



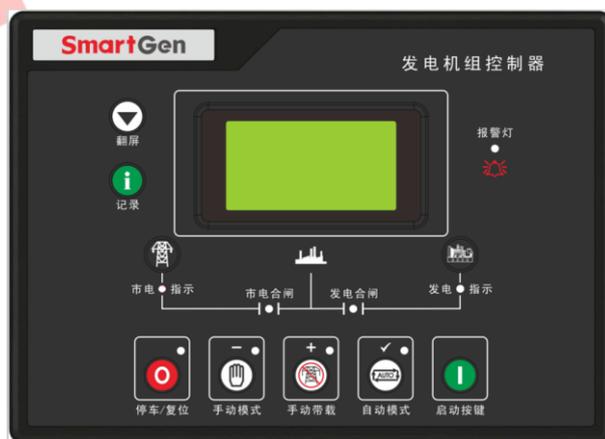
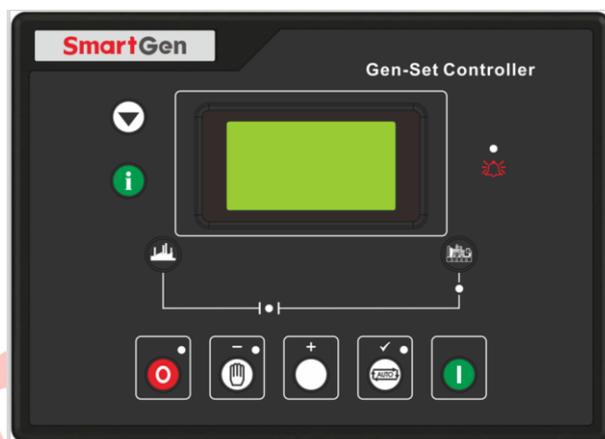
**SmartGen**  
ideas for power

## HGM8100A GENSET CONTROLLER

(HGM8110A/HGM8120A)

(VFD DISPLAY)

## USER MANUAL



SMARTGEN (ZHENGZHOU) TECHNOLOGY CO., LTD.



Chinese trademark

**SmartGen** English trademark

**SmartGen** – make your generator smart

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**Table 1 Software Version**

Date	Version	Note
2013-01-29	1.0	Original release.
2013-04-12	1.1	Modify some details.
2013-06-17	1.2	Modify case dimension; Modify the contents of "Oil Pressure Sensor"
2013-11-20	1.3	Add "Loss of Speed Signal Shutdown" in output port settings.
2013-12-23	1.4	Add function: Long pressing "i" button can reset trip alarm.
2014-10-23	1.5	Change the "Working Conditions" and "Storage Condition" temperature as (-40~+70)°C
2016-09-28	1.6	Modify the picture of mask and the graph of controller dimension.
2021-03-24	1.7	Modify the error in specification and other translation problems.

This manual is suitable for HGM8110A/HGM8120A controller only.

Clarification of notation used within this publication.

**Table 2 Notation Clarification**

Sign	Instruction
 NOTE	Highlights an essential element of a procedure to ensure correctness.
 CAUTION!	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
 WARNING!	Indicates error operation may cause death, serious injury and significant property damage.

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## 1 OVERVIEW

HGM8110A/8120A genset controllers are especially designed for extremely high/low temperature environment (-40~+70)°C. The controllers can operate reliably in extreme temperature conditions with the help of VFD display and the components that resist extreme temperature. All display information is Chinese (English is optional). Operation information, status information and faults information are all displayed which make commissioning convenience for factory personnel. Controller can be used under complex electromagnetic interference environment with the strong ability of anti-electromagnetic interference. Easy to maintain and upgrade due to the plug-in terminal. HGM8110A/8120A genset controllers integrate digitization, intelligentization and network technology which are used for genset automation and monitor control system of single unit to achieve automatic start/stop, data measuring, alarm protection and “four remotes” (remote control, remote measuring, remote communication and remote regulating).

HGM8110A/8120A genset controllers adopt micro-processor technology with precision parameters measuring, fixed value adjustment, time setting and threshold adjusting and etc. Majority parameters can be configured from front panel, and all parameters can be configured by RS485 interface (or RS232) to adjust via PC. It can be widely used in all types of automatic genset control system with compact structure, advanced circuits, simple connections and high reliability.

## 2 PERFORMANCE AND CHARACTERISTICS

- ◆ HGM8100A series controller has two types:
  - HGM8110A:** ASM (Automatic Start Module), used for single automation systems;
  - HGM8120A:** AMF (Auto Mains Failure), updates based on HGM8110A, moreover, has mains electric quantity monitoring and mains/generator automatic transfer control function, especially for automatic system composed by generator and mains;
- ◆ With ARM-based 32-bit SCM, highly integrated hardware, new reliability level;
- ◆ Vacuum fluorescent display (VFD), selectable Chinese/English interface which can be chosen at the site, making commissioning convenience for factory personnel;
- ◆ Widely temperature range: (-40~+70)°C, can be used in extreme temperature environment;
- ◆ 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 or mains;

### Mains

Line voltage (Uab, Ubc, and Uca)	V (unit)
Phase voltage (Ua, Ub, and Uc)	V (unit)
Frequency f	Hz (unit)

### Generator

Line voltage (Uab, Ubc, and Uca)	V (unit)
Phase voltage (Ua, Ub, and Uc)	V (unit)
Frequency f	Hz (unit)

### Load

3-phase Current	Ia, Ib, Ic	A (unit)
Active power (P)		kW (unit)
Apparent power (S)		kVA (unit)
Power factor (λ)		
Accumulate total generator power (W)		kWh (unit)

- ◆ For Mains, controller has over and under voltage, over and under frequency, loss of phase and reverse phase sequence detection functions; For generator, controller has over and under voltage, over and under frequency, over current, over and reverse power, loss of phase, reverse phase sequence detection functions;
- ◆ 3 fixed analog sensors (temperature, oil pressure and liquid level);

- ◆ 2 configurable sensors can be set as sensor of temperature, oil pressure or fuel level;
- ◆ Precision measure and display parameters about Engine,
  - Temp. (WT)                    °C/°F both be displayed
  - Oil pressure (OP)            **kPa/psi/bar** all be displayed
  - Speed (RPM)
  - Voltage of Battery (VB)    **V (unit)**
  - Voltage of Charger (VD)    **V (unit)**
  - Hour count (HC) can accumulate to max. 65535 hours.
  - Start times can accumulate to max. 65535 times.
- ◆ Protection: automatic start/stop of the gen-set, ATS (Auto Transfer Switch) control with perfect fault display and protection function;  
Fault display and protection items:
  - High temperature alarm
  - High temperature shutdown
  - Low oil pressure alarm
  - Low oil pressure shutdown
  - Over speed shutdown
  - Low fuel level warn
  - Battery voltage high warn
  - Battery voltage low warn
  - Load over current shutdown
  - Fail to start alarm
  - Fail to stop alarm
  - Emergency stop alarm
  - Oil pressure sensor open circuit alarm
  - Temperature sensor open circuit alarm
- ◆ 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 RS485/RS232 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;

- ◆ Real time clock and run time accumulation function. 99 pieces of event logs can be circularly stored and inquired on the spot; also can be print or be inquired via PC;
- ◆ Scheduled start & stop generator (can be set as start genset once a week/month);
- ◆ With maintenance function. Actions (warning, shutdown or trip and stop) can be set when maintenance time out;
- ◆ Can be used on pumping units and as an indicating instrument (indicate and alarm are enable only, relay is inhibited);
- ◆ Accumulative total electric energy. Users can reset it and re-accumulate the value which make convenience to users to count the total value as their wish;
- ◆ Widely power supply range: DC (8~35)V, suitable to 12/24V starting battery voltage environment;
- ◆ With international standard MODBUS communication protocol, better error checking capability, and with RS232 and RS485 (coupling isolation) communication interface, can realize functions of remote control, remote measuring, remote communication and remote regulating, facilitate remote centralized monitoring of genset;
- ◆ 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, pluggable connection terminals and embedded installation way; compact structure with easy mounting.

