

# SmartGen

MAKING CONTROL SMARTER

## HEM4300 ENGINE CONTROLLER USER MANUAL



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**Table 1 Software Version**

Date	Version	Note
2022-03-10	1.0	Original release.
2023-09-01	1.1	1. Add descriptions of post processing function of CUMMINS engine; 2. Add descriptions of proportional valve control function, module type setting, high torque protection setting and other functions.
2023-12-06	1.2	Modify terminal description errors in Table 9.
2023-12-21	1.3	1. Modify the figure of front panel; 2. Modify terminal numbers in typical application diagram; 3. Add functions of under speed warn, overload control and ECU communication failure action setting.

**Table 2 Notation Clarification**

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

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## 1 OVERVIEW

**HEM4300 Engine Controller** is used for electronic engine control and data display to realize engine start/stop, speed control, data measurement, maintenance, alarm protection and “four remotes” (remote control, remote measurement, remote adjusting, remote communication). It adopts color LCD, which can display Chinese, English and other languages. The engine working parameters can be visually displayed on the screen. It is easy and reliable to run.

**HEM4300 Engine Controller** applies 32-bit micro-processor technology, which can realize functions of precise measurement for many parameters, set-point adjustment, timing and threshold setting etc. A majority of parameters can be adjusted from the control panel. All parameters can be adjusted and monitored on PC by RS485 or USB port. It can be widely used for various engineering machinery automation system like jumbo, crushing plant, tunnel tractor, air compressor, hydraulic power station, mining machinery with compact structure, simple wiring, high protection level and high reliability.

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## 2 PERFORMANCE AND CHARACTERISTICS

- 32-bit ARM SCM, high hardware integration;
- 4.3-inch color LCD display with resolution 480x272, adjustable backlight; Optional Chinese, English and other languages, which is convenient for commissioning;
- Silicon and hard screen acrylic front panel;
- CANBUS port can connect ECU with J1939, which not only can monitor ECU common data (speed, water temperature, oil pressure, fuel consumption etc.), but also can realize engine start, stop, raise speed and drop speed;
- With 6-way analog sensors, 3 ways are fixed resistance type, 3 ways can be flexibly configured as resistance, current or voltage type;
- Multiple temperature, pressure, level and vibration sensor curves can be used directly, and custom sensor curve is available;
- Precisely collect all kinds of engine parameters including speed, water temperature, oil pressure, battery voltage, charger voltage, accumulated start time and start times. Complete protection functions that provide high water temperature, low oil pressure, over speed protection etc.;
- With aftertreatment SCR air inlet temperature, outlet temperature, urea level detection functions; with aftertreatment DPF regeneration status display and manual regeneration control function, suitable for engines that meet the China IV emission standard of non-road mobile machinery;
- Optional four speed control modes (key/potentiometer/throttle/key + throttle), which can meet different speed control demands of engineering machinery;
- Various start/stop control methods can realize controller key start/stop, remote start/stop of input port, external key start/stop, which can meet various control demands of engineering machinery;
- With idle/high speed transfer function and high speed value can be memorized, which is convenient for returning to last adjusted speed;
- With 2-way PWM output, which can realize drive control of hydraulic proportional valve in engineering machinery;
- With jumbo lever control logic that can realize manual lever control;
- With 8-way digital outputs, all ports are transistor active output with over voltage, over current, over temperature protection function;
- With 8-way digital inputs, all ports can be separately configured as low/high electric level active, wiring is flexible;
- With RS485 communication port that can flexibly configure whether 120Ω resistor is matched internally;
- Three crank disconnect conditions (speed, oil pressure, speed + oil pressure) are optional;
- Wide power supply range DC (8~35V), which can suit for different starting battery voltage environment;
- Event log function can record up to 200 pieces of log and record engine speed, water temperature, oil pressure, battery voltage, loading status, other detailed data and SPN code of ECU alarm;
- Heater, cooler and fuel pump control functions;
- Up to 15 maintenance records function; maintenance name can be configured;
- Sealing gasket is designed for enclosure and IP65 whole protection class;
- With embedded-in panel installation and holder mount;
- Modular design, anti-flaming plastic shell, pluggable waterproof terminals, compact structure and easy installation.

3 SPECIFICATION

Table 3 Technical Parameters

Items	Contents
Operating Voltage	DC8V~DC35V, DC reverse connection protection
Battery Voltage	Resolution: 0.1V Accuracy: 1%
Power Consumption	<5W (Standby mode: ≤3W)
Analog Sensor	Resistance Input Range: 0Ω ~ 6000Ω Resolution: 0.1Ω Accuracy: 1Ω (below 300Ω)
	Voltage Input Range: 0V ~ 5V Resolution: 0.01V Accuracy: 1%
	Current Input Range: 0mA ~ 20mA Resolution: 0.01mA Accuracy: 1%
Digital Output 1~8	Transistor active output, rated 4A.
Digital Input 1~8	Low active: low on threshold voltage below 1.2V, max input voltage is 60V; High Active: high on threshold voltage over 1.8V, max input voltage is 60V.
RS485	Isolated, half-duplex, 9600 baud rate, max. communication distance is 1000m.
MSC CAN	Isolated, max. communication distance is 250m, using Belden 9841 cable or equivalence.
CE-EMC Certificate	EN 55032, EN 55024
Vibration	5Hz~8Hz, amplitude=±17mm 8Hz~100Hz, a=4g 100Hz~500Hz, a=2g IEC 60068-2-6
Shock	50g, 11ms, half-sine, complete shock test from three mutual perpendicular directions, and 18 times shock for each test IEC 60068-2-27
Bump	25g, 16ms, half-sine IEC 60255-21-2
Safety Requirement	According to EN 61010-1 installation category (over voltage category) III, 300V, pollution class 2, altitude 3000m.
Case Dimensions	189mm x 131mm x 61mm
Working Temperature	(-30~+70)°C
Working Humidity	(20~93)%RH
Storage Temperature	(-40~+80)°C
Protection Level	IP65





























Items	Contents
Weight	0.35kg

## 4 OPERATION

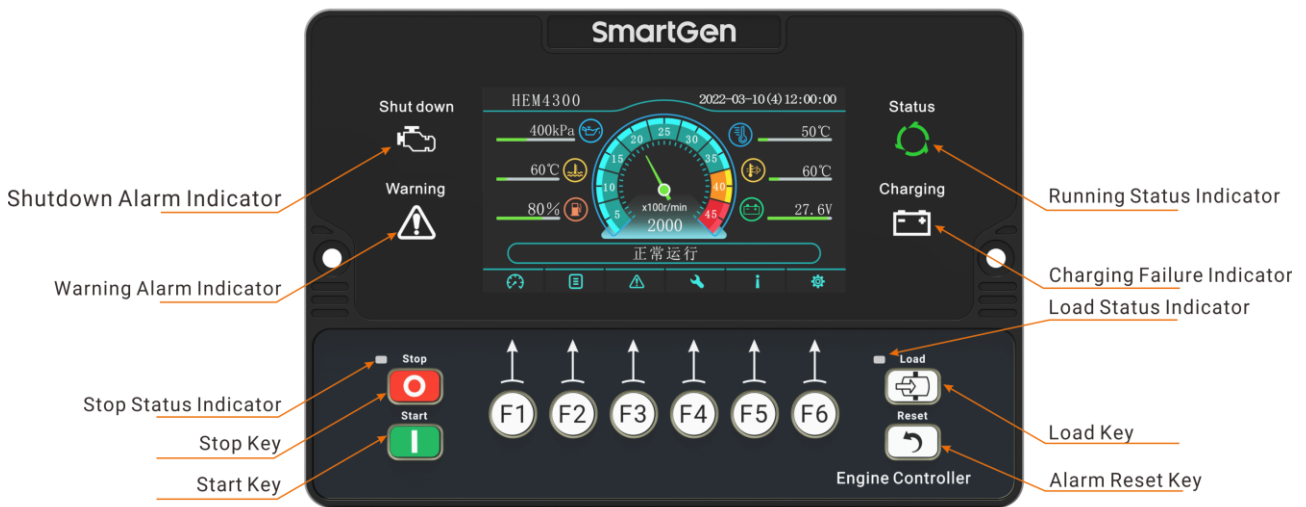
### 4.1 KEY FUNCTION DESCRIPTION

**Table 4 Key Description**

Icon	Key	Description
	Stop	<ol style="list-style-type: none"> <li>1. Stop the running engine at control mode;</li> <li>2. Press it for 3s or longer, test whether panel indicators are normal (lamp test);</li> <li>3. Press it again in stop process and controller can be stopped faster.</li> </ol>
	Start	Pres it to start engine in control mode.
	Load	During start idle and normal running, load outputs after pressing it; press again, load disconnects.
	Alarm Reset	Press it can quickly enter alarm page; press again, alarm is reset. After that, press it to exit alarm page.
	F1	<p>In main interface , press it to enter speed control mode;</p> <p>In speed governor interface , press it to exit speed control mode;</p> <p>In other interface , it is Up/Increase key.</p> <ol style="list-style-type: none"> <li>1. Scroll up;</li> <li>2. Move up cursor or increase the value in setting menu.</li> </ol>
	F2	<p>In main interface , press it to enter engine details page;</p> <p>In other interface , it is Down/Decrease key.</p> <ol style="list-style-type: none"> <li>1. Scroll down;</li> <li>2. Move down cursor or decrease the value in setting menu.</li> </ol>
	F3	<p>In main interface , press it to enter alarm page;</p> <p>In speed governor interface , press it to raise speed;</p> <p>In other interface , it is Left key.</p> <ol style="list-style-type: none"> <li>1) Page scroll;</li> <li>2) Left move the cursor in setting menu.</li> </ol>
	F4	<p>In main interface , press it to enter maintenance page;</p> <p>In speed governor interface , press it to drop speed;</p> <p>In other interface , it is Right key.</p> <ol style="list-style-type: none"> <li>1) Page scroll;</li> <li>2) Right move the cursor in setting menu.</li> </ol>
	F5	<p>In main interface , press it to enter About page;</p> <p>In other interface , it is Confirm key that confirms set information.</p>
	F6	<p>In main interface , press it to enter parameter setting menu;</p> <p>In main interface , press it to return homepage;</p> <p>In other interface , it is Exit key that can return to previous menu in setting.</p>

**NOTE:** Press any key to mute alarms in main interface.

## 4.2 CONTROLLER PANEL



**Fig.1 HEM4300 Front Panel Description**

**NOTE:** Indicators description.

**Table 5 Indicators Description**

Type	Description
Stop Alarm Indicator	Red, fast flashes (5 times/s)
Warning Alarm Indicator	Yellow, slow flashes (1 times/s)
Running Status Indicator	Green, always illuminates after safety running
Charging Failure Indicator	Red, always illuminates after charging failure
Stop Status Indicator	Red, always illuminates in stop status
Load Status Indicator	Red, always illuminates in load status

## 4.3 PARAMETER SETTING

Press F6  in the main screen, it will enter user menu.

- After entering correct password, it can enter related parameter setting, lock setting, maintenance setting, default password is 01234.
- Language: optional Simplified Chinese, English and others (default Traditional Chinese).
- DPF: display DPF regeneration status indicator.
- Event log: enter event log detail page.

Parameter setting includes the following contents:

- Module setting;
- Timer setting;
- Parameter setting;
- Temperature setting;
- Oil pressure setting;
- Aux. sensor 1;
- Aux. sensor 2;
- Aux. sensor 3;
- Aux. sensor 4;
- Aux. sensor 5;
- Aux. sensor 6;
- Sensor correlation setting;
- Speed control setting;

- Input port setting;
- Output port setting;
- Alt. configuration setting;
- Maintenance setting;
- ECU information display setting.
- Proportional valve setting.

Example:


Return	>Preheat time	<p>Screen 1:</p> <p>↑, ↓ for changing contents to be set, ✓ for entering setting (screen 2), ↩ for exiting setting.</p>
Module setting	>Fuel time	
Timer setting >	>Crank time	
Parameter setting	>Crank rest time	
Temperature setting	>Safety run time	
Oil pressure setting	>Start idle time	
Aux. sensor 1	>Warming up time	
Aux. sensor 2	>Cooling time	
Aux. sensor 3	>Stop idle time	
Aux. sensor 4	>ETS time	

Return	>Preheat time	<p>Screen 2:</p> <p>↑, ↓ for changing contents to be set, ✓ for entering setting (screen 3), ↩ for returning to previous screen (screen 1).</p>
Module setting	>Fuel time	
Timer setting >	>Crank time	
Parameter setting	>Crank rest time	
Temperature setting	>Safety run time	
Oil pressure setting	>Start idle time	
Aux. sensor 1	>Warming up time	
Aux. sensor 2	>Cooling time	
Aux. sensor 3	>Stop idle time	
Aux. sensor 4	>ETS time	

Return	>Preheat time	<p>Screen 3:</p> <p>↑, ↓ for changing contents to be set, ✓ for confirming setting, ↩ for returning to previous screen (screen 1).</p>
Module setting	>Fuel time	
Timer setting >	>Crank time	
Parameter setting	>Crank rest time	
Temperature setting	>Safety run time	
Oil pressure setting	>Start idle time	
Aux. sensor 1	>Warming up time	
Aux. sensor 2	>Cooling time	
Aux. sensor 3	>Stop idle time	
Aux. sensor 4	>ETS time	


>Preheat time		Screen 4: ✓ for entering setting (screen 5). ↩ for returning to previous unselected status (screen 3).
>Fuel time	00001	
>Crank time		
>Crank rest time		
>Safety run time		
>Start idle time		
>Warming up time		
>Cooling time		
>Stop idle time		
>ETS time		

>Preheat time		Screen 5: ←, → for changing cursor position, ↑, ↓ for changing cursor value, ✓ for confirming setting. After setting is confirmed, parameters will be automatically saved in system internal storage, ↩ for exiting setting.
>Fuel time	00001	
>Crank time		
>Crank rest time		
>Safety run time		
>Start idle time		
>Warming up time		
>Cooling time		
>Stop idle time		
>ETS time		


**▲NOTE:** Press  or long press ↩ can directly exit setting.

## 4.4 MANUAL START/STOP OPERATION



### 4.4.1 START SEQUENCE

- Press  and start engine;
- If preheat time is configured, then preheat relay outputs (if configured); LCD displays “Preheat Delay xx”;
- After preheat delay is over, fuel relay outputs the pre-set fuel time before start (default: 1s), then crank relay outputs; If engine crank disconnect fails during “Crank Time”, then fuel relay and crank relay stop outputting, and enter “Crank Rest Time”, waiting for next crank;
- After the pre-set start attempts, if engine doesn't succeed to start, then controller issues crank failure shutdown, meanwhile LCD alarm page displays “Crank Failure” alarm;
- During any one of the start attempts, if crank disconnect is fulfilled, then it enters “Safety Run Time”, during which oil pressure low, water temperature high, charging failure alarms are all inactive; after safety run time it enters “Start Idle Delay” (if configured);
- During start idle delay, after it is over, engine enters “Warming Up Time” (if configured);
- When warming up time is ended, engine enters normal running status; if speed is abnormal, controller shall issue alarms and stops it (LCD alarm page displays alarm information).

