SmartGen

MAKING CONTROL SMARTER

HGM9600 SERIES

(HGM9610/HGM9620)

GENSET CONTROLLER

USER MANUAL

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Table 1 Software Version

Date	Version	Note
2012-03-08	1.0	Original release.
2014-08-27	1.1	Modify the external view and the main display description.
2023-09-19	1.2	Modify the image to be consistent with the indicator.

This manual is suitable for HGM9600 series controller only. (HGM9610/HGM9620)

Clarification of notation used within this publication.

Table 2 Sign Instruction

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 error operation may cause death, serious injury and significant property damage.

1 OVERVIEW

HGM9600 series genset controllers are used for genset automation and monitor control system of single unit to achieve automatic start/stop, data measure, alarm protection and “three remote” (remote control, remote measuring and remote communication). The controller adopts large liquid crystal display (LCD) and selectable Chinese, English or other languages interface with easy and reliable operation.

HGM9600 controller adopts 32-bit micro-processor technology with precision parameters measuring, fixed value adjustment, time setting and threshold adjusting and etc. The majority of parameters can be set using front panel and all the parameters can be set using PC (via USB port) and can be adjusted and monitored with the help of RS485 and ETHERNET ports. Controllers are fitted with Micro SD for real-time operation data recording for convenient browsing and timely fault detection. It can be widely used in a number of automatic genset control system with compact structure, simple connections and high reliability.

2 MODELS COMPARISON

Table 3 Model Comparison

Item		HGM 9210	HGM 9220	HGM 9310	HGM 9320	HGM 9410	HGM 9420	**HGM 9610**	**HGM 9620**	HGM 9510	HGM 9520
LCD	Dimension	3.7”						4.3”			
	Pixel	132 x 64						480 x 272			
AMF			●		●		●		●		●
BUS monitoring										●	
Parallel connection										●	●
Expansion module								●	●		
Input port number		7	7	7	7	7	7	8	8	7	8
Output port number		8	8	8	8	8	8	8	8	8	8
Sensor number		5	5	5	5	5	5	5	5	5	5
Neutral (earth) current								●	●		
Schedule function		●	●	●	●	●	●	●	●	●	●
ETHERNET								●	●		
RS485				●	●	●	●	●	●	●	●
GSM				●	●	●	●	●	●		
J1939						●	●	●	●	●	●
USB		●	●	●	●	●	●	●	●	●	●
LINK		●	●								
Real-time clock		●	●	●	●	●	●	●	●	●	●
Event log		●	●	●	●	●	●	●	●	●	●
Micro SD card								●	●		

NOTE:

(1) Two of the outputs are fixed: start output and fuel output.

(2) HGM96XX’s analog sensors are composed by 3 fixed sensors (temperature, pressure, liquid level) and 2 configurable sensors.

NOTE: Functions of mentioned herein HGM9210/HGM9220/HGM9310/HGM9320/HGM9410/HGM9420 /HGM9510/HGM9520 controllers can be changed, please check the corresponding user manual for accurate information.

3 PERFORMANCE AND CHARACTERISTICS

HGM9610, used for single automation systems, auto start/stop of the unit performed with the help of remote signal.

HGM9620, has all functions of HGM9610 as well as mains electric quantity monitoring and mains/generator automatic transfer control function (AMF), particularly suits for single automation systems that include mains and generator.

Key characteristics,

- With ARM-based 32-bit SCM, highly integrated hardware, higher reliability;
- 480x272 LCD with backlight, multilingual interface (including English, Chinese or other languages) which can be chosen at the site, making commissioning convenient for factory personnel;
- Improved LCD wear-resistance and scratch resistance due to hard screen acrylic;
- Silicon panel and pushbuttons for better operation in high-temperature environment;
- RS485 communication port enabling remote control, remote measuring, remote communication via ModBus protocol;
- ETHERNET communication port with multiple monitoring modes;
- Micro SD port for recording of real-time operation data;
- Equipped with SMS (Short Message Service) function. When genset is alarming, controller can send short messages via SMS automatically to setting 5 telephone numbers. Besides, generator status can be controlled and checked using SMS;
- Equipped with CANBUS port and can communicate with J1939 genset. Not only can you monitor frequently-used data (such as water temperature, oil pressure, speed, fuel consumption and so on) of ECU machine, but also control starting up, shutdown, speed raise and drop via CANBUS port;
- Suitable for 3-phase 4-wire, 3-phase 3-wire, single phase 2-wire, and 2-phase 3-wire systems with voltage 120/240V and frequency 50/60Hz;
- Collect and show 3-phase voltage, current, power parameter and frequency of generator or mains.

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

Each phase and total active power kW

Each phase and total reactive power kvar

Each phase and total apparent power KVA

Each phase and average power factor PF

Accumulate total generator power kWh, kvarh, kVAh

- For mains, controller has over and under voltage, over and under frequency, loss of phase and phase sequence wrong detection functions; For generator, controller has over and under voltage, over and under frequency, loss of phase, phase sequence wrong, over and reverse power, over current functions;
- 3 fixed analog sensors (temperature, oil pressure and level) are fitted;
- 2 configurable sensors can be set as sensor of temperature, oil pressure or fuel level;
- Precision measure and display parameters about engine,

  Temp. (WT) °C/°F both be displayed

  Oil pressure (OP) kPa/Psi/Bar all be displayed

  Fuel level (FL) % (unit)

  Speed (SPD) r/min (unit)

  Voltage of Battery (VB) V (unit)

  Voltage of Charger (VD) V (unit)

  Hour count (HC) can accumulate to max. 65535 hours.

  Start times can accumulate to max. 65535 times.
- Protection: automatic start/stop of the gen-set, ATS (Auto Transfer Switch) control with perfect fault indication and protection function;
- All output ports are relay-out;
- Parameter setting: parameters can be modified and stored in internal EEPROM memory and cannot be lost even in case of power outage; most of them can be adjusted via front panel of the controller and all of them can be modified with PC via USB, RS485 or ETHERNET ports.
- More kinds of curves of temperature, oil pressure, fuel level can be used directly and users can define the sensor curves by themselves;
- Multiple crank disconnect conditions (speed sensor, oil pressure, generator frequency) are optional;
- Widely power supply range DC(8~35)V, suitable for different starting battery voltage environment;
- Event log, real-time clock, scheduled start & stop generator (can be set as start genset once a day/week/month whether with load or not);
- Can be used on pumping units and as an indicating instrument (indication and alarm are enabled, relay is inhibited);
- Accumulative total run time and total electric energy of A and B. Users can reset it as 0 and re-accumulate the value which make convenience to users to count the total value as their wish;
- Can control engine heater, cooler and fuel pump;
- With maintenance function. Actions (warning, shutdown or trip and stop) can be set when

maintenance time out;

- All parameters use digital adjustment, instead of conventional analog modulation with normal potentiometer, improving reliability and stability;
- Waterproof security level IP55 due to rubber seal installed between the controller enclosure and panel fascia;
- Metal fixing clips enable perfect performance in high temperature environment;
- Modular design, anti-flaming ABS enclosure, pluggable connection terminals and embedded installation way; compact structure with easy mounting.

4 SPECIFICATION

Table 4 Technical Parameters

Items	Contents
Operating Voltage	DC8.0V to DC35.0V, Continuous Power Supply
Power Consumption	<4W (standby ≤2W)
Alternator Input Range 3-Phase 4-Wire 3-Phase 3-Wire Single-Phase 2-Wire 2-Phase 3-Wire	 AC15V - AC360V (ph-N) AC30V - AC620V (ph-ph) AC15V - AC360V (ph-N) AC15V - AC360V (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 at supply output
Fuel Relay Output	16A DC28V at supply output
Programmable Relay Output (1)	7A DC28V at supply output
Programmable Relay Output (2)	7A DC28V at supply output
Programmable Relay Output (3)	7A DC28V at supply output
Programmable Relay Output (4)	7A AC250V voltage free output
Programmable Relay Output (5)	7A AC250V voltage free output
Programmable Relay Output (6)	7A AC250V voltage free output
Case Dimension	266mm x182mm x45mm
Panel Cutout	214mm x160mm
C.T. Secondary	5A rated
Working Temperature	(-25~+70)°C
Working Humidity	(20~93)%RH
Storage Temperature	(-25~+70)°C
Protection Level	IP55 Gasket
Insulating Intensity	Apply AC2.2kV voltage between high voltage terminal and low voltage terminal; The leakage current is not more than 3mA within 1min.
Weight	0.95kg

5 OPERATION

5.1 INDICATOR LIGHT

Fig.1 HGM9610 Front Panel

Fig.2 HGM9620 Front Panel

NOTE: Selected light indicators description:

Table 5 Warning and Alarm Indicator

Alarm Type	Warning Indicator	Alarm Indicator
Warning	Slow flashing	Slow flashing
Trip Alarm	Slow flashing	Slow flashing
Shutdown Alarm	Off	Fast flashing
Trip and Stop Alarm	Off	Fast flashing

Running indicator: illuminated from crank disconnect to ETS while off during other periods.

Gen normal indicator: It is light on when generator is normal; flashing when generator state is abnormal; off when there is no generator power.

Mains normal indicator: It is light on when mains is normal; flashing when mains state is abnormal; off when there is no mains power.

5.2 KEY FUNCTIONS

Table 6 Key Function Description

Icon	Key	Function Description
	Stop	Stop running genset in Auto/Manual mode; Lamp test (press at least 3 seconds); Reset alarm in stop mode; During stopping process, press it again to stop genset immediately.
	Start	Start genset in **Manual** mode.
	Manual Mode	Press it and controller enters **Manual** mode.
	Auto Mode	Press it and controller enters **Auto** mode.
	Mute/Reset Alarm	Alarming sound off; If there is trip alarm, pressing the button at least 3 seconds can reset this alarm.
	Gen Close/Open	Control gen close/open in manual mode. (unavailable for HGM9610)
	Mains Close/Open	Control mains close/open in manual mode. (unavailable for HGM9610)
	Close	Control close breaker in manual mode. (unavailable for HGM9620)
	Open	Control open breaker in manual mode. (unavailable for HGM9620)
	Up/Increase	1) Screen scroll; 2) Up cursor and increase value in setting menu.
	Down/Decrease	1) Screen scroll; 2) Down cursor and decrease value in setting menu.
	Left	1) Page scroll; 2) Left move cursor in setting menu.
	Right	1) Page scroll; 2) Right move cursor in setting menu.
	Set/Confirm	1) Select viewing area; 2) Press it over 3s can enter parameter setting; 3) Confirm setting information.
	Exit	1) Return to main menu; 2) Return to previous menu in setting menu.