### 3 SPECIFICATION

**Table 3 Technical Parameters**

Item	Content
Operating Voltage	DC8. 0V to 35. 0V, Continuous Power Supply
Power Consumption	<6W (Standby mode: ≤3W)
Alternator Input Range	
3-Phase 4 Wire	AC20V - AC360V (ph-N)
3-Phase 3 Wire	AC30V - AC600V (ph-ph)
Single-Phase 2 Wire	AC20V - AC360V (ph-N)
2-Phase 3 Wire	AC20V - AC360V (ph-N)
Alternator Frequency	50Hz/60Hz
Speed Sensor Voltage	1.0V to 24.0V (RMS)
Speed Sensor Frequency	10,000 Hz (max)
Start Relay Output	16A DC28V at supply output
Fuel Relay Output	16A DC28V at supply output
Aux. Output 1	16A DC28V at supply output
Aux. Output 2	16A DC28V at supply output
Aux. Output 3	16A DC28V at supply output
Aux. Output 4	16A AC250V passive
Gen Close Relay	16A AC250V passive
Aux. Output 5	
Mains Close Relay	16A AC250V passive
Aux. Output 6	
Overall Dimensions	243.7mm x 176.2mm x 51.2mm
Panel Cutout	214mm x 160mm
C. T. Secondary	5A (rated)
Working Conditions	Temperature: (-40~+70)°C Humidity: (20~93)%RH
Storage Condition	Temperature: (-40~+70)°C
Protective 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.
Weight	0.80kg

## 4 OPERATION

### 4.1 KEY FUNCTION

**Table 4 Key Descriptions**

Key	Name	Description
	Stop/Reset	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/ Config. '-'	Pressing this key will set the module into manual mode. In setting parameter status, press this key will decrease setting value.
	Test mode/ Config. '+'	Pressing this key will set the module into test mode (only for HGM8120A). In setting parameter status, press this key will increase setting value.
	Auto mode/Confirm	Pressing this key will set the module into auto mode. In setting parameter status, press this key will right shift cursor or confirm setting value.
	Event log	Pressing this key will view shutdown history records. Again pressing this key will exit. When there is trip alarm occurs, pressing and holding this button for more than 3 seconds can reset the alarm.
	Page Down	Screen scroll in parameters interface or event log interface.

**NOTE:** In manual mode, pressing  and  simultaneously will force generator to crank. Successful start will not be judged according to crank disconnect conditions, operator will have to crank the starter motor manually; when operator decides that the engine has fired, he/she should release the button and start relay will be deactivated, safety on delay will start.

**NOTE:** Pressing and holding  for more than 3 seconds enters basic parameter configuration menu;

**NOTE:** Pressing  and  enters advanced parameter configuration menu;

**CAUTION:** Default password is 00318, user can change it in case of others change the advanced parameters setting. Please clearly remember the password after changing. If you forget it, please contact Smartgen services.

## 4.2 INDICATOR LIGHT

**Table 5 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)

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

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

Generator close light: It is light on when generator close; off when generator open.

Mains close light: It is light on when mains close; off when mains open. (HGM8120A)

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### 4.3 LCD DISPLAY

#### 4.3.1 MAIN DISPLAY

Main screen is used to display real time data of all parameters, use  to scroll the screen and view parameters.

★**Status**, including as below,

Status of genset, mains (HGM8120A), and ATS.

★**Mains**, including as below

Phase voltage, Line voltage, frequency.

▲**NOTE:** HGM8110A has no mains status screen.

★**Gen**, including as below,

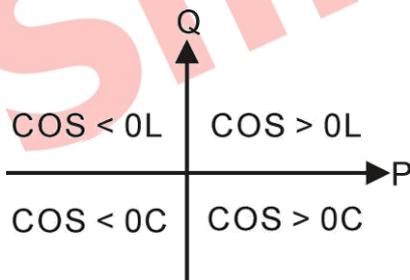
Phase voltage, Line voltage, frequency.

★**Load**, including as below,

Each phase current, total active power (positive and negative), total reactive power (positive and negative), total apparent power, average power factor (positive and negative), accumulated energy (**kWh, kVarh, kVAh**).

▲**NOTE:** When mains close indicator lights, 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 reactive power

**Table 6 Power Factor**

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

**NOTE:**

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

**★Engine**, including as below,

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

**★Alarm:**

Display all kinds of alarm information, such as Gen Overvoltage, Gen Undervoltage, Gen Over Frequency, Gen Under Frequency and so on.

**★Event log**

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

Example:

<b>Gen</b>			
UL-L	0	0	0V
UL-N	0	0	0V
F = 0.0Hz	Orpm		
<b>Stop Mode</b>			

<b>Load</b>			
Current	0.0	0.0	0.0A
Power	0.0kW	0.0	kVA
cosΦ = 0.00	0.0	kVar	
<b>Gen Overvoltage Warn</b>			

**4.3.2 BASIC PARAMETER SETTING MENU**

Basic parameters setting including as following,

- ★Mains Rated Voltage (HGM8120A)
- ★Mains Rated Frequency (HGM8120A)
- ★Crank Disconnect Condition
- ★Flywheel Teeth

- ★Rated Speed
- ★Gen Rated Voltage
- ★Gen Rated Frequency
- ★CT Ratio
- ★Rated Current
- ★Rated Power
- ★Battery Voltage
- ★Date and Time
- ★Start Delay
- ★Stop Delay
- ★Pre-heat Delay
- ★Cranking Time
- ★Crank Rest Time
- ★Safety On Delay
- ★Start Idle Time
- ★Warming Up Time
- ★Cooling Time
- ★Stop Idle Time
- ★ETS Solenoid Hold
- ★Fail to Stop Delay
- ★After Stop Time

Example:

Basic Parameter Setting >Return >Mains Rated Frequency >Crank Disconnect Condition	Form 1:   are used for changing the setting contents.  to enter settings (form 2),  to exit setting.
---	--

Crank Disconnect Condition 2: Speed sensor + Gen freq.	Form 2: Press  to enter settings (form 3); press  or  or  to return to previous menu. (form 1).
---	---

Crank Disconnect Condition 2: Speed sensor + Gen freq.	Form 3:   are used for changing the setting contents.  Confirm setting (form 2),  exit setting (form 2).
---	--

### 4.3.3 ADVANCED PARAMETERS SETTING

Advanced parameter setting including as following,

- ★Mains settings
- ★Timer settings
- ★Engine settings
- ★Generator settings
- ★Load settings
- ★ATS settings
- ★Analog sensor settings
- ★Input port settings
- ★Output port settings
- ★Module settings
- ★Scheduling and maintenance settings

Example,

<b>Advanced Parameters Setting</b> >Mains >Timers >Engine >Generator	Form 1:   are used for changing the setting contents.  to enter settings (form 2),  to exit setting.
--	--

<b>Generator Setting</b> >Return >AC System >Poles >Rated Voltage	Form 2:   are used for changing the setting contents (form 3). Select "Return" and press  to return to previous menu (form 1). Press  also can return to previous menu (form 1)
---	---

<b>Generator Setting</b> >Gen Undervolt Shutdown >Gen Overfreq. Shutdown >Gen Underfreq. Shutdown >Gen Overvolt Warn	Form 3:   are used for changing the setting contents.  Confirm setting (form 4),  exit setting (form 1).
--	--

<b>Gen Overvolt Warn</b> Sel: Disable Set Value: 00110% Return Value: 00108% Delay: 00005	Form 4: Press  to enter settings (form 5); Press  or  or  to return to previous menu. (Form 3).
---	---

Gen Overvolt Warn		Form 5:   are used for changing the setting contents (form 6).  Confirm setting (form 7),  return to previous menu (form 4)
Sel:	Disable	
Set Value:	00110%	
Return Value:	00108%	
Delay:	00005	

Gen Overvolt Warn		Form 6:   are used for changing the setting contents (form 5).  Confirm setting (form 7),  return to previous menu (form 4)
Sel:	Disable	
Set Value:	00110%	
Return Value:	00108%	
Delay:	00005	

Gen Overvolt Warn		Form 7:   are used for changing the setting contents (form 5).  Confirm setting,  return to previous menu (form 4).
Sel:	Enable	
Set Value:	00000	
Return Value:	00108%	
Delay:	00005	

Gen Overvolt Warn		Form 8:   are used for changing the setting contents.  Confirm setting (form 4),  return to previous menu (form 4).
Sel:	Enable	
Set Value:	0000	
Return Value:	00108%	
Delay:	00005	

**NOTE:** Pressing and holding for a long time can exit setting directly during setting.

## 4.4 AUTOMATIC START/STOP OPERATION

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

### Starting Sequence,

1. **HGM8120A:** When Mains is abnormal (over and under voltage, over and under frequency), it enters into mains “abnormal delay” and VFD displays count down time. When mains abnormal delay is over, it enters into “start delay”;
2. **HGM8110A:** Generator enters into “start delay” as soon as “Remote Start” is active;
3. “Start delay” timer is shown on VFD display;
4. When start delay is over, preheat relay outputs (if this be configured), “preheat delay XX s” is shown on VFD;
5. When preheat delay is over, fuel relay outputs 1s and then start relay output; if engine crank fails during “cranking time”, the fuel relay and start relay deactivated and enter into “crank rest time” to wait for next crank;
6. If engine crank fails within setting times, the controller sends “Fail to start” signal and “Fail to start” message appears on VFD alarm page;
7. In case of successful crank attempt, “safety on” timer starts. During this period, low oil pressure, high water temperature, under speed, charge failure alarms and Aux. input (if configured) are disabled. As soon as this delay is over, “start idle delay” is initiated (if configured);
8. During “start idle delay”, under speed, under frequency, under voltage alarms are inhibited. When this delay is over, “warming up delay” starts (if configured);
9. When “warming up delay” is over, if generator state is normal, its indicator will be illuminated. If voltage and frequency have reached on-load requirements, the closing relay will be energized, generator will accept load, generator power indicator will turn on, and generator will enter Normal Running state; if voltage and frequency are abnormal, the controller will initiate alarm (alarm type will be displayed on VFD).

