SmartGen

MAKING CONTROL SMARTER

HGM1791LT_HGM1791LT-CAN

GENSET CONTROLLER

USER MANUAL

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Table 1 Software Version

Date	Version	Note
2025-07-02	1.0	Original release.

Table 2 Notation Clarification

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

CONTENT

1 OVERVIEW

HGM1791LT/HGM1791LT-CAN genset controller is suitable for single unit automation and monitoring control (also can be used for pumping unit). It can realize manual start/stop of genset, and it can also automatically start/stop genset by remote start signal. HGM1791LT/HGM1791LT-CAN controller can monitor and protect genset operation by collecting and analyzing genset data like generation voltage, current, water temperature, oil pressure and so on, and it can indicate fault conditions and do maintenance as soon as possible. The controller employs OLED graphical display to show Chinese and English languages. Touch-button operation makes it clear and intuitive. Moreover, parameter threshold and delay value can be adjusted via front panel or USB port (communicated with PC software).

2 PERFORMANCE AND CHARACTERISTICS

— 128x64 OLED display, Chinese and English operation interface to be set by on-site engineer for commissioning and testing;

— Hard screen acrylic material is used to protect screen.

— Silicone panel and buttons are adopted to increase high and low temperature adaption ability;

— Equipped with an RS485 communication interface, enabling remote measurement and remote communication functions using the MODBUS protocol;

— The CANBUS interface is used for connecting to J1939 engine. It can not only monitor common data (such as coolant temperature, oil pressure, RPM, fuel consumption, etc.), but also control start/sop, high/low speed via the CANBUS interface (requires using a controller with a CANBUS interface);

— Power supply range DC (8~35)V, compatible with 12V or 24V starting batteries;

— Generator single phase voltage, current, frequency, power and load percentage parameters are measured and displayed:

Generator Voltage	V	Generator Frequency	Hz
Generator Power	kW	Generator Current	A
Load Percentage	%		

— Precision measured and displayed parameters of engine:

Oil Pressure	kPa	Temperature	ºC
Fuel Level	%	Total Running Time	H (max. 65535 hours)
Battery Voltage	V	Engine Speed	RPM

Accumulated Start Times (max. 65534 times)

— With genset fault protection and display functions.

— 3 working modes: manual, auto, stop;

— Compatible with multiple temperature, pressure, fuel level sensors, which can be user-defined and used directly; temperature sensors, pressure sensors can be used in parallel with annunciator, providing analog quantity and increasing protection level at the same time;

— Multiple crank disconnection conditions to select (engine speed sensor, oil pressure, generator frequency);

— 3 configurable input ports which can be set as digital input or sensor input;

— 2 fixed relay outputs (fuel relay, start relay);

— 3 configurable output ports which can be set as common alarm output, preheat output or idle control output;

— Parameters can be set and modified by users, and they will not be lost in case of power off. Parameters of the controller can be modified by the front panel and all parameters can be adjusted by PC software via RS485;

— Digital regulation of all parameters to make control more reliable and stable;

— Modular design, self-extinguishing ABS plastic enclosure, pluggable terminal blocks/connectors, embedded installation way, small size and compact structure for easy mounting.

Table 3 Technical Parameters

Item	Content
Working Voltage	DC8.0V to 35.0V, Continuous Power Supply
Power Consumption	<1.8W (Standby mode: ≤0.8W)
Alternator Voltage Input	AC 15V ~ AC 360 V (ph-N)
Alternator Frequency	50Hz/60Hz
Speed Sensor Voltage	1V to 24V (RMS)
Speed Sensor Frequency	Max. 10,000Hz
Start Relay Output	1A DC28V DC power supply
Fuel Relay Output	1A DC28V DC power supply
Aux. Output 1	1A DC28V DC power supply
Aux. Output 2	1A DC28V DC power supply
Aux. Output 3	1A DC28V DC power supply
Programmable Digital Input	Active when connected to B-
Case Dimensions	96mm x 86mm x 467mm
Panel Cutout	78mm x 66mm
CT Secondary Current	Rated value: 5A
Working Temperature	(-40~+70) °C
Working Humidity	(20~93) %RH
Storage Temperature	(-40~+80) °C
Protection Level	IP65: When waterproof rubber gasket will be installed between the controller and panel fascia.
Insulation Intensity	Attach AC2.2kV voltage between AC high voltage terminal and low voltage terminal (leak current below 3mA in 1 minute).
Weight	0.17kg

3 OPERATION

3.1. FRONT PANEL DESCRIPTION

Fig.1 HGM1791LT_HGM1791LT-CAN Front Panel

3.2. INDICATOR DESCRIPTION

Stop status indicator light: genset in stop mode.

Auto status indicator light: genset in auto mode.

Manual start indicator light: only light up when genset starts and is in manual mode.

Alarm indicator light: blink slowly (1 time/s) when warn alarm occurred; blink fast (5 times/s) when shutdown alarm occurred.

3.3. PANEL KEYS

Table 4 Key Descriptions

Key	Definition	Description
	Stop/Reset	Can stop the running genset in Manual/Stop Mode; Can reset any shutdown alarm in genset stop status; In stop mode, hold and press this key for more than 3s can test whether the panel indicators and LCD are OK. During the shutdown process, press it again for quick stop; During the parameter setting, press this key to quickly exit the setting screen.
	Auto/Decrease	Press this key, controller will enter the Auto Mode. In this mode, the genset is controlled according to the remote start input signal; In parameter setting, page up the setting item or decrease the cursor value; In parameter setting , exit the menu if there is no cursor.
	Start/Confirm	Press this key to start the genset; In parameter setting, move the cursor and confirm the setting information;

Key	Definition	Description
	Down/Increase	OLED's screen change display; Hold and press this key for more than 3s to enter the parameter setting; In parameter setting, page down the setting item or increase the cursor value.

3.4. AUTO START/STOP OPERATION

Auto mode is selected by pressing  button, and the LED indicator beside the button will light up to confirm the operation.

Automatic Start Sequence:

1) When "Remote Start" is active (Input terminal configuration is "Remote Start"), "Start Delay" timer is initiated, then the status screen will be "Start Delay" countdown;
2) When start delay is over, preheat relay energizes (if configured), "Preheat Delay" starts to count, then the status screen will be "Preheat Delay XXs".
3) After the preheat delay, the Fuel Relay is energized, and one second later, the Start Relay is engaged. If the genset fails to fire during "Cranking Time", then the fuel relay and start relay stop to output; "Crank Rest Time" begins and wait for the next cranking attempt.
4) After setup number of cranking attempts, if genset fails to start, the start sequence will be terminated, and "Fail to Start" alarm will be displayed on OLED screen, and meanwhile alarm indicator light is blinking.
5) In case of successful crank attempt, the "Safety On" timer is activated, Low Oil Pressure, High Temperature and other alarms are inactive during the period. As soon as this delay is over, "Start Idle" delay is initiated (if configured).
6) During "Start Idle" delay, under speed, under frequency, under voltage alarms are inhibited. When this delay is over, "Warming up" delay is initiated (if configured).
7) When "Warming up" delay is over, if power generation runs normal, the power generation indicator will light up. When generator voltage and frequency meet load requirement, the generation switch-on relay will output, then genset start to load and power supply indicator lights up, which means genset starts normal running; if generator voltage or frequency is abnormal, shutdown alarm signals will be sent by the controller (alarm page on OLED screen will show power generation alarm).

