HMC6000 SERIES
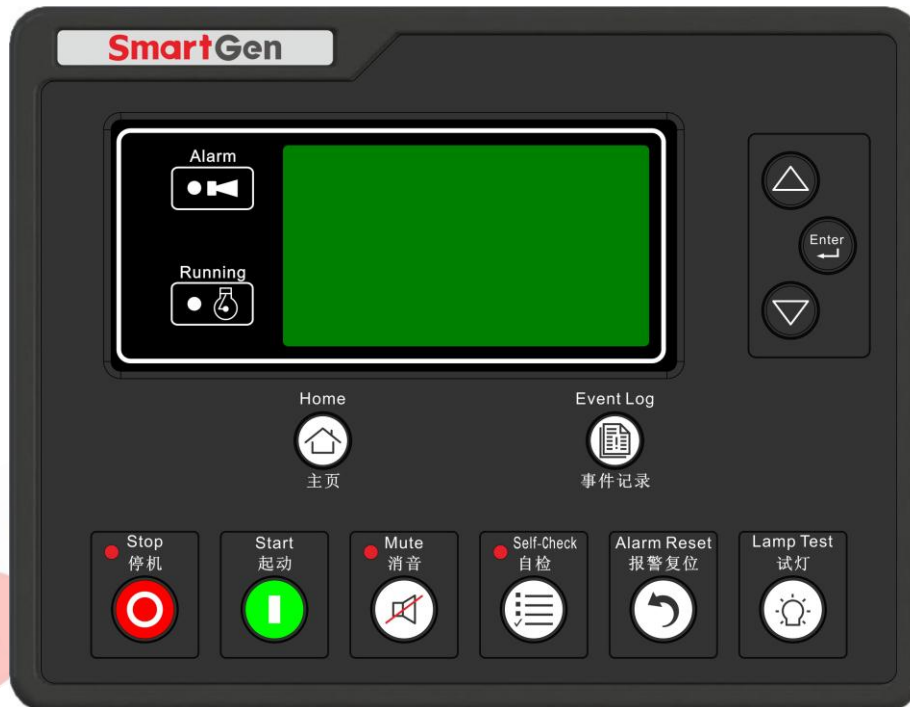
(HMC6000S/HMC6000E)

DIESEL ENGINE CONTROLLER

USER MANUAL

SMARTGEN (ZHENGZHOU) TECHNOLOGY CO.,LTD.

Chinese trademark

SmartGenEnglish trademark

SmartGen — make your generator *smart*

SMARTGEN(ZHENGZHOU) TECHNOLOGY CO., LTD
No.28 Jinsuo Road, Zhengzhou, Henan Province, China
Tel: +86-371-67988888/67981888/67992951
    +86-371-67981000(overseas)
Fax: +86-371-67992952
Email: sales@smartgen.cn
Web: www.smartgen.com.cn
      www.smartgen.cn

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Table 1 - Version history

Date	Version	Content
2015-11-20	1.0	Original release
2021-03-24	1.1	1. Upgrade the translation; 2. Change the manual font and the format of header and footer.

CONTENTS

1   OVERVIEW

HMC6000 diesel engine controller integrates digitization, intelligentization and network technology which are used for genset automation and monitor control system of single unit to achieve automatic start/stop, data measure, alarm protection and "three remote" (remote control, remote measuring and remote communication). It fit with 132*64 liquid display, optional Chinese/English languages interface, and it is reliable and easy to use.

The powerful 32-bit ARM processor contained within the module allows for precision parameters measuring, fixed value adjustment, time setting and set value adjusting and etc..Majority parameters can be configured from front panel and can be configured by communication interface via PC. Due to its compact structure, simple connections and high reliability, **HMC6000** can be widely used in marine emergency engines, main propulsion engines, main generator engines and pumping engines.

HMC6000 diesel engine controller has an expansion CANBUS port that will be connected to a remote control module or expansion digital output module, LED indicator expansion module and security module.

2   MODEL COMPARISON

Table 2 − Model Comparison

MODEL	FUNCTION							
	INPUT	OUTPUT	SENSOR	RS485	CANBUS	DOUT16A (expansion output module)	LA16 (LED expansion module)	RPU560 (Security Module)
HMC6000S	10	8	5	●	●	●	●	●
HMC6000E	10	8	5	-	●	●	●	●
HMC6000RM	0	0	0	-	●	-		

3 PERFORMANCE AND CHARACTERISTICS

- 32-bit ARM micro-processor, 132*64 liquid display, optional Chinese/English interface, push-button operation;

- Remote monitoring and remote start/stop control via CANBUS port; **HMC6000** panel lock in remote mode, making work safe and convenient.

