



SmartGen
ideas for power

HEM4000 ENGINE CONTROLLER USER MANUAL



SMARTGEN (ZHENGZHOU) TECHNOLOGY CO.,LTD.



Chinese trademark

SmartGen English trademark

SmartGen — make your generator *smart*

SmartGen Technology Co., Ltd.

No. 28 Jinsuo Road

Zhengzhou

Henan Province

P. R. China

Tel: 0086-371-67988888/67981888

0086-371-67991553/67992951

0086-371-67981000(overseas)

Fax: 0086-371-67992952

Web: www.smartgen.com.cn

www.smartgen.cn

Email: sales@smartgen.cn

All rights reserved. No part of this publication may be reproduced in any material form (including photocopying or storing in any medium by electronic means or other) without the written permission of the copyright holder.

Applications for the copyright holder's written permission to reproduce any part of this publication should be addressed to SmartGen Technology at the address above.




Any reference to trademarked product names used within this publication is owned by their respective companies.

SmartGen Technology reserves the right to change the contents of this document without prior notice.

Table 1 - Software Version

Date	Version	Note
2019-01-28	1.0	Original release

Table 2 - Notation Clarification

SIGN	INSTRUCTION
 NOTE	Highlights an essential element of a procedure to ensure correctness.
 CAUTION!	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
 WARNING!	Indicates error operation may cause death, serious injury and significant property damage.

SmartGen



CONTENTS

1	OVERVIEW	5
2	PERFORMANCE AND CHARACTERISTICS	5
3	SPECIFICATION	7
4	OPERATION	8
4.1	KEY FUNCTIONS DESCRIPTION	8
4.2	CONTROLLER PANEL	9
4.3	AUTO START/STOP OPERATION	9
4.3.1	AUTOMATIC START SEQUENCE	9
4.3.2	AUTOMATIC STOP SEQUENCE.....	10
4.4	MANUAL START/STOP OPERATION	10
4.4.1	MANUAL START OPERATION	10
4.4.2	MANUAL STOP OPERATION.....	10
4.5	START OPERATION OF FUEL PRE-SUPPLY OUTPUT	11
4.6	IDLE SPEED MODE	11
4.7	IDLE/HIGH SPEED MODE	11
4.8	EMERGENCY START.....	12
4.9	ENGINE SPEED REGULATION OPERATION	12
5	PUMP GENSET (WITH SUCTION PUMP) APPLICATION OPERATIONS	13
5.1	D-DRIVEN PUMP START/STOP	13
5.2	E-DRIVEN PUMP START/STOP	13
6	PROTECTION	14
6.1	WARNINGS.....	14
6.2	SHUTDOWN ALARM.....	15
7	WIRING CONNECTION	16
8	SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS	18
8.1	CONTENTS AND SCOPES OF PARAMETERS	18
8.2	DEFINABLE CONTENTS OF PROGRAMMABLE OUTPUT PORTS 1-6	26
8.2.1	CUSTOM PERIOD OUTPUT	30
8.2.2	CUSTOM COMBINED OUTPUT.....	30
8.3	DEFINED CONTENTS OF PROGRAMMABLE INPUT PORTS.....	31
8.4	SELECTION OF SENSORS	33
8.5	CONDITION SELECTION OF CRANK DISCONNECTION.....	34
8.6	MAINTENANCE SETTING	34
9	PARAMETER SETTING	35
10	SENSOR SETTING	37
11	COMMISSIONING	38
12	TYPICAL APPLICATION	38
13	INSTALLATION	40
13.1	FIXING CLIPS.....	40
13.2	OVERALL DIMENSION AND CUTOUT	40
14	FAULT DROPPING	41
15	PACKING LIST	42

1 OVERVIEW

HEM4000 ENGINE CONTROLLER is used for controlling engine to realize engine auto start/stop, data measure, alarm protection and “three remotes” (remote control, remote measuring and remote communication) functions. It provides speed regulation function, not only with relay speed-adjusting output but also with GOV interface, which can control all kinds of non-EFI engines’ speed.

HEM4000 ENGINE CONTROLLER adopts large liquid crystal display (LCD) and selectable Chinese and English interface with easy and reliable operation. Users can read engine working parameters from the LCD directly.

HEM4000 ENGINE CONTROLLER uses 32 bits ARM micro-processor technology with the functions of precise parameters measuring, fixed value adjustment, time setting and threshold adjusting etc. The majority of parameters can be set on the front panel and all the parameters can be set and monitored via USB port or RS485 port by using PC. With compact structure, simple connections and high reliability, it can be widely used in a number of genset control systems, which include water pump system, bacon system, air compressor, engineering and machinery system and so on.

2 PERFORMANCE AND CHARACTERISTICS

Key characteristics are as below,

- 132x64 LCD with backlight, multilingual interface (including English and Chinese languages) and easy operating interface;
- Hard acrylic screen protection with improved wear-resistance and scratch resistance;
- Silicon panel and pushbuttons for better operation in high and low temperature environment;
- RS485 communication port to realize remote controlling, remote measuring, remote communicating via ModBus protocol;
- 6 channels of analog sensors, 3 channels of fixed resistor sensors, and 3 channels of flexible sensors, which can be configured as resistor/current/ voltage type sensors;
- Multiple temperature, pressure and level sensor curves can be used and user-defined directly;
- Precisely collecting various engine parameters provides complete protection functions, such as engine high water temperature/ low oil pressure, over speed and under speed protection;
- With mechanical speed regulation function and GOV speed adjustment function, it can control engine speed up and down manually;
- High speed/idling speed switchover function;
- All outputs are relay outputs;

- With the function of parameter setting, it allows users to change and set the parameters and at the same time they will be stored in the internal FLASH memorizer and cannot be lost in case of power outage;
- Alternate crank disconnect conditions (engine speed, oil pressure);
- Engine speed can be obtained by speed sensor or W/L charging generator;
- Wide power supply range DC(8~35)V, which is suitable to different start battery voltage environment;
- Event log, real-time clock, scheduled start & stop functions (start one time once a day/week/month);
- Heater, cooler and fuel pump control functions;
- Maintenance function. Actions (warning or shutdown) can be set when maintenance time due;
- All parameters adopts digital adjustment instead of conventional analog modulation with a potentiometer, which improves the reliability and stability;
- Waterproof security level IP65 of the front panel due to the rubber seal in the case design;
- Metal fixing clips enable perfect performance in high temperature environment;
- Modular design, flame retardant ABS case, pluggable connecting terminals and embedded installation way; Structure is compact and the installation is very easy.

3 SPECIFICATION









Table 3 – Technical Parameters

Items	Contents
Operating Voltage	DC8.0V to DC35.0V, Continuous Power Supply.
Power Consumption	<3W (standby ≤2W)
Speed Sensor Voltage	1.0V to 24.0V (RMS)
Speed Sensor Frequency	10,000 Hz (max.)
GOV Output Range	0V-10V
Charging Generator W/L	Voltage(1.0-24)V(RMS) frequency(50-1000)Hz
Start Relay Output	5A DC28V
Auxiliary Relay Output 1	5A DC28V
Auxiliary Relay Output 2-6	1A DC28V
Analog Sensor	3 channels of fixed resistor sensors (temperature, flexible sensor 1, flexible sensor 2); 3 channels of sensors can be configured as resistor/current/voltage type sensors (oil pressure, flexible sensor 3, flexible sensor 4)
Case Dimension	135mm x 110mm x 44mm
Panel Cutout	116mm x 90mm
Working Conditions	Temperature: (-25~+70)°C; Humidity: (20~93)%RH
Storage Condition	Temperature:(-25~+70)°C
Protection Level	IP65 Gasket
Net Weight	0.35kg

4 OPERATION

4.1 KEY FUNCTIONS DESCRIPTION

Table 4 – Keys Description

Icons	Keys	Description
	Stop/Reset	<ol style="list-style-type: none"> 1. Stop running generator in Auto/Manual mode; 2. Reset alarms in stop mode; 3. Pressing over 3 seconds can know whether the panel lamp is OK (Lamp test); 4. Press this again in stop process can stop the engine immediately;
	Auto	Press this key and controller goes to Auto mode;
	Manual	Press this key and controller goes to Manual mode;
	Speed	If speed adjusting enabled, press this key to enter adjusting speed page to raise/drop engine speed;
	Start	Start genset in Manual mode;
	Up/Increase	<ol style="list-style-type: none"> 1. Screen scroll; 2. Moving cursor up and increase value in setting menu;
	Down/Decrease	<ol style="list-style-type: none"> 1. Screen scroll; 2. Moving cursor Down and decrease value in setting menu;
	Set/Confirm	<ol style="list-style-type: none"> 1. Entering into parameter setting page after pressing this key in main screen; 2. Confirm information in setting page;

4.2 CONTROLLER PANEL



Fig.1 – Front Panel Drawing

NOTE: Parts of indicators description:

Warning indicator: warning alarms occur: slowly flash; Shutdown alarms occur: fast flash; no alarms occur: extinguished;
 Status indicator: It is illuminated when generator is normal; flashing when generator is in stop delay;
 Auto mode indicator: It is illuminated in auto mode; flashing in start delay.

4.3 AUTO START/STOP OPERATION

4.3.1 AUTOMATIC START SEQUENCE

- Press , the indicator right by illuminates, which means the generator is in auto start mode;
- When “Remote Start” input is active, “Start Delay” is initiated, and auto mode indicator flashes at the same time;
- After start delay, auto mode indicator changed from flashing to illuminating, and preheating relay outputs (if configured), “preheating delay XX s” will be displayed on the LCD;
- After the preheating delay, the fuel relay outputs pre-start fuel time (1 second default) and then the start relay outputs. If it fails to start in the start time, the fuel relay and start relay stop outputs and enter “start rest time, waiting for another start”;
- During the set starting times, if the engine fails to start, the controller will output starting failure and stop to start and meanwhile the alarm page shows starting failure and the alarm rings;
- If it starts successfully in the starting attempts, it goes to “safe operation time”, during which low oil pressure, high temperature, under speed and charging failure alarming inputs are all disabled. As soon as the safe operation delay is over, “start idling delay” is initiated (if configured);



- g) During the “start idling delay”, under speed alarming is disabled. When this delay is over, “high-speed warming up delay” is initiated (if configured);
- h) After the “warming up delay” has expired, the engine goes to normal operation state. If the rotating speed is abnormal, the controller will alarm and stop (alarming output will be displayed on the LCD).

