

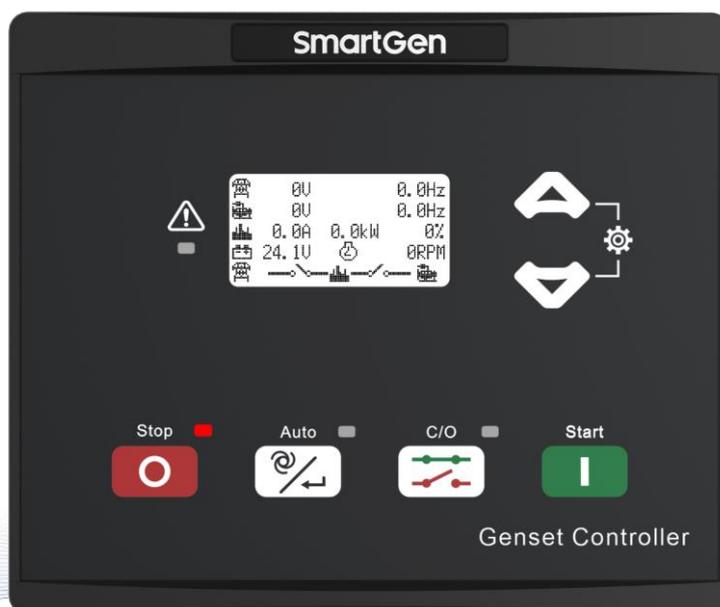
# SmartGen

MAKING CONTROL SMARTER

## HGM3020

### GENSET CONTROLLER

### USER MANUAL



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

**SmartGen** Registered trademark

No. 28 Xuemei Street, Zhengzhou, Henan, China

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

+86-371-67981000(overseas)

Fax: +86-371-67992952

Web: [www.smartgen.com.cn](http://www.smartgen.com.cn)

[www.smartgen.cn](http://www.smartgen.cn)

Email: [sales@smartgen.cn](mailto:sales@smartgen.cn)

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

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

**Table 1 Software Version**

Date	Version	Note
2025-08-22	1.0	Original release.

**Table 2 Symbol Instruction**

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

SmartGen

## CONTENTS

1	OVERVIEW .....	5
2	PERFORMANCE AND CHARACTERISTICS.....	5
3	SPECIFICATION .....	7
4	OPERATION.....	9
4.1	KEY FUNCTION.....	9
4.2	CONTROLLER PANEL .....	10
4.3	AUTO START/STOP OPERATION.....	10
4.4	MANUAL START/STOP OPERATION .....	12
4.5	EMERGENCY START UP .....	12
5	GENSET CONTROLLER SWITCHING CONTROL PROCEDURE.....	12
5.1	HGM3020 SWITCHING CONTROL PROCEDURE.....	12
5.1.1	MANUAL TRANSFER PROCEDURE.....	12
5.1.2	AUTO TRANSFER PROCEDURE .....	13
6	PROTECTION.....	14
6.1	WARNINGS.....	14
6.2	SHUTDOWN ALARM.....	15
7	WIRING CONNECTION.....	18
8	SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS.....	20
9	PARAMETERS SETTING.....	35
10	SENSOR SETTING.....	37
11	COMMISSIONING .....	38
12	TYPICAL APPLICATION.....	39
13	INSTALLATION .....	41
14	FAULT FINDING .....	43

## 1 OVERVIEW

**HGM3020 Genset Controller** integrates digital, intelligent and network technology which are used for genset automation and monitor control system of single unit to achieve automatic start/stop, data measurement, alarm protection, etc. functions. It fits with LCD display, optional languages interface (Chinese, English, Spanish, Russian, Turkish, French, Portuguese, and Polish), and it is reliable and easy to use.

**HGM3020 Genset Controller** adopts micro-processor technology with precision parameters measuring, fixed value adjustment, time setting and set value adjusting, etc. All parameters can be configured from front panel or RS485 interface via PC. It can be widely used in non-ECU genset automatic control system with compact structure, advanced circuits, simple connections and high reliability.

## 2 PERFORMANCE AND CHARACTERISTICS

**HGM3020** has mains electric quantity monitoring and mains/generator automatic transfer control function (AMF), especially for automatic system composed by generator and mains.

Main features as follows:

- 128x64 LCD with backlight, selectable language interface (Chinese, English, Spanish, Russian, Turkish, French, Portuguese, and Polish), push-button operation;
- Hard-screen acrylic material been used to protect screen with great wear-resisting and scratch-resisting functions;
- Single-layer surface covering and pushbuttons can be used in extreme temperature environment;
- RS485 communication interface enables "Three remote" functions (remote control, remote measuring and remote communication) according to MODBUS protocol;
- Suitable for 3P4W, 3P3W, 1P2W and 2P3W systems with voltage 120/240V and frequency 50/60Hz;
- Collect and display 3-phase voltage, 3-phase current, frequency and power parameter of generator or mains;

**Table 3 Data Collection**

Type	Items	Symbol	Unit
Mains	Line Voltage	$U_{ab}, U_{bc}, U_{ca}$	V
	Phase Voltage	$U_a, U_b, U_c$	V
	Frequency	$f$	Hz
	Phase Sequence	/	°
Generation	Line Voltage	$U_{ab}, U_{bc}, U_{ca}$	V
	Phase Voltage	$U_a, U_b, U_c$	V
	Frequency	$f$	Hz
	Phase Sequence	/	°
Load	Current	$I_a, I_b, I_c$	A
	Different Phases and Total Active Power	P	kW
	Reactive Power	Q	kvar



3 SPECIFICATION

Table 4 Technical Parameters

Items	Contents
Operating Voltage	DC8.0V to DC35.0V, continuous power supply.
Power Consumption	<2.5W (standby ≤1W)
Alternator Volt Input Range	
3Phase 4Wire	AC15V - AC360V (ph-N)
3Phase 3Wire	AC30V - AC620V (ph-ph)
Single Phase 2Wire	AC15V - AC360V (ph-N)
2Phase 3Wire	AC15V - AC360V (ph-N)
Alternator Frequency	50Hz/60Hz
AC Current	CT secondary: 5A
Speed Sensor Voltage	1.0V to 24.0V (RMS)
Speed Sensor Frequency	5~10000Hz
Analog Input	Resistance Input Range: 0 ~ 6000Ω Resolution: 0.1Ω Accuracy: 1Ω (below 1000Ω)
Starting Relay Output	7A DC24V (Relay output)
Programmable Relay Output 1	1A DC28V (Relay output)
Programmable Relay Output 2	1A DC30V (Volts free output)
Programmable Relay Output 3	1A DC30V (Volts free output)
Programmable Relay Output 4	1A DC30V (Volts free output)
RS485 Interface	Isolated, half-duplex, 9600 baud rate, maximum communication length 1000m
Case Dimension	126mm x 106 mm x 46.5 mm
Panel Cutout	111mm x 91mm
Vibration	5Hz~ 8 Hz: ±17 mm 8Hz~100Hz: 4g 100Hz~500Hz: 2g IEC 60068-2-6
Shock	50 g <sub>n</sub> , 11ms, half-sine, three consecutive shocks are applied in each of the three mutually perpendicular directions, i.e. a total of 18 times. IEC 60068-2-27
Bump Test	20 g <sub>n</sub> , 16ms, half-sine IEC 60255-21-2
Production Compliance	According to EN 61010-1 installation category (over voltage category) III, 300V, pollution class 2, altitude 3000m
CT Secondary Current	5A rated
Working Temperature	(-25~+70)°C
Working Humidity	(20~93)%RH
Storage Temperature	(-30~+80)°C
Protection Rating	Front Panel: IP65, when water proof gasket ring inserted between panel and housing.

