | DL Connection Delay 2 | (0~3600)s | 1 | |
| 7. | DL Auto Trip | (0~1) | 0 | |

| No. | Items | Parameters | Defaults | Description |
|-------------------------|---------------------------|---------------|----------|---|
| 8. | DL Trip Value | (0~200)% | 50 | |
| 9. | DL Trip Delay | (0~3600)s | 5 | |
| Heavy Load | | | | |
| 1. | Heavy Load 1 Request Load | (0~6000)kW | 400 | Details of function description please see the following description. |
| 2. | Heavy Load 1 Rated Load | (0~6000)kW | 200 | |
| 3. | Heavy Load 1 Stable Delay | (0~3600)s | 5 | |
| 4. | Heavy Load 1 ACK Delay | (0~3600)s | 5 | |
| 5. | Heavy Load 2 Request Load | (0~6000)kW | 400 | |
| 6. | Heavy Load 2 Rated Load | (0~6000)kW | 200 | |
| 7. | Heavy Load 2 Stable Delay | (0~3600)s | 5 | |
| 8. | Heavy Load 2 ACK Delay | (0~3600)s | 5 | |
| Sync Calibration | | | | |
| MSC | | | | |
| 1. | MSC ID | (0~31) | 1 | It is the ID in the MSC communication network, which indicates that the MSC ID in the entire communication network should be unique. (Not available for HGM9520N) |
| 2. | Module Priority | (0~31) | 0 | Smaller the value, higher the priority. (Not available for HGM9520N) |
| Sync Control | | | | |
| 1. | Slip Freq | (0~1.00)Hz | 0.10 | Adjust generator frequency so that gen frequency is greater than slip frequency of bus. Phase synchronization adjustment is conducted when the sync difference frequency is set to 0. |
| 2. | Sync Freq (Volt) | (0~500)% | 20 | Gain(P) |
| | | (0~2000)% | 20 | Stability(I) |
| | | (0~2000)% | 0 | Rate of change (D) |
| 3. | Sync Freq (Relay) | (0.25~4.00)Hz | 1.20 | Response |
| | | (0.05~1.60)s | 0.20 | Stability |
| | | (0~100)% | 10 | Gain |
| | | (0~10.0)% | 1.0 | Dead area |
| 4. | Sync Volt (Volt) | (0~500)% | 20 | Gain(P) |

| No. | Items | Parameters | Defaults | Description |
|---------------------|--------------------------|---------------|----------|--|
| | | (0~2000)% | 20 | Stability(I) |
| | | (0~2000)% | 0 | Rate of change (D) |
| 5. | Sync Volt (Relay) | (0.25~4.00)Hz | 1.20 | Response |
| | | (0.05~1.60)s | 0.20 | Stability |
| | | (0~100)% | 10 | Gain |
| | | (0~10.0)% | 1.0 | Dead area |
| 6. | Sync Phase (Stable Time) | (0.1~20.0)s | 2.0 | Sync. confirmation time during phase sync adjustment |
| 7. | Sync Phase (Volt) | (0~500)% | 20 | Gain(P) |
| | | (0~2000)% | 20 | Stability(I) |
| | | (0~2000)% | 0 | Rate of change (D) |
| 8. | Sync Phase (Relay) | (0.25~4.00)Hz | 1.20 | Response |
| | | (0.05~1.60)s | 0.20 | Stability |
| | | (0~100)% | 10 | Gain |
| | | (0~10.0)% | 1.0 | Dead area |
| Load Control | | | | |
| 1. | kW Control (Volt) | (0~500)% | 20 | Gain(P) |
| | | (0~2000)% | 20 | Stability(I) |
| | | (0~2000)% | 0 | Rate of change (D) |
| 2. | kW Control (Relay) | (0.25~4.00)Hz | 1.20 | Response |
| | | (0.05~1.60)s | 0.20 | Stability |
| | | (0~100)% | 10 | Gain |
| | | (0~10.0)% | 1.0 | Dead area |
| 3. | kvar Control (Volt) | (0~500)% | 20 | Gain(P) |
| | | (0~2000)% | 20 | Stability(I) |
| | | (0~2000)% | 0 | Rate of change (D) |
| 4. | kvar Control (Relay) | (0.25~4.00)Hz | 1.20 | Response |
| | | (0.05~1.60)s | 0.20 | Stability |
| | | (0~100)% | 10 | Gain |
| | | (0~10.0)% | 1.0 | Dead area |
| Load | | | | |
| 1. | Load Minimum | (0~100.0)% | 1.0 | It is the load percentage when the soft unload is opened. |
| 2. | Load Mode | (0~3) | 0 | 0: Gen; 1: Mains; 2: Takeover; 3: Load Control. |
| 3. | Export Mode(W) | (0~1) | 0 | 0: Fixed Power; 1: Frequency-Power. It is active when Load mode is Gen control mode. |
| 4. | Export Mode(var) | (0~1) | 0 | 0: Fixed Power; 1: Voltage-Power. It is active when Load mode is Gen control mode. |
| 5. | Export Power(W) | (0~100.0)% | 30.0 | It is used to load control. |

| No. | Items | Parameters | Defaults | Description |
|----------------------|-----------------------|----------------------------------|-------------------|---|
| 6. | Export Power Opt | (0~1) | 0 | 0: kvar Reactive Power Control; 1: PF Power Factor Control. |
| 7. | Export Power (var) | (0~100.0)% | 8.0 | It is used to load control. |
| 8. | Analogue Adjust (W) | (0~1) | 0 | 0: Disable; 1: Enable. When it is enabled, flexible sensor 1 is used as analog input. It is active when active power output mode is configured as Fixed Power. |
| 9. | Analogue Adjust (var) | (0~1) | 0 | 0: Disable; 1: Enable. When it is enabled, flexible sensor 2 is used as analog input. It is active when reactive power output mode is configured as Fixed Power. |
| 10. | Export Curve (W) | | | Configure gen frequency-active power curve. It is active when active power output mode is configured as Frequency-Power. |
| 11. | Export Curve (var) | | | Configure gen voltage-reactive power curve. It is active when active power output mode is configured as Voltage-Power. |
| GOV/AVR | | | | |
| 1. | GOV SW1 | (0~20.00) | 0 | Center voltage, default 0V. |
| 2. | GOV SW2 | (0~10.00) | 2.00 | Voltage range, default (-2.5~+2.5V). |
| 3. | AVR SW1 | (0~20.00) | 0 | Center voltage, default 0V. |
| 4. | AVR SW2 | (0~10.00) | 2.0 | Voltage range, default (-2.5~+2.5V). |
| Mains Setting | | | | |
| 1. | AC System | (0~3) | 0 | 0: 3P4W; 1: 3P3W; 2: 2P3W; 3: 1P2W. |
| 2. | Rated Voltage | (30~30000)V | 230 | Offer standards for detecting mains' over/under voltage. (It is primary voltage when voltage transformer is used; it is line voltage when AC system is 3P3W while it is phase voltage when other AC system is used. |
| 3. | Mains Rated Frequency | (10.0~75.0)Hz | 50.0 | Offer standards for detecting over/under frequency. |
| 4. | Volt. Trans.(PT) | (0~1) | 0 | 0: Disable ; 1: Enable |
| 5. | Mains Split Action | (0~1) | 0 | 0: Trip and Stop; 1: Aux. Mains Fail. |
| 6. | Mains Over Voltage | (0~1) (0~200.0)% (0~20.0)s | 1 110.0 0.1 | Set value is percentage of mains rated volt. |
| 7. | Mains Under | (0~1) | 1 | |

| No. | Items | Parameters | Defaults | Description |
|-------------------------|-----------------------|------------------------------------|-------------------|--|
| | Voltage | (0~200.0)% (0~20.0)s | 90.0 0.1 | |
| 8. | Mains Frequency Over | (0~1) (0~200.0)% (0~20.0)s | 1 101.0 0.1 | Set value is mains rated frequency's percentage. |
| 9. | Mains Frequency Under | (0~1) (0~200.0)% (0~20.0)s | 1 99.0 0.1 | |
| 10. | ROCOF | (0~1) (0~1.00)Hz/s (0~20.0)s | 1 0.20 0.1 | Set value is frequency change rate of mains (ROCOF). |
| 11. | Vector Shift | (0~1) (0~20.0)° (0~20.0)s | 1 6.0 0.1 | Set value is phase angle's change rate of mains voltage waveform (VECTOR SHIFT). |
| Expansion Module | | | | |
| 1. | Expand DIN16 | (0~1) | 0 | 0: Disable ; 1: Enable |
| 2. | Expand DOUT16 | (0~1) | 0 | 0: Disable ; 1: Enable |
| 3. | Expand AIN24 1 | (0~1) | 0 | 0: Disable ; 1: Enable |
| 4. | Expand AIN24 2 | (0~1) | 0 | 0: Disable ; 1: Enable |
| 5. | Expand AIN8 | (0~1) | 0 | 0: Disable ; 1: Enable |

7.2 ENABLE DEFINITION OF DIGITAL OUTPUT PORTS

7.2.1 DEFINITION OF DIGITAL OUTPUT PORTS

Table 17 Definition of Digital Output Ports

| No. | Type | Description |
|-----|-----------------------|--|
| 0 | Not Used | |
| 1 | Custom Period 1 | Details of function description please see the following description. |
| 2 | Custom Period 2 | |
| 3 | Custom Period 3 | |
| 4 | Custom Period 4 | |
| 5 | Custom Period 5 | |
| 6 | Custom Period 6 | |
| 7 | Custom Combined 1 | |
| 8 | Custom Combined 2 | |
| 9 | Custom Combined 3 | |
| 10 | Custom Combined 4 | |
| 11 | Custom Combined 5 | |
| 12 | Custom Combined 6 | |
| 13 | Reserved | |
| 14 | Reserved | |
| 15 | Gas Choke On | Act in cranking. Action time is the preset time for it. |
| 16 | Gas Ignition | Act when genset is starting, and disconnect when engine is stopped. |
| 17 | Air Flap Control | Act on over speed shutdown and emergence stop. Air inflow can be closed to stop the engine quicker. |
| 18 | Audible Alarm | Act on warning, shutdown, and electrical trips. An annunciator can be connected externally. If "alarm mute" configurable input port is active, this is prohibited. |
| 19 | Louver Control | Act when genset is starting and disconnect when genset is stopped completely. |
| 20 | Fuel Pump Control | It is controlled by limit values of level sensor fuel pump. |
| 21 | Heater Control | It is controlled by heating limit values of temperature sensor. |
| 22 | Cooler Control | It is controlled by cooler limit values of temperature sensor. |
| 23 | Oil Pre-supply Output | Act from "crank on" to "safety on". |
| 24 | Generator Excite | Output in start process. If there is not generator frequency during hi-speed running, it shall output for 2 seconds again. |
| 25 | Pre-Lubricate | Act from pre-heating to safety run. |
| 26 | Remote Control Output | This port is controlled by communication (PC). |
| 27 | Reserved | |
| 28 | Sync Indication | |
| 29 | Close Gen Output | It can control generating switch to take load. |
| 30 | Open Gen Output | It can control generating switch to take off load. |
| 31 | Close Mains Output | It can control mains switch to take load. |

