SmartGen

MAKING CONTROL SMARTER

HEM8500

ENGINE CAN MONITORING CONTROLLER

USER MANUAL

郑州众智科技股份有限公司

SMARTGEN(ZHENGZHOU)TECHNOLOGY CO.,LTD.

SmartGen众智Chinese trademark

SmartGenEnglish trademark

SmartGen — make your generator *smart*

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Table 1 Software Version

Date	Version	Content
2020-04-23	1.0	Initial release.
2020-10-21	1.1	1. Modify the output port name of the controller in the example of J1939 connection between the controller and engine; 2. Add the example of connection between the controller and Weichai WISE15 electric-controlled engine.
2021-03-04	1.2	Add some function descriptions.
2022-07-28	1.3	1. Update the logo of SmartGen; 2. Add related functions for input port; 3. Add description of "Clutch Control Output "for output port; 4. Add descriptions for some protection settings (ECU) and other functions.

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.

CONTENTS

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).

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 starting battery voltage environments;

━ There is rubber seal ring between shell and control panel. IP65 protective level can be achieved.

3 SPECIFICATION

Table 3 Technical Parameters

Parameter	Details
Working Voltage	DC10. 0V to 35. 0V continuous power supply
Overall Consumption	<5W (Standby mode: ≤3.5W)
Starter 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;
Analog Sensor	Aux. Sensor 1, Aux. Sensor 2, Fuel Level Sensor Resistance Input Range: 0~6000Ω Resolution: 0.1 Accuracy: 1Ω (below 300Ω) Aux. Sensor 3, and Aux. Sensor 4 Current Input Range: 0~20mA Resolution: 0.01mA Accuracy: 1%
Case Dimension	247mm × 191mm × 72mm
Panel Cutout	214mm × 160mm
Mounting Screw Dimension	4 × M4
Working Temperature	(-25~+70)°C
Working Humidity	(20~93)%RH
Storage Temperature	(-30~+80)°C
Protection Level	IP65 front panel
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	Stop the running engine; Reset shutdown alarms when engine alarms occur.
Start	Start	Start engine in standby status.
Power	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.
→0	Subtotal Zero	Press it for 3s and "subtotal time", "subtotal fuel consumption" and "subtotal avg. fuel consumption" become "0".
Home/Set	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	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	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 HEM8500 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, after entering boot password, controller will get into normal running interface as bellow:

Please enter boot password ***	Initial boot password is 000, which can be changed in password setting page of module setting interface. Through [↓] [↑] keys to choose numbers, and use [⌂/⚙] key to set next number. Press [⌂/⚙] key after three password numbers finished to enter into the normal display interface.
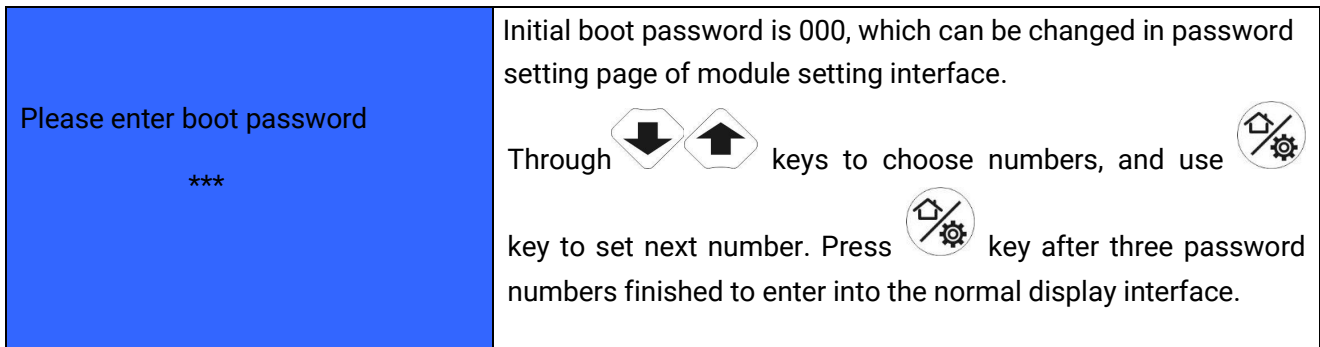
Fig. 2 Start Interface