**NOTE:** **HGM8110A:** In case of “Remote Start (off Load)”, the procedure is the same, except for step No. 9: generator close relay will NOT be energized, genset will NOT accept load.

### Stopping Sequence

- 1) **HGM8120A:** If mains turns normal during genset is running, it enters into mains voltage “normal delay” and its indicator illuminates after mains is confirmed normally, “stop delay” is beginning;
- 2) **HGM8110A:** Genset enters into “stop delay” as soon as “Remote Start” input is inactive;
- 3) **HGM8120A:** After stop delay ends, it enters “cooling time”, and generator close relay is disconnected, after “switch transfer delay”, mains close relay output, mains is on-load, generator

- power supply indicator is extinguishing, and mains power supply indicator is illuminated;
- 4) Idle relay is output when the controller enters “stop idle delay”;
  - 5) Enter into “ETS delay” and ETS relay is active. Fuel relay output is disconnected;
  - 6) Genset can automatically judge if it is steady when the controller enters “Genset after stop time”;
  - 7) After genset stops steadily, enter generator standby status; if genset does not stop, then controller will alarm (VFD screen display stop failure warn);
  - 8) Enter “generator at rest” as soon as “after stop time” is over.

#### 4.5 MANUAL START/STOP OPERATION

- 1) **HGM8120A:** “Manual Mode” is active when press  key and its indicator illuminates. Press  key, then controller enters “**Test Mode**” and indicator illuminates. Under the both modes, press  key to start genset, and it automatically detects if it starts successfully and accelerates to high speed running. With high temperature, low oil pressure, over speed and abnormal voltage during diesel genset running, controller can protect genset to stop effectively and quickly (please refer to No.4~9 of **Starting Sequence** for more details). Under “**Manual Mode** ”, genset on-load is decided by whether mains is normal or not. If mains is normal, loading switch isn’t transferred; while mains is abnormal, loading switch is transferred into generator’s side. Under “**Test Mode** ”, after genset runs well in high speed, no matter mains is normal or not, loading switch must be transferred into Generator’s side.
- 2) **HGM8110A:** “**Manual Mode**” is active when press  key, and its indicator is illuminated. Then press  key to start generator, it automatically detects if it is started successfully and genset automatically accelerates to high speed running. With high temperature, low oil pressure, over speed and voltage abnormal during diesel genset running, controller can protect genset to stop effectively and quickly (please refer to No.4~9 of **Starting Sequence** for more details). After genset runs well in high speed, if remote start signal is active, controller will send signal of Generator close; otherwise, it will not.
- 3) Manual stop: press  key can shut down the running genset (please refer to No.3~7 of **Stopping Sequence** for more details).

## 4.6 GENSET CONTROLLER ATS CONTROL PROCEDURES

### 1. HGM8120A ATS CONTROL PROCEDURES

#### 1) If input port is configured as Closed Auxiliary

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

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

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

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

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

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

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

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

### 2. HGM8110A ATS CONTROL PROCEDURES

#### 1) If input port is configured as Closed Auxiliary

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

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

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

If transfer failed and warning is "Enable", there is alarming signal whatever switch on or off failure.

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

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

Generator unload is transferred into generator load, after the delay of switch on, detecting transfer

failure while switch on outputting. When detecting time out, if switch on failed, it waits for switch on. Otherwise, switch on is completed.

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

## 2) If input port is not configured as Closed 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 "Disable" or "Enable" both are OK. If choose "Enable", switch off output should be configured;

When using AC contactor, switch off "Enable" is recommended.

## 4.7 VIEWING EVENT LOG

On the control panel, press  key to view previous running records of the controller, including all start/stop records (shutdown, trip and stop, manual/auto start/stop) and corresponding time. Press  key to view records backward. Again press  key to return real time display status of the controller. HGM8100A controller can save recent 99-piece event log records.

## 5 PROTECTION

### 5.1 WARNING

When controller detects the warning signal, it sends alarm only and doesn't stop the genset, besides, the VFD displays the warning information.

**Table 7 Warning Alarm**

No.	Type	Description
1	Over Speed Warn	When controller detects the speed is higher than the set value, it will send warn signal.
2	Under Speed Warn	When controller detects the speed is lower than the set value, it will send warn signal.
3	Loss of Speed Signal Warn	When controller detects the speed is 0 and the action selects "Warning", it will send warn signal.
4	Over Frequency Warn	When controller detects the frequency is higher than the set value, it will send warn signal.
5	Under Frequency Warn	When controller detects the frequency is lower than the set value, it will send warn signal.
6	Over Voltage Warn	When controller detects the voltage is higher than the set value, it will send warn signal.
7	Under Voltage Warn	When controller detects the voltage is lower than the set value, it will send warn signal.
8	Over Current Warn	When controller detects the current is higher than the set value, it will send warn signal.
9	Fail to Stop	When generator not stops after the "stop delay" is over, it will send warn signal.
10	Charge Alt Fail	When controller detects the charger voltage is lower than the set value, it will send warn signal.
11	Battery Over Voltage	When controller detects the battery voltage is higher than the set value, it will send warn signal.
12	Battery Under Voltage	When controller detects the battery voltage is lower than the set value, it will send warn signal.
13	Maintenance Due	When count down time is 0 and the action selects "Warning", it will send warn signal.
14	Reverse Power	When controller detects the reverse power value (power is negative) is higher than the set value, it will send warn signal.
15	Over Power	When controller detects the power value (power is positive) is higher than the set value, it will send warn signal.

No.	Type	Description
16	Gen Loss of Phase	When controller detects the generator loss phase, it will send warn signal.
17	Gen Reverse Phase Sequence	When controller detects the reverse phase, it will send warn signal.
18	Switch Fail Warn	When controller detects the switch on and off fail, and the action is selected enable, it will send warn signal.
19	Temp. Sensor Open	When controller detects the sensor is open circuit, and the action selects "Warning", it will send warn signal.
20	High Temp. Warn	When controller detects the temperature is higher than the set value, it will send warn signal.
21	Low Temp. Warn	When controller detects the temperature is lower than the set value, it will send warn signal.
22	OP Sensor Open	When controller detects the sensor is open circuit, and the action selects "Warning", it will send warn signal.
23	Low OP Warn	When controller detects the oil pressure is lower than the set value, it will send warn signal.
24	Level Sensor Open	When controller detects the sensor is open circuit, and the action selects "Warning", it will send warn signal.
25	Low Level Warn	When controller detects the level is lower than the set value, it will send warn signal.
26	Flexible Sensor 1 Open	When controller detects the sensor is open circuit, and the action selects "Warning", it will send warn signal.
27	Flexible Sensor 1 High	When controller detects the sensor value is higher than the max. set value, it will send warn signal.
28	Flexible Sensor 1 Low	When controller detects the sensor value is lower than the min. set value, it will send warn signal.
29	Flexible Sensor 2 Open	When controller detects the sensor is open circuit, and the action selects "Warning", it will send warn signal.
30	Flexible Sensor 2 High	When controller detects the sensor value is higher than the max. set value, it will send warn signal.
31	Flexible Sensor 2 Low	When controller detects the sensor value is lower than the min. set value, it will send warn signal.
32	Digital Input Warn	When digit input port is set as warning and active, controller sends corresponding warning signal.

## 5.2 SHUTDOWN ALARM

When controller detects shutdown alarm, it will send generator close signal and stop the generator immediately.