- LA16 indicator module and RPU560A security module can be expanded via CANBUS port.

- RS485 communication ports enable data transmission as well as remote control, remote measurement and remote communication to be performed with the help of PC monitoring software via MODBUS protocol;

- Control and protection: remote/local start and stop, alarm protection.

- Override mode, in which only overspeed shutdown and emergency shutdown can be able to stop the engine;

- Parameter setting: parameters can be modified and stored into internal FLASH memory and can not be lost even in case of power outage;

- Five sensor inputs for pressure, temperature, liquid level or other sensors; pressure sensor, aux. sensor also can be set to 4-20mA inputs and voltage type inputs;

- Real-time clock, engine total run-time accumulation, display the total start times;

- Built-in watchdog to ensure smooth program execution;

- Built-in speed detection that accurately estimates starter disconnect speed, rated speed and overspeed.

- 99 event logs can be saved circularly and can be inquired on the spot.

- Digital regulation of all parameters - instead of analog regulation using conventional potentiometer - and, therefore, higher reliability and stability;

- Modular design, self extinguishing ABS plastic enclosure and embedded installation way; small size and compact structure with easy mounting

4   TECHNICAL PARAMETERS
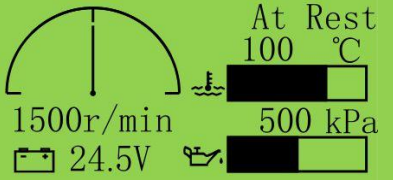
Table 3 − Technical Parameters

Parameter	Details
Working Voltage	DC8.0V to DC35.0V, uninterrupted power supply.
Power Consumption	<3W (Standby mode: ≤2W)
Speed Sensor Voltage	1.0V to 24V (RMS)
Speed Sensor Frequency	Max 10,000 Hz
Start Relay Output	16 A Connect to common output port.
Stop Relay Output	16 A Connect to common output port.
Fuel Relay Output	16 A Connect to common output port.
Audio Alarm Output	7 A Connect to common output port.
Common Alarm Output	7 A Connect to common output port.
Aux. Relay Output 1	7 A 250VAC voltage free output
Aux. Relay Output 2	7 A 250VAC voltage free output
Aux. Relay Output 3	7 A 250VAC voltage free output
Case Dimension	197 mm x 152 mm x 47 mm
Panel Cutout	186mm x 141mm
Working Conditions	Temperature: (-25~70)ºC; Humidity: (20~93)%RH
Storage Conditions	Temperature: (-25~70)ºC
Protection Level	IP55 Gasket
Insulation Intensity	Apply AC2.2kV voltage between high voltage terminal and low voltage terminal; The leakage current is not more than 3mA within 1min.
Weight	0.70kg

5 INTERFACE

5.1 MAIN INTERFACE

Table 4 – Main Interface Display

First Panel	At Rest 100 ℃ 1500r/min 500 kPa 24.5V	Simulated rotate speed meter (0-3000r/min)	Genset status
			Water temperature display (0-150℃)
		Rotate speed value	Oil pressure display (0-1000kPa)
		Battery voltage	
Second Panel	Start Attempts 0 Local Mode	Start Attempts, active when in local mode.	
	Charger 24.5V Oil Tem 100℃	Oil temperature value; Charger voltage	
	Sensor 1 10℃	Aux. sensor 1	
	Sensor 2 20℃	Aux. sensor 2	
	Accumulated Time 000000.0h	Accumulated running time.	
Third Panel	Alarm 1/2	Alarm page Page 1 of 2	
	High Water Temperature Shutdown	Alarm content	
		Alarm content	
	Low Oil Pressure Warn	Alarm content	
	Over Speed Warn	Alarm content	
	Low Battery Voltage Warn		
Alarm Record Panel	Alarm Record 1/3	Alarm record page	
	Low Oil Pressure Shutdown	Low oil pressure shutdown records	
	Oil Pressure：30kPa	Shutdown value	
	2014-10-05 11:11:10	Shutdown time	

5.2 CONTROLLER INFORMATION INTERFACE

Table 5 – Controller Interface Display

After pressing Enter for 3s, the controller will enter into select interface of parameter setting and controller information.	Return Parameter Setting Controller Information	After selected controller information, press Enter to enter into controller information interface.
First Panel	Controller Information Software Version 1.3 2015.05.15（5）09:30:10	This panel will display software version, hardware version and controller time. Press ▲ or ▼ to enter into second panel.
Second Panel	I:E S S L R O F 1 2 3 O:S F S H A 1 2 3 Standby	This panel will display input port status, output port status, and genset status. Press ▲ or ▼ to enter into first panel.