Items	Contents
	Back Panel: IP20
Insulating Intensity	Apply AC2.2kV voltage between high voltage terminal and low voltage terminal; The leakage current is not more than 3mA within 1min.
Product Compliance	GBT 37089 Controllers for reciprocating internal combustion engine driven AC generating sets.
Weight	0.232Kg

SmartGen

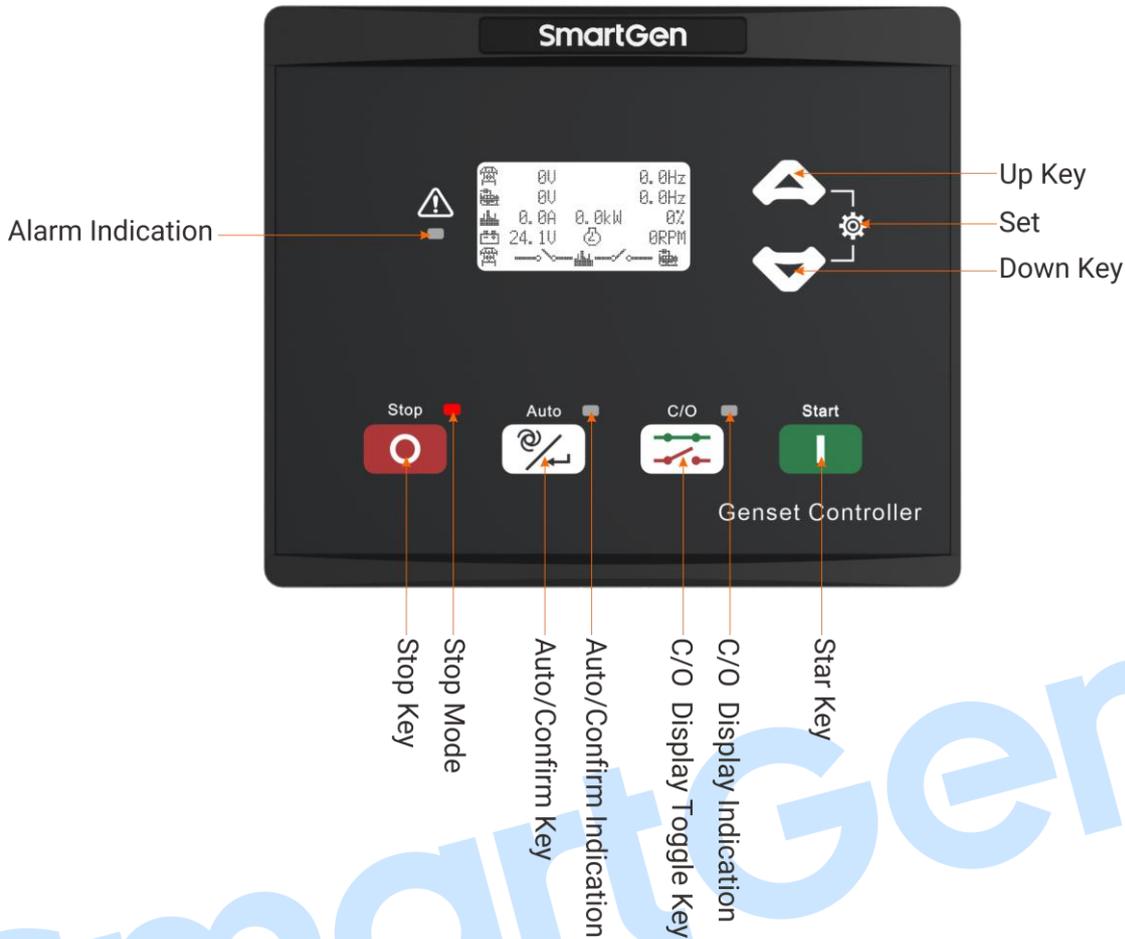
## 4 OPERATION

### 4.1 KEY FUNCTION

**Table 5 Key Descriptions**

Icon	Function	Description	
	Stop/Reset	<ol style="list-style-type: none"> <li>1.Stop the running generator under Auto/Manual mode;</li> <li>2.In stop mode, press this key will reset alarm;</li> <li>3.In stop mode, press and hold the key for more than 3 seconds to test indicator lights (lamp test);</li> <li>4.During stop process, press this key again to stop generator immediately.</li> <li>5.Press this key on main interface to return to home page; during parameter configuration, press this key to return to the previous parameter setting page.</li> </ol>	
	Start	<ol style="list-style-type: none"> <li>1.In non-auto mode, press this key will start genset;</li> <li>2.Press this key during genset startup, genset will skip to the next status, enabling rapid startup.</li> </ol>	
	Auto/Confirm	<ol style="list-style-type: none"> <li>1.Press this key will set the module into Auto Mode.</li> <li>2.In Auto Mode, the genset startup is based on the remote start signal input.</li> <li>3.Press this key to enter the menu list; move the cursor and confirm the settings during parameter configuration,</li> </ol>	
	C/O	<p>Press this key to toggle the display between C/O and the main page. In C/O interface under manual mode, press Up or Down key to control switch close or open.</p>	
	Up	<ol style="list-style-type: none"> <li>1.Scrolls the screen up; Shift the cursor up or increase the set value in parameter setting menu.</li> <li>2.In C/O interface under manual mode: press this key can control mains close or open;</li> </ol>	<ol style="list-style-type: none"> <li>1. Press and hold both keys for 1 second to enter the parameter configuration interface.</li> <li>2. Press and hold both keys for 3 seconds to activate LCD backlight illumination.</li> </ol>
	Down	<ol style="list-style-type: none"> <li>1.Scrolls the screen down; Shift the cursor down or decrease the set value in parameter setting menu.</li> <li>In C/O interface under manual mode: press this key can control gen close or open.</li> </ol>	

## 4.2 CONTROLLER PANEL



**Fig.1 HGM3020 Front Panel Indication**

**NOTE:** Part of indicator lights illustration:

**Alarm Indicators:** slowly flash when warn alarms; fast flash when shutdown alarms; light is off when no alarms.

## 4.3 AUTO START/STOP OPERATION

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

### Auto Start Sequence:

- 1) When mains is abnormal (over and under voltage, loss of phase), it enters into mains "abnormal delay" and LCD displays count down time. When mains abnormal delay is over, it enters "start delay";
- 2) "Start delay" countdown is shown on LCD;
- 3) When start delay is over, preheat relay outputs (if this be configured), "preheat start delay XX s" is shown on LCD;
- 4) When preheat delay is over, fuel relay outputs XXs of delay and then starting relay outputs; if engine crank fails during "cranking time", the fuel relay and starting relay deactivated and it enters into "crank rest time" to wait for next crank;
- 5) If engine crank fails within setting times, the fifth line of LCD turns black and "fail to start" message appears on LCD;
- 6) In case of successful crank attempt, "safety on delay" starts. During this period, low oil pressure,

high water temperature, under speed, charging failure alarms and auxiliary inputs (if configured) are disabled. As soon as this delay is over, "start idle delay" is initiated (if configured);

- 7) During "start idle delay", under speed, under frequency, under voltage alarms are inhibited. When this delay is over, "warming up delay" starts (if configured);
- 8) When "warming up delay" is over, if generator state is normal, if voltage and frequency of generator have reached on-load requirements, the closing relay will be energized, generator will take load, and generator will enter normal running state; if voltage or frequency is abnormal, the controller will initiate shutdown alarm (shutdown alarm will be displayed on LCD alarm page).

**Auto Stop Sequence:**

- 1) When mains returns normal during genset running, it enters into mains voltage "normal delay". After mains comes to normal, "stop delay" initiated;
- 2) When stop delay is over, close generator relay is un-energized; generator enters "cooling down time". After "transfer rest time", close mains relay is energized. Mains takes load;
- 3) Idle relay is energized as soon as entering "stop idle delay" (if configured);
- 4) If enter "ETS hold delay", ETS relay is energized. Fuel relay is deactivated;
- 5) Then enters gen-set "fail to stop time", auto decides whether generator stops or not automatically;
- 6) Enter "generator at rest" as soon as "after stop time" is over. If genset fails to stop, controller will initiate alarms (fail to stop warning is shown on LCD).

SmartGen

## 4.4 MANUAL START/STOP OPERATION

- 1) Press  key and to enter the **Manual Mode** and 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 it to stop (detail procedures please refer to No.4~9 of Auto start sequence). Under **Manual Mode**, load breaker won't transfer automatically and  key should be pushed to enter the C/O interface. Through  key to control mains switch open/close and  key to control generator switch open/close.
- 2) **Manual stop:** press  key can stop the running genset. (detail procedures please refer to No.3~6 of Auto stop sequence)

## 4.5 EMERGENCY START UP

Simultaneously press  and  in **Non-Auto mode** 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 unit has fired, he/she should release the key and starting output will be deactivated, safety on delay will be initiated.

## 5 GENSET CONTROLLER SWITCHING CONTROL PROCEDURE

### 5.1 HGM3020 SWITCHING CONTROL PROCEDURE

#### 5.1.1 MANUAL TRANSFER PROCEDURE

When the controller is in Manual Mode, the switching control executes the manual transfer process.

Operators control ATS load transfer via the C/O key.

-- If no OPEN command output is configured, press  key to enter close/open interface, use  key to control generator switch close, press  key, the mains opens, generator closes. Press  key to enter the close/open interface, use  key to control mains switch close, press  key, the generator opens, mains closes.

-- If OPEN command output is configured, during Mains-to-Gen transfer, firstly press  key to enter close/open interface, then use  key to control mains switch open/close (if mains is closed, press  key, mains opens; if mains is open, press  key, mains closes), press



key, mains opens after opening delay. Then press



key to enter open/close interface,

use



key to control generator switch open/close (if generator is closed, press



key,

generator opens; if generator is open, press



key, generator closes), press



key,

generator closes and takes load after closing delay. It is the same principle applies as above during Gen-to-Mains transfer.

## 5.1.2 AUTO TRANSFER PROCEDURE

When the controller is in Auto or Stop Mode, the switching control executes the automatic transfer process.

— If mains/generator “Closed Status” auxiliary input is configured:

- Mains-to-Gen Transfer: After mains opening delay, mains opens; after generator closing delay, if the CLOSED status input feedback of generator is active, the generator closes.

- Gen-to-Mains Transfer: same principle applies as above.

