SmartGen

MAKING CONTROL SMARTER

APC715N

ENGINE PUMP CONTROLLER

USER MANUAL

郑州众智科技股份有限公司

SMARTGEN(ZHENGZHOU)TECHNOLOGY CO.,LTD.

CONTENTS

SmartGen Registered trademark
No.28 Xuemei Street, Zhengzhou, Henan, China
Tel: +86-371-67988888/67981888/67992951
+86-371-67981000(overseas)
Fax: +86-371-67992952
Email: sales@smartgen.cn
Web: www.smartgen.com.cn
www.smartgen.cn

Table 1 – Software Version

Date	Version	Note
2022-12-06	1.0	Original release.

Table 2 – Symbol Instruction

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

1 OVERVIEW

APC715N Engine Pump Controller is used for diesel engine pump unit to realize the start/stop, speed regulation, data measurement, alarm protection and “four remotes” function of engine pump. It fits with LCD display, optional languages display (including Chinese, Englishes and other languages). The exact parameters of engine and pump unit are indicated by the LCD display on the front panel and the controller is reliable and easy to use.

Utilizing the GOV (Engine Speed Governor) control function, the controller is able to stabilize the outlet/inlet pressure. Relay, GOV and CANBUS (SAE J1939) interfaces enable the controller to communicate with various ECU or non-ECU engine pumps.

APC715N Engine Pump Controller adopts 32-bit ARM micro-processor technology with precision parameters measuring, fixed value adjustment, time setting and threshold setting and etc. The majority of parameters can be configured from front panel and all the parameters can be set using PC (via USB port) and can be adjusted and monitored with the help of RS485 port. It can be widely used in a number of pump control systems (land reclamation pump, fire pump, high-pressure pump, hydraulic pump, mud pump, plunger pump, etc) with compact structure, simple connections and high reliability

2 PERFORMANCE AND CHARACTERISTICS

——Adopts 32-bit ARM SCM, high hardware integration;
——240x128 pixel, 4.3-inch LCD display with backlight, multilingual interface (including Chinese, English and other languages), which can be closen at the site, making commissioning convenience for factory personel;
——Silicon front panel + hard screen acrylic;
——Dual RS485 communication port and can realize “four remotes” functions via MODBUS protocol;
——Equipped with CANBUS port and can communicate with J1939 engine. Not only can monitor frequently-used data (such as water temperature, oil pressure, engine speed, fuel consumption and so on) of ECU, but also control start/stop, speed raising/droop via CANBUS port;
——GOV Function; outlet/ inlet pressure can be adjusted via GOV function. GOV port: Relay output; Analog output (for speed control unit); CANBUS port (for engine control unit);
——With post-processing SCR inlet/outlet temperature, ureal level detection functions; post-processing DPF regeneration state display and manual regeneration control function, which are suitable for engines that meet the requirements of the fourth stage emission standard of non-road mobile machinery;
——2 speed detection ports, the controller detects not only engine speed, but also gearbox speed;
——10 analog sensors; 3 fixed resistor types, 5 sensors can be flexibly configured as resistor type, current type and voltage type, 2 fixed current type;
——More kinds of curves of temperature, oil pressure, fuel level can be used directly and users can define the sensor curves by themselves;
——Precision measure and display parameters about engine and pump unit; e.g. engine high water temperature, low oil pressure, over speed, high/low water pressure, over flow and other kinds of fault indication and protection function;
——Two kinds of speed adjustment ways: manually and automatically; users can adjust the speed on the panel;
——Idle control function;
——All output ports are relay-out;
——PLC programming function; can be applied to complex system;
——Self-defined main interface display function, the information is displayed by customized main interface of PC;
——Multiple crank disconnect conditions (speed sensor, oil pressure) are optional;
——Wide power supply range DC(8~35)V, suitable for different starting battery voltage environment;
——Event log function can record up to 200 items and the SPN of ECU alarm;
——Real-time clock, scheduled start & stop pump unit (can be set as start pump unit once a day/week/month whether with load or not);
——Accumulative total run time A and B. Users can reset it as 0 and re-accumulate the value which make convenience to users to count the total value as their wish;
——Can control engine heater, cooler and fuel pump;
——With maintenance function. Actions can be set when maintenance time out;
——All parameters used digital adjustment, instead of conventional analog modulation with normal potentiometer, improving reliability and stability;

——IP65 due to rubber seal installed between the controller enclosure and panel fascia;

——Metal fixing clips enable perfect performance in high temperature environment;

——Modular design, anti-flaming ABS plastic enclosure, pluggable connection terminals and embedded installation mode; compact structure with easy mounting.

3 SPECIFICATION

Table 3 – Performance Parameter

Item	Contents
Operating Voltage Range	DC8V ~ DC35V, DC reverse protection
Battery Voltage	Resolution: 0.1V Accuracy: 1%
Overall Consumption	<6W (Standby Mode：≤2W)
Speed Sensor	Voltage Range: 1.0V ~ 24V (RMS) Frequency Range: 5Hz ~ 10000Hz
Charger (D+) Voltage	Range: DC0V~DC60V Resolution: 0.1V Accuracy: 1%
Analog Sensor	Resistor Input Range: 0Ω ~ 6000Ω Resolution: 0.1V Accuracy: 1Ω (below 300Ω)
	Voltage Input Range: 0V ~ 5V Resolution: 0.01V Accuracy: 1%
	Current Input Range: 0mA ~ 20mA Resolution: 0.01mA Accuracy: 1%
Start Relay Output	16A DC24V DC supply output
Fuel Relay Output	16A DC24V DC supply output
Programmable Relay Output 1~ 6	7A DC24V DC supply output
Programmable Relay Output 7~10	7A DC24V volts free output
Digital Input Port 1~10	Low threshold voltage is 1.2V; high limit voltage is 60V
RS485 Interface	Isolation, half-duplex, 9600 baud rate, maximum communication length 1000m
Ethernet Interface	Self-adaption 10/100Mbit
CAN Interface	Isolation, max communication length 250m, using Belden 9841 cable or equivalent
CE-EMC	EN 55032, EN55035
Vibration	5 Hz ~8 Hz: ±17mm 8 Hz ~ 100 Hz: 4 g 100Hz~500Hz: 2g IEC 60068-2-6
Shock	50g, 11ms, half-sine, complete shock test from three directions, and 18 times shock for each test IEC 60068-2-27
Bump Test	25g, 16ms, half-sine

Item	Contents
	IEC 60255-21-2
Production Compliance	According to EN 61010-1 installation category (over voltage category) III, 300V, pollution class 2, altitude 3000m
Overall Dimensions	242mm x 186mm x 49mm
Panel Cutout	214mm x 160mm
Working Temperature	(-25~+70)°C
Working Humidity	(20~93)%RH
Storage Temperature	(-30~+80)°C
Protection Level	IP65, when water proof gasket ring inserted between panel and housing.
Weight	1.0kg

4 OPERATION

4.1 INDICATORS

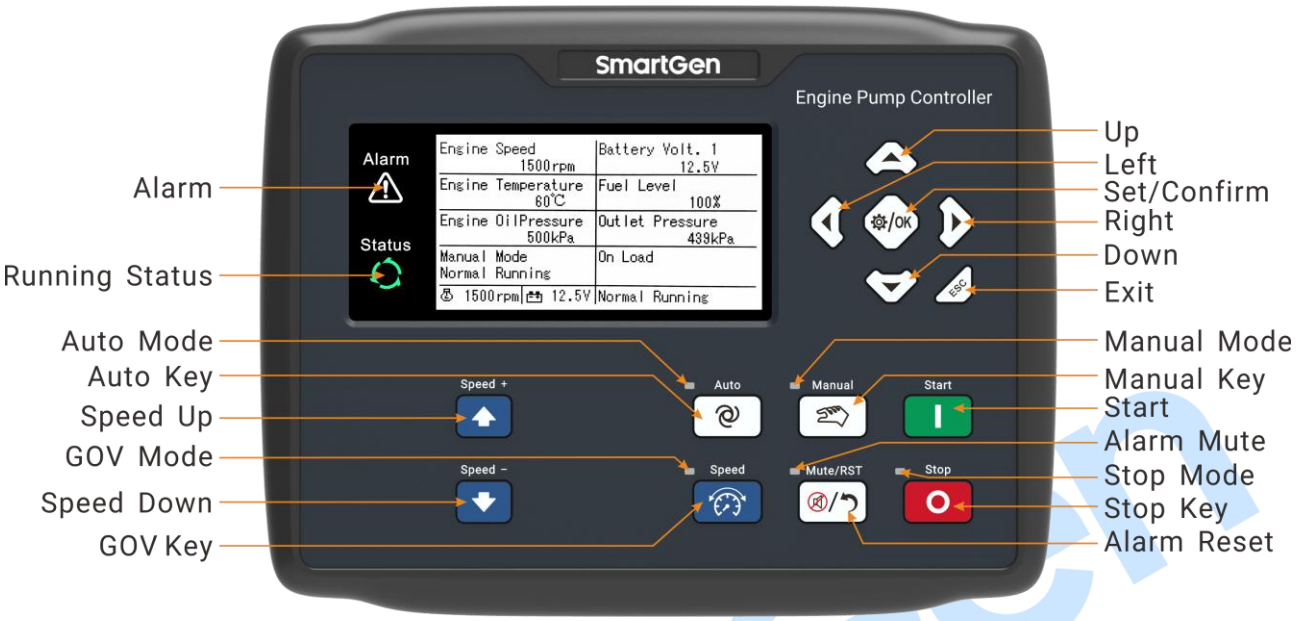


Fig.1 – APC715N Front Panel

NOTE: Selected indicators description.

Table 4 – Alarm Indicators

Type	Alarm Indicator
Warning Alarm	Slow Flashing (1 time per second)
Fault Idle Speed	Slow Flashing (1 time per second)
Shutdown Cooling	Fast Flashing (5 times per second)
Shutdown Alarm	Fast Flashing (5 times per second)
No Alarm	Extinguished

Running Indicator: illuminated from crank success to ETS while off during other periods.

4.2 KEY FUNCTIONS

Table 5 – Keys Descriptions

Icon	Keys	Description
	Stop	Stop the running pump unit in Manual/ Auto mode; Lamp test (press at least 3 seconds); During stopping process, press this key again to stop pump unit immediately.
	Start	Start pump unit in Manual/Test mode.
	Manual	Press this key and controller enters in Manual mode.
	Auto	Press this key and controller enters in Auto mode.
	GOV	Enter/Exit the GOV interface.
	Alarm Rest	Press this key to enter the alarm page. Press this key in alarm page to reset the alarm.
	Speed Up	Press this key in GOV page to speed up manually.
	Speed Down	Press this key in GOV page to speed down manually.
	Up/Increase	1. Screen scroll; 2. Up cursor and increase value in setting menu;
	Down/Decrease	1. Screen scroll; 2. Down cursor and decrease value in setting menu screen;
	Left	1. Screen scroll; 2. Left move cursor in setting menu.
	Right	1. Screen scroll; 2. Right move cursor in setting menu.
	Set/Confirm	1. Pressing and holding for more than 1 second can enter parameter configuration menu; 2. In setting menu, enter the next menu or confirm the set information.
	Exit	1. Exit and return to the homepage; 2. In setting menu, return to the previous menu.

NOTE: Press any key to mute sound in main interface.

NOTE: Press  and  simultaneously will force the unit to crank. Successful start will not be judged according to crank disconnect conditions, operator will have to crank the starter motor manually; when operator decides that the engine has fired, he/she should release the button and start relay will be deactivated, safety on delay will start.

CAUTION: The default password is "00318", operator can change it in case of others change the advanced parameter setting. Please clearly remember the password after changing. If you forget it, please contact SmartGen services and send all PD information in the controller page of "**ABOUT**" to us.

4.3 LCD DISPLAY

4.3.1 MAIN DISPLAY

The main display is divided into pages,  are used for page turning,  are used for screen scrolling.

★The main interface includes the following contents:

Engine speed, engine temperature, engine oil pressure, fuel level, battery 1 voltage, outlet pressure, engine status, loading status, etc.

NOTE: The information of main display can be displayed via PC self-defined.

★Engine:

Engine status, engine temperature, engine oil pressure, configurable sensor 1~10, battery 1 voltage, battery 2 voltage, charger voltage, accumulated run time, accumulated start times.

★ECU:

NOTE: If connected with J1939 engine via CANBUS port, ECU page includes: coolant pressure, coolant level, fuel temperature, fuel pressure, inlet temperature, exhaust temperature, turbo pressure, fuel consumption, total fuel consumption, engine load rate, urea level, SCR inlet temperature, SCR exhaust temperature and so on. (The displayed parameters can be configured).

★Pump Unit:

Gear box speed, outlet pressure, inlet pressure, pipe pressure, pump flow, pump lift, start flow and total pump flow.

Formula: Pump Head = (Outlet pressure - Static Pressure)/0.0098.

Pump flow is calculated according to relation curve of outlet pressure and flow; the relation curve should be set by users according to the actual usage or the flow sensor can be used directly.

★AIN8 Expand Analog:

Expand configurable sensor 1~8 (if configured)

★Alarm:

Display all warnings, shutdown alarms, fault idle speed, cooling shutdown alarms.

NOTE: For ECU warnings and shutdown alarms, if the alarm information is displayed, check engine according to it, otherwise, please check the manual of engine according to SPN alarm code.

★Event Log:

Records all start/stop events (shutdown, cooling shutdown, manual/auto start or stop) and the real time when event occurs. If it is ECU shutdown alarm, it will record the SPN of latest alarm.

★Maintenance Information:

Displays the maintenance time and contents of 1~5 (if configured).

★Others:

Time and date, input/output ports status, communication status, expand input/output ports status (if configured), Ethernet port configuration (if configured).

★About:

Issue time of software and hardware version, product PD number.

★**Status:**

Engine speed, battery 1 voltage, engine status.

4.3.2 USER MENU AND PARAMETER SETTING

Press and hold  for more than 1s to enter into user menu;

★Parameter

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

★Language

Selectable Chinese, English and others (default: Traditional Chinese).

★Commissioning

On load, off load or custom commissioning can be chosen. Custom commissioning can configure on load or not during commissioning, when to commissioning and select the mode after commissioning (manual mode, auto mode and stop mode).

★Clear users' accumulation

Can clear User Accumulated Run A, User Accumulated Run B, Engine Accumulated Run time and Accumulated Start times.

★Post-processing Panel

Display the post-processing status indicator of engine.

Parameter setting:

——Module Setting
——Timer Setting
——Engine Parameter Setting
——Analog Sensor Setting
——Digital Input Port Setting
——Digital Output Port Setting
——GOV Setting
——Gearbox Setting
——Scheduling and Maintenance Setting
——ECU Display Setting
——Network Communication Setting
——Expand Digital Input Setting
——Expand Digital Output Setting
——Expand AIN8 Setting

Examples:

>Return >Module >Timer >Engine Parameter >Analog Sensor >Digital Input Port >Digital Output Port >GOV >Pump Unit	>Start Delay >Stop Delay >Preheating Delay >Fuel Time Before Cranking >Cranking Time >Cranking Rest Time >Safety On Time >Start Idle Time >Warming Up Time	 are used to scroll settings,  is used to enter settings (Interface 2),  is used to exit settings menu.