Automatic Stop Sequence:

1) When the "Remote Start" signal doesn't work, "Stop Delay" is initiated;
2) Once this "Stop Delay" has expired, the "Cooling Delay" is then initiated.;
3) During "Stop Idle" Delay (if configured), idle relay is energized;
4) When "ETS Delay" begins, ETS relay switches on while fuel relay switches off.;

5) When genset enters "Wait Stop Time", it automatically detects whether genset stops completely;

6) Genset enters standby status after it stops completely. Otherwise, the controller enters stop failure and issues "Stop Failure" warning.

NOTE:

1) **When press stop button in auto start status, genset will stop and enter into stop mode simultaneously.**
2) **In process of crank rest delay, ETS output is energized when fuel output is de-energized and crank rest time countdown is less than 7s. After crank rest delay, ETS output is de-energized, fuel relay starts output, and preheat output switches off before crank.**

3.5. MANUAL START/STOP OPERATION

1) **MANUAL START**: Press  button to start the genset (Please refer to No.2~7 of **Automatic Start Sequence** for detail procedures). With high temperature, low oil pressure, over speed and abnormal voltage during generator running, controller can protect genset to stop quickly.

2) **MANUAL STOP**: Press  button can shut down the running genset. (Please refer to No.2~6 of **Automatic Stop Sequence** for detail procedures).

4 PROTECTION

4.1. SHUTDOWN

When controller detects shutdown warning signals, it switches off to stop at once and issues warning type.

Table 5 Controller Shutdown Alarms

No.	Type	Description
1	Emergency Stop	When controller detects emergency stop alarm signal, it issues emergency shutdown alarm signal.
2	Over Speed Shut	When controller detects engine speed is over preset over speed stop threshold, it issues shutdown alarm signal.
3	Under Speed Shut	When controller detects engine speed is under preset over speed stop threshold, it issues shutdown alarm signal.
4	Loss of Speed Signal	When controller detects speed is 0, and speed signal loss action is "Shutdown", it issues shutdown alarm signal.
5	Genset Over Frequency Shut	When controller detects genset frequency is over preset over frequency stop threshold, it issues shutdown alarm signal.
6	Genset Under Frequency Shut	When controller detects genset frequency is under preset over frequency stop threshold, it issues shutdown alarm signal.
7	Genset Over Voltage Shut	When controller detects genset voltage is over preset over voltage stop threshold, it issues shutdown alarm signal.
8	Genset Under Voltage Shut	When controller detects genset voltage is under preset over voltage stop threshold, it issues shutdown alarm signal.
9	Failed to Start	When engine fails to start after pre-set start attempts, controller issues shutdown alarm signal.
10	Genset Over Current Shut	When controller detects genset current is over preset over current stop threshold, it issues shutdown alarm signal.
11	High Temp. Shut IN	When controller input port is set to High Temp Shutdown Input and it is active, it issues shutdown alarm signal.
12	Low Oil Pressure Shut IN	When controller input port is set to Low Oil Pressure Shutdown Input and it is active, it issues shutdown alarm signal.
13	High Temp. Shut ECU	When controller detects ECU temperature value is above pre-set shutdown value, it issues shutdown alarm signal.
14	Low Oil Pressure Shut ECU	When controller detects ECU oil pressure is below pre-set shutdown value, it issues shutdown alarm signal.
15	Low Temp. Shut ECU	When controller detects ECU temperature value is below pre-set shutdown value, it issues shutdown alarm signal.
16	High Oil Pressure Shut ECU	When controller detects ECU oil pressure is above pre-set shutdown value, it issues shutdown alarm signal.
17	Aux. Temp. Sensor X Open (X can be 1~3, the below same)	Set sensor X as temperature sensor, when controller detects sensor is open, and action type is “Shutdown”, it issues shutdown alarm signal.
18	Aux. Sensor X High Temp.	Set sensor X as temperature sensor, when controller detects sensor value is above pre-set shutdown upper limit value, it issues shutdown alarm signal.
19	Aux. Sensor X Low Temp.	Set sensor X as temperature sensor, when controller detects sensor value is below pre-set shutdown lower limit value, it issues shutdown alarm signal.
20	Aux. Oil Pressure Sensor X Open	Set sensor X as oil pressure sensor, when controller detects sensor open, and action type is “Shutdown”, it issues shutdown alarm signal.

No.	Type	Description
21	Aux. Oil Pressure Sensor X High	Set sensor X as oil pressure sensor, when controller detects sensor value is above pre-set shutdown upper limit value, it issues shutdown alarm signal.
22	Aux. Oil Pressure Sensor X Low	Set sensor X as oil pressure sensor, when controller detects sensor value is below pre-set shutdown lower limit value, it issues shutdown alarm signal.
23	Aux. Level Sensor X Open	Set sensor X as level sensor, when controller detects sensor open, and action type is “Shutdown”, it issues shutdown alarm signal.
24	Aux. Sensor X High Level	Set sensor X as level sensor, when controller detects sensor value is above pre-set shutdown upper limit value, it issues shutdown alarm signal.
25	Aux. Sensor X Low Level	Set sensor X as level sensor, when controller detects sensor value is below pre-set shutdown lower limit value, it issues shutdown alarm signal.
26	ECU Comm. Failure	When controller is set as ECU genset, if it detects communication failure, it issues communication failure signal.
27	ECU Shutdown	When controller detects shutdown alarm signal from ECU, it issues shutdown alarm signal.
28	External Shutdown Alarm Input	When controller input port is set as external shutdown alarm, and it is active, it issues shutdown alarm signal to the same input port.

NOTE:

3) **Shutdown signal is latched signal, and press the “Stop” button can clear the alarm; Warning signal will not be latched.**
4) **If shutdown alarm delay time is set, after the time is over, then controller issues shutdown alarm signal.**

4.2. WARNINGS

When controller detects warning signal, it only issues warning without shutdown.

Table 6 Warnings

No.	Type	Description
1	Over Speed Warn	When controller detects speed is above the pre-set over speed warning threshold, it issues warning signal.
2	Under Speed Warn	When controller detects speed is under the pre-set under speed warning threshold, it issues warning signal.
3	Loss of Speed Signal	When controller detects speed is 0, and speed signal loss action is “Warning”, it issues warning signal.
4	Genset Over Frequency Warn	When controller detects genset frequency is over preset over frequency stop threshold, it issues warning signal.
5	Genset Under Frequency Warn	When controller detects genset frequency is under preset over frequency stop threshold, it issues warning signal.
6	Genset Over Voltage Warn	When controller detects genset voltage is over preset over voltage stop threshold, it issues warning signal.
7	Genset Under Voltage Warn	When controller detects genset voltage is under preset over voltage stop threshold, it issues warning signal.
8	Genset Over Current Warn	When controller detects genset current is over preset over current stop threshold, it issues warning signal.
9	Stop Failure	When engine stop delay is over and engine doesn't stop completely, controller issues warning signal.
10	Battery Over Voltage	When controller detects genset battery voltage is above pre-set threshold, it issues warning signal.