| No. | Type | Description |
|-----|---------------------------|---|
| 32 | Open Mains Output | It can control mains switch to take off load. |
| 33 | Start Relay | Act when gen cranks, disconnect at ETS Stop period; Used to control engine starter; |
| 34 | Fuel Relay | Act when genset is starting and disconnect at ETS Stop. When gas timer is enabled, fuel relay output is used to control gas valve. |
| 35 | Idle Control | It is used for engine with idling control. Close before starting and open in warming up delay; Close during stop idle mode and open when stop is completed. |
| 36 | Speed Raise Relay | Act during warming up time. |
| 37 | Speed Drop Relay | Act between the period of "stop idle" and "failed to stop". |
| 38 | Energize to Stop | It is used for engines with ETS electromagnet. Close when stop idle is over and open when pre-set "ETS delay" is over. |
| 39 | Speed Drop Pulse | Act for 0.1s when controller enters "stop idle", used for control parts of ECU dropping to idle speed. |
| 40 | ECU Stop | Used for ECU engine and control its stop. |
| 41 | ECU Power Supply | Used for ECU engine to control its power. |
| 42 | Speed Raise Pulse | Act for 0.1s when controller enters warming up delay; used to control parts of ECU raising to normal speed. |
| 43 | Crank Success | Close when a successful start signal is detected. |
| 44 | Gen OK | Act when generator is normally running. |
| 45 | Gen Load Available | Act between normal running and hi-speed cooling. |
| 46 | Reserved | |
| 47 | Synchronizing | Act when controller is synchronizing. |
| 48 | Common Alarm | Act when genset common warning, common shutdown, and common trip alarms occur. |
| 49 | Common Trip and Stop | Act when common trip and stop alarm occurs. |
| 50 | Common Shutdown | Act when common shutdown alarm occurs. |
| 51 | Common Trip | Act when common trip alarm occurs. |
| 52 | Common Warn | Act when common warning alarm occurs. |
| 53 | Common Block | Act when common block alarm occurs. |
| 54 | Battery Over Voltage | Act when battery's over voltage warning alarm occurs. |
| 55 | Battery Under Voltage | Act when battery's low voltage warning alarm occurs. |
| 56 | Charge Alternator Failure | Act when charging failure warning alarm occurs. |
| 57 | Common Safety Stop | Act when common safety stop alarm occurs. |
| 58 | Common Safety Trip | Act when common safety trip alarm occurs. |
| 59 | Reserved | |
| 60 | ECU Warning | Indicates ECU sends a warning signal. |
| 61 | ECU Shutdown | Indicates ECU sends a shutdown signal. |
| 62 | ECU Comm. Fail | Indicates controller is not communicating with ECU. |
| 63 | PWM Voltage Raise | When output type of AVR is set as "Relay output", controller adjusts voltage and reactive power via "Sync Raise Volt" and |
| 64 | PWM Voltage Drop | |

| No. | Type | Description |
|-------|-------------------------|--|
| | | "Sync Drop Volt". |
| 65 | PWM Speed Raise | When output type of GOV is set as "Relay output", controller adjusts speed and power via "Sync Raise Speed" and "Sync Drop Speed". |
| 66 | PWM Speed Drop | |
| 67 | Reserved | |
| 68 | Reserved | |
| 69 | Digital Input 1 Active | Act when input port 1 is active. |
| 70 | Digital Input 2 Active | Act when input port 2 is active. |
| 71 | Digital Input 3 Active | Act when input port 3 is active. |
| 72 | Digital Input 4 Active | Act when input port 4 is active. |
| 73 | Digital Input 5 Active | Act when input port 5 is active. |
| 74 | Digital Input 6 Active | Act when input port 6 is active. |
| 75 | Digital Input 7 Active | Act when input port 7 is active. |
| 76 | Digital Input 8 Active | Act when input port 8 is active. |
| 77 | Digital Input 9 Active | Act when input port 9 is active. |
| 78 | Digital Input 10 Active | Act when input port 10 is active. |
| 79 | Reserved | |
| 80 | Reserved | |
| 81 | Exp DI Input 1 Active | Act when expansion digital input 1 is active. |
| 82 | Exp DI Input 2 Active | Act when expansion digital input 2 is active. |
| 83 | Exp DI Input 3 Active | Act when expansion digital input 3 is active. |
| 84 | Exp DI Input 4 Active | Act when expansion digital input 4 is active. |
| 85 | Exp DI Input 5 Active | Act when expansion digital input 5 is active. |
| 86 | Exp DI Input 6 Active | Act when expansion digital input 6 is active. |
| 87 | Exp DI Input 7 Active | Act when expansion digital input 7 is active. |
| 88 | Exp DI Input 8 Active | Act when expansion digital input 8 is active. |
| 89 | Exp DI Input 9 Active | Act when expansion digital input 9 is active. |
| 90 | Exp DI Input 10 Active | Act when expansion digital input 10 is active. |
| 91 | Exp DI Input 11 Active | Act when expansion digital input 11 is active. |
| 92 | Exp DI Input 12 Active | Act when expansion digital input 12 is active. |
| 93 | Exp DI Input 13 Active | Act when expansion digital input 13 is active. |
| 94 | Exp DI Input 14 Active | Act when expansion digital input 14 is active. |
| 95 | Exp DI Input 15 Active | Act when expansion digital input 15 is active. |
| 96 | Exp DI Input 16 Active | Act when expansion digital input 16 is active. |
| 97-98 | Reserved | |
| 99 | Emergency Stop | Act when emergency stop alarm occurs. |
| 100 | Fail To Start | Act when start failure alarm occurs. |
| 101 | Fail To Stop | Act when stop failure alarm occurs. |
| 102 | Under Speed Warn | Act when under speed alarm occurs. |
| 103 | Under Speed Shutdown | Act when under speed alarm (except warning) occurs. |
| 104 | Over Speed Warn | Act when over speed warning occurs. |

| No. | Type | Description |
|---------|----------------------------|--|
| 105 | Over Speed Shutdown | Act when over speed alarm (except warning) occurs. |
| 106 | Reserved | |
| 107 | Reserved | |
| 108 | Reserved | |
| 109 | Gen Over Freq. Warn | Act when generator over frequency warning occurs. |
| 110 | Gen Over Freq. Shut | Act when generator over frequency alarm (except warning) occurs. |
| 111 | Gen Over Volt Warn | Act when generator over voltage warning occurs. |
| 112 | Gen Over Volt Shut | Act when generator over voltage alarm (except warning) occurs. |
| 113 | Gen Under Freq. Warn | Act when generator low frequency warning occurs. |
| 114 | Gen Under Freq. Shut | Act when generator low frequency alarm (except warning) occurs. |
| 115 | Gen Under Volt. Warn | Act when generator low voltage warning occurs. |
| 116 | Gen Under Volt. Shut | Act when generator low voltage alarm (except warning) occurs. |
| 117 | Gen Loss of Phase | Act when generator loss phase occurs. |
| 118 | Gen Phase Sequence Wrong | Act when generator reverse phase occurs. |
| 119 | Over Power Warn | Act when gen over power warning occurs. |
| 120 | Over Power Alarm | Act (except warning) when over power warning occurs. |
| 121 | Gen Reverse Power Warn | Act when gen reverse power warning occurs. |
| 122 | Gen Reverse Power Alarm | Act (except warning) when controller detects generator have reverse power. |
| 123 | Over Current Warn | Act when over current warning occurs. |
| 124 | Over Current Alarm | Act when gen over current alarm (except warning) occurs. |
| 125 | No Mains | Act when Mains voltage is 0. |
| 126 | Mains Over Frequency | Act when Mains over frequency occurs. |
| 127 | Mains Over Voltage | Act when Mains over voltage occurs. |
| 128 | Mains Under Frequency | Act when Mains under frequency occurs. |
| 129 | Mains Under Voltage | Act when Mains under voltage occurs. |
| 130 | Mains Phase Sequence Wrong | Act when Mains phase sequence is wrong. |
| 131 | Mains Loss of Phase | Act when Mains loss of phase occurs. |
| 132-133 | Reserved | |
| 134 | NEL1 Trip | Details of function description please see the following description. |
| 135 | NEL2 Trip | |
| 136 | NEL3 Trip | |
| 137-138 | Reserved | |
| 139 | High Temp Warn | Act when hi-temperature warning occurs. |
| 140 | Low Temp Warn | Act when low temperature warning occurs. |
| 141 | High Temp Alarm | Act when hi-temperature alarm (except warning) occurs. |
| 142 | Reserved | |

| No. | Type | Description |
|---------|------------------------------|--|
| 143 | Low OP Warn | Act when low oil pressure warning occurs. |
| 144 | Low OP Alarm | Act when low oil pressure alarm (except warning) occurs. |
| 145 | Oil Pressure Open Circuit | Act when oil pressure sensor is open circuit. |
| 146 | Reserved | |
| 147 | Low Fuel Level Warn | Act when controller has low fuel level warning alarm. |
| 148 | Low Fuel Level Alarm | Act when controller has low fuel level alarm (except warning). |
| 149 | Reserved | |
| 150 | Flexible Sensor 1 High Warn | Act when controller has flexible sensor 1 high warning alarm. |
| 151 | Flexible Sensor 1 Low Warn | Act when controller has flexible sensor 1 low warning alarm. |
| 152 | Flexible Sensor 1 High Alarm | Act when controller has flexible sensor 1 high alarm (except warning). |
| 153 | Flexible Sensor 1 Low Alarm | Act when controller has flexible sensor 1 low alarm (except warning). |
| 154 | Flexible Sensor 2 High Warn | Act when controller has flexible sensor 2 high warning alarm. |
| 155 | Flexible Sensor 2 Low Warn | Act when controller has flexible sensor 2 low warning alarm. |
| 156 | Flexible Sensor 2 High Alarm | Act when controller has flexible sensor 2 high alarm (except warning). |
| 157 | Flexible Sensor 2 Low Alarm | Act when controller has flexible sensor 2 low alarm (except warning). |
| 158-161 | Reserved | |
| 162 | Exp1 Ch15 High Alarm | Act when expansion AIN24 1 sensor 15 high alarm (except warning) occurs. |
| 163 | Exp1 Ch15 High Warn | Act when expansion AIN24 1 sensor 15 high warning occurs. |
| 164 | Exp1 Ch15 Low Alarm | Act when expansion AIN24 1 sensor 15 low alarm (except warning) occurs. |
| 165 | Exp1 Ch15 Low Warn | Act when expansion AIN24 1 sensor 15 low warning occurs. |
| 166 | Exp1 Ch16 High Alarm | Act when expansion AIN24 1 sensor 16 high alarm (except warning) occurs. |
| 167 | Exp1 Ch16 High Warn | Act when expansion AIN24 1 sensor 16 high warning occurs. |
| 168 | Exp1 Ch16 Low Alarm | Act when expansion AIN24 1 sensor 16 low alarm (except warning) occurs. |
| 169 | Exp1 Ch16 Low Warn | Act when expansion AIN24 1 sensor 16 low warning occurs. |
| 170 | Exp1 Ch17 High Alarm | Act when expansion AIN24 1 sensor 17 high alarm (except warning) occurs. |
| 171 | Exp1 Ch17 High Warn | Act when expansion AIN24 1 sensor 17 high warning occurs. |
| 172 | Exp1 Ch17 Low Alarm | Act when expansion AIN24 1 sensor 17 low alarm (except warning) occurs. |
| 173 | Exp1 Ch17 Low Warn | Act when expansion AIN24 1 sensor 17 low warning occurs. |
| 174 | Exp1 Ch18 High Alarm | Act when expansion AIN24 1 sensor 18 high alarm (except warning) occurs. |
| 175 | Exp1 Ch18 High Warn | Act when expansion AIN24 1 sensor 18 high warning occurs. |
| 176 | Exp1 Ch18 Low Alarm | Act when expansion AIN24 1 sensor 18 low alarm (except |

