



SmartGen
ideas for power

HEM8500

ENGINE CAN MONITORING CONTROLLER

USER MANUAL



SMARTGEN (ZHENGZHOU) TECHNOLOGY CO., LTD.



Chinese trademark

SmartGen English trademark

SmartGen — make your generator *smart*

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Table 1 Software Version

Date	Version	Content
2020-04-23	1.0	Initial release.

Table 2 Symbol Instruction

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

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1 OVERVIEW

HEM8500 Engine CAN Monitoring Controller is an intelligent instrument and controlling device that combined microelectronic technique, electric measurement technique, digital-analog hybrid signal processing technique, CAN communication technique, vehicle controlling technique and engine electronic control technique. It is the ideal product for engineering vehicles' CAN communication and electric device control with its high integration and powerful CAN gateway functions (can replace Murphy display totally).

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2 PERFORMANCE AND CHARACTERISTICS

- With 32-bit ARM microprocessor as the core, 4.3 inch LCD display, touch buttons operation and English/Chinese language can be optional;
- Two CANBUS ports, one is connecting with engine ECU, and the other one is standby;
- RS485 communication port enables data communication via MODBUS protocol through PC monitoring software;
- 4-20mA output, which can connect speed tachometer and torque indicator;
- Through CANBUS port can read real time data of the running engine, such as speed, torque, water temperature, oil pressure, oil temperature, total fuel consumption and instant fuel consumption etc.
- With a reset zero button for integrated panel engine, press and hold it for more than 3s to reset subtotal time and subtotal fuel consumption;
- With a fault diagnosis button for integrated panel engine, press it to enter into diagnostic mode, if ECU alarms occur in this mode, users can check corresponding fault alarm information through flicker times of engine red light, and press it again to exit diagnostic mode;
- Manual throttle switch: push button on the panel, press it after engine start to activate manual throttle, which can accurately control engine speed;
- Emergency stop button on the front panel, which can control engine stop;
- Users can change parameters settings, and changed parameters will be memorized into internal FLASH storage simultaneously to avoid losing data in case of power down;
- Real-time calendar, RTC, and running time accumulation functions;
- Diesel engine total start times display;
- 99 pieces of shutdown alarm records can be cyclically stored and records can be checked on the site;
- Use hard screen acrylic material to protect screen with strong wear-resistance and scratch resistance;
- Rubber panel and buttons with strong performance to work in high/low temperature;
- Widely power supply range (10-35) V DC, which can adapt to various battery volt environments;
- There is rubber seal ring between shell and control panel. IP65 protective performance can be achieved.

3 SPECIFICATION












Table 3 Technical Parameters

Parameter	Details
Working Voltage	DC10. 0V to 35. 0V continuous
Overall Consumption	<5W (Standby mode: ≤3.5W)
Start Relay Output	16A DC28V power supply output
ECU Power Relay Output	16A DC28V power supply output
Programmable Relay Output 1-2	7A DC28V power supply output
4-20mA Output	Range: 4-20mA Resolution: 0.01mA Accuracy: 1% Tachometer or torque indicator can be connected;
Analogue Sensor	Aux. Sensor 1, Aux. Sensor 2, Fuel Level Sensor Resistance Input Range: 0-6000Ω Resolution: 0.1 Accuracy: 1Ω (below 300Ω) Current Input of Aux. Sensor 3, and Aux. Sensor 4 Range: 0-20mA Resolution: 0.01mA Accuracy: 1%
Case Dimension	247mm×191mm×72mm
Panel Cutout	214mm×160mm
Mounting Screw Dimension	4 × M4
Working Conditions	Temperature: (-25~+70)°C Humidity: (20~93)%RH
Storage Conditions	Temperature:(-25~+70)°C
Protection Level	IP65
Weight	0.90kg
Insulation Intensity	Apply AC2.2kV voltage between high voltage terminal and low voltage terminal. The leakage current is not more than 3mA within 1min.

4 OPERATION

4.1 KEY FUNCTION DESCRIPTION

Table 4 Key Function Description

Icons	Keys	Description
	Stop	Stop the running engine; Reset shutdown alarms when engine alarms occur;
	Start	Start genset in standby status;
	Power	In standby status, press longer to turn off the power; In power off status, press longer to turn on the power;
Diag	Engine Diagnosis	It can put the controller in diagnostic mode, and its indicator lights up; Press it again and it exits diagnostic mode, and its indicator lights off.
	Paging Up	In Diagnostic mode, if multiple ECU alarms occur, it can check the flashing status of the last alarm.
	Paging Down	In Diagnostic mode, if multiple ECU alarms occur, it can check the flashing status of the next alarm.
on/off	Manual Throttle	After the engine starts, it can put the engine in manual throttle mode, its indicator lights up, and speed can be adjusted by throttle knob. Press it again and engine exits manual throttle mode, its indicator lights off, and speed cannot be adjusted at this moment.
	Subtotal Zero	Press it for 3s and "subtotal time", "subtotal fuel consumption" and "subtotal avg. fuel consumption" become "0".
	Home/Set	In main menu page, it can enter parameter setting interface; in other pages, it can make it faster to return the main menu page.
	Up/Increase	1) Screen scroll; 2) Move up cursor and increase value in setting menu.
	Down/Decrease	1) Screen scroll; 2) Move down cursor and decrease value in setting menu.
	Throttle	In manual throttle mode, forward/backward rotate this knob to increase/decrease target speed; Press the knob and it can return to 'Idle Speed'.
	E-Stop	Press it, start output and ECU power will be disconnected and meanwhile stop process will be executed.

4.2 CONTROLLER PANEL




Fig. 1 Front Panel Indication

Table 5 Indicator Description

Indicators	Description
	Engine shutdown alarm indication, when diagnostic mode is active, if ECU alarms occur, users can check corresponding fault alarm information through flicker times of this indicator. Or when E-stop button is pressed, engine stop indicator flashes quickly. (engine red light)
	Engine warning alarm indication, when controller detects warning alarm signals, this indicator flashes. (engine yellow light)
	Engine pre-heating indication, when engine preheat starts, ECU initiates corresponding preheating command.
	Charging indication, after charging indication input accessing to the controller, when charge, it will light off, otherwise, it will light on.

5 LCD DISPLAY

5.1 MAIN DISPLAY

When system power is connected (controller has no power right now), press power key  for more than 2s, then controller starts power up, right now, enter power-on password and get into normal running interface as bellow:

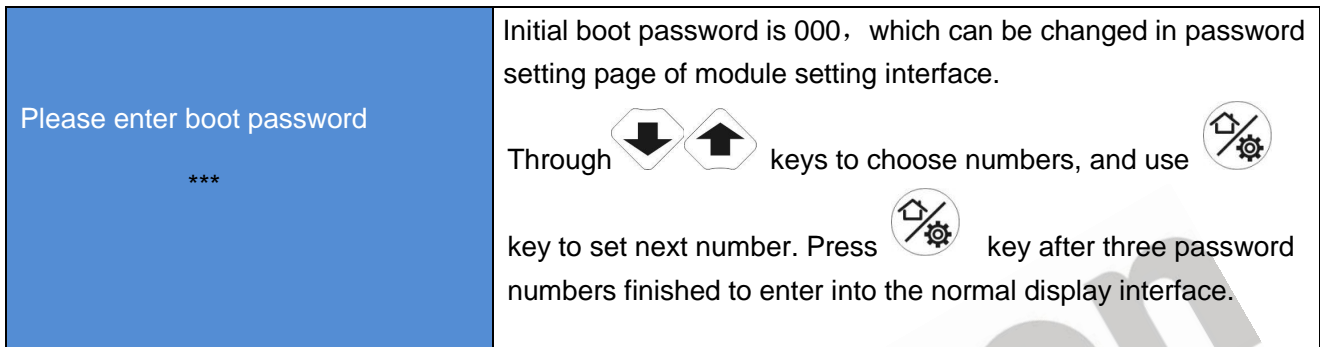





Fig. 2 Start Interface

Interface display can be divided into multi pages: Main Screen display, Engine Data display, Alarm Data display, Event log Data display, and Others information display.