## 4.4.2 STOP SEQUENCE

- a) Press , and stop the running engine; before stop if load control outputs, then disconnect load control;
- b) If "Cooling Time" is configured, then "cooling delay" starts; when cooling delay is over, it enters "Stop Idle Delay";
- c) When it enters stop idle delay (if configured), then idle relay is energized to output;
- d) It enters "ETS Delay", and ETS relay is energized to output; fuel relay output is disconnected;
- e) It enters "Wait Stop Time", and automatically judges whether it stops completely;
- f) When engine stops completely, it enters "After Stop Time"; Otherwise controller enters stop failure and issues "Stop Failure" warning (after the alarm is issued, if engine stops completely, then it enters "After Stop Time", and meanwhile "Stop Failure" alarm is removed automatically);
- g) When "After Stop Time" is over, it enters standby status.

## 4.5 EMERGENCY START

Press  and  simultaneously and engine can be started forcibly. At this time controller doesn't detect the unit crank disconnect by crank conditions. Starter's disconnect is controlled by the operator. When operator observes the unit has started, he/she should release the key. Then starter stops outputting and controller enters safety run delay.






## 4.6 EXTERNAL KEY START/STOP

When instrument mode or external key start is active, if controller detects speed or oil pressure reaches set crank disconnect conditions, external key start is active. After delay 1s, controller enters normal running. When speed and oil pressure do not meet conditions, external key stop is active. After delay 1s, controller enters standby. In normal running, controller can manually adjust speed, alarm protection and other functions are active.

## 4.7 SPEED CONTROL

### 4.7.1 KEY SPEED CONTROL

After setting manual speed control, select speed control type: 0: Key Speed Control.

Press  key, then it enters speed control interface; press , engine speed increases set step value (default 100r/min); press , engine speed decreases set step value (default 100r/min); press  or  to exit speed control mode and return to homepage.

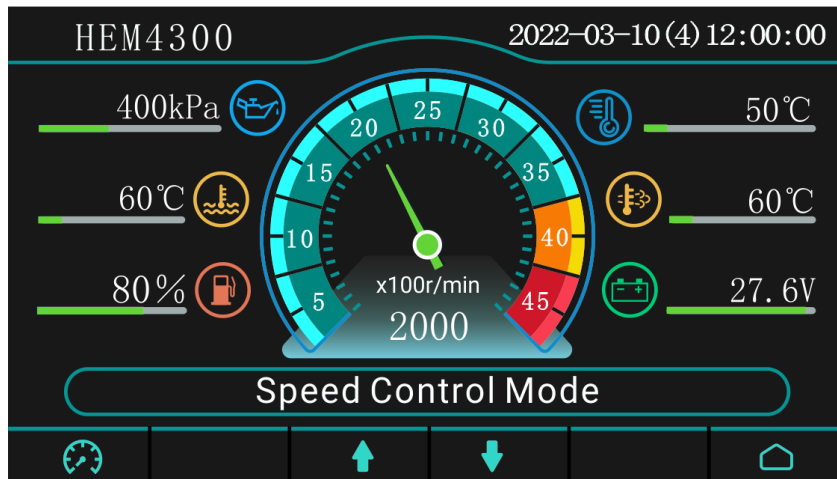


Fig.2 Speed Control Interface

4.7.2 POTENTIOMETER SPEED CONTROL

After setting manual speed control, select speed control type: 1: Potentiometer Speed Control.

Parameter setting example:

Potentiometer speed control: 1: Enable;

Start resistance value: 50Ω;

Max. resistance value: 950Ω;

Potentiometer sensor channel: 1: Aux. Sensor 1;

Aux. sensor 1 curve: 1: Custom Resistance Curve;

Engine rated speed: 2000r/min;

Engine idle speed: 40.0% (800) r/min;

Speed upper limit: 2000r/min.

When it is applied, connect potentiometer to the input port of aux. sensor 1, the other one is connected to sensor COM. The potentiometer start resistance value corresponds to engine idle speed, max resistance value corresponds to engine speed control upper limit. Change the resistance value, speed changes accordingly. The potentiometer resistance value is proportional to speed. Speed control curve is as following:

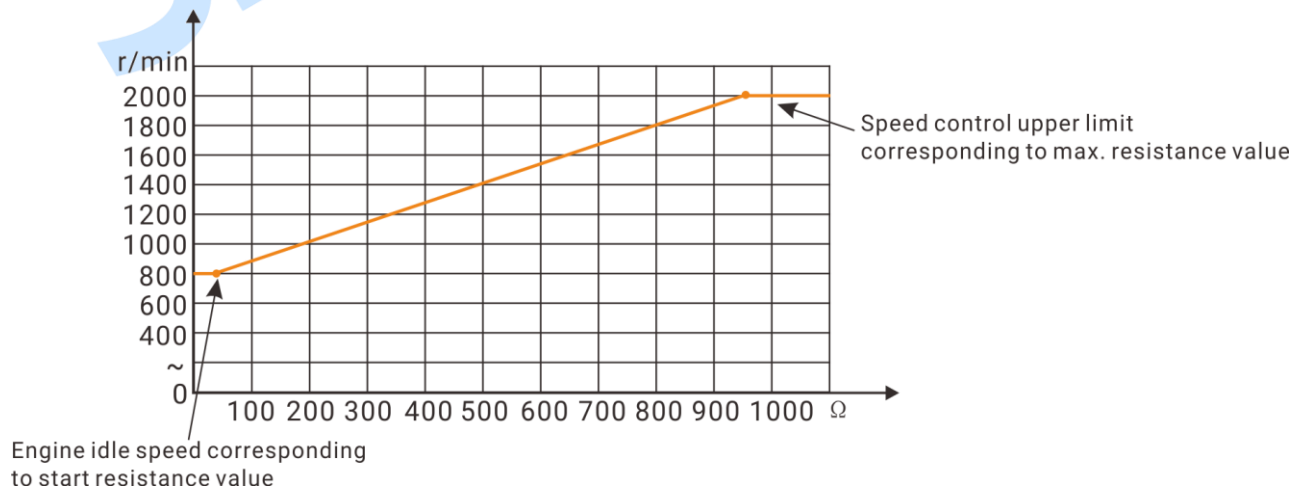


Fig.3 Potentiometer Speed Control Curve

**4.7.3 THROTTLE SPEED CONTROL**

After setting manual speed control, select speed control type: **2: Throttle Speed Control**.

Parameter setting example:

Throttle speed control: 1: Enable;

Start voltage value: 0.75V;

Max. voltage value: 3.84V;

Throttle sensor channel: 1: Aux. Sensor 1;

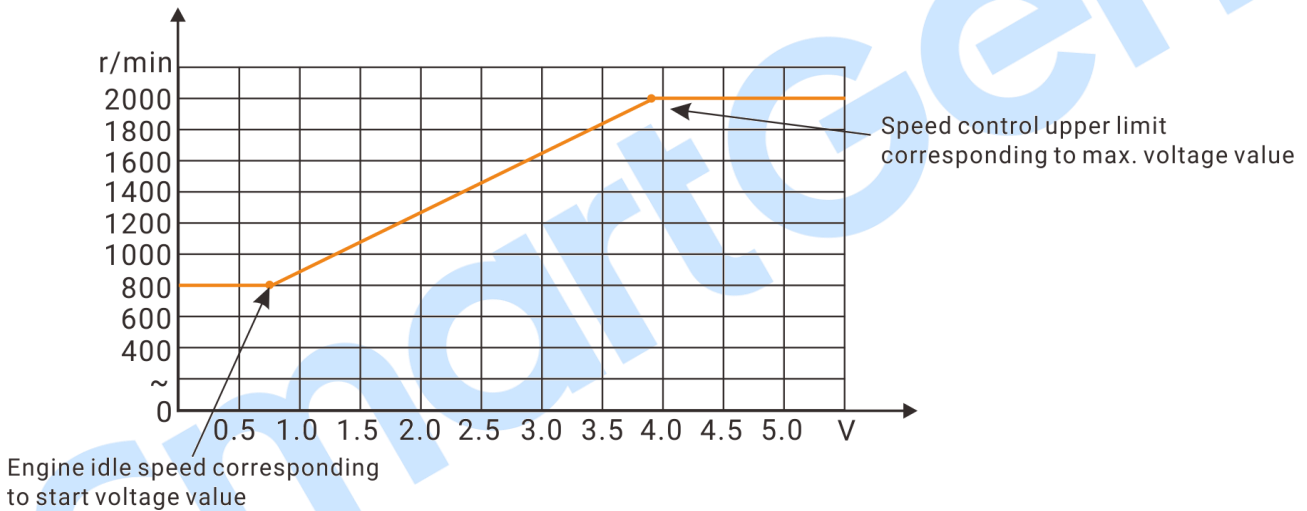
Aux. sensor 1 curve: 3: Custom Voltage Curve;

Engine rated speed: 2000r/min;

Engine idle speed: 40.0% (800) r/min;

Speed upper limit: 2000r/min.

When it is applied, connect throttle sensor voltage signal port to input port of aux. sensor 1, sensor supply port is connected to (+5V OUT) port, the other one is connected to sensor COM. Throttle start voltage value corresponds to engine idle speed value, max. voltage value corresponds to speed upper limit. Change the throttle voltage value, speed changes accordingly. The throttle voltage value is proportional to speed. Speed control curve is as following:



**Fig.4 Throttle Speed Control Curve**

**4.7.4 KEY + THROTTLE SPEED CONTROL**

After setting manual speed control, select speed control type: **3: Key + Throttle Speed Control**.

Parameter setting is same as **2: Throttle Speed Control**. The control logic is that engine is stabilized to adjusted speed through speed raise/drop key after normal running. The speed is adjusted by user according to actual application condition. After key adjusting, user can control speed via throttle, engine speed takes key adjusting speed as the start. When throttle increases, engine speed will increase from speed set by the key directly without idle; when throttle decreases, engine will slow down. It can decrease to key adjusting speed to a minimum.

## 5 MANUAL DPF REGENERATION

### 5.1 ILLUSTRATION








For engines meeting the fourth stage emission standard of non-road mobile machinery, if the post processing technology route includes DPF, the DPF regeneration function is required.

Usually engine can clear the particulates in DPF by automatic regeneration function. However, engine usually is at short-time state, no-load running or low-speed low-load running state, automatic regeneration cannot completely clear out the DPF particulates, and there may appear particulate block, and beyond the limitation. Under this circumstance, manual DPF regeneration operation is needed.

Controller supports manual regeneration function. It can realize manual DPF regeneration operation.

### 5.2 PANEL ICON DESCRIPTION OF AFTERTREATMENT

**Table 6 Aftertreatment Panel Icon Description**

Icon	Description
	Engine fault indicator
	NCD status indicator
	DPF exhaust temperature indicator
	DPF manual regeneration request indicator
	DPF regeneration inhibit indicator
	DPF regeneration acknowledge indicator
	Driver warning indicator/DEF low level warning indicator



**NOTE:** DPF: Diesel Particulate Filter;  
 NCD: NOx Control Diagnosis.  
 DEF: Diesel Exhaust Fluid

### 5.3 DPF MANUAL REGENERATION OPERATION

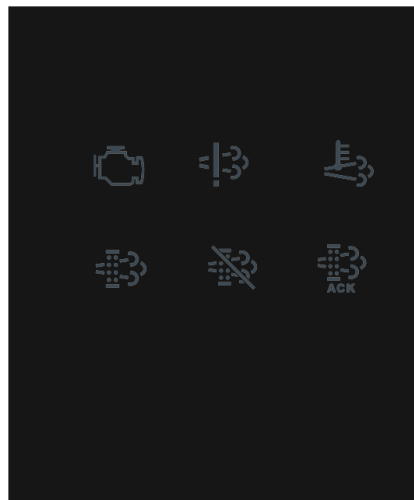
#### 5.3.1 "YANMAR" ENGINE REGENERATION OPERATION

Engine type is set to "33: YANMAR".

Configure an input port and set it to "DPF Manual Regeneration Request", and connect a button (not self-lock) externally.

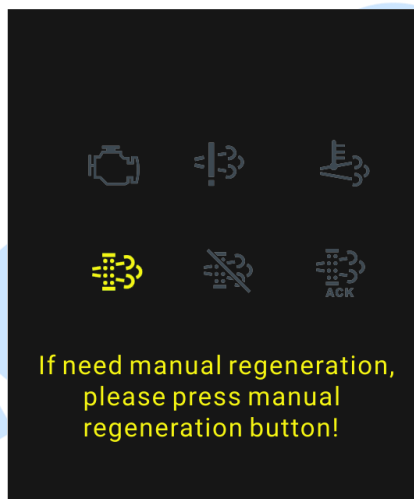
Press  on controller panel and enter parameter setting menu. Press  and select "DPF Regeneration", it will enter DPF regeneration. Controller display is as Fig.5:





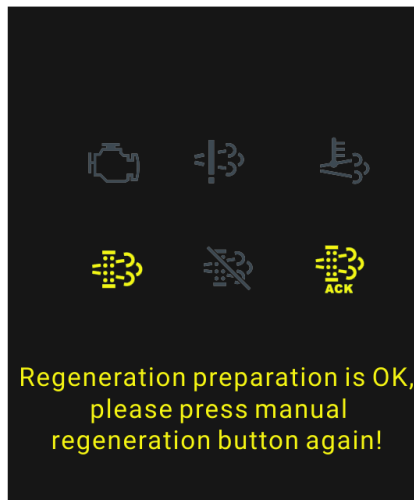
**Fig.5 DPF Regeneration**

When manual regeneration is needed, manual regeneration request indicator is always illuminated, and "If need manual regeneration, please press manual regeneration button!" is presented. Controller display is as Fig.6:



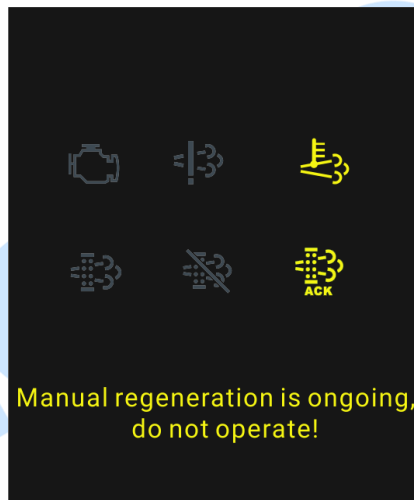
**Fig.6 DPF Regeneration Request**

Press "DPF Manual Regeneration Request" button, DPF acknowledge indicator lights on, and it enters DPF regeneration preparation status. When request indicator is always illuminated on the panel, and acknowledge indicator flashes at the same time (once per second), it means that regeneration preparation is well. "Regeneration preparation is OK, please press manual regeneration button again!" is presented. Controller display is as Fig.7:



**Fig.7 DPF Regeneration Preparation OK**

Press “DPF Manual Regeneration Request” again, and manual regeneration starts. DPF regeneration request indicator lights off, DPF acknowledge indicator and DPF discharge temperature indicator is always illuminated. “Manual regeneration is ongoing, do not operate!” is presented. Controller screen is as Fig.8:



**Fig.8 DPF Regeneration Start**

When manual regeneration is completed, DPF acknowledge indicator and DPF discharge temperature indicator light off. Controller screen is as Fig.5 shows.

5.3.2 “CUMMINS” ENGINE REGENERATION OPERATION

Engine type is set to “30: CUMMINS-QSG12”.