NOTE: In manual mode, pressing  and  simultaneously will force generator to crank. Successful start will not be judged according to crank disconnect conditions, operator will have to crank the starter motor manually;

when operator decides that the engine has fired, he/she should release the button and start output will be deactivated, safety on delay will start.

CAUTION: Default password is 00318, user can change it in case of others change the advanced parameters setting. Please clearly remember the password after changing. If you forget it, please contact SmartGen services and send all information in the controller page of "**ABOUT**" to us.

5.3 LCD DISPLAY

5.3.1 MAIN DISPLAY

Main screen show pages; use  to scroll the pages and  to scroll the screen.

★**Main Screen**, including as below,

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

Bus: voltage, frequency

Engine: speed

Some status.

★**Status**, including as below,

Status of genset, mains, and ATS.

NOTE: HGM9610 has no mains status screen.

★**Engine**, including as below,

Speed, temperature of engine, engine oil pressure, (fuel) level, configure sensor 1, configure sensor 2, battery voltage, charger voltage, accumulated run time, accumulated start times.

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

★**Gen**, including as below,

Phase voltage, Line voltage, frequency, phase sequence.

★**Mains**, including as below,

Phase voltage, Line voltage, frequency, phase sequence.

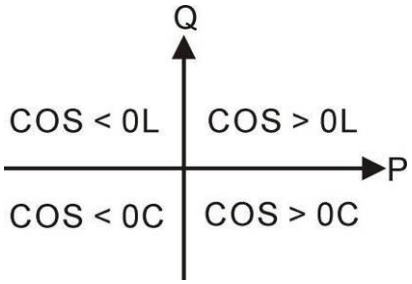
NOTE: HGM9610 has no this page.

★**Load**, including as below,

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), accumulated energy (**kWh, kvarh, kVAh**) and earth current.

NOTE: When only mains switch on indicator lights, count active and inactive power, apparent power, power factor, but accumulate electric energy. Counting the generator active and reactive power, apparent power, power factor, and accumulate electric energy under other conditions.

NOTE: Power factor shows as following,



Remark:
P stands for active power
Q stands for reactive power

Table 7 Power Factor Description

Power factor	Conditions	Active power	Reactive power	Remark
COS>0L	P>0,Q>0	Input	Input	Load is inductive resistance.
COS>0C	P>0,Q<0	Input	Output	Load is capacitance resistance.
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.

NOTE:

1. Input active power, generator or mains supplies electricity to load.
2. Output active power, load supplies electricity 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.

★Alarm:

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

◙ **Event log**

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

Others, including,

Time and date, count down time for maintenance (if it is enable), input/output ports status, NET status and SD status.

◙ **About,** including,

Issue time of software and hardware version, product PD number.

5.3.2 USER MENU AND PARAMETERS SETTING

Press and hold Enter for more than 3 seconds to enter user menu;

★Parameter

After entering the correct password (factory default password is 00318) you can enter parameter

settings screen.

★Language

Selectable Chinese, English and others (default: Espanol)

★Commissioning

On load, off load or custom commissioning can be chosen. Custom commissioning can configure on load or not during commissioning, when to commissioning and select the mode after commissioning (manual mode, auto mode and stop mode).

★Clear users' accumulation

Can clear total run time A and B, total electric energy A and B.

Parameter setting Including as following,

★Mains settings

★Timer settings

★Engine settings

★Generator settings

★Load settings

★Switch settings

★Analog sensor settings

★Input port settings

★output port settings

★Module settings

★Scheduling and maintenance settings

★GSM settings

Example,

Return Mains Timers >>> Engine Generator Load Switch Temp. Sensor OP Sensor Level Sensor Config. Sensor 1 Config. Sensor 2	> Start Delay > Return Delay > Preheat Delay > Cranking Time > Crank Rest Time > Safety On Time > Start Idle Time > Warming Up Time > Cooling Time > Stop Idle Time > ETS Hold Time > Wait Stop Time	Form 1: Use  to scroll settings,  to enter settings (form 2),  to exit settings menu.

Return Mains **Timers >** Engine Generator Load Switch Temp. Sensor OP Sensor Level Sensor Config. Sensor 1 Config. Sensor 2	> Start Delay > Return Delay > Preheat Delay > Cranking Time > Crank Rest Time > Safety On Time > Start Idle Time > Warming Up Time > Cooling Time > Stop Idle Time > ETS Hold Time > Wait Stop Time	Form 2: Use ▲▼ to scroll settings, Enter to enter settings (form 3), Esc to return to previous menu. (form 1).

Return Mains **Timers >** Engine Generator Load Switch Temp. Sensor OP Sensor Level Sensor Config. Sensor 1 Config. Sensor 2	> Start Delay > Return Delay > Preheat Delay > Cranking Time > Crank Rest Time > Safety On Time > Start Idle Time > Warming Up Time > Cooling Time > Stop Idle Time > ETS Hold Time > Wait Stop Time	Form 3: Use ▲▼ to scroll settings, Enter to enter settings (form 4), Esc to return to previous menu. (form 1).

> Start Delay > Return Delay > Preheat Delay **> Cranking Time** > Crank Rest Time > Safety On Time > Start Idle Time > Warming Up Time > Cooling Time > Stop Idle Time > ETS Hold Time > Wait Stop Time	**00008**	Form 4: Press Enter to enter settings (form 5), Esc to return to previous menu. (form 6).

> Start Delay > Return Delay > Preheat Delay > Cranking Time > Crank Rest Time > Safety On Time > Start Idle Time > Warming Up Time > Cooling Time > Stop Idle Time > ETS Hold Time > Wait Stop Time	00008	Form 5: Press ◄ ► to change cursor position, ▲ ▼ are used for changing cursor value, Enter Confirm setting (form 4), Esc exit setting (form 4).

> Start Delay > Return Delay > Preheat Delay > Cranking Time > Crank Rest Time > Safety On Time > Start Idle Time > Warming Up Time > Cooling Time > Stop Idle Time > ETS Hold Time > Wait For Stop	00008	Form 6: ▲ ▼ are used for changing the setting contents. Enter Confirm setting (form 4), Esc to return to previous menu. (form 1).

NOTE: Pressing Stop can exit setting directly during configuration.

5.4 AUTO START/STOP OPERATION

Press Auto, its indicator lights, and controller enters **Auto** mode.

Starting Sequence,

1. **HGM9620**: When mains power is abnormal (over and under voltage, over and under frequency, loss of phase, phase sequence wrong), it enters mains “abnormal delay” and LCD display count down time. When mains abnormal delay is over, it enters into “start delay”; it also enters this mode when “remote start on load” is active.
2. **HGM9610:** Generator enters “start delay” as soon as “remote start on load” is active.
3. Start Delay timer is shown on Status page of LCD.
4. When start delay is over, preheat relay outputs (if this be configured), “preheat start delay XX s” is shown at the bottom line of 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 “crank rest time” to wait for next crank.

6. If engine crank fails within setting times, the controller sends Fail to Start signal 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 accept load.

Stopping Sequence:

1. **HGM9620:** When mains return normal during gen-set running, it enters mains voltage “normal delay”. When mains normal delay is over, enter “stop delay”; also can be into this mode when “remote start on load” is inactive.
2. **HGM9610:** Generator enters “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.

5.5 MANUAL START/STOP OPERATION

1. MANUAL START: Press 

, controller enters Manual mode and its indicator lights. Press 

to start generator, can automatically detect crank disconnected, 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 (please refer to No.4~9 of Auto start operation for detail procedures).

2. MANUAL STOP: Press 

can stop the running gensets. (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.

5.6 SWITCH CONTROL PROCEDURES

5.6.1 HGM9620 SWITCH CONTROL PROCEDURES

Manual transfer procedures

When controller is in **Manual** mode, the switch control procedures will start through manual transfer.

Users can control the loading transfer of ATS via pressing button to switch on or off.

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

Press generator switch on or off key 

, if generator has taken load, it will open; if off-load, it will close; if mains has taken load, mains will open, and after open delay, generator will close.

Press mains switch on or off key 

, if mains has taken load, it will open; if off-load, it will close; if generator has taken load, generator will open, and after open delay, mains will close.

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

To transfer load from mains to generator need to press mains switch off key 

firstly. After switch off delay, press generator switch on key 

, and generator will close (there is no action when pressing switch on key directly).

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

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 "SELECT Enable"

When transferring load from mains to generator, controller begins to detect "fail to transfer" after open delay and transfer rest. When detecting time out, if switch off failed, the generator will not close, otherwise, generator is closed. Detecting transfer failure while generator switch on. When detecting time out, if switch on failed, it needs to wait for generator to switch on. If transfer failed and warning

"SELECT Enable", there is warning signal whatever switch on or off failure.

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

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

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

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.

5.6.2 HGM9610 SWITCH CONTROL PROCEDURES

Manual control procedures,

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

Users can control switch on or off by pressing key.

Press generator switch on key Open Close, generator will output close signal. Press generator switch off key Open Close, generator will output open signal.

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 "SELECT Enable"

Generator load is transferred into generator off-load, after the delay of switch off, detecting transfer failure while switch off outputs. 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 failed and warning "SELECT Enable", there is warning signal whatever switch on or off failure.

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

Generator load is transferred into generator offload, 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 “SELECT Enable”, there is warning signal that “switch on fail”.

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

Generator off-load is transferred into generator load, close generator outputs.

Generator load is transferred into generator off-load, open generator outputs.

NOTE:

When using ATS of no interposition, switch off detecting should “SELECT Disable”;

When using ATS of having interposition, switch off “SELECT Disable” or “SELECT Enable” both are OK. If choose “SELECT Enable”, switch off output should be configured;

When using AC contactor, switch off “SELECT Enable” is recommended.

6 PROTECTION

6.1 WARNINGS

When controller detects the warning signal, alarm only and not stop genset.