6   OPERATOR INTERFACE

6.1 PUSHBUTTONS DESCRIPTION

Table 6 − Pushbuttons Description

Button	Function	Description
⏺	Stop	Stop running generator in local mode; During stopping process, press this button again to stop generator immediately.
❚	Start	Start genset in local mode.
🔇	Mute	Alarm sound off;
☰	Self-checking	In standby mode, pressing this button the screen will scroll and 'sensor data' and 'alarm info' will be displayed and can also test alarm without rotate speed.
↩	Reset	If alarm occurs, pressing this button will reset it.
💡	Lamp Test	Press this button will test panel LED indicators and display screen.
⌂	Home	Shortcut to return to the main screen.
📖	Event Log	Shortcut to the alarm history page.
△	Up/Increase	Screen scroll. Up cursor and increase value in setting menu.
▽	Down/Decrease	Screen scroll. Down cursor and decrease value in setting menu.
Enter ↵	Set/Confirm	1. Pressing and holding for more than 3 seconds entry the parameter configuration menu; 2. In settings menu confirms the set value

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6.2 CONTROLLER PANEL

Fig.1 − Controller Panel

6.3 START/STOP OPERATION OF REMOTE CONTROL

6.3.1 ILLUSRATION

Deploy any aux. input port to remote start input. After the "remote mode" is active, remote start/stop operation can be initiated.

6.3.2 REMOTE START SEQUENCE:

1) When "Remote Start" is active, "Start Delay" timer is initiated;
2) "Start Delay" countdown will be displayed on LCD;
3) When start delay is over, preheat relay energizes (if configured), "preheat delay XX s" information will be displayed on LCD;
4) After the above delay, the Fuel Relay is energized, and then one second later, the Start Relay is engaged. Genset is cranked for a pre-set time. If genset fails to fire during this cranking attempt then the fuel relay and start relay are disengaged for the pre-set rest period; "crank rest time" begins and wait for the next crank attempt.
5) Should this start sequence continue beyond the set number of attempts, the start sequence will be terminated, the first line of LCD display will be highlighted with black and Fail to Start fault will be displayed.
6) In case of successful crank attempt, the "Safety On" timer is activated. As soon as this delay is over, "start idle" delay is initiated (if configured).

7) After the start idle, if the Rotate Speed, Temperature, Oil Pressure of controller are regular, the generator will enter into Normal Running status directly.

6.3.3 REMOTE STOP SEQUENCE:

1) When the "Remote Stop" or "Stop Input" signal is active, the Stop Delay is initiated.

2) Once this "stop delay" has expired, the "Stop Idle" is initiated. During "Stop Idle" Delay (if configured), idle relay is energized.

3) Once this "Stop Idle" has expired, the "ETS Solenoid Hold" begins. ETS relay is energized while fuel relay is de-energized.

4) Once this "ETS Solenoid Hold" has expired, the "Fail to Stop Delay" begins. Complete stop is detected automatically.

5) Generator is placed into its standby mode after its complete stop. Otherwise, fail to stop alarm is initiated and the corresponding alarm information is displayed on LCD (If generator is stop successfully after "fail to stop" alarm has initiated, "After stop" delay will be initiated).

6.4 AUTO MODE START/STOP OPERATION

6.4.1 ILLUSRATION

Deploy any Aux. input port to auto-mode input. After the "auto mode" is active, Start/Stop operation can be initiated.

6.4.2 AUTO START SEQUENCE:

1) When "Start Input" signal is active, "Start Delay" is initiated.

2) "Start Delay" count down information will be displayed on LCD.

3) After the "Start Delay" has expired, preheat relay energizes (if configured), "preheat delay XX s" information will be displayed on LCD;

4) After the above delay, the Fuel Relay is energised, and then one second later, the Start Relay is engaged. The genset is cranked for a pre-set time. If the genset fails to fire during this cranking attempt then the fuel relay and start relay are disengaged for the pre-set rest period; "crank rest time" begins and wait for the next crank attempt.