4.3.2 AUTOMATIC STOP SEQUENCE

- a) When the “remote start” signal is not available, and the “remote stop” signal is effective, the stop delay is initiated, and the status indicator flashes;
- b) Once the “stop delay” ends, “high-speed radiating delay” is then initiated. During the radiating delay, if the “remote start” signal is active again, the controller will re-enter running status. If radiating delay ends, stop idling delay is initiated;
- c) During the stop idling delay (if configured), idling relay outputs with power;
- d) The ETS (Electrical Trip Solenoid) delay goes on next, ETS relay is energized and fuel relay is de-energized;
- e) Stop delay begins, and complete stop is detected automatically;
- f) When the generator stops completely, after-stop delay will be initiated. Otherwise, the controller fails to stop and meanwhile the alarm of stop failure is initiated. (If the generator stops successfully after “fail to stop” alarm is initiated, after-stop delay will be initiated and the alarm will be removed automatically);
- g) After the after-stop delay, the generator will be in standby mode.

4.4 MANUAL START/STOP OPERATION

4.4.1 MANUAL START OPERATION

- a) Press  button and Manual mode is on. Indicator right by is light;
- b) Press  and the engine starts; Successful start can be detected automatically and the generator accelerates to high-speed running automatically;
- c) The controller can protect the genset to stop quickly if high temperature, low oil pressure, over speed and abnormal voltage appears during the running process. (please refer to operating procedure 4.3.1,c)~h)).

4.4.2 MANUAL STOP OPERATION

Press  and the running generator stops. (please refer to 4.3.2,b)~g)).

4.5 START OPERATION OF FUEL PRE-SUPPLY OUTPUT

When output is set as “Fuel Pre-supply Output”, and auto/manual mode starting is active:

If the fuel pre-supply set time is under or equal to pre-heating time, LCD will display “pre-heating delay XX”, and both pre-heating relay (if configured) and fuel pre-supply relay (fuel pre-supply set time) output; After the pre-heating delay, fuel relay outputs the pre-starting fuel time (default: 1 second), then the starting relay outputs; The remaining starting process is the same as automatic starting procedure (please refer to 4.3.1, d)~h)).

If the fuel pre-supply set time is more than the pre-heating time, pre-heating delay starts and fuel pre-supply relay outputs. Pre-heating delay ends, the remaining fuel pre-supply time starts and it enters fuel pre-supply phase. LCD will display “fuel pre-supply time XX” and fuel pre-supply relay is energized; when the fuel pre-supply delay is expired, fuel relay outputs the pre-starting fuel time setting (default: 1 second) and afterwards starting relay outputs; The remaining starting process is the same as the auto starting procedure (please refer to 4.3.1, d)~h)).

When the output port is set “fuel pre-supply output” and the engine is in the standby status, the “fuel pre-supply time interval” and “fuel pre-supply time” settings output circularly; If the “fuel pre-supply time interval” is 0, the fuel pre-supply does not work.


4.6 IDLE SPEED MODE

Input setting 8: Idle Speed Mode

If engine is in good running status and the idle speed mode input is active, the idle speed mode starts and the engine enters idle speed running. At this time the idle speed relay is energized and the speed-reducing relay starts.

If engine is in the standby status and the idle speed mode input is active, the auto/manual mode starts regularly; “Safely running delay” ends, and the engine enters “starting idle speed delay (if configured)”; When the starting idle speed delay ends, the engine enters idle speed running. Idle speed controlling relay outputs and the speed-reducing relay outputs.

In the idle speed mode engine is in the idle speed running process; The idle speed mode input is invalid, it will exit from the idle speed mode. The engine enters regular operation, the idle speed controlling relay stops outputting and the speed-reducing relay stops outputting.

In the idle speed mode, engine is in the idle speed running process; Press  and make the engine stop. The engine goes from “idle speed running” to “stopping idle speed delay” (if configured), and the remaining stopping process is the same as the auto stopping procedure (please refer to the auto stopping procedure 4.3.2, c)~g)).

If the configured speed adjustment type is relay or GOV, the speed can be adjusted in the regular running phase.

4.7 IDLE/HIGH SPEED MODE


Input setting 14: Idle/High Speed.

If engine is in good running status and the idle/high speed mode input is active, the engine enters idle speed running status. The idle speed controlling relay outputs and the speed-reducing relay outputs. If the configured speed change type is relay or GOV, press the speed-increasing button, and the idle speed relay stops outputting and the speed-reducing relay is the same. The speed can be adjusted in




the idle mode running phase.

If the engine is in the standby status and the idle/high speed input is active, the auto or manual mode can work normally. After the “safely running delay”, engine goes to “starting idle speed delay” status (if configured). After starting idle speed delay, it enters idle speed running state, the idle speed controlling relay outputs and the speed-reducing relay outputs. If the configured speed-changing type is relay or GOV, press the speed-increasing button, and the idle speed controlling relay and the speed-reducing relay both stop outputting. The speed can be adjusted in the idle mode running phase.

When the engine is running in the idle speed mode, the idle/high speed input is invalid. It will exit from the idle speed operation and goes to high speed warming-up phase; at this time speed-increasing relay outputs. When the “high speed warming-up delay” ends, the speed-increasing stops outputting, the engine goes to regular running. After speed adjustment type collocation, speed can be adjusted in normal running status.

In the process of the idle speed running, press  and make the engine stop. The engine goes from “idle speed running” to “stop idle speed delay”(if configured), and the remaining stop process is the same as the auto stop procedure(please refer to the auto stopping procedure 4.3.2,c~g)).

4.8 EMERGENCY START

 NOTE: Pressing  and  simultaneously can force the engine to start. At this moment, whether the genset starts successfully is not based on the cranking disconnecting conditions by the controller. The starter disconnection is controlled by the operator. When the operator observes that the genset has started successfully, he/she can release the button, then the starting stops outputting and the controller enter safely running delay.





4.9 ENGINE SPEED REGULATION OPERATION

Configuration of speed regulation input type: 1: Relay Speed Adjustment

If the relay speed adjustment, relay output ports need to be configured as “Speed Raise Output” and “Speed Drop Output”.

Configuration of speed regulation input type: 2: GOV Speed Adjustment

Set the corresponding GOV voltage output center and voltage output range according to the type of electronic speed controller, and then set the stepping coefficient of GOV speed regulation.

Press  and the speed adjustment screen shall be as below. While the engine speed is regularly running the speed can be adjusted. At this moment, press  to raise the speed and press  to reduce the speed. Press  again to exit and stop speed adjustment.

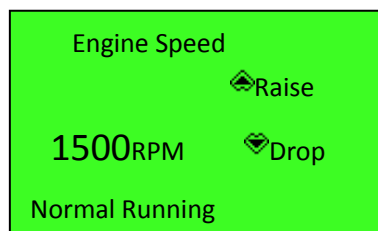


Fig.2 – Speed regulation screen

 NOTE: speed can be adjusted up to 110% of rated speed.

5 PUMP GENSET (WITH SUCTION PUMP) APPLICATION OPERATIONS

5.1 D-DRIVEN PUMP START/STOP

Set input function: D-driven pump started, suction pump pressure is formed;

Set output function: D-driven pump starting outputs, D-driven suction pump stops outputting.

Suction pump type: D-driven

——D-driven Pump Start:

- After auto/manual start mode is active, pre-heating relay outputs (if configured) and LCD screen displays “pre-heating delay XX”. After the pre-heating delay, D-driven suction pump’s starting relay outputs (output is to be configured). If the successful starting input (output is to be configured) is invalid during the “D-driven suction pump’s starting time”, the pump starting relay stops outputting and enter “pump starting interval”, waiting for next starting; during the starting times set, if the pump fails to start, the controller will output starting failure alarm and stop starting, and the alarm screen displays “pump stopped as the starting failure alarm rings.”;
- At any one time of starting, if D-driven pump succeeds, it will enter “waiting for pressure coming” delay. When the delay is overtime, pressure coming output (need to be configured) is invalid and the controller conducts pump starting failure alarm and stops the pump; Meanwhile, the screen displays pump fault alarm and shutdown;
- For the time of waiting for pressure coming, if the pressure coming input is active (input is to be configured), pre-starting fuel time set in the fuel relay is outputted (default: 1 second). Afterwards the starting relay outputs. The remaining starting process is the same as the auto starting procedure (for the details please refer to 4.3.1,d)~h));
- fuel relay output set “Prestart Fuel Time” (default 1s) after “Press. to Suction Pump” (need to be configured) is valid, and then start relay outputs. The rest start processes are same with auto start (please refer to 4.3.1,d)~h));

——D-driven pump stopping: after “safely running delay”, D-driven pump stopping outputs (output is to be configured), and it stops to output after the setting time (powered stop time).

5.2 E-DRIVEN PUMP START/STOP

Input port function setup is needed: suction pump pressure coming.


Output port function setup is needed: E-driven pump starting.

Set the suction pump type E-driven suction pump.

——E-driven pump start: After suction pump type is set to be E-driven pump and safe running delay is over, the starting relay outputs (to be configured).

——E-driven pump stop:

- When the engine is between starting idle time and high-speed cooling time, if the input is pump pressure coming (to be configured) or the out-flowing pressure is larger than the value of stop pressure of E-driven suction pump, the start relay stops to output.
- If the engine is in the phase of powered stop delay, the start relay stops to output.

 **Note:** The mentioned out-flowing pressure of E-driven pump needs out-flowing pressure associative setup to relate to corresponding auxiliary sensor.

6 PROTECTION

6.1 WARNINGS

When the controller detects warning signals, it only outputs warnings without shutdown. If warnings are cleared, they will disappear automatically.

