



SmartGen
ideas for power

HGM4020DC GENSET CONTROLLER USER MANUAL



SMARTGEN (ZHENGZHOU) TECHNOLOGY CO., LTD.



Chinese trademark

SmartGen English trademark

SmartGen — make your generator *smart*

SmartGen Technology Co., Ltd.

No.28 Jinsuo Road

Zhengzhou City

Henan Province

P. R. China

Tel: 0086-371-67988888/67981888

0086-371-67991553/67992951

0086-371-67981000(overseas)

Fax: 0086-371-67992952

Web: www.smartgen.com.cn

www.smartgen.cn

Email: sales@smartgen.cn

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Table 1 - Software Version

Date	Version	Note
2019-04-10	1.0	Original Release

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1 OVERVIEW

HGM4020DC genset controller is specially designed for mobile communication base station, and its functions are completely followed by the actual situation of the mobile station. It not only fits with auto start/stop genset function in multiple boot conditions, data measurement function, alarm protection function and etc, but also can control switches of 6 rectifiers at most and their parameters, at the same time it can monitor machine room temperature and voltage of battery packs to automatically start/stop genset and ensure normal working of base station.

HGM4020DC genset controller adopts micro-processor technology with precise parameters measuring, fixed value adjustment, time setting and set value adjusting functions and etc. All parameters can be configured from front panel or through programmable interface (USB or RS485 interface) 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

- 132x64 LCD with backlit, selectable language interface (Chinese and English), push-button operation;
- Hard-screen acrylic material been used to protect screen with great wear-resisting and scratch-resisting performance.
- Silicone panel and pushbuttons, which can be used in extreme temperature environment.
- Two ways of RS485 communication port, one of which controls rectifiers and provide 5V power for them, and the other is used for remote control.
- 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 mains 3-phase voltage/frequency parameters.

Mains

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

- For Mains, controller has over and under voltage and loss of phase detection functions, and mains have rules can be selected.
- Precisely collects parameters about Engine.

Oil Pressure (OP)	kPa/psi/bar	
Fuel Level (FL)	%(unit)	Fuel Quantity Left L(unit)
Speed (RPM)	r/min (RPM)	
Voltage of Battery	V (unit)	
Voltage of Charger	V (unit)	
Hour count accumulation		
Start times accumulation		
- Machine room temperature can be collected, if temperature is too high, air conditioner in the machine will be started;
- Battery pack voltage(48V) can be collected, if battery pack is under voltage, generator will be started to charge the battery;
- 6 start conditions can be grouped at random: mains abnormal signal, remote start signal, mains abnormal and temperature of machine room is high, mains abnormal and battery pack voltage is low, scheduled start, and cyclic start/stop;
- 4 selectable stop requirements and battery charging completed groups to complete stop after mains abnormal and battery voltage low;
- 5 relay output ports, and they are respectively 1 start output port, 1 fuel level output port, 3 programmable output ports;
- 6 digital input ports, in which input port 5 and input port 6 can be multiplexed as flexible sensor 1 and flexible sensor 2;
- 2 flexible sensors, which can be selected as temperature sensor, pressure sensor or fuel level sensor; flexible sensor 1 also can be configured as machine room temperature sensor;
- Multiple temperature, pressure and fuel level sensors can be used directly and parameters can be users-defined;

- Fits with switches to control rectifiers, and functions of setting output voltage and current;
- Multiple crank disconnect conditions (speed sensor, generating and oil pressure) can be selected;
- Access monitoring function, which can provide security for the machine room;
- With emergency start function;
- With scheduled not run function(monthly, weekly, daily, duration time can be set);
- With inhibit to run setting, which shall inhibit genset to run in auto mode;
- With cyclic start/stop function, controlling genset start/stop for how much time circularly;
- With run log and real-time clock. Maximum 50 running records can be memorized (loop save);
- With maintenance log. Maximum 20 records can be memorized (loop save);
- With event log. Maximum 99 records can be memorized (loop save);
- Parameter setting function: users can configure parameters and users-defined parameters will be stored in the internal FLASH to avoid parameters lost in case of power dropout. All parameters can be configured from front panel or through programmable interface (USB or RS485 interface) via PC;
- Waterproof security level IP65 due to rubber seal installed between the controller enclosure and panel fascia;
- With metal fixing clips;
- Modular design, anti-flaming ABS plastic enclosure, pluggable connection terminals and embedded installation way; compact structure with easy mounting.

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3 SPECIFICATION OPERATION

Table 2 – Technical Parameters

Items	Contents
Operating Voltage	DC48V continuous; Range (20-65)V;
Power Consumption	<3W (standby ≤2W)
Alternator Volt Input Range 3Phase 4Wire 3Phase 3Wire Single Phase 2Wire 2Phase 3Wire	15V AC - 360 V AC (ph-N) 30V AC - 620 V AC (ph-ph) 15V AC - 360 V AC (ph-N) 15V AC - 360 V AC (ph-N)
Alternator Frequency	50Hz/60Hz
Speed sensor voltage	1.0V to 24.0V (RMS)
Speed sensor Frequency	10,000 Hz (max.)
Start Relay Output	8 A DC28V DC B+ power supply output
Fuel Relay Output	8 A DC28V DC B+ power supply output
Fan Relay Output	8 A DC28V DC B+ power supply output
Programmable Relay Output 1	8 A DC28V DC B+ power supply output
Programmable Relay Output 2	8 A DC28V DC B+ power supply output
Battery Pack Volt Input	0V DC - 35 V DC
RS485-1 Interface	Communication port with rectifiers
RS485-2 Interface	Baud rate 9600bps; 2 stop bit; no parity check Communication protocol YD 6313
Case Dimension	135mm x 110mm x 44mm
Panel Cutout	116mm x 90mm
Working Conditions	Temperature: (-25~+70)°C; Relative Humidity: (20~93)%RH
Storage Condition	Temperature: (-30~+80)°C
Protection Level	Front panel: IP65
Insulating Intensity	Apply AC2.2kV voltage between high voltage terminal and low voltage terminal; The leakage current is not more than 3mA within 1min.
Net Weight	0.32kg

4 OPERATION

4.1 KEY FUNCTION

Table 3 - Key Function Description

Icon	Function	Description
	Stop/ Reset	Stop running generator in Auto/Manual mode; In case of alarm condition, pressing the button will reset alarms; In stop mode, pressing and holding the button for 3 seconds will test indicator lights (lamp test); During stopping process, press this button again to stop generator immediately.
	Start	Under manual mode, press this button will start genset; press this button during genset start up, genset will jump to next status and genset can fast-boot.
	Manual	Pressing this key will set the module into manual mode.
	Auto	Pressing this key will set the module into auto mode.
	Close/Open	Reserved
	Set/Confirm	Pressing this key will enter into Main Menu; In setting parameter status, press this key will shift cursor or confirm setting value.
	Up/Increase	Scrolls the screen up; Shift the cursor up or increase the set value in parameter setting menu.
	Down/Decrease	Scrolls the screen down; Shift the cursor down or decrease the set value in parameter setting menu.