5) Should this start sequence continue beyond the set number of attempts, the start sequence will be terminated, the first line of LCD display will be highlighted with black and Fail to Start fault will be displayed.

6) In case of successful crank attempt, the "Safety On" timer is activated. As soon as this delay is over, "start idle" delay is initiated (if configured).

7) When the "start idle" delay is over, "warming up" delay is initiated (if configured).

8) When "warming up" delay is over, generator will enter into Normal Running status.

6.4.3 AUTO STOP SEQUENCE：

1) When "Stop Input" is active, the "Stop Delay" is initiated.

2) Once the "Stop Delay" has expired, the "Cooling Delay" is then initiated.

3) Once the "Cooling Delay" has expired, the "Stop Idle" delay is initiated (if configured). During "Stop Idle" Delay, idle relay is energized.

4) Once the "Stop Idle" delay has expired, "ETS Solenoid Hold" begins. ETS relay is energized while fuel relay is de-energized.

5) Once this "ETS Solenoid Hold" has expired, the "Fail to Stop Delay" begins. Complete stop is detected automatically.

6) Generator is placed into its standby mode after its complete stop. Otherwise, fail to stop alarm is initiated and the corresponding alarm information is displayed on LCD (If generator is stop successfully after "fail to stop" alarm has initiated, "After stop" delay will be initiated and the alarm will be removed).

6.5 LOCAL START/STOP OPERATION

6.5.1 ILLUSRATION

Deploy any programme input port to local-mode input. After the "local mode" is active, Start/Stop operation will be doable by pressing buttons on the controller.

6.5.2 LOCAL START SEQUENCE:

1) Press ⓘ tton to start the gen-set; preheat relay energizes (if configured), "preheat delay XX s" information will be displayed on LCD;

2) After the above delay, the Fuel Relay is energised, and then one second later, the Start Relay is engaged. The genset is cranked for a pre-set time. If the genset fails to fire during this cranking attempt then the fuel relay and start relay are disengaged for the pre-set rest period; "crank rest time" begins and wait for the next crank attempt.

3) Should this start sequence continue beyond the set number of attempts, the start sequence will be terminated, the first line of LCD display will be highlighted with black and Fail to Start fault will be displayed.

4) In case of successful crank attempt, the "Safety On" timer is activated. As soon as this delay is over, "start idle" delay is initiated (if configured).

5) After the "start idle" delay expired, if the Rotate Speed, Temperature, Oil Pressure of controller are regular, the generator will enter into Normal Running status directly.

6.5.3 LOCAL STOP SEQUENCE:

1) Press ![Stop button] button to stop the gen-set and the "Stop Idle" delay is initiated (if configured). During "Stop Idle" Delay, idle relay is energized.

2) Once the "Stop Idle" delay has expired, "ETS Solenoid Hold" begins. ETS relay is energized while fuel relay is de-energized.

3) Once the "ETS Solenoid Hold" delay has expired,"Fail to Stop Delay" begins. Complete stop is detected automatically.

4) Generator is placed into its standby mode after its complete stop. Otherwise, fail to stop alarm is initiated and the corresponding alarm information is displayed on LCD (If generator is stop successfully after "fail to stop" alarm has initiated, "After stop" delay will be initiated).

Table 7- Start/Stop Description of HMC6000

	Local Start	Local Stop	Input Start	Input Stop	Input Start/Stop	Remote Start	Remote Stop
Local	●	●	-	-	-	-	-
Remote	-	-	●	●	●	●	●
Auto	-	-	●	●	●	-	-

7   PROTECTION

7.1 WARNING

Warnings are not shutdown alarms and do not affect the operation of the gen-set. Warning alarms does not lead to shutdown and the detailed alarm information will be displayed on LCD.

Table − 8 Warning types

No.	Type	Detection Range	Description
1.	Over speed	Always active.	When the controller detects that the engine speed has exceeded the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
2.	Under speed	From "Warming up" to "Cooling" delay	When the controller detects that the engine speed has fallen below the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
3.	Loss of Speed Signal	From "Start Idle" delay to "Stop Idle" delay	When the controller detects that the engine speed is 0, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
4.	Failed to start	Among set crank times, after "Start Compeleted"	Among set crank times, if genset failed to start, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
5.	Failed to stop	After "Fail to Stop" Delay	After "fail to stop" delay, if genset does not stop completely, it will initiate a warning alarm and the