No.	Type	Description
11	Battery Under Voltage	When controller detects engine battery voltage is below pre-set threshold, it issues warning signal.
12	ECU Warn	When controller receives warning signal of engine by J1939, it issues warning signal.
13	High Temp. Warn ECU	When controller detects ECU temperature value is above pre-set shutdown value, it issues warning signal.
14	Low Oil Pressure Warn ECU	When controller detects ECU oil pressure is below pre-set shutdown value, it issues warning signal.
15	Low Temp. Warn ECU	When controller detects ECU temperature value is below pre-set shutdown value, it issues warning signal.
16	High Oil Pressure Warn ECU	When controller detects ECU oil pressure is above pre-set shutdown value, it issues warning signal.
17	Aux. Temp. Sensor X Open	Set sensor X as temperature sensor, when controller detects sensor is open, and action type is “Warning”, it issues warning signal.
18	Aux. Sensor X High Temp.	Set sensor X as temperature sensor, when controller detects sensor value is above pre-set warning upper limit value, it issues warning signal.
19	Aux. Sensor X Low Temp.	Set sensor X as temperature sensor, when controller detects sensor value is below pre-set warning lower limit value, it issues warning signal.
20	Aux. Oil Pressure Sensor X Open	Set sensor X as oil pressure sensor, when controller detects sensor open, and action type is “Warning”, it issues warning signal.
21	Aux. Sensor X High Oil Pressure	Set sensor X as oil pressure sensor, when controller detects sensor value is above pre-set warning upper limit value, it issues warning signal.
22	Aux. Sensor X Low Oil Pressure	Set sensor X as oil pressure sensor, when controller detects sensor value is below pre-set warning lower limit value, it issues warning signal.
23	Aux. Level Sensor X Open	Set sensor X as level sensor, when controller detects sensor open, and action type is “Warning”, it issues warning signal.
24	Aux. Sensor X High Level	Set sensor X as level sensor, when controller detects sensor value is above pre-set warning upper limit value, it issues warning signal.
25	Aux. Sensor X Low Level	Set sensor X as level sensor, when controller detects sensor value is below pre-set warning lower limit value, it issues warning signal.

NOTE5: If warning alarm delay time is set, after the time is over, then controller issues warning signal.

5 WIRING CONNECTION

Fig.2 Controller Back Panel

Table 7 Terminals Description

No.	Function	Cable Size	Remarks
1	DC Voltage Input B-	1.5mm^2	Connect to negative of starting battery
2	DC Voltage Input B+	1.5mm^2	Connected to positive of starting battery. If wire length is over 30m, better to use double wires in parallel. Max. 20A fuse is recommended.
3	Emergency Stop Input	1.0mm^2	B+ voltage input is active, and connected to emergency stop normal closed button.
4	Fuel Relay Output	1.0mm^2	B+ is supplied by No.3 point, rated 1A.
5	Crank Relay Output	1.0mm^2	B+ is supplied by No.3 point, rated 1A.
6	Aux. Input 1	1.0mm^2	Ground connected is active (B-) if it is configured as digital input. Connect to resistive sensor if it is configured as sensor 1.
7	Aux. Input 2	1.0mm^2	Ground connected is active (B-) if it is configured as digital input. Connect to resistive sensor if it is configured as sensor 2.
8	Aux. Input 3	1.0mm^2	Ground connected is active (B-) if it is configured as digital input. Connect to resistive sensor if it is configured as

No.	Function	Cable Size	Remarks
			sensor 3.
9	CANL/MP2	0.5mm^2	If controller model is HGM1791LT: connect to B-; If controller model is HGM1791LT-CAN: connect to CANL signal line.
10	CANH/MP1	0.5mm^2	If controller model is HGM1791LT: connect to speed sensor, and shielded wire is recommended; Another end of speed sensor is connected to B-. If controller model is HGM1791LT-CAN: connect to CANH signal line.
11	Gen Volt Monitoring Input	1.0mm^2	Connect to generator voltage output port. (2A fuse is recommended)
12		1.0mm^2	
13	Load Current (Inlet Loop)	1.5 mm^2	Connect to secondary coil of current transformer. (Rated 5A)
14	Load Current (Outlet Loop)	1.5 mm^2	
15	Aux. Output 1	1.0 mm^2	B+ is supplied by No.2 point, rated 1A.
16	Aux. Output 2	1.0 mm^2	B+ is supplied by No.2 point, rated 1A.
17	Aux. Output 3	1.0 mm^2	B+ is supplied by No.2 point, rated 1A.
18	/	/	/
19	RS485 B(-)	0.5mm^2	It is recommended to use a shielding wire with impedance-120Ω and single-end grounded.
20	RS485 A(+)	0.5mm^2	

6 PARAMETER RANGE AND DEFINITION

6.1. PARAMETERS CONTENTS AND RANGE

Table 8 Parameter Setting Contents and Range

No.	Parameter	Range	Default Value	Description
Timer Setting				
1	Start Delay	(0-3600)s	1	Time from remote start signal being active to genset start.
2	Stop Delay	(0-3600)s	1	Time from remote start signal being inactive to genset stop.
3	Preheat Time	(0-3600)s	0	Time to pre-energize heat plug before starter is powered on.
4	Cranking Time	(3-60)s	8	Time to power on the starter for every crank attempt
5	Crank Rest Time	(3-60)s	10	The waiting time before second power on when engine start fails.
6	Safety On Delay	(0-3600)s	10	Alarms for low oil pressure, high temperature, under speed, under frequency, under voltage and charging failure are inactive.
7	Start Idle Time	(0-3600)s	0	Idle running time after genset starts.
8	Warming Up Time	(0-3600)s	10	Warming time between genset switch on and normal running.
9	Cooling Time	(0-3600)s	10	Radiating time before genset stop, after it unloads.
10	Stop Idle Time	(0-3600)s	0	Idle running time after genset stops.
11	ETS Solenoid Hold	(0-120)s	20	The time of powering up the electromagnet during stop procedure.
12	Wait Stop Time	(0-3600)s	0	Time between ending of genset idle delay and stopped when “ETS Solenoid Hold” is set as 0; Time between ending of ETS hold delay and stopped when “ETS Solenoid Hold” is not 0.
Engine Setting				
1	Engine Type	(0-39)	0	Default: non-ECU genset.
2	Flywheel Teeth	(10.0-300.0)	118.0	Tooth number of the engine is for judging of crank disconnect conditions and inspecting of engine speed. See the installation instructions.

No.	Parameter	Range	Default Value	Description
3	Rated Speed	(0-6000)RPM	1500	Baseline for over speed, under speed and load speed detection.
4	Idle Speed	(0-6000)RPM	750	It is set for GTSC1 genset to control idle speed.
5	Load Speed	(0-100)%	90	Set value is percentage of rated speed. Before load stage if controller detects speed is below idle speed, the genset won't enter to normal running stage.
6	Speed Signal Loss Delay	(0-3600)s	5	Time from detecting speed is 0 to confirm action.
7	Speed Signal Loss Action	(0-1)	0	0: Warning; 1: Shutdown.
8	Over Speed Shutdown	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	114	Set value is percentage of rated speed.
		(0-3600)s	2	Delay value.
9	Under Speed Shutdown	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	80	Set value is percentage of rated speed.
		(0-3600)s	3	Delay value.
10	Over Speed Warn	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	110	Set value is percentage of rated speed.
		(0-200)%	108	Return value is percentage of rated speed.
		(0-3600)s	5	Delay value.
11	Under speed Warn	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	86	Set value is percentage of rated speed.
		(0-200)%	90	Return value is percentage of rated speed.
		(0-3600)s	5	Delay value.
12	Battery Rated Voltage	(0-60.0)V	24.0	Baseline for battery over/under voltage detection.
13	Battery Over Voltage Warn	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	120	Set value is percentage of rated voltage.
		(0-200)%	115	Return value is percentage of rated voltage.
		(0-3600)s	60	Delay value.
14	Battery Under Voltage Warn	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	85	Set value is percentage of rated voltage.
		(0-200)%	90	Return value is percentage of rated voltage.
		(0-3600)s	60	Delay value.
15	Start Attempts	(1-10)times	3	Maximum start times in case of failed to start; when this number is reached, controller shall issue Failed to Start signal.
16	Crank Disconnect	(0-6)	2	Please refer to Table 12. There are three kinds of disconnection conditions between engine and starter. They can work separately or together to separate starter motor and engine as soon as possible.
17	Disconnect Frequency	(0-200)%	24	Set value is the percentage of rated frequency, when frequency is above

