Smartgen®

HGM7211/HGM7221 GENSET CONTROLLER

USER MANUAL

Smartgen Technology

众智电子 **Chinese trademark**

Smartgen® **English trademark**

Smartgen — make your generator ***smart***

Smartgen Technology Co., Ltd.
No. 28 Jinsuo Road
Zhengzhou city
Henan Province
P. R. China
Tel: +86-371-67988888/67981888
+86-371-67991553/67992951
+86-371-67981000(overseas)
Fax: 0086-371-67992952
Web: http://www.smartgen.com.cn
http://www.smartgen.cn
Email: sales@smartgen.cn

Version history

Date	Version	Contents
2013-12-12	1.0	Original release

This manual is suitable for HGM7211 and HGM7221 series controller only.

Clarification of notation used within this publication.

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

Clarification of notation displayed on the LCD

SIGN	INSTRUCTION
	Home page
	Engine
	Generator
	Mains
	Load
	Alarm
	Event log
	Battery voltage
	Engine temperature
	Engine pressure
	Keyboard is locked.
	No signal
	Very weak signal
	Weak signal
	Strong signal

CONTENTS

1 OVERVIEW

HGM7211/7221 series genset controllers are used for genset automation and monitor control system of single unit to achieve automatic start/stop, data measurement, alarm protection as well as remote control, remote measurement and remote communication function. It fit with TFT display, optional Chinese, English and other languages interface, and it is reliable and easy to use.

The powerful 32-bit Microprocessor contained within the module allows for precision parameters measuring, fixed value adjustment, time setting and set value adjusting and etc..Majority parameters can be configured from front panel, and all parameters can be configured by USB interface (or RS485) to adjust via PC. It can be widely used in all types of automatic gen-set control system with compact structure, advanced circuits, simple connections and high reliability.

2 MODULES COMPARISON

	HGM7221	HGM7211
Digital Input Port	7	7
Relay Output Port ①	8	8
Sensor Number ②	5	5
AMF	●	
RS485	●	●
GSM	●	●
CAN (J1939)	●	●
USB	●	●
Real-time clock	●	●
Event log	●	●

NOTE:

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

②Analog sensors are composed by 3 fixed sensors (temperature, pressure, level) and 2 configurable sensors.

3 PERFORMANCE AND CHARACTERISTICS

HGM7211, Auto Start Module, controls genset to start or stop automatically by remote start signal. HGM7221, Auto Main Failure, updates based on HGM7211, especially for automatic system composed by generator and mains.

Main characteristics,

- With ARM-based 32-bit SCM, high integration of hardware and more reliable;
- 480x272 TFT 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 TFT LCD wear-resistance and scratch resistance due to hard screen acrylic;
- Silicon panel and pushbuttons for better operation in high/low temperature environment;
- RS485 communication port enable remote control, remote measuring, remote communication via ModBus protocol.
- Equipped with SMS (Short Message Service) function. When genset is alarming, controller can send short messages via SMS automatically to max. 5 telephone numbers. besides, generator status can be controlled and checked using SMS;
- Fitted with CANBUS port and can communicate with J1939 genset. Not only can you monitoring frequently-used data (such as water temperature, oil pressure, engine speed, fuel consumption and so on) of ECU machine, but also control start, stop, raising speed and speed droop via CANBUS port.
- Suitable for 3-phase 4-wire, 3-phase 3-wire, single phase 2-wire, and 2-phase 3-wire systems with voltage 120/240V and frequency 50/60Hz;
- Collects and shows 3-phase voltage, current, power parameter and frequency of generator/mains.

  Parameters:

Mains	Gens
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 gens 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 liquid level);
- 2 configurable sensors can be set as sensor of temperature or fuel level;
- Precision measure and display parameters about Engine,

Temp. (WT)	°C/°F both be display
Oil pressure (OP)	kPa/Psi/Bar all be displayed
Fuel level (FL)	% (unit)
Speed (SPD)	RPM (unit)
Battery Voltage (VB)	V (unit)
Charger Voltage (VD)	V (unit)

Hour count (HC) can accumulate Max. 65535 hours.

Start times can accumulate 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 using front panel of the controller and all of them can be modified using PC via USB or RS485 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 to different starting battery voltage environment;
- Event log and real-time clock.
- Scheduled start & stop generator (can be set as start genset once a day/week/month whether with load or not; also can be set as customer weekly in which users can set the start time separately from Monday to Sunday);

- Selectivity configuration. Users can choose different configuration by input port.
- Can be used on pumping units and as an indicating instrument (indicate and alarm are enable only, relay is inhibited);
- With maintenance function. Actions (warning, shutdown or trip and stop) can be set when maintenance time out;
- All parameters used digital adjustment, instead of conventional analog modulation with normal potentiometer, more reliability and stability;
- Waterproof security level IP55 due to rubber seal installed between the controller enclosure and panel fascia;
- Metal fixing clips enable perfect in high temperature environment;
- Modular design, self extinguishing ABS plastic enclosure, pluggable connection terminals and embedded installation way; compact structure with easy mounting.

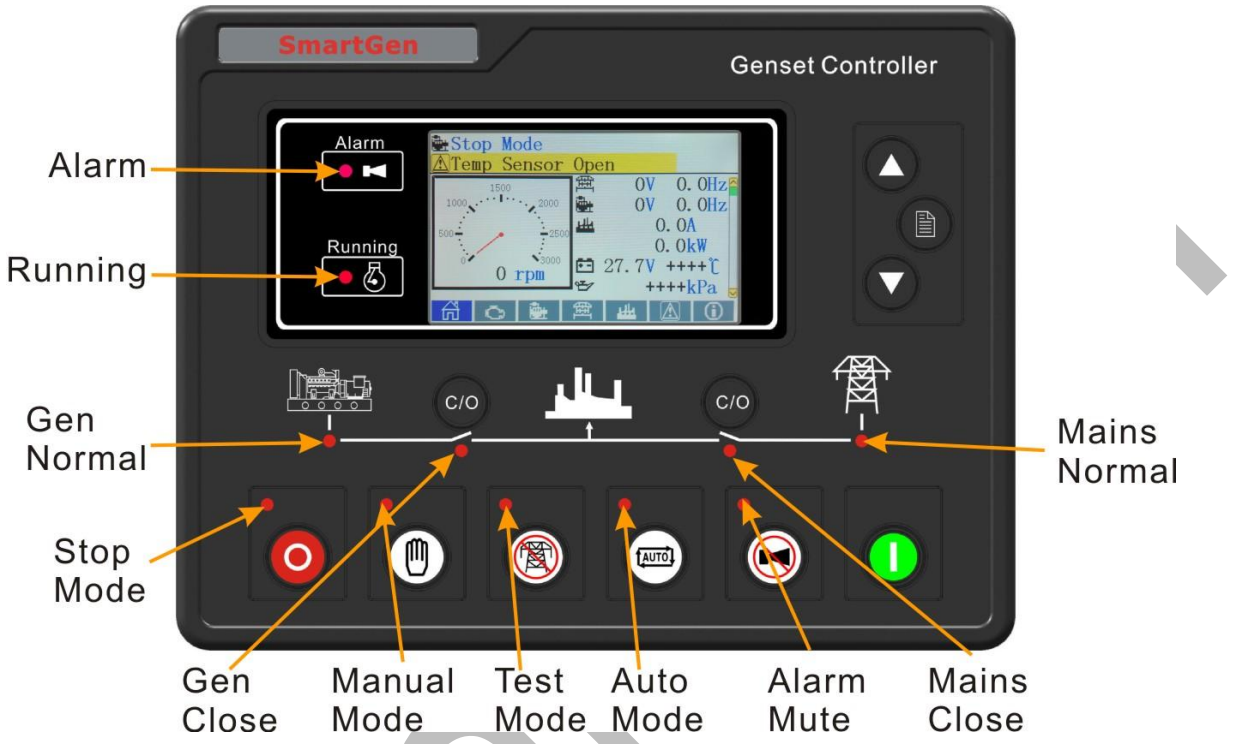
4 SPECIFICATION

Items	Contents
Operating Voltage	DC8.0V to 35.0V, Continuous power supply.
Power Consumption	≤3W (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	50/60/400Hz
Speed sensor voltage	1.0V to 24.0V (RMS)
Speed sensor Frequency	10,000 Hz (max.)
Start Relay Output	16 Amp DC28V at supply output
Fuel Relay Output	16 Amp DC28V at supply output
Auxiliary Relay Output (1)	7 Amp DC28V at supply output
Auxiliary Relay Output (2)	7 Amp AC250V voltage free output
Auxiliary Relay Output (3)	16 Amp AC250V voltage free output
Auxiliary Relay Output (4)	16 Amp AC250V voltage free output
Auxiliary Relay Output (5)	7 Amp DC28V at supply output
Auxiliary Relay Output (6)	7 Amp DC28V at supply output
Case Dimension	197mm x152mm x47mm
Panel Cutout	186mm x141mm
C.T. Secondary	5A rated
Working Conditions	Temperature: (-25~+70)°C; Humidity: (20~93)%RH
Storage Condition	Temperature: (-25~+70)°C
Protection Level	IP55 Gasket
Insulation Intensity	Apply AC2.2kV voltage between high voltage terminal and low voltage terminal; The leakage current is not more than 3mA within 1min.
Net Weight	0.75kg