Table 8 Warnings

No.	Warn	Description
1	Over Speed	When controller detects the speed is higher than the set value, it will send warn signal.
2	Under Speed	When controller detects the speed is lower than the set value, it will send warn signal.
3	Loss of Speed Signal	When controller detects the speed is 0 and the action select “Warn”, it will send warn signal.
4	Gen Over Frequency	When controller detects the frequency is higher than the set value, it will send warn signal.
5	Gen Under Frequency	When controller detects the frequency is lower than the set value, it will send warn signal.
6	Gen Over Voltage	When controller detects the voltage is higher than the set value, it will send warn signal.
7	Gen Under Voltage	When controller detects the voltage is lower than the set value, it will send warn signal.
8	Gen Over Current	When controller detects the current is higher than the set value, it will send warn signal.
9	Fail to Stop	When generator not stops after the “stop delay” is over.
10	Charge Alt Fail	When controller detects the charger voltage is lower than the set value, it will send warn signal.
11	Battery Over Voltage	When controller detects the battery voltage is higher than the set value, it will send warn signal.
12	Battery Under Voltage	When controller detects the battery voltage is lower than the set value, it will send warn signal.
13	Maintenance Due	When count down time is 0 and the action select “Warn”, it will send warn signal.
14	Reverse Power	When controller detects the reverse power value (power is negative) is lower than the set value, it will send warn signal.
15	Over Power	When controller detects the reverse power value (power is positive) is higher than the set value, it will send warn signal.
16	ECU Warn	When controller gets the alarm signal from engine via J1939, it will send warn signal.
17	Gen Loss of Phase	When controller detects the generator loss phase, it will send warn signal.
18	Gen Phase Sequence Wrong	When controller detects the reverse phase, it will send warn signal.
19	Switch Fail Warn	When controller detects the switch on and off fail, and the action

No.	Warn	Description
		select enable, it will send warn signal.
20	Temp. Sensor Open	When controller detects the sensor is open circuit, and the action select “warn”, it will send warn signal.
21	High Temp.	When controller detects the temperature is higher than the set value, it will send warn signal.
22	Low Temp.	When controller detects the temperature is lower than the set value, it will send warn signal.
23	Oil Pressure Sensor Open	When controller detects the sensor is open circuit, and the action select “warn”, it will send warn signal.
24	Low Oil Pressure	When controller detects the oil pressure is lower than the set value, it will send warn signal.
25	Level Sensor Open	When controller detects the sensor is open circuit, and the action select “warn”, it will send warn signal.
26	Low Level	When controller detects the oil lever is lower than the set value, it will send warn signal.
27	Flexible Sensor 1 Open	When controller detects the sensor is open circuit, and the action select “warn”, it will send warn signal.
28	Flexible Sensor 1 High	When controller detects the sensor value is higher than the max. set value, it will send warn signal.
29	Flexible Sensor 1 Low	When controller detects the sensor value is lower than the min. set value, it will send warn signal.
30	Flexible Sensor 2 Open	When controller detects the sensor is open circuit, and the action select “warn”, it will send warn signal.
31	Flexible Sensor 2 High	When controller detects the sensor value is higher than the max. set value, it will send warn signal.
32	Flexible Sensor 2 Low	When controller detects the sensor value is lower than the min. set value, it will send warn signal.
33	Digital Input	When digit input port is set as warning and active, controller sends corresponding warning signal.
34	GSM Comm. Fail	When select GSM enable but the controller couldn’t detect GSM model, controller sends corresponding warning signal.
35	Earth Fault	When controller detects earth current is greater than value of setting, and the action “Warning” alarm is set, it will send a “warning” alarm signal.

6.2 SHUTDOWN ALARM

When controller detects shutdown alarm, it will send signal to stop the generator.

Table 9 Shutdown Alarms

No.	Shutdown	Description
1	Emergency Stop	When controller detects emergency stop signal, it will send a stop signal.
2	Over Speed	When controller detects the speed value is higher than the set value, it will send a stop signal.
3	Under Speed	When controller detects the speed value is lower than the set value, it will send a stop signal.
4	Loss of Speed Signal	When controller detects speed value equals to 0, and the action select “Shutdown”, it will send a stop alarm signal
5	Gen Over Frequency	When controller detects the frequency value is higher than the set value, it will send a stop signal.
6	Gen Under Frequency	When controller detects the frequency value is lower than the set value, it will send a stop signal.
7	Gen Over Voltage	When controller detects the voltage value is higher than the set value, it will send a stop signal.
8	Gen Under Voltage	When controller detects the voltage value is lower than the set value, it will send a stop signal.
9	Fail to Start	If genset start fail within setting of start times, controller will send a stop signal.
10	Gen Over Current	When controller detects the current value is higher than the set value, it will send a stop signal.
11	Maintenance Due	When count down time is 0 and the action select “Shutdown”, it will send a stop alarm signal.
12	ECU shutdown	When controller gets stop signal from engine via J1939, it will send a stop signal.
13	ECU Comm. Fail	When controller NOT gets data from engine via J1939, it will send a stop signal.
14	Reverse Power	When controller detects reverse power value (power is negative) is lower than the set value, and the reverse power action select “shutdown”, it will send a stop alarm signal.
15	Over Power	When controller detects reverse power value (power is positive) is higher than the set value, and the reverse power action select “shutdown”, it will send a stop signal.
16	Temp. Sensor Open	When controller detects sensor is open circuit, and the action select “shutdown”, it will send a stop signal.
17	High Temp.	When controller detects temperature is higher than the set value, it will send a stop signal.
18	Oil Pressure Sensor Open	When controller detects sensor is open circuit, and the action select “shutdown”, it will send a stop signal.

No.	Shutdown	Description
19	Low Oil Pressure	When controller detects oil pressure is lower than the set value, it will send a stop signal.
20	Level Sensor Open	When controller detects sensor is open circuit, and the action select “shutdown”, it will send a stop signal.
21	Flexible Sensor 1 Open	When controller detects sensor is open circuit, and the action select “shutdown”, it will send a stop signal.
22	Flexible Sensor 1 High	When controller detects the sensor value is higher than the max. set value, it will send stop signal.
23	Flexible Sensor 1 Low	When controller detects the sensor value is lower than the min. set value, it will send stop signal.
24	Flexible Sensor 2 Open	When controller detects sensor is open circuit, and the action select “shutdown”, it will send a stop signal.
25	Flexible Sensor 2 High	When controller detects the sensor value is higher than the max. set value, it will send stop signal.
26	Flexible Sensor 2 Low	When controller detects the sensor value is lower than the min. set value, it will send stop signal.
27	Digital Input Port	When digital input port is set as shutdown, and the action is active, it will send a shutdown signal.
28	Earth Fault	When controller detects the earth current is higher than the set value, and the action select “shutdown”, it will send stop signal.

6.3 TRIP AND STOP ALARM

When controller detects trip and stop alarm signal, it will shut down generator quickly and stop after high speed cooling.

Table 10 Trip and Stop Alarm

No.	Trip and Stop	Description
1	Over Current	When controller detects the value is higher than the set value, and the action select “trip and stop”, it will send trip and stop signal.
2	Maintenance Due	When count down time is 0 and the action select “trip and stop”, it will send a trip and stop signal.
3	Reverse Power	When controller detects reverse power value (power is negative) is lower than the set value, and the action select “trip and stop”, it will send a trip and stop signal.
4	Over Power	When controller detects the over power value (power is positive) is higher than the set value, and the action select “trip and stop”, it will send a trip and stop signal.
5	Digital Input	When digital input port is set as “trip and stop”, and the action is active, it will send a trip and stop signal.
6	Earth Fault	When controller detects the earth current is higher than the set value, and the action select “trip and stop”, it will send a trip and stop signal.

6.4 TRIP ALARM

When controller detects trip alarm, it will break close generator signal quickly, but genset not stop.

Table 11 Trip Alarm

No.	Trip	Description
1	Over Current	When controller detects the value is higher than the set value, and the action select “trip”, it will send trip signal.
2	Reverse Power	When controller detects reverse power value (power is negative) is lower than the set value, and the action select “trip”, it will send a trip signal.
3	Over Power	When controller detects the over power value (power is positive) is higher than the set value, and the action select “trip”, it will send a trip signal.
4	Digital Input	When digital input port is set as “trip”, and the action is active, it will send a trip signal.
5	Earth Fault	When controller detects the earth current is higher than the set value, and the action select “trip”, it will send a trip signal.

7 WIRINGS CONNECTION

HGM9600 series controller's rear as following:

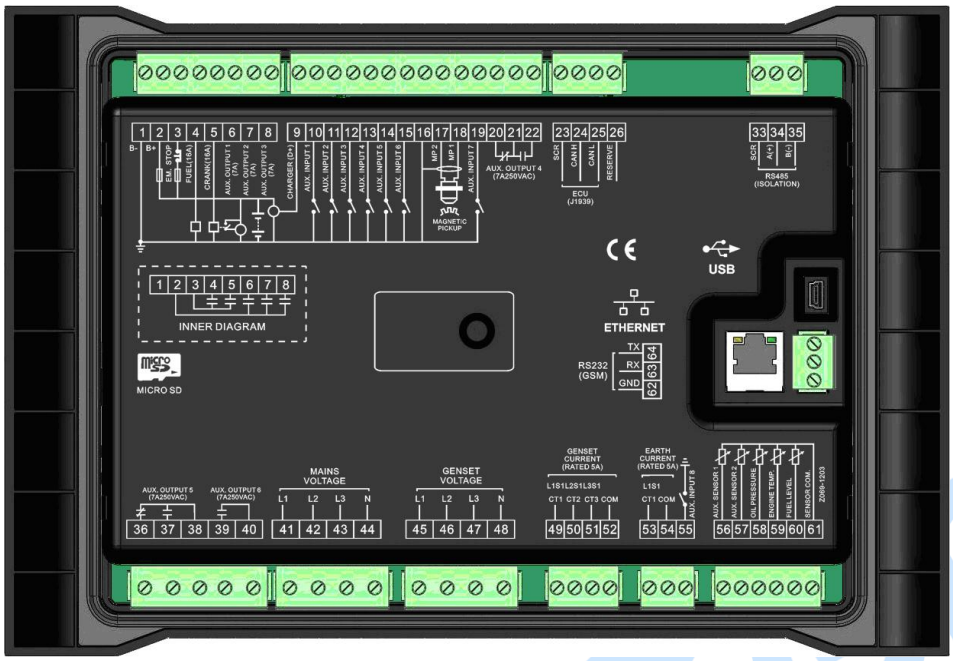


Fig.3 HGM9600 Rear Panel

Table 12 Description of Terminal 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 14
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	
9	Charger(D+)	1.0mm²	Connected with charger starter's D+ (WL) terminals. Being hang up If there is no this terminal	
10	Aux. Input 1	1.0mm²	Ground connected is active (B-)	Details see Table 15
11	Aux. Input 2	1.0mm²	Ground connected is active (B-)	
12	Aux. Input 3	1.0mm²	Ground connected is active (B-)	
13	Aux. Input 4	1.0mm²	Ground connected is active (B-)	
14	Aux. Input 5	1.0mm²	Ground connected is active (B-)	