No.	Parameter	Range	Default Value	Description
				the set value, starter shall disconnect. Please refer to the Section 6.5 Conditions of Crank Disconnect Selection
18	Disconnect Speed	(0-200)%	24	Set value is the percentage of rated speed, when speed is above the set value, starter shall disconnect. Please refer to the Section 6.5 Conditions of Crank Disconnect Selection
19	Disconnect OP	(0-1000)kPa	200	When oil pressure is above set value, starter shall disconnect. Please refer to the Section 6.5 Conditions of Crank Disconnect Selection.
Generator Setting				
1	Power Supply System	(0-3)	0	0: 3P4W; 1: 3P3W; 2: 2P3W; 3: 1P2W.
2	Generator Poles	(2-64)	4	Numbers of generator poles (even number). The value could be used for calculation of engine speed when there is no speed sensor.
3	Rated Voltage	(30-30000)V	230	Baseline for over/under voltage and load voltage detection. If there is a potential transformer(PT), the value means primary voltage of transformer.
4	Load Voltage	(0-200)%	85	Set value is percentage of rated voltage. Before load stage if controller detects voltage is below load voltage, the genset won't enter to normal running stage.
5	Rated Frequency	(10.0-600.0)Hz	50.0	Baseline for over/under frequency and load frequency.
6	Load Frequency	(0-200)%	85	Set value is percentage of rated frequency. Before load stage if controller detects frequency is below load frequency, the genset won't enter to normal running stage.
7	Potential Transformer (PT) Setting	(0-1)	0	0: Disable; 1: Enable.
8	Primary Voltage of PT	(30-30000)V	100	The value means primary voltage of transformer.
9	Secondary Voltage of PT	(30-1000)V	100	The value means secondary voltage of transformer.
10	Generator Over Voltage Shut	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	120	Set value is percentage of rated voltage.
		(0-3600)s	3	Delay value.
11	Generator Under Voltage Shut	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	80	Set value is percentage of rated voltage.

No.	Parameter	Range	Default Value	Description
		(0-3600)s	3	Delay value.
12	Generator Over Frequency Shut	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	114	Set value is percentage of rated frequency.
		(0-3600)s	2	Delay value.
13	Generator Under Frequency Shut	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	80	Set value is percentage of rated frequency.
		(0-3600)s	3	Delay value.
14	Generator Over Voltage Warn	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	110	Set value is percentage of rated voltage.
		(0-200)%	108	Return value is percentage of rated voltage.
		(0-3600)s	5	Delay value.
15	Generator Under Voltage Warn	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	84	Set value is percentage of rated voltage.
		(0-200)%	86	Return value is percentage of rated voltage.
		(0-3600)s	5	Delay value.
16	Generator Over Frequency Warn	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	110	Set value is percentage of rated frequency.
		(0-200)%	108	Return value is percentage of rated frequency.
		(0-3600)s	5	Delay value.
17	Generator Under Frequency Warn	(0-1)	1	0: Disable; 1: Enable.
		(0-200)%	84	Set value is percentage of rated frequency.
		(0-200)%	86	Return value is percentage of rated frequency.
		(0-3600)s	5	Delay value.
Load Setting				
1	Transformation ratio of CT	(5-6000)/5	500	Transformation ratio of external current transformer (CT).
2	Rated Current	(5-6000)A	500	It is rated current of generator, as baseline for load current.
3	Rated Power	(0-6000.0)kW	276.0	It is rated power of generator, as baseline for load power.
4	Over Current Protection	(0-1)	1	0: Disable; 1: Enable.
5	Overload Current	(0-200)%	120	Set value is percentage of rated current.
6	Over Current Action	(0-1)	1	0: Warning; 1: Shutdown.
7	Over Current Delay Type	(0-1)	0	0: Definite-time Delay; 1: Inverse-time Delay.

No.	Parameter	Range	Default Value	Description
8	Delay 1 Setting (Delay Value)	(0-3600)s	10	Delay value.
9	Delay 2 Setting (Multiple Delay Value)	(1-36)	36	Multiple value of inverse-time delay.
Module Setting				
1	Power On Mode	(0-3)	0	0: Stop; 1: Manual; 2: Auto; 3: Rental. Functions see Note 6.
2	Module Address	(1-254)	1	The communication address of controller.
3	Language	(0-2)	0	0: Simplified Chinese; 1: English; 2: Others.
4	Password Set	(0-65534)	00318	It is used for advanced parameter setting.
5	Temperature Sampling Option	(0-1)	0	0: Controller; 1: ECU.
6	Oil Pressure Sampling Option	(0-1)	0	0: Controller; 1: ECU.
7	Speed Sampling Option	(0-1)	0	0: Controller; 1: ECU.
8	Main Display Lines	(0-1)	0	0: 4 Lines; 1: 5 Lines.
Analog Sensor Setting				
1	Sensor 1	(0-4)	1	0: Not Used 1: Temperature Sensor 2: Oil Pressure Sensor 3: Level Sensor 4: Auxiliary Input 1 (Set the sensor as 4 before configure the input 1 function)
2	Sensor 2	(0-4)	2	0: Not Used 1: Temperature Sensor 2: Oil Pressure Sensor 3: Level Sensor 4: Auxiliary Input 2 (Set the sensor as 4 before configure the input 2 function)
3	Sensor 3	(0-4)	3	0: Not Used 1: Temperature Sensor 2: Oil Pressure Sensor 3: Level Sensor 4: Auxiliary Input 3 (Set the sensor as 4 before configure the input 3 function)
Temperature Sensor				
1	Curve Type	(0-15)	7	SGX. See table 11.
2	Open Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No Action.

No.	Parameter	Range	Default Value	Description
3	Over Temp. Shutdown	(0-1)	1	0: Disable; 1: Enable.
		(-50-300)°C	98	Set value is engine temperature. This value will be detected only after safety on delay.
		(0-3600)s	3	Delay value.
4	Under Temp. Shutdown	(0-1)	0	0: Disable; 1: Enable.
		(-50-300)°C	0	Set value is engine temperature. This value will be detected only after safety on delay.
		(0-3600)s	0	Delay value.
5	Over Temp. Warn	(0-1)	1	0: Disable; 1: Enable.
		(-50-300)°C	95	Set value is engine temperature. This value will be detected only after safety on delay.
		(-50-300)°C	93	Return value is engine temperature. This value will be detected only after safety on delay.
		(0-3600)s	5	Delay value.
6	Under Temp. Warn	(0-1)	0	0: Disable; 1: Enable.
		(-50-300)°C	70	Set value is engine temperature. This value will be detected only after safety on delay.
		(-50-300)°C	75	Return value is engine temperature. This value will be detected only after safety on delay.
		(0-3600)s	5	Delay value.
Oil Pressure Sensor				
1	Curve Type	(0-15)	7	SGX. See table 11.
2	Open Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No Action.
3	High OP Shutdown	(0-1)	0	0: Disable; 1: Enable.
		(0-1000)kPa	0	Set value is engine oil pressure. This value will be detected only after safety on delay.
		(0-3600)s	0	Delay value.
4	Low OP Shutdown	(0-1)	1	0: Disable; 1: Enable.
		(0-1000)kPa	103	Set value is engine oil pressure. This value will be detected only after safety on delay.
		(0-3600)s	3	Delay value.
5	High OP Warn	(0-1)	0	0: Disable; 1: Enable.