**Table 8 Shutdown Alarm**

No.	Type	Description
1	Emergency Stop	When controller detects emergency stop signal, it will send stop signal.
2	Over Speed	When controller detects the speed value is higher than the set value, it will send stop signal.
3	Under Speed	When controller detects the speed value is lower than the set value, it will send stop signal.
4	Loss of Speed Signal	When controller detects speed value equals to 0, and the action selects "Shutdown", it will send stop signal
5	Over Frequency	When controller detects the frequency value is higher than the set value, it will send stop signal.
6	Under Frequency	When controller detects the frequency value is lower than the set value, it will send stop signal.
7	Over Voltage	When controller detects the voltage value is higher than the set value, it will send stop signal.
8	Under Voltage	When controller detects the voltage value is lower than the set value, it will send stop signal.
9	Fail To Start	If genset start failure within setting of start times, controller will send stop signal.
10	Over Current	When controller detects the current value is higher than the set value, it will send stop signal.
11	Maintenance Due	When count down time is 0 and the action selects "Shutdown", it will send stop signal.
12	Reverse Power Shutdown	When controller detects reverse power value (power is negative) is higher than the set value, and the reverse power action selects "Shutdown", it will send stop signal.
13	Over Power Shutdown	When controller detects power value (power is positive) is higher than the set value, and the reverse power action selects "Shutdown", it will send stop signal.
14	Temp. Sensor Open	When controller detects sensor is open circuit, and the action selects "Shutdown", it will send stop signal.
15	High Temp. Shutdown	When controller detects temperature is higher than the set



No.	Type	Description
		value, it will send stop signal.
16	OP Sensor Open	When controller detects sensor is open circuit, and the action selects "Shutdown", it will send stop signal.
17	Low OP Shutdown	When controller detects oil pressure is lower than the set value, it will send stop signal.
18	Level Sensor Open	When controller detects sensor is open circuit, and the action selects "Shutdown", it will send stop signal.
19	Flexible Sensor 1 Open	When controller detects sensor is open circuit, and the action selects "Shutdown", it will send stop signal.
20	Flexible Sensor 1 High	When controller detects the sensor value is higher than the max. set value, it will send stop signal.
21	Flexible Sensor 1 Low	When controller detects the sensor value is lower than the min. set value, it will send stop signal.
22	Flexible Sensor 2 Open	When controller detects sensor is open circuit, and the action selects "Shutdown", it will send stop signal.
23	Flexible Sensor 2 High	When controller detects the sensor value is higher than the max. set value, it will send stop signal.
24	Flexible Sensor 2 Low	When controller detects the sensor value is lower than the min. set value, it will send stop signal.
25	Digital Input Port	When digital input port is set as shutdown, and the action is active, it will send stop signal.

### 5.3 TRIP AND STOP ALARM

When controller detects trip and stop alarm signal, it will break generator close signal quickly and stop the genset after high speed cooling.

**Table 9 Trip and Stop Alarm**

No.	Type	Description
1	Over Current	When controller detects the value is higher than the set value, and the action selects "Trip and Stop", it will send trip and stop signal.
2	Maintenance Due	When count down time is 0 and the action selects "Trip and Stop", it will send a trip and stop signal.
3	Reverse Power	When controller detects reverse power value (power is negative) is higher than the set value, and the action selects "Trip and Stop", it will send a trip and stop signal.
4	Over Power	When controller detects the power value (power is positive) is higher than the set value, and the action selects "Trip and Stop", it will send a trip and stop signal.
5	Digital Input Ports	When digital input port is set as "Trip and Stop", and the action is active, it will send a trip and stop signal.

### 5.4 TRIP ALARM

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

**Table 10 Trip Alarm**

No.	Type	Description
1	Over Current	When controller detects the value is higher than the set value, and the action selects "Trip", it will send trip signal.
2	Reverse Power	When controller detects reverse power value (power is negative) is higher than the set value, and the action selects "Trip", it will send a trip signal.
3	Over Power	When controller detects the power value (power is positive) is higher than the set value, and the action selects "Trip", it will send a trip signal.
4	Digital Input Ports	When digital input port is set as "Trip", and the action is active, it will send a trip signal.

## 6 WIRING CONNECTION

Compared with HGM8120A, HGM8110A has no 3-phase mains voltage input terminal. The back panel of HGM8110A and HGM8120A controller is shown as follows:

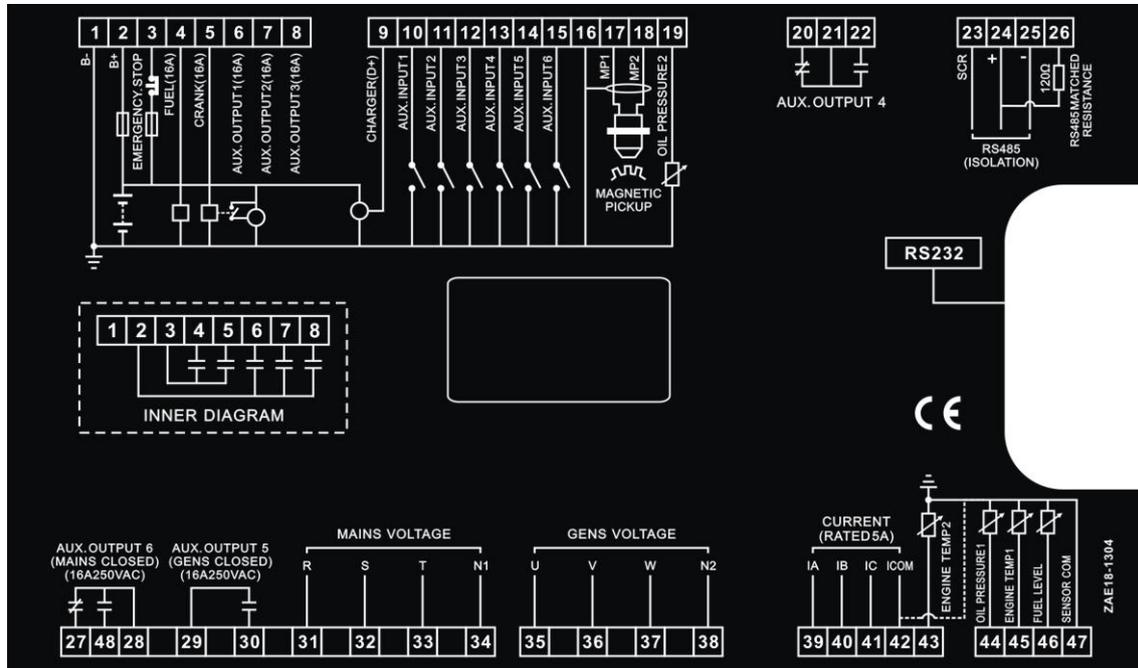


Fig.1 HGM8110A/HGM8120A Back Panel

Table 11 Terminal Wiring Connection Description

No.	Function	Cable Size (mm <sup>2</sup> )	Remarks
1	DC input B-	2.5	Connected with negative of starter battery.
2	DC input B+	2.5	Connected with positive of starter battery. Max. 20A fuse is recommended.
3	Emergency stop	2.5	Connected with DC power supply via emergency stop button. Also supply power to fuel relay and crank relay. Max. 30A fuse is recommended.
4	Fuel relay output	2.5	DC power is supplied by 3 terminal, rated 16A.
5	Crank relay output	2.5	DC power is supplied by 3 terminal, rated 16A.
6	Aux. Output 1	2.5	B+ output, rated 16A.
7	Aux. Output 2	2.5	B+ output, rated 16A.
8	Aux. Output 3	2.5	B+ output, rated 16A.
9	Charger(D+)	1.0	Connected with charger starter's D+ terminal. Ground connected is not allowed.
10	Aux. Input 1	1.0	Ground connected is active (B-)
11	Aux. Input 2	1.0	Ground connected is active (B-)
12	Aux. Input 3	1.0	Ground connected is
			Details see table 13
			Details see table 14



No.	Function	Cable Size (mm <sup>2</sup> )	Remarks
			active (B-)
13	Aux. Input 4	1.0	Ground connected is active (B-)
14	Aux. Input 5	1.0	Ground connected is active (B-)
15	Aux. Input 6	1.0	Ground connected is active (B-)
16	Magnetic Pickup	1.0	Common grounded; Connected with enclosure or negative of starter battery.
17	Magnetic Pickup +	1.0	Connected to speed sensor
18	Magnetic Pickup -	1.0	
19	Oil pressure sensor 2	1.0	Oil pressure sensor input, can be connected to an external resistance sensor. (Also can be set as Temperature sensor or Fuel level sensor).
20	Aux. Output 4	2.5	Volts free contactors, rated 16A. Details see table 13
21			
22			
23	RS485	0.5	Opto-isolation; (Impedance-120Ω shielding wire is recommended, its single-end earthed. Hang up the 26 terminal.)
24	RS485+	0.5	
25	RS485-	0.5	
26	Matched Resistance		If needed, please make this terminal and 25 terminal short circuit. If not, hang it in the air.
27	Aux. Output 6	2.5	Control mains to take load. Volts free contactor. Rated 16A. (Also can be set as other function; Details see table 13).
28	Mains Close Relay		
48	Output		
29	Aux. Output 5	2.5	Control generator to take load. Normally open volts free contactor. Rated 16A. (Also can be set as other function; Details see table 13).
30	Gen Close Relay Output		
31	Mains A-phase voltage sensing input	1.0	Connected to A-phase of mains (2A fuse is recommended) (HGM8110A without).
32	Mains B-phase voltage sensing input	1.0	Connected to B-phase of mains (2A fuse is recommended) (HGM8110A without).
33	Mains C-phase voltage sensing input	1.0	Connected to C-phase of mains (2A fuse is recommended) (HGM8110A without).
34	Mains N-wire input	1.0	Connected to N-wire of mains (HGM8110A without).
35	Genset A-phase voltage sensing input	1.0	Connected to A-phase of genset (2A fuse is recommended).
36	Genset B-phase voltage sensing input	1.0	Connected to B-phase of genset (2A fuse is recommended).
37	Genset C-phase voltage sensing input	1.0	Connected to C-phase of genset (2A fuse is recommended).