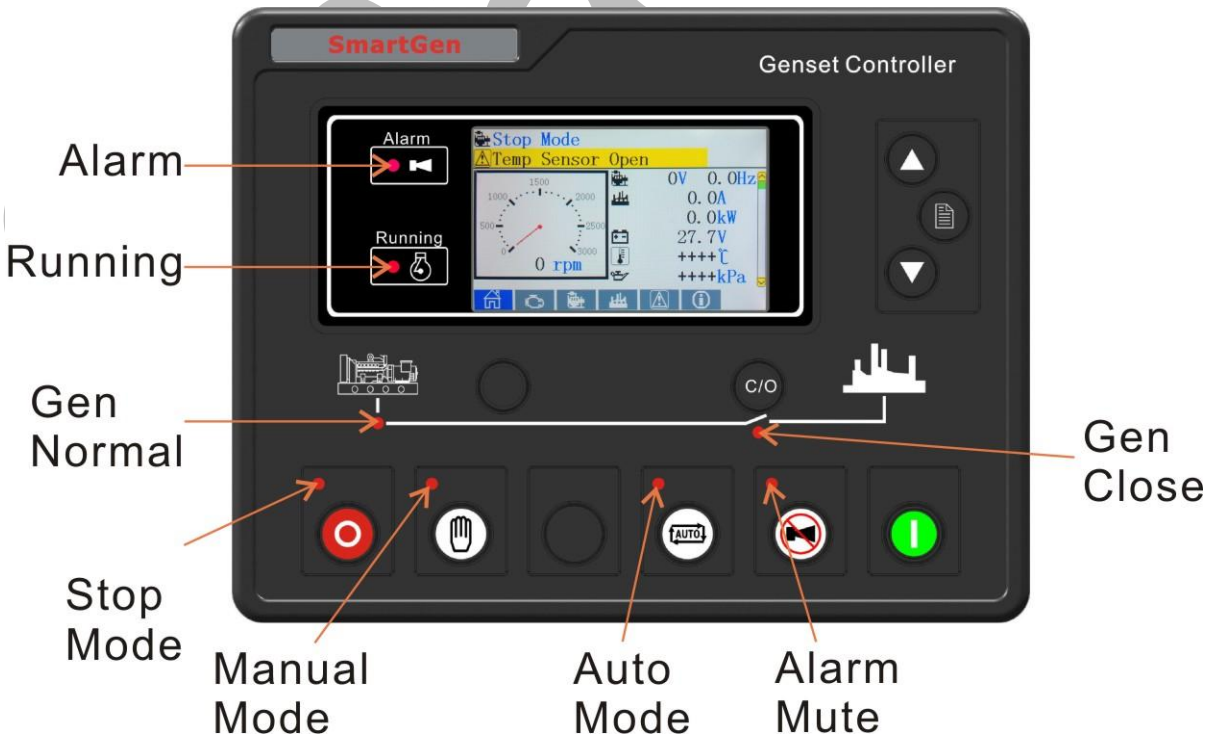
5 OPERATION

5.1 INDICATOR LIGHT

HGM7221



HGM7211



NOTE: Selected light indicators description:

Alarm indicator:

Alarm Type	Alarm Indicator
Warning	Slow flashing (1 time per sec.)
Trip Alarm	Slow flashing (1 time per sec.)
Shutdown Alarm	Fast flashing (5 times per sec.)
Trip and Stop Alarm	Fast flashing (5 times per sec.)

Running light：It is light on from crank disconnect to ETS while extinguishing in other period.

Gens normal light：It is light on when gens is normal; It is twinkling when gens is abnormal; It is extinguishing when there is no power.

Mains normal light：It is light on when mains is normal; It is twinkling when mains is abnormal; It is extinguishing when there is no power.

5.2 PUSHBUTTONS

	Stop	Stop running generator in Auto/Manual mode; Lamp test (press at least 3 seconds); Reset alarm in stop mode; During stopping process, press this button again to stop generator immediately.
	Start	Start genset in **Manual/Test** mode.
	Manual Mode	Press this key and controller enters in **Manual** mode.
	Auto Mode	Press this key and controller enters in **Auto** mode.
	Running With Load	Press this key and controller enters in Manual Test mode. **(HGM7211** without)
	Mute/Reset Alarm	Alarming sound off; If trip alarm occurs, pressing the button at least 3 seconds can reset this alarm.
	Gen Closed/Open	Can control generator to switch on or off in **manua**l mode.
	Mains Closed/Open	Can control mains to switch on or off in **manual** mode **(HGM7211** without).
	Page Scroll /Confirm	1) Page turning; 2) Press it at least 3 seconds to enters in basic parameter setting menu and shift cursor to confirm the set information.
	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.

NOTE: Press more than 3 seconds will enter into basic parameters setting menu.

NOTE: Press and simultaneously, then input the correct password will enter into advanced parameters setting menu.

WARNING: 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 controller's version information them. Input "05945" password users can inquire the controller's version information.

5.3 LCD DISPLAY

5.3.1 MAIN DISPLAY

Main display show pages, use to scroll the pages and to scroll the screen.

★**Main Screen**, including as below,

Engine speed, generator voltage, generator frequency, mains voltage (HGM7221), mains frequency(HGM7221), load current, active power, engine temperature, oil pressure, genset status, mains status (HGM7221), ATS status.

★**Engine**, including as below,

Battery voltage, charger voltage, engine accumulated run, accumulated start times, date and time, maintenance due, engine speed, engine temperature, engine oil pressure, fuel level, flexible sensor 1, flexible sensor 2.

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, fuel consumption, total fuel consumption and so on. (Different engine with different parameters)

★**Generator**, including as below,

Phase voltage, line voltage, frequency, phase sequence.

★**Mains**, including as below,

Phase voltage, line voltage, frequency, phase sequence

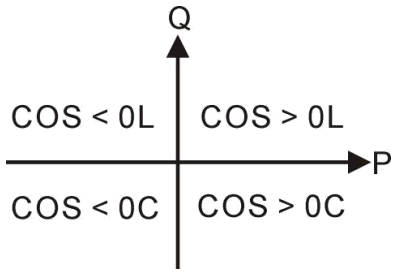
NOTE: HGM7211 has no this page..

★**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).

Note: When only mains closed indicator is illuminating, count mains active and reactive 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 inactive power

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 is equal to one under excitation generator.
COS<0C	P<0,Q<0	Output	Output	Load is equal to one over excitation generator.

Note:

1. Input active power, generator or mains supply electricity to load.
2. Output active power, load supply electricity to generator or mains.
3. Input reactive power, generator or mains send reactive power to load.
4. Output reactive power, load send reactive power to generator or mains.

★Alarm:

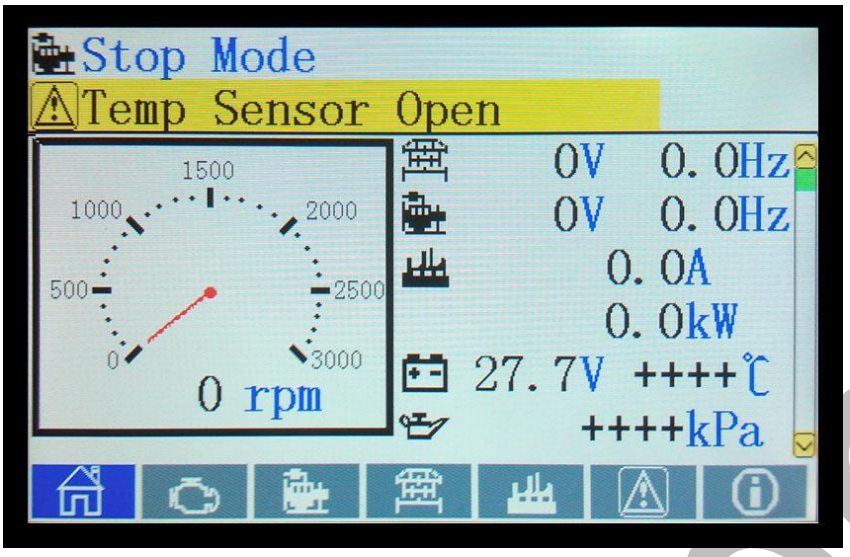
Warning alarm, shutdown alarm, trip alarm, trip and stop alarm.

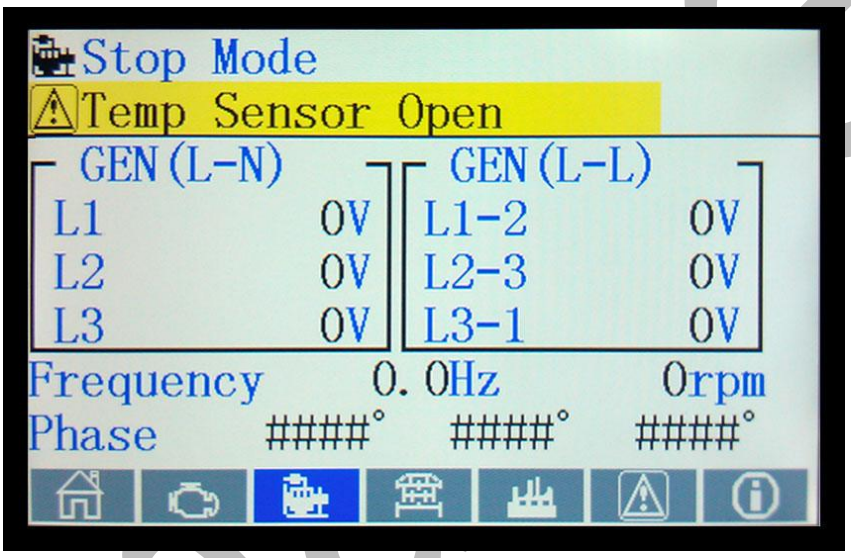
NOTE: For ECU alarms and shutdown alarms, if the alarm information is displayed, check engine according to it, otherwise, please check the generator manual according to SPN alarm code.

