



**SmartGen**  
ideas for power

# APC615 PUMP UNIT CONTROLLER USER MANUAL



**SMARTGEN (ZHENGZHOU) TECHNOLOGY CO., LTD.**



Chinese trademark

**SmartGen** English trademark

SmartGen – make your generator *smart*

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**Table 1 - Software Version**

Date	Version	Content
2017-10-20	1.0	Original release.
2021-03-30	1.1	1. Modify the CAN sign in typical application diagram; 2. Add new functions description.

This user manual only suits for APC615 controller.

**Table 2 - Notation Clarification**

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

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## 1 OVERVIEW

**APC615 Pump Unit Controller** is designed for pump systems which controlled by engine. It allows automatic start/stop, data measurement, alarm protection as well as remote control, remote measurement and remote communication function. Utilizing the GOV (Engine Speed Governor) control function, the controller is able to stabilize the outlet/inlet pressure via regulating engine speed. Besides that, CANBUS (SAE J1939) interface enables the controller to communicate with various engines which fitted with/not with J1939 interface.

**APC615 Pump Unit Controller**, reliable and easy to use, fits with LCD display and optional languages interface (including English and Chinese languages). Simultaneously the exact parameters of pump unit and engine are indicated by the LCD display on the front panel.

**APC615 Pump Unit Controller** adopts powerful 32-bit ARM microprocessor technology with following functions: precision parameters measuring, fixed value adjustment, time setting & set value adjusting and etc. The majority of parameters can be configured from front panel and all the parameters can be adjusted and monitored using PC (via RS485 or LINK port). It can be widely used in a number of pump control systems with compact structure, simple connections and high reliability.

## 2 PERFORMANCE AND CHARACTERISTICS

Main characteristics are as follows,

- 132x64 pixel LCD with backlight, multilingual interface (including English and Chinese languages), and easy operation interface;
- Improved LCD wear-resistance and scratch resistance due to hard screen acrylic;
- Silicon panel and pushbuttons for better operation in high/low temperature environment;
- RS485 communication port enabling remote control, remote measuring, remote communication via ModBus protocol;
- Equipped with CANBUS port and can communicate with J1939 engine. It not only can monitor frequently-used data (such as water temperature, oil pressure, engine speed, fuel consumption and so on) of unit, but also can control start, stop, and raise/drop speed via CANBUS port;
- With speed regulation function (relay and CANBUS speed control interfaces), the controller is able to stabilize the outlet/inlet pressure via regulating engine speed;
- Discharge pressure curve and flow curve are user-defined;
- 6 analog sensors: 2 sensors can switch between resistor type and current type using jumper and the other 4 sensors can switch among resistor type, current type and voltage type using jumper;
- 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 water pressure, low water pressure, over flow and other kinds of fault indication and protection function;
- Auto and manual speed regulation functions that can be operated from the front panel of



- controller directly;
- Idle speed control function;
- All output ports are relay-out;
- Parameter setting: parameters can be modified and stored in internal FLASH memory and cannot be lost even in case of power outage;
- Multiple crank disconnect conditions (speed sensor, oil pressure) are optional;
- Widely power supply range DC(8~35)V, suitable to different starting battery voltage environment;
- Event log, real-time clock, scheduled start & stop pump unit (can be set as start pump unit once a day/week/month);
- Can control engine heater, cooler and fuel pump.
- With maintenance function. Actions can be set when maintenance time due;
- All parameters used digital adjustment, instead of conventional analog modulation with normal potentiometer, more reliability and stability;
- Waterproof security level 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 way; compact structure with easy mounting.

### 3 SPECIFICATION

**Table 3 - Technical Parameters**












Items	Content
Working Voltage	DC8.0V to 35.0V, Continuous Power Supply.
Overall Consumption	<3W (Standby mode: ≤2W)
Speed Sensor Voltage	1.0 to 24V (effective value)
Speed Sensor Frequency	10,000Hz (max)
Starting Relay Output	16A Connect to common port output
Fuel Relay Output	16A Connect to common port output
Programmable Relay Output 1	16A Connect to common port output
Programmable Relay Output 2	7A Connect to common port output
Programmable Relay Output 3	7A Connect to common port output
Programmable Relay Output 4	7A AC250V Volt free output
Programmable Relay Output 5	7A AC250V Volt free output
Programmable Relay Output 6	7A AC250V Volt free output
Analog Sensor	4 fixed sensors, 2 configurable sensors
Overall Dimensions	197mm x 152mm x 47mm
Panel Cutout	186mm x 141mm
Working Condition	Temperature: (-25~+70)°C Humidity: (20~93)%RH
Storage Condition	Temperature: (-25~+70)°C
Protection Level	IP65 Gasket
Insulating Intensity	Apply AC2.2kV voltage between high voltage terminal and low voltage terminal; The leakage current is not more than 3mA within 1min.
Weight	0.70kg



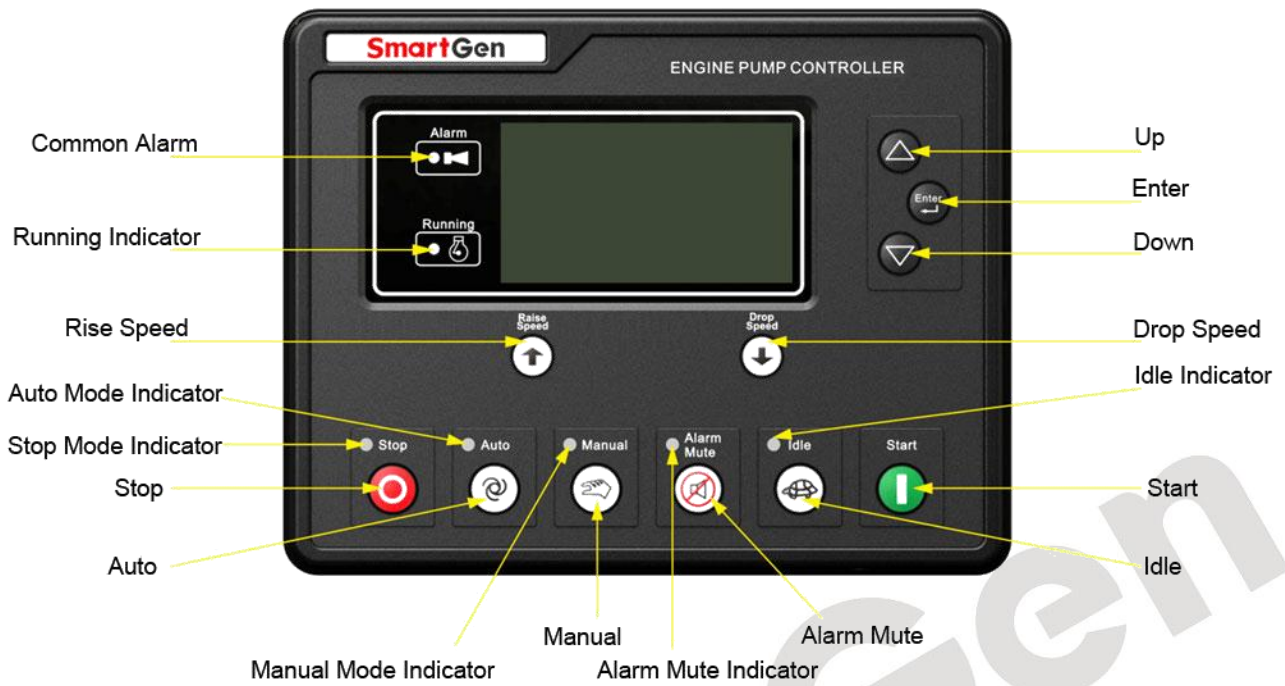
## 4 OPERATION

### 4.1 PUSH BUTTONS DESCRIPTION

**Table 4 - Keys Function**

Icons	Function	Description
	Stop	<ol style="list-style-type: none"> <li>1. Stop running pump unit in Auto/Manual mode;</li> <li>2. Reset alarm in stop mode;</li> <li>3. Press at least 3 seconds to test lights are normal or not (Lamp test).</li> </ol>
	Auto	Press it to set controller enters into Auto mode.
	Manual	Press it to set controller enters into Manual mode.
	Mute	Press it to mute controller alarms.
	Idle	Press it to set controller enters into Idle mode.
	Start	Press it to start engine in auto mode.
	Raise Speed	Press it to raise engine speed in manual speed control status.
	Drop Speed	Press it to drop engine speed in manual speed control status.
	Up/Increase	<ol style="list-style-type: none"> <li>1. Screen scroll;</li> <li>2. Up cursor and increase value in setting menu.</li> </ol>
	Down/Decrease	<ol style="list-style-type: none"> <li>1. Screen scroll;</li> <li>2. Down cursor and decrease value in setting menu.</li> </ol>
	Set/Confirm	<ol style="list-style-type: none"> <li>1. Enter into Parameter Setting screen after holding and pressing over 3s;</li> <li>2. Confirm setting information.</li> </ol>

## 4.2 INDICATOR LIGHT



**Fig.1 - APC615 Front Panel**


**NOTE:** Selected indicators description:

Common alarm indicator: flash slowly when warning alarms occur; flash quickly when shutdown alarms occur; light is off when there are no alarms.

Running indicator: always light when engine is normally running.

## 4.3 AUTO START/STOP OPERATION

### 4.3.1 AUTOMATIC START SEQUENCE



- a) Press  and indicator beside it illuminates, which means pump unit is in Auto Start mode.
- b) If remote input is active, controller "Start Delay" begins countdown, meanwhile, "Remote Start Warning" displayed on the LCD of controller with the buzzing sound of buzzer (remind people keep away).
- c) When start delay is over, buzzing sound stops and preheat relay energizes (if configured), "Preheat Delay XX s" information will be displayed on LCD;
- d) After the above delay, the Fuel Relay is energized, and then one second (pre-set fuel time before crank) later, the Start Relay is engaged. If the pump unit fails to fire during this cranking attempt then the fuel relay and starting relay are disengaged for the pre-set rest period; "Crank Rest Time" begins and wait for the next crank attempt.
- e) 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.
- f) In case of successful crank attempt, the "Safety On" timer is activated, allowing Low Oil Pressure, High Temperature, "Under Speed" and "Charge Alternator Failure" inputs to stabilize without triggering the fault. As soon as this delay is over, "Start Idle" delay is initiated (if configured).
- g) During "Start Idle" delay, under speed alarm is deactivated. When this delay is over, "Warming Up" delay is initiated (if configured).
- h) After the "Warming Up" delay, pump unit will enter into Normal Running status. If engine speed is abnormal, controller will shut down with alarms (alarm information will be displayed on alarm page of LCD).

### 4.3.2 AUTOMATIC STOP SEQUENCE

- a) When remote start signal is deactivated and remote stop signal is active, "Stop Delay" timer is initiated.
- b) Once this "Stop Delay" has expired, the "Cooling Delay" starts. If remote start signal is active again during cooling delay, pump unit will enter into running status again. When cooling delay expired, pump unit enters into "Stop Idle" delay.
- c) During "Stop Idle" Delay (if configured), idle relay is energized.
- d) "ETS Solenoid Hold" begins, ETS relay is energized while fuel relay is de-energized.
- e) "Wait for Stop Delay" begins, and complete stop is detected automatically.
- f) Pump unit is placed into its "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).
- g) Pump unit is placed into its standby mode after its "After Stop Time".

## 4.4 MANUAL START/STOP OPERATION


### 4.4.1 MANUAL START SEQUENCE

- a) Press  to enter into "Manual Mode", and indicator besides it illuminated;
- b) Press  to start the unit, and automatic detect whether unit start successfully or not. Then


unit accelerates to high-speed running automatically;


- c) If high temperature, low oil pressure and over speed occur during pump unit running, controller can protect it to stop quickly (Please refer to 4.3.1, No. c~h of AUTO START SEQUENCE for detail procedures).


#### 4.4.2 MANUAL STOP SEQUENCE


Press  can stop the running pump unit. (Please refer to 4.3.2, No. b~g of AUTO STOP SEQUENCE for detail procedures).

#### 4.5 IDLE SPEED OPERATION

Press  during engine is normal running, idle speed indicator lights up and it enters into "Idle Mode". Engine enters into "Cooling Delay", and then idle running starts and idle relay energized (if idle control is configured) after cooling delay expired.