No.	Parameter	Range	Default Value	Description
		(0-1000)kPa	0	Set value is engine oil pressure. This value will be detected only after safety on delay.
		(0-1000)kPa	0	Return value is engine oil pressure. This value will be detected only after safety on delay.
		(0-3600)s	0	Delay value.
6	Low OP Warn	(0-1)	1	0: Disable; 1: Enable.
		(0-1000)kPa	124	Set value is engine oil pressure. This value will be detected only after safety on delay.
		(0-1000)kPa	138	Return value is engine oil pressure. This value will be detected only after safety on delay.
		(0-3600)s	5	Delay value.
Level Sensor				
1	Curve Type	(0-15)	4	SGH. See table 11.
2	Open Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No Action.
3	High Level Shutdown	(0-1)	0	0: Disable; 1: Enable.
		(0-300)%	0	Set value is level value. This value will be detected only after safety on delay.
		(0-3600)s	0	Delay value.
4	Low Level Shutdown	(0-1)	0	0: Disable; 1: Enable.
		(0-300)%	8	Set value is level value. This value will be detected only after safety on delay.
		(0-3600)s	5	Delay value.
5	High Level Warn	(0-1)	0	0: Disable; 1: Enable.
		(0-300)%	0	Set value is level value. This value will be detected only after safety on delay.
		(0-300)%	0	Return value is level value. This value will be detected only after safety on delay.
		(0-3600)s	0	Delay value.
6	Low Level Warn	(0-1)	1	0: Disable; 1: Enable.
		(0-300)%	10	Set value is level value. This value will be detected only after safety on delay.
		(0-300)%	15	Return value is level value. This value will be detected only after safety on delay.
		(0-3600)s	5	Delay value.

No.	Parameter	Range	Default Value	Description
Digital Input Ports Setting				
Input Port 1 Setting (Set sensor 1 as auxiliary input 1 before configuration)				
1	Content Setting	(0-7)	0	Not in use. See table 10.
Input Port 2 Setting (Set sensor 2 as auxiliary input 2 before configuration)				
1	Content Setting	(0-7)	0	Not in use. See table 10.
Input Port 3 Setting (Set sensor 2 as auxiliary input 3 before configuration)				
1	Content Setting	(0-7)	0	Not in use. See table 10.
Relay Output Ports Setting				
Output Port 1 Setting				
1	Content Setting	(0-10)	3	Idle speed control. See table 9.
Output Port 2 Setting				
1	Content Setting	(0-10)	2	Energize to Stop. See table 9.
Output Port 3 Setting				
1	Content Setting	(0-10)	1	Common alarm. See table 9.

NOTE 6: Rental mode: based on the auto mode, only the navigation keys remain operational. When remote startup is active, a single startup procedure is executed while preventing starter relay output during the startup period. If remote startup is inactive, an alarm reset operation is performed

6.2. DEFINABLE CONTENTS OF RELAY OUTPUTS

Table 9 Definable Contents of Relay Outputs

No.	Items	Description
0	Not Used	Output is not active if select this option.
1	Common Alarm	Includes all shutdown alarms and warning alarms. Warning alarms are not self-latching, while shutdown alarms are self-latching and will not disappear until they are reset.
2	Energize to Stop	Suitable for the genset with stop electromagnet. The electromagnet closes when stop idle is over. And opens when ETS delay is over.
3	Idle Control	Used for machines that have idles. Closes during cranking, disconnects during warming up, closes during stop idle delay, disconnects after complete stop.
4	Preheat Control	It closes before starting and opens before starter is powered on.
5	Closing Gens	During normal operation of the generator, closes the breaker.
6	High Speed Output	Output when entering high speed warming up and disconnect after high speed cooling.
7	Rated Speed Output	Output when speed is normal.
8	Over Speed Output	Output when speed is over the set limit value.

No.	Items	Description
9	Low Battery Voltage Warn	Output when controller detects battery voltage is low and issues warning signal.
10	Low Level Warn	Output when sensor is set as level sensor and there is low level warning signal.

6.3. DEFINABLE CONTENTS OF DIGITAL INPUTS

Table 10 Definable Contents of Digital Inputs (Active When GND (B-) Connected)

No.	Description	Notes
0	Not Used	
1	High Temperature Alarm	If these signals are activated after safety on delay, shutdown alarm will be immediately initiated.
2	Low OP Alarm	
3	Reserved	
4	Auxiliary Shutdown	Shutdown alarm will be immediately initiated if this input is active.
5	High Temperature Cooling Shutdown	When the genset is working normally and this signal is active, 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	Remote Start	When the controller is in auto mode, if this input is active, the genset will start automatically.
7	Reserved	

6.4. SENSOR SELECTION

Table 11 Sensor Selection

No.	Items	Content	Remark
1	Temperature Sensor	0 Not used 1 User defined resistor curve 2 User defined current/voltage curve 3 VDO 4 CURTIS 5 VOLVO-EC 6 CURTIS 7 SGX 8 SGD 9 SGH 10 SUZUKI	The range of user-defined resistor type sensor is 0-6000Ω, and the default selection is temperature sensor.

No.	Items	Content	Remark
		11-15 Reserved	
2	Oil Pressure Sensor	0 Not used 1 User defined resistor curve 2 User defined current /voltage curve 3 VDO 10Bar 4 CURTIS 5 VDO 5Bar 6 DATCON 10Bar 7 SGX 8 SGD 9 SGH 10 VOLVO-EC 11 SUZUKI 12 4-20mA 10Bar 13 0-5V 10Bar 14-15 Reserved	The range of user-defined resistor type sensor is 0-6000Ω, and the default selection is pressure sensor. If select voltage or current type sensor, the hardware will be changed. And it needs to be specified when order.
3	Fuel Level Sensor	0 Not used 1 User defined resistor curve 2 User defined current/voltage curve 3 SGD 4 SGH 5 SUZUKI 6-15 Reserved	The range of user-defined resistor type sensor is 0-6000Ω, and the default selection is level sensor.

6.5. CONDITIONS OF CRANK DISCONNECT SELECTION

Table 12 Crank Disconnect Conditions Selection

No	Content
0	Generator Frequency
1	Speed
2	Speed + Generator Frequency
3	Oil pressure
4	Generator Frequency + Oil pressure
5	Speed + Oil pressure
6	Generator Frequency + Speed+ Oil pressure

1) There are 3 conditions to make starter separate with engine; Speed, generator frequency and oil pressure can be used separately while oil pressure is recommended to use together with speed and generator frequency. The aim is to disconnect the starter motor as soon as possible.