— If no mains/generator “Closed Status” auxiliary input is configured:

- Mains-to-Gen Transfer: After mains opening delay, mains opens; after generator closing delay, the generator closes.

- Gen-to-Mains Transfer: same principle applies as above.

**NOTE1: For open-transition ATS: Configure NO OPEN command output.**

**NOTE2: For delayed-transition ATS: Configure OPEN command output.**

## 6 PROTECTION

### 6.1 WARNINGS

When controller detects the warning signals, it will only send alarms and not stop the genset, besides, the LCD displays the warning information.

**Table 6 Warning Alarms**

No.	Type	Description
1	High Temperature	When the controller detects that temperature has exceeded the pre-set value while shutdown is prohibited, or detects that the Aux. input high temperature while shutdown is prohibited, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
2	Low Oil Pressure	When the controller detects that the oil pressure has fallen below the pre-set value while shutdown is prohibited, or detects that the Aux. input low oil pressure while shutdown is prohibited, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
3	Gen Over Current	When the controller detects that the genset current has exceeded the pre-set value and the over current delay has expired, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
4	Fail to Stop	After "fail to stop" delay/ETS delay has expired, if genset does not stop completely, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
5	Low Fuel Level	When the controller detects that the fuel level has fallen below the pre-set value while shutdown is prohibited, or detects that the Aux. input low fuel level while shutdown is prohibited, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
6	Charge Alt Failure	When the controller detects that charger voltage has fallen below the battery voltage and the difference value exceeds pre-set charging voltage difference value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
7	Battery Under Volt	When the controller detects that battery voltage has fallen below the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
8	Battery Over Volt	When the controller detects that battery voltage has exceeded the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
9	External Input	When the controller detects that the external warning input is active, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
10	Loss of Speed Signal	When the controller detects that the engine speed is 0 and the delay is 0, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
11	Low Coolant Level	When the controller detects the low coolant level input is active, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.

No.	Type	Description
12	Temp. Sensor Open	When the controller detects that the temperature sensor is open circuit and the action selects "Warn", it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
13	Oil Pressure Sensor Open	When the controller detects that the oil pressure sensor is open circuit and the action selects "Warn", it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
14	Fuel Level Sensor Open	When the controller detects that the level sensor is open circuit and the action selects "Warn", it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
15	Gen Over Volt.	When controller detects the voltage is higher than the set value, it will send warn signals and the corresponding alarm information will be displayed on LCD.
16	Gen Under Volt.	When controller detects the voltage is lower than the set value, it will send warn signals and the corresponding alarm information will be displayed on LCD.
17	Gen Over Freq.	When controller detects the frequency is higher than the set value, it will send warn signals and the corresponding alarm information will be displayed on LCD.
18	Gen Under Freq.	When controller detects the frequency is lower than the set value, it will send warn signals and the corresponding alarm information will be displayed on LCD.
19	Charge Alt Failure	When controller detects the charger alt failure warn input is active, it will send alarm signals and the corresponding alarm information will be displayed on LCD.
20	Over Power	When controller detects the power value (power is positive) is higher than the set value and the action select warn, it will send warn signals and the corresponding alarm information will be displayed on LCD.
21	Fuel Leakage Warning	When fuel leakage warning input is active, controller will send warning alarm signal and it will be displayed on LCD.

## 6.2 SHUTDOWN ALARM

When controller detects shutdown alarm, it will send signals to stop the generator and the corresponding alarm information will be displayed on LCD.

**Table 7 Shutdown Alarms**

No.	Type	Description
1	Emergency Stop	When controller detects emergency stop signals, it will send stop signals and the corresponding alarm information will be displayed on LCD.
2	Over Speed	When controller detects the speed value is higher than the set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
3	Under Speed	When controller detects the speed value is lower than the set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.

No.	Type	Description
4	Loss of Speed Signal	When controller detects speed value equals to 0, and delay value isn't 0 (action selects "Shutdown"), it will send stop signals and the corresponding alarm information will be displayed on LCD.
5	Gen Over Frequency	When controller detects the frequency value is higher than the set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
6	Gen Under Frequency	When controller detects the frequency value is lower than the set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
7	Gen Over Voltage	When controller detects the voltage value is higher than the set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
8	Gen Under Voltage	When controller detects the voltage value is lower than the set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
9	Gen Over Current	When controller detects the current value is higher than the set value and the delay value is not 0, it will send stop signals and the corresponding alarm information will be displayed on LCD.
10	Fail to Start	If genset starts failure within setting start times, controller will send stop signals and the corresponding alarm information will be displayed on LCD.
11	High Temp.	When controller detects temperature of water/cylinder is higher than the set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
12	Low Oil Pressure	When controller detects oil pressure is lower than the set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
13	No Generate Electricity	When controller detects frequency of genset is 0, it will send stop signals and the corresponding alarm information will be displayed on LCD.
14	Low Fuel Level	When controller detects fuel level value is lower than the pre-set value or the low fuel level input is active, controller sends stop signals and the corresponding alarm information will be displayed on LCD.
15	Low Coolant Level	When controller detects low coolant level input is active, controller sends stop signals and the corresponding alarm information will be displayed on LCD.
16	Temp. Sensor Open	When controller detects sensor, which connected to temperature sensor, is open circuit, and the action selects "Shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.
17	Oil Pressure Sensor Open	When controller detects sensor, which connected to oil pressure sensor, is open circuit, and the action selects "Shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.

No.	Type	Description
18	Fuel Level Sensor Open	When controller detects sensor, which connected to fuel level sensor, is open circuit, and the action selects "Shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.
19	Over Power	When controller detects the power value (power is positive) is higher than the max. set value and the action selects "Shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.
20	External Alarm Shutdown	When controller detects external active shutdown alarm signals, it will send stop signals and the corresponding alarm information will be displayed on LCD.
21	Current Imbalance	When current imbalance alarm is enabled and the max. difference value is higher than the set value, it will send alarm signal and the corresponding alarm information will be displayed on LCD.

**▲NOTE:** For warnings and shutdown alarms: "IN" suffix in the alarm message indicates the trigger source is an external input signal.

7 WIRING CONNECTION

HGM3020 controller back panel is as follows:

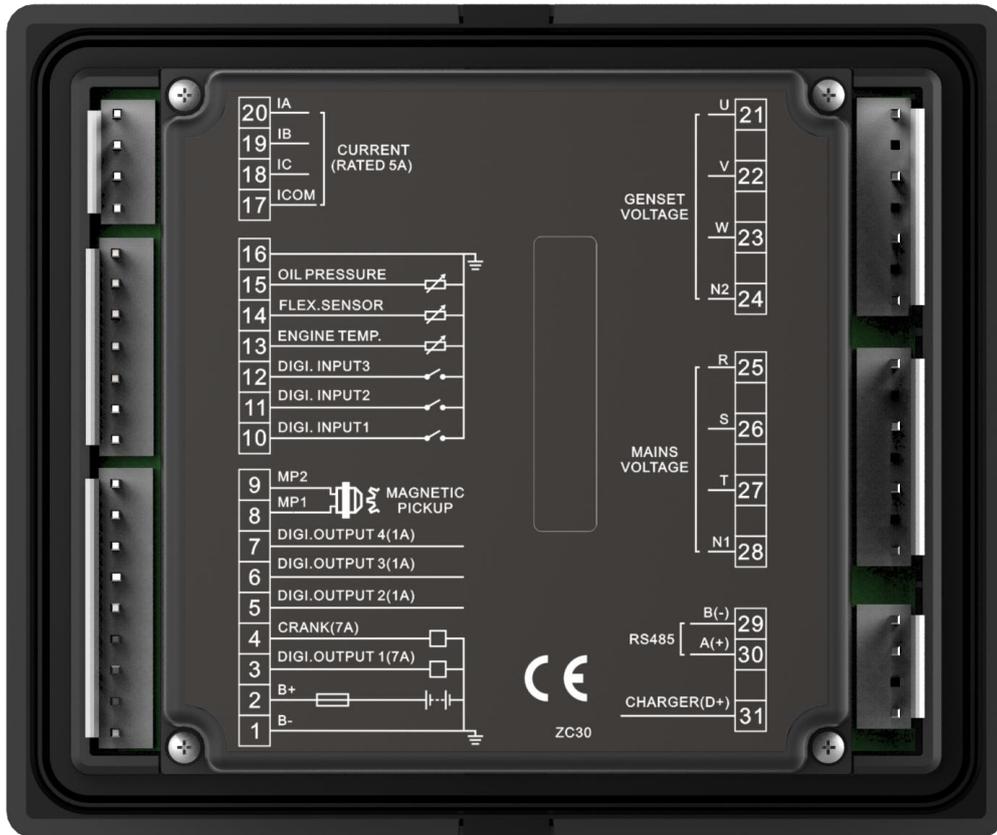


Fig.3 HGM3020 Back Panel

Table 8 Terminal Wiring Connection

No.	Function	Cable Size	Remarks
1	B-	2.5mm <sup>2</sup>	Connected with negative of starter battery.
2	B+	2.5mm <sup>2</sup>	Connected with positive of starter battery. If wire length is over 30m, better to double wires in parallel. Max. 20A fuse is recommended.
3	Fuel Relay Output	1.5mm <sup>2</sup>	B+ is supplied by Terminal 2, rated 7A. Parameter set as "programmable relay output 1".
4	Crank Relay Output	1.5mm <sup>2</sup>	B+ is supplied by Terminal 2, rated 7A.
5	Digi. Output 2	1.0mm <sup>2</sup>	B+ is supplied by Terminal 2, rated 1A.
6	Digi. Output 3	1.0mm <sup>2</sup>	B+ is supplied by Terminal 2, rated 1A.
7	Digi. Output 4	1.0 mm <sup>2</sup>	B+ is supplied by Terminal 2, rated 1A.
8	Speed Sensor Input (MP1)	0.5mm <sup>2</sup>	Connected with speed sensor; the internal circuit has been made compatible, so there is no need to distinguish between positive and negative when connecting external wiring. Shielding wire is
9	Speed Sensor Input (MP2)	0.5mm <sup>2</sup>	