★Event log

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

Example:





5.3.2 USER MENU AND PARAMETERS SETTING MENU

Parameter setting including as following,

★Mains rated voltage

★Mains rated frequency

★Crank disconnect

★Flywheel teeth

★Engine rated speed

★Generator rated voltage

★Generator rated frequency

★CT ratio

★Rated current

★Rated power

★Battery Voltage

★Start delay

★Stop delay

★Preheat timer

★Cranking timer

★Crank Rest Timer

★Safety on timer

★Start idle timer

★Warming up timer

★Cooling timer

★Stop idle timer

★ETS(Energize to Stop) hold time

★Fail to stop time

★After stop time

★Time and Date

Basic Parameters > Return > Crank Disconnect > Flywheel Teeth > Rated speed > Rated Voltage > Rated Frequency > CT Ratio > Rated Current	Form1: Use to scroll settings, to enter settings (form 2), to exit settings menu.

Crank Disconnect Setting 1 frequency + speed	Form 2: to enter settings (form 3); press or to return to previous menu (form 1), or press to return to previous menu (form 1).

Crank Disconnect Setting 1 frequency + speed	Form 3：Use to scroll settings, to confirm setting (form2) ， to exit settings menu (form2).

5.3.3 ADVANCED PARAMETERS SETTING MENU

Parameter setting including as following,

- Mains
- Timers
- Engine
- Generator
- Load
- ATS
- Analog Sensor
- Digital Inputs
- Digital Outputs
- Module
- Scheduled and maintenance
- GSM

Advanced Parameters	
>Mains >Timer >Engine **>Generator** >Load >ATS >Analog Sensor > Digital Inputs	Form1: Use to scroll settings, to enter settings (form 2), to exit settings menu.

Advanced Parameters		
> Mains >Timer >Engine **> Generator** > Load >ATS >Analog Sensor > Digital Inputs	**> Return** > AC system > Poles > Rated voltage >Load Voltage > Rated Frequency > Load Frequency >CT Ratio	Form 2: Use to scroll settings (form 3); select “return” and press to return to previous menu(form 1), or press to return to previous menu (form 1).

Advanced Parameters		
> Mains >Timer >Engine **> Generator** > Load >ATS >Analog Sensor > Digital Inputs	> Rated Frequency > Load Frequency >CT Ratio >Over Volt Shut >Under Volt Shut >Over Freq Shut >Under Freq Shut **>Over Volt Warn**	Form 3: Use to scroll settings; to confirm setting (form 4), to return to previous menu (form 1).

Over Voltage Warn Sel: Disable Set value: 00110% Return value: 00108% Delay time: 00005	Form 4: to enter settings (form 5); press or to return to previous menu(form 3), or press to return to previous menu (form 3)

Over Voltage Warn Sel: Disable Set value: 00110% Return value: 00108% Delay time: 00005	Form 5: Use to scroll settings (form 6); to confirm setting (form 7), to exit settings menu (form 4).

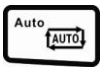
Over Voltage Warn Sel: Enable Set value: 00110% Return value: 00108% Delay time: 00005	Form 6: Use to scroll settings (form 5); to confirm setting (form 7), to exit settings menu (form 4).

Over Voltage Warn Sel: Enable Set value: 00110% Return value: 00108% Delay time: 00005	Form 7: Use to scroll settings; to confirm setting, to exit settings menu (form 4).

Over Voltage Warn Sel: Disable Set value: 00110% Return value: 00108% Delay time: 00005	Form 8: Use to scroll settings; to confirm setting, to exit settings menu (form 4).

NOTE: Long pressing Stop can exit setting directly during setting.

5.4 AUTO START/STOP OPERATION

Auto mode is selected by pressing the 

button; a LED besides the button will illuminate to confirm the operation.

Automatic Start Sequence:

1. HGM7221: When mains is abnormal (over and under voltage, over and under frequency, loss of phase, phase sequence wrong), enter into “mains abnormal delay” and TFT LCD displays count down time. When the delay is over, “Start Delay” timer is initiated; or when “Remote Start (with load)” is active, “Start Delay” timer is initiated.
2. HGM7211: When “Remote Start (with load)” is active, “Start Delay” timer is initiated.
3. “Start Delay” countdown will be displayed on TFT LCD display;
4. When start delay is over, preheat relay energizes (if configured), “preheat delay XXs” information will be displayed on TFT LCD display;
5. After the above delay, the Fuel Relay (if configured) is energized, and then one second later, the Start Relay is engaged. The engine is cranked for a pre-set time. If the engine fails to fire during this cranking attempt then the fuel relay and start relay are disengaged for the pre-set rest period; “crank rest time” begins and wait for the next crank attempt.
6. Should this start sequence continue beyond the set number of attempts, the start sequence will be terminated, and Fail to Start fault will be displayed on TFT LCD display.
7. In case of successful crank attempt, the “Safety On” timer is activated, allowing Low Oil Pressure, High Temperature, Under speed and Charge Alternator Failure inputs to stabilise without triggering the fault. 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 is initiated (if configured).
9. After the “warming up” delay, if generator status is normal, its indicator will be illuminated. If generator voltage and frequency have reached on-load requirements, then the generator close relay will be energized; genset will take load; generator power indicator will illuminate and generator will enter into Normal Running status. If voltage or frequency is abnormal, the controller will initiate shutdown alarm (alarm information will be displayed on TFT LCD display).

Note: When started via “Remote Start (off Load)” input, same procedures as above but generator close relay deactivated, moreover, genset off load in procedure 9.

Automatic Stop Sequence,

1) HGM7221: during normal running process, if mains return into normal status, enters into “Mains Normal Delay”. When mains indicator illuminates, “Stop Delay” begins; or when the “Remote Start” signal is removed, the Stop Delay is initiated.
2) HGM7211: When the “Remote Start” signal is removed, the Stop Delay is initiated.

3) Once this “stop delay” has expired, the Generator Breaker will open and the “Cooling Delay” is then initiated. After “Transfer Delay”, the mains close relay will be energized; mains will take load; generator power indicator will extinguish while mains power indicator will illuminate.
4) During “Stop Idle” Delay (if configured), idle relay is energized.
5) “ETS Solenoid Hold” begins, ETS relay is energized while fuel relay is de-energized, complete stop is detected automatically.
6) "Fail to Stop Delay" begins, complete stop is detected automatically.
7) When generator is stop completely, “After stop” delay will be initiated. Otherwise, fail to stop alarm is initiated and the corresponding alarm information is displayed on TFT LCD display. (If generator is stop successfully after “fail to stop” alarm has initiated, “After stop” delay will be initiated and the alarm will be removed).
8) Generator is placed into its standby mode after its “After stop” delay.

5.5 MANUAL START/STOP OPERATION

1 **HGM7221:** Manual mode is selected by pressing the button; a LED besides the button will illuminate to confirm the operation; Test mode is selected by pressing the button; a LED besides the button will illuminate to confirm the operation; Under the two modes, press button to start the genset, it can automatically judge crank success and accelerate to high speed running. If high temperature, low oil pressure, over speed and abnormal voltage occur during genset running, controller can effectively protect genset to stop (detail procedures please refer to No.4~9 of Auto Start Sequence). Under **Test Mode**, after genset high speed normal running, no matter mains normal or not, load will be transferred to generator. Under **Manual Mode**, the procedures of ATS please refer to ***Switch Control Procedure*** of generator in this manual.

2 **HGM7211**: Manual mode is selected by pressing the button; a LED besides the button will illuminate to confirm the operation; Then press button to start the generator, it can automatically judge crank success and accelerate to high speed running. If high temperature, low oil pressure, over speed and abnormal voltage occur during genset running, controller can effectively protect genset to stop (detail procedures please refer to No.3~9 of Auto Start Sequence). After genset high speed normal running, controller will send Gen Closed signal if remote start signal is active; otherwise, controller won’t send.

3 Manual stop: pressing key can shut down the running genset. (detail procedures please refer to No.3~8 of ***Auto Stop Sequence***)

5.6 SWITCH CONTROL PROCEDURES

5.6.1 HGM7221 SWITCH CONTROL PROCEDURES

Manual Transfer Procedures:

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

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

- **If "Open breaker detect" is "Select Disable"**

  Press generator switch on or off key C/O, if generator has taken load, will send unload signal; if taken no load, generator will send load signal; if mains has taken load, mains will unload, and then generator will take load.

  Press mains switch on or off key C/O, if mains has taken load, will send unload signal; if taken no load, mains will send load signal; if generator has taken load, generator will unload, and then mains will take load.

- **If "Open breaker detect" is "Select Enable"**

  To transfer load from mains to generator need to press mains switch off key C/O firstly. After close delay, press generator switch on key C/O ,and generator will take load (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/TEST/STOP 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, the open delay and transfer rest delay will be initiated, then switch off signal will be output while "fail to transfer" delay will be initiated. Once the delay has expired, if switch open failed, the generator will not switch on, otherwise, generator switch on. Controller begins detecting "fail to transfer" while generator switch on. When detecting time out, if switch on fail, it is need to wait for generator to switch on. If "fail to transfer" warn is "Enable", alarm signal will be initiated 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 open delay and transfer rest delay, then generator switch on signal will be output while "fail to transfer" delay will be initiated. Once the delay has expired, if switch on failed, then wait for generator switch on. If "fail to transfer" warn is "Enable", alarm signal will be initiated if switch on failure.