2) Speed sensor is the magnetic equipment which be installed in starter for detecting flywheel teeth.
3) 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.
4) If genset without speed sensor please don’t select corresponding items, otherwise, “start fail” or “loss speed signal” maybe caused.
5) If genset without oil pressure sensor, please don’t select corresponding items.
6) If not select generator frequency in crank disconnect setting, controller will not collect and display the relative electric quantity (can be used in water pump set); if not select speed in crank disconnect setting, the speed displayed in controller is calculated by generator signal.

7 CONTROLLER FUNCTION SETTING

7.1. SETTING

When the controller is in standby mode, hold and press for 3s to enter into menu interface, and menu items is listed as follows:

Parameter setting
Language
Event log
Controller information

7.2. PARAMETER SETTING

1) Press or button to change setting option, then press button to enter into password interface;
2) In password interface, press button to move the cursor, then press or button to set the password, after finish the setting, press button to confirm;
3) The password of "00318" has the highest authority, after inputting it, you can set all parameter items. If you change the default password of "00318", when you set parameters by PC software, you need to input the same password with controller first. If you want to set more parameters, such as voltage value and current value, or forget the password, please contact with the manufacturer.

Attention:

a) Please change the controller parameters when generator is in standby mode only (e. g. crank disconnect conditions selection, configurable input, configurable output, various delay), otherwise, shutdown and other abnormal conditions may happen.
b) Upper set value must be higher than lower set value, for example, 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) When you do the alarm setting, please set the correct return value, or it won't issue warning successfully. When you set upper alarm value, return value should be less than set value; as for lower alarm value, return value should be more than set value.
e) Please set the generator frequency value as low as possible when cranking, in order to make the starter be separated quickly as soon as crank disconnect.
f) Auxiliary input port 1-3 can't be set as same item, otherwise it won't function properly. Auxiliary output port 1-3 can be set as same item.
g) At any time, press can stop current parameter setting immediately.

7.3. LANGUAGE

In language setting interface, the options are simplified Chinese, English and Others. The default of “Others” will be English.

7.4. EVENT LOG

Event log function can record up to 99 logs. The time of event log will be the cumulative running time.

7.5. CONTROLLER INFORMATION

a) In this interface, it will show you the development information, such as software version, hardware version, PC version and release date.

b) In this interface, press  button to show the status of digital input and output ports.

8 SENSOR SETTINGS

a) Sensors connected to the controller are all resistor type. Parts of build-in standard sensor curves in the controller can be selected by users. If users want to use defined sensor curve, it needs to be set via host PC software (see details in table 10).

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

c) If sensor type is set as “not used”, sensor curve will not work.

d) The first or last few values in the vertical coordinates can be set as same as below:

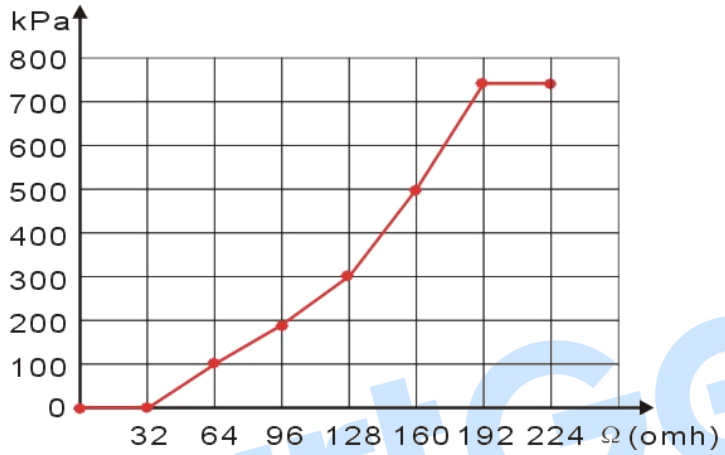

Fig.3 Sensor Curve

Table 13 Normal Pressure Unit Conversion Table

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

9 COMMISSIONING

Please make sure the following checks are made before commissioning;

a) Ensure all the connections are correct and wires diameter is suitable;

b) Ensure that the controller DC power has fuse, controller's positive and negative correctly connected to starting battery;

c) Take proper action to prevent engine to crank success (e. g. Remove the connection wire of fuel valve). If checking is OK, make the starting battery power on; choose manual mode and controller will executive routine;

d) Set controller under manual mode, press "start" button, genset will start. After the cranking times as setting, controller will send signal of Start Failure; then press "stop" to reset controller;

e) 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 normal 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;

f) Any other questions please contact with SmartGen's service personnel.