No.	Function	Cable Size (mm <sup>2</sup> )	Remarks
38	Genset N-wire input	1.0	Connected to N-wire of genset.
39	CT A-phase sensing input	2.5	Outside connected to secondary coil of current transformer (rated 5A).
40	CT B-phase sensing input	2.5	Outside connected to secondary coil of current transformer (rated 5A).
41	CT C-phase sensing input	2.5	Outside connected to secondary coil of current transformer (rated 5A).
42	CT COM	2.5	Common grounded; Connected with negative of starter battery.
43	Temperature sensor 2	1.0	Temperature sensor input, can be connected to an external resistance sensor. (Also can be set as Oil Pressure sensor or Fuel level sensor).
44	Oil pressure sensor 1	1.0	Oil pressure sensor input, can be connected to an external resistance sensor.
45	Temperature sensor 1	1.0	Temperature sensor 1 input, can be connected to an external resistance sensor.
46	Fuel level sensor	1.0	Fuel level sensor input, can be connected to an external resistance sensor.
47	Sensor COM	/	Public terminal of sensor, (B-) has already connected.
	RS232 connector	0.5	Communication with the computer (2-RXD, 3-TXD, 5-GND).

**NOTE:** Prohibit removing starting battery when the engine is running, or it will damage the control system because of over DC input voltage.

## 7 SCOPES AND DEFINITIONS OF CONFIGURABLE PARAMETERS

HGM8110A/8120A genset controllers can set the following parameters, (HGM8110A has no mains items)

### 7.1 CONTENTS AND SCOPES OF PARAMETERS

**Table 12 Parameter Setting Contents and Scopes**

No.	Items	Parameters	Defaults	Description
<b>Mains Setting</b>				
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)%	Disable	Setting value is mains rated frequency's percentage, return value and delay value can be set.
10	Under Frequency	(0~1000)%	Disable	
11	Loss of Phase	(0~1)	1	0: Disable; 1: Enable
12	Reverse Phase	(0~1)	1	
<b>Timer Setting</b>				
1	Start Delay	(0~3600)s	1	Time from mains abnormal or remote start signal is active to start genset.
2	Stop Delay	(0~3600)s	1	Time from mains normal or remote start signal is deactivated to stop genset.
3	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.



No.	Items	Parameters	Defaults	Description
7	Start Idle Time	(0~3600)s	0	Idle running time of genset when starting.
8	Warming Up Time	(0~3600)s	10	Warming time between genset switch on and high speed 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	Stop electromagnet's power on time when genset is stopping.
12	Fail to Stop Delay	(0~3600)s	0	Time between ending of genset idle delay and stopped when "ETS output time" is set as 0; Time between ending of ETS hold delay and stopped when "ETS output time" is not 0.
13	After Stop Time	(0~3600)s	0	Time between genset stopped and standby.
<b>Engine Setting</b>				
1	Engine Type	Fixed value: 0	0	Default: Conventional unit (non-ECU).
2	Flywheel Teeth	(10~300)	118	Tooth number of the engine, for judging of starter separation conditions and inspecting of engine speed. See the installation instructions.
3	Rated Speed	(0~6000)r/min	1500	Offer standard for 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 Delay	(0~3600)s	5	Time from detecting speed is 0 to confirm the action.
6	Loss of Speed Signal 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 also 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 also can be set.
10	Under Speed Warn	(0~200)%	86	



No.	Items	Parameters	Defaults	Description
11	Battery Rated Voltage	(0~60.0)V	24.0	Standard for detecting over/under voltage of battery.
12	Battery Over Volts	(0~200)%	120	Setting value is percentage of rated voltage of battery. Delay value & return value also 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 attempts. When reaches this number, controller will send start failure signal.
16	Crank Disconnect	(0~6)	2	See table 16. There are 3 conditions of disconnecting starter with engine. Each condition can be used alone and simultaneously to separating the start motor and engine as soon as possible.
17	Disconnect Generator Freq	(0~200)%	24%	When generator frequency higher than the set value, starter will be disconnected. See the installation instruction.
18	Disconnect Engine Speed	(0~200)%	24%	Setting value is percentage of rated speed. When the 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.
<b>Generator Setting</b>				
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, genset 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 freq. Delay value also 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 also can be set.
13	Under Volt. Warn	(0~1000)%	84	
14	Over Freq. Warn	(0~1000)%	110	
15	Under Freq. Warn	(0~1000)%	84	Setting value is percentage of generator rated freq. Delay value and return value also can be set.
16	Loss of Phase	(0~1)	1	0: Disable 1: Enable
17	Reverse Phase Sequence	(0~1)	1	
<b>Load Setting</b>				
1	Current Trans.	(5~6000)/5	500	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 load current. Delay value also can be set as DMT or IDMT.
5	Over Power	(0~1)	0	0: Disable 1: Enable
6	Reverse Power	(0~1)	0	0: Disable 1: Enable
<b>Switch Setting</b>				
1	Transfer Time	(0~7200)s	5	Interval time from mains switch off to



No.	Items	Parameters	Defaults	Description
				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	Transfer Failure Warn Enable	(0~1)	0	0: Disable 1: Enable
6	Check Enable	(0~1)	0	0: Disable 1: Enable
7	Enable Trip Immediate Mains Dropout	(0~1)	1	0: Disable 1: Enable
<b>Module Setting</b>				
1	Power Mode on	(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.
<b>Scheduling and Maintenance Setting</b>				
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
<b>Analog Sensors Setting</b>				
Temperature Sensor				
1	Curve Type	(0~15)	7	SGX. See table 15.
2	Open Circuit Action	(0~2)	0	0: Warn; 1: Shutdown; 2: No action
3	High Temp. Shutdown	(0~300)°C	98	Shutdown when sensor temperature higher than this value. Detecting only after safety delay is over. The delay value also can be set.
4	High Temp. Warn	(0~300) °C	95	Warn when sensor temperature higher than this value. Detecting only after safety delay is over. The delay value and return value also can be set.



No.	Items	Parameters	Defaults	Description
5	Low Temp. Warn	(0~1)	0	0: Disable; 1: Enable
<b>Oil Pressure Sensor</b>				
1	Curve Type	(0~15)	7	SGX. See table 15.
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 also can be set.
4	Low OP Warn	(0~1000)kPa	124	Warn when oil pressure higher than this value. Detecting only after safety delay is over. The delay value and return value also can be set.
<b>Level Sensor</b>				
1	Curve Type	(0~15)	4	SGH. See table 15.
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 also can be set.
<b>Flexible Sensor 1</b>				
1	Flexible Sensor 1 Setting	(0~1)	0	0: Disable 1: Enable; (can be set as temperature/pressure/lever sensor).
<b>Flexible Sensor 2</b>				
1	Flexible Sensor 2 Setting	(0~1)	0	0: Disable; 1: Enable; (can be set as temperature/pressure/lever sensor).
<b>Flexible Input Ports</b>				
<b>Flexible Input Port 1</b>				
1	Contents Setting	(0~50)	28	Remote start (on load). See table 14.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
<b>Flexible Input Port 2</b>				
1	Contents Setting	(0~50)	26	High temperature shutdown. See table 14.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
<b>Flexible Input Port 3</b>				
1	Contents Setting	(0~50)	27	Low oil pressure shutdown. See table 14.



No.	Items	Parameters	Defaults	Description
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
<b>Flexible Input Port 4</b>				
1	Contents Setting	(0~50)	0	User defined. See table 14.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
3	Active Range	(0~3)	2	0: From safety on 1: From starting 2: Always 3: Never
4	Active 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			User defined.
<b>Flexible Input Port 5</b>				
1	Contents Setting	(0~50)	0	User defined. See table 14.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
3	Active Range	(0~3)	2	0: From safety on 1: From starting 2: Always 3: Never
4	Active 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			User defined.
<b>Flexible Input Port 6</b>				
1	Contents Setting	(0~50)	0	User defined. See table 14.
2	Active Type	(0~1)	0	0: Closed to active 1: Open to active
3	Active Range	(0~3)	2	0: From safety on 1: From starting 2: Always 3: Never
4	Active 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			User defined.
<b>Flexible Output Ports</b>				
<b>Flexible Output Port 1</b>				
1	Contents Setting	(0~239)	1	User defined period output 1 (default output is in preheating). See table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close
<b>Flexible Output Port 2</b>				



No.	Items	Parameters	Defaults	Description
1	Contents Setting	(0~239)	48	Common alarm. See table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close
Flexible Output Port 3				
1	Contents Setting	(0~239)	38	ETS solenoid hold. See table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close
Flexible Output Port 4				
1	Contents Setting	(0~239)	35	Idle speed control. See table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close
Flexible Output Port 5				
1	Contents Setting	(0~239)	29	Generator closed output. See table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close
Flexible Output Port 6				
1	Contents Setting	(0~239)	31	Mains closed output. See table 13.
2	Active Type	(0~1)	0	0: Normally open; 1: Normally close