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

Mains load is transferred into generator load, after the open delay and transfer rest delay, generator switch on.

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

5.6.2 HGM7211 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 panel button.

Press generator switch on key C/O, if generator have taken load, will output unload signal; if taken no load, generator will output load signal.

Auto control procedures,

When controller is in AUTO/TEST/STOP mode, auto control will be executive.

1. If input port is configured as Close Mains Auxiliary

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

Generator load is transferred into generator un-load, after the open delay; switch off signal will be output while "fail to transfer" delay will be initiated. Once the delay has expired, if switch off failed, it will wait for switch off. Otherwise, switch off is completed.

Generator unload is transferred into generator load, after the close delay, switch on signal will be output while "fail to transfer" delay will be initiated. Once the delay has expired, if switch on failed, it will wait for switch on. Otherwise, switch on is completed.

If "fail to transfer" warn is "Enable", alarm signal will be initiated whatever switch on or off failure.

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

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

Generator unload is transferred into generator load, after the close delay, switch on signal will be output while “fail to transfer” delay will be initiated. Once the delay has expired, if switch on failed, it will wait for switch on. Otherwise, switch on is completed.

If “fail to transfer” warn is “Enable”, alarm signal will be initiated f switch on failure.

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

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

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

NOTE:

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 PROTECTIONS

6.1 WARNING ALARMS

Warnings are not shutdown alarms and do not affect the operation of the gen-set. Warning alarms does not lead to shutdown. Warning alarms types are as follows:

No	Type	Description
1	Over Speed	When the controller detects that the engine speed has exceeded the pre-set value, it will initiate a warning alarm.
2	Under Speed	When the controller detects that the engine speed has fallen below the pre-set value, it will initiate a warning alarm.
3	Loss of Speed Signal	When the controller detects that the engine speed is 0 and the action select “Warn”, it will initiate a warning alarm.
4	Gen Over Frequency	When the controller detects that the genset frequency has exceeded the pre-set value, it will initiate a warning alarm.
5	Gen Under Frequency	When the controller detects that the genset frequency has fallen below the pre-set value, it will initiate a warning alarm.
6	Gen Over Voltage	When the controller detects that the generator voltage has exceeded the pre-set value, the controller will initiate a warning alarm.
7	Genset Under Voltage	When the controller detects that the genset voltage has fallen below the pre-set value, it will initiate a warning alarm.
8	Gen Over Current	When the controller detects that the genset current has exceeded the pre-set value and the action select “Warn”, it will initiate a warning alarm.
9	Fail To Stop	After “fail to stop” delay, if gen-set does not stop completely, it will initiate a warning alarm.
10	Charge Alternator Failure	When the controller detects that charger voltage has fallen below the pre-set value, it will initiate a warning alarm.
11	Battery Over Volt	When the controller detects that start battery voltage has exceeded the pre-set value, it will initiate a warning alarm.
12	Battery Under Volt	When the controller detects that start battery voltage has fallen below the pre-set value, it will initiate a warning alarm.
13	Maintenance Due	When count down time is 0 and the action select “Warn”, it will initiate a warning alarm.
14	Reverse Power	If reverse power detection is enabled, when the controller detects that the reverse power value (power is negative) has fallen below the pre-set value and the action select “Warn”, it will initiate a warning alarm.
15	Over Power	If over power detection is enabled, when the controller detects that the over power value (power is positive) has exceeded the pre-set value and the action select “Warn”, it will initiate a warning alarm.
16	ECU Warn	If an error message is received from ECU via J1939, it will initiate a warning alarm.
17	Gen Loss of Phase	If loss of phase detection is enabled, When controller detects the generator loss phase, it will initiate a warning alarm.
18	Gen Phase Sequence Wrong	When the controller detects a phase rotation error, it will initiate a warning alarm.

No	Type	Description
19	Switch Fail Warn	When the controller detects that the breaker close or open failure occurs, and the action select “Warn”, it will initiate a warning alarm.
20	Temperature Sensor Open Circuit	When the controller detects that the temperature sensor is open circuit and the action select “Warn”, it will initiate a warning alarm.
21	High Temperature	When the controller detects that engine temperature has exceeded the pre-set value, it will initiate a warning alarm.
22	Low Temperature	When the controller detects that engine temperature has fallen below the pre-set value, it will initiate a warning alarm.
23	Oil Pressure Open Circuit	When the controller detects that the oil pressure sensor is open circuit and the action select “Warn”, it will initiate a warning alarm.
24	Low Oil Pressure	When the controller detects that the oil pressure has fallen below the pre-set value, it will initiate a warning alarm.
25	Level Sensor Open Circuit	When the controller detects that the level sensor is open circuit and the action select “Warn”, it will initiate a warning alarm.
26	Low Fuel Level	When the controller detects that the fuel level has fallen below the pre-set value, it will initiate a warning alarm.
27	Flexible Sensor 1 Open Circuit	When the controller detects that the flexible sensor 1 is open circuit and the action select “Warn”, it will initiate a warning alarm.
28	Flexible Sensor 1 High	When the controller detects that the sensor 1 value has exceeded the pre-set value, it will initiate a warning alarm.
29	Flexible Sensor 1 Low	When the controller detects that the sensor 1 value has fallen below the pre-set value, it will initiate a warning alarm.
30	Flexible Sensor 2 Open Circuit	When the controller detects that the flexible sensor 2 is open circuit and the action select “Warn”, it will initiate a warning alarm.
31	Flexible Sensor 2 High	When the controller detects that the sensor 2 value has exceeded the pre-set value, it will initiate a warning alarm.
32	Flexible Sensor 2 Low	When the controller detects that the sensor 2 value has fallen below the pre-set value, it will initiate a warning alarm.
33	Digital Input	When digit input port is set as warning and the alarm is active, it will initiate a warning alarm.
34	GSM COM Failure	When GSM is enable but the controller couldn’t detect GSM module, it will initiate a warning alarm.

6.2 SHUTDOWN ALARMS

When controller detects shutdown alarm, it will send signal to open breaker and shuts down generator.

Shutdown alarms as following:

No	Type	Description
1	Emergency Stop	When the controller detects an emergency stop alarm signal, it will initiate a shutdown alarm.
2	Over Speed	When the controller detects that the generator speed has exceeded the pre-set value, it will initiate a shutdown alarm.
3	Under Speed	When the controller detects that the generator speed has fallen below the pre-set value, it will initiate a shutdown alarm.
4	Loss of Speed Signal	When the controller detects that the engine speed is 0 and the action select “Shutdown”, it will initiate a shutdown alarm.
5	Gen Over Frequency	When the controller detects that the genset frequency has exceeded the pre-set value, it will initiate a shutdown alarm.
6	Gen Under Frequency	When the controller detects that the genset frequency has fallen below the pre-set value, it will initiate a shutdown alarm.
7	Gen Over Voltage	When the controller detects that the generator voltage has exceeded the pre-set value, the controller will initiate a shutdown alarm.
8	Genset Under Voltage	When the controller detects that the genset voltage has fallen below the pre-set value, it will initiate a shutdown alarm.
9	Fail To Start	If the engine does not fire after the pre-set number of attempts, it will initiate a shutdown alarm.
10	Gen Over Current	When the controller detects that the genset current has exceeded the pre-set value and the action select “Shutdown”, it will initiate a shutdown alarm.
11	Maintenance Due	When count down time is 0 and the action select “Shutdown”, it will initiate a shutdown alarm.
12	ECU Shutdown	If an error message is received from ECU via J1939, it will initiate a shutdown alarm.
13	ECU Com Fail	If the module does not detect the ECU data, it will initiate a shutdown alarm.
14	Reverse Power	If reverse power detection is enabled, when the controller detects that the reverse power value (power is negative) has fallen below the pre-set value and the action select “Shutdown”, it will initiate a shutdown alarm.
15	Over Power	If over power detection is enabled, when the controller detects that the over power value (power is positive) has exceeded the pre-set value and the action select “Shutdown”, it will initiate a shutdown alarm.
16	Temperature Sensor Open Circuit	When the controller detects that the temperature sensor is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
17	High Temperature	When the controller detects that engine temperature has exceeded the pre-set value, it will initiate a shutdown alarm.

No	Type	Description
18	Oil Pressure Open Circuit	When the controller detects that the oil pressure sensor is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
19	Low Oil Pressure	When the controller detects that the oil pressure has fallen below the pre-set value, it will initiate a shutdown alarm.
20	Level Sensor Open Circuit	When the controller detects that the level sensor is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
21	Flexible Sensor 1 Open Circuit	When the controller detects that the flexible sensor 1 is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
22	Flexible Sensor 1 High	When the controller detects that the sensor 1 value has exceeded the pre-set value, it will initiate a shutdown alarm.
23	Flexible Sensor 1 Low	When the controller detects that the sensor 1 value has fallen below the pre-set value, it will initiate a shutdown alarm.
24	Flexible Sensor 2 Open Circuit	When the controller detects that the flexible sensor 2 is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
25	Flexible Sensor 2 High	When the controller detects that the sensor 2 value has exceeded the pre-set value, it will initiate a shutdown alarm.
26	Flexible Sensor 2 Low	When the controller detects that the sensor 2 value has fallen below the pre-set value, it will initiate a shutdown alarm.
27	Digital Input	When digit input port is set as shutdown and the alarm is active, it will initiate a shutdown alarm.