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 voltage	Controller gathered battery voltage
Inst. FC 1L/h	Engine instant fuel consump.	ECU data analysis
Accum. FC 25L	Engine total fuel consump.	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 accum. 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 diesel 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
Outlet Temp 25°C	Outlet temp display	ECU data analysis

Turbo Pressure	100kPa	Turbo 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 engine 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 PARARMETER 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)

>Return >Module >Timers >Engine >Sensor >Inputs >Outputs >4~20mA Output	Screen 1: Use ⬇ ⬆ to change settings and ⚙ to enter settings (Screen 2).
>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)

>Return >Module >Timers >Engine >Sensor >Inputs >Outputs >4~20mA Output >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 2: Use ⬇⬆ to change settings and ⚙ to enter settings (Screen 3).

Table 9 Parameter Setting Example (Screen 3)

>Return >Pre-heat Delay >Cranking Time >Crank Rest Time >Safety On Delay >Cooling Time >ETS Solenoid Hold >Fail to Stop Delay >Power Off Delay 00010s	Screen 3: Use ⬇⬆ to change settings and ⚙ to enter settings (Screen 4).

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 00010s	Screen 4: Use ⬇⬆ to change settings and ⌂/⚙ to move setting numbers and confirm setting data.

⚠**NOTE:** press 🔴 and it can exist parameter settings directly.

5.3 START/STOP OPERATION

a) Press start key, then engine is cranking;

b) "Preheat Delay XX s" information will be displayed on LCD;

c) After the preheat delay, Starter relay is engaged. If the engine fails to fire during this cranking attempt then the Starter 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,

Speed	800 r/min
Torque	20%
Coolant Temp	35°C
Oil Pressure	100kPa
Battery Voltage	24.5V
Inst. FC	1L/h
Accum. FC	25L
Subtotal FC	25L
Total Time	2:18:25
Subtotal Time	2.3
Manual throttle is active.	
Target Speed	800r/min
At Rest	

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 OPERATION

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.

6   PROTECTION

6.1 WARNINGS

When controller detects warning alarms, it only sends warnings but not shuts down the engine, 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	Aux. Sensor 1~2 Open Circuit	After sensors are enabled, when controller detects corresponding sensor is open circuit. It will initiate a warning alarm.
9	Aux. 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	Aux. Sensor 1~2 Low	After sensors are enabled, When the controller detects that the sensor value has fallen below the pre-set lower limit value, it will initiate a warning alarm.
11	Aux. Sensor 3~4 Open Circuit (current type)	After sensors are enabled, When the controller detects the sensor is open, it will issue corresponding sensor open warning signal.
12	Aux. Sensor 3~4 High (current type)	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	Aux. Sensor 3~4 Low (current type)	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 digital input port is set as warning and the alarm is active, it will initiate a warning alarm.

No	Type	Description
15	Air Filter Block	When air 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.
18	High Temp (ECU)	When controller detects that the ECU temperature is above the pre-set upper limit of warning value, it will initiate a warning signal.
19	Low OP (ECU)	When controller detects that the oil pressure is below the pre-set lower limit of warning value, it will initiate a warning signal.

6.2 SHUTDOWN ALARMS

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

⚠**NOTE:** When shutdown alarm inhibition enables, for No. 1~9, when shutdown alarms occur for controller, it only displays shutdown alarm information, but not control ECU shutdown; if stop is needed please press stop button. No. 10 controls ECU shutdown; when shutdown alarm inhibition disables, shutdown alarms occur for controller, , it will control ECU shutdown.