Press  during engine is in standby status, idle speed indicator lights up and it starts in "Manual Mode" or "Auto Mode". Engine enters into "Start Idle Delay" (if configured) after safety on delay is expired, and then idle running starts and idle relay energized (if idle control is configured) after start idle delay expired.

When engine is idle running in "Idle Mode", press  to exit idle mode, and idle speed indicator is extinguished. Then engine enters into "Warming Up Delay" (if configured), and after warming up delay is expired, it enters into normal running status.

When engine is idle running in "Idle Mode", press  to stop the engine, and it enters into "Stop Idle Delay" (if configured) from "Idle Running". The remaining stop process is the same as auto stop procedure (details please to see 4.3.2, No. c~g of AUTO STOP SEQUENCE).

#### 4.6 DIESEL DRIVEN PUMP START/STOP OPERATION

Water suction pump type set as diesel driven suction pump.

— Diesel driven pump start:

- After auto/manual start is active, pre-heat relay starts output (if configured), and "Pre-heat Delay xx" is displayed on the LCD of controller. Then starter relay of diesel driven pump outputs (if configured) after pre-heat delay expired. If the diesel driven pump unit crank disconnect input is deactivated (input port needs to be configured) during "Diesel Driven Pump Cranking Time", the starter relay stops output, and "Crank Rest Time" begins and wait for the next crank attempt. Should this start sequence continue beyond the set number of attempts, the start sequence will be terminated, and controller initiates "Fail to Start" alarm and corresponding alarm information will be displayed on LCD.
- In case of successful crank attempt, the "Waiting Pressure to" timer is activated. If the "Pressure to Suction Pump" input (input port needs to be configured) is deactivated over the delay, controller will initiate suction pump fault shutdown alarms and corresponding alarm information will be displayed on the LCD of the controller.
- If the "Pressure to Suction Pump" input (input port needs to be configured) is active during

the time of “Waiting Pressure to”, fuel relay outputs, and after 1s (default fuel time before cranking) later, starter relay will output. The remaining stop process is the same as auto stop procedure (details please to see 4.3.1, No. d~h of AUTO START SEQUENCE).

— Diesel driven pump stop:

Stop diesel driven pump outputs (output port needs to be configured) after safety on delay of engine, and unit stops output after pre-set delay (ETS Solenoid Hold).

#### 4.7 ELECTRIC DRIVEN PUMP START/STOP OPERATION

Water suction pump type set as electric driven suction pump.



— Electric driven pump start:

When suction pump type set as electric driven suction pump, its starter relay starts output (output port needs to be configured) after safety on delay expired.

— Electric driven pump stop:

- When engine is between start idle and high speed cooling status, if the “Pressure to Suction Pump” input (input port needs to be configured) is active or outlet pressure exceeds shutdown outlet pressure limit of electric driven pump, its starter relay will stop output.
- When engine is in “ETS Solenoid Hold”, starter relay of electric driven suction pump will stop output.

#### 4.8 EMERGENCY START

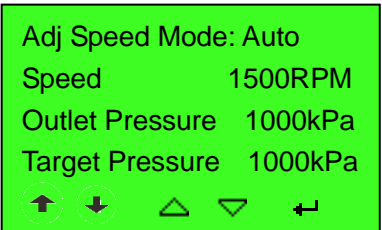




**NOTE:** In manual mode, press  and  at the same time can force start unit. At this moment, whether unit starts successfully or not is not based on the crank disconnect conditions. The starter disconnection is controlled by the operator, operator releases the buttons when he/she observed unit had already started successfully, and then start stops output and controller enters into safety on delay.



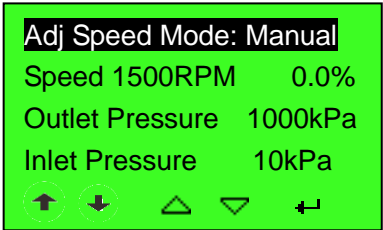




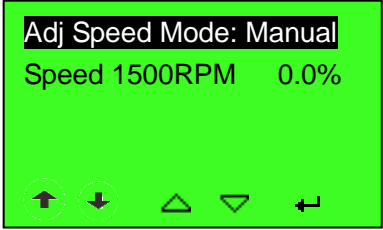




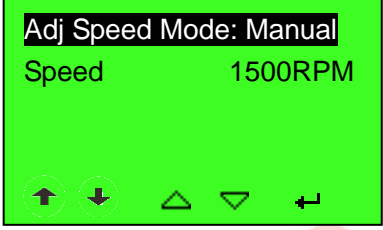




#### 4.9 PUMP UNIT CONTROLLER ADJUST SPEED OPERATION

Pump unit controller is able to adjust the outlet/inlet pressure via regulating engine speed, and stabilize the outlet pressure to the rated value finally. Speed regulation includes automatically and manually adjust speed.



Press raise speed or drop speed key to display speed regulation page in main screen.

**Table 5 - LCD Display**

Display	Description
	<p>Adjust speed type set as 1: <i>Relay Adjust Speed</i>; adjust speed stable object set as 0: <i>Outlet Pressure</i>; display screen is showed as left. In this screen, users can select adjust speed mode (manual or auto) via pressing  and  keys. In manual mode, through pressing  or  key to connect or disconnect raise/drop speed relay;</p>

Display	Description
	in auto mode, through pressing  or  key to adjust target pressure.
	Adjust speed type set as 2: <i>CAN Adjust Speed</i> ; adjust speed stable object set as 1: <i>Inlet Pressure</i> ; display screen is showed as left. In this screen, users can select adjust speed mode (manual or auto) via pressing  and  keys. In manual mode, through pressing  or  key to adjust percentage; in auto mode, percentage is adjusted automatically, thus the speed can be adjusted.
	Adjust speed type set as 2: <i>CAN Adjust Speed</i> ; adjust speed stable object set as 2: <i>Engine Speed</i> ; display screen is showed as left. In this screen, users can select adjust speed mode (manual or auto) via pressing  and  keys. In manual mode, through pressing  or  key to adjust percentage; in auto mode, percentage is adjusted automatically, thus the speed can be adjusted.
	Adjust speed type set as 1: <i>Relay Adjust Speed</i> ; adjust speed stable object set as 3: <i>Manual Adjust Speed</i> ; display screen is showed as left. In this screen, users can select adjust speed mode (manual or auto) via pressing  and  keys. In manual mode, through pressing  or  key to connect or disconnect raise/drop speed relay; in auto mode, speed control doesn't work.

**NOTE:** If adjust speed object is inlet pressure, flexible sensor 1 needs to be set as inlet pressure, and curve type must be effective.

**Manual Adjust Speed:** Select "Adjust Speed Type" in "Adjust Speed" item and configure it as "3: Manual Adjust Speed". In adjust speed screen, users can manually adjust speed via pressing  or  (manually raise/drop speed only works in manual adjust speed mode and engine is normally running).

**Auto Adjust Speed:** After setting "Auto Adjust Speed Mode", when engine is normally running, controller will auto adjust speed based on the parameters that the user defined, and adjust the user-defined regulation object (outlet pressure/Inlet pressure/Engine speed) to the target value and keep it stable.

Auto adjust speed includes relay adjust speed and CAN adjust speed.

Relay adjust speed controls the actuating motor of engine through raise/drop speed function of output port.

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CAN adjust speed controls the speed of the ECU engine via CAN port. When CAN adjust speed is selected, output center (SW1) needs to be set as 5.0, and output range (SW2) needs to be set as 2.0. then configure the speed gain and stability according to the actual situations.

**▲NOTE:** Raise speed adjust can be reached to the 110% of the rated speed.

## 5 PROTECTION

### 5.1 WARNINGS

Warnings are not shutdown alarms and do not affect the operation of the engine. Warning does not lead to shutdown, and when warning condition is no longer present, warning alarm will be cleared automatically.

**Table 6 - Warning Types**

No.	Type	Description
1	Engine Over Speed	When the controller detects that the engine speed has exceeded the pre-set value, it will initiate a warning alarm.
2	Engine Under Speed	When the controller detects that the engine speed has fallen below the pre-set value, it will initiate a warning alarm.
3	Loss of Speed Signal	When the controller detects that the engine speed is 0 and the action select "Warning", it will initiate a warning alarm.
4	Fail to Stop	After "After Stop" delay is expired, if unit does 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.
6	Battery Over Voltage	When the controller detects that battery voltage has exceeded the pre-set value, it will initiate a warning alarm.
7	Battery Under Voltage	When the controller detects that battery voltage has fallen below the pre-set value, it will initiate a warning alarm.
8	ECU Warning	When the controller receives engine warning signals from ECU via J1939, it will initiate a warning alarm.
9	Engine Temperature Sensor Open Circuit	When the controller detects that the temperature sensor is open circuit and the action selects "Warning", it will initiate a warning alarm.
10	Engine High Temp.	When the controller detects that engine temperature has exceeded the pre-set value, it will initiate a warning alarm.
11	Engine Low Temp.	When the controller detects that engine temperature has fallen below the pre-set value, it will initiate a warning alarm.
12	Engine Fuel Level Sensor Open Circuit	When the controller detects that the level sensor is open circuit and the action selects "Warning", it will initiate a warning alarm.
13	Engine Low Fuel Level	When the controller detects that the fuel level has fallen below the pre-set value, it will initiate a warning alarm.
14	Oil Pressure Sensor Open Circuit	When the controller detects that the oil pressure sensor is open circuit and the action selects "Warning", it will initiate a warning alarm.
15	Engine Low Oil Pressure	When the controller detects that the oil pressure has fallen below the pre-set value, it will initiate a warning alarm.
16	Outlet Pressure Sensor Open Circuit	When the controller detects that the pressure sensor is open circuit and the action selects "Warning", it will initiate a warning alarm.
17	High Outlet Pressure	When the controller detects that the sensor value has exceeded the





No.	Type	Description
		upper limit of outlet pressure warning threshold, it will initiate a warning alarm.
18	Low Outlet Pressure	When the controller detects that the sensor value has fallen below the lower limit of outlet pressure warning threshold, it will initiate a warning alarm.
19	Flexible Sensor 1~2 Open Circuit	When the controller detects that the sensor is open circuit and the action selects "Warning", it will initiate a warning alarm.
20	Flexible Sensor 1~2 High	When the controller detects the sensor value is higher than the max. set value, it will initiate a warning alarm.
21	Flexible Sensor 1~2 Low	When the controller detects the sensor value is lower than the min. set value, it will initiate a warning alarm.
22	Over Flow Warning	When the controller detects the flow value is higher than the max. set value, it will initiate a warning alarm.
23	Digital Input 1~5 Warning	When the action of digital input port selects "Warning" and active, it will initiate a warning alarm.
24	Maintenance 1~5 Warning	When maintenance countdown is 0 and action selects "Warning", it will initiate a warning alarm.
25	End of Mandate Time	When the time of the controller reaches mandate time and action selects "Warning", it will initiate a warning alarm.

## 5.2 SHUTDOWN ALARM

When controller detects shutdown alarm, it will shut down the unit immediately. Shutdown alarm must be cleared manually and the fault removed to reset the module.