- **Main Screen** includes the following contents.

Table 6 Display Content Description

Main Screen Display Content		
Display Content	Description	Data Sources
	Engine fuel level indication	Fuel level sensor data
Speed 800 r/min	Engine running speed	ECU data analysis
Torque 20%	Engine Torque	ECU data analysis
Coolant Temp 35°C	Engine coolant temp display	ECU data analysis
Oil Pressure 100kPa	Engine oil pressure display	ECU data analysis
Battery Voltage 24.5V	System power supply volt	Controller gathered battery volt
Inst. FC 1L/h	Engine instant fuel consump.	ECU data analysis
Accum. FC 25L	Engine total fuel consumption	ECU data analysis
Subtotal FC 25L	Fuel used after engine start	FC calculation after engine start
Total Time 2:38:25	Total engine running time	Engine running time accumulation
Subtotal Time 2.3	Running time after engine start	Time accumulation after engine start
 0 0.0 250	Oil filter running time	Run time after new oil filter changed
 0 0.0 250	Diesel filter running time	Run time after new filter changed.
At Rest	Engine status	
Engine Page Display Content		
Display	Description	Data Sources
Engine		
Oil Pressure Sensor 68kPa		
Temp Sensor 65°C		
Aux. Sensor 3 80kPa		Current type sensor
Aux. Sensor 4 80kPa		Current type sensor
Oil Temp 25°C	Oil temp display	ECU data analysis
Fuel Temp 25°C	Fuel temp display	ECU data analysis
Fuel Pressure 100kPa	Fuel pressure display	ECU data analysis
Inlet Temp 25°C	Inlet temp display	ECU data analysis
Exhaust Temp 25°C	Outlet temp display	ECU data analysis

Turbo Pressure	100kPa	Turbine pressure display	ECU data analysis
Coolant Pressure	30kPa	Coolant pressure display	ECU data analysis
Coolant Level	80%	Coolant level sensor display	ECU data analysis
Subtotal Avg FC	5L/h	Subtotal avg. FC display	Calculated by subtotal FC & time
Starts	12	Start times display	Start times accumulation

NOTE: Different engines contain different data.

- **Alarm** page concludes:

Display all warnings and shutdown information.

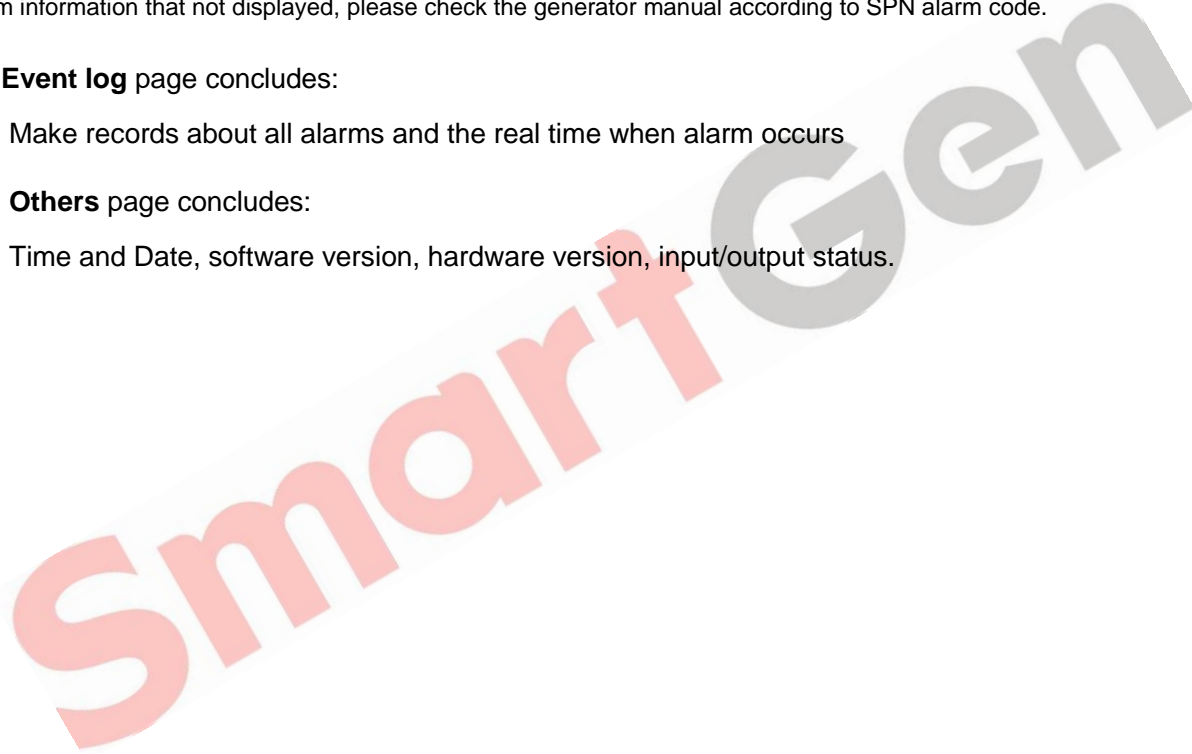
NOTE: For ECU alarms and shutdown alarms, which can display most of alarms content and SPN codes, if there is alarm information that not displayed, please check the generator manual according to SPN alarm code.

- **Event log** page concludes:


Make records about all alarms and the real time when alarm occurs

- **Others** page concludes:

Time and Date, software version, hardware version, input/output status.



5.2 USER MENU AND PARAMETER SETTINGS

Press  key and enter user menu:

- Parameter

After entering the correct password (factory default password is 00318) you can enter parameter settings interface.

- Module Settings
- Timer settings
- Engine settings
- Sensor Settings (flexible sensor 1-2, fuel level sensor setting, flexible sensor 3-4 (current type sensor) settings;)
- Input port settings
- Output port settings
- 4-20mA output settings

Table 7 Parameter Setting Example (Screen 1)




<ul style="list-style-type: none"> >Return >Module <li style="background-color: #D9E1F2;">>Timers >Engine >Sensor > Inputs > Outputs > 4-20mA Output 	<p>Screen 1:</p> <p>Use   to change settings and  to enter settings (Screen 2).</p>
<ul style="list-style-type: none"> >Return >Pre-heat Delay >Cranking Time >Crank Rest Time >Safety On Time >Cooling Time >ETS Solenoid Hold >Fail to Stop Delay >Power Off Delay 	




Table 8 Parameter Setting Example (Screen 2)


<ul style="list-style-type: none"> >Return >Module >Timers >Engine >Sensor > Inputs > Outputs > 4-20mA Output 	<p>Screen 2:</p> <p>Use to change settings and to enter settings (Screen 3).</p>
<ul style="list-style-type: none"> >Return <li style="background-color: #FFD700;">>Pre-heat Delay >Cranking Time >Crank Rest Time >Safety On Delay >Cooling Time >ETS Solenoid Hold >Fail to Stop Delay >Power Off Delay 	

Table 9 Parameter Setting Example (Screen 3)

<ul style="list-style-type: none"> >Return <li style="background-color: #FFD700;">>Pre-heat Delay >Cranking Time >Crank Rest Time >Safety On Delay >Cooling Time >ETS Solenoid Hold >Fail to Stop Delay >Power Off Delay 	<p>Screen 3:</p> <p>Use to change settings and to enter settings (Screen 4).</p>
<p>00010s</p>	

Table 10 Parameter Setting Example (Screen 4)

>Return >Pre-heat Delay >Cranking Time >Crank Rest Time >Safety On Delay >Cooling Time >ETS Solenoid Hold >Fail to Stop Delay >Power Off Delay	Screen 4: Use   to change settings and  to move setting numbers and confirm setting data.
00010s	

NOTE: press  and it can exist parameter settings directly.