4.2 CONTROLLER PANEL

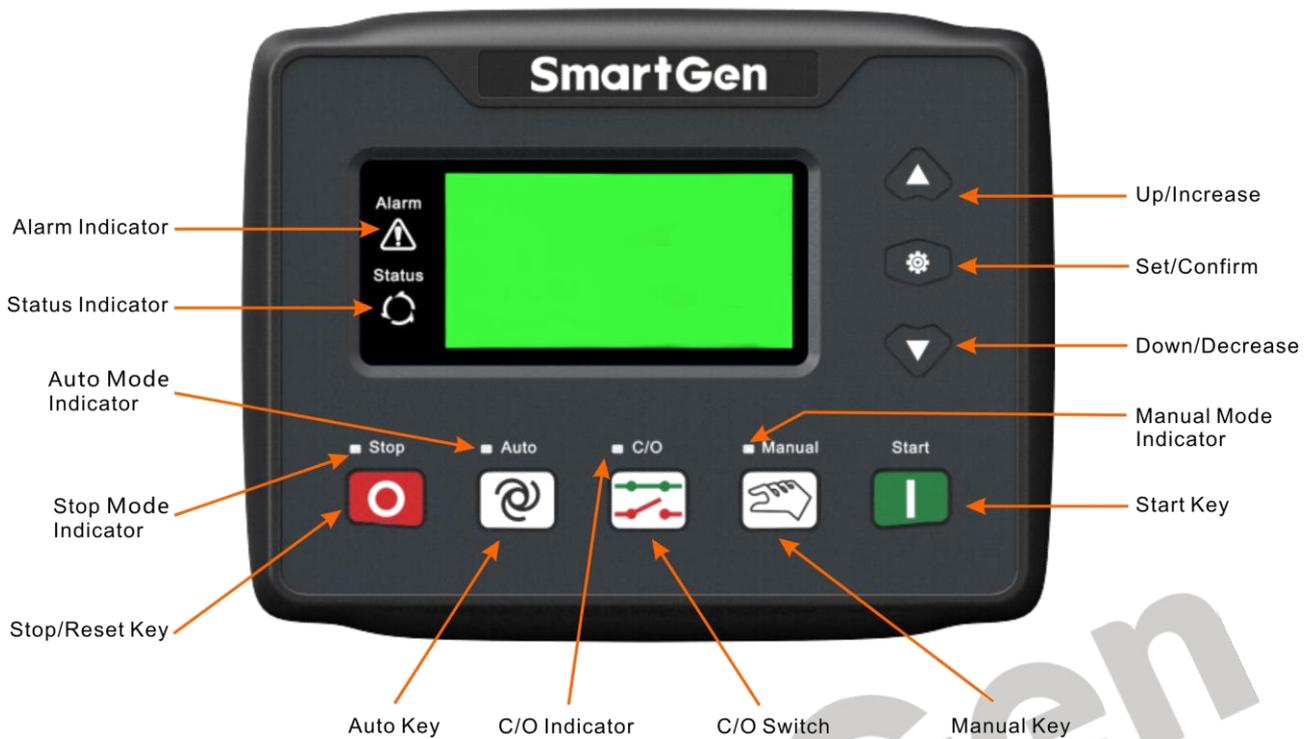


Fig.1 - HGM4020DC Front Panel Indication

NOTE: Part of indicator lights illustration:

Alarm Indicators: slowly flash when warning alarms occur; fast flash when shutdown alarms occur; light is off when no alarms occur.

Status Indicators: Light is off when genset is standby; flash once per second during start up or shut down; always on when in normal operation.

4.3 AUTO START/STOP OPERATION

4.3.1 ILLUSTRATION

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

4.3.2 AUTO START SEQUENCE

- When pre-set start conditions is satisfied, auto mode indicator flashes and meanwhile “start delay” countdown is displayed on LCD;
- After start delay, preheat relay outputs (if configured), and “preheat time x s” is shown on LCD.
- When preheat delay is over, fuel relay outputs for 1s and then start relay outputs; if engine crank fails during cranking time, the fuel relay and start relay is deactivated and enter into “crank rest time” to wait for next crank.
- If engine crank fails within setting times, the fifth line of LCD turns black and “failed to start” alarm appears on the fifth line of LCD display at the same time.
- In case of successful crank attempt, “safe time x s” starts. During this period, low oil pressure, under speed, charge failure alarms and auxiliary inputs (if configured) are disabled. As soon as this delay is over, “start idle x s” is initiated (if configured).
- In the process of “start idle speed”, under speed, under frequency, under voltage alarms are inactive. When this delay is over, “start warm up x s” starts (if configured).
- When warming up is over, if generator state is normal, then its indicator will be illuminated. If generator voltage has reached on-load requirements, the controller shall control rectifiers to output, and output indicators shall be displayed on LCD. Generator goes into normal running state; if generator voltage is abnormal, the controller will initiate shutdown alarm (shutdown alarm will be displayed on LCD).

4.3.3 AUTO STOP SEQUENCE

- a) If pre-set start conditions cannot be satisfied, “stop delay x s” will be started.
- b) When stop delay is over, “cooling time x s” is started, and rectifier output is closed;
- c) When “stop idle x s” (if configured) starts, idle speed relay is energized;
- d) When “ETS hold time x s” starts, ETS relay is energized. Fuel relay output is deactivated;
- e) When “wait stop x s” starts, the controller automatically detects whether the genset stops completely;
- f) When genset stops completely, it enters standby status; If genset fails to stop, controller will initiate “failed to stop warn” alarm (“fail to stop warn” is displayed on LCD).

4.4 MANUAL START/STOP OPERATION

- a) **Manual Start:** Press  and controller enters Manual Mode. A LED besides the button will be illuminated; In this mode, press  button to start the genset, and controller shall automatically judge crank success and accelerate to high speed running. If low oil pressure, over speed and abnormal voltage occurs during genset running, controller can effectively protect genset to stop (for detailed procedures please refer to No.b~g of Auto start sequence). When genset goes into normal running, the controller shall control rectifiers to output.
- b) **Manual Stop:** Press  key and it can stop the running genset. (for detailed procedures please refer to No.b~f of Auto stop sequence)

4.5 EMERGENCY START UP

Simultaneously press  and  in manual mode and it can force generator to crank. At this time, successful start will not be judged according to crank disconnect conditions, but operator will have to control crank disconnect manually; when operator observes that the engine has fired, he/she should release the button and start output will be deactivated, safety on delay will be initiated.

4.6 GENERATOR AUTO START CONDITIONS

There are 6 generator auto start conditions. Genset will start up in case any one condition is satisfied; after genset is started automatically, if corresponding stop condition is reached, genset will stop.

Table 4 – Start Conditions

No.	Conditions	Description	Corresponding Stop Conditions
1	Mains Fail Start	Genset will start when mains is abnormal.	Genset will stop when mains is normal.
2	Remote Start	Genset will start when remote start signal is active.	Genset will stop when remote start signal is deactivated.
3	Cycle Run	Genset will start when its stop time is over cyclic stop time (single unit cycle).	Genset will stop when normal running time is over cyclic start time (single unit cycle) .
4	Scheduled Run	Genset will start when scheduled start timer is due.	Genset will stop when scheduled running timer is overdue.
5	Mains Fail And Pile Under Volt Start	Genset will start when mains is abnormal and battery voltage is lower than the pre-set limit of battery pack.	If mains is normal, battery pack charging time reaches to charging complete time or complied with selected stop conditions, genset will stop.
6	Mains Fail And Room Temp High Start	Genset will start when mains is abnormal and machine room temperature is higher than the setting temperature upper limit.	Genset will stop when mains is normal and machine room temperature is under the setting temperature lower limit.

4.7 STOP CONDITIONS SELECTION

When mains is abnormal and pile is under voltage, genset will be started. If mains goes back to normal status and battery pack charging time reaches to charge completion time or complied with selected stop conditions, genset will stop.

Optional stop contions are as below:

- 0: Pile Volt is higher than the upper limit and load current is lower than the lower limit;
- 1: Pile volt is higher than the upper limit;
- 2: Load current is lower than the lower limit;
- 3: Pile Volt is higher than the upper limit or load current is lower than the lower limit;

NOTE: Load current lower limit detection is active only while genset is normal running and meanwhile genset will stop only when load current detection time is reached.

4.8 MAINS HAVE RULES

Mains have rules suit for 3P4W/3P3W AC system.

Table 5 – Mains Have Rules

No.	Rules Description	
1	Phase A must be electrified.	B/C phase cannot be missing;
2		One of phase B/C can be missing;
3		Two of phase B/C can be missing;
4	Phase A can not be electrified.	One of three phases can be missing;
5		Two of three phases can be missing;

5 PROTECTION

5.1 WARNINGS

When controller detects warning signals, it is warning only and not to stop the genset. Besides, the LCD displays the warning information.

Table 6 - Warning Alarm Types

No.	Type	Description
1	Low Pressure Warn	When the controller detects that the oil pressure has fallen below the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
2	Failed to Stop Warn	After ETS hold time/wait stop delay has expired, if gen-set does not stop completely, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
3	Low Fuel Level Warn	When the controller detects that the fuel level has fallen below the pre-set value, or detects that the low fuel level warning input is active, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
4	Reserved	
5	Bat. Under Volt Warn	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.
6	Bat. Over Volt Warn	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.
7	Input Warn	When the controller detects that the auxiliary input warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
8	Loss Speed Warn	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.
9	Room Temp High Warn	When the controller detects that the temperature of machine room has exceeded pre-set temp. value (including sensor open circuit), it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.