No.	Type	Detection Range	Description
			corresponding alarm information will be displayed on LCD.
6.	Charge Alt Fail	When generator is normal running	When the controller detects that charger voltage has fallen below the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
7.	Aux. Input 1-3	User defined	When the controller detects that the auxiliary input 1-3 warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
8.	High Water Temperature	Bigger than set speed	When the controller detects that the high water temperature warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
9.	High Oil Temperature	Bigger than set speed	When the controller detects that the high oil temperature warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
10.	Low Oil Pressure	Bigger than set speed	When the controller detects that the low oil pressure warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
11.	Aux. Sensor 1-2 High	Bigger than set speed	When the controller detects that the aux. sensor 1-2 warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
12.	Aux. Sensor 1-2 Low	Bigger than set speed	When the controller detects that the aux. sensor 1-2 warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
13.	Water Temperature Open	Always active.	When the controller detects that the water temperature sensor open warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
14.	Oil Temperature Open	Always active.	When the controller detects that the oil temperature sensor open warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
15.	Oil Pressure Open	Always active.	When the controller detects that the oil pressure sensor open warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
16.	Aux. Sensor 1-2 Open	Always active.	When the controller detects that the aux. sensor 1-2 open warning signals, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.

No.	Type	Detection Range	Description
17.	Bat under volt	Always active.	When the controller detects that the battery voltage has fallen below the pre-set value for more than 20s, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
18.	Bat over volt	Always active.	When the controller detects that the battery voltage has exceeded the pre-set value, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
19.	DOUT Com Fail	Always active (When DOUT16 is enabled).	When the controller detects DOUT module communication failure, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
20.	HMC6000RM Communication Failed	Always active (When HMC6000RM is enabled)	When the controller detects HMC6000RM module communication failure, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
21.	LA16Com Fail	Always active (When LA16 is enabled).	When the controller detects LA16 module communication failure, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
22.	RPU560Com Fail	Always active (When RPU560 is enabled).	When the controller detects RPU560 module communication failure, it will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
23.	Fresh Water Pressure Low Input	Always active.	When the input port defines this function, the controller will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
24.	Fresh Water Level Low Input	Always active.	When the input port defines this function, the controller will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
25.	Grease Level Low Input	Always active.	When the input port defines this function, the controller will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.
26.	Fuel Leakage Input	Always active.	When the input is active, the controller will initiate a warning alarm and the corresponding alarm information will be displayed on LCD.

⚠ NOTE: The warning types of Auxiliary input are active only when they are configured by users.

⚠ NOTE：The aux. input port 1~3 are corresponding with the input port A~C on the backplate of the controller.

⚠ NOTE：The aux. sensor 1~2 are corresponding with the sensor A~B on the backplate of the controller.

DOUT16: 16-channel digital output expansion module

LA16: 16-channel LED lamp expansion module

RPU560A：security expansion module

![SmartGen logo - ideas for power]

8   PARAMETER CONFIGURATION LIST

Long press ![Enter button] for 3s after starting the controller to enter the parameter setting menu, the correct password is required to enter the menu. The default password of the controller is 00318.

Please contact with the manufacturer if you forgot the password or sensor resistance/current calibration is required.

<div align="center">Table – 9 Parameter Configuration Items</div>

Parameter	Range	Default	Remarks
1. Start delay	(0-3600) s	1	The time from remote start signal active to complete start when the controller is in local/auto mode.
2. Return delay	(0-3600) s	1	The time from remote stop signal active to complete stop when the controller is in local/auto mode.
3. Preheat delay	(0-3600) s	0	The time of heater plug energized before starter energized.
4. Cranking Time	(3-60) s	8	The every starter energized time.
5. Crank rest Time	(3-60) s	10	The waiting time before second energizes start when starter failed to start.
6. Safety on Time	(0-3600) s	10	First running time after machine started.
7. Start idle time	(0-3600) s	0	Idle time when genset start.
8. Warming up time	(0-3600) s	10	Warming up time after genset running up.
9. Cooling time	(0-3600)s	10	Cooling time before stop.
10. Stop idle time	(0-3600) s	0	Stop idle time when stop.
11. ETS hold time	(0-3600) s	20	Stop magnet energized time when the genset is to stop.
12. Wait stop time	(0-3600) s	0	Time from idle delay finished to wait stop when "ETS hold time" is set to 0; time from ETS hold to wait stop when "ETS hold time" isn't set to 0.
13. Start Button Confirm Delay	(0.2-5.0) s	0.2	The time from pressing start button to start performance when the controller starts by button-press.
14. Stop Button Confirm Delay	(0.2-5.0) s	0.2	The time from pressing stop button to stop performance when the controller stops by button-press.