Table 5 – Controller Warning Alarms

No.	Type	Description
1	Over Speed	When the controller detects that the engine speed has exceeded the pre-set value, it will initiate a warning alarm.
2	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 selected action for speed loss is “Warning”, it will initiate a warning alarm.
4	Fail To Stop	After “fail to stop” delay, if engine does not stop completely, it will initiate a warning alarm.
5	Charging Failure	When the controller detects that charger voltage is less than the pre-set value, it will initiate a warning alarm.
6	Battery High Voltage	When the controller detects that engine charger voltage has exceeded the pre-set value, it will initiate a warning alarm.
7	Battery Low Voltage	When the controller detects that engine charger voltage has fallen below the pre-set value, it will initiate a warning alarm.
8	Engine Temperature Sensor Open Circuit	When the controller detects that the temperature sensor is open circuit and the selected action is “Warning”, it will initiate a warning alarm.
9	Engine High Temperature	When the controller detects that engine temperature has exceeded the pre-set value, it will initiate a warning alarm.
10	Engine Low Temperature	When the controller detects that engine temperature has fallen below the pre-set value, it will initiate a warning alarm.
11	Engine Oil Pressure Open Circuit	When the controller detects that the oil pressure sensor is open circuit and the selected action is “Warning”, it will initiate a warning alarm.
12	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.
13	Auxiliary Sensor 1~4 Open Circuit	When the controller detects that the sensor 1 ~ 4 is open circuit and the selected action is “Warning”, it will initiate a warning alarm.
14	Programmable Sensor 1~4 High Value	When the controller detects that the sensor 1~4 value has exceeded the pre-set upper limit value, it will initiate a warning alarm.
15	Programmable Sensor 1~4 Low Value	When the controller detects that the sensor 1~4 value has fallen below the pre-set lower limit value, it will initiate a warning alarm.
16	Over Flow	When the controller detects that the flow value has exceeded the pre-set upper limit value, it will initiate a warning alarm.
17	Input Port 1~5 Warning	When digital input is configured as “Warning”, and input port is active, controller will initiate a warning alarm.
18	Maintenance 1~5 Due	When the countdown time is 0 and the selected action is “Warning”, it will initiate a warning alarm.



No.	Type	Description
19	Authorized Time Due	When the controller reaches authorized time, and selected action is "Warning", it will initiate a warning alarm.
20	Battery Undervoltage	Under automatic power up condition, before starting, when controller detects battery voltage is lower than the pre-set value, it will initiate a warning alarm. This warning cannot disappear automatically, and it needs to press "Stop" key in stop mode to remove this warning.

6.2 SHUTDOWN ALARM

When controller detects shutdown alarm, the screen displays shutdown contents and it will shut down immediately. When the genset stopped completely, users need to press alarm reset button to reset shutdown alarms.

Table 6 - Shutdown alarms

No.	Type	Description
1	Emergency Stop	When the controller detects emergency stop alarm signals, it will initiate a shutdown alarm.
2	Over Speed	When the controller detects that the engine speed has exceeded the pre-set value, it will initiate a shutdown alarm.
3	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 selected action is "Shutdown", it will initiate a shutdown alarm.
5	Fail To Stop	If engine fails to start within preset attempts, it will initiate a shutdown alarm.
6	High Temperature Input Shutdown	When the input port of controller is set as "High Temp. Shutdown" and it is valid, controller will initiate a shutdown alarm.
7	Low Oil Pressure Input Shutdown	When the input port of controller is set as "Low Oil Pressure Shutdown" and is active, controller will initiate a shutdown alarm.
8	Engine Temp. Sensor Open Circuit Shutdown	When the controller detects that the temp. sensor is open circuit and selected action is shutdown, it will initiate a shutdown alarm.
9	Engine High Temp. Shutdown	When the controller detects that temperature has exceeded the pre-set value, it will initiate a shutdown alarm.
10	Engine Oil Pressure Sensor Open Circuit	When the controller detects that the sensor is open circuit and selected action is shutdown, it will initiate a shutdown alarm.
11	Engine Low Oil Pressure Shutdown	When the controller detects that engine oil pressure has fallen below the pre-set value, it will initiate a shutdown alarm.
12	Auxiliary Sensor 1~4 Open Circuit	When the controller detects that sensor 1 ~ 4 is open circuit and the selected action is shutdown, it will initiate a shutdown alarm.
13	Auxiliary Sensor 1~4 High Value	When the controller detects that sensor 1 ~ 4 value has exceeded the pre-set upper limit value, it will initiate a shutdown alarm.
14	Auxiliary Sensor 1~4 Low Value	When the controller detects that sensor 1~4 value has fallen below the pre-set lower limit value, it will initiate a shutdown alarm.
15	Suction Pump Cranking Fail	If diesel driven pump fails to start within preset attempts, controller will initiate a shutdown alarm.



No.	Type	Description
16	Suction Pump Breakdown	When the controller is in the phase of breakdown stop delay and the input pressure coming signal is invalid, controller will initiate a shutdown alarm.
17	Input Port 1~5 Shutdown	When digital input is configured as shutdown, and is active, controller will initiate a corresponding shutdown alarm.
18	Over Flow	When the controller detects that the flow value has exceeded the pre-set upper limit value, it will initiate a shutdown alarm.
19	Maintenance 1~5 Due	When countdown time is 0 and the selected action for maintenance due is shutdown, it will initiate a shutdown alarm.
20	Authorized Time Due	When controller reaches authorized time, and the selected action is shutdown, it will initiate a shutdown alarm.

7 WIRING CONNECTION

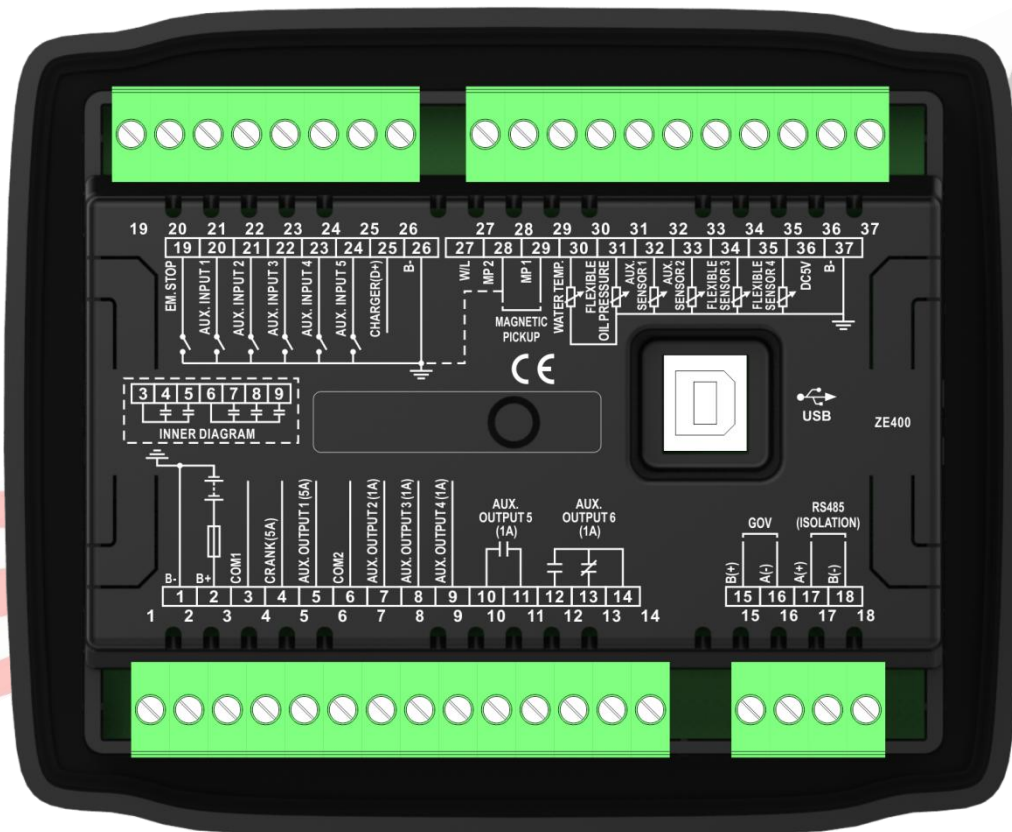


Fig.3 – Controller Rear Panel Drawing

Table 7 - Terminal Connection Description

No.	Function	Cable Size	Remarks
1	B-	1.5mm ²	Connected with negative terminal of starting battery.
2	B+	1.5mm ²	Connected with positive terminal of starting battery.
3	COM1 Relay Common Port	1.5mm ²	Connected with COM1 common port output, rated 5A DC28V.
4	Starting Relay Output	1.5mm ²	
5	Aux. Relay Output 1	1.5mm ²	



No.	Function	Cable Size	Remarks		
6	COM2 Relay Common Port	1.0mm ²	Connected with COM2 common port output, rated 1A DC28V.	For settings refer to Table 9.	
7	Aux. Relay Output 2	1.0mm ²			
8	Aux. Relay Output 3	1.0mm ²			
9	Aux. Relay Output 4	1.0mm ²			
10	Aux. Relay Output 5	1.0mm ²			Relay's normally open passive contact, rated 1A DC28V.
11		1.0mm ²			
12	Aux. Relay Output 6	1.0mm ²			Normally open, rated 1A DC28V
13		1.0mm ²			Normally close, rated 1A DC28V
14		1.0mm ²	Relay common port		
15	B(+)	0.5mm ²	GOV speed adjustment output		
16	A(-)	0.5mm ²			
17	RS485 A(+)	0.5mm ²			
18	RS485 B(-)	0.5mm ²			
19	Emergency Shutdown Input	0.5mm ²	Once it is valid, controller stops genset immediately.		
20	Aux. Input 1	0.5mm ²	Ground connected is active (B-).	For settings refer to Table 10.	
21	Aux. Input 2	0.5mm ²	Ground connected is active (B-).		
22	Aux. Input 3	0.5mm ²	Ground connected is active (B-).		
23	Aux. Input 4	0.5mm ²	Ground connected is active (B-).		
24	Aux. Input 5	0.5mm ²	Ground connected is active (B-).		
25	Charger (D+) Input	1.0mm ²	Connected with D + (W/L) of charger. If it does not exist, please hang it in the air.		
26	Aux. Input Common Port	0.5mm ²	Has been connected to (B-) Internally.		
27	W/L	0.5mm ²	Connected with W terminal of charging generator.		
28	MP2 speed sensor input, controller internally has connected to B(-)	0.5mm ²	Connected with engine speed sensor. Shielding wire is recommended.		
29	MP1 speed sensor input	0.5mm ²			
30	Temp. Sensor	1.0mm ²	Connected with temperature sensor (resistor type).	For settings refer to Table 11.	
31	Oil Pressure Sensor	1.0mm ²	Connected with pressure sensor(resistor/current/voltage type).		
32	Aux. Sensor 1	1.0mm ²	User-defined (resistor type)		
33	Aux. Sensor 2	1.0mm ²	User-defined (resistor type)		
34	Aux. Sensor 3	1.0mm ²	User-defined (resistor/current/voltage type)		
35	Aux. Sensor 4	1.0mm ²	User-defined (resistor/current/voltage type)		
36	DC5V	1.0mm ²	Provide power for voltage type sensor		



No.	Function	Cable Size	Remarks
37	Sensor COM (B-)	1.0mm ²	Sensor common port. Controller inside has connected with B-.
	USB	/	Communicating with PC monitoring software.