6.3 TRIP AND STOP ALARMS

On initiation of the trip and stop condition the controller will de-energize the ‘Close Generator’ Output to remove the load from the generator. Once this has occurred the controller will start the Cooling delay and allow the engine to cool before shutting down the engine.

No	Type	Description
1	Gen Over Current	When the controller detects that the genset current has exceeded the pre-set value and the action select “Trip and Stop”, it will initiate a trip and stop alarm.
2	Maintenance Due	When count down time is 0 and the action select “Trip and Stop”, it will initiate a trip and stop alarm.
3	Reverse Power	If reverse power detection is enabled, when the controller detects that the reverse power value (power is negative) has fallen below the pre-set value and the action select “Trip and Stop”, it will initiate a trip and stop alarm.
4	Over Power	If over power detection is enabled, when the controller detects that the over power value (power is positive) has exceeded the pre-set value and the action select “Trip and Stop”, it will initiate a trip and stop alarm.
5	Digital Input	When digit input port is set as “Trip and Stop” and the alarm is active, it will initiate a trip and stop alarm.

6.4 TRIP ALARM

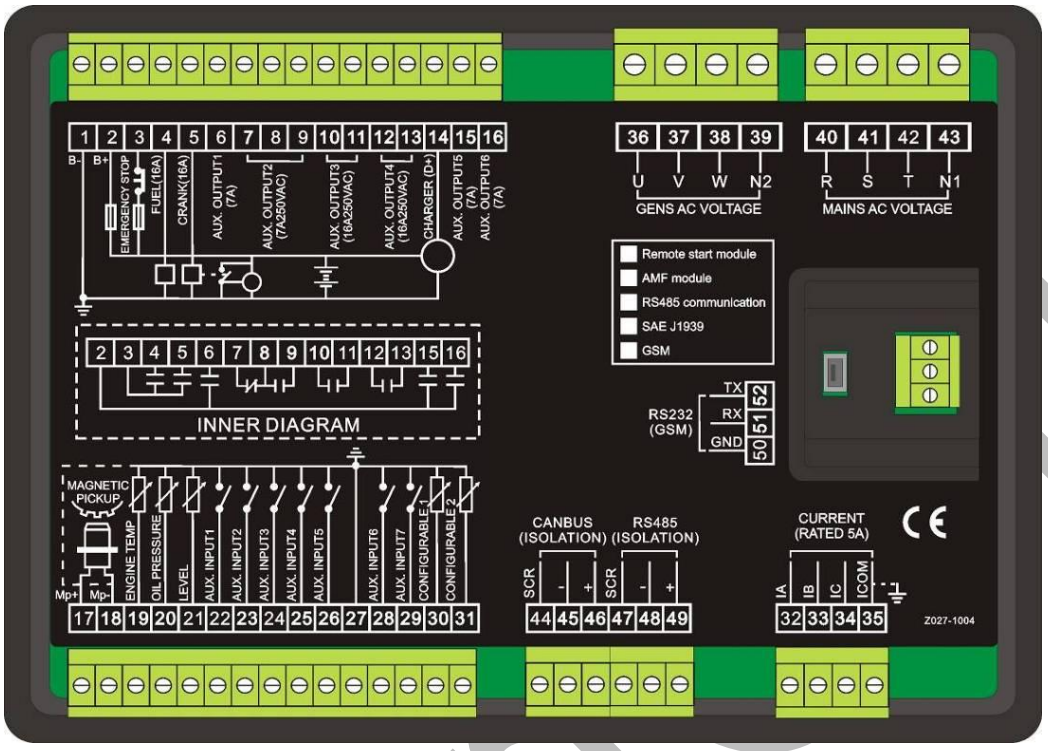
On initiation of the trip condition the controller will de-energize the ‘Close Generator’ Output without stop the generator.

Trip alarm as following,

No	Type	Description
1	Gen Over Current	When the controller detects that the genset current has exceeded the pre-set value and the action select “Trip”, it will initiate a trip alarm.
2	Reverse Power	If reverse power detection is enabled, when the controller detects that the reverse power value (power is negative) has fallen below the pre-set value and the action select “Trip”, it will initiate a trip alarm.
3	Over Power	If over power detection is enabled, when the controller detects that the over power value (power is positive) has exceeded the pre-set value and the action select “Trip”, it will initiate a trip alarm.
4	Digital Input	When digit input port is set as “Trip” and the alarm is active, it will initiate a trip alarm.

7 WIRING CONNECTION

HGM7211/7221 series controller's rear as following:



Description of terminal connection:

NO.	Functions	Cable Size	Remark	
1	DC input -Ve	2.5mm^2	Connected with negative of starter battery.	
2	DC input +Ve	2.5mm^2	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	2.5mm^2	Connected with +Ve via emergency stop button.	
4	Fuel relay	1.5mm^2	+Ve is supplied by terminal 3, rated 16A	
5	Crank	1.5mm^2	+Ve is supplied by terminal 3, rated 16A	Connected to starter coil
6	Aux. output 1	1.5mm^2	B+ is supplied by terminal 2, rated 7A	Details see form 2
7	Aux. output 2	1.5mm^2	Normally close outputs, rated 7A	
8			Public points of relay	
9			Normally open outputs, rated 7A	
10	Aux. output 3	2.5mm^2	Normally open volts free outputs, rated 16A	
11				
12	Aux. output 4	2.5mm^2		
13				
14	Charger (D+)	1.0mm^2	Connected with charger's D+ (WL) terminals. Be hanging in the air If there is no this terminal.	
15	Aux. output 5	1.5mm^2	+Ve is supplied by terminal 2, rated 7A	Details see form 2
16	Aux. output 6	1.5mm^2		
17	MP+	Connected with Speed sensor, shielding line is recommended.		

NO.	Functions	Cable Size	Remark
18	MP-, (-Ve) has already connected with speed sensor 2		
19	Engine Temp.	Connect to temperature Sensor.	Details see form 4
20	Oil pressure	Connect to oil pressure sensor.	
21	Fuel level	Connect to fuel level sensor.	
22	Aux. input 1	1.0mm^2	Ground connected is active (-Ve)
23	Aux. input 2	1.0mm^2	Ground connected is active (-Ve)
24	Aux. input 3	1.0mm^2	Ground connected is active (-Ve)
25	Aux. input 4	1.0mm^2	Ground connected is active (-Ve)
26	Aux. input 5	1.0mm^2	Ground connected is active (-Ve)
27	Sensor COM	A public terminal of sensor, (-Ve) has already connected internal.	
28	Aux. input 6	1.0mm^2	Ground connected is active (-Ve)
29	Aux. input 7	1.0mm^2	Ground connected is active (-Ve)
30	Aux. sensor 1	Connect to temperature, oil pressure or fuel level sensors.	Details see form 4
31	Aux. sensor 2		
32	CT A-phase sensing input	1.5mm^2	Outside connected to secondary coil of current transformer (rated 5A).
33	CT B-phase sensing input	1.5mm^2	Outside connected to secondary coil of current transformer (rated 5A).
34	CT C-phase sensing input	1.5mm^2	Outside connected to secondary coil of current transformer (rated 5A).
35	CT COM	1.5mm^2	See following installation instruction.
36	Gen-set A-phase voltage sensing input	1.0mm^2	Connected to A-phase of gen-set (2A fuse is recommended).
37	Gen-set B-phase voltage sensing input	1.0mm^2	Connected to B-phase of gen-set (2A fuse is recommended).
38	Gen-set C-phase voltage sensing input	1.0mm^2	Connected to C-phase of gen-set (2A fuse is recommended).
39	Gen-set N-wire input	1.0mm^2	Connected to N-wire of gen-set.
40	Mains A-phase voltage sensing input	1.0mm^2	Connected to A-phase of mains (2A fuse is recommended).
41	Mains B-phase voltage sensing input	1.0mm^2	Connected to B-phase of mains (2A fuse is recommended).
42	Mains C-phase voltage sensing input	1.0mm^2	Connected to C-phase of mains (2A fuse is recommended).
43	Mains N-wire input	1.0mm^2	Connected to N-wire of mains (HGM7211 without).
44	CAN COM(GND)	0.5mm^2	Impedance-120Ω shielding wire is recommended, its single-end earthed.
45	CAN-	0.5mm^2	
46	CAN+	0.5mm^2	
47	RS485 COM(GND)	0.5mm^2	Impedance-120Ω shielding wire is recommended, its single-end earthed. (There is no these terminals in which controller has no RS485)
48	RS485-	0.5mm^2	
49	RS485+	0.5mm^2	

NO.	Functions	Cable Size	Remark
50	RS232 COM(GND)	0.5mm^2	Connected to GSM module.
51	RS232 RX	0.5mm^2	
52	RS232 TX	0.5mm^2	

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

NOTE: Please refer to the Modules Comparison in this manual for more products' functions.

8 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

8.1 CONTENTS AND SCOPES OF PARAMETERS

Form 1

No.	Items	Parameters	Defaults	Description
Mains Setting				
1	AC System	(0~3)	0	0: 3P4W; 1: 3P3W; 2: 2P3W; 3: 1P2W.
2	Rated Voltage	(30~30000)V	230	Standard for checking mains over/under voltage. (It is primary voltage when using voltage transformer).
3	Rated Frequency	(10.0~75.0) Hz	50.0	Standard for checking mains over/under frequency.
4	Normal 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	(0~1000)%	120%	Setting value is mains rated voltage's percentage, and return value and delay value can be set.
8	Under Voltage	(0~1000)%	80%	
9	Over Frequency	(0~1000)%	114%	Setting value is mains rated frequency's percentage, return value and delay value can be set.
10	Under Frequency	(0~1000)%	90%	
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	Stop 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 when engine start fail.
6	Safety On Delay	(0~3600)s	10	Alarms for low oil pressure, high temperature, under speed, under frequency /voltage, charge fail are inactive.
7	Start Idle Time	(0~3600)s	0	Idle running time of genset when starting.