| No. | Type | Description |
|-----|----------------------|--|
| | | warning) occurs. |
| 177 | Exp1 Ch18 Low Warn | Act when expansion AIN24 1 sensor 18 low warning occurs. |
| 178 | Exp1 Ch19 High Alarm | Act when expansion AIN24 1 sensor 19 high alarm (except warning) occurs. |
| 179 | Exp1 Ch19 High Warn | Act when expansion AIN24 1 sensor 19 high warning occurs. |
| 180 | Exp1 Ch19 Low Alarm | Act when expansion AIN24 1 sensor 19 low alarm (except warning) occurs. |
| 181 | Exp1 Ch19 Low Warn | Act when expansion AIN24 1 sensor 19 low warning occurs. |
| 182 | Exp1 Ch20 High Alarm | Act when expansion AIN24 1 sensor 20 high alarm (except warning) occurs. |
| 183 | Exp1 Ch20 High Warn | Act when expansion AIN24 1 sensor 20 high warning occurs. |
| 184 | Exp1 Ch20 Low Alarm | Act when expansion AIN24 1 sensor 20 low alarm (except warning) occurs. |
| 185 | Exp1 Ch20 Low Warn | Act when expansion AIN24 1 sensor 20 low warning occurs. |
| 186 | Exp1 Ch21 High Alarm | Act when expansion AIN24 1 sensor 21 high alarm (except warning) occurs. |
| 187 | Exp1 Ch21 High Warn | Act when expansion AIN24 1 sensor 21 high warning occurs. |
| 188 | Exp1 Ch21 Low Alarm | Act when expansion AIN24 1 sensor 21 low alarm (except warning) occurs. |
| 189 | Exp1 Ch21 Low Warn | Act when expansion AIN24 1 sensor 21 low warning occurs. |
| 190 | Exp1 Ch22 High Alarm | Act when expansion AIN24 1 sensor 22 high alarm (except warning) occurs. |
| 191 | Exp1 Ch22 High Warn | Act when expansion AIN24 1 sensor 22 high warning occurs. |
| 192 | Exp1 Ch22 Low Alarm | Act when expansion AIN24 1 sensor 22 low alarm (except warning) occurs. |
| 193 | Exp1 Ch22 Low Warn | Act when expansion AIN24 1 sensor 22 low warning occurs. |
| 194 | Exp1 Ch23 High Alarm | Act when expansion AIN24 1 sensor 23 high alarm (except warning) occurs. |
| 195 | Exp1 Ch23 High Warn | Act when expansion AIN24 1 sensor 23 high warning occurs. |
| 196 | Exp1 Ch23 Low Alarm | Act when expansion AIN24 1 sensor 23 low alarm (except warning) occurs. |
| 197 | Exp1 Ch23 Low Warn | Act when expansion AIN24 1 sensor 23 low warning occurs. |
| 198 | Exp1 Ch24 High Alarm | Act when expansion AIN24 1 sensor 24 high alarm (except warning) occurs. |
| 199 | Exp1 Ch24 High Warn | Act when expansion AIN24 1 sensor 24 high warning occurs. |
| 200 | Exp1 Ch24 Low Alarm | Act when expansion AIN24 1 sensor 24 low alarm (except warning) occurs. |
| 201 | Exp1 Ch24 Low Warn | Act when expansion AIN24 1 sensor 24 low warning occurs. |
| 202 | AIN8 Ch 1 High Alarm | Act when expansion AIN8 sensor 1 high alarm (except warning) occurs. |
| 203 | AIN8 Ch1 High Warn | Act when expansion AIN8 sensor 1 high warning occurs. |
| 204 | AIN8 Ch 1 Low Alarm | Act when expansion AIN8 sensor 1 low alarm (except |

| No. | Type | Description |
|---------|-------------------------|--|
| | | warning) occurs. |
| 205 | AIN8 Ch 1 Low Warn | Act when expansion AIN8 sensor 1 low warning occurs. |
| 206 | AIN8 Ch 2 High Alarm | Act when expansion AIN8 sensor 2 high alarm (except warning) occurs. |
| 207 | AIN8 Ch 2 High Warn | Act when expansion AIN8 sensor 2 high warning occurs. |
| 208 | AIN8 Ch 2 Low Alarm | Act when expansion AIN8 sensor 2 low alarm (except warning) occurs. |
| 209 | AIN8 Ch 2 Low Warn | Act when expansion AIN8 sensor 2 low warning occurs. |
| 210 | AIN8 Ch 3 High Alarm | Act when expansion AIN8 sensor 3 high alarm (except warning) occurs. |
| 211 | AIN8 Ch 3 High Warn | Act when expansion AIN8 sensor 3 high warning occurs. |
| 212 | AIN8 Ch 3 Low Alarm | Act when expansion AIN8 sensor 3 low alarm (except warning) occurs. |
| 213 | AIN8 Ch 3 Low Warn | Act when expansion AIN8 sensor 3 low warning occurs. |
| 214 | AIN8 Ch 4 High Alarm | Act when expansion AIN8 sensor 4 high alarm (except warning) occurs. |
| 215 | AIN8 Ch 4 High Warn | Act when expansion AIN8 sensor 4 high warning occurs. |
| 216 | AIN8 Ch 4 Low Alarm | Act when expansion AIN8 sensor 4 low alarm (except warning) occurs. |
| 217 | AIN8 Ch 4 Low Warn | Act when expansion AIN8 sensor 4 low warning occurs. |
| 218-219 | Reserved | |
| 220 | DL1 Connection | Details of function description please see the following description. |
| 221 | DL2 Connection | |
| 222 | DL3 Connection | |
| 223 | Ground Relay Output | Details of function description please see the following description.(Not available for HGM9520N) |
| 224 | Redundancy Active | Details of function description please see the following description. (Not available for HGM9520N) |
| 225 | HC1 ACK Output | Details of function description please see the following description. (Not available for HGM9520N) |
| 226 | HC2 ACK Output | Details of function description please see the following description. (Not available for HGM9520N) |
| 227-229 | Reserved | |
| 230 | Stop Mode | Act when the system is in Stop mode. |
| 231 | Manual Mode | Act when the system is in Manual mode. |
| 232 | Reserved | Reserved |
| 233 | Auto Mode | Act when the system is in Auto mode. |
| 234 | Gen Onload Indication | Act when gen takes load. |
| 235 | Mains Onload Indication | Act when Mains takes load. |
| 236-239 | Reserved | |
| 240-279 | PLC Flag1~40 | PLC flag output. |
| 280-299 | Reserved | |

7.2.2 DEFINED PERIOD OUTPUT

Defined period output is composed by 2 parts, **period output S1** and **condition output S2**.



While **S1** and **S2** are **TRUE** synchronously, **OUTPUT**;

While **S1** or **S2** is **FALSE**, **NOT OUTPUT**.

Period output S1 can be set to generator's one or more period output freely, the delayed output time and output time after enter into period can also be configured.

Condition output S2 can set as any contents in output ports.

NOTE: when delay time and output time both are 0 in period output S1, it is TRUE in this period.

Output period: start

Delay output time: 2s

Output time: 3s

Condition output contents: output port 1 is active

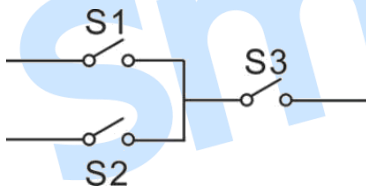
Close when condition output active/inactive: close when active (disconnect when inactive);

Output port 1 active, after enter "starts time" and delay 2s, this defined period output is outputting, after 3s, stop outputting;

Output port 1 inactive, defined output period is not outputting.

7.2.3 DEFINED COMBINATION OUTPUT

Defined combination output is composed by 3 parts, **or condition output S1**, **or condition output S2**, and **condition output S3**.



S1 or S2 is **TRUE**, while S3 is **TRUE**, defined combination output is outputting;

S1 and S2 are **FALSE**, or S3 is **FALSE**, defined combination output is not outputting.

NOTE: S1, S2, S3 can be set as any contents except for "defined combination output" in the output setting.

NOTE: 3 parts of defined combination output (S1, S2, S3) couldn't include or recursively include themselves.

For example:

Contents of or condition output S1: output port 1 is active;

Close when or condition output S1 is active /inactive: close when active (disconnect when inactive);

Contents of or condition output S2, output port 2 is active;

Close when or condition output S2 is active /inactive: close when active (disconnect when inactive);

Contents of and condition output S3: output port 3 is active;


Close when and condition output S3 is active /inactive: close when active (disconnect when inactive);

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

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

7.3 DEFINED CONTENTS OF DIGITAL INPUT PORTS

Table 18 Definition of Digital Input Ports

| No. | Type | Description |
|-----|-------------------------|---|
| 0 | Users Configured | Users-defined alarm. Active range: Never: input inactive. Always: input is active all the time. From crank: detecting as soon as start. From safety on: detecting after safety on run delay. |
| 1 | Reserved | |
| 2 | Alarm Mute | Can prohibit 'Audible Alarm' output when input is active. |
| 3 | Reset Alarm | Can reset shutdown alarm and trip alarm when input is active. |
| 4 | 60Hz Active | Use for CANBUS ECU engine and it is 60Hz when input is active. |
| 5 | Lamp Test | All LED indicators are illuminated when input is active. |
| 6 | Panel Lock | All buttons on panel are inactive except navigation buttons and there is  in the right top corner on LCD when input is active. |
| 7 | Redundancy Active | Not available for HGM9520N. |
| 8 | Idle Control Mode | Under voltage/frequency/speed protection is inactive. |
| 9 | Inhibit Auto Stop | In Auto mode, during generator normal running, when input is active, prohibit generator shutdown automatically. |
| 10 | Inhibit Auto Start | In Auto mode, prohibit generator start automatically when input is active. |
| 11 | Inhibit Scheduled Start | In Auto mode, prohibit fixed timing start genset when input is active. |
| 12 | Gen Close Inhibit | When input is active and "Gen Close" needs to be outputted, "Gen Close" process will wait and will not close genset. |
| 13 | Gen Closed Input | Connect generator loading switch's auxiliary point. |
| 14 | Inhibit Gen Load | Prohibit genset to take load when input is active, and gen close process won't be conducted. |
| 15 | Mains Closed Input | Connect Mains loading switch's auxiliary point. |
| 16 | Inhibit Mains Load | Prohibit Mains to take load when input is active, and Mains close process won't be conducted. |
| 17 | Auto Mode Input | When input is active, controller enters into Auto mode. |
| 18 | Auto Mode Inhibit | When input is active, controller won't work under Auto mode. Auto key and simulate auto key inputs do not work. |
| 19 | Static Parallel | Not available for HGM9520N. |
| 20 | Black Start Input | Not available for HGM9520N. |
| 21 | Inhibit Alarm Stop | All shutdown alarms are prohibited except emergence stop.(Means battle mode) |
| 22 | Instrument Mode | All outputs are prohibited in this mode. |
| 23 | Non-Parallel Mode | No parallel process when load is transferred under this mode. |
| 24 | Reset Maintenance | Controller will set maintenance time and date as default when input is active. |