>Start Delay >Stop Delay >Preheat Delay > Fuel Time Before Cranking >Cranking Time >Crank Rest Time >Safety On Time >Start Idle Time >Warming Up Time	00001s	Interface 2:  are used to change the setting contents,  is used to enter the setting (Interface 3),  is used to return to the previous menu (Interface 1).

> Start Delay >Stop Delay >Preheat Delay >Fuel Time Before Cranking >Cranking Time >Crank Rest Time >Safety On Time >Start Idle Time >Warming Up Time	00001s	Interface 3:  is used to enter into the setting (Interface 4),  is used to return to the previous unselected state (Interface 2).

> Start Delay >Stop Delay >Preheat Delay >Fuel Time Before Cranking >Cranking Time >Crank Rest Time >Safety On Time > tart Idle Time >Warming Up Time	00001s	Interface 4:  are used to change cursor position,   are used to change the cursor value,  is used to confirm setting. After the settings are confirmed, the parameters are automatically saved to the internal storage space.  is used to exit settings menu.

NOTE: Press  to exit the setting directly during setting.

4.4 AUTO START/STOP OPERATION

Auto mode is selected by pressing  key; a LED besides the key will illuminate to confirm the operation.

Auto Start Sequence:

1) When “Remote Start (On Load)” is active, “Start Delay” timer is initiated;
2) When start delay is over, preheat relay energizes (if configured), “Preheat Delay XX s” information will be displayed on LCD;
3) After the above delay, the Fuel Relay is energized, and then one second later, the Start Relay is engaged. If the pump unit fails to fire during the “Cranking Time”, then the fuel relay and start relay are disengaged for the pre-set rest period; “Crank Rest Time” begins and wait for the next crank attempt;
4) Should this start sequence continue beyond the set number of attempts, the start sequence will be terminated, the Fail to Start fault will be displayed on LCD;
5) In case of successful crank attempt, the “Safety On” timer is activated, during this period, Low Oil Pressure, High Temperature, Under Speed and Charge Alternator Failure alarms are inactive. As soon as this delay is over, “Start Idle” delay is initiated (if configured);
6) During “Start Idle” delay, under speed alarm is inhibited. When this delay is over, “Warming up” delay is initiated (if configured);
7) After the “Warming up” delay, if engine speed has reached on-load requirements, then the pump close relay will be energized; pump unit will take load; pump unit will enter into Normal Running status.

NOTE: In case of “Remote Start (off Load)”, the procedure is the same, except for step No. 7: the pump unit close relay will NOT be energized, generator will NOT accept load.

Auto Stop Sequence:

1) When the “Remote Start” signal is deactivated while the “Remote Stop” signal is active, the “Stop Delay” is initiated;
2) Once this stop delay has expired, the Pump Unit Breaker will open and the “Cooling Delay” is then initiated. Should the Remote Start signal be re-activated during the cooling down period, the unit will return to running status. Once the “Cooling Delay” expires, the “Stop Idle” delay is initiated;
3) During “Stop Idle” Delay (if configured), idle relay is energized;
4) “ETS Solenoid Hold” begins, ETS relay is energized while fuel relay is de-energized and complete stop is detected automatically;
5) "Fail to Stop Delay" begins, complete stop is detected automatically;
6) Pump unit is placed into “After Stop Time” after its complete stop. Otherwise, fail to stop alarm is initiated and the corresponding alarm information is displayed on LCD (If pump unit stopped successfully after “Failed to Stop” alarm, it will enter “After stop time” and remove alarm);
7) Pump unit is placed into its standby mode after its “After Stop Time”.

4.5 MANUAL START/STOP OPERATION

1) Manual Start: Manual mode is selected by pressing  key, a LED beside the key will illuminate to confirm the operation.

   Press  key to start the unit, it can automatically detect crank successfully, and will accelerates to high-speed running automatically.

   When **"Idle Run without Load"** is enabled, the unit is idle running when crank succeeds; after the input port is configured "Manual Load Input" or Water Blast Gun Input" is active, it will enter into high-speed running with load.

   With high water temperature, low oil pressure and over speed during pump unit running, controller can protect it to stop quickly (please refer to No.2~7 of Auto start operation for detail procedures).

2) Manual Stop: press  key to stop the running unit. (Please refer to No.2~7 of Auto stop operation for detail procedure).

NOTE: In manual mode, users can control the unit on load or off load via input port "Manual on load input".

4.6 ON-LOAD CONTROL PROCEDURE

When controller is in Auto mode, auto control will be executed during on load procedure. The unit will automatically take load after normal running and meets the load requirements while automatically unload when unit stops.

When controller is in manual mode, manual control will be executed during on load procedure. Whether the unit is on load or off load will by the configuration of input port "Manual Load Input" or "Water Blast Gun"

"Idle Run without Load" 0: Disable"

Start the pump unit in manual mode and it enters into normal running. The input port is configured "Manual Load Input" or "Water Blast Gun Input" and it is active, the engine will run on load; when the input port is inactive, the engine will unload and the unit will keep high-speed running.

"Idle Run without Load" 1: Enable"

Start the pump unit in manual mode and it will keep in idle speed running. The input port is configured "Manual Load Input" or "Water Blast Gun Input" and it is active, the engine will enter into high-speed running, and it will take load as soon as the on-load requirements have reached. When the unit is normal running on load, the input port is inactive, the engine will unload (i.e. the load relay is deactivated). When the unit enters into high-speed cooling delay, it will enter into idle running after the the delay ends and then keeps the idle running status.

"Idle Run without Load"2: Only auto GOV enables:

Start the pump unit manually, only in auto GOV mode, the idle running, high-speed running and loading/unloading will be switched according to the input port status.

4.7 ADJUST SPEED CONTROL PROCEDURE

Users can set the outlet pressure as the rated value simply by adjusting the engine speed. The "Adjust Speed Control" was divided into auto control and manual control.

Manual Adjust Speed: Adjust Speed mode is selected by pressing the key; In this interface, users can adjust speed using navigational key: , manual adjust speed; , auto adjust speed; , manual raise speed; , manual drop speed. " , manual raise speed" and " , manual drop speed" keys are active only when pump unit is normal running under "Manual Adjust Speed" mode.

Auto Adjust Speed: Under this mode, during the unit is normal running, the controller will automatically adjust the outlet pressure/inlet pressure/engine speed according to the pre-set value to rated speed and maintain it steadily.

The "Auto Adjust Speed" was divided into relay adjust speed, GOV adjust speed and CAN adjust speed.

Relay Adjust Speed: Control the engine servo motor simply by using speed raise relay and speed drop relay.

GOV Adjust Speed: Control the electronic speed regulator simply by using GOV analog signal. Users should set parameters according to the actual situation as different GOVs have different parameters.

CAN Adjust Speed: Control the ECU engine speed simply by using CAN interface. According to the different gain, stability, dead band and acceleration/deceleration rate to control the engine speed.

5 MANUAL DPF REGENERATION

5.1 ILLUSTRATION

For engine meeting Emission Standard for Stage IV of non-road mobile machinery, if the post-processing technology line contains DPF, so it needs the DPF regeneration function.

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

Controller supports manual regeneration function to realize manual DPF regeneration operation.

5.2 PANEL ICON DESCRIPTION OF POST-PROCESSING

Table 6 – Post-processing Panel Icon Description

Icon	Description
	Engine fault indicator
	DPF discharge temperature high indicator
	DPF regeneration status indicator
	DPF regeneration inhibition indicator
	Driver warning indicator/DEF low level warning indicator

NOTE: DPF: Diesel Particulate Filter;

DEF: Diesel Exhaust Fluid;

5.3 DPF MANUAL REGENERATION OPERATION

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

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

Press  on controller panel and enter into parameter setting menu. Press  and select “Post-processing Panel”. Controller display is as Fig.2:

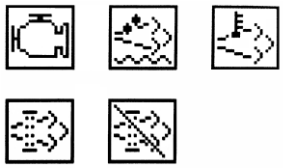


Fig.2 – Post-processing Panel

When DPF regeneration indicator always illuminates or flashes, it means the manual regeneration is needed, the operator will park to regenerate and the controller display is as Fig.3:

Fig.3 – DPF Request Regeneration

Press “DPF Manual Regeneration” key, if the ECU detects that the current status meets the DPF regeneration conditions, DPF regeneration will be activated and the engine will enter the DPF regeneration status. DPF exhaust temperature indicator is always illuminated and the controller display is as Fig.4:

Fig.4 – DPF Regenerating

When manual regeneration is completed, the DPF exhaust temperature indicator is extinguished, the controller display is as the above Fig.2.

If regeneration needs to be stopped, press “DPF Regeneration Inhibition” key. When DPF regeneration inhibition is activated, DPF regeneration inhibition indicator is always illuminated.

6 PROTECTION

6.1 WARNINGS

When controller detects warnings, it only sends waring signal but not shut down the unit.

Table 7 – Warning Alarms

No.	Type	Description
1	Over Speed	When the controller detects that the engine speed has exceeded the pre-set value, it will initiate a warning alarm. Alarm detection range: always detects.
2	Under Speed	When the controller detects that the engine speed has fallen below the pre-set value, it will initiate a warning alarm. Alarm detection range: after high-speed warming up and before stop idle.
3	Loss of Speed Signal	When the controller detects that the engine speed is 0 and the action selects “Warn”, it will initiate a warning alarm. Alarm detection range: after safety on and before ETS hold.
4	Fail To Stop	After “fail to stop” delay, if unit is not stop completely, it will initiate a warning alarm.
5	Charge Alt Fail	When the controller detects that charger voltage has fallen below the pre-set value, it will initiate a warning alarm. Alarm detection range: normal running detects.
6	Battery 1 Over Voltage	When the controller detects that battery 1 voltage has exceeded the pre-set value, it will initiate a warning alarm. Alarm detection range: always detects.
7	Battery 1 Under Voltage	When the controller detects that battery 1 voltage has fallen below the pre-set value, it will initiate a warning alarm. Alarm detection range: always detects.
8	ECU Warn	When controller receives the engine warning signal via J1939, and detects the DPF request, it will initiate a warning signal. Alarm detection range: always detects.
9	DPF Regeneration	When engine type selects “ Comm TIER4 Unit” or “GTSC1-TIER”, and controller detects DPF regeneration request, it will initiate a warning signal to remind operator.
10	High Temperature	When the controller detects that engine temperature has exceeded the pre-set value, it will initiate a warning alarm. Alarm detection range: after safety on and before ETS hold.
11	Low Temperature	When the controller detects that engine temperature has fallen below the pre-set value, it will initiate a warning alarm. Alarm detection range: after safety on and before ETS hold.
12	Low Oil Pressure	When the controller detects that the oil pressure has fallen below the pre-set value, it will initiate a warning alarm. Alarm detection range: after safety on and before ETS hold.
13	Flexible Sensor 1~10 Open	When the controller detects that the sensor is open circuit and the action selects “Warn”, it will initiate a warning alarm.

No.	Type	Description
		Alarm detection range: always detects.
14	Flexible Sensor 1~10 High	When the controller detects that the sensor value is higher than the max. set value, it will initiate a warning alarm. Alarm detection range: according to the set range to detect.
15	Flexible Sensor 1~10 Low	When the controller detects that the sensor value is lower than the min. set value, it will initiate a warning alarm. Alarm detection range: according to the set range to detect.
16	AIN8 Sensor 1~8 Open	When the controller detects that the sensor is open circuit and the action selects “Warn”, it will initiate a warning alarm. Alarm detection range: always detects.
17	AIN8 Sensor 1~8 High	When the cotroller detects that the sensor value is higher than the max. set value, it will initiate a warning alarm. Alarm detection range: according to the set range to detect.
18	AIN8 Sensor 1~8 Low	When the controller detects that the sensor value is lower than the min. set value, it will initiate a warning alarm. Alarm detection range: according to the set range to detect.
19	Extended Input 1~16	When the digital input port of extension input module is configured as “Warn” and it is active, the controller will initiate a corresponding warning signal. Alarm detection range: according to the set range to detect.
20	PLC Function 1~20	When PLC function selects the user-defined and active, and the action is set as “Warn”, the controller will initiate a corresponding PLC function warning alarm. Alarm detection range: according to the PLC function set range to detect.
21	Digital Input 1~9 Warn	When the action of digital input port select “Warn” and active, the controller will initiate a warning alarm. Alarm detection range: according to the set range to detect.
22	Battery 2 Over Voltage	When the controller detects that battery 2 voltage has exceeded the pre-set value, the controller will initiate a warning alarm. Alarm detection range: always detects.
23	Battery 2 Under Voltage	When the controller detects that battery 2 voltage has fallen below the pre-set value, the controller will initiate a warning alarm. Alarm detection range: always detects.
24	Over Flow Warn	When the controller detects the flow value is higher than the max. set value, the controller will initiate a warning alarm. Alarm detection range: after safety on and before ETS hold.
25	Gearbox Over speed	When the controller detects that the gearbox speed has exceeded the pre-set value, the controller will initiate a warning alarm. Alarm detection range: after safety on and before ETS hold.
26	Gearbox Under speed	When the controller detects that the gearbox speed has fallen below the pre-set value, the controller will initiate a warning alarm. Alarm detection range: after safety on and before ETS hold.
27	Authorization Time Due	When the mandate time has expired and the action selects “Warn”, the controller will initiate a warning alarm.

No.	Type	Description
		Alarm detection range: always detects.
28	Maintenance 1~5	When maintenance enables and the maintenance countdown is 0, the action is set as “Warn”, the controller will initiate a warning alarm. Alarm detection range: always detects.
29	Extension Input Module Comm Fail	After extension input module enables, when the controller cannot receive the communication data and the failure action is set as “Warn”, the controller will initiate a warning alarm.
30	Extension Output Module Comm Fail	After extension output module enables, when the controller cannot receive the communication data and the failure action is set as “Warn”, the controller will initiate a warning alarm.
31	AIN8 Comm Fail	After AIN8 module enables, when the controller cannot receive the communication data and the failure action is set as “Warn”, the controller will initiate a warning alarm.

6.2 SHUTDOWN ALARM

When controller detects shutdown alarm, it will send signal to open breaker and stop the unit. Shutdown alarm must be cleared manually and the fault removed to reset the module.

Table 8 – Shutdown Alarm

No.	Type	Description
1	Emergency Stop	When the controller detects an emergency stop alarm signal, it will initiate a shutdown alarm. Alarm detection range: always detects.
2	Over Speed	When the controller detects that the engine speed has exceeded the pre-set value, it will initiate a shutdown alarm. Alarm detection range: always detects.
3	Under Speed	When the controller detects that the engine speed has fallen below the pre-set value, it will initiate a shutdown alarm. Alarm detection range: after safety on and before ETS hold.
4	Loss of Speed Signal	When the controller detects that the engine speed is 0 and the action selects “Shutdown”, it will initiate a shutdown alarm. Alarm detection range: after safety on and before ETS hold.
5	Fail to Start	Within the setting start attemps, if the genset fail to start, it will initiate a shutdown alarm.
6	ECU Shutdown	If shutdown alarm signal is received from ECU via J1939, it will initiate a shutdown alarm. Alarm detection range: always detects.
7	ECU Comm Fail	If the module does not detect the J1939 data, it will initiate a shutdown alarm. Alarm detection range: after safety on and before ETS hold.
8	High Temp Input	When the controller detects that the high temperature is active, it will initiate a shutdown alarm. Alarm detection range: after safety on and before ETS hold.
9	Low Oil Pressure Input	When the controller detects that the low oil pressure input is active, it will initiate a shutdown alarm. Alarm detection range: after safety on and before ETS hold.
10	High Engine Temperature	When the controller detects that engine temperature has exceeded the pre-set value, it will initiate a shutdown alarm. Alarm detection range: after safety on and before ETS hold.
11	Low Engine Oil Pressure	When the controller detects that the oil pressure has fallen below the pre-set value, it will initiate a shutdown alarm. Alarm detection range: after safety on and before ETS hold.
12	Flexible Sensor 1~10 Open	When the controller detects that the sensor is open circuit and the action selects “Shutdown”, it will initiate a shutdown alarm. Alarm detection range: always detects.
13	Flexible Sensor 1~10 High	When the controller detects the sensor value is higher than the max. set value, it will initiate a shutdown alarm. Alarm detection range: according to the set range to detect.