**Table 7 - Shutdown Alarm**

No.	Type	Description
1	Emergency Stop	When the controller detects an emergency stop alarm signal, it will initiate a shutdown alarm.
2	Engine Over Speed	When the controller detects that the engine speed has exceeded the pre-set value, it will initiate a shutdown alarm.
3	Engine Under Speed	When the controller detects that the engine speed has fallen below the pre-set value, it will initiate a shutdown alarm.
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.
5	Failed to Start	If pump unit failed to start within pre-set start attempts, 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.
7	Aux. High Temp. Shutdown	When the input port of controller set as "Aux. High Temp. Shutdown" and input is active, it will initiate a shutdown alarm.
8	Aux. Low Oil Pressure	When the input port of controller set as "Aux. Low Oil Pressure



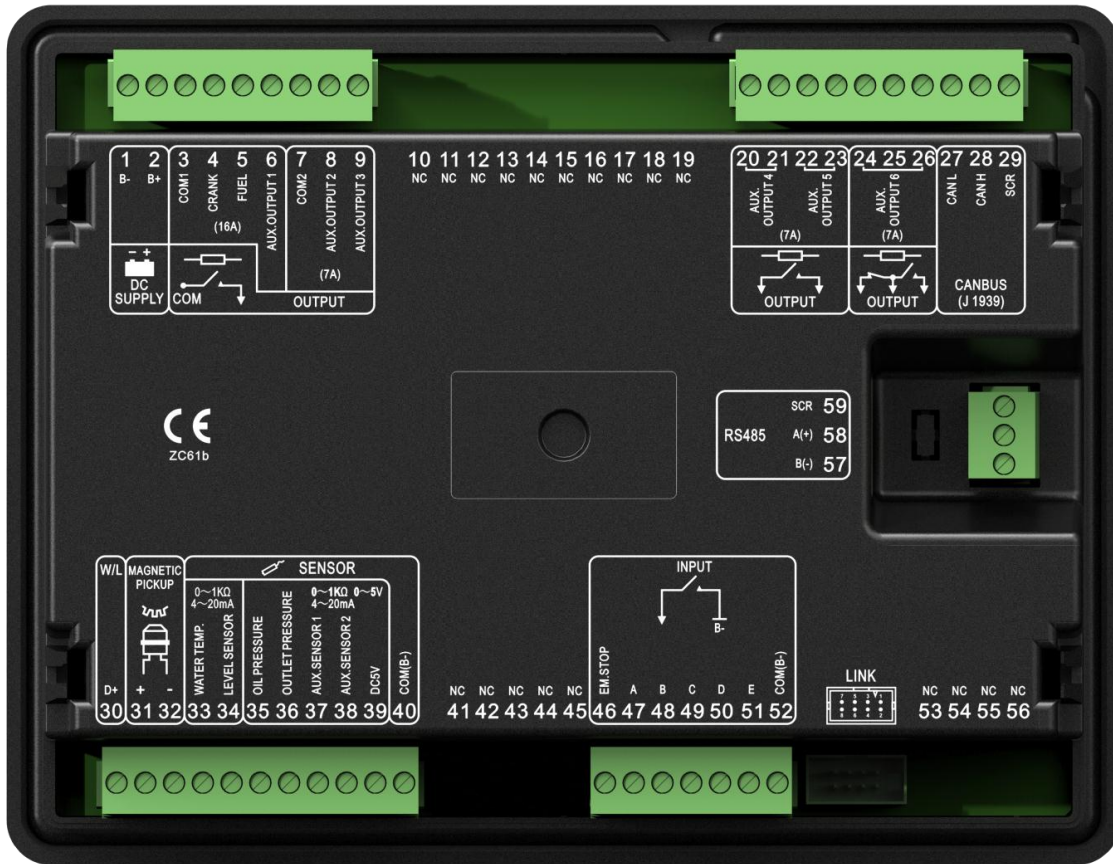
No.	Type	Description
	Shutdown	Shutdown” and input is active, it will initiate a shutdown alarm.
9	ECU Communication Fail Shutdown	If controller receives no data via J1939 after starting the engine, it will initiate a shutdown alarm.
10	Engine Temperature Sensor Open Circuit	When the controller detects that the temperature sensor is open circuit and the action selects “Shutdown”, it will initiate a shutdown alarm.
11	Engine High Temp.	When the controller detects that engine temperature has exceeded the pre-set value, it will initiate a shutdown alarm.
12	Fuel Level Sensor Open Circuit	When the controller detects that the sensor is open circuit and the action selects “Shutdown”, it will initiate a shutdown alarm.
13	Engine Low Level Shutdown	When the controller detects that the fuel level has fallen below the pre-set value, it will initiate a shutdown alarm.
14	Engine Oil Pressure Open Circuit	When the controller detects that the oil pressure sensor is open circuit and the action selects “Shutdown”, it will initiate a shutdown alarm.
15	Engine Low Oil Pressure	When the controller detects that the oil pressure has fallen below the pre-set value, it will initiate a shutdown alarm.
16	Outlet Pressure Sensor Open Circuit	When the controller detects that the sensor is open circuit and the action selects “Shutdown”, it will initiate a shutdown alarm.
17	Outlet Pressure High	When the controller detects that the sensor value is higher than the max. set value, it will initiate a shutdown alarm.
18	Outlet Pressure Low	When the controller detects that the sensor value is lower than the min. set value, it will initiate a shutdown alarm.
19	Flexible Sensor 1~2 Open Circuit	When the controller detects that the sensor is open circuit and the action selects “Shutdown”, it will initiate a shutdown alarm.
20	Flexible Sensor 1~2 High	When the controller detects the sensor value is higher than the max. set value, it will initiate a shutdown alarm.
21	Flexible Sensor 1~2 Low	When the controller detects the sensor value is lower than the min. set value, it will initiate a shutdown alarm.
22	Suction Pump Crank Fail	If diesel driven suction pump failed to start during in pre-set diesel pump start attempts, it will initiate a shutdown alarm.
23	Suction Pump Fault	If “Pressure to Suction Pump” input port is deactivated during in pre-set “Suction Pump Fault Shutdown” delay, controller will initiate a shutdown alarm.
24	Digital Input 1~5 shutdown	When the action of digital input port selects “Shutdown” and active, it will initiate a shutdown alarm.
25	Over Flow Shutdown	When the controller detects the flow value is higher than the max. set value, it will initiate a shutdown alarm.



No.	Type	Description
26	Maintenance Shutdown 1~5	When maintenance countdown is 0 and action selects "Shutdown", it will initiate a shutdown alarm.
27	End of Mandate Time	When the time of the controller reaches mandate time and action selects "Shutdown", it will initiate a shutdown alarm.

**▲NOTE:** ECU warning and ECU shutdown illustration: if detailed alarm content displayed on the LCD of controller, please check engine condition according to the displayed content; otherwise, please look up engine user manual based on the SPN code to receive information.

## 6 CONNECTIONS



**Fig. 2 - APC615 Back Panel**

**Table 8 - Description of Terminal Connections**

No.	Function	Cable Size	Description	
1	B-	2.5mm <sup>2</sup>	Connected with negative of starter battery.	
2	B+	2.5mm <sup>2</sup>	Connected with positive of starter battery. If wire length is over 30m, better to double wires in parallel. Max. 20A fuse is recommended.	
3	COM1 Relay Common Port	1.5mm <sup>2</sup>	Connect to COM1 output with rated 16A.	
4	Crank	1.5mm <sup>2</sup>		
5	Fuel	1.5mm <sup>2</sup>		
6	Aux. Output 1	1.5mm <sup>2</sup>	Connect to COM2 output with rated 7A.	
7	COM2	1.5mm <sup>2</sup>		
8	Aux. Output 2	1.5mm <sup>2</sup>		
9	Aux. Output 3	1.5mm <sup>2</sup>	Detailed setting items please to see Table 10.	
10~19	NC			
20	Aux. Output 4	1.5mm <sup>2</sup>	Relay normally open volt free contactor	



No.	Function	Cable Size	Description
21		1.5mm <sup>2</sup>	with rated 7A, volt free output.
22	Aux. Output 5	1.5mm <sup>2</sup>	Relay normally open volt free contactor with rated 7A, volt free output.
23		1.5mm <sup>2</sup>	
24		1.5mm <sup>2</sup>	
25	Aux. Output 6	1.5mm <sup>2</sup>	Relay common point.
26		1.5mm <sup>2</sup>	Normally open output with rated 7A.
27	ECU CAN L	0.5mm <sup>2</sup>	120Ω impedance shielded wire is recommended to use, and single-end earthed.
28	ECU CAN H	0.5mm <sup>2</sup>	
29	ECU SCR	/	
30	Charging Generator D+ Input	1.0mm <sup>2</sup>	Connect to D+ (WL) terminal of charging generator, if there is no this terminal in the charger, this terminal is suspended.
31	Speed Sensor Input	0.5mm <sup>2</sup>	Connect to speed sensor of engine, shield line is recommended to use.
32	Speed sensor input, internal of controller has connected with B-	0.5mm <sup>2</sup>	
33	Temperature sensor	1.0mm <sup>2</sup>	Connected to temp. sensor (Resistor/current type).
34	Fuel level sensor	1.0mm <sup>2</sup>	Connected to fuel level sensor (Resistor/current type).
35	Oil pressure sensor	1.0mm <sup>2</sup>	Connected to oil pressure sensor (Resistor/current/voltage type).
36	Outlet Pressure Sensor Input	1.0mm <sup>2</sup>	Connected to outlet pressure sensor of pump unit (Resistor/current/voltage type).
37	Flexible Sensor 1	1.0mm <sup>2</sup>	User-defined (Resistor/current/voltage type).
38	Flexible Sensor 2	1.0mm <sup>2</sup>	User-defined (Resistor/current/voltage type).
39	DC5V	1.0mm <sup>2</sup>	Supply power for voltage type sensor.
40	Sensor COM	1.0mm <sup>2</sup>	Sensor common port, internal of controller has connected with B-.
41~45	NC	/	/
46	Emergency Stop	0.5 mm <sup>2</sup>	Controller emergency stop the genset if input port is active.
47	Aux. Input 1(A)	0.5 mm <sup>2</sup>	Ground connected is active (B-)
48	Aux. Input 2(B)	0.5 mm <sup>2</sup>	Ground connected is active (B-)

Detailed setting items please to see Table 12.

Detailed setting items please to



No.	Function	Cable Size	Description	
49	Aux. Input 3(C)	0.5 mm <sup>2</sup>	Ground connected is active (B-)	see Table 11.
50	Aux. Input 4(D)	0.5 mm <sup>2</sup>	Ground connected is active (B-)	
51	Aux. Input 5(E)	0.5 mm <sup>2</sup>	Ground connected is active (B-)	
52	Aux. Input COM	0.5 mm <sup>2</sup>	Internal of controller has connected with B-.	
53~56	NC	/	/	
57	RS485-(B)	0.5mm <sup>2</sup>	120Ω impedance shielded wire is recommended to use, and single-end earthed.	
58	RS485+(A)	0.5mm <sup>2</sup>		
59	RS485 Shield	/		
	Link	/	Can realize communicate with PC monitoring software.	

## 7 DEFINITION AND RANGE OF PARAMETERS

### 7.1 PARAMETER CONTENTS AND RANGE

**Table 9 - Parameter Contents and Range**

No.	Items	Parameter	Default	Description
<b>Language Setting</b>				
1	Language	(0-2)	0	0: Simplified Chinese; 1: English; 2: Other
<b>Timers Setting</b>				
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 stop 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.
4	Pre-start Fuel Time	(0-3600)s	1	Fuel relay output time before starter power on.
5	Cranking Time	(3-60)s	8	Time of starter powers up. (If diesel driven pump unit is enabled, this time also can be cranking time of diesel driven pump unit).
6	Crank Rest Time	(3-60)s	10	The waiting time before second power up when engine starts fail. (If diesel driven pump unit is enabled, this time also can be crank rest time of diesel driven pump unit).
7	Safety On Delay	(0-3600)s	10	Alarms for low oil pressure, high temperature, under speed, under frequency/voltage, charge fail are deactivated during "Safety On Delay".
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. (If diesel driven pump unit is enabled, this time also can be stop output time of diesel driven pump unit).
13	Wait for Stop Time	(0-3600)s	0	Time between ending of pump unit idle delay and stopped when "ETS output time" is set