No.	Type	Description
10	Oil Sensor Open Warn	When the controller detects that the oil pressure sensor is open circuit and the action selects "Warning", it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
11	Fuel Sensor Open Warn	When the controller detects that the fuel level sensor is open circuit and the action selects "Warning", it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
12	Gen Over Voltage Warn	When controller detects the genset voltage is higher than the set value, it will send warning signals and the corresponding alarm information will be displayed on LCD.
13	Gen Under Voltage Warn	When controller detects the voltage is lower than the set value, it will send warning signals and the corresponding alarm information will be displayed on LCD.
14	Reserved	
15	Reserved	
16	Reserved	
17	Reserved	
18	Maintenance Time Warn	When genset running time has exceeded the user-set maintenance time and the action selects "Warning", it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD. The maintenance alarm will reset if the action selects "Inactive".
19	Failed to Charge IN	When the controller detects that external battery "failed to charge" input is active, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
20	Pile Under Voltage Warn	When the controller detects that battery pack voltage has fallen below the pre-set lower limit value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
21	Door Inhibit Warn	When the controller detects that door inhibit input is active, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
22	Reserved	
23	Reserved	
24	Temp 1 Open Warn	If the config. sensor 1 is set as temperature sensor, when the controller detects that the temperature sensor 1 is open circuit and the action selects "Warn", it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
25	Pressure 2 Open Warn	If the config. Sensor 1 is set as oil pressure sensor, 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.
26	Level 2 Open Warn	If the config. sensor 1 is set as level sensor, 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.
27	Temp 2 Open Warn	If the config. sensor 2 is set as temperature sensor, 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.
28	Pressure 3 Open Warn	If the config. Sensor 2 is set as oil pressure sensor, 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.



No.	Type	Description
29	Level 3 Open Warn	If the config. sensor 2 is set as level sensor, 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.
30	High Temp.1 Warn	When the controller detects that config. Sensor 1 temperature (sensor type: temperature sensor) has exceeded the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
31	Low Pressure 2 Warn	When the controller detects that config. sensor 1 oil pressure (sensor type: oil pressure sensor) has fallen below the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
32	Low Level 2 Warn	When the controller detects that config. Sensor 1 fuel level (sensor type: level sensor) has fallen below the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
33	High Temp.2 Warn	When the controller detects that config. Sensor 2 temperature (sensor type: temperature sensor) has exceeded the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
34	Low Pressure 3 Warn	When the controller detects that config. sensor 2 oil pressure (sensor type: oil pressure sensor) has fallen below the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
35	Low Level 3 Warn	When the controller detects that config. Sensor 2 fuel level (sensor type: level sensor) has fallen below the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
36	Low Oil Level Warn IN	When any one of inputs is configured as "Low Oil Level Warn", and is input port is active, controller will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.

5.2 SHUTDOWN ALARMS

When controller detects shutdown alarm, it will immediately control rectifiers to stop outputting and stop the genset, and the corresponding alarm information will be displayed on LCD.

Table 7 – Shutdown Alarms

No.	Type	Description
1	Emergency Stop Alarm	When controller detects emergency stop input is active, it will send stop signals and the corresponding alarm information will be displayed on LCD.
2	Over Speed Shutdown	When controller detects the engine 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 Shutdown	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.
4	Loss Speed Shutdown	When controller detects speed value equals to 0, and delay value isn't 0, it will send stop signals and the corresponding alarm information will be displayed on LCD.
5	Reserved	
6	Reserved	
7	Gen Over Volt Shutdown	When controller detects the generator 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 Volt Shutdown	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	Over Current Shutdown	When controller detects the current value is higher than the set value and duration time is over than over current delay, and alarm action selects "shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.
10	Failed To Start	If genset start fails within setting of start times, controller will send stop signals and the corresponding alarm information will be displayed on LCD.
11	High Temp. Shutdown	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 Pressure Shutdown	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 Gen Freq Shutdown	When controller detects genset voltage is 0, it will send stop signals and the corresponding alarm information will be displayed on LCD.
14	Input Shutdown	When controller detects active external shutdown alarm signals, it will send stop signals and the corresponding alarm information will be displayed on LCD.
15	Fuel Level Shutdown	When controller detects the sample value, which adopted by the programmable fuel level sensor, is lower than the pre-set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
16	Oil Sensor Open Shut.	When controller detects sensor, which connects 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.
17	Fuel Sensor Open Shut	When controller detects sensor, which connects 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.
18	Reserved	
19	Maintenance Time Shut.	When genset operation time exceeds maintenance time that user pre-set and the action selects "shutdown", it will send stop signals and the



No.	Type	Description
		corresponding alarm information will be displayed on LCD.
20	Temp 1 Open Shutdown	When controller detects temp. sensor, which connects to programmable sensor 1, is open circuit, and the action selects "shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.
21	Pressure 2 Open Shut.	When controller detects pressure sensor, which connects to programmable sensor 1, is open circuit, and the action selects "shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.
22	Level 2 Open Shutdown	When controller detects fuel level sensor, which connects to programmable sensor 1, is open circuit, and the action selects "shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.
23	Temp 2 Open Shutdown	When controller detects temp. sensor, which connects to programmable sensor 2, is open circuit, and the action selects "shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.
24	Pressure 3 Open Shut.	When controller detects pressure sensor, which connects to programmable sensor 2, is open circuit, and the action selects "shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.
25	Level 3 Open Shutdown	When controller detects fuel level sensor, which connects to programmable sensor 2, is open circuit, and the action selects "shutdown", it will send stop signals and the corresponding alarm information will be displayed on LCD.
26	High Temp. 1 Shutdown	When controller detects the sample value, which adopted by the programmable sensor 1(sensor type is temp. sensor), is higher than the pre-set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
27	Low Pressure 2 Shutdown	When controller detects the sample value, which adopted by the programmable sensor 1(sensor type is pressure sensor), is lower than the pre-set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
28	Low Fuel Level 2 Shutdown	When controller detects the sample value, which adopted by the programmable sensor 1 (sensor type is level sensor), is lower than the pre-set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
29	High Temp. 2 Shutdown	When controller detects the sample value, which adopted by the programmable sensor 2(sensor type is temp. sensor), is higher than the pre-set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
30	Low Pressure 3 Shutdown	When controller detects the sample value, which adopted by the programmable sensor 2(sensor type is pressure sensor), is lower than the pre-set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.
31	Low Fuel Level 3 Shutdown	When controller detects the sample value, which adopted by the programmable sensor 2 (sensor type is level sensor), is lower than the pre-set value, it will send stop signals and the corresponding alarm information will be displayed on LCD.

5.3 TRIP AND STOP ALARMS

When controller detects trip and stop alarms, it will immediately control rectifiers to stop outputting, and stop the genset after cooling time.

Table 8 – Trip and Stop Alarms

No.	Type	Description
1	Over Current ELE Trip	When controller detects the genset current is over than the pre-set value (delay time is expired) and the action selects “trip and stop”, it will send alarm signals and the corresponding alarm information will be displayed on LCD.

