HGM8100Z SERIES

(HGM8110Z_ HGM8120Z)

GENSET CONTROLLER

USER MANUAL

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SmartGen

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Table 1 Software Version

Date	Version	Note
2023-03-10	1.0	Original release.
2025-04-25	1.1	1. Added related alarm of louver control; 2. Added parameter configuration of louver; 3. Added related input ports, output ports of louver; 4. Added "Mains Onload Available Under Stop Mode" setting.

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This manual is suitable for HGM8110Z and HGM8120Z controllers only.

Table 2 Notation Clarification

Sign	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.

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CONTENTS

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1 OVERVIEW

HGM8100Z series genset controllers are designed especially for extremely high/low temperature environment (-40~+70)°C. The controllers can operate reliably in extreme temperature conditions with the help of heatable LCD and the electronic components that withstand extreme temperature. The controllers have strong electromagnetic compatibility, and can run normally under complex environment with intense electromagnetic interference. It is easy to maintain and upgrade due to the plug-in terminals. The language options are Chinese, English and other languages.

HGM8100Z series genset controllers integrate digital, intelligent and network technology. They are used for automation and monitor control system of single genset to achieve automatic start/stop, data measurement, alarm protection and "Three Remote" functions (remote control, remote measuring and remote communication). The controllers adopt 32-bit microprocessor to realize precise parameters measuring, fixed value adjustment, time setting and threshold setting, etc. Major parameters can be configured directly from front panel, and all parameters can be configured by PC via USB interface, or adjusted and monitored via RS485 and ETHERNET interface. It can be widely used in all types of automatic genset control system with compact structure, easy wiring connection and high reliability.

2 PERFORMANCE AND FEATURES

HGM8110Z: It is used for automation system of single genset, and can control genset auto start/stop through remote start signal.

HGM8120Z: Based on HGM8110Z, it adds AMF (Auto Mains Failure) function and automatic transfer function for mains and generator, especially for the single genset automatic system of mains and one genset.

Main features are as below:

1) With 32-bit microprocessor, it has higher integration density and operation reliability;

2) Large size of graphic dot matrix LCD screen (it can be heated according to the environment temperature), optional Chinese/English interface which can be set on the site, making commissioning convenient for factory personnel;

3) The protection layer of LCD screen uses hard acrylic material with good abrasion-resistant and scratch-resistant performance;

4) Silicone front panel and pushbuttons can be used in extreme temperature environment;

5) With RS485 and RS232 communication interfaces, it can realize "Three Remote" functions (remote control, remote measuring and remote communication) under MODBUS protocol;

6) With Ethernet communication interface, it can realize monitoring function;

7) With CANBUS port, it can connect to the J1939 genset. It can not only monitor frequently-used data (such as water temperature, oil pressure, speed, fuel consumption, etc.) of ECU engine, but also control the start, stop, speed rise and droop via CANBUS port;

8) Suitable for 3-phase 4-wire, 3-phase 3-wire, single phase 2-wire, and 2-phase 3-wire AC systems with voltage of 120/240V AC and frequency of 50/60Hz;

9) It can collect and show 3-phase voltage, current, frequency and power parameter of mains or generator;

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Mains		Generator	
Line voltage	(Uab, Ubc, and Uca)	Line voltage	(Uab, Ubc, and Uca)
Phase voltage	(Ua, Ub, and Uc)	Phase voltage	(Ua, Ub, and Uc)
Phase sequence		Phase sequence	
Frequency	Hz	Frequency	Hz

Load

Current	Ia, Ib, Ic	A (unit)
Each phase and total active power	P	kW (unit)
Each phase and total reactive power	Q	kVar (unit)
Each phase and total apparent power	S	kVA (unit)
Each phase and average power factor	λ	1 (unit)
Accumulative total generating capacity	W	kWh, kVarh, kVAh (unit)
Earth current	I	A (unit)

10) For Mains, the controller has over/under voltage, over/under frequency, loss of phase and reverse phase sequence detection functions; for generator, it has over/under voltage, over/under frequency, over current, over/reverse power, loss of phase, and reverse phase sequence functions;

11) 3 fixed analog sensors (temperature, oil pressure and fuel level);

12) 2 configurable analog sensors can be set as sensor of temperature, pressure or level;

13) It can measure and display various engine parameters precisely:

Temperature (WT)	Unit can be set as °C or °F
Oil pressure (OP)	Unit can be set as kPa/Psi/Bar
Fuel level (FL)	% (unit)
Speed (SPD)	r/min (unit)
Voltage of Battery (VB)	V (unit)
Voltage of Charger (VD)	V(unit)
Hour count (HC)	Up to max. 65535 hours.
Start times	Up to max. 65535 times.

14) Control and protection functions: automatic start/stop of the genset, ATS (Auto Transfer Switch) control, clear fault alarm and protection function;

15) All output ports are relay type;

16) Parameter setting: parameters can be modified by users. They will be stored in internal FLASH memory and won't be lost even in case of power outage; most of them can be adjusted on the front panel of the controller and all of them can be modified by PC via USB, RS485 or ETHERNET ports;

17) Various kinds of sensor curves of temperature, pressure, fuel level can be used directly and users can self-define the sensor curves;

18) Multiple options of crank disconnection condition (speed, oil pressure, generator frequency);

19) Wide power supply range of (8~35)V DC, which is suitable for different voltages of starting battery;

20) Functions of event log, real-time clock, and scheduled start & stop (the genset start frequency can be set as once a day/week/month whether with load or not);

21) PLC (Programmable Logic Control) function. Users can use graphical programming to achieve

specific functions;

22) It can be used on pump units or as an indication instrument (indicate and alarm are enabled only, relay is inhibited);

23) With maintenance function, actions (warning, shutdown or trip and stop) can be set when maintenance time is up;

24) All parameters use digital adjustment, instead of conventional analog modulation with potentiometer, which has higher reliability and stability;

25) Waterproof level of IP55 due to the rubber sealing gasket installed between the controller enclosure and panel;

26) Metal fixing clips enable perfect performance in high temperature environment;

27) With modular design, pluggable connection terminals, compact structure and embedded installation method, it is easy to install;

28) With accumulative running time A, B and accumulative power capacity A, B functions, users can reset the data and recount, which is convenient for users to count the data.

3 SPECIFICATION

Table 3 Technical Parameters

Item	Contents
Operating Voltage	8.0V to 35.0V DC, Continuous Power Supply.
Power Consumption	<4W (standby mode ≤2W)
Alternator Input Range 3Phase 4Wire 3Phase 3Wire Single Phase 2Wire 2Phase 3Wire	 15V ~ 360V AC (ph-N) 30V ~ 620V AC (ph-ph) 15V ~ 360V AC (ph-N) 15V ~ 360V AC (ph-N)
Alternator Frequency	50Hz/60Hz
Speed Sensor Voltage	1.0V to 24.0V (RMS)
Speed Sensor Frequency	10,000 Hz (Max.)
Start Relay Output	16A DC28V active output
Fuel Relay Output	16A DC28V active output
Programmable Relay Output 1	7A DC28V active output
Programmable Relay Output 2	7A DC28V active output
Programmable Relay Output 3	7A DC28V active output
Programmable Relay Output 4	7A AC250V passive output
Programmable Relay Output 5	8A 250V AC passive output
Programmable Relay Output 6	8A 250V AC passive output
Case Dimension	242mm x 186mm x 53mm
Panel Cutout	214mm x 160mm
CT Secondary Current	5A rated
Working Temperature	(-40~+70)°C
Working Humidity	(20~93)%RH
LCD Display	When the temperature is -40°C, the controller can normally display within 25 seconds after it powers on, and response speed of dynamic data display gets normal after 2 minutes.
Storage Temperature	(-40~+80)°C
IP Rating	IP55 when waterproof rubber sealing gasket is installed.
Dielectric Strength	Apply voltage of 2.2kV AC between AC high voltage terminal and low voltage terminal, and the leakage current is below 3mA in one minute.
Weight	0.85kg

4   OPERATION

4.1 FRONT PANEL

Alarm Indicator
Status Indicator
Auto Mode Indicator
Mute Indicator
Stop Mode Indicator
Load Indicator
Gen. Normal Indicator
Setting Indicator
Manual Mode Indicator

Mains Normal Indicator

Fig.1 HGM8110Z and HGM8120Z (below) Front Panel

⚠**NOTE: Instruction of some indicators.**

Table 4 Alarm Indicators

Alarm Type	Alarm Indicator
No Alarm	Alarm indicator is off
Warning	Slow flashes (1 time/s)
Trip Alarm	Slow flashes (1 time/s)
Shutdown	Fast flashes (5 times/s)
Trip and Stop Alarm	Fast flashes (5 times/s)

Status Indicator: After crank disconnects, it stays on before ETS and off during other periods.

Gen. Normal Indicator: It lights on when generator works normally; It flashes when generator is abnormal; It goes out when there is no generator power.

Mains Normal Indicator: It lights on when mains is normal; It flashes when mains is abnormal; It goes out when there is no mains power.

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Table 5 Key Function Description

Icon	Key	Description
	Stop	Stop the running generator in Auto/Manual mode; Reset the alarm in Stop mode; Press it for more than 3 seconds to test indicators on the front panel; During the stopping process, press the button again to stop generator at once.
	Start	Start the genset in Manual mode.
	Manual Mode	Press it and the controller enters Manual mode.
	Auto Mode	Press it and the controller enters Auto mode.
	Mute/Reset Alarm	Mute the alarm sound; If there is a trip alarm, press the button for more than 3 seconds to reset the alarm.
合闸 分闸	Gen Close/Open	It can control generator to switch on or off in Manual mode. (HGM8110Z doesn't have the key)
合闸 分闸	Mains Close/Open	It can control mains to switch on or off in manual mode. (HGM8110Z doesn't have the key)
	Close	It can close the breaker in manual mode. (HGM8120Z doesn't have the key)
	Open	It can open the breaker in manual mode. (HGM8120Z doesn't have the key)
	Set	Press the key to enter setting interface.
	Up/Increase	1. Screen scroll; 2. Move the cursor up and increase value in setting menu.
	Down/Decrease	1. Screen scroll; 2. Move the cursor down and decrease value in setting menu.
	Left	1. Page scroll; 2. Move the cursor left in setting menu.
	Right	1. Page scroll; 2. Move the cursor right in setting menu.
确定	Confirm	In setting menu, press it to confirm the set value.

Icon	Key	Description
返回	Exit	1. Press it to return to the previous screen; 2. In settings menu, press it to return to the previous menu.

⚠NOTE: In manual mode, pressing ✍ and ▮ simultaneously will force the generator to start. Successful start will not be judged according to crank disconnection conditions, the operator will control and crank the starter motor manually; when the operator finds that the engine has started, he/she should release the button and start output will be deactivated, safety on delay will start.

⚠CAUTION: Default password is "00318", the operator can change it in case of others change the advanced parameters setting. Please remember the password after changing it. If you forget it, please contact SmartGen's service and send PD information in the controller page of "ABOUT" to us.

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4.3 LCD DISPLAY

4.3.1 MAIN DISPLAY

Main screen shows data and information in pages; Use ◀▶ to scroll the pages and ▲▼ to scroll the screen.

★**Main Screen** includes as below:

    1) Partial status display;

    2) Gen: voltage, frequency;

    3) Load: current, active power, reactive power, power factor;

    4) Mains: voltage, frequency;

    5) Engine: speed, temperature, oil pressure.

⚠**NOTE: HGM8110Z doesn't show the data of mains; It will automatically scroll pages if there is no action after enter the main screen.**

★**Status** includes as below:

Status of genset, mains, and ATS.

⚠**NOTE: HGM8110Z has no status page of mains.**

★**Engine** includes as below:

Speed, temperature of engine, engine oil pressure, fuel level, programmable sensor 1, programmable sensor 2, battery voltage, charger voltage, accumulative running time, accumulative start times, user A and user B accumulative start times.

⚠**NOTE: If it is connected to J1939 engine via CANBUS port, this page also includes: coolant pressure, coolant level, fuel temperature, fuel pressure, induction temperature, exhaust temperature, turbo pressure, total fuel consumption and so on. (Different engine with different parameters)**

★**Gen** includes as below:

Phase voltage, line voltage, frequency, phase sequence.

★**Load** includes as below:

Each phase current, each phase and total active power (positive and negative), each phase and total reactive power (positive and negative), each phase and total apparent power, each phase and average power factor (positive and negative), accumulative generating capacity, earth current and user A and user B accumulative power capacity.

⚠**NOTE:** Power factor shows as follows:


```
          Q
          ▲
 COS < 0L | COS > 0L
 _____|_____ ▶ P
 COS < 0C | COS > 0C
          |
```
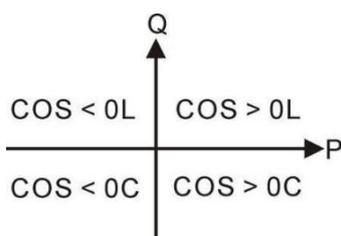
Remark:

P stands for active power

Q stands for reactive power

Table 6 Power Factor Descriptions

Power Factor	Conditions	Active Power	Reactive Power	Remark
COS>0L	P>0,Q>0	Input	Input	Load is inductive type.
COS>0C	P>0,Q<0	Input	Output	Load is capacitive type.
COS<0L	P<0,Q>0	Output	Input	Load equals to one under excitation generator.
COS<0C	P<0,Q<0	Output	Output	Load equals to one over excitation generator.