No.	Items	Parameter	Default	Description
				as 0; Time between ending of ETS delay and stopped completely when "ETS output time" is not 0.
14	After Stop Time	(0-3600)s	0	Time between pump unit stopped and standby.
15	Fuel Pre-supply Interval Time	(0-12)h	2	When unit is in standby status and the output port is configured as "Fuel Pre-supply", it is interval time from the pre-supply output is completed to the next pre-supply output. If this time is configured as "0", fuel pre-supply doesn't output in standby status.
16	Fuel Pre-supply Time	(3-30)s	5	It is fuel pre-supply output time if the output port is configured as "Fuel Pre-supply".
<b>Engine Setting</b>				
1	Engine Type	(0-39)	0	Default: Conventional engine (not J1939). When connected to J1939 engine, choose the corresponding type.
2	Flywheel Teeth	(10-300)	118	Tooth number of the engine, for judging of starter separation conditions and inspecting of engine speed. See the following Installation Instruction.
3	Rated Speed	(0-6000)r/min	1500	Offer standard to judge over/under/loading speed.
4	Start Attempts	(1-10)times	3	The maximum start attempts if engine failed to start. When the pre-set number of start attempts has been reached, controller initiates failed to start alarms. (If diesel driven pump unit is enabled, it also can be start attempts of diesel driven pump unit).
5	Crank Disconnect Condition	(0-2)	2	Details please to see Table 14. There are three conditions that can be used separately or together aiming to disconnect starter motor and engine as soon as possible.
6	Disconnect Speed	(0-1000)%	24	Setting value is percentage of rated speed. If speed exceeds the setting point, starter will disconnect. Please to see the following installation instruction.
7	Disconnect Oil Pressure	(0-1000)kPa	200	If oil pressure exceeds the setting point, starter will disconnect.
8	Over Speed Set	(0-1000)%	110	Setting value is percentage of rated speed,





No.	Items	Parameter	Default	Description
	Warning	Value		and return value and delay value can be set.
		Return Value	(0-1000)% 108	
		Delay	(0-3600)s 5	
9	Under Speed Warning	Set Value	(0-1000)% 86	
		Return Value	(0-1000)% 90	
		Delay	(0-3600)s 5	
10	Over Speed Shutdown	Set Value	(0-1000)% 114	Setting value is percentage of rated speed, and return value and delay value can be set.
		Delay	(0-3600)s 2	
11	Under Speed Shutdown	Set Value	(0-1000)% 80	
		Delay	(0-3600)s 3	
12	Loss of Speed Signal Delay	(0-3600)s	5	Time from detecting speed is 0 to confirm the action.
13	Loss of Speed Action	(0-1)	0	0: Warning; 1: Shutdown
14	Battery Voltage Rated	(0-60.0)V	24.0	Provide standard for judgment of over /under voltage.
15	Bat. Over Voltage Warning	Set Value	(0-1000)% 120	Setting value is percentage of rated voltage, and return value and delay value can be set.
		Return Value	(0-1000)% 115	
		Delay	(0-3600)s 60	
16	Bat. Under Voltage Warning	Set Value	(0-1000)% 85	
		Return Value	(0-1000)% 90	
		Delay	(0-3600)s 60	
17	Charge Alt Fail	Set Value	(0-60.0)V 8.0	In normal running, when charger D+ (WL) voltage under this value, charge failure alarms.
		Return Value	(0-60.0)V 10.0	
		Delay	(0-3600)s 10	
18	Engine Idle	(0-100)%	60	Setting value is percentage of rated speed, and speed need to be stabilized at the setting point while in idle running.
19	Suction Pump Crank	(0-2)	0	0: Not used; 1: D-driven Suction Pump; 2: E-driven Suction Pump
20	D-driven Suction Pump Fault Shutdown Delay	(0-3600)s	90	It is time waiting for pressure to suction pump (input port is active).



No.	Items	Parameter	Default	Description
21	E-driven Suction Pump Shutdown Outlet Pressure	(0-1000)kPa	100	It is the value of stopping output crank E-driven suction pump.
<b>Module Setting</b>				
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 remote sensing.
3	Stop Bits	(0-1)	0	0: 2 stop bits; 1: 1 stop bit (PC software setting)
4	Password	(0-65535)	00318	For entering advanced parameters setting. <b>▲CAUTION:</b> Factory default password is "00318", operator can change the password to avoid non-professionals modification. Please keep in mind of the new password, if forget, please contact with factory service personnel.
5	Time and Date			Users can calibrate date and time.
<b>Scheduler and Maintenance Setting</b>				
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
4	Maintenance 2	(0-1)	0	Users can set maintenance time, maintenance due action, time and action of pre-alarm A and pre-alarm B, timer mode and reset maintenance alarm. If maintenance due alarm occurs, users can reset maintenance alarm to remove it. Details please to see Table 15.
5	Maintenance 3	(0-1)	0	
6	Maintenance 4	(0-1)	0	
7	Maintenance 5	(0-1)	0	
<b>Analog Sensors</b>				
Temperature Sensor				
1	Curve Type	(0-15)	9	SGD. See table12.
2	Open Circuit Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No action
3	Display Unit	(0-1)	0	0: °C; 1: °F
4	High Temp. Shutdown	(0~300)°C	98	Shutdown when external sensor temperature is higher than this value. Detecting only after safety delay is over. The delay value can be set.
5	High Temp. Warning	(0~300)°C	95	Warning when external sensor temperature is higher than this value. Detecting only after safety delay is over. The delay value and return value can be set.
6	Low Temp. Warning	(0-300)°C	70	Warning when external sensor temperature is lower than this value. Detecting only after safety delay is over. The delay value and return value can be set.
7	Heater Control	((-50)-300)°C	50	Heater control outputs when external sensor



No.	Items	Parameter	Default	Description
				temperature is lower than this value. The delay value and return value can be set.
8	Cooler Control	((-50)-300)°C	80	Heater control outputs when external sensor temperature is higher than this value. The delay value and return value can be set.
9	Custom Curve			Users should set the corresponding curve when select resistor curve type or current curve type.
<b>Fuel Level Sensor</b>				
1	Curve Type	(0-15)	4	SGD. See table 12.
2	Open Circuit Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No action
3	Display Unit	(0-1)	0	0: %; 1: L
4	Fuel Tank Capacity	(0-10000)L	1000	It is can be set if fuel unit select "L".
5	Low Level Shutdown	(0-1000)%	0	Shutdown when fuel level of external connected sensor is lower than this value. The delay value can be set.
6	Low Level Warning	(0-1000)%	10	Warning when fuel level of external connected sensor is lower than this value. It is detecting all the time. The delay value and return value can be set.
7	Fuel Pump Output	(0-1000)%	10	Fuel pump outputs when fuel level of external connected sensor is lower than this value. The delay value and return value can be set.
8	Custom Curve			Users should set the corresponding curve when select resistor curve type or current curve type.
<b>Engine Oil Pressure Sensor</b>				
1	Curve Type	(0-15)	9	SGD. See table 12.
2	Open Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No action.
3	Display Unit	(0-2)	0	0: kPa; 1: bar; 2: psi;
4	Low Oil Pressure Shutdown	(0-1000)kPa	103	Shutdown when oil pressure of external connected sensor is lower than this value. Detecting only after safety delay is over. The delay value can be set.
5	Low Oil Pressure Warning	(0-1000)kPa	124	Warn oil pressure of external connected sensor is lower than this value. Detecting only after safety delay is over. The delay value and return value can be set.
6	Custom Curve			Users should set the corresponding curve when select resistor curve type or current curve type.
<b>Outlet Pressure Sensor</b>				
1	Curve Type	(0-15)	2	Custom 4-20mA curve. See table 12.



No.	Items	Parameter	Default	Description
2	Open Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No action.
3	Display Unit	(0-3)	0	0: kPa; 1: bar; 2: psi; 3: MPa;
4	High Shutdown	(0-9000)%	120	Shutdown when value of external connected sensor is higher than this value. Alarm enabled or not and delay value can be set.
5	Low Shutdown	(0-9000)%	10	Shutdown when value of external connected sensor is lower than this value. Alarm enabled or not and delay value can be set.
6	High Warning	(0-9000)%	110	Warning when value of external connected sensor is higher than this value. Alarm enabled or not, return value, and delay value can be set.
7	Low Warning	(0-9000)%	20	Warning when value of external connected sensor is lower than this value. Alarm enabled or not, return value, and delay value can be set.
8	Custom Curve			Users should set the corresponding curve when select resistor curve type or current curve type.
9	Rated Outlet Pressure	(0-9000)kPa	1000	Configure the rated working pressure of outlet.
10	Static Pressure	(-9000-9000)kPa	0	Configure the static pressure of outlet.
11	Flow Enable	(0-1)	0	0: Disable; 1: Enable
12	Flow Unit	(0-1)	0	0: m <sup>3</sup> /h; 1:L/s
13	Rated Flow	(0-10000)m <sup>3</sup> /h	1000	Rated working flow of pump unit.
14	Over Flow Warning	(0-1000)%	110	While unit is running, if flow exceeds the setting point, warning alarms will be initiated. Alarm enabled or not, return value, and delay value can be set.
15	Over Flow Shutdown	(0-1000)%	120	While unit is running, if flow exceeds the setting point, shutdown alarms will be initiated. Alarm enabled or not, return value, and delay value can be set.
16	Flow Curve			Different discharge pressures correspond to different flow values.
Flexible Sensor 1~2				
1	Flexible Sensor Setting	(0-7)	0	0: Not used ; 1: Temperature sensor; 2: Pressure Sensor; 3: Fuel level Sensor; 4: Flow sensor; 5: Pipe pressure sensor; 6: Inlet pressure sensor; 7: Water level sensor of tank.
2	Curve Type			It is depends on sensor type.
3	Open Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No action.
4	Display Unit	(0-1)	0	0: °C; 1: °F



No.	Items	Parameter	Default	Description
				<b>NOTE:</b> Different sensor displays different unit.
5	High Shutdown	(0-9000)	0	Shutdown when external sensor value is higher than this value. Alarm enabled or not and delay value can be set.
6	Low Shutdown	(0-9000)	0	Shutdown when external sensor value is lower than this value. Alarm enabled or not and delay value can be set.
7	High Warning	(0-9000)	0	Warn when external sensor value is higher than this value. Alarm enabled or not, return value, and delay value can be set.
8	Low Warning	(0-9000)	0	Warn when external sensor value is lower than this value. Alarm enabled or not, return value, and delay value can be set.
9	Custom Curve			Users should set the corresponding curve when select resistor curve type or current curve type.
<b>Digital Input Ports Setting</b>				
Digital Input Port 1				
1	Contents Setting	(0-53)	28	Remote start. See table 11.
2	Active Type	(0-1)	0	0: Close 1: Open
Digital Input Port 2				
1	Contents Setting	(0-53)	26	High temperature shutdown. See table 11.
2	Active Type	(0-1)	0	0: Close 1: Open
Digital Input Port 3				
1	Contents Setting	(0-53)	27	Low oil pressure shutdown. See table 11.
2	Active Type	(0-1)	0	0: Close 1: Open
Digital Input Port 4				
1	Contents Setting	(0-53)	0	User defined. See table 11.
2	Active Type	(0-1)	0	0: Close 1: Open
3	Arming	(0-3)	2	0: From safety on; 1: From crank; 2: Always; 3: Never.
4	Active Actions	(0-2)	0	0: Warning; 1: Shutdown; 2: Indication.
5	Active Delay	(0-20.0)s	2.0	It is time from detecting input port is active to action confirmation.
6	Input Port Description			User defined.
Digital Input Port 5				
1	Contents Setting	(0-53)	0	User defined. See table 11.
2	Active Type	(0-1)	0	0: Close 1: Open
3	Arming	(0-3)	2	0: From safety on; 1: From crank; 2: Always; 3: Never.
4	Active Actions	(0-2)	1	0: Warning; 1: Shutdown; 2: Indication.
5	Active Delay	(0-20.0)s	2.0	It is time from detecting input port is active to action confirmation.