No.	Function	Cable Size	Remarks	
15	Aux. Input 6	1.0mm²	Ground connected is active (B-)	
16	Magnetic Pickup	0.5mm²	Connected with Speed sensor, shielding line is recommended. (B-) has already connected with speed sensor 2	
17	MP 2			
18	MP 1			
19	Aux. Input 7	1.0mm²	Ground connected is active (B-)	Details see Table 15
20	Aux. Output 4	1.5mm²	Normally close output, rated 7A	Details see Table 14
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	0.5mm²		
25	ECU CAN L	0.5mm²		
26	RESERVE	/	Empty terminal	
33	RS485	/	Impedance-120Ω shielding wire is recommended, its single-end earthed	
34	RS485-	0.5mm²		
35	RS485+	0.5mm²		
36	Aux. Output 5	2.5mm²	Normally close output, rated 7A	Details see Table 14
37		2.5mm²	Normally close output, rated 7A	
38		2.5mm²	Public points of relay	
39	Aux. Output 6	2.5mm²	Normally close output, rated 7A	
40		2.5mm²	Public points of relay	
41	Mains Voltage L1	1.0mm²	Connected to A-phase of mains (2A fuse is recommended) (HGM9610 without)	
42	Mains Voltage L2	1.0mm²	Connected to B-phase of mains (2A fuse is recommended) (HGM9610 without)	
43	Mains Voltage L3	1.0mm²	Connected to C-phase of mains (2A fuse is recommended) (HGM9610 without)	
44	Mains Voltage N	1.0mm²	Connected to N-wire of mains (HGM9610 without)	
45	Genset Voltage L1	1.0mm²	Connected to A-phase of gen-set (2A fuse is recommended)	
46	Genset Voltage L2	1.0mm²	Connected to B-phase of gen-set (2A fuse is recommended)	
47	Genset Voltage L3	1.0mm²	Connected to C-phase of gen-set (2A fuse is recommended)	
48	Genset Voltage N	1.0mm²	Connected to N-wire of gen-set	
49	CT1	1.5mm²	Outside connected to secondary coil of current transformer (rated 5A)	
50	CT2	1.5mm²	Outside connected to secondary coil of current transformer (rated 5A)	
51	CT3	1.5mm²	Outside connected to secondary coil of current transformer (rated 5A)	
52	CT COM	1.5mm²	See following installation instruction	

No.	Function	Cable Size	Remarks	
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 15
56	Aux. Sensor 1	1.0mm²	Connected to temperature, oil pressure or fuel level sensors	Details see Table 16
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	/	Public terminal of sensor, (B-) has already connected	
62	RS232	0.5mm²	Connected to GSM module	
63	RS232 RX	0.5mm²		
64	RS232 TX	0.5mm²		

NOTE: USB ports in controller rear panel are programmable parameter ports, user can directly configure controller via PC.

NOTE: Ethernet ports in controller rear panel are website port, user can directly configure and monitor controller via PC.

NOTE: Please refer to the Module Comparison in this manual for more details.

8 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

8.1 CONTENTS AND SCOPES OF PARAMETERS

Table 13 Parameter Setting 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	Provide standard for checking mains over/under voltage. (It is primary voltage when using voltage transformer; it is line voltage when AC system is 3P3W while it is phase voltage when using other AC system).
3	Rated Frequency	(10.0~75.0)Hz	50.0	Provide standard for checking mains over/under frequency.
4	Normal Time	(0~3600)s	10	The delay from mains abnormal to normal.
5	Abnormal Time	(0~3600)s	5	The delay from mains normal to abnormal.
6	Volt. Trans.(PT)	(0~1)	0	0: Disable; 1: Enable
7	Over Voltage	(0~200)%	120%	Setting value is mains rated voltage's percentage, and return value (default: 116%) and delay value (default: 5s) can be set.
8	Under Voltage	(0~200)%	80%	Setting value is mains rated voltage's percentage, and return value (default: 84%) and delay value (default: 5s) can be set.
9	Over Frequency	(0~200)%	114%	Setting value is mains rated frequency's percentage, return value (default: 110%) and delay value(default: 5s) can be set.
10	Under Frequency	(0~200)%	90%	Setting value is mains rated frequency's percentage, return value (default: 94%) and delay value(default: 5s) can be set.
11	Loss of Phase	(0~1)	1	0: Disable; 1: Enable
12	Reverse Phase	(0~1)	1	
Timer Setting				
1	Start Delay	(0~3600)s	1	Time from mains abnormal or remote start signal is active to start genset.
2	Return Delay	(0~3600)s	1	Time from mains normal or remote start signal is deactivated to genset stop.
3	Preheat Delay	(0~3600)s	0	Time of pre-powering heat plug before starter is powered up.
4	Cranking Time	(3~60)s	8	Time of starter power up.
5	Crank Rest Time	(3~60)s	10	The waiting time before second power up

No.	Items	Parameters	Defaults	Description
				when engine start fail.
6	Safety On Delay	(0~60)s	10	Alarms for low oil pressure, high temperature, under speed, under frequency /voltage, charge fail are inactive.
7	Start Idle Time	(0~3600)s	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	Radiating time before genset stop, after it unloads.
10	Stop Idle Time	(0~3600)s	0	Idle running time when genset stop.
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 time” is set as 0; Time between ending of ETS hold delay and stopped when “ETS Hold output time” is not 0.
13	After Stop Time	(0~3600)s	0	Time between genset stopped and standby
Engine Setting				
1	Engine Type	(0~39)	0	Default: Conventional genset (not J1939) When connected to J1939 engine, choose the corresponding type.
2	Flywheel Teeth	(10~300)	118	Tooth number of the engine, for judging of crank disconnect conditions and inspecting of engine speed. See the installation instructions.
3	Rated Speed	(0~6000)r/min	1500	Offer standard to judge over/ under/loading speed.
4	Speed on Load	(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 loading speed.
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: Warn; 1: Shutdown
7	Over Speed Shutdown	(0~200)%	114%	Setting value is percentage of rated speed and delay value (default: 2s) also can be set.
8	Under Speed Shutdown	(0~200)%	80%	Setting value is percentage of rated speed and delay value (default: 3s) also can be set.

No.	Items	Parameters	Defaults	Description
9	Over Speed Warn	(0~200)%	110%	Setting value is percentage of rated speed and delay value (default: 5s) and return value (default: 108%) also can be set.
10	Under Speed Warn	(0~200)%	86%	Setting value is percentage of rated speed and delay value (default: 5s) and return value (default: 90%) also can be set.
11	Battery Rated Voltage	(0~60.0)V	24.0	Standard for detecting over/under voltage of battery.
12	Battery Over Volts	(0~200)%	120%	Setting value is percentage of rated voltage of battery. Delay value (default: 60s) & return value (default: 115%) also can be set.
13	Battery Under Volts	(0~200)%	85%	Setting value is percentage of rated voltage of battery. Delay value (default: 60s) & return value (default: 90%) also can be set.
14	Charge Alt Fail	(0~60.0)V	8.0	In normal running, when charger D+(WL) voltage under this value, charge failure alarms. Delay value (default: 10s) & return value (default: 10.0V) also can be set.
15	Start Attempts	(1~10) times	3	Max. Crank times of crank attempts. When reach this number, controller will send start failure signal.
16	Crank Disconnect	(0~6)	2	See Table 17. 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.
17	Disconnect Generator Freq.	(0~200)%	24%	When generator frequency higher than the set value, starter will be disconnected. See the installation instruction.
18	Disconnect Engine Speed	(0~200)%	24%	When generator speed higher than the set value, starter will be disconnected. See the installation instruction.
19	Disconnect Oil Pressure	(0~1000)kPa	200	When generator oil pressure 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	(2~32)	4	Numbers of generator pole, used for calculating starter rotate speed when

No.	Items	Parameters	Defaults	Description
				without speed sensor.
3	Rated Voltage	(30~30000)V	230	To offer standards for detecting of generator' over/under voltage and loading voltage. (It is primary voltage when using voltage transformer; it is line voltage when AC system is 3P3W while it is phase voltage when using other AC system).
4	Loading Voltage	(0~200)%	85%	Setting value is percentage of generator rated voltage. Detect when controller ready to loading. If generator voltage under load voltage, won't enter into normally running.
5	Rated Frequency	(10.0~75.0)Hz	50.0	To offer standards for detecting of over/under/load frequency.
6	Loading 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	Volt. Trans.(PT)	(0~1)	0	0: Disable; 1:Enable
8	Over Volt. Shutdown	(0~200)%	120%	Setting value is percentage of generator rated volt. Delay value (default: 3s) also can be set.
9	Under Volt. Shutdown	(0~200)%	80%	
10	Over Freq. Shutdown	(0~200)%	114%	Setting value is percentage of generator rated freq. Delay value (default: 2s) also can be set.
11	Under Freq. Shutdown	(0~200)%	80%	Setting value is percentage of generator rated freq. Delay value (default: 3s) also can be set.
12	Over Volt. Warn	(0~200)%	110%	Setting value is percentage of generator rated volt. Delay value(default: 5s) and return value(default: 108%) also can be set.
13	Under Volt. Warn	(0~200)%	84%	Setting value is percentage of generator rated volt. Delay value (default: 5s) and return value (default: 86%) also can be set.
14	Over Freq. Warn	(0~200)%	110%	Setting value is percentage of generator rated freq. Delay value (default: 5s) and return value (default: 108%) also can be set.
15	Under Freq. Warn	(0~200)%	84%	Setting value is percentage of generator rated freq. Delay value (default: 5s) and return value (default: 86%) also can be set.
16	Loss of Phase	(0~1)	1	0: Disable 1: Enable

No.	Items	Parameters	Defaults	Description
17	Phase Sequence Wrong	(0~1)	1	
Load Setting				
1	Current Trans.	(5~6000)/5	500/5	The ratio of external CT
2	Full Current Rating	(5~6000)A	500	Generator's rated current, standard of load current.
3	Full kW rating	(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 volt. Delay value also can be set.
5	Over Power	(0~1)	0	0: Disable 1: Enable
6	Reverse Power	(0~1)	0	0: Disable 1: Enable
7	Earth Fault	(0~1)	0	0: Disable 1: Enable
Switch 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 Time	(0~20.0)s	5.0	Pulse width of mains/generator switch on. When it is 0, means output constantly.
3	Open Time	(0~20.0)s	3.0	Pulse width of mains/generator switch off.
4	Check Time	(0~20.0)s	5.0	Time of detecting switch auxiliary contacts after transferred.
5	Warn Enable	(0~1)	0	0: Disable 1: Enable
6	Check Enable	(0~1)	0	0: Disable 1: Enable
7	Enable immediate mains Dropout	(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
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	Ethernet	(0-1)	1	0: Disable 1: Enable All the settings about Ethernet (IP address, subnet mask) will active after the next time power on.
7	SD Card	(0-1)	1	0: Disable 1: Enable
GSM Setting				