Configure an input port and set it to “DPF Manual Regeneration Request”, and connect a button (not self-lock) externally;

Configure an input port and set it to “DPF Manual Regeneration Inhibit”, and connect a button or switch externally.

After configuration, the icon status of aftertreatment is displayed in main interface, and the display effect is as follows:



Fig.9 Main Interface of CUMMINS-QSG12 Aftertreatment

Press F5i button on the panel and enter the “About” interface, it will display the corresponding icon status of aftertreatment and DPF regeneration process, the controller interface is shown as the following figure:

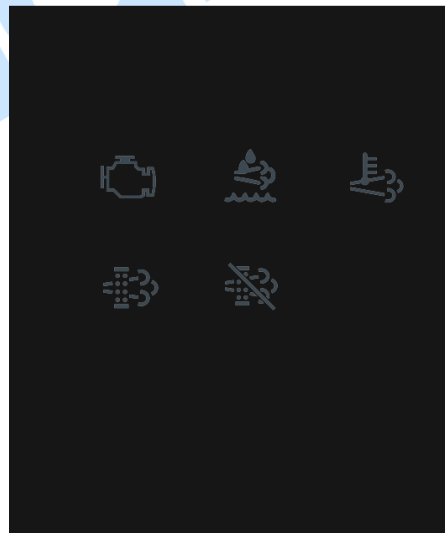
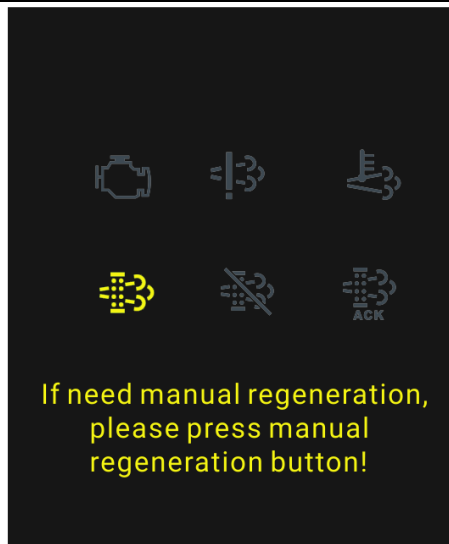


Fig.10 DPF Regeneration Panel

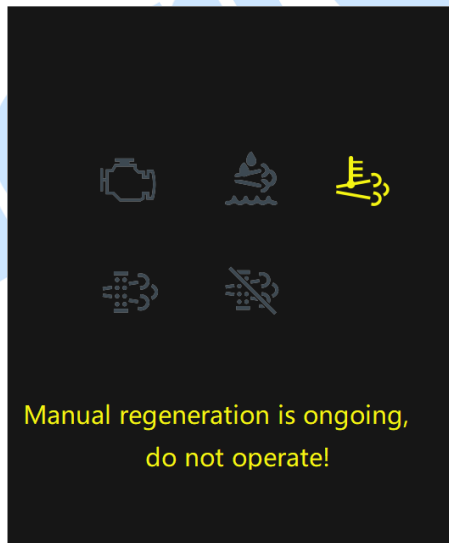
When manual regeneration is required, the manual regeneration indicator is illuminated, and indicates “If need manual regeneration, please press manual regeneration button!”, the controller interface is shown as the following figure:



**Fig.11 DPF Regeneration Request**

When regeneration request indicator flashes (once per second), it means the regeneration request level is severe, and prompting “If need manual regeneration, please press manual regeneration button!”

Press the button of “DPF Manual Regeneration” and the engine will detect if it meets the regeneration requirements. If the regeneration requirements are met, manual regeneration starts, the DPF regeneration request indicator is extinguished, and DPF exhaust temperature indicator is illuminated, prompting “Manual regeneration is ongoing, do not operate!” and the controller interface is shown as the following figure:



**Fig.12 DPF Regeneration Start**

When manual regeneration is done, the DPF exhaust temperature indicator is extinguished and the controller interface is shown as the following figure:

If in special circumstances, manual regeneration is not allowed, or encounter a sudden state during the regeneration process, press “DPF Regeneration Inhibit” switch to stop the engine regeneration. The controller interface is shown as the following figure:

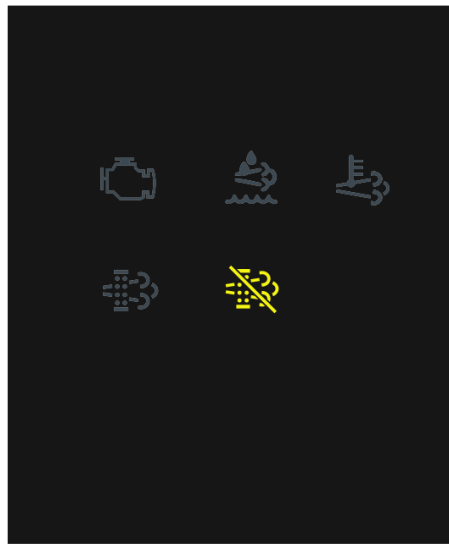


Fig.13 DPF Regeneration Inhibit

6 PROTECTION

6.1 WARNINGS

When controller detects warning signal, it only issues warning, not shutdown.

Table 7 Warnings

No.	Type	Description
1	Over Speed Warn	When controller detects speed is above the pre-set over speed warning threshold, it issues warning signal.
2	Under Speed Warn	When controller detects speed is under the pre-set under speed warning threshold, it issues warning signal.
3	Loss of Speed Signal	When controller detects speed is 0, and speed signal loss action is selected "Warning", it issues warning signal.
4	Load Rate High	When controller detects load rate is above the set threshold, it issues warning signal and limits engine speed to the value in high load rate.
5	High Torque Warn	When controller detects the engine torque is greater than the set high threshold value, controller issues warning signal.
6	Stop Failure	When engine stop delay is over and engine doesn't stop completely, controller issues warning signal.
7	Charge Alt Fail	When controller detects engine charger voltage is less than pre-set threshold, it issues warning signal.
8	Battery Overvoltage	When controller detects engine battery voltage is larger than pre-set threshold, it issues warning signal.
9	Battery Undervoltage	When controller detects engine battery voltage is less than pre-set threshold, it issues warning signal.
10	Urea Level Low	When controller detects engine urea level is less than pre-set threshold, it issues warning signal.
11	ECU Warn	When controller receives warning signal of engine by J1939, it issues warning signal.

No.	Type	Description
12	ECU Comm. Failure Warn	After controller starts the engine, if it can't receive data via J1939, ECU fails to communicate and issues warning signal, controller issues communication failure warning signal.
13	ECU Aftertreatment	When controller receives aftertreatment unit warning signal, it issues warning signal.
14	Temp Sensor Open Warn	When controller detects sensor is open and action type is selected "Warning", it issues warning signal.
15	High Temp Warn	When controller detects temperature is higher than pre-set high temp warning value, it issues warning signal.
16	Low Temp Warn	When controller detects temperature is lower than pre-set low temp warning value, it issues warning signal.
17	Temp Sensor Error	When controller detects temperature is above the sampling range, it issues warning signal,
18	OP Sensor Open Warn	When controller detects oil pressure sensor is open, and action type is selected "Warning", it issues warning signal.
19	Low OP Warn	When controller detects oil pressure value is below pre-set oil pressure warning value, it issues warning signal.
20	OP Sensor Error	When controller detects oil pressure value is above the sampling range, it issues warning signal.
21	Aux. Sensor 1~6 Open	When controller detects sensor is open, and action type is selected "Warning", it issues warning signal.
22	Aux. Sensor 1~6 High	When controller detects sensor value is above pre-set upper limit of warning values, it issues warning signal.
23	Aux. Sensor 1~6 Low	When controller detects sensor value is below pre-set lower limit of warning values, it issues warning signal.
24	Aux. Sensor 1~6 Error	When controller detects sensor value is above the sampling range, it issues warning signal.
25	Input 1~8 Warn	When digital input port is configured to "Warning", and it is active, controller issues corresponding input warning signal.
26	Maintenance 1~15 Warn	When maintenance countdown reaches set time or date and action type is selected "Warning", controller issues warning signal.
27	End of Mandate Time	When controller time reaches mandate time, and mandate time due action is selected "Warning", controller issues warning signal.

## 6.2 SHUTDOWNS

When controller detects shutdown alarm signal, it immediately stops and displays alarm type.

**Table 8 Shutdown Alarms**

No.	Type	Description
1	Emergency Stop	When controller detects emergency stop alarm signal, it issues emergency shutdown alarm signal.
2	Engine Overspeed Shut	When controller detects engine speed is over preset over speed stop threshold, it issues shutdown alarm signal.
3	Loss of Speed Signal	When controller detects speed is 0, and speed signal loss action is

No.	Type	Description
		selected "Shutdown", it issues shutdown alarm signal.
4	Failed to Start	When engine fails to start during pre-set start attempts, controller issues shutdown alarm signal.
5	ECU Shutdown	When controller receives shutdown alarm signal via J1939, it issues shutdown alarm signal.
6	Urea Level Low	When controller detects urea level is less than pre-set threshold, it issues shutdown alarm signal.
7	High Temp. Shut	When controller input port is set to High Temp Shutdown Input and it is active, it issues shutdown alarm signal.
8	Low Oil Pressure Shut	When controller input port is set to Low Oil Pressure Shutdown Input and it is active, it issues alarm signal.
9	ECU Comm. Failure	When engine start is completed, but controller doesn't receive data via J1939, ECU fails to communicate and issues warning signal to shut down, controller issues communication failure signal.
10	ECU Aftertreatment	When controller receives aftertreatment unit shutdown alarm signal, it issues shutdown alarm signal.
11	Air Filter Block Input	When controller input port is set to Air Filter Block Shutdown Input and it is active, it issues shutdown alarm signal.
12	Temp Sensor Open	When controller detects sensor open, and action type is selected "Shutdown", it issues shutdown alarm signal.
13	High Temp Shut	When controller detects temperature value is above pre-set shutdown value, it issues shutdown alarm signal.
14	OP Sensor Open	When controller detects sensor is open and action type is selected "Shutdown", it issues shutdown alarm signal.
15	Low OP Shut	When controller detects oil pressure is below pre-set shutdown value, it issues shutdown alarm signal.
16	Aux. Sensor 1~6 Open	When controller detects sensor is open, and action type is selected "Shutdown", it issues shutdown alarm signal.
17	Aux. Sensor 1~6 High	When controller detects sensor value is above pre-set upper shutdown limit value, it issues shutdown alarm signal.
18	Aux. Sensor 1~6 Low	When controller detects sensor value is below pre-set lower shutdown limit value, it issues shutdown alarm signal.
19	Input 1~8 Shut	When digital input is configured to shutdown alarm, and if it is active, it issues corresponding input shutdown alarm signal.
20	Maintenance 1~15 Shut	When maintenance countdown reaches set time or date and action type is selected "Shutdown", controller issues shutdown alarm signal.
21	End of Mandate Time	When controller time reaches mandate time, and mandate time due action is selected "Shutdown", controller issues shutdown alarm signal.

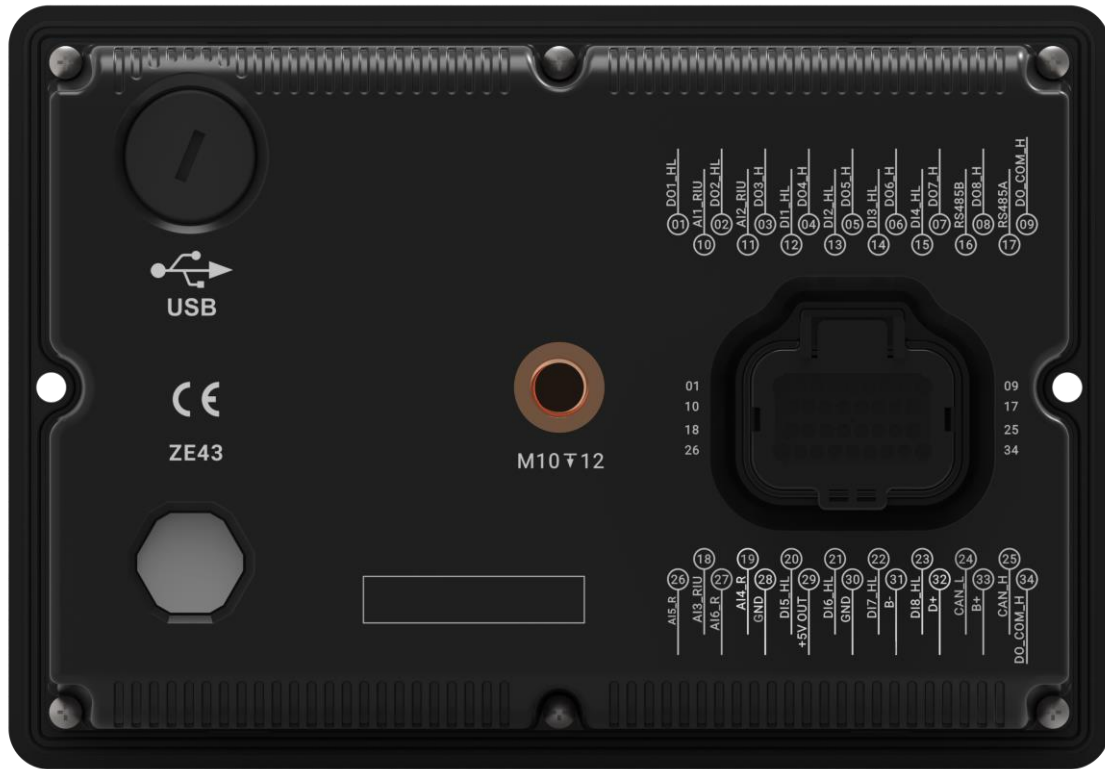





Fig.14 Controller Back Panel

Table 9 Connection Terminal Description

No.	Function	Cable Size	Remark	
1	DO1_HL	1.0mm <sup>2</sup>	Aux. output port, transistor active output, rated 4A.	Setting items see Table 10.
2	DO2_HL	1.0mm <sup>2</sup>		
3	DO3_H	1.0mm <sup>2</sup>		
4	DO4_H	1.0mm <sup>2</sup>		
5	DO5_H	1.0mm <sup>2</sup>		
6	DO6_H	1.0mm <sup>2</sup>		
7	DO7_H	1.0mm <sup>2</sup>		
8	DO8_H	1.0mm <sup>2</sup>		
9	DO_COM_H	1.0mm <sup>2</sup>	Output port active COM, connects starting battery positive.  <b>Warning!</b> Power reverse connection is prohibited for DO_COM_H port, otherwise controller will damage.	
10	AI1_RIU	1.0mm <sup>2</sup>	Analog input port, resistance/current/voltage type can be configured.	Setting items see Table 10.
11	AI2_RIU	1.0mm <sup>2</sup>		
12	DI1_HL	1.0mm <sup>2</sup>	Aux. input port, high/low electric level active can be configured.	Setting items see Table 10.
13	DI2_HL	1.0mm <sup>2</sup>		
14	DI3_HL	1.0mm <sup>2</sup>		
15	DI4_HL	1.0mm <sup>2</sup>		



No.	Function	Cable Size	Remark
16	RS485B	0.5mm <sup>2</sup>	Shielded twisted-pair cable is recommended to use, single end is grounded. External 120Ω resistor is not required, whether using internal 120Ω match resistor can be determined by "Match Resistor Enable" item.
17	RS485A	0.5mm <sup>2</sup>	
18	AI3_RIU	1.0mm <sup>2</sup>	Analog input port, resistance/current/voltage type can be configured.
19	AI4_R	1.0mm <sup>2</sup>	Resistance type analog input port.
20	DI5_HL	1.0mm <sup>2</sup>	Aux. input port, high/low electric level active can be configured.
21	DI6_HL	1.0mm <sup>2</sup>	
22	DI7_HL	1.0mm <sup>2</sup>	
23	DI8_HL	1.0mm <sup>2</sup>	
24	CAN_L	0.5mm <sup>2</sup>	Shielded twisted-pair cable is recommended to use, single end is grounded. There is 120Ω match resistor between CAN_L and CAN_H inside controller.
25	CAN_H	0.5mm <sup>2</sup>	
26	AI5_R	1.0mm <sup>2</sup>	Resistance type analog input port.
27	AI6_R	1.0mm <sup>2</sup>	
28	GND	1.0mm <sup>2</sup>	Analog input port COM.
29	+5V OUT	1.0mm <sup>2</sup>	Output DC+5V.
30	GND	1.0mm <sup>2</sup>	Analog input port COM.
31	B-	1.0mm <sup>2</sup>	Connects starting battery negative.
32	D+	1.0mm <sup>2</sup>	Connects charger D+ (WL) terminal, it hangs in the air if there is no this terminal on the charger.
33	B+	1.0mm <sup>2</sup>	Connects starting battery positive.
			 <b>Warning!</b> When DO_COM_H port active COM is connected to external power supply, power reverse connection is prohibited, otherwise controller will damage.
34	DO_COM_H	1.0mm <sup>2</sup>	Output port active COM, connects starting battery positive.  <b>Warning!</b> Power reverse connection is prohibited for DO_COM_H port, otherwise controller will damage.