Table 12 Shutdown Alarms

No.	Type	Description
1	ECU Shutdown	When the controller received engine shutdown signals via J1939, it will initiate a shutdown alarm signal and fault code and name will be displayed.
2	ECU Comm. Failure	When the engine start up but controller didn't via J1939 receive engine shutdown signals, it will initiate a shutdown alarm signal.
3	Aux. 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 shutdown alarm signal.
4	Aux. 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 shutdown alarm signal.
5	Aux. Sensor 3~4 High Shutdown (current type)	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	Aux. Sensor 3~4 Low Shutdown (current type)	After sensors are enabled, when controller detects sensor value has fallen below the pre-set lower 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 shutdown alarm signal.
8	High Temp Shutdown (ECU)	when controller detects the ECU temperature is above the pre-set upper shutdown value, it will initiate high temperature shutdown alarm signal.
9	Low OP Shutdown (ECU)	when controller detects oil pressure has fallen below the pre-set lower shutdown value, it will initiate low oil pressure shutdown alarm signal.
10	Emergency Stop	When it is active, starting 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 Panel)			
1	Ground Loop	1.0mm²	ECU ground loop
2	4~20mA Output-	1.0mm²	4~20mA output negative
3	Aux. Input 5	1.0mm²	Discrete input port
4	Aux. Input 4	1.0mm²	Discrete input port
5	GND	1.0mm²	GND
6	Aux. Input 2	1.0mm²	Discrete input port
7	Aux. Input 3	1.0mm²	Discrete input port
8	Air Filter Block Alarm Input	1.0mm²	Air filter block alarm input
9	Charging Indicator Input	1.0mm²	Discrete input port
10	Shutdown Indicator Input (red light)	1.0mm²	Discrete input port
11	Warning Indicator Input (yellow light)	1.0mm²	Discrete input port
12	Waiting for Start Indicator Input	1.0mm²	Discrete input port
13	Diagnosis Paging Up Output	1.0mm²	Output port control
14	4~20mA Output+	1.0mm²	4~20mA output positive
15	NC	1.0mm²	NC
16	GND	1.0mm²	GND
17	NC	1.0mm²	NC
18	Aux. Sensor 3 Input (4~20mA)	1.0mm²	Analog input port
19	Aux. Sensor 4 Input (4~20mA)	1.0mm²	Analog input port
20	Aux. Input 1	1.0mm²	Discrete input port
21	Low Water Level Warning	1.0mm²	Low water level input port
22	GND	1.0mm²	GND
23	Aux. Sensor 2 Input	1.0mm²	Analog input port
24	Diagnosis Output	1.0mm²	Output after diagnosis is active
25	Diagnosis Paging Down Output	1.0mm²	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 starting 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 starting 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 PARAMETER SETTING

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.
9	Wake Up Timeout	(0~3600) s	20	When engine status is in normal running, no active delay time of wake up input has been detected.
Engine Settings				
1	Engine Type	(0~39)	1	Default: Common ECU Engine. When connected to J1939 engine, choose the corresponding type.
2	SPN Alarm Version	(1~3)	1	Selection for SPN alarm version.
3	Start Attempts	(1~30) times	1	Max. crank times. When reach this number, controller will send start failure signal.
4	Disconnect Speed	(1~1000) r/min	350	When engine 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 /under voltage.
6	Battery Over Volt Warn	(0~200) %	125	When battery volt is higher than preset volt percentage, controller will send battery voltage high warning alarm.
7	Battery Under Volt Warn	(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.	0~3000 r/min	2500	The max engine speed of throttle can be