Remark:

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

★**Mains** includes as below:

Phase voltage, line voltage, frequency, phase sequence.

⚠**NOTE: HGM8100Z doesn't have this page.**

★**Alarm:**

Display all alarm information, including warning, shutdown, trip shutdown and trip without shutdown.

⚠**NOTE:** For ECU alarms and shutdowns, if the alarm information is displayed, check engine according to it, otherwise, please check the engine manual according to SPN alarm code.

★**Event log:**

Records all start/stop events (shutdown, trip and shutdown, manual/auto start or stop), the real time and genset parameters when alarm occurs.

★**Others** includes:

Time and date, countdown time for maintenance, input/output ports status, network setting status, etc.

★**About** includes:

Software and hardware version and PD number of the controller.

4.3.2 PARARMETERS SETTING MENU

Press ⚙ to enter user menu;

Parameter: After entering the correct password (default password is 00318) you can enter parameter setting screen.

Language: Options of Simplified Chinese, English and others (default of others: Spanish).

Commissioning: On load, off load and self-defined commissioning are optional. Self-defined commissioning can be configured as on load or off load during commissioning, when to commission and select the running mode after commissioning (manual mode, auto mode and stop mode).

Clear users' accumulative data: It can clear accumulative running time A and B, total power capacity A and B.

4.3.3 PARAMETER SETTINGS

● Mains setting
● Timer setting

- Engine setting
- Generator setting
- Load setting
- Switch setting
- Temperature sensor setting
- Oil pressure sensor setting
- Level sensor setting
- Programmable sensor 1
- Programmable sensor 2
- Digital input setting
- Output port setting
- Module setting
- Scheduling and maintenance setting
- Expansion module setting

⚠**NOTE: Pressing** 🔴 **can exit setting menu directly during setting.**

4.4 AUTO START/STOP OPERATION

Press ⬚, the indicator besides the key lights on, and the controller enters **Auto** mode.

Starting Sequence:

1) **HGM8120Z:** When mains is abnormal (over and under voltage, over and under frequency, loss of phase, reverse phase sequence), it enters into mains "abnormal delay" and LCD display countdown time. When mains abnormal delay is over, it enters into "start delay"; it also enters into this mode when "remote start (on load)" is active.

2) **HGM8110Z:** Generator enters into "start delay" as soon as "remote start (on load)" is active.

3) Start Delay timer is shown on LCD.

4) When start delay is over, preheat relay outputs (if configured), "preheat start delay XX s" is shown on LCD.

5) When preheat delay is over, fuel relay outputs 1s and then start relay output; if engine crank fails during "cranking time", the fuel relay and start relay deactivated and enter into "crank rest time" to wait for next crank.

6) If engine crank fails within setting times, the controller sends Fail to Start signals and Fail to Start message appears on LCD alarm page.

7) In case of successful crank attempt, "safety on timer" starts. During this period, low oil pressure, high water temperature, under speed, charge failure alarms are disabled. As soon as this delay is over, "start idle delay" is initiated (if configured).

8) During "start idle delay", under speed, under frequency, under voltage alarms are inhibited. When this delay is over, "warming up delay" starts (if configured).

9) When "warming up delay" is over, if generator state is normal, its indicator will be illuminated. If voltage and frequency has reached on-load requirements, the closing relay will be energized, generator will accept load, generator power indicator will turn on, and generator will enter Normal Running state; if

voltage and frequency are abnormal, the controller will initiate alarm (alarm type will be displayed on LCD alarm page).

⚠**NOTE: In case of "Remote Start (off Load)", the procedure is the same, except for step NO. 9: the closing relay will NOT be energized, generator will NOT be on load.**

Stopping Sequence:

1) **HGM8120Z:** When mains gets normal during genset running, it enters into mains voltage "normal delay". When mains normal delay is over, it enters into "stop delay"; it also can enter into this mode when "remote start" is inactive.

2) **HGM8110Z:** Generator enters into "stop delay" as soon as "remote start (on load)" is inactive.

3) When stop delay is over, close generator relay is un-energized; generator enters into "cooling down time". After "transfer rest time", close mains relay is energized. Generator indicator extinguish while mains indicator lights.

4) Idle relay is energized as soon as entering "stop idle delay".

5) If enter "ETS hold delay", ETS relay is energized. Fuel relay is deactivated and decides whether generator is stopped or not automatically.

6) Then enter gen-set "fail to stop time", auto decides whether generator is stopped or not automatically.

7) Enter "after stop time" (if configured) as soon as generator stops. Otherwise, controller will send "fail to stop" alarm. (If gen-set stopped successfully after warning of "fail to stop", it will enter "after stop time" and remove alarm.)

8) Enter "generator at rest" as soon as "after stop time" is over.

4.5 MANUAL START/STOP OPERATION

1) **MANUAL START:** Press ⬚, controller enters into Manual mode and its indicator lights. Press 🟩 to start generator, it can automatically detect crank disconnection, and generator accelerates to high-speed running automatically. With high temperature, low oil pressure and abnormal voltage during generator running, controller can protect genset to stop quickly. Press 🟥 (HGM8120Z) or press 🟩 and 🟥 (HGM8110Z) to open or close the switch. (Please refer to No.4~9 of Auto start operation for detail procedures, which the difference is only the way of switch open and close).

2) **MANUAL STOP:** Press 🟥 can stop the running generators. (Please refer to No.3~8 of Auto stop operation for detail procedures).

⚠**NOTE: In "manual mode", the procedures of ATS please refer to ATS procedure of generator in this manual.**

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4.6 GENSET CONTROLLER ATS CONTROL PROCEDURES

4.6.1 HGM8120Z ATS CONTROL PROCEDURES

4.6.1.1 MANUAL TRANSFER PROCEDURES

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

A. If "Open breaker detect" is selected "Disable"

Press generator close/open key 合闸/分闸, if generator has taken load, it will send open signals; if load disconnects, it will send gen close signals; if mains has taken load, mains will open breaker, and then generator will close after open delay over.

Press mains close/open key 合闸/分闸, if mains has taken load, it will send open signals; if load disconnects, it will send mains close signals; if generator has taken load, generator will open breaker, and then mains will close after open delay over.

B. If "Open breaker detect" is selected "Enable"

To transfer load from mains to generator need to press mains close/open key 合闸/分闸 firstly. After open delay, press generator close/open key 合闸/分闸, and generator will close breaker. (there is no action when pressing generator close/open key directly.)

The way to transfer load from generator to mains is as same as above.

4.6.1.2 AUTO TRANSFER PROCEDURES

When controller is in **AUTO** mode, switch control procedures will start through automatic transfer.

1) If input port is configured as Close Mains Auxiliary

A. If "Open breaker detect" is selected "Enable"

When transferring load from mains to generator, controller begins detecting "fail to transfer", then the open delay and transfer rest delay will begin. When detecting time out, if switch open failed, the generator will not switch on, otherwise, generator switch on. Detecting transfer failure while generator switch on. When detecting time out, if switch on fail, it needs to wait for generator to switch on. If transfer failure warning is selected "Enable", there is warning signals whatever switch on or off failure.

The way to transfer load from generator to mains is as same as above.

B. If "Open breaker detect" is selected "Disable"

Mains load is transferred into generator load, after the delay of switch off and transfer interval, generator switch on. Detecting transfer failure while generator switches on. After detecting time out, if switch on fail, then wait for generator switch on. If transfer failure warning is selected "Enable", there is warning signals.

2) If input port is not configured as Close Mains Auxiliary

Mains load is transferred into generator load, after switch off and transfer interval delay, generator switch on.

The way to transfer generator load to mains load is as same as above.

4.6.2 HGM8110Z ATS CONTROL PROCEDURES

4.6.2.1 MANUAL CONTROL PROCEDURES

When controller is in Manual mode, manual control will be executed.

Users can control switch on or off by pressing [switch on icon] and [switch off icon] key.

Press generator switch on key [switch on icon], generator will output load signals. Press generator switch off key [switch off icon], generator will output unload signals.

4.6.2.2 AUTO CONTROL PROCEDURES

When controller is in Auto mode, switch control procedures will start auto transfer.

1)   If input port is configured as Close Mains Auxiliary

A.   If "Open breaker detect" is selected "Enable"

Generator load is transferred into generator un-load, after the delay of switch off, detecting transfer failure while switch off output. When detecting time out, if switch off failed, it will wait for switch off. Otherwise, switch off is completed.

Generator unload is transferred into generator load, after the delay of switch on, detecting transfer failure while switch on outputting. When detecting time out, if switch on failed, it will wait for switch on. Otherwise, switch on is completed.

If transfer failure warning is selected "Enable", there is warning signals whatever switch on or off failure.

B.   If "Open breaker detect" is selected "Disable"

Generator load is transferred into generator unload, after the delay of switch off, switch off is completed.

Generator unload is transferred into generator load, after the delay of switch on, detecting transfer failure while switch on outputting. When detecting time out, if switch on failed, to wait for switch on. Otherwise, switch on is completed.

If transfer failure warning is selected "Enable", there is warning signal when "switch on fail".

2)   If input port is not configured as Close Mains Auxiliary

Generator un-load is transferred into generator load, close generator output.

Generator load is transferred into generator un-load, open generator output.

⚠NOTE 1: When using ATS of no interposition, switch off detecting should "Disable";

⚠NOTE 2: When using ATS of having interposition, switch off "Disable" or "Enable" both are OK. If choose "Enable", switch off output should be configured;

⚠NOTE 3: When using AC contactor, switch off "Enable" is recommended.

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5 PROTECTION

5.1 WARNINGS

When the controller detects the warning signals, it issues alarm only and doesn't stop the genset.

Table 7 Warning Alarms

No.	Type	Description
1	Over Speed	When controller detects the speed is higher than the set value, it will send warning signals.
2	Under Speed	When controller detects the speed is lower than the set value, it will send warning signals.
3	Loss of Speed Signal	When controller detects the speed is 0 and the action selects "Warning", it will send warning signals.
4	Over Frequency	When controller detects the frequency is higher than the set value, it will send warning signals.
5	Under Frequency	When controller detects the frequency is lower than the set value, it will send warning signals.
6	Over Voltage	When controller detects the voltage is higher than the set value, it will send warning signals.
7	Under Voltage	When controller detects the voltage is lower than the set value, it will send warning signals.
8	Over Current	When controller detects the current is higher than the set value, it will send warning signals.
9	Fail to Stop	When generator can't stop after the "stop delay" is over.
10	Charging Failure	When controller detects the charger voltage is lower than the set value, it will send warning signals.
11	Battery Over Voltage	When controller detects the battery voltage is higher than the set value, it will send warning signals.
12	Battery Under Voltage	When controller detects the battery voltage is lower than the set value, it will send warning signals.
13	Maintenance Due	When countdown time is 0 and the action selects "Warning", it will send warning signals.
14	Reverse Power	When controller detects the reverse power value (power is negative) is higher than the set value, it will send warning signals.
15	Over Power	When controller detects the power value (power is positive) is higher than the set value, it will send warning signals.
16	ECU Warning	When controller gets the alarm signals from engine via J1939, it will send warning signals.
17	Gen Loss of Phase	When controller detects the generator's loss of phase, it will send warning signals.
18	Gen Reverse Phase Sequence	When controller detects the reverse phase sequence, it will send warning signals.
19	Switch Failure	When controller detects the switch on and off failure, and the action selects enable, it will send warning signals.
20	Temp. Sensor Open	When controller detects the sensor is open circuit, and the action

No.	Type	Description
		selects "warning", it will send warning signals.
21	High Temp.	When controller detects the temperature is higher than the set value, it will send warning signals.
22	Low Temp.	When controller detects the temperature is lower than the set value, it will send warning signals.
23	Oil Pressure Sensor Open	When controller detects the sensor is open circuit, and the action selects "warning", it will send warning signals.
24	Low Oil Pressure	When controller detects the oil pressure is lower than the set value, it will send warning signals.
25	Level Sensor Open	When controller detects the sensor is open circuit, and the action selects "warning", it will send warning signals.
26	Low Level	When controller detects the lever is lower than the set value, it will send warning signals.
27	Programmable Sensor 1 Open	When controller detects the sensor is open circuit, and the action selects "warning", it will send warning signals.
28	Programmable Sensor 1 High	When controller detects the sensor value is higher than the maximum set value, it will send warning signals.
29	Programmable Sensor 1 Low	When controller detects the sensor value is lower than the minimum set value, it will send warning signals.
30	Programmable Sensor 2 Open	When controller detects the sensor is open circuit, and the action selects "warning", it will send warning signals.
31	Programmable Sensor 2 High	When controller detects the sensor value is higher than the maximum set value, it will send warning signals.
32	Programmable Sensor 2 Low	When controller detects the sensor value is lower than the minimum set value, it will send warning signals.
33	Digital Input	When digital input port is set as warning and active, controller sends corresponding warning signals.
34	Earth Fault	When controller detects earth current is greater than set value, and the action selects "warning", it will send warning signals.
35	Louver Open Fail	When "Louver Opened In Place" is configured for the input port, if louver hasn't opened in place at the end of countdown time, it will send warning signals.
36	Louver Close Fail	1. When "Louver Closed In Place" is configured for the input port, if louver hasn't closed in place at the end of countdown time, it will send warning signals. 2. When "Louver Closed In Place" is not configured for the input port, but "Louver Opened In Place" is configured for it, if louver has been opened in place at the end of detection time, it will send warning signals.
37	Louver Status Error	1. The input signal of "Louver Closed In Place" is detected when the louver is supposed to be open. 2. The input signal of "Louver Opened In Place" is detected when the louver is supposed to be closed.
38	Louver Open Signal	When "Louver Opened In Place" is configured for the input port,

No.	Type	Description
	Loss	signal of "Louver Opened In Place" is lost after the louver is opened, it will send warning signals.
39	Louver Close Signal Loss	When "Louver Closed In Place" is configured for the input port, signal of "Louver Closed In Place" is lost after the louver is closed, it will send warning signals.