**NOTE1:** The back USB port is for parameter programming, PC can be used to program controller;

**NOTE2:** HEM4300 controller can suit for DC (8~35)V battery voltage environment, battery negative must be reliably connected to engine shell. The sectional area from power B+ and B- to positive and negative connection line is not less than 1.0mm<sup>2</sup>. If floating charger is installed, please direct connect its output line to battery positive and negative, then separately connect battery positive and negative to controller input port of positive and negative power, preventing charger disturbing controller's normal running.

**NOTE3:** All outputs of controller are transistor active outputs. If need expand relay, please add freewheel diode (when expand relay coil has DC) or RC circuit (when expand relay coil has AC) to coil two terminals of expand relay, preventing it disturbing controller or other equipment.

8 CONFIGURATION PARAMETER RANGE AND DEFINITION

8.1 PARAMETER RANGE AND DEFINITION

Table 10 Parameter Setting Contents and Range List

No.	Item		Range	Default	Description
Language Setting					
1	Language		(0-3)	0	0: Simplified Chinese; 1: English; 2: Others (can write language pack via PC software, default Traditional Chinese). 3. Russian
Lock Setting					
1	Lock Password		(0-65534)	01234	It is used for entering lock setting. <b>▲Caution!</b> Default password is "01234"; It can be changed by operator for purpose of preventing others changing lock status randomly. Please remember clearly after change. If it is forgotten, please contact company service personnel.
2	Lock Setting		(0-1)	0	0: Unlock; 1: Lock <b>▲ Caution!</b> After locking, controller will display lock mode, then engine can't start.
Module Setting					
1	Password Set		(0-65534)	01234	It used for advanced parameter setting. <b>▲Caution!</b> Default password is "01234"; It can be changed by operator for purpose of preventing others changing controller advanced configuration randomly. Please remember clearly after change. If it is forgotten, please contact company service personnel.
2	RS485 Comm. Set	Baud Rate	(0-3)	2	0: 2400bps; 1: 4800bps; 2: 9600bps; 3: 19200bps.
		Stop Bit	(1-2)	2	1: 1-bit; 2: 2-bit.
		Parity Bit	(0-2)	0	0: No Parity; 1: Odd Parity; 2: Even Parity.
		Match Resistor	(0-1)	1	0: Disable; 1: Enable.
3	Comm. Address		(1-254)	1	Controller address for remote monitoring.
4	CAN Comm. Set		(0-2)	1	0: 125kbps; 1: 250kbps; 2: 500kbps.
5	LCD Backlit Set	Brightness	(0-5)	5	Backlit brightness level.

No.	Item	Range	Default	Description
	Delay	(0-3600)min	0	When the backlit delay is set to 0, backlit is always illuminated.
6	Date and Time			Users can calibrate date and time.
7	Controller Mode	(0-1)	1	0: Instrument Mode; 1: Control Mode.
8	Control Method	(0-2)	0	0: Controller Start/Stop Control; 1: External Key Start/Stop Control; 2: Controller + Key Start/Stop Control.
9	Stop Key Active	(0-1)	0	0: Disable; 1: Enable.
10	Protection Out Active	(0-1)	0	0: Disable; 1: Enable.
11	Boot Screen	(0-1)	1	0: Disable; 1: Enable. After it is enabled, user custom boot screen can be displayed for each power-on.
12	Main Screen Theme	(0-1)	0	0: Default Theme (display 6 parameters); 1: Theme 1 (display 4 parameters). <b>NOTE:</b> After switching theme, corresponding theme screen needs to be written via upper computer. If need to customize theme, please contact service personnel.
13	Module Type	(0-1)	0	0: Local Module 1: Remote Module <b>NOTE:</b> When switch to the remote module, it needs to connect to the local module via RS485 port. Otherwise, a communication failure warning is issued.
14	Main Interface Left 1 Display	(0-14)	0	0: Default 1: DPF Outlet Temperature
15	Main Interface Left 2 Display	(0-14)	0	2: Urea Level 3. Engine Temperature
16	Main Interface Left 3 Display	(0-14)	0	4: Engine Oil Pressure 5: Fuel Level
17	Main Interface Right 1 Display	(0-14)	0	6: Hydraulic Temperature 7: Exhaust Temperature
18	Main Interface Right 2 Display	(0-14)	0	8: Battery Voltage 9: Aux. Sensor 1
19	Main Interface Right 3 Display	(0-14)	0	10: Aux. Sensor 2 11: Aux. Sensor 3 12: Aux. Sensor 4 13: Aux. Sensor 5 14: Aux. Sensor 6
Timer Setting				
1	Preheat Delay	(0-3600)s	0	Time for pre-heating plug to be energized before starter is energized.
2	Prestart Fuel Time	(0-3600)s	1	Time for fuel relay output every time

No.	Item	Range	Default	Description
				before starter is energized.
3	Cranking Time	(3-60)s	8	Time for starter to be energized every time.
4	Crank Rest Time	(3-60)s	10	Waiting time before second energization when engine fails to start.
5	Safety On Delay	(0-3600)s	10	During this time oil pressure low, temp. high, under speed, under frequency, under voltage, and charge alt failure alarms are all inactive.
6	Start Idle Time	(0-3600)s	10	Time for engine idle running in start process.
7	Warming Up Time	(0-3600)s	0	Warming up time for engine before normal running after high speed running.
8	Cooling Time	(0-3600)s	0	Cooling time before stop
9	Stop Idle Time	(0-3600)s	10	Time for engine idle running in stop process.
10	ETS Solenoid Hold	(0-3600)s	20	Time for ETS to be energized before stop.
11	Wait Stop Time	(0-3600)s	0	Time after idle running delay before complete stop when "ETS Solenoid Hold" is set 0; When it is not 0, it is time after ETS delay before complete stop.
12	After Stop Time	(0-3600)s	0	Time from complete stop to standby status.
<b>Engine Setting</b>				
1	Engine Type	(0-39)	39	Default: 39: GTSC1-PLUS.
2	ECU Alarm Shut	(0-1)	0	0: Disable 1: Enable <b>NOTE:</b> When engine detects red light alarm, it will stop when it is enabled.
3	ECU Source Address	(0-255)	3	Source address of ECU speed control communication.
4	Rated Speed	(0-6000)r/min	2000	Provide standard for over speed, under speed and load speed detection.
5	Idle Speed Set	(0-100.0)%	40.0	Set value is percentage of rated speed. Please stabilize speed to set value when idle running is required.
6	Start Attempts	(1-10)times	1	Maximum start times in case of failed start; when this number is reached, controller shall issue Failed to Start signal.
7	Crank Disconnect	(0-2)	2	Please refer to Table 14. There are two kinds of disconnect conditions for engine and starter. They can be used separately or together,

No.	Item	Range	Default	Description	
				aiming to separate starter motor and engine as soon as possible.	
8	Disconnect Speed	(0-200)%	24.0	Set value is the percentage of rated speed; when speed is above the set value, starter shall disconnect; Please refer to the rear installation.	
9	Disconnect OP	(0-1000)kPa	200	When Oil Pressure is above pre-set value, starter shall disconnect. Please refer to the following installation instruction.	
10	Overspeed Warn	Enable	(0-1)	1	Set value is the percentage of rated speed; When controller detects engine speed is above the set threshold, it issues warning signal.
		Set	(0-200.0)%	110.0	
		Return	(0-200.0)%	108.0	
		Delay	(0-3600)s	5	
11	Overspeed Shutdown	Enable	(0-1)	0	Set value is the percentage of rated speed; When controller detects engine speed is above the set threshold, it issues shutdown alarm signal.
		Set	(0-200.0)%	114.0	
		Delay	(0-3600)s	2	
12	Speed Signal Loss	Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No Action.
		Delay	(0-3600)s	5	Time from detecting speed is 0 to confirm action.
13	Battery Rated Voltage	(0-60.0)V	24.0	Provide standard for battery over/under voltage detection.	
14	Battery Overvolt Warn	Enable	(0-1)	1	Set value is the percentage of battery rated voltage. When controller detects battery voltage is above the set threshold, it issues overvoltage warning signal.
		Set	(0-200.0)%	125.0	
		Return	(0-200.0)%	115.0	
		Delay	(0-3600)s	60	
15	Battery Undervolt Warn	Enable	(0-1)	1	Set value is the percentage of battery rated voltage. When controller detects battery voltage is below the set threshold, it issues undervoltage warning signal.
		Set	(0-200.0)%	85.0	
		Return	(0-200.0)%	90.0	
		Delay	(0-3600)s	60	
16	Charge Alt Fail	Enable	(0-1)	1	During engine normal running process, when charger D+ voltage is below this value, controller issues charge alt fail warning.
		Set	(0-60.0)V	8.0	
		Return	(0-60.0)V	10.0	
		Delay	(0-3600)s	10	
17	Raise Speed Rate Set	(30-2000)r/s	500	Engine raise/drop speed rate.	
18	Drop Speed Rate Set	(30-2000)r/s	500		
19	Urea Level Low Shut	Enable	(0-1)	0	Get engine urea level data, set value is urea level. When controller detects urea level is below the set threshold, it issues urea level low shutdown signal.
		Set	(0-100)%	10	
		Delay	(0-3600)s	5	

No.	Item	Range	Default	Description	
20	Urea Level Low Warn	Enable	(0-1)	0	Get engine urea level data, set value is urea level. When controller detects urea level is below the set threshold, it issues urea level low warning signal.
		Set	(0-100)%	20	
		Return	(0-100)%	30	
		Delay	(0-3600)s	5	
21	Load Rate High Protect	Enable	(0-1)	0	Get engine load rate data, set value is engine load rate. When controller detects load rate is above the set threshold, it issues load rate high warning signal.
		Set	(0-200)%	90	
		Return	(0-200)%	70	
		Delay	(0-3600)s	5	
22	Load Rate High Speed	(0-100.0)%	70.0	When controller issues load rate high warning signal, it will drop speed to the value of high load rate.	
23	CAN Upload Data	(0-1)	0	0: Disable; 1: Enable. After it is enabled, upload analog data collected by controller to CAN BUS via CAN port.	
24	High Torque Protection	Enable	(0-1)	0	To obtain the engine torque data, the setting value is the engine torque. When controller detects the engine torque is greater than the set threshold value, it will issue a warning signal,
		Set	(0-200)%	90	
		Return	(0-200)%	70	
		Delay	(0-3600)s	5	
25	DPF Control Source Address Setting	(0-255)	33	The communication source address of ECU speed control.	
26	Overload Output Control	Enable	(0-1)	0	During controller is under normal running stage, if it detects engine speed is lower than overload output threshold value, output type will be overload output control, after the speed rises to return value, output port will stop.
		Set	(0-4000)r/min	1500	
		Return	(0-4000) r/min	1600	
		Delay	(0-3600)s	2	
27	Under Speed Setting	Enable	(0-1)	0	Set value is percentage of rated speed, when controller detects engine speed is lower than under speed warning threshold value, it issues a warning signal.
		Set	(0-200.0)%	55.0	
		Return	(0-200.0)%	60.0	
		Delay	(0-3600)s	5	
28	ECU Comm. Failure Action	(0-2)	0	0: Shutdown; 1: Warning; 2: No Action.	
Analog Sensor Setting					
Engine Temperature Setting					
1	Curve Type	(0-15)	9	SGD. See table 13.	
2	Open Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No Action.	
3	Display Unit	(0-1)	0	0: °C; 1: °F	
4	Over Temp Shutdown	Enable	(0-1)	0	When temp. sensor value is larger than this value, controller issues temp. high shutdown alarm; This value is detected
		Set	((-50)-300)°C	98	
		Delay	(0-3600)s	3	

No.	Item	Range	Default	Description	
				only after safety on delay.	
5	Over Temp Warn	Enable	(0-1)	1	When temp. sensor value is over this value, controller issues temp. high warning alarm; This value is detected only after safety on delay.
		Set	((-50)-300)°C	95	
		Return	((-50)-300)°C	93	
		Delay	(0-3600)s	5	
6	Under Temp Warn	Enable	(0-1)	0	When temp. sensor value is less than this value, controller issues temp. low warning alarm; This value is detected always.
		Set	((-50)-300)°C	10	
		Return	((-50)-300)°C	25	
		Delay	(0-3600)s	5	
7	Heater Control	Enable	(0-1)	0	When temp. sensor value is less than this value, heater control outputs.
		On	((-50)-300)°C	50	
		Off	((-50)-300)°C	55	
		Max. On Time	(0-3600)min	60	
8	Cooler Control	Enable	(0-1)	0	When temp. sensor value is larger than this value, cooler control outputs.
		On	((-50)-300)°C	95	
		Off	((-50)-300)°C	92	
		Max. On Time	(0-3600)min	60	
9	Preheat Output Correlation	Enable	(0-1)	0	After it is enabled, if engine temperature is larger than set value, preheat stops output, preheat delay is over.
		Set Value	(0-300)°C	5	
10	Custom Curve			Corresponding curve needs to be set in choosing custom resistance /voltage/current type curve.	
<b>Engine Oil Pressure Setting</b>					
1	Curve Type	(0-15)	9	SGD. See table 13.	
2	Open Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No Action.	
3	Display Unit	(0-2)	0	0: kPa 1: bar 2: psi	
4	OP Low Shutdown	Enable	(0-1)	0	When oil pressure sensor value is less than this value, controller issues OP low shutdown alarm. This value is detected only after safety on delay.
		Set	(0-1000)kPa	103	
		Delay	(0-3600)s	3	
5	OP Low Warn	Enable	(0-1)	0	When oil pressure sensor value is less than this value, controller issues OP low warning alarm. This value is detected only after safety on delay.
		Set	(0-1000)kPa	124	
		Return	(0-1000)kPa	138	
		Delay	(0-3600)s	5	
6	Custom Curve			Corresponding curve needs to be set in choosing custom resistance /voltage/current type curve.	
<b>Aux. Sensor 1~6 Setting</b>					
1	Sensor Type	(0-4)	0	0: Not Used 1: Temperature Sensor	