8 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

8.1 CONTENTS AND SCOPES OF PARAMETERS

Table 8 – Parameter Contents and Scopes

No.	Item	Range	Default	Description
Language Setting				
1	Language	(0-2)	0	0: Simplified Chinese; 1: English; 2: Other
Override Mode				
1	Override Mode	(0-1)	0	0: Disable; 1: Enable
Module Setting				
1	Power On Mode	(0-2)	0	0: Stop Mode; 1: Manual Mode; 2: Auto Mode
2	Module Address	(1-254)	1	Remote monitoring controller address
3	Communication Stop Bit	(0-1)	0	0: 2-bit Stop Bit; 1: 1-bit Stop Bit (PC software set)
4	Password Setting	(0-9999)	0318	<p>This password is used for entering high level parameter setting.</p> <p>⚠ CAUTION: original password is "0318", and operator can change it to prevent others from changing controller's advanced configuration at will. Please memorize the new password after changing. If forget it, please contact with supplier service personnel.</p>
5	LCD Backlight	Contrast Ratio	(0-10)	5
		Brightness	(0-5)	5
		Backlight Delay	(0-3600)min	5
6	Date And Time			Users can calibrate date and time by themselves.
Timers Setting				
1	Start Delay	(0-3600)s	1	Time from remote start signal is active to genset starting
2	Stop Delay	(0-3600)s	1	Time from remote stop signal is active to genset stop
3	Preheating Delay	(0-3600)s	0	Time of pre-powering of preheating plug



No.	Item	Range	Default	Description
				before starter is powered up
4	Prestart Fuel Time	(0-3600)s	1	Time of fuel relay output before starter powered up
5	Cranking Time	(3-60)s	8	Time of starter powered up every time (If diesel driven suction pump enabled, it is also can be the cranking time).
6	Cranking Rest Time	(3-60)s	10	The waiting time before the second powering up when engine starting fails (If diesel driven suction pump enabled, it is also can be cranking rest time of diesel driven suction pump).
7	Safety On Delay	(0-3600)s	10	Alarms for low oil pressure, high temperature, under speed, under frequency /voltage, charging failure are inactive during this time
8	Start Idle Time	(0-3600)s	0	Idle running time of genset when starting
9	High-speed Warming Up Time	(0-3600)s	10	Warming-up time for engine after high speed running and before loading
10	High-speed Cooling Time	(0-3600)s	10	Heat dissipating time before genset stop
11	Stop Idle Time	(0-3600)s	0	Idle running time when genset stop.
12	ETS Stop Output Time	(0-3600)s	20	The time of powering up the ETS before stopping (If diesel driven suction pump enabled, it is also can be stop output time of diesel driven suction pump).
13	Waiting Stop Time	(0-3600)s	0	Time between ending of genset idle delay and stopping completely when ETS Stop Output Time is 0; Time between ending of ETS stop delay and stopping when ETS Stop Output Time is not 0.
14	After Stop Time	(0-3600)s	0	Time between genset stop and standby status
15	Fuel Pre-supply Rest Time	(0-12)h	2	Interval between the completion of the pre-fuel supply output and the next pre-supply output in standby status when output is configured as "Fuel Pre-supply"; If time is 0, fuel pre-supply is not outputted in standby status.
16	Fuel Pre-supply Time	(3-30)s	5	Fuel pre-supply output time when output is configured as "Fuel Pre-supply".
Engine Setting				
1	Speed Signal Source	(0-1)	0	0: speed sensor; 1: W/L
2	W/L Ratio	(0-99.99)	9.04	



No.	Item	Range	Default	Description	
3	Flywheel Teeth	(1.0-300.0)	118.0	Tooth number of the engine, which is used for judging crank disconnect conditions and detecting rotate speed; Refer to the installation instructions.	
4	Rated Speed	(0-6000) r/min	1500	Provide standard to judge over/under/loading speed	
5	Start Attempts	(1-10) Times	3	Maximum starting times when engine fails to start; When the number is 10, controller will send starting failure signal. (If diesel driven suction pump enabled, it is also can be start attempts of diesel driven suction pump).	
6	Crank Disconnect Conditions	(0-2)	2	See table 12. There are 2 conditions of disconnecting starter with engine. Each condition can be used alone and simultaneously to separate the start motor and genset as soon as possible.	
7	Disconnect Speed	(0-200)%	24	Set value is the percentage of rated speed. When generator speed is higher than the set value, starter will be disconnected. See the installation instruction.	
8	Disconnect Oil Pressure	(0-1000)kPa	200	When oil pressure is higher than the set value, starter will be disconnected. See the installation instruction.	
9	Overspeed Warn	Set Value	(0-200.0)%	110.0	Set value is the percentage of rated speed. Return value and delay value can also be set.
		Return	(0-200.0)%	108.0	
		Delay	(0-3600)s	5	
10	Underspeed Warn	Set Value	(0-200.0)%	55.0	
		Return	(0-200.0)%	60.0	
		Delay	(0-3600)s	5	
11	Overspeed Shutdown	Set Value	(0-200.0)%	114.0	Set value is the percentage of rated speed. Return value and delay value can also be set.
		Delay	(0-3600)s	2	
12	Underspeed Shutdown	Set Value	(0-200.0)%	50.0	
		Delay	(0-3600)s	3	
13	Loss of Speed Signal Delay	(0-3600)s	5	Time from detecting speed is 0 to action gets confirmed.	
14	Loss of Speed Signal Action	(0-1)	0	0: Warning; 1: Shutdown	



No.	Item	Range	Default	Description	
15	Battery Rated Voltage	(0-60.0)V	24.0	Standard for detecting over/under voltage of battery.	
16	Battery Overvoltage Warn	Set Value	(0-200)%	120	Set value is percentage of rated voltage of battery. Delay value and return value can also be set.
		Return	(0-200)%	115	
		Delay	(0-3600)s	60	
17	Battery Undervolt Warn	Set Value	(0-200)%	85	
		Return	(0-200)%	90	
		Delay	(0-3600)s	60	
18	Charge Alt Fail	Set Value	(0-60.0)V	8.0	In normal running, when charger D+ (WL) voltage is under this value, charge failure alarms.
		Return	(0-60.0)V	10.0	
		Delay	(0-3600)s	10	
19	Battery Undervolt Detection	Enable	(0-1)	0	Detection before scheduled start. If battery voltage is lower than set value, battery undervolt alarms.
		Set Value	(0-60.0)V	18.0	
20	Engine Idle	(0-100)%	60	Set value is percentage of rated speed. If idle running is needed, speed will be stabilized in set value.	
21	Pump Cranking	(0-2)	0	0: Not Used; 1: D-driven Suction Pump; 2: E-driven Suction Pump	
22	D-driven Suction Pump Fault Shutdown Delay	(0-3600)s	90	Time for waiting for pressure coming (Input port is valid).	
23	Out-flowing Pressure for E-driven Suction Pump Stop	(0-1000)kPa	100	Pressure value when E-driven pump start output stops outputting.	
Analog Sensor Setting					
Temperature Sensor					
1	Curve Type	(0-15)	9	SGD. Details see Table 11.	
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 alarm when external sensor temperature is higher than this value. It is detected after safety delay. The delay value can be set.	
5	High Temp. Warning	(0-300)°C	95	Warning when external sensor temperature is higher than this value. It is detected after safety delay. The delay value and return value can be set.	
6	Low Temp. Warning	(0-300)°C	70	Warning when sensor temperature is lower than this value. It is detected always. The delay value and return value	



No.	Item	Range	Default	Description
				can be set.
7	Heater Control	((-50)-300)°C	50	When the temperature value of external sensor is lower than it, the heating controller outputs. The delay value and return value can be set.
8	Cooler Control	((-50)-300)°C	80	When the temperature value of external sensor is higher than it, the cooling controller outputs. The delay value and return value can be set.
9	Custom Curve			Setting curves according to sensors' performance.
Oil Pressure Sensor				
1	Curve Type	(0-15)	9	SGD. Details see Table 11.
2	Open Circuit 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	Engine will shut down when oil pressure of external sensor is lower than this value. It is detected after safety delay. The delay value can be set.
5	Low Oil Pressure Warning	(0-1000)kPa	124	Warning when oil pressure is lower than this value. It is detected after safety delay. The delay value and return value can be set.
6	Custom Curve			Select users-defined resistor/current/voltage curve from the curve types; It needs to set corresponding curves.
Auxiliary Sensor 1~4				
1	Sensor Selection	(0-8)	0	0: Not Used; 1: Temperature Sensor; 2: Pressure Sensor; 3: Level Sensor; 4: Flow Sensor; 5: Pipe Pressure Sensor; 6: Inlet Pressure Sensor; 7: Water Level Sensor; 8: Outlet Pressure Sensor.
2	Curve Type			Changing based on the sensor type
3	Open Circuit Action	(0-2)	0	0: Warning; 1: Shutdown; 2: No Action
4	Display Unit	(0-1)	0	0: °C; 1: °F Note: different sensors with different units.
5	Over Limit Shutdown	(0-9000)	100	Shutdown when external sensor value is higher than this value. Enable alarms and delay value can be set.
6	Under Limit Shutdown	(0-9000)	10	Shutdown when external sensor value is lower than this value. Alarms enable and delay value can be set.