No.	Type	Description
14	Flexible Sensor 1~10 Low	When the controller detects the sensor value is lower than the min. set value, it will initiate a shutdown alarm. Alarm detection range: according to the set range to detect.
15	AIN8 Sensor 1~8 Open	When the controller detects the sensor is open circuit and the action selects “Shutdown”, it will initiate a shutdown alarm. Alarm detection range: always detects.
16	AIN8 Sensor 1~8 High	When the controller detects the sensor value is higher than the max. set value, it will initiate a shutdown alarm. Alarm detection range: according to the set range to detect.
17	AIN8 Sensor 1~8 Low	When the controller detects the sensor value is lower than the min. set value, it will initiate a shutdown alarm. Alarm detection range: according to the set range to detect.
18	Input Port 1~9 Shutdown	When the digital input port is set “Shutdown” and active, the controller will initiate a shutdown alarm. Alarm detection range: according to the set range to detect.
19	PLC Function 1~20	When PLC function selects the user-defined and it is active, and the action is set as “Shutdown”, the controller will initiate a corresponding PLC function shutdown alarm. Alarm detection range: according to the PLC function set range to detect.
20	Maintenance 1~5	When maintenance enables and the maintenance countdown is 0, the action is set as “Shutdown”, the controller will initiate a shutdown alarm. Alarm detection range: always detects.
21	Extended Input 1~16	When the digital input port of extension input module is configured as “Shutdown” and active, the controller will initiate a corresponding shutdown signal.
22	Over Flow Shutdown	When the controller detects the flow value is higher than the max. set value, it will initiate a shutdown alarm. Alarm detection range: after safety on and before ETS hold.
23	Gearbox Over speed	When the controller detects that the gearbox speed has exceeded the pre-set value, it will initiate a shutdown alarm. Alarm detection range: after safety on and before ETS hold.
24	Gearbox Under speed	When the controller detects that the gearbox speed has fallen below the pre-set value, it will initiate a shutdown alarm. Alarm detection range: after safety on and before ETS hold.
25	Authorization Time Due	When the mandate time has expired and the action selects “Shutdown”, it will initiate a shutdown alarm. Alarm detection range: always detects.
26	Extension Input Module Comm Fail	After extension input module enables, when the controller cannot receive the communication data and the failure action is set as “Shutdown”, the controller will initiate a shutdown alarm.
27	Extension Output Module Comm Fail	After extension output module enables, when the controller cannot receive the communication data and the failure action is set as “Shutdown”, the controller will initiate a shutdown alarm.

No.	Type	Description
28	AIN8 Comm Fail	After AIN8 module enables, when the controller cannot receive the communication data and the failure action is set as “Shutdown”, the controller will initiate a shutdown alarm.

6.3 COOLING SHUTDOWN ALARM

On initiation of the “cooling shutdown” condition, the controller will de-energize the load output to remove the load from the unit. Once this has occurred, the controller will start the cooling delay and allow the engine to cool before shutting down the engine. This alarm must be cleared manually and the fault removed to reset the module.

Table 9 – Cooling Shutdown Alarm

No.	Types	Description
1	Digital Input 1~9	When the action of digital input port selects “Cooling Shutdown” and active, it will initiate the corresponding alarm. Alarm detection range: according to the set range to detect.
2	Extended Input 1~16	When the digital input port of extension input module selects “Cooling Shutdown” and active, it will initiate the corresponding alarm. Alarm detection range: according to the set range to detect.
3	PLC Function 1~20	When PLC function selects the user-defined and active, and the action is set as “Cooling Shutdown”, the controller will initiate the corresponding alarm. Alarm detection range: according to the PLC function set range to detect.

6.4 FAULT IDLE ALARM

On initiation of the “fault idle” condition, the controller will de-energize the load output to remove the load from the unit. Once this has occurred, the controller will enter idle running after cooling delay.

Table 10 – Fault Idle Alarm

No.	Types	Description
1	Digital Input 1~9	When the action of digital input port selects “Fault Idle” and active, it will initiate a fault idle alarm. Alarm detection range: according to the set range to detect.
2	Extended Input 1~16	When the action of digital input port of extension input module selects “Fault Idle” and active, it will initiate a fault idle alarm. Alarm detection range: according to the set range to detect.
3	PLC Function 1~20	When the action of PLC function selects the user-defined and active, and the action is set as “Fault Idle”, it will initiate a fault idle alarm. Alarm detection range: according to the PLC function set range to detect.

6.5 INDICATION ALARM

On initiation of the indication alarm the controller does not perform any action, and the alarm information will be displayed on Alarm page.

Table 11 – Indication Alarm

No.	Type	Description
1	Digital Input 1~9	When the action of digital input port selects “Indication” and active, it will initiate a fault idle alarm. Alarm detection range: according to the set range to detect.
2	Extended Input 1~16	When the action of digital input port of extension input module selects “Indication” and active, it will initiate a fault idle alarm. Alarm detection range: according to the set range to detect.
3	PLC Function 1~20	When the action of PLC function selects the user-defined and active, and the action is set as “Indication”, it will initiate a fault idle alarm. Alarm detection range: according to the PLC function set range to detect.

7 WIRING CONNECTION

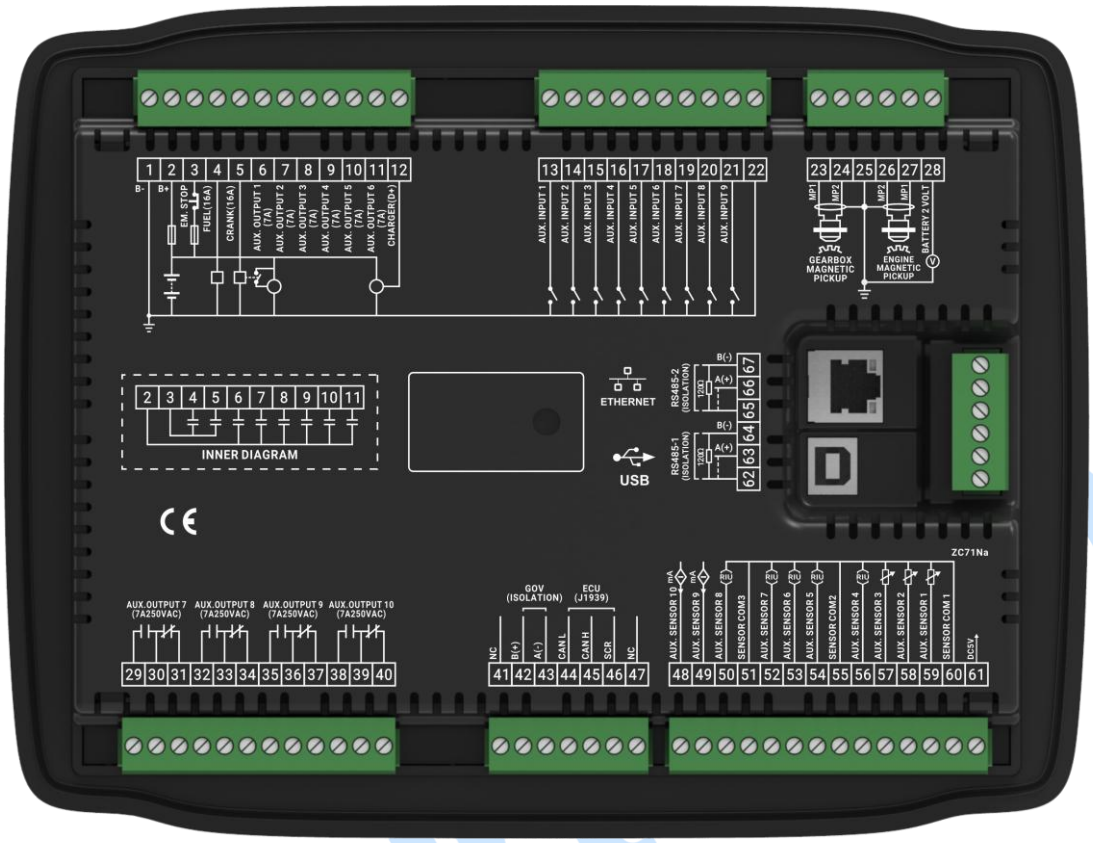


Fig.5 – Controller Rear Panel

Table 12 – Description of Terminal Connection

No.	Function	Cable Size	Description	
1	B-	2.5mm²	Connected with negative of starter battery.	
2	B+	2.5mm²	Battery 1 voltage, connected with positive of starter battery. If wire length is over 30m, better to double wires in parallel. Max. 20A fuse is recommended.	
3	Emergency Stop	2.5 mm²	Connected with B+ power supply via emergency stop button.	
4	Fuel Relay Output	2.5mm²	B+ power is supplied by terminal 3, rated 16A	
5	Crank Relay Output	2.5mm²	B+ power is supplied by terminal 3, rated 16A	Connected to starter coil
6	Aux. Output 1	1.5mm²	B+ power is supplied by terminal 2, rated 7A	Details see table 14
7	Aux. Output 2	1.5mm²	B+ power is supplied by terminal 2, rated 7A	
8	Aux. Output 3	1.5mm²	B+ power is supplied by terminal 2, rated 7A	
9	Aux. Output 4	1.5mm²	B+ power is supplied by terminal 2, rated 7A	
10	Aux. Output 5	1.5mm²	B+ power is supplied by terminal 2, rated 7A	

No.	Function	Cable Size	Description	
11	Aux. Output 6	1.5mm²	B+ power is supplied by terminal 2, rated 7A	
12	Charger(D+)	1.0mm²	Connected with charger starter's D+ (WL) terminals. Being hang up If there is no this terminal.	
13	Aux. Input 1	1.0mm²	Ground connected is active (B-)	Details see table 15
14	Aux. Input 2	1.0mm²	Ground connected is active (B-)	
15	Aux. Input 3	1.0mm²	Ground connected is active (B-)	
16	Aux. Input 4	1.0mm²	Ground connected is active (B-)	
17	Aux. Input 5	1.0mm²	Ground connected is active (B-)	
18	Aux. Input 6	1.0mm²	Ground connected is active (B-)	
19	Aux. Input 7	1.0mm²	Ground connected is active (B-)	
20	Aux. Input 8	1.0mm²	Ground connected is active (B-)	
21	Aux. Input 9	1.0mm²	Ground connected is active (B-)	
22	Common GND (B-)	1.0mm²	(B-) has already connected internally.	
23	Gearbox Magnetic Pickup 1	0.5mm²	Connected with Gearbox Speed Sensor, shielding line is recommended. (B-) has already connected with speed sensor 2 internally.	
24	Gearbox Magnetic Pickup 2			
25	Magnetic Pickup GND	/	(B-) has already connected with ground internally.	
26	Engine Magnetic Pickup 2	0.5mm²	Connected with Engine Speed Sensor, shielding line is recommended. (B-) has already connected with speed sensor 2 internally.	
27	Engine Magnetic Pickup 1			
28	Battery 2 Volt	1.0mm²	Connected with positive of battery 2.	
29	Aux. Output 7	1.5mm²	N/C, rated 7A	Details see table 14
30			Common of relay	
31			N/O, rated 7A	
32	Aux. Output 8	1.5mm²	N/C, rated 7A	
33			Common of relay	
34			N/O, rated 7A	
35	Aux. Output 9	1.5mm²	N/C, rated 7A	
36			Common of relay	
37			N/O, rated 7A	
38	Aux. Output 10	1.5mm²	N/C, rated 7A	
39			Common of relay	
40			N/O, rated 7A	
41	NC	/		
42	GOV B(+)	0.5mm²	Shielding wire is recommended, its GOV end shall be earth connected.	
43	GOV A(-)	0.5mm²		
44	ECU CAN L	0.5mm²	Impedance-120Ω shielding wire is recommended, its single-end earthed. 120Ω matched resistance has already connected internally.	
45	ECU CAN H	0.5mm²		
46	ECU SCR	/		
47	NC	/		

No.	Function	Cable Size	Description	
48	Aux. sensor 10	1.0mm²	Connected with current type (4-20mA) sensor.	Details see table 16
49	Aux. sensor 9	1.0mm²		
50	Aux. sensor 8	1.0mm²	Connected with resistance type or current type (4-20mA) or voltage type (0-5V) sensor.	
51	Sensor COM 3	1.0mm²	Sensor common port, controller has been connected with B- internally.	
52	Aux. sensor 7	1.0mm²	Connected with resistance type or current type (4-20mA) or voltage type (0-5V) sensor.	
53	Aux. sensor 6	1.0mm²		
54	Aux. sensor 5	1.0mm²		
55	Sensor COM 2	1.0mm²	Sensor common port, controller has been connected with B- internally.	
56	Sensor COM 4	1.0mm²	Connected with resistance type or current type (4-20mA) or voltage type (0-5V).	
57	Aux. sensor 3	1.0mm²	Connected with resistance type sensor.	
58	Aux. sensor 2	1.0mm²		
59	Aux. sensor 1	1.0mm²		
60	Sensor COM 1	1.0mm²	Sensor common port, controller has been connected with B- internally.	
61	DC5V	1.0mm²	Provide +5V for voltage type sensor, the current is less than 50mA.	
62	Terminal Matching Resistor (120Ω)	0.5mm²	The leading-out terminal of 120Ω matching resistor in RS485 communication port. A 120Ω resistor is short connected between Terminal 62 and 63, and it will not be connected externally.	
63	RS485-1 A(+)	0.5mm²	The default baud rate 9600bps, no parity bit, 1 stop bit and standard MODBUS-RTU protocol.	
64	RS485-1 B(-)	0.5mm²		
65	Terminal Matching Resistor (120Ω)	0.5mm²	The leading-out terminal of 120Ω matching resistor in RS485 communication port. A 120Ω resistor is short connected between Terminal 65 and 66, and it will not be connected externally.	
66	RS485-2 A(+)	0.5mm²	The default baud rate 9600bps, no parity bit, 1 stop bit and standard MODBUS-RTU protocol.	
67	RS485-2 B(-)	0.5mm²		
	ETHERNET	/	RJ45 interface, connected PC testing software to configure parameter or other monitoring platforms.	
	USB	/	USB-TYPE B interface, connected with PC testing software to configure parameter and upgrade program.	