Parameter	Range	Default	Remarks
15. Flywheel teeth	(1-300)	118	The flywheel teeth installed in genset is used for judgement of separate conditions and detection of rotate speed. See 14 Installations.
16. Rated speed	(1-5999)r/min	1500	Provide standard for judgement of over speed, under speed and on load rotate speed.
17. Start Attempts	(1-30)	3	The maximum of start attempts when genset failed to start. When it arrive pre-set value, the controller will send failed to start signal.
18. Disconnect Conditions	(0-2) 0：Speed 1：OP 2：Speed+OP	0: Speed	There're three disconnect conditions to be used separately or at the same time. The purpose is to disconnect the starter motor from the engine as quickly as possible.
19. Disconnect OP	(10-1000)kPa	80	The starter will be sperated when OP is greater than the pre-set value.
20. Disconnect Speed	(0-200)%	25%	Set value is percentage of rated rotate speed. When speed exceeds pre-set value, starter will separate.
21. Under Speed Shut Enabled	(0-1) 0 Disabled 1 Enabled	1 Enabled	Under speed shut setting.
22. Under Speed Threshold (Shut)	(0-200)%	85%	
23. Under Speed Delay	(0-3600) s	1	
24. Under Speed Warn Enabled	(0-1) 0 Disabled 1 Enabled	1 Enabled	Under speed warn setting.
25. Under Speed Threshold (Warn)	(0-200)%	90%	
26. Under Speed Return	(0-200)%	92%	
27. Under Speed Delay	(0-3600) s	3	
28. Over Speed Shut Enabled	(0-1) 0 Disabled 1 Enabled	1 Enabled	Over speed shut setting.
29. Over Speed Threshold (Shut)	(0-200)%	115%	
30. Over Speed Delay	(0-3600) s	1	
31. Over Speed Warn Enabled	(0-1)	1 Enabled	Over speed warn setting.

Parameter	Range	Default	Remarks
	0 Disabled 1 Enabled		
32. Over Speed Threshold (Warn)	(0-200)%	110%	
33. Over Speed Return	(0-200)%	108%	
34. Speed Lose Delay	(0-3600) s	1	The time from that detecting speed is 0 to confirm action.
35. Speed Lose Act	(0-2) 0: No Action 1: Shutdown 2: Warn	1：Shutdown	The action after detecting loss of speed.
36. Charge Alt Fail	(0-60.0)V	16.0	The time from that detecting speed is 0 to confirm action.
37. Bat Rated Volt	(1-60.0)V	24.0	Provide standard for judgement of over voltage and under voltage.
38. Bat Over Volt	(0-200)%	125%	Set value is percentage of battery rated voltage.
39. Bat Under Volt	(0-200)%	75%	
40. Heating Up Limit	(0-100)℃	42	Open when temperature of water temperature sensor larger than pre-set value.
41. Heat Down Limit	(0-100)℃	37	Close when temperature of water temperature sensor less than pre-set value.
42. Cyc Lubri ENable	(0-1)0 Disabled 1 Enabled	0 Disabled	It can circulate prelubricate for genset after setting enabled.
43. Cyc Gap Period	(0-7200)min	300	It can set circulate period after circulate prelubrication.
44. Lubri Time	(0-7200)s	300	The time of each prelubrication.
45. Rated Idle	(1-2000)r/min	700	When the controller is speed regulating automatically, the controller needs a stable rotate speed value.
46. No Working Area	(0-10.0)%	1.0	Relay automatic speed regulation setting.
47. Gain	(0-100)%	10	
48. Response	0.25-4.00	0.50	
49. Stablization	(0.05-1.60)s	1.0	
50. Device ID	(1-254)	1	RS485 Comm. Address.
51. Language Select	(0-1) 0: Chinese 1: English	0: Chinese	Language selections.
52. Password Set	(0-99999)	00318	Password of parameter setting.
53. DOUT Enable	(0-1)	0 Disabled	If DOUT16A module is needed to expand, this setting enabled is needed.