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When the controller detects the shutdown signals, it will send generator open signals and stop the generator at once.

Table 8 Shutdowns

No.	Type	Description
1	Emergency Stop	When controller detects emergency stop signals, it will send shutdown signals.
2	Over Speed	When controller detects the speed value is higher than the set value, it will send shutdown signals.
3	Under Speed	When controller detects the speed value is lower than the set value, it will send shutdown signals.
4	Loss of Speed Signal	When controller detects speed value equals to 0, and the action selects "shutdown", it will send shutdown signals
5	Over Frequency	When controller detects the frequency value is higher than the set value, it will send shutdown signals.
6	Under Frequency	When controller detects the frequency value is lower than the set value, it will send shutdown signals.
7	Over Voltage	When controller detects the voltage value is higher than the set value, it will send shutdown signals.
8	Under Voltage	When controller detects the voltage value is lower than the set value, it will send shutdown signals.
9	Fail to Start	If genset fails to start within the setting of start times, the controller will send shutdown signals.
10	Over Current	When controller detects the current value is higher than the set value, it will send shutdown signals.
11	Maintenance Due	When count down time is 0 and the action selects "Shutdown", it will send shutdown signals.
12	ECU Shutdown	When controller receives engine shutdown signals via J1939, controller send shutdown signals.
13	ECU Comm. Failure	After engine start, controller does not receive data signals via J1939, controller sends shutdown signals.
14	Reverse Power	When controller detects reverse power value (power is negative) is higher than the set value, and the reverse power action selects "shutdown", it will send shutdown signals.
15	Over Power	When controller detects power value (power is positive) is higher than the set value, and the reverse power action selects "shutdown", it will send shutdown signals.
16	Temp. Sensor Open	When controller detects sensor is open circuit, and the action selects "shutdown", it will send shutdown signals.
17	High Temperature	When controller detects temperature is higher than the set value, it will send shutdown signals.
18	Pressure Sensor Open	When controller detects sensor is open circuit, and the action selects "shutdown", it will send shutdown signals.
19	Low Oil Pressure	When controller detects oil pressure is lower than the set value, it

No.	Type	Description
		will send shutdown signals.
20	Level Sensor Open	When controller detects sensor is open circuit, and the action selects "shutdown", it will send shutdown signals.
21	Programmable Sensor 1 Open	When controller detects sensor is open circuit, and the action selects "shutdown", it will send shutdown signals.
22	Programmable Sensor 1 High	When controller detects the sensor value is higher than the maximum set value, it will send shutdown signals.
23	Programmable Sensor 1 Low	When controller detects the sensor value is lower than the minimum set value, it will send shutdown signals.
24	Programmable Sensor 2 Open	When controller detects sensor is open circuit, and the action selects "shutdown", it will send shutdown signals.
25	Programmable Sensor 2 High	When controller detects the sensor value is higher than the maximum set value, it will send shutdown signals.
26	Programmable Sensor 2 Low	When controller detects the sensor value is lower than the minimum set value, it will send shutdown signals.
27	Digital Input	When digital input port is set as shutdown, and the action is active, it will send shutdown signals.
28	Earth Fault	When controller detects the earth current of genset exceeds preset earth fault threshold and the earth fault action selects "shutdown", it will send shutdown signals.
29	Louver Open Fail	When "Louver Opened In Place" is configured for the input port, if louver hasn't opened in place at the end of countdown time, it will send shutdown signals.
30	Louver Close Fail	1. When "Louver Closed In Place" is configured for the input port, if louver hasn't closed in place at the end of countdown time, it will send shutdown signals. 2. When "Louver Closed In Place" is not configured for the input port, but "Louver Opened In Place" is configured for it, if louver has been opened in place at the end of detection time, it will send shutdown signals.
31	Louver Status Error	1. The input signal of "Louver Closed In Place" is detected when the louver is supposed to be open. 2. The input signal of "Louver Opened In Place" is detected when the louver is supposed to be closed.
32	Louver Open Signal Loss	When "Louver Opened In Place" is configured for the input port, signal of "Louver Opened In Place" is lost after the louver is opened, it will send shutdown signals.
33	Louver Close Signal Loss	When "Louver Closed In Place" is configured for the input port, signal of "Louver Closed In Place" is lost after the louver is closed, it will send shutdown signals.

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When the controller detects trip and stop alarm signals, it will send generator open signals and stop after high speed cooling.

Table 9 Trip and Stop Alarms

No.	Type	Description
1	Over Current	When controller detects the value is higher than the set value, and the action selects "trip and stop", it will send trip and stop signals.
2	Maintenance Due	When count down time is 0 and the action selects "trip and stop", it will send trip and stop signals.
3	Reverse Power	When controller detects reverse power value (power is negative) is higher than the set value, and the action selects "trip and stop", it will send trip and stop signals.
4	Over Power	When controller detects the power value (power is positive) is higher than the set value, and the action selects "trip and stop", it will send trip and stop signals.
5	Digital Input	When digital input port is set as "trip and stop", and the action is active, it will send trip and stop signals.
6	Earth Fault	When controller detects the earth current of genset exceeds preset earth fault threshold and the earth fault action selects "trip and stop", it will send trip and stop signals.

5.4 TRIP ALARM

When controller detects trip alarm, it will send generator open signals quickly, but genset doesn't stop.

Table 10 Trip Alarms

No.	Type	Description
1	Over Current	When controller detects the value is higher than the set value, and the action selects "trip", it will send trip signals.
2	Reverse Power	When controller detects reverse power value (power is negative) is higher than the set value, and the action selects "trip", it will send trip signals.
3	Over Power	When controller detects the power value (power is positive) is higher than the set value, and the action selects "trip", it will send trip signals.
4	Digital Input	When digital input port is set as "trip", and the action is active, it will send trip signals.
5	Earth Fault	When controller detects the earth current of genset exceeds preset earth fault threshold and the earth fault action select "trip" it will send trip signals.

![SmartGen]

6 WIRING CONNECTION

HGM8100Z series controller's back panel as following:
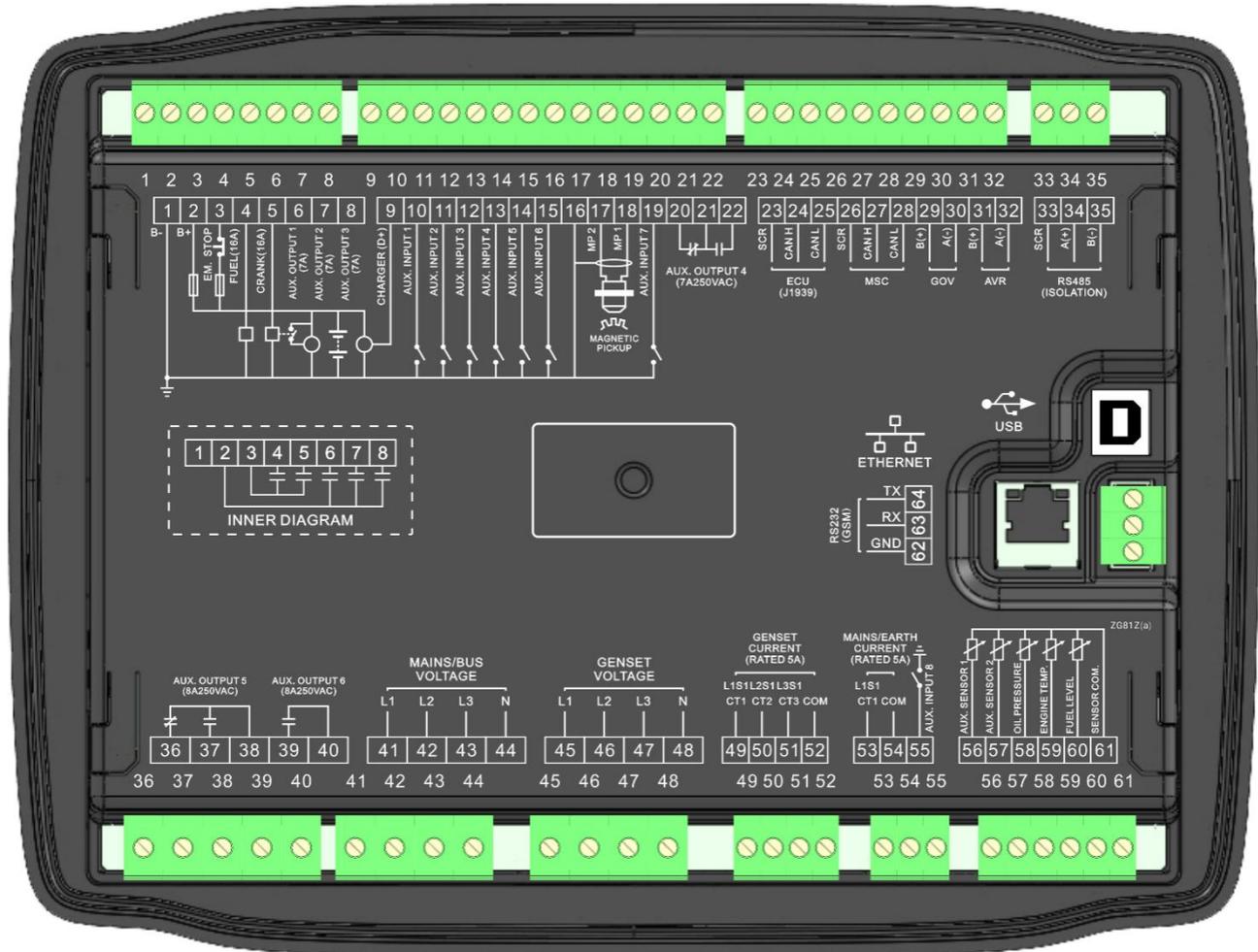
Fig.2 HGM8100Z Back Panel

Table 11 Terminal Wiring Connection

No.	Function	Cable Size	Remarks	
1	B-	2.5mm²	Connected with negative of starter battery.	
2	B+	2.5mm²	Connected with positive of starter battery. If wire length is over 30m, better to double wires in parallel. Max. 20A fuse is recommended.	
3	Emergency stop	2.5mm²	Connected with B+ via emergency stop button.	
4	Fuel relay output	1.5mm²	B+ is supplied by 3 terminal, rated 16A.	
5	Start relay output	1.5mm²	B+ is supplied by 3 terminal, rated 16A.	Connected to starter coil.
6	Aux. Output 1	1.5mm²	B+ is supplied by 2 terminal, rated 7A.	Details see Table 13.
7	Aux. Output 2	1.5mm²	B+ is supplied by 2 terminal, rated 7A.	
8	Aux. Output 3	1.5mm²	B+ is supplied by 2 terminal, rated 7A.	

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No.	Function	Cable Size	Remarks	
9	Charger(D+)	1.0mm^2	Connected with charger starter's D+ (WL) terminals. Being hang up If there is no this terminal.	
10	Aux. Input 1	1.0mm^2	Ground connected is active (B-).	Details see Table 14.
11	Aux. Input 2	1.0mm^2	Ground connected is active (B-).	
12	Aux. Input 3	1.0mm^2	Ground connected is active (B-).	
13	Aux. Input 4	1.0mm^2	Ground connected is active (B-).	
14	Aux. Input 5	1.0mm^2	Ground connected is active (B-).	
15	Aux. Input 6	1.0mm^2	Ground connected is active (B-).	
16	Magnetic Pickup	0.5mm^2	Connected with Speed sensor, shielding line is recommended. (B-) has already inside connected with speed sensor 2.	
17	MP 2			
18	MP 1			
19	Aux. Input 7	1.0mm^2	Ground connected is active (B-).	Details see Table 14.
20	Aux. Output 4	1.5mm^2	Normally close output, rated 7A.	Details see Table 13.
21			Public points of relay.	
22			Normally close output, rated 7A.	
23	ECU CAN	/	Impedance-120Ω shielding wire is recommended, its single-end earthed.	
24	ECU CAN H	0.5mm^2		
25	ECU CAN L	0.5mm^2		
26-32	RESERVE	/	Empty terminal.	
33	RS485	/	Impedance-120Ω shielding wire is recommended, its single-end earthed.	
34	RS485A(+)	0.5mm^2		
35	RS485B(-)	0.5mm^2		
36	Aux. Output 5	2.5mm^2	Normally close output, rated 8A.	Details see Table 13.
37		2.5mm^2	Normally close output, rated 8A.	
38		2.5mm^2	Public points of relay.	
39	Aux. Output 6	2.5mm^2	Normally close output, rated 8A.	
40		2.5mm^2	Public points of relay.	