No.	Items	Parameters	Defaults	Description
	Speed			adjusted.
10	Throttle Resolution	0~100 r/min	50	Resolution of the throttle knob each turn of a grid.
11	SPN Alarm Mask Code 1	(0~65535)	0	It is can shield corresponding SPN alarm.
12	SPN Alarm Mask Code 2	(0~65535)	0	It is can shield corresponding SPN alarm.
13	SPN Alarm Mask Code 3	(0~65535)	0	It is can shield corresponding SPN alarm.
14	ECU Comm. Failure Action	(0~1)	0	0: Warning; 1: Shutdown
15	Alt. Config. 1 Speed	(0~3000)r/min	1500	Alt. configuration 1 speed associated with alt. configuration 1 of input port.
16	Alt. Config. 2 Speed	(0~3000)r/min	1500	Alt. configuration 2 speed associated with alt. configuration 2 of input port.
17	Alt. Config. 3 Speed	(0~3000)r/min	1500	Alt. configuration 3 speed associated with alt. configuration 3 of input port.
18	External Crank Set	(0-1)	0	0: Disable; 1: Enable
19	ECU Comm. Address	(0-255)	7	It is used for setting ECU communication address.
20	Shutdown Alarm Inhibition	(0-1)	1	0: Disable; 1: Enable When it enables, only emergency stop and emergency shutdown of input port can stop.
21	Speed control step	(0~1000)r	266	The step length of each increasing speed.
22	Speed Control Slope	(0~1000)r/s	100	The increasing number of speed per second.
23	RP Speed Control Enable	(0-1)	0	0: Disable; 1: Enable When the speed adjustment of potentiometer enables and the throttle switch is active to realize potentiometer speed regulation.
24	RP Start Resistance	(0~5000) Ω	0	The Initial resistance value of potentiometer.
25	RP Max. Resistance	(0~5000) Ω	1000	The max. resistance value of potentiometer.
26	RP Sensor Select	(0~2)	0	0: Not Used; 1: Flexible Sensor 1; 2: Flexible Sensor 2.
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

No.	Items	Parameters	Defaults	Description
				2: Traditional Chinese
3	Password	(0~9999)	00318	For entering advanced parameters setting.
4	Oil Filter 1st Time Maintenance	(1~5000) h	200	First maintenance time of oil filter setting.
5	Oil Filter Maintenance Time	(1~5000) h	250	Oil filter's normal maintenance interval setting.
6	Diesel Filter 1st Time Maintenance	(1~5000) h	200	First maintenance time of filters setting.
7	Diesel Filter Maintenance Time	(1~5000) h	250	Diesel filter's 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.
11	Boot Screen Enable	(0-1)	0	0: Disable; 1: Enable
12	Mode Selection	(0-1)	0	0: Local Mode; 1: Remote Mode
Fuel Level Sensor				
1	Curve Type	(0~15)	3	SGD
2	Low Level Warning	(0~100) %	10	When the value of external 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 level sensor is below preset warning value, controller will initiate corresponding alarm.
Aux Sensor 1~2				
1	Sensor Type	(0~3)	0	0: Not used 1: Pressure 2: Temp 3: Liquid Level
2	Curve Type	(0~15)	0	Changed according to sensor type. Sensor types details please to see Table 20.
3	Alarm Speed Setting	(0~3000) r/min	1200	When controller detects engine speed exceeds preset alarm 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	(0~400)	0	Sensor lower limit shutdown value setting.

No.	Items	Parameters	Defaults	Description
	Value			
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.
Aux 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	Alarm Speed Setting	(0~3000) r/min	1200	When controller measures engine speed is above preset 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.
6	Stop Delay	(0~3600) s	5	Setting of sensor upper limit shutdown 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.
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.

No.	Items	Parameters	Defaults	Description
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.
High Temperature Protection Setting (ECU)				
1	Alarm Speed Set	(0~3000)r/min	1200	The system starts to alarm when the controller measures the engine speed is above the preset alarm speed.
2	Upper Limit Shutdown Enable	(0~1)	0	The upper limit shutdown enable set of high ECU temperature.
3	Upper Limit Shutdown Value	(0~300)	98	The upper Limit shutdown value of high ECU temperature.
4	Stop Delay Time	(0~3600)s	5	The stop delay time of high ECU temperature.
5	Upper Limit Warn Enable	(0~1)	0	The upper limit warn enable set of high ECU temperature.
6	Upper Limit Warn Value	(0~300)	92	The upper limit warn value of high ECU temperature.
7	Upper Limit Warn Return Value	(0~300)	85	The upper limit warn return value of high ECU temperature.
8	Warn Delay	(0~3600)s	2	The upper limit warn delay value of high ECU temperature.
Low OP Protection Setting (ECU)				
1	Alarm Speed Set	(0~3000)r/min	1200	The system starts to alarm when the controller measures the engine speed is above the preset alarm speed.
2	Lower Limit Shutdown Enable	(0~1)		The lower limit shutdown enable set of low ECU oil pressure.
3	Lower Limit Shutdown Value	(0~1000)		The lower Limit shutdown value of low ECU oil pressure.
4	Stop Delay Time	(0~3600)s		The stop delay time of low ECU oil pressure.
5	Lower Limit Warn Enable	(0~1)		The lower Limit warn enable set of low ECU oil pressure.
6	Lower Limit Warn Value	(0~1000)		The lower limit warn value of low ECU oil pressure.
7	Lower Limit Warn Return Value	(0~1000)		The lower limit warn return value of low ECU oil pressure.
8	Warn Delay	(0~3600)s		The lower limit warn delay value of low ECU oil pressure.
Digital Input Ports				
Digital Input Port 1				
1	Content Setting	(0~50)	0	Not used.
2	Active Type	(0~1)	0	0: Close; 1: Open