5.3 START/STOP OPERATION

- a) Press start key, then engine is cranking.
- b) Preheat relay energizes (if configured), “preheat delay XX s” information will be displayed on LCD;
- c) After the preheat delay, Start Relay is engaged. If the engine fails to fire during this cranking attempt then the start relay stop outputting; “crank rest time” begins and wait for the next crank attempt.
- d) During the set start attempts, if engine fails to start, it will issue failed to start alarm.
- e) In case of successful crank attempt, the “Safety On” timer is activated. As soon as this delay is over, engine enters into normal running status.
- f) During the engine normal running process, when manual throttle is active, users can adjust engine speed through manual throttle knob.
- g) Press stop key, engine enters into stopping process.
- h) Engine enters “ETS Solenoid Hold”. ECU power off and ETS delay timer is energized.
- i) After ETS delay is over, it enters into “After stop” delay.
- j) Engine is placed into its standby mode after its “Waiting for Stop” delay expired.

5.4 SPEED REGULATION OPERATION

- a) After controller normal running, press **on/off** key (manual throttle is active), controller's main screen is showing as bellow,

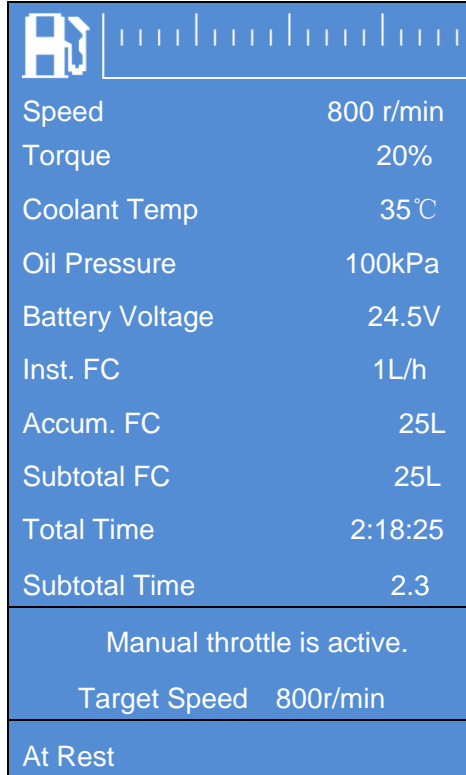


Fig. 3 GOV Interface

Initial target speed value is initial throttle speed value that user-defined.

- b) Target speed changes along with regulating throttle knob, then engine speed will be controlled by the controller on the basis of target speed value. The speed resolution (throttle knob each turn of a grid) is the setting throttle resolution, if adjusted target speed by throttle knob is over the max pre-set throttle speed, it will be forced to be equal to the max speed value; if adjusted target speed by throttle knob is below the pre-set minimum throttle speed, it will be forced to be equal to the minimum speed value.
- c) Press throttle knob, engine target speed value will be forced to be equal to the minimum setting speed value.
- d) Again to press **on/off** to exit manual throttle mode.

5.5 ENGINE DIAGNOSIS ACTION

- a) Press **Diag** key to enter into **Diagnostic Mode** if ECU alarms of controller occur.
- b) After system enters into diagnostic mode, if the first ECU alarm is shutdown alarm, engine red light will flash once at first; if ECU alarm is warning alarm, engine yellow light will flash once at first.
- c) After alarm types were indicated, engine detailed fault information can be checked according to the red light flash frequency, for example, red light first time flashes twice, second time flashes 3 times, and third time flashes 5 times, then fault code (indicator) data is 235, and corresponding fault information is low coolant level alarm.
- d) If ECU fault occurs, fault information is the same failure, and then the light flashes twice.
- e) If there are other ECU alarms, please repeat step b-c.
- f) Again press **Diag** key to exit diagnostic mode.
- g) If ECU has no alarms, press **Diag** key, both engine red light and yellow light are light off.

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6 PROTECTIONS

6.1 WARNING ALARMS

Warning alarms does not lead to shutdown, and corresponding warning alarm types are displayed on LCD. If controller detects more than one ECU alarms (if more than 5 pieces), LCD will display max 5 ECU alarms.

Table 11 Warning Alarms

No	Type	Description
1	Battery Over Volt	When the controller detects that the battery voltage has exceeded the pre-set value, it will initiate a warning alarm
2	Battery Under Volt	When the controller detects that the battery voltage has fallen below the pre-set value, it will initiate a warning alarm
3	Oil Filter Maintenance Due	When the running time is arrived at preset oil filter maintenance time, it will initiate a warning alarm.
4	Diesel Filter Maintenance Due	When the running time is arrived at preset filter maintenance time, it will initiate a warning alarm.
5	ECU Warning	When the controller received engine warning signals via J1939, it will initiate a warning alarm and fault code and name will be displayed.
6	Low Fuel Level	When the controller detects that the fuel level has fallen below the pre-set value, it will initiate a warning alarm.
7	Fuel Level Open Circuit	When the controller detects that the fuel level sensor open circuit, it will initiate a warning alarm.
8	Flexible Sensor 1-2 Open Circuit	After sensors are enabled, when controller detects corresponding sensor is open circuit. It will initiate a warning alarm.
9	Flexible Sensor 1-2 High	After sensors are enabled, When the controller detects that the sensor value has exceeded the pre-set upper limit value, it will initiate a warning alarm.
10	Flexible Sensor 1-2 Low	After sensors are enabled, When the controller detects that the sensor 1 value has fallen below the pre-set lower limit value, it will initiate a warning alarm.
11	Sensor 3-4 Low Warn	After sensors are enabled, When the controller detects the sensor is open, it will issue corresponding sensor open warning signal.
12	Sensor 3-4 Low Warn	After sensors are enabled, When the controller detects the sensor value is above the pre-set upper limit of warning value, it will issue sensor high warning signal.
13	Sensor 3-4 Low Warn	After sensors are enabled, When the controller detects the sensor value is below the pre-set lower limit of warning value, it will issue sensor low warning signal.
14	Input 1-5 Warning	When digit input port is set as warning and the alarm is active, it will initiate a warning alarm.

No	Type	Description
15	Empty Filter Block	When empty filter block input is active, it will initiate a warning alarm.
16	Low Water Level	When low water level input is active, it will initiate a warning alarm.
17	Failed to Start	If the number of controller start attempts exceeds pre-set start times, it will initiate a warning alarm.

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6.2 SHUTDOWN ALARMS

When controller detects shutdown alarms, detailed alarms information will be displayed on LCD alarm page.

NOTE: For No. 1-7, when shutdown alarms occur for controller, it only display shutdown alarm information, but not control ECU shutdown; if stop is needed please press stop button. No. 8 controls ECU shutdown.

Table 12 Shutdown Alarms

No.	Type	Description
1	ECU Shutdown	When the controller received engine warning signals via J1939, it will initiate a warning alarm and fault code and name will be displayed.
2	ECU Communicate Fail	When the engine start up but controller didn't via J1939 receive engine warning signals, it will initiate a warning alarm.
3	Flexible Sensor 1-2 High	After sensors are enabled, When the controller detects that the sensor value has exceeded the pre-set upper limit value, it will initiate a warning alarm.
4	Flexible Sensor 1-2 Low	After sensors are enabled, When the controller detects that the sensor 1 value has fallen below the pre-set lower limit value, it will initiate a warning alarm.
5	Sensor 3-4 High Shutdown	After sensors are enabled, When controller detects sensor value is above the pre-set upper shutdown value, it will initiate sensor high shutdown alarm signal.
6	Sensor 3-4 Low Shutdown	After sensors are enabled, When controller detects sensor value is above the pre-set upper shutdown value, it will initiate sensor low shutdown alarm signal.
7	Input 1-5 Shutdown	When digital input port is configured as "shutdown" and after it is active, it will initiate a warning alarm.
8	Emergency Stop	When it is active, start output and ECU power output is disconnected.