| No. | Type | Description |
|-------|--------------------------|--|
| 25 | Reserved | |
| 26 | Aux. High Temp | Connected sensor digital input. |
| 27 | Aux. Low OP | Connected sensor digital input. |
| 28 | Remote Start (On Load) | In Auto mode, when input is active, genset can start automatically and take load after genset is OK; when input is inactive, genset will stop automatically. |
| 29 | Remote Start (Off Load) | In Auto mode, when input is active, genset can start automatically and won't take load after genset is OK; when input is inactive, genset will stop automatically. |
| 30 | Aux. Manual Start | In Manual mode, when input is active, genset will start automatically; when input is inactive, genset will stop automatically |
| 31 | Remote Start (On Demand) | In Auto mode, when input is active, all gensets that need to be paralleled will start according to the priority and call other generators according to the load. |
| 32 | Remote Start (Island) | In Auto mode, when input is active, genset can start automatically and take load when gen is Ok; Mains takes off load. When input is inactive, Mains takes load, Gen takes off load, genset stops automatically. |
| 33 | Simulate Stop key | An external button (Not Self-locking) can be connected and pressed as simulate panel button. |
| 34 | Simulate Manual key | |
| 35 | Reserved | |
| 36 | Simulate Auto key | An external button (Not Self-locking) can be connected and pressed as simulate panel button. |
| 37 | Simulate Start key | |
| 38 | Simulate G-Load key | |
| 39 | Simulate M-Load key | |
| 40 | NEL Manual Trip | An external button (Not Self-locking) can be connected. Details of function description please see the following. |
| 41 | NEL Manual Re-connection | |
| 42 | Power Manager Mode | Power management mode will be displayed on the LCD when the input is active. In this mode, the controller will control genset synchronization, power sharing, scheduled start/stop, breaker open/close. Details of function description please see the following. |
| 43 | Mains Parallel Mode | Not available for HGM9520N. |
| 44 | First Priority | Not available for HGM9520N. |
| 45-46 | Reserved | |
| 47 | Alternative Config 1 | When input is active, alternative configuration is active. Users can set different parameters to make it easy to select current configuration via input port. |
| 48 | Alternative Config 2 | |
| 49 | Alternative Config 3 | |
| 50 | Balance Test | Not available for HGM9520N. |
| 51 | Speed Raise | |

| No. | Type | Description |
|-----|---------------------|---|
| 52 | Speed Drop | |
| 53 | Voltage Raise | |
| 54 | Voltage Drop | |
| 55 | Reserved | |
| 56 | Low Coolant Level | Connect with water level sensor digital input port. |
| 57 | Detonation Shutdown | Connect with detection module alarm input port. |
| 58 | Gas Leak Shutdown | Connect with detection module alarm input port. |
| 59 | DL Manual Connect | An external button (Not Self-locking) can be connected. Details of function description please see the following. |
| 60 | DL Manual Trip | |
| 61 | HC1 Request | Not available for HGM9520N. |
| 62 | HC1 Feedback | Not available for HGM9520N. |
| 63 | HC2 Request | Not available for HGM9520N. |
| 64 | HC2 Feedback | Not available for HGM9520N. |
| 65 | Ground Relay Closed | Not available for HGM9520N. |
| 66 | Reserved | |
| 67 | Reserved | |
| 68 | Reserved | |
| 69 | Reserved | |
| 70 | Reserved | |

7.4 SELECTION OF SENSORS

Table 19 Sensor Selection

| No. | | Description | Remark |
|-----|--------------------|---|--|
| 1 | Temperature Sensor | 0 Not used 1 Custom Res Curve 2 Custom (4-20)mA curve 3 Custom (0-5)V curve 4 VDO 5 CURTIS 6 DATCON 7 SGX 8 SGD 9 SGH 10 PT100 11 SUSUKI 12 PRO 13-15 Reserved | Defined resistance's range is (0~6)kΩ. |
| 2 | Pressure Sensor | 0 Not used 1 Custom Res Curve 2 Custom (4-20)mA curve 3 Custom (0-5)V curve 4 VDO 10Bar 5 CURTIS 6 DATCON 10Bar 7 SGX 8 SGD 9 SGH 10 VDO 5Bar 11 DATCON 5Bar 12 DATCON 7Bar 13 SUSUKI 14 PRO 15 Reserved | Defined resistance's range is (0~6)kΩ. |
| 3 | Level Sensor | 0 Not used 1 Custom Res Curve 2 Custom (4-20)mA curve 3 Custom (0-5)V curve 4 SGD 5 SGH 6~15 Reserved | Defined resistance's range is (0~6)kΩ. |

NOTE: User should make special declare at ordering controller if your engine temperature sensor, fuel level sensor or flexible sensor 2 uses non-resistance sensor.

7.5 CONDITIONS OF CRANK DISCONNECT SELECTION

Table 20 Crank Disconnect Conditions

| No. | Setting Description |
|-----|--------------------------------------|
| 0 | Gen frequency |
| 1 | Speed |
| 2 | Speed + Gen frequency |
| 3 | Oil pressure |
| 4 | Oil pressure + Gen frequency |
| 5 | Oil pressure + Speed |
| 6 | Oil pressure + Speed + Gen frequency |

▲NOTES:

- 1) There are 3 conditions to make starter disconnected with engine, that is, speed sensor, generator frequency and engine oil pressure. They all can be used separately. We recommend that engine oil pressure should be used with speed sensor and generator frequency together, in order to make the starter motor separated with engine as soon as possible.
- 2) Speed is the collected signal by magnetic sensor and magnetic sensor is the magnetic equipment installed in starter for detecting flywheel teeth.
- 3) When speed is selected, users must ensure that the number of flywheel teeth is the same with setting, otherwise, "over speed stop" or "under speed stop" may be caused.
- 4) If genset is without magnetic sensor, please don't select corresponding items, otherwise, "start fail" or "loss speed signal" may be caused.
- 5) If genset is without oil pressure sensor, please don't select corresponding items.
- 6) If speed is not selected in crank disconnect setting, the rotating speed displayed on controller is calculated by generating signals.

8 PARAMETERS SETTING

▲CAUTION: Please change the controller parameters when generator is in standby mode only (e. g. Start conditions selection, configurable input, configurable output, various delay etc.), otherwise, alarming to stop and other abnormal conditions may happen.

▲NOTE: Maximum set value must be over minimum set value in case that the condition of too high as well as too low will happen.

▲NOTE: When the warning alarm is set, please set the correct return value; otherwise, maybe there is abnormal alarm. When the maximum value is set, the return value must be less than the set value; when the minimum value is set, the return value must be over the set value.

▲NOTE: Please set the generator frequency value as low as possible when the genset is cranking, in order to make the starter be separated quickly as soon as crank disconnection happens.

▲NOTE: Configurable inputs could not be set as the same items; otherwise, there are abnormal functions. However, the configurable outputs can be set as the same items.

9 SENSOR SETTING

- 1) When sensors are reselected, the sensor curves will be transferred into the standard value. For example, if temperature sensor is SGD (120°C resistor type), its sensor curve is SGD (120°C resistor type); if select the SGH (120°C resistor type), the temperature sensor curve is SGH curve.
- 2) When there is difference between standard sensor curves and used sensor curves, users can adjust it in the “sensor curve type”.
- 3) When the sensor curve is inputted, x value (resistor) must be inputted from small to large, otherwise, mistake occurs.
- 4) If sensor type is selected as “none”, sensor curve is not working.
- 5) If the corresponding sensor has alarm switch only, users must set this sensor as “none”, otherwise, shutdown or warning may occur.
- 6) The headmost or backmost values in the vertical coordinates can be set as the same as below.

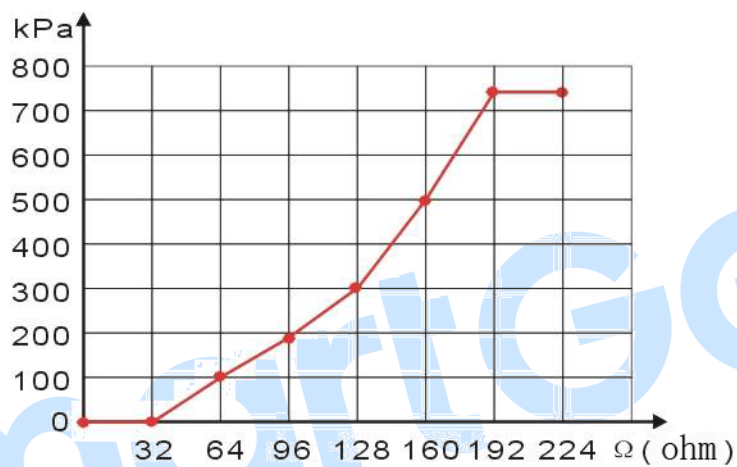


Fig. 4 Sensor Curve Diagram

Table 21 Normal Pressure Unit Conversion Form

| | pa | kgf/cm ² | bar | psi |
|----------------------|----------------------|-----------------------|-----------------------|-----------------------|
| 1Pa | 1 | 1.02x10 ⁻⁵ | 1x10 ⁻⁵ | 1.45x10 ⁻⁴ |
| 1kgf/cm ² | 9.8x10 ⁴ | 1 | 0.98 | 14.2 |
| 1bar | 1x10 ⁵ | 1.02 | 1 | 14.5 |
| 1psi | 6.89x10 ³ | 7.03x10 ⁻² | 6.89x10 ⁻² | 1 |

10 COMMISSIONING

10.1 STEP 1: SINGLE UNIT DEBUGGING

- 1) Check the parameter configurations of the controller;
- 2) Check the genset wiring connections.
- 3) Start genset manually, check whether engine and generator data is normal;
- 4) Start genset manually, check whether switch open and close is normal;
- 5) Start genset manually, after closing the breaker check whether generator frequency can be adjusted to the rated frequency (e.g. set the rated frequency as 52Hz/48Hz);
- 6) Start genset manually, after closing the breaker check whether generator voltage can be adjusted to the rated voltage (e.g. set the rated voltage as 240V/220V);
- 7) Activate manual start on-load, and check whether power factor, active power and reactive power are normal; if negative value occurs, check generator voltage and current phase sequences, the incoming line direction of current transformer, and secondary current dotted terminal of current transformer;
- 8) Start genset manually, do genset performance tests according to the national standards.

▲NOTE: Please refer to *Genset Parallel Scheme* for more information on GOV and AVR settings.

10.2 STEP 2: MANUAL PARALLEL OPERATION OFF-LOAD

- 1) Set controller to Gen control mode, active power 0%, reactive power 0%;
- 2) Manually close parallel sets, and check whether the parallel synchronization is steady and whether the close impulse current is too high or not;
- 3) After the genset is connected in parallel off-load, observe whether the active power, reactive power outputs are "0"; if they are not 0, observe whether there is power oscillation; if they are 0, users can properly modify the gain and stability values, or adjust the engine GOV or generator AVR gain and stability potentiometer, in order to avoid active and reactive power oscillation and make output close to 0.

10.3 STEP 3: MANUAL PARALLEL OPERATION ON-LOAD

- 1) Set controller to Gen control mode, active power 50%, reactive power 20%;
- 2) After manually parallel the genset, do soft loading test. Check whether there is very big overshooting or power oscillation phenomenon; if there is, users can properly adjust load ramp;
- 3) After manually parallel the genset and taking load, do soft unloading test; observe whether genset unloading reaches the pre-set min. loading percentage value and then breaker opens.

10.4 STEP 4: AUTOMATIC PARALLEL OPERATION

- 1) Set controller to Gen control mode, active power 50%, reactive power 20%;
- 2) In auto status, Mains OK, observe Mains switch can be closed normally. When digital input of remote start onload (on demand) is active, genset will start and parallel automatically, and upload to the pre-set power. When digital input of remote start onload (on demand) is inactive, genset will automatically unload and stop.

11 MAINS PARALLEL MODE

11.1 GEN CONTROL MODE

Output pre-set active power, reactive power or power factor.

Constant Power Output Mode

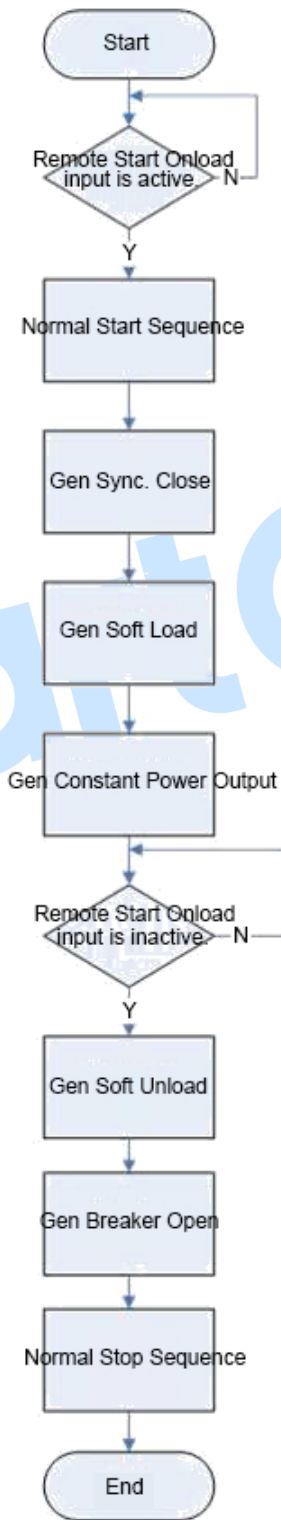


Fig. 5 Constant Power Output Mode

11.2 MAINS CONTROL MODE

Set Mains onload power value, the part which surpasses mains power set is taken by Gen. Mains control mode must connect Mains CT.