No.	Items	Parameters	Defaults	Description
Digital Input Port 2				
1	Content Setting	(0~50)	0	Not used.
2	Active Type	(0~1)	0	0: Close; 1: Open
Digital Input Port 3				
1	Content Setting	(0~50)	0	Not used.
2	Active Type	(0~1)	0	0: Close; 1: Open
Digital Input Port 4				
1	Content Setting	(0~50)	0	Not used.
2	Active Type	(0~1)	0	0: Close; 1: Open
Digital Input Port 5				
1	Content Setting	(0~50)	0	Not used.
2	Active Type	(0~1)	0	0: Close; 1: Open
Relay Outputs				
Relay Output 1				
1	Content Setting	(0~50)	0	Not used.
2	Active Type	(0~1)	0	0: Normally Open; 1: Normally Close
Relay Output 2				
1	Content Setting	(0~50)	0	Not Used
2	Active Type	(0~1)	0	0: Normally Open; 1: Normally Close
4~20mA Output				
1	4~20mA Output	(0~2)	1	0: Not Used 1: Custom Speed Curve 2: Custom Torque Curve

8.2 DEFINABLE CONTENTS OF PROGRAMMABLE OUTPUT PORTS 1~2

Table 15 Definable Contents of Programmable Output Ports 1~2

No.	Type	Description
0	Not Used	
1	User Configured	See *Table 16 Users-defined Functions of Programmable Output Ports*
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	Starter Relay Output	Output when controller starts up.
6	Fuel Relay Output	When fuel outputs, the relay outputs; when ETS outputs, the relay stops outputting.
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.

No.	Type	Description
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	Output after engine crank successfully.
22	Normal Running Output	Output after engine running normally.
23	ECU Comm. Failure	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.
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 Warning	Warning alarm outputs when flexible sensor 1 is open circuit.
33	Sensor 1 Warning	Warning alarm outputs when flexible sensor 1 is high/low.
34	Sensor 1 Shutdown	Shutdown alarm outputs when flexible sensor 1 is high/low.
35	Sensor 2 Open Warning	Warning alarm outputs when flexible sensor 2 is open circuit.
36	Sensor 2 Warning	Warning alarm outputs when flexible sensor 2 is high/low.
37	Sensor 2 Shutdown	Shutdown alarm outputs when flexible sensor 2 is high/low.
38	Fuel Level Sensor Open Warning	Warning alarm outputs when fuel level sensor is open circuit.
39	Fuel Level Sensor Warning	Warning alarm outputs when fuel level is low.
40	Reserved	Reserved
41	Sensor 3 Open 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 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	Clutch Control Output	After the wake-up delay is over, the clutch control outputs; when gear position input is active, the clutch control will disconnect output.
48~50	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	Active Speed	0~2000r/min	
4	Delay Output Time	(0~100.0) s	
5	Output Time	(0~3600) s	