No.	Items	Parameter	Default	Description
6	Input Port Description			User defined.
<b>Relay Output Ports Setting</b>				
Relay Output Port 1				
1	Contents Setting	(0-239)	1	User defined period output 1. See table 10.
2	Active Type	(0-1)	0	0: Normally open; 1: Normally close
Relay Output Port 2				
1	Contents Setting	(0-239)	35	Idle speed control. See table 10.
2	Active Type	(0-1)	0	0: Normally open; 1: Normally close
Relay Output Port 3				
1	Contents Setting	(0-239)	33	Start relay output. See table 10.
2	Active Type	(0-1)	0	0: Normally open; 1: Normally close
Relay Output Port 4				
1	Contents Setting	(0-239)	34	Fuel relay output. See table 10.
2	Active Type	(0-1)	0	0: Normally open; 1: Normally close
Relay Output Port 5				
1	Contents Setting	(0-239)	38	ETS control. See table 10.
2	Active Type	(0-1)	0	0: Normally open; 1: Normally close
Relay Output Port 6				
1	Contents Setting	(0-239)	48	Common Alarm. See table 10.
2	Active Type	(0-1)	0	0: Normally open; 1: Normally close
<b>Adjust Speed Setting</b>				
1	Adjust Speed Type	(0-2)	0	0: Not used; 1: Relay adjust speed; 2: CAN adjust speed.
2	Output Center: SW1	(0-10.0)	5.0	Default center voltage is 2.5V. Center voltage=set value*0.5.
3	Output Range: SW2	(0-10.0)	2.0	Center voltage range is (-1.5~+1.5)V. Center voltage range=±(set value*0.5+0.5).
4	Speed Gain	(0-1000)%	20	Automatic speed gain control.
5	Speed Control Stability	(0-1000)%	20	Automatic speed control stability.
6	Relay Adjust Speed Dead	(0-10.0)%	1.0	Relay auto adjust speed control.
7	Speed Adjusting Relay Gain	(0-100)%	10	
8	Speed Adjusting Relay Stability	(0.05-1.60)s	0.10	
9	Speed Adjusting Relay Response	(0.25-4.00)	0.5	
10	Adjust Speed Stable Object	(0-3)	0	0: Outlet pressure; 1: Inlet pressure; 2: Engine speed; 3: Manual adjust speed. When the object set as "Inlet pressure", flexible sensor 1 is considered as inlet pressure sensor.



No.	Items	Parameter	Default	Description
11	Inlet Pressure Stable Value	(0-2000)kPa	10	When adjust object is inlet pressure, users need to stabilize the inlet pressure as the pre-set point.
12	Manual Adjust Speed Stepping coefficient	(0-1000)	20	
<b>Alternative Configuration Setting</b>				
Alt. Config. 1				
1	Engine Rated Speed	(0-6000) r/min	1500	Standard for judging over/under/loading speed.
2	Engine Idle Speed	(0-100)%	60	Set value is the percentage of rated speed. When idle running is needed, speed should be stabilized to the set value.
3	Rated Outlet Pressure	(0-9000)kPa	1000	Set the rated work pressure of pump outlet.
4	CAN Adjust Speed Center Point (SW1)	(0-10.0)	5.0	Default center voltage is 2.5V. Center voltage=set value*0.5.
Alt. Config. 2				
1	Engine Rated Speed	(0-6000) r/min	1500	Standard for judging over/under/loading speed.
2	Engine Idle Speed	(0-100)%	60	Set value is the percentage of rated speed. When idle running is needed, speed should be stabilized to the set value.
3	Rated Outlet Pressure	(0-9000)kPa	1000	Set the rated work pressure of pump outlet.
4	CAN Adjust Speed Center Point (SW1)	(0-10.0)	5.0	Default center voltage is 2.5V. Center voltage=set value*0.5.
Alt. Config. 3				
1	Engine Rated Speed	(0-6000) r/min	1500	Standard for judging over/under/loading speed.
2	Engine Idle Speed	(0-100)%	60	Set value is the percentage of rated speed. When idle running is needed, speed should be stabilized to the set value.
3	Rated Outlet Pressure	(0-9000)kPa	1000	Set the rated work pressure of pump outlet.
4	CAN Adjust Speed Center Point (SW1)	(0-10.0)	5.0	Default center voltage is 2.5V. Center voltage=set value*0.5.

## 7.2 DEFINED CONTENTS OF RELAY OUTPUT PORTS 1-6

### 7.2.1 DEFINED CONTENTS TABLE OF RELAY OUTPUT PORTS 1-6

**Table 10 - Defined Contents Table of Relay Output Ports 1-6**

No.	Type	Description
0	Not Used	
1	Custom Period 1	Details of function description please see the following.
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	
13~16	Reserved	
17	Air Flap Control	Action when over speed shutdown and emergence stop alarms occur. It can close the air inflow to stop the engine as soon as possible.
18	Audible Alarm	Action when warning or shutdown alarms occur. It is can connect with an annunciator externally. When "alarm mute" input port is active, the alarm will be prohibit.
19	Louver Control	Action when engine starts up and disconnect after engine stops completely.
20	Fuel Pump Control	It is controlled by fuel pump of level sensor controls upper and lower limits to control its action.
21	Heater Control	It is controlled by heating of temperature sensor controls upper and lower limits to control its action.
22	Cooler Control	It is controlled by cooler of temperature sensor controls upper and lower limits to control its action.
23	Fuel Pre-supply	In standby status, "Fuel Pre-supply" output port is active, it will cycle output based on the "Fuel Pre-supply Interval Time" and "Fuel Pre-supply Time"; if "Fuel Pre-supply Interval Time" is configured as 0, it will not output. Before crank, it will output based on the preset "Fuel Pre-supply Time". If pre-heat time is not configured, it will output in fuel pre-supply stage; If pre-heat time is configured, it will output in pre-heat stage.
24	Reserved	
25	Pre-Lubricate	Actions in period of pre-heating to safety run.
26	Remote Control	This port is controlled by RS485 communication.



No.	Type	Description
27~32	Reserved	
33	Start Relay	Action while engine is starting and disconnect after engine started completely.
34	Fuel Relay	Action while engine is starting and disconnect while waiting for stop.
35	Idle Control	Used for engine which has idles. It closes before starting and opens when enters into warming up status; and it closes during stopping idle process and opens when engine stopped completely. For other status, if idle input is active or idle button been pressed, relay will close and output.
36	Speed Raise Relay	Action in warming up delay, and in normal running process, it is controlled by GOV.
37	Speed Drop Relay	Action between the period from "stop idle" to "wait for stop" and in normal running process, it is controlled by GOV.
38	Energize to Stop	Used for engines with ETS electromagnet. Close when stop idle is over and open when pre-set "ETS delay" is over.
39	Reserved	
40	ECU Stop	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	Normal Running	Close when detects unit is normal running.
45	Reserved	
46	Reserved	
47	Reserved	
48	Common Alarm	Action when pump unit common warning and common shutdown alarms occur.
49	Reserved	
50	Common Shutdown	Action when common shutdown alarms occur.
51	Reserved	
52	Common Warn Alarm	Action when common warning alarms occur.
53	Reserved	
54	Battery High Voltage	Action when battery over voltage warning alarms occur.
55	Battery Low Voltage	Action when battery low voltage warning alarms occur.
56	Charge Alt Fail	Action when charge failure warning alarms occur.
57~59	Reserved	
60	ECU Warning	Indicate ECU sends a warning signal.
61	ECU Shutdown	Indicate ECU sends a shutdown signal.
62	ECU Communicate Fail	Indicate controller cannot communicate with ECU.
63	Reserved	
64	Reserved	

No.	Type	Description
65	Diesel Driven Pump Start	When suction pump type set as "D-driven Suction Pump", "Diesel Driven Pump Start" outputs.
66	Diesel Driven Pump Stop	When suction pump type set as "D-driven Suction Pump", "Diesel Driven Pump Stop" outputs.
67	Electric Driven Pump Start	When suction pump type set as "E-driven Suction Pump", it is output when electric driven suction pump starts and stops output when electric driven suction pump closes down.
68	Reserved	
69	Digital Input 1 Active	Action when input port 1 is active.
70	Digital Input 2 Active	Action when input port 2 is active.
71	Digital Input 3 Active	Action when input port 3 is active.
72	Digital Input 4 Active	Action when input port 4 is active.
73	Digital Input 5 Active	Action when input port 5 is active.
74~98	Reserved	
99	Emergency Stop	Action when emergency stop alarms occur.
100	Fail to Start	Action when failed start alarms occur.
101	Fail to Stop	Action when failed stop alarms occur.
102	Engine Under Speed Warning	Action when under speed alarms occur
103	Engine Under Speed Shutdown	Action when under speed shutdown alarms occur.
104	Engine Over Speed Warning	Action when over speed warning alarms occur.
105	Engine Over Speed Shutdown	Action when over speed shutdown alarms occur.
106~135	Reserved	
136	Bypass Control	
137	Reserved	
138	Reserved	
139	Engine High Temp Warn	Action when high temperature warning alarms occur.
140	Engine Low Temp Warn	Action when low temperature warning alarms occur.
141	Engine High Temp Shutdown	Action when hi-temperature Shutdown alarms occur.
142	Reserved	
143	Engine Low Fuel Level Warning	Action when low fuel level warning alarms occur.
144	Reserved	
145	Reserved	
146	Reserved	
147	Engine Low Oil Pressure Warning	Action when low oil pressure warning alarms occur.
148	Engine Low Oil Pressure Shutdown	Action when low oil pressure shutdown alarms occur.
149	Engine Oil pressure Open	Action when low oil pressure sensor is open circuit.

No.	Type	Description
150	Reserved	
151	Over Flow Shutdown	Action when over flow shutdown alarms occur.
152	Over Flow Warning	Action when over flow warning alarms occur.
153	Outlet Pressure High Warning	Action when outlet pressure high warning alarms occur.
154	Outlet Pressure Low Warning	Action when outlet pressure low warning alarms occur.
155	Outlet Pressure High Shutdown	Action when outlet pressure high shutdown alarms occur.
156	Outlet Pressure Low Shutdown	Action when outlet pressure low shutdown alarms occur.
157	Flexible Sensor 1 High Warning	Action when flexible sensor 1 high warning alarms occur.
158	Flexible Sensor 1 Low Warning	Action when flexible sensor 1 low warning alarms occur.
159	Flexible Sensor 1 High Shutdown	Action when flexible sensor 1 high shutdown alarms occur.
160	Flexible Sensor 1 Low Shutdown	Action when flexible sensor 1 low shutdown alarms occur.
161	Flexible Sensor 2 High Warning	Action when flexible sensor 2 high warning alarms occur.
162	Flexible Sensor 2 Low Warning	Action when flexible sensor 2 low warning alarms occur.
163	Flexible Sensor 2 High Shutdown	Action when flexible sensor 2 high shutdown alarms occur.
164	Flexible Sensor 2 Low Shutdown	Action when flexible sensor 2 low shutdown alarms occur.
165~229	Reserved	
230	System In Stop Mode	Action when system is in stop mode.
231	System In Manual Mode	Action when system is in manual mode.
232	Reserved	Reserved
233	System In Auto Mode	Action when system is in auto mode.
234~239	Reserved	

### 7.2.2 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 delay time and output time both 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: output port 1 is active

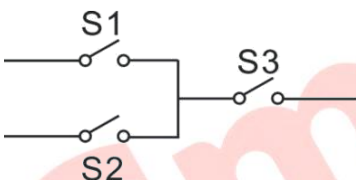
Close when condition output active/inactive: close when active (disconnect when inactive);

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

Output port 1 inactive, defined output period is not outputting

### 7.2.3 CUSTOM COMBINED OUTPUT

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



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

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

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

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

Contents of "or" condition output S1: output 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, output 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: output 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.