No.	Items	Parameters	Defaults	Description
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 can be set.
8	Under Speed Shutdown	(0~200)%	80%	
9	Over Speed Warn	(0~200)%	110%	Setting value is percentage of rated speed; delay value and return value can be set.
10	Under Speed Warn	(0~200)%	86%	
11	Battery Rated	(0~60.0)V	24.0	Standard for detecting over/under

No.	Items	Parameters	Defaults	Description
	Voltage			voltage of battery.
12	Battery Over Volts	(0~200)%	120%	Setting value is percentage of rated voltage of battery. Delay value & return value can be set.
13	Battery Under Volts	(0~200)%	85%	
14	Charge Alt Fail	(0~60.0)V	8.0	In normal running, when charger D+(WL) voltage under this value, charge failure alarms.
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 form 5 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%	Setting value is percentage of generator rated frequency. When generator frequency higher than the set value, starter will be disconnected. See the installation instruction.
18	Disconnect Engine Speed	(0~200)%	24%	Setting value is percentage of generator rated speed. 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 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).
4	Loading Voltage	(0~200)%	85%	Setting value is percentage of generator rated voltage. Detect when controller ready to loading. If generator voltage

No.	Items	Parameters	Defaults	Description
				under load voltage, won't enter into normally running.
5	Rated Frequency	(10.0~600.0) 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 can be set.
9	Under Volt. Shutdown	(0~200)%	80%	
10	Over Freq. Shutdown	(0~200)%	114%	Setting value is percentage of generator rated frequency. Delay value can be set.
11	Under Freq. Shutdown	(0~200)%	80%	
12	Over Volt. Warn	(0~1000)%	110%	Setting value is percentage of generator rated voltage. Delay value and return value can be set.
13	Under Volt. Warn	(0~1000)%	84%	
14	Over Freq. Warn	(0~1000)%	110%	Setting value is percentage of generator rated frequency. Delay value and return value can be set.
15	Under Freq. Warn	(0~1000)%	84%	
16	Loss of Phase	(0~1)	1	0: Disable 1: Enable
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 full rated current. Delay value can be set as Definite Time or Inverse Definite Minimum Time(IDMT).
5	Over Power	(0~1)	0	0: Disable 1: Enable
6	Reverse Power	(0~1)	0	0: Disable 1: Enable
Switch Setting				

No.	Items	Parameters	Defaults	Description
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.
GSM Setting				
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.
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 form 4.
2	Open Circuit Action	(0~2)	0	0: Warn; 1: Shutdown; 2: No action
3	High Temp. Shutdown	(0~300)ºC	98	Shutdown when sensor temperature higher than this value. Detecting only after safety delay is over. The delay

No.	Items	Parameters	Defaults	Description
				value can be set.
4	High Temp. Warn	(0~300)ºC	95	Warn when sensor temperature higher than this value. Detecting only after safety delay is over. The delay value and return value 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 form 4.
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 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 and return value can be set.
Liquid Level Sensor				
1	Curve Type	(0~15)	4	SGH See form 4
2	Open Circuit Action	(0~2)	0	0:Warn; 1:Shutdown; 2:No action
3	Low Level Warn	(0~300)%	10	Warn when level lower than this value. It is detecting all the time. The delay value and return value 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).
Unit Select				
1	Temperature Unit	(0-1)	0	0：℃；1：℉.
2	Pressure Unit	(0-2)	0	0：kPa；1：psi; 2：bar。
Flexible Input Ports				
Flexible Input Port 1				
1	Contents Setting	(0~50)	28	Remote start (on load). See form 3
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active

No.	Items	Parameters	Defaults	Description
Flexible Input Port 2				
1	Contents Setting	(0~50)	26	High temperature shutdown See form 3
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
Flexible Input Port 3				
1	Contents Setting	(0~50)	27	Low oil pressure shutdown See form 3
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
Flexible Input Port 4				
1	Contents Setting	(0~50)	0	User defined. See form 3
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			TFT display detailed contents when the input is active.
Flexible Input Port 5				
1	Contents Setting	(0~50)	0	User defined. See form 3
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)	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			TFT display detailed contents when the input is active.
Flexible Input Port 6				
1	Contents Setting	(0~50)	0	User defined.See form 3
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			TFT display detailed contents when the input is active.

No.	Items	Parameters	Defaults	Description
Flexible Input Port 7				
1	Contents Setting	(0~50)	5	Lamp test. See form 3
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
Flexible Output Ports				
Flexible Output Port 1				
1	Contents Setting	(0~239)	1	User defined period output (default output is in preheating) See Form 2
2	Active Type	(0~1)	0	0:Normally open; 1:Normally close
Flexible Output Port 2				
1	Contents Setting	(0~239)	35	Idle control output. See Form 2
2	Active Type	(0~1)	0	0:Normally open; 1:Normally close
Flexible Output Port 3				
1	Contents Setting	(0~239)	29	Generator closed output. See form 2
2	Active Type	(0~1)	0	0:Normally open; 1:Normally close
Flexible Output Port 4				
1	Contents Setting	(0~239)	31	Mains closed output. See form 2
2	Active Type	(0~1)	0	0:Normally open; 1:Normally close
Flexible Output Port 5				
1	Contents Setting	(0~239)	38	ETS solenoid hold. See form 2
2	Active Type	(0~1)	0	0:Normally open; 1:Normally close
Flexible Output Port 6				
1	Contents Setting	(0~239)	48	Common alarm. See form 2
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.

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 PROGRAMMABLE OUTPUT PORTS

Form 2

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 Control	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 when genset starting and disconnect when genset stopped 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 limited threshold.
22	Cooler Control	It is controlled by cooler of temperature sensor’s limited threshold.
23	Oil Pre-supply Output	Action from “crank on” to “safety on”.
24	Generator Excite	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 Control Output	This port is controlled by communication (PC).
27	GSM Power Supply	Power for GSM module (GSM module is reset when GSM communication failed).
28	Reserved	
29	Close Gen Output	Control generator to take load.
30	Open Gen Output	Control generator to off load.
31	Close Mains Output	Control mains to take load.
32	Reserved	
33	Start Relay	
34	Fuel Relay	Action when genset is starting and disconnect when stop is completed.
35	Idle Control	Used for engine which has idles. Close before starting and open in warming up delay; Close during stopping idle mode and open when stop is completed.
36	Speed Raise Relay	Action in warming up delay.
37	Speed Drop Relay	Action between the period from “stop idle” to “failed to stop”.
38	Energize to Stop	Used for engines with ETS electromagnet. Close when stop idle is over and open when pre-set “ETS delay” is over.
39	Speed Drop Pulse	Active 0.1s when controller 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 Supply	Used for ECU engine and control its power.
42	Speed Raise Pulse	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 Load Available	Action in period of generator ok to hi-speed cooling.
46	Mains OK	
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	Action when common trips alarm.
52	Common Warn	Action when common warning alarm.
53	Reserved	
54	Battery Over Voltage	Action when battery’s over voltage warning alarm.
55	Battery Under Voltage	Action when battery’s low voltage warning alarm.
56	Charge Alternator Failure	Action when charge fail warning alarms.
57	Reserved	
58	Reserved	
59	Reserved	
60	ECU Warning	Indicate ECU sends a warning signal.

61	ECU Shutdown	Indicate ECU sends a shutdown signal.
62	ECU Com Fail	Indicate controller not communicates with ECU.
63	Reserved	
64	Reserved	
65	Reserved	
66	Reserved	
67	Reserved	
68	Reserved	
69	Digital Input 1 Active	Action when input port 1 is active
70	Digital Input 2 Active	Action when input port 2 is active
71	Digital Input 3 Active	Action when input port 3 is active
72	Digital Input 4 Active	Action when input port 4 is active
73	Digital Input 5 Active	Action when input port 5 is active
74	Digital Input 6 Active	Action when input port 6 is active
75	Digital Input 7 Active	Action when input port 7 is active
76~98	Reserved	
99	Emergency Stop	Action when emergency stop alarm.
100	Fail To Start	Action when failed start alarm.
101	Fail 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 Phase Sequence Wrong	Action when generator reverse phase.
119	Reserved	
120	Over Power	Action when controller detects generator have over power.
121	Reserved	
122	Generator Reverse Power	Action when controller detects generator have reverse power.
123	Over Current	Action when over current.
124	Reserved	
125	Mains Inactive	

126	Mains Over Freq	
127	Mains Over Volt	
128	Mains Under Freq	
129	Mains Under Volt	
130	Mains Reverse Phase	
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 Level Warn	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	Test Mode	Action in Manual test mode.
233	Auto Mode	Action in Auto mode.
234	Generator On Load	
235	Mains On Load	

236	Reserved	
237	Reserved	
238	Reserved	
239	Reserved	

8.2.1 DEFINED PERIOD OUTPUT

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

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

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

Period output S1, can 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.

NOTE: The controller will output circularly only when output period is in standby period.