Parameter	Range	Default	Remarks
54. HMC6000RM Module Enable	(0-1)	0 Disabled	If HMC6000RM module is needed to expand, this setting enabled is needed.
55. LA16 Enable	(0-1)	0: Disabled	If LA16 module is needed to expand, this setting enabled is needed.
56. RPU560 Enable	(0-1)	0: Disabled	If RPU560A module is needed to expand, this setting enabled is needed.
57. Baud Rate	(0-1) 0: 250kbps 1: 125kbps	0: 250kbps	CANBUS port communication Baud rate.
58. Date & Time			Date&Time setting.
59. Water Temperature Sensor set (Resistance input)	See 9.3. Sensor function settings Note: Resistance type input measuring range is not applicable.		Water temperature sensor setting.
60. Oil Temperature Sensor set (Resistance input)	See 9.3. Sensor function settings Note: Resistance type input measuring range is not applicable.		Oil temperature sensor setting.
61. Oil Pressure Sensor set (Resistance input)	See 9.3. Sensor function settings Note: Resistance type input measuring range is not applicable.		Oil pressure sensor setting.
62. Aux. Sensor 1 Set (Resistance/Current input)	See 9.3. Sensor function settings Note: Resistance type input measuring range is not applicable.		Aux. sensor1 setting.
63. Aux. Sensor 2 Set (Resistance/Current input)	See 9.3. Sensor function settings		Aux. sensor2 setting.
64. Input 1 Set	(0-50)	0：Not Used	See table 9.1.2.
65. Active type	(0-1)	0 ： Close to activate	Set up input port active of close or open.
66. Input 2 Set	(0-50)	0：Not Used	See table 9.1.2.
67. Active type	(0-1)	0 ： Close to activate	Set up input port active of close or open.
68. Input 3 Set	(0-50)	0：Not Used	See table 9.1.2.
69. Active type	(0-1)	0 ： Close to activate	Set up input port active of close or open.
70. Output 1 Set	(0-100)	0：Not Used	See table 9.2.2.
71. Output type	(0-1)	0：Normally open	Set up output port be always open or always close.
72. Output 2 set	(0-100)	0：Not Used	See table 9.2.2.
73. Output type	(0-1)	0：Normally open	Set up output port be always open or always close output.
74. Output 3 set	(0-100)	0：Not Used	See table 9.2.2.

Parameter	Range	Default	Remarks
75. Output type	(0-1)	0：Normally open	Set up output port be always open or always close output.

⚠ NOTE：The aux. input port 1~3 are corresponding with the input port A~C on the backplate of the controller.

⚠ NOTE：The aux. output port 1~3 are corresponding with the output port A~C on the backplate of the controller.

⚠ NOTE：The aux. sensor 1~2 are corresponding with the sensor A~B on the backplate of the controller.

9   INPUT/OUTPUT PORTS CONFIGURATION
9.1 AUXILIARY INPUTS 1~3 FUNCTIONAL CONFIGURATION

9.1.1 DIGITAL INPUT PORT OF CONFIGURATION

Table − 10 Digital Input of Configuration

No.	Settings	Contents	Description
1	Feature Set	(0- 50)	See 9.1.0 Input Port Functions
2	Active type	(0-1)	0：Close to activate 1：Open to activate
3	Arming	(0-3)	0：From Safety on 1：From Crank 2：Always 3：Never
4	Action	(0-2)	0：Warn 1：Shutdown 2：Indication
5	Input Delay	(0-20.0)s	
6	Displayed string	User-defined input port names	20 English symbols or 10 Chinese characters

9.1.2 INPUT PORTS FUNCTIONS

Table − 11 Input Port Functions

No.	Function	Description
0.	Not used	Not used
1.	User-defined	Users configured input port settings
2.	Alarm Mute	Can prohibit "Audible Alarm" output when input is active.
3.	Reset alarm	Can reset all alarms when input is active.
4.	Pre-lubricate	If output is set as pre-lubrication output, the relay disconnects after the set pre-lubrication delay.
5.	Reserved	
6.	Panel lock	All buttons in panel is inactive except ⧏⧐ ▲ ▼ Enter↵ Esc and there is 🔒 in the left of first row in LCD when input is

No.	Function	Description
		active.
7.	Quick start	Cranking will start directly (without preheating) when the input is active.
8.	Remote start/stop	Automatically starts the generator in remote mode; the generator will shut down when this input is deactivated.(Only in automatic mode)
9.	Auto Input	When the input is active, enter into auto mode, the local mode and remote mode is inactive and start/stop can only be achieved via input port.
10.	Turning Chain	Start inhibition when the input is active.
11.	Reserved	
12.	Low Fresh Water Pressure Input	Connect to digital input of sensor.
13.	Low Fresh Water Level Input	Connect to digital input of sensor.
14.	Low Grease Level Input	Connect to digital input of sensor.
15.	High Water Temperature Shutdown Input	Connect to digital input of sensor.
16.	High Oil Temperature Shutdown Input	Connect to digital input of sensor.
17.	Low Oil Pressure Shutdown Input	Connect to digital input of sensor.
18~50	Reserved	

⚠ **NOTE:** The name of the input ports 1~3 only can be configured via PC software.