No.	Function	Cable Size	Remarks
			recommended.
10	Digi. Input 1	1.0mm <sup>2</sup>	Ground connected is active (B-)
11	Digi. Input 2	1.0mm <sup>2</sup>	Ground connected is active (B-)
12	Digi. Input 3	1.0mm <sup>2</sup>	Ground connected is active (B-)
13	Temperature Sensor	1.0mm <sup>2</sup>	Connected with water temperature or cylinder temperature resistor type sensor.
14	Aux. Sensor Input	1.0mm <sup>2</sup>	Used as level sensor or digital input port 4.
15	Oil Pressure Sensor	1.0mm <sup>2</sup>	Connected with oil pressure resistor type sensor.
16	Input COM	1.0mm <sup>2</sup>	Inside connected to B-.
17	CT COM	1.5mm <sup>2</sup>	Reference to Installation Instruction.
18	CT C-phase Monitoring Input	1.5mm <sup>2</sup>	Outside connected to secondary coil of CT (5A rated).
19	CT B-phase Monitoring Input	1.5mm <sup>2</sup>	Outside connected to secondary coil of CT (5A rated).
20	CT A-phase Monitoring Input	1.5mm <sup>2</sup>	Outside connected to secondary coil of CT (5A rated).
21	Genset U-phase Voltage monitoring Input	1.0mm <sup>2</sup>	Connected to U-phase output of genset (2A fuse recommended).
22	Genset V-phase Voltage monitoring Input	1.0mm <sup>2</sup>	Connected to V-phase output of genset (2A fuse recommended).
23	Genset W-phase Voltage monitoring Input	1.0mm <sup>2</sup>	Connected to W-phase output of genset (2A fuse recommended).
24	Genset Line N2 Input	1.0mm <sup>2</sup>	Connected to N-line output of genset.
25	Mains R-phase Voltage Monitoring Input	1.0mm <sup>2</sup>	Connected to R-phase of mains (2A fuse recommended).
26	Mains S-phase Voltage Monitoring Input	1.0mm <sup>2</sup>	Connected to S-phase of mains (2A fuse recommended).
27	Mains T-phase Voltage Monitoring Input	1.0mm <sup>2</sup>	Connected to T-phase of mains (2A fuse recommended).
28	Mains line N1 Input	1.0mm <sup>2</sup>	Connected to line N of mains.
29	RS485-	0.5mm <sup>2</sup>	Impedance-120Ω shielding wire is recommended, its single-end earthed.
30	RS485+	0.5mm <sup>2</sup>	
31	Charger(D+)	1.0mm <sup>2</sup>	Connected with charger starter's D+ (WL) terminals. Being hang up If there is no this terminal.

**NOTE:** RS485 ports in controller back panel are programmable parameter ports, user can directly configure controller via PC.

8 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

8.1 CONTENTS AND SCOPES OF PARAMETERS

Table 9 Parameters Contents and Scopes

No.	Items	Range	Default	Description
<b>Mains Setting</b>				
1	Mains Options	(0-1)	0	0: AMF 1: Display only.
2	Mains Normal Delay	(0-3600)s	10	The time from mains abnormal to normal.
3	Mains Abnormal Delay	(0-3600)s	5	The time from mains normal to abnormal.
4	Mains Under Voltage Value	(30-620)V	184	When mains voltage has fallen below the set value, Mains Under Voltage is active. When set the value as 30V, the controller does not detect under voltage signal. Back lash: 10V.
5	Mains Over Voltage Value	(30-620)V	276	When mains voltage has exceeded the set value, Mains Over Voltage is active. When set the value as 620V, the controller does not detect over voltage signal. Back lash: 10V.
6	Mains Phase Loss Check	(0-1)	1	0: Disable 1: Enable
<b>Power Generation Setting</b>				
1	Poles	(2-64)	4	Numbers of generator poles, which can be used to calculate generator speed (generator with no speed sensor).
2	Gen Abnormal Delay	(0-20.0)s	10.0	The alarm delay of generator under voltage.
3	Gen Over Volt. Delay	(0-20.0)s	10.0	When generator volt exceeds the pre-set shutdown value and persists for the pre-set time delay , Gen Over Voltage Shutdown is active.
4	Gen Over Volt. Warning	(30-620)V	253	When generator voltage exceeds pre-set value, Gen Over Voltage is active and a warning alarm is sent. (No detection for over volt signal if the value set as 620V.)
5	Gen Over Volt. Shutdown	(30-620)V	276	When generator voltage exceeds the pre-set value and persists for the "Gen abnormal delay", Gen Over Voltage is active and gen abnormal shutdown alarm is sent. No

No.	Items	Range	Default	Description
				detection for over voltage signal if the value set as 620V.
6	Gen Under Volt. Warning	(30-620)V	193	When sampling voltage is below pre-set value, gen under voltage warning alarm will be sent. No detection for under voltage signal if the value set as 30V.
7	Generator Under Volt. Shutdown	(30-620)V	184	When generator voltage has fallen below the pre-set value and persists for the "Gen abnormal delay", Gen Under Voltage is active. No detection for under voltage signal if the value set as 30V.
8	Gen Over Freq. Delay	(0-20.0)s	2.0	When generator frequency exceeds the pre-set shutdown value and persists for the delay, it is considered as gen over frequency shutdown.
9	Gen Over Freq. Warning	(0-75.0)Hz	55.0	When generator frequency exceeds the pre-set value, Over Frequency is active. It will initiate a warning signal.
10	Gen Over Freq. Shutdown	(0-75.0)Hz	57.0	When generator frequency exceeds the pre-set value and persists for 2s, Over Frequency is active. It will initiate an alarm signal.
11	Gen Under Freq. Warning	(0-75.0)Hz	42.0	When generator frequency has fallen below the pre-set value, Under Frequency is active. It will initiate a warning signal.
12	Gen Under Frequency Shutdown	(0-75.0)Hz	40.0	When generator frequency has fallen below the pre-set value but not equal to 0 for 10s, Under Frequency is active. It will initiate an alarm signal.
<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	Preheat Delay			Power-on time of heater plug before starter is powered up.
3	Fuel Output Time	(1-60)s	1	Fuel output time before start output.
4	Cranking Time	(3-60)s	8	Power-on time of starter.
5	Crank Rest Time	(3-60)s	10	The waiting time before second power up when engine start failure.
6	Safety On Delay	(1-60)s	10	Alarms for low oil pressure, high

No.	Items	Range	Default	Description
				temperature, under speed, under frequency/voltage, charge alt failure are inactive.
7	Start Idle Time	(0-3600)s	0	Idle running time of genset when starting.
8	Warming Up Time	(0-3600)s	10	Warming time between genset switch on and high speed running.
9	Stop Delay	(0-3600)s	1	Time from mains normal or remote start signal is deactivated to stop genset.
10	Cooling Time	(3-3600)s	10	The high-speed cooling time before genset stop, after it unloads.
11	Stop Idle Time	(0-3600)s	0	Idle running time when genset stop.
12	ETS Solenoid Hold	(0-120)s	20	Stop electromagnet's power on time when genset is stopping.
13	Fail to Stop Delay	(0-120)s	5	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.
14	Raise Speed Pulse Time	(0-20.0)s	0.2	It is output when genset enters warming up period.
15	Drop Speed Pulse Time	(0-20.0)s	0.2	It is output when genset enters stop idling period.
<b>Engine Setting</b>				
1	Engine Type	(0-0)	0	Conventional engine.
2	Flywheel Teeth	(1.0-300.0)	118.0	Tooth number of the engine, for judging of starter crank disconnect conditions and inspecting of engine speed.
3	Rated Speed	(0-6000)r/min	1500	Provide standards for over/under speed and load speed judgement.
4	Idle Speed	(0-6000)r/min	750	During the ready for load phase, if the speed is lower than the load speed, it will not enter the normal running phase.
5	Start Attempts	(1-10)times	3	Maximum crank times of crank attempts. When reach this number, controller will send start failure signal.
6	Crank Disconnect	(0-6)	2	There are 3 conditions of disconnecting starter with engine: Generator, Speed and Oil Pressure. Aiming at to separating the starting