8 DEFINITION AND RANGE OF PARAMETERS

8.1 PARAMETER CONTENTS AND RANGES

Table 13 – Parameter Contents and Ranges

No.	Item		Range	Default	Description
Module Setting					
1	Power on Mode		(0-2)	0	0: Stop mode; 1: Manual mode; 2: Auto mode.
2	Module Address		(1-254)	1	Controller's address during RS485 networking communication.
3	Password		(0-65534)	00318	For entering advanced parameters setting.
4	Comm Port 1	Baud Rate	(0-3)	2	0：2400 bps 1：4800 bps 2：9600 bps 3：19200 bps
		Stop Bit	(1-2)	1	1 stop bit or 2 stop bits can be set.
		Parity Bit	(0-2)	0	0：None 1：Odd Stop Bit 2：Even Stop Bit
5	Comm Port 2	Baud Rate	(0-3)	2	0：2400 bps 1：4800 bps 2：9600 bps 3：19200 bps
		Stop Bit	(1-2)	1	1 stop bit or 2 stop bits can be set.
		Parity Bit	(0-2)	0	0：None 1：Odd Stop Bit 2：Even Stop Bit
6	LCD Backlight		(0-3600)s	300	Set backlight delay to 0, the backlight is always illuminated.
7	Start Interface	Enable	(0-1)	0	0：Disable 1：Enable
		Delay	(0-3600)s	3	
8	Date and Time				Users can manually calibrate the date and time.
9	Language Selection		(0-2)	0	0: Chinese; 1: English; 2: Others
Timer Setting					
1	Start Delay		(0-3600)s	1	Time from remote start signal is active to start the pump unit.
2	Stop Delay		(0-3600)s	1	Time from remote start signal is deactivated to stop the pump unit.
3	Preheat Delay		(0-3600)s	0	Time of pre-powering heat plug before starter is powered up.

No.	Item	Range	Default	Description
4	Fuel Time before Cranking	(0-3600)s	1	The fuel relay output time before starter is powered up.
5	Cranking Time	(3-60)s	8	Time of starter power up.
6	Crank Rest Time	(3-60)s	10	The waiting time before second power up when engine start fail.
7	Safety On Delay	(0-3600)s	10	Alarms for low oil pressure, high temperature, under speed, under frequency/voltage, charge failure are inactive.
8	Start Idle Time	(0-3600)s	0	Idle running time of the pump unit when starting.
9	Warming Up Time	(0-3600)s	10	Warming time between the pump unit take load and high speed running.
10	Cooling Time	(0-3600)s	10	Radiating time before stop the pump unit, after it unloads.
11	Stop Idle Time	(0-3600)s	0	Idle running time when pump unit stop.
12	ETS Solenoid Hold	(0-3600)s	20	Stop electromagnet's power on time when pump unit is stopping.
13	Fail to Stop Delay	(0-3600)s	0	Time between ending of pump unit idle delay and stopped when "ETS output time" is set as 0; Time between ending of ETS hold delay and stopped when "ETS output time" is not 0.
14	After Stop Time	(0-3600)s	0	Time between pump unit stopped and standby.
Engine Setting				
1	Engine Type	(0-39)	0	Default: Conventional engine (not J1939). When connected to J1939 engine, choose the corresponding type.
2	ECU Address	(0-255)	03	ECU communication source address.
3	Flywheel Teeth	(10.0-300.0)	118.0	Tooth number of the engine, for judging of starter separation conditions and inspecting of engine speed. See the following Installation Instruction.
4	Rated Speed	(0-6000)r/min	1500	Offer standard to judge over/under/loading speed.
5	Engine Idle Set	(0-100.0)%	60.0	Setting value is percentage of rated speed. Stabilize the engine speed on the set value if idle running is

No.	Item		Range	Default	Description
					needed.
6	Speed on Load		(0-100.0)%	30.0	Setting value is percentage of rated speed. Controller detects when it is ready to load. It won't enter into normal running process when speed is lower than loading speed.
7	Start Attempts		(1-10) Times	3	Max. crank attempts. When reach this number, controller will send start failure signal.
8	Crank Disconnect		(0-2)	2	See table 17. There are 3 conditions of disconnecting starter with engine. Each condition can be used alone and simultaneously to separating the start motor and genset as soon as possible.
9	Disconnect Engine Speed		(0-100.0)%	24.0	Setting value is percentage of rated speed. When engine speed is higher than the set value, starter will be disconnected. See the following Installation Instruction.
10	Disconnect Oil Pressure		(0-1000)kPa	200	When engine oil pressure is higher than the set value, starter will be disconnected. See the following Installation Instruction.
11	After Unload Idle		(0-2)	0	0: Disable; 1: Enable; 2: Only when auto GOV enables; Active in manual mode, the unit will enter the idle running after unloading or offloading.
12	Bat 1 Rated Volt.		(0-60.0)V	24.0	Standard for detecting over/under voltage of battery.
13	Bat 1 Over Volt. Warn	Enable	(0-1)	1	Setting value is percentage of battery rated voltage. When controller detects that the battery voltage is higher than the set value, it will send a warning signal of over voltage.
		Set	(0-200.0)%	120.0	
		Return	(0-200.0)%	115.0	
		Delay	(0-3600)s	60	
14	Bat 1 Under Volt. Warn	Enable	(0-1)	1	Setting value is percentage of battery rated voltage. When controller detects that the battery voltage is less than the set value, it will send a warning signal of under voltage.
		Set	(0-200.0)%	85.0	
		Return	(0-200.0)%	90.0	
		Delay	(0-3600)s	60	
15	Bat 2 Rated Volt.		(0-60.0)V	24.0	Offer standard to judge battery under voltage.

No.	Item		Range	Default	Description
16	Bat 2 Over Volt. Warn	Enable	(0-1)	0	Setting value is percentage of battery rated voltage. When controller detects that the battery voltage is higher than the set value, it will send a warning signal of over voltage.
		Set	(0-200.0)%	120.0	
		Return	(0-200.0)%	115.0	
		Delay	(0-3600)s	60	
17	Bat 2 Under Volt. Warn	Enable	(0-1)	0	Setting value is percentage of battery rated voltage. When controller detects that the battery voltage is less than the set value, it will send a warning signal of under voltage.
		Set	(0-200.0)%	85.0	
		Return	(0-200.0)%	90.0	
		Delay	(0-3600)s	60	
18	Charge Alt Fail	Enable	(0-1)	1	In normal running, when charger D+(WL) voltage under this value, charge failure alarms.
		Set	(0-60.0)V	8.0	
		Return	(0-60.0)V	10.0	
		Delay	(0-3600)s	10	
19	Loss of Speed Signal	Act	(0-2)	0	0: Warn; 1: Shutdown; 2:None. From detecting the speed is 0 to comfirm action.
		Delay	(0-3600)s	5	
20	Over Speed Shutdown	Enable	(0-1)	1	Setting value is percentage of rated speed. When controller detects that the engine speed is greater than the set value, it will send a signal of shutdown alarm.
		Set	(0-200.0)%	114.0	
		Delay	(0-3600)s	2	
21	Over Speed Warn	Enable	(0-1)	1	Setting value is percentage of rated speed. When controller detects that the engine speed is less than the set value, it will send a signal of shutdown alarm.
		Set	(0-200.0)%	110.0	
		Return	(0-200.0)%	108.0	
		Delay	(0-3600)s	5	
22	Under Speed Shutdown	Enable	(0-1)	0	Setting value is percentage of rated speed. When controller detects that the engine speed is less than the set under speed limit, it will send a signal of shutdown alarm.
		Set	(0-200.0)%	80.0	
		Delay	(0-3600)s	3	
23	Under Speed Warn	Enable	(0-1)	0	Setting value is percentage of rated speed. When controller detects that the engine speed is less than the set under speed limit, it will send a warning signal.
		Set	(0-200.0)%	86.0	
		Return	(0-200.0)%	90.0	
		Delay	(0-3600)s	5	
Analog Sensors Setting					
Flexible Sensor 1					
1	Sensor Selection		(0-5)	1	0: Disable; 1: Temperature Sensor; 2: Pressure Sensor; 3: Level Sensor; 4: Flow Sensor; 5: Virbration Sensor.

No.	Item		Range	Default	Description
2	Curve Type		(0-15)	9	SGD. See table 16.
3	Open Action		(0-2)	0	0: Warn; 1: Shutdown Alarm; 2: No action.
4	Display Unit		(0-1)	0	0：℃;　1：℉.
5	Alarm Detection Range		(0-3)	0	0: After Safety Delay; 1: Cranking Start; 2: Alaways; 3: After loading.
6	High Shutdown	Enable	(0-1)	1	Shutdown when external sensor value is higher than this value. The delay value and “warn enable” can be set.
		Set	(0-9000) ℃	98	
		Delay	(0-3600)s	3	
7	Low Shutdown	Enable	(0-1)	0	Shutdown when external sensor value is lower than this value. The delay value and “warn enable” can be set.
		Set	(0-9000) ℃	50	
		Delay	(0-3600)s	3	
8	High Warn	Enable	(0-1)	1	Warn when external sensor value is higher than this value. The delay value, “warn enable” and return value can be set.
		Set	(0-9000)℃	95	
		Return	(0-9000)℃	93	
		Delay	(0-3600)s	5	
9	Low Warn	Enable	(0-1)	0	Warn when external sensor value is lower than this value. The delay value, “warn enable” and return value can be set.
		Set	(0-9000) ℃	70	
		Return	(0-9000) ℃	75	
		Delay	(0-3600)s	5	
10	Custom Curve				Users should set the corresponding curve when select resistor curve type or current curve type.
Flexible Sensor 2					
1	Sensor Selection		(0-5)	2	0: Disable; 1: Temperature Sensor; 2: Pressure Sensor; 3: Level Sensor; 4: Flow Sensor; 5: Virbration Sensor.
2	Curve Type		(0-15)	9	SGD. See table 16.
3	Open Action		(0-2)	0	0: Warn; 1: Shutdown Alarm; 2: No action.
4	Display Unit		(0-3)	0	0：kPa；1：bar；2：psi；　3:MPa。
5	Alarm Detection Range		(0-3)	0	0: After Safety Delay; 1: Cranking Start; 2: Alaways; 3: After loading.

No.	Item		Range	Default	Description
6	High Shutdown	Enable	(0-1)	0	Shutdown when external sensor value is higher than this value. The delay value and “warn enable” can be set.
		Set	(0-9000) kPa	1000	
		Delay	(0-3600)s	3	
7	Low Shutdown	Enable	(0-1)	1	Shutdown when external sensor value is lower than this value. The delay value and “warn enable” can be set.
		Set	(0-9000) kPa	103	
		Delay	(0-3600)s	3	
8	High Warn	Enable	(0-1)	0	Shutdown when external sensor value is higher than this value. The delay value, return value and “warn enable” can be set.
		Set	(0-9000) kPa	950	
		Return	(0-9000) kPa	900	
		Delay	(0-3600)s	5	
9	Low Warn	Enable	(0-1)	1	Warn when external sensor value is lower than this value. The delay value, “warn enable” and return value can be set.
		Set	(0-9000) kPa	124	
		Return	(0-9000) kPa	138	
		Delay	(0-3600)s	5	
10	Custom Curve				Users should set the corresponding curve when select resistor curve type or current curve type.
Flexible Sensor 3					
1	Sensor Selection		(0-5)	3	0: Disable; 1: Temperature Sensor; 2: Pressure Sensor; 3: Level Sensor; 4: Flow Sensor; 5: Virbration Sensor.
2	Curve Type		(0-15)	4	SGD. See table 16.
3	Open Action		(0-2)	0	0: Warn; 1: Shutdown Alarm; 2: No action.
4	Display Unit		(0-0)	0	0：%。
5	Alarm Detection Range		(0-3)	2	0: After Safety Delay; 1: Cranking Start; 2: Alaways; 3: After loading.
6	High Shutdown	Enable	(0-1)	0	Shutdown when external sensor value is higher than this value. The delay value and “warn enable” can be set.
		Set	(0-9000) %	100	
		Delay	(0-3600)s	3	
7	Low Shutdown	Enable	(0-1)	0	Shutdown when external sensor value is lower than this value. The delay value and “warn enable” can be set.
		Set	(0-9000) %	8	
		Delay	(0-3600)s	3	
8	High Warn	Enable	(0-1)	0	Shutdown when external sensor

No.	Item		Range	Default	Description
		Set	(0-9000) %	100	value is higher than this value. The delay value, return value and “warn enable” can be set.
		Return	(0-9000) %	100	
		Delay	(0-3600)s	5	
9	Low Warn	Enable	(0-1)	1	Warn when external sensor value is lower than this value. The delay value, “warn enable” and return value can be set.
		Set	(0-9000) %	10	
		Return	(0-9000) %	15	
		Delay	(0-3600)s	5	
10	Custom Curve				Users should set the corresponding curve when select resistor curve type or current curve type.
Flexible Sensor 4~10					
1	Sensor Selection		(0-5)	0	0: Disable; 1: Temperature Sensor; 2: Pressure Sensor; 3: Level Sensor; 4: Flow Sensor; 5: Virbration Sensor.
2	Curve Type		(0-15)	0	SGD. See table 16.
3	Open Action		(0-2)	0	0: Warn; 1: Shutdown Alarm; 2: No action.
4	Display Unit		(0-1)	0	0：℃；1：℉。
5	Alarm Detection Range		(0-3)	0	0: After Safety Delay; 1: Cranking Start; 2: Alaways; 3: After loading.
6	High Shutdown	Enable	(0-1)	0	Shutdown when external sensor value is higher than this value. The delay value and “warn enable” can be set.
		Set	(0-9000) ℃	100	
		Delay	(0-3600)s	3	
7	Low Shutdown	Enable	(0-1)	0	Shutdown when external sensor value is lower than this value. The delay value and “warn enable” can be set.
		Set	(0-9000) ℃	10	
		Delay	(0-3600)s	3	
8	High Warn	Enable	(0-1)	0	Shutdown when external sensor value is higher than this value. The delay value, return value and “warn enable” can be set.
		Set	(0-9000) ℃	90	
		Return	(0-9000) ℃	80	
		Delay	(0-3600)s	5	
9	Low Warn	Enable	(0-1)	0	Warn when external sensor value is lower than this value. The delay value, “warn enable” and return value can be set.
		Set	(0-9000) ℃	20	
		Return	(0-9000) ℃	30	
		Delay	(0-3600)s	5	
10	Custom Curve				Users should set the corresponding curve when select resistor curve type

No.	Item		Range	Default	Description
					or current curve type.
Engine Temperature Setting					
1	Signal Source		(0-10)	1	0: ECU; 1: Flexible Senosr 1; 2: Flexible Senosr 2; 3: Flexible Senosr 3; 4: Flexible Senosr 4; 5: Flexible Senosr 5; 6: Flexible Senosr 6; 7: Flexible Senosr 7; 8: Flexible Senosr 8; 9: Flexible Senosr 9; 10: Flexible Senosr 10;
2	High Shutdown (ECU)	Enable	(0-1)	1	When signal source selects “0”: ECU, and the temperature value is higher than this value, it will send a shutdown alarm. This value is determined only after the end of the safety delay.
		Set	(0-300)°C	98	
		Delay	(0-3600)s	3	
3	High Warn (ECU)	Enable	(0-1)	1	When signal source selects “0”: ECU, and the temperature value is higher than this value, it will send a warning. This value is determined only after the end of the safety delay.
		Set	(0-300)°C	95	
		Return	(0-300)°C	93	
		Delay	(0-3600)s	5	
4	Low Warn (ECU)	Enable	(0-1)	0	When signal source selects “0”: ECU, and the temperature value is lower than this value, it will send a warning. This value is always determined.
		Set	(0-300)°C	10	
		Return	(0-300)°C	25	
		Delay	(0-3600)s	5	
5	Heater Control	Enable	(0-1)	0	When engine temperature is lower than this value, the heater control will output.
		Open	(0-300)°C	50	
		Close	(0-300)°C	55	
		Max. Open Time	(0-3600)min	60	
6	Cooler Control	Enable	(0-1)	0	When engine temperature is higher than this value, the cooler control will output.
		Open	(0-300)°C	95	
		Close	(0-300)°C	92	
		Max. Open Time	(0-3600)min	60	
Engine Oil Pressure					
1	Signal Source		(0-10)	2	0: ECU; 1: Flexible Senosr 1; 2: Flexible Senosr 2;