Example:

Output period: start

Delay output time: 2s

Output time: 3s

Condition output contents: output port 1 is active

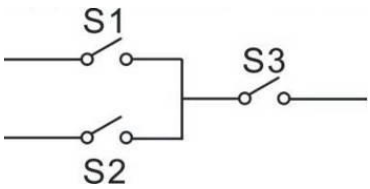
Close when condition output active/inactive: close when active (disconnect when inactive);

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

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

8.2.2 DEFINED COMBINATION 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: output 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, output 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: output 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 PROGRAMMABLE INPUT PORTS (ALL ACTIVE WHEN CONNECT TO GRAND (B~))

Form 3

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 🔒 on the TFT display when input is active.
7	Reserved	
8	Idle Control Mode	Under voltage/frequency/speed protection is inactive.
9	Inhibit Auto Stop	In **Auto** mode, during generator normal running, when input is active, inhibit generator shutdown automatically.
10	Inhibit Auto Start	In **Auto** mode, inhibit generator start automatically when input is active.
11	Inhibit Scheduled	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 keys except  are inactive, and 🔒 will

		show on the TFT display.
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 or override 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	Simulate Up key	An external button can be connected and pressed as simulate panel.
32	Simulate Down key	
33	Simulate Stop key	
34	Simulate Manual key	
35	Simulate Test key	
36	Simulate Auto key	
37	Simulate Start key	
38	Simulate G-Load key	
39	Simulate M-Load key	
40	Pulse Raise Speed Input	
41	Pulse Drop Speed Input	
42	Idle Pulse Input	
43	Simulate Page key	An external button can be connected and pressed as simulate panel.
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

Form4

No.		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	Oil 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 DINSCONNECT 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:

a. 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.

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

c. When set as speed sensor, must ensure that the number of flywheel teeth is as same as setting, otherwise, “over speed stop” or “under speed stop” may be caused.

d. If genset without speed sensor, please don’t select corresponding items, otherwise, “start fail” or “loss speed signal” maybe caused.

e. If genset without oil pressure sensor, please don’t select corresponding items.

f. 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 HGM7211 controller, there are no items of mains in setting and also no mains items in auxiliary input/output ports.

CAUTION: Please change the controller parameters when generator is in standby mode only (e. g. Start conditions selection, auxiliary input, auxiliary output, various delay), otherwise, alarming to stop 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 setting; when setting the minimum value, the return value must over setting.

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

10 SENSORS SETTING

10.1 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.

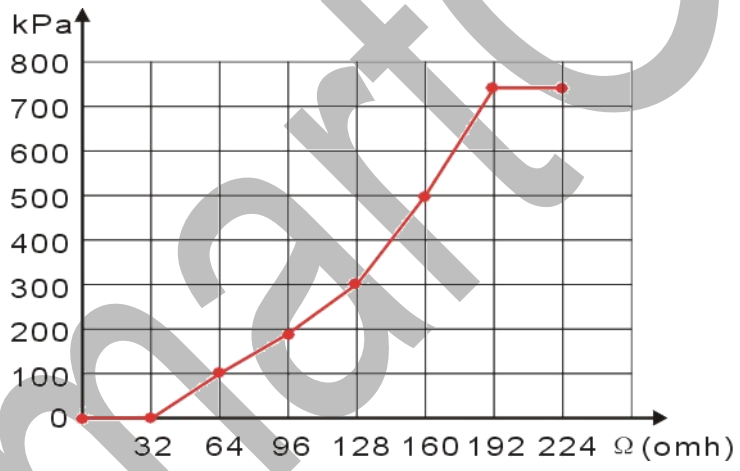
10.2 When there is difference between standard sensor curves and using sensor, user can adjust it in “curve type”.

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

10.4 If select sensor type as “None”, sensor curve is not working.

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

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



Normal Pressure Unit Conversion Form

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

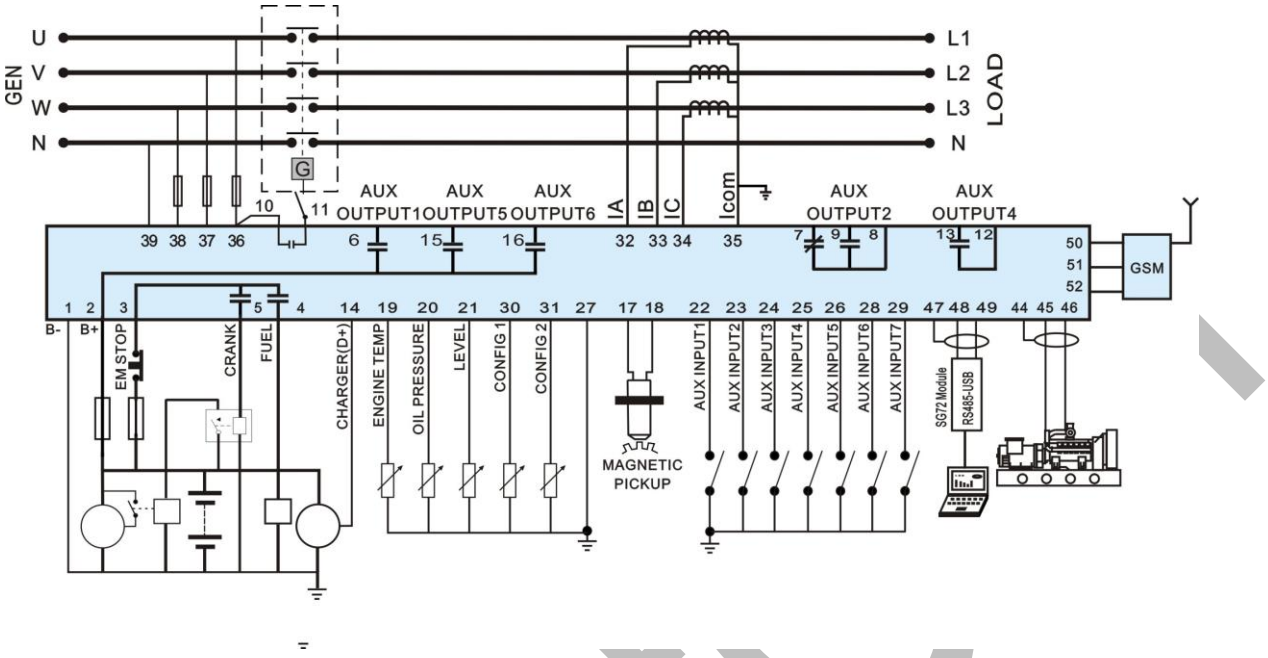
11 COMMISSIONING

Please make the under procedures checking before commissioning,

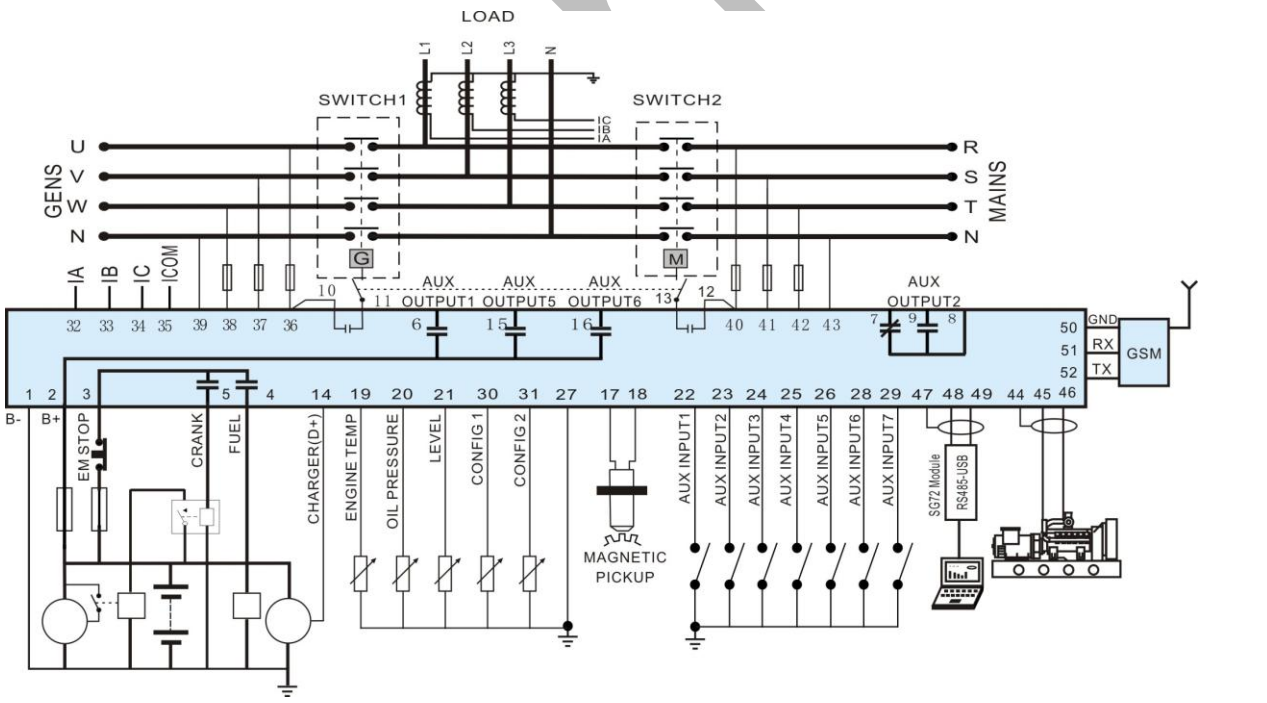
1. Ensure all the connections are correct and wires diameter is suitable.
2. Ensure that the controller DC power has fuse, controller‘s positive and negative connected to start battery are correct.
3. Emergence stop must be connected with positive of start battery via scram button’s normal close point 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 “at rest” mode until there is abnormal of mains.
8. When mains is abnormal again, genset will be started automatically and into normal running, then controller send signal to making generator switch on, and control the ATS as generator load. If not like this, please check ATS’ wires connection of control part according to this manual.
9. If there is any other question, please contact Smartgen’s service.