6 WIREING CONNECTION

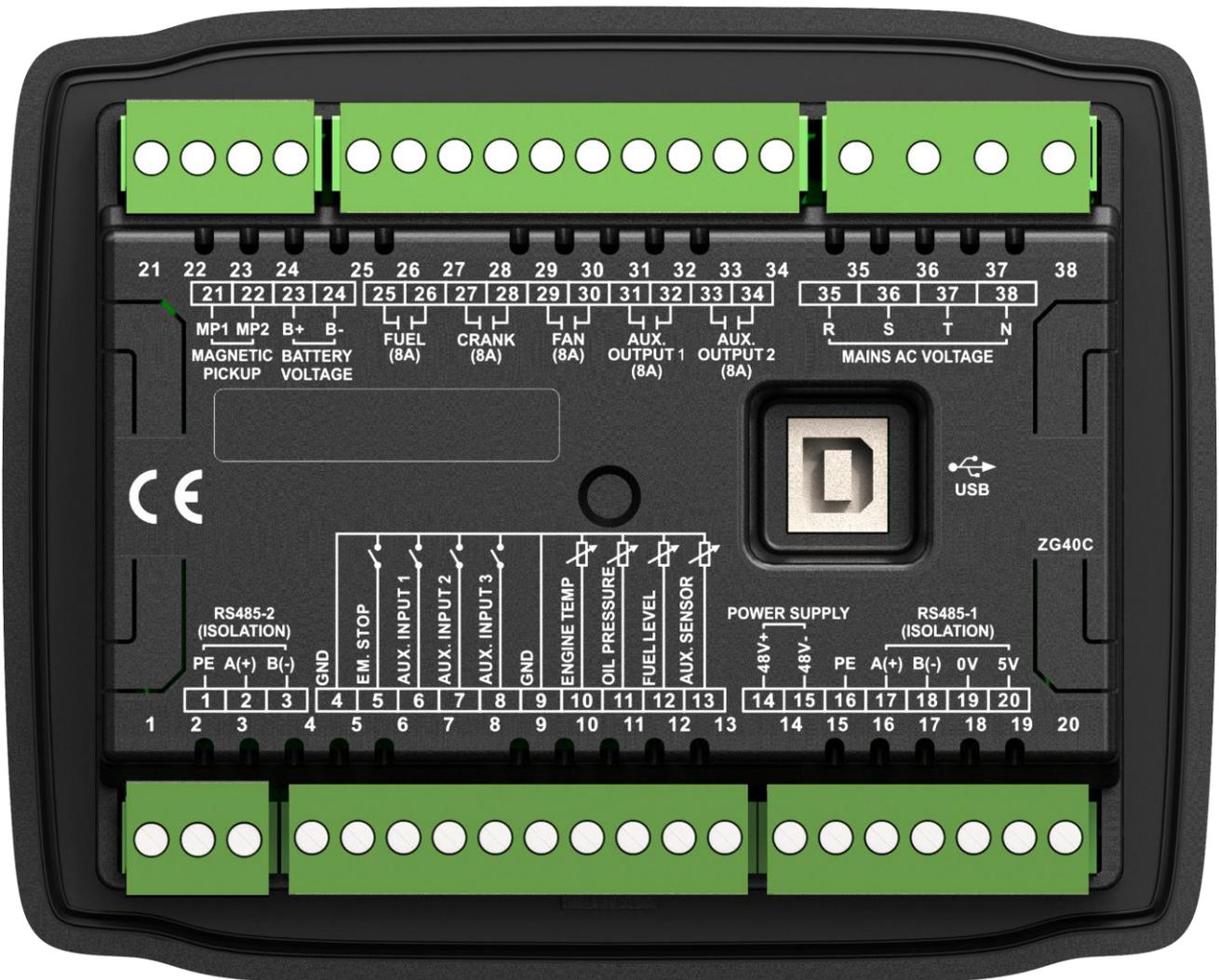


Fig.2 – Rear Panel Drawing



Table 9 –Terminal Wire Connection

No.	Function	Cable Size	Remark	
1	PE	1.0mm ²	Ground connected terminal for anti-thunder;	
2	RS485+	0.5mm ²	Communication terminal for connecting remote monitoring device;	
3	RS485-	0.5mm ²	Resistance-120Ω shielding wire is recommended; single end of which shall be ground connected.	
4	GND	1.0mm ²	Connects B-;	
5	EM. STOP	1.0mm ²	Ground connected is active (B-);	
6	AUX. INPUT 1	1.0mm ²	Ground connected is active (B-);	For settings please see Table 12.
7	AUX. INPUT 2	1.0mm ²	Ground connected is active (B-);	
8	AUX. INPUT 3	1.0mm ²	Ground connected is active (B-);	
9	GND	1.0mm ²	Connects B-;	
10	ENGINE TEMP	1.0mm ²	Act as programmable sensor 1, or digital input 5;	For settings please see Table 13.
11	OIL PRESSURE	1.0mm ²	Connects oil pressure resistive sensor;	
12	FUEL LEVEL	1.0mm ²	Connects level resistive sensor;	
13	AUX. SENSOR	1.0mm ²	Act as programmable sensor 2, or digital input 6;	For settings please see Table 13.
14	POWER SUPPLY 48V+	2.5mm ²	Connects battery positive; if it is over 30m, be in parallel with double wires; max. 20A fuse is advised.	
15	POWER SUPPLY 48V-	2.5mm ²	Connects battery negative;	
16	PE	1.0mm ²	Ground connected terminal for anti-thunder;	
17	RS485+	0.5mm ²	Communication terminal for connecting remote monitoring device;	
18	RS485-	0.5mm ²	Resistance-120Ω shielding wire is recommended; single end of which shall be ground connected.	
19	0V	0.5mm ²	Power for rectifier module;	
20	5V	0.5mm ²		
21	MP1	0.5mm ²	Connects turbo sensor; shielding wire is advised; MP2 connects B- inside controller already.	
22	MP2	0.5mm ²		
23	Battery Voltage B+	1.0mm ²	Connects starter battery positive;	
24	Battery Voltage B-	1.0mm ²	Connects starter battery negative;	
25	FUEL (8A)	1.5mm ²	Free volts relay output, rated 8A;	
26		1.5mm ²		
27	CRANK (8A)	1.5mm ²	Free volts relay output, rated 8A;	
28		1.5mm ²		
29	FAN (8A)	1.5mm ²	Free volts relay output, rated 8A;	
30		1.5mm ²		
31	AUX. OUTPUT 1 (8A)	1.5mm ²	Free volts relay output, rated 8A;	
32		1.5mm ²		
33	AUX. OUTPUT 2 (8A)	1.5mm ²	Free volts relay output, rated 8A;	
34		1.5mm ²		
35	Mains R-phase voltage monitoring input	1.0mm ²	Connected to R-phase of mains (2A fuse recommended).	
36	Mains S-phase voltage monitoring input	1.0mm ²	Connected to S-phase of mains (2A fuse recommended).	
37	Mains T-phase voltage monitoring input	1.0mm ²	Connected to T-phase of mains (2A fuse recommended).	
38	Mains line N1 Input	1.0mm ²	Connected to line N of mains	

7 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

7.1 CONTENTS AND SCOPES OF PARAMETERS

Table 10 - Parameters Settings and Scope

No.	Items	Range	Default	Description
Mains				
1	Mains AC System	(0-3)	0	0: 3 Phase, 4 Wire(3P4W); 1: 2 Phase, 3 Wire (2P3W); 2: 1 Phase, 2 Wire (1P2W); 3: 3 Phase, 3 Wire (3P3W).
2	Mains Normal Delay	(0-3600)s	10	The time from mains abnormal to normal or from normal to abnormal;
3	Mains Abnormal Delay	(0-3600)s	5	
4	Mains Over Voltage	(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. Backlash: 10V.
5	Mains Under Voltage	(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. Backlash: 10V.
6	Mains Have Rules	(0-4)	0	0: A: Must have; B/C can't lack; 1:A: Must have; B/C can lack one; 2:A: Must have; B/C can lack two; 3:A: Can have; A/B/C can lack one; 4:A: Can have; A/B/C can lack two;
Timers				
1	Start Delay	(0-3600)s	1	Time from auto start signal is active to genset is started.
2	Stop Delay	(0-3600)s	1	Time from auto start signal is deactivated to genset is stopped.
3	Pre-heat Delay	(0-300)s	0	Power-on time of heater plug before starter is powered up.
4	Cranking Time	(3-60)s	8	Power-on time of starter for each time.
5	Crank Rest Time	(3-60)s	10	The waiting time before second power up when engine start fails.
6	Safety On Time	(1-60)s	10	Alarms for low oil pressure, under speed, under frequency/voltage, charge alt failure are inactive.
7	Start Idle Time	(0-3600)s	0	Idle speed running time of genset at starting.
8	Warming Up Time	(0-3600)s	10	Warming time before genset takes load, after it goes into high speed running.
9	Cooling Time	(3-3600)s	10	Radiating time before genset stop, after it unloads.
10	Stop Idle Time	(0-3600)s	0	Idle speed running time at genset stopping.
11	ETS Solenoid Hold	(0-120)s	20	Stop electromagnet's power on time at genset stopping.
12	Stop Duration	(0-120)s	0	When "ETS time" is set as 0, it is time needed between ending of genset idle delay and genset complete stop; When "ETS time" is not 0, it is time between ending of ETS hold delay and genset complete stop.
13	Louver Hold Open	(0-3600)s	30	Keeping open time of Louver after genset's complete stop;