7 WIRING CONNECTION

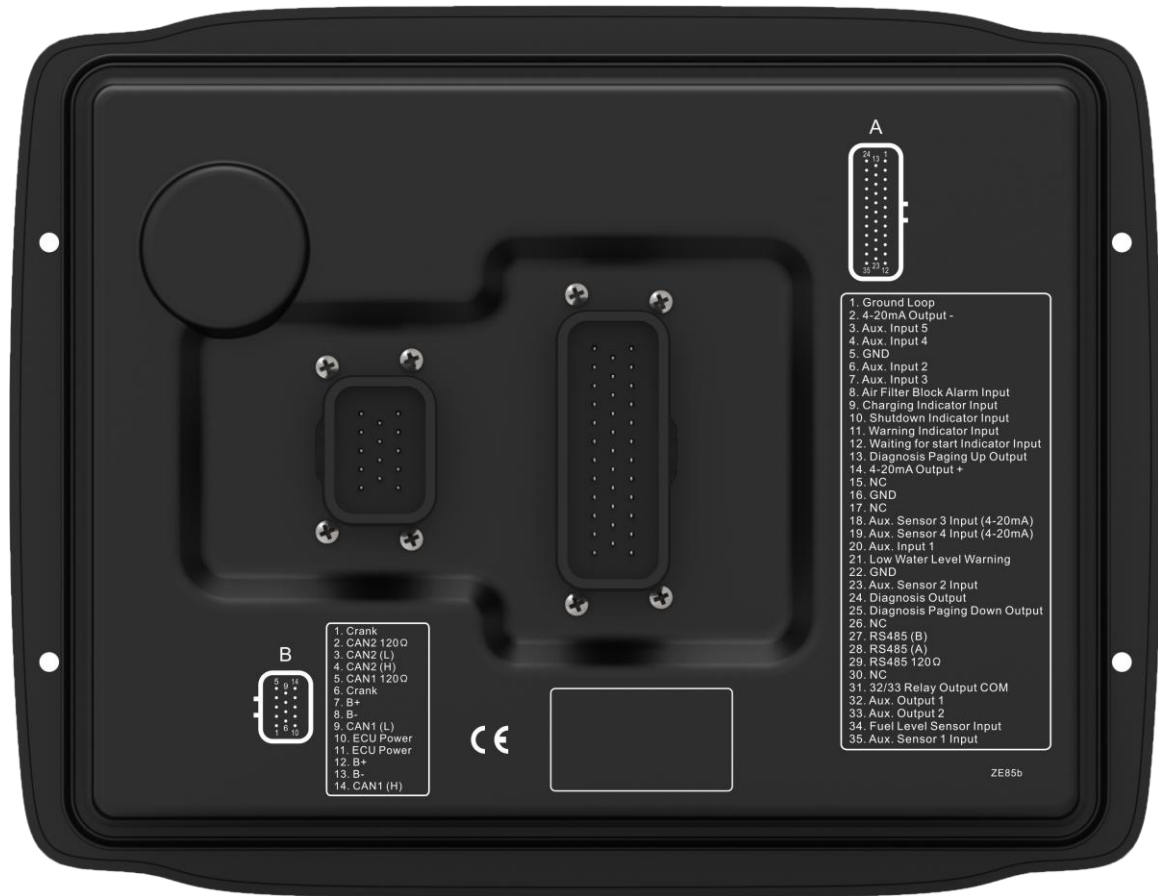


Fig. 4 Controller Back Panel

Table 13 Terminal Wiring Description

No.	Functions	Cable Size	Remark
A Plug Terminal (Back Penal)			
1	Ground Loop	1.0mm ²	ECU ground loop
2	4-20mA Output-	1.0mm ²	4-20mA output negative
3	Aux. Input 5	1.0mm ²	Discrete input port
4	Aux. Input 4	1.0mm ²	Discrete input port
5	GND	1.0mm ²	GND
6	Aux. Input 2	1.0mm ²	Discrete input port
7	Aux. Input 3	1.0mm ²	Discrete input port
8	Air Filter Block Alarm Input	1.0mm ²	Air filter block alarm input
9	Charging Indicator Input	1.0mm ²	Discrete input port
10	Shutdown Indicator Input	1.0mm ²	Discrete input port
11	Warning Indicator Input	1.0mm ²	Discrete input port
12	Waiting for start Indicator Input	1.0mm ²	Discrete input port
13	Diagnosis Paging Up Output	1.0mm ²	Output port control
14	4-20mA Output +	1.0mm ²	4-20mA output positive
15	NC	1.0mm ²	NC
16	GND	1.0mm ²	GND
17	NC	1.0mm ²	NC
18	Aux. Sensor 3 Input (4-20mA)	1.0mm ²	Analogue input port
19	Aux. Sensor 4 Input (4-20mA)	1.0mm ²	Analogue input port
20	Aux. Input 1	1.0mm ²	Discrete input port
21	Low Water Level Warning	1.0mm ²	Low water level input port
22	GND	1.0mm ²	GND
23	Aux. Sensor 2 Input	1.0mm ²	Analog input port
24	Diagnosis Output	1.0mm ²	Output after diagnosis is active
25	Diagnosis Paging Down Output	1.0mm ²	Diagnosis paging down output



No.	Functions	Cable Size	Remark
26	NC	1.0mm ²	NC
27	RS485 (B)	0.5mm ²	RS485 (B)
28	RS485 (A)	0.5mm ²	RS485 (A)
29	RS485 120Ω	0.5mm ²	RS485 (SCR)
30	NC	1.0mm ²	NC
31	32/33 Relay Output COM	1.0mm ²	32/33 relay output common port
32	Aux. Output 1	1.5mm ²	Output port control, the max contact capacity is 7A
33	Aux. Output 2	1.5mm ²	Output port control, the max contact capacity is 7A
34	Fuel Level Sensor Input	1.0mm ²	Analog input port
35	Aux. Sensor 1 Input	1.0mm ²	Analog input port
B Plug Terminal (Back Panel)			
1	Crank	1.5mm ²	Connecting with start output capacity 16A
2	CAN2 120Ω	0.5mm ²	Standby CANBUS
3	CAN2 (L)	0.5mm ²	Standby CANBUS
4	CAN2 (H)	0.5mm ²	Standby CANBUS
5	CAN1 120Ω	0.5mm ²	Engine J1939 CANBUS
6	Crank	1.5mm ²	Connecting with start output capacity 16A
7	B+	1.5mm ²	Working power supply DC B+
8	B-	1.5mm ²	Working power supply DC B-
9	CAN1(L)	0.5mm ²	Engine J1939 CANBUS
10	ECU Power	1.5mm ²	Connecting with ECU power output capacity 16A
11	ECU Power	1.5mm ²	Connecting with ECU power output capacity 16A
12	B+	1.5mm ²	Working power supply DC B+
13	B-	1.5mm ²	Working power supply DC B-
14	CAN1 (H)	0.5mm ²	Engine J1939 CANBUS