No.	Item		Range	Default	Description
					3: Flexible Senosr 3; 4: Flexible Senosr 4; 5: Flexible Senosr 5; 6: Flexible Senosr 6; 7: Flexible Senosr 7; 8: Flexible Senosr 8; 9: Flexible Senosr 9; 10: Flexible Senosr 10;
2	Low Shutdown (ECU)	Enable	(0-1)	1	When signal source selects “0”: ECU, and the oil pressure value is lower than this value, it will send a shutdown alarm. This value is determined only after the end of the safety delay.
		Set	(0-1000)kPa	103	
		Delay	(0-3600)s	3	
3	Low Warn (ECU)	Enable	(0-1)	1	When signal source selects “0”: ECU, and the oil pressure value is lower than this value, it will send a warning. This value is determined only after the end of the safety delay.
		Set	(0-1000)kPa	124	
		Return	(0-1000)kPa	138	
		Delay	(0-3600)s	5	
Fuel Level Setting					
1	Signal Source		(0-10)	3	0: Not used; 1: Flexible Senosr 1; 2: Flexible Senosr 2; 3: Flexible Senosr 3; 4: Flexible Senosr 4; 5: Flexible Senosr 5; 6: Flexible Senosr 6; 7: Flexible Senosr 7; 8: Flexible Senosr 8; 9: Flexible Senosr 9; 10: Flexible Senosr 10;
2	Fuel Pump Control	Enable	(0-1)	0	When fuel level is less than this value, the fuel pump control will output.
		Open	(0-1000)%	10	
		Close	(0-1000) %	80	
		Max. Open Time	(0-3600)s	60	
Outlet Pressure Setting					
1	Signal Source		(0-10)	0	0: Not used; 1: Flexible Senosr 1; 2: Flexible Senosr 2; 3: Flexible Senosr 3; 4: Flexible Senosr 4; 5: Flexible Senosr 5; 6: Flexible Senosr 6;

No.	Item		Range	Default	Description
					7: Flexible Senosr 7; 8: Flexible Senosr 8; 9: Flexible Senosr 9; 10: Flexible Senosr 10;
2	Rated Outlet Pressure		(0-9000)kPa	1000	Set the outlet port's rated working pressure of pump unit.
3	Static Pressure		(0-9000)kPa	0	Set the outlet port's static water pressure of pump unit.
4	Idle in High Pressure Control	Enable	(0-1)	0	When the outlet pressure is higher than this value ,the engine will be idle running.
		Set	(0-9000)kPa	2500	
		Return	(0-9000)kPa	2000	
		Delay	(0-3600)s	5	
Inlet Pressure Setting					
1	Signal Source		(0-10)	0	0: Not used; 1: Flexible Senosr 1; 2: Flexible Senosr 2; 3: Flexible Senosr 3; 4: Flexible Senosr 4; 5: Flexible Senosr 5; 6: Flexible Senosr 6; 7: Flexible Senosr 7; 8: Flexible Senosr 8; 9: Flexible Senosr 9; 10: Flexible Senosr 10;
Pipe Pressure Setting					
1	Signal Source		(0-10)	0	0: Not used; 1: Flexible Senosr 1; 2: Flexible Senosr 2; 3: Flexible Senosr 3; 4: Flexible Senosr 4; 5: Flexible Senosr 5; 6: Flexible Senosr 6; 7: Flexible Senosr 7; 8: Flexible Senosr 8; 9: Flexible Senosr 9; 10: Flexible Senosr 10;
2	Start Return	Enable	(0-1)	0	When configuration enables, in auto mode, if the pipe pressure is higher than the setting value, the engine will shut down.
		Set	(0-9000)kPa	2000	
		Delay	(0-3600)s	3	
3	Under Start	Enable	(0-1)	0	When configuration enables, in auto mode, if the pipe pressure is lower than the setting value, the engine will start.
		Set	(0-9000)kPa	200	
		Delay	(0-3600)s	3	
Flow Setting					

No.	Item		Range	Default	Description
1	Signal Source		(0-10)	0	0: Not used; 1: Flexible Senosr 1; 2: Flexible Senosr 2; 3: Flexible Senosr 3; 4: Flexible Senosr 4; 5: Flexible Senosr 5; 6: Flexible Senosr 6; 7: Flexible Senosr 7; 8: Flexible Senosr 8; 9: Flexible Senosr 9; 10: Flexible Senosr 10; 11: Outlet Pressure Sensor.
2	Flow Enable		(0-1)	0	0: Disable; 1: Enable.
3	Rated Flow		(0-10000)m³/h	1000	The rated working flow of the unit.
4	Over Flow Shutdown	Enable	(0-1)	0	During unit running, when the flow is over than this value, it will send a shutdown alarm.
		Set	(0-300.0)%	120.0	
		Delay	(0-3600)s	5	
5	Over Flow Warn	Enable	(0-1)	0	During unit running, when the flow is over than this value, it will send a warning alarm.
		SET	(0-300.0) %	110.0	
		Return	(0-300.0) %	105.0	
		Delay	(0-3600)s	5	
6	Custom Curve				Set the corresponding flow curves of different outlet pressures.
Digital Input Port Setting					
Digital Input Port 1					
1	Content		(0-53)	28	Remote start (onload). Details see table 15.
2	Active Type		(0-1)	0	0: Close; 1: Open
Digital Input Port 2					
1	Content		(0-53)	26	High temperature shutdown input. Details see table 15.
2	Active Type		(0-1)	0	0: Close; 1: Open
Digital Input Port 3					
1	Content		(0-53)	27	Low oil pressure shutdown input. Details see table 15.
2	Active Type		(0-1)	0	0: Close; 1: Open
Digital Input Port 4					
1	Content		(0-53)	1	User-defined. Details see table 15.
2	Active Type		(0-1)	0	0: Close; 1: Open
3	Arming		(0-3)	2	0: Fron safety on; 1: From crank; 2: Always

No.	Item		Range	Default	Description
					3: Never;
4	Action		(0-4)	0	0: Warn; 1: Shutdown Alarm; 2: Cooling Shutdown; 3: Fault Idle; 4: Indication.
5	Delay		(0-20.0)s	2.0	From detection input active to confirmation.
6	Decription				User-defined.
Digital Input Port 5~9					
1	Content		(0-53)	0	Not used. Details see table 15.
2	Active Type		(0-1)	0	0: Close; 1: Open
Digital Output Port					
Digital Output Port 1					
1	Content		(0-299)	1	Output 1 during custom period (the default output is during preheating). Details see table 14.
2	Type		(0-1)	0	0: N/O; 1: N/C.
Digital Output Port 2					
1	Content		(0-299)	35	Idle control. Details see table 14.
2	Type		(0-1)	0	0: N/O; 1: N/C.
Digital Output Port 3					
1	Content		(0-299)	29	Load control. Details see table 14.
2	Type		(0-1)	0	0: N/O; 1: N/C.
Digital Output Port 4					
1	Content		(0-299)	0	Not used. Details see table 14.
2	Type		(0-1)	0	0: N/O; 1: N/C.
Digital Output Port 5					
1	Content		(0-299)	38	ETS solenoid hold. Details see table 14.
2	Type		(0-1)	0	0: N/O; 1: N/C.
Digital Output Port 6					
1	Content		(0-299)	48	Common alarm. Detals see table 14.
2	Type		(0-1)	0	0: N/O; 1: N/C.
Digital Output Port 7~10					
1	Content		(0-299)	0	Not used. Details see table 14.
2	Type		(0-1)	0	0: N/O; 1: N/C.
GOV Setting					
1	GOV Port Type		(0-3)	2	0: Not used; 1: Relay adjust speed; 2: GOV analog adjust speed; 3: CAN adjust speed.
2	Relay Adjust	Dead Band	(0-10.0)%	1.0	Relay auto speed control.
		Gain	(0-100)%	10	

No.	Item		Range	Default	Description
	Speed	Stability	(0.05-1.60)s	0.10	
		Response	(0.25-4.00)	0.50	
3	GOV	Reverse	(0-1)	0	0: Disable; 1: Enable.
		GOV SW1	(0-10.0)	0	GOV auto speed control.
		GOV SW2	(0-10.0)	2.0	
		GOV Gain	(0-100)	20	
		GOV Stability	(0-100)	20	
4	CAN	Dead Band	(0-100.0)%	2.0	CAN auto speed control.
		Gain	(0-1000)	200	
		Stability	(0-1000)	20	
5	Manual Adjust Step		(0-1000)r	50	When manually adjust speed, press the key of speed up or speed down, the engine will raise or droop the speed.
6	Raise Speed Rate		(0-1000)r/s	150	The engine speed change rate.
7	Droop Speed Rate		(0-1000)r/s	150	
8	Idle Speed Adjust Speed		(0-1)	0	0: Disable (It will enter into normal running after the end of start idle delay, the engine speed will automatically raise to the rated speed); 1: Enable (It will enter into normal running after the end of start idle delay, the engine speed will keep the idle value and needs to be raised manually).
9	Adjust Speed Object		(0-3)	0	0: Outlet Pressure; 1: Inlet Pressure; 2: Engine Speed; 3: Manually Adjust Speed.
10	Inlet Pressure		(0-2000)kPa	0	Stabilize the inlet pressure on the set value if the object is set as “Inlet Pressure”.
11	GOV Adjust Speed Step		(0-1000)	20	For GOV speed control, single-step adjustment for speed control via communication protocol.
12	Power on Adjust Speed Mode		(0-2)	0	0: Auto Mode; 1: Manual Mode; 2: Last Mode.
Gearbox Setting					
1	Speed Enabled		(0-1)	0	0: Disable; 1: Enable.
2	Flywheel Teeth		(1-300.0)	118.0	The teeth number of gearbox flywheel.
3	Rated Speed		(0-6000)r/mi	500	Offer standard for gearbox

No.	Item		Range	Default	Description
			n		over/under speed judgement.
20	Over Speed Shutdown	Enable	(0-1)	1	The setting value is the percentage of rated speed. When the controller detects that the engine speed is over the set shutdown limit threshold, it will send a shutdown alarm.
		Set	(0-200.0)%	114.0	
		Delay	(0-3600)s	2	
21	Over Speed Warn	Enable	(0-1)	1	The setting value is the percentage of rated speed. When the controller detects that the engine speed is over the set shutdown limit threshold, it will send a warning alarm.
		Set	(0-200.0)%	110.0	
		Return	(0-200.0)%	108.0	
		Delay	(0-3600)s	5	
22	Under Speed Shutdown	Enable	(0-1)	0	The setting value is the percentage of rated speed. When the controller detects that the engine speed is under the set shutdown limit threshold, it will send a shutdown alarm.
		Set	(0-200.0)%	80.0	
		Delay	(0-3600)s	3	
23	Under Speed Warn	Enable	(0-1)	0	The setting value is the percentage of rated speed. When the controller detects that the engine speed is under the set shutdown limit threshold, it will send a warning alarm.
		Set	(0-200.0)%	86.0	
		Return	(0-200.0)%	90.0	
		Delay	(0-3600)s	5	
Scheduling and Maintenance Setting					
1	Scheduled Run		(0-1)	0	0: Disable; 1: Enable.
2	Scheduled Not Run		(0-1)	0	0: Disable; 1: Enable.
3	Maintenance 1		(0-1)	0	0: Disable; 1: Enable. Maintenance time, maintenance time due act, time and act of alarm A and alarm B, maintenance timing mode, maintenance time reset can be set simultaneously. After the maintenance, the maintenance time due alarm can be reset. Details see table 18.
4	Maintenance 2		(0-1)	0	
5	Maintenance 3		(0-1)	0	
6	Maintenance 4		(0-1)	0	
7	Maintenance 5		(0-1)	0	
ECU Display Setting					
1	ECU Information Smart Display		(0-1)	1	0: Disable (No data and display "###"; 0: Enable (No data and not display).
2	D+ Voltage		(0-1)	1	0: Analog; 1: ECU.
3	Oil Temperature		(0-1)	1	0: Not display; 1: Display (When smart display is active and no data receiced will not
4	Fuel Temperature		(0-1)	1	
5	Fuel Pressure		(0-1)	1	

No.	Item	Range	Default	Description
6	Inlet Temperature	(0-1)	1	display).
7	Outlet Temperature	(0-1)	1	
8	Turbo Pressure	(0-1)	1	
9	Coolant Pressure	(0-1)	1	
10	Coolant Level	(0-1)	1	
11	Fuel Used	(0-1)	1	
12	Sum Fuel Used	(0-1)	1	
13	Load Ratio	(0-1)	1	
14	Urea Level	(0-1)	1	
15	SCR Inlet Temperature	(0-1)	1	
16	SCR Outlet Temperature	(0-1)	1	
Network Communication Setting				
1	Enable	(0-1)	0	
2	IP Address			Default 192.168.000.100
3	Subnet Mask			Default 255.255.255.000
4	Default Gateway			Default 192.168.000.002
Extended Digital Input Port				
1	Enable	(0-1)	0	0: Disable; 1: Enable.
2	Comm Failed Act	(0-4)	0	0: Warn; 1: Shutdown Alarm; 2: Cooling Stop; 3: Fault Idle; 4: Indication.
3	Extension Input Port 1~16	(0-53)	0	The functions and active types of 16 digital input ports of DIN16A can be set.
Extended Digital Output				
1	Enable	(0-1)	0	0: Disable; 1: Enable.
2	Comm Failed Act	(0-4)	0	0: Warn; 1: Shutdown Alarm; 2: Cooling Stop; 3: Fault Idle; 4: Indication.
3	Extension Output Port 1~16	(0-299)	0	The functions and active types of 16 digital output ports of DOUT16B can be set.
Expand AIN8				
1	Enable	(0-1)	0	0: Disable; 1: Enable.
2	Comm Failed Act	(0-4)	0	0: Warn; 1: Shutdown Alarm; 2: No Act.

No.	Item	Range	Default	Description
3	Extension Sensor 1~8			The related settings of 8-way sensors of AIN8 module can be set.

CAUTION: Please modify the parameters of the controller in standby mode (e.g. crank disconnect conditions, Aux. input/output port configuration, delays, etc.), otherwise, shutdown alarm or other abnormal circumstances may occur.

NOTE: High threshold value must be higher than the low threshold value, otherwise, both too high and too low may occur at the same time.

NOTE: When set warning alarm, please set the correct return value, otherwise, the abnormal alarm may occur. When set the high warning, the return value should be lower than the set value; while set the low warning, the return value should be higher than the set value.