Mains Peak Clipping Mode

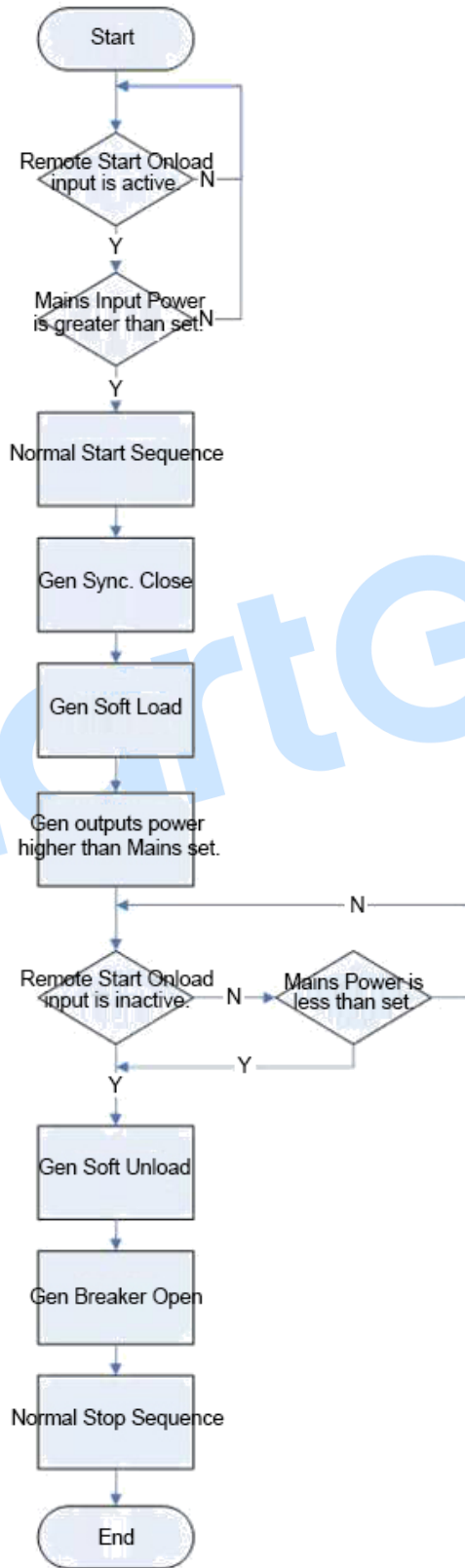


Fig. 6 Mains Peak Clipping Mode

11.3 LOAD RECEIPT MODE

Load receipt mode must connect Mains CT.

Load Receipt Mode

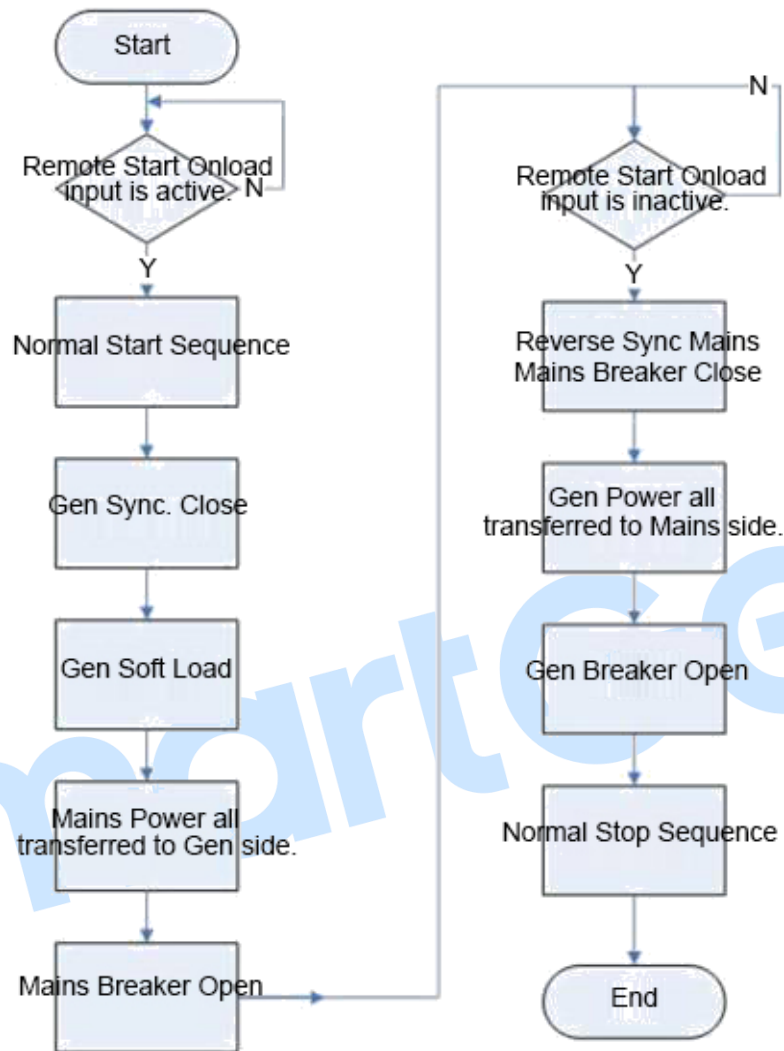


Fig. 7 Load Receipt Mode

11.4 AMF CONTROL MODE

AMF start mode.