No.	Item	Range	Default	Description	
				2: Pressure Sensor 3: Level Sensor 4: Vibration Sensor	
2	Curve Type			Change according to sensor types;	
3	Open Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No Action.	
4	Display Unit	(0-1)	0	0: °C 1: °F <b>NOTE:</b> Unit is different for different sensor.	
5	Over Shutdown	Enable	(0-1)	When external sensor value is larger than this value, controller issues shutdown alarm; Alarm enable and delay value can be set.	
		Set	(0-9000)		100
		Delay	(0-3600)s		5
6	Under Shutdown	Enable	(0-1)	When external sensor value is less than this value, controller issues shutdown alarm; alarm enable and delay value can be set.	
		Set	(0-9000)		10
		Delay	(0-3600)s		5
7	Over Warn	Enable	(0-1)	When external sensor value is larger than this value, controller issues warning alarm; alarm enable, return and delay values can be set.	
		Set	(0-9000)		90
		Return	(0-9000)		80
		Delay	(0-3600)s		5
8	Under Warn	Enable	(0-1)	When external sensor value is less than this value, controller issues warning alarm; alarm enable, return and delay values can be set.	
		Set	(0-9000)		20
		Return	(0-9000)		30
		Delay	(0-3600)s		5
9	Custom Curve			Corresponding curve needs to be set in choosing custom resistance /voltage/current type curve.	
<b>Sensor Correlation Setting</b>					
1	Temp. Correlation	(0-6)	0	0: ECU Coolant Temp; 1: Aux. Sensor 1; 2: Aux. Sensor 2; 3: Aux. Sensor 3; 4: Aux. Sensor 4; 5: Aux. Sensor 5; 6: Aux. Sensor 6.	
2	Oil Pressure Correlation	(0-6)	0	0: ECU Oil Pressure; 1: Aux. Sensor 1; 2: Aux. Sensor 2; 3: Aux. Sensor 3; 4: Aux. Sensor 4; 5: Aux. Sensor 5; 6: Aux. Sensor 6.	
3	Fuel Level Correlation	Correlation Channel	(0-6)	1	0: Not Used; 1: Aux. Sensor 1;
		Fuel Pump	(0-1)	0	2: Aux. Sensor 2;



No.	Item	Range	Default	Description
	Control			3: Aux. Sensor 3;
	Fuel Pump On Set Value	(0-100)%	10	4: Aux. Sensor 4; 5: Aux. Sensor 5; 6: Aux. Sensor 6.
	Fuel Pump Off Set Value	(0-100)%	80	After correlation, corresponding channel value will be displayed on fuel level of main screen.
	Max. On Time	(0-3600)s	60	
4	Hydraulic Temp Correlation	(0-6)	2	0: Not Used; 1: Aux. Sensor 1; 2: Aux. Sensor 2; 3: Aux. Sensor 3; 4: Aux. Sensor 4; 5: Aux. Sensor 5; 6: Aux. Sensor 6. After correlation, corresponding channel value will be displayed on hydraulic temperature of main screen.
5	Exhaust Temp Correlation	(0-6)	3	0: Not Used; 1: Aux. Sensor 1; 2: Aux. Sensor 2; 3: Aux. Sensor 3; 4: Aux. Sensor 4; 5: Aux. Sensor 5; 6: Aux. Sensor 6. After correlation, corresponding channel value will be displayed on exhaust temperature of main screen.
<b>Speed Control Setting</b>				
1	Speed Control Method	(0-2)	1	0: Not Control; 1: Manual Speed Control; 2: Auto Stable Speed.
2	Auto Stabilization Object	(0-0)	0	Engine speed.
3	Manual Speed Control Type	(0-3)	0	0: Key Speed Control; 1: Potentiometer Speed Control; 2: Throttle Speed Control; 3: Key + Throttle Speed Control.
4	Manual Speed Control Step	(1-1000)r/min	100	When manual key speed control is applied, press raise/drop key once, engine will raise or drop speed.
5	Speed Control Upper Limit	(0-6000)r/min	2000	The max. speed of engine.
6	Idle Speed Control	(0-1)	1	0: Disable (After start idle delay is over, engine enters normal running, engine speed automatically raises to rated

No.	Item	Range	Default	Description	
				speed); 1: Enable (After start idle delay is over, engine enters normal running, engine speed keeps idle value, you need to manually raise speed).	
7	Potentiometer Speed Control	Enable	(0-1)	0	0: Disable; 1: Enable.
		Start Resist. Value	(0-5000) $\Omega$	50	Corresponding engine idle value.
		Max. Resist. Value	(0-5000) $\Omega$	950	Corresponding engine speed control upper limit.
		Local Sensor Channel	(0-6)	0	0: Not Used; 1: Aux. Sensor 1; 2: Aux. Sensor 2; 3: Aux. Sensor 3; 4: Aux. Sensor 4; 5: Aux. Sensor 5; 6: Aux. Sensor 6.
		Remote Sensor Channel	(0-6)	0	0: Not Used; 1: Aux. Sensor 1; 2: Aux. Sensor 2; 3: Aux. Sensor 3; 4: Aux. Sensor 4; 5: Aux. Sensor 5; 6: Aux. Sensor 6.
8	Throttle Speed Control	Enable	(0-1)	0	0: Disable; 1: Enable.
		Start Volt Value	(0-5.00)V	0.75	Corresponding engine idle value.
		Max. Volt Value	(0-5.00)V	3.84	Corresponding engine speed control upper limit.
		Local Sensor Channel	(0-6)	0	0: Not Used; 1: Aux. Sensor 1; 2: Aux. Sensor 2; 3: Aux. Sensor 3; 4: Aux. Sensor 4; 5: Aux. Sensor 5; 6: Aux. Sensor 6.
		Remote Sensor Channel	(0-6)	0	0: Not Used; 1: Aux. Sensor 1; 2: Aux. Sensor 2; 3: Aux. Sensor 3; 4: Aux. Sensor 4; 5: Aux. Sensor 5; 6: Aux. Sensor 6.

No.	Item	Range	Default	Description
9	Continuous Active for Key Speed Control	(0-1)	0	0: Disable; 1: Enable.
Aux. Input Ports				
Aux. Input 1				
1	Contents Setting	(0-59)	4	Emergency stop input. Details see Table 12.
2	Active Type	(0-1)	0	0: Close 1: Open
3	Active Electric Level	(0-1)	0	0: Low electric level; 1: High electric level.
Aux. Input 2				
1	Contents Setting	(0-59)	3	Alarm reset. Details see Table 12.
2	Active Type	(0-1)	0	0: Close 1: Open
3	Active Electric Level	(0-1)	0	0: Low electric level; 1: High electric level.
Aux. Input 3				
1	Contents Setting	(0-59)	26	High temp shutdown input. Details see Table 12.
2	Active Type	(0-1)	0	0: Close 1: Open
3	Active Electric Level	(0-1)	0	0: Low electric level; 1: High electric level.
Aux. Input 4				
1	Contents Setting	(0-59)	27	Low oil pressure shutdown input. Details see Table 12.
2	Active Type	(0-1)	0	0: Close 1: Open
3	Active Electric Level	(0-1)	0	0: Low electric level; 1: High electric level.
Aux. Input 5				
1	Contents Setting	(0-59)	29	Raise speed input. Details see Table 12.
2	Active Type	(0-1)	0	0: Close 1: Open
3	Active Electric Level	(0-1)	0	0: Low electric level; 1: High electric level.
Aux. Input 6				
1	Contents Setting	(0-59)	30	Drop speed input. Details see Table 12.
2	Active Type	(0-1)	0	0: Close 1: Open
3	Active Electric Level	(0-1)	0	0: Low electric level; 1: High electric level.
Aux. Input 7				
1	Contents Setting	(0-59)	1	Users defined. Details see Table 12.
2	Active Type	(0-1)	0	0: Close 1: Open
3	Active Electric Level	(0-1)	0	0: Low electric level; 1: High electric level.
4	Active Range	(0-3)	0	0: After safety on delay; 1: From Start; 2: Always; 3: Inactive.

No.	Item	Range	Default	Description
5	Active Action	(0-2)	0	0: Warning; 1: Shutdown; 2: Indication.
6	Active Delay	(0-600.0)s	2.0	Time from detecting input is active to confirm.
7	Input Description			User defined.
Aux. Input 8				
1	Contents Setting	(0-59)	0	Not used. Details see Table 12.
2	Active Type	(0-1)	0	0: Close 1: Open
3	Active Electric Level	(0-1)	0	0: Low electric level; 1: High electric level.
Aux. Outputs				
Aux. Output 1				
1	Contents Setting	(0-139)	29	Fuel output. Details see Table 11.
2	Output Type	(0-1)	0	0: Normally open; 1: Normally close
Aux. Output 2				
1	Contents Setting	(0-139)	28	Starting output. Details see Table 11.
2	Output Type	(0-1)	0	0: Normally open; 1: Normally close
Aux. Output 3				
1	Contents Setting	(0-139)	30	Idle speed control. Details see Table 11.
2	Output Type	(0-1)	0	0: Normally open; 1: Normally close
Aux. Output 4				
1	Contents Setting	(0-139)	26	Load control. Details see Table 11.
2	Output Type	(0-1)	0	0: Normally open; 1: Normally close
Aux. Output 5				
1	Contents Setting	(0-139)	39	Normal running output. Details see Table 11.
2	Output Type	(0-1)	0	0: Normally open; 1: Normally close
Aux. Output 6				
1	Contents Setting	(0-139)	42	Common alarm. Details see Table 11.
2	Output Type	(0-1)	0	0: Normally open; 1: Normally close
Aux. Output 7				
1	Contents Setting	(0-139)	0	Not used. Details see Table 11.
2	Output Type	(0-1)	0	0: Normally open; 1: Normally close
Aux. Output 8				
1	Contents Setting	(0-139)	0	Not used. Details see Table 11.
2	Output Type	(0-1)	0	0: Normally open; 1: Normally close
Alternate Configuration Setting				
Alternate Configuration 1				
1	Enable Choose	(0-1)	0	0: Disable 1: Enable
2	Engine Rated Speed	(0-6000)r/min	2000	When this is enabled, if input is configured to "Alt Config. 1 Active" and input is active, speed shall be adjusted according to alternate configuration settings.
3	Engine Idle Speed	(0-100.0)%	40.0	
4	Speed Control Upper Limit	(0-6000)r/min	2000	

No.	Item	Range	Default	Description
5	Load Output	(0-3)	1	0: Load Control; 1: Load Control 1; 2: Load Control 2; 3: Load Control 3.
6	Load Rate High Speed	(0-100.0)%	70.0	When controller issues load rate high warning signal, it will drop speed to the value of high load rate.
<b>Alternate Configuration 2</b>				
1	Enable Choose	(0-1)	0	0: Disable 1: Enable
2	Engine Rated Speed	(0-6000)r/min	2000	When this is enabled, if input is configured to "Alt Config. 2 Active" and input is active, speed shall be adjusted according to alternate configuration settings.
3	Engine Idle Speed	(0-100.0)%	40.0	
4	Speed Control Upper Limit	(0-6000)r/min	2000	
5	Load Output	(0-3)	2	0: Load Control; 1: Load Control 1; 2: Load Control 2; 3: Load Control 3.
6	Load Rate High Speed	(0-100.0)%	70.0	When controller issues load rate high warning signal, it will drop speed to the value of high load rate.
<b>Alternate Configuration 3</b>				
1	Enable Choose	(0-1)	0	0: Disable 1: Enable
2	Engine Rated Speed	(0-6000)r/min	2000	When this is enabled, if input is configured to "Alt Config. 3 Active" and input is active, speed shall be adjusted according to alternate configuration settings.
3	Engine Idle Speed	(0-100.0)%	40.0	
4	Speed Control Upper Limit	(0-6000)r/min	2000	
5	Load Output	(0-3)	3	0: Load Control; 1: Load Control 1; 2: Load Control 2; 3: Load Control 3.
6	Load Rate High Speed	(0-100.0)%	70.0	When controller issues load rate high warning signal, it will drop speed to the value of high load rate.
<b>Maintenance Setting</b>				
1	Password Set	(0-65534)	01234	It used for entering maintenance parameter setting. <b>⚠Caution!</b> Default password is "01234"; It can be changed by operator for purpose of preventing others changing controller advanced configuration randomly. Please remember clearly after change. If it is forgotten, please contact company service personnel.

No.	Item	Range	Default	Description
2	Maintenance 1 Set	(0-1)	0	0: Disable 1: Enable Maintenance time, maintenance time due action, maintenance timing method, reset maintenance time can be set at the same time; After maintenance, maintenance time due alarm can be removed by resetting maintenance time. Details see Table 15.
3	Maintenance 2 Set	(0-1)	0	
4	Maintenance 3 Set	(0-1)	0	
5	Maintenance 4 Set	(0-1)	0	
6	Maintenance 5 Set	(0-1)	0	
7	Maintenance 6 Set	(0-1)	0	
8	Maintenance 7 Set	(0-1)	0	
9	Maintenance 8 Set	(0-1)	0	
10	Maintenance 9 Set	(0-1)	0	
11	Maintenance 10 Set	(0-1)	0	
12	Maintenance 11 Set	(0-1)	0	
13	Maintenance 12 Set	(0-1)	0	
14	Maintenance 13 Set	(0-1)	0	
15	Maintenance 14 Set	(0-1)	0	
16	Maintenance 15 Set	(0-1)	0	
ECU Information Display Setting				
1	ECU Information Display	(0-1)	1	0: Disable (Display “###” when ECU not send data); 1: Enable (Not display when ECU not send data).
2	D+ Voltage	(0-1)	1	0: Analog; 1: ECU.
3	Oil Temperature	(0-1)	1	0: Shield; 1: Display (When smart delay is active, it will not display as not receiving data).
4	Fuel Temperature	(0-1)	1	
5	Fuel Pressure	(0-1)	1	
6	Inlet Temperature	(0-1)	1	
7	Outlet Temperature	(0-1)	1	
8	Turbo Pressure	(0-1)	1	
9	Coolant Pressure	(0-1)	1	
10	Coolant Level	(0-1)	1	
11	Fuel Consumption	(0-1)	1	
12	Accum. Fuel Consumption	(0-1)	1	
13	Load Rate	(0-1)	1	
14	Torque Percentage	(0-1)	1	
15	Water in Fuel	(0-1)	1	
16	Urea Level	(0-1)	1	
17	DPF Smoke Load Rate	(0-1)	1	
18	SCR Inlet Temperature	(0-1)	1	
19	SCR Outlet Temperature	(0-1)	1	
20	ECU Accum. Run Time	(0-1)	1	
Proportional Valve Setting				
Output Port 1PWM Set				
1	Enable Select	(0-1)	0	0: Disable; Enable.
2	Frequency	(50-300)Hz	200	

No.	Item	Range	Default	Description
Output Port 2PWM Set				
1	Enable Select	(0-1)	0	0: Disable; Enable.
2	Frequency	(50-300)Hz	200	
Proportional Valve Control Setting				
1	Enable Select	(0-1)	0	0: Disable; Enable.
2	Resistance Value	(0-100.0) $\Omega$	12.0	
3	Control Channel Select	(0-1)	0	0: 1PWM outputs; 1: 2PWM outputs;
Gear Output Current				
Gear (1~12)				
1	Gear Speed	(0-6000)r/min	1000	Different defaults for different gears.
2	Turning-point Speed	(0-6000)r/min	1000	
3	Output Current	(0-2000)mA	600	

### ▲NOTES:

- After using USB, cover USB protective cap for better dustproof and waterproof effect;
- Regarding parameter setting on PC software, it does not need to input default factory password "01234" if not change; if it is the first time to do configuration on PC, then input module password is necessary;
- After entering correct password, it can enter parameter setting without repeatedly entering it within 5min;
- Aux. input ports cannot be set the same items. Otherwise function shall not work correctly; Output ports can be set the same item;
- Engine temperature sensor correlation settings: If it is conventional engine and engine temperature is needed, engine temperature correlation sensor needs to be set. Engine temperature will display after choosing corresponding aux. sensor channels that connects temperature sensor;
- Engine oil pressure correlation settings: If it is conventional engine and it is needed to use engine oil pressure to judge crank disconnect, engine oil pressure correlation sensor needs to be set. Engine oil pressure will display and be used as crank disconnect conditions after choosing corresponding aux. sensor channels that connects oil pressure sensor.

## 8.2 DEFINABLE CONTENTS OF AUXILIARY OUTPUT PORTS 1~8

### 8.2.1 DEFINABLE CONTENTS OF AUXILIARY OUTPUT PORTS 1~8

**Table 11 Definable Contents of Auxiliary Output Ports 1~8**

No.	Type	Function Description
0	Not Used	Please refer to the following contents for function details.
1	Custom Period 1	
2	Custom Period 2	
3	Custom Period 3	
4	Custom Period 4	
5	Custom Period 5	
6	Custom Period 6	
7	Custom Combined 1	
8	Custom Combined 2	
9	Custom Combined 3	
10	Custom Combined 4	

No.	Type	Function Description
11	Custom Combined 5	
12	Custom Combined 6	
13	Overload Output Control	During controller is under normal running stage, if it detects engine speed is lower than overload output threshold value, output port acts, and it stops after the speed rises to return value.
14	Reserved	
15	Air Flap Control	Act at the time of over speed shutdown alarm and emergency stop; Air flap can be closed to realize fast stop.
16	Audible Alarm	Act at the time of warning and shutdown alarms; annunciator can be connected externally; It can be inhibited to output when input port "Alarm Mute" is active or any key is pressed; When there is new warning or shutdown alarm, it outputs again.
17	Louver Control	Act at the time of engine start; Disconnect after engine stop.
18	Fuel Pump Control	Act by fuel pump control upper and lower limits of fuel level sensor.
19	Heater Control	Act by heater control upper and lower limits of temp. sensor.
20	Cooler Control	Act by cooler control upper and lower limits of temp. sensor.
21	Fuel Pre-supply	Act during crank to safety run.
22	Preheat Output	Output in preheat period. If preheat related temperature is enabled, engine temperature stops output when reaches set value and controller enters fuel period.
23	Pre-lubricate	Act during preheat to safety run.
24	Remote Control	Control output by communication (PC).
25	Proportional Valve Control	When proportional valve enables, according to the setting output current, adjust PWM output current, and the control proportional valve outputs the corresponding current.
26	Load Control	Action after pressing load key during start idle to normal running.
27	Reserved	
28	Crank Relay	Act at engine start; and disconnect after successful start.
29	Fuel Relay	Act at engine start; and disconnect at ETS stop.
30	Idle Control	Used for engine with idle speed; Pull in before start, and disconnect at entering warming up time; Pull in at the process of stop idle speed, and disconnect when engine stops completely.
31	Speed Raise Output	Output in warming up period.
32	Speed Drop Output	Output during stop idle to waiting for stop period.
33	Energize to Stop	Used for engine with stop ETS; Pull in when stop idle speed is over, and disconnect when pre-set "ETS Solenoid Hold" is over.
34	Run Key Switch Control	Used for checking ECU data immediately at power on; it outputs after it is powered on; it stops outputting the signal at ETS stop time and failed to stop time, controls run key switch signal.
35	ECU Stop	Applicable for engine supporting ECU, and used to control ECU stop. It outputs during ETS, wait for stop, stop failure period.
36	ECU Power	Applicable for engine supporting ECU, and used to control ECU power. It outputs in engine starting and stops during ETS, wait for



No.	Type	Function Description
		stop, stop failure period.
37	Aftertreatment Power	It outputs in engine starting and stops until after stop delay is over. If there is shutdown alarm in standby status, it does not output when entering ETS.
38	Crank Success	Pull in when it detects crank success signal.
39	Normal Running	Outputs when it is in normal running period.
40	Reserved	
41	Reserved	
42	Common Alarm	Act at the time of common alarm and common shutdown.
43	Common Shutdown	Act at the time of common shutdown.
44	Common Warning	Act at the time of common warning.
45	Reserved	
46	Battery Overvoltage	Act when battery voltage high warning occurs.
47	Battery Undervoltage	Act when battery voltage low warning occurs.
48	Failed to Charge	Act when failed to charge warning occurs.
49	Reserved	
50	ECU Warning	ECU issued a warning alarm signal.
51	ECU Shutdown	ECU issued a shutdown alarm signal.
52	ECU Comm. Failure	Controller cannot communicate with ECU.
53	Reserved	
54	NCD Lamp Output	DPF regeneration related lamp outputs of Euro V engine.
55	Regen Request Lamp	
56	Regen Inhibit Lamp	
57	Exhaust Temp Lamp	
58	Regen Ack. Lamp	
59	Input 1 Active	Act when input port 1 is active.
60	Input 2 Active	Act when input port 2 is active.
61	Input 3 Active	Act when input port 3 is active.
62	Input 4 Active	Act when input port 4 is active.
63	Input 5 Active	Act when input port 5 is active.
64	Input 6 Active	Act when input port 6 is active.
65	Input 7 Active	Act when input port 7 is active.
66	Input 8 Active	Act when input port 8 is active.
67	Emergency Stop	Act when emergency stop alarm occurs.
68	Failed to Start	Act when failed to start alarm occurs.
69	Failed to Stop	Act when failed to stop alarm occurs.
70	Reserved	
71	Reserved	
72	Over Speed Warn	Act when engine over speed warning occurs.
73	Over Speed Shutdown	Act when engine over speed shutdown occurs.
74	Reserved	
75	Reserved	
76	Load Control 1	When "Alt Config. 1 Active" is active, under normal running state, load control 1 outputs.

No.	Type	Function Description
77	Load Control 2	When "Alt Config. 2 Active" is active, under normal running state, load control 2 outputs.
78	Load Control 3	When "Alt Config. 3 Active" is active, under normal running state, load control 3 outputs.
79	High Temp Warning	Act when high temp. warning alarm occurs.
80	Low Temp Warning	Act when low temp. warning alarm occurs.
81	High Temp Shutdown	Act when high temp. shutdown alarm occurs.
82	Reserved	
83	Engine Low OP Warn	Act when low oil pressure warning occurs.
84	Engine Low OP Shut	Act when low oil pressure shutdown occurs.
85	Engine OP Open	Act when oil pressure is open.
86	Reserved	
87	Reserved	
88	Reserved	
89	Reserved	
90	Reserved	
91	Reserved	
92	Reserved	
93	Reserved	
94	Reserved	
95	Reserved	
96	Reserved	
97	Reserved	
98	Reserved	
99	Reserved	
100	Reserved	
101	Sensor 1 High Warn	Act when sensor 1 high warning occurs.
102	Sensor 1 Low Warn	Act when sensor 1 low warning occurs.
103	Sensor 1 High Shut	Act when sensor 1 high shutdown occurs.
104	Sensor 1 Low Shut	Act when sensor 1 low shutdown occurs.
105	Sensor 2 High Warn	Act when sensor 2 high warning occurs.
106	Sensor 2 Low Warn	Act when sensor 2 low warning occurs.
107	Sensor 2 High Shut	Act when sensor 2 high shutdown occurs.
108	Sensor 2 Low Shut	Act when sensor 2 low shutdown occurs.
109	Sensor 3 High Warn	Act when sensor 3 high warning occurs.
110	Sensor 3 Low Warn	Act when sensor 3 low warning occurs.
111	Sensor 3 High Shut	Act when sensor 3 high shutdown occurs.
112	Sensor 3 Low Shut	Act when sensor 3 low shutdown occurs.
113	Sensor 4 High Warn	Act when sensor 4 high warning occurs.
114	Sensor 4 Low Warn	Act when sensor 4 low warning occurs.
115	Sensor 4 High Shut	Act when sensor 4 high shutdown occurs.
116	Sensor 4 Low Shut	Act when sensor 4 low shutdown occurs.
117	Sensor 5 High Warn	Act when sensor 5 high warning occurs.
118	Sensor 5 Low Warn	Act when sensor 5 low warning occurs.

No.	Type	Function Description
119	Sensor 5 High Shut	Act when sensor 5 high shutdown occurs.
120	Sensor 5 Low Shut	Act when sensor 5 low shutdown occurs.
121	Sensor 6 High Warn	Act when sensor 6 high warning occurs.
122	Sensor 6 Low Warn	Act when sensor 6 low warning occurs.
123	Sensor 6 High Shut	Act when sensor 6 high shutdown occurs.
124	Sensor 6 Low Shut	Act when sensor 6 low shutdown occurs.
125	Urea Level Low Warn	Act when urea level low warning occurs.
126	Urea Level Low Shut	Act when urea level low shutdown occurs.
127	Load Rate High Warn	Act when load rate high warning occurs.
128	High Torque Warn	Act when engine torque high warning occurs.
129	Reserved	
130	Forward Rotation	During start idle to stop cooling, if forward rotation input is active, it outputs; if limit input is active, it stops output.
131	Backward Rotation	During start idle to stop cooling, if backward rotation input is active, it outputs; if limit input is active, it stops output.
132	Light Clamp	During start idle to stop cooling, if light clamp input is active, it outputs; if input is inactive, it stops output.
133	Reserved	
134	Reserved	
135	Reserved	
136	Reserved	
137	Reserved	
138	Reserved	
139	Reserved	

## 8.2.2 CUSTOM PERIOD OUTPUT

Defined period output is composed by 2 parts: period output S1 and condition output S2.



S1 and S2 both are true, then it outputs; S1 or S2 is false, it doesn't output;

Period output S1 can be configured randomly to one, or several period outputs; Delay time and output time after entering period can be set;

Condition output S2 can be any contents of output settings.

**▲NOTE:** When period output S1 delay time and output time are both 0, configurations of period output S1 are both true.

Output period: Start

Delay output time: 2s

Output time: 3s

Condition output contents: Input 1 is active;

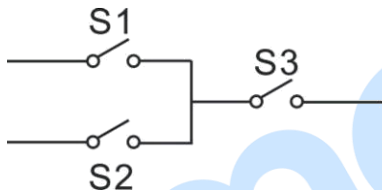
Condition output active/inactive close; close when active (disconnect when inactive)

When input port 1 is active, and it enters start time and delays for 2s, custom period output starts to output, after outputting for 3s, it stops outputting;

When input port 1 is inactive, custom output doesn't output.

## 8.2.3 DEFINED COMBINATION OUTPUT

Defined combination output is composed by 3 parts: OR condition output S1, OR condition output S2, AND condition output S3.



S1 or S2 is true, and S3 is true, then combination output works.

S1 and S2 both are false, or S3 is false, then combination output doesn't work.

**▲NOTE:** S1, S2 and S3 can be any contents except itself defined combination output of the output settings.

**▲NOTE:** S1, S2 and S3 cannot include or recursively include itself.

Contents of OR condition output S1: input port 1 is active;

Close when OR condition output S1 is active/inactive: close when active (disconnect when inactive);

Contents of OR condition output S2, input port 2 is active;

Close when OR condition output S2 is active/inactive: close when active (disconnect when inactive);

Contents of AND condition output S3: input port 3 is active;

Close when AND condition output S3 is active/inactive: close when active (disconnect when inactive);

When input port 1 is active or input port 2 is active, if input port 3 is active, defined combination output is working; if input port 3 is inactive, defined combination output is not working;

When input port 1 is inactive and port 2 is inactive, no matter port 3 is active or not, defined combination output is not working.

8.3 DEFINED CONTENTS OF DIGITAL INPUT PORTS 1~8

Table 12 Defined Contents of Digital Input Ports 1~8

No.	Type	Description
0	Not Used	
1	Users Configured	<p>Users can define the following functions:</p> <p>Input port active type;</p> <p>Input port active electric level;</p> <p>Input port active range:</p> <p>Never: input is inactive.</p> <p>Always: input is active all the time.</p> <p>From crank: start to detect at the time of start.</p> <p>From safety on: start to detect after safety on run delay.</p> <p>Input port active action;</p> <p>Warning: warning only, not shutdown.</p> <p>Shutdown: alarm and shutdown immediately.</p> <p>No Action: No alarm.</p> <p>Input port delay.</p>
2	Alarm Mute	Can prohibit output configurations "Audible Alarm" outputs when input is active.
3	Alarm Reset	Can reset shutdown, trip alarm when input is active.
4	Emergency Stop	Controller emergency stop when input is active.
5	Lamp Test	All LED indicators are illuminated when input is active.
6	Panel Lock	All keys in panel are inactive and key inhibit status is displayed when input is active.
7	Crank Success Input	When this function is active, it means the engine starts successfully. If this function is configured, the speed and oil pressure of crank success conditions will be invalid.
8	LCD Backlight Off	Light off the LCD backlight when input is active.
9	Local/Remote Control (CAN)	Control start, stop and speed adjustment of engine by CAN communication when input is active.
10	Local Speed Control Input Inhibit	CAN communication will not send the command of speed adjustment when input is active.
11	Neutral Gear Switch Input	Disable the engine to start in standby status when input is active.
12	Reserved	
13	Idle/High Speed (Memory)	It enters idle speed running when input is active; returns high speed running (transfers to speed before idle running) when input is inactive.
14	Idle/High Speed	It enters idle speed running when input is active; returns high speed running when input is inactive.
15	Reserved	
16	DPF Manual Regen. Request	A button can be connected externally (not self-lock); For engine with Euro V standard, if PDF regeneration is needed, press the button and controller shall issue manual request command to ECU.

No.	Type	Description
17	DPF Regeneration Inhibit	For engine with Euro V standard, if DPF regeneration Inhibit is needed, so when input is active, controller issues inhibition command to ECU.
18	DPF Regeneration Test Mode	It simulates DPF regeneration request when input is active.
19	Reserved	
20	Reserved	
21	Alarm Stop Inhibit	All shutdown alarms are inhibited except emergency stop and over speed shutdown. (i.e. battle mode or override mode)
22	Local/Remote Throttle Channel	
23	Reserved	
24	Remote Control Mode	Controller will not start and remote start/stop can be realized via "Remote Start/Stop Input" or RS485 communication when input is active.
25	External Charging Failure	When input is active, failed to charge warning alarm occurs.
26	High Temp Shutdown	Connects to sensor digital input.
27	Low OP Shutdown	Connects to sensor digital input.
28	Remote Start/Stop	In remote control mode, when input is active, engine can start. When input is inactive, engine will stop.
29	Raise Speed	A button can be connected externally (not self-lock), manually control speed.
30	Drop Speed	
31	Reserved	
32	Simulate Stop Key	An external button (unlatched) can be connected and pressed as simulate panel key.
33	Simulate Start Key	
34	Simulate Load Key	
35	Simulate Reset Key	
36	Simulate F1 Key	
37	Simulate F2 key	
38	Simulate F3 key	
39	Simulate F4 key	
40	Simulate F5 key	When input port is active, configuration is active; Different parameters can be set for it, making convenience for users to choose current configuration by input port.
41	Simulate F6 key	
42	Alt Config. 1 Active	
43	Alt Config. 2 Active	
44	Alt Config. 3 Active	
45	Reserved	
46	Reserved	
47	Load Input	Act between start idle and stop idle; When input is active, load control outputs; When it is inactive, load control stops outputting.
48	Reserved	
49	Air Filter Block	Air filter alarm occurs when input is active.
50	Forward Rotation	Forward rotation outputs when input is active.
51	Backward Rotation	Backward rotation outputs when input is active.

No.	Type	Description
52	Light Clamp	Light clamp outputs when input is active.
53	Forward Rotation Limit	Forward rotation stops output when limit is active.
54	Backward Rotation Limit	Backward rotation stops output when limit is active.
55	Reserved	
56	Reserved	
57	Reserved	
58	Reserved	
59	Reserved	

## 8.4 SELECTION OF SENSORS

**Table 13 Sensors Selection**

No.	Items	Description	Remark
1	Temperature Sensor	0 Not used 1 Custom Res Curve 2 Custom (4-20)mA Curve 3 Custom Volt Curve 4 VDO 5 CURTIS 6 VOLVO-EC 7 DATCON 8 SGX 9 SGD 10 SGH 11 PT100 12 Cu50 13 PT1000 14 Reserved 15 Reserved	Defined resistance's range is (0~6)kΩ, default is "Not Used"; Users can select the corresponding curve by themselves. If pre-set sensor channel doesn't support current and voltage type, then curve type item 2 and 3 display "Reserved".
2	Oil Pressure Sensor	0 Not used 1 Custom Res Curve 2 Custom (4-20)mA Curve 3 Custom Volt Curve 4 VDO 10bar 5 CURTIS 6 VOLVO-EC 7 DATCON 10bar 8 SGX 9 SGD 10 SGH 11 -15 Reserved	Defined resistance's range is (0~6)kΩ, default is "Not Used"; Users can select the corresponding curve by themselves. If pre-set sensor channel doesn't support current and voltage type, then curve type item 2 and 3 display "Reserved".

No.	Items	Description	Remark
3	Level Sensor	0 Not used 1 Custom Res Curve 2 Custom (4-20)mA Curve 3 Custom Volt Curve 4 SGD 5 SGH 6 10-130Ω 7 70-10Ω 8 4-180Ω 9 12-170Ω 10 -15 Reserved	Defined resistance's range is (0~6)kΩ, default is "Not Used"; Users can select the corresponding curve by themselves. If pre-set sensor channel doesn't support current and voltage type, then curve type item 2 and 3 display "Reserved".
4	Vibration Sensor	0 Not used 1 Custom Res Curve 2 Custom (4-20)mA Curve 3 Custom Volt Curve 4-15 Reserved	Defined resistance's range is (0~6)kΩ, default is "Not Used"; Users can select the corresponding curve by themselves. If pre-set sensor channel doesn't support current and voltage type, then curve type item 2 and 3 display "Reserved".

## 8.5 CONDITIONS OF CRANK DISCONNECT SELECTION

**Table 14 Crank Disconnect Conditions**

No.	Setting Description
0	Engine speed
1	Oil pressure
2	Oil pressure + Engine speed

### ▲NOTES:

- There are 2 conditions to make starter disconnected with engine. Engine speed and oil pressure can be used separately. We recommend that oil pressure should be used with speed sensor together, in order to make the starter motor separate with engine immediately and can check crank disconnect exactly;
- Speed sensor is the magnetic equipment installed in starter for detecting flywheel teeth;
- If engine does not have speed sensor please do not select corresponding items, otherwise, "start failure" or "loss speed signal" may be caused;
- If engine does not have oil pressure sensor, please do not select corresponding items.



8.6 MAINTENANCE SETTING

Table 15 Maintenance Setting

Item	Content	Description
Enable Choose	0: Disabled, 1: Enabled	Set maintenance function active or not.
Maintenance Time	(0-30000)h	It is hours from the time the maintenance is enabled to when maintenance is required.
Maintenance Due Action	0: Warning; 1: Shutdown; 2: No Action.	Alarm action when maintenance time is due.
Maint. Pre-alarm Time	(0-30000)h	It is hours from the time the maintenance is enabled to when maintenance is required.
Maint. Pre-alarm Time Due Action	0: Warning; 1: Shutdown; 2: No Action.	Alarm action when maintenance pre-alarm time is due.
Maint. Timing Method	0: Running Time 1: Real Time Clock 2: Running Time + Real Time Clock	The timing of maintenance.
Reset Maintenance		After maintenance completion, through this item reset maintenance time.
Maintenance Description		Users can input maintenance name, like Change Engine Oil.

9 SENSOR SETTING

- If a sensor is needed to change again, the sensor curve will be transferred into the standard value. For example, if the default temperature sensor is SGD, the sensor curve is SGD curve; if it is set SGX, the temperature sensor curve is SGX curve.
- If there is difference between standard sensor curve and the used sensor, users can choose “defined sensor”, and input defined sensor curve.
- At the time of inputting the sensor curve, X value must be inputted from small to large, otherwise, some mistake may occur.
- If sensor is selected to “Not Used”, then sensor curve doesn't work.
- If corresponding sensor only has alarm switch, then it is a must that set the sensor “Not Used”, otherwise shutdown alarm or warning may occur.
- It is applicable to set the headmost and backmost values in the vertical coordinate as the same as the following figure.

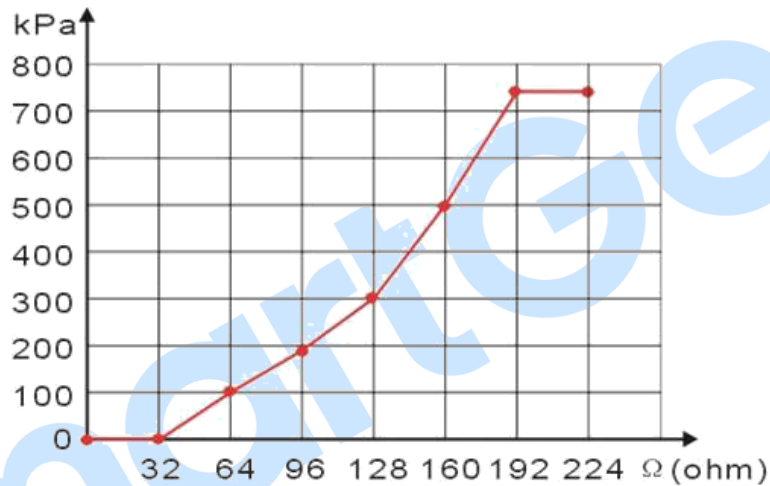


Fig.15 Sensor Curve Setting

Table 16 Common Pressure Unit Conversion Table

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

## 10 COMMISSIONING

It is suggested to do the following examination before formal system operation:

- Check all the connections are correct and wire diameter is suitable.
- Ensure that controller DC power has fuse, controller's positive and negative are correctly connected to starting battery.
- Take proper action to prevent engine from crank disconnect (e. g. Remove the connection wire of fuel valve). If everything is OK, make the starting battery power on and controller will execute routine.
- Press "start" key, engine will start. After pre-set start times, controller will send failed to start signal; then press "stop" key to reset controller.
- Recover the action of stop engine start (e. g. Connect wire of fuel valve), and press start button again, then engine will start. If everything goes well, engine will go to normal running after idle running (if idle running is set). During this time, please observe engine's running situation.
- If there is any other question, please contact SmartGen's service.

## 11 TYPICAL APPLICATION

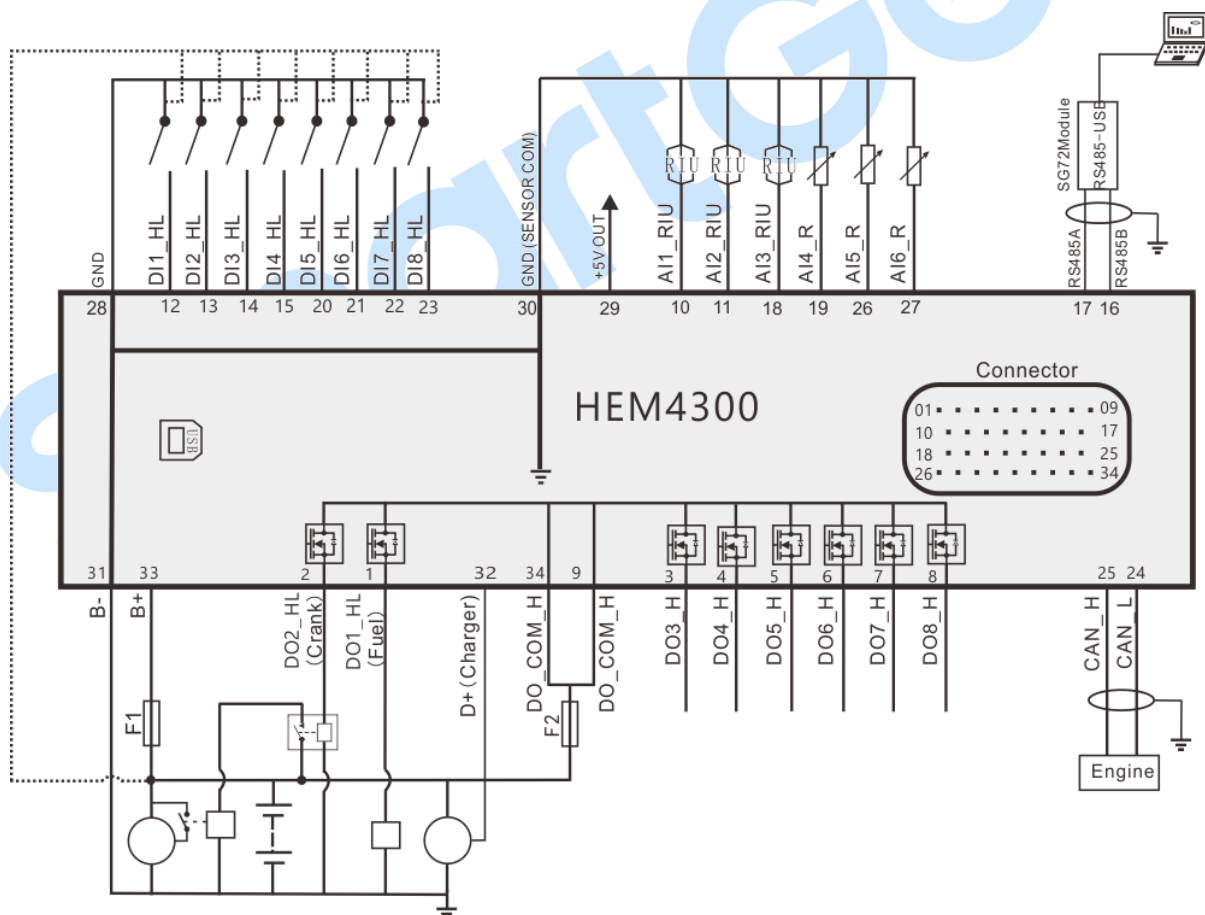
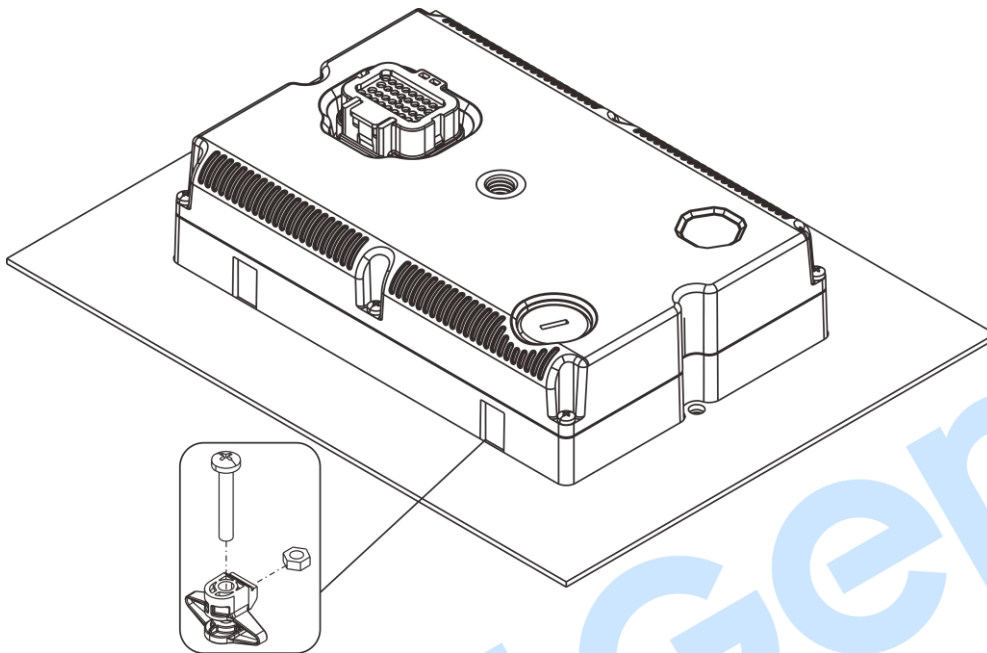


Fig.16 HEM4300 Typical Application Diagram

- NOTE:**
- Large relay is recommended to use for crank, fuel output ports;
  - It can connect battery positive when high electric level active is configured for input port.

## 12 INSTALLATION

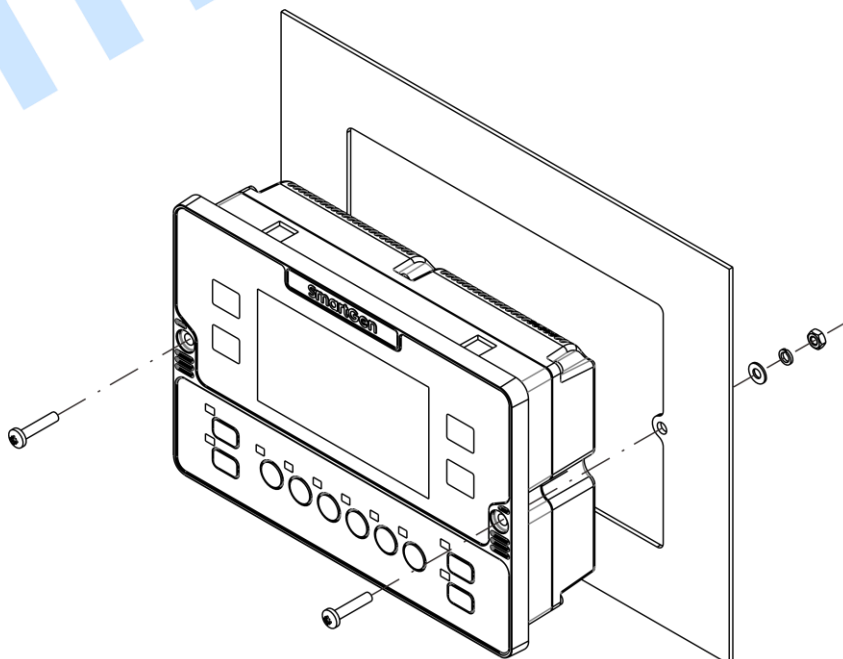
### 12.1 CLIP INSTALLATION



**Fig.17 HEM4300 Clip Installation Diagram**

- Assemble four clips in sequence and put in front panel's groove in proper order;
- Use cross screwdriver to tighten four screws in turn.

### 12.2 SCREW INSTALLATION



**Fig.18 HEM4300 Screw Installation Diagram**

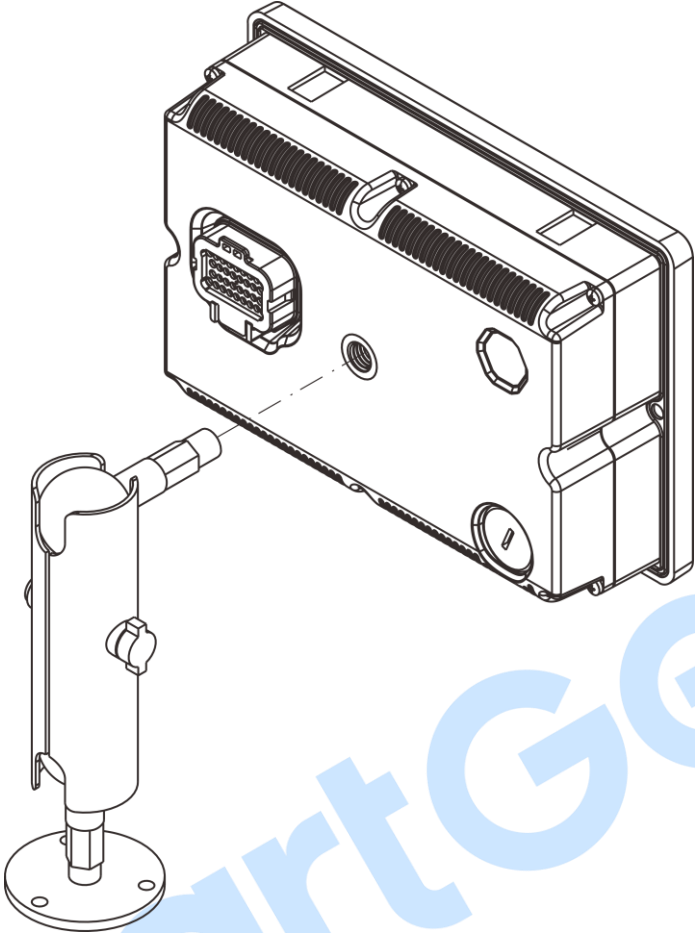


Fig.19 HEM4300 Holder Installation Diagram

12.4 OVERALL AND CUTOUT DIMENSIONS

Unit: mm

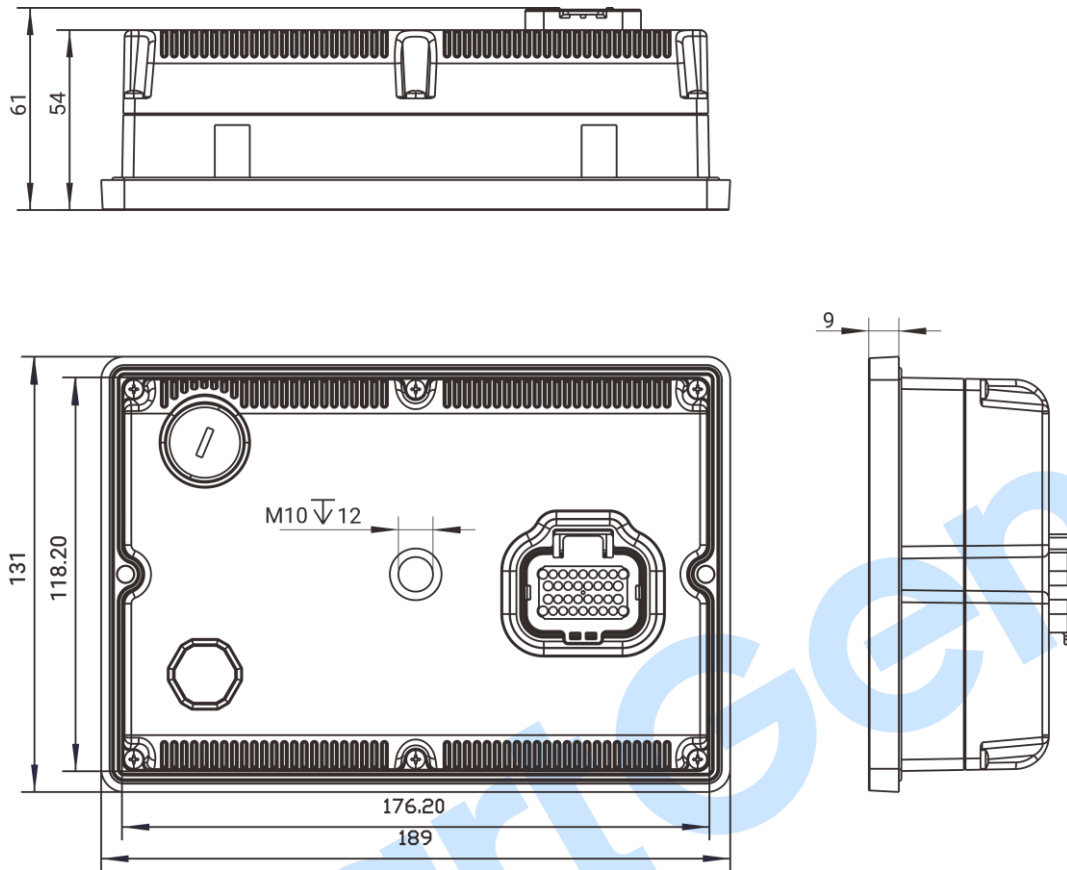


Fig.20 Overall Dimensions

Unit: mm

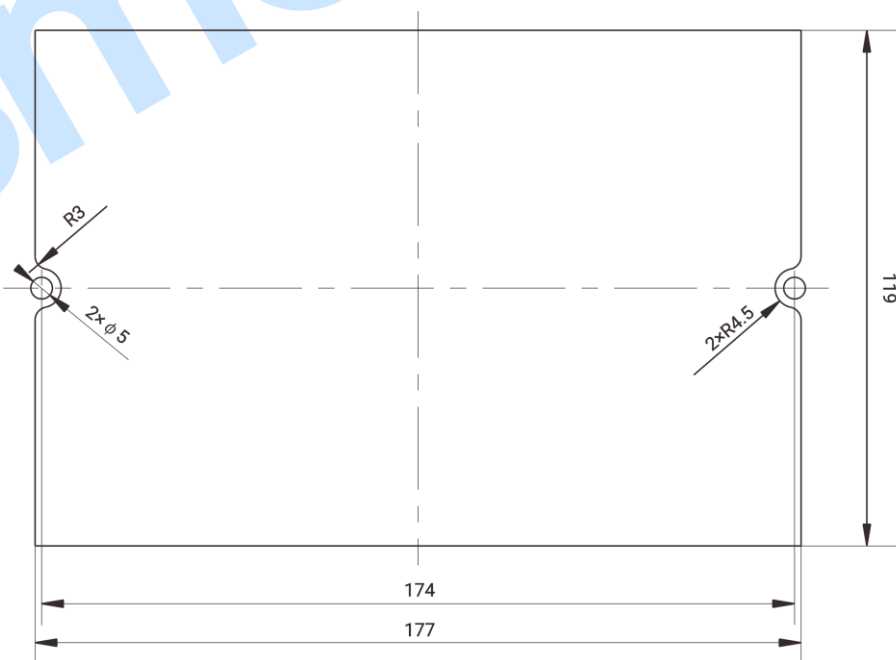


Fig.21 Cutout Dimension

13 CONNECTIONS OF CONTROLLER WITH J1939 ENGINE

13.1 CUMMINS QSL9

Suitable for CM850 engine control module.

Table 17 50-pin Connector

Terminals of controller	50 pins connector	Remark
Aux. output 1	39	Configure it as "Fuel Output".
Aux. output 2	-	Configure it as "Crank Output". Connect to starter coil directly via expand relay.

Table 18 9-pin Connector

Terminals of controller	9 pins connector	Remark
CAN(H)	SAE J1939 signal-C	Using twisted-pair shielded line with single end grounded.
CAN(L)	SAE J1939 return-D	

Engine type: Cummins-CM850.

13.2 CUMMINS QSX15-CM570

Suitable for CM570 engine control module. Engine type is QSX15 etc.

Table 19 50-pin Connector

Terminals of controller	50 pins connector	Remark
Aux. output 1	38	Configure it as "Fuel Output".
Aux. output 2	-	Configure it as "Crank Output". Connect to starter coil directly via expand relay.

Table 20 9-pin Connector

Terminals of controller	9 pins connector	Remark
CAN(H)	SAE J1939 signal-C	Using twisted-pair shielded line with single end grounded.
CAN(L)	SAE J1939 return-D	

Engine type: Cummins QSX15-CM570.

13.3 CUMMINS QSM11

Table 21 Engine OEM Connector

Terminals of controller	OEM connector of engine	Remark
Aux. output 1	38	Oil injection switch. Configure it as "Fuel Output".
Aux. output 2	-	Configure it as "Crank Output". Connect to starter coil directly via expand relay.
CAN(H)	46	Using twisted-pair shielded line with single end grounded.
CAN(L)	37	

Engine type: Common J1939.

13.4 CUMMINS QSZ13

Table 22 Engine OEM Connector

Terminals of controller	OEM connector of engine	Remark
Aux. output 1	45	Oil injection switch. Configure it as "Fuel Output".
Aux. output 2	-	Configure it as "Crank Output". Connect to starter coil directly via expand relay.
CAN(H)	1	Using twisted-pair shielded line with single end grounded.
CAN(L)	21	

Engine type: Cummins-QSZ13.

13.5 DEUTZ EMR2

Table 23 F Connector

Terminals of controller	F connector	Remark
Aux. output 1	Expansion 30A relay, providing battery voltage for 14; Fuse is 16A.	Configure it as "Fuel Output".
Aux. output 2	-	Configure it as "Crank Output". Connect to starter coil directly via expand relay.
-	1	Connect to battery negative pole.
CAN(H)	12	Using twisted-pair shielded line with single end grounded.
CAN(L)	13	

Engine type: DEUTZ-EMR2.

13.6 MTU ADEC (SMART MODULE)

Suitable for MTU engine with ADEC (ECU8) and SMART module.

Table 24 ADEC (X1 Port)

Terminals of controller	ADEC (X1 port)	Remark
Aux. output 1	X1 10	Configure it as "Fuel Output". X1 Terminal 9 connected to negative of battery.
Aux. output 2	X1 34	X1 Terminal 33 connected to negative of battery.

Table 25 ADEC (X4 Port)

Terminals of controller	SMART (X4 port)	Remark
CAN(H)	X4 1	Using twisted-pair shielded line with single end grounded.
CAN(L)	X4 2	

Engine type: MTU-ADEC.



## 13.7 SCANIA

Suitable for S6 engine control module.

**Table 26 B1 Connector**

Terminals of controller	B1 connector	Remark
Aux. output 1	3	Configure it as "Fuel Output".
Aux. output 2	-	Configure it as "Crank Output". Connect to starter coil directly via expand relay.
CAN(H)	9	Using twisted-pair shielded line with single end grounded.
CAN(L)	10	

Engine type: SCANIA-S8.

## 13.8 VOLVO EDC3

Suitable engine control mode is TAD1240, TAD1241, and TAD1242.

**Table 27 "Stand alone" Connector**

Terminals of controller	"Stand alone" connector	Remark
Aux. output 1	H	Configure it as "Fuel Output".
Aux. output 2	E	Configure it as "Crank Output". Connect to starter coil directly via expand relay.
Aux. output 3	P	Configure it as "ECU power".

**Table 28 "Data Bus" Connector**

Terminals of controller	"Data bus" connector	Remark
CAN(H)	1	Using twisted-pair shielded line with single end grounded.
CAN(L)	2	

Engine type: VOLVO-EMS2.

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

## 13.9 VOLVO-EMS2

Volvo Engine models are TAD734, TAD940, TAD941, TAD1640, TAD1641, and TAD1642.

**Table 29 Engine CAN Port**

Terminals of controller	Engine's CAN port	Remark
Aux. output 1	6	Configure it as "ECU stop".
Aux. output 2	5	Configure it as "ECU power".
-	3	Negative power.
-	4	Positive power.
CAN(H)	1(Hi)	Using twisted-pair shielded line with single end grounded.
CAN(L)	2(Lo)	

Engine type: VOLVO-EMS2.

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

## 13.10 YUCHAI

Suitable for Yuchai BOSCH common rail electronic-controlled engine.

**Table 30 Engine 42-pin Port**

Terminals of controller	Engine 42 pins port	Remark
Aux. output 1	1.40	Configure it as "Fuel Output". Connects to engine ignition switch.
Aux. output 2	-	Configure it as "Crank Output". Connect to starter coil directly via expand relay.
CAN(H)	1.35	Using twisted-pair shielded line with single end grounded.
CAN(L)	1.34	

Engine type: YUCHAI.

## 13.11 WEICHAJ

Suitable for Weichai BOSCH common rail electronic-controlled engine.

**Table 31 Engine Port**

Terminals of controller	Engine port	Remark
Aux. output 1	1.40	Configure it as "Fuel Output". Connects to engine ignition switch.
Aux. output 2	1.61	Configure it as "Crank Output". Connect to starter coil directly via expand relay.
CAN(H)	1.35	Using twisted-pair shielded line with single end grounded.
CAN(L)	1.34	

Engine type: GTSC1.

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

**Table 32 Troubleshooting**

Symptoms	Possible Solutions
Controller no response with power	Check starting battery; Check controller wirings; Check DC fuse.
Engine stop	Check water/cylinder temperature is too high; Check AC generator voltage; Check DC fuse.
Controller emergency stop	Check emergency stop button function is right or not; Check emergency stop input is configured or not; Check wire connection is open circuit or not.
Oil pressure low alarm after crank disconnection	Check oil pressure sensor and its wire connections.
Water temp. high alarm after crank disconnection	Check water temperature sensor and its wire connections.
Shutdown alarm in running	Check related switch and wirings according to LCD information; Check aux. input ports.
Crank failure	Check fuel circuit and related wirings; Check starting battery; Check speed sensor and its wire connections; Refer to engine manual.
No response for starter	Check starter wire connections; Check starting battery.
RS485 communication abnormal	Check RS485 wire connections; Check RS485 A and B are connected reversely or not; Check PC communication port is damaged or not; Check 120Ω resistor is enabled or not.