NOTE: The Aux. input ports cannot be set as the same item, otherwise, the correct functions will not be realized. But the Aux. output ports can be set as the same items.

8.2 DEFINED CONTENTS OF DIGITAL OUTPUT PORTS

8.2.1 DEFINED CONTENTS OF DIGITAL OUTPUT PORTS

Table 14 – Defined Contents of Digital Output Ports

No.	Type	Description
0	Not Used	
1	Custom Period 1	Please see the following for function details.
2	Custom Period 2	
3	Custom Period 3	
4	Custom Period 4	
5	Custom Period 5	
6	Custom Period 6	
7	Custom Combined 1	
8	Custom Combined 2	
9	Custom Combined 3	
10	Custom Combined 4	
11	Custom Combined 5	
12	Custom Combined 6	
13	Reserved	
14	Reserved	
15	Reserved	
16	Start Relay B	If “Start Relay B” is configured, start relay and start relay B will output alternately in multi-startup process; can be used to control double power supply ATS.
17	Air Flap	Act when over speed shutdown and emergence stop. It can close the air inflow to stop the engine as soon as possible.
18	Audible Alarm	Act when warning or shutdown occurs. Can be connected annunciator externally. When “alarm mute” input port is active, the alarm will be prohibit.
19	Louver Control	Act in genset starting and disconnect when genset stopped completely.
20	Fuel Pump Control	It is controlled by fuel pump of level sensor’s limited threshold.
21	Heater Control	It is controlled by heating of temperature sensor’s limited threshold.
22	Cooler Control	It is controlled by cooler of temperature sensor’s limited threshold.
23	Fuel Pre-supply	Act in period of cranking to safety run.
24	Reserved	
25	Pre-lubricate	Act in period of pre-heating to safety run.
26	Remote Control	This port is controlled by RS485 communication (PC).
27	Reserved	
28	Reserved	

No.	Type	Description
29	Load Control	Control generator to take load or off load.
30	Reserved	
31	Reserved	
32	Reserved	
33	Crank Relay	Act when engine is starting and disconnect when crank is successful.
34	Fuel Relay	Act when engine is starting and disconnect when stop is completed.
35	Idle Control	Used for engine which has idles. Close before starting and open in warming up delay; Close during stopping idle process and open when stop is completed.
36	Speed Raise Relay	Act in warming up delay and be controlled by GOV in normal running process.
37	Speed Drop Relay	Act between the period from “stop idle” to “failed to stop” and be controlled by GOV in normal running process.
38	ETS Control	Used for engines with ETS electromagnet. Close when stop idle is over and open when pre-set “ETS delay” is over.
39	Rerserved	
40	ECU Stop	Suitable for engines which fitted with ECU; used for control ECU stop.
41	ECU Power Supply	Suitable for engines which fitted with ECU; used for control ECU power supply.
42	Reserved	
43	Crank Success	Close when detects a successful start signal.
44	By-pass Control	Act when water blast gun input is active, and between start/stop-stop idle.
45	Rerserved	
46	Rerserved	
47	Start Battery Cycle	During cranking process, start battery will be switched circularly if multiple crank is needed.
48	Common Alarm	Action when pump unit common warns common shutdown alarms.
49	Common Trip	Act when common trip alarms.
50	Common Shutdown	Act when common shutdown alarms.
51	Common Fault Idle Alarm	Act when fault idle alarms.
52	Common Warn Alarm	Act when common warning alarms.
53	Rerserved	
54	Battery 1 High Volts	Act when battery 1 over voltage warning alarms.
55	Battery 1 Low Volts	Act when battery 1 low voltage warning alarms.
56	Charge Alt Fail	Act when charge failure warning alarms.
57	Rerserved	
58	Rerserved	

No.	Type	Description
59	Rerserved	
60	ECU Warn	Indicate ECU sends a warning signal.
61	ECU Shutdown	Indicate ECU sends a shutdown signal.
62	ECU Comm Fail	Indicate controller cannot communicate with ECU.
63	Rerserved	
64	Rerserved	
65	Regeneration Status Indicator	The related indicator status output of post-processing of fourth stage.
66	Regeneration Inhibit Indicator	
67	High Exhaust Temp. Indicator	
68	Driver Warn Indicator	
69	Aux Input 1 Active	Act when input port 1 is active.
70	Aux Input 2 Active	Act when input port 2 is active.
71	Aux Input 3 Active	Act when input port 3 is active.
72	Aux Input 4 Active	Act when input port 4 is active.
73	Aux Input 5 Active	Act when input port 5 is active.
74	Aux Input 6 Active	Act when input port 6 is active.
75	Aux Input 7 Active	Act when input port 7 is active.
76	Aux Input 8 Active	Act when input port 8 is active.
77	Aux Input 9 Active	Act when input port 9 is active.
78	Rerserved	
79	Rerserved	
80	Rerserved	
81	Expansion Input 1 Active	Act when expansion input port 1 is active.
82	Expansion Input 2 Active	Act when expansion input port 2 is active.
83	Expansion Input 3 Active	Act when expansion input port 3 is active.
84	Expansion Input 4 Active	Act when expansion input port 4 is active.
85	Expansion Input 5 Active	Act when expansion input port 5 is active.
86	Expansion Input 6 Active	Act when expansion input port 6 is active.
87	Expansion Input 7 Active	Act when expansion input port 7 is active.
88	Expansion Input 8 Active	Act when expansion input port 8 is active.
89	Expansion Input 9 Active	Act when expansion input port 9 is active.
90	Expansion Input 10 Active	Act when expansion input port 10 is active.
91	Expansion Input 11 Active	Act when expansion input port 11 is active.
92	Expansion Input 12 Active	Act when expansion input port 12 is active.
93	Expansion Input 13 Active	Act when expansion input port 13 is active.
94	Expansion Input 14 Active	Act when expansion input port 14 is active.
95	Expansion Input 15 Active	Act when expansion input port 15 is active.
96	Expansion Input 16 Active	Act when expansion input port 16 is active.
97	Rerserved	
98	Rerserved	
99	Rerserved	
100	Rerserved	
101	Battery 2 High Volts	Act when battery 2 over voltage warning alarms.
102	Battery 2 Low Volts	Act when battery 2 low voltage warning alarms.

No.	Type	Description
103	Emergency Stop	Act when emergency stop alarms.
104	Fail to Start	Act when fail to start alarms.
105	Fail to Stop	Act when fail to stop alarms.
106	Under Speed Warn	Act when under speed warns.
107	Under Speed Shutdown	Act when under speed shuts down.
108	Over Speed Warn	Act when over speed warns.
109	Over Speed Shutdown	Over Speed when under speed shuts down.
110	Rerserved	
111	High Temp Warn	Act when high temperature warns.
112	Low Temp Warn	Act when low temperature warns.
113	High Temp Shutdown	Act when high temperature shutdown alarms.
114	Rerserved	
115	Low OP Warn	Act when low oil pressure warns.
116	Low OP Shutdown	Act when low oil pressure shuts down.
117	Rerserved	
118	Rerserved	
119	Config Sensor 1 High Warn	Act when configurable sensor 1 high warns.
120	Config Sensor 1 Low Warn	Act when configurable sensor 1 low warns.
121	Config Sensor 1 High Shutdown	Act when configurable sensor 1 high shuts down.
122	Config Sensor 1 Low Shutdown	Act when configurable sensor 1 low shuts down.
123	Config Sensor 2 High Warn	Act when configurable sensor 2 high warns.
124	Config Sensor 2 Low Warn	Act when configurable sensor 2 low warns.
125	Config Sensor 2 High Shutdown	Act when configurable sensor 2 high shuts down.
126	Config Sensor 2 Low Shutdown	Act when configurable sensor 2 low shuts down.
127	Config Sensor 3 High Warn	Act when configurable sensor 3 high warns.
128	Config Sensor 3 Low Warn	Act when configurable sensor 3 low warns.
129	Config Sensor 3 High Shutdown	Act when configurable sensor 3 high shuts down.
130	Config Sensor 3 Low Shutdown	Act when configurable sensor 3 low shuts down.
131	Config Sensor 4 High Warn	Act when configurable sensor 4 high warns.
132	Config Sensor 4 Low Warn	Act when configurable sensor 4 low warns.
133	Config Sensor 4 High Shutdown	Act when configurable sensor 4 high shuts down.
134	Config Sensor 4 Low Shutdown	Act when configurable sensor 4 low shuts down.
135	Config Sensor 5 High Warn	Act when configurable sensor 5 high warns.
136	Config Sensor 5 Low Warn	Act when configurable sensor 5 low warns.
137	Config Sensor 5 High Shutdown	Act when configurable sensor 5 high shuts down.
138	Config Sensor 5 Low Shutdown	Act when configurable sensor 5 low shuts down.
139	Config Sensor 6 High Warn	Act when configurable sensor 6 high warns.
140	Config Sensor 6 Low Warn	Act when configurable sensor 6 low warns.
141	Config Sensor 6 High Shutdown	Act when configurable sensor 6 high shuts down.
142	Config Sensor 6 Low Shutdown	Act when configurable sensor 6 low shuts down.
143	Config Sensor 7 High Warn	Act when configurable sensor 7 high warns.
144	Config Sensor 7 Low Warn	Act when configurable sensor 7 low warns.
145	Config Sensor 7 High Shutdown	Act when configurable sensor 7 high shuts down.
146	Config Sensor 7 Low Shutdown	Act when configurable sensor 7 low shuts down.

No.	Type	Description
147	Config Sensor 8 High Warn	Act when configurable sensor 8 high warns.
148	Config Sensor 8 Low Warn	Act when configurable sensor 8 low warns.
149	Config Sensor 8 High Shutdown	Act when configurable sensor 8 high shuts down.
150	Config Sensor 8 Low Shutdown	Act when configurable sensor 8 low shuts down.
151	Config Sensor 9 High Warn	Act when configurable sensor 9 high warns.
152	Config Sensor 9 Low Warn	Act when configurable sensor 9 low warns.
153	Config Sensor 9 High Shutdown	Act when configurable sensor 9 high shuts down.
154	Config Sensor 9 Low Shutdown	Act when configurable sensor 9 low shuts down.
155	Config Sensor 10 High Warn	Act when configurable sensor 10 high warns.
156	Config Sensor 10 Low Warn	Act when configurable sensor 10 low warns.
157	Config Sensor 10 High Shutdown	Act when configurable sensor 10 high shuts down.
158	Config Sensor 10 Low Shutdown	Act when configurable sensor 10 low shuts down.
159	Rerserved	
160	Rerserved	
161	Over Flow Shutdown	Act when over flow shutdown alarms.
162	Over Flow Warn	Act when over flow warning alarms.
163-177	Rerserved	
178	AIN8 Sensor 1 High Shutdown	Act when AIN8 flexible sensor 1 high shuts down.
179	AIN8 Sensor 1 High Warn	Act when AIN8 flexible sensor 1 high warns.
180	AIN8 Sensor 1 Low Shutdown	Act when AIN8 flexible sensor 1 low shuts down.
181	AIN8 Sensor 1 Low Warn	Act when AIN8 flexible sensor 1 low warns.
182	AIN8 Sensor 2 High Shutdown	Act when AIN8 flexible sensor 2 high shuts down.
183	AIN8 Sensor 2 High Warn	Act when AIN8 flexible sensor 2 high warns.
184	AIN8 Sensor 2 Low Shutdown	Act when AIN8 flexible sensor 2 low shuts down.
185	AIN8 Sensor 2 Low Warn	Act when AIN8 flexible sensor 2 low warns.
186	AIN8 Sensor 3 High Shutdown	Act when AIN8 flexible sensor 3 high shuts down.
187	AIN8 Sensor 3 High Warn	Act when AIN8 flexible sensor 3 high warns.
188	AIN8 Sensor 3 Low Shutdown	Act when AIN8 flexible sensor 3 low shuts down.
189	AIN8 Sensor 3 Low Warn	Act when AIN8 flexible sensor 3 low warns.
190	AIN8 Sensor 4 High Shutdown	Act when AIN8 flexible sensor 4 high shuts down.
191	AIN8 Sensor 4 High Warn	Act when AIN8 flexible sensor 4 high warns.
192	AIN8 Sensor 4 Low Shutdown	Act when AIN8 flexible sensor 4 low shuts down.
193	AIN8 Sensor 4 Low Warn	Act when AIN8 flexible sensor 4 low warns.
194	AIN8 Sensor 5 High Shutdown	Act when AIN8 flexible sensor 5 high shuts down.
195	AIN8 Sensor 5 High Warn	Act when AIN8 flexible sensor 5 high warns.
196	AIN8 Sensor 5 Low Shutdown	Act when AIN8 flexible sensor 5 low shuts down.
197	AIN8 Sensor 5 Low Warn	Act when AIN8 flexible sensor 5 low warns.
198	AIN8 Sensor 6 High Shutdown	Act when AIN8 flexible sensor 6 high shuts down.
199	AIN8 Sensor 6 High Warn	Act when AIN8 flexible sensor 6 high warns.
200	AIN8 Sensor 6 Low Shutdown	Act when AIN8 flexible sensor 6 low shuts down.
201	AIN8 Sensor 6 Low Warn	Act when AIN8 flexible sensor 6 low warns.
202	AIN8 Sensor 7 High Shutdown	Act when AIN8 flexible sensor 7 high shuts down.
203	AIN8 Sensor 7 High Warn	Act when AIN8 flexible sensor 7 high warns.

No.	Type	Description
204	AIN8 Sensor 7 Low Shutdown	Act when AIN8 flexible sensor 7 low shuts down.
205	AIN8 Sensor 7 Low Warn	Act when AIN8 flexible sensor 7 low warns.
206	AIN8 Sensor 8 High Shutdown	Act when AIN8 flexible sensor 8 high shuts down.
207	AIN8 Sensor 8 High Warn	Act when AIN8 flexible sensor 8 high warns.
208	AIN8 Sensor 8 Low Shutdown	Act when AIN8 flexible sensor 8 low shuts down.
209	AIN8 Sensor 8 Low Warn	Act when AIN8 flexible sensor 8 low warns.
210-229	Rerserved	
230	In Stop Mode	Act when system is in stop mode.
231	In Manual Mode	Act when system is in manual mode.
232	Rerserved	Rerserved.
233	In Auto Mode	Act when system is in auto mode.
234	Load Indication	Indicate when load status.
235-239	Rerserved	
240-279	PLC Flag 1-40	PLC sign outputs.
280-299	Rerserved	

8.2.2 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 pump unit'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 both delay time and output time are 0 in **period output S1**, it is **True** in this period.

Example,

Output period: start

Delay output time: 2s

Output time: 3s

Condition output contents: input port 1 is active

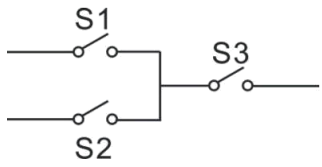
Close when condition output active/inactive: close when active (disconnect when inactive);

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.

8.2.3 CUSTOM COMBINED OUTPUT

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



S1 or S2 is **TRUE**, 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, S3) couldn’t include or recursively include themselves.

Example,

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

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

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

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

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

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

When input port 1 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**.