No.	Items	Range	Default	Description
Engine				
1	Flywheel Teeth	(10.0-300.0)	118.0	Tooth number of the engine, it is for judging starter crank disconnect conditions and inspecting engine speed.
2	Under Speed Shutdown	(0-6000)RPM	1200	When engine speed has fallen below the set value and delay time is expired, "Under Speed Shutdown" is active. It will initiate a shutdown alarm signal.
3	Over Speed Shutdown	(0-6000)RPM	1710	When engine speed has exceeded the set value and delay time is expired, "Over Speed Shutdown" is active. It will initiate a shutdown alarm signal.
4	Loss Speed Delay	(0-20.0)s	5.0	It is delay time after speed signal lost, if the delay time is set as 0s, it is only warning not shutdown.
5	Battery Over Volt	(12.0-40.0)V	33.0	When battery voltage has exceeded the set value and remains for 20s, it will initiate a warning alarm signal. It is only warning, not to shutdown the generator.
6	Battery Under Volt	(4.0-30.0)V	8.0	When battery voltage has fallen below the set value and remains for 20s, It will initiate a warning alarm signal. It is only warning, not to shutdown the generator.
7	Charge Alt. Fail	(0.0-30.0)V	6.0	As generator is normal running, when voltage difference between alternator D+(WL) and B+ exceeds the set value and remains for 5s, it will initiate a charging failure warning alarm signal.
8	Start Attempts	(1-10) times	3	Maximum times of crank attempts. When it reaches this number, controller will send start failure signal.
9	Disconnect Conditions	(0-6)	2	Crank disconnect conditions: generating, speed and oil pressure, aiming at disconnect the motor and engine as soon as possible.
10	Disconnect Speed	(0-3000)RPM	360	When engine speed is higher than the set value, then it is considered that genset start is successful, and starter will be disconnected.
11	Disconnect Voltage	(0-99.9)V	14.0	During starting process, when generator voltage is higher than the set value, starter will be disconnected.
12	Disconnect OP	(0-400)kPa	200	During starting process, when generator oil pressure is higher than the set value, then it is considered that genset start is successful, and starter will be disconnected.
13	Disconnect OP Time	(0.0-20.0)s	0.0	When crank disconnect condition contains oil pressure, if engine oil pressure is higher than pre-set value and delay time is expired, then it is considered that genset start is successful, and starter will be disconnected.
Generator				
1	Over Volt Shutdown	(3.0-99.9)V	60.0	Over volt shutdown setpoint and delay value; when it is set to 620V, over voltage shutdown signal shall not be detected;
2		(0-60.0)s	10.0	
3	Under Volt Shutdown	(3.0-99.9)V	40.0	Under volt shutdown setpoint and delay value; when it is set to 30V, under voltage shutdown signal shall not be detected;
4		(0-60.0)s	10.0	



No.	Items	Range	Default	Description
5	Over Volt Warn	(3.0-99.9)V	58.0	When generating voltage is higher than this value, then it is considered that over voltage is established, and meanwhile warning alarm is initiated. When it is set to 620V, warning signal shall not be detected;
6	Under Volt Warn	(3.0-99.9)V	46.0	When sample voltage is lower than this, then it is considered under voltage is established, and meanwhile warning signal is initiated. When it is set to 30V, warning signal shall not be detected.
Load				
1	Full Load Current	(5-6000)A	50	It used for load over current calculating.
2	Over Current	(0-3)	2	0: Not used; 1: Warn; 2: Shutdown; 3: ELE Trip.
		(50-130)%	120	Over current delay starts when load current exceeded the set percentage value.
3	Over Current Delay	(0-1)	0	0: Definite Time; 1: IDMT(Inverse Definite Minimum Time).
		(0-3600)s	30	Definite Time: over current delay value
		(1-36)	36	IDMT: delay multiplier value.
Inhibit Run				
1	Inhibit Run 1 Start	(0-23)h: (0-59)min	0 0	In auto mode, inhibit genset running between start time and end time.
2	Inhibit Run 1 Stop	(0-23)h: (0-59)min	0 0	
3	Inhibit Run 2 Start	(0-23)h: (0-59)min	0 0	
4	Inhibit Run 2 Stop	(0-23)h: (0-59)min	0 0	
5	Inhibit Run 3 Start	(0-23)h: (0-59)min	0 0	
6	Inhibit Run 3 Stop	(0-23)h: (0-59)min	0 0	
Analog Sensors				
Oil Pressure Sensor				
1	Curve Type	(0-12)	8	Default as SGX. For details please see Table 13.
2	Open Act	(0-2)	1	0 : Indication (oil pressure sensor will show “+++”); 1: Warn; 2: Shutdown
3	Low OP Shutdown	(0-400)kPa	103	When the oil pressure of the external sensor falls below the set value (only detect after “safety on delay”), “low oil pressure” shutdown alarm is initiated. If it is configured as 0, “low oil pressure” alarm signal will not be initiated (only applicable for oil pressure sensor).
4	Low OP Warn	(0-400)kPa	124	When the oil pressure of the external sensor falls below the set value (only detect after “safety on delay”), “low oil pressure” warning alarm is initiated. If it is configured as 0, “low oil pressure” alarm signal will not be initiated (only applicable for oil pressure sensor).
Fuel level Sensor				
1	Curve Type	(0-7)	3	Default is SGD. For details please see Table 13.
2	Open Act	(0-2)	1	0: Indication (fuel level sensor will show “+++”); 1: Warn; 2: Shutdown



No.	Items	Range	Default	Description
3	Low Level Shutdown	(0-100)%	0	When the fuel level of the external sensor falls below the set value (always detect), "low fuel level" shutdown alarm is initiated. If it is configured as 0, "low fuel level" alarm signal will not be initiated.
4	Low Level Warn	(0-100)%	20	When the fuel level of the external sensor falls below the set value (always detect), "low fuel level" warning alarm is initiated. If it is configured as 0, "low fuel level" alarm signal will not be initiated.
5	Fuel Pump On	(0-100)%	25	If fuel level falls below the pre-set value and lasts for over 10s, "fuel pump on" signal will be initiated.
6	Fuel Pump Off	(0-100)%	80	If fuel level exceeds the pre-set value and lasts for over 10s, "fuel pump off" signal will be initiated.
7	Fuel Tank Capacity Enable	(0-1)	0	0: Disable; 1: Enable
8	Fuel Tank Capacity	(0-10000)L	1000	Convert the fuel level percentage display to volume display.
Auxiliary Sensor 1				
1	Sensor Type	(0-4)	4	0: Digital input 5; 1: Temperature sensor; 2: Pressure sensor; 3: Level sensor; 4: Room temperature sensor.
2	Curve Type	(0-10) (0-10) (0-5) (0-10)	9	Make a choice according to sensor type; for details please see Table 13.
3	Open Act	(0-2)	1	0: Indication (related sensor will show "+++"); 1: Warn; 2: Shutdown.
4	Shutdown Value	(0-400)	98	Set this according to the sensor type; For temp. sensor, if sampling value exceeds the pre-set value, controller will initiate shutdown alarms. If it is set as 140, shutdown alarms will not be sent. For oil pressure sensor and fuel level sensor, if sampling value falls below the pre-set value, controller will initiate shutdown alarms. If it is set as 0, shutdown alarms will not be sent.
5	Warn Value	(0-400)	95	Set this according to the sensor type; For temp. sensor, if sampling value exceeds the pre-set value, controller will initiate warning alarms. If it is set as 140, warning alarms will not be sent. For oil pressure sensor and fuel level sensor, if sampling value falls below the pre-set value, controller will initiate warning alarms. If it is set as 0, warning alarms will not be sent.
6	Room Temp. High Warn	(0-60)°C	40	If temperature of machine room exceeds the pre-set value, controller will initiate warning alarms.
7	Fan On Temp	(0-400) °C	85	When temp. sensor is selected, fan



No.	Items	Range	Default	Description
8	Fan Off Temp	(0-400) °C	80	open/close is based on the values.
Aux. Sensor 2				
1	Sensor Type	(0-3)	0	0: Digital input 6; 1: Temperature sensor; 2: Oil pressure sensor; 3: Fuel level sensor;
2	Curve Type	(0-10) (0-10) (0-5)	3	Make a choice according to sensor type; for details please see Table 13.
3	Open Act	(0-2)	1	0: Indication (related sensor will show “+++”); 1: Warn; 2: Shutdown.
4	Shutdown Value	(0-400)	98	Set this according to the sensor type; For temp. sensor, if sampling value exceeds the pre-set value, controller will initiate shutdown alarms. If it is set as 140, shutdown alarms will not be sent. For oil pressure sensor and fuel level sensor, if sampling value falls below the pre-set value, controller will initiate shutdown alarms. If it is set as 0, shutdown alarms will not be sent.
5	Warn Value	(0-400)	95	Set this according to the sensor type; For temp. sensor, if sampling value exceeds the pre-set value, controller will initiate warning alarms. If it is set as 140, warning alarms will not be sent. For oil pressure sensor and fuel level sensor, if sampling value falls below the pre-set value, controller will initiate warning alarms. If it is set as 0, warning alarms will not be sent.
Digital Input Ports				
1	Input 1 Setting	(0-31)	3	Factory default: emergency stop alarm input, for details please see Table 12.
		(0-1)	0	0: close to activate; 1: open to activate.
		(0-20.0)s	2.0	It is time from detection of the input port is active to action confirm.
2	Input 2 Setting	(0-31)	9	Factory default: remote start (on load), for details please see Table 12.
		(0-1)	0	0: close to activate; 1: open to activate.
		(0-20.0)s	2.0	It is time from detection of the input port is active to action confirm.
3	Input 3 Setting	(0-31)	22	Factory default: door inhibit input, for details please see Table 12.
		(0-1)	0	0: close to activate; 1: open to activate.
		(0-20.0)s	2.0	It is time from detection of the input port is active to action confirm.
4	Input 4 Setting	(0-31)	0	Factory default: not used, for details please see Table 12.
		(0-1)	0	0: close to activate; 1: open to activate.
		(0-20.0)s	2.0	It is time from detection of the input port is active to action confirm.
5	Input 5 Setting	(0-31)	0	Factory default: not used, for details please see Table 12.
		(0-1)	0	0: close to activate; 1: open to activate.
		(0-20.0)s	2.0	It is time from detection of the input port is active to action confirm.