No.	Items	Range	Default	Description
				motor and genset as soon as possible. Details see Table 13.
7	Crank Disconnected Speed	(0-6000)r/min	360	When engine speed is higher than the pre-set value, starter will be disconnected.
8	Generator Freq. of Crank Disconnected	(0.0-30.0)Hz	14.0	When generator frequency is higher than the pre-set value, starter will be disconnected.
9	Oil Pressure of Crank Disconnected	(0-400)kPa	200	When generator oil pressure is higher than the pre-set value, starter will be disconnected.
10	Oil Pressure Delay of Crank Disconnected	(0-20.0)s	0.0	When crank disconnected condition includes oil pressure, oil pressure of engine exceeds the pre-set crank disconnected value and the delay has expired, then it can be considered as genset start successfully and starter will be disconnected.
11	Under Speed Shutdown	(0-6000)r/min	1200	When engine speed has fallen below the pre-set value for 10s, Under Speed is active. It will initiate a shutdown alarm signal.
12	Over Speed Shutdown	(0-6000)r/min	1710	When engine speed has exceeded the pre-set value for 2s, Over Speed is active. It will initiate a shutdown alarm signal.
13	Loss of Speed Signal Delay	(0-20.0)s	5.0	If the pre-set value is 0s, only warning and not to shut down the generator.
14	Voltage Difference of Charge Alt Failure	(0-30)V	6.0	During generator is normal running, when voltage difference between alternator D+(WL) and B+ exceeds the pre-set value and remains for 5s, It will initiate a charge alt failure warning.
15	Battery Over Voltage	(12-40)V	33.0	When battery voltage has exceeded the pre-set value and remains for 20s, it will initiate a warning alarm signal. Only warning and not to shut down the generator.
16	Battery Under Voltage	(4-30)V	8.0	When battery voltage has fallen below the pre-set value and remains for 20s, it will initiate a warning alarm signal. Only warning and not

No.	Items	Range	Default	Description
				to shut down the generator.
<b>Load Setting</b>				
1	Current Transform	(5-6000)/5	500	The ratio of external CT.
2	Rated Current	(5-6000)A	500	Refer to the rated current of generator, and it is used to provide standards for load current.
3	Rated Power	(0-6000.0)kW	276	Provide standards for load percentage judgement.
4	Over Current Delay	(0-3600)s	30	When load current has exceeded the pre-set value and the "over current" delay has expired, over current alarm is initiated. When the set value is 0, only warning and not to shut down the generator.
5	Over Current PCT	(50-130)%	120	When the load current has exceeded the pre-set value, "over current" delay is initiated.
6	Over Current Warning	(50-130)%	110	When load current exceeds the pre-set value, "over current" warning signals will be sent. (No warning alarms been sent if the value set as 0.)
7	Over Power Set	(0-6000)kW (0-6000)kW (0-3600)s	304 290 5	Over power pre-set value Over power warn return value Over power delay value When power value exceeds preset value and delay has expired, over power is active. Both return value and delay value can be set.
8	Over Power Act	(0-2)	0	0: Deactivated; 1: Warning; 2: Alarm Shutdown
9	Current Imbalance Set	(0-1) (0-130)% (0-3600)s	0 25 10	0: Disabled; 1: Enable The percentage of current imbalance shutdown threshold. Functions details: see Note 7. Current imbalance shutdown delay value.
<b>Switch Setting</b>				
1	Switch Close Time	(0-10)s	5.0	Pulse width of mains/generator switch on. When it is 0, means output constantly.
2	Switch Transfer Time	(0-99.9)s	1.0	The interval time from mains open to generator closed or from gen open to mains closed.
3	Manual Close Enable	(0-1)	1	0: Disabled; 1: Enabled;

No.	Items	Range	Default	Description
	Selection			When enabled, switch by pressing key; when disabled, switch automatically.
<b>Analog Sensor Setting</b>				
1	Curve Type	(0-12)	8	SGX. Details see Table 12.
2	Open Action	(0-2)	0	0: None; 1: Warning; 2: Alarm Shutdown
3	High Temp. Shutdown Inhibit	(0-1)	0	Factory default: when high temperature occurs, shutdown alarm is initiated. Details see Note 1.
4	High Temp. Shutdown Action	(0-1)	0	0: Immediate Shutdown; 1: Cooling Shutdown
5	High Temp. Shutdown Threshold	(0-300)°C	98	When the temperature of the external temperature sensor exceeds this value, a high-temperature signal is initiated. This value is only judged after the safety delay period has expired, and only applies to temperature sensors connected to the temperature sensor input port. When the set value equals to 300, a high-temperature signal is not triggered (this applies only to the temperature sensor input and excludes high-temperature alarm signals received via the digital input port).
6	High Temp. Warning Threshold	(0-300)°C	95	When the temperature of the external temperature sensor exceeds this value, a high-temperature signal is initiated. This value is only judged after the safety delay period has expired, and only applies to temperature sensors connected to the temperature sensor input port. When the set value equals to 300, a high-temperature signal is not triggered (this applies only to the temperature sensor input and excludes high-temperature alarm signals received via the digital input port).

No.	Items	Range	Default	Description	
7	Heater Setting	Open Value	(0-300)°C	50	When an output port is configured as a heater output, it controls turning the heater on and off.
		Close Value	(0-300)°C	55	
		Max. Heating Time	(0-3600)min	60	
8	Cooling Fan Setting	Open Value	(0-255)°C	60	When an output port is configured as a cooling fan output, it controls turning the cooling fan on and off.
		Close Value	(0-255)°C	40	
9	Custom Curve Setting			Input the resistance, current, or voltage value of each point on the curve along with its corresponding value. A total of 8 points must be entered.	
<b>Oil Pressure Sensor</b>					
1	Curve Type	(0-12)	8	SGX. Details see Table 12.	
2	Open Action	(0-2)	0	0: None; 1: Warning; 2: Alarm Shutdown	
3	Low Oil Pressure Shutdown Inhibit	(0-1)	0	Factory default: when low oil pressure occurs, shutdown alarm is initiated. Detail to see Note 2.	
4	Low Oil Pressure Shutdown Threshold	(0-1000)kPa	103	When the pressure of an external pressure sensor falls below this value, a low oil pressure shutdown is initiated. This value is only judged after the safety delay period has expired. When set to 0, a low oil pressure signal will not be triggered (this applies only to pressure sensor inputs and excludes low-pressure alarm signals received via digital input ports).	
5	Low Oil Pressure Warning Threshold	(0-1000)kPa	124	When the pressure of an external pressure sensor falls below this value, a low oil pressure shutdown is initiated. This value is only judged after the safety delay period has expired. When set to 0, a low oil pressure signal will not be triggered (this applies only to pressure sensor inputs and excludes low-pressure alarm signals received via digital input ports).	
6	Custom Curve Setting			Input the resistance, current, or voltage value of each point on the curve along with its corresponding	

No.	Items	Range	Default	Description
				value. A total of 8 points must be entered.
Level Sensor				
1	Input Type	(0-1)	0	0 Digital Input Port 4 Set 1 Level Sensor Function details see Note 4.
2	Curve Type	(0-7)	3	SGD. Details see Table 12.
3	Open Action	(0-2)	0	0: None; 1: Warning; 2: Alarm Shutdown
4	Low Level Shutdown Inhibit	(0-1)	1	Factory default: when low oil pressure occurs, shutdown alarm is initiated. Detail to see Note 2.
5	Low Level Warning Threshold	(0-100)%	10	When the liquid level of an external fuel level sensor falls below this value, a low fuel level warning is initiated. (This applies only to the fuel level sensor and excludes low-level alarm signals received via digital input ports.)
6	Low Level Warning Threshold	(0-100)%	20	When the liquid level of an external fuel level sensor falls below this value, a low fuel level warning is initiated. (This applies only to the fuel level sensor and excludes low-level alarm signals received via digital input ports.)
7	Fuel Pump Output Set	(0-100)%	25	When the fuel level remains below the set value for 10 seconds, the fuel pump ON signal is output.
		(0-100)%	80	When the fuel level remains above the set value for 10 seconds, the fuel pump OFF signal is output.
8	Custom Curve Setting			Input the resistance, current, or voltage value of each point on the curve along with its corresponding value. A total of 8 points must be entered.
9	Fuel Tank Capacity Set	(0-1)	0	0: Disable; 1: Enable
		(0-10000)L	1000	Set total fuel tank capacity.
Digital Input Port Setting				
Input Port 1				
1	Contents	(0-40)	1	Factory default: High Temp. Alarm Input. Details see Table 11.
2	Type	(0-1)	0	0: Close; 1: Open.