### 7.3 DEFINED CONTENTS OF DIGITAL INPUT PORTS

**Table 11 - Defined Contents of Digital Input Ports**

No.	Type	Description
0	Users Configured	Including following functions, Indication: indicate only, not warning or shutdown. Warning: warning only, not shutdown. Shutdown: alarm and shutdown immediately Never: input inactive. Always: input is active all the time. From crank: detecting as soon as start. From safety on: detecting after safety on run delay.
1	Reserved	
2	Alarm Mute	Can prohibit "Audible Alarm" output when input is active.
3	Alarm Reset	Can reset shutdown alarm when input is active.
4	Reserved	
5	Lamp Test	All LED indicators are illuminating when input is active.
6	Panel Lock	When input is active, all buttons are inactive except for UP, CONFIRM and DOWN keys. Users can configure language, check event logs and controller information, but cannot set parameters. At the lower right corner of the screen displays  .
7	Crank Success Input	When input is active, which means engine starts successfully, crank disconnect conditions (engine speed, oil pressure) are inactive.
8	Idle Speed Active	Unit enters into idle speed mode if input is active.
9	Auto Stop Inhibit	In <b>Auto</b> mode, when input is active after engine is normal running, pump unit automatic stop is inhibiting.
10	Auto Start Inhibit	In <b>Auto</b> mode, when input is active, pump unit automatic start is inhibit.
11	Scheduled Run Inhibit	In <b>Auto</b> mode, inhibit pump unit scheduled run when input is active.
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	
16	Reserved	
17	Reserved	
18	Diesel driven pump unit started	When input port is active, it is means diesel driven suction pump unit has started successfully.
19	Pressure to Suction Pump	When input is active, it is means pressure has arrived to suction pump.
20	Water Blast Gun Input	When this input is active while unit is normal running, bypass-valve outputs (if output port is configured).
21	Alarm Stop Inhibit	All alarms are inhibited except for alarm of emergency stop. (Battle Mode)
22	Instrument Mode	All outputs are inhibited in this mode.
23	Reserved	



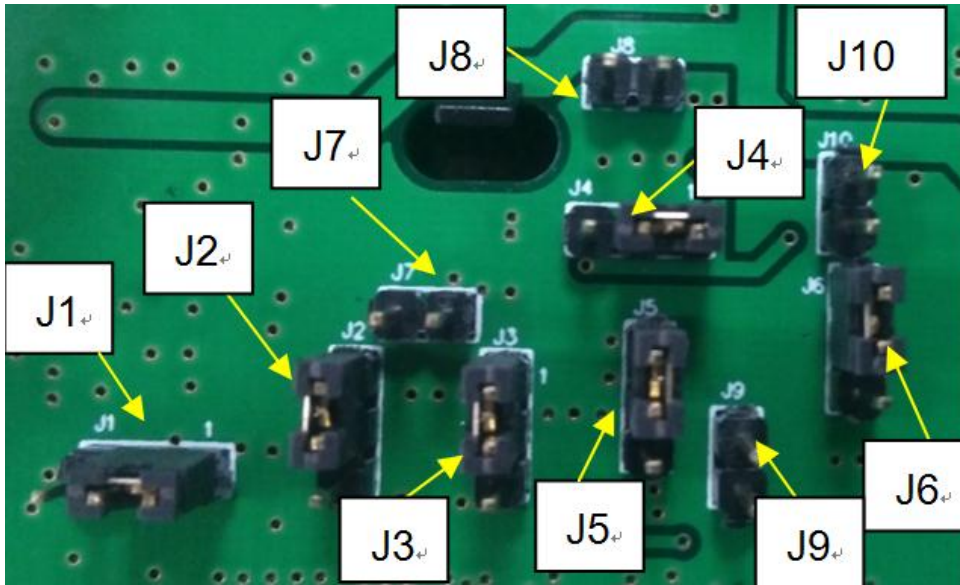
No.	Type	Description
24	Reset Maintenance	When this input is active, controller will reset maintenance time 1 as preset value.
25	External Charge Fail Input	When this input is active, controller will initiate charge fail warning alarms.
26	High Temperature Shutdown	Connect to sensor digital input port.
27	Low Oil Pressure Shutdown	Connect to sensor digital input port.
28	Remote Start	When this input is active in auto mode, pump unit can be started automatically.
29	Remote Stop	When this input is active in auto mode (remote start is deactivated), pump unit can stop automatically.
30	High Water Level Input	When this input is active in auto mode, pump unit can be started automatically (drain flood).
31	Low Water Level Input	When this input is active in auto mode ("High Level of Water Tank" input is deactivated), pump unit can be stopped automatically (drain flood).
32	Manual Start Input	In manual mode, when this input is active, pump unit can start automatically; When this input is deactivated, pump unit can stop automatically.
33	Reserved	
34	Simulated Stop Key	An external button can be connected (not self-lock), and simulated panel key is pressed.
35	Simulated Manual Key	
36	Simulated Auto Key	
37	Simulated Start Key	
38	Simulated Idle Key	
39	Reserved	
40	Reserved	
41	Reserved	
42	Alt. Config. 1 Active	When input is active, alternative configuration is active. It can set different parameters, make convenience for user to select current configuration via input port only.
43	Alt. Config. 2 Active	
44	Alt. Config. 3 Active	
45~51	Reserved	
52	Raise Speed	An external button can be connected (not self-lock), and manual control speed regulation.
53	Drop Speed	

## 7.4 SELECTION OF SENSORS

**Table 12 - Sensors Selection**

No.		Description	Remark
1	Temperature Sensor	0 Not used 1 Custom Res Curve 2 Custom 4-20mA curve 3 Custom Volt Curve 4 VDO 5 CURTIS 6 VOLVO-EC 7 DATCON 8 SGX 9 SGD 10 SGH 11 PT100 12 Voltage Type (0.5V-4.5V) 13-15 Reserved	Defined resistance's range is (0~1)KΩ, default is SGD sensor.
2	Fuel Level Sensor	0 Not used 1 Custom Res Curve 2 Custom 4-20mA curve 3 Custom Volt Curve 4 SGD 5 SGH 6 Voltage Type (0.5V-4.5V) 7-15 Reserved	Defined resistance's range is (0~1)KΩ, default is SGD sensor.
3	Pressure Sensor	0 Not used 1 Custom Res Curve 2 Custom 4-20mA curve 3 Custom Volt Curve 4 VDO 10bar 5 CURTIS 6 VOLVO-EC 7 DATCON 10bar 8 SGX 9 SGD 10 SGH 11 Voltage Type (0.5V-4.5V) 12~15 Reserved	Defined resistance's range is (0~1)KΩ, default is SGD sensor.
4	Flow Sensor	0 Not used 1 Custom Res Curve 2 Custom 4-20mA curve 3 Custom Volt Curve 4-15 Reserved	

**NOTE:** User should open the shell of controller to change the jumper plug if your pump unit fitted with 4~20mA sensor or voltage sensor.



**Fig.3 - Jumper Plug Transition Diagram**

**Table 13 - Sensor Type Conversion**

Sensor Name	Jumper Hat	Reistor-type (Jumper)	Voltage-type (Jumper)	Current-type (Jumper)
Temp. Sensor	Corresponding to J1	Jumper plug to J1's No.1 and No.2 terminals	/	Jumper plug to J1's No.2 and No.3 terminals
Fuel Level Sensor	Corresponding to J2	Jumper plug to J2's No.1 and No.2 terminals	/	Jumper plug to J2's No.2 and No.3 terminals
Oil Pressure Sensor	Corresponding to J3 and J7	Jumper plug to J3's No.1 and No.2 terminals	Jumper plug to J7.	Jumper plug to J3's No.2 and No.3 terminals
Outlet Pressure Sensor	Corresponding to J4 and J8	Jumper plug to J4's No.1 and No.2 terminals	Jumper plug to J8.	Jumper plug to J4's No.2 and No.3 terminals
Flexible Sensor 1	Corresponding to J5 and J9	Jumper plug to J5's No.1 and No.2 terminals	Jumper plug to J9.	Jumper plug to J5's No.2 and No.3 terminals
Flexible Sensor 2	Corresponding to J6 and J10	Jumper plug to J6's No.1 and No.2 terminals	Jumper plug to J10.	Jumper plug to J6's No.2 and No.3 terminals



## 7.5 CONDITIONS OF CRANK DISCONNECT SELECTION

**Table 14 - Crank Disconnect Conditions Selection**

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

**NOTE:**


- There are 3 conditions to make starter disconnected with engine. Engine speed sensor and oil pressure both can be used separately. We recommend that oil pressure should be using with engine speed sensor together, in order to make the starter motor is separated with engine immediately and can check crank disconnect exactly.
- Engine speed sensor is the magnetic equipment which be installed in starter for detecting flywheel teeth.
- 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.
- If pump unit without engine speed sensor, please don't select corresponding items, otherwise, "start fail" or "loss speed signal" maybe caused.
- If unit without oil pressure sensor, please don't select corresponding items.

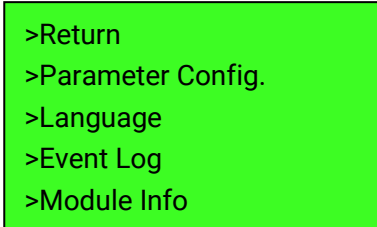
## 7.6 MAINTENANCE SETTING

**Table 15 - Maintenance Settings**

Items	Content	Description
Enable Select	0: Disable; 1: Enable	Used for setting the current maintenance function.
Maintenance Interval	(0-30000)h	It is time interval between enabled maintenance to need to maintenance.
Maintenance Due Action	0: No Action; 1: Warning; 2: Shutdown; 3: Indication.	They are the alarm action types when the maintenance time is due.
Pre-alarm A Time	(0-30000)h	Maintenance remaining time.
Pre-alarm A Action	Similar to "Maintenance Due Action"	They are the alarm action types when the maintenance remaining time is reaching pre-alarm A time.
Pre-alarm B Time	(0-30000)h	Maintenance remaining time.
Pre-alarm B Action	Similar to "Maintenance Due Action"	They are the alarm action types when the maintenance remaining time is reaching pre-alarm B time.
Maintenance Clock	0: Running Time; 1: Real Time Clock	It is the timing pattern of maintenance.
Reset Maintenance		Reset maintenance time after the maintenance completed.
Maintenance Description		The maintenance names are user-set. E.g. Change oil.

## 8 PARAMETERS SETTING











After controller is powered up, hold and press  for 3s to enter into "Parameter Config." menu, and menu items are as follows,



Select "Parameter Config." item to enter into parameters setting screen after entering the correct password (default 00318).

Detailed parameters setting method is as below,

Parameter Config. >Return <b>&gt;Timers</b> >Engine >Module	Screen 1: Use  ,  to scroll settings,  to enter settings (Screen 2), and press  to go back. Choose "Return" and press "Confirm" key to return to the previous level.
Timers >Return <b>&gt;Start Delay</b> >Stop Delay >Preheat Delay	Screen 2: Use  ,  to scroll settings,  to enter settings (Screen 3), and press  to go back (Screen 1). Choose "Return" and press "Confirm" key to return to the previous level (Screen 1).
Start Delay 0000  s	Screen 3: Pressing  to shift cursor to select the digit that to be configured, and change the digit through pressing  or  . After the parameter is setting completed, press  to save it, and then press "Down" key to return to the previous level (Screen 2).
Timers >Return >Start Delay <b>&gt;Stop Delay</b> >Preheat Delay	Screen 4: Pressing  to select target item, and the setting method is the same as Screen 2 and Screen 3.
Over Shutdown <b>Enable Choose: Enable</b> SetVal: +00098 DelayVal: 00003s	Screen 5: Setting sensor shutdown parameters. Choose "Over Shutdown Setting" and press  enters into parameter setting page. Then press  again, controller displays interface of screen 5. Pressing  or  to select the item that need to be configured, and pressing  to save it, meanwhile, cursor shifts down and

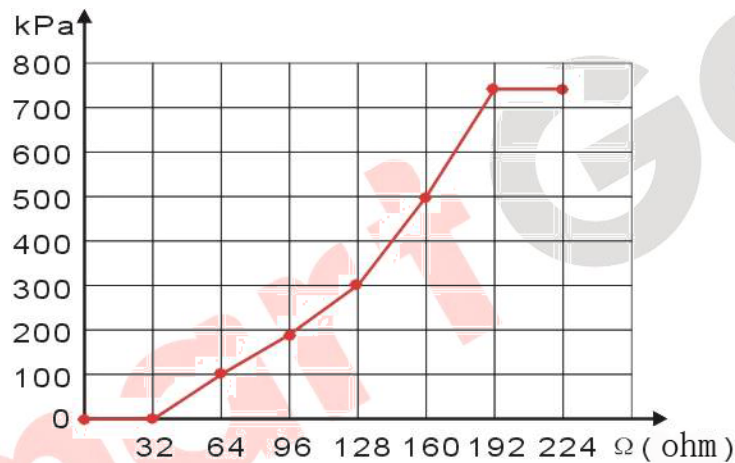
	controller displays screen 6 as below.
<p>Over Shutdown          Enable Choose: Enable          SetVal: <b>+</b>00098          DelayVal: 00003s</p>	<p>Screen 6: Pressing  or  to change "+" or "-" of the parameter.          Pressing  to continue setting the next digit until all digits are set completed. Then pressing  enters into delay value setting, If it doesn't need to change, press  to return to the previous level.</p>
<p>Show Unit          0: %</p>	<p>Screen 7: Fuel level setting. Select fuel level sensor setting item and enter into "Show Unit" setting, and then Press  to change the unit. If unit select "1: L", screen 8 will be displayed.</p>
<p>Show Unit          1: L          Fuel Tank Capacity 01000</p>	<p>Screen 8: pressing  after screen 8 is displayed, cursor will shift to digit of fuel tank capacity setting. Users can change parameters via pressing  or , and press  to save it.</p>

**NOTE:**

- Please change the controller parameters when engine is in standby mode only (e. g. Crank disconnect conditions selection, digital input, digital output, various delays), otherwise, shutdown and other abnormal conditions may occur.
- Maximum set value must over minimum set value in case that the condition of too high as well as too low will happen.
- When setting the warning alarms, please set the correct return values; otherwise, abnormal alarms may occur. When setting the maximum value, the return value must less than set value; when setting the minimum value, the return value must over than set value.
- Digital input could not be set as the same items; otherwise, the functions cannot work efficiently. However, the digital output can be set as the same items.