No.	Item	Range	Default	Description
7	Over Limit Warning	(0-9000)	90	Warning when external sensor value is higher than this value. Alarms enable and delay value can be set.
8	Under Limit Warning	(0-9000)	20	Warning when external sensor value is lower than this value. Alarms enable and delay value can be set.
9	Custom Curve			Select users-defined resistor/current/voltage curve from the curve types; It needs to set corresponding curves.
Fuel Level Sensor Correlate				
1	Correlated Sensor Setting	(0-4)	0	0: Not Used 1: Auxiliary Sensor 1 2: Auxiliary Sensor 2 3: Auxiliary Sensor 3 4: Auxiliary Sensor 4
2	Fuel Pump Control	(0-1000)%	10	If the fuel level value of external sensor is lower than this value, fuel pump controller outputs. Both return value and delay value can be set.
3	Fuel Tank Capacity Setting	(0-10000)L	1000	
Outlet Pressure Correlated Setting				
1	Correlated Sensor Setup	(0-4)	0	0: Not Used 1: Auxiliary Sensor 1 2: Auxiliary Sensor 2 3: Auxiliary Sensor 3 4: Auxiliary Sensor 4
2	Pump Head Enable	(0-1)	0	0: Disable; 1: Enable
3	Pump Flow Enable	(0-1)	0	0: Disable; 1: Enable
4	Static Water Pressure	(-9000-9000)kPa	0	Setting static pressure of pump outlet.
5	Flow Unit	(0-1)	0	0: m ³ /h; 1:L/s
6	Rated Flow	(0-10000)m ³ /h	1000	Rated working flow of engine.
7	Over Flow Warn	(0-1000)%	110	Warning if flow value is higher than this value during genset running. Alarms enable, return value and delay value can be set.
8	Over Flow Shutdown	(0-1000)%	120	Shutdown if flow value is higher than this value during genset running. Alarms enable and delay value can be set.
9	Flow Curve Setting			Set the related curve between outlet pressures and the corresponding flows.
Auxiliary Input Ports				
Input 1				



No.	Item	Range	Default	Description
1	Content Set	(0-53)	28	Remote Start Details see Table 10.
2	Active Type	(0-1)	0	0: Close; 1: Open
Input 2				
1	Content Set	(0-53)	26	High Temp. Shutdown Details see Table 10.
2	Active Type	(0-1)	0	0: Close; 1: Open
Input 3				
1	Content Set	(0-53)	27	Low OP Shutdown Details see Table 10.
2	Active Type	(0-1)	0	0: Close; 1: Open
Input 4				
1	Content Set	(0-53)	0	User-defined Details see Table 10.
2	Active Type	(0-1)	0	0: Close; 1: Open
3	Active Range	(0-3)	2	0: After safety on delay; 1: Cranking starts; 2: Always; 3: Never
4	Active Action	(0-4)	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 is confirmed.
6	Description			User-defined
Input 5				
1	Content Set	(0-53)	0	User Configured Details see Table 10.
2	Active Type	(0-1)	0	0: Close; 1: Open
3	Active Range	(0-3)	2	0: From Safety on; 1: From Crank; 2: Always; 3: Never
4	Active Action	(0-4)	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 confirmed.
6	Description			User-defined
Auxiliary Output Ports				
Output 1				
1	Content Set	(0-119)	29	Fuel relay outputs. Details see Table 9.
2	Active Type	(0-1)	0	0: Normally Open; 1: Normally Close
Output 2				
1	Content Set	(0-119)	28	Start Relay outputs. Details see Table 9.
2	Active Type	(0-1)	0	0: Normally Open; 1: Normally Close



No.	Item	Range	Default	Description
Output 3				
1	Content Set	(0-119)	30	Idle Control Details see Table 9.
2	Active Type	(0-1)	0	0: Normally Open; 1: Normally Close
Output 4				
1	Content Set	(0-119)	31	Speed Raise Output Details see Table 9.
2	Active Type	(0-1)	0	0: Normally Open; 1: Normally Close
Output 5				
1	Content Set	(0-119)	32	Speed Drop Output Details see Table 9.
2	Active Type	(0-1)	0	0: Normally Open; 1: Normally Close
Output 6				
1	Content Set	(0-119)	1	Custom Period Output Details see Table 9.
2	Active Type	(0-1)	0	0: Normally Open; 1: Normally Close
Speed Adjustment Setting				
1	Interface Type	(0-2)	0	0: Not Used; 1: Relay Speed Adjustment; 2: GOV Speed Adjustment.
2	Stepping Coefficient	(0-100)	1	Higher GOV speed ratio, bigger the stepping coefficient. On the contrary, it will be smaller.
3	GOV Centre (SW1)	(0-10.0)V	5.0	Central voltage of electrical speed adjust
4	GOV Scope (SW2)	(0-10.0)V	2.0	The scope of central voltage that can be changed up and down
5	GOV Output Reverse	(0-1) 0: Not Reverse 1: Reverse	0: Not Reverse	Whether reverse GOV output
Scheduling And Maintenance Setting				
1	Scheduled Run	(0-1)	0	0: Disable; 1: Enable
2	Scheduled Not Run	(0-1)	0	0: Disable; 1: Enable
3	Maintenance 1	(0-1)	0	0: Disable; 1: Enable Set maintenance time, maintenance time to action, forewarning A and forewarning B time and action, maintenance timing way, and reset maintenance time. can be set simultaneously. After genset maintenance the maintenance time due alarm can be reset by maintenance time reset. Details see Table 13.
4	Maintenance 2	(0-1)	0	
5	Maintenance 3	(0-1)	0	
6	Maintenance 4	(0-1)	0	
7	Maintenance 5	(0-1)	0	

NOTE:



- When parameter configuration is going on via PC software, there is no need to input password if default password (0318) isn't changed; if default password has been changed, for the first time when parameters are setting via PC software, it is requested to write password in the password input window.
- Auxiliary inputs are prohibited to set same items, or there will not appear correct functions. Programmable outputs are allowed to set same items.
- Fuel level sensor correlated Setting: if fuel level is needed, any one of programmable sensor 1-4 should be set level sensor, and meanwhile curve type should be set the corresponding one. Then set fuel level correlated sensor and choose the corresponding programmable sensor, so the programmable sensor is the fuel level sensor, which can realize the function of fuel pump control and fuel tank capacity display.
- Outlet pressure correlated setting: if flow and head are to be calculated via water pressure, one of programmable sensor 1-4 needs to be configured as outlet pressure sensor, and meanwhile, curve type needs to be the corresponding one. Then set the outlet pressure correlated sensor and select the corresponding programmable sensor, and at this time, flow and head can be calculated via water pressure.
- If E-driven suction pump needs to judge whether it has stopped output by water pressure, Setting outlet pressure correlation is also needed.

8.2 DEFINABLE CONTENTS OF PROGRAMMABLE OUTPUT PORTS 1-6

Table 9 – Definable Contents of Auxiliary Output 1-6

No.	Type	Description
0	Not Used	
1	Custom Period Output 1	Details of function description please see the following.
2	Custom Period Output 2	
3	Custom Period Output 3	
4	Custom Period Output 4	
5	Custom Period Output 5	
6	Custom Period Output 6	
7	Custom Combined 1	
8	Custom Combined 2	
9	Custom Combined 3	
10	Custom Combined 4	
11	Custom Combined 5	
12	Custom Combined 6	
13	Reserved	
14	Reserved	
15	Air Flap Control	Act when over speed shutdown and emergence stop, and it can close the air inflow to stop the engine sooner.
16	Audible Alarm	Act when warning and shutdown alarms occur, it can be connected to annunciator externally. When auxiliary input "alarm mute" is active or press any key on the panel, it can be stopped. When new alarm or shutdown occurs, it will output again.
17	Louver Control	Act when genset is cranking and disconnect when genset stops completely.
18	Fuel Pump Control	It is controlled by fuel pump control threshold of level sensor.
19	Heater Control	It is controlled by heater control threshold of temperature sensor.



No.	Type	Description
20	Cooler Control	It is controlled by cooler control threshold of temperature sensor.
21	Fuel Pre-supply Output	In standby status, when fuel pre-supply output is active, fuel pre-supply rest time and fuel pre-supply time settings are outputted circularly. If fuel pre-supply rest time set is 0, fuel pre-supply is not outputted. Before starting the fuel pre-supply time set is outputted. If the preheating time is not configured, fuel pre-supply phase is outputted. If there is pre-heating configuration, then the preheating phase will be outputted.
22	Reserved	
23	Pre-lubricate Output	Act in the course of pre-heating, cranking and cranking rest time.
24	Remote Control	This port is controlled by RS485 communication port.
25	Reserved	
26	Reserved	
27	Reserved	
28	Start Relay	Act when genset is cranking and disconnect when cranking is successful.
29	Fuel Relay	Act when genset is cranking and disconnect when it stops completely.
30	Idle Speed Control	Applicable to engines with idle speed. Close before starting and open after starting high-speed warming up; Close during stop idle speed process and open when stop is completed. In other statuses, if idle speed control input is active or idle speed button is pressed, relay will close and starts outputting.
31	Speed Raise Output	Act in the course of high-speed warming up. It is controlled by speed adjustment during regular working period.
32	Speed Drop Output	Act during the period from stop idle speed time to waiting stop time. It is controlled by speed adjustment during regular working period.
33	ETS Stop Control	Applicable to oil engines with ETS electromagnets. Close when stop idle speed time is over and open when ETS stop delay time set is over.
34	Reserved	
35	Reserved	
36	Reserved	
37	Reserved	
38	Cranking Success Output	Close when a successful starting signal is detected.
39	Regular Running Output	Relay closes when genset is regularly running.
40	Reserved	
41	Reserved	
42	Common Alarm	Act when genset common warnings or shutdown alarms happen.
43	Common Shutdown Alarm	Act when common shutdown alarms happen.
44	Common Warning Alarm	Act when common warning alarms happen.
45	Reserved	
46	Battery Overvoltage	Act when battery overvoltage alarms happen.