12 TYPICAL APPLICATION

HGM7211 typical application diagram

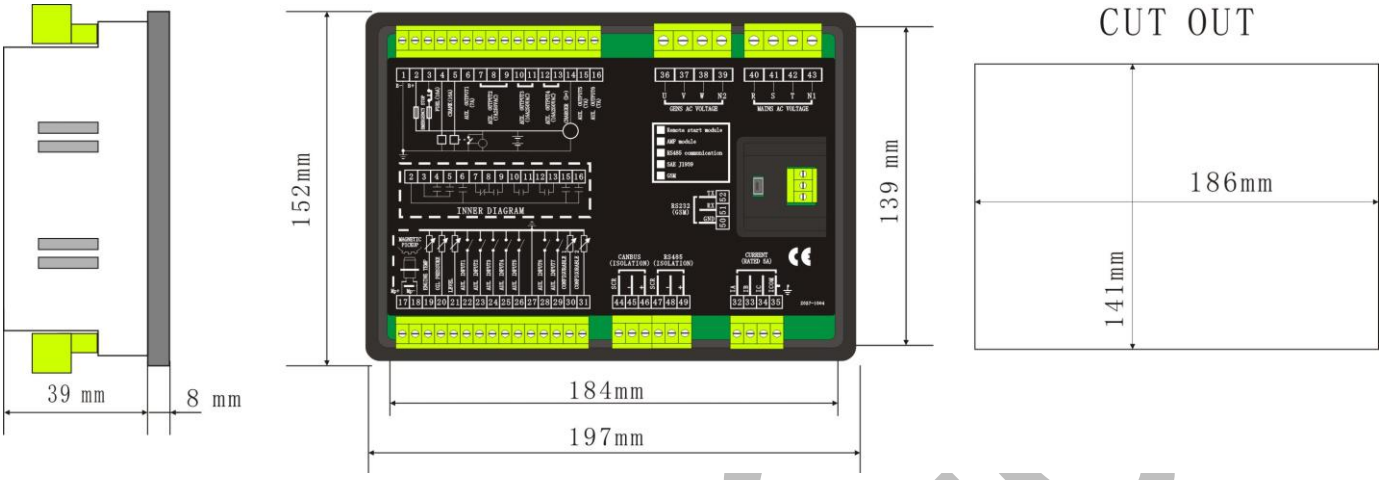


HGM7221 typical application diagram



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,



1) Battery Voltage Input

NOTE: HGM7211/7221 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 teeth of flywheel. Its connection wires to controller should apply for 2 cores shielding line. The shielding layer should connect to No. 18 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 has DC current) or, increase resistance-capacitance return circuit (when coils of relay has 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:

NO.	SMS Orders	Pass back Information	Description	
1	SMS GENSET	GENSET ALARM	When genset is shutdown alarm	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 TEST MODE GENSET AT REST	At rest status in Test 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 TEST MODE GENSET IS RUNNING	Running status in Test mode	
		SYSTEM IN AUTO MODE GENSET AT RUNNING	Running status in Auto mode	
2	SMS START	GENSET ALARM	Generator is shutdown alarm or trip alarm	Start genset
		STOP MODE NOT	Cannot start in stop	

		START	mode	
		SMS START OK	Start in manual/test 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 TEST MODE	SMS TEST MODE OK	Set as test mode	
6	SMS AUTO MODE	SMS AUTO MODE OK	Set as auto mode	
7	SMS DETAIL	Pass back information can be set via PC software.	Gets details information of genset.	
8	SMS INHIBIT START	INHIBIT START OK	Set as “INHIBIT START”	
9	SMS PERMIT START	PERMIT START OK	Remove “INHIBIT START” order	

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

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.

15 CONNECTIONS OF CONTROLLER WITH J1939 ENGINE

15.1 CUMMINS ISB/ISBE

Terminals of controller	Connector B	Remark
Fuel relay output	39	
Start relay output	-	Connect with starter coil directly
Auxiliary output port 1	Expand 30A relay, battery voltage of 01,07,12,13 is supplied by relay	ECU power Set Auxiliary output 1 as “ECU power”

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

Engine type: Cummins ISB

15.2 CUMMINS QSL9

Suitable for CM850 engine control module

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

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	Impedance 120Ω connecting line is recommended.
CAN(L)	SAE J1939 return-D	Impedance 120Ω connecting line is recommended.

Engine type: Cummins-CM850

15.3 CUMMINS QSM11(IMPORT)

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

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

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

Engine type: Cummins ISB

15.4 CUMMINS QSX15-CM570

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

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

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	Impedance 120Ω connecting line is recommended.
CAN(L)	SAE J1939 return-D	Impedance 120Ω connecting line is recommended.

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.

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

Terminals of controller	D-SUB connector 06	Remark
RS485 GND	20	CAN communication shielding line(connect with ECU terminal only)
RS485+	21	Impedance 120Ω connecting line is recommended.
RS485-	18	Impedance 120Ω connecting line is recommended.

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

15.6 CUMMINS QSM11

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	Impedance 120Ω connecting line is recommended.
CAN(L)	37	Impedance 120Ω connecting line is recommended.

Engine type: common J1939

15.7 CUMMINS QSZ13

Terminals of controller	OEM connector of engine	Remark
Fuel relay output	45	
Start relay output	-	Connect to starter coil directly
Programmable 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.
Programmable 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	Impedance 120Ω connecting line is recommended.
CAN(L)	21	Impedance 120Ω connecting line is recommended.

Engine type: Common J1939

15.8 DETROIT DIESEL DDEC III / IV

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)	Impedance 120Ω connecting line is recommended.
CAN(L)	CAN(L)	Impedance 120Ω connecting line is recommended.

Engine type: Common J1939

15.9 DEUTZ EMR2

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	Impedance 120Ω connecting line is recommended.
CAN(L)	13	Impedance 120Ω connecting line is recommended.

Engine type: VolvoEDC4

15.10 JOHN DEERE

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	Impedance 120Ω connecting line is recommended.
CAN(L)	U	Impedance 120Ω connecting line is recommended.

Engine type: John Deere

15.11 MTU MDEC

Suitable for MTU engines, 2000 series, 4000series

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	Impedance 120Ω connecting line is recommended.
CAN(L)	F	Impedance 120Ω connecting line is recommended.

Engine type: MTU-MDEC-303

15.12 MTU ADEC(SMART MODULE)

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

Terminals of controller	ADEC (X1port)	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

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	Impedance 120Ω connecting line is recommended.
CAN(L)	X4 2	Impedance 120Ω connecting line is recommended.

Engine type: MTU-ADEC

15.13 MTU ADEC(SAM MODULE)

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

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

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	Impedance 120Ω connecting line is recommended.
CAN(L)	X23 1	Impedance 120Ω connecting line is recommended.

Engine type: Common J1939

15.14 PERKINS

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

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	Impedance 120Ω connecting line is recommended.
CAN(L)	32	Impedance 120Ω connecting line is recommended.

Engine type: Perkins

15.15 SCANIA

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

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	Impedance 120Ω connecting line is recommended.
CAN(L)	10	Impedance 120Ω connecting line is recommended.

Engine type: Scania

15.16 VOLVO EDC3

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

Terminals of controller	"Stand alone" connector	Remark
Fuel relay output	H	
Start relay output	E	
programmable output 1	P	ECU power Configurable output 1,"ECU power"

Terminals of controller	"Data bus" connector	Remark
CAN GND	-	CAN communication shielding line(connect with controller's terminal only)
CAN(H)	1	Impedance 120Ω connecting line is recommended.
CAN(L)	2	Impedance 120Ω connecting line is recommended.

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.

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	Impedance 120Ω connecting line is recommended.
CAN(L)	13	Impedance 120Ω connecting line is recommended.

Engine type: VolvoEDC4

15.18 VOLVO-EMS2

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

Terminals of controller	Engine's CAN port	Remark
programmable output 1	6	ECU stop Configurable output 1 "ECU stop"
Programmable output 2	5	ECU power Configurable output 2 "ECU power"
	3	Negative power
	4	Positive power
CAN GND	-	CAN communication shielding line(connect with controller's terminal only)
CAN(H)	1(Hi)	Impedance 120Ω connecting line is recommended.
CAN(L)	2(Lo)	Impedance 120Ω connecting line is recommended.

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 pump engine.

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	Impedance 120Ω connecting line is recommended.
CAN(L)	1.34	Impedance 120Ω connecting line is recommended.

Battery	Engine 2 pins	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 pump engine.

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	Impedance 120Ω connecting line is recommended.
CAN(L)	1.34	Impedance 120Ω connecting line is recommended.

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 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 AC voltage; Check DC fuse.
Controller emergency stop	Check emergence stop button is correct or not; Check whether the starting battery positive be connected with the emergency stop input correctly; Check whether the circuit is open.
Low oil pressure alarm after crank disconnect	Check the oil pressure sensor and its connections.
High water temperature 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 TFT; Check auxiliary input ports.
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 is abnormal	Check connections; Check setting of COM port is correct or not; Check RS485's connections of A and B is reverse connect 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 alarm page; If there is detailed alarm, check engine according to description. If not, please refer to engine manual according to SPN alarm code.