## 9 SENSOR SETTING

- When reselect sensors, the sensor curve will be transferred into the standard value. For example, if temperature sensor is SGD (120°C resistor type), its sensor curve is SGD (120°C resistor type); if select the SGX (120°C resistor type), the temperature sensor curve is SGX curve.
- When there is difference between standard sensor curves and using sensor, user can adjust it in “curve type”.
- When input the sensor curve, X value (resistor) must be input from small to large, otherwise, mistake occurs.
- If select sensor type as “None”, sensor curve is not working.
- If there is alarm switch only for the select sensor, user must set the sensor as “None”, otherwise, maybe shutdown or warning occurs.
- The headmost or backmost values in the vertical coordinates can be set as same as below,



**Fig. 4 - Curve Setting**

**Table 16 - Common Pressure Unit Conversion Table**

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

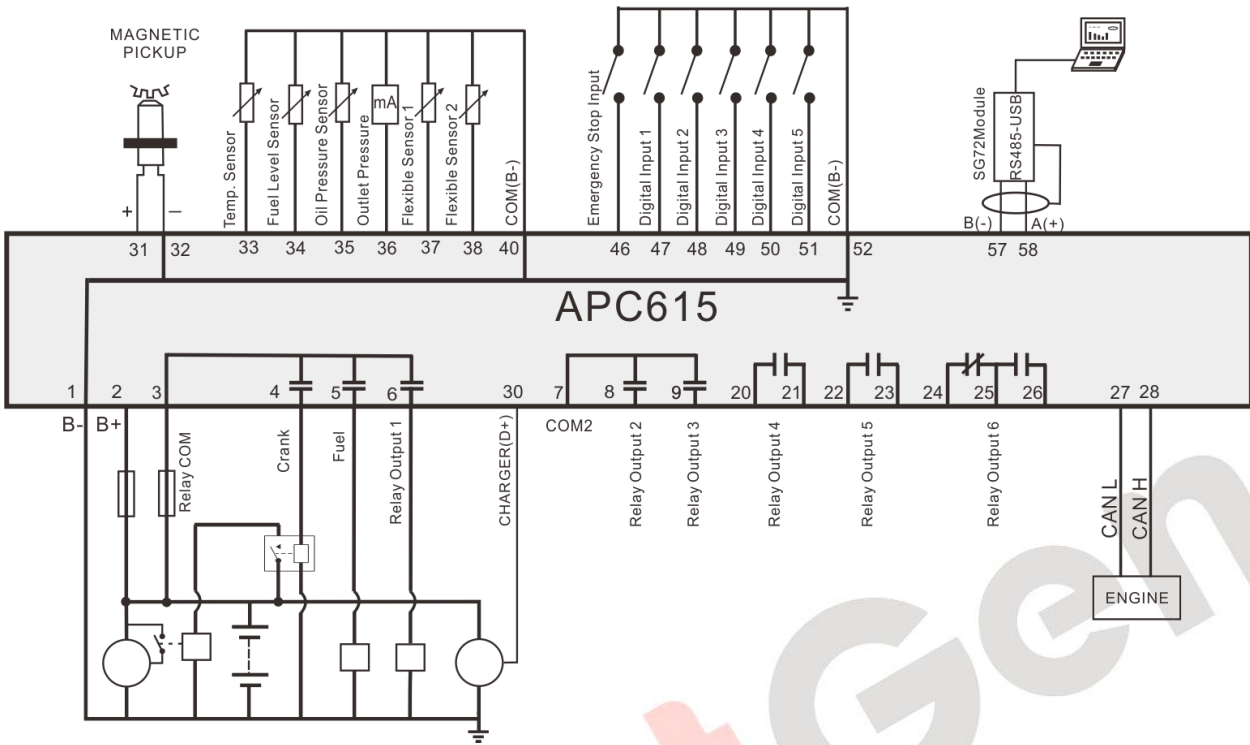
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## 10 COMMISSIONING

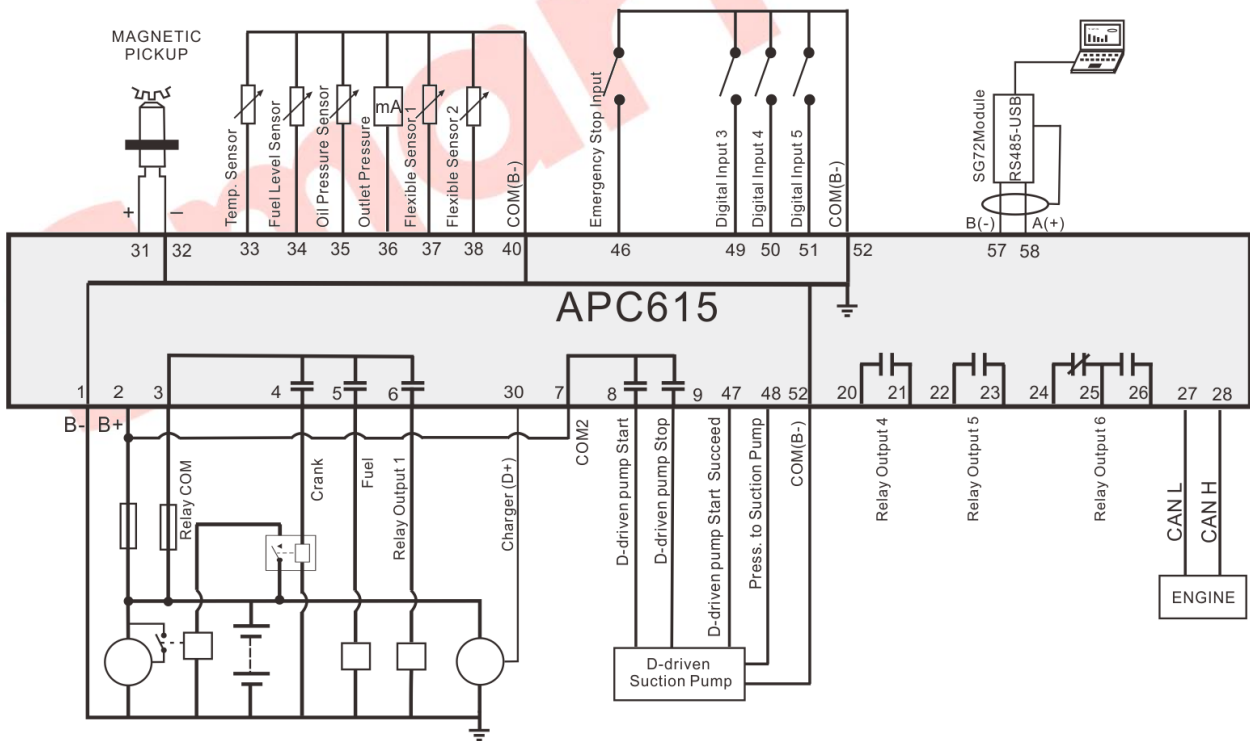
Please make sure the following checks are made before commissioning,

- a) Ensure all the connections are correct and wires diameter is suitable;
- b) Ensure that the controller DC power has fuse, controller's positive and negative connected to starting battery correctly;
- c) Take proper action to prevent engine to crank success (e. g. Remove the connection wire of fuel valve). If checking is OK, make the start battery power on; choose manual mode and controller will executive routine;
- d) Set controller under manual mode, press "start" button, engine will start. After the cranking times as setting, controller will send signal of start failure; then press "Stop" to reset controller;
- e) Recover the action to prevent engine to crank success (e. g. Connect wire of fuel valve), press start button again, engine will start. If everything goes well, engine will normally run after idle running (if idle run be set). During this time, please watch for engine's running situations;
- f) If there is any other question, please contact SmartGen's service.

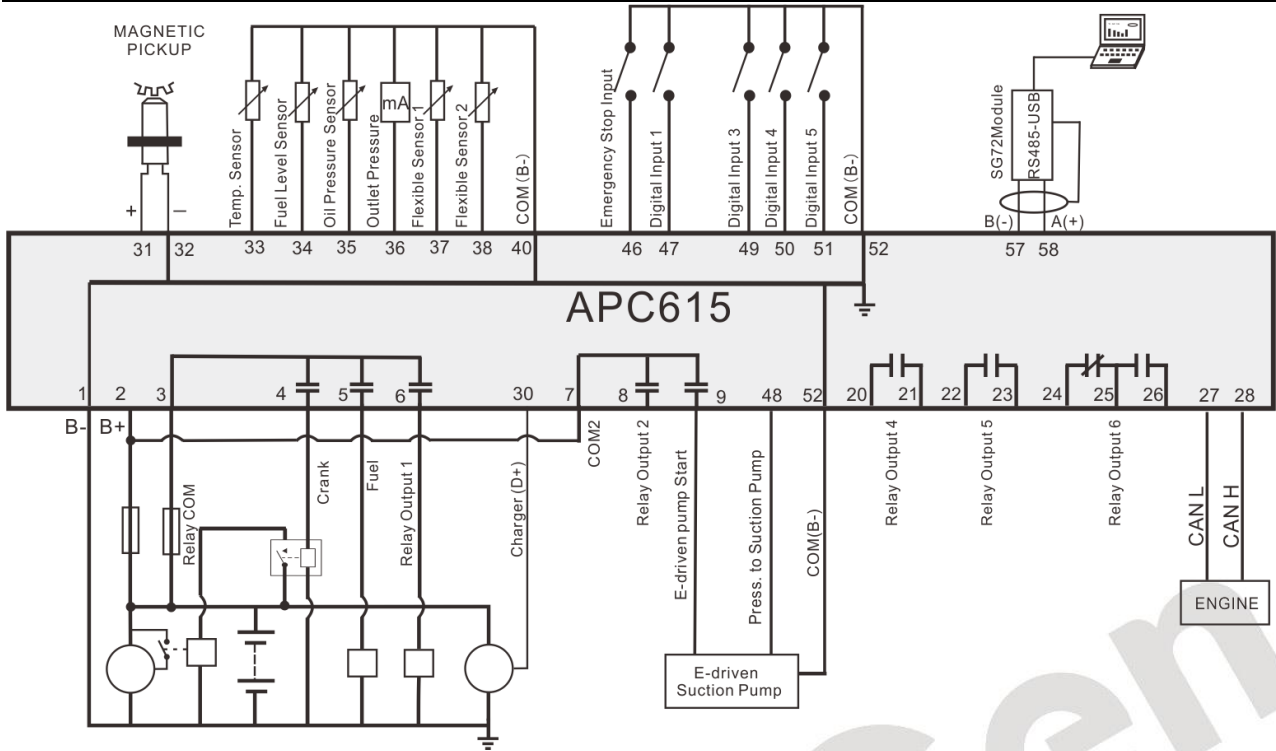
## 11 TYPICAL APPLICATION



**Fig. 5 - APC615 Typical Application Diagram**



**Fig. 6 - Typical Application with Diesel Driven Suction Pump**



**Fig. 7 - Typical Application with Electric Driven Suction Pump**



## 12 INSTALLATION

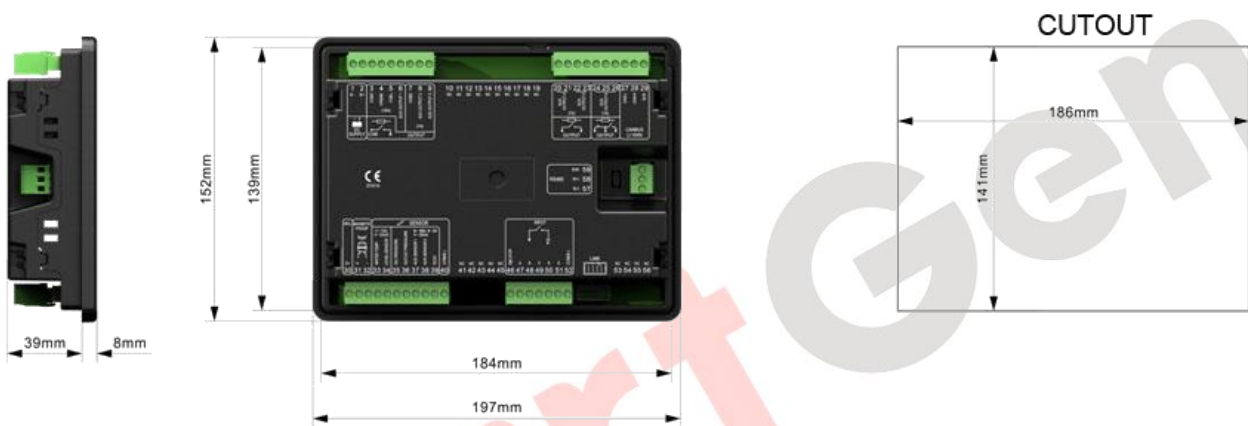
### 12.1 FIXING CLIPS

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

- Withdraw the fixing clip screw (turn anticlockwise) until it reaches proper position.
- Pull the fixing clip backwards (towards the back of the module) ensuring four clips are inside their allotted slots.
- Turn the fixing clip screws clockwise until they are fixed on the panel.