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

8.3 DEFINABLE CONTENTS OF PROGRAMMABLE INPUT PORTS

Table 17 Input Port Function List

No.	Type	Description
0.	Not Used	
1.	User Defined	Details to *Table 18 User-defined Functions of Programmable Input Ports.*
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.	Reserved	Reserved
11.	Reserved	Reserved
12.	Simulate Stop Key	When the simulate stop key is active, it will stop.
13.	Simulate Start Key	When the simulate start key is active, it will start.
14.	Reserved	
15.	Reserved	
16.	Reserved	
17.	Emergency Stop Alarm	When input is active, it can execute stop process.
18.	Reserved	
19.	Remote Start/Stop	When input is active, it will start; when inactive, it will stop.
20.	Reserved	
21.	Reserved	
22.	Alt. Config. 1 Active	When it is active, speed cannot be adjusted, constant for Alt. config. 1 speed.
23.	Alt. Config. 2 Active	When it is active, speed cannot be adjusted, constant for Alt. config. 2 speed.
24.	Alt. Config. 3 Active	When it is active, speed cannot be adjusted, constant for Alt. config. 3 speed.
25.	Reserved	
26.	Reserved	
27.	Simulate Gear Button	When engine type selects 13.VOLVO-EMS 2.4 and the manual throttle is active, short press by this input port to increase the engine speed according to (speed control step and slope). Long press and hold it for more than 4s to return to idle speed value.

No.	Type	Description
28.	N Position Input	Only when the neutral input is active, the unit is allowed to start; and non-neutral gear is not allowed (input port configuration). Otherwise, the panel button can start normally.
29.	Wake-up Input	When the engine speed is greater than the initial speed of the throttle, the engine will run normally, and within the set wake-up delay time, the wake-up input is detected within the set time, the engine is in normal state.
30.	Regeneration Inhibition	When engine type selects 13.VOLVO-EMS 2.4, the corresponding ID is sent after processing to prohibit regenerative output.
31.	Manual Regeneration	When engine type selects 13.VOLVO-EMS 2.4, the corresponding ID is sent after processing to manually regenerate the output.
32~50	Reserved	Reserved

Table 18 User-defined Functions of Programmable Input Ports

No.	Item	Content	Remark
1	Setting	(0~50)	See *Input Port Function List*
2	Active Type	(0~1)	0: Close to activate 1: Open to activate
3	Active Speed	(0~2500) r/min	Alarm is active when speed exceeded this threshold.
4	Active 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.
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

a)   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.

b)   When there is difference between standard sensor curves and using sensor, user can adjust it in "curve type" and input target curvilinear coordinate.

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

d)   The headmost or backmost values in the vertical coordinates can be set as same as below.

e)   For current type sensor, sensor curve is linear, and it only needs to set the coordinate of two points.
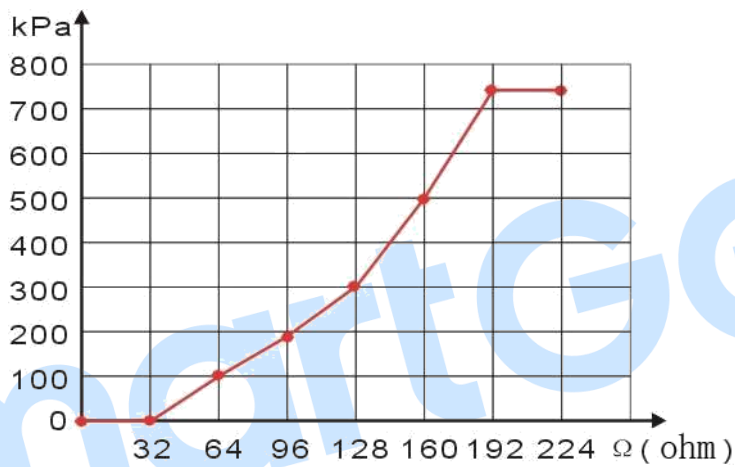
Fig. 5 Oil Pressure Sensor Curve

Table 22 Normal Pressure Unit Conversion Form

Item	N/m^2 (pa)	kgf/cm^2	bar	psi
1Pa	1	1.02×10^{-5}	1×10^{-5}	1.45×10^{-4}
1kgf/cm^2	9.8×10^4	1	0.98	14.2
1bar	1×10^5	1.02	1	14.5
1psi	6.89×10^3	7.03×10^{-2}	6.89×10^{-2}	1