AMF Mode

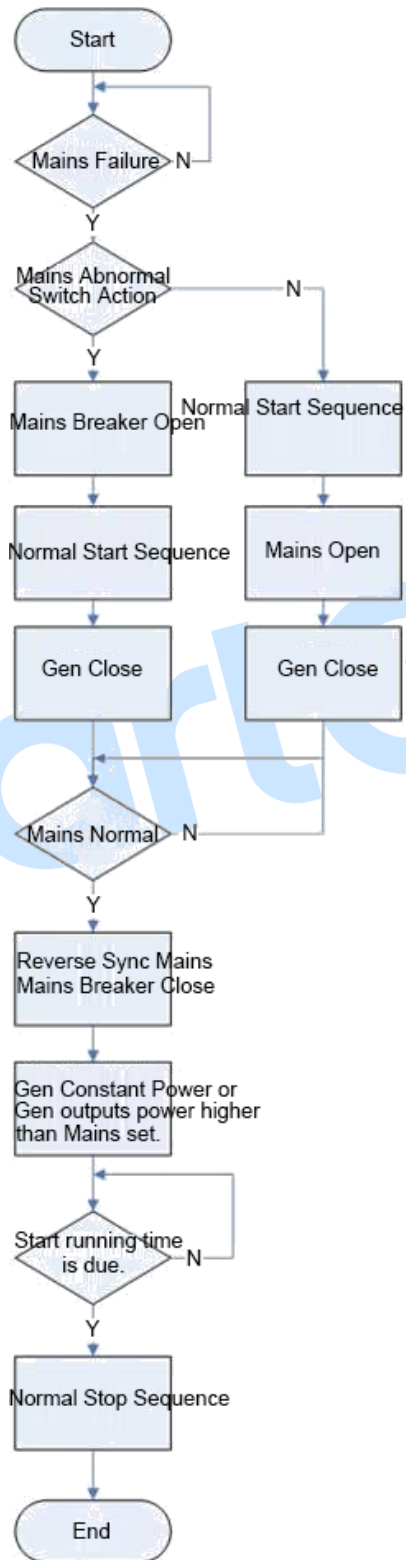


Fig. 8 AMF Mode

11.5 ISLAND START MODE

Island Output Mode

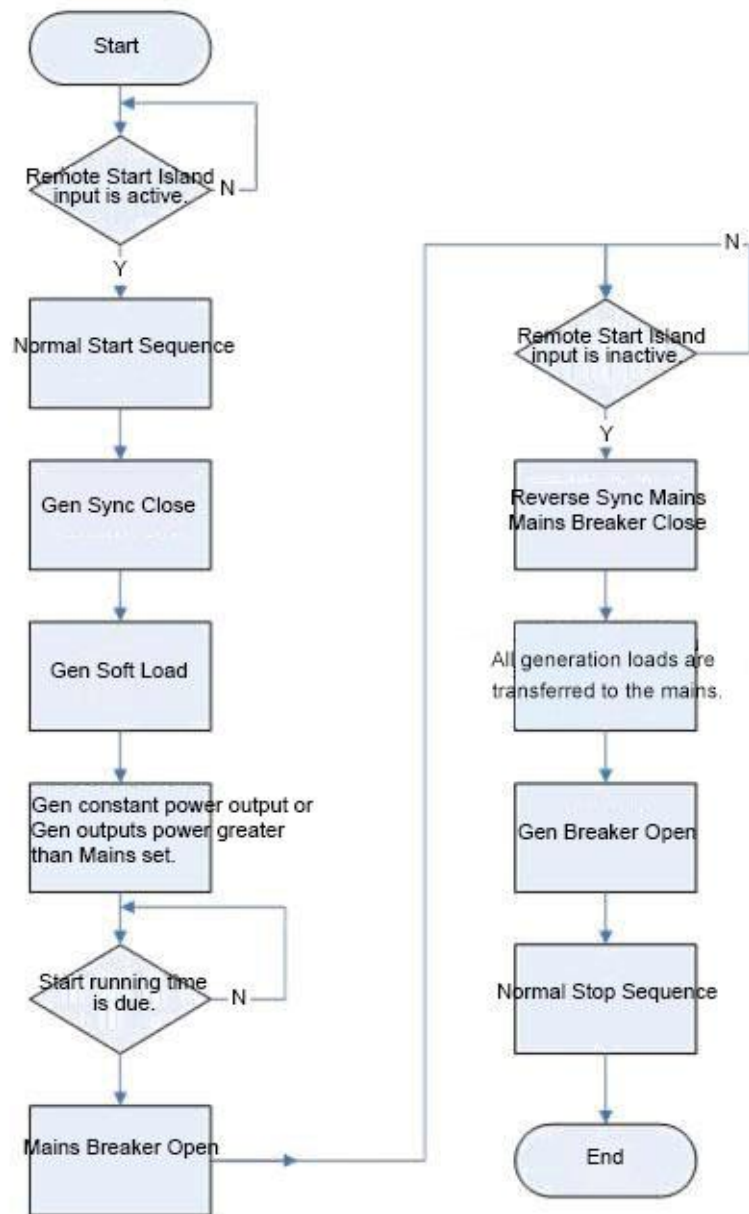


Fig. 9 Island Output Mode

12 TYPICAL APPLICATION

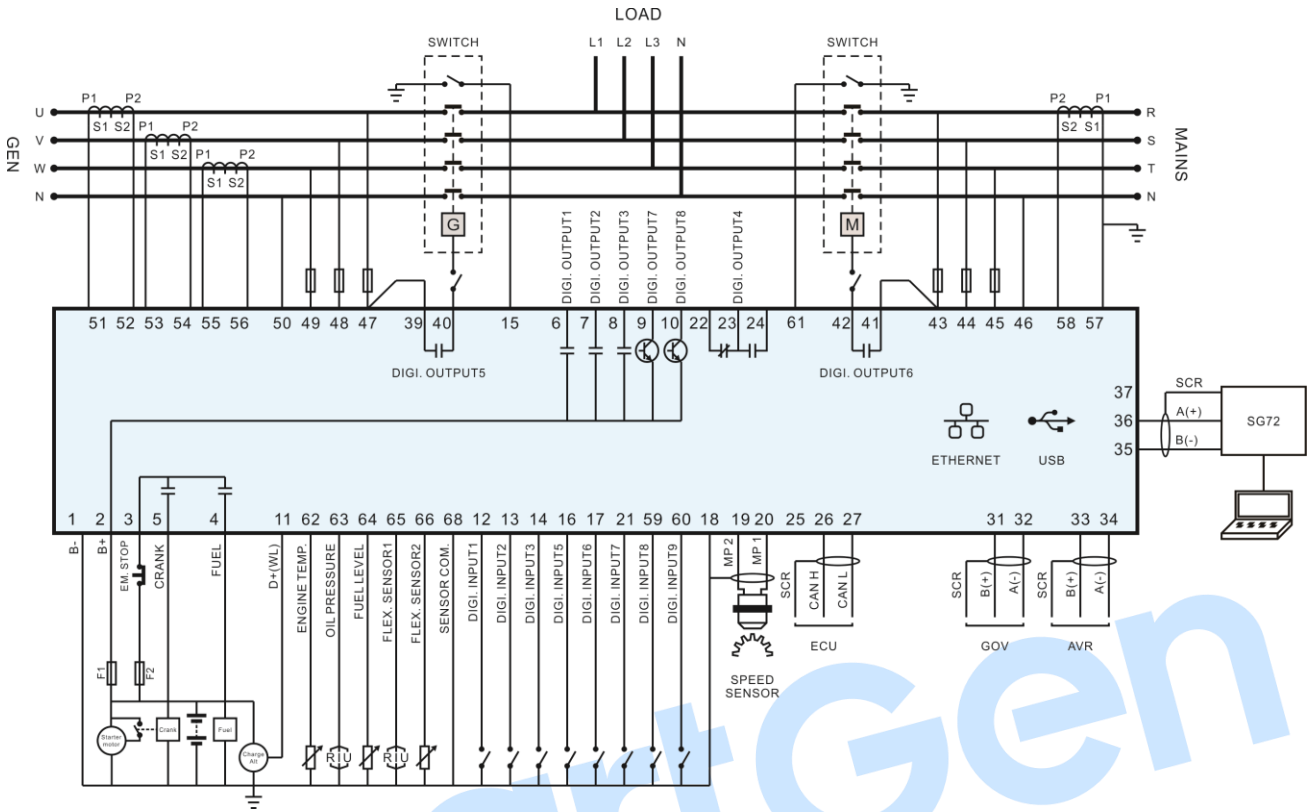


Fig. 10 HGM9520N 3-Phase 4-Wire Typical Application Diagram

NOTE: Fuse F1: min. 2A; max. 20A; Fuse F2: max. 32A. Users should select the suitable fuse depending on practical application.



Fig. 11 3-Phase 3-Wire Application Diagram



Fig. 12 2-Phase 3-Wire Application Diagram

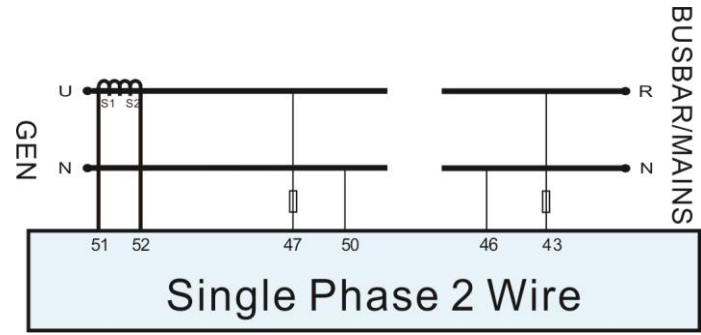


Fig. 13 Single Phase 2-Wire Application Diagram

13 POWER MANAGEMENT MODE

Power management mode is to be selected via a digital input port.

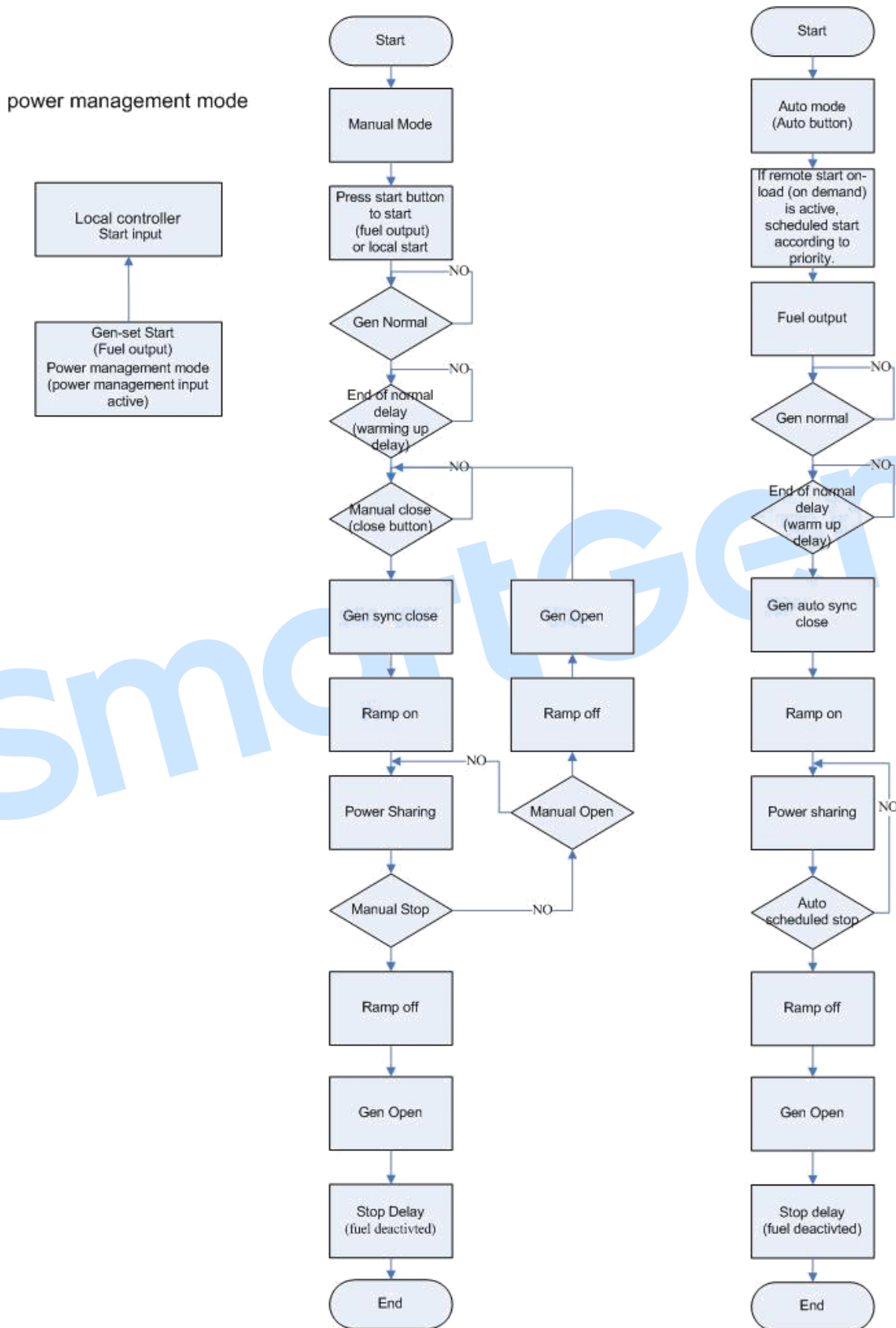


Fig.14 Power Management Logic

14 NEL TRIP DESCRIPTION

Non-essential Load -- NEL is the abbreviation.

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

◆ Auto Trip:

When NEL auto trip is enabled:

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

When NEL auto reconnection is enabled:

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

t1: NEL Trip Delay
t2: Reconnection Delay

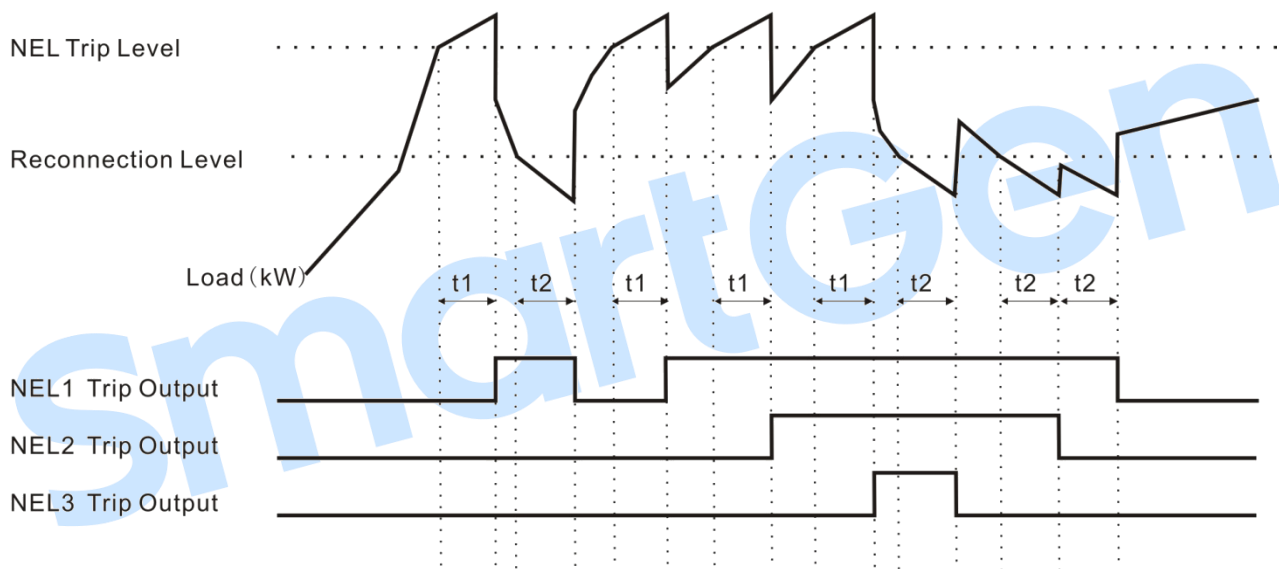


Fig.15 NEL Sequence

◆ Manual Trip

If NEL manual trip input is active (earthed failing edge is active), NEL1 will trip without delay; If NEL manual trip input is active again, NEL2 will trip; If NEL manual trip input is active the third time, NEL3 will trip. During this process, the controller does not detect if the genset power has exceed the NEL trip value or not.

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

▲NOTE: When auto trip and auto reconnection are enabled, manual trip is still active.

15 DUMMY LOAD CONNECTION

Dummy Load -- DL for short.

The controller can control the 3 ways of DL connect separately. The order of the essentiality is: DL1 > DL2 > DL3

◆ Auto operation:

When DL auto connect is enabled:

If the genset power has fallen below the DL connection value, after the connection delay, DL1 will connect the earliest, and then is DL2, DL3;

When DL auto disconnect is enabled:

If the genset power has exceed the DL disconnect value, after the disconnect delay, DL3 will disconnect the earliest, and then is DL2, DL1.