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No.	Function	Cable Size	Remarks	
41	Mains Voltage L1	1.0mm²	Connected to A-phase of mains (2A fuse is recommended) (HGM8110Z doesn't have this one).	
42	Mains Voltage L2	1.0mm²	Connected to B-phase of mains (2A fuse is recommended) (HGM8110Z doesn't have this one).	
43	Mains Voltage L3	1.0mm²	Connected to C-phase of mains (2A fuse is recommended) (HGM8110Z doesn't have this one).	
44	Mains Voltage N	1.0mm²	Connected to N-wire of mains (HGM8110Z doesn't have this one).	
45	Genset Voltage L1	1.0mm²	Connected to A-phase of genset (2A fuse is recommended).	
46	Genset Voltage L2	1.0mm²	Connected to B-phase of genset (2A fuse is recommended).	
47	Genset Voltage L3	1.0mm²	Connected to C-phase of genset (2A fuse is recommended).	
48	Genset Voltage N	1.0mm²	Connected to N-wire of gen-set.	
49	Genset CT1	1.5mm²	Outside connected to secondary coil of current transformer (rated 5A).	
50	Genset CT2	1.5mm²	Outside connected to secondary coil of current transformer (rated 5A).	
51	Genset CT3	1.5mm²	Outside connected to secondary coil of current transformer (rated 5A).	
52	Genset Current COM	1.5mm²	See following installation instruction.	
53	Earth Current	1.5mm²	Outside connected to secondary coil of current transformer (rated 5A).	
54		1.5mm²		
55	Aux. Input 8	1.0mm²	Ground connected is active (B-).	Details see Table 14.
56	Aux. Sensor 1	1.0mm²	Connected to temperature, oil pressure or fuel level sensors.	Details see Table 15.
57	Aux. Sensor 2	1.0mm²		
58	Oil Pressure Sensor	1.0mm²	Connected to oil pressure sensor.	
59	Temperature Sensor	1.0mm²	Connected to temperature sensor.	
60	Fuel Level Sensor	1.0mm²	Connected to fuel level sensor.	
61	Sensor COM	/	Common terminal of sensor, (B-) has already connected.	
62	RS232	0.5mm²	MODBUS protocol is supported, it can be connected to remote communication.	
63	RS232 RX	0.5mm²		
64	RS232 TX	0.5mm²		

⚠**NOTE 1: USB port on the controller back panel is used for parameter programming, user can directly configure the controller via PC.**

⚠**NOTE 2: Ethernet port on the controller back panel is used for monitoring, user can directly configure and monitor the controller via PC.**

7 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

7.1 CONTENTS AND SCOPES OF PARAMETERS

Table 12 Parameters Contents and Scopes

No.	Items	Parameters	Defaults	Description
Mains Setting				
1	AC System	(0~3)	0	0: 3P4W; 1: 3P3W; 2: 2P3W; 3: 1P2W.
2	Rated Voltage	(30~30000)V	230	Standard for checking mains over/under voltage. It is primary voltage when using voltage transformer.
3	Rated Frequency	(10.0~75.0) Hz	50.0	Standard for checking mains over/under frequency.
4	Normal Delay	(0~3600)s	10	The delay from mains abnormal to normal.
5	Abnormal Delay	(0~3600)s	5	The delay from mains normal to abnormal.
6	Voltage Transformer (PT)	(0~1)	0	0: Disable; 1: Enable.
7	Primary Voltage	(30-30000)V	5	Primary voltage setting of PT.
8	Secondary Voltage	(30-1000)V	0	Secondary voltage setting of PT.
9	Over Voltage	(0~200)%	120	Setting value is mains rated voltage's percentage, return value (default: over voltage: 116; under voltage: 84), delay value (default: 5s) and alarm enable can be set.
10	Over Voltage Return Value	(0~200)%	116	
11	Over Voltage Delay	(0~3600)s	5	
12	Under Voltage	(0~200)%	80	
13	Under Voltage Return Value	(0~200)%	84	
14	Under Voltage Delay	(0~3600)s	5	
15	Over Frequency	(0~200)%	114	Setting value is mains rated frequency's percentage, return value (default: over voltage: 110; under voltage: 94), delay value (default: 5s) and alarm enable can be set.
16	Over Frequency Return Value	(0~200)%	110	
17	Over Frequency Delay	(0~3600)s	5	
18	Under Frequency	(0~200)%	90	
19	Under Frequency Return Value	(0~200)%	94	
20	Under Frequency Delay	(0~3600)s	5	
21	Loss of Phase	(0~1)	1	0: Disable; 1: Enable
22	Reverse Phase Sequence	(0~1)	1	
23	Mains Option	(0~1)	0	0: AMF; 1: Display only.
24	Mains Onload Available Under Stop Mode	(0~1)	0	0: Enable; the mains power is allowed to close with load when the it is in normal state under stop mode.

No.	Items	Parameters	Defaults	Description
				1: Disable; the mains power is not allowed to close with load when the it is in normal state under stop mode.
Timer Setting				
1	Start Delay	(0~3600)s	1	Time from mains abnormal or remote start signal is active to start genset.
2	Stop Delay	(0~3600)s	1	Time from mains normal or remote start signal is deactivated to stop genset.
3	Pre-heat Delay	(0~3600)s	0	Time of pre-powering heat plug before starter is powered on.
4	Cranking Time	(3~60)s	8	Time of starter power on.
5	Crank Rest Time	(3~60)s	10	The waiting time before second power on when engine start fails.
6	Safety On Delay	(0~3600)s	10	Alarms for low oil pressure, high temperature, under speed, under frequency/voltage, charging fail are inactive.
7	Start Idle Time	(0~3600)s	0	Idle running time of genset when starting.
8	Warming Up Time	(0~3600)s	10	Warming time between genset switch on and normal running.
9	Cooling Time	(0~3600)s	10	Cooling time before genset stops, after it unloads.
10	Stop Idle Time	(0~3600)s	0	Idle running time when genset stops.
11	ETS Solenoid Hold	(0~3600)s	20	The time of powering up the electromagnet during stop procedure.
12	Fail to Stop Delay	(0~3600)s	0	Time between ending of genset idle delay and stopped when "ETS output time" is set as 0; Time between ending of ETS hold delay and stopped when "ETS output time" is not 0.
13	After Stop Time	(0~3600)s	0	Time between genset stop and standby.
Smart Pre-heat Setting				
1	Smart Pre-heat	(0-1)	0	0: Disable; 1: Enable
2	Upper Threshold Setting	(0-1000)	40	When the value measured by the sensor exceeds the "upper threshold", it can skip the pre-heat phase and move on to the next phase of operation.
3	Sensor Select	(0-4)	0	Sensor type: 0: Temperature Sensor1 1: Aux. Sensor1 2: Aux. Sensor2 3: Oil Pressure Sensor 4: Fuel Level Sensor

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No.	Items	Parameters	Defaults	Description
Louver Setting				
1	Louver Open Time	(0-360.0)s	5.0	When the opening and closing time are both 0s, it means that the louver is controlled in a continuous mode. When the opening and closing time are both more than 0s, it means that the louver is controlled in a pulsed mode.
2	Louver Close Time	(0-360.0)s	5.0	
3	Louver Detection Time	(0-360.0)s	5.0	The detection time after the louver is opened and closed.
4	Open Fail Alarm Action	(0-2)	0	0: Warning 1: Shutdown 2: None
5	Close Fail Alarm Action	(0-2)	0	0: Warning 1: Shutdown 2: None
6	Pre-heat Skip in Open Fail	(0-1)	1	0: Disable, it can jump to the next unit operation stage of preheating when the louver is opened completely. 1: Enable, it can jump to the next stage of the unit's operation after preheat countdown is over whether or not the louver is opened completely.
7	Status Error Alarm Action	(0-2)	0	0: Warning 1: Shutdown 2: None
8	Open Signal Loss Action	(0-2)	0	0: Warning 1: Shutdown 2: None
9	Close Signal Loss Action	(0-2)	0	0: Warning 1: Shutdown 2: None
Engine Setting				
1	Engine Type	(0~39)	0	Default: Non-ECU engine. When connected to J1939 engine, choose the corresponding type.
2	Flywheel Teeth	(10~300)	118	Teeth number of the engine flywheel, for judging of crank disconnection conditions and inspecting of engine speed. See the installation instructions.
3	Rated Speed	(0~6000)r/min	1500	Offer standard to judge over/under/on load speed.
4	On Load Speed	(0~100)%	90	Setting value is percentage of rated speed. Controller detects when it is ready to load. It won't switch on when speed is under the speed.

No.	Items	Parameters	Defaults	Description
5	Loss of Speed Signal	(0~3600)s	5	Time from detecting speed is 0 to confirm the action.
6	Loss of Speed Action	(0~1)	0	0: Warning; 1: Shutdown
7	Over Speed Shutdown	(0~200)%	114	Setting value is percentage of rated speed, delay value (over speed default as 2s, under speed default as 3s) and alarm enable also can be set.
8	Over Speed Shutdown Delay	(0~3600)s	2	
9	Under Speed Shutdown	(0~200)%	80	
10	Under Speed Shutdown Delay	(0~3600)s	3	
11	Over Speed Warning	(0~200)%	110	Setting value is percentage of rated speed and delay value (default: 5s) and return value (default: over speed: 108; under speed: 90) also can be set.
12	Under Speed Warning	(0~200)%	86	
13	Battery Rated Voltage	(0~60.0)V	24.0	Standard for detecting over/under voltage of battery.
14	Battery Over Voltage Warning	(0~200)%	120	Setting value is percentage of rated voltage of battery. Delay value (default: 60s), return value (default: over voltage: 115; under voltage: 90) and alarm enable also can be set.
15	Battery Over Voltage Return Value	(0~200)%	115	
16	Battery Over Voltage Delay	(0~3600)s	60	
17	Battery Under Voltage Warning	(0~200)%	85	
18	Battery Under Voltage Return Value	(0~200)%	90	
19	Battery Under Voltage Delay	(0~3600)s	60	
20	Charge Failure	(0~60.0)V	8.0	In normal running, when charger D+(WL) voltage is under this value, charge failure alarms.
21	Charge Failure Return Value	(0~60.0)V	10.0	
22	Charge Failure Delay	(0~3600)s	10	
23	Start Attempts	(1~10) times	3	Max. Crank times of crank attempts. When reach this number, controller will send start failure signal.
24	Crank Disconnect	(0~6)	2	See Table 16. There are 3 conditions of disconnecting starter with engine. Each condition can be used alone and simultaneously to separating the start motor and genset as soon as possible.
25	Disconnect Generator Frequency	(0~200)%	24	When generator frequency is higher than the set value, starter will be disconnected.

No.	Items	Parameters	Defaults	Description
				See the installation instruction.
26	Disconnect Engine Speed	(0~200)%	24	When generator speed is higher than the set value, starter will be disconnected. See the installation instruction.
27	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.
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, it is used for calculating starter rotate speed when without speed sensor.
3	Rated Voltage	(30~30000)V	230	To offer standards for detecting of generator' over/under voltage and on load voltage. It is primary voltage when using voltage transformer.
4	On Load Voltage	(0~200)%	85	Setting value is percentage of generator rated voltage. Detect when controller is ready to load. If generator voltage is under load voltage, it won't enter into normal running.
5	Rated Frequency	(10.0~75.0) Hz	50.0	To offer standards for detecting of over/under/load frequency.
6	On Load Frequency	(0~200)%	85	Setting value is percentage of generator rated frequency. When generator frequency under load frequency, it won't enter into normal running.
7	Voltage Transformer (PT)	(0~1)	0	0: Disable; 1: Enable
8	Primary Voltage	(30-30000)V	100	Primary voltage setting of PT.
9	Secondary Voltage	(30-1000)V	100	Secondary voltage setting of PT.
10	Over Voltage Shutdown	(0~200)%	120	Setting value is percentage of generator rated volt. Delay value (default: 3s) and alarm enable also can be set.
11	Over Voltage Shutdown Delay	(0~3600)s	3	
12	Under Voltage Shutdown	(0~200)%	80	
13	Under Voltage Shutdown Delay	(0~3600)s	3	
14	Over Frequency Shutdown	(0~200)%	114	Setting value is percentage of generator rated freq. Delay value (default: over frequency: 2s; under frequency: 3s) and alarm enable also can be set
15	Over Frequency Shutdown Delay	(0~3600)s	3	