No.	Items	Range	Default	Description
				active to action confirm.
6	Input 6 Setting	(0-31)	0	Factory default: not used, for details please see Table 12.
		(0-1)	0	0: close to activate; 1: open to activate.
		(0-20.0)s	2.0	It is time from detection of the input port is active to action confirm.
Relay Output Ports				
1	Output 1	(0-50)	20	Factory default: fuel output, for details please see Table 11.
2	Output 2	(0-50)	19	Factory default: start output, for details please see Table 11.
3	Output 3	(0-50)	38	Factory default: fan output, for details please see Table 11.
4	Output 4	(0-50)	0	Factory default: not used, for details please see Table 11.
5	Output 5	(0-50)	0	Factory default: not used, for details please see Table 11.
Module Settings				
1	Power On Mode	(0-2)	0	0: Stop Mode; 1: Manual Mode; 2: Auto Mode.
2	Module Address	(1-254)	1	It is communication address of the controller.
3	Password	(0-9999)	0318	For details please see NOTE 2.
4	Date and Time			It is used to set date of controller.
5	Door Opening Time	(1-20)s	3	Pulse output time of opening door remotely;
6	Rectifier Volt	(0.0-99.9)V	53.5	
7	Rectifier Current	(0.0-99.9)A	50.0	
8	Rectifier Amount	(1-6)	4	
Inhibit Auto Start				
1	Inhibit Auto Start Set	(0-1)	0	0: Disable; 1: Enable
2	Inhibit AutoStartTim	(0-2)	0	Cyclic selection:
		(1-31)	1	0: Monthly; 1: Weekly; 2: Daily;
		(0-6)	0	Day(cyclic selection: 0: monthly)
		(0-23)h	0	Week(cycle selection: 1: weekly)
		(0-59)min	0	Time(Hour)
		(0-30000)min	30	Time(Minute) Duration time
Auto Start				
Mains Abnormal Start				
1	Start Set	(0-1)	0	0: Not Start; 1: Start
Remote Start				
1	Start Set	(0-1)	1	0: Not Start; 1: Start
Cycle Start				
1	Start Set	(0-1)	0	0: Not Start; 1: Start
2	Cycle Run Time	(0-6000)min	0	It is genset running time, if the set time is arrived, genset will stop.
3	Cycle Stop Time	(0-6000)min	0	It is genset standby time, if the set time is arrived, genset will start.
Scheduled Run				
1	Start Set	(0-1)	1	0: Not Start; 1: Start
2	Scheduled Run	(0-1)	0	0: Disable; 1: Enable
		(0-1)	0	0: Off-load; 1: On-load
3	Scheduled Period	(0-2)	0	Cyclic selection:
		(1-31)	1	0: Monthly; 1: Weekly; 2: Daily.
		(0-6)	0	Day(cyclic selection: 0: monthly)
		(0-23)h	0	Week(cyclic selection: 1: weekly)
		(0-59)min	0	Time(Hour)



No.	Items	Range	Default	Description
		(0-30000)min	30	Time(Minute) Duration time
Mains Abnormal And Pile Low Volt Start				
1	Start Set	(0-1)	1	0: Not Start; 1: Start
2	Stop Condition	(0-3)	0	0: Pile Volt High and Current Low 1: Pile Volt High 2: Current Low 3: Pile Volt High or Current Low
3	Pile Volt Upper Limit	(0-100.0)V	58.0	It is battery voltage when battery is completely charged.
4	Pile Volt Lower Limit	(0-100.0)V	45.0	It is battery pack under voltage limit. If voltage of battery falls below the setting value, genset will be started.
5	Charge Finish Time	(1-6000)min	720	It is the maximum time to charge for once.
6	Under Current	(1-100)%	15	When load current of switch power is lower than the set value, and battery voltage is higher than the upper limit value as well, genset will be allowed to stop.
7	Under Current Delay	(10-3600)s	30	When genset is normal running, if load current is below pre-set lower limit value, this delay will be started.
8	Minimum Charge Time	(0-360)min	30	When battery charging time exceeds the set value, and if temperature of machine room is high, air conditioner will be started.
Mains Abnormal And Room Temp. High Start				
1	Start Set	(0-1)	1	0: Not Start; 1: Start;
2	Room Temp. Upper Limit	(15-55)°C	28	Genset will start up if machine room is higher than this value.
3	Room Temp. Lower Limit	(15-55)°C	22	After genset starts up because of the high temp. of machine room, if room temp. falls below the set value, genset will stop.

NOTES:

- 1) When parameter configuration is operated via PC software, there is no need to input password if default password (0318) isn't changed. On the contrary, if default password has been changed or it is the first time to set parameters via PC, password is needed to input in the password interface.
- 2) After the correct password is entered, before LCD backlight gets dark, parameter setting interface can be entered directly by inputting parameter serial at secondary entering the password interface.

7.2 DEFINABLE CONTENT LIST OF PROGRAMMABLE OUTPUT PORTS 1-5

Table 11 – Definable Contents of Programmable Outputs 1~5

No.	Items	Function Description
0	Not Used	Output port don't output when it is chosen.
1	Common Alarm	Include all shutdown alarms, trip and stop alarms and warning alarms. When there is warning alarm only, it is not self-locked; when a shutdown alarm occurs, it is self-locked until the alarm is reset.
2	Common ELE Trip	Output when a common trip shutdown alarm occurs.
3	Common Shutdown	Output when a shutdown alarm occurs.
4	Common Warn Alarm	Output when a common warning alarm occurs.
5	Audible Alarm	When warning, trip shutdown and shutdown alarms appear, audible alarm output is fixed for 300s, during which if any button on the panel is pressed, or "alarm mute" input is active, or any keys on the panel is active, the alarms shall be removed.
6	Energized to Stop	Applicable for genset with stop electromagnet; it shall pull in when stop idle speed running ends and disconnect when the set ETS delay is over.
7	Idle Control	Applicable for genset with idle speed; it shall pull in when genset starts and disconnect when warming up is initiated; it shall pull in during stop idle speed process and disconnect when genset stops completely.



No.	Items	Function Description
8	Preheat Control	Close before start and open before power up;
9	Raise Speed	Action while in hi-speed warming up running period.
10	Drop Speed	Action while in the period time from stop idle speed to wait for stop.
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	
16	Reserved	
17	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” value and low fuel level warning input is deactivated;
18	High Speed Control	Close when the generator enters into warming up time and open after cooling delay.
19	Crank Out	Output while engine is cranking.
20	Fuel Out	Action at generator start; disconnect at “wait for stop”.
21	Generator Excite	Output in start period. If there is not generator frequency during high-speed running, it shall output for 2 seconds again.
22	Advance Oil Output	Output while genset is between the periods from pre-heat to stop idle speed.
23	Room Fan Control	Output is controlled according to the upper/lower limit of the engine room temperature.
24	Run Out	Output while genset is between periods from normal running to hi-speed cooling.
25	Timing Start	Output while genset is in the period of scheduled start.
26	Charge Alt. Fail	Output when charger fails to charge the batteries.
27	In Auto Mode	Action while system is in auto mode.
28	In Manual Mode	Action while system is in manual mode.
29	In Stop Mode	Action while system is in stop mode.
30	High Room Temp Warn	When temperature of machine room reaches the “room high temp warn” limit, alarms will be initiated.
31	Mains Abnormal	Action when mains over/under frequency, over/under voltage or aux. mains abnormal input is active.
32	Louvre Control	Action when genset starts up and disconnect after genset stops and “louver hold open” time is expired.
33	Battery Over Volt	Output when battery voltage high warning occurs.
34	Battery Under Volt	Output when battery voltage low warning occurs.
35	Tele. Open Door	This output is remotely controlled by Modbus-RTU protocol, and output time is “Telecontrol Open Door Output Time”.
36	Failed to Start	Output when engine fails to start.
37	Pre-Oil	Output while genset is between periods from pre-heat to safety running.
38	Fan Control	It is controlled by fan open and fan close according to temperature value of temp. sensor selected for programmable sensor 1.
39	Reserved	
40	Reserved	
41	Reserved	
42	Reserved	
43	Reserved	
44	Reserved	
45	Reserved	
46	Reserved	
47	Reserved	
48	Reserved	
49	Reserved	
50	Reserved	

7.3 DEFINABLE CONTENTS OF PROGRAMMABLE INPUT PORTS 1-7

Table 12 - Definable Contents of Programmable Inputs 1~7(Ground connected (B-) is active.)