10 TYPICAL APPLICATION

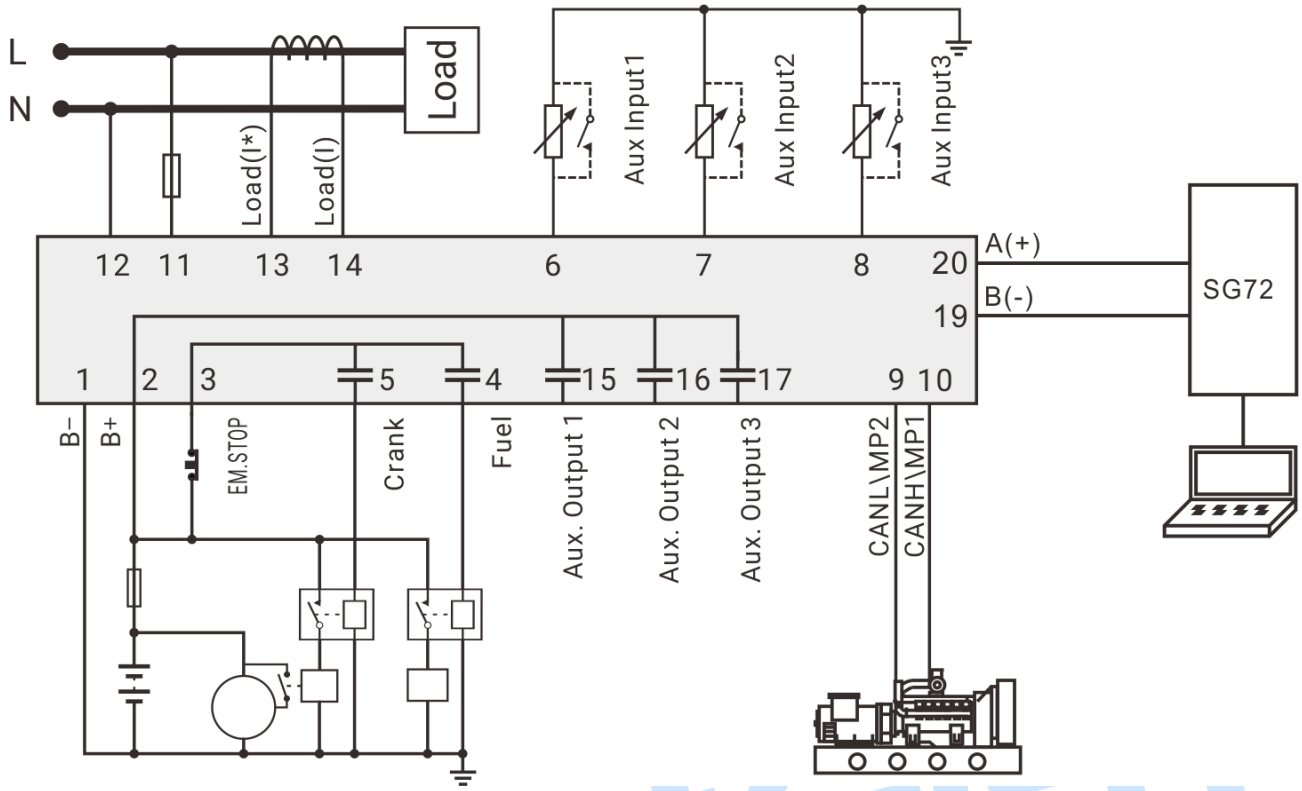

Fig.4 HGM1791LT_HGM1791LT-CAN Typical Application Diagram

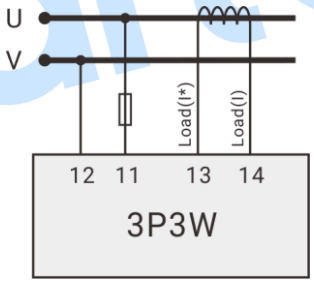

Fig.5 HGM1791LT_HGM1791LT-CAN 3P3W Application Diagram

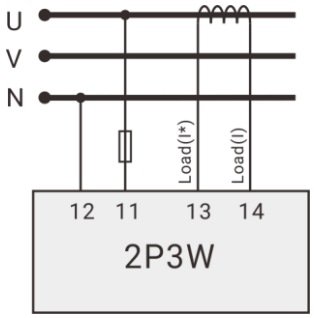

Fig.6 HGM1791LT_HGM1791LT-CAN 2P3W Application Diagram

⚠**CAUTION: Crank and fuel output ports should be extended to large capacity relays.**

11 INSTALLATION

11.1. 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.

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

11.2. OVERALL DIMENSION

Unit: mm

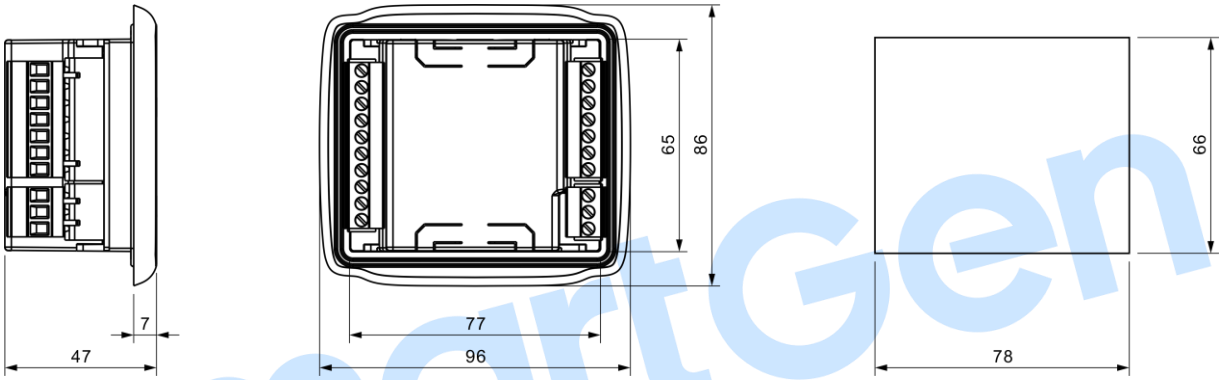

Fig.7 Overall and Cutout Dimensions

— BATTERY VOLTAGE INPUT

HGM1791LT_HGM1791LT-CAN controller can suit for widely range of battery voltage DC(8~35)V. Negative of battery must be connected with the engine shell. Diameter of wire that connects from power supply to battery must be over 1.5mm^2. 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. 1 terminal in controller while another side is hanging in air. The else two signal wires are connected to No.1 and No.10 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.

WARNING: When there is load current, transformer's secondary side is prohibited to open circuit.

— **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.

12 FAULT FINDING

Table 14 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 temperature sensor and its connections.
Shutdown alarm in running	Check related switch and its connections according to the information on OLED display; Check programmable inputs.
Crank not disconnect	Check fuel circuit and its connections; Check starting batteries; Check speed sensor and its connections; Refer to engine manual.
Starter no response	Check starter connections; Check starting batteries.

13 CONNECTIONS OF CONTROLLER WITH J1939 ENGINE

13.1. CUMMINS-ISB/ISBE

Table 15 B Connector

Terminals of controller	B connector	Remark
Fuel Relay Output	39	
Crank Relay Output	-	Connect to starter coil directly.
Aux. Output	Connect to extension 30A relay to provide battery voltage for terminal 01, 07, 12, and 13.	ECU power Configure the auxiliary output 2 as "ECU power".

Table 16 9-pin Connector

Terminals of controller	9 pins connector	Remark
CAN(H)	SAE J1939 signal	Use connection cable in 120 ohms impedance.
CAN(L)	SAE J1939 return	Use connection cable in 120 ohms impedance.

Engine type: Cummins-ISB.

13.2. CUMMINS QSL9

Table 17 50-pin Connector

Terminals of controller	50 pins connector	Remark
Fuel Relay Output	39	
Crank Relay Output	-	Connect to starter coil directly.

Table 18 9-pin Connector

Terminals of controller	9 pins connector	Remark
CAN(H)	SAE J1939 signal-C	Use connection cable in 120 ohms impedance.
CAN(L)	SAE J1939 return-D	Use connection cable in 120 ohms impedance.

Engine type: Cummins-CM850. Suitable for CM850 engine control module.

13.3. CUMMINS QSM11

Table 19 C1 Connector

Terminals of controller	C1 connector	Remark
Fuel Relay Output	5&8	Connect to external extension relay. When it is configured as fuel output, connect terminal 5 to terminal 8.
Crank Relay Output	-	Connect to starter coil directly.

Table 20 3-pin Data Link Connector

Terminals of controller	3 pins data link connector	Remark
CAN(H)	A	Use connection cable in 120 ohms impedance.
CAN(L)	B	Use connection cable in 120 ohms impedance.

Engine type: Cummins-ISB. Suitable for CM570 engine control module. The engine model is

QSM11 G1 and QSM11 G2.

13.4. CUMMINS QSX15-CM570

Table 21 50-pin Connector

Terminals of controller	50 pins connector	Remark
Fuel Relay Output	38	Oil injection switch.
Crank Relay Output	-	Connect to starter coil directly.

Table 22 9-pin Connector

Terminals of controller	9 pins connector	Remark
CAN(H)	SAE J1939 signal-C	Use connection cable in 120 ohms impedance.
CAN(L)	SAE J1939 return-D	Use connection cable in 120 ohms impedance.

Engine type: Cummins-CM570. Suitable for CM570 engine control module. The engine model is QSX15.

13.5. CUMMINS QSM11

Table 23 Engine OEM Connector

Terminals of controller	Engine OEM connector	Remark
Fuel Relay Output	38	
Crank Relay Output	-	Connect to starter coil directly.
CAN(H)	46	Use connection cable in 120 ohms impedance.
CAN(L)	37	Use connection cable in 120 ohms impedance.

Engine type: Common J1939.

13.6. CUMMINS QSZ13

Table 24 Engine OEM Connector

Terminals of controller	Engine OEM connector	Remark
Fuel Relay Output	45	
Crank Relay Output	-	Connect to starter coil directly.
Aux. output 1	16&41	Configure it as “Idle control”, and output normal closing. Use external relay to make controller into high speed running, and terminal 19 and 41 close.
Aux. output 2	19&41	Configure it as “Pulsed speed up control”, and output normal opening. Use external relay to make controller into warming up, and terminal 19 and 41 close for 0.1s.
CAN(H)	1	Use connection cable in 120 ohms impedance.
CAN(L)	21	Use connection cable in 120 ohms impedance.