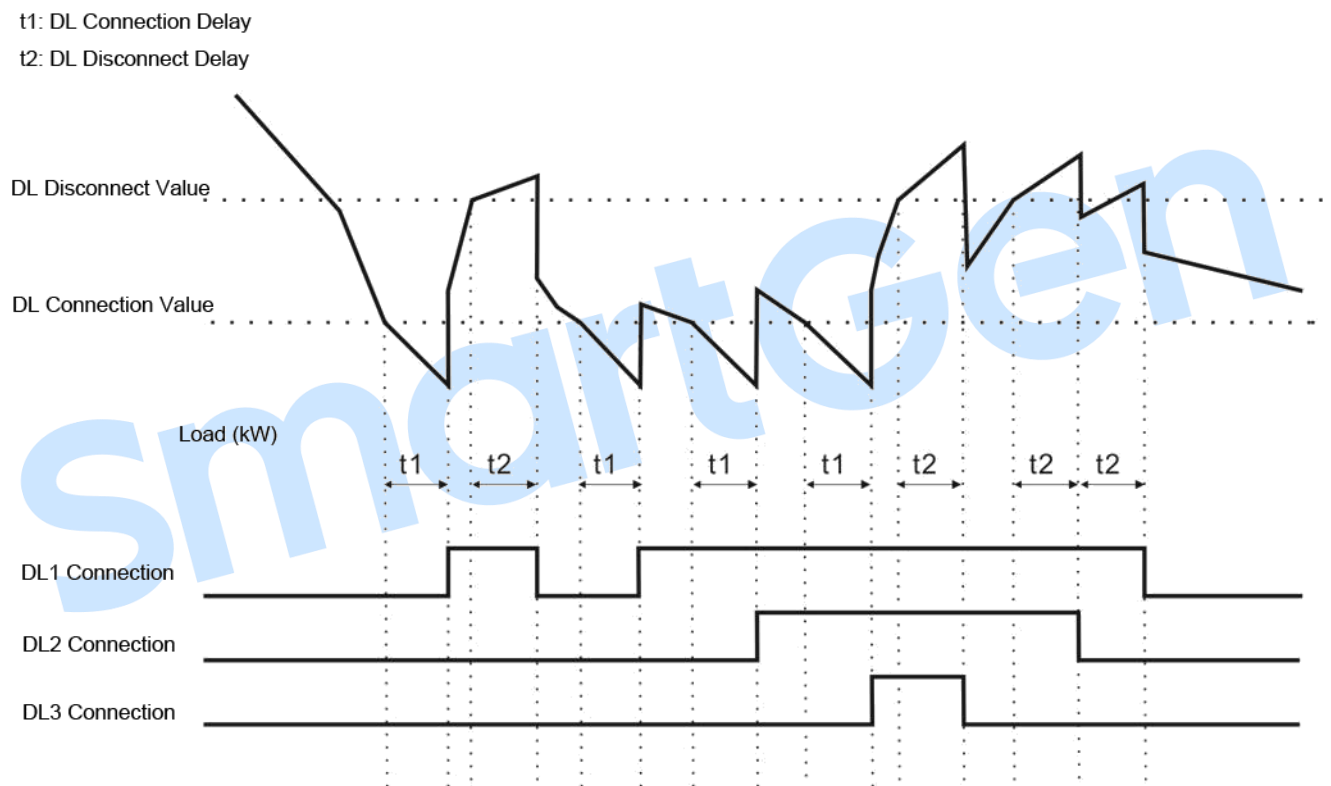


Fig.16 DL Sequence

◆ Manual Operation

If manual DL connect input is active (earthed failing edge is active), DL1 will connect without delay; If manual DL connect input is active again, DL2 will connect; If manual DL connect input is active the third time, DL3 will connect. During this process, the controller will detect if the genset power has fallen the DL connection value or not. If genset power is below DL connection value, this input is active, otherwise, it will be ignored.

If manual DL disconnect input is active (earthed failing edge is active), DL3 will disconnect without delay; If manual DL disconnect input is active again, DL2 will disconnect; If manual DL disconnect input is active the third time, DL1 will disconnect.

▲NOTE: When auto connection and auto disconnection are enabled, manual operation is still active.

16 INSTALLATION

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

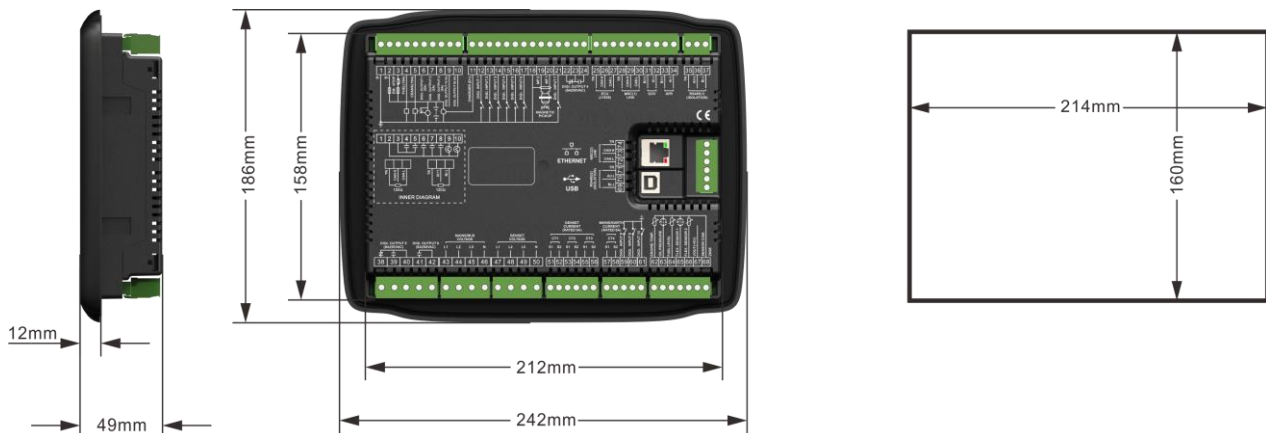


Fig. 17 Overall Dimension and Cutout Size

1) Battery Voltage Input

NOTE: HGM9520N controller can suit for wide range of battery voltage (8~35) VDC. Battery negative electrode must be connected with the starter shell stably. The wire area connecting controller power B+/B- with negative and positive electrodes mustn't be less than 2.5mm². If floating charger is configured, please firstly connect output wires of charger to battery's positive and negative directly, and then connect wires from battery's positive and negative to controller's positive and negative input ports separately in order to prevent the charger from disturbing the controller's normal working.

2) Speed Sensor Input

NOTE: Speed sensor is the magnetic equipment installed in the engine body to detect flywheel teeth number. The wires used to connect with the controller shall be 2-core shielding wires. The shielding layer shall be connected to No. 18 terminal on the controller, and meanwhile the other terminal shall be hanging in the air. Another two signal wires shall be connected to No.19 and No.20 terminals on the controller. The output voltage of the speed sensor shall be within (1~24) VAC (effective value) in the range of full speed and 12VAC is recommended (at rated speed). As to speed sensor installation, the sensor can firstly be spun to the connection flywheel, then invert 1/3 lap, and finally tighten up the screw on the sensor.

3) Output and Expand Relays

CAUTION: All controller outputs are relay contact outputs. If the expansion relay is needed, freewheel diode (relay coils is DC) and resistor and capacitor circuit (AC) shall be added to the two ends of the relay coils in order to prevent disturbing the controller or others equipments.

4) Alternate Current Input

Controller current input must be connected to outside current transformer. The secondary side current of the current transformer must be 5A and at the same time current transformer phase and input voltage phase must be correct, otherwise the collected current and active power are maybe not correct.

NOTE: ICOM port must be connected to negative pole of battery.



WARNING! When there is load current, transformer's secondary side is prohibited open circuit.

5) Withstand Voltage Test

CAUTION! When controller had been installed in control panel, if need the high voltage test, please disconnect controller's all terminal connections, in order to prevent high voltage into controller and damage it.

17 CONNECTIONS OF CONTROLLER AND J1939 ENGINE

17.1 CUMMINS ISB/ISBE

Table 22 Connector B

| Terminals of controller | Connector B | Remark |
|-------------------------|---|---|
| Fuel relay output | 39 | |
| Starting relay output | - | Connected with starter coil directly; |
| Auxiliary output 1 | Expansion 30A relay; providing battery voltage for terminal 01, 07, 12, 13. | ECU power; Set output 1 as "ECU power". |

Table 23 9-Pin Connector

| Terminals of controller | 9 pins connector | Remark |
|-------------------------|------------------|--|
| CAN GND | SAE J1939 shield | CAN communication shielding line (connected with ECU terminal only). |
| CAN(H) | SAE J1939 signal | Impedance 120Ω connecting line is recommended. |
| CAN(L) | SAE J1939 return | Impedance 120Ω connecting line is recommended. |

Engine type: Cummins ISB.

17.2 CUMMINS QSL9

Suitable for CM850 engine control module.

Table 24 50-Pin Connector

| Terminals of controller | 50 pins connector | Remark |
|-------------------------|-------------------|-------------------------------------|
| Fuel relay output | 39 | |
| Starting relay output | - | Connected to starter coil directly. |

Table 25 9-Pin Connector

| Terminals of controller | 9 pins connector | Remark |
|-------------------------|--------------------|--|
| CAN GND | SAE J1939 shield-E | CAN communication shielding line (connected with ECU terminal only). |
| CAN(H) | SAE J1939 signal-C | Using impedance 120Ω connecting line. |
| CAN(L) | SAE J1939 return-D | Using impedance 120Ω connecting line. |

Engine type: Cummins-CM850.

17.3 CUMMINS QSM11 (IMPORT)

It is suitable for CM570 engine control module. Engine type is QSM11 G1, QSM11 G2.

Table 26 C1 Connector

| Terminals of controller | C1 connector | Remark |
|-------------------------|--------------|--|
| Fuel relay output | 5&8 | External expansion relay; on fuel output, make port 5 and port 8 of C1 connector be connected. |
| Starting relay output | - | Connected to starter coil directly. |

Table 27 3-Pin Data Link Connector

| Terminals of controller | 3 pins data link connector | Remark |
|-------------------------|----------------------------|--|
| CAN GND | C | CAN communication shielding line (connected with ECU terminal only). |
| CAN(H) | A | Using impedance 120Ω connecting line. |
| CAN(L) | B | Using impedance 120Ω connecting line. |

Engine type: Cummins ISB.

17.4 CUMMINS QSX15-CM570

It is suitable for CM570 engine control module. Engine type is QSX15 etc.

Table 28 50-Pin Connector

| Terminals of controller | 50 pins connector | Remark |
|-------------------------|-------------------|-------------------------------------|
| Fuel relay output | 38 | Injection switch; |
| Starting relay output | - | Connected to starter coil directly. |

Table 29 9-Pin Connector

| Terminals of controller | 9 pins connector | Remark |
|-------------------------|--------------------|--|
| CAN GND | SAE J1939 shield-E | CAN communication shielding line (connected with ECU terminal only). |
| CAN(H) | SAE J1939 signal-C | Using impedance 120Ω connecting line. |
| CAN(L) | SAE J1939 return-D | Using impedance 120Ω connecting line. |

Engine type: Cummins QSX15-CM570.

17.5 CUMMINS GCS-MODBUS

It is suitable for GCS engine control module. Use RS485-MODBUS to read information of engine. Engine types are QSX15, QST30, QSK23/45/60/78 and so on.

Table 30 D-SUB Connector 06

| Terminals of controller | D-SUB connector 06 | Remark |
|-------------------------|--------------------|--|
| Fuel relay output | 5&8 | Outside expansion relay; on fuel output, make port 05 and 08 of connector 06 be connected. |
| Starting relay output | - | Connected to starter coil directly. |
| RS485 GND | 20 | CAN communication shielding line (connected with ECU terminal only). |
| RS485+ | 21 | Using impedance 120Ω connecting line. |
| RS485- | 18 | Using impedance 120Ω connecting line. |

Engine type: Cummins-QSK-MODBUS, Cummins-QST-MODBUS, Cummins-QSX-MODBUS.