No.	Items	Range	Default	Description
3	Delay	(0-20.0)s	2.0	Time from input activation to confirmation.
<b>Input Port 2</b>				
1	Contents	(0-40)	2	Factory default: Low Oil Pressure Alarm Input. Details see Table 11.
2	Type	(0-1)	0	0: Close; 1: Open.
3	Delay	(0-20.0)s	2.0	Time from input activation to confirmation.
<b>Input Port 3</b>				
1	Contents	(0-40)	10	Factory default: Remote Start Input. Details see Table 11.
2	Type	(0-1)	0	0: Close; 1: Open.
3	Delay	(0-20.0)s	2.0	Time from input activation to confirmation.
<b>Input Port 4</b>				
1	Contents	(0-40)	11	Factory default: Low Fuel Level Warning Input. Details see Table 11.
2	Type	(0-1)	0	0: Close; 1: Open.
3	Delay	(0-20.0)s	2.0	Time from input activation to confirmation.
<b>Relay Output Port Setting</b>				
<b>Output Port 1</b>				
1	Contents	(0-40)	14	Factory default: Fuel Relay Output. Details see Table 10.
2	Type	(0-1)	0	0: Normally Open; 1: Normally Closed.
<b>Output Port 2</b>				
1	Contents	(0-40)	2	Factory default: ETS Hold. Details see Table 10.
2	Type	(0-1)	0	0: Normally Open; 1: Normally Closed.
<b>Output Port 3</b>				
1	Contents	(0-40)	3	Factory default: Idle Speed Control. Details see Table 10.
2	Type	(0-1)	0	0: Normally Open; 1: Normally Closed.
<b>Output Port 4</b>				
1	Contents	(0-40)	5	Factory default: Power Generation Closed. Details see Table 10.
2	Type	(0-1)	0	0: Normally Open; 1: Normally Closed.
<b>Module Setting</b>				
1	Power On Mode	(0-2)	0	0: Stop Mode 1: Manual Mode

No.	Items	Range	Default	Description
				2: Auto Mode
2	Communication Address	(1-254)	1	The address of remote monitoring.
3	Language	(0-7)	0	0: English; 1: Simplified Chinese; 2: Spanish; 3: Russian; 4: Turkish; 5: French; 6: Portuguese; 7: Polish.
4	Password Set	(0-65534)	00318	This password is used to access the advanced parameter settings.
5	AC System	(0-3)	0	0: 3P4W; 1: 2P3W; 2: 1P2W; 3: 3P3W.
6	Startup Interface Set	Enable Selection (0-1)	0	0: Disable; 1: Enable.
		Delay (0-3600s)	10s	

## ▲NOTES:

- 1) If the parameter configured as High Temperature Stop Inhibit or configured digital input port as High Temperature Stop Inhibit (input port is active), controller only send high temperature alarm signals instead of shutdown signals when temperature value is higher than the preset value or high temperature stop signals is active.
- 2) If the parameter configured as Low Oil Pressure Stop Inhibit or configured digital input port as Low Oil Pressure Stop Inhibit (input port is active), controller only send low oil pressure alarm signals instead of shutdown signals when oil pressure value is lower than the preset value or low oil pressure stop signals is active.
- 3) If the parameter configured as Low Fuel Level Stop Inhibit or configured digital input port as Low Fuel Level Stop Inhibit (input port is active), controller only send low fuel level alarm signals instead of shutdown signals when fuel level value is lower than the preset value or low fuel level stop signals is active.
- 4) Multiplex input port configured as either digital value or sensor, the corresponding items are active. E.g. if configured multiplex input port 4 as digital input port, the corresponding digital input port 4 items are active; if configured multiplex input port 4 as liquid level sensor, the corresponding liquid level sensor items are active.
- 5) When doing parameter configuration via PC software, there is no need to input password if default password (0318) isn't change; otherwise, if default password been changed or first time to set parameters via PC, password need to be written into the password interface.
- 6) After the correct password is entered, parameter setting interface can be entered directly by inputting parameter serial when secondary entering the password interface before LCD backlight darken.
- 7) Current Imbalance Detection Criteria: the difference between the maximum and minimum current values is recorded as Cur.Diff; the product of full-load current and current imbalance threshold percentage is recorded as Unbal\_Cur\_SET; when  $Cur.Diff > Unbal\_Cur\_SET$  and this condition persists longer than the set delay time, a current imbalance shutdown alarm will be triggered.

8.2 DEFINED CONTENTS OF PROGRAMMABLE OUTPUT PORTS 1~5

Table 10 Defined Contents of Programmable Output Ports 1~5

No.	Items	Description
0	Not Used	Output port is deactivated when "Not Used" is selected.
1	Common Alarm	Include all shutdown alarms and warning alarms. When there is warning alarm only, it is not self-lock; when a shutdown alarm occurs, it is self-lock until the alarm is reset.
2	Energize to Stop	Suitable for genset with electromagnet and will active after "stop idle delay". It is deactivated when the "ETS Solenoid Delay" expires.
3	Idle Control	Used for engine which has idles. Close before starting and open in warming up delay; Close during stop idle delay and open when stop is completed.
4	Preheat Control	Close before starting and open before power up;
5	Close Generator Output	Can control generator switch take load.
6	Close Mains Output	Can control mains switch take load.
7	Breaker Open	When close time is 0, it's disabled.
8	Raise Speed Control	Close when the generator enters Warming Up delay (close time: warming up delay) while open when Aux.
9	Drop Speed Control	Close when the generator enters Stop Idle delay/ Energized to Stop delay (close time: Stop Idle delay) while open when Aux.
10	Generator Run Output	Action when genset is normal running while deactivated when engine speed is lower than the "crank disconnect speed".
11	Fuel Pump Control	Close when fuel level is lower than the "Fuel Pump On" value or when low fuel level warning input is active; Open when fuel level is higher than the "Fuel Pump Off" and low fuel level warning input is deactivated;
12	High Speed Control	Close when the generator enters Warming Up delay while open after cooling delay.
13	In Auto Mode	The controller is in auto mode.
14	Fuel Relay Output	Action when generator start; disconnect when wait for stop.
15	Excite Generator	Output in start period. If there is no generator frequency during safety running, output for 2 seconds.
16	Cooler Output	Control air cooler to start/stop according to cooler temperature.
17	Louver Control	Action in genset starting and disconnect when genset stopped completely.
18	Shutdown Alarm Output	Output when shutdown alarms appeared.
19	Audible Alarm	When warning and shutdown alarms appear, audible alarm output is fixed as 300s. When "alarm mute" or any keys on the panel configurable input port is active, it can remove the alarm.
20	Heater Control	Controlled by the upper or lower limit of temperature sensor.
21	Reserved	
22	Crank Output	Output when in start status; disconnected in other status.
23-27	Reserved	

No.	Items	Description
28	Speed Raise Pulse	It is speed raise time when genset enters high-speed warming up period.
29	Speed Drop Pulse	It is speed drop time when genset enters stop idle period.
30	Reserved	
31	Over Speed Output	Output when speed is over the pre-set limit value.
32	Fuel Leakage Output	Output when fuel leakage alarms.
33-40	Reserved	

**8.3 DEFINED CONTENTS OF DIGITAL INPUT PORTS 1~5**

**Table 11 Defined Contents of Digital Input Ports 1~5 (All Grounded (B-) Active)**

No.	Items	Description
0	Not Used	
1	High Temperature Shutdown	If these signals are active after safety on delay, shutdown alarm will be immediately initiated.
2	Low Oil Pressure Shutdown	
3	External Warning Input	Only warning and not stops if this input is active.
4	Emergency Stop	Shutdown alarm will be immediately initiated if this input is active.
5	Cooling Stop when High Temp.	When the genset is running normally and this signal is activated, if there is a high temperature situation, the controller will first cool down the generator and then stop it; if the signal is deactivated and a high temperature situation occurs, the controller will shut down the genset without cooling down.
6	Generator Closed Auxiliary	Connected to the auxiliary switch of the generator on load.
7	Mains Closed Auxiliary	Connected to the auxiliary switch of the mains on load.
8	Inhibit Water Temp. High Stop	When it is active, prohibit stopping when high temperature occurs. Details to see <a href="#">Table 7 NOTE 2</a> .
9	Inhibit Oil Pressure Low Stop	When it is active, prohibit stopping when low oil pressure occurs. Details to see <a href="#">Table 7 NOTE 3</a> .
10	Remote Start	When this input is active in auto mode, genset start automatically and on load after running. Otherwise, genset will stop automatically if it is inactive.
11	Low Fuel Level Warn	Connected to digital input port of sensor, if this input is active, controller will send warn alarm signal.
12	Low Coolant Level Warn	
13	Low Fuel Level Shut.	Connected to digital input port of sensor, if this input is active, controller will send shutdown alarm signal.
14	Low Coolant Level Shut.	
15	Inhibit Start Auto	In Auto mode, if this input is active, whether mains is normal or not, the controller will not give a start command to the generator. If generator is normal running, stop command won't be executed. When this input is deactivated, genset will automatically start or stop according to the mains status (normal or abnormal).
16	Remote Control	When the input is active, keys on the panel are locked except for   keys and remote mode will display on the LCD. Remote