No.	Items	Function Description
0	Not Used	Input port is inactive.
1	Alarm Mute	If input port is active, “audible alarm” output will be inhibited.
2	Reset Alarm	If input port is active, shutdown alarms and ELE trip alarms can be reset.
3	Emergency Stop	If input port is active, genset will alarm shutdown immediately.
4	High Temp Shutdown	After safety on delay is expired, if this input is active, genset will alarm shutdown immediately.
5	Low OP Shutdown	After safety on delay is expired, if this input is active, genset will alarm shutdown immediately.
6	Fuel Level Warn	If this input is active, controller will send low fuel level warning alarm signal.
7	Warn Input	If this input is active, controller will send external warning alarm signal.
8	Shutdown Input	If this input is active, genset will alarm shutdown immediately.
9	Remote Start Onload	When this input is active in auto mode, genset starts automatically and takes on load after normal running. Otherwise, genset will stop automatically if this input is deactivated.
10	Remote Start Offload	When this input is active in auto mode, genset starts automatically and without taking load after normal running. Otherwise, genset will stop automatically if this input is deactivated.
11	Reset Maint. Time	When this input port is valid, reset the maintenance time countdown, it is invalid for the maintenance date.
12	Panel Lock	When input is active, all keys except    are inactive.  will display on the right side of fifth line of LCD main page.
13	Inhibit Timing Start	When input port is active in auto mode, genset scheduled run is inhibited.
14	Inhibit Auto Start	When input port is active in auto mode, genset auto start is inhibited.
15	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 module pattern and start/stop operation can be switched by keys on the panel.
16	Charge Alt Fail IN	When the input is active, controller will send failed to charge warning.
17	Low Oil Level Warn	When input port is active, controller will initiate low oil level warning alarm.
18	Manual/Auto Switch	When input is active, it switches to auto mode automatically, panel buttons and local operation are inactive; When input is inactive, it switches to manual mode automatically, remote operation is inhibited.
19	Reserved	
20	Idle Input	When the input is active, idle speed control starts outputting.
21	Reserved	
22	Control At Gate	When the input is active, controller will send access control input warning.
23	Aux. Mains Fail	Simulate mains is abnormal.
24	Aux. Mains OK	Simulate mains is normal.
25	Pile Under Volt	When the input is active, it is considered battery is under voltage. If crank disconnect conditions are configured, genset will be started in auto mode.
26	Reserved	
27	Reserved	
28	Reserved	
29	Reserved	
30	Reserved	
31	Reserved	

7.4 SELECTION OF SENSORS

Table 13 – Sensors Selection

No.	Items	Content	Remark
1	Temperature Sensor	0 Not used 1 Defined Curve 2 VDO 3 SGH 4 SGD 5 CURTIS 6 DATCON 7 VOLVO-EC 8 SGX 9 PT100 10 Reserved	Defined resistance range is 0Ω~999.9Ω.
2	Pressure Sensor	0 Not used 1 Defined Curve 2 VDO 10Bar 3 SGH 4 SGD 5 CURTIS 6 DATCON 10Bar 7 VOLVO-EC 8 SGX 9 Reserved 10 Reserved 11 Digital Closed 12 Digital Open	Defined resistance range is 0Ω~999.9Ω.
3	Fuel Level Sensor	0 Not used 1 Defined Curve 2 SGH 3 SGD 4 Reserved 5 Reserved 6 Digital Closed 7 Digital Open	Defined resistance range is 0Ω~999.9Ω.

NOTE: The room temperature sensor's curve type is the same as temperature sensor's.

7.5 CONDITIONS OF CRANK DISCONNECT SELECTION

Table 14 – Crank Disconnect Conditions

No.	Setting Content
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

- a) There are 3 conditions to make starter separate with engine; speed, generator frequency and oil pressure, and all of them can be used separately. It is recommended to use oil pressure and speed cooperatively, for the purpose of disconnecting the starter motor as soon as possible.
- b) Speed means real rotation speed detected by the speed sensor. Speed sensor is the magnetic equipment which is installed in starter for detecting flywheel teeth.
- c) In case speed is selected, it must be confirmed that the number of flywheel teeth is as same as the setting, otherwise, “over speed shutdown” or “under speed shutdown” may be caused.
- d) If genset does not fit speed sensor, please don't select corresponding items, otherwise, “start fail” or “loss speed signal” maybe caused.
- e) If genset does not fit oil pressure sensor, please don't select corresponding items.

8 PARAMETERS SETTING

8.1 CONTROLLER PARAMETER SETTING

After controller is powered on, press  and it shall enter parameter setting menu. Menu items are as follows:

- 1 Set Parameters
- 2 Information
- 3 Set Language
- 4 Event Log
- 5 Maintenance
- 6 Run Log
- 7 Maintenance Log

When password is inputted, “0318” can set all parameter items in Table 10. If the password is changed, parameter setting can only be accessed by inputting the same password as the controller via PC software configuration. If more parameters are needed to set, or password is forgot, for example, voltage/current calibration, please contact the factory.

Attention:

- 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 limit must be higher than under voltage set limit, 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 at cranking, in order to make the starter be separated quickly as soon as possible.
- e) Auxiliary input 1~6 could not be set as the same items; otherwise, they are abnormal functions. However, the auxiliary output 1~5 can be set as the same items.
- f) Programmable sensor 1 and sensor 2 both can be set as discrete input or analog input port. If discrete input port is selected, corresponding discrete input settings are active; otherwise, if analog input is selected, corresponding sensor parameters settings are active.

8.2 CONTROLLER INFORMATION

- a) LCD will display development information of the controller, such as software version, hardware and issue date of the controller.
- b) **▲NOTE:** In this interface, press  and auxiliary inputs and outputs status shall display.
- c) LCD contrast control
- d) Press  and  or  and  simultaneously to adjust LCD contrast ratio and make LCD character display more clearly. Contrast ratio adjustment range: 0-7.

8.3 LANGUAGE SELECTION

Chinese and English can be optional.

8.4 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.

8.5 MAINTENANCE

It needs to input password at entering into the maintenance interface, default is 0 (if password is changed, please contact with SmartGen service personnel or sales personnel). Setting maintenance parameters will refresh maintenance time.

▲NOTE: Refresh maintenance time and enter into the next maintenance period in maintenance interface when “Maintenance Due Alarm” occurs.

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9 SENSOR SETTING

- When sensors are reselected, 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 it is SGD (120°C resistor type), the temperature sensor curve is SGD curve.
- When there is difference between standard sensor curves and used sensor, user can adjust it in “curve type”.
- When sensor curve is inputted, X value (resistor) must be inputted from small to large, otherwise, mistake occurs.
- If there is not oil pressure sensor, but there is only 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:

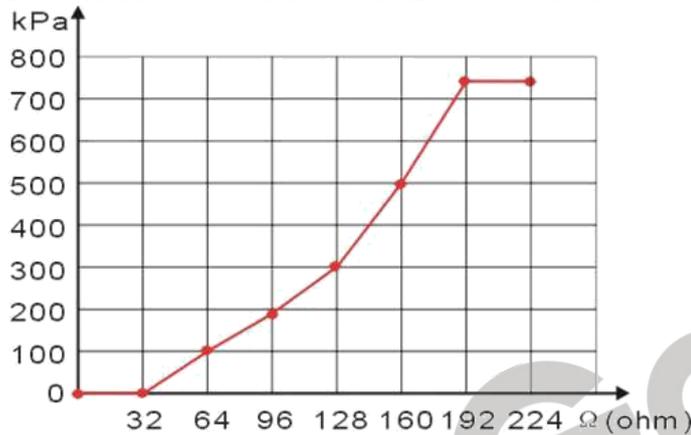


Table 15 - Common Unit Conversion Table

	N/m ² (pa)	kgf/cm ²	bar	(p/in ² .psi)
1Pa	1	1.02x10 ⁻⁵	1x10 ⁻⁵	1.45x10 ⁻⁴
1kgf/cm ²	9.8x10 ⁴	1	0.98	14.2
1bar	1x10 ⁵	1.02	1	14.5
1psi	6.89x10 ³	7.03x10 ⁻²	6.89x10 ⁻²	1

10 COMMISSIONING

Please make sure the following checks are made before commissioning:

- Ensure all the connections are correct and wire diameter is suitable.
- Ensure controller DC power has fuse, and controller’s positive and negative connection with start battery are correct.
- Take proper action to prevent engine from crank success (e. g. remove the connection wire of fuel valve). If checking is OK, make the start battery power on; choose manual mode and controller will execute routine.
- Set controller under manual mode, press “start” button, genset will start. After the cranking times preset, controller will send signal of Start Failure; then press “stop” to reset controller.
- Recover the action to prevent engine from crank success (e. g. connect wire of fuel valve), press start button again, genset will start. If everything goes well, genset will goes normal running after idle speed running (if configured). During this time, please watch for engine’s running situation and AC generator’s voltage and frequency. If something abnormal occurs, stop genset and check all wire connections according to this manual.
- If there is any other question, please contact SmartGen’s service.