17.6 CUMMINS QSM11

Table 31 Engine OEM Connector

| Terminals of controller | OEM connector of engine | Remark |
|-------------------------|-------------------------|--|
| Fuel relay output | 38 | |
| Starting relay output | - | Connected with starter coil directly. |
| CAN GND | - | CAN communication shielding line (connected with controller's this terminal only). |
| CAN(H) | 46 | Using impedance 120Ω connecting line. |
| CAN(L) | 37 | Using impedance 120Ω connecting line. |

Engine type: Common J1939.

17.7 CUMMINS QSZ13

Table 32 Engine OEM Connector

| Terminals of controller | OEM connector of engine | Remark |
|-------------------------|-------------------------|--|
| Fuel relay output | 45 | |
| Starting relay output | - | Connected to starter coil directly. |
| Auxiliary output 1 | 16&41 | Set as idling speed control; (N/C) output; by expansion relay, make 16&41 close as the controller is running. |
| Auxiliary output 2 | 19&41 | Set as pulse speed raising control; (N/O) output; by expansion relay, make 19&41 close for 1s as the controller is entering warming-up time. |
| CAN GND | - | CAN communication shielding line (connected with controller's this terminal only). |
| CAN(H) | 1 | Using impedance 120Ω connecting line. |
| CAN(L) | 21 | Using impedance 120Ω connecting line. |

Engine type: Common J1939.

17.8 DETROIT DIESEL DDEC III/IV

Table 33 Engine CAN Port

| Terminals of controller | CAN port of engine | Remark |
|-------------------------|---|---|
| Fuel relay output | Expansion 30A relay, proving battery voltage for ECU. | |
| Starting relay output | - | Connected to starter coil directly. |
| CAN GND | - | CAN communication shielding line (connected with controller terminal only). |
| CAN(H) | CAN(H) | Using impedance 120Ω connecting line. |
| CAN(L) | CAN(L) | Using impedance 120Ω connecting line. |

Engine type: Common J1939.

17.9 DEUTZ EMR2

Table 34 F Connector

| Terminals of controller | F connector | Remark |
|-------------------------|---|---|
| Fuel relay output | Expansion 30A relay, proving battery voltage for 14; Fuse is 16A. | |
| Starting relay output | - | Connected to starter coil directly. |
| - | 1 | Connected to battery negative. |
| CAN GND | - | CAN communication shielding line (connected with controller terminal only). |
| CAN(H) | 12 | Impedance 120Ω connecting line is recommended. |
| CAN(L) | 13 | Impedance 120Ω connecting line is recommended. |

Engine type: Volvo EDC4.

17.10 JOHN DEERE

Table 35 21-Pin Connector

| Terminals of controller | 21 pins connector | Remark |
|-------------------------|-------------------|---|
| Fuel relay output | G, J | |
| Starting relay output | D | |
| CAN GND | - | CAN communication shielding line (connected with controller's terminal only). |
| CAN(H) | V | Using impedance 120Ω connecting line. |
| CAN(L) | U | Using impedance 120Ω connecting line. |

Engine type: John Deere.

17.11 MTU ADEC (SMART MODULE)

Suitable for MTU engines with ADEC (ECU8) and SMART module.

Table 36 ADEC (X1 Port)

| Terminals of controller | ADEC (X1 port) | Remark |
|-------------------------|----------------|---------------------------------------|
| Fuel relay output | X1 10 | X1 9 shall connect battery negative. |
| Starting relay output | X1 34 | X1 33 shall connect battery negative. |

Table 37 SMART (X4 Port)

| Terminals of controller | SMART (X4 port) | Remark |
|-------------------------|-----------------|--|
| CAN GND | X4 3 | CAN communication shielding line (connected with one terminal only). |
| CAN(H) | X4 1 | Using impedance 120Ω connecting line. |
| CAN(L) | X4 2 | Using impedance 120Ω connecting line. |

Engine type: MTU-ADEC.

17.12 MTU ADEC (SAM MODULE)

It is suitable for MTU engine with ADEC (ECU7) and SAM module.

Table 38 ADEC (X1 Port)

| Terminals of controller | ADEC (X1 port) | Remark |
|-------------------------|----------------|--|
| Fuel relay output | X1 43 | X1 28 shall connect negative of battery. |
| Starting relay output | X1 37 | X1 22 shall connect negative of battery. |

Table 39 SAM (X23 Port)

| Terminals of controller | SAM (X23 port) | Remark |
|-------------------------|----------------|--|
| CAN GND | X23 3 | CAN communication shielding line (connected with controller's this terminal only). |
| CAN(H) | X23 2 | Using impedance 120Ω connecting line. |
| CAN(L) | X23 1 | Using impedance 120Ω connecting line. |

Engine type: Common J1939.

17.13 PERKINS

It is suitable for ADEM3/ADEM4 engine control module. Engine type is 2306, 2506, 1106, and 2806.

Table 40 Connector

| Terminals of controller | Connector | Remark |
|-------------------------|-------------------|---|
| Fuel relay output | 1, 10, 15, 33, 34 | |
| Starting relay output | - | Connected to starter coil directly. |
| CAN GND | - | CAN communication shielding line (connected with controller terminal only). |
| CAN(H) | 31 | Using impedance 120Ω connecting line. |
| CAN(L) | 32 | Using impedance 120Ω connecting line. |

Engine type: Perkins.

17.14 SCANIA

It is suitable for S6 engine control module. Engine type is DC9, DC12, and DC16.

Table 41 B1 Connector

| Terminals of controller | B1 connector | Remark |
|-------------------------|--------------|---|
| Fuel relay output | 3 | |
| Starting relay output | - | Connected to starter coil directly. |
| CAN GND | - | CAN communication shielding line (connected with controller's terminal only). |
| CAN(H) | 9 | Using impedance 120Ω connecting line. |
| CAN(L) | 10 | Using impedance 120Ω connecting line. |

Engine type: Scania.

17.15 VOLVO EDC3

Suitable engine control mode is TAD1240, TAD1241, and TAD1242.

Table 42 "Stand Alone" Connector

| Terminals of controller | "Stand alone" connector | Remark |
|-------------------------|-------------------------|--|
| Fuel relay output | H | |
| Starting relay output | E | |
| Auxiliary output 1 | P | ECU power; Set output 1 as "ECU power". |

Table 43 "Data Bus" Connector

| Terminals of controller | "Data bus" connector | Remark |
|-------------------------|----------------------|---|
| CAN GND | - | CAN communication shielding line (connected with controller's terminal only). |
| CAN(H) | 1 | Using impedance 120Ω connecting line. |
| CAN(L) | 2 | Using impedance 120Ω connecting line. |

Engine type: Volvo.

NOTE: When this engine type is selected, preheating time should be set to at least 3 seconds.

17.16 VOLVO EDC4

Suitable engine types are TD520, TAD520 (optional), TD720, TAD720 (optional), TAD721, TAD722, and TAD732.

Table 44 Connector

| Terminals of controller | Connector | Remark |
|-------------------------|--|---|
| Fuel relay output | Expansion 30A relay, providing battery voltage for terminal 14. Fuse is 16A. | |
| Starting relay output | - | Connected to starter coil directly. |
| | 1 | Connected to negative of battery. |
| CAN GND | - | CAN communication shielding line (connected with controller's terminal only). |
| CAN(H) | 12 | Using impedance 120Ω connecting line. |
| CAN(L) | 13 | Using impedance 120Ω connecting line. |

Engine type: Volvo EDC4.

17.17 VOLVO-EMS2

Volvo Engine types are TAD734, TAD940, TAD941, TAD1640, TAD1641, and TAD1642.

Table 45 Engine CAN Port

| Terminals of controller | Engine's CAN port | Remark |
|-------------------------|-------------------|---|
| Auxiliary output 1 | 6 | ECU stop; Set output 1 "ECU stop". |
| Auxiliary output 2 | 5 | ECU power; Set output 2 "ECU power". |
| | 3 | Power negative. |
| | 4 | Power passive. |
| CAN GND | - | CAN communication shielding line (connected with controller's terminal only). |
| CAN(H) | 1(Hi) | Using impedance 120Ω connecting line. |
| CAN(L) | 2(Lo) | Using impedance 120Ω connecting line. |

Engine type: Volvo-EMS2.

NOTE: When this engine type is selected, preheating time should be set to at least 3 seconds.

17.18 YUCHAI

It is suitable for Yuchai BOSCH common rail electronic-controlled engine.

Table 46 Engine 42-Pin Port

| Terminals of controller | Engine 42 pins port | Remark |
|-------------------------|---------------------|---|
| Fuel relay output | 1.40 | Connected to engine ignition lock. |
| Starting relay output | - | Connected to starter coil directly. |
| CAN GND | - | CAN communication shielding line (connected with this terminal only). |
| CAN(H) | 1.35 | Using impedance 120Ω connecting line. |
| CAN(L) | 1.34 | Using impedance 120Ω connecting line. |

Table 47 Engine 2-Pin Port

| Battery | Engine 2 pins port | Remark |
|------------------|--------------------|------------------------------------|
| Battery negative | 1 | Wire diameter 2.5mm ² . |
| Battery positive | 2 | Wire diameter 2.5mm ² . |

Engine type: BOSCH.

17.19 WEICHAI

It is suitable for Weichai BOSCH common rail electronic-controlled engine.

Table 48 Engine Port

| Terminals of controller | Engine port | Remark |
|-------------------------|-------------|--|
| Fuel relay output | 1.40 | Connected to engine ignition lock. |
| Starting relay output | 1.61 | |
| CAN GND | - | CAN communication shielding line (connected to the controller at this end only). |
| CAN(H) | 1.35 | Using impedance 120Ω connecting line. |
| CAN(L) | 1.34 | Using impedance 120Ω connecting line. |

Engine type: GTSC1.

▲NOTE: If there is any question of connection between controller and ECU communication, please feel free to contact SmartGen's service.

18 FAULT FINDING

Table 49 Fault Finding

| Symptoms | Possible Solutions |
|---|---|
| Power on but no response for the controller | Check starting batteries; Check controller connection wirings; Check DC fuse. |
| Genset shutdown | Check the water/cylinder temperature is too high or not; Check the genset AC voltage; Check DC fuse. |
| Controller emergency stop | Check emergence stop button is correct or not; Check whether the starting battery positive is connected with the emergency stop input; Check whether there is open circuit. |
| Low oil pressure alarm after crank disconnect | Check the oil pressure sensor and its connections. |
| High water temperature alarm after crank disconnect | Check the water temperature sensor and its connections. |
| Shutdown alarm in running | Check related switch and its connections according to the information on LCD; Check programmable inputs. |
| Crank disconnect failure | Check fuel circuit and its connections; Check starting batteries; Check speed sensor and its connections; Refer to engine manual. |
| No response for starter | Check starter connections; Check starting batteries. |
| Genset is running but ATS does not transfer. | Check ATS; Check the connections between ATS and controllers. |
| RS485 communication is abnormal. | Check connections; Check settings of COM port is correct or not; Check RS485's A and B connections is reversely connected or not; Check RS485 transfer module is damaged or not; Check communication port of PC is damaged or not. |
| ECU communication failure | Check the polarity of CAN high and CAN low; Check 120Ω terminal resistor is correctly connected or not; Check engine type is correctly chosen or not; Check the connection between controller and engine is correct or not; Check output port setting is right or not. |
| ECU alarm | Get information from LCD alarm page; If there is detailed alarm information, check the engine according to the description. If not, please refer to engine manual according to SPN alarm code. |