No.	Items	Description
		module pattern and start/stop operation can be switched by the keys on the panel.
17	Charge Alt Failure	Connected to charge alt failure output port.
18	Panel Lock	When input is active, all keys except the   buttons are inactive,  will be displayed on the right side of the fourth line of the panel LCD homepage.
19	Manual/Auto Switch	When input is active, it enters auto mode automatically, panel buttons and local operation are inactive; When input is inactive, it enters manual mode automatically, remote operation is inhibited.
20	Alarm Mute	When input is active, "Audible Alarm" output can be inhibited.
21	Idle Input	Idle control output when input is active.
22-25	Reserved	
26	Shutdown Input	Genset will warn and shutdown immediately if the signal is active.
27	Instrument Mode	All the outputs will be inhibited in this mode.
28	Battle Mode	In this mode, except for emergency stop and over speed stop, other alarms will not stop, not open.
29	Equal Power Input	When input port is active, the voltage alarm threshold is halved and the current alarm threshold is doubled.
30	Single Phase Load Input	When input port is active, the AC system changes to single phase two wire.
31	Fuel Leakage Input	When input port is active, the alarm of fuel leakage is initiated.
32-40	Reserved	

8.4 SELECTION OF SENSORS

Table 12 Sensors Selection

No.	Item	Description	Remark
1	Temperature Sensor	0 Not used 1 User Configured (Resistor type Curve) 2 VDO 3 SGH 4 SGD 5 CURTIS 6 DATCON 7 VOLVO-EC 8 SGX 9 Reserved 10 Reserved 11 Digital Low Input Active 12 Digital High Input Active	Defined resistance's range is 0Ω-6000Ω, default is SGX sensor.
2	Pressure Sensor	0 Not used 1 User Configured (Resistor type Curve) 2 VDO 10Bar 3 SGH 4 SGD 5 CURTIS 6 DATCON 10Bar 7 VOLVO-EC 8 SGX 9 Reserved 10 Reserved 11 Digital Low Input Active 12 Digital High Input Active	Defined resistance's range is 0Ω-999.0Ω, default is SGX sensor.
3	Fuel Level Sensor	0 Not used 1 User Configured (Resistor type Curve) 2 SGH 3 SGD 4 reserved 5 reserved 6 Digital Low Input Active 7 Digital High Input Active	Defined resistance's range is 0Ω-999.0Ω, default is SGD sensor.

8.5 CONDITIONS OF CRANK DISCONNECT SELECTION

Table 13 Crank Disconnect Conditions Selection

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

**NOTES:**

- a) There are 3 conditions to make starter separate with engine; speed, generator frequency and oil pressure can be used separately while oil pressure suggest to be used together with speed and generator frequency. The aim is to disconnect the starter motor as soon as possible.
- b) Speed stands for the real rotation speed detected by the speed sensor. Speed sensor is the magnetic equipment which be installed in starter for detecting flywheel teeth.
- c) When set as speed, must ensure that the number of flywheel teeth is as same as setting, otherwise, "over speed shutdown" or "under speed shutdown" may be caused.
- d) If genset without speed sensor please don't select corresponding items, otherwise, "start failure" 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 in crank disconnect setting, the engine speed displayed in controller is calculated by generator signal.

## 9 PARAMETERS SETTING

### 9.1 CONTROLLER PARAMETER SETTING

Start the controller, then press   at the same time to enter the parameters setting menu, menu items as follows:

- 1 Set Parameters
- 2 Information
- 3 Language
- 4 Event Log

When entered password interface, inputting "00318" can set all parameter items in [Table 7](#). If the password is changed, only input the password same as controllers', can the parameter be set via PC software. If there is need to set more parameters (e.g. voltage calibration; current calibration), please contact the factory.

#### NOTES:

- a) Please change the controller parameters when generator is in standby mode only (e. g. Crank disconnect conditions selection, auxiliary input, auxiliary output, various delay), otherwise, shutdown and other abnormal conditions may occur.
- b) Over voltage set value must be higher than under voltage set value, otherwise over voltage and under voltage condition may occur simultaneously.
- c) Over speed set value must be higher than under speed set value, otherwise over speed and under speed condition may occur simultaneously.
- d) Please set the generator frequency value as low as possible when cranking, in order to make the starter be separated quickly as soon as possible.
- e) Auxiliary input 1~4 could not be set as same items; otherwise, there are abnormal functions. However, the auxiliary output 1~4 can be set as same items.
- f) Level sensor can be set as fuel level sensor or digital input port 4; Choose either sensor or digital input port, if digital input port be selected, corresponding set parameters be functional and sensor parameters are inactive and reserved; otherwise, if sensor be selected, corresponding sensor parameters be functional and digital input port parameters are inactive and reserved.
- g) If need to shut down after cooling, please set any auxiliary input as "High Temperature Stop Input", then connect this input port to GND or set "High Temperature Stop Input" action as "Cooling Stop"

## 9.2 CONTROLLER INFORMATION

- a) LCD will display software version, hardware version and issue date of the controller.

In this interface, press  will display the auxiliary inputs and outputs status.

- b) LCD contrast control

Press  and  or  and  simultaneously to adjust LCD contrast ratio and make

LCD character display more clearly. Contrast ratio adjustment range: 0-9.

## 9.3 LANGUAGE SELECTION

Chinese, English, Spanish, Russian, Turkish, French, Portuguese and Polish can be optional.

## 9.4 EVENT LOG

View event log from this interface, including start/stop information and shutdown alarm information log. It can record and display up to 99 pieces.

SmartGen

10 SENSOR SETTING

- When reselect sensors, the sensor curve will be transferred into the standard value. For example, if temperature sensor is SGH (120°C resistor type), its sensor curve is SGH (120°C resistor type); if select the SGD (120°C resistor type), the temperature sensor curve is SGD curve.
- When there is difference between standard sensor curves and using sensor, user can adjust it in "curve type".
- When input the sensor curve, X value (resistor) must be input from small to large, otherwise, mistake occurs.
- If there is no oil pressure sensor, but there is low oil pressure alarm switch, user must set the oil pressure sensor as "None", otherwise, maybe low oil pressure shutdown occurs.
- The headmost or backmost values in the vertical coordinates can be set as same as below,

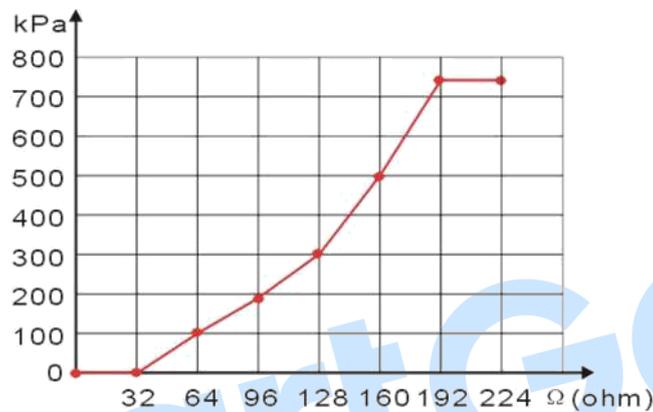


Fig.3 Sensor Curve Diagram

Table 14 Common Pressure Unit Conversion Table

	N/m <sup>2</sup> (pa)	kgf/cm <sup>2</sup>	bar	(p/in <sup>2</sup> .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

## 11 COMMISSIONING

Please make sure the following checks are made before commissioning,

- Ensure all the connections are correct and wires diameter is suitable;
- Ensure that the controller DC power has fuse, controller's positive and negative connected to starting battery are correct;
- Take proper action to prevent engine to crank success (e. g. Remove the connection wire of fuel valve). If checking is OK, make the start battery power on, controller will executive routine;
- Press "start" button, genset will start. After the cranking times as setting, controller will send signal of Start Failure; then press "stop" to reset controlle;
- Recover the action to prevent engine to crank success (e. g. Connect wire of fuel valve), press start button again, genset will start. If everything goes well, genset will normally running 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 and check all wires connection according to this manual;
- 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 mains abnormal situation;
- When mains is abnormal again, genset will be started automatically and enter into normal running, then controller send signal to making generator switch on, and control the ATS transfer into generator load. If not like this, please check ATS' wires connection according to this manual;
- If there is any other question, please contact SmartGen's service personnel.

12 TYPICAL APPLICATION

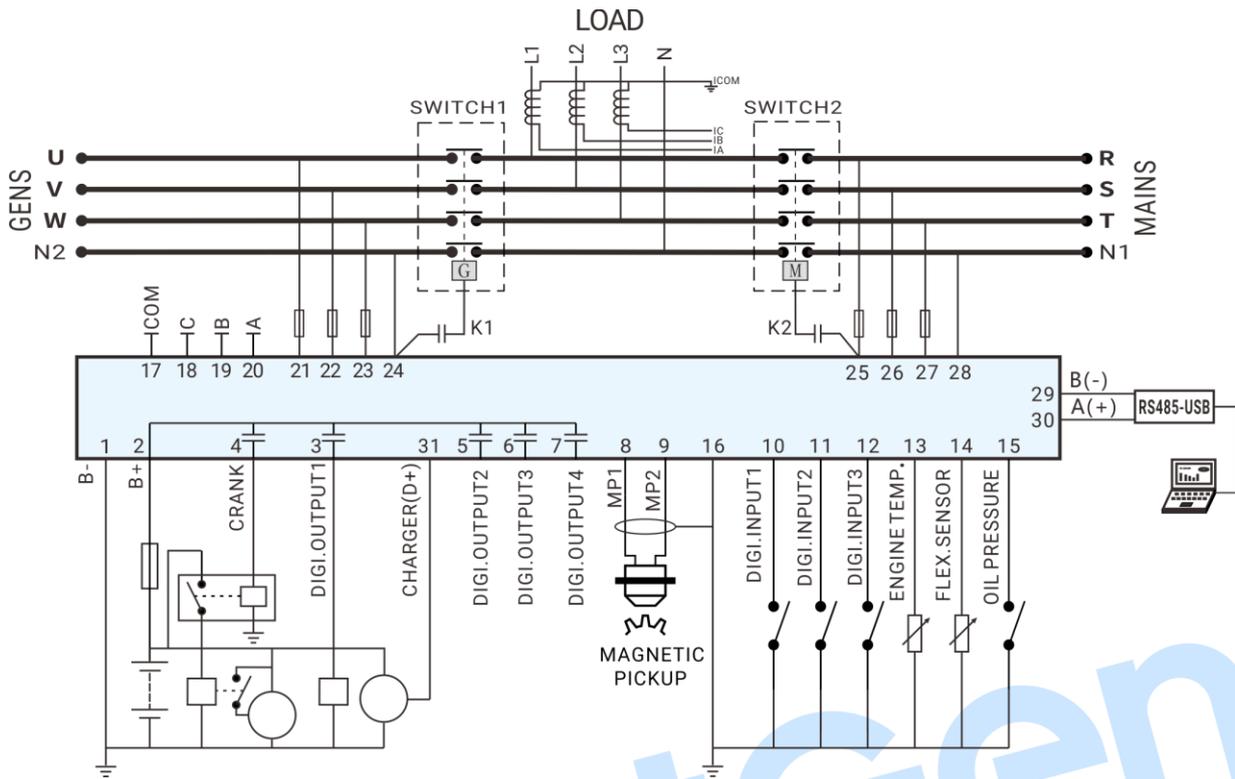


Fig.4 HGM3020N Typical Application

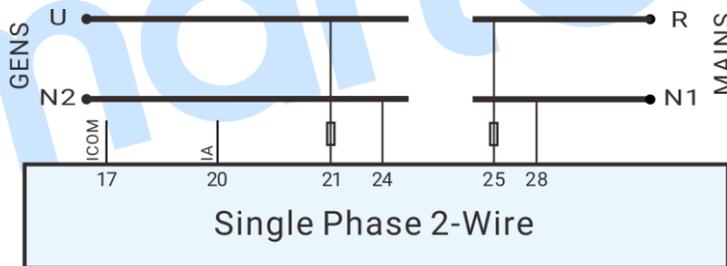


Fig.5 Single Phase 2-Wire Connection Diagram

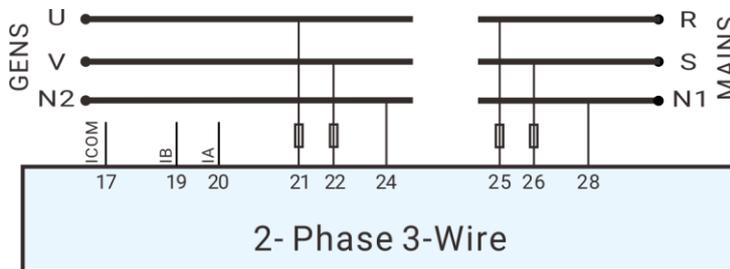
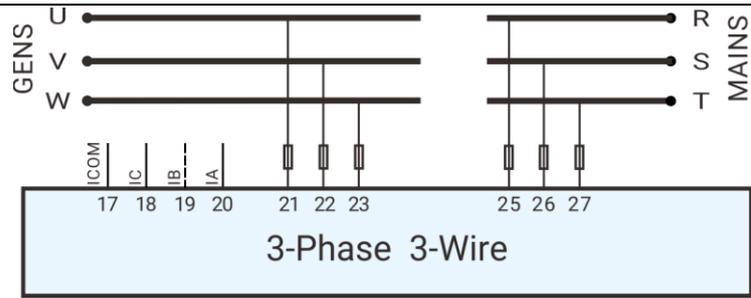


Fig.6 2-Phase 3-Wire Connection Diagram



**Fig.7 3-Phase 3-Wire Connection Diagram**

- ▲ NOTE1: Expand relay with high capacity in start and fuel output is recommend.
- ▲ NOTE2: When the AC system is a 3P3W, the IB may not require connection to a CT.
- ▲ NOTE3: The level sensor is programmable and can be reused as an input port.

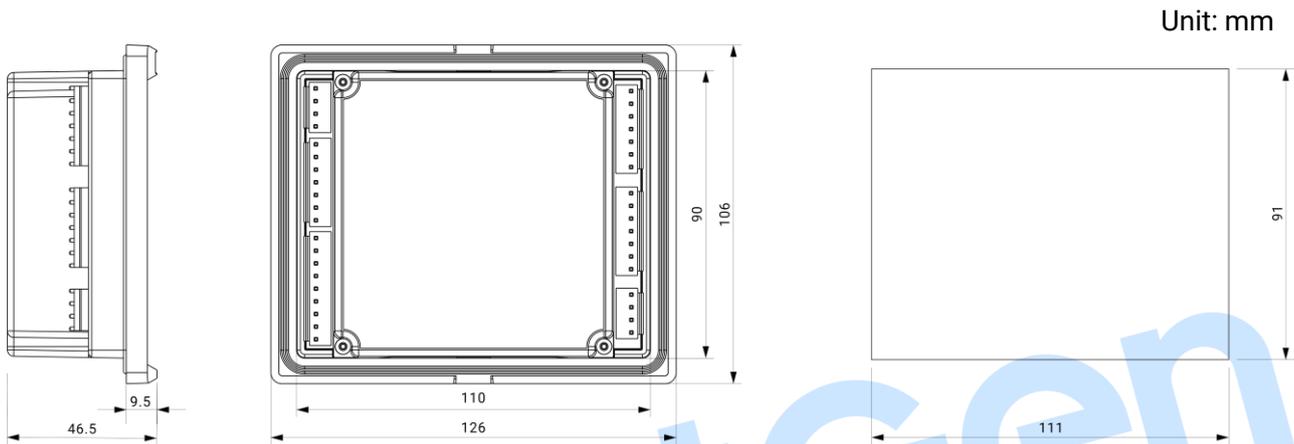
SmartGen

## 13 INSTALLATION

### 13.1 FIXING CLIPS

- 1) Controller is panel built-in design; it is fixed by clips when installed.
- 2) Withdraw the fixing clip screw (turn anticlockwise) until it reaches proper position.
- 3) Pull the fixing clip backwards (towards the back of the module) ensuring two clips are inside their allotted slots.
- 4) Turn the fixing clip screws clockwise until they are fixed on the panel.
- 5) Care should be taken not to over tighten the screws of the fixing clips.

### 13.2 OVERALL DIMENSION AND CUTOUT



**Fig.8 Overall Dimensions and Cutout**

HGM3020 controller can suit for widely range of battery voltage (8~35)VDC. Negative of battery must be connected with the engine shell. Diameter of wire that connects from power supply to battery must be over 2.5mm<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.

#### — SPEED SENSOR INPUT

Speed sensor is the magnetic equipment which be installed in starter and for detecting flywheel teeth. Its connection wires to controller should apply for 2 cores shielding line. The shielding layer should connect to No. 16 terminal in controller while another side is hanging in air. The else two signal wires are connected to No.8 and No.9 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.

#### — OUTPUT AND EXPAND RELAYS

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

#### — 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.

## — WITHSTAND VOLTAGE TEST

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.

### ▲NOTES:

- 1) ICOM port must be connected to negative pole of battery.
- 2) When there is load current, transformer's secondary side prohibit open circuit.

SmartGen

14 FAULT FINDING

Table 15 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.
Low oil pressure alarm after crank disconnect	Check the oil pressure sensor and its connections.
High water temp. alarm after crank disconnect	Check the water temperature sensor and its connections.
Shutdown alarm in running	Check related switch and its connections according to the information on LCD; Check digital inputs.
Crank not disconnect	Check fuel oil circuit and its connections; Check starting batteries; Check speed sensor and its connections; Refer to engine manual.
Starter no response	Check starter connections; Check starting batteries.
Genset running while ATS not transfer	Check ATS; Check the connections between ATS and controllers.
RS485 communication is abnormal	Check connections; Check setting of COM port is correct or not; Check RS485's connections of A and B is reverse connected or not; Check communication port of PC whether damage; 120Ω resistance is recommended to add between RS485's A and B when the communication distance is long.