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

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

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

IDMT formula:

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

T: Overcurrent delay (second)

T: Timing multiplier ratio

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

IT: Overcurrent setting value

Example:

$$t = 36$$

$$IA = 550A$$

$$IT = 500A$$

Conclusion: T = 3600s (1 hour)

## 7.2 ENABLE DEFINITION OF PROGRAMMABLE OUTPUT PORTS 1-6

### 7.2.1 DEFINED CONTENTS OF PROGRAMMABLE OUTPUT PORTS 1-6

**Table 13 Defined Contents of Programmable Output Ports 1-6**

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

No.	Type	Description
27	Reserved	
28	Reserved	
29	Close Generator	Control generator to take load.
30	Open Breaker	Control breaker to off load.
31	Close Mains	Control mains to take load.
32	Reserved	
33	Crank Relay	
34	Fuel Relay	Action when genset is starting and disconnect when stop is completed.
35	Idle Control	Used for machine which has idles. Close before starting and open in warming up delay; Close during stopping idle mode and open when stop is completed.
36	Raise Speed	Action in warming up delay.
37	Drop Speed	Action between the period from "stop idle" to "failed to stop".
38	ETS Control	Used for engines with ETS electromagnet. Close when stop idle is over and open when pre-set "ETS delay" is over.
39	Pulse Drop Speed	Active 0.1s when controller enter into stop idle, used for control part of ECU dropping to idle speed (temporary reserved).
40	Reserved	
41	Reserved	
42	Pulse Raise Speed	Active 0.1s when controller enter into warming up delay; used for control part of ECU raising to normal speed (temporary reserved).
43	Crank Success	Close when detects a successful start signal.
44	Generator OK	Action when generator is normal.
45	Generator Available	Action in period of generator ok to high-speed cooling.
46	Mains OK	Action when mains normal.
47	Reserved	
48	Common Alarm	Action when genset common warning, common shutdown, common trips alarm.
49	Common Trip and Stop	Action when common trip and stop alarm.
50	Common Shutdown	Action when common shutdown alarm.
51	Common Trip Alarm	Action when common trip alarm.
52	Common Warn Alarm	Action when common warning alarm.
53	Reserved	
54	Battery High Volts	Action when battery's over voltage warning alarm.
55	Battery Low Volts	Action when battery's low voltage warning alarm.
56	Charge Alt Fail	Action when charge failure warning alarm.
57	Reserved	

No.	Type	Description
58	Reserved	
59	Reserved	
60	Reserved	
61	Reserved	
62	Reserved	
63	Reserved	
64	Reserved	
65	Reserved	
66	Reserved	
67	Reserved	
68	Reserved	
69	Aux Input 1 Active	Action when input port 1 is active
70	Aux Input 2 Active	Action when input port 2 is active
71	Aux Input 3 Active	Action when input port 3 is active
72	Aux Input 4 Active	Action when input port 4 is active
73	Aux Input 5 Active	Action when input port 5 is active
74	Aux Input 6 Active	Action when input port 6 is active
75~98	Reserved	
99	Emergency Stop Alarm	Action when emergency stop alarm.
100	Failed To Start Alarm	Action when failed start alarm.
101	Failed To Stop Alarm	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	Loss of Speed Signal Shutdown	Action when loss of speed signal shutdown alarm.
107	Reserved	
108	Reserved	
109	Gen Over Freq Warn	Action when generator over frequency warning.
110	Gen Over Freq Shut	Action when generator over frequency shutdown alarm.
111	Gen Over Volt Warn	Action when generator over voltage warning.
112	Gen Over Volt Shut	Action when generator over voltage shutdown.
113	Gen Under Freq. Warn	Action when generator low frequency warning.
114	Gen Under Freq. Shut	Action when generator low frequency shutdown.
115	Gen Under Volt. Warn	Action when generator low voltage warning.
116	Gen Under Volt. Shut	Action when generator low voltage shutdown.
117	Gen Loss of Phase	Action when generator loss phase.
118	Gen Reverse Phase	Action when generator reverse phase.
119	Reserved	
120	Over Power	Action when controller detects generator have over

No.	Type	Description
		power.
121	Reserved	
122	Reverse Power	Action when controller detects generator have reverse power.
123	Over Current	Action when over current.
124	Reserved	
125	Mains 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 high-temperature warning.
140	Low Temp Warn	Action when low temperature warning.
141	High Temp Shutdown	Action when high-temperature shutdown alarm.
142	Reserved	
143	Low OP Warn	Action when low oil pressure warning.
144	Low OP Shutdown	Action when low oil pressure shutdown.
145	OP Sensor Open	Action when oil pressure sensor is open circuit.
146	Reserved	
147	Low Fuel Level Alarm	Action when controller has low oil level alarm.
148	Reserved	
149	Reserved	
150	Flexible Sensor 1 High Warn	
151	Flexible Sensor 1 Low Warn	
152	Flexible Sensor 1 High Shut	
153	Flexible Sensor Low Shut	
154	Flexible Sensor 2 High Warn	
155	Flexible Sensor 2 Low Warn	
156	Flexible Sensor 2 High Shut	
157	Flexible Sensor 2 Low Shut	
158~229	Reserved	
230	Stop Mode	Action in Stop mode.
231	Manual Mode	Action in Manual mode.
232	Test Mode	Action in Test mode. (HGM8110A without)
233	Auto Mode	Action in Auto mode.
234	Generator On Load	
235	Mains On Load	
236	Reserved	

No.	Type	Description
237	Reserved	
238	Reserved	
239	Reserved	

### 7.2.2 CUSTOM PERIOD OUTPUT

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



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

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

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

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

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

Example,

Output period: start

Delay output time: 2s

Output time: 3s

Condition output contents: output port 1 is active

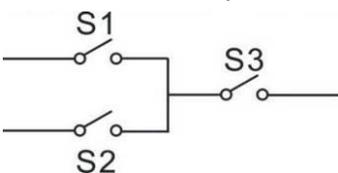
Close when condition output active/inactive: close when active (disconnect when inactive);

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

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

### 7.2.3 CUSTOM COMBINED OUTPUT

Defined combination output is composed by 3 parts, OR condition output S1, OR condition output S2, AND condition output S3.



S1 or S2 is **TRUE**, 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 OR condition output S1: output port 1 is active;

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

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

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

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

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

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

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

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### 7.3 DEFINED CONTENTS OF CONFIGURABLE INPUT PORTS 1-6

**Table 14 Defined Contents of Configurable Input Ports (All GND Connected (B-) Active)**

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 shuts down after high-speed cooling Trip: alarm, generator unloads but not shutdown. Never: input inactive. Always: input is active all the time. From crank: detecting as soon as start. From safety on: detecting after safety on run delay.
1	Reserved	
2	Alarm Mute	Can prohibit "Audible Alarm" output when input is active.
3	Reset Alarm	Can reset shutdown 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 keys in panel is inactive except   and there is  in the right of first row in VFD when input is active.
7	Reserved	
8	Idle Control Mode	Under voltage/frequency/speed protection is inactive.
9	Inhibit Auto Stop	In <b>Auto</b> mode, during generator normal running, when input is active, inhibit generator stop automatically.
10	Inhibit Auto Start	In <b>Auto</b> mode, inhibit generator start automatically when input is active.
11	Inhibit Scheduled Start	In <b>Auto</b> 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 in the right of first line of VFD display.
18	Auto Mode Invalid	When input is active, controller won't work under Auto



No.	Type	Description
		mode.  key and simulate auto key input does not work.
19	Reserved	
20	Reserved	
21	Inhibit Alarm Stop	All shutdown alarms are prohibited except emergency 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 Oil Pressure	Connected sensor digital input.
28	Remote Start (On Load)	In <b>Auto</b> mode, when input active, genset can start automatically and take load after normal running; when input inactive, genset will stop automatically.
29	Remote Start (Off Load)	In <b>Auto</b> mode, when input is active, genset can start automatically and NOT take load after normal running; when input is inactive, genset will stop automatically.
30	Aux. Manual Start	In <b>Manual</b> mode, when input active, genset will start automatically; when input inactive, genset will stop automatically.
31	Reserved	
32	Reserved	
33	Simulate Stop key	An external button can be connected and pressed as simulate panel.
34	Simulate Manual key	
35	Simulate Manual Test key	
36	Simulate Auto key	
37	Simulate Start key	
38	Reserved	
39	Reserved	
40	Reserved	
41	Reserved	
42	Reserved	
43	Reserved	
44	Reserved	
45	Aux Mains OK	In <b>Auto</b> mode, mains normal when input is active (HGM8120A).
46	Aux Mains Fail	In <b>Auto</b> mode, mains abnormal when input is active



No.	Type	Description
		(HGM8120A).
47	Alternative Config1	When input is active, alternative configuration is active. It can set different parameters, which makes it easy to select current configuration via input port.
48	Alternative Config2	
49	Alternative Config3	
50	Reserved	

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## 7.4 SELECTION OF SENSORS

**Table 15 Sensors Selection**

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 VDO 5bar 11~15 Reserved	Defined resistance's range is 0~6KΩ, default is SGX sensor.
3	Fuel Level Sensor	0 Not used 1 Custom Res Curve 2 Custom 4-20mA curve 3 SGD 4 SGH 5~15 Reserved	Defined resistance's range is 0~6KΩ, default is SGH sensor.