8 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

8.1 CONTENTS AND SCOPES OF PARAMETERS

Table 14 Parameter Setting Contents and Scopes

No.	Items	Parameters	Defaults	Description
Timer Settings				
1	Pre-heat Delay	(0~3600)s	0	Time of pre-powering heat plug before starter is powered up.
2	Cranking Time	(3~60)s	8	Time of starter power on
3	Crank Rest Time	(3~60)s	10	The waiting time before second power up when engine start fail.
4	Safety On Delay	(0-3600)s	10	A short of running time after engine start up.
5	Cooling Time	(0-3600)s	10	Cooling time for engine before stop.
6	ETS Solenoid Hold	(0~3600)s	20	ECU power off time after pressing stop key.
7	Fail to Stop Time	(0~3600)s	0	Time from gen-set ETS solenoid hold time expired to stop completely.
8	Power Off Delay	(15-150)s	35	The delay time for power off after pressing power key.
Engine Settings				
1	Engine Type	(0~39)	1	Default: J1939 Engine When connected to J1939 engine, choose the corresponding type.
2	SPN Version	(1-3)	1	Selection for SPN alarm version.
3	Start Attempts	(1~30) times	1	Max. Crank times of crank attempts. When reach this number, controller will send start failure signal.
4	Disconnect Speed	(1-1000)r/min	350	When generator speed is higher than the set value, starter will be disconnected.
5	Battery Rated Volt	(0-60.0)V	24.0	Provide standard judgment for battery over voltage/under voltage.
6	Battery Over Volt Alarm	(0~200)%	125	When battery volt is higher than preset volt percentage, controller will send battery voltage high warning alarm.
7	Battery Under Volt Alarm	(0-200)%	80	When battery volt is lower than preset volt percentage, controller will send battery voltage low warning alarm.
8	Throttle Start Speed	0-2000 r/min	800	The minimum engine speed of throttle can be adjusted.
9	Throttle Max. Speed	0-3000 r/min	2500	The max engine speed of throttle can be adjusted.



No.	Items	Parameters	Defaults	Description
10	Throttle Resolution	0-100 r/min	50	Resolution of the throttle knob each turn of a grid.
11	SPN Alarm Mask Code1	(0-65535)	0	It is can shield corresponding SPN alarm.
12	SPN Alarm Mask Code2	(0-65535)	0	It is can shield corresponding SPN alarm.
13	SPN Alarm Mask Code3	(0-65535)	0	It is can shield corresponding SPN alarm.
14	ECU Com. Fail Act	(0-1)	0	0: Warning; 1: Shutdown
Module Setting				
1	Module Address	(1~254)	1	It is used for setting RS485 communication address.
2	Language	(0~2)	0	0: Simplified Chinese 1: English 2: Traditional Chinese
3	Password	(0~9999)	00318	For entering advanced parameters setting.
4	Oil Filter 1 st Time Maintenance	(1-5000)h	200	First maintenance time of oil filter setting.
5	Oil Filter Maintenance Time	(1-5000)h	250	Oil filters normal maintenance interval setting.
6	Diesel Filter 1 st Time Maintenance	(1-5000)h	200	First maintenance time of filters setting.
7	Diesel Filter Maintenance Time	(1-5000)h	250	Diesel filters normal maintenance interval setting.
8	Boot Password Setting	(0-999)	0	Press start key and enter start password to get into controller main screen.
9	Boot Password Enable	(0-1)	0	0: Disable; 1:Enable
10	Date & Time			Users can manually calibrate date and time.
Fuel Level Sensor				
1	Curve Type	(0-15)	3	SGD
2	Low Level Warning	(0-100)%	10	When the value of external liquid level sensor bellows the default value, controller will initiate corresponding alarm. (it is always available)
3	Warning Delay	(0-3600)s	2	When the value of liquid level sensor is below preset warning value, controller will initiate corresponding alarm.
Flexible Sensor 1-2				
1	Sensor Type	(0-3)	0	0: Not used 1:Pressure 2:Temp 3:Liquid Level

No.	Items	Parameters	Defaults	Description
2	Curve Type	(0-15)	0	Changed according to sensor type. Sensor types details please to see Table 19.
3	Warn Speed Setting	(0-3000)r/min	1200	When controller detects engine speed exceeds preset warning speed, system starts detecting and initiating alarms.
4	Upper Limit Shut Enabled	(0-1)	1	Sensor upper limit shutdown enabled setting.
5	Upper Limit Shut Value	(0-6000)	98	Sensor upper limit shutdown value setting.
6	Stop Delay	(0-3600)s	5	Sensor upper limit stop delay setting.
7	Lower Limit Shut Enabled	(0-1)	0	Sensor lower limit shutdown enabled setting.
8	Lower Limit Shut Value	(0-400)	0	Sensor lower limit shutdown value setting.
9	Stop Delay	(0-3600)s	5	Sensor lower limit stop delay setting.
10	Upper Limit Warning Enabled	(0-1)	1	Sensor upper limit warning enabled setting.
11	Upper Limit Warning Value	(0-6000)	92	Sensor upper limit warning value setting.
12	Warning Delay	(0-3600)s	2	Sensor upper limit warning delay setting.
13	Lower Limit Warning Enabled	(0-1)	0	Sensor lower limit warning enabled setting.
14	Lower Limit Warning Value	(0-4000)	0	Sensor lower limit warning value setting.
15	Warning Delay	(0-3600)s	2	Sensor lower limit warning delay setting.
Flexible Sensor 3-4				
1	Sensor Type	(0-3)	0	0: Not Used 1: Pressure 2: Temperature 3: Fuel Level
2	Curve Type	(0-15)	0	Change according to sensor type; Refer to Table 21 for detailed sensor type list.
3	Warn Speed Setting	(0-3000)r/min	1200	When controller measures engine speed is above pre-set alarm speed value, system starts to detect alarms.
4	Upper Limit Shut Enabled	(0-1)	1	Setting of sensor upper limit shutdown enable
5	Upper Limit Shut Value	(0-6000)	98	Setting of sensor upper limit shutdown value enable
6	Stop Delay	(0-3600)s	5	Setting of sensor upper limit shutdown

No.	Items	Parameters	Defaults	Description
				delay
7	Lower Limit Shut Enabled	(0-1)	0	Setting of sensor lower limit shutdown enable
8	Lower Limit Shut Value	(0-400)	0	Setting of sensor lower limit shutdown value
9	Stop Delay	(0-3600)s	5	Setting of sensor lower limit shutdown delay
10	Upper Limit Warning Enabled	(0-1)	1	Setting of sensor upper limit warning enable
11	Upper Limit Warning Value	(0-6000)	92	Setting of sensor upper limit warning value enable
12	Warning Delay	(0-3600)s	2	Setting of sensor upper limit warning delay
13	Lower Limit Warning Enabled	(0-1)	0	Setting of sensor lower limit warning enable
14	Lower Limit Warning Value	(0-4000)	0	Setting of sensor lower limit warning value
15	Warning Delay	(0-3600)s	2	Setting of sensor lower limit warning delay
Digital Input Ports				
Digital Input Port 1				
1	Content Setting	(0-50)	0	Not used
2	Activate Type	(0-1)	0	0: Close to activate 1: Open to activate
Digital Input Port 2				
1	Content Setting	(0-50)	0	Not used
2	Activate Type	(0-1)	0	0: Close to activate 1: Open to activate
Digital Input Port 3				
1	Content Setting	(0-50)	0	Not used
2	Activate Type	(0-1)	0	0: Close to activate 1: Open to activate
Digital Input Port 4				
1	Content Setting	(0-50)	0	Not used
2	Activate Type	(0-1)	0	0: Close to activate 1: Open to activate
Digital Input Port 5				
1	Content Setting	(0-50)	0	Not used
2	Activate Type	(0-1)	0	0: Close to activate 1: Open to activate
Relay Outputs				
Relay Output 1				
1	Content Setting	(0-50)	0	Not used

No.	Items	Parameters	Defaults	Description
2	Activate Type	(0-1)	0	0: Close to activate 1: Open to activate
Relay Output 2				
1	Content Setting	(0-50)	0	Not Used
2	Activate Type	(0-1)	0	0: Close to activate 1: Open to activate
4-20mA Output				
1	4-20mA Output	(0-2)	1	0: Not Used 1: Custom Speed Curve 2: Custom Torque Curve