No.	Items	Parameters	Defaults	Description
1	GSM Enable	(0~1)	0	0: Disable; 1: Enable
2	Phone Number	Max.20 digits	0	0: Disable; 1: Enable Its national and area's cods must be added. e.g. China: 8613666666666. Users can set max. 5 phone numbers.
Scheduling And Maintenance Setting				
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 Sensors Setting				
Temperature Sensor				
1	Curve Type	(0~15)	7	SGX See Table 16.
2	Open Circuit Action	(0~2)	0	0: Warn; 1: Shutdown; 2: No action
3	High Temp. Shutdown	(-50~+300)°C	98	Shutdown when sensor temperature higher than this value. Detecting only after safety delay is over. The delay value (default: 3s) also can be set.
4	High Temp. Warn	(-50~+300)°C	95	Warn when sensor temperature higher than this value. Detecting only after safety delay is over. The delay value (default: 5s) and return value (default: 93) also can be set.
5	Low Temp. Warn	(0~1)	0	0: Disable; 1: Enable
Oil Pressure Sensor				
1	Curve Type	(0~15)	7	SGX. See Table 16.
2	Open Circuit Action	(0~2)	0	0: Warn 1: Shutdown 2: No action
3	Low OP Shutdown	(0~1000)kPa	103	Shutdown when oil pressure lower than this value. Detecting only after safety delay is over. The delay value (default: 3s) also can be set.
4	Low OP Warn	(0~1000)kPa	124	Warn when oil pressure higher than this value. Detecting only after safety delay is over. The delay value (default: 5s) and return value (default: 138) also can be set.
Liquid Level Sensor				
1	Curve Type	(0~15)	4	SGH. See Table 16.
2	Open Circuit Action	(0~2)	0	0: Warn; 1: Shutdown; 2: No action

No.	Items	Parameters	Defaults	Description
3	Low Level Warn	(0~300)%	10	Warn when level lower than this value. It is detecting all the time. The delay value (default: 5s) and return value (default: 15%) also can be set.
Flexible Sensor 1				
1	Flexible Sensor 1 Setting	(0~1)	0	0: Disable 1: Enable; (can be set as temperature/pressure/liquid lever sensor).
Flexible Sensor 2				
1	Flexible Sensor 2 Setting	(0~1)	0	0: Disable; 1: Enable; (can be set as temperature/pressure/liquid lever sensor).
Aux. Input Ports				
Aux. Input Port 1				
1	Contents Setting	(0~50)	28	Remote start (on load). See Table 15.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
Aux. Input Port 2				
1	Contents Setting	(0~50)	26	High temperature shutdown See Table 15.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
Aux. Input Port 3				
1	Contents Setting	(0~50)	27	Low oil pressure shutdown See Table 15.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
Aux. Input Port 4				
1	Contents Setting	(0~50)	0	User defined. See Table 15.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
3	Arming	(0~3)	2	0: From safety on 1: From starting 2: Always 3: Never
4	Active Actions	(0~4)	0	0: Warn; 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.
Aux. Input Port 5				
1	Contents Setting	(0~50)	0	User defined. See Table 15.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
3	Arming	(0~3)	2	0: From safety on 1: From starting 2: Always 3: Never

No.	Items	Parameters	Defaults	Description
4	Active Actions	(0~4)	1	0: Warn; 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.
Aux. Input Port 6				
1	Contents Setting	(0~50)	0	User defined .See Table 15.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
3	Arming	(0~3)	2	0: From safety on 1: From starting 2: Always 3: Never
4	Active Actions	(0~4)	2	0: Warn; 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.
Aux. Input Port 7				
1	Contents Setting	(0~50)	5	Lamp test. See Table 15.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
Aux. Input Port 8				
1	Contents Setting	(0~50)	0	User defined. See Table 15.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
3	Arming	(0~3)	0	0: From safety on 1: From starting 2: Always 3: Never
4	Active Actions	(0~4)	0	0: Warn; 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.
Aux. Output Ports				
Aux. Output Port 1				
1	Contents Setting	(0~239)	1	User defined period output (default output is in preheating). See Table 14.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close
Aux. Output Port 2				
1	Contents Setting	(0~239)	35	Idle control output. See Table 14.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close
Aux. Output Port 3				

No.	Items	Parameters	Defaults	Description
1	Contents Setting	(0~239)	29	Generator closed output. See Table 14.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close
Aux. Output Port 4				
1	Contents Setting	(0~239)	31	Mains closed output. See Table 14.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close
Aux. Output Port 5				
1	Contents Setting	(0~239)	38	ETS solenoid hold. See Table 14.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close
Aux. Output Port 6				
1	Contents Setting	(0~239)	48	Common alarm. See Table 14.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close

NOTE: Overcurrent setting details about definite time delay and inverse definite minimum time are as follows:

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

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

IDMT formula:

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

T: Overcurrent delay (second)

t: Timing multiplier ratio

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

IT: Overcurrent setting value

Example:

t = 36

IA = 550A

IT =500A

Conclusion: T = 3600s (1hour)

8.2 ENABLE DEFINITION OF AUXILIARY OUTPUT PORTS

8.2.1 DEFINED CONTENTS OF AUXILIARY OUTPUT PORTS

Table 14 Defined Contents of Auxiliary Output Ports

No.	Type	Description
0	Not Used	
1	Custom Period 1	Details of function description please see the following.
2	Custom Period 2	
3	Custom Period 3	
4	Custom Period 4	
5	Custom Period 5	
6	Custom Period 6	
7	Custom Combined 1	
8	Custom Combined 2	
9	Custom Combined 3	
10	Custom Combined 4	
11	Custom Combined 5	
12	Custom Combined 6	
13	Reserved	
14	Reserved	
15	Reserved	
16	Reserved	
17	Air Flap	Action when over speed shutdown and emergence stop. It also can close the air inflow to stop the engine as soon as possible.
18	Audible Alarm	Action when warning, shutdown, trips. Can be connected annunciator externally. When “alarm mute” configurable input port is active, it can remove the alarm.
19	Louver Control	Action in genset starting and disconnect when genset stops completely.
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	Action in period of crank to safety run.
24	Excite Generator	Output in start period. If there is no generator frequency during hi-speed running, output for 2 seconds again.
25	Pre-Lubricate	Actions in period of pre-heating to safety run.
26	Remote PC Output	This port is controlled by communication (PC).
27	GSM Power	Power for GSM module (GSM module is reset when GSM communication failed).

No.	Type	Description
28	Reserved	
29	Close Generator	Control generator to take load.
30	Open Breaker	Control generator to off load.
31	Close Mains	Control mains to take 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	Raise Speed	Action in warming up delay.
37	Drop Speed	Action between the period from “stop idle” to “failed to stop”.
38	ETS Control	Used for engines with ETS electromagnet. Close when stop idle is over and open when pre-set “ETS delay” is over.
39	Pulse Drop speed	Active 0.1s when controller enter into 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	Pulse raise speed	Active 0.1s when controller enter into 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 hi-speed cooling.
46	Mains OK	Action when mains normal.
47	Reserved	
48	Common Alarm	Action when genset common warning, common shutdown, common trips alarm.
49	Common Trip and Stop	Action when common trip and stop alarm.
50	Common Shutdown	Action when common shutdown alarm.
51	Common Trip Alarm	Action when common trips alarm.
52	Common Warn Alarm	Action in common warning alarm.
53	Reserved	
54	Battery High Volts	Action when battery’s over voltage warning alarm.
55	Battery Low Volts	Action when battery’s low voltage warning alarm.
56	Charge Alt Fail	Action when charge failure warning alarms.
57	Reserved	
58	Reserved	
59	Reserved	
60	ECU Warn	Indicate ECU sends a warning signal.
61	ECU Shutdown	Indicate ECU sends a shutdown signal.
62	ECU Comm. Fail	Indicate controller not communicates with ECU.

No.	Type	Description
63	Reserved	
64	Reserved	
65	Reserved	
66	Reserved	
67	Reserved	
68	Reserved	
69	Aux. Input 1 Active	Action when input port 1 is active
70	Aux. Input 2 Active	Action when input port 2 is active
71	Aux. Input 3 Active	Action when input port 3 is active
72	Aux. Input 4 Active	Action when input port 4 is active
73	Aux. Input 5 Active	Action when input port 5 is active
74	Aux. Input 6 Active	Action when input port 6 is active
75	Aux. Input 7 Active	Action when input port 7 is active
76	Aux. Input 8 Active	Action when input port 8 is active
77~98	Reserved	
99	Emergency Stop	Action when emergency stop alarm.
100	Failed to Start	Action when failed start alarm.
101	Failed to Stop	Action when failed stop alarm.
102	Under Speed Warn	Action when under speed alarm.
103	Under Speed Shutdown	Action when under speed shuts down.
104	Over Speed Warn	Action when over speed warn.
105	Over Speed Shutdown	Action when over speed shutdown alarm.
106	Reserved	
107	Reserved	
108	Reserved	
109	Gen Over Freq. Warn	Action when generator over frequency warning.
110	Gen Over Freq. Shut	Action when generator over frequency shutdown alarm.
111	Gen Over Volt Warn	Action when generator over voltage warning.
112	Gen Over Volt Shut	Action when generator over voltage shutdown.
113	Gen Under Freq. Warn	Action when generator low frequency warning.
114	Gen Under Freq. Shut	Action when generator low frequency shutdown.
115	Gen Under Volt. Warn	Action when generator low voltage warning.
116	Gen Under Volt. Shut	Action when generator low voltage shutdown.
117	Gen Loss of Phase	Action when generator loss phase.
118	Gen Reverse Phase Seq.	Action when generator reverse phase.
119	Reserved	
120	Over Power	Action when controller detects generator have over power.
121	Reserved	
122	Reverse Power	Action when controller detects generator have reverse power.
123	Over Current	Action when over current.
124	Reserved	
125	Mains Blackout	

No.	Type	Description
126	Mains Over Freq.	
127	Mains Over Volt	
128	Mains Under Freq.	
129	Mains Under Volt	
130	Mains Reverse Phase Seq.	
131	Mains Loss of Phase	
132~138	Reserved	
139	High Temp Warn	Action when hi-temperature warning.
140	Low Temp Warn	Action when low temperature warning.
141	High Temp Shutdown	Action when hi-temperature shutdown alarm.
142	Reserved	
143	Low OP Warn	Action when low oil pressure warning.
144	Low OP Shutdown	Action when low oil pressure shutdown.
145	OP Sensor Open	Action when oil pressure sensor is open circuit.
146	Reserved	
147	Low Fuel Level	Action when controller has low oil level alarm.
148	Reserved	
149	Reserved	
150	Config1 High Warn	
151	Config1 Low Warn	
152	Config1 High Shut	
153	Config1 Low Shut	
154	Config2 High Warn	
155	Config2 Low Warn	
156	Config2 High Shut	
157	Config2 Low Shut	
158~229	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	Reserved	
237	Reserved	
238	Reserved	
239	Reserved	

8.2.2 CUSTOM PERIOD OUTPUT

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

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

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

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

Condition output S2; can 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

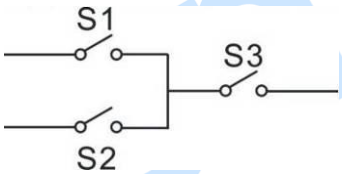
Close when condition output active/inactive: close when active (disconnect when inactive);

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

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

8.2.3 CUSTOM COMBINED OUTPUT

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



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

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

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

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

Example,

Contents of probably condition output S1: input port 1 is active;

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

Contents of probably condition output S2, input port 2 is active;

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

Contents of probably condition output S3: input port 3 is active;

Close when probably 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.

8.3 DEFINED CONTENTS OF AUXILIARY INPUT PORTS (ALL GND (B-) ACTIVE)

Table 15 Defined Contents of Auxiliary Input Ports

No.	Type	Description
0	Users Configured	Including following functions, Indication: indicate only, not warning or shutdown. Warning: warn only, not shutdown. Shutdown: alarm and shutdown immediately Trip and stop: alarm, generator unloads and shutdown after hi-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 alarm and trip alarm when input is active.
4	60Hz Active	Use for CANBUS engine and it is 60Hz when input is active.
5	Lamp Test	All LED indicators are illuminating when input is active.
6	Panel Lock	All buttons in panel is inactive except  and there is 🔒 in the right of first row in LCD when input is active.
7	Reserved	
8	Low Speed Mode	Under voltage/frequency/speed protection is inactive.
9	Inhibit Auto Stop	In **Auto** mode, during generator normal running, when input is active, inhibit generator shutdown automatically.
10	Inhibit Auto Start	In **Auto** mode, inhibit generator start automatically when input is active.
11	Inhibit Scheduled Start	In **Auto** mode, inhibit scheduled run genset when input is active.
12	Reserved	
13	Aux Gen Closed	Connect generator loading switch’s Aux. Point.
14	Inhibit Gen Load	Prohibit genset switch on when input is active.
15	Aux Mains Closed	Connect mains loading switch’s Aux. Point.
16	Inhibit Mains Load	Prohibit mains switch on when input is active.
17	Auto Mode Lock	When input is active, controller enters into Auto mode; all the

No.	Type	Description
		keys except  are inactive.
18	Auto Mode Invalid	When input is active, controller won't work under Auto mode.  key and simulate auto key input does not work.
19	Reserved	
20	Reserved	
21	Inhibit Alarm Stop	All shutdown alarms are prohibited except emergence stop.(Means battle mode)
22	Aux Instrument Mode	All outputs are prohibited in this mode.
23	Reserved	
24	Reset Maintenance	Controller will set maintenance time and date as default when input is active.
25	Reserved	
26	Aux. High Temp	Connected sensor digital input.
27	Aux. Low OP	Connected sensor digital input.
28	Remote Start (On Load)	In **Auto** mode, when input active, genset can be started automatically and take load after genset normal running; when input inactive, genset will stop automatically.
29	Remote Start (Off Load)	In **Auto** mode, when input is active, genset can be started automatically and NOT take load after genset normal running; when input is inactive, genset will stop automatically.
30	Aux. Manual Start	In **Manual** mode, when input active, genset will start automatically; when input 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 G-Load key	This is simulate G-close key when HGM9610 controller is applied.
39	Simulate M-Load key	This is simulate M-open key when HGM9610 controller is applied.
40	Reserved	
41	Reserved	
42	Reserved	
43	Reserved	

No.	Type	Description
44	Reserved	
45	Aux Mains OK	In **Auto** mode, mains are normal when input is active.
46	Aux Mains Fail	In **Auto** mode, mains are abnormal when input is active.
47	Alternative Config1	Users can set different parameters to make it easy to select current configuration via input port.
48	Alternative Config2	
49	Alternative Config3	
50	Reserved	

8.4 SELECTION OF SENSORS

Table 16 Sensors Selection

No.	Sensor	Description	Remark
1	Temperature Sensor	0 Not used 1 Custom Res Curve 2 Custom 4-20mA curve 3 VDO 4 CURTIS 5 VOLVO-EC 6 DATCON 7 SGX 8 SGD 9 SGH 10 PT100 11~15 Reserved	Defined resistance's range is 0~6KΩ, default is SGX sensor.
2	Pressure Sensor	0 Not used 1 Custom Res Curve 2 Custom 4-20mA curve 3 VDO 10Bar 4 CURTIS 5 VOLVO-EC 6 DATCON 10Bar 7 SGX 8 SGD 9 SGH 10~15 Reserved	Defined resistance's range is 0~6KΩ, default is SGX sensor.
3	Fuel Level Sensor	0 Not used 1 Custom Res Curve 2 Custom 4-20mA curve 3 SGD 4 SGH 5~15 Reserved	Defined resistance's range is 0~6KΩ, default is SGH sensor.

NOTE: User should make special declare when order controller if your genset equip with sensor of 4~20mA.

8.5 CONDITIONS OF CRANK DISCONNECT SELECTION

Table 17 Crank Disconnect Condition 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.

9 PARAMETERS SETTING

In **HGM9610** 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: Maximum set value must over minimum set value in case that the condition of too high as well as too low will happen.

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

NOTE: 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 disconnect.

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

10 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 resistor type), its sensor curve is SGX (120°C resistor type); if select the SGD (120°C resistor 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 (resistor) 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,

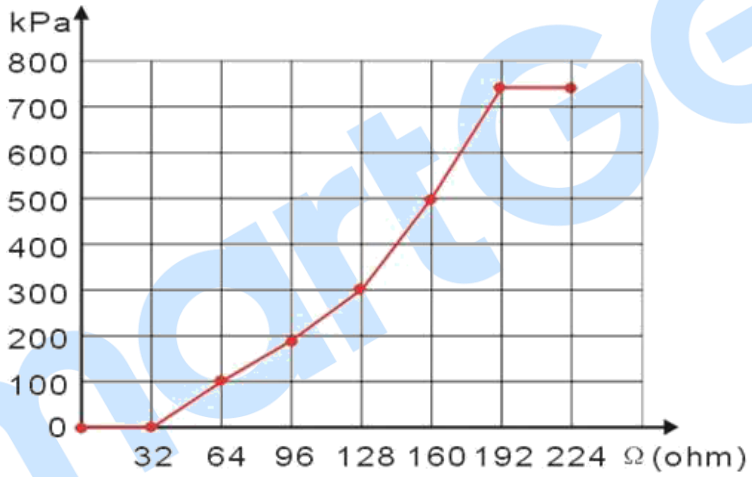


Fig.4 Sensor Curve

Table 18 Normal Pressure Unit Conversion

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

11 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, the controller's positive and negative connected to start battery are correct.
3. Emergence stop must be connected with positive of start 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 start battery power on; choose manual mode and controller will executive 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 "standby" mode until there is abnormal of mains.
8. When mains power 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.

12 TYPICAL APPLICATION

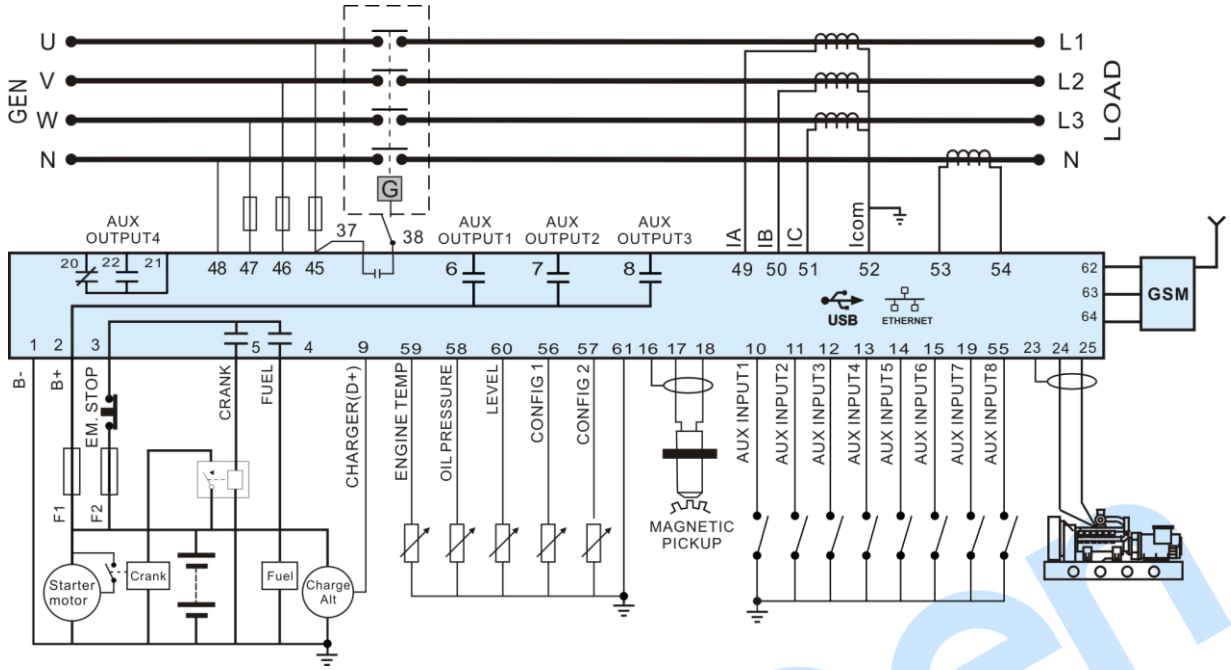


Fig.5 HGM9610 Typical Application Diagram

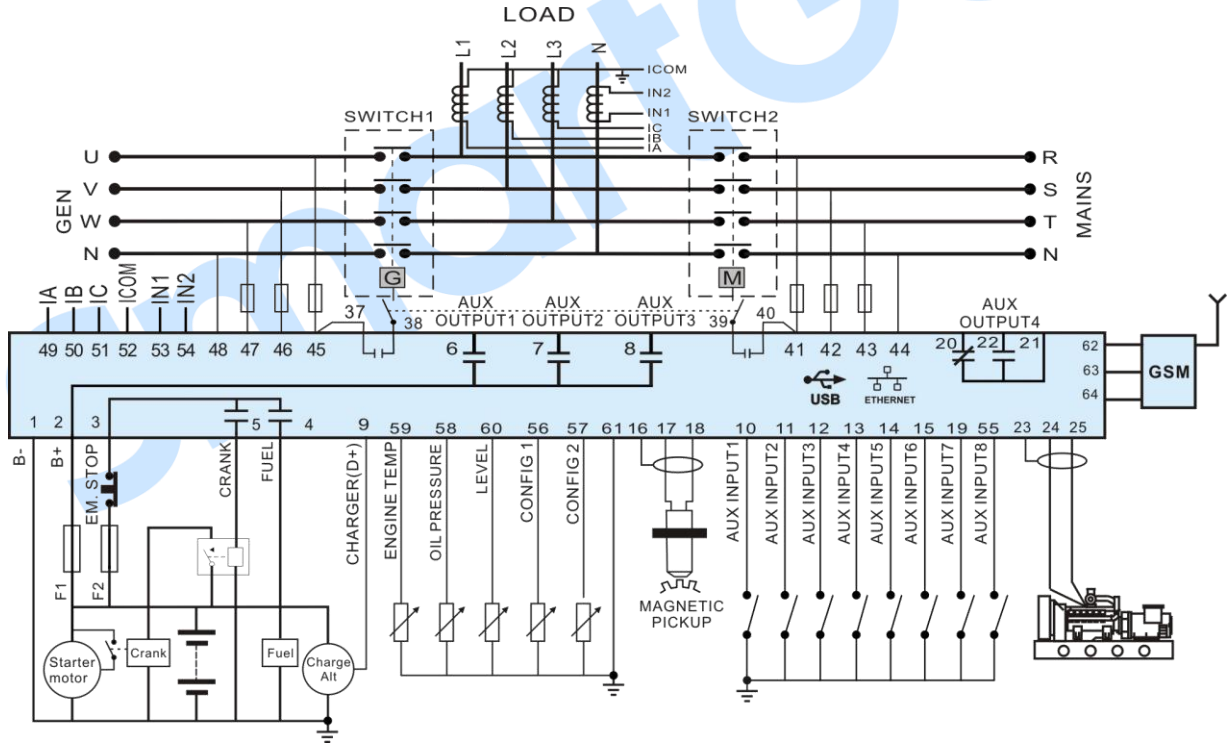


Fig.6 HGM9620 Typical Application Diagram

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

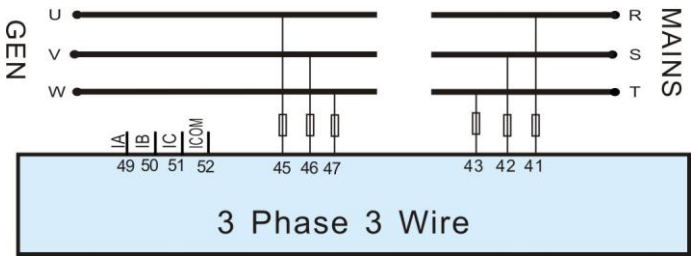


Fig.7 3 Phase 3 Wire Application Diagram

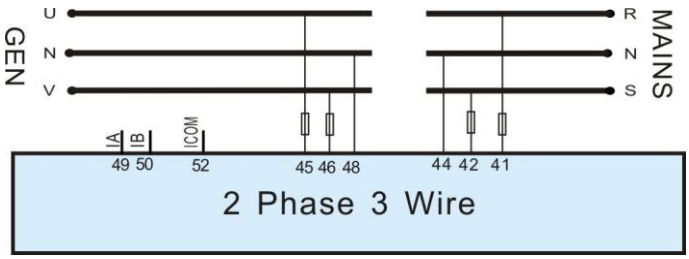


Fig.8 2 Phase 3 Wire Application Diagram

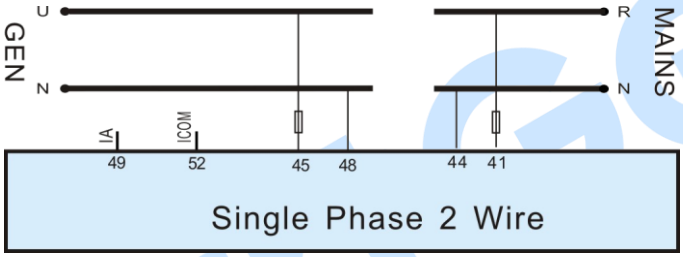


Fig.9 Single Phase 2 Wire Application Diagram

13 INSTALLATION

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,

Unit: mm

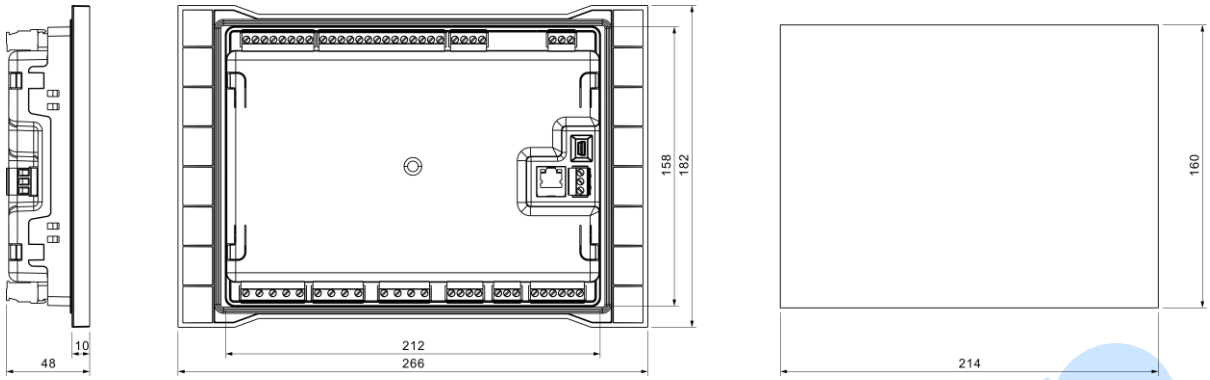


Fig.10 Overall Dimension and Cutout

1) Battery Voltage Input

NOTE: HGM9600 series controller can suit for widely range of battery voltage DC(8~35)V. Negative of battery must be connected with the engine shell. The diameter of wire which from power supply to battery must be over 2.5mm^2. If floating charge 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 charge disturbing the controller's normal working.

2) Speed Sensor Input

NOTE: 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 AC(1~24)V (effective value) during the full speed. AC12V 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.

3) Output and Expand 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.

4) 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 prohibit open circuit.

5) Withstand Voltage Test

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

14 GSM SHORT MESSAGE ALARM AND REMOTE CONTROL

14.1 GSM SHORT MESSAGE ALARM

When controller detects alarm, it will send short message to phone automatically.

NOTE: All alarms about shutdown, trip and stop and trip will be sent to the pre-set phone. Warnings are sent to the phone according to the pre-set.

14.2 GSM SHORT MESSAGE REMOTE CONTROL

Users send order message to GSM module, then controller will make actions according to this SMS order and pass back corresponding operations information. Controllers only execute the orders by pre-set. Detail orders as following:

Table 19 SMS Orders

No.	SMS Orders	Pass Back Information	Description	
1	SMS GENSET	GENSET ALARM	When genset is stopping alarm	Obtain status of genset
		SYSTEM IN STOP MODE GENSET AT REST	At rest status in stop mode	
		SYSTEM IN MANUAL MODE GENSET AT REST	At rest status in manual mode	
		SYSTEM IN AUTO MODE GENSET AT REST	At rest status in auto mode	
		SYSTEM IN STOP MODE GENSET IS RUNNING	Running status in stop mode	
		SYSTEM IN MANUAL MODE GENSET IS RUNNING	Running status in manual mode	
		SYSTEM IN AUTO MODE GENSET AT RUNNING	Running status in stop mode	
2	SMS START	GENSET ALARM	Generator is shutdown alarm or trip alarm	Start genset
		STOP MODE NOT START	Cannot start in stop mode	
		SMS START OK	Start in manual mode	
		AUTO MODE NOT START	Cannot start in auto mode	
3	SMS STOP MODE	SMS STOP OK	Set as stop mode	
4	SMS MANUAL MODE	SMS MANUAL MODE OK	Set as manual mode	
5	SMS AUTO MODE	SMS AUTO MODE OK	Set as auto mode	
6	SMS DETAIL	Pass back information can be set via PC software.	Gets details information of genset.	

NOTE: When sending orders, users need to follow SMS orders in above form and all the letters must be capital.

NOTE: Pass back information from SMS DETAIL including: working mode, mains voltage, generator voltage, load current, mains frequency, generator frequency, active power, apparent power, power factor, battery voltage, D+ voltage, water temperature, oil pressure, oil level, engine speed, total running time, genset status, and alarm status.

NOTE: Its national and area's cods must be added. e.g. China: 8613666666666.

14.3 CONTROLLER AND GSM MODULE CONNECTION

The diagram below illustrates the application of SmartGen GSM-3 module (international version).

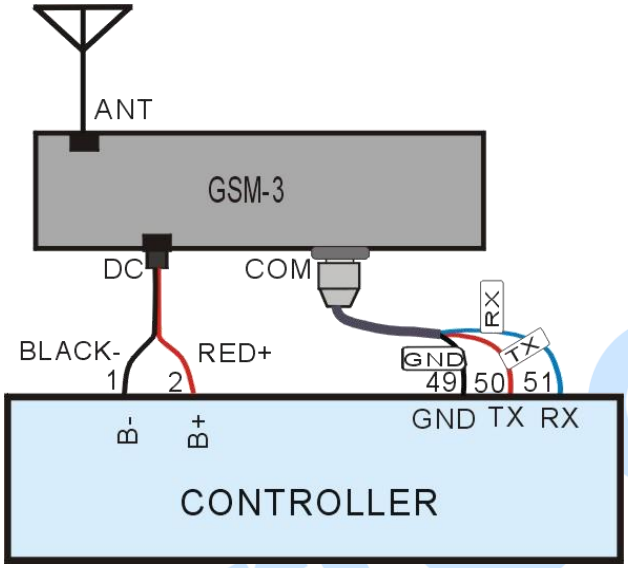


Fig.11 Controller and GSM Module Connection

15 CONNECTIONS OF CONTROLLER WITH J1939 ENGINE

15.1 CUMMINS ISB/ISBE

Table 20 Connector B

Terminals of controller	Connector B	Remark
Fuel relay output	39	
Start 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 21 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	Using impedance 120Ω connecting line.
CAN(L)	SAE J1939 return	Using impedance 120Ω connecting line.

Engine type: Cummins ISB.

15.2 CUMMINS QSL9

Suitable for CM850 engine control module.

Table 22 50-pin Connector

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

Table 23 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.

15.3 CUMMINS QSM11(IMPORT)

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

Table 24 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.
Start relay output	-	Connect to starter coil directly.

Table 25 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.

15.4 CUMMINS QSX15-CM570

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

Table 26 50-pin Connector

Terminals of controller	50 pins connector	Remark
Fuel relay output	38	Oil spout switch.
Start relay output	-	Connect to starter coil directly.

Table 27 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.

15.5 CUMMINS GCS-MODBUS

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

Table 28 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.
Start relay output	-	Connect to starter coil directly.

Table 29 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.

15.6 CUMMINS QSM11

Table 30 Engine OEM Connector

Terminals of controller	OEM connector of engine	Remark
Fuel relay output	38	
Start 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.

15.7 CUMMINS QSZ13

Table 31 Engine OEM Connector

Terminals of controller	OEM connector of engine	Remark
Fuel relay output	45	
Start relay output	-	Connect to starter coil directly
Auxiliary output 1	16&41	Setting to idle speed control, normally open 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.

15.8 DETROIT DIESEL DDEC III / IV

Table 32 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.	
Start 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.

15.9 DEUTZ EMR2

Table 33 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.	
Start 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	Using impedance 120Ω connecting line.
CAN(L)	13	Using impedance 120Ω connecting line.

Engine type: VolvoEDC4.

15.10 JOHN DEERE

Table 34 21-pin Connector

Terminals of controller	21 pins connector	Remark
Fuel relay output	G, J	
Start 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.

15.11 MTU MDEC

Suitable for MTU engines, 2000 series, 4000 series.

Table 35 X1 Connector

Terminals of controller	X1 connector	Remark
Fuel relay output	BE1	
Start 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.

15.12 MTU ADEC (SMART MODULE)

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

Table 36 ADEC (X1 Port)

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

Table 37 SMART (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.

15.13 MTU ADEC (SAM MODULE)

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

Table 38 ADEC (X1 Port)

Terminals of controller	ADEC (X1port)	Remark
Fuel relay output	X1 43	X1 Terminal 28 Connected to negative of battery.
Start relay output	X1 37	X1 Terminal 22 Connected to negative of battery.

Table 39 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.

15.14 PERKINS

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

Table 40 Connector

Terminals of controller	Connector	Remark
Fuel relay output	1, 10, 15, 33, 34	
Start 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.

15.15 SCANIA

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

Table 41 B1 Connector

Terminals of controller	B1 connector	Remark
Fuel relay output	3	
Start 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.

15.16 VOLVO EDC3

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

Table 42 "Stand alone" Connector

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

Table 43 "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.

15.17 VOLVO EDC4

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

Table 44 Connector

Terminals of controller	Connector	Remark
Fuel relay output	Expanded 30A relay, and relay offers battery voltage for terminal14. Fuse is 16A.	
Start 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.

15.18 VOLVO-EMS2

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

Table 45 Engine CAN Port

Terminals of controller	Engine's CAN port	Remark
Auxiliary output 1	6	ECU stop; Set 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.

15.19 YUCHAI

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

Table 46 Engine 42-pin Port

Terminals of controller	Engine 42 pins port	Remark
Fuel relay output	1.40	Connect to engine ignition lock.
Start 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 47 Engine 2-pin Port

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

Engine type: BOSCH.

15.20 WEICHAI

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

Table 48 Engine Port

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

Engine type: GTSC1.

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

16 ETHERNET PORT

16.1 ILLUSTRATION

ETHERNET port, used for controller monitoring, has two connection modes: network client mode and web server mode.

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

16.2 NETWORK CLIENT 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 sub network of the controller. The IP address must in the same network segment as the IP address of 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, sub network mask 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: In this connection mode controller parameters can be set. SmartGen provides testing software for this connection mode. Communication protocol can be obtained from the SmartGen service.

16.3 WEB SERVER MODE

If the controller acts as a web server, it can be controlled via web browser using PC.

The procedure is the following:

1. Set IP address and subnet mask of the controller. The IP address must be in the same network segment as the IP address of monitoring equipment (such as PC), e.g.: if monitoring equipment IP address is 192.168.0.16, controller IP can be 192.168.0.18, sub network mask 255.255.255.0
2. Connect the controller. It can be connected to the monitoring equipment directly using network cable or via switchboard.
3. In order to monitor the controller, input its IP address in web browser (such as IE) address bar. E.g.: http://192.168.0.18.

NOTE: in this connection mode, controller parameters cannot be altered.

Browser screen capture:

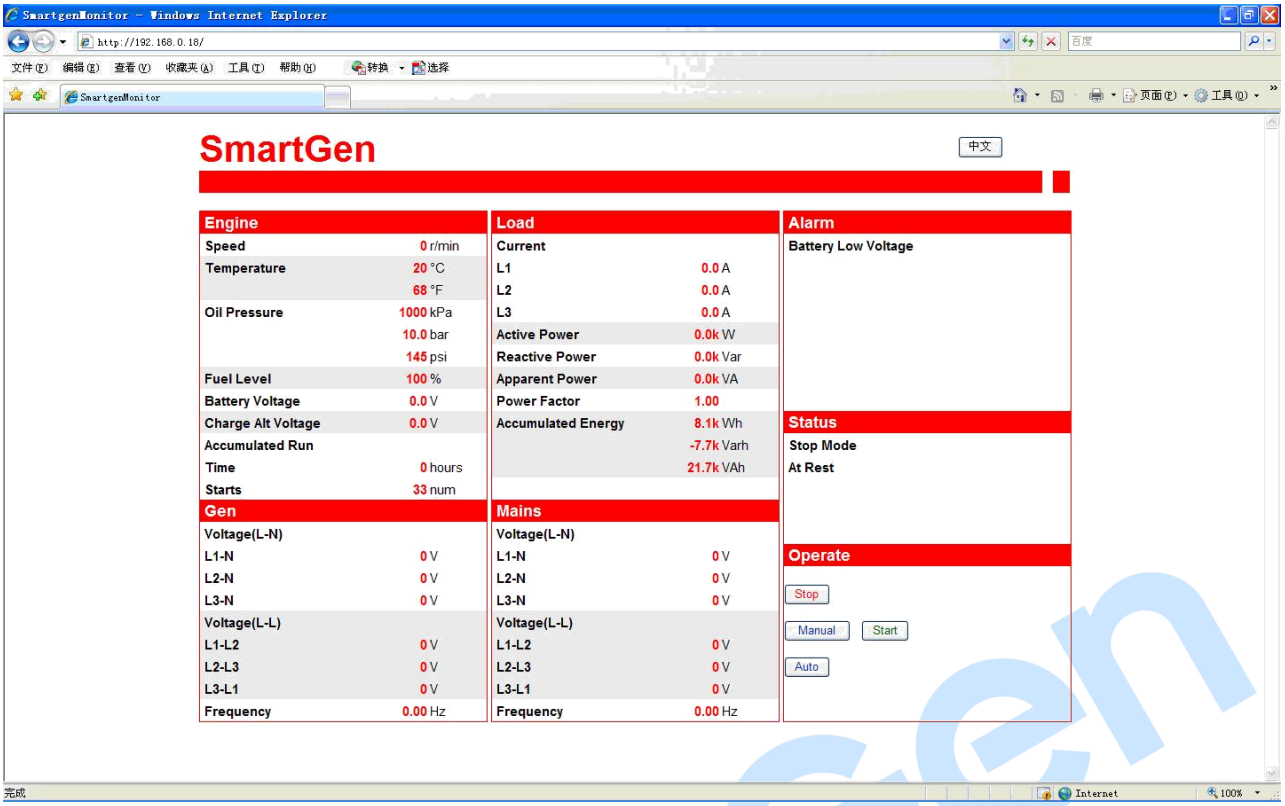


Fig.12 WEB Server Mode

16.4 NETWORK CABLE CONNECTION

1. Controller network port description

Table 49 Controller Network Port Description

No.	Name	Description
1	TX+	Tranceive Data+
2	TX-	Tranceive 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

2. Controller and PC are connected directly using a network cable:

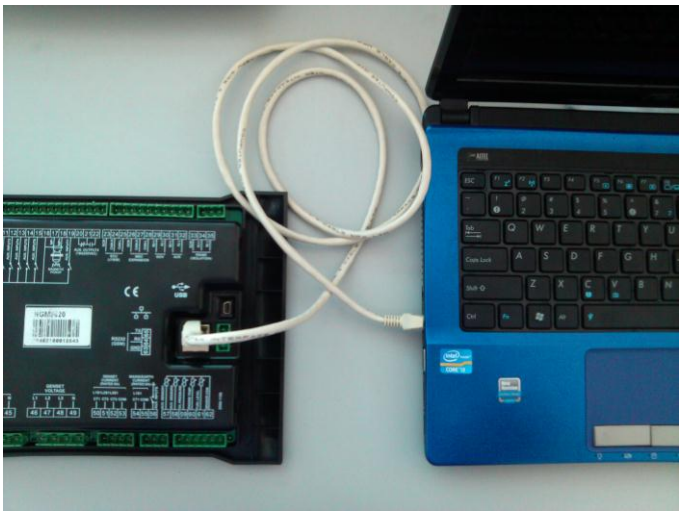


Fig.13 Network Cable Connection

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.

3. 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.

17 MICRO SD

HGM9600 series controller supports Micro SD card, the controller can regularly save gen-set operation data (engine speed, temperature, oil pressure, generator voltage, generator frequency, load current, load power, alarm information etc.) to Micro SD card. For user convenience, the controller creates a date named file (e.g. 20120605.dat) every day, where it records operating data of that day; it creates a year and month named folder (e.g. 201206) every month, where all files of the month are saved. Data can be then analysed with the help of SDTool software provided by SmartGen.

NOTE: At present the controller supports ≤8GB Micro SD card.

Micro SD card installation direction:

Fig.15 Micro SD Card Installation Direction

18 USB

Users can set the controller's parameters and monitor the controller's status via the test software provided by SmartGen. The connection way between PC and controller as following:

Fig.16 Connection Way

19 FAULT FINDING

Table 50 Fault Finding

Symptoms	Possible Solutions
Controller no response with power	Check starting batteries; Check controller connection wirings; Check DC fuse.
Genset shutdown	Check the water/cylinder temperature is too high or not; Check the genset voltage; Check DC fuse.
Controller emergency stop	Check emergence stop button is correct or not; Check whether the starting battery positive is connected with the emergency stop input; Check whether the circuit is open.
Low oil pressure alarm after crank disconnect	Check the oil pressure sensor and its connections.
High water temp. alarm after crank disconnect	Check the temperature sensor and its connections.
Shutdown alarm in running	Check related switch and its connections according to the information on LCD; Check programmable inputs.
Crank not disconnect	Check fuel oil circuit and its connections; Check starting batteries; Check speed sensor and its connections; Refer to engine manual.
Starter no response	Check starter connections; Check starting batteries.
Genset running while ATS not transfer	Check ATS; Check the connections between ATS and controllers.
RS485 communication abnormal	Check connections; Check setting of COM port is correct or not; Check RS485's connections of A and B is reversely connected or not; Check RS485 transfer model whether damage or not; Check communication port of PC whether damage.
ECU communication failed	Check connections of CAN high and low polarity; Check if correctly connected of 120Ω resister; Check if type of engine correct; Check if connections from controller to engine and setting of outputs 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.