No.	Type	Description
47	Battery Undervoltage	Act when battery undervoltage alarms happen.
48	Charging Failure	Act when genset charging failure alarms happen.
49	Reserved	
50	Reserved	
51	Reserved	
52	Reserved	
53	Reserved	
54	Reserved	
55	D-driven Pump Start Output	Pump start outputs when it is set as diesel-driven suction pump.
56	D-driven Pump Stop Output	Pump stop outputs when it is set as diesel-driven suction pump.
57	E-driven Pump Start Output	Pump outputs as it starts, and pump stops outputting as it stops when it is set as electronic-driven suction pump.
58	Reserved	
59	Input Port 1 Active	Act when input port 1 is active
60	Input Port 2 Active	Act when input port 2 is active
61	Input Port 3 Active	Act when input port 3 is active
62	Input Port 4 Active	Act when input port 4 is active
63	Input Port 5 Active	Act when input port 5 is active
64	Reserved	
65	Reserved	
66	Reserved	
67	Emergency Stop Alarm	Act when emergency stop alarms happen.
68	Start Failure Alarm	Act when start failure alarms happen.
69	Stop Failure Alarm	Act when stop failure alarms happen.
70	Under Speed Alarm	Act when under speed alarms happen.
71	Under Speed Shutdown	Act when under speed shutdown alarms happen.
72	Over Speed Alarm	Act when over speed alarms happen.
73	Over Speed Shutdown	Act when over speed shutdown alarms happen.
74	Reserved	
75	Reserved	
76	Bypass Control Output	Output from start idle speed time to stop idle speed time when water blast gun on-off input is active.
77	Reserved	
78	Reserved	
79	Engine High Temp. Warning	Act when high temp. warnings happen.
80	Engine Low Temp. Warning	Act when low temp. warnings happen.
81	Engine High Temp. Shutdown	Act when high temp. shutdown alarms happen.
82	Reserved	
83	Engine Low Oil Pressure Warning	Act when low oil pressure warnings happen.
84	Engine Low Oil Pressure Shutdown	Act when low oil pressure shutdown alarms happen.
85	Oil Pressure Sensor Open	Act when oil pressure sensor is open circuit.



No.	Type	Description
86	Reserved	
87	Sensor 1 High Warning	Act when auxiliary sensor 1 high warnings happen.
88	Sensor 1 Low Warning	Act when auxiliary sensor 1 is low warnings happen.
89	Sensor 1 High Shutdown	Act when auxiliary sensor 1 is high shutdowns happen.
90	Sensor 1 Low Shutdown	Act when auxiliary sensor 1 is low shutdowns happen.
91	Over Flow Shutdown	Act when genset over flow shutdown alarms occur.
92	Over Flow Warning	Act when genset over flow warnings occur.
93	Sensor 2 High Warning	Act when auxiliary sensor 2 high warnings happen.
94	Sensor 2 Low Warning	Act when auxiliary sensor 2 is low warnings happen.
95	Sensor 2 High Shutdown	Act when auxiliary sensor 2 is high shutdowns happen.
96	Sensor 2 Low Shutdown	Act when auxiliary sensor 2 is low shutdowns happen.
97	Sensor 3 High Warning	Act when auxiliary sensor 3 high warnings happen.
98	Sensor 3 Low Warning	Act when auxiliary sensor 3 is low warnings happen.
99	Sensor 3 High Shutdown	Act when auxiliary sensor 3 is high shutdowns happen.
100	Sensor 3 Low Shutdown	Act when auxiliary sensor 3 is low shutdowns happen.
101	Sensor 4 High Warning	Act when auxiliary sensor 4 high warnings happen.
102	Sensor 4 Low Warning	Act when auxiliary sensor 4 is low warnings happen.
103	Sensor 4 High Shutdown	Act when auxiliary sensor 4 is high shutdowns happen.
104	Sensor 4 Low Shutdown	Act when auxiliary sensor 4 is low shutdowns happen.
105	Reserved	
106	Reserved	
107	Reserved	
108	Reserved	
109	Reserved	
110	Reserved	
111	Reserved	
112	Reserved	
113	System in Stop Mode	Act when system is in stop mode.
114	System in Manual Mode	Act when system is in manual mode.
115	System in Auto Mode	Act when system is in auto mode.
116	Reserved	
117	Reserved	
118	Reserved	
119	Reserved	

8.2.1 CUSTOM PERIOD OUTPUT

Users-defined period output is composed by 2 parts: period output S1 and conditional output S2.



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

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

Period output S1 can be configured to one or several period outputs of the engine freely. Delay time after entering the period before outputting and output time can be set.

Conditional output S2 can be set as any conditions in output port setting.

▲NOTE: when both period output S1's delay output time and output time are 0, period output S1 is **TRUE** in its setting period.

Output period: start

Delay output time: 2s

Output time: 3s

Conditional output content: output port 1 is active

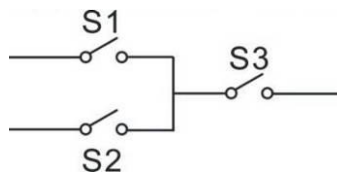
Close Status when conditional output is active/inactive: close when active (disconnect when inactive);

When output port 1 is active, it enters start time and after it delays for 2s, the user-defined period output starts to output, then after outputting for 3s, it stops outputting;

When output port 1 is inactive, the users-defined output does not output.

8.2.2 CUSTOM COMBINED OUTPUT

Users-defined combined output is composed by 3 parts: alternate conditional output S1 or S2 and bilateral conditional output S3.



If S1 or S2 is **TRUE**, and S3 is **TRUE**, users-defined combined output works;

If both S1 and S2 are **FALSE**, or S3 is **FALSE**, users-defined combined output does not work.

▲NOTE: S1, S2, and S3 can be any other contents except original users-defined combined output in the output setting.

▲NOTE: The 3 parts of users-defined combined output (S1, S2, and S3) cannot include or recursively include original outputs.

Alternate conditional output S1 contents: output port 1 is active;


Alternate conditional output S1 close status (active/inactive): close when active (disconnect when inactive);

Alternate conditional output S2 contents: output port 2 is active;

Alternate conditional output S2 close status (active/inactive): close when active (disconnect when inactive);
 Bilateral conditional output S3 contents: output port 3 is active;
 Bilateral conditional output S3 close status (active/inactive): close when active (disconnect when inactive);
 When input port 1 is active or input port 2 is active, if input port 3 is active, users-defined combined output works; if input port 3 is inactive, it does not output;
 When input port 1 is inactive and input port 2 is inactive as well, whether input port 3 is active or not, users-defined combined output does not work.

8.3 DEFINED CONTENTS OF PROGRAMMABLE INPUT PORTS

Table 10 – Defined contents of Programmable Input Ports

No.	Type	Description
0	Users-defined	Users-defined functions are as below: Indicator: Only display; No warning; No shutdown; Warning: Only warning; No shutdown; Shutdown: alarm and shutdown immediately Invalid: not working when inputting; Valid always: detecting always when inputting; Valid from cranking: starting to detect from cranking; Valid when safe running: starting to detect from safely running delay;
1	Reserved	
2	Alarm Mute	Prohibit Audible Alarm in the output setting when input is active;
3	Alarm Reset	Reset shutdown alarm when input is active;
4	Reserved	
5	Lamp Test	All the indicator lights on the panel are light when input is active;
6	Panel Button Lock	All buttons on the panel do not work and cannot conduct parameter setting, but can do language setting and check event log and controller information when input is active except Page Up, Confirm and Page Down ones; Home screen displays  icon at the bottom right corner;
7	Cranking Success Input	Start is successful when input is active; If it is configured, rotating speed and oil pressure starting conditions shall be invalid;
8	Idle Speed Mode	Enter idle mode when input is active;
9	Auto Stop Inhibition	Prohibit engine to stop automatically when input is active after regular running in Auto mode;
10	Auto Start Inhibition	Prohibit engine to start automatically when input is active in Auto mode;
11	Power-on by Alarm inhibition	Prohibit engine to resume by alarm when input is active in Auto mode;
12	Reserved	
13	Reserved	
14	Idle/High Speed	Enter into idle mode when input is active; Get back to high-speed running when input is invalid;

No.	Type	Description
15	Reserved	
16	Reserved	
17	Reserved	
18	D-driven Suction Pump Start Success	Pump start succeeds when input is active;
19	Suction Pump Pressure Coming	Pressure forms when input is active;
20	Water Blast Gun Status	Normal status: if input is active, bypass control outputs from starting idle speed time to stopping idle speed time; Idle speed running status: if input is active, engine goes from idle speed working to regular working status, and meanwhile bypass control outputs (if configured);
21	Alarm Stop Inhibition	All shutdown alarms are inhibited except for emergency stop and over speed shutdown; (Override Mode)
22	Gauge Mode	All outputs are inhibited in this mode.
23	Reserved	
24	Reset Maintenance Time	Maintenance 1 's Time and Date is set as preset value when input is active;
25	External Charging Failure	When input is active, charging failure alarms happen;
26	High Temp. Shutdown	Connect sensor digital input;
27	Low OP Shutdown	Connect to sensor digital input;
28	Remote Start	In Auto mode, when input is active, engine can be started automatically.
29	Remote Stop	In Auto mode, when input is active and remote start input is inactive, engine can be stopped automatically.
30	High Level Input	In Auto mode, when input is active, engine can be started automatically (drain flood).
31	Low Level Input	In Auto mode, when input is active and high level input is inactive, engine can be stopped automatically (drain flood).
32	Manual Start Input	In Auto mode, when input is active, engine can be started automatically; when input is inactive, engine can be stopped automatically.
33	Reserved	
34	Simulate Stop key	Connect an external button (unlatched) and press simulate panel buttons;
35	Simulate Manual key	
36	Simulate Auto key	
37	Simulate Start key	
38	Simulate Speed Adjustment Key	
39-51	Reserved	
52	Speed Raise	Connect an external button (unlatched) and control speed manually;
53	Speed Drop	

8.4 SELECTION OF SENSORS

Table 11 – Sensor Selection

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

8.5 CONDITION SELECTION OF CRANK DISCONNECTION

Table 12 – Crank Disconnection Conditions

No.	Setting description
0	Engine Speed
1	Oil pressure
2	Oil pressure + Engine Speed

NOTE:


- There are 3 kinds of conditions that can disconnect the starter and the engine. Speed sensor and oil pressure sensor can be used independently. It is suggested that oil pressure sensor matches speed sensor together aiming to separate starting motor from the engine as soon as possible and judge whether it is started successfully precisely.
- Speed sensor is the magnetic equipment which is installed in the engine for detecting flywheel teeth number.
- If speed sensor is selected, please make sure that the flywheel teeth number is the same as the settings, or over speed shutdown and under speed shutdown may happen.
- If there is not speed sensor in the genset, please do not select corresponding items, or start failure and loss of speed signal alarm and shutdown may happen.
- If there is not oil pressure sensor in the genset, please do not select corresponding items.