**▲NOTE:** Care should be taken not to over tighten the screws of fixing clips.

### 12.2 OVERALL DIMENSION



**Fig. 8 - Overall & Cutout Dimensions**

#### — **Battery Voltage Input**

APC615 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<sup>2</sup>. 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.

#### — **Speed Sensor Input**

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 No. 32 terminal of controller while another side is hanging in air. The else two signal wires are connected to No. 31 and No. 32 terminals of controller. The output voltage of speed sensor should be within AC(1~24)V (effective value) during the full speed. AC12V is recommended (in 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.

---

— **Output and Expansion Relay**

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.

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## 13 CONNECTIONS OF CONTROLLER WITH J1939 ENGINE

### 13.1 CUMMINS ISB/ISBE

**Table 17 - Connector B**

Terminals of controller	Connector B	Remark
Fuel relay output	39	
Starting relay output	-	Connect with starter coil directly.
Auxiliary output 1	Expand 30A relay, battery voltage of 01, 07, 12, 13 is supplied by relay.	ECU power; Auxiliary output 1 configured as "ECU power".

**Table 18 - 9 Pins Connector**

Terminals of controller	9 pins connector	Remark
-	SAE J1939 shield	CAN communication shielding wire (connect to ECU terminal only).
CAN(H)	SAE J1939 signal	Using 120Ω impedance connecting wire.
CAN(L)	SAE J1939 return	Using 120Ω impedance connecting wire.

**Engine type: Cummins ISB.**

### 13.2 CUMMINS QSL9

Suitable for CM850 engine control module.

**Table 19 - 50 Pins Connector**

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

**Table 20 - 9 Pins Connector**

Terminals of controller	9 pins connector	Remark
-	SAE J1939 shield-E	CAN communication shielding wire (connect to ECU terminal only).
CAN(H)	SAE J1939 signal-C	Using 120Ω impedance connecting wire.
CAN(L)	SAE J1939 return-D	Using 120Ω impedance connecting wire.

**Engine type: Cummins-CM850.**

### 13.3 CUMMINS QSM11

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

**Table 21 - 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 22 - 3 Pins Data Link Connector**

Terminals of controller	3 pins data link connector	Remark
-	C	CAN communication shielding wire (connect to ECU terminal only).
CAN(H)	A	Using 120Ω impedance connecting wire.
CAN(L)	B	Using 120Ω impedance connecting wire.

**Engine type: Cummins ISB.**

#### 13.4 CUMMINS QSX15-CM570

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

**Table 23 - 50 Pins Connector**

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

**Table 24 - 9 Pins Connector**

Terminals of controller	9 pins connector	Remark
-	SAE J1939 shield-E	CAN communication shielding wire (connect to ECU terminal only).
CAN(H)	SAE J1939 signal-C	Using 120Ω impedance connecting wire.
CAN(L)	SAE J1939 return-D	Using 120Ω impedance connecting wire.

**Engine type: Cummins QSX15-CM570.**

#### 13.5 CUMMINS GCS-MODBUS

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

**Table 25 - D-SUB Connector 06**

Terminals of controller	D-SUB connector 06	Remark
Fuel relay output	5&8	Outside expand relay, when fuel output, making port 5 and 8 of the connector 06 be connected.
Starting relay output	-	Connect to starter coil directly.

**Table 26 - D-SUB Connector 06**

Terminals of controller	D-SUB connector 06	Remark
-	20	Communication shielding wire (connect to ECU terminal only).
RS485+	21	Using 120Ω impedance connecting wire.
RS485-	18	Using 120Ω impedance connecting wire.

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

### 13.6 CUMMINS QSM11

**Table 27 - Engine OEM Connector**

Terminals of controller	OEM connector of engine	Remark
Fuel relay output	38	
Starting relay output	-	Connect with starter coil directly.
CAN(H)	46	Using 120Ω impedance connecting wire.
CAN(L)	37	Using 120Ω impedance connecting wire.

**Engine type: common J1939.**

### 13.7 CUMMINS QSZ13

**Table 28 - Engine OEM Connector**

Terminals of controller	OEM connector of engine	Remark
Fuel relay output	45	
Starting relay output	-	Connect to starter coil directly.
Auxiliary output 1	16&41	Setting to idle speed control, normally close output. Making 16 connect to 41 during high-speed running of controller via external expansion relay.
Auxiliary 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(H)	1	Using 120Ω impedance connecting wire.
CAN(L)	21	Using 120Ω impedance connecting wire.

**Engine type: QSZ13, speed regulation can be implemented.**

### 13.8 DETROIT DIESEL DDEC III / IV

**Table 29 - 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(H)	CAN(H)	Using 120Ω impedance connecting wire.
CAN(L)	CAN(L)	Using 120Ω impedance connecting wire.

**Engine type: Common J1939.**

### 13.9 DEUTZ EMR2

**Table 30 - F Connector**

Terminals of controller	F connector	Remark
Fuel relay output	Expand 30A relay, battery voltage of 14 is supplied by relay. Fuse is 16A.	
Starting relay output	-	Connect to starter coil directly.
-	1	Connect to battery negative pole.
CAN(H)	12	Using 120Ω impedance connecting wire.
CAN(L)	13	Using 120Ω impedance connecting wire.

**Engine type: VolvoEDC4.**

### 13.10 JOHN DEERE

**Table 31 - 21 Pins Connector**

Terminals of controller	21 pins connector	Remark
Fuel relay output	G, J	
Starting relay output	D	
CAN(H)	V	Using 120Ω impedance connecting wire.
CAN(L)	U	Using 120Ω impedance connecting wire.

**Engine type: John Deere.**

### 13.11 MTU MDEC

Suitable for MTU engines, 2000 series, 4000 series.

**Table 32 - X1 Connector**

Terminals of controller	X1 connector	Remark
Fuel relay output	BE1	
Starting relay output	BE9	
-	E	Communication shielding wire (connect to ECU terminal only).
CAN(H)	G	Using 120Ω impedance connecting wire.
CAN(L)	F	Using 120Ω impedance connecting wire.

**Engine type: MTU-MDEC-303.**

### 13.12 MTU ADEC (SMART MODULE)

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

**Table 33 - 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 34 - SMART (X4 Port)**

Terminals of controller	SMART (X4 port)	Remark
CAN(H)	X4 1	Using 120Ω impedance connecting wire.
CAN(L)	X4 2	Using 120Ω impedance connecting wire.

**Engine type: MTU-ADEC.**

### 13.13 MTU ADEC (SAM MODULE)

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

**Table 35 - 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 36 - SAM (X23 Port)**

Terminals of controller	ADEC (X23 port)	Remark
CAN(H)	X23 2	Using 120Ω impedance connecting wire.
CAN(L)	X23 1	Using 120Ω impedance connecting wire.

**Engine type: Common J1939.**

### 13.14 PERKINS

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

**Table 37 - Connector**

Terminals of controller	Connector	Remark
Fuel relay output	1, 10, 15, 33, 34	
Starting relay output	-	Connect to starter coil directly.
CAN(H)	31	Using 120Ω impedance connecting wire.
CAN(L)	32	Using 120Ω impedance connecting wire.

**Engine type: Perkins.**

### 13.15 SCANIA

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

**Table 38 - B1 Connector**

Terminals of controller	B1 connector	Remark
Fuel relay output	3	
Starting relay output	-	Connect to starter coil directly.
CAN(H)	9	Using 120Ω impedance connecting wire.
CAN(L)	10	Using 120Ω impedance connecting wire.

**Engine type: Scania.**

### 13.16 VOLVO EDC3

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

**Table 39 - "Stand alone" Connector**

Terminals of controller	"Stand alone" connector	Remark
Fuel relay output	H	
Starting relay output	E	
Auxiliary output 1	P	ECU power; Auxiliary output 1 configured as "ECU power".

**Table 40 - "Data bus" Connector**

Terminals of controller	"Stand alone" connector	Remark
CAN(H)	1	Using 120Ω impedance connecting wire.
CAN(L)	2	Using 120Ω impedance connecting wire.

**Engine type: Volvo.**

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



### 13.17 VOLVO EDC4

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

**Table 41 - Connector**

Terminals of controller	Connector	Remark
Fuel relay output	Expanded 30A relay, and relay offers battery voltage for terminal 14. Fuse is 16A.	
Starting relay output	-	Connect to starter coil directly.
	1	Connected to negative of battery.
CAN(H)	12	Using 120Ω impedance connecting wire.
CAN(L)	13	Using 120Ω impedance connecting wire.

**Engine type: VolvoEDC4.**

### 13.18 VOLVO-EMS2

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

**Table 42 - Engine CAN Port**

Terminals of controller	Engine's CAN port	Remark
Auxiliary output 1	6	ECU stop; Auxiliary output 1 configured as "ECU stop".
Auxiliary output 2	5	ECU power; Auxiliary output 2 configured as "ECU power".
	3	Negative power.
	4	Positive power.
CAN(H)	1(Hi)	Using 120Ω impedance connecting wire.
CAN(L)	2(Lo)	Using 120Ω impedance connecting wire.

**Engine type: Volvo-EMS2,** speed regulation can be implemented.

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

### 13.19 YUCHAI

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

**Table 43 - Engine 42 Pins 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(H)	1.35	Using 120Ω impedance connecting wire.
CAN(L)	1.34	Using 120Ω impedance connecting wire.

**Table 44 - Engine 2 Pins Port**

Battery	Engine 2 pins port	Remark
Battery Negative	1	Wire diameter is 2.5mm <sup>2</sup> .
Battery Positive	2	Wire diameter is 2.5mm <sup>2</sup> .

**Engine type: BOSCH**, speed regulation can be implemented.

### 13.20 WEICHAH

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

**Table 45 - Engine Port**

Terminals of controller	Engine port	Remark
Fuel relay output	1.40	Connect to engine ignition lock
Starting relay output	1.61	
CAN(H)	1.35	Using 120Ω impedance connecting wire.
CAN(L)	1.34	Using 120Ω impedance connecting wire.

**Engine type: GTSC1**, speed regulation can be implemented.

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

## 14 TROUBLESHOOTING

**Table 46 - Troubleshooting**

Symptoms	Possible Solutions
Controller no response with power.	Check starting batteries; Check 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 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 communication fail	Check connections; Check setting of COM port is correct or not; 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 communication fail	Check connections of CAN high and low polarity; Check if correctly connected of 120Ω resistor; 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.

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**15 PACKING LIST****Table 47 - Packing List**

No.	Name	Quantity	Remark
1	Controller	1	
2	Fixing Clips	4	
3	120Ω Resistor	2	
4	Certification	1	
5	Installation Instruction	1	