Fig. 6 HEM8500 Typical Application Diagram

11 INSTALLATION

11.1 INSTALLATION METHOD

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.
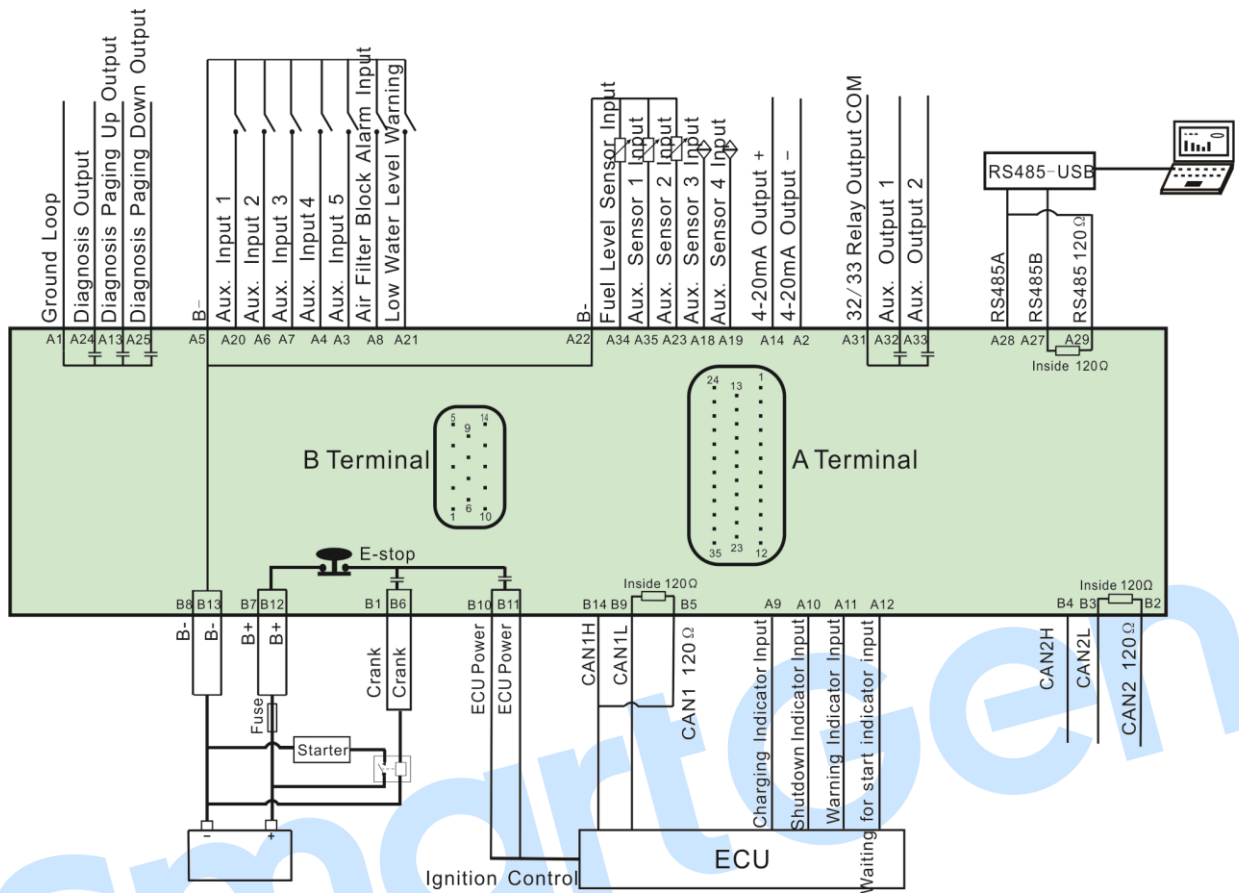
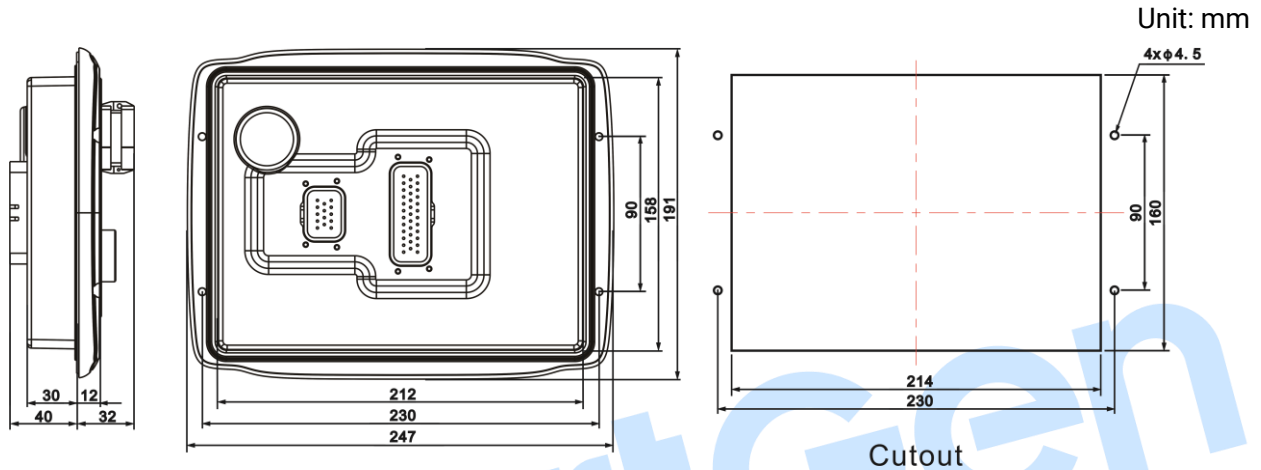### 11.2 OVERALL DIMENSION AND PANEL CUTOUT