8.6 MAINTENANCE SETTING

Table 13 – Maintenance Setting

Item	Content	Description
Enable Choice	0: Disabled, 1: Enabled	Applicable to set whether maintenance function is active or not;
Maintenance Time	(0-30000)h	Hours from maintenance enable to maintenance start;
Maintenance Time Due	0: No Action; 1: Warning; 2: Shutdown; 3: Indication.	Alarm action when remaining maintenance time is 0;
Pre-alarm A Time	(0-30000)h	Remaining maintenance time
Pre-alarm A Action	Same as the Maintenance Time Due	Action when remaining maintenance time reaches pre-alarm A time;
Pre-alarm B Time	(0-30000)h	Remaining maintenance time
Pre-alarm B Action	Same as the Maintenance Time Due	Action when remaining maintenance time reaches pre-alarm B time;
Maintenance Timing Way	0: Genset Running Time 1: Real Time Clock	The timing way of maintenance
Reset Maintenance Time		Applicable to reset maintenance time after maintenance is finished.
Maintenance Description		Applicable to put in maintenance name, e.g. change engine oil.
























9 PARAMETER SETTING

Press  key and setting menu appears after controller is powered on. The menu list is as below:















- >Return
- >Parameter Setting
- > Override Mode
- >Language
- >Event Log
- >Module Info

Select “Parameter Setting” and input the password (default: 0318) to the parameter setting interface.

Parameter setting process details are as below:

Parameter Setting >Return >Module Set > Timer Set > Engine Set	Screen 1: press   to change the settings; press  to confirm and the parameter setting (Screen 2) appears; press  to return to previous level; Select “Return” and press “Confirm” button the previous screen appears.
Timer Set >Return >Start Delay > Stop Delay > Preheating Delay	Screen 2: Press   to change the settings; press  to enter parameter setting (Screen 3); press  to return to the last screen (Screen 1). Select “Return” and press “Confirm” button the previous screen appears.
Start Delay 00001s	Screen 3: Press  and move the cursor, then pick on the value that needs to be changed and press   to modify. After modification, press  to save. Then press  to return to previous screen (Screen2).
Timer Set >Return > Start Delay > Stop Delay > Preheating Delay	Screen 4: Press  , select and modify the value (same with Screen and Screen 3).
Over Shutdown Enable Choice: Enabled Value Set: +00098 Delay Value: 00003s	Screen 5: Sensor shutdown parameter setting. Select >Over Shutdown, press  to enter, and then press  again to enter Screen 5. Press   to select setting, then press  to save and meanwhile the cursor will move down as Screen 6 shows.
Over Shutdown Enable Choose: Enabled Value Set: +00098 Delay Value: 00003s	Screen 6: Press   to change plus or minus, then press  to next bit. After setting finished, press  to enter delay setting. If there



	is no need to modify, press  to return.
Pump Cranking Setting 0: Not Used	Screen 7: Pump cranking setting. Select > Pump Cranking Setting, press  to enter setting, press  again to enter Screen 7, press   to select setting (as Screen 8).
Pump Cranking Setting 1:D-driven Suction Pump Fault Shutdown Delay 00090s	Screen 8: Press   to show more setting information. Press  to configure next setting (such as Screen 9). If there is no need to change, press  to return.
Pump Cranking Setting 1:D-driven Suction Pump Fault Shutdown Delay 00090s	Screen 9: Press  and move cursor, select the value and press   to modify. Press  to save your modification. Then press  to return.



Note:

- Please modify inner parameters under the standby status (e.g.: cranking disconnection condition selection, auxiliary input/output configuration, all kinds of configurations etc.), otherwise shutdown or other abnormal phenomenon shall appear.
- High threshold must be bigger than low threshold, otherwise over high and over low may appear at the same time.
- Please set return value correctly as to setting warning alarms, otherwise the controller cannot alarm normally. The return value shall be less than the value set as to setting over high warning; the return value shall be higher than the value set as to setting over low warning.
- Auxiliary inputs must not be set the same value, otherwise normal function cannot be produced. Auxiliary outputs can be the same.

10 SENSOR SETTING

----- Standard value shall be transferred for the sensor curve when sensors are reselected. For example, if the temperature sensor set in the delivery process is SGD, it will be SGD curve; if SGX, it will be SGX curve.

----- If there is difference between standard sensor curve and the using sensor, users-defined sensor can be selected, and it naturally is defined sensor curve.

----- If "Not Used" is selected, the sensor curve does not work.

----- "Not Used" must be selected if the sensor only has a warning switch, otherwise shutdown or warning may happen.

----- The Y-axis values of the several points at the headmost and backmost can be set the same. Please see Fig. 4.

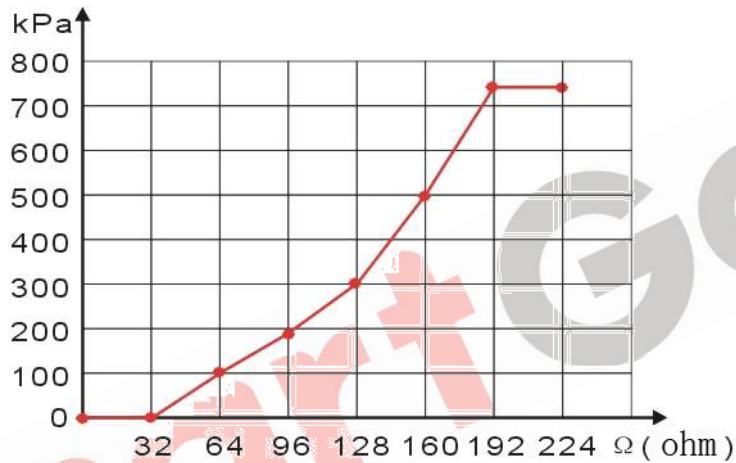


Fig.4 – Curve Setting

Table 14 - Normal Pressure Unit Conversion Form

Item	N/m ² (Pa)	kgf/cm ²	bar	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

11 COMMISSIONING

Before formal operation, following examinations are suggested:

- a) Ensure all the connections are correct and wire network is suitable.
- b) Ensure the current power of the controller is equipped with fuse and that it is correctly connected with the passive and negative anodes of the starter battery.
- c) Take proper measures to stop engine to crank successfully (e. g.: remove the connection wire of the fuel valve.). Make sure everything is correct and power on the starter battery, then the controller shall conduct program.
- d) Press “Start” button, and the genset shall start. After the starting times set, the controller shall give out starting failure signal. Press “Stop” button and the controller shall recover.
- e) Recover the actions that stop the genset to start successfully (recover the connection wire of the fuel valve.), and press the “Start” button again and the genset shall start. If everything is Ok, the genset shall work from idle speed running (if there is idle speed set) to normal running. During this period, please observe the working situation of the engine.
- f) If there is any other question, please contact SmartGen’s service personnel.