11 TYPICAL APPLICATION

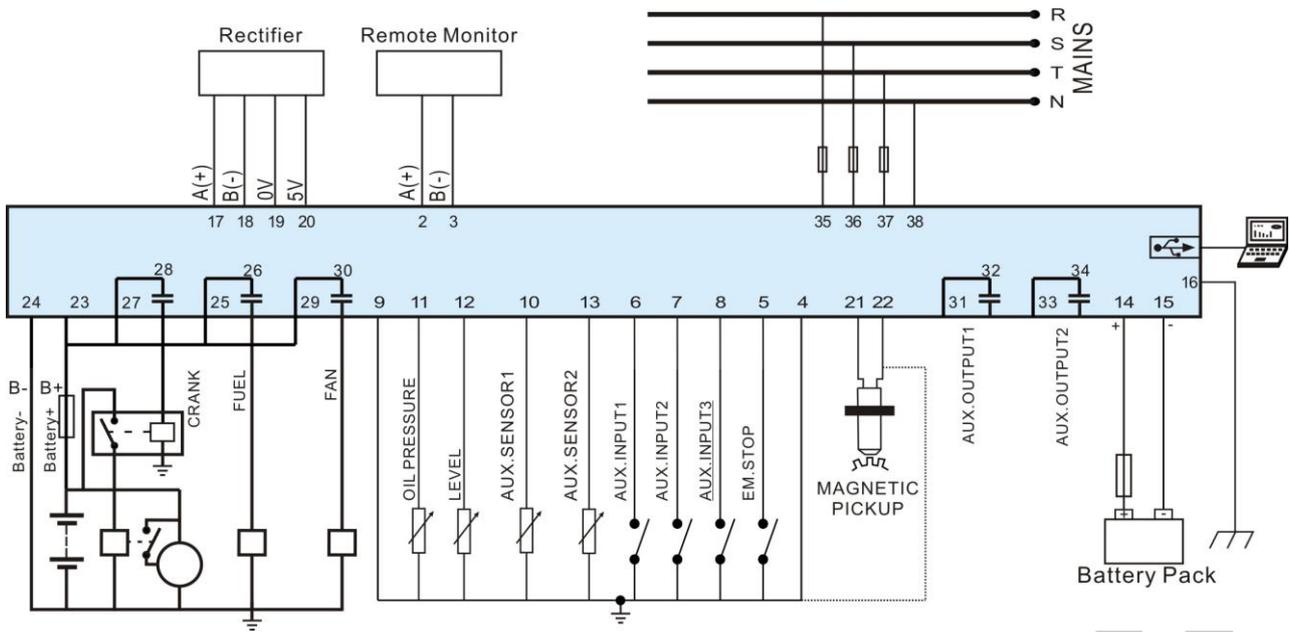


Fig. 3 - Typical Application Drawing

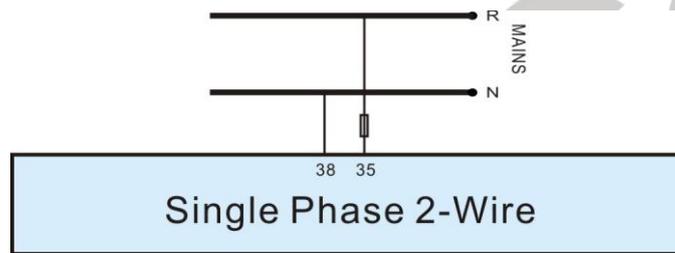


Fig. 4 - Single Phase 2-Wire Connection Diagram

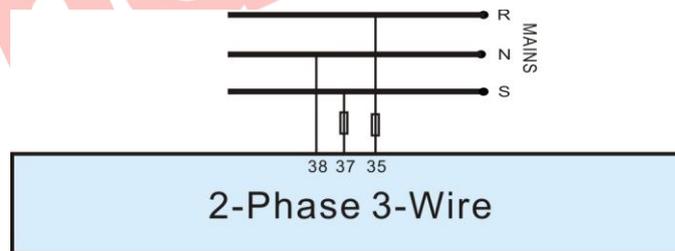


Fig. 5 - 2-Phase 3-Wire Connection Diagram

NOTE: Expand relay with high capacity in start and fuel output is needed.

12 INSTALLATION

12.1 FIXING CLIPS

- Controller is panel built-in design; it is fixed by clips when installed.
- Withdraw the fixing clip screw (turn anticlockwise) until it reaches proper position.
- Pull the fixing clip backwards (towards the back of the module) ensuring two clips are inside their allotted slots.
- Turn the fixing clip screws clockwise until they are fixed on the panel.

NOTE: Care should be taken not to over tighten the screws of fixing clips.

12.2 OVERALL DIMENSION

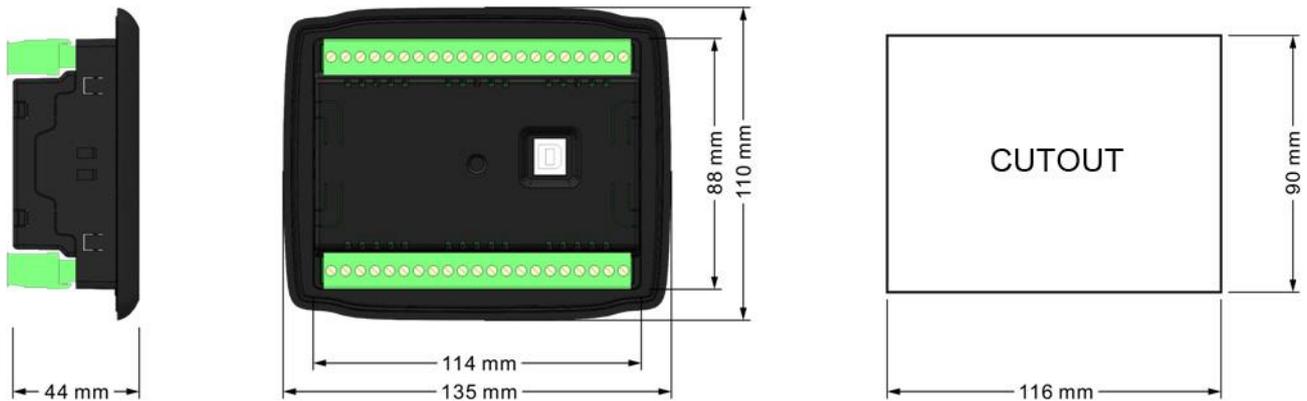


Fig.6 - Overall Dimensions

HGM4020DC controller is applicable for 48VDC battery voltage environment. Negative of battery must be connected with the engine shell. Diameter of wire that connects controller power B+/B- with battery positive/negative mustn't be less than 2.5mm^2 . If floating charger is 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 from disturbing the controller's normal working.

— SPEED SENSOR INPUT

Speed sensor is the magnetic equipment which is installed in starter and is used for detecting flywheel teeth. Its connection wires with controller should apply 2 cores shielding line. The shielding layer should connect to No. 16 terminal in controller while another side is hanging up. The other two signal wires are connected to No. 21 and No. 22 terminals in controller respectively. The output voltage of speed sensor should be within (1~24)V AC(effective value) during the full speed. 12VAC is recommended (at rated speed). When the speed sensor is installed, let the sensor 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 it needs to expand the relays, please add freewheel diode to both ends of expansion relay's coils (when coils of relay has DC current) or, increase resistance-capacitance return circuit (when coils of relay has AC current), in order to prevent disturbance to controller or other equipments.

— WITHSTAND VOLTAGE TEST

When controller had been installed on control panel, if high voltage test is needed, please disconnect controller's all terminal connections, in order to prevent high voltage from entering controller and damaging it.