9.2 OUTPUTS PORTS DEFINITION

9.2.1 DIGITAL OUTPUT DEFINITION CONTENTS

Table – 12 Digital Output Definition Contents

No.	Items	Contents	Note
1	Output Function Configuration	(0-100)	
2	Effective ways	0 Always Open 1 Always Close	
3	Effective duration	Bit0: Not Used Bit1: Standby Bit2: Preheat Bit3: Fuel Output Bit4: Start Bit5: Cran Rest Time Bit6: Safety Delay Bit7: Start Idle Bit8: Warm Up Bit9: Wait to Load Bit10: Normally Working Bit11: Cool Bit12: Stop Idle Bit13: ETS	

No.	Items	Contents	Note
		Bit14: Wait for Stop Bit15: Fail to Stop	
5	Delay output time	(0-100.0)s	
6	Output time	(0-3600)s	

9.2.2 OUTPUT PORT1-3 FUNCTIONS DEFINITION

Table − 13 Functions Definition

No.	Items	Description
0.	Not used	Not used
1.	Reserved	
2.	Air flap	Action when over speed shutdown and emergence stop. It also can close the air inflow to stop the engine as soon as possible.
3.	Audible alarm	Action when warning, shutdown, trips. Can be connected annunciator externally. When "alarm mute" configurable input port is active, it can remove the alarm.
4.	Crank Relay	Action when genset is starting and disconnect when crank success.
5.	Fuel Relay	Action when genset is starting and disconnect when stop is completed.
6.	ETS Hold	Action period: ETS hold delay.
7.	Reserved	
8.	Reserved	
9.	Loss of Speed	After safety on delay, the controller active when the engine speed is 0.
10.	Pre-lubricate	The controller output when the engine is in standby mode (user-defined output delay) if pre-lubrication input is active.
11.	Over Ride Output	The controller output when it is in override mode.
12.	Ready Go	The controller output when it is in standby mode and no alarms.
13.	Heating Control	It is controlled by heating temperature sensor's limited threshold.
14.	Idle Control	Action from "crank delay" to "start idle delay" and from "stop idle delay" to "wait for stop delay".
15.	Common Alarm	Action when genset common warning, common shutdown alarm.
16.	Common Shutdown	Action when common shutdown alarm.
17.	Common Warn	Action when common warning alarm.
18.	Aux. Input 1 Active	Action when input port 1 is active.
19.	Aux. Input 2 Active	Action when input port 2 is active.
20.	Aux. Input 3 Active	Action when input port 3 is active.
21.	Reserved	
22.	Crank Success	The gen-set start when the engine speed reaches requirements。
23.	Normal Running	The gen-set is normal running when the speed reaches rated requirements.

No.	Items	Description
24.	Remote Mode	The controller output in remote control mode.
25.	Local Mode	The controller output in local mode.
26.	Reserved	
27.	DOUT16 Com Fail	Action when the controller detects communication failure with DOUT16. (3s overtime)
28.	Shutdown Output	The controller output when it is shutdown mode.
29.	Bat Under Volt	Action when the controller detects that the battery voltage has fallen below the set value.
30.	Bat Over Volt	Action when the controller detects that the battery voltage has exceeded the set value.
31.	Under Speed Warn	Action when under speed warning.
32.	Under Speed Shutdown	Action when under speed shutdown alarm.
33.	Over Speed Warn	Action when over speed warning.
34.	Over Speed Shutdown	Action when over speed shutdown alarm.
35.	Emergency Stop	Action when emergency stop alarm.
36.	Charge Alt Fail	Action when charge failure warning.
37.	Failed To Start	Action when failed start alarm.
38.	Failed To Stop	Action when failed stop alarm.
39.	Reserved	
40.	Water Temperature Sensor Open	Action when water temperature sensor is open circuit.
41.	High Water Temperature Warn	Action when high water temperature sensor warning alarm.
42.	High Water Temperature Shutdown	Action when high water temperature sensor shutdown alarm.
43.	Oil Temperature Sensