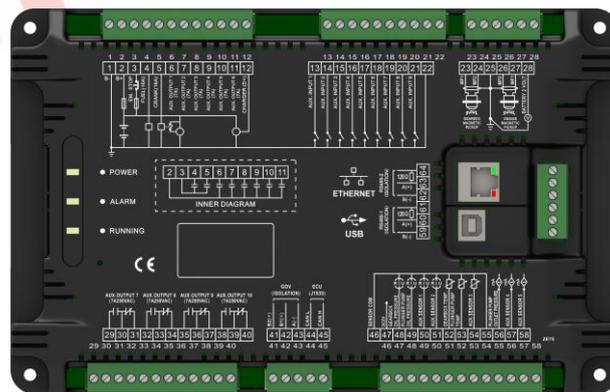# HEM750

FRACTURING TRUCK CONTROLLER

USER MANUAL

HMU8-750 DISPLAY MODULE

HEM750 MASTER CONTROL MODULE

SMARTGEN (ZHENGZHOU) TECHNOLOGY CO., LTD.

Chinese trademark

SmartGen **English trademark**

SmartGen — make your generator *smart*

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Table 1 - Software Version

Date	Version	Note
2020-09-10	1.0	Original release.
2021-01-13	1.1	Modified the front panel picture of HMU8-750.

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 error operation may cause death, serious injury and significant property damage.

CONTENTS

1 OVERVIEW

HEM750 Fracturing Truck Controller is used for single fracturing truck control, which can realize functions of manual start and stop, throttle control, gear position control, data measurement, alarm protection and "four remotes" (remote control, remote measuring, remote communication and remote adjusting). It applies split mode of "Master Control + Display" and transmits data through RS485.

The display module of the controller applies 8-inch 800*600 resolution capacitive touch screen with Chinese and English display, which can realize the control, data monitoring and parameter adjustment of the master control module with simple operation and high reliability.

The master control module of the controller accurately monitors various working status of engine, gearbox and plunger pump, making it possible to realize the precise control and alarm protection for the plunger pump. It has SAE J1939 interface and can communicate with a variety of ECU (ENGINE CONTROL UNIT) who has J1939 interface. Compared with PLC controlled fracturing truck system, it has compact structure, simple connection and higher reliability.

2   PERFORMANCE AND CHARACTERISTICS

HEM750 controller is used for the data monitoring and control of a single fracturing truck. It consists of two modules: HMU8-750 (Display Module) and HEM750 (Master Control Module), and the two modules are connected through RS485 communication.

Main features are the followings:

— The display module adopts an 8-inch LCD with 800*600 resolution, HMI display and capacitive touch screen operation. Chinese and English operations are optional for on-site selection and convenient for commissioning staff;

— The display module can record and display the last 2000 outlet pressure and flow data points after the plunger pump's work, and the recording interval is 5 seconds;

— The speed of homepage interface of the display module, sensor head and bar chart could display the alarm set value and maximum range of the master control module;

— With the control functions of engine emergency stop, startup, shutdown, throttle increase/decrease   and slight increase/decrease;

—With the control functions of upshift/downshift of gearbox, one-key idle and brake.

—Collecting and displaying various parameters of the engine:

Speed	Unit: r/min
Temperature	Unit: °C/°F
Oil Pressure	Unit: MPa/bar/psi
Battery 1 Voltage	Unit: V
Battery 2 Voltage	Unit: V
Charger D+ Voltage	Unit: V
Current Boot Time:	Up to 65,535 hours
Total Starting-up Time:	Up to 65,535 hours
Total Starting-up Times:	Up to 65,535 times

—Collecting and displaying various parameters of the gearbox:

Speed	Unit: r/min
Oil Temperature	Unit: °C/°F
Oil Pressure	Unit: MPa/bar/psi
Current Gear Position	
Request Gear Position	
Locked Status	

—Collecting and displaying various parameters of the plunger pump:

Outlet Pressure	Unit: MPa/bar/psi
Outlet Flow	Unit: m³/min
Current Starting-up Flow:	Unit: m³

Oil Temperature	Unit: °C/°F
Oil Pressure	Unit: MPa/bar/psi

— A variety of temperature, pressure, level sensor curves can be directly used, and the sensor curve could be customized;

—Crank disconnect conditions (speed and oil pressure) can be selected;

—With perfect fault protection function and can display fault details;

—RTC display and even log function, which can circularly record 200 data;

— With the customized description display function, it can display the customized description character string set by the master control module;

— Allow users to change and set the parameters of the display module, which will not be lost in case of power failure. All parameters are changed through the touch screen;

— Allow users to change and set the parameters of the master control module, which will not be lost in case of power failure. Most parameters of the master control module can be changed through the display module, all parameters of the master control module can be adjusted through PC software;

— All parameters are applied digital adjustment, which eliminates the simulation adjustment method of conventional potentiometer, and improves the reliability and stability of the whole unit;

—Adapt to environment of the starting battery voltage 12/24VDC;

— With maintenance function, and the maintenance type can be selected as date, running time or date + running time, and maintenance time due action can be set (indication, warning, fault idle, cooling shutdown and alarm shutdown);

—With the speed regulation functions of CAN, GOV and relay.

2.1 HMU8-750 DISPLAY MODULE

It is used for parameters displaying collected by the master control module, the control of the main control module and parameter adjustment can be realized through the touch screen.

Main features are the followings:

—With power indicator, communication indicator and alarm indicator;

— The module has 10 levels of dimming, which can adjust the brightness according to different environments;

— With 4 RS485 interfaces, 1 CANBUS interface, 1 ETHERNET interface, among which the RS485-1 communicates with the master control module, and the others are reserved interfaces;

—With USB device interface, used to upgrade the firmware of the display module;

— With USB host interface, used to upgrade the interface picture and font library of the display module;

— A rubber sealing ring is designed between the enclosure and the control panel. The waterproof property of the front panel can reach IP65;

—The controller is fixed with metal clips;

— Modular structure design, pluggable wiring terminal, embedded installation mode, compact structure and easy installation.

2.2 HEM750 MASTER CONTROL MODULE

It is used for the data acquisition, monitoring and protection of engine, gearbox and plunger pump to realize the control of engine start and stop, throttle and gear position.

Main features are the followings:

— With 2 RS485 interfaces, "four remotes" functions (remote control, remote measuring, remote communication and remote adjusting) can be realized by MODBUS protocol;

— With 1 CANBUS interface, which can connect to ECU with J1939. It can not only monitor the common data of ECU (such as water temperature, oil pressure, speed, fuel consumption, etc.), but also control the startup, shutdown, speed control and so on through CANBUS interface;

— With 1 USB device interface, 1 Ethernet communication interface, which can connect PC and host computer for communication, data monitoring and parameter configuration;

— A total of 10-way analog sensors, including 3-way resistance type, 3-way current type, the other 4-way can be flexibly configured as resistor type, current type and voltage type;

— Modular structure design, flame retardant ABS shell, pluggable wiring terminal, 35mm guide rail or screw mounting, compact structure, easy installation.

3   SPECIFICATION

Table 3 - Performance Parameters of Display Module

Items	Contents
Working Voltage	DC10V~DC35V Continuous power, DC reverse connection protection.
Overall Power Consumption	<6W
RS485 Interface	Isolation, Half Duplex, Baud Rate: 9600/19200/38400/57600/115200bps, the maximum communication distance is 1000m (at 9600bps baud rate).
Ethernet	Adaptive 10/100Mbit
CAN BUS Interface	Isolation, the maximum communication distance is 250m, using Belden 9841 cable or equivalent.
Vibration	5-8Hz: ±7.5mm 8-500Hz: 2g IEC60068-2-6
Shock	50 g, 11 ms, half sine, finish the shock test from three directions. There are total 18 shocks per test. IEC60068-2-27
Collision	25g, 16ms, half sine IEC 60255-21-2
Case Dimension	221mm x 163mm x 51mm
Panel Cutout	205mm x 147mm
Working Conditions	Temperature: (-25~+70)°C; Humidity: (20~93)%RH
Storage Condition	Temperature: (-30~+80)°C
Protection Level	Front Panel: IP65, when a waterproof rubber ring is installed between the controller and the panel. Rear Panel: IP20
Weight	1.3kg

Table 4 -Performance Parameter of the Master Control Module

Items	Contents
Working Voltage	DC10V - DC35V continuous power supply，DC reverse connection protection Resolution：0.1V Accuracy：1%
Overall Power Consumption	<6W(Standby mode：≤1.5W)
Speed Sensor	Voltage Range：1.0 - 24V(Effective Value) Frequency Range：5Hz - 10000Hz
Charger (D+) Voltage	Range：DC0V - DC60V continuous power supply Resolution：0.1V Accuracy：1%
Analog Sensor	Resistor Input Range：0 - 6000Ω Resolution：0.1 Accuracy：1Ω (Below 300Ω)
	Voltage Input Range：0 - 5V Resolution：0.001V Accuracy：1%
	Current Input Range：0 - 20mA Resolution：0.01mA Accuracy：1%
Fuel Output Port	16A　B+ DC power supply relay output
Crank Output Port	16A　B+ DC power supply relay output
Digital Output Port 1-6	7A　　B+ DC power supply relay output
Digital Output Port 7-10	7A　AC250V relay passive output
Digital Input Port 1-9	Low on limit voltage value 1.2V, maximum input voltage 60V
RS485-1 Interface	Isolation, Half Duplex,
RS485-2 Interface	Baud Rate: 9600/19200/38400/57600/115200bps, the maximum communication distance is 1000m (at 9600bps baud rate).
Ethernet	Adaptive 10/100Mbit
MSC CAN Interface	Isolation, the maximum communication distance is 250m, using Belden 9841 cable or equivalent.
EMC/CE Certification	EN 61326-1:2013
Vibration	5-8Hz: ±7.5mm 8-500Hz: 2g IEC60068-2-6
Shock	50 g, 11 ms, half sine, finish the shock test from three directions. There are total 18 shocks per test. IEC60068-2-27
Collision	25g, 16ms, half sine

Items	Contents
	IEC 60255-21-2
Case Dimension	248 mm x 158 mm x 49 mm
Installation	35mm guide rail or screw mounting
Working Condition	Temperature：(-25~+70)°C Humidity: (20~93)%RH
Storage	Temperature：(-30~+80)°C
Protection Level	IP20
Insulation	AC 2.2kV voltage should be applied between the AC high voltage terminal and the low voltage terminal, and the leakage current should not be greater than 3mA within 1min.
Weight	0.8kg

4 DISPLAY AND OPERATION

4.1 FRONT PANEL OF DISPLAY MODULE

Fig.1-Display Module Front Panel

Table 5 −Description of Indicators

Indicators	Description
Alarm	Warning alarm：slow flashing (1 time per second) Fault idle alarm：slow flashing (1 time per second) Cooling shutdown alarm: slow flashing (5 times per second) Shutdown alarm: fast flashing (5 times per second) No alarm: extinguished.
Communication	The light is illuminated when the communication is normal between display module and master control module； The light is extinguished when the communication is abnormal.
Power	The light is illuminated when controller is power on and in operation; The light is extinguished when controller stops working.

4.2 DISPLAY INTERFACE AND OPERTION

There are 5 interfaces of the display module, namely homepage, detailed information, alarm, event log and "about" interface. Switch them through the button icon in the page switching bar.

4.2.1 HOMEPAGE DISPLAY
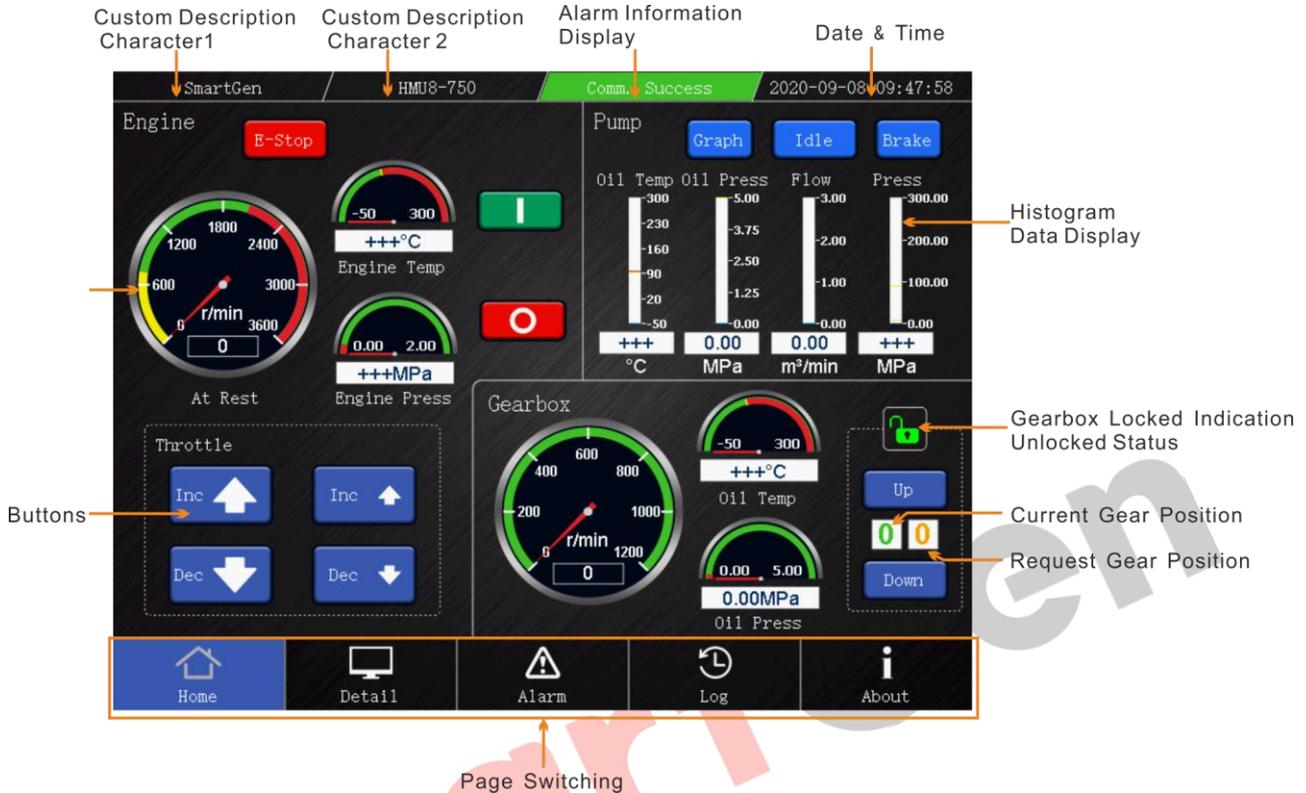
Fig. 2 – Homepage Display Interface

The dial plate data and bar graph data on the homepage can display the set alarm limit value of the sensor and the current sensor value.

Table 6 – Homepage Button Description

Icon	Button	Description
E-Stop	Emergency Stop	Press this button to stop the engine in operation immediately and initiate an emergency stop alarm at the same time.
I	Start	Press this button to start a stationary engine.
O	Stop	Press this button to stop the engine in operation. In the process of shutdown, press this button again to stop quickly.
Inc ⬆	Throttle Increase	According to the set big value of throttle adjustment to increase or decrease.
Dec ⬇	Throttle Decrease	
Inc ⬆	Throttle Slight Increase	According to the set small value of throttle adjustment to increase or decrease.

Icon	Button	Description
Dec ⬇	Throttle Slight Decrease	
Up	Upshift	When the engine is normally running and the gearbox is in the unlocked status, the gearbox requests to increase or decrease one gear position, and the actual gear position postpones the output according to the corresponding setting.
Down	Downshift	
Idle	One-key Idle	Press this button, the engine will return to idle state and the gearbox will switch to N neutral positon, and the master control module will initiate the forced fault idle alarm.(When one-key fault idle alarm is enabled)
Brake	Brake	Press this button, the gearbox brake outputs 2 seconds. Press the button can continuously to prolong the brake output time
Graph	Curve Diagram	Press this button to open the curve diagram of pressure and flow at the plunger pump outlet. The diagram displays the sampled data points from right to left at an interval of 5 seconds.

4.2.2　DETAILED INFORMATION DISPLAY

Fig.3-Detailed Information Display Interface

The detailed information interface displays the details of engine, gearbox, plunger plum, AUX. sensor and maintenance time. The data display position is synchronized according to the configuration of the master control module.

4.2.3 ALARM DISPLAY
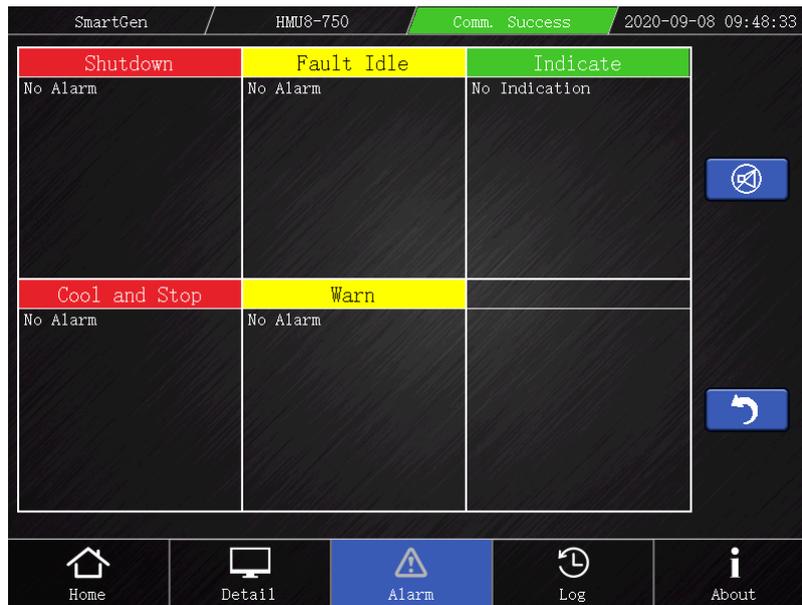
Fig.4-Alarm Display Interface

The alarm interface can display 4 types of alarms: shutdown alarm, cooling shutdown alarm, fault idle alarm and warning alarm. Each type of alarm can display up to 9 detailed contents. For the ECU with J1939 interface, if there are specific alarm contents, check the engine according to the content; otherwise, please refer to the engine manual according to the SPN alarm code for information.

At the same time, the alarm interface can also display up to 9 instructions, including the input indications of the master control module and the maintenance indications.

Table 7- Button Descriptions of Alarm Interface

Icon	Button	Description
	Alarm Mute	Press this button to eliminate the alarm sound of display module and master control module, and the white part of the button will turn red at the same time. Press this button again, the alarm sound is active again, and the red part of the button turns white.
	Alarm Reset	Press this button to reset the alarm initiated by the master controller module.

Fig.5-Event Log Display Interface

Each page of the event log interface can display 5 event records, including the serial number/total numbers of the current event, the type of event, the detailed contents of the event and the time when it happened.

Up to 200 event records can be viewed through the up and down buttons.

Table 8-Display Contents of Event Log

No.	Event Type	Contents
1	Event Start/Stop	1：Manual start 2：Manual stop
2	Shutdown Alarm	Shutdown alarm value.
3	Cooling Shutdown Alarm	Cooling shutdown alarm value.
4	Fault Idle Alarm	Fault idle alarm value.

4.2.5 ABOUT DISPLAY
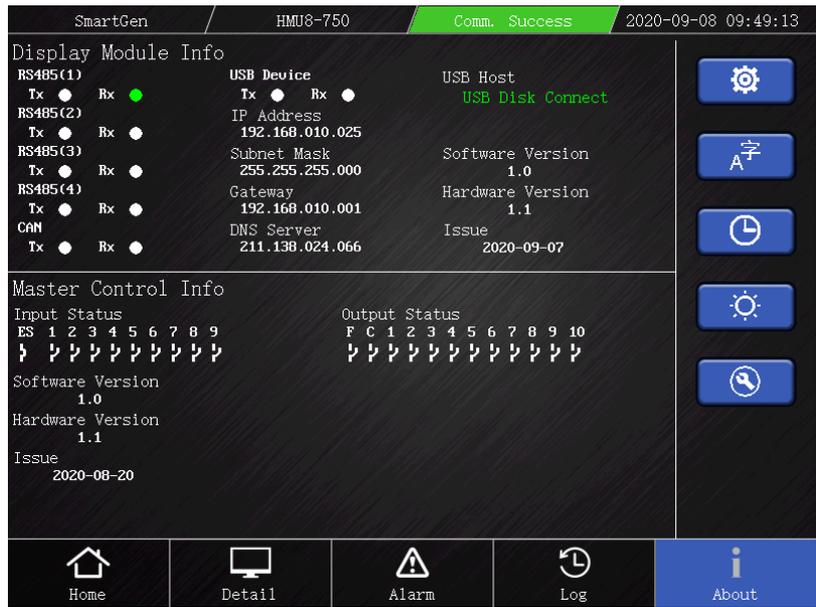
Fig.6-About Display Interface

The about display interface includes hardware information, the version of hardware and software, release date and other data of display module and master control module, as well as some function setting buttons.

Table 9-Button Descriptions of About Interface

Icon	Button	Description
⚙	Parameter Setting	Press this button to select display module and master module for parameter setting respectively.
A字	Language Setting	Press this button to set the language of display module as Chinese or English.
🕒	Time and Date	Press this button to set the time and date of master control module.
☼	Brightness	Press this button to adjust the screen brightness of the display module, and conduct lamp test operation for 2 seconds at the same time.
🔧	Advanced Parameter Setting	Press this button and enter the password to perform data calibration and parameter recovery of the master control module.

4.3 PARAMETR CONFIGURATION

In the "About" interface, press ⚙ button to enter the module selection page and select the module that needs configuration parameters.
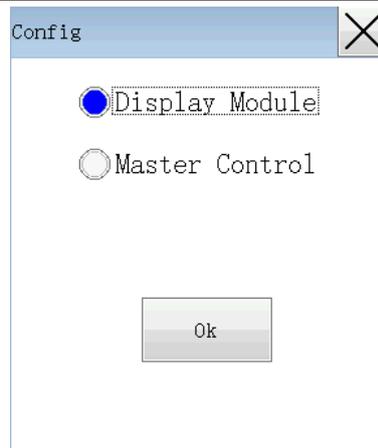
Fig.7-Module Selection Interface

4.3.1 PARAMETER CONFIGURATION OF DISPLAY MODULE
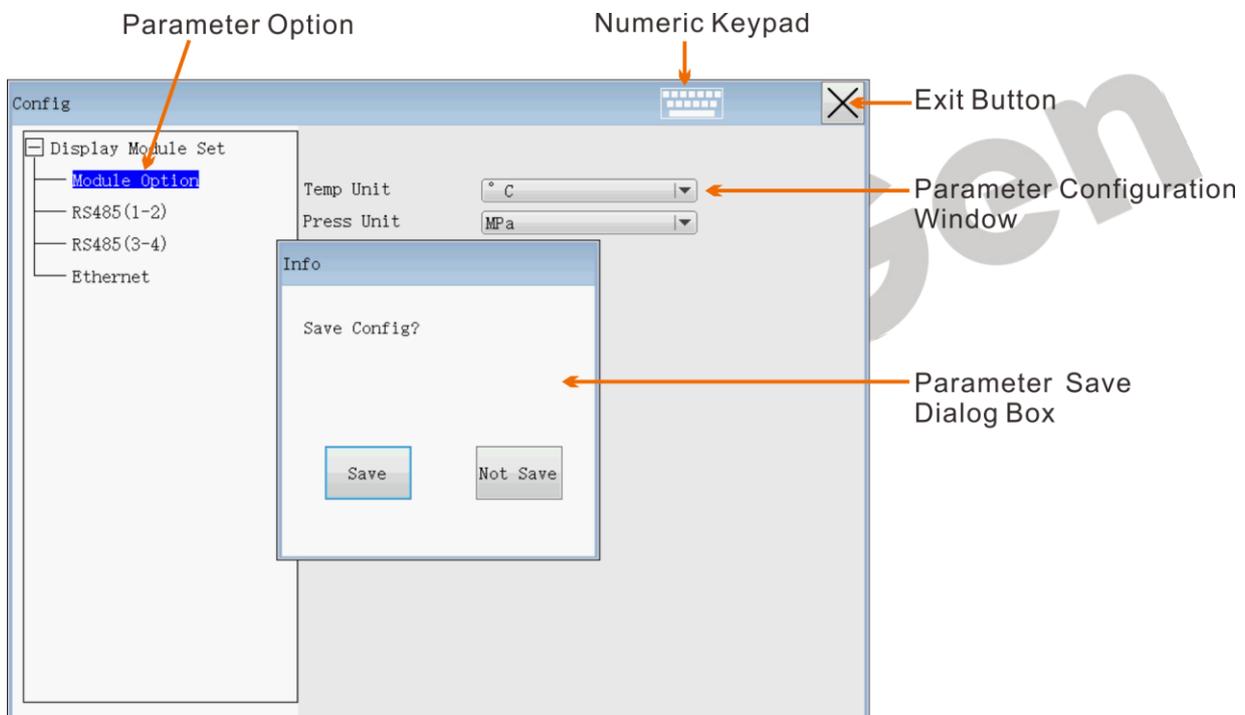
Fig.8-Parameter Configuration Interface of Display Module

The parameter configuration steps of the display module are as follows:

1) Select parameters to be configured by the tree diagram;
2) Set parameters to be changed in the right window. Press the numeric keypad button when necessary to pop up the numeric keypad;
3) After the parameter configuration, press the exit button to pop up the parameter saving dialog box and save according to the prompts.

4.3.2   PARAMETER CONFIGURATION OF MASTER CONTROL MODULE
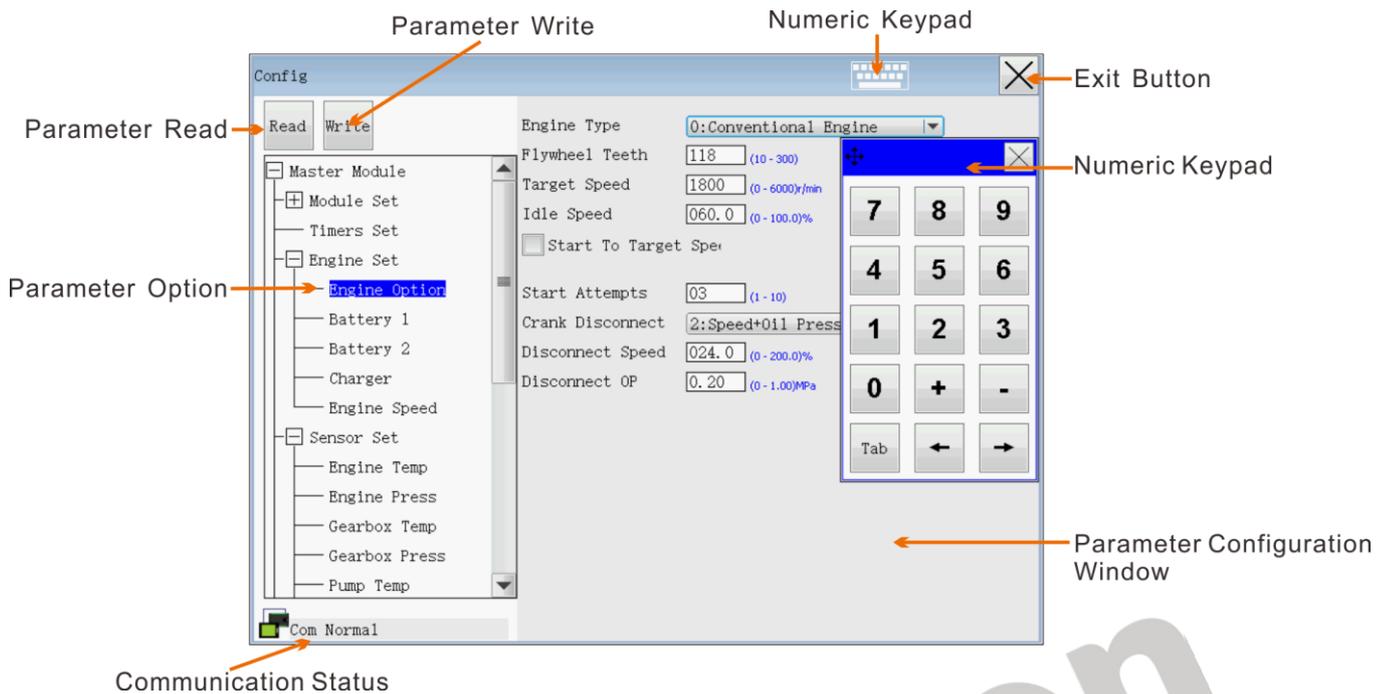
Fig.9-Parameter Configuration Interface of Master Control Module

Before entering the parameter configuration interface of the master control module, the display module will first read the parameters of the master control module. If communication fails at this time, the display module will load the factory default parameter values of the master control module.

The parameter configuration steps of the master control module are as follows:

1) Select parameters to be configured by the tree diagram;
2) Set parameters to be changed in the right window. Press the numeric keypad button when necessary to pop up the numeric keypad
3) After the parameter configuration, click the parameter write button to write the parameter. Before writing, if the password saved by the display module is inconsistent with the password of the main control module itself, a password dialog box will pop up. After entering the correct password of the main control module, the parameters can be written successfully; otherwise, it cannot be written. If the correct master control module password has been saved before, the parameter is written directly.
4) After the parameters are written, click the exit button to exit the interface.

Note 1: The default password of the main control module is "00318". If you forget the password, please contact the manufacturer.

Note 2: In the process of parameter configuration, if communication fails and then returns to normal, the display module will re-read and load the parameter configuration of the main control module.

Note 3: The display module can only configure part of the parameters of the master control module, and all the parameters need to be configured by PC software.

Attentions:

a) Please modify the internal parameters of the controller in standby mode (eg: selection of crank disconnect conditions, programmable input, output configuration, various delays, etc.), otherwise shutdown alarm or other abnormal phenomena may occur.

b) Higher limit value must greater than lower limit value, such as over voltage limit value must greater than under voltage limit value, otherwise both over voltage and under voltage may occur at the same time.

c) Over speed limit value must great than under speed limit value, otherwise both over speed and under speed may occur at the same time.

d) When setting the warning alarm, please set the return value correctly, otherwise it will fail to alarm normally. When setting over limit warning, the return value should be less than the set value; When setting under limit warning, the return value should be greater than the set value.

e) The programmable input port 1-9 cannot be set to the same item, otherwise the correct function will not appear, while the programmable input port 1-10 can be set to the same item.

4.3.3 ADVANCED PARAMETER CONFIGURATION

The advanced parameter configuration includes calibration and reset of parameters and setting of SPN mask off code. Part of the items need to enter a specific password to access, if necessary, please contact the manufacturer.

4.4 MANUAL START/STOP OPERATION

4.4.1 START SEQUENCE

a) In standby mode, press the button to start the engine;

b) If the preheating time is set, preheating relay outputs (if configured), the status page of display module displays "Start preheat delay XXs";

c) After the end of preheating delay, the fuel relay outputs 1s and then the starter relay outputs; If the crank disconnect is not realized within the " Cranking Time ", the fuel oil relay and the starter relay will stop output and enter the " Crank Rest Time ", waiting for the next cranking; within the setting cranking attempts, if the crank disconnect is not realized, the controller will issue the starting failure shutdown, and the alarm page of the module will display the alarm of starting failure.

d) At any one cranking, if crank disconnect, it will enter the "safe operation time". During this time, the alarms such as low oil pressure, high water temperature, under speed, charging failure, etc. are inactive. After the safe operation delay, it will enter the "Start Idle Delay" (if the start idle delay is configured);

e) In the process of start idle delay, the alarms such as under speed, under frequency, under voltage are inactive, after the end of start idle delay, it will enter "Warming Up Time Delay" (if the warming up time delay is configured).

f) After the warming up delay, the unit will enter the normal running status.

4.4.2 STOP SEQUENCE

a) Press the stop button to stop the engine in normal operation;

b) If cooling time delay is configured, then starts "Cooling Time Delay";

c) After the cooling time delay, enters "Stop Idle Delay" (if configured), the idle speed control relay will power up and output;

d) Enter the "ETS Solenoid Hold", the ETS solenoid relay will power up and output, the fuel relay output is disconnected, then the unit will stop;

e) When the unit stops successfully, enter the "after stop delay"; otherwise the controller will fail to stop and issue a "Fail to Stop Delay" warning (after the stop failure alarm, if the unit stops successfully, enter the "after stop delay" and automatically eliminated the stop failure waring);

f) The unit will enter the standby mode after its "after stop delay".

4.5 SPEED REGULATION OPERATION

4.5.1 CAN

a) The engine type is set to support the type of CAN speed regulation;

b) The speed regulation type is set as "1: CAN Speed Regulation";

c) Set the throttle adjustment coefficient, big adjustment to set 10, press the throttle increase and decrease buttons, each time the engine speed increases and decreases 10r/min; small adjustment to set 1, press the throttle to increase or decrease slightly, each time the engine speed increases or decreases 1r/min;

d) In the idle speed stage of start and stop, it will automatically stabilize to the idle speed value, and in the normal running stage, the speed can be adjusted manually.

4.5.2 GOV

a) Speed regulation type is set to "2: GOV speed regulation";

b) Set the throttle adjustment coefficient, big adjustment to set 10, press the throttle increase and decrease buttons, Increase and decrease the output of GOV range (SW2) by 10 ‰; small adjustment to set 1, press the throttle to increase or decrease slightly, each time the engine speed increases or decreases GOV range (SW2) by 1‰;

c) In the idle speed stage of start and stop, output voltage value from the lower limit range of center point, automatically adjust the output and stabilize to the idle speed value. In the normal running stage, the output voltage can be adjusted manually.

4.5.3 RELAY

a) Speed regulation type is set to "3: Relay speed regulation";

b) The output ports are configured as "Throttle Increase Output" and "Throttle Decrease Output";

c) Set the throttle adjustment coefficient, big adjustment to set 10, press the throttle increase and decrease buttons, the output time of "Throttle Increase Output" or "Throttle Decrease Output" is 10*100ms; small adjustment to set 1, press the throttle to increase or decrease slightly, the output time of "Throttle Increase Output" or "Throttle Decrease Output" is 1*100ms;

d) In the idle speed stage of start and stop, the speed is automatically stabilized to the idle speed value according to the response, gain and stability of relay speed regulation control. In the normal operation stage, the throttle increase and decrease output can be adjusted manually.

Note 1: Speed regulation, maximum speed rise to 110% of the rated speed.

Note 2: If starting operation is enabled to the rated speed, it will be automatically stabilized to the declared speed during normal operation.

5 PROTECTION

5.1 WARNING ALARM

When controller detects the warning signal, the controller only alarms without stopping, and the warning alarm will automatically reset.

Table-10 Warning Alarm

No.	Type	Description
1	Engine Over Speed	When controller detects that the engine speed is over the pre-set limit of over speed, it will initiate a warning. It is always detected.
2	Engine Under Speed	When controller detects that the engine speed is under the pre-set limit of under speed, it will initiate a warning. It is detected after 'warming up' and before 'stop idle'.
3	Loss of Engine Speed Signal	When controller detects that the engine speed is 0 and the action type of loss of speed signal selects warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
4	Gearbox Over Speed	When controller detects that the gearbox speed is over the pre-set limit of over speed, it will initiate a warning. The current position is not 0 and it is always detected.
5	Gearbox Under Speed	When controller detects that the gearbox speed is under the pre-set limit of under speed, it will initiate a warning. The current position is not 0 and it is detected after 'warming up' and before 'stop idle'.

No.	Type	Description
6	Loss of Gearbox Speed Signal	When controller detects that the gearbox speed is 0 and the action type of loss of speed signal selects warning, it will initiate a warning. The request position output is not 0 and it is detected after 2s delay.
7	Stop Failure Alarm	After the engine stop delay but it fails to stop, the controller will initiate a warning.
8	ECU Alarm	When controller receives the engine waring signal through J1939, the controller will initiate a warning. It is always detected.
9	Engine Temp. Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects warning, the controller will initiate a warning. It is always detected.
10	Engine High Temp.	When controller detects that the temperature is higher than the pre-set limit of high temperature warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
11	Engine Low Temp.	When controller detects that the temperature is lower than the pre-set limit of low temperature warning, it will initiate a warning. It is always detected.
12	Engine OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.
13	Engine Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit of oil pressure warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
14	Gearbox OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.
15	Gearbox High Oil Pressure	When controller detects that the oil pressure is above the pre-set limit of high oil pressure warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
16	Gearbox Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit of low oil pressure warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
17	Plunger Pump OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.

No.	Type	Description
18	Plunger Pump High Oil Pressure	When controller detects that the oil pressure is above the pre-set limit of high oil pressure warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
19	Plunger Pump Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit of low oil pressure warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
20	Flex. Sensor 1 Open Circuit	When controller detects that the sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.
21	Flex. Sensor 1 High	When the controller detects that the sensor value is above the pre-set upper limit, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
22	Flex. Sensor 1 Low	When the controller detects that the sensor value is below the pre-set low limit, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
23	Flex. Sensor 2 Open Circuit	When controller detects that the sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.
24	Flex. Sensor 2 High	When the controller detects that the sensor value is above the pre-set upper limit, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
25	Flex. Sensor 2 Low	When the controller detects that the sensor value is below the pre-set low limit, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.

No.	Type	Description
26	Gearbox Oil Temp. Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.
27	Gearbox High Oil Temp.	When controller detects that the gearbox oil temperature is higher than the pre-set limit of high temperature warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
28	Gearbox Low Oil Temp.	When controller detects that the gearbox oil temperature is lower than the pre-set limit of low temperature warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
29	Plunger Pump OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.
30	Plunger Pump High Oil Temp.	When controller detects that the oil temperature of plunger pump is higher than the pre-set limit of high temperature warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
31	Plunger Pump Low Oil Temp.	When controller detects that the oil temperature of plunger pump is lower than the pre-set limit of low temperature warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
32	Flex. Sensor 3 Open Circuit	When controller detects that the sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.
33	Flex. Sensor 3 High	When the controller detects that the sensor value is above the pre-set upper limit, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
34	Flex. Sensor 3 Low	When the controller detects that the sensor value is below the pre-set low limit, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
35	Outlet Pressure Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.

No.	Type	Description
36	Outlet High Pressure	When controller detects that the outlet pressure value is above the pre-set limit of high pressure warning, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
37	Outlet Low Pressure	When controller detects that the outlet pressure value is below the pre-set limit of low pressure warning, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
38	Flex. Sensor 4 Open Circuit	When controller detects that the sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.
39	Flex. Sensor 4 High	When the controller detects that the sensor value is above the pre-set upper limit, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
40	Flex. Sensor 4 Low	When the controller detects that the sensor value is below the pre-set low limit, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
41	Flex. Sensor 5 Open Circuit	When controller detects that the sensor is open and the open action type selects warning, it will initiate a warning. It is always detected.
42	Flex. Sensor 5 High	When the controller detects that the sensor value is above the pre-set upper limit, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.

No.	Type	Description
43	Flex. Sensor 5 Low	When the controller detects that the sensor value is below the pre-set low limit, it will initiate a warning. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
44	Battery 1 High Voltage	When controller detects that the engine battery 1 voltage is higher than the pre-set limit voltage value, it will initiate a warning. It is always detected.
45	Battery 1 Low Voltage	When controller detects that the engine battery 1 voltage is lower than the pre-set limit voltage value, it will initiate a warning. It is always detected.
46	Battery 2 High Voltage	When controller detects that the engine battery 2 voltage is higher than the pre-set limit value, it will initiate a warning. It is always detected.
47	Battery 2 Low Voltage	When controller detects that the engine battery 2 voltage is lower than the pre-set limit value, it will initiate a warning. It is always detected.
48	Charging Failure Alarm	When controller detects that the charging voltage value is lower than the pre-set limit value, it will initiate a waring. It is detected when normal running.
49	Authorization Time Due	When controller's time reaches the authorization time, and the action type of authorization time due selects warning, it will initiate a warning. It is always detected.
50	Digital Input 1-9 Alarm	When the digital input is selected as user-defined and effective, the controller will initiate a corresponding input port warning It is detected within the detection range set by the input port.
51	Maintenance 1-5 Time Due Alarm	When the timing mode is set to "unit running time", the maintenance timing will reach the setting maintenance time, and the action type of maintenance time due is selected as warning, the controller will initiate a warning. When the timing mode is set to "date", the action type of maintenance date due and maintenance time due are selected as warning, the controller will initiate a warning. It is always detected.
52	Gear Position 1-8 Outlet Pressure High	When controller detects that the current gear position outlet pressure is higher than the pre-set limit value, and the action type of alarm is selected as warning, it will initiate a warning. It is always detected.

5.2 SHUTDWON ALARM

When the controller detects the shutdown alarm signal, it will stop immediately and need to reset the alarm manually.

Table-11 Shutdown Alarm

No.	Type	Description
1	Emergency Shutdown	When controller detects the emergency shutdown alarm, it will initiate a shutdown alarm. It is always detected.
2	Engine Over Speed	When controller detects that the engine speed is over the pre-set limit of over speed value, it will initiate a shutdown alarm. It is always detected.
3	Engine Under Speed	When controller detects that the engine speed is under the pre-set limit of under speed value, it will initiate a shutdown alarm. It is detected after 'warming up' and before 'stop idle'.
4	Loss of Engine Speed Signal	When controller detects that the engine speed is 0 and the action type of loss of speed signal selects shutdown, it will initiate a shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
5	Gearbox Over Speed Alarm	When controller detects that the gearbox speed is over the pre-set limit of over speed, it will initiate a shutdown alarm. The current position is not 0 and it is always detected.
6	Gearbox Under Speed	When controller detects that the gearbox speed is under the pre-set limit of under speed, it will initiate a shutdown alarm. The current position is not 0 and it is detected after 'warming up' and before 'stop idle'.
7	Loss of Gearbox Speed Signal	When controller detects that the gearbox speed is 0 and the action type of loss of speed signal selects shutdown, it will initiate a shutdown alarm. The request position output is not 0 and it is detected after 2s delay.
8	Start Fail Alarm	When the controller starts within the set number of times, if the engine does not start successfully, it will initiate a start failure alarm.
9	ECU Alarm	When the controller receives the engine shutdown alarm through J1939, it will initiate a shutdown alarm. It is always detected.
10	Gearbox High Temp. Input	When the controller input port is set to the gearbox high temperature shutdown input and effective, it will initiate an alarm of gearbox high temperature input and shutdown. It is detected after 'safety on time' before 'ETS solenoid hold'.

No.	Type	Description
11	Gearbox Low OP Input	When the controller input port is set to the gearbox low oil pressure shutdown input and effective, it will initiate an alarm of gearbox low oil pressure input and shutdown. It is detected after 'safety on time' before 'ETS solenoid hold'.
12	Engine High Temp. Input	When the controller input port is set to high temperature shutdown input and effective, it will initiate an alarm of high temperature input shutdown. It is detected after 'safety on time' before 'ETS solenoid hold'.
13	Engine Low OP Input	When the controller input port is set to the low oil pressure shutdown input and effective, it will initiate an alarm of low oil pressure input and shutdown. It is detected after 'safety on time' before 'ETS solenoid hold'.
14	Engine ECU Communication Failure	When the controller doesn't receive the data through J1939 after starting the engine, it will initiate a communication failure shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
15	Gearbox ECU Communication Failure	When the gearbox doesn't receive the data through J1939 after starting the engine by the controller, the controller will initiate a communication failure shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
16	Engine Temp. Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.
17	High Engine Temp.	When controller detects that the temperature is above the pre-set limit of high temperature of shutdown, it will initiate a shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
18	Low Engine Temp.	When controller detects that the temperature is below the pre-set limit of low temperature of shutdown, it will initiate a shutdown alarm. It is always detected.
19	Engine OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.
21	Engine Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit of oil pressure shutdown, it will initiate a shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
22	Gearbox OP Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.

No.	Type	Description
23	Gearbox High Oil Pressure	When controller detects that the oil pressure of the gearbox is above the pre-set limit of high oil pressure shutdown, it will initiate a shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
24	Gearbox Low Oil Pressure	When controller detects that the oil pressure of the gearbox is below the pre-set limit of low oil pressure shutdown, it will initiate a shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
25	Plunger Pump OP Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.
26	Plunger Pump High Oil Pressure	When controller detects that the oil pressure is above the pre-set limit of high oil pressure shutdown, it will initiate a shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
27	Plunger Pump Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit of low oil pressure warning, it will initiate a warning. It is detected after 'safety on time' before 'ETS solenoid hold'.
28	Flex. Sensor 1 Open Circuit	When controller detects that the sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.
29	Flex. Sensor 1 High	When the controller detects that the sensor value is above the pre-set upper limit, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
30	Flex. Sensor 1 Low	When the controller detects that the sensor value is below the pre-set low limit, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
31	Flex. Sensor 2 Open Circuit	When controller detects that the sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.

No.	Type	Description
32	Flex. Sensor 2 High	When the controller detects that the sensor value is above the pre-set upper limit, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
33	Flex. Sensor 2 Low	When the controller detects that the sensor value is below the pre-set low limit, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
34	Gearbox Oil Temp. Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.
35	Gearbox High Oil Temp.	When controller detects that the gearbox oil temperature is higher than the pre-set limit of high temperature shutdown, it will initiate a shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
36	Gearbox Low Oil Temp.	When controller detects that the gearbox oil temperature is lower than the pre-set limit of low temperature shutdown, it will initiate a shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
37	Plunger Pump OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.
38	Plunger Pump High Oil Temp.	When controller detects that the oil temperature of plunger pump is higher than the pre-set limit of high temperature shutdown, it will initiate a shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
39	Plunger Pump Low Oil Temp.	When controller detects that the oil temperature of plunger pump is lower than the pre-set limit of low temperature shutdown, it will initiate a shutdown alarm. It is detected after 'safety on time' before 'ETS solenoid hold'.
40	Flex. Sensor 3 Open Circuit	When controller detects that the sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.

No.	Type	Description
41	Flex. Sensor 3 High	When the controller detects that the sensor value is above the pre-set upper limit, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
42	Flex. Sensor 3 Low	When the controller detects that the sensor value is below the pre-set low limit, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
43	Outlet Pressure Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.
44	Outlet High Pressure	When controller detects that the outlet pressure value is above the pre-set limit of high pressure shutdown, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
45	Outlet Low Pressure	When controller detects that the outlet pressure value is below the pre-set limit of low pressure warning, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
46	Flex. Sensor 4 Open Circuit	When controller detects that the sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.
47	Flex. Sensor 4 High	When the cotroller detects that the sensor value is above the pre-set upper limit, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.

No.	Type	Description
48	Flex. Sensor 4 Low	When the controller detects that the sensor value is below the pre-set low limit, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
49	Flex. Sensor 5 Open Circuit	When controller detects that the sensor is open and the open action type selects shutdown, it will initiate a shutdown alarm. It is always detected.
50	Flex. Sensor 5 High	When the controller detects that the sensor value is above the pre-set upper limit, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
51	Flex. Sensor 5 Low	When the controller detects that the sensor value is below the pre-set low limit, it will initiate a shutdown alarm. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
52	Battery 1 High Voltage	When controller detects that the engine battery 1 voltage is higher than the pre-set limit voltage value, it will initiate a shutdown alarm. It is always detected
53	Battery 1 Low Voltage	When controller detects that the engine battery 1 voltage is lower than the pre-set limit voltage value, it will initiate a shutdown alarm. It is always detected
54	Battery 2 High Voltage	When controller detects that the engine battery 2 voltage is higher than the pre-set limit value, it will initiate a shutdown alarm. It is always detected
55	Battery 2 Low Voltage	When controller detects that the engine battery 2 voltage is lower than the pre-set limit value, it will initiate a shutdown alarm. It is always detected.
56	Charging Failure Alarm	When controller detects that the charging voltage value is lower than the pre-set limit value, it will initiate a shutdown alarm. It is detected when normal running.

No.	Type	Description
57	Authorization Time Due	When controller's time reaches the authorization time, and the action type of authorization time due selects shutdown, it will initiate a shutdown alarm. It is always detected.
58	Digital Input 1-9 Alarm	When the digital input is selected as user-defined and effective, the controller will initiate a corresponding input port warning It is detected within the detection range set by the input port.
59	Maintenance 1-5 Time Due Alarm	When the timing mode is set to "unit running time", the maintenance timing will reach the setting maintenance time, and the action type of maintenance time due is selected as shutdown, the controller will initiate a shutdown alarm. When the timing mode is set to "date", the action type of maintenance date due and maintenance time due are selected as shutdown, the controller will initiate a shutdown alarm. It is always detected.
60	Gear Position 1-8 Outlet Pressure High	When controller detects that the current gear position outlet pressure is higher than the pre-set limit value, and the action type of alarm is selected as shutdown, it will initiate a shutdown alarm. It is always detected.

5.3 FAULT IDLE ALARM

When the controller detects the fault idle alarm signal, it will run in Neutralposition immediately and need to reset the alarm manually.

Table-12 Fault Idle Alarm

No.	Type	Description
1	Engine Over Speed	When controller detects that the engine speed is over the pre-set limit of over speed, it will initiate a fault idle signal. It is always detected.
2	Engine Under Speed	When controller detects that the engine speed is under the pre-set limit of under speed, it will initiate a fault idle signal. It is detected after 'warming up' and before 'stop idle'.
3	Loss of Engine Speed Signal	When controller detects that the engine speed is 0 and the action type of loss of speed signal selects fault idle, it will initiate a fault idle signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
4	Gearbox Over Speed	When controller detects that the gearbox speed is over the pre-set limit of over speed, it will initiate a fault idle signal. The current gear position is not 0 and it is always detected.
5	Gearbox Under Speed	When controller detects that the gearbox speed is under the pre-set limit of under speed, it will initiate a fault idle signal. The current gear position is not 0 and it is detected after 'warming up' and before 'stop idle'.

No.	Type	Description
6	Loss of Gearbox Speed Signal	When controller detects that the gearbox speed is 0 and the action type of loss of speed signal selects fault idle, it will initiate a fault idle signal. The request gear position output is not 0 and it is detected after 2s delay.
7	Forced Fault Idle Effective	When press "One-key Idle" of display module, the engine returns to idle status and the gearbox will switch to neutral position, the main control module will initiate a forced fault idle alarm (when the one-key fault idle alarm is enabled).
8	Engine Temp. Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
9	Engine High Temp.	When controller detects that the temperature is higher than the pre-set limit value of fault idle, it will initiate a fault idle signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
10	Engine Low Temp.	When controller detects that the temperature is lower than the pre-set limit value of fault idle, it will initiate a fault idle signal. It is always detected.
11	Engine OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
12	Engine Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit of oil pressure fault idle, it will initiate a fault idle. It is detected after 'safety on time' before 'ETS solenoid hold'.
13	Gearbox OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
14	Gearbox High Oil Pressure	When controller detects that the oil pressure is above the pre-set limit of high oil pressure fault idle, it will initiate a fault idle signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
15	Gearbox Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit of low oil pressure fault idle, it will initiate a fault idle signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
16	Plunger Pump OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.

No.	Type	Description
17	Plunger Pump High Oil Pressure	When controller detects that the oil pressure is above the pre-set limit of high oil pressure fault idle, it will initiate a fault idle signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
18	Plunger Pump Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit of low oil pressure fault, it will initiate a fault idle signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
19	Flex. Sensor 1 Open Circuit	When controller detects that the sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
20	Flex. Sensor 1 High	When the controller detects that the sensor value is above the pre-set upper limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'. It is always detected when the sensor is selected as level sensor.
21	Flex. Sensor 1 Low	When the controller detects that the sensor value is below the pre-set low limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
22	Flex. Sensor 2 Open Circuit	When controller detects that the sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
23	Flex. Sensor 2 High	When the controller detects that the sensor value is above the pre-set upper limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.

No.	Type	Description
24	Flex. Sensor 2 Low	When the controller detects that the sensor value is below the pre-set low limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
25	Gearbox Oil Temp. Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
26	Gearbox High Oil Temp.	When controller detects that the sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
27	Gearbox Low Oil Temp.	When controller detects that the gearbox oil temperature is lower than the pre-set limit value of fault idle, it will initiate a fault idle signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
28	Plunger Pump OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
29	Plunger Pump High Oil Temp.	When controller detects that the oil temperature of plunger pump is higher than the pre-set limit value of fault idle, it will initiate a fault idle signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
30	Plunger Pump Low Oil Temp.	When controller detects that the oil temperature of plunger pump is lower than the pre-set limit value of fault idle, it will initiate a fault idle signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
31	Flex. Sensor 3 Open Circuit	When controller detects that the sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
32	Flex. Sensor 3 High	When the controller detects that the sensor value is above the pre-set upper limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.

No.	Type	Description
33	Flex. Sensor 3 Low	When the controller detects that the sensor value is below the pre-set low limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
34	Outlet Pressure Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
35	Outlet High Pressure	When controller detects that the outlet pressure value is above the pre-set limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
36	Outlet Low Pressure	When controller detects that the outlet pressure value is below the pre-set limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
37	Flex. Sensor 4 Open Circuit	When controller detects that the sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
38	Flex. Sensor 4 High	When the controller detects that the sensor value is above the pre-set upper limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.

No.	Type	Description
39	Flex. Sensor 4 Low	When the controller detects that the sensor value is below the pre-set low limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
40	Flex. Sensor 5 Open Circuit	When controller detects that the sensor is open and the open action type selects fault idle, it will initiate a fault idle signal. It is always detected.
41	Flex. Sensor 5 High	When the controller detects that the sensor value is above the pre-set upper limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
42	Flex. Sensor 5 Low	When the controller detects that the sensor value is below the pre-set low limit value of fault idle, it will initiate a fault idle signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
43	Battery 1 High Voltage	When controller detects that the engine battery 1 voltage is higher than the pre-set limit voltage value, it will initiate a fault idle signal. It is always detected.
44	Battery 1 Low Voltage	When controller detects that the engine battery 1 voltage is lower than the pre-set limit voltage value, it will initiate a fault idle signal. It is always detected.
45	Battery 2 High Voltage	When controller detects that the engine battery 2 voltage is higher than the pre-set limit value, it will initiate a fault idle signal. It is always detected.
46	Battery 2 Low Voltage	When controller detects that the engine battery 2 voltage is lower than the pre-set limit value, it will initiate a fault idle signal. It is always detected.

No.	Type	Description
47	Charging Failure Alarm	When controller detects that the charging voltage value is lower than the pre-set limit value, it will initiate a fault idle signal. It is detected when normal running.
48	Digital Input 1-9 Alarm	When the digital input is selected as user-defined and effective, the controller will initiate a corresponding input port alarm. It is detected within the detection range set by the input port.
49	Maintenance 1-5 Time Due Alarm	When the timing mode is set to "unit running time", the maintenance timing will reach the setting maintenance time, and the action type of maintenance time due is selected as fault idle, the controller will initiate a fault idle signal. When the timing mode is set to "date", the action type of maintenance date due and maintenance time due are selected as fault idle, the controller will initiate a fault idle signal. It is always detected.
50	Gear Position 1-8 Outlet Pressure High	When controller detects that the current position outlet pressure is higher than the pre-set limit value, and the action type of alarm is selected as fault idle, it will initiate a fault idle signal. It is always detected.

5.4 COOLING SHUTDOWN ALARM

When controller detects the cooling shutdown alarm signal, it will stop after the cooling time and need to reset the alarm manually.

Table-13 Cooling Shutdown Alarm

No.	Type	Description
1	Engine Over Speed	When controller detects that the engine speed is over the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
2	Engine Under Speed	When controller detects that the engine speed is under the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'warming up' and before 'stop idle'.
3	Loss of Engine Speed Signal	When controller detects that the engine speed is 0 and the action type of loss of speed signal selects cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
4	Gearbox Over Speed	When controller detects that the gearbox speed is over the pre-set limit value of cooling shutdown, it will initiate a cooling down signal. The current position is not 0 and it is always detected.

No.	Type	Description
5	Gearbox Under Speed	When controller detects that the gearbox speed is under the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. The current position is not 0 and it is detected after 'warming up' and before 'stop idle'.
6	Loss of Gearbox Speed Signal	When controller detects that the gearbox speed is 0 and the action type of loss of speed signal selects cooling shutdown, it will initiate a cooling shutdown signal. The request position output is not 0 and it is detected after 2s delay.
7	Engine Temp. Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
8	Engine High Temp.	When controller detects that the temperature is higher than the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown. It is detected after 'safety on time' before 'ETS solenoid hold'.
9	Engine Low Temp.	When controller detects that the temperature is lower than the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
10	Engine OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
11	Engine Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit of oil pressure cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
12	Gearbox OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
13	Gearbox High Oil Pressure	When controller detects that the oil pressure is above the pre-set limit of high oil pressure cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
14	Gearbox Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'safety on time' before 'ETS solenoid hold'.

No.	Type	Description
15	Plunger Pump OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects cooling shutdown, it will initiate a shutdown alarm. It is always detected.
16	Plunger Pump High Oil Pressure	When controller detects that the oil pressure is above the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
17	Plunger Pump Low Oil Pressure	When controller detects that the oil pressure is below the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
18	Flex. Sensor 1 Open Circuit	When controller detects that the sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
19	Flex. Sensor 1 High	When the controller detects that the sensor value is above the pre-set upper limit value of cooling shutdown, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
20	Flex. Sensor 1 Low	When the controller detects that the sensor value is below the pre-set low limit value of cooling shutdwon, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
21	Flex. Sensor 2 Open Circuit	When controller detects that the sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
22	Flex. Sensor 2 High	When the controller detects that the sensor value is above the pre-set upper limit value of cooling shutdown, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'. It is always detected when the sensor is selected as level sensor.

No.	Type	Description
23	Flex. Sensor 2 Low	When the controller detects that the sensor value is below the pre-set low limit value of cooling shutdown, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'. It is always detected when the sensor is selected as level sensor.
24	Gearbox Oil Temp. Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
25	Gearbox High Oil Temp.	When controller detects that the gearbox oil temperature is higher than the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
26	Gearbox Low Oil Temp.	When controller detects that the gearbox oil temperature is lower than the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
27	Plunger Pump OP Sensor Open Circuit	When controller detects that the OP sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
28	Plunger Pump High Oil Temp.	When controller detects that the oil temperature of plunger pump is higher than the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
29	Plunger Pump Low Oil Temp.	When controller detects that the oil temperature of plunger pump is lower than the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. It is detected after 'safety on time' before 'ETS solenoid hold'.
30	Flex. Sensor 3 Open Circuit	When controller detects that the sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
31	Flex. Sensor 3 High	When the controller detects that the sensor value is above the pre-set upper limit value of cooling shutdown, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'. It is always detected when the sensor is selected as level sensor.

No.	Type	Description
32	Flex. Sensor 3 Low	When the controller detects that the sensor value is below the pre-set low limit value of cooling shutdown, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
33	Outlet Pressure Sensor Open Circuit	When controller detects that the sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
34	Outlet High Pressure	When controller detects that the outlet pressure value is above the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'. It is always detected when the sensor is selected as level sensor.
35	Outlet Low Pressure	When controller detects that the outlet pressure value is below the pre-set limit value of cooling shutdown, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'. It is always detected when the sensor is selected as level sensor.
36	Flex. Sensor 4 Open Circuit	When controller detects that the sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
37	Flex. Sensor 4 High	When the controller detects that the sensor value is above the pre-set upper limit value of cooling shutdown, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.

No.	Type	Description
38	Flex. Sensor 4 Low	When the controller detects that the sensor value is below the pre-set low limit value of cooling shutdown, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
39	Flex. Sensor 5 Open Circuit	When controller detects that the sensor is open and the open action type selects cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.
40	Flex. Sensor 5 High	When the controller detects that the sensor value is above the pre-set upper limit value of cooling shutdown, it will initiate a cooling shutdown signal. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
41	Flex. Sensor 5 Low	When the controller detects that the sensor value is below the pre-set low limit value of cooling shutdown, it will initiate a cooling shutdown. When the sensor is selected as temperature sensor and pressure sensor, it is detected after 'safety on time' before 'ETS solenoid hold'; It is always detected when the sensor is selected as level sensor.
42	Battery 1 High Voltage	When controller detects that the engine battery 1 voltage is higher than the pre-set limit voltage value, it will initiate a cooling shutdown signal. It is always detected.
43	Battery 1 Low Voltage	When controller detects that the engine battery 1 voltage is lower than the pre-set limit voltage value, it will initiate a cooling shutdown signal. It is always detected.
44	Battery 2 High Voltage	When controller detects that the engine battery 2 voltage is higher than the pre-set limit value, it will initiate a cooling shutdown signal. It is always detected.
45	Battery 2 Low Voltage	When controller detects that the engine battery 2 voltage is lower than the pre-set limit value, it will initiate a cooling shutdown signal. It is always detected.

No.	Type	Description
46	Charging Failure Alarm	When controller detects that the charging voltage value is lower than the pre-set limit value, it will initiate a cooling shutdown signal. It is detected when normal running.
47	Digital Input 1-9 Alarm	When the digital input is selected as user-defined and effective, the controller will initiate a corresponding input port alarm. It is detected within the detection range set by the input port.
48	Maintenance 1-5 Time Due Alarm	When the timing mode is set to "unit running time", the maintenance timing will reach the setting maintenance time, and the action type of maintenance time due is selected cooling shutdown, the controller will initiate a cooling shutdown signal. When the timing mode is set to "date", the action type of maintenance date due and maintenance time due are selected as cooling shutdown, the controller will initiate a cooling shutdown signal. It is always detected.
49	Gear Position 1-8 Outlet Pressure High	When controller detects that the current position outlet pressure is higher than the pre-set limit value, and the action type of alarm is selected as cooling shutdown, it will initiate a cooling shutdown signal. It is always detected.

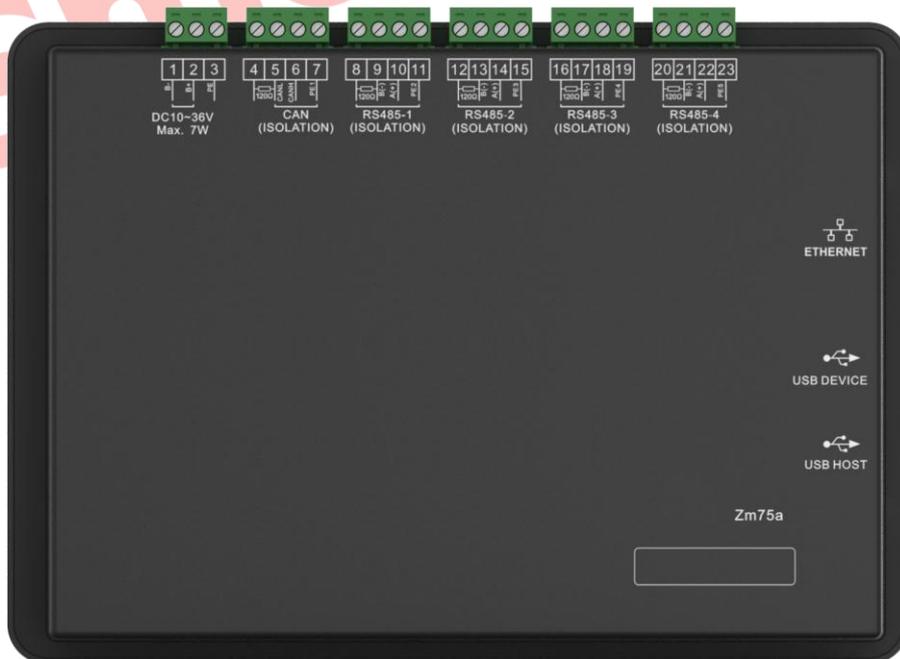## 6 WIRING

6.1 REAR PANEL OF HUM8-750 DISPLAY MODULE

Fig.10-Rear Panel of the Controller

Table 14 – Terminal Wiring Description

No.	Function		Cable Size	Remark
1	B-		1.0mm^2	Connect with starter battery negative.
2	B+		1.0mm^2	Connect with starter battery positive.
3	PE			Protect earth.
4	CAN	Terminal matching resistance (120Ω)	0.5mm^2	Reserved port. It is recommended to use a twisted-pair shielded wire with an impedance of 120Ω, and the shielded wire should be grounded at one end. Connect No. 4 and No. 6 terminals to a 120Ω terminal resistance.
5		CAN L	0.5mm^2	
6		CAN H	0.5mm^2	
7		PE1		Protect earth.
8	RS485-1	Terminal matching resistance (120Ω)	0.5mm^2	Used for connecting with the master control module. It is recommended to use a twisted-pair shielded wire with an impedance of 120Ω, and the shielded wire should be grounded at one end. Connect No. 8 and No. 10 terminals to a 120Ω terminal resistance
9		B(-)	0.5mm^2	
10		A(+)	0.5mm^2	
11		PE2		Protect earth.
12	RS485-2	Terminal matching resistance (120Ω)	0.5mm^2	Reserved port. It is recommended to use a twisted-pair shielded wire with an impedance of 120Ω, and the shielded wire should be grounded at one end. Connect No. 12 and No. 14 terminals to a 120Ω terminal resistance.
13		B(-)	0.5mm^2	
14		A(+)	0.5mm^2	
15		PE3		Protect earth.
16	RS485-3	Terminal matching resistance (120Ω)	0.5mm^2	Reserved port. It is recommended to use a twisted-pair shielded wire with an impedance of 120Ω, and the shielded wire should be grounded at one end. Connect No. 16 and No. 18 terminals to a 120Ω terminal resistance.
17		B(-)	0.5mm^2	
18		A(+)	0.5mm^2	
19		PE4		Protect earth.
20	RS485-4	Terminal matching resistance (120Ω)	0.5mm^2	Reserved port. It is recommended to use a twisted-pair shielded wire with an impedance of 120Ω, and the shielded wire should be grounded at one end. Connect No. 20 and No. 22 terminals to a 120Ω terminal resistance.
21		B(-)	0.5mm^2	
22		A(+)	0.5mm^2	
23		PE5		Protect earth.

Note 1: The slave USB port of the controller side is used for controller firmware upgrade.

Note 2: The master USB port of the controller side is used for controller display image and font library update.

Note 3: The ETHERNET port is the reserved port.

6.2 THE PANEL OF MASTER CONTROL MODULE HEM750
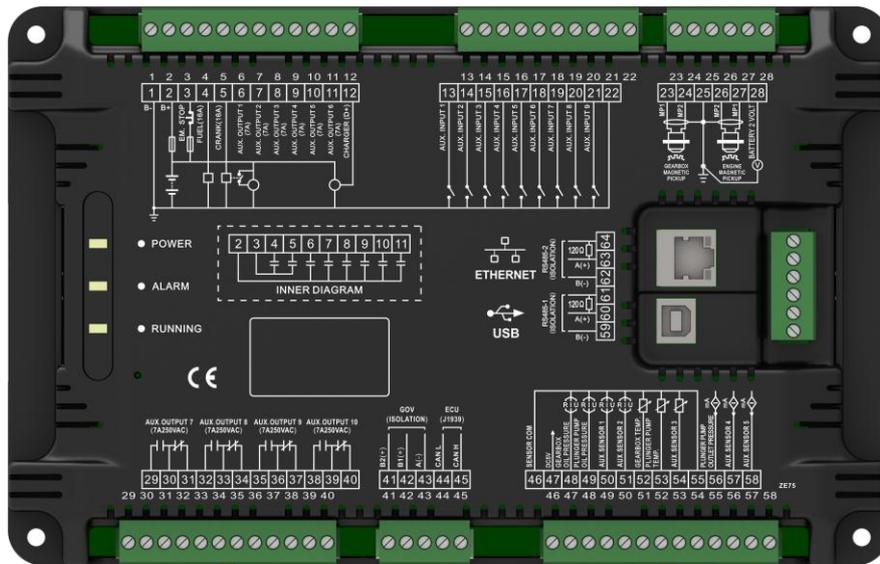
Fig.11- The Panel of Master Control Module

Table-15 Indicators

Indicators	Description
Power	The light is illuminated when the controller is power-on; the light is extinguished when the controller is power-off.
Alarm	Warning Alarm: slow flashing (1 time per second) Fault Idle Alarm: slow flashing (1 time per second) Cooling Shutdown Alarm: fast flashing (5 times per second) Shutdown Alarm: fast flashing (5 times per second) No Warning: extinguished.
Running	It is illuminated during safe running and shutdown idle, other states are extinguished.

Table 16-Terminal Wiring Description

No.	Function	Cable Size	Remark	
1	B-	2.5mm^2	Connect with starter battery negative.	
2	B+	2.5mm^2	Connect with starter battery negative. If wire length is over 30m, it's better to double wires in parallel. Max. 20A fuse is recommended.	
3	Emergency Stop	2.5mm^2	Connect with B+ via emergency stop button	
4	Fuel Relay Output	2.5mm^2	B+ is supplied by 3 points, rated 16A.	
5	Starter Relay Output	2.5mm^2	B+ is supplied by 3 points, rated 16A. Connect to starter coil.	
6	Digi. output 1	1.5mm^2	B+ is supplied by 2 points, rated 7A.	The setting items are shown in Table 20.
7	Digi. output 2	1.5mm^2	B+ is supplied by 2 points, rated 7A.	
8	Digi. output 3	1.5mm^2	B+ is supplied by 2 points, rated 7A.	

No.	Function	Cable Size	Remark	
9	Digi. output 4	1.5mm^2	B+ is supplied by 2 points, rated 7A.	
10	Digi. output 5	1.5mm^2	B+ is supplied by 2 points, rated 7A.	
11	Digi. output 6	1.5mm^2	B+ is supplied by 2 points, rated 7A.	
12	Charger (D+) Input	1.0 mm^2	Connect with Charger D+ (WL) terminal. If this terminal doesn't exist, hang it in the air.	
13	Digi. input 1	1.0mm^2	Ground connected is active (B-).	
14	Digi. input 2	1.0mm^2	Ground connected is active (B-).	
15	Digi. input 3	1.0mm^2	Ground connected is active (B-).	
16	Digi. input 4	1.0mm^2	Ground connected is active (B-).	
17	Digi. input 5	1.0mm^2	Ground connected is active (B-).	The setting items are shown in Table 21.
18	Digi. input 6	1.0mm^2	Ground connected is active (B-).	
19	Digi. input 7	1.0mm^2	Ground connected is active (B-).	
20	Digi. input 8	1.0mm^2	Ground connected is active (B-).	
21	Digi. input 9	1.0mm^2	Ground connected is active (B-).	
22	Input Common Port	1.0mm^2	Internal Connection (B-)	
23	MP1 Speed Sensor Input	1.0mm^2	Gearbox speed detection, connected to the speed sensor, shielded wire is recommended and it should be grounded at one end.	
24	MP2 speed sensor input, controller internal has been connected to the battery	1.0mm^2		
25	Common Port	1.0mm^2	Internal Connection (B-)	
26	MP2 speed sensor input, controller internal has been connected to the battery	1.0mm^2	Engine speed detection, connected to the speed sensor, shielded wire is recommended and it should be grounded at one end.	
27	MP1 Speed Sensor Input			
28	Battery Voltage 2 Detection Input	1.0mm^2	Detect the battery 2 voltage	
29	Digi. Output 7	1.5mm^2	Rated 7A AC250V Passive output	
30		1.5mm^2		
31		1.5mm^2		
32	Digi. Output 8	1.5mm^2	Rated 7A AC250V Passive output	
33		1.5mm^2		
34		1.5mm^2		
35	Digi. Output 9	1.5mm^2	Rated 7A AC250V Passive output	
36		1.5mm^2		

No.	Function		Cable Size	Remark
37			1.5mm^2	
38	Digi. Output 10		1.5mm^2	Rated 7A AC250V Passive output
39			1.5mm^2	
40			1.5mm^2	
41	GOV	B2(+)	0.5mm^2	Shielded wire is recommended, and it should be grounded at one end.
42		B1(+)	0.5mm^2	Note: B2(+) is used for special ESC engines, while ordinary ESC engines only need to use B1(+) and A(-) wiring.
43		A (-)	0.5mm^2	
44	ECU	CAN L	0.5mm^2	It is recommended to use a shielded wire with an impedance of 120Ω, and the shielded wire should be grounded at one end. There is 120 Ω matching resistor between CAN L and CAN H terminals.
45		CAN H	0.5mm^2	
46	Sensor Common Port		1.0mm^2	Sensor common port, the controller interior has been connected to B-.
47	DC 5V Output		1.0mm^2	Provide DC 5V power supply for voltage type sensor.
48	Gearbox Oil Pressure		1.0mm^2	Connect to gearbox OP sensor.(support resistor type/current type/voltage type)
49	Plunger Pump Oil Pressure		1.0mm^2	Connect to plunger pump OP sensor.(support resistor type/current type/voltage type)
50	Flex. Sensor 1		1.0mm^2	User configurable.(support resistor type/current type/voltage type)
51	Flex. Sensor 2		1.0mm^2	User configurable.(support resistor type/current type/voltage type)
52	Gearbox Temp.		1.0mm^2	Connect to gearbox temperature sensor.(resistor type)
53	Plunger Pump Temp.		1.0mm^2	Connect to plunger pump temperature sensor.(resistor type)
54	Flex. Sensor 3		1.0mm^2	User configurable.(resistor type)
55	Sensor Common Port		1.0mm^2	Sensor common port, the controller interior has been connected to B-.
56	Plunger Pump Outlet Pressure		1.0mm^2	Connect to plunger pump outlet pressure sensor.(current type)
57	Flex. Sensor 4		1.0mm^2	User configurable.(current type)
58	Flex. Sensor 5		1.0mm^2	User configurable.(current type)
59	RS485-1	B(-)	0.5mm^2	It is recommended to use a shielded wire with an impedance of 120Ω, and the shielded wire should be grounded at one end. There is 120 Ω terminal matching resistor for short connection between No.59 and No.61 terminals.
60		A(+)	0.5mm^2	
61		Terminal Matching Resistance (120Ω)	0.5mm^2	
62	RS485-2	B(-)	0.5mm^2	It is recommended to use a shielded wire with an impedance of 120Ω, and the shielded wire should be grounded at one end. There is 120 Ω terminal matching resistor for short connection between No.62 and No.64 terminals.
63		A(+)	0.5mm^2	
64		Terminal Matching Resistance (120Ω)	0.5mm^2	

No.	Function	Cable Size	Remark
	USB	/	Realize communication with PC software.
	ETHERNET	/	Realize communication with PC software.

6.3 WIRING DIAGRAM OF DISPLAY MODULE AND MASTER CONTROL MODULE
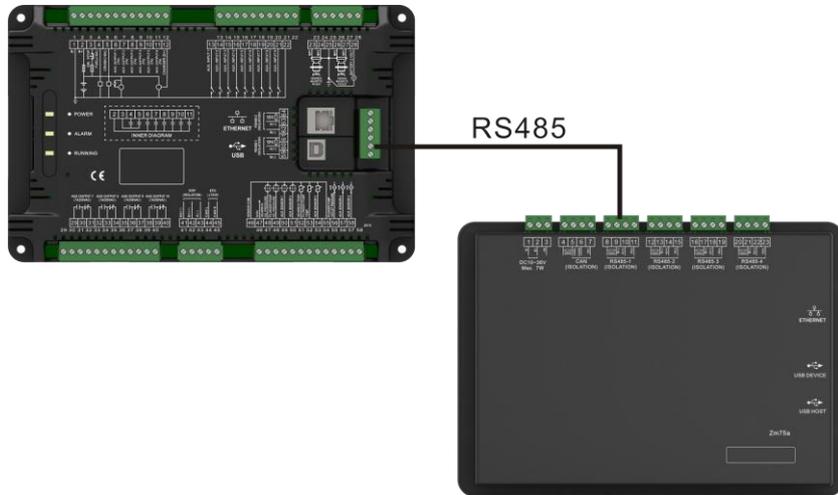
Fig.12-Wiring Diagram of Display Module and Master Control Module

7 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

7.1 CONTENTS AND SCOPES OF PARAMETER SETTING OF DISPLAY MODULE

Table-17 Contents and Scopes of Parameter Setting

No.	Item	Parameter Range	Defaults	Description
Module Setting				
1	Temperature Unit	(0-1)	0	0：℃ 1：℉
2	Pressure Unit	(0-2)	0	0：MPa 1：bar 2：psi
RS485-1 Setting				
1	Module Address	(1-254)	1	The module address of current RS485 interface is not used when communicating with the master control module.
2	Baud Rate	(0-4)	4	0：9600bps 1：19200bps 2：38400bps 3：57600bps 4：115200bps
3	Parity Bit	(0-2)	0	0：None 1：Odd Parity Check 2：Even Parity Check

No.	Item	Parameter Range	Defaults	Description
4	Stop Bit	(0-1)	0	0：2 Bytes 1：1 Bit
RS485-2 Setting (Reserved)				
1	Module Address	(1-254)	1	The module address of current RS485 interface is not used when communicating with the master control module.
2	Baud Rate	(0-4)	0	0：9600bps 1：19200bps 2：38400bps 3：57600bps 4：115200bps
3	Parity Bit	(0-2)	0	0：None 1：Odd Parity Check 2：Even Parity Check
4	Stop Bit	(0-1)	0	0：2 Bytes 1：1 Bit
RS485-3 Setting (Reserved)				
1	RS485-3 Module Address	(1-254)	1	The module address of current RS485 interface is not used when communicating with the master control module.
2	RS485-3 Baud Rate	(0-4)	0	0：9600bps 1：19200bps 2：38400bps 3：57600bps 4：115200bps
3	RS485-3 Parity Bit	(0-2)	0	0：None 1：Odd Parity Check 2：Even Parity Check
4	RS485-3 Stop Bit	(0-1)	0	0：2 Bytes 1：1 Bit
RS485-4 Setting (Reserved)				
1	RS485-4 Module Address	(1-254)	1	The module address of current RS485 interface is not used when communicating with the master control module.
2	RS485-4 Baud Rate	(0-4)	0	0：9600bps 1：19200bps 2：38400bps 3：57600bps 4：115200bps
3	RS485-4 Parity Bit	(0-2)	0	0：None 1：Odd Parity Check 2：Even Parity Check

No.	Item	Parameter Range	Defaults	Description
4	RS485-4 Stop Bit	(0-1)	0	0：2 Bytes 1：1 Bit
ETHERNET Setting (Reserved)				
1	Network Communication Enable	(0-1)	0	0：Disable 1：Enable
2	IP Address	192.168.10.25		
3	Subnet Mask	255.255.255.0		
4	Gateway	192.168.10.1		
5	DNS Address	211.138.24.66		

7.2 CONTENTS AND SCOPES OF PARAMETER SETTING OF MASTER CONTROL MODULE

Table 18- Contents and Scopes of Parameter Setting

No.	Item	Parameter Range	Defaults	Description
Module Address				
1	Communication Addrss	(1-254)	1	The controller address of remote control.
2	RS485-1 Baud Rate	(0-4)	4	0：9600bps 1：19200bps 2：38400bps 3：57600bps 4：115200bps
3	RS485-1 Parity Bit	(0-2)	0	0：None 1：Odd Parity Check 2：Even Parity Check
4	RS485-1 Stop Bit	(0-1)	0	0：2 Bytes 1：1 Bit
5	RS485-2 Baud Rate	(0-4)	0	0：9600bps 1：19200bps 2：38400bps 3：57600bps 4：115200bps
6	RS485-2 Parity Bit	(0-2)	0	0：None 1：Odd Parity Check 2：Even Parity Check
7	RS485-2 Stop Bit	(0-1)	0	0：2 Bytes 1：1 Bit

No.	Item	Parameter Range	Defaults	Description
8	Password Setting	(0-65535)	00318	This password is needed when setting the parameters of the main control module through the display module or the host computer ⚠ Caution: The factory default password is "00318". The operator can change the password to prevent others from changing the advanced configuration of the controller. Please remember to change your password. If you forget your password, please contact our service personnel.
9	Self-defined Description 1			Write the self-defined descriptions through PC software.
10	Self-defined Description 2			

ETHERNET Setting

No.	Item	Parameter Range	Defaults	Description
1	Network Communication Enable	(0-1)	0	0：Disable 1：Enable
2	IP Address	192.168.0.100		
3	Subnet Mask	255.255.255.0		
4	Gateway	192.168.0.2		
5	DNS Address	211.138.24.66		
6	MAC Address	00-08-DC-01-02-03		

Timer Setting

No.	Item	Parameter Range	Defaults	Description
1	Preheat Time	(0-3600)s	0	Time for pre-powering the heat plug before starter is powered up.
2	Cranking Time	(3-60)s	8	Time for starter power on each time.
3	Crank Rest Time	(3-60)s	10	The waiting time before second power up when engine start fails.
4	Safety On Time	(0-3600)s	10	Alarms for low oil pressure, high temperature, under speed, under frequency /voltage, charge fail are inactive.
5	Start Idle Time	(0-3600)s	10	Running time for engine idle speed when the genset is starting.
6	Warming Up Time	(0-3600)s	0	Warming up time between genset switch on and high speed running..

No.	Item	Parameter Range	Defaults	Description
7	Cooling Time	(0-3600)s	0	Radiating time before genset stop, after it unloads.
8	Stop Idle Time	(0-3600)s	10	Running time for genset idling speed when the genset is stopping..
9	ETS Solenoid Hold	(0-3600)s	20	Time for the stop electromagnet energization as the engine is stopping.
10	Fail to Stop Time	(0-3600)s	0	Time after 'idle delay' is over before the complete stop when 'ETS Solenoid Hold' is set "0"; time after 'ETS Solenoid Hold' delay is over before the complete stop when it is set other than "0".
11	After Stop Time	(0-3600)s	0	Time between a complete stop and standby.
Engine Setting				
1	Engine Type	(0-39)	0	Default: conventional engine
2	Flywheel Teeth	(10-300)	118	Tooth number of the engine, for judging of starter separation conditions and inspecting of engine speed. See the installation instructions.
3	Declared Speed	(0-6000) r/min	1500	Offer standard to judge over/under/loading speed.
4	Engine Idling	(0-100.0)%	60.0	Percentage of engine declared speed.
5	Running at declared speed after crank diconnection	(0-1)	0	0：Disable 1：Enable
6	Start Attempts	(1-10) Times	1	Maximum crank times for start failures; when it reaches this, controller will send start failure signal.
7	Crank Disconnect	(0-2)	2	Refer to Table 23 There are 3 conditions of disconnecting starter with engine. Each condition can be used alone and simultaneously to separate the start motor and engine as soon as possible.

No.	Item	Parameter Range	Defaults	Description
8	Disconnect Speed	(0-200.0)%	24.0	Percentage of the declared speed; when generator speed is higher than the set value, starter will be disconnected. See the installation instruction.
9	Disconnect OP	(0-1.00)MPa	0.20	When engine oil pressure is higher than the set value, starter will be disconnected. See the installation instruction.
10	Loss Of Speed Signal Action	(0-4)	1	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown 4：Alarm shutdown
11	Loss Of Speed Signal Delay	(0-3600)s	5	The time to confirm the action from the detected speed is 0
12	Over Speed 1 Set	(0-200.0)%	114.0	Percentage of the declared speed, the return value and delay value can also be set. Refer to Table 19 for details.
13	Under Speed 1 Set	(0-200.0)%	10.0	
14	Over Speed 2 Set	(0-200.0)%	110.0	
15	Under Speed 2 Set	(0-200.0)%	10.0	
16	Battery 1 Volt	(0-60.0)V	24.0	Set rated voltage of battery, offer standards for judging batter over/under voltage.
17	Battery 1 Over Volt 1	(0-200.0)%	120.0	Percentage of the rated voltage of the battery, the return value and delay value can also be set. Refer to Table 19 for details.
18	Battery 1 Under Volt 2	(0-200.0)%	85.0	
19	Battery 1 Over Volt 2	(0-200.0)%	110.0	
20	Battery Under Volt 2	(0-200.0)%	90.0	
21	Battery 2 Volt	(0-60.0)V	24.0	Percentage of the rated voltage of the battery, the return value and delay value can also be set. Refer to Table 19 for details.
22	Battery 2 Over Volt 1	(0-200.0)%	120.0	
23	Battery 2 Under Volt 1	(0-200.0)%	85.0	
24	Battery 2 Over Volt 2	(0-200.0)%	110.0	
25	Battery 2 Under Volt 2	(0-200.0)%	90.0	
26	Charging Failure	(0-60.0)V	8.0	In the process of normal running, it will initiate a charging failure alarm when the voltage of charger D+(WL) is lower than this value. Refer to Table 19 for details.
Analog Sensor Seting				
Engine Temperatugre Display and Protection Control				
1	Curve Type	(0-15)	9	SGD. Refer to Table 22 in details.

No.	Item	Parameter Range	Defaults	Description
2	Open Circuit Action	(0-4)	1	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
3	Unit	(0-0)	0	℃. It can only be set to Celsius.
4	High Temp. Alarm 1	(-50-300)℃	98	When the temperature value of the external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
5	High Temp. Alarm 2	(-50-300)℃	95	
6	Low Temp. Alarm 1	(-50-300)℃	20	When the temperature value of the external temperature sensor is lower than this value, an alarm will be initiated. Return value and delay value can also be set. Refer to Table 19 for details.
7	Heater Control	(0-1)	0	0：Disable; 1：Enable.
		(-50-300)℃	50	When the temperature value of the external temperature sensor is lower than this value, the heater control outputs.
		(-50-300)℃	55	When the temperature value of the external temperature sensor is lower than this value, the heater control stops output.
		(0-3600)min	60	The longest time for each output of the heater control.
8	Cooler Control	(0-1)	0	0：Disable; 1：Enable.
		(-50-300)℃	80	When the temperature value of the external temperature sensor is greater than this value, the cooler control outputs.
		(-50-300)℃	75	When the temperature value of the external temperature sensor is lower than this value, the cooler control stops output.

No.	Item	Parameter Range	Defaults	Description
		(0-3600)min	60	The longest time for each output of the cooler control.
9	Temperature Sensor Related Settings	(0-5)	1	0：Not used 1：Flex. Sensor 1; 2：Flex. Sensor 2; 3：Flex. Sensor 3; 4：Flex. Sensor 4; 5：Flex. Sensor 5. To specify the source channel of engine water temperature and temperature protection control displayed on the homepage of the display module. To specify the sensor channel corresponding to the engine temperature when the engine type is set to "normal unit". When the engine type is set to ECU, the engine temperature is forced to be obtained through the ECU protocol, the display and protection control are still in effect.
Engine Oil Pressure Display and Protection				
1	Curve Type	(0-15)	9	SGD. Refer to Table 22 in details.
2	Open Circuit Action	(0-4)	1	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
3	Unit	(0-2)	0	0：MPa； 1：bar； 2：psi。
4	Low Temp. Alarm 1	(0-2.00)MPa	0.12	When the pressure value of the external OP sensor is lower than this value, low oil pressure shutdown alarm will be initiated. This value is determined only after the end of the safety delay. Delay value can be set. Refer to Table 19 for details.

No.	Item	Parameter Range	Defaults	Description
5	Low Temp. Alarm 2	(0-2.00)MPa	0.13	When the pressure value of the external OP sensor is lower than this value, low oil pressure warning will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
6	OP Sensor Related Settings	(0-5)	2	0：Not used 1：Flex. Sensor 1; 2：Flex. Sensor 2; 3：Flex. Sensor 3; 4：Flex. Sensor 4; 5：Flex. Sensor 5. To specify the source channel of engine oil pressure and oil pressure protection displayed on the homepage of the display module. To specify the sensor channel corresponding to the engine oil pressure when the engine type is set to "normal unit". When the engine type is set to ECU, the engine oil pressure is forced to be obtained through the ECU protocol, the display and protection control are still in effect.
Gearbox Oil Temperature				
1	Curve Type	(0-15)	9	SGD. Refer to Table 22 in details.
2	Open Circuit Action	(0-4)	1	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
3	Unit	(0-0)	0	℃
4	High Temp. Alarm 1	(-50-300)℃	98	When the temperature value of the external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
5	High Temp. Alarm 2	(-50-300)℃	95	

No.	Item	Parameter Range	Defaults	Description
6	Low Temp. Alarm 1	(-50-300)°C	5	When the temperature value of the external temperature sensor is lower than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
7	Low Temp. Alarm 2	(-50-300)°C	20	
Gearbox Oil Pressure				
1	Curve Type	(0-15)	2	Self-defined 4-20mA curve. Refer to Table 22 in details.
2	Open Circuit Action	(0-4)	1	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
3	Unit	(0-2)	0	0：MPa; 1：bar; 2：psi。
4	High Pressure Alarm 1	(0-5.00) MPa	3.60	When the temperature value of the external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
5	High Pressure Alarm 2	(0-5.00) MPa	3.60	
6	Low Pressure Alarm 1	(0-5.00) MPa	0.5	When the temperature value of the external temperature sensor is lower than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
7	Low Pressure Alarm 2	(0-5.00) MPa	0.5	
Plunger Pump Oil Temperature				
1	Curve Type	(0-15)	9	SGD. Refer to Table 22 in details.
2	Open Circuit Action	(0-4)	1	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
3	Unit	(0-0)	0	℃

No.	Item	Parameter Range	Defaults	Description
4	High Temp. Alarm 1	(-50-300)°C	98	When the temperature value of the external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
5	High Temp. Alarm 2	(-50-300)°C	95	
6	Low Temp. Alarm 1	(-50-300)°C	5	When the temperature value of the external temperature sensor is lower than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
7	Low Temp. Alarm 2	(-50-300)°C	20	
Plunger Pump Oil Pressure				
1	Curve Type	(0-15)	2	Self-defined 4-20mA curve. Refer to Table 22 in details.
2	Open Circuit Action	(0-4)	1	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
3	Unit	(0-2)	0	0：MPa； 1：bar； 2：psi。
4	High Pressure Alarm 1	(0-5.00) MPa	2.60	When the temperature value of the external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
5	High Pressure Alarm 2	(0-5.00) MPa	2.60	
6	Low Pressure Alarm 1	(0-5.00) MPa	0.50	When the temperature value of the external temperature sensor is lower than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
7	Low Pressure Alarm 2	(0-5.00) MPa	0.40	

No.	Item	Parameter Range	Defaults	Description
Plunger Pump Outlet Pressure				
1	Curve Type	(0-15)	2	Self-defined 4-20mA curve. Refer to Table 22 in details.
2	Open Circuit Action	(0-4)	1	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
3	Unit	(0-2)	0	0：MPa; 1：bar; 2：psi。
4	High Pressure Alarm 1	(0-300.00) MPa	100.00	When the temperature value of the external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
5	High Pressure Alarm 2	(0-300.00) MPa	90.00	
6	Low Pressure Alarm 1	(0-300.00) MPa	5.00	When the temperature value of the external temperature sensor is lower than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
7	Low Pressure Alarm 2	(0-300.00) MPa	10.00	
Flex. Sensor 1				
1	Sensor Selection	(0-3)	0	0：Not used; 1：Temp. sensor; 2：OP sensor; 3：Level sensor.
2	Curve Type	(0-15)	0	Not used. Refer to Table 22 in details.
3	Open Circuit Action	(0-4)	0	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
4	Unit	(0-0)	0	℃
5	High Alarm 1	(0-30000)℃	100	When the temperature value of the

No.	Item	Parameter Range	Defaults	Description
6	High Alarm 2	(0-30000)℃	90	external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
7	Low Alarm 1	(0-30000)℃	10	When the temperature value of the external temperature sensor is lower than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
8	Low Alarm 2	(0-30000)℃	20	
9	Sensor Name			The sensor name needs to be written through PC software.
Flex. Sensor 2				
1	Sensor Selection	(0-3)	0	0：Not used; 1：Temp. sensor; 2：OP sensor; 3：Level sensor.
2	Curve Type	(0-15)	0	Not used. Refer to Table 22 in details.
3	Open Circuit Action	(0-4)	0	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
4	Unit	(0-0)	0	℃
5	High Alarm 1	(0-30000)℃	100	When the temperature value of the external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
6	High Alarm 2	(0-30000)℃	90	
7	Low Alarm 1	(0-30000)℃	10	When the temperature value of the

No.	Item	Parameter Range	Defaults	Description
8	Low Alarm 2	(0-30000)℃	20	external temperature sensor is lower than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
9	Sensor Name			The sensor name needs to be written through PC software.
Flex. Sensor 3				
1	Sensor Selection	(0-3)	0	0：Not used; 1：Temp. sensor; 2：OP sensor; 3：Level sensor.
2	Curve Type	(0-15)	0	Not used. Refer to Table 22 in details.
3	Open Circuit Action	(0-4)	0	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
4	Unit	(0-0)	0	℃
5	High Alarm 1	(0-30000)℃	100	When the temperature value of the external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
6	High Alarm 2	(0-30000)℃	90	
7	Low Alarm 1	(0-30000)℃	10	When the temperature value of the external temperature sensor is lower than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
8	Low Alarm 2	(0-30000)℃	20	
9	Sensor Name			The sensor name needs to be written through PC software.
Flex. Sensor 4				

No.	Item	Parameter Range	Defaults	Description
1	Sensor Selection	(0-3)	0	0：Not used; 1：Temp. sensor; 2：OP sensor; 3：Level sensor.
2	Curve Type	(0-15)	0	Not used. Refer to Table 22 in details.
3	Open Circuit Action	(0-4)	0	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
4	Unit	(0-0)	0	℃
5	High Alarm 1	(0-30000)℃	100	When the temperature value of the external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
6	High Alarm 2	(0-30000)℃	90	
7	Low Alarm 1	(0-30000)℃	10	When the temperature value of the external temperature sensor is lower than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
8	Low Alarm 2	(0-30000)℃	20	
9	Sensor Name			The sensor name needs to be written through PC software.
Flex. Sensor 5				
1	Sensor Selection	(0-3)	0	0：Not used; 1：Temp. sensor; 2：OP sensor; 3：Level sensor.
2	Curve Type	(0-15)	0	Not used. Refer to Table 22 in details.
3	Open Circuit Action	(0-4)	0	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
4	Unit	(0-0)	0	℃

No.	Item	Parameter Range	Defaults	Description
5	High Alarm 1	(0-30000)℃	100	When the temperature value of the external temperature sensor is greater than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
6	High Alarm 2	(0-30000)℃	90	
7	Low Alarm 1	(0-30000)℃	10	When the temperature value of the external temperature sensor is lower than this value, an alarm will be initiated. This value is determined only after the end of the safety delay. Return value and delay value can also be set. Refer to Table 19 for details.
8	Low Alarm 2	(0-30000)℃	20	
9	Sensor Name			The sensor name needs to be written through PC software.
Gearbox Setting				
1	Gearbox Type	(0-1)	0	0：Conventional Gearbox； 1：General J1939 gearbox
2	Gearbox Speed Enable	(0-1)	1	0：Disable；1：Enable
3	Gearbox Teeth	(1-300)	118	The number of teeth of the flywheel mounted on the gearbox for speed detection.
4	Declared Speed	(0-6000)r/min	500	Provide standards for over speed, under speed and loading speed determination.
5	1 Gear Position Ratio	(0-90.00)	3.75	The speed ratio of engine speed and gearbox, and to calculate the current gear value.
6	2 Gear Position Ratio	(0-90.00)	2.69	
7	3 Gear Position Ratio	(0-90.00)	2.20	
8	4 Gear Position Ratio	(0-90.00)	1.77	
9	5 Gear Position Ratio	(0-90.00)	1.58	
10	The Sixth Gear Ratio	(0-90.00)	1.27	
11	7 Gear Position Ratio	(0-90.00)	1.00	
12	8 Gear Position Ratio	(0-90.00)	1.00	
13	The Top Gear Position	(0-8)	6	The maximum gear position that allowed to increase.

No.	Item		Parameter Range	Defaults	Description
14	The minimum interval of gear position switching		(0-3600)s	2	During the switching time, press the button to continuously increase the gear position. When the minimum interval is exceeded, the corresponding gear position will output.
15	The Netural Gear Position Output Setting		(0-0x00FF)	0x08	The gear position operation examples:
16	1 Gear Position Output Setting		(0-0x00FF)	0x09	
17	2 Gear Position Output Setting		(0-0x00FF)	0x01	0x01 gear position control 1 output
18	3 Gear Position Output Setting		(0-0x00FF)	0x0A	0x02 gear position control 2 output
19	4 Gear Position Output Setting		(0-0x00FF)	0x0C	0x04 gear position control 3 output
20	5 Gear Position Output Setting		(0-0x00FF)	0x02	0x08 gea position control 4 output
21	6 Gear Position Output Setting		(0-0x00FF)	0x04	
22	7 Gear Position Gear Output Setting		(0-0x00FF)	0x08	
23	8 Gear Position Output Setting		(0-0x00FF)	0x08	
24	Over Speed 1 Setting		(0-200.0)%	114.0	The setting value is the pencentage of the declared speed of gearbox. The return value and delay value can also be set. Refer to Table 19 for details
25	Under Speed 1 Setting		(0-200.0)%	10.0	
26	Over Speed 2 Setting		(0-200.0)%	110.0	
27	Under Speed 2 Setting		(0-200.0)%	10.0	
28	Loss of Speed Signal Action		(0-4)	0	0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
29	Delay of Loss of Speed Signal		(0-3600)s	5	The time from detecting that the speed is 0 to confirming the action.
30	The Pressure Protection 1-8 Gear Position Setting	Action	(0-4)	0	： Action Selection: 0：No action; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown.
31		Setting Value	(0-300.00) MPa	100.00	
32		Return Value	(0-300.00) MPa	80.00	
33		Delay Value	(0-3600)s	5	
34	One-key Idle Alarm Enable		(0-1)	0	0: Disable；1: Enable。
Plunger Pump Setting					
1	Number of Plunger Pump Cylinders		(3-5)	3	Plunger pump flow calculation required parameters
2	Water Power Coefficient		(0-100.0)%	95.0	Flow = water power coefficient *
3	Plunger Pump Diameter		(0-5000)mm	127	number of cylinders * stroke times
4	Length of Stroke		(0-5000)mm	203	* plunger pump area * length of

No.	Item	Parameter Range	Defaults	Description
5	Gear Ratio	(0-10.000)	6.353	stroke
Digital Input Port Setting				
Input Port 1 Setting				
1	Input Port Content Setting	(0-60)	8	Idle mode. Refer to Table 21 for details.
2	Effective Type of Input Port	(0-1)	0	0：Closed；1：Open。
Input Port 2 Setting				
1	Input Port Content Setting	(0-60)	26	High engine temperature shutdown. Refer to Table 21 for details.
2	Effective Type of Input Port	(0-1)	0	0：Closed；1：Open。
Input Port 3 Setting				
1	Input Port Content Setting	(0-60)	27	Low engine oil pressure shutdown. Refer to Table 21 for details.
2	Effective Type of Input Port	(0-1)	0	0：Closed；1：Open。
Input Port 4-9 Setting				
1	Input Port Content Setting	(0-60)	0	User-defined. Refer to Table 21 for details.
2	Effective Type of Input Port	(0-1)	0	0：Closed；1：Open。。
3	Effective Range of Input Port	(0-3)	0	0：From Safety On；1：From Crank；2：Always； 3：Never。
4	Effective Action of Input Poer	(0-5)	0	0：None; 1：Warning; 2：Fault idle; 3：Cooling shutdown; 4：Alarm shutdown; 5: Indication.
5	Effective Delay of Input Port	(0-20.0)s	2.0	The time from detecting that the speed is 0 to confirming the action.
6	Input Port Descritpion			The PC is required to write the description; When the input port is effective, the display module displays the corresponding content.
Relay Output Port Setting				
Output Port 1 Setting				
1	Output Port Content Setting	(0-239)	35	Idle control. Refer to Table 20 for details.
2	Output Type of Output Port	(0-1)	0	0: Normally open; 1: Normaller close.
Output Port 2 Setting				
1	Output Port Content Setting	(0-239)	36	Throttle increase outputs. Refer to Table 20.

No.	Item	Parameter Range	Defaults	Description
2	Output Type of Output Port	(0-1)	0	0: Normally open; 1: Normaller close.
Output Port 3 Setting				
1	Output Port Content Setting	(0-239)	37	Throttle decrease outputs. Refer to Table 20.
2	Output Type of Output Port	(0-1)	0	0: Normally open; 1: Normaller close.
Output Port 4 Setting				
1	Output Port Content Setting	(0-239)	38	ETS Control. Refer to Table 20 for details.
2	Output Type of Output Port	(0-1)	0	0: Normally open; 1: Normaller close.
Output Port 5 Setting				
1	Output Port Content Setting	(0-239)	31	Neutral gear position outputs. Refer to Table 20 for details.
2	Output Type of Output Port	(0-1)	0	0: Normally open; 1: Normaller close.
Output Port 6 Setting				
1	Output Port Content Setting	(0-239)	48	Common alarm. Refer to Table 20 for details.
2	Output Type of Output Port	(0-1)	0	0: Normally open; 1: Normaller close.
Output Port 7 Setting				
1	Output Port Content Setting	(0-239)	63	Gear position control 1. Refer to Table 20 for details.
2	Output Type of Output Port	(0-1)	0	0: Normally open; 1: Normaller close.
Output Port 8 Setting				
1	Output Port Content Setting	(0-239)	64	Gear position control 2. Refer to Table 20 for details.
2	Output Type of Output Port	(0-1)	0	0: Normally open; 1: Normaller close.
Output Port 9 Setting				
1	Output Port Content Setting	(0-239)	65	Gear position control 3. Refer to Table 20 for details.
2	Output Type of Output Port	(0-1)	0	0: Normally open; 1: Normaller close.
Output Port 10 Setting				
1	Output Port Content Setting	(0-239)	66	Gear position control 4. Refer to Table 20 for details.
2	Output Type of Output Port	(0-1)	0	0: Normally open; 1: Normaller close.
Speed Regulation Setting				

No.	Item		Parameter Range	Defaults	Description
1	Interface Type		(0-3)	0	0: Not used; 1: CAN 2: GOV; 3: Relay.
2	Stabilizing Object		0	0	Engine speed.
3	Reverse Selection of Speed Regulation output		(0-1)	0	0: Disable 1: Enable
4	Throttle Big Adjustment		(0-1000)	10	Increase or decrease of throttle length.
5	Throttle Small Adjustment		(0-1000)	1	Slight increase or decrease of throttle length.
6	GOV Speed Regulation	Center	(0-10.0)	0	Automatic speed control setting.
7		Range	(0-10.0)	2.0	
8		Gain	(0-1000)%	20	
9		Stability	(0-1000)%	20	
10	Relay Speed Regulation	Response	(0.25-4.00)	0.50	Automatic speed control setting.
11		Gain	(0-100)%	10	
12		Stability	(0.05-1.60)s	0.1	
13		Dead Zone	(0-10.0)%	1.0	
Maintenance Setting					
1	Maintenance Setting 1-5	Maintenance Enable Setting	(0-1)	0	0: Disable 1: Enable
2		Maintenance Time Due Action	(0-5)	0	0: None; 1: Warning; 2: Fault idle; 3: Cooling shutdown; 4: Alarm shutdown; 5: Indication.
3		Maintenance Timing Mode	(0-2)	0	0: Running time; 1: Date; 2: Running time+date.
4		Maintenance Timing	(0-30000)h	500	When the maintenance time is up, then perform the maintenance alarm action
5		Maintenance Date			Set by year/month/day.
6		Maintenance Alarm Action	(0-5)	0	0: None; 1: Warning; 2: Fault idle; 3: Cooling shutdown; 4: Alarm shutdown; 5: Indication

No.		Item	Parameter Range	Defaults	Description
7		Maintenance Alarm Time	(0-30000)h	450	When the maintenance time reaches this alarm time, then perform the maintenance alarm action.
8		Reset Maintenance Time			
9		Self-defined Maintenance Name			Need to write customized name through host computer.

7.3 ALARMS ITEMS SETTING

Table 19 – Alarm Setting Contents

No.	Parameter Contents	Description
1	Enable Setting	0: Disable 1: Enable.
2	Action Setting	0: No action; 1: Warning; 2: Fault idle; 3: Cooling shutdown; 4: Alarm shutdown;
3	Setting Value	The setting value of sensor alarm.
4	Return Value	This setting is effective when the sensor alarm action is set to a warning
5	Delay Value	The time required to confirm the alarm.

7.4 THE DEFINABLE CONTENT OF PROGTAMMALBE OUTPUT PORT 1-10

Table 20 – The Definable Content of Programmable Output Ports 1~10

No.	Name	Function Description
0	Not Used	
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	Details of function description please see the following text.
8	Custom Combined 2	
9	Custom Combined 3	
10	Custom Combined 4	
11	Custom Combined 5	
12	Custom Combined 6	

No.	Name	Function Description
13	Reserved	
14	Reserved	
15	Reserved	
16	Start Relay B Output	The switching input of starter is effective. After the output of starter relay, it fails to start. After the end of the interval, it will start the relay B to output.
17	Air Flap Control	Act on over speed shutdown and emergence stop. Air inflow can be closed.
18	Audible alarm	Act on warning, shutdown, etc. An annunciator can be connected externally. If 'alarm mute' configurable input port is active, this is prohibited.
19	Louver Control	Act when engine is starting and disconnect when genset is stopped completely.
20	Reserved	
21	Heater Control	It is controlled by heating limit values of temperature sensor.
22	Cooler Control	It is controlled by cooler limit values of temperature sensor.
23	Pre-fuel output	Act in the period from 'cranking' to 'safety on'.
24	Reserved	Reserved
25	Pre-lubricate	Act from pre-heating to safety on.
26	Remote Control	This port is controlled by communication (PC).
27-30	Reserved	Reserved
31	Neutral Gear Position Output	
32	Gearbox Lock Output	Output when gearbox lock input is active.
33	Start Relay A Output	Starter relay output.
34	Fuel Relay Output	Act when engine is starting and disconnect when stop is completed.
35	Idle Control	It is used for engine with idling control. Close before starting and open in warming up delay; Close during stopping idle mode and open when stop is completed.
36	Throttle Incrase Output	Act during warming up running. The speed regulation interface type is set as relay speed regulation, which is controlled by speed regulation.
37	Throttle Decrease Output	Act during stop idle and fail to stop time. The speed regulation interface type is set as relay speed regulation, which is controlled by speed regulation.
38	Energize to Stop	It is used for engines with ETS electromagnet. Close when stop idle is over and open when pre-set 'ETS delay' is over.
39	Reserved	
40	ECU Stop	Used for ECU engine to control its stop.
41	ECU Power Supply	Used for ECU engine to control its power.
42	Reserved	
43	Crank Success	Close when a successful start signal is detected.

No.	Name	Function Description
44	Brake Control Output	Controlled by brake button, press the button to output 2s, and then press again within 2s to continue the output. Controlled by input port brake, if the input port is active, the brake will control the output, if inactive, it will stop the output.
45	Reserved	
46	Reserved	
47	Crank Battery Switching	When crank fails, the crank battery will switch to start.
48	Common Alarm	Act when engine common warning, common shutdown, common trip, common trip and stop, common block alarms occur.
49	Common Cooling Shutdown	Act when common cooling shutdown alarm occurs.
50	Common Shutdown	Act when common shutdown alarm occurs.
51	Common Fault Idle	Act when fault idle alarm occurs.
52	Common Warning	Act when common warning alarm occurs.
53	Reserved	
54	Battery 1 Over Voltage	Act when battery's over voltage warning alarm occurs.
55	Battery Under Voltage	Act when battery's low voltage warning alarm occurs.
56	Charging Failure	Act when charging failure warning alarm occurs.
57	Reserved	
58	Reserved	
59	Reserved	
60	ECU Warning	Indicates ECU sends a warning signal.
61	ECU Shutdown	Indicates ECU sends a shutdown signal.
62	ECU Comm Fail	Indicates controller is not communicating with ECU.
63	Gear Position Control 1	Configure the corresponding gear position output signal and the corresponding gear position controls its output.
64	Gear Position Control 2	Configure the corresponding gear position output signal and the corresponding gear position controls its output.
65	Gear Position Control 3	Configure the corresponding gear position output signal and the corresponding gear position controls its output.
66	Gear Position Control 4	Configure the corresponding gear position output signal and the corresponding gear position controls its output.
67	Reserved	
68	Reserved	
69	Input 1 Active	Act when input port 1 is active.
70	Input 2 Active	Act when input port 2 is active.
71	Input 3 Active	Act when input port 3 is active.
72	Input 4 Active	Act when input port 4 is active.
73	Input 5 Active	Act when input port 5 is active.
74	Input 6 Active	Act when input port 7 is active.

No.	Name	Function Description
75	Input 7 Active	Act when input port 7 is active.
76	Input 8 Active	Act when input port 8 is active.
77	Input 9 Active	Act when input port 9 is active.
78-96	Reserved	
97	Battery 2 Over Voltage	Act when battery's over voltage warning alarm occurs.
98	Battery 2 Under Voltage	Act when battery's under voltage warning alarm occurs.
99	Emergency Stop	Act when emergency stop alarm occurs.
100	Fail To Start	Act when start failure alarm occurs.
101	Fail To Stop	Act when stop failure alarm occurs.
102	Under Speed Warn	Act when under speed alarm occurs.
103	Under Speed Shutdown	Act when under speed shutdown alarm occurs.
104	Over Speed Warn	Act when over speed warning occurs.
105	Over Speed Shutdown	Action when over speed shutdown alarm occurs.
106-109	Reserved	
110	Gearbox Under Speed Warning	Act when gearbox under speed warning occurs.
111	Gearbox Under Speed Shutdown	Act when gearbox under speed shutdown alarm occurs.
112	Gearbox Over Speed Warning	Act when gearbox over speed occurs.
113	Gearbox Over Speed Shutdown	Act when gearbox over speed alarm occurs.
114-119	Reserved	
120	High Temp. Warning	Act when high temperature alarm occurs.
121	Low Temp. Warning	Act when low temperature warning occurs.
122	High Temp. Shutdown	Act when high temperature shutdown warning occurs.
123	保留 Reserved	
124	Engine High Temp. Cooling Shutdown	Act when high temperature cooling occurs.
125	Reserved	
126	Engine High Temp. Fault Idle	Act when high temperature fault idle occurs.
127	Reserved	
128	Low OP Warning	Act when low oil pressure warning occurs.
129	Engine Low OP Shutdown	Act when low oil pressure shutdown alarm occurs.
130	OP Sensor Open	Act when oil pressure sensor is open circuit.
131	Reserved	
132	Reserved	
133	Engine Low OP Cooling Shutdown	Act when low oil pressure cooling shutdown occurs.
134	Reserved	
135	Engine Low OP Fault Idle	Act when low oil pressure fault idle occurs.
136	Gearbox High OP Warning	Act when corresponding alarm output occurs.

No.	Name	Function Description
137	Gearbox Low OP Warning	
138	Gearbox High OP Shutdown	
139	Gearbox Low OP Shutdown	
140	Gearbox High OP Cooling Shutdown	
141	Gearbox Low OP Cooling Shutdown	
142	Gearbox High OP Fault Idle	
143	Gearbox Low OP Fault Idle	
144	Plunger Pump High OP Warning	
145	Plunger Pump Low OP Warning	
146	Plunger Pump High OP Shutdown	
147	Plunger Pump Low OP Shutdown	
148	Plunger Pump High OP Cooling Shutdown	
149	Plunger Pump Low OP Cooling Shutdown	
150	Plunger Pump High OP Fault Idle	
151	Plunger Pump Low OP Fault Idle	
152	Flex. Sensor 1 High Warning	
153	Flex. Sensor 1 Low Warning	
154	Flex. Sensor 1 High Shutdown	
155	Flex. Sensor 1 Low Shutdown	
156	Flex. Sensor 1 High Cooling Shutdown	
157	Flex. Sensor 1 Low Cooling Shutdown	
158	Flex. Sensor 1 High Fault Idle	
159	Flex. Sensor 1 Low Fault Idle	

No.	Name	Function Description
160	Flex. Sensor 2 High Warning	
161	Flex. Sensor 2 Low Warning	
162	Flex. Sensor 2 High Shutdown	
163	Flex. Sensor 2 Low Shutdown	
164	Flex. Sensor 2 High Cooling Shutdown	
165	Flex. Sensor 2 Low Cooling Shutdown	
166	Flex. Sensor 2 High Fault Idle	
167	Flex. Sensor 2 Low Fault Idle	
168	Gearbox High Oil Temp. Warning	
169	Gearbox Low Oil Temp. Warning	
170	Gearbox High Oil Temp. Shutdown	
171	Gearbox Low Oil Temp. Shutdown	
172	Gearbox High Oil Temp. Cooling Shutdown	
173	Gearbox Low Oil Temp. Cooling Shutdown	
174	Gearbox High Oil Temp. Fault Idle	
175	Gearbox Low Oil Temp. Fault Idle	
176	Plunger Pump High Oil Temp. Warning	
177	Plunger Pump Low Oil Temp. Warning	
178	Plunger Pump High Oil Temp. Shutdown	
179	Plunger Pump Low Oil Temp. Shutdown	
180	Plunger Pump High Oil Temp. Cooling Shutdown	
181	Plunger Pump Low Oil Temp. Cooling Shutdown	

No.	Name	Function Description
182	Plunger Pump High Oil Temp. Fault Idle	
183	Plunger Pump Low Oil Temp. Fault Idle	
184	Flex. Sensor 3 High Warning	
185	Flex. Sensor 3 Low Warning	
186	Flex. Sensor 3 High Shutdown	
187	Flex. Sensor 3 Low Shutdown	
188	Flex. Sensor 3 High Cooling Shutdown	
189	Flex. Sensor 3 Low Cooling Shutdown	
190	Flex. Sensor 3 High Fault Idle	
191	Flex. Sensor 3 Low Fault Idle	
192	Outlet Pressure High Warning	
193	Outlet Pressure Low Warning Warning	
194	Outlet Pressure High Shutdown	
195	Outlet Pressure Low Shutdown	
196	Outlet Pressure High Cooling Shutdown	
197	Outlet Pressure Low Cooling Shutdown	
298	Outlet Pressure High Fault Idle	
299	Outlet Pressure Low Fault Idle	
200	Flex. Sensor 4 High Warning	
201	Flex. Sensor 4 Low Warning	
202	Flex. Sensor 4 High Shutdown	
203	Flex. Sensor 4 Low Shutdown	

No.	Name	Function Description
204	Flex. Sensor 4 High Cooling Shutdown	
205	Flex. Sensor 4 Low Cooling Shutdown	
206	Flex. Sensor 4 High Fault Idle	
207	Flex. Sensor 4 Low Fault Idle	
208	Flex. Sensor 5 High Warning	
209	Flex. Sensor 5 Low Warning	
210	Flex. Sensor 5 High Shutdown	
211	Flex. Sensor 5 Low Shutdown	
212	Flex. Sensor 5 High Cooling Shutdown	
213	Flex. Sensor 5 Low Cooling Shutdown	
214	Flex. Sensor 5 High Fault Idle	
215	Flex. Sensor 5 Low Fault Idle	
216-223	Reserved	
224	1 Gear Position Over Volt. Alarm	
225	2 Gear Position Over Volt. Alarm	
226	3 Gear Position Over Volt. Alarm	
227	4 Gear Position Over Volt. Alarm	
228	5 Gear Position Over Volt. Alarm	
229	6 Gear Position Over Volt. Alarm	
230	7 Gear Position Over Volt. Alarm	
231	8 Gear Position Over Volt. Alarm	
232-239	Reserved	

7.4.1 CUSTOM PERIOD OUTPUT

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

While **S1** and **S2** are **TRUE** synchronously, **OUTPUT**;

While **S1** or **S2** is **FALSE**, **NOT OUTPUT**.

Period output S1 can set engine's one or more period output freely, can set the delayed time and output time after enter into period.

Condition output S2 can set as any conditions in output ports.

⚠**NOTE:** when delay time and output time both are 0 in period output S1, it is TRUE in this period.

⚠**NOTE:** when selected period is standby, it is cycle output and other periods are single output.

Example:

Output period: start

Delay output time: 2s

Output time: 3s

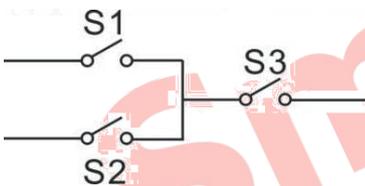Condition output contents: output port 1 is active.

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

Output port 1 active, after enter "start time" and delay 2s, this defined period output is outputting, after 3s, stop outputting;

Output port 1 inactive, defined output period is not outputting.

7.4.2 CUSTOM COMBINED OUTPUT

Defined combination output is composed by 3 parts, condition output S1 or S2 and condition output S3.

S1 **or** S2 is **TRUE**, while S3 is **TRUE**, defined combination output is outputting;

S1 **and** S2 are **FALSE**, or S3 is **FALSE**, defined combination output is not outputting.

⚠**NOTE:** S1, S2, S3 can be set as any contents except for "defined combination output" in the output setting.

⚠**NOTE:** 3 parts of defined combination output (S1, S2, and S3) couldn't include or recursively include themselves.

Example,

Contents of probably condition output S1: output port 1 is active;

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

Contents of probably condition output S2, output port 2 is active;

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

Contents of probably condition output S3: output port 3 is active;

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

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

When input port 1 inactive and input port 2 inactive, whatever input port 3 is active or not, Defined combination output is not outputting.

7.5 DEFINED CONTENTS OF DIGITAL INPUT PORTS 1~9

Table 21 – Definition of Digital Inputs 1~9 (Ground connected is active (B-))

No	Items	Description
0	User Configured	Users can define contents as bellow: Indication: only display without warning and shutdown. Warning: only warning without shutdown. Alarm Shutdown: alarm and shutdown immediately. Cooling Shutdown: alarm and shutdown after engine cooling. Fault Idle: alarm and engine enters idle stage. Inactive: input doesn't work. Always active: input detects all the time. Active from crank: start detecting at the beginning of startup. Active from safety on: detecting after safety on delay is expired.
1	Reserved	
2	Alarm Mute	When input is active, "Audible Alarm" output is inhibited.
3	Reset Alarm	When input is active, shutdown alarms, cooling shutdown, fault idle and warning can be reset.
4	Reserved	
5	Lamp Test	When input is active, all LED indicators are on.
6	Reserved	
7	Crank Success Input	When this function is active, it means the engine starts successfully. If this function is configured, the successful crank conditions of speed and oil pressure will be invalid.
8	Idle Control Mode	No under speed protection, it will go back to idle (switch to neutral positon) after the input is active, it is inactive and enters normal operation.
9	Reserved	
10	Reserved	
11	Reserved	
12	Starter Swithing Input	It is necessary to configure and start the output of B relay. After the input port is active, if the first start is not successful, the output of B relay will be automatically switched and started. If the output of starting B relay is still unsuccessful, it will be switched back to the output of starting relay.
13-20	Reserved	
21	Inhibit Alarm Shutdown	All shutdown alarms are prohibited except emergence stop.(Means battle mode or override mode)
22	Instrument Mode	All outputs are prohibited in this mode.
23	Reserved	
24	Reserved	

No	Items	Description
25	Reserved	
26	High Temp. Shutdown	Connected sensor digital input.
27	Low OP Shutdown	Connected sensor digital input.
28	Reserved	
29	Reserved	
30	Manual Start Input	When input is active in manual mode, engine will be started automatically. When input is inactive, engine will be stopped automatically.
31	Reserved	
32	Reserved	
33	Simulate Stop Key	Externally connecting a button to simulate key function on the panel.
34	Simulate Manual Key	
35	Simulate Throttle Increase	Externally connecting a button to simulate key function on the panel.
36	Simulate Throttle decrease	
37	Simulate Upshift	
38	Simulate Downshift	
39	Simulate Alarm Rest	
40	Simulat Idle	
41	Reserved	
42	Reserved	
43	Gearbox High Oil Temp. Shutdown	Connecting digital input of oil temperature sensor.
44	Gearbox Low OP Shutdown	Connecting digital input of oil pressure sensor.
45	Gearbox Lock	Gearbox is locked when input port is active; Gearbox is unlocked when input port is inactive.
46	Remote Control Active	Remote control is active when input port is active; Local control is active when input port is inactive.
47	Reserved	
48	Reserved	
49	Reserved	
50	Upshift	Request the gear to upshift 1 when input port is active.
51	Downshift	Request the gear to dowshift 1 when input port is active.
52	Throttle Increase Input	Increase speed when input port is active.
53	Throttle Dncrease Input	Decrease speed when input port is active.
54	Brake Control Input	Brake control output when input port is active.
55-60	Reserved	

7.6 SELECTION OF SENSORS

Table 22 - Sensors Selection

No.	Sensor	Curve Type	Remark
1	Temperature Sensor	0 Not used 1 Custom resistor type curve 2 Custom 4-20mA curve 3 Custom 0-5V curve 4 VDO 5 CURTIS 6 VOLVO-EC 7 DATCON 8 SGX 9 SGD 10 SGH 11 PT100 12 cu50 13-15 Reserved	Defined resistance's range is 0~6KΩ, default is SGD sensor.
2	Oil Pressure (Pressure) Sensor	0 Not used 1 Custom resistor type curve 2 Custom 4-20mA curve 3 Custom 0-5V curve 4 VDO 10bar 5 CURTIS 6 VOLVO-EC 7 DATCON 10bar 8 SGX 9 SGD 10 SGH 11-15 Reserved	Factory default is resistor type pressure sensor and defined resistance's range is 0~6KΩ, default is SGD sensor.
3	Liquid (Fuel) Level Sensor	0 Not used 1 Custom resistor type curve 2 Custom 4-20mA curve 3 Custom 0-5V curve 4 SGD 5 SGH 6-15 Reserved	Defined resistance's range is 0~6KΩ.

⚠**NOTE:** Oil pressure sensors of gearbox and plunger pump, flexible sensor 1 and flexible sensor 2 connected input signals are resistor, current and voltage signals. The connected signal type can be modified by modifying the curve type.

7.7 CONDITIONS OF CRANK DISCONNECT SELECTION

Table 23 - Crank Disconnect Conditions Selection

No.	Setting Description
0	Speed
1	Oil pressure
2	Oil pressure + Speed

⚠**NOTES:**

a) There are 2 conditions to make starter separate with engine; speed and oil pressure can be used separately while it is suggested that oil pressure is used together with speed. The aim is to disconnect the starter motor as soon as possible.

b) Speed sensor is the magnetic equipment installed in starter for detecting flywheel teeth.

c) When it is setting speed, users must ensure that the number of flywheel teeth is as same as the set, otherwise, "over speed shutdown" or "under speed shutdown" may be caused.

d) If genset is without speed sensor, please don't select corresponding items, otherwise, "start fail" or "loss speed signal" maybe be caused.

e) If engine is without oil pressure sensor, please don't select corresponding items.

7.8 MAINTENANCE SETTING

Table 24- Maintenance Setting

Item	Contents	Description
Enable Selection	0: Disable 1: Enable	Used to set whether the current maintenance function is active.
Maintenance Time	(0-30000)h	It is the number of hours between maintence enablement and maintenance required.
Maintenance Time Due Action	0: No action; 1: Warning; 2: Fault Cooling 3: Cooling Shutdown 4: Alarm Shutdown; 5: Indication.	Alarm action between maintenance timing and maintenance setting time.
Maintenance Alarm Time	(0-30000)h	It is the number of hours between maintenance enablement and maintenance required.
Maintenance Alarm Time Due Action	0: No action; 1: Warning; 2: Fault Cooling 3: Cooling Shutdown 4: Alarm Shutdown; 5: Indication.	Alarm action between maintenance timing and maintenance setting time.
Maintenance Timing Mode	0: Running time; 1: Date; 2: Running time + Date	The timing mode of Maintenance.
Reset Maintenance		After Maintenance, reset the maintenance

Item	Contents	Description
		time by setting this.
Maintenance Description		Maintenance description string can be set, the user can enter the maintenance name through the PC, such as: oil change.

8   SENSOR SETTING

— When sensors are reselected, the sensor curve will be transferred into the standard value. For example, if temperature sensor is SGH (120°C resistor type) at default factory, its sensor curve is SGH (120°C resistor type); if SGD (120°C resistor type) is selected, the temperature sensor curve is SGD curve.

— If there is difference between standard sensor curves and the used sensor, users can select "defined sensor", and then input defined sensor curve.

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

— If sensor is selected as "Not Used", sensor curve will not work.

— The corresponding sensor must be configured as "Not Used" if sensor only has alarm switch, otherwise, alarm shutdown or warning may occur.

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

Fig. 13 – Curve Setting

Table 24 - Common Unit Conversion Table

Items	N/m² (Pa)	kPa	MPa	kgf/cm²	bar	psi
1Pa	1	1×10^{-3}	1×10^{-6}	1.02×10^{-5}	1×10^{-5}	1.45×10^{-4}
1kPa	1×10^{3}	1	1×10^{-3}	1.02×10^{-2}	1×10^{-2}	0.145
1MPa	1×10^{6}	1×10^{3}	1	10.2	10	145
1kgf/cm²	9.8×10^{4}	98	9.8×10^{-2}	1	0.98	14.2
1bar	1×10^{5}	100	0.1	1.02	1	14.5
1psi	6.89×10^{3}	6.89	6.89×10^{-3}	7.03×10^{-2}	6.89×10^{-2}	1

9   COMMISSIONING

Please make sure the following checks are made before commissioning,

— Ensure all the wiring connections are correct and wire diameter is suitable.

— Ensure that the controller DC power has fuse, and controller's positive and negative and start battery are correctly connected.

— Emergency stop input is connected to the positive pole of starter battery via emergency stop button's normally closed point and fuse.

— Take proper actions to prevent engine from cranking successfully (e. g. Remove the connection wire of fuel valve). If checking is OK, make the start battery power on; choose manual mode and controller will executive routine.

— Press "start" button, and engine will start. After the cranking times set before, controller will initiate signal of Start Failure; then press "Alarm Reset" button to reset controller.

— Recover the action to prevent engine from cranking successfully (e. g. Connect wire of fuel valve), press start button again, and engine will start. If everything goes well, engine will be normally running after idle running (if idle run is set). During this time, please observe engine's running situation. If there is something abnormal, stop engine and check all wiring connections according to this manual.

— If there is any other question, please contact SmartGen's service.
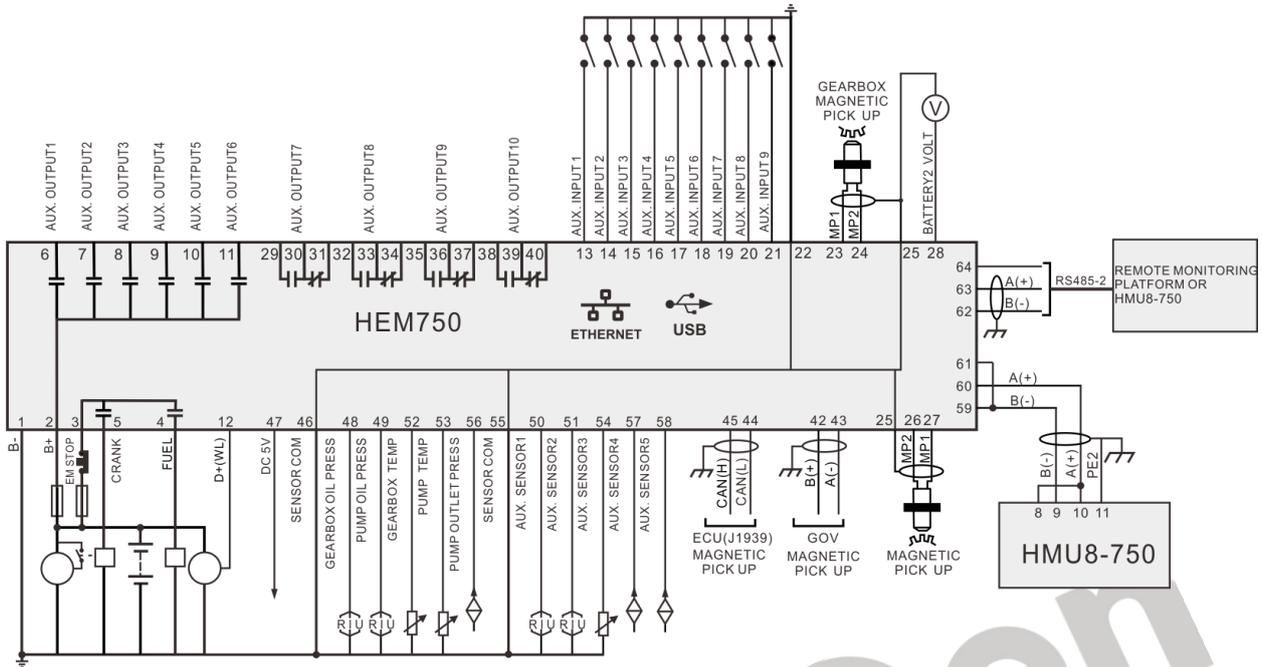
10 TYPICAL APPLICATION

Fig. 14 – HEM750 Typical Application

⚠ **NOTE:** Expand relay with high capacity in start and fuel output is recommend.

11 INSTALLATION

11.1 HUM8-750

11.1.1 FIXING CLIPS

— Controller is panel built-in design; it is fixed by clips when installed.

— Withdraw the fixing clip screw (turn anticlockwise) until it reaches proper position.

— Pull the fixing clip backwards (towards the back of the module) and ensure four clips are inside their allotted slots.

— Turn the fixing clip screws clockwise until they are fixed on the panel.

— Care should be taken not to over tighten the screws of fixing clips, the torque is 2.75 kgf.cm (0.27 N.m).

11.1.2 OVERALL DIMENSION AND PANEL CUTOUT

Unit:mm
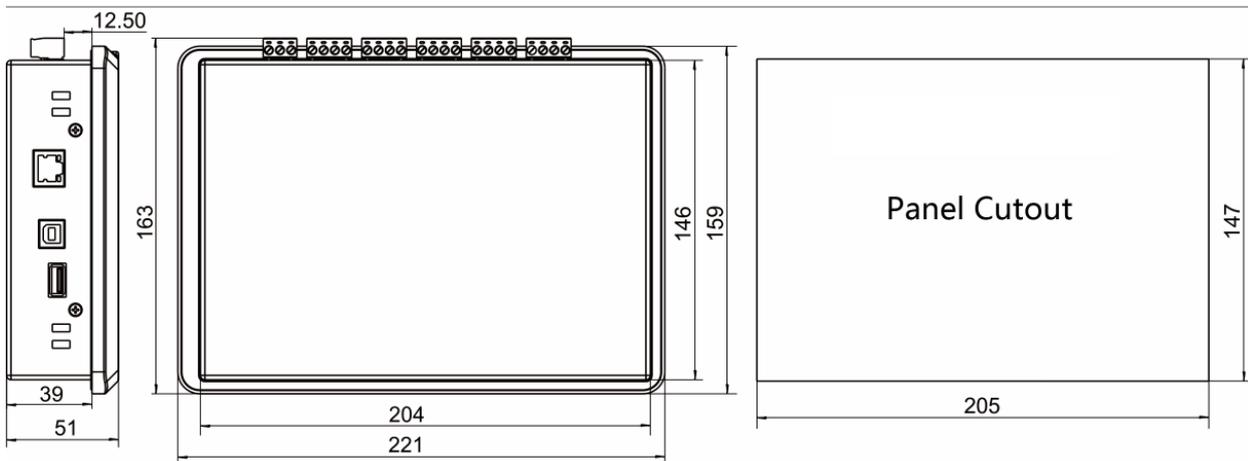
Fig. 15 – Overall Dimension and Panel Cutout

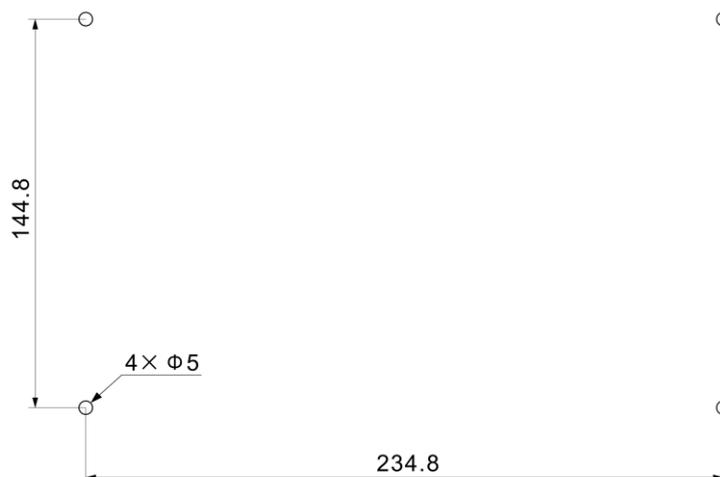### 11.2 HEM750

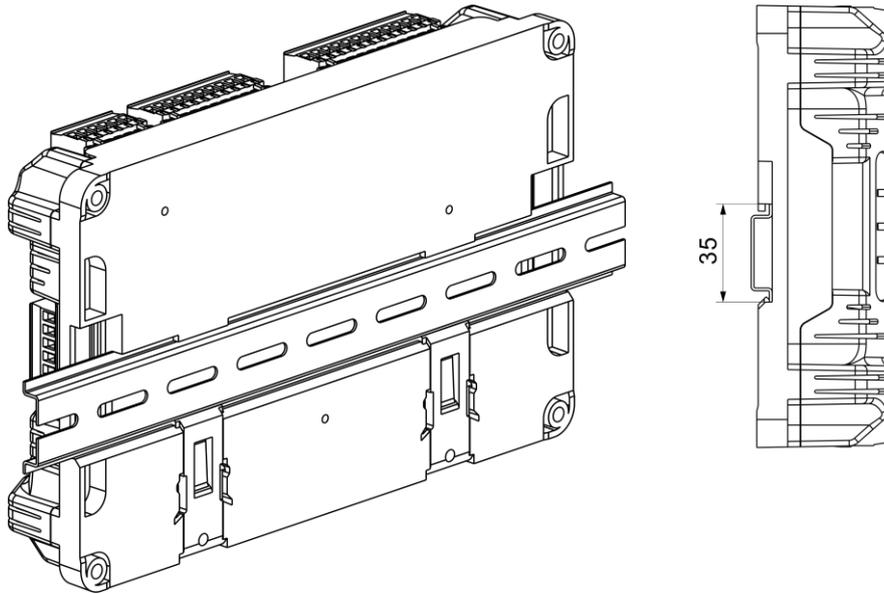#### 11.2.1 SCREWS AND GUIDE RAIL MOUNTING

Unit: mm

Fig. 16-Screws Installation

Fig.17-Guide Rail Installation

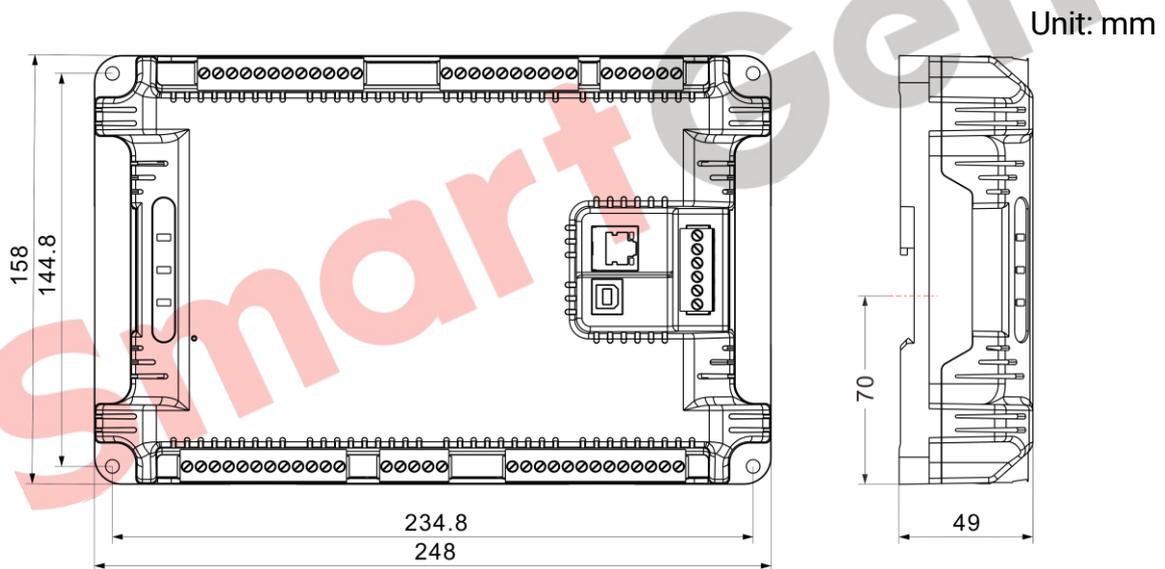## 11.2.2 OVERALL DIMENSIONS

Unit: mm

Fig. 18 – HEM750 Overall Dimensions

HEM750 master control module can suit for (8~35) VDC battery voltage environment. Battery negative electrode must be connected with the starter shell stably. The wire area connecting controller power B+/B- with negative and positive electrodes of battery mustn't be less than 2.5mm². If floating charger is configured, please firstly connect output wires of charger to battery's positive and negative directly, and then connect wires from battery's positive and negative to controller's positive and negative input ports separately in order to prevent the charger from disturbing the controller's normal working.

— Speed Sensor Input: Speed sensor is the magnetic equipment installed in the engine body to detect flywheel teeth number. The wires used to connect with the controller shall be 2-core shielding wires. The shielding layer shall be connected to No. 25 terminal on the controller, and meanwhile the other terminal shall be hanging in the air. Another two signal wires shall be connected to No.26 and No.27 terminals on the controller. The output voltage of the speed sensor shall be within (1~24) VAC (effective value) in the

range of full speed and 12VAC is recommended (at rated speed). As to speed sensor installation, the sensor can firstly be spun to the connection flywheel, then invert 1/3 lap, and finally tighten up the screw on the sensor.

— **Output And Expand Relays:** All controller outputs are relay contact outputs. If the expansion relay is needed, freewheel diode (relay coil is DC) and resistor and capacitor circuit (relay coil is AC) shall be added to the two ends of the relay coils in order to prevent disturbing the controller or others equipments.

— **Withstand Voltage Test:** When controller had been installed in control panel, if high voltage test is needed, please disconnect controller's all terminal connections, in order to prevent high voltage into controller and damage it.

12   CONNECTIONS OF CONTROLLER AND J1939 ENGINE

12.1   CUMMINS ISB/ISBE

Table 26 Connector B

Terminals of controller	Connector B	Remark
Aux. output port 1	39	Configured to "Fuel Output";
Start relay output	-	Connected with starter coil directly;
Aux. output port 2	Expansion 30A relay; providing battery voltage for terminal 01,07,12,13;	Set to "ECU power";

Table 27 9-Pin Connector

Terminals of controller	9 pins connector	Remark
CAN_SCR	SAE J1939 shield	CAN communication shielding line(connected with ECU terminal only);
CAN(H)	SAE J1939 signal	Impedance 120Ω connecting line is recommended.
CAN(L)	SAE J1939 return	Impedance 120Ω connecting line is recommended.

Engine type: Cummins ISB.

12.2   CUMMINS QSL9

It is suitable for CM850 engine control module.

Table 28 50-Pin Connector

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

Table 29 9-Pin Connector

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

Engine type: Cummins-CM850.

12.3   CUMMINS QSM11 (IMPORT)

It is suitable for CM570 engine control module. Engine type is QSM11 G1, QSM11 G2.

Table 30 C1 Connector

Terminals of controller	C1 connector	Remark
Aux. output port 1	5&8	Configured to "Fuel Output"; External expansion relay; at fuel output, make port 5 and port 8 of C1 connector connected;
Start relay output	-	Connected to starter coil directly;

Table 31 3-Pin Data Link Connector

Terminals of controller	3 pins data link connector	Remark
CAN_SCR	C	CAN communication shielding line(connected with ECU terminal only);
CAN(H)	A	Using impedance 120Ω connecting line;
CAN(L)	B	Using impedance 120Ω connecting line;

Engine type: Cummins ISB.

12.4   CUMMINS QSX15-CM570

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

Table 32   50-Pin Connector

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

Table 33 9-Pin Connector

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

Engine type: Cummins QSX15-CM570.

12.5   CUMMINS GCS-MODBUS

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

Table 34 D-SUB Connector 06

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

Table 35 D-SUB Connector 06

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

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

12.6   CUMMINS QSM11

Table 36 Engine OEM Connector

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

Engine type: Common J1939.

12.7   CUMMINS QSZ13

Table 37 Engine OEM Connector

Terminals of controller	OEM connector of engine	Remark
Aux. output 1	45	
Start relay output	-	Connected to starter coil directly;
Aux. output 2	16&41	Set as idling speed control; (N/C) output; by expansion relay, make 16&41 close as the controller is running.
Aux. output 3	19&41	Set as pulse speed raising control; (N/O) output; by expansion relay, make 19&41 close for 1s as the controller is entering warming-up time.
CAN_SCR	-	CAN communication shielding line;
CAN(H)	1	Using impedance 120Ω connecting line;
CAN(L)	21	Using impedance 120Ω connecting line;

Engine type: Common J1939.

12.8 DETROIT DIESEL DDEC III/IV

Table 38 Engine CAN Port

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

Engine type: Common J1939.

12.9 DEUTZ EMR2

Table 39 F Connector

Terminals of controller	F connector	Remark
Aux. output port 1	Expansion 30A relay, proving battery voltage for 14; Fuse is 16A.	Configured to "Fuel Output";
Start relay output	-	Connected to starter coil directly;
-	1	Connected to battery negative;
CAN_SCR	-	CAN communication shielding line;
CAN(H)	12	Impedance 120Ω connecting line is recommended.
CAN(L)	13	Impedance 120Ω connecting line is recommended.

Engine type: Volvo EDC4.

12.10 JOHN DEERE

Table 40 21-Pin Connector

Terminals of controller	21 pins connector	Remark
Aux. output port 1	G, J	Configured to "Fuel Output";
Start relay output	D	
CAN_SCR	-	CAN communication shielding line;
CAN(H)	V	Using impedance 120Ω connecting line;
CAN(L)	U	Using impedance 120Ω connecting line;

Engine type: John Deere.

12.11   MTU MDEC

It is suitable for 2000 series and 4000 series with MTU engine type.

Table 41 X1 Connector

Terminals of controller	X1 Connector	Remark
Aux. output port 1	BE1	Configured to "Fuel Output";
Start relay output	BE9	
CAN_SCR	E	CAN communication shielding line(connected with one terminal only);
CAN(H)	G	Using impedance 120Ω connecting line;
CAN(L)	F	Using impedance 120Ω connecting line;

Engine type: MTU-MDEC-303.

12.12   MTU ADEC (MODULE MODULE)

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

Table 42 ADEC (X1 Port)

Terminals of controller	ADEC (X1port)	Remark
Aux. output port 1	X1 10	Configured to "Fuel Output"; X1 9 shall connect negative of battery.
Start relay output	X1 34	X1 33 shall connect negative of battery.

Table 43 SMART (X4 Port)

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

Engine type: MTU-ADEC.

12.13   MTU ADEC (SAM MODULE)

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

Table 44 ADEC (X1 Port)

Terminals of controller	ADEC (X1port)	Remark
Aux. output port 1	X1 43	Configured to "Fuel Output"; X1 28 shall connect negative of battery.
Start relay output	X1 37	X1 22 shall connect negative of battery.

Table 45 SAM (X23 Port)

Terminals of controller	SAM (X4 port)	Remark
CAN_SCR	X23 3	CAN communication shielding line;
CAN(H)	X23 2	Using impedance 120Ω connecting line;
CAN(L)	X23 1	Using impedance 120Ω connecting line;

Engine type: Common J1939.

12.14 PERKINS

It is suitable for ADEM3/ ADEM4 engine control module. Engine type is 2306, 2506, 1106, and 2806.

Table 46 Connector

Terminals of controller	Connector	Remark
Aux. output port 1	1,10,15,33,34	Configured to "Fuel Output";
Start relay output	-	Connected to starter coil directly;
CAN_SCR	-	CAN communication shielding line;
CAN(H)	31	Using impedance 120Ω connecting line;
CAN(L)	32	Using impedance 120Ω connecting line;

Engine type: Perkins.

12.15 SCANIA

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

Table 47 B1 Connector

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

Engine type: Scania or Scania-S8.

12.16 VOLVO EDC3

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

Table 48 "Stand Alone" Connector

Terminals of controller	"Stand alone" connector	Remark
Aux. output port 1	H	Configured to "Fuel Output";
Start relay output	E	
Aux. output 2	P	Set output 2 as "ECU power";

Table 49 "Data Bus" Connector

Terminals of controller	"Data bus" connector	Remark
CAN_SCR	-	CAN communication shielding line;
CAN(H)	1	Using impedance 120Ω connecting line;
CAN(L)	2	Using impedance 120Ω connecting line;

Engine type: Volvo.

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

12.17 VOLVO EDC4

It is suitable engine types are TD520, TAD520 (optional), TD720, TAD720 (optional), TAD721, TAD722, and TAD732.

Table 50 Connector

Terminals of controller	Connector	Remark
Aux. output port 1	Expansion 30A relay, providing battery voltage for terminal 14. Fuse is 16A.	Configured to "Fuel Output";
Start relay output	-	Connected to starter coil directly;
	1	Connected to negative of battery;
CAN_SCR	-	CAN communication shielding line;
CAN(H)	12	Using impedance 120Ω connecting line;
CAN(L)	13	Using impedance 120Ω connecting line;

Engine type: Volvo EDC4.

12.18   VOLVO-EMS2

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

Table 51 Engine CAN Port

Terminals of controller	Engine's CAN port	Remark
Aux. output 1	6	Set output 1 "ECU stop";
Aux. output 2	5	Set output 2 "ECU power";
	3	Power negative;
	4	Power passive;
CAN_SCR	-	CAN communication shielding line;
CAN(H)	1(Hi)	Using impedance 120Ω connecting line;
CAN(L)	2(Lo)	Using impedance 120Ω connecting line;

Engine type: Volvo-EMS2.

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

12.19   YUCHAI

It is suitable for BOSCH common rail pump engine.

Table 52 Engine 42-Pin Port

Terminals of controller	Engine 42 pins port	Remark
Aux. output port 1	1.40	Configured to "Fuel Output"; Connected to engine ignition lock;
Start relay output	-	Connected to starter coil directly;
CAN_SCR	-	CAN communication shielding line;
CAN(H)	1.35	Using impedance 120Ω connecting line;
CAN(L)	1.34	Using impedance 120Ω connecting line;

Table 53 Engine 2-Pin Port

Battery	Engine 2 pins	Remark
Battery negative	1	Wire diameter 2.5mm^2;
Battery positive	2	Wire diameter 2.5mm^2;

Engine type: BOSCH.

12.20 WEICHAI

It is suitable for Weichai BOSCH common rail pump engine.

Table 54 Engine Port

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

Engine type: GTSC1.

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

13 TROUBLESHOOTING

Table 55 - Troubleshooting

Symptoms	Possible Solutions
Power on but no response for the controller	Check starting batteries; Check controller connection wirings; Check DC fuse.
Engine shutdown	Check the water/cylinder temperature is too high or not; Check DC fuse.
Controller emergency stop	Check the function of emergency stop is correct or not; Check whether wire connection is open circuit or not.
Low oil pressure alarm after crank disconnect	Check the oil pressure sensor and its connections.
High water temp. alarm after crank disconnect	Check the temperature sensor and its connections.
Shutdown Alarm in running	Check related switch and its connections according to the information on LCD; Check digital inputs.
Crank disconnect failure	Check fuel circuit and its connections; Check starting batteries; Check speed sensor and its connections; Refer to engine manual.
No response for starter	Check starter connections; Check starting batteries.
RS485 communication is abnormal	Check connections; Check setting of COM port is correct or not; Check RS485's A and B connection is reversely connected or not; Check whether the RS485 conversion module is damaged or not; Check communication port of PC is damaged or not.
ECU communication failure	Check the polarity of CAN high and CAN low; Check 120Ω terminal resistor is correctly connected or not; Check engine type is correctly chosen or not; Check whether wire connection between controller and engine is correct, whether output port setting is correct.
ECU alarm or shutdown	Get information from LCD alarm page; If there is detailed alarm information, check the engine according to the description. If not, please refer to engine manual according to SPN alarm code.

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