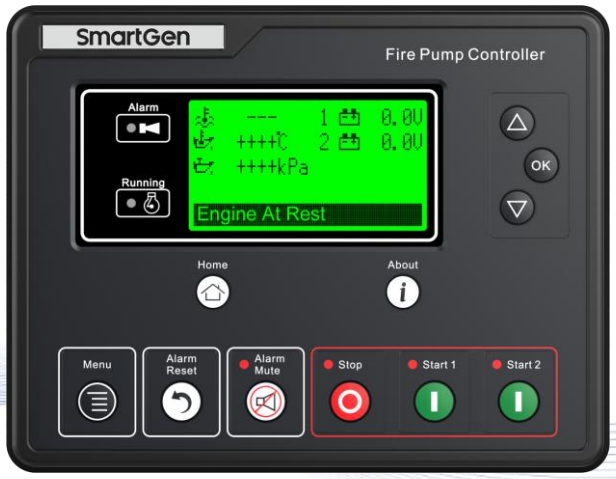
SmartGen

MAKING CONTROL SMARTER

FPC615

FIRE PUMP CONTROLLER

USER MANUAL



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SMARTGEN(ZHENGZHOU)TECHNOLOGY CO.,LTD.

SmartGen 众智 **Chinese trademark**

SmartGen **English trademark**

SmartGen — make your generator ***smart***

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Table 1- Software Version

Date	Version	Content
2017-12-07	1.0	Original release.
2018-02-02	1.1	Added "Auto Mode"; Added two transistor output ports; Modified schematic description and terminal drawing illustration.
2022-11-15	1.2	Modified some translations; Updated the manual format and logo of SmartGen.

This user manual only suits for FPC615 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.

CONTENT

1 OVERVIEW

FPC615 Fire Pump Controller designed for controlling of fire pump unit. It fits with auto/manual mode transfer function, which can start unit automatically via remote input signals in auto mode as well as manual start unit via pressing start key on the front panel of the controller. It is able to monitor voltage status of two battery packs and simultaneous collect sensor and digital signals of the unit to monitor genset running status. Moreover, based on the user-defined data protection threshold, controller can initiate warning or shutdown alarms and corresponding information will be displayed on LCD of the controller to realize the intelligent protection for genset.

2 PERFORMANCE AND CHARACTERISTICS

Main characteristics are as follows,

- 132x64 pixel LCD with backlight, graphic screen with visualized display and easy operation;
- Improved LCD wear-resistance and scratch resistance due to hard screen acrylic;
- Silicon panel and pushbuttons for better operation in high/low temperature environment;
- Detection function of engine speed;
- 3 analog sensors (water temperature sensor, oil pressure sensor and water temperature sensor);
- 2 voltage sampling points of battery packs and 1 voltage sampling points of battery charger;
- 3 programmable digital input ports;
- 8 fixed relay output ports (start 1, start 2, stop, running, over speed, high engine temperature, low engine temperature, and low oil pressure);
- 1 fixed transistor output port (high raw water temperature output) and 1 programmable transistor output port;
- 2 battery packs can be switched to start the unit;
- With engine high water temperature and engine low oil pressure protection functions;
- Event log (max. 99 pieces), real-time clock;
- 3 groups of maintenance function, and actions can be set when maintenance time due;
- Built-in multiple user-defined sensor curves;
- Parameter setting function: parameters can be configured from front panel of controller and will

not lost in case of power dropout;

- Widely power supply range DC (8-35) V, which is suitable for different voltage environment of starting battery;
- Waterproof security level IP55 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	10000Hz (max.)
Start 1 Relay Output	16Amp Connect to common port output
Start 2 Relay Output	16Amp Connect to common port output
Stop Relay Output	16Amp Connect to common port output
Genset Running Relay Output	7Amp Connect to common port output
Over Speed Relay Output	7Amp Connect to common port output
Engine High Temp. Relay Output	7Amp Connect to common port output
Engine Low Temp. Relay Output	7Amp Connect to common port output
Engine Low Oil Pressure Relay Output	7Amp Connect to common port output
High Raw Water Temp. Transistor Output	B+ DC power supply output, 0.5A output current
Programmable Transistor Output	B+ DC power supply output, 0.5A output current
Analog Sensor	3 fixed sensors
Digital Input Port	3 digital input ports active when connect to B-
Overall Dimensions	197 mm x 152 mm x 47 mm
Panel Cutout	186mm x 141mm
Working Condition	Temperature: (-25~+70)°C Humidity: (20~93)%RH
Storage Condition	Temperature: (-25~+70)°C

Items	Content
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	0.6kg

4 OPERATION

4.1 INDICATOR LIGHT

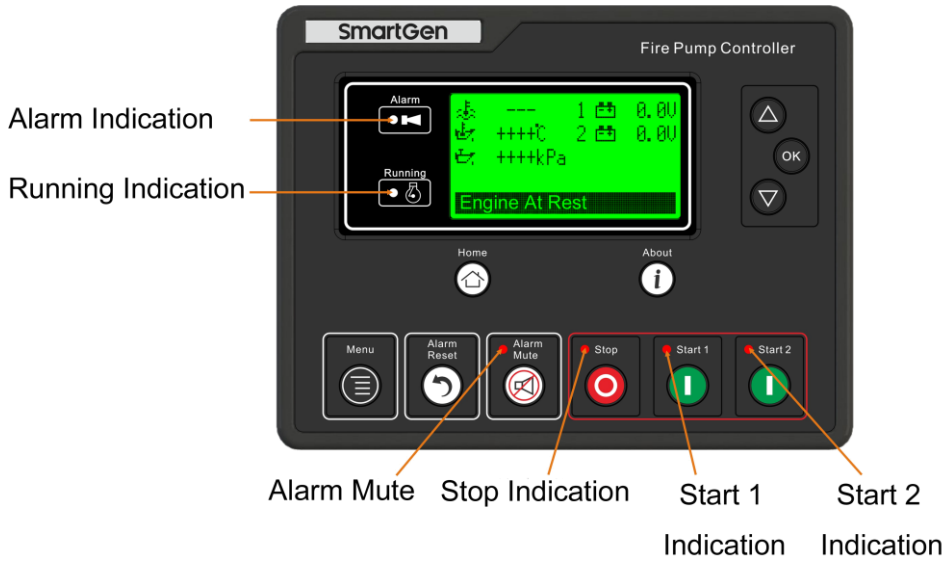

Fig.1 – FPC615 Front Panel

Note: Selected indicators description:

Alarm indicator: flash slowly when warning alarms occur; flash quickly when shutdown alarms occur;

Running indicator: after genset start up, it is always light before energize to stop; for other periods, it is extinguished.

4.2 PUSH BUTTONS DESCRIPTION

Table 4 – Keys Function

Icons	Function	Description
	Menu	Press and hold it for 1s to enter into menu configuration screen; Return to the previous level of menu while configuring settings.
	Reset Alarm	Press it to reset shutdown alarms while unit is in standby mode.
	Mute	Press it to mute controller alarms when alarms occur, meanwhile, alarm screen will be displayed.
	Stop	Stop running pump unit in auto/manual mode; Press it again in stop process will stop pump unit quickly; Press at least 3 seconds to test lights are normal or not.
	Start 1 Start 2	Use different battery pack to start the unit. Press it, starter relay starts output; Release it, starter relay stops output.
	Homepage	Press it to return to the 1st screen quickly.
	Event Log	Press it to enter into event log screen quickly.
	Up	Screen scroll
	Confirm	Confirm setting information.
	Down	Screen scroll

4.3 MAINS SCREEN DISPLAY

Table 5 – Display Description

Operation	Display Content	Remark
1st Screen: Press  enters this screen	 35℃ 1  27.6V  35℃ 2  27.6V  100kpa  1500r/min Engine Status And Alarm	Engine temep. 1# Battery voltage Raw water temp. 2# Battery voltage Oil pressure Engine speed Engine status and alarm display in turn.
2nd Screen: Press  or  to display this screen	D+ Voltage 27.6V Total Runing 00:00 Total Starts 1000 2016-03-05(6) 10:00:00 Engine Status And Alarm	Voltage of chrger Total running time Total start times Current time of controller
3rd Screen: Press  or  to display this screen	Maint. 1 Countdown 30:00 Maint. 2 Countdown 30:00 Maint. 3 Countdown 30:00 Engine Status And Alarm	It is maintenance countdown time display; if disabled maintenance function, this screen is not display.
4th Screen: Press  or  to display this screen	Genset Status Auto Mode Start Delay 1s Engine Standby	Genset status display screen, controller working mode and engine status.
5th Screen: Press  or  to display this screen	Alarm 1/2 Warning Low Oil Pressure Shutdown	Alarms display, and scroll screen based on the pages. The maximum alarm amount is 30 items.
Press  to display this screen, and press  again (or ) to exit	Event Log 1/3 Shutdown Alarm High Temp. Shutdown 2016-03-05(6) 10:00:00 Engine Status And Alarm	Event logs display, and one screen displays one piece of event log. The maximum event log amount is 99 pieces.
User Manu: Long-pressed  enters into this screen, and press  again to exit	Exit Parameter Set Controller Information	1. Check controller software version, hardware version and input/output port status. 2. Setting parameters

4.4 PARAMETER SET SCREEN

Hold and press enters into menu screen, and select "Set Parameter" item enters into parameter setting screen after entering the correct password (default:00318).

Parameter settings include contents as below,

- Timers
- Engine
- Maintenance
- Sensors
- Digital Inputs
- Output
- Module

Taking the example of setting engine overspeed shutdown:

Table 6 – Parameter Setting

1st Step	2nd Step	3rd Step
>Exit >Timers >Engine >Scheduler And Maintenance > Sensors	>Return >Flywheel Teeth >Engine Rated Speed >Loss Speed Signal >Over Speed Shutdown	Over Speed Shutdown Enable：Enabled Set Value：00114% Delay Value：00005
Press or key select "Engine" Setting and press enters into parameter setting screen.	Press or key select "Over Speed Shutdown" Setting and press enters into this setting screen.	Press to adjust cursor position and press or key to adjust delay value, and then press to confirm the parameter setting.
In all processes, press can cancel the current setting or return to the previous menu.		

4.5 MANUAL START/STOP OPERATION

Manual start sequence:

a) Take start 1 as example, hold and press (start 1), start I indicator illuminate and start1 relay starts output simultaneously.

b) Release after genset started successfully (through configure engine crank disconnect conditions) and starter relay stops output. Then genset enters into safety on delay state, in which time, alarms of high temperature, low oil pressure, and under speed are inactive. After safety on delay expired, unit enters into high-speed warming up delay.

c) When warming up delay is expired, pump unit enters into normal running status.

Manual stop sequence:

a) After pressing , pump unit starts stop and cooling and then enters into "ETS Solenoid Hold"

after cooling delay is expired;

b) During in period of “ETS Solenoid Hold”, ETS relay energized and automatic judging whether pump unit is completely stop or not.

c) "Wait for Stop Delay" begins, and complete stop is detected automatically.

d) If pump unit stopped completely, “After stop” delay begins; 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)

e) Pump unit enters into standby state after “After stop Delay” is expired.

4.6 AUTO START/STOP OPERATION

Auto start sequence:

a) If remote input is active, controller “Start Delay” begins countdown.

b) When start delay is over, start relay energized; if the pump unit fails to fire during this cranking attempt then the start relay is disengaged for the pre-set rest period; “crank rest time” begins and wait for the next crank attempt.

c) Should this start sequence continue beyond the set number of attempts, the fifth line of LCD shadowed with black and “Fail to Start “ alarm will be displayed on the fifth line of LCD.

d) In case of successful crank attempt, the “Safety On” timer is activated, allowing low oil pressure, high temperature, under speed, charge alternator failure and auxiliary inputs (if configured) to stabilize without triggering the fault alarms. As soon as this delay is over, “warming up” delay starts (if configured).

e) After the “warming up” delay, pump unit will enter into Normal Running status.

Auto stop sequence:

a) When remote start signal is deactivated, “Stop Delay” timer is initiated.

b) Once this “stop delay” has expired, the “Cooling Delay” starts..

c) When “ETS Solenoid Hold” begins, ETS relay is energized while fuel relay is de-energized.

d) "Wait for Stop Delay" begins, and complete stop is detected automatically.

e) Pump unit enters into its standby mode after the pump unit stopped completely; if pump unit stop fail, controller will initiate alarm signals (LCD displays alarm information).

NOTE1: configure input ports as “Manual/Auto Switch” and “Remote Start”.

NOTE2: while unit is in remote start status, if stop key is pressed, engine also stops. If need remote signals to start unit, remote start input must be invalid fist and then activate it again.

CAUTION: If shutdown alarms occur while unit is in remote start status, remote start input must be disconnected first and then reset shutdown alarms, otherwise, unit will start again.

4.7 START BATTERY SWITCHOVER IN AUTO MODE

While unit is in start period, two battery packs are not under voltage, if 1# battery pack fails to start, 2# battery pack will be changed to start unit, if fails to start again, then change back to 1#...until reach the maximum crank attempts. If unit is still fails to start, alarms will be initiated by the controller.

While unit is in start period, if there is one battery pack is under voltage, the other one battery pack will responsible for starting the unit. If unit fails to start when reach the maximum start attempts, alarms will be initiated by the controller.

5 PROTECTION

5.1 WARNINGS

When the controller has detected warning alarm signals, it alarms only without shutdown. When warning condition is no longer present, corresponding alarm will be cleared automatically. Warning types are as follows:

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	Battery1 Over Voltage	When the controller detects that battery1 voltage has exceeded the pre-set value, it will initiate a warning alarm.
7	Battery1 Under Voltage	When the controller detects that battery1 voltage has fallen below the pre-set value, it will initiate a warning alarm.
8	Battery2 Over Voltage	When the controller detects that battery2 voltage has exceeded the pre-set value, it will initiate a warning alarm.
9	Battery2 Under Voltage	When the controller detects that battery2 voltage has fallen below the pre-set value, it will initiate a warning alarm.
10	Engine Temperature Sensor Open Circuit	When the controller detects that the temperature sensor is open circuit and the action select “Warning”, it will initiate a warning alarm.
11	Engine High Temperature	When the controller detects that engine temperature has exceeded the pre-set value, it will initiate a warning alarm.
12	Engine Low Temperature	When the controller detects that engine temperature has fallen below the pre-set value, it will initiate a warning alarm.
13	Oil Pressure Sensor Open Circuit	When the controller detects that the oil pressure sensor is open circuit and the action select “Warning”, it will initiate a warning alarm.
14	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.
15	Oil Temperature Sensor Open Circuit	When the controller detects that the oil temperature sensor is open circuit and the action select “Warning”, it will initiate a warning alarm.
16	High Oil Temperature	When the controller detects that oil temperature has exceeded the pre-set value, it will initiate a warning alarm.
17	Low Oil Temperature	When the controller detects that oil temperature has fallen below the pre-set value, it will initiate a warning alarm.
18	Digital Input Port A/B/C Warning	When digital input port configures as “Warning” and it is active, controller will initiate a corresponding warning alarm.
19	Maintenance Time Due	When maintenance countdown time is 0, and the action select “Warning”, it will initiate a warning alarm.

5.2 SHUTDOWN ALARM

When controller detects shutdown alarm, it will shutdown the unit immediately. Shutdown alarm must be cleared manually and the fault removed to reset the module. Shutdown alarm types are as follows:

No.	Type	Description
1	Engine Over Speed	When the controller detects that the generator speed has exceeded the pre-set value, it will initiate a shutdown alarm.
2	Engine Under Speed	When the controller detects that the generator speed has fallen below the pre-set value, it will initiate a shutdown alarm.
3	Loss of Speed Signal	When the controller detects that the engine speed is 0 and the action select “Shutdown”, it will initiate a shutdown alarm.
4	Water Temperature Sensor Open Circuit	When the controller detects that the water temperature sensor is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
5	Water High Temperature	When the controller detects that water temperature has exceeded the pre-set value, it will initiate a shutdown alarm.
6	Water Low Temperature	When the controller detects that water temperature has fallen below the pre-set value, it will initiate a shutdown alarm.
7	Engine Oil Pressure Open Circuit	When the controller detects that the oil pressure sensor is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
8	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.
9	Oil Temperature Sensor Open Circuit	When the controller detects that the sensor is open circuit and the action select “Shutdown”, it will initiate a shutdown alarm.
10	High Oil Temperature	When the controller detects that the sensor value is higher than the max. set value, it will initiate a shutdown alarm.
11	Digital Input Port A/B/C Warning	When digital input port configures as “Shutdown” and it is active, controller will initiate a corresponding shutdown alarm.
12	Maintenance Time Due	When maintenance countdown time is 0, and the action select “Shutdown”, it will initiate a shutdown alarm.

6 CONNECTIONS

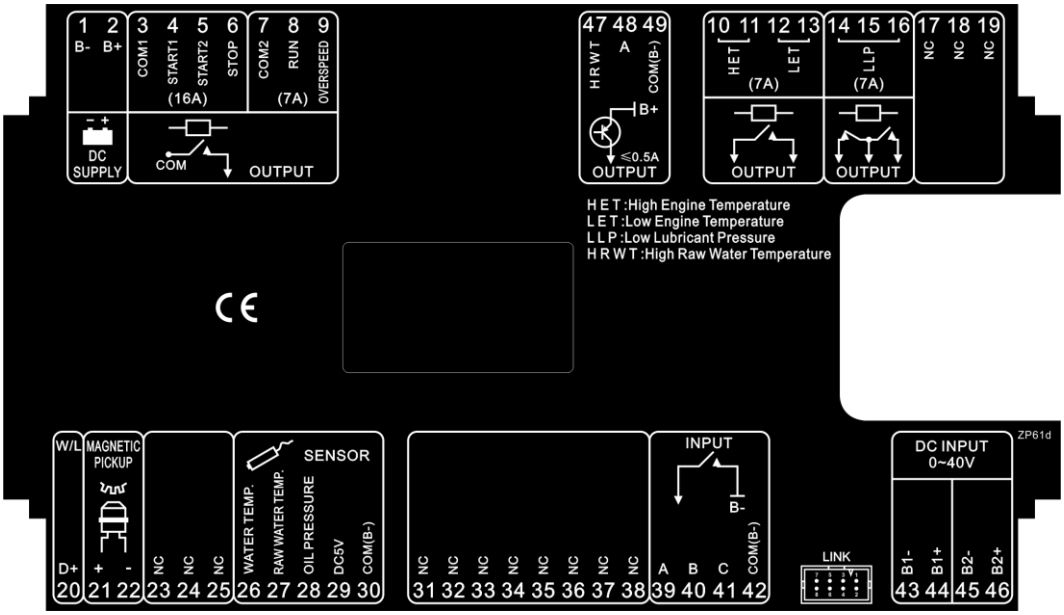

Fig.2 – FPC615 Back Panel

Description of terminal connections:

Table 9 – Terminal Connection

No.	Function	Cable Size	Description	
1	B-	2.5mm²	Connected with negative of starter battery.	
2	B+	2.5mm²	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	2.5mm²	Relay output common port of No.4, No.5 and No.6.	
4	Start 1	2.5mm²	Rated 16A.	Connect to starter coil
5	Start 2	2.5mm²	Rated 16A.	Connect to starter coil
6	Stop Relay Output	2.5mm²	Rated 16A.	connect to stop electromagnet
7	COM2 Relay Common Port	1.5mm²	Relay output common port of No.8 and No.9.	
8	Running Relay Output	1.5mm²	Rated 7A	It is output when genet meet with the crank disconnect conditions.
9	Over Speed Relay Output	1.5mm²	Rated 7A	It is output after genset sending over speed alarm signals.
10 11	High Water Temperature Relay Output	1.5mm²	Rated 7A	It is output after genset sending high water temperature alarm signals.
12 13	Low Water Temperature Relay Output	1.5mm²	Rated 7A	It is output after genset sending low water temperature alarm signals.
14	Low Lubricant Pressure Relay Output (Normally Close)	1.5mm²	Rated 7A	

No.	Function	Cable Size	Description	
15	Low Lubricant Pressure Relay Common Output	1.5mm²		
16	Low Lubricant Pressure Relay Output (Normally Open)	1.5mm²	Rated 7A	It is output after genset sending low lubricant pressure alarm signals.
17-19 Not Connected (NC)				
20	Charger D+ Input	1.0mm²	Connected with D+(W/L) terminal of charger. If there is no D+(W/L) terminal in charger, it is suspended.	
21	Speed Sensor Input +	0.5mm²	Connected with engine speed sensor, and shielding wire is recommended to use. "Speed Sensor Input –"has connected with B- in the controller.	
22	Speed Sensor Input -			
23-25 Not Connected (NC)				
26	Water Temperature Sensor Input	1.0mm²	Connected with analog quantity of temperature sensor.	
27	Oil Temperature Sensor Input	1.0mm²	Connected with analog quantity of temperature sensor.	
28	Oil Pressure Sensor Input	1.0mm²	Connected with analog quantity of pressure sensor.	
29	Output DC 5V	1.0mm²	Voltage type sensor power supply terminal	
30	COM(B-)	1.0mm²	Sensor common port, which internal of controller has connected with B-.	
31-38 Not Connected (NC)				
39	Digital Input A	1.0mm²	Ground connected is active (B-)	
40	Digital Input B	1.0mm²	Ground connected is active (B-)	
41	Digital Input C	1.0mm²	Ground connected is active (B-)	
42	Digital Input Common Ground	1.0mm²	Ground connected is active (B-)	
43	B1- Input	1.0mm²	Connected with battery 1	
44	B1+Input	1.0mm²		
45	B2- Input	1.0mm²	Connected with battery 2	
46	B2+Input	1.0mm²		
47	High Raw Water Tempe. Output	1.0mm²	B+ voltage output with rated current 0.5 A	
48	Relay Output A	1.0mm²	B+ voltage output with rated current 0.5 A	
49	COM(B-)	1.0mm²		

7 DEFINITION AND RANGE OF PARAMETERS

7.1 PARAMETER CONTENTS AND RANGE

Table 10 Parameter Definition & Scope

No.	Items	Parameter	Default	Description
Timers				
1	Start Delay	(0-3600) s	1	When controller is in auto mode, it is time from remote start signal activated to genset start.
2	Return Delay	(0-3600) s	1	When controller is in auto mode, it is time from remote start signal deactivated to genset stop.
3	Cranking Time	(3-60) s	8	It is time of starter powers up.
4	Crank Rest Time	(3-60) s	10	It is the waiting time before second power up when engine starts fail.
5	Safety On Delay	(0-3600)s	10	Alarms for low oil pressure, high temperature, under speed, charge fail are deactivated during “Safety On Delay”..
6	Warming Up Time	(0-3600)s	10	Warming time between the pump unit takes load and high-speed running.
7	Cooling Time	(0-3600)s	10	It is the radiating time before stop the pump unit, after it unloads.
8	ETS Hold Time	(0-3600)s	20	Stop electromagnet’s power on time when pump unit is stopping.
9	Wait for Stop Time	(0-3600)s	0	Time between ending of pump unit cooling delay and stopped completely when “ETS Solenoid Hold” is set as 0; Time between ending of ETS delay and stopped completely when “ETS Hold output time” is not 0.
10	After Stop Time	(0-3600)s	0	Time between pump unit stopped and standby.
Engine				
1	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.
2	Rated Speed	(0-6000)r/min	1500	Offer standard to judge over/under speed.
4	Loss of Speed Signal Delay	(0-3600)s	5	Time from detecting speed is 0 to confirm the action.
5	Loss of Speed Signal Action	(0-1)	0	0: Warning; 1: Shutdown
6	Over Speed Shutdown	(0-1000)%	114%	Setting value is percentage of rated speed, and delay value can be set.
7	Under Speed Shutdown	(0-1000)%	80%	
8	Over Speed Warning	(0-1000)%	110%	Setting value is percentage of rated speed, and return value and delay value can be set.
9	Under Speed	(0-1000)%	86%	

No.	Items	Parameter	Default	Description
	Warning			
10	Battery 1 Rated Voltage	(0-60.0)V	24.0	Offer standard to judge battery over/under voltage.
11	Battery 1 High Voltage Warning	(0-1000)%	120%	Setting value is percentage of rated voltage, and return value and delay value can be set.
12	Battery 1 Low Voltage Warning	(0-1000)%	85%	
13	Battery 2 Rated Voltage	(0-60.0)V	24.0	Offer standard to judge battery over/under voltage.
14	Battery 2 High Voltage Warning	(0-1000)%	120%	Setting value is percentage of rated voltage, and return value and delay value can be set.
15	Battery 2 Low Voltage Warning	(0-1000)%	85%	
16	Charge Alt Fail Warning	(0-60.0)V	8.0	In normal running, when charger D+(WL) voltage under this value, charge failure alarms.
17	Start Attempts	(1-10)	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.
18	Crank Disconnect Conditions	(0-6)	1	Details please to see *Table 11*
19	Speed of Crank Disconnect	(0-100)%	24	It is percentage speed of crank disconnect.
20	Oil Pressure of Crank Disconnect	(0-1000)kPa	200	
Maintenance				
1	Maintenance 1	(0-1)	0	0: Disable；1: Enable Actions of maintenance time and maintenance time due can be set at the same time.
2	Maintenance 2	(0-1)	0	
3	Maintenance 3	(0-1)	0	
Analog Sensors				
Water Temperature Sensor				
1	Curve Type	(0-15)	7	SGX. See table14.
2	Open Circuit Action	(0-2)	0	0: None; 1: Warning; 2: Shutdown
3	High Water 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.
4	Low Water Temp. Shutdown	(0-300)°C	20	Shutdown when external sensor temperature is lower than this value. The delay value can be set.
5	High Water 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.

No.	Items	Parameter	Default	Description
6	Low Water Temp. Warning	(0-300)°C	70	Warning when external sensor temperature is lower than this value. The delay value and return value can be set.
7	Custom Curve			Users should set the corresponding curve when select resistor curve type or current curve type.
Raw Water Temperature Sensor				
1	Curve Type	(0-15)	7	SGX. See table 14.
2	Open Circuit Action	(0-2)	0	0: None; 1: Warning; 2: Shutdown
3	High Raw Water 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.
4	High Raw Water Temp. Warning	(0~300)°C	95	Warning when external sensor temperature is higher than this value. Detecting only after safety delay is over. The return value and delay value can be set.
5	Custom Curve			Users should set the corresponding curve when select resistor curve type or current curve type.
Engine Oil Pressure Sensor				
1	Curve Type	(0-15)	4	CURTIS. See table 14.
2	Open Action	(0-2)	0	0: No action; 1: Warning; 2: Shutdown
3	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.
4	Low Oil Pressure Warning	(0-1000)kPa	124	Warning 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.
5	Custom Curve			Users should set the corresponding curve when select resistor curve type or current curve type.
Digital Input Ports				
Digital Input Port A				
1	Contents Setting	(0-53)	8	Details please see table 12.
2	Active Type	(0-1)	0	0: Active: Close 1: Active: Open
Digital Input Port B				
1	Contents Setting	(0-53)	9	Details please see table 12.
2	Active Type	(0-1)	0	0: Active: Close 1: Active: Open
Digital Input Port C				
1	Contents Setting	(0-53)	27	Details please see table 12.
2	Active Type	(0-1)	0	0: Active: Close 1: Active: Open

No.	Items	Parameter	Default	Description
Relay Output Port				
1	Output A	(0-33)	23	Details please to see table 13.
Module				
1	Slave ID	(1-254)	1	An address communicates with PC software.
2	Language	(0-2)	0	0: Simplified Chinese 1: English 2: Other
3	Password	(0-65535)	00318	Password enters into parameter setting screen.
4	Date and Time			Users can calibrate date and time by themselves.
5	Temperature Unit	(0-1)	0	0: ℃ 1: F
6	Pressure Unit	(0-2)	0	0:kPa 1:Bar 2:PSI

CAUTION: please modify controller parameters (digital input configuration and all delays) in standby status, otherwise, shutdown alarms or other abnormal situations may occur.

NOTE: while setting parameter threshold, please make sure that upper limit value must higher than the lower limit value, otherwise, both over limit alarms and under limit alarms may occur.

NOTE: while setting warning alarms please set return value correctly, otherwise, alarms fault may occur (return value must lower the over limit warning setting point and higher than the under limit warning setting point).

NOTE: digital input ports cannot set as the same content, otherwise, errors will occur.

7.2 CONDITIONS OF CRANK DISCONNECT SELECTION

Table 11 – Crank Disconnect Conditions Selection

No.	Setting description
0	External Input
1	Engine Speed
2	External Input+ Engine Speed
3	Oil Pressure
4	Oil Pressure+ External Input
5	Engine Speed+ Oil Pressure
6	Engine Speed+ Oil Pressure+ External Input

NOTE:

a) Separation between starter and engine only controlling by the "Start" key, and crank disconnect conditions only use to judge whether engine crank successfully or not.

b) Engine speed sensor is the magnetic equipment which be installed in starter for detecting flywheel teeth. After selecting "Engine Speed", please make sure that engine flywheel teeth number is the same as the preset value; if there is no magnetic sensor, please don't select conditions that including "Engine Speed".

c) If select conditions that including "external Input", users need to configure the input port as "7: Crank Success Input".

7.3 DEFINITION CONTENT OF DIGITAL INPUT PORTS (Ground connected is active (B-))

Table 12 – 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	Reserved	
7	Crank Success Input	If select conditions that including "external Input", users need to configure the input port as "7: Crank Success Input"; when input is active, which means generator starts successfully,
8	Manual/Auto Switch	If input port is deactivated, controller is in manual mode; otherwise, controller is in auto mode.
9	Remote Start	In auto mode, when input is active, it can start genset automatically.
10	Reserved	

No.	Type	Description
11	Reserved	
12	Over Speed Check	When input is active, if engine speed exceeds 67% of rated speed, and over speed shutdown delay is expired, shutdown action will be executed.
13	Reserved	
14	Reserved	
15	Reserved	
16	Reserved	
17	Reserved	
18	Reserved	
19	Reserved	
20	Reserved	
21	Reserved	
22	Reserved	
23	Reserved	
24	Reset Maintenance 1	When this input is active, controller will reset maintenance time 1 as preset value.
25	High Raw Water Temp. Shutdown	Connect to sensor digital input port.
26	High Water Temperature Shutdown	Connect to sensor digital input port.
27	Low Oil Pressure Shutdown	Connect to sensor digital input port.
28	Reserved	
29	Reserved	
30	Reserved	
31	Simulated Up Key	An external button can be connected (not self-lock), and simulated panel key is pressed.
32	Simulated Down Key	An external button can be connected (not self-lock), and simulated panel key is pressed.
33-53	Reserved	

7.4 DEFINITION CONTENT OF RELAY OUTPUT PORTS

Table 13 – Functions of Output Ports

No.	Type	Function Description
0	Not Used	Not output
1	Reserved	
2	Louver Control	Action when engine starts up and disconnect after genset stopped completely.
3	Fuel Pre-supply	Actions in period of cranking to safety run.
4	Pre-lubricate	Actions in period of pre-heating to safety run.
5	Common Alarm	Action when common warning and common shutdown alarms occur.
6	Reserved	
7	Common Shutdown	Action when common shutdown alarms occur.
8	Reserved	
9	Common Warning	Action when common warning alarms occur.
10	Reserved	
11	Battery 1 High Volt.	Action when voltage of battery1 is over high.
12	Battery 1 Low Volt.	Action when voltage of battery1 is over low.
13	Charge Alt Fail	Action when charge failure warning alarms occur.
14	Battery 2 High Volt.	Action when voltage of battery2 is over high.
15	Battery 2 Low Volt.	Action when voltage of battery2 is over low.
16	Fail to Start	Action when failed start alarms occur.
17	Fail to Stop	Action when failed stop alarms occur.
18	Under Speed Warning	Action when under speed warning alarms occur
19	Under Speed Shutdown	Action when under speed shutdown alarms occur.
20	Over Speed Warning	Action when engine over speed warning alarms occur.
21	Over Speed Shutdown	Action when engine over speed shutdown alarms occur.
22	Reserved	
23	Energize to Stop	Output when unit shuts down.
24	Start Success	Output after unit meeting with the crank disconnect conditions.
25	High Water Temp.	Output when high water temp. alarm occur.
26	Low Water Temp.	Output when low water temp. alarms occur.
27	Low Oil Pressure	Output when low oil pressure alarms occur.
28	Raw Water High Temp.	Output when high raw water temperature alarms occur
29	Reserved	
30	System In Auto Mode	Controller outputs in auto mode.
31	System In Manual Mode	Controller outputs in manual mode.
32	Reserved	
33	Reserved	

7.5 SENSOR SELECTION

Table 14 – Description of Sensors

No.		Content	Remark
1	Water Temp. Sensor & Raw Water Sensor Temp. Sensor	0 Not used 1 Custom Res Curve 2 Custom 4-20mA curve 3 VDO 4 CURTIS 5 VOLVO-EC 6 DATCON 7 SGX 8 SGD 9 SGH 10 Reserved 11 Cu50 12-15Reserved	Defined resistance's range is (0~6)KΩ, default is SGX sensor.
2	Oil Pressure Sensor	0 Not used 1 Custom Res Curve 2 Custom 4-20mA curve 3 VDO 10Bar 4 CURTIS 5 VOLVO-EC 6 DATCON 10Bar 7 SGX 8 SGD 9 SGH 10-14 Reserved 15 Custom Voltage Curve	Defined resistance's range is (0~6)KΩ, default is CURTIS sensor.

7.6 SENSOR SELECT

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

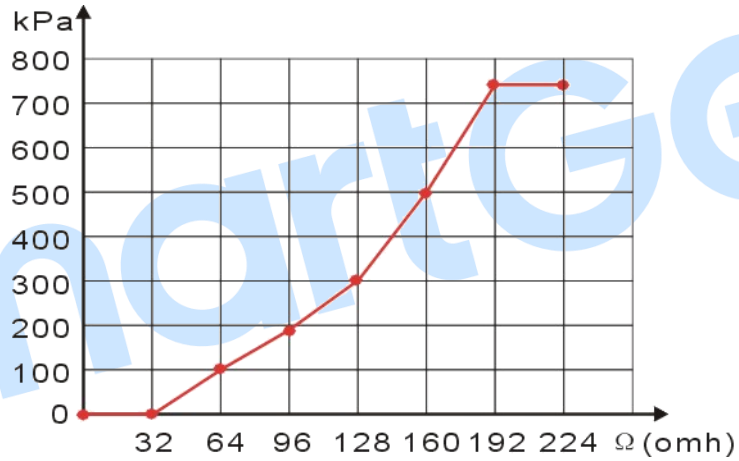

Fig.3 – Pressure Setting Curve

Table 15 - Common unit conversion table

Items	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

8 TYPICAL APPLICATION

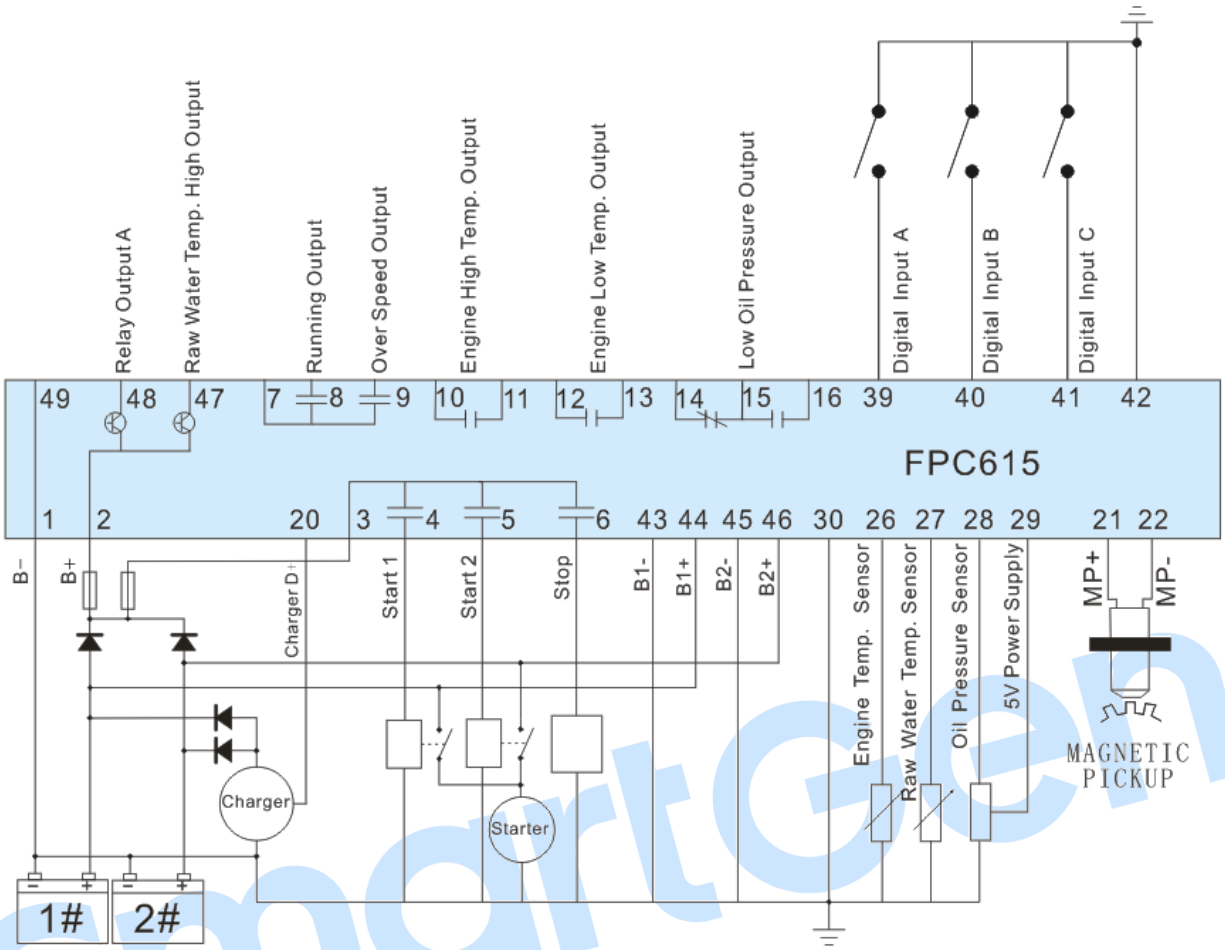

Fig.4 - FPC615 Typical Application Diagram

NOTE: relay output port A (terminal No.48) and high raw water temp. output port (terminal No. 47) are output B+, and output current cannot exceed 500mA.

9 COMMISSIONING

Please make sure the following checks are made before commissioning,

- Ensure all the connections are correct and wires diameter is suitable.
- Ensure that the controller DC power has fuse, controller's positive and negative connected to start battery are correct.
- Separately start genset with battery 1 and battery 2, observe whether starter disconnect immediately and genset is normal running. If errors occur, stop the unit and check wire connection according to the user manual.

If there is any other question, please contact SmartGen's service.

10 INSTALLATION

Controller is panel built-in design and it is fixed by clips when installed. Overall and cutout dimensions are as follows,

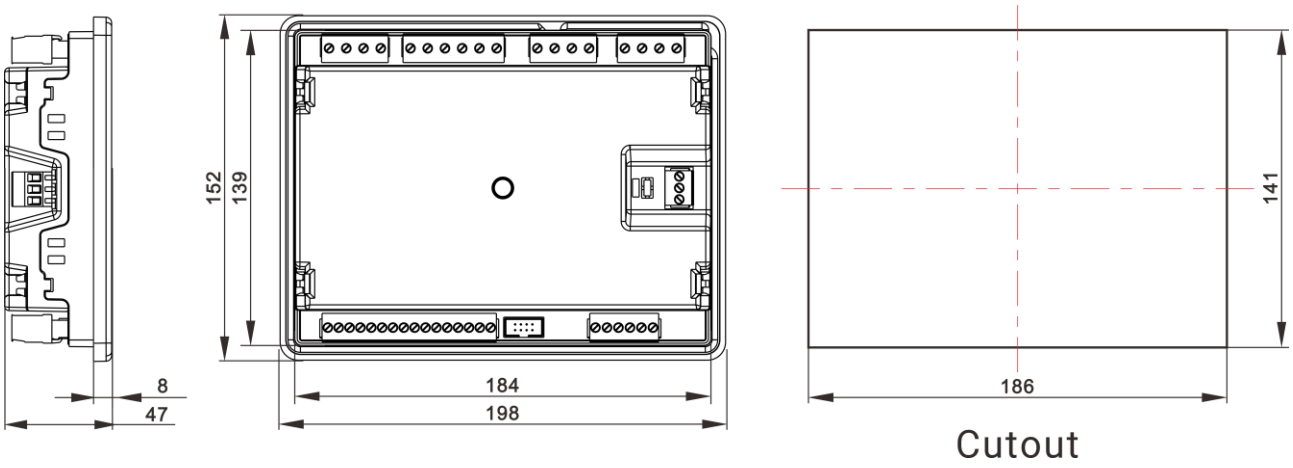

Fig.5 – Overall & Cutout Dimensions

1) **Battery Voltage Input**

NOTE: FPC615 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 that connects from power supply to battery must be over 2.5mm^2. If floating charge 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 charge 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. One side is hanging in air and the else two signal wires are connecting to No. 21 and No. 22 terminals of controller and No. 22 terminal internal connected with B-. 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 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 has DC current) or add resistance-capacitance return circuit (when coils of relay has AC current), in order to prevent disturbance to controller or others equipment.