8.3 DEFINED CONTENTS OF DIGITAL INPUT PORTS

Table 15 – Defined Contents of Digital Input Ports

No.	Type	Description
0	Not Used	
1	User Configured	Including the following functions: Warning Action: Indication: indicate only, not warn or shut down. Warning: warn only, not shut down. Fault Idle: idle running after cooling delay. Cooling Stop: stop after cooling delay. Shutdown Alarm: alarm and stop immediately. Arming: Deactivated: the input not deactivate. Always: input always detects. From Crank: detect as soon as start. From safety on: detect after safety on running delay.
2	Alarm Mute	Can prohibit “Audible Alarm” output when input is active.
3	Reset Alarm	Can reset shutdown alarm when input is active.
4	Reserved	
5	Lamp Test	All LED indicators are illuminated when input is active.
6	Panel Lock	All buttons on the panel are inactive except  and there is 🔒 in the right of first row on LCD when input is active.
7	Crank Success	It means that the engine starts successfully when the input is active. Crank success conditions of speed and oil pressure are disabled if it is configured.
8	Idle Speed Mode	Under speed protection is inactive.
9	Inhibit Auto Stop	In auto mode, during pump unit normal running, when input is active, inhibit pump unit shut down automatically.
10	Inhibit Auto Start	In auto mode, inhibit pump unit start automatically when input is active.
11	Inhibit Scheduled Start	In auto mode, inhibit pump unit scheduled run when input is active.
12	Reserved	
13	Loading Status	Connect to Aux. Points of clutch.
14	Load Inhibit	Prohibit pump unit on-load when input is active.
15	Idle/High Speed (memory)	When input port is active, it will enter idle speed running; while inactive, it will return to high speed running. (Switch to the speed before the idle speed).
16	Reserved	
17	Reserved	
18	Reserved	
19	Manual Load Input	In manual mode, when the input port is active, the unit will take

No.	Type	Description
		load after loading requiremnts are reached; while it is not allowed to take load when the input port is inactive.
20	Water Blast Gun Input	Connect to Aux. Points of water blast gun.
21	Inhibit Alarm Shutdown	All shutdown alarms are prohibited except emergence stop. (Means battle mode)
22	Aux Instrument Mode	All outputs are prohibited in this mode.
23	Reserved	
24	Reset Maintenance	Controller will reset maintenance 1 time and date as default when input is active.
25	Reserved	
26	Aux. High Temp	Connect to sensor digital input.
27	Aux. Low OP	Connect to sensor digital input.
28	Remote Start (On Load)	In auto mode, when the input is active, pump unit can start automatically and take load after normal running.
29	Remote Start (Off Load)	In auto mode, when the input is active, pump unit can start automatically and NOT take load after normal running.
30	Aux. Manual Start	In manual mode, when the input is active, pump unit will start automatically; when input inactive, pump unit will stop automatically.
31	Reserved	
32	Remote Stop	In auto mode, when the input is active as well as remote start signal is inactive, pump unit can be stopped automatically.
33	Simulate Stop key	An external button (not self-locking) can be connected and pressed as simulate panel.
34	Simulate Manual key	
35	Simulate Reset key	
36	Simulate Auto key	
37	Simulate Start key	
38	Simulate GOV key	
39	Simulate Speed Raise Key	
40	Simulate Speed Drop Key	
41	Reserved	
42	Reserved	
43	DPF Manual Regeneration	An external button (not self-locking) can be connected. For engine that meets the Stage IV of non-road standard, if the DPF regeneration is needed, press the button and the controller will send a request order to ECU.
44	DPF Regeneration Inhibit	For engine meeting Stage IV standard of non-road mobile machinery, if DPF regeneration is prohibited, the controller will send a DPF regeneration inhibit order to ECU.
45	DPF Regeneration Test Mode	When input port is active, DPF regeneration request is simulated.
46-5	Reserved	

No.	Type	Description
1		
52	Speed Raise Input	An external button (not self-locking) can be connected and control GOV manually.
53	Speed Drop Input	

8.4 SENSOR SELECTION

Table 16– Sensor Selection

No.		Content	Remark
1	Temperature Sensor	0: Not used 1: Custom resistor curve 2: Custom (4-20) mA curve 3: Cutsom voltage curve 4: VDO 5: CURTIS 6: VOLVO-EC 7: DATCON 8: SGX 9: SGD 10: SGH 11: PT100 12: Reserved 13: Reserved 14: Reserved 15: Reserved	The custom resistor range is (0~6) kΩ, and the factory default is “SGD”, users can select the corresponding curves. If the sensor cannot support the current type and voltage type, the No.2 and No.3 of the curve types will display “Reserved”.
2	Pressure Sensor	0: Not used 1: Custom resistor curve 2: Custom (4~20) mA curve 3: Cutsom voltage curve 4: VDO 10bar 5: CURTIS 6: VOLVO-EC 7: DATCON 10bar 8: SGX 9: SGD 10: SGH 11~15 Reserved	The custom resistor range is (0~6) kΩ, and the factory default is “SGD”, users can select the corresponding curves. If the sensor cannot support the current type and voltage type, the No.2 and No.3 of the curve types will display “Reserved”.
3	Level Sensor	0: Not used 1: Custom resistor curve 2: Custom (4~20) mA curve 3: Cutsom voltage curve 4: SGD 5: SGH 6: Reserved 7: 0~130Ω 8: 10~180Ω	The custom resistor range is (0~6) kΩ, and the factory default is “SGD”, users can select the corresponding curves. If the sensor cannot support the current type and voltage type, the No.2 and No.3 of the curve types will display “Reserved”.

No.		Content	Remark
		9: 240~33Ω 10: 70~10Ω 11~15 Reserved	
4	Flow Sensor	0: Not used 1: Custom resistor curve 2: Custom (4~20) mA curve 3: Cutsom voltage curve 4~15 Reserved	The custom resistor range is (0~6) kΩ, and users can select the corresponding curves. If the sensor cannot support the current type and voltage type, the No.2 and No.3 of the curve types will display “Reserved”.
5	Vibration Sensor	0: Not used 1: Custom resistor curve 2: Custom (4~20) mA curve 3: Cutsom voltage curve 4~15 Reserved	The custom resistor range is (0~6) kΩ, and users can select the corresponding curves. If the sensor cannot support the current type and voltage type, the No.2 and No.3 of the curve types will display “Reserved”.

8.5 CONDITIONS OF CRANK DISCONNECT SELECTION

Table 17– Crank Disconnect Conditions Selection

No.	Setting Contents
0	Speed
1	Oil Pressure
2	Oil Pressure+ Engine Speed

NOTE:

1. There are 3 conditions to make starter disconnected with engine. Engine speed and oil pressure both can be used separately. We recommend that oil pressure should be used with engine speed together, in order to make the starter motor separated with engine immediately and can check crank disconnect exactly.
2. Engine speed is the magnetic equipment which be installed in starter for detecting flywheel teeth.
3. When set as engine speed, must ensure that the number of flywheel teeth is as same as setting, otherwise, “over speed shutdown” or “under speed shutdown” may be caused.
4. If pump unit without engine speed sensor, please don’t select corresponding items, otherwise, “start fail” or “loss speed signal” maybe caused.
5. If pimp unit without oil pressure sensor, please don’t select corresponding items.

8.6 MAINTENANCE SETTING

Table 18– Maintenance Setting

Items	Content	Description
Enable Select	0: Disable; 1: Enable	Used for setting the current maintenance function.
Maintenance Interval	(0-30000)h	The time interval between two maintenance.
Maintenance Due Action	0: No Action; 1: Warn; 2: Shutdown; 3: Indication.	They are the alarm action types when the maintenance time is due.
Pre-alarm A	(0-30000)h	Maintenance remaining time.
Pre-alarm A Action	Same as maintenance due action.	Action when the maintenance remaining time is left pre-alarm A time only.
Pre-alarm B	(0-30000)h	Maintenance remaining time.
Pre-alarm B Action	Same as maintenance due action.	Action when the maintenance remaining time is left pre-alarm B time only.
Timer Mode	0: Running Time; 1: Real Time Clock	The maintenance timer mode.
Reset Maintenance Time		Reset maintenance alarm when the maintenance time is due.
Description		The maintenance name are user-set. E.g. Change oil.

9 SENSOR SETTING

When reselect sensors, the sensor curve will be transferred into the standard value. For example, if temperature sensor is SGD, its sensor curve is SGD; if select the SGX, the temperature sensor curve is SGX curve.

When there is difference between standard sensor curves and using sensor, users can select “Custom Sensor”, then input the custom sensor curve.

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

If select sensor type as “Not Used”, sensor curve is not working.

If there is alarm switch only for the select sensor, user must set the sensor as “Not Used”, otherwise, maybe shutdown or warning occurs.

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

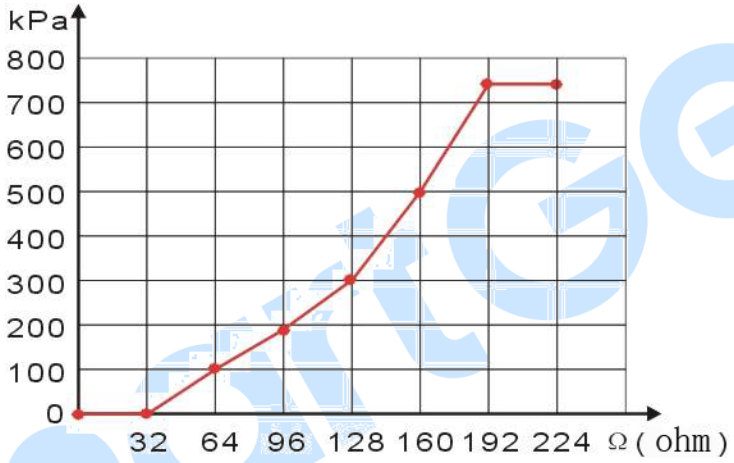


Fig.6 – Sensor Curve

Table 19– Common Unit Pressure Conversion Table

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

10 COMMUNICATION CONFIGURATION AND CONNECTION

10.1 ILLUSTRATION

APC715N pump unit controller has RS485 communication port, USB port and ETHERNET port. The RS485 communication port allows to connect the LAN with open struction, the Modbus communication protocol applied can collect the running software of the system via PC or data to realize the four remotes function (“remote control, remote measurement, remote communication and remote adjustment”).

Please refer to *APC715N COMMUNICATION PROTOCOL* for details.

10.2 RS485 COMMUNICATION DESCRIPTION

APC715N pump unit controller has two isolated RS485 communication ports, one of the two can monitor the RS485 LAN and the other one can connect with CMM366 series modules to realize the cloud monitoring.

Communication Protocol：Modbus-RTU

Communication Parameters

Module Address	1(Range: 1~254)
Baud Rate	9600bps(2400/4800/9600/19200bps)
Data Bit	8
Parity Check Bit	None (no parity, odd parity, even parity)
Stop Bit	1(1 or 2)

10.3 TERMINAL RESISTANCE

At both ends of a linear network (furthest apart), a terminal resistnace of 120Ω is needed to be connected in parallel with a pair of communication line. According to the theory of a transmission line, the terminal resistance can absorb the reflected waves on the network to effectively enhance the signal. The value of the two terminal resistances in parallel should be approximately equal to the characteristic impedance of the transmission line at communication frequency.

A formal RS485 network usually uses the terminal resistance. The terminal may not be used when the network connection is very short, for temporary use or testing room.

10.4 USB COMMUNICATION DESCRIPTION

The D-type USB communication port can connect with PC testing software to set parameters and upgrade the module software.

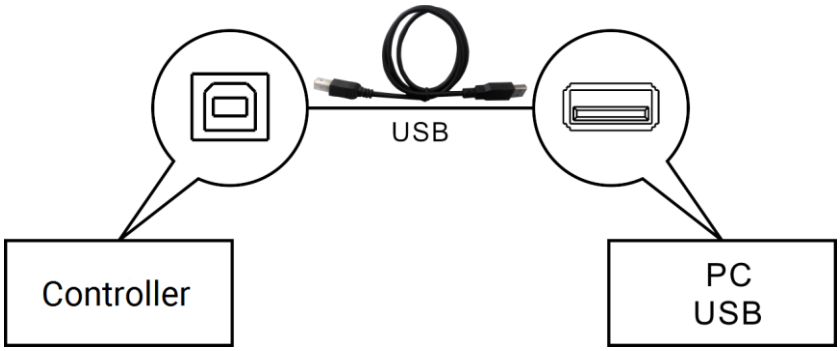


Fig.7 – USB Connection Diagram

11 TYPICAL APPLICATION

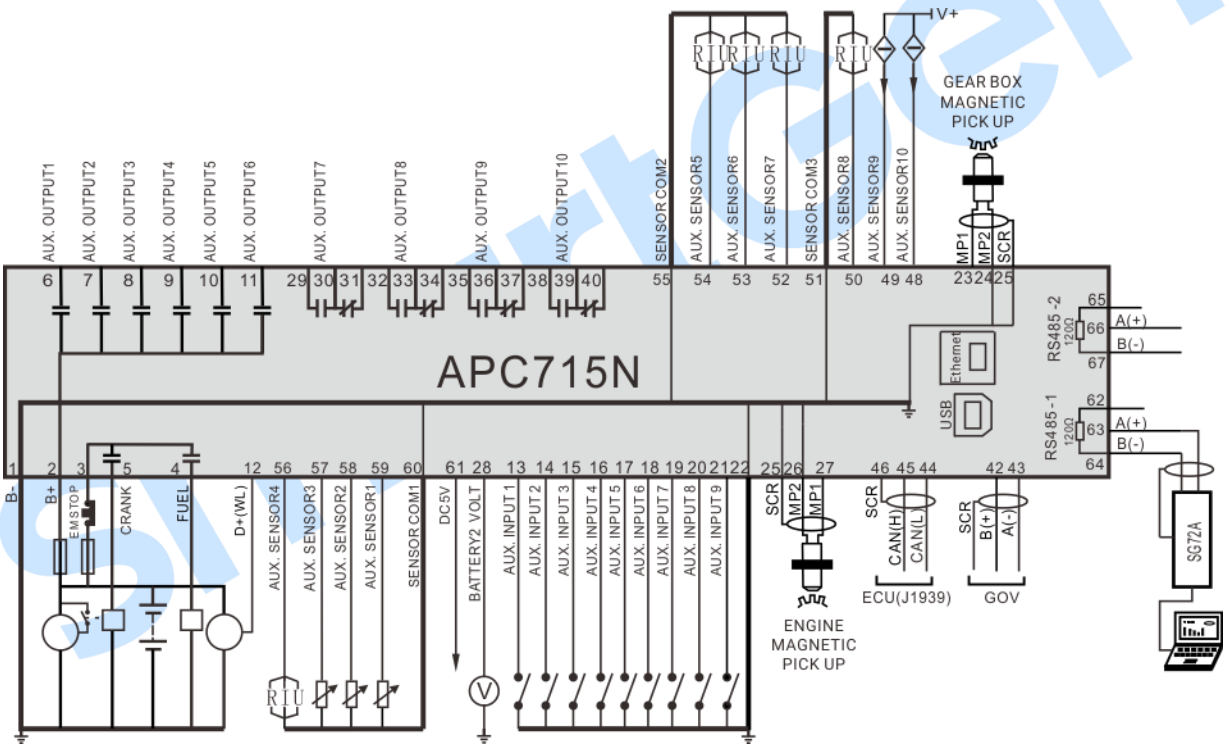


Fig.8 – Typical Application Diagram

12 INSTALLATION

The controller is panel built-in design and fixed by clips when installed.