8.2 DEFINABLE PROGRAMMABLE OUTPUT PORTS

Table 15 Definable Contents of Programmable Output Ports 1-2

No.	Type	Description
0	Not Used	
1	User Configured	See <i>Table 16 Users-defined Functions of Programmable Output Ports</i>
2	Audible Alarm	Output when alarms occur.
3	ECU Power Supply	Output after controller is powered on, and disconnect at ETS.
4	Reserved	Reserved
5	Start Relay Output	Output when controller starts up.
6	Reserved	Reserved
7	ETS Output	Output when controller stops.
8	Reserved	Reserved
9	Reserved	Reserved
10	Common Alarm	Output when controller has warning/shutdown alarms.
11	Common Shutdown Alarm	Output when controller has shutdown alarms.
12	Common Warning Alarm	Output when controller has warning alarms.
13	Digital Input 1 Active	Output when programmable input port 1 is active.
14	Digital Input 2 Active	Output when programmable input port 2 is active.
15	Digital Input 3 Active	Output when programmable input port 3 is active.
16	Digital Input 4 Active	Output when programmable input port 4 is active.
17	Digital Input 5 Active	Output when programmable input port 5 is active.
18	Reserved	Reserved
19	Reserved	Reserved
20	Reserved	Reserved
21	Crank Success	Output after engine crank successfully.
22	Normal Running	Output after engine running normally.
23	ECU Comm. Fail	Shutdown alarm outputs when ECU fails to communicate.
24	Battery Under Volt Alarm	Warning alarm outputs when controller battery volt is high.
25	Battery Over Volt Alarm	Warning alarm outputs when controller battery volt is low.



No.	Type	Description
26	Reserved	Reserved
27	Reserved	Reserved
28	Reserved	Reserved
29	Fail to Start	Alarm outputs when controller fails to start.
30	Reserved	Reserved
31	Reserved	Reserved
32	Sensor 1 Open Circuit Warning	Warning alarm outputs when programmable sensor1 is open circuit.
33	Sensor 1 Warning	Warning alarm outputs when programmable sensor1 is high/low.
34	Sensor 1 Shutdown	Shutdown alarm outputs when programmable sensor1 is high/low.
35	Sensor 2 Open Circuit Warning	Warning alarm outputs when programmable sensor2 is open circuit.
36	Sensor 2 Warning	Warning alarm outputs when programmable sensor2 is high/low.
37	Sensor 2 Shutdown	Shutdown alarm outputs when programmable sensor2 is high/low.
38	Level Sensor Open Circuit Warning	Warning alarm outputs when fuel level sensor is open circuit.
39	Level Sensor Warning	Warning alarm outputs when fuel level is low.
40	Reserved	Reserved
41	Sensor 3 Open Circuit Warning	Output when flexible sensor 3 open circuit warning occurs;
42	Sensor 3 Warning	Output when flexible sensor 3 high/low warning occurs;
43	Sensor 3 Shutdown	Output when flexible sensor 3 high/low shutdown occurs;
44	Sensor 4 Open Circuit Warning	Output when flexible sensor 4 open circuit warning occurs;
45	Sensor 4 Warning	Output when flexible sensor 4 high/low warning occurs;
46	Sensor 4 Shutdown	Output when flexible sensor 4 high/low shutdown occurs;
47-50	Reserved	Reserved

Table 16 Users-defined Functions of Programmable Output Ports

No.	Item	Content	Remark
1	Function Selection	(0-50)	
2	Output Type	0 Close 1 Open	
3	Activate Speed	0-2000r/min	
4	Delay Duration	(0-100.0)s	
5	Duration	(0-3600)s	

NOTE: Effective Speed, delay output time, output time settings can only be set via PC software.

8.3 DEFINABLE PROGRAMMABLE INPUT PORTS

Table 17 Input Port Function List

No.	Type	Description
0.	Not Used	
1.	User Configured	Details to <i>Table 18 User-defined Functions of Programmable Input Ports.</i>
2.	Alarm Mute	Through this key to mute alarms if audible alarms occurred.
3.	Alarm Reset	Trough this key to reset alarms if shutdown alarms occurred.
4.	Reserved	Reserved
5.	Reserved	Reserved
6.	Idle Mode	When input is active, it returns to the beginning speed (idle speed).
7.	Manual Throttle Control	When input is active, speed can be adjusted manually.
8.	Speed Raise Input	When input is active, for speed raise once (step length is throttle resolution), self-reset button can be connected.
9.	Speed Drop Input	When input is active, for speed drop once (step length is throttle resolution), self-reset button can be connected.
10-50	Reserved	Reserved

Table 18 User-defined Functions of Programmable Input Ports

No.	Item	Content	Remark
1	Setting	(0-50)	See <i>Input Port Function List</i>
2	Activate Type	(0-1)	0: Close to activate 1: Open to activate
3	Activate Speed	(0-2500)r/min	Alarm is active when speed exceeded this threshold value.
4	Activate Action	(0-2)	0: Warning 1: Shutdown 2: No Action
5	Delay	(0-20.0)s	

NOTE: User-defined input ports character strings can be set only via PC software.

8.4 4-20mA OUTPUT CONTENT LIST

Table 19 4-20mA Output Function List

No.	Type	Function Description
0	Not Used	
1	Custom Speed Curve	Set mA output current of speed correspondence; externally connect tachometer if this is selected. Min. set current 4mA, max. set current 20mA.
2	Custom Torque Curve	Set mA output current of torque correspondence; externally connect torque indicator if this is selected. Min. set current 4mA, max. set current 20mA.

NOTE: Custom curve coordinate point can only be set by PC software. Curve is linear and set the coordinate of two points.

8.5 SENSORS SELECTION

Table 20 Sensor Selection List (Resistance)

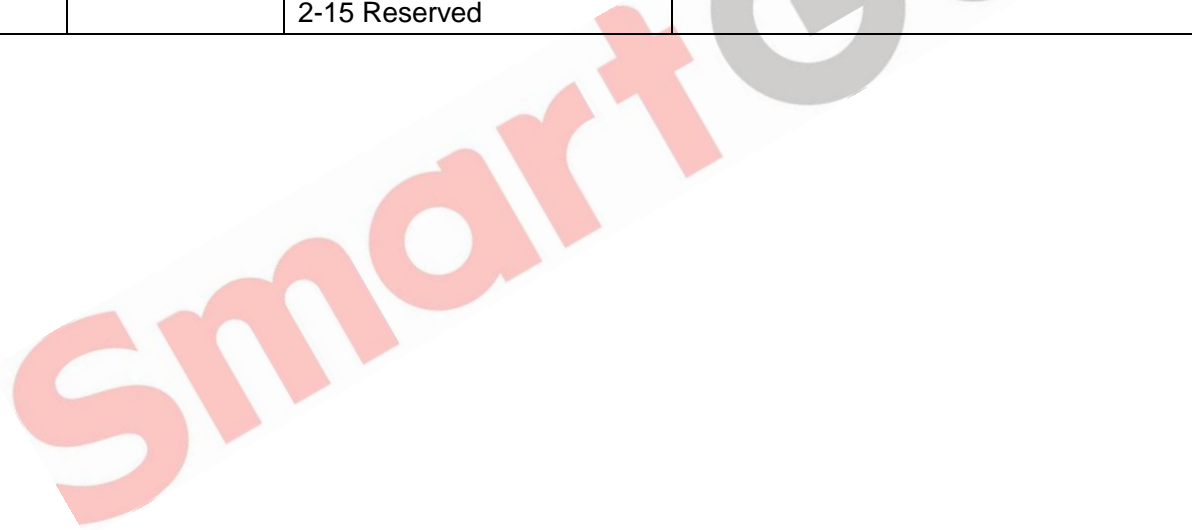
No.	Type	Content	Remark
1	Pressure Sensor	0 Not Used 1 Reserved 2 Custom Resistance Curve 3 VDO 10Bar 4 CURTIS 5 VOLVO-EC 6 DATCON 10Bar 7 SGX 8 SGD 9 SGH 10-15 Reserved	Defined resistance's range is 0~6kΩ, default is reserved.
2	Temp Sensor	0 Not Used 1 Reserved 2 Custom Resistance Curve 3 VDO 4 CURTIS 5 VOLVO-EC 6 DATCON 7 SGX 8 SGD 9 SGH 10 PT100 11-15 Reserved	Defined resistance's range is 0~6kΩ, default is reserved.



No.	Type	Content	Remark
3	Fuel Level Sensor	0 Not Used 1 Custom Resistance Curve 2 Reserved 3 SGD 4 SGH 5-15 Reserved	Defined resistance's range is 0~6kΩ, default is SGD sensor.

Table 21 Sensor Selection List (Current)

No.	Type	Content	Remark
1	Pressure Sensor	0 Not Used 1 Custom 4-20mA Curve 2-15 Reserved	Custom current type input current range is 0-20mA; default is reserved.
2	Temp. Sensor	0 Not Used 1 Custom 4-20mA Curve 2-15 Reserved	Custom current type input current range is 0-20mA; default is reserved.
3	Fuel Level Sensor	0 Not Used 1 Custom 4-20mA Curve 2-15 Reserved	Custom current type input current range is 0-20mA; default is reserved.



9 SENSORS SETTING

- When reselect sensors, the sensor curve will be transferred into the standard value. For example, if temperature sensor is SGH (120°C resistor type), its sensor curve is SGH (120°C resistor type); if select the SGD (120°C resistor type), the temperature sensor curve is SGD curve.
- When there is difference between standard sensor curves and using sensor, user can adjust it in “curve type” and input target curvilinear coordinate.
- When input the sensor curve, X value (resistor) must be input from small to large, otherwise, mistake occurs.
- The headmost or backmost values in the vertical coordinates can be set as same as below.
- For current type sensor, sensor curve is linear, and it only needs to set the coordinate of two points.

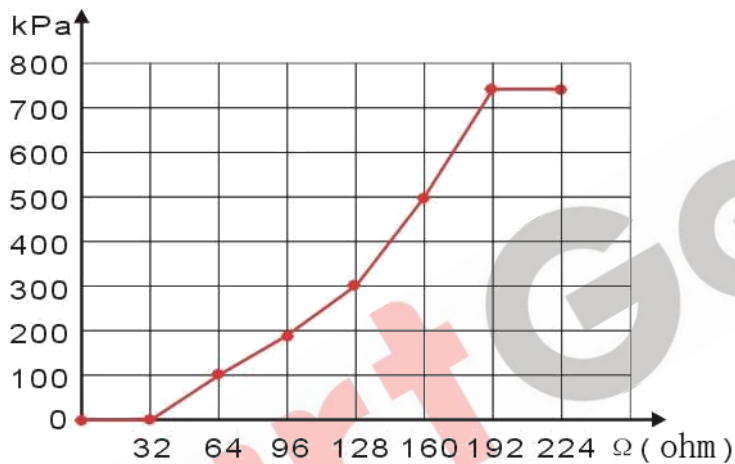


Fig. 5 Oil Pressure Sensor Curve

Table 22 Normal Pressure Unit Conversion Form

	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

10 TYPICAL APPLICATION

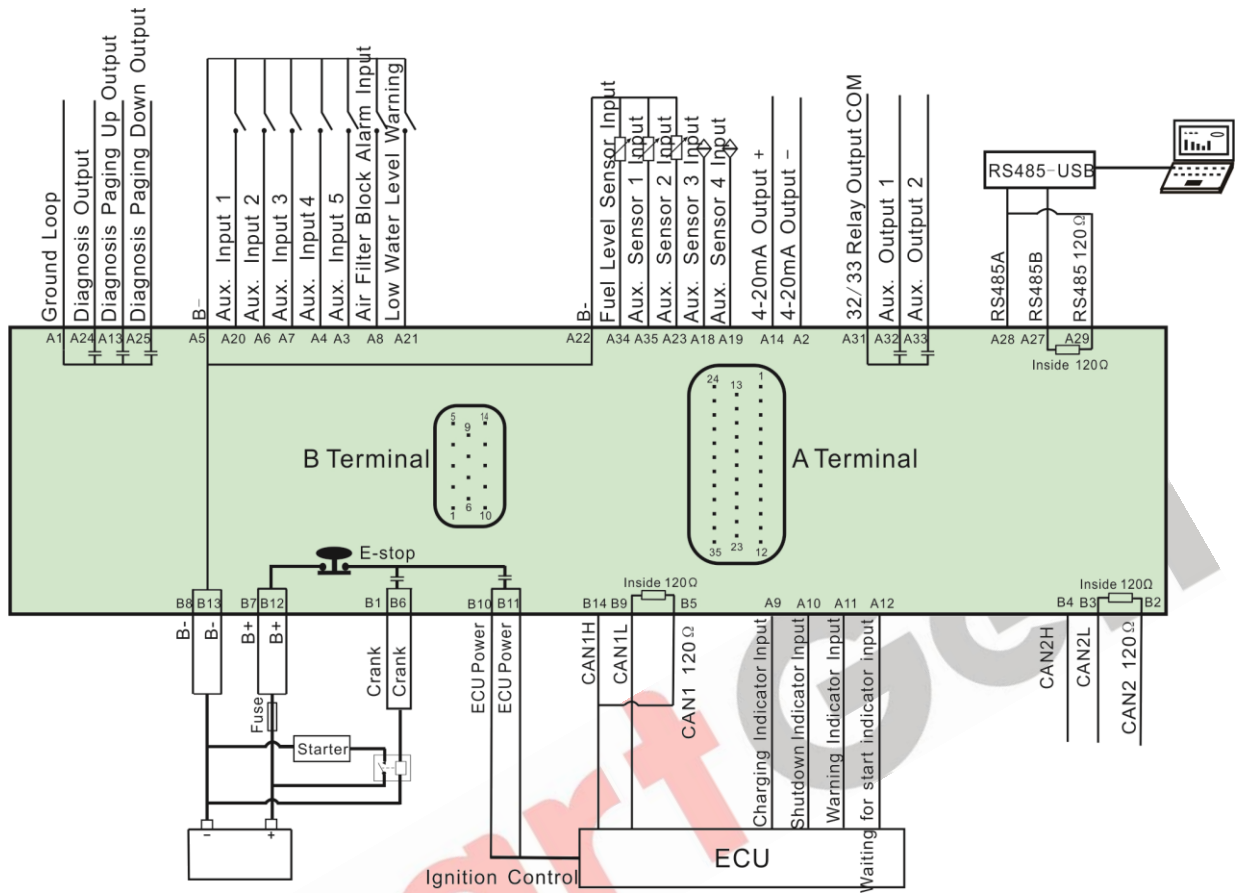


Fig. 6 HEM8500 Typical Diagram

11 INSTALLATION

11.1 FIXING CLIPS

- 1) The module is held into the panel fascia using the supplied fixing bolts.
- 2) Use 4 pieces of M4 screws and nuts fixed on the 4 corresponding screw holes.
- 3) Care should be taken not to over tighten the screws of fixing screws.

11.2 OVERALL DIMENSION AND PANEL CUTOUT

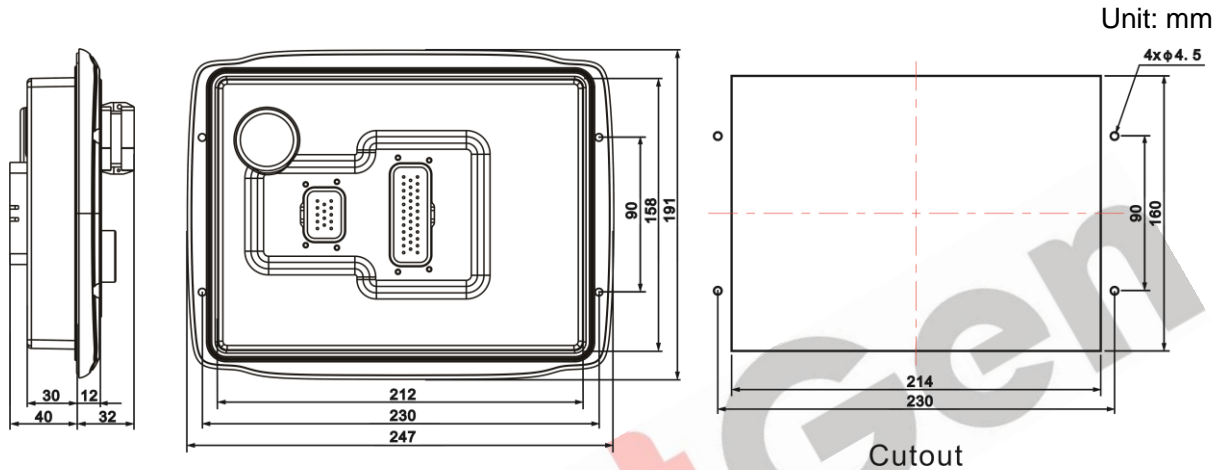


Fig. 7 Overall Dimensions and Panel Cutout

HEM8500 controller can suit for wide range of battery voltage DC (10~35) V. Negative of battery must be connected with the shell of starter. The wire's diameter of battery negative and positive, which is connected to B+ and B- of controller power must be over 2.5mm^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.

a) **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 expand relay's coils (when coils of relay has DC current) or, increase resistance-capacitance return circuit (when coils of relay has AC current), in order to prevent disturbance to controller or other's equipment.

b) **Withstand Voltage Test**

When controller had been installed in control panel, if it needs the high voltage test, please disconnect controller's all terminal connections, in order to prevent high voltage into controller and damage it.

12 CONNECTIONS OF CONTROLLER AND J1939 ENGINE

If CAN 1 needs to match 120Ω resistance, short connect outside CAN1 (H) and CAN1 120Ω, which is short connect B14 and B5.

12.1 CUMMINS QSL9

Suitable for CM850 engine control module.

Table 23 50-Pin Connector

Terminals of controller	50 pins connector	Remark
Aux. output 1	39	Configured to "Fuel Output";
Start relay output	-	Connected to starter coil directly;

Table 24 9-Pin Connector

Terminals of controller	9 pins connector	Remark
	SAE J1939 shield-E	CAN communication shielding line
CAN(H)	SAE J1939 signal-C	Using impedance 120Ω connecting line;
CAN(L)	SAE J1939 return-D	Using impedance 120Ω connecting line;

Engine type: Cummins-CM850.

12.2 CUMMINS QSX15-CM570

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

Table 25 50-Pin Connector

Terminals of controller	50 pins connector	Remark
Aux. output 1	38	Injection switch; Configured to "Fuel Output";
Start relay output	-	Connected to starter coil directly;

Table 26 9-Pin Connector

Terminals of controller	9 pins connector	Remark
	SAE J1939 shield-E	CAN communication shielding line;
CAN(H)	SAE J1939 signal-C	Using impedance 120Ω connecting line;
CAN(L)	SAE J1939 return-D	Using impedance 120Ω connecting line;

Engine type: Cummins QSX15-CM570.

12.3 CUMMINS GCS-MODBUS

It is suitable for GCS engine control module. Use RS485-MODBUS to read information of engine. Engine types are QSX15, QST30, QSK23/45/60/78 and so on.

Table 27 D-SUB Connector 06

Terminals of controller	D-SUB connector 06	Remark
Aux. output 1	5&8	Configured to "Fuel Output"; Outside expansion relay; at fuel output, make port 05 and port 08 of connector 06 connected.
Start relay output	-	Connected to starter coil directly;

Table 28 D-SUB Connector 06

Terminals of controller	D-SUB connector 06	Remark
RS485 GND	20	CAN communication shielding line (connected with ECU terminal only);
RS485+	21	Using impedance 120Ω connecting line;
RS485-	18	Using impedance 120Ω connecting line;

Engine type: Cummins-QSK-Modbus, Cummins- QST-Modbus, Cummins-QSX-Modbus.

12.4 CUMMINS QSM11

Table 29 Engine OEM Connector

Terminals of controller	OEM connector of engine	Remark
Aux. output 1	38	Configured to "Fuel Output";
Start relay output	-	Connected with starter coil directly;
	-	CAN communication shielding line
CAN(H)	46	Using impedance 120Ω connecting line;
CAN(L)	37	Using impedance 120Ω connecting line;

Engine type: General J1939.

12.5 DETROIT DIESEL DDEC III/IV

Table 30 Engine CAN Port

Terminals of controller	CAN port of engine	Remark
Aux. output 1	Expansion 30A relay, proving battery voltage for ECU;	Configured to "Fuel Output";
Start relay output	-	Connected to starter coil directly;
	-	CAN communication shielding line
CAN(H)	CAN(H)	Using impedance 120Ω connecting line;
CAN(L)	CAN(L)	Using impedance 120Ω connecting line;

Engine type: General J1939.

12.6 MTU ADEC (SMART MODULE)

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

Table 31 ADEC (X1 Connector)

Terminals of controller	ADEC (X1 port)	Remark
Aux. output 1	X1 10	Configured to "Fuel Output"; X1 9 shall connect negative of battery.
Start relay output	X1 34	X1 33 shall connect negative of battery.

Table 32 SMART (X4 Connector)

Terminals of controller	SMART (X4 port)	Remark
	X4 3	CAN communication shielding line
CAN(H)	X4 1	Using impedance 120Ω connecting line;
CAN(L)	X4 2	Using impedance 120Ω connecting line;

Engine type: mtu-ADEC.

12.7 MTU ADEC (SAM MODULE)

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

Table 33 ADEC (X1 Port)

Terminals of controller	ADEC (X1 port)	Remark
Aux. output 1	X1 43	Configured to "Fuel Output"; X1 28 shall connect negative of battery.
Start relay output	X1 37	X1 22 shall connect negative of battery.

Table 34 SAM (X23 Port)

Terminals of controller	SAM (X23 Port)	Remark
	X23 3	CAN communication shielding line
CAN(H)	X23 2	Using impedance 120Ω connecting line;
CAN(L)	X23 1	Using impedance 120Ω connecting line;

Engine type: General J1939.

12.8 SCANIA

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

Table 35 B1 Connector

Terminals of controller	B1 connector	Remark
Aux. output 1	3	Configured to "Fuel Output";
Start relay output	-	Connected to starter coil directly;
	-	CAN communication shielding line
CAN(H)	9	Using impedance 120Ω connecting line;
CAN(L)	10	Using impedance 120Ω connecting line;

Engine type: Scania.

12.9WEICHAI

It is suitable for Weichai BOSCH common rail engine.

Table 36 Engine Port

Terminals of controller	Engine port	Remark
Aux. output 1	1.40	Configured to "Fuel Output"; Connected to engine ignition lock;
Start relay output	1.61	
	-	
CAN(H)	1.35	Using impedance 120Ω connecting line;
CAN(L)	1.34	Using impedance 120Ω connecting line;

Engine type: GTSC1.

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



13 FAULT FINDING
Table 37 Fault Finding

Symptoms	Possible Solutions
Controller no response with power.	Check starting batteries; Check controller connection wirings; Check DC fuse.
Shutdown Alarm in running	Check related switch and its connections according to the information on LCD; Check programmable inputs.
Fail to Start	Check fuel oil circuit and its connections; Check starting batteries; Check speed sensor and its connections; Refer to engine manual.
Starter no response	Check starter connections; Check starting batteries.