Unit: mm

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 engine. 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 individually 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 have DC current) or, increase resistance-capacitance return circuit (when coils of relay have 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

It is suitable for CM850 engine control module.

Table 23 50-Pin Connector

Terminals of controller	50 pins connector	Remark
ECU Power	39	
Starting 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
ECU Power	38	Injection switch;
Starting 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 -CM570.

12.3 CUMMINS QSM11

Table 27 Engine OEM Connector

Terminals of controller	OEM connector of engine	Remark
ECU Power	38	
Starting 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: common ECU.

12.4 DETROIT DIESEL DDEC III/IV

Table 28 Engine CAN Port

Terminals of controller	CAN port of engine	Remark
ECU Power	Expansion 30A relay, proving battery voltage for ECU.	
Starting 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: common ECU.

12.5 MTU ADEC (SMART MODULE)

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

Table 29 ADEC (X1 Port)

Terminals of controller	ADEC (X1 port)	Remark
ECU Power	X1 10	X1 9 shall connect negative of battery.
Starting Relay Output	X1 34	X1 33 shall connect negative of battery.

Table 30 SMART (X4 Port)

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.

12.6 MTU ADEC (SAM MODULE)

It is suitable for MTU engine with ADEC (ECU7) and SAM module.

Table 31 ADEC (X1 Port)

Terminals of controller	ADEC (X1 port)	Remark
ECU Power	X1 43	X1 28 shall connect negative of battery.
Starting Relay Output	X1 37	X1 22 shall connect negative of battery.

Table 32 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: Common ECU.

12.7 SCANIA

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

Table 33 B1 Connector

Terminals of controller	B1 connector	Remark
ECU Power	3	
Starting 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.

12.8 WEICHAI

It is suitable for Weichai BOSCH common rail electric-controlled engine.

Table 34 Engine Port

Terminals of controller	Engine port	Remark
ECU Power	1.40	Connected to engine ignition lock.
Starting 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.

It is suitable for Weichai WISE15 electric-controlled engine.

Table 35 Engine Port

Terminals of controller	Engine port	Remark
ECU Power	1.59	Connected to engine ignition lock.
Starting relay output	1.58	
CAN_SCR	-	CAN communication shielding line.
CAN(H)	1.42	Using impedance 120Ω connecting line.
CAN(L)	1.43	Using impedance 120Ω connecting line.

Engine type: GTSC1.

⚠**NOTE:** If there is any problem in the communication between the controller and ECU, please contact our service personnel.

13 FAULT FINDING

Table 36 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 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.

_____