No.	Items	Parameters	Defaults	Description
16	Under Frequency Shutdown	(0~200)%	80	
17	Under Frequency Shutdown Delay	(0~3600)s	3	
18	Over Voltage Warning	(0~200)%	110	Setting value is percentage of generator rated volt. Delay value (default: 5s), return value (default: over voltage: 108; under voltage: 86) and alarm enable also can be set.
19	Over Voltage Warning Return Value	(0~200)%	108	
20	Over Voltage Warning Delay	(0~3600)s	5	
21	Under Voltage Warning	(0~200)%	84	
22	Under Voltage Warning Return Value	(0~200)%	86	
23	Under Voltage Warning Delay	(0~3600)s	5	
24	Over Frequency Warning	(0~200)%	110	Setting value is percentage of generator rated freq. Delay value (default: 5s), return value (default: over frequency: 108; under frequency: 86) and alarm enable also can be set.
25	Over Frequency Warning Return Value	(0~200)%	108	
26	Over Frequency Warning Delay	(0~3600)s	5	
27	Under Frequency Warning	(0~200)%	84	
28	Under Frequency Warning Return Value	(0~200)%	86	
29	Under Frequency Warning Delay	(0~3600)s	5	
30	Loss of Phase	(0~1)	1	0: Disable 1: Enable. When it is enabled, controller begins to monitor alarms.
31	Reverse Phase Sequence	(0~1)	1	
Load Setting				
1	CT Ratio	(5~6000)/5	500	The ratio of external current transformer.
2	Rated Current	(5~6000)A	500	Generator's rated current, standard of load current.
3	Rated Power	(0~6000)kW	276	Generator's rated power, standard of load power.
4	Over Current	(0~200)%	120	Setting value is percentage of generator rated current.
5	Over Current Action	(0~3)	0	0: Warning; 1: Shutdown; 2: Trip and Stop; 3: Trip
6	Over Current Delay Type	(0~1)	0	0: Definite time delay 1: Inverse time delay
7	Over Current Delay	(0~3600)s	10	Delay time of over current warning.
8	Over Power	(0~1)	0	0: Disable 1: Enable

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No.	Items	Parameters	Defaults	Description
9	Over Power Action	(0~3)	0	0: Warning; 1: Shutdown; 2: Trip and Stop; 3: Trip
10	Over Power Threshold	(0~200)%	110	Setting value is the percentage of generator rated power. Return value, delay value and alarm enable also can be set. If the active power is positive and above the threshold, after the delay time, it is still above the threshold, then the controller will issue the alarm.
11	Over Power Return Value	(0~200)%	105	
12	Over Power Delay	(0~3600)s	5	
13	Reverse Power	(0~1)	0	0: Disable 1: Enable
14	Reverse Power Action	(0~3)	0	0: Warning; 1: Shutdown; 2: Trip and Stop; 3: Trip
15	Reverse Power Threshold	(0~200)%	10	Setting value is the percentage of generator rated power. Return value, delay value and alarm enable also can be set. If the active power is negative and above the threshold, after the delay time, it is still below the threshold, then the controller will issue the alarm.
16	Reverse Power Return Value	(0~200)%	5	
17	Reverse Power Delay	(0~3600)s	5	
18	Earth Fault	(0~1)	0	0: Disable 1: Enable
19	Earth Fault Action	(0~3)	0	0: Warning; 1: Shutdown; 2: Trip and Stop; 3: Trip
20	Earth Fault Threshold	(0~200)%	20	Setting value is the percentage of generator rated current. Return value, delay value and alarm enable also can be set.
21	Earth Fault Return Value	(0~200)%	15	
22	Earth Fault Delay	(0~3600)s	5	
ATS Setting				
1	Transfer Time	(0~7200)s	5	Interval time from mains switch off to generator switch on; or from generator switch off to mains switch on.
2	Close Delay	(0~20.0)s	5.0	Pulse width of mains/generator switch on. When it is 0, it means output constantly.
3	Open Delay	(0~20.0)s	3.0	Pulse width of mains/generator switch off.
4	Transfer Check Delay	(0~20.0)s	5.0	Time of detecting ATS auxiliary contacts after transferred.
5	Transfer Failure Warning	(0~1)	0	0: Disable 1: Enable
6	Open Check	(0~1)	0	0: Disable 1: Enable
7	Abnormal Mains Trip	(0~1)	1	0: Disable 1: Enable
Module Setting				
1	Power On Mode	(0~2)	0	0: Stop mode 1: Manual mode 2: Auto mode

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No.	Items	Parameters	Defaults	Description
2	Module Address	(1~254)	1	Controller's address during remote sensing.
3	Stop Bits	(0~1)	0	0: 2 stop bits; 1: 1 stop bit
4	Language	(0~2)	0	0: Simplified Chinese; 1: English; 2: Others.
5	Password	(0~65535)	00318	For entering advanced parameters setting.
6	Temperature Unit	(0~1)	0	0: ºC 1: ºF
7	Press Unit	(0~2)	0	0: kPa; 1: Psi; 2: Bar
8	Time and Date			Current time and date can be set by users.
9	Ethernet	(0~1)	1	0: Disable 1: Enable All the settings about Ethernet (IP address, subnet mask) will be active after the next power on.

Scheduling and Maintenance Setting

No.	Items	Parameters	Defaults	Description
1	Scheduled Run	(0~1)	0	0: Disable; 1: Enable
2	Scheduled Not Run	(0~1)	0	0: Disable; 1: Enable
3	Maintenance	(0~1)	0	0: Disable; 1: Enable

Analog Sensor Setting

Temperature Sensor

No.	Items	Parameters	Defaults	Description
1	Curve Type	(0~15)	7	SGX. See Table 15.
2	Open Circuit Action	(0~2)	0	0: Warning; 1: Shutdown; 2: No action
3	High Temperature Shutdown	(0~300)°C	98	Shutdown will be issued when sensor temperature is higher than this value. Detecting only after safety delay is over. The delay value (default: 3s) and alarm enable also can be set.
4	High Temperature Shutdown Delay	(0~3600)s	3	
5	High Temperature Warning	(0~300)°C	95	Warning will be issued when sensor temperature is higher than this value. Detecting only after safety delay is over. The delay value (default: 5s), return value (default: 93) and alarm enable also can be set.
6	High Temperature Warning Return Value	(0~300)°C	93	
7	High Temperature Warning Delay	(0~3600)s	5	
8	Low Temperature Warning Setting	(0~1)	0	0: Disable; 1: Enable
9	Low Temperature Warning	(-40~300)°C	70	Warning will be issued when sensor temperature is lower than this value. Detecting only after safety delay is over. The delay value (default: 5s), return value (default: 75) and alarm enable also can be set.
10	Low Temperature Warning Return Value	(-40~300)°C	75	
11	Low Temperature Warning Delay	(0~3600)s	5	

Oil Pressure Sensor

No.	Items	Parameters	Defaults	Description
1	Curve Type	(0~15)	7	SGX. See Table 15.
2	Open Circuit Action	(0~2)	0	0: Warning; 1: Shutdown; 2: No action
3	Low Oil Pressure	(0~1000)kPa	103	Shutdown will be issued when oil pressure

No.	Items	Parameters	Defaults	Description
	Shutdown			is lower than this value. Detecting only after safety delay is over. The delay value (default: 3s) and alarm enable also can be set.
4	Low Oil Pressure Shutdown Delay	(0~3600)s	3	
5	Low Oil Pressure Warning	(0~1000)kPa	124	Warning will be issued when oil pressure is lower than this value. Detecting only after safety delay is over. The delay value (default: 5s) and return value (default: 138) and alarm enable also can be set.
6	Low Oil Pressure Warning Return Value	(0~1000)kPa	138	
7	Low Oil Pressure Warning Delay	(0~3600)s	5	
Level Sensor				
1	Curve Type	(0~15)	4	SGH. See Table 15.
2	Open Circuit Action	(0~2)	0	0: Warning; 1: Shutdown; 2: No action
3	Low Level Warning	(0~300)%	10	Warning will be issued when level is lower than this value. It is detected all the time. The delay value (default: 5s), return value (default: 15) and alarm enable also can be set.
4	Low Level Warning Return Value	(0~300)%	15	
5	Low Level Warning Delay	(0~3600)s	5	
Programmable Sensor 1				
1	Programmable Sensor 1 Setting	(0~3)	0	0: Disable; 1: Temperature sensor; 2: Pressure sensor; 3: Level sensor.
Programmable Sensor 2				
1	Programmable Sensor 2 Setting	(0~3)	0	0: Disable; 1: Temperature sensor; 2: Pressure sensor; 3: Level sensor.
Digital Inputs Setting				
Digital Input Port 1				
1	Contents Setting	(0~100)	28	Remote start (on load). See Table 14.
2	Active Type	(0~1)	0	0: Closed to active; 1: Open to active
Digital Input Port 2				
1	Contents Setting	(0~100)	26	High temperature shutdown. See Table 14.
2	Active Type	(0~1)	0	0: Closed to active; 1: Open to active
Digital Input Port 3				
1	Contents Setting	(0~100)	27	Low oil pressure shutdown. See Table 14.
2	Active Type	(0~1)	0	0: Closed to active; 1: Open to active
Digital Input Port 4				
1	Contents Setting	(0~100)	0	User defined. See Table 14.
2	Active Type	(0~1)	0	0: Closed to active; 1: Open to active
3	Active Range	(0~3)	2	0: From safety on 1: From starting 2: Always 3: Never
4	Active Action	(0~4)	0	0: Warning; 1: Shutdown; 2: Trip and stop; 3: Trip; 4: Indication
5	Active Delay	(0~20.0)s	2.0	Time from detecting active to confirm
6	Description			LCD display detailed contents when the

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No.	Items	Parameters	Defaults	Description
				input is active.
Digital Input Port 5				
1	Contents Setting	(0~100)	0	User defined. See Table 14.
2	Active Type	(0~1)	0	0: Closed to active; 1: Open to active
3	Active Range	(0~3)	2	0: From safety on 1: From starting 2: Always 3: Never
4	Active Action	(0~4)	1	0: Warning; 1: Shutdown; 2: Trip and stop; 3: Trip; 4: Indication
5	Active Delay	(0~20.0)s	2.0	Time from detecting active to confirm
6	Description			LCD display detailed contents when the input is active.
Digital Input Port 6				
1	Contents Setting	(0~100)	0	User defined. See Table 14.
2	Active Type	(0~1)	0	0: Closed to active; 1: Open to active
3	Active Range	(0~3)	2	0: From safety on 1: From starting 2: Always 3: Never
4	Active Action	(0~4)	2	0: Warning; 1: Shutdown; 2: Trip and stop; 3: Trip; 4: Indication
5	Active Delay	(0~20.0)s	2.0	Time from detecting active to confirm
6	Description			LCD display detailed contents when the input is active.
Digital Input Port 7				
1	Contents Setting	(0~100)	5	Indicator test. See Table 14.
2	Active Type	(0~1)	0	0: Closed to active; 1: Open to active
Digital Input Port 8				
1	Contents Setting	(0~100)	0	User defined. See Table 14.
2	Active Type	(0~1)	0	0: Closed to active; 1: Open to active
3	Active Range	(0~3)	2	0: From safety on 1: From starting 2: Always 3: Never
4	Active Action	(0~4)	0	0: Warning; 1: Shutdown; 2: Trip and stop; 3: Trip; 4: Indication
5	Active Delay	(0~20.0)s	2.0	Time from detecting active to confirm
6	Description			LCD display detailed contents when the input is active.
Relay Outputs Setting				
Relay Output Port 1				
1	Contents Setting	(0~299)	1	User defined period output 1 (default as in preheat output). See Table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close.
Relay Output Port 2				
1	Contents Setting	(0~299)	35	Idle control. See Table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close.
Relay Output Port 3				
1	Contents Setting	(0~299)	29	Generator closed output. See Table 13.

No.	Items	Parameters	Defaults	Description
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close.
Relay Output Port 4				
1	Contents Setting	(0~299)	31	Mains closed output. See Table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close.
Relay Output Port 5				
1	Contents Setting	(0~299)	38	ETS. See Table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close.
Relay Output Port 6				
1	Contents Setting	(0~299)	48	Common alarm. See Table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close.

7.2 DEFINABLE CONTENTS OF DIGITAL OUTPUT PORTS

7.2.1 DEFINABLE CONTENTS OF DIGITAL OUTPUT PORTS

Table 13 Definable Contents of Digital Output Ports

No.	Type	Description
0	Not Used	
1	Self-defined Period 1	
2	Self-defined Period 2	
3	Self-defined Period 3	
4	Self-defined Period 4	
5	Self-defined Period 5	
6	Self-defined Period 6	Details of function please see the following.
7	Self-defined Combined 1	
8	Self-defined Combined 2	
9	Self-defined Combined 3	
10	Self-defined Combined 4	
11	Self-defined Combined 5	
12	Self-defined Combined 6	
13	Preheat Output	When the controller starting engine is in preheating, and preheat is enabled (PC sensor 4 configuration interface), it outputs when lower the threshold, not output when over the threshold.
14	Reserved	
15	Reserved	
16	Reserved	
17	Air Flap Control	Action when over speed shutdown and emergency stop is issued. It also can close the air in flow.
18	Audible Alarm	Action when warning, shutdown, trips is issued. It can be connected annunciator externally. When "Alarm Mute" configurable input port is active, it can remove the alarm.
19	Louver Control	Action when genset starts, and disconnects when genset stops completely.

No.	Type	Description
20	Fuel Pump Control	It is controlled by fuel pump of level sensor's limited threshold.
21	Heater Control	It is controlled by heating of temperature sensor's setting bound.
22	Cooler Control	It is controlled by cooler of temperature sensor's setting bound.
23	Fuel Pre-Supply Output	Action when start and running safety period.
24	Generator Excite	Output in start period. If there is no generator frequency during high-speed running, output for 2 seconds again.
25	Pre-Lubricate	Actions in period of pre-heating to safety run.
26	Remote Control Output	This port is controlled by communication (PC).
27	Reserved	
28	Key Output	When the unit type is SINOTRUK Or SINOTRUK3000, it constantly outputs after preheating.
29	Close Gen Output	Control generator to load.
30	Open Output	Control generator to unload.
31	Close Mains Output	Control mains to load.
32	Reserved	
33	Start Relay	
34	Fuel Relay	Action when genset is cranking and disconnect when stopped completely.
35	Idle Control	Used for engine which has idles. Close before starting and open in warming up delay; Close during stopping idle mode and open when stop is completed.
36	Speed Raise Output	Action in warming up delay.
37	Speed Drop Output	Action between the period from "stop idle" to "wait for stop".
38	Energize to Stop	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	Active 0.1s when controller enters stop idle, used for control part of ECU dropping to idle speed.
40	ECU Stop	Used for ECU engine and control its stop.
41	ECU Power	Used for ECU engine and control its power.
42	Speed Raise Pulse	Active 0.1s when controller enters warming up delay; used for control part of ECU raising to normal speed.
43	Crank Success	Close when detects a successful start signal.
44	Generator OK	Action when generator is normal.
45	Generator Available	Action in period of generator ok to high-speed cooling.
46	Mains OK	Action when mains normal.
47	Reserved	
48	Common Alarm	Action when genset common warning, common shutdown, common trips alarm occurs.
49	Common Trip and Stop	Action when common trip and stop alarm occurs.
50	Common Shutdown	Action when common shutdown occurs.

No.	Type	Description
51	Common Trip	Action when common trips alarm occurs.
52	Common Warning	Action when common warning alarm occurs.
53	Reserved	
54	Battery Over Voltage	Action when battery's over voltage warning occurs.
55	Battery Under Voltage	Action when battery's low voltage warning occurs.
56	Charging Failure	Action when charge failure warning occurs.
57	Reserved	
58	Reserved	
59	Reserved	
60	ECU Warning	Indicate ECU sends a warning signal.
61	ECU Shutdown	Indicate ECU sends a shutdown signal.
62	ECU Comm. Failure	Indicate controller not communicate with ECU.
63	Reserved	
64	Reserved	
65	Reserved	
66	Reserved	
67	Reserved	
68	Reserved	
69	Digital Input 1 Active	Action when input port 1 is active.
70	Digital Input 2 Active	Action when input port 2 is active.
71	Digital Input 3 Active	Action when input port 3 is active.
72	Digital Input 4 Active	Action when input port 4 is active.
73	Digital Input 5 Active	Action when input port 5 is active.
74	Digital Input 6 Active	Action when input port 6 is active.
75	Digital Input 7 Active	Action when input port 7 is active.
76	Digital Input 8 Active	Action when input port 8 is active.
77~80	Reserved	
81~96	Expand Digital Input 1~16 Active	Action when expand digital input port is active.
97~98	Reserved	
99	Emergency Stop	Action when emergency stop alarm is issued.
100	Fail to Start	Action when failed start alarm is issued.
101	Fail to Stop	Action when failed stop alarm is issued.
102	Under Speed Warning	Action when under speed warning is issued.
103	Under Speed Shutdown	Action when under speed shutdown is issued.
104	Over Speed Warning	Action when over speed warning is issued.
105	Over Speed Shutdown	Action when over speed shutdown is issued.
106	Reserved	
107	Reserved	
108	Reserved	
109	Gen Over Freq. Warning	Action when generator over frequency warning is issued.
110	Gen Over Freq. Shutdown	Action when generator over frequency shutdown is issued.

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No.	Type	Description
111	Gen Over Volt. Warning	Action when generator over voltage warning is issued.
112	Gen Over Volt. Shut	Action when generator over voltage shutdown is issued.
113	Gen Under Freq. Warning	Action when generator low frequency warning is issued.
114	Gen Under Freq. Shut	Action when generator low frequency shutdown is issued.
115	Gen Under Volt. Warning	Action when generator low voltage warning is issued.
116	Gen Under Volt. Shut	Action when generator low voltage shutdown is issued.
117	Gen Loss of Phase	Action when generator loss of phase occurs.
118	Gen Reverse Phase Seq.	Action when generator reverse phase sequence occurs.
119	Reserved	
120	Over Power Alarm	Action when controller detects generator is over power.
121	Reserved	
122	Reverse Power Alarm	Action when controller detects generator is reverse power.
123	Over Current Alarm	Action when over current alarm is issued.
124	Reserved	
125	Mains Inactive	
126	Mains Over Freq.	
127	Mains Over Volt.	
128	Mains Under Freq.	
129	Mains Under Volt.	
130	Mains Phase Seq. Fault	
131	Mains Loss of Phase	
132~138	Reserved	
139	High Temp. Warning	Action when high temperature warning is issued.
140	Low Temp. Warning	Action when low temperature warning is issued.
141	High Temp. Shutdown	Action when high temperature shutdown is issued.
142	Reserved	
143	Low Oil Pressure Warning	Action when low oil pressure warning is issued.
144	Low Oil Pressure Shutdown	Action when low oil pressure shutdown is issued.
145	Oil Pressure Sensor Open	Action when oil pressure sensor is open circuit.
146	Reserved	
147	Low Fuel Level	Action when controller has low fuel level alarm.
148	Reserved	
149	Reserved	
150	Programmable Sensor 1 High Warning	
151	Programmable Sensor 1 Low Warning	
152	Programmable Sensor 1 High Shut	
153	Programmable Sensor 1 Low Shut	
154	Programmable Sensor 2 High	

No.	Type	Description
	Warning	
155	Programmable Sensor 2 Low Warning	
156	Programmable Sensor 2 High Shut	
157	Programmable Sensor 2 Low Shut	
158~161	Reserved	
162	Expansion 1 Sensor 15 High Shut.	
163	Expansion 1 Sensor 15 High Alarm	
164	Expansion 1 Sensor 15 Low Shut.	
165	Expansion 1 Sensor 15 Low Alarm	
166~201	Expansion 1 Sensor 16~24	
202~229	Reserved	
230	Stop Mode	Action in Stop mode.
231	Manual Mode	Action in Manual mode.
232	Reserved	
233	Auto Mode	Action in Auto mode.
234	Generator On Load	
235	Mains On Load	
236~239	Reserved	
240~279	PLC Flag 1~40	Action when PLC flag is 1.
280~289	Reserved	
290	Louver Open	Louver open control signal, only need to configure this input when louver uses continuous control.
291	Louver Close	Louver close control signal, only need to configure this input when louver uses pulse control. The louver opening time and closing time should be greater than 0s in pulse control.
292-299	Reserved	

7.2.2 SELF-DEFINED PERIOD OUTPUT

Self-defined period output is composed by 2 parts: **period output S1** and **condition output S2**.

While **S1** and **S2** are **TRUE** at the same time, **OUTPUT**;

While **S1** or **S2** is **FALSE**, **DON'T OUTPUT**.

Period output S1 can set generator's one or more period outputs, the delay time and the output time after entering into period.

Condition output S2 can be set as any conditions in output ports.

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

Example,

Output period: start

Delay output time: 2s

Output time: 3s

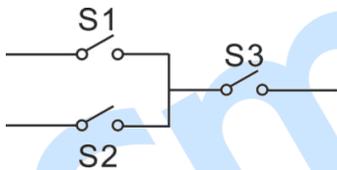Condition output contents: input port 1 is active

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

Input port 1 active, after enter "start time" and delay 2s, this defined period outputs, after 3s, stop output;

Input port 1 inactive, defined output period doesn't output.

7.2.3 SELF-DEFINED COMBINED 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**, and 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: Three parts of defined combination output (S1, S2, S3) couldn't include or recursively include themselves.**

Example,

Contents of or condition output S1: input 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, input 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: input 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.

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Table 14 Defined Contents of Digital Input Ports

No.	Type	Description
0	Users Defined	Including following functions, Indication: indicate only, not warning or shutdown. Warning: warning only, not shutdown. Shutdown: alarm and shutdown immediately Trip and stop: alarm, generator unloads and shuts down after high-speed cooling Trip: alarm, generator unloads but not shutdown. 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 and trip alarm when input is active.
4	60Hz Active	Used for ECU engine with CANBUS and it is 60Hz when input is active.
5	Indicator Test	All LED indicators light on when input is active.
6	Panel Lock	All buttons in panel is inactive except direction buttons and there is 🔒 in the right of first row in LCD when input is active.
7	Reserved	
8	Idle Speed Active	Under voltage/frequency/speed protection is inactive.
9	Auto Stop Inhibit	In **Auto** mode, during generator normal running, when input is active, inhibit generator shutdown automatically.
10	Auto Start Inhibit	In **Auto** mode, inhibit generator start automatically when input is active.
11	Scheduled Run Inhibit	In **Auto** mode, inhibit scheduled run genset when input is active.
12	Reserved	
13	Gen Closed Auxiliary	Connect generator on-load switch's Aux. Point.
14	Gen Load Inhibit	Prohibit genset switch on when input is active.
15	Mains Closed Auxiliary	Connect mains on-load switch's Aux. Point.
16	Mains Load Inhibit	Prohibit mains switch on when input is active.
17	Auto Mode Lock	When input is active, controller enters into Auto mode; mode selection buttons are inactive.
18	Auto Mode Inhibit	When input is active, controller won't work under Auto mode. Auto mode key and simulate auto key input does not work.
19	Reserved	
20	Reserved	
21	Alarm Stop Inhibit	All shutdowns are prohibited except emergency stop.

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No.	Type	Description
22	Instrument Mode	All outputs are prohibited in this mode.
23	Reserved	
24	Reset Maintenance Time	Controller will set maintenance time and date as default when input is active.
25	Reserved	
26	High Temperature Shutdown	Connected sensor digital input.
27	Low Oil Pressure Shutdown	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 normal running; 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 NOT take load after genset normal running; when input is inactive, genset will stop automatically.
30	Manual Start	In **Manual** mode, when input is active, genset will start automatically; when input is inactive, genset will stop automatically.
31	Reserved	
32	Reserved	
33	Simulate Stop Key	An external button can be connected and pressed as simulate panel.
34	Simulate Manual Key	
35	Reserved	
36	Simulate Auto Key	An external button can be connected and pressed as simulate panel.
37	Simulate Start Key	
38	Simulate Generator Load Key	This is to simulate Gen-close key when HGM8110Z controller is applied.
39	Simulate Mains Load Key	This is to simulate Gen-open key when HGM8110Z controller is applied.
40	Reserved	
41	Reserved	
42	Reserved	
43	Reserved	
44	Reserved	
45	Aux. Mains OK	In **Auto** mode, mains normal when input is active.
46	Aux. Mains Failure	In **Auto** mode, mains abnormal when input is active.
47	Alternative Config. 1	Alternative configuration is active when input 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	Reserved	
51	Reserved	
52	Reserved	
53	Reserved	
54	Reserved	
55	Louver Opened In Place	The feedback signal of louver opened in place.

No.	Type	Description
56	Louver Closed In Place	The feedback signal of louver closed in place.
57~100	Reserved	

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7.4 SELECTION OF SENSORS

Table 15 Sensors Selection

No.		Description	Remark
1	Temperature Sensor	0 Not used 1 Self-defined Res Curve 2 Self-defined 4-20mA curve 3 VDO 4 CURTIS 5 VOLVO-EC 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, default is SGX sensor.
2	Pressure Sensor	0 Not used 1 Self-defined Res Curve 2 Self-defined 4-20mA curve 3 VDO 10Bar 4 CURTIS 5 VOLVO-EC 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, default is SGX sensor.
3	Fuel Level Sensor	0 Not used 1 Self-defined Res Curve 2 Self-defined 4-20mA curve 3 SGD 4 SGH 5~15 Reserved	Defined resistance's range is (0~6)KΩ, default is SGH sensor.

⚠**NOTE: User should make special declaration when order controller if your genset is equipped with sensor of 4~20mA.**

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Table 16 Crank Disconnection Conditions Selection

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

⚠**NOTE:**

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 using with speed sensor and generator frequency together, in order to make the starter motor is separated with engine immediately and can check crank disconnect exactly.

2. Speed sensor is the magnetic equipment which be installed in starter for detecting flywheel teeth.

3. When set as speed sensor, must ensure that the number of flywheel teeth is as same as setting, otherwise, "over speed shutdown" or "under speed shutdown" may be caused.

4. If genset without speed sensor, please don't select corresponding items, otherwise, "start fail" or "loss speed signal" maybe caused.

5. If genset without oil pressure sensor, please don't select corresponding items.

6. If not select generator frequency in crank disconnect setting, controller will not collect and display the relative power quantity (can be used in water pump set); if not select speed sensor in crank disconnect setting, the rotating speed displayed in controller is calculated by generator frequency and number of poles.

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8   PARAMETERS SETTING

In **HGM8110Z** controller, there are no items of mains in setting and also no mains items in configurable ports of input/output.

⚠**CAUTION: Please change the controller parameters when generator is in standby mode only (e. g. Crank disconnect conditions selection, configurable input, configurable output, various delay), otherwise, shutdown and other abnormal conditions may happen.**

⚠**NOTE:**

1. **Maximum set value must over minimum set value in case that the condition of too high as well as too low will happen.**

2. **When setting the warning alarm, please set the correct return value; otherwise, maybe there will be abnormal alarm. When setting the maximum value, the return value must be less than the set value; when setting the minimum value, the return value must be over the set value.**

3. **Please set the generator frequency value as low as possible when cranking in order to make the starter be separated quickly as soon as crank disconnects.**

4. **Configurable input could not be set as same items; otherwise, there are abnormal functions. However, the configurable output can be set as same items.**

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9   SENSORS SETTING

1. When reselect sensors, the sensor curve will be transferred into the standard value. For example, if temperature sensor is SGX (120°C resistance-type), its sensor curve is SGX (120°C resistance-type); if select the SGD (120°C resistance-type), the temperature sensor curve is SGD curve.

2. When there is difference between standard sensor curves and using sensor, user can adjust it in "curve type".

3. When input the sensor curve, X value (resistance) must be input from small to large, otherwise, mistake occurs.

4. If select sensor type as "None", sensor curve is not working.

5. If corresponding sensor has alarm switch only, user must set this sensor as "None", otherwise, maybe there is shutdown or warning.

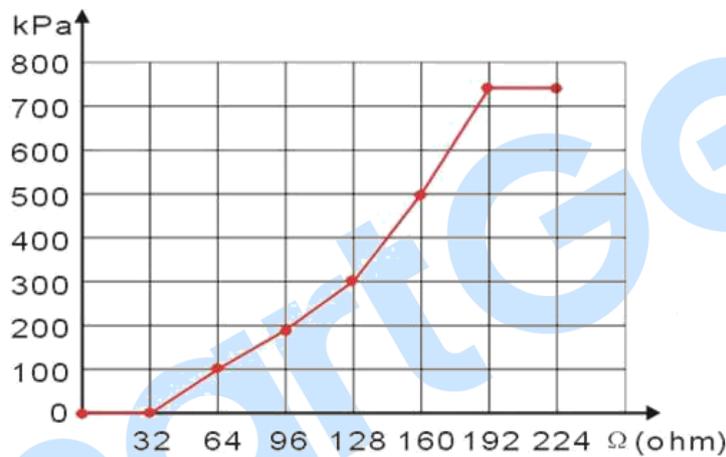6. The headmost or backmost values in the vertical coordinates can be set as same as below,

Fig.3 Sensor Curve Setting

Table 17 Normal Pressure Unit Conversion

	N/m^2 (pa)	kgf/cm^2	bar	psi
1Pa	1	1.02×10^{-5}	1×10^{-5}	1.45×10^{-4}
1kgf/cm^2	9.8×10^4	1	0.98	14.2
1bar	1×10^5	1.02	1	14.5
1psi	6.89×10^3	7.03×10^{-2}	6.89×10^{-2}	1

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10 COMMISSIONING

Please make the under procedures checking before commissioning,

1) Ensure all the connections are correct and wires diameter is suitable.

2) Ensure that the controller DC power has fuse, controller's positive and negative correctly connected to starting battery.

3) Emergency stop must be connected to the positive of starting battery via scram button's normal close point and fuse.

4) Take proper action to prevent engine to crank disconnect (e. g. Remove the connection wire of fuel valve). If checking is OK, make the starting battery power on; choose manual mode and controller will execute routine.

5) Set controller under manual mode, press "start" button, genset will start. After the setting times as setting, controller will send signal of Start Fail; then press "stop" to reset controller.

6) Recover the action of stop engine start (e. g. Connect wire of fuel valve), press start button again, genset will start. If everything goes well, genset will normal run after idle running (if idle run be set). During this time, please watch for engine's running situations and AC generator's voltage and frequency. If abnormal, stop genset running and check all wires connection according to this manual.

7) Select the **AUTO** mode from controller's panel, connect mains signal. After the mains normal delay, controller will transfer ATS (if fitted) into mains load. After cooling time, controller will stop genset and make it into "at rest" mode until there is abnormal of mains.

8) When mains is abnormal again, genset will be started automatically and into normal running, then controller send signal to making generator switch on, and control the ATS as generator load. If not like this, please check ATS' wires connection of control part according to this manual.

9) If there is any other question, please contact SmartGen's service personnel.
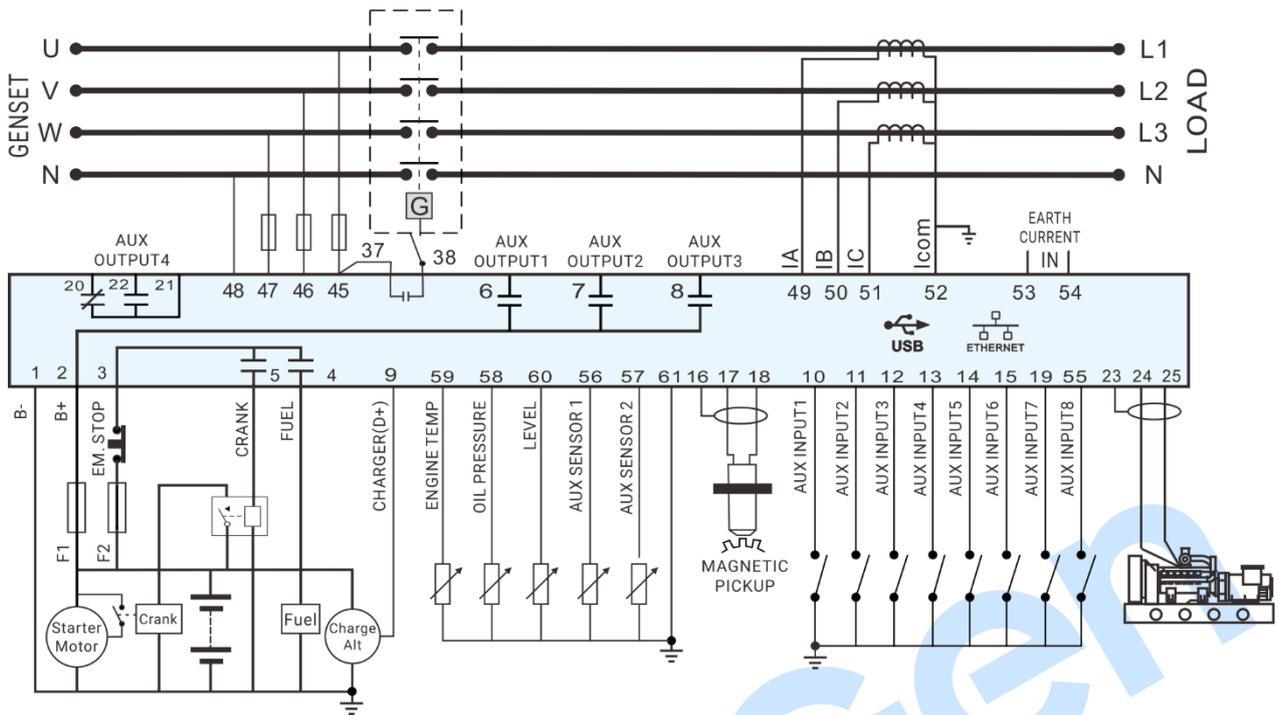
11 TYPICAL APPLICATION

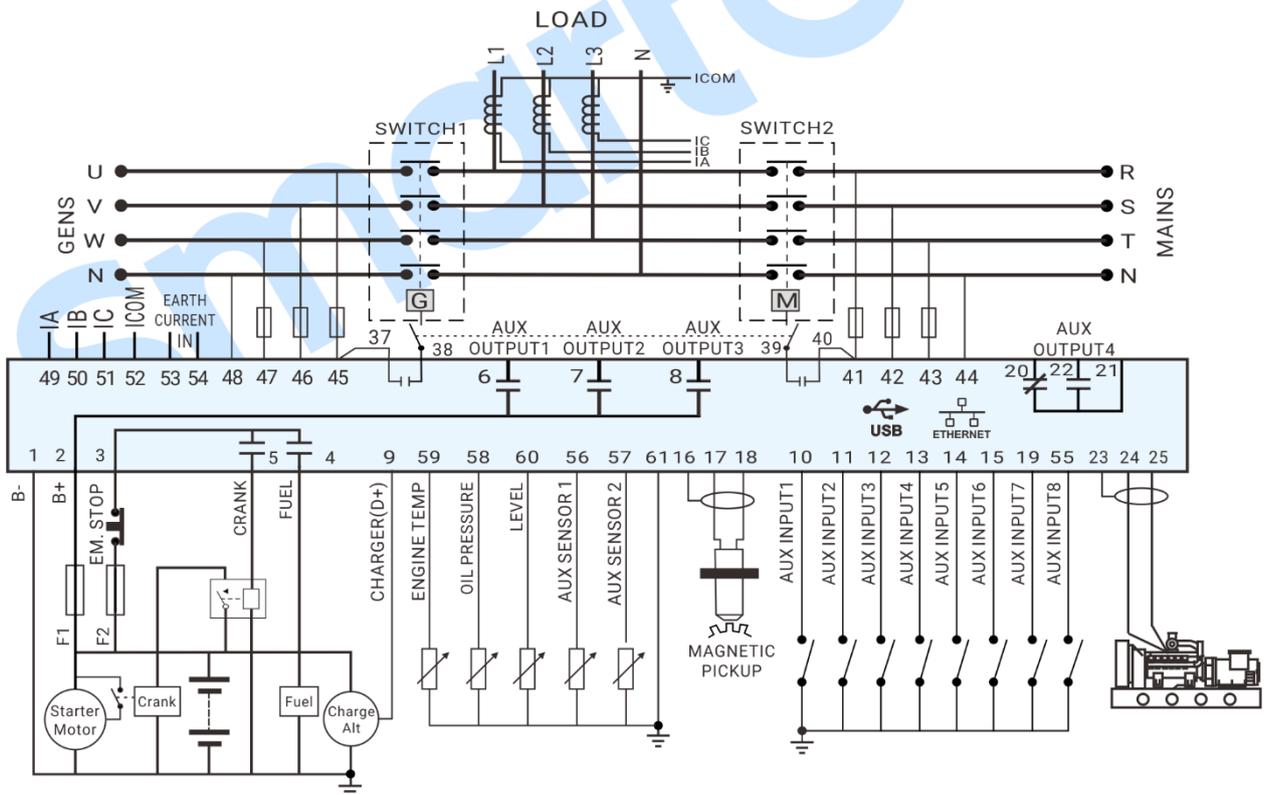**Fig.4 HGM8110Z Typical Application Diagram**

Fig.5 HGM8120Z Typical Application Diagram

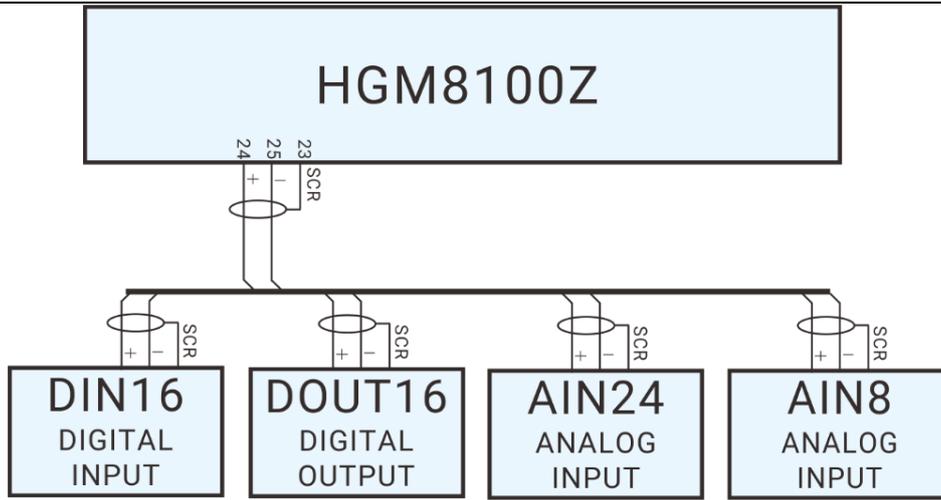⚠**NOTE: Fuse F1: min. 2A; max. 20A. Fuse F2: max. 32A. Users should select suitable fuse based on practical application.**

Fig.6 HGM8100Z Expansion Module Typical Application Diagram

12 INSTALLATION

12.1 OVERALL DIMENSION

Controller is panel built-in design; it is fixed by clips when installed. The controller's overall dimensions and cutout dimensions for panel, please refers to as following:
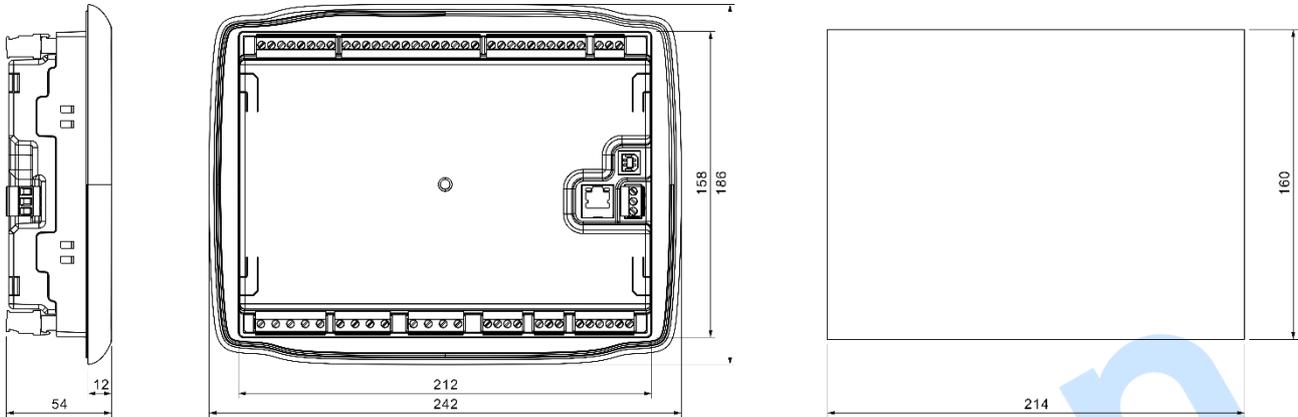

Fig.7 Overall Dimensions and Panel Cutout (Unit: mm)

⚠**NOTE: The torque of 0.27N·m (2.75kgf·cm) for fixing clip is recommended.**

12.2 BATTERY VOLTAGE INPUT

HGM8100Z series controller can suit for widely range of battery voltage of (8~35)VDC. Negative of battery must be connected with the engine shell. Diameter of wire that connects from power supply to battery must be over 2.5mm^2. If floating charger configured, please firstly connect output wires of charger to battery's positive and negative directly, then, connect wires from battery's positive and negative to controller's positive and negative input ports in order to prevent charger disturbing the controller's normal working.

12.3 SPEED SENSOR INPUT

Speed sensor is the magnetic equipment which be installed in starter and for detecting flywheel teeth. Its connection wires to controller should apply for 2 cores shielding line. The shielding layer should connect to No.16 terminal in controller while another side is hanging in air. The else two signal wires are connected to No.17 and No.18 terminals in controller. The output voltage of speed sensor should be within (1~24)VAC (effective value) during the full speed. 12VAC is recommended (in rated speed). When install the speed sensor, let the sensor is spun to contacting flywheel first, then, port out 1/3 lap, and lock the nuts of sensor at last.

12.4 OUTPUT AND EXPANSION RELAYS

⚠**CAUTION: All outputs of controller are relay contact output type. If need to expand the relays, please add freewheel diode to both ends of expand relay's coils (when coils of relay have DC current) or, increase resistance-capacitance return circuit (when coils of relay have AC current) in order to prevent disturbance to controller or others equipment.**

12.5 AC INPUT

Current input of controller must be connected to outside current transformer. And the current transformer's

secondary side current must be 5A. At the same time, the phases of current transformer and input voltage must correct. Otherwise, the current of collecting and active power maybe not correct.

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

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

12.6 WITHSTAND VOLTAGE TEST

⚠CAUTION: When controller has been installed in control panel, if need to do the withstand voltage test, please disconnect controller's all terminal connections in order to prevent high voltage damaging the controller.

13 CONNECTIONS OF CONTROLLER WITH J1939 ENGINE

13.1 CUMMINS ISB/ISBE

Table 18 Connector B

Terminals of controller	Connector B	Remark
Fuel relay output	39	
Starting relay output	-	Connect with starter coil directly.
Auxiliary output 1	Expand 30A relay, battery voltage of 01, 07, 12, 13 is supplied by relay.	ECU power; Set auxiliary output 1 as "ECU power".

Table 19 9-Pin Connector

Terminals of controller	9 pins connector	Remark
CAN GND	SAE J1939 shield	CAN communication shielding line (connect 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.

13.2 CUMMINS QSL9

Suitable for CM850 engine control module.

Table 20 50-Pin Connector

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

Table 21 9-Pin Connector

Terminals of controller	9 pins connector	Remark
CAN GND	SAE J1939 shield-E	CAN communication shielding line (connect 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.

13.3 CUMMINS QSM11 (IMPORT)

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

Table 22 C1 Connector

Terminals of controller	C1 connector	Remark
Fuel relay output	5&8	Outside expand relay, when fuel output, making port 5 and port 8 of C1 be connected.
Starting relay output	-	Connect to starter coil directly.

Table 23 3-Pin Data Link Connector

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

Engine type: Cummins ISB.

13.4 CUMMINS QSX15-CM570

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

Table 24 50-Pin Connector

Terminals of controller	50 pins connector	Remark
Fuel relay output	38	Oil spout switch.
Starting relay output	-	Connect 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 (connect 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.

13.5 CUMMINS GCS-MODBUS

It is suitable for GCS engine control module. RS485-MODBUS used to read information of engine. Engine types are QSX15, QST30, SK23/45/60/78 and so on.

Table 26 D-SUB Connector 06

Terminals of controller	D-SUB connector 06	Remark
Fuel relay output	5&8	Outside expand relay, when fuel output, making port 05 and 08 of the connector 06 be connected.
Starting relay output	-	Connect to starter coil directly.

Table 27 D-SUB Connector 06

Terminals of controller	D-SUB connector 06	Remark
RS485 GND	20	CAN communication shielding line (connect 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.

13.6 CUMMINS QSM11

Table 28 Engine OEM Connector

Terminals of controller	OEM connector of engine	Remark
Fuel relay output	38	
Starting relay output	-	Connect with starter coil directly.
CAN GND	-	CAN communication shielding line (connect 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.

13.7 CUMMINS QSZ13

Table 29 Engine OEM Connector

Terminals of controller	OEM connector of engine	Remark
Fuel relay output	45	
Starting relay output	-	Connect to starter coil directly.
Auxiliary output 1	16&41	Setting to idle speed control, normally close output. Making 16 connect to 41 during high-speed running of controller via external expansion relay.
Auxiliary output 2	19&41	Setting to pulse raise speed control, normally open output. Making 19 connect with 41 for 0.1s during high-speed warming of controller via external expansion relay.
CAN GND	-	CAN communication shielding line (connect 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.

13.8 DETROIT DIESEL DDEC III/IV

Table 30 Engine CAN Port

Terminals of controller	CAN port of engine	Remark
Fuel relay output	Expand 30A relay, battery voltage of ECU is supplied by relay.	
Starting relay output	-	Connect to starter coil directly.
CAN GND	-	CAN communication shielding line (connect with controller's terminal only).
CAN(H)	CAN(H)	Using impedance 120Ω connecting line.
CAN(L)	CAN(L)	Using impedance 120Ω connecting line.

Engine type: Common J1939.

13.9 DEUTZ EMR2

Table 31 F Connector

Terminals of controller	F connector	Remark
Fuel relay output	Expand 30A relay, battery voltage of 14 is supplied by relay. Fuse is 16A.	
Starting relay output	-	Connect to starter coil directly.
-	1	Connect to battery negative pole.
CAN GND	-	CAN communication shielding line (connect with controller's terminal only).
CAN(H)	12	Impedance 120Ω connecting line is recommended.
CAN(L)	13	Impedance 120Ω connecting line is recommended.

Engine type: VolvoEDC4.

13.10 JOHN DEERE

Table 32 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 (connect 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.

13.11 MTU MDEC

Suitable for MTU engines, 2000 series, 4000 series.

Table 33 X1 Connector

Terminals of controller	X1 connector	Remark
Fuel relay output	BE1	
Starting relay output	BE9	
CAN GND	E	CAN communication shielding line (connect with one terminal only).
CAN(H)	G	Using impedance 120Ω connecting line.
CAN(L)	F	Using impedance 120Ω connecting line.

Engine type: MTU-MDEC-303.

13.12   MTU ADEC (SMART MODULE)

It is suitable for MTU engine with ADEC (ECU8) and SMART module.

Table 34 ADEC (X1 Port)

Terminals of controller	ADEC (X1 port)	Remark
Fuel relay output	X1 10	X1 Terminal 9 Connected to negative of battery.
Starting relay output	X1 34	X1 Terminal 33 Connected to negative of battery.

Table 35 ADEC (X4 Port)

Terminals of controller	SMART (X4 port)	Remark
CAN GND	X4 3	CAN communication shielding line (connect to controller's this terminal only).
CAN(H)	X4 1	Using impedance 120Ω connecting line.
CAN(L)	X4 2	Using impedance 120Ω connecting line.

Engine type: MTU-ADEC.

13.13   MTU ADEC (SAM MODULE)

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

Table 36 ADEC (X1 Port)

Terminals of controller	ADEC (X1 port)	Remark
Fuel relay output	X1 43	X1 Terminal 28 Connected to negative of battery.
Starting relay output	X1 37	X1 Terminal 22 Connected to negative of battery.

Table 37 SAM (X23 Port)

Terminals of controller	SAM (X23 port)	Remark
CAN GND	X23 3	CAN communication shielding line (connect 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.

13.14 PERKINS

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

Table 38 Connector

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

Engine type: Perkins.

13.15 SCANIA

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

Table 39 B1 Connector

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

Engine type: Scania.

13.16 VOLVO EDC3

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

Table 40 "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 auxiliary output 1 as "ECU power".

Table 41 "Data bus" Connector

Terminals of controller	"Data bus" connector	Remark
CAN GND	-	CAN communication shielding line (connect 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.**

13.17 VOLVO EDC4

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

Table 42 Connector

Terminals of controller	Connector	Remark
Fuel relay output	Expanded 30A relay, and relay offers battery voltage for terminal14. Fuse is 16A.	
Starting relay output	-	Connect to starter coil directly.
	1	Connected to negative of battery.
CAN GND	-	CAN communication shielding line (connect with controller's terminal only).
CAN(H)	12	Using impedance 120Ω connecting line.
CAN(L)	13	Using impedance 120Ω connecting line.

Engine type: VolvoEDC4.

13.18 VOLVO-EMS2

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

Table 43 Engine CAN Port

Terminals of controller	Engine's CAN port	Remark
Auxiliary output 1	6	ECU stop; Set auxiliary output 1 as "ECU stop".
Auxiliary output 2	5	ECU power; Set auxiliary output 2 as "ECU power".
	3	Negative power.
	4	Positive power.
CAN GND	-	CAN communication shielding line (connect 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.**

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13.19 YUCHAI

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

Table 44 Engine 42-Pin Port

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

Table 45 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.

13.20 WEICHAI

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

Table 46 Engine Port

Terminals of controller	Engine port	Remark
Fuel relay output	1.40	Connect to engine ignition lock.
Starting relay output	1.61	
CAN GND	-	CAN communication shielding line (connect with controller's this terminal 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 personnel.**

14   ETHERNET INTERFACE

14.1   ETHERNET INTERFACE INTRODUCTION

ETHERNET port is used for controller monitoring, and it can realize network client connection mode.

⚠**NOTE: After changing controller network parameters (e.g. IP address, subnet mask etc.) new settings will take effect only after the controller is restarted.**

14.2   NETWORK CLIENT CONNECTION MODE

When the controller is used as network client, it can be monitored via network port using TCP ModBus protocol.

The procedure is the following:

1) Set IP address and subnet mask of the controller. The IP address should be in the same network segment and different from the IP address used by the monitoring equipment (e.g. PC). e.g.: if monitoring equipment IP address is 192.168.0.16, controller IP can be 192.168.0.18, subnet mask is 255.255.255.0.

2) Connect the controller. It can be connected to the monitoring equipment directly using network cable or via switchboard.

3) The communication between the controller and monitoring equipment is carried out using TCP ModBus protocol.

⚠**NOTE: Controller parameters can be set in this connection mode. SmartGen provides testing software for this connection mode. Communication protocol can be obtained from the SmartGen's service.**

14.3   CONTROLLER AND NETWORK CABLE CONNECTION

Table 47 Controller Internet Access

No.	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	NC	Not connected
5	NC	Not connected
6	RX-	Receive Data-
7	NC	Not connected
8	NC	Not connected

1) Controller and PC connection via a line of cable

   For this connection crossover cable must be used.

   Crossover cable: EIA/TIA 568A standard on one end and EIA/TIA 568B on the other end.

⚠**NOTE: If PC network port has Auto MDI/MDIX function, parallel cable can also be used.**

2) Controller and PC connection via switchboard (or router).

   Parallel lines must be used.

   Parallel cable: EIA/TIA 568A standard on both ends or EIA/TIA 568B standard on both ends.

⚠**NOTE: If switchboard (or router) network port has Auto MDI/MDIX function, crossover cable can also be used.**

15 TROUBLESHOOTING

Table 48 Troubleshooting

Troubles	Possible Solutions
Controller no response with power.	Check starting batteries; Check controller wiring connections; 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 emergency stop button is correct or not; Check whether the starting battery positive connects to the emergency stop input; Check whether the circuit is open.
Low oil pressure alarm after crank disconnects	Check the oil pressure sensor and its connections.
High water temp. alarm after crank disconnects	Check the water temperature sensor and its connections.
Shutdown in running	Check related switches and its connections according to the information on LCD; Check digital inputs.
Crank disconnection failure	Check fuel circuit and its connections; Check starting batteries; Check speed sensor and its connections; Refer to engine manual.
Starter no response	Check starter's wiring connections; Check starting batteries.
Genset running while ATS not transfer	Check ATS; Check the connections between ATS and controllers.
RS485 communication is abnormal	Check wiring connections; Check setting of COM port is correct or not; Check RS485's wires of A and B is reverse connected or not; Check RS485 transfer module is damaged or not; Check communication port of PC is damaged or not.
ECU communication failed	Check connections of CAN high and low polarity; Check if 120Ω resistor is correctly connected; Check if the type of engine is correct; Check if connections from controller to engine and setting of outputs are correct.
ECU warning or stop	Get information from LCD of alarm page; If there is detailed alarm, check engine according to description. If not, please refer to engine manual according to SPN alarm code.

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