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

## 7.5 CONDITIONS OF CRANK DISCONNECT SELECTION

**Table 16 Crank Disconnect Conditions Selection**

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

**NOTE:**

1. There are 3 conditions to make starter disconnected with engine, that is, speed sensor, generator frequency and engine oil pressure. They all can be used separately. We recommend that engine oil pressure should be used with speed sensor and generator frequency together, in order to make the starter motor separate with engine immediately and can check crank disconnect exactly.
2. Speed sensor is the magnetic equipment which be installed in starter for detecting flywheel teeth.
3. When set as speed sensor, must ensure that the number of flywheel teeth is as same as setting, otherwise, "over speed shutdown" or "under speed shutdown" may be caused.
4. If genset without speed sensor, please don't select corresponding items, otherwise, "start fail" or "loss speed signal" maybe caused.
5. If genset without oil pressure sensor, please don't select corresponding items.
6. If not select generator 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.

## 8 PARAMETER EDITING

- 1) **Advanced Parameters Setting:** After controller start, press  and  to advanced parameter password confirmation interface (picture on the right). Press “+” and “-” to increase or decrease values and input the corresponding password; press “√” key to right move the bit, in fourth bit press “√” key to check password. If password is correct, enter into advanced parameter setting interface, otherwise, exit directly. (Factory default password is **00318** and users can modify it.)

Input Password

0\*\*\*\*

Press “+” key and “-” key to scroll screen; select parameter you want to configure and press “√” key (the parameter will highlight with black), press “+” key or “-” key to change parameter value, press “√” key to move the bit, in fourth bit press “√” key to confirm setting.

- 2) **Basic Parameter Setting:** After controller start, press  for more than 3s to enter into Basic Parameter Setting interface; The frequently-used parameters can be set via both Basic Parameter Setting and Advanced Parameter Setting, however, set the frequently-used parameters via Basic Parameter Setting is recommended as there are lots of parameters in Advanced Parameter Setting and inconvenience. The picture on the right is “Basic Parameter Setting” interface, the parameter which highlight with black is the current setting one.

Basic Parameter Setting

>Return

>Mains Rated Voltage

>Mains Rated Frequency

>Crank Disconnect

- 3) **Date and Time Setting:** After controller start, press  and  to the Date and Time Setting interface (picture on the right). The digit which highlights with black is currently adaptable for user by pressing “+” key and “-” key to increase and decrease the value. Press “√” key to confirm setting and the bit will right move automatically. Number “6” in the parenthesis is the day of the week. It is set by the microprocessor based on current date, so the user does not need to modify it.

Date and Time

2013.01.26 (6) 15:19:22

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

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

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

**NOTE:** Please set the generator frequency value as low as possible when cranking, in order to make the starter be separated quickly as soon as crank disconnect.

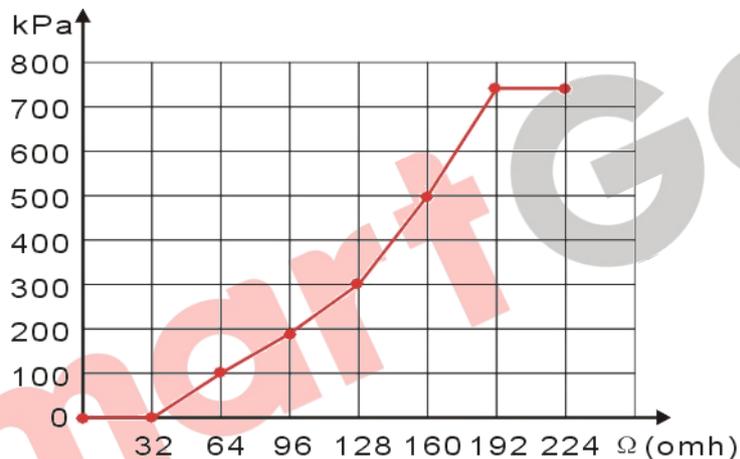
**NOTE:** Configurable input could not be set as same items; otherwise, there are abnormal functions. However, the configurable output can be set as same items.

**NOTE:** HGM8110A controller has no items about mains. Pressing and holding  for a long time can exit parameter setting menu directly and set the controller into standby mode.

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## 9 SENSORS SETTING

1. When reselect sensors, the sensor curve will be transferred into the standard value. For example, if temperature sensor is SGX (120°C resistor type), its sensor curve is SGX (120°C resistor type); if select the SGD (120°C resistor type), the temperature sensor curve is SGD curve.
2. When there is difference between standard sensor curves and using sensor, user can adjust it in "curve type".
3. When input the sensor curve, X value (resistor) must be input from small to large, otherwise, mistake occurs.
4. If select sensor type as "None", sensor curve is not working.
5. If corresponding sensor has alarm switch only, user must set this sensor as "None", otherwise, maybe there is shutdown or warning.
6. The headmost or backmost values in the vertical coordinates can be set as same as below,



**Fig.2 Sensor Curve**

**Table 17 Normal Pressure Unit Conversion Form**

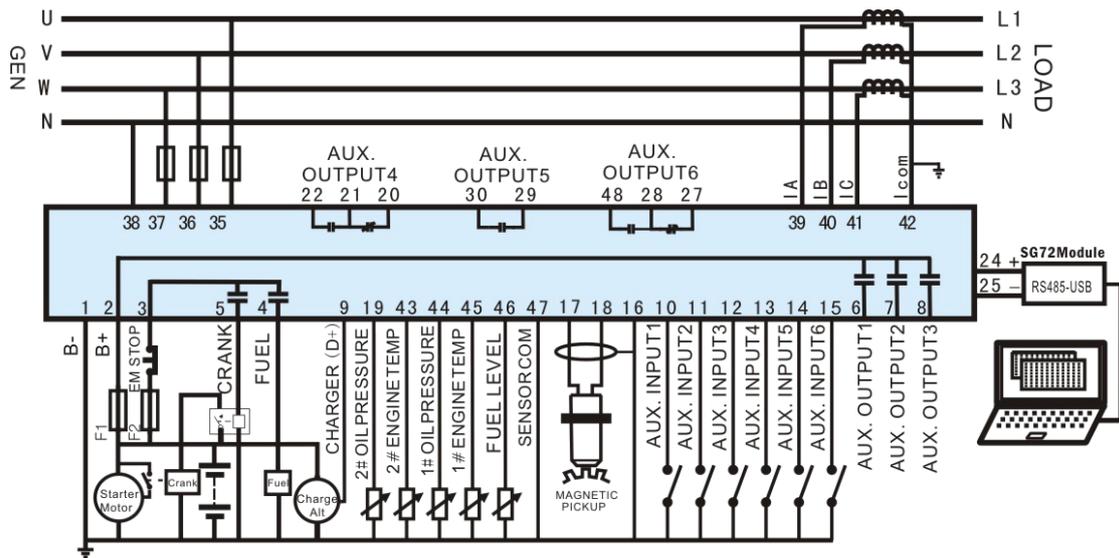
	N/m <sup>2</sup> (pa)	kgf/cm <sup>2</sup>	bar	psi
1Pa	1	1.02x10 <sup>-5</sup>	1x10 <sup>-5</sup>	1.45x10 <sup>-4</sup>
1kgf/cm <sup>2</sup>	9.8x10 <sup>4</sup>	1	0.98	14.2
1bar	1x10 <sup>5</sup>	1.02	1	14.5
1psi	6.89x10 <sup>3</sup>	7.03x10 <sup>-2</sup>	6.89x10 <sup>-2</sup>	1

## 10 COMMISSIONING

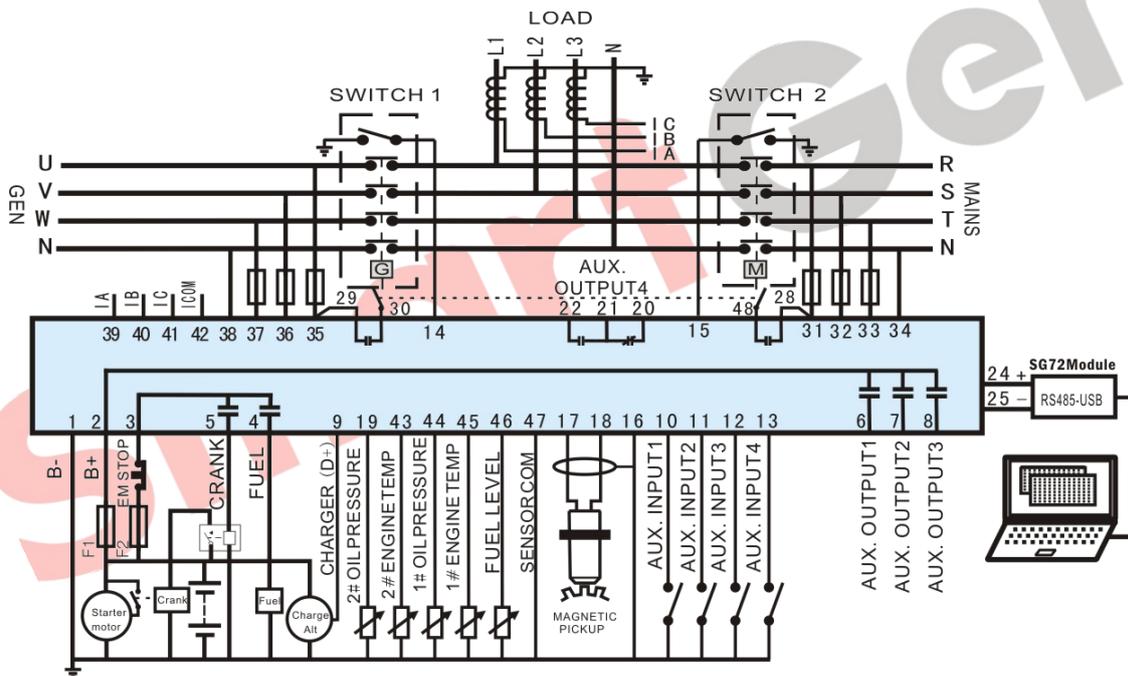
Please make the under procedures checking before commissioning,

1. Ensure all the connections are correct and wires diameter is suitable;
2. Ensure that the controller DC power has fuse, controller's positive and negative connected to starting battery are correct;
3. Emergence stop must be connected with positive of starting battery via scram button's normal close point and fuse;
4. Take proper action to prevent engine to crank disconnect (e. g. Remove the connection wire of fuel valve). If checking is OK, make the starting battery power on; choose manual mode and controller will executive routine;
5. Set controller under manual mode, press "start" button, genset will start. After the cranking times as setting, controller will send signal of Start Failure; then press "stop" to reset controller;
6. Recover the action of stop engine start (e. g. Connect wire of fuel valve), press start button again, genset will start. If everything goes well, genset will normal run after idle running (if idle run be set). During this time, please watch for engine's running situations and AC generator's voltage and frequency. If abnormal, stop genset running and check all wires connection according to this manual;
7. Select the **AUTO** mode from controller's panel, connect mains signal. After the mains normal delay, controller will transfer ATS (if fitted) into mains load. After cooling time, controller will stop genset and make it into standby status until there is abnormal of mains;
8. When mains is abnormal again, genset will start automatically and enter into normal running, then controller sends signal to make 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.

## 11 TYPICAL APPLICATION

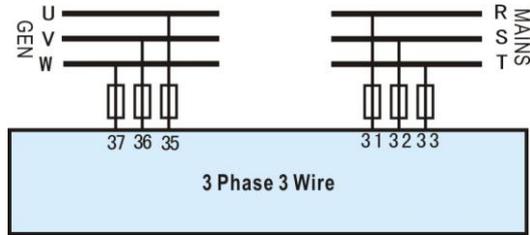


**Fig.3 HGM8110A Typical Application Diagram**



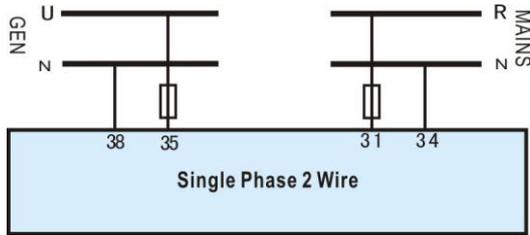
**Fig.4 HGM8120A Typical Application Diagram**

**NOTE:** If the engine starting battery voltage is 24V, starting output, fuel output and stop output (according to user's configuration) should not be less than 2Ω for battery cathode resistance, if less than 2Ω, please expand relays with more than 30A current in corresponding output. If the engine starting battery voltage is 12V, starting output, fuel output and stop output (according to user's configuration) should not be less than 1Ω for battery cathode resistance; if less than 1Ω, please expand relays with more than 30A current in corresponding output.

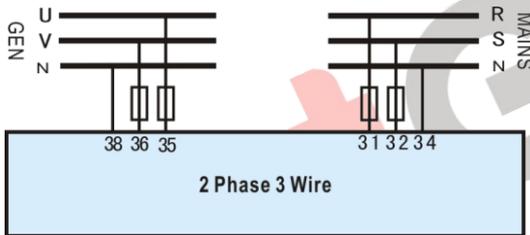


**Fig.5 3 Phase 3 Wire Connection Diagram (take HGM8120A for example)**

Single Phase 2 Wire (take HGM8120A for example)



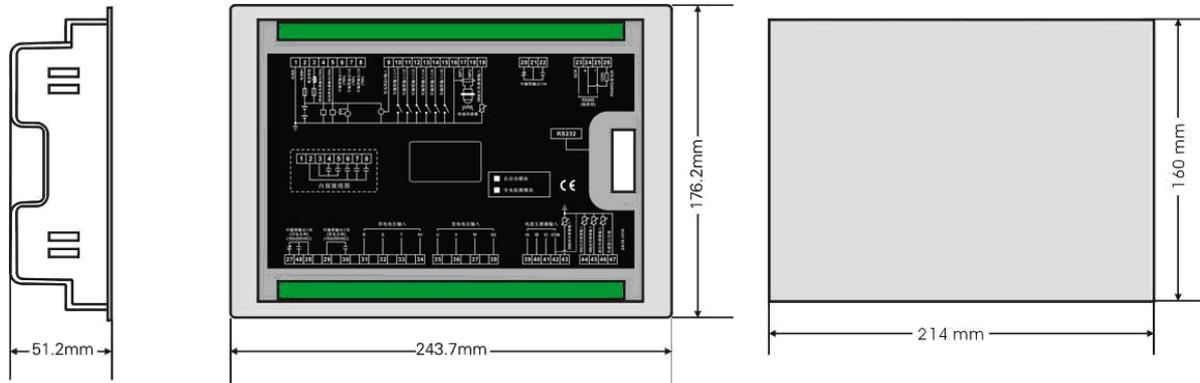
**Fig.6 Single Phase 2 Wire Connection Diagram (take HGM8120A for example)**



**Fig.7 2 Phase 3 Wire Connection Diagram (take HGM8120A for example)**

## 12 INSTALLATION

The installation dimension of **HGM8110A** is just the same with **HGM8120A**. Controller is panel built-in design; it is fixed by clips when installed. The controller's overall dimensions and cutout dimensions for panel, please refers to as following,



**Fig.8 Overall and Cutout Dimensions**

### 12.1 BATTERY VOLTAGE INPUT

**NOTE:** HGM8110A/8120A 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<sup>2</sup>. If floating charger configured, please firstly connect output wires of charger to battery's positive and negative directly, then, connect wires from battery's positive and negative to controller's positive and negative input ports in order to prevent charger disturbing the controller's normal working.

### 12.2 SPEED SENSOR INPUT

**NOTE:** Speed sensor is the magnetic equipment which be installed in starter and for detecting flywheel teeth. Its connection wires to controller should apply for 2 cores shielding line. The shielding layer should connect to No. 16 terminal in controller while another side is hanging in air. The else two signal wires are connected to No.17 and No.18 terminals in controller. The output voltage of speed sensor should be within AC (1~24)V (effective value) during the full speed. AC12V is recommended (at rated speed). When install the speed sensor, let the sensor is spun to contacting flywheel first, then, port out 1/3 lap, and lock the nuts of sensor at last.

### 12.3 OUTPUT AND EXPAND RELAYS

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

### 12.4 AC INPUT

Current input of HGM8110A/8120A 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 is prohibited open circuit.

## 12.5 WITHSTAND VOLTAGE TEST

 **CAUTION!** When controller has 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.

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## 13 FAULT FINDING

Here are the common faults and troubleshooting. If there is any other problem, please feel free to contact Smartgen's service.

**Table 18 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; Check whether the circuit is open.
Low oil pressure alarm after crank disconnect	Check the oil pressure sensor and its connections.
High water temp. alarm after crank disconnect	Check the temperature sensor and its connections.
Shutdown alarm in running	Check related switch and its connections according to the information on VFD; Check programmable inputs.
Crank not disconnect	Check fuel 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 module whether damage or not; Check communication port of PC whether damage.