Engine type: Common J1939.

13.7. DETROIT DIESEL DDEC III / IV

Table 25 Engine CAN Port

Terminals of controller	Engine CAN port	Remark
Fuel Relay Output	Connect to extension 30A relay to provide battery voltage for ECU.	
Crank Relay Output	-	Connect to starter coil directly.
CAN(H)	CAN(H)	Use connection cable in 120 ohms impedance.
CAN(L)	CAN(L)	Use connection cable in 120 ohms impedance.

Engine type: Common J1939.

13.8. DEUTZ EMR2

Table 26 F Connector

Terminals of controller	F connector	Remark
Fuel Relay Output	Connect to extension 30A relay to provide battery voltage for terminal 14. Fuse is 16A.	
Crank Relay Output	-	Connect to starter coil directly.
-	1	Connect to negative pole of battery.
CAN(H)	12	Use connection cable in 120 ohms impedance.
CAN(L)	13	Use connection cable in 120 ohms impedance.

Engine type: VOLVO-EDC4.

13.9. JOHN DEERE

Table 27 21-pin Connector

Terminals of controller	21-pin connector	Remark
Fuel Relay Output	G, J	
Crank Relay Output	D	
CAN(H)	V	Use connection cable in 120 ohms impedance.
CAN(L)	U	Use connection cable in 120 ohms impedance.

Engine type: JOHN DEERE.

13.10. MTU MDEC

Table 28 X1 Connector

Terminals of controller	X1 connector	Remark
Fuel Relay Output	BE1	
Crank Relay Output	BE9	
CAN(H)	G	Use connection cable in 120 ohms impedance.
CAN(L)	F	Use connection cable in 120 ohms impedance.

Engine type: MTU-MDEC-303. Suitable for MTU engines of 2000 series and 4000 series.

13.11. MTU ADEC (SMART Module)

Table 29 ADEC (X1 Port)

Terminals of controller	ADEC (X1 port)	Remark
Fuel Relay Output	X1 10	Connect X1 9 to negative pole of battery.
Crank Relay Output	X1 34	Connect X1 33 to negative pole of battery.

Table 30 SMART Module (X4 Port)

Terminals of controller	SMART (X4 port)	Remark
CAN(H)	X4 1	Use connection cable in 120 ohms impedance.
CAN(L)	X4 2	Use connection cable in 120 ohms impedance.

Engine type: MTU-ADEC. Suitable for MTU engines with ADEC (ECU8) or SMART module.

13.12. MTU ADEC (SAM Module)

Suitable for MTU engines with ADEC (ECU7) and SAM module.

Table 31 ADEC (X1 Port)

Terminals of controller	ADEC (X1 port)	Remark
Fuel Relay Output	X1 43	Connect X1 28 to negative pole of battery.
Crank Relay Output	X1 37	Connect X1 22 to negative pole of battery.

Table 32 SAM (X23 Port)

Terminals of controller	SAM (X23 port)	Remark
CAN(H)	X23 2	Use connection cable in 120 ohms impedance.
CAN(L)	X23 1	Use connection cable in 120 ohms impedance.

Engine type: Common J1939. Suitable for MTU engines with ADEC (ECU7) or SAM module.

13.13. PERKINS

Table 33 Connector

Terminals of controller	Connector	Remark
Fuel Relay Output	1,10,15,33,34	
Crank Relay Output	-	Connect to starter coil directly.
CAN(H)	31	Use connection cable in 120 ohms impedance.
CAN(L)	32	Use connection cable in 120 ohms impedance.

Engine type: PERKINS. Suitable for ADEM3/ADEM4 engine control module. The engine models are 2306, 2506, 1106, 2806.

13.14. SCANIA

Table 34 B1 Connector

Terminals of controller	B1 connector	Remark
Fuel Relay Output	3	
Crank Relay Output	-	Connect to starter coil directly.
CAN(H)	9	Use connection cable in 120 ohms impedance.
CAN(L)	10	Use connection cable in 120 ohms impedance.

Engine type: SCANIA. Suitable for S6 engine control module. The engine models are DC9, DC12, DC16.

13.15. VOLVO EDC3

Table 35 "Stand Alone" Connector

Terminals of controller	"Stand Alone" connector	Remark
Fuel Relay Output	H	
Crank Relay Output	E	
Aux. output 1	P	ECU power Configure the auxiliary output 1 as "ECU power".

Table 36 "Data Bus" Connector

Terminals of controller	"Data Bus" connector	Remark
CAN(H)	1	Use connection cable in 120 ohms impedance.
CAN(L)	2	Use connection cable in 120 ohms impedance.

Engine type: VOLVO. Suitable for engine models of TAD1240, TAD1241, TAD1242.

NOTE: When this engine type is selected, preheating time should be set at least 3 seconds.

13.16. VOLVO EDC4

Suitable for engine models of TD520, TAD520 (optional), TD720, TAD720 (optional), TAD721, TAD722, TAD732.

Table 37 Connector

Terminals of controller	Connector	Remark
Fuel Relay Output	Connect to extension 30A relay to provide battery voltage for terminal 14. Fuse is 16A.	
Crank Relay Output	-	Connect to starter coil directly.
	1	Connect to negative pole of battery.
CAN(H)	12	Use connection cable in 120 ohms impedance.
CAN(L)	13	Use connection cable in 120 ohms impedance.

Engine type: VOLVO-EDC4.

13.17. VOLVO-EMS2

Table 38 Engine CAN Port

Terminals of controller	Engine CAN port	Remark
Aux. output 1	6	ECU shutdown Configure the auxiliary output 1 as “ECU shutdown”.
Aux. output 2	5	ECU power Configure the auxiliary output 1 as “ECU power”.
	3	Negative pole of battery
	4	Positive pole of battery
CAN(H)	1(Hi)	Use connection cable in 120 ohms impedance.
CAN(L)	21(Lo)	Use connection cable in 120 ohms impedance.

Engine type: VOLVO-EMS2. Suitable for Volvo engine models of TAD734, TAD940, TAD941, TAD1640, TAD1641, TAD1642.

NOTE: When this engine type is selected, preheating time should be set at least 3 seconds.

13.18. YUCHAI

Table 39 Engine 42-pin Port

Terminals of controller	Engine 42 pins port	Remark
Fuel Relay Output	1.40	Connect to engine ignition switch.
Crank Relay Output	-	Connect to starter coil directly.
CAN(H)	1.35	Use connection cable in 120 ohms impedance.
CAN(L)	1.34	Use connection cable in 120 ohms impedance.

Table 40 Engine 2-pin Connector

Terminals of controller	Engine 2-pin connector	Remark
Negative pole of battery	1	The diameter of connection cable should be 2.5mm^2.
Positive pole of battery	2	The diameter of connection cable should be 2.5mm^2.

Engine type: BOSCH. Suitable for Yuchai BOSCH common rail electronic-controlled engine.

13.19. WEICHAI

Table 41 Engine Port

Terminals of controller	Engine port	Remark
Fuel Relay Output	1.40	Connect to engine ignition switch.
Crank Relay Output	1.61	
CAN_SCR		CAN communication shielded cable
CAN(H)	1.35	Use connection cable in 120 ohms impedance.
CAN(L)	1.34	Use connection cable in 120 ohms impedance.

Engine type: GTSC1. Suitable for Weichai BOSCH common rail electronic-controlled engine.

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