Unit: mm

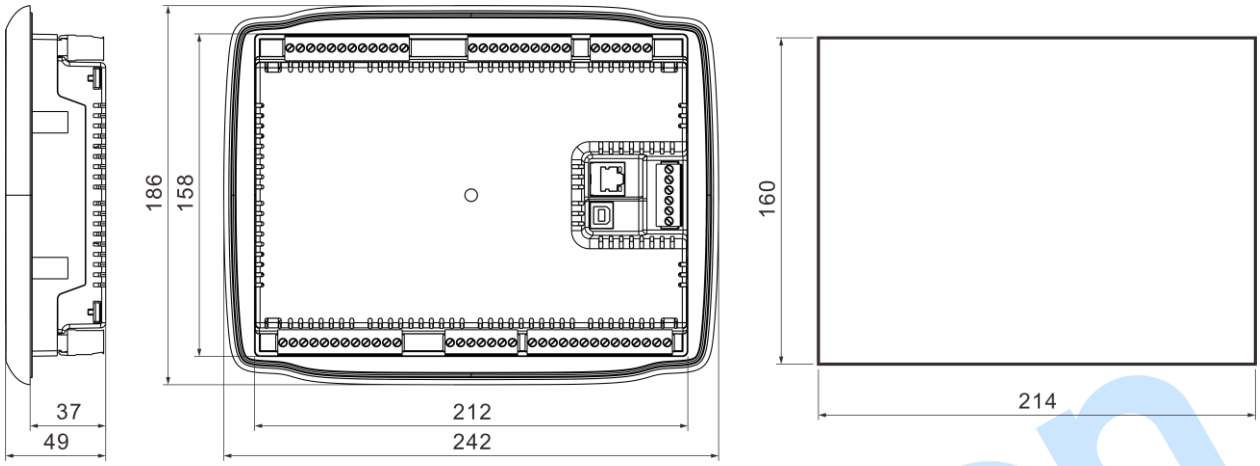


Fig.9 – Overall Dimension and Panel Cutout

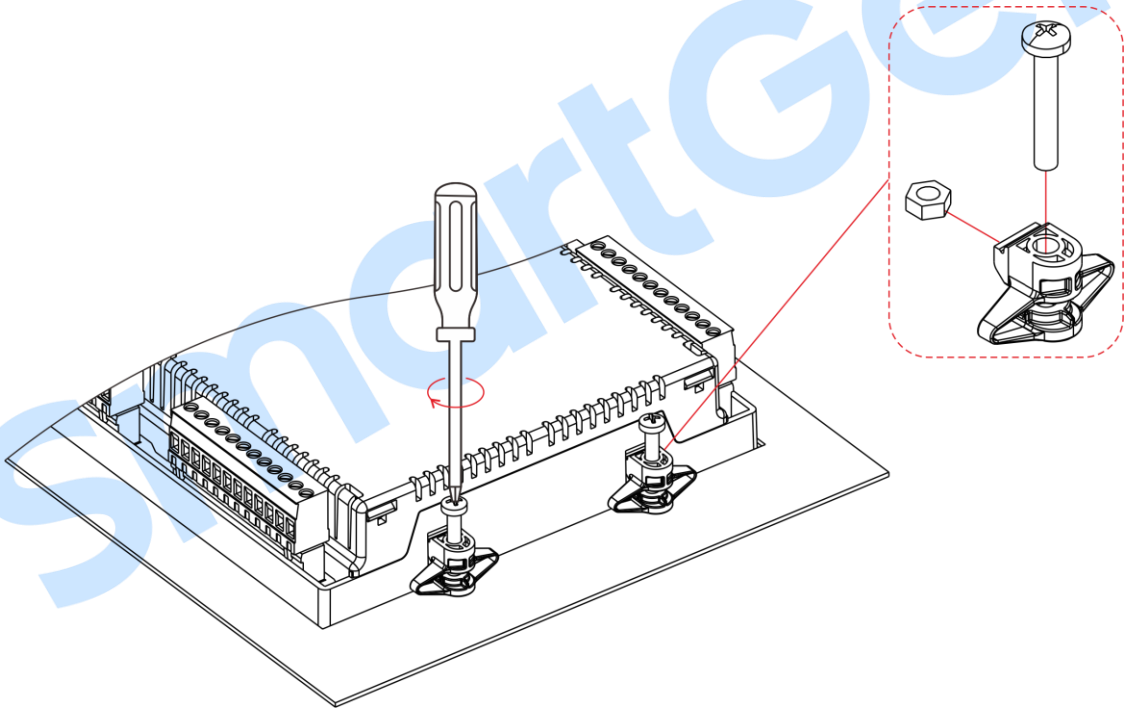


Fig.10 – Clips Installation

1) Battery Voltage Input

NOTE: APC715N controller can suit for widely range of battery voltage DC(8~35)V. Negative of battery must be connected with the engine shell soundly. The diameter of wire which from power supply to battery must be over 2.5mm^2. If floating charger configured, please firstly connect output wires of charger to battery's positive and negative directly, then, connect wires from battery's positive and negative to controller's corresponding input ports in order to prevent charger disturbing the controller's normal working.

2) Speed Sensor Input

NOTE: Speed sensor is the magnetic equipment which be installed in starter and for detecting flywheel teeth. Its

connection wires to controller should apply for 2 cores shielding line. The shielding layer should connect to shielding GND terminal in controller while another side is hanging in air. The else two signal wires are connected to MP1 and MP2 terminals, moreover, MP2 has already connected to B- internally. The output voltage of speed sensor should be within AC(1~24)V (effective value) during the full speed. AC12V is recommended (at rated speed). When install the speed sensor, let the sensor is spun to contacting flywheel first, then, port out 1/3 lap, and lock the nuts of sensor at last.

3) Output and Expansion Relay

CAUTION: All outputs of controller are relay contact output type. If need to expand the relays, please add freewheel diode to both ends of expand relay's coils (when coils of relay have DC current) or, add resistance-capacitance return circuit (when coils of relay have AC current), in order to prevent disturbance to controller or others equipment.

13 CONNECTION OF CONTROLLER WITH J1939 ENGINE

13.1 CUMMINS QSL9

Suitable for CM850 engine control module.

Table 20 – 50-pin Connector

Terminals of controller	50 pins connector	Remark
Fuel relay output	39	
Starting relay output	-	Connect to starter coil directly.

Table 21– 9-pin Connector

Terminals of controller	9 pins connector	Remark
CAN GND	SAE J1939 shield-E	CAN communication shielding line (connect with ECU terminal only).
CAN(H)	SAE J1939 signal-C	Impedance 120Ω connecting line is recommended.
CAN(L)	SAE J1939 return-D	Impedance 120Ω connecting line is recommended.

Engine Type: CUMMINS-CM850.

13.2 CUMMINS QSM11(IMPORT)

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

Table 22 – C1 Connector

Terminals of controller	C1 connector	Remark
Fuel relay output	5&8	Outside expand relay, when fuel output, making port 5 and port 8 of C1 be connected.
Starting relay output	-	Connect to starter coil directly.

Table 23 – 3-pin Data Link Connector

Terminals of controller	3 pins data link connector	Remark
CAN GND	C	CAN communication shielding line (connect with ECU terminal only).
CAN(H)	A	Impedance 120Ω connecting line is recommended.
CAN(L)	B	Impedance 120Ω connecting line is recommended.

Engine Type: CUMMINS-CM570.

13.3 CUMMINS QSX15-CM570

It is suitable for CM570 engine control module. Engine type is QSX15 and so on.

Table 24– 50-pin Connector

Terminals of controller	50 pins connector	Remark
Fuel relay output	38	Oil spout switch.
Starting relay output	-	Connect to starter coil directly.

Table 25– 9-pin Connector

Terminals of controller	9 pins connector	Remark
CAN GND	SAE J1939 shield-E	CAN communication shielding line (connect with ECU terminal only).
CAN(H)	SAE J1939 signal-C	Impedance 120Ω connecting line is recommended.
CAN(L)	SAE J1939 return-D	Impedance 120Ω connecting line is recommended.

Engine Type: CUMMINS-CM570.

13.4 CUMMINS QSZ13

Table 26– Engine OEM Connector

Terminals of controller	OEM connector of engine	Remark
Fuel relay output	45	
Starting relay output	-	Connect to starter coil directly.
Programmable output 1	16&41	Setting to idle speed control, normally open output. Making 16 connect to 41 during high-speed running of controller via external expansion relay.
Programmable output 2	19&41	Setting to pulse raise speed control, normally open output. Making 19 connect with 41 for 0.1s during high-speed warming of controller via external expansion relay.
CAN GND	-	CAN communication shielding line (connect with controller's this terminal only).
CAN(H)	1	Impedance 120Ω connecting line is recommended.
CAN(L)	21	Impedance 120Ω connecting line is recommended.

Engine Type: CUMMINS-QSZ13.

13.5 DETROIT DIESEL DDEC III/IV

Table 27– Engine CAN Port

Terminals of controller	CAN port of engine	Remark
Fuel relay output	Expand 30A relay, battery voltage of ECU is supplied by relay.	
Starting relay output	-	Connect to starter coil directly.
CAN GND	-	CAN communication shielding line (connect with controller's terminal only).
CAN(H)	CAN(H)	Impedance 120Ω connecting line is recommended.
CAN(L)	CAN(L)	Impedance 120Ω connecting line is recommended.

Engine Type: Common J1939.

13.6 MTU ADEC (SMART MODULE)

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

Table 28– ADEC (X1 Port)

Terminals of controller	ADEC (X1 port)	Remark
Fuel relay output	X1 10	X1 Terminal 9 Connected to negative of battery.
Starting relay output	X1 34	X1 Terminal 33 Connected to negative of battery.

Table 29– SMART (X4 Port)

Terminals of controller	SMART (X4 port)	Remark
CAN GND	X4 3	CAN communication shielding line (connect to controller's this terminal only).
CAN(H)	X4 1	Impedance 120Ω connecting line is recommended.
CAN(L)	X4 2	Impedance 120Ω connecting line is recommended.

Engine Type: MTU-ADEC。

13.7 MTU ADEC (SAM MODULE)

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

Table 30– ADEC (X1 Port)

Terminals of controller	ADEC (X1 port)	Remark
Fuel relay output	X1 43	X1 Terminal 28 Connected to negative of battery.
Starting relay output	X1 37	X1 Terminal 22 Connected to negative of battery.

Table 31– SAM (X23 Port)

Terminals of controller	SAM (X23 port)	Remark
CAN GND	X23 3	CAN communication shielding line (connect with controller's this terminal only).
CAN(H)	X23 2	Impedance 120Ω connecting line is recommended.
CAN(L)	X23 1	Impedance 120Ω connecting line is recommended.

Engine Type: Common J1939.

13.8 SCANIA

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

Table 32– B1 Connector

Terminals of controller	B1 connector	Remark
Fuel relay output	3	
Starting relay output	-	Connect to starter coil directly.
CAN GND	-	CAN communication shielding line (connect with controller's terminal only).
CAN(H)	9	Impedance 120Ω connecting line is recommended.
CAN(L)	10	Impedance 120Ω connecting line is recommended.

Engine Type: SCANIA-S8.

13.9 VOLVO EDC3

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

Table 33– "Stand alone" Connector

Terminals of controller	"Stand alone" connector	Remark
Fuel relay output	H	
Starting relay output	E	
Programmable output 1	P	ECU power supply; Set programmable output 1 as "ECU power".

Table 34– "Data bus" Connector

Terminals of controller	"Data bus" connector	Remark
CAN GND	-	CAN communication shielding line (connect with controller's terminal only).
CAN(H)	1	Impedance 120Ω connecting line is recommended.
CAN(L)	2	Impedance 120Ω connecting line is recommended.

Engine Type: VOLVO-EMS2.

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

13.10 VOLVO EDC4

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

Table 35– Connector

Terminals of controller	Connector	Remark
Fuel relay output	Expanded 30A relay, and relay offers battery voltage for terminal14. Fuse is 16A	
Starting relay output	-	Connect to starter coil directly.
	1	Connected to negative of battery.
CAN GND	-	CAN communication shielding line (connect with controller's terminal only).
CAN(H)	12	Impedance 120Ω connecting line is recommended.
CAN(L)	13	Impedance 120Ω connecting line is recommended.

Engine Type: VOLVO.

13.11 VOLVO-EMS2

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

Table 36– Engine CAN Port

Terminals of controller	Engine's CAN port	Remark
Programmable output 1	6	ECU stop; Set programmable output 1 as "ECU stop".
Programmable output 2	5	ECU power; Set programmable output 2 as "ECU power".
	3	Negative power.
	4	Positive power.
CAN GND	-	CAN communication shielding line (connect with controller's terminal only).
CAN(H)	1(Hi)	Impedance 120Ω connecting line is recommended.
CAN(L)	2(Lo)	Impedance 120Ω connecting line is recommended.

Engine Type: VOLVO-EMS2, speed regulation can be implemented.

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

13.12 YUCHAI

It is suitable for Yuchai BOSCH common rail electronic-controlled engine.

Table 37– Engine 42-pin Port

Terminals of controller	Engine 42 pins port	Remark
Fuel relay output	1.40	Connect to engine ignition lock
Starting relay output	-	Connect to starter coil directly
CAN GND	-	CAN communication shielding line (connect with controller's this terminal only)
CAN(H)	1.35	Impedance 120Ω connecting line is recommended.
CAN(L)	1.34	Impedance 120Ω connecting line is recommended.

Table 38– Engine 2-pin Port

Battery	Engine 2 pins port	Remark
Battery negative	1	Wire diameter: 2.5mm^2.
Battery positive	2	Wire diameter: 2.5mm^2.

Engine Type: BOSCH。

13.13 WEICHAI

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

Table 39– Engine Port

Terminals of controller	Engine port	Remark
Fuel relay output	1.40	Connect to engine ignition lock.
Starting relay output	1.61	
CAN GND	-	CAN communication shielding line (connect to the controller at this end only).
CAN(H)	1.35	Impedance 120Ω connecting line is recommended.
CAN(L)	1.34	Impedance 120Ω connecting line is recommended.

Engine Type: GTSC1。

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

14 FAULT FINDING

Table 40– Fault Finding

Symptoms	Possible Solutions
Controller no response with power	Check starting batteries; C heck controller connection wirings; Check DC fuse.
Genset shutdown	Check the water/cylinder temperature is too high or not; Check DC fuse.
Controller emergency stop	Check emergence stop button is correct or not; Check whether the positive of starting battery is connected with the emergency stop input; Check whether the circuit is open.
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 programmable inputs.
Crank not disconnect	Check fuel oil circuit and its connections; Check starting batteries; Check speed sensor and its connections; Refer to engine manual.
Starter no response	Check starter connections; Check starting batteries.
RS485 comm. failure	Check connections; Check RS485's connections of A and B is reverse connect or not; Check RS485 transfer module whether damage or not; Check communication port of PC whether damage.
ECU comm. failure	Check connections of CAN high and low polarity; Check if correctly connected of 120Ω resister; Check if engine type is correct; Check if connections from controller to engine and outputs setting are correct.
ECU warning or shutdown	Get information from LCD of alarm page; If there is detailed alarm, check engine according to description. If not, please refer to engine manual according to SPN alarm code.