12 TYPICAL APPLICATION

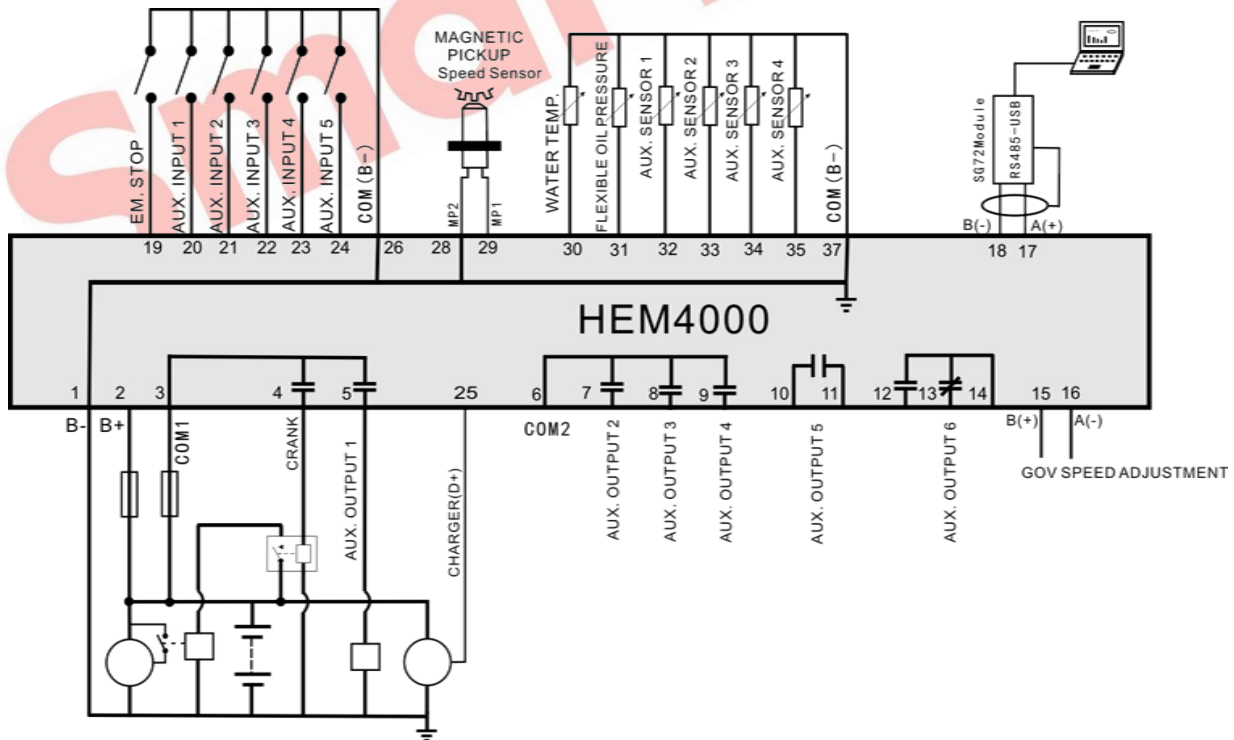


Fig.5 – HEM4000 Typical Application Diagram

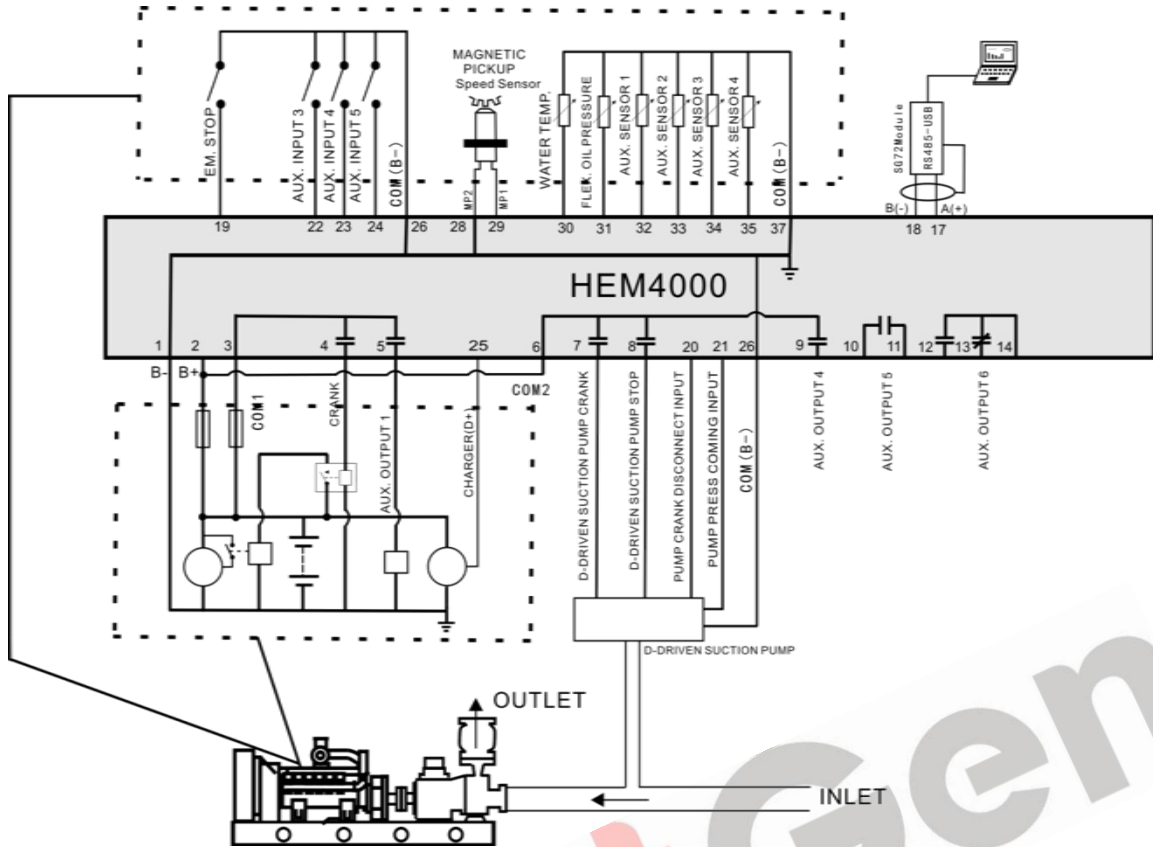


Fig.6 – Connecting to D-driven Suction Pump Typical Application Diagram

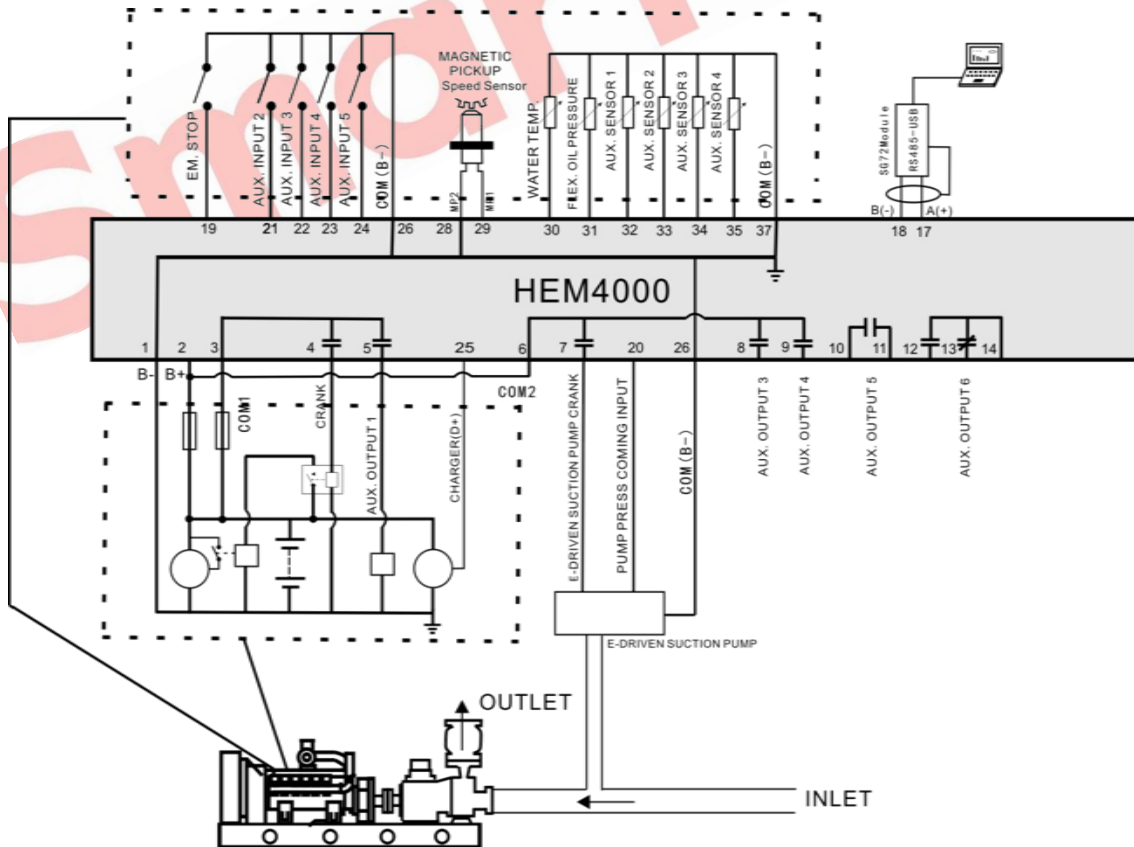


Fig.7 – Connecting to E-driven Suction Pump Typical Application Diagram

13 INSTALLATION

13.1 FIXING CLIPS

HEM4000 controller is designed as panel mounting. Panels are fixed by the clips.

- Screw out the metal clips to proper position anticlockwise.
- Pull the fixed clips towards the controller back direction, and ensure four fixed metal clips are all fixed inside the allotted slots.
- Screw up the metal clips clockwise, and make sure they are fixed on the panels.
- Turn the fixing clip screws clockwise until they are fixed on the panel.

▲ Note: The screw of the clips shall not be tightened up too much.

13.2 OVERALL DIMENSION AND CUTOUT

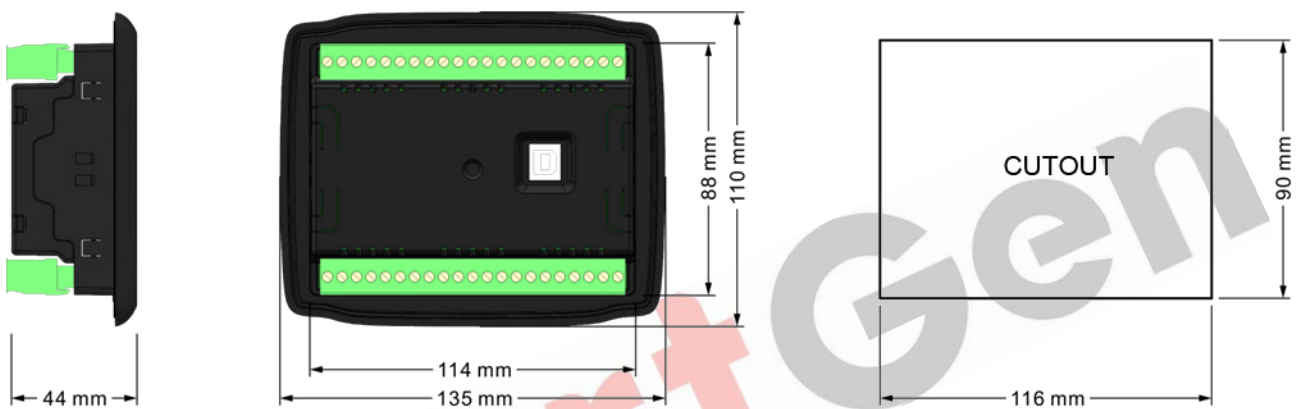


Fig.8 - Overall Dimensions and Cutout

— BATTERY VOLTAGE INPUT

HEM4000 controller is applicable to battery voltage DC(8~35)V environment. Negative anode of the battery must be connected with the engine shell. Sectional area of the wire that connects with the controller power B+ and B- must be equal to or over 1.5mm². If floating charger is configured, please connect output wires directly to the battery's positive and negative anodes, and then connect wires from battery's positive and negative to the controller's positive and negative input ends in order to prevent charger disturbing the controller's normal working.

— SPEED SENSOR INPUT

Speed sensor is the magnetic equipment installed in the engine body to detect flywheel teeth number. The wires used to connect with the controller shall be 2-core shielding wires. The shielding layer shall be connected to No. 28 terminal on the controller, and meanwhile the other terminal shall be hanging in the air. Another two signal wires shall be connected to No.28 and No.29 terminals on the controller. The output voltage of the speed sensor shall be within AC(1~24)V (effective value) in the range of full speed and AC12V is recommended (at rated speed). As to speed sensor installation, the sensor can firstly be spun to the connection flywheel, then invert 1/3 lap, and finally tighten up the screw on the sensor.

— OUTPUT AND EXPAND RELAYS

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

14 FAULT DROPPING

Table 15 – Fault Dropping

Fault Symptoms	Possible Solutions
No response when controller is power on	Check starting battery; Check controller connection wirings; Check DC fuse;
Genset shutdown	Check whether the water/cylinder temperature is too high or not; Check DC fuse;
Controller emergency stop	Check whether emergence stop button is correct or not; Check whether the connection circuit is open;
Low oil pressure alarm after successful start	Check the oil pressure sensor and its connection wires.
High water temp. alarm after successful start	Check the temperature sensor and its connection wires.
Shutdown alarm in running	Check relating switches and connection wires according to the information on the LCD; Check auxiliary input ports.
Start failure	Check fuel oil circuit and its connections; Check starting battery; Check speed sensor and its connections; Refer to engine manual.
No response for the starter	Check starter connections; Check starting battery.
RS485 abnormal communication	Check connections; Check whether COM port settings are correct or not; Check whether A and B wires of RS485 are reversely connected or not; Check whether RS485 transformation module is damaged or not; Check whether the communication port of PC is damaged or not.

15 PACKING LIST

Table 45 – Packing List

No.	Name	Quantity	Remark
1	Controller	1	
2	Fixed Clip	2	
3	Certification	1	
4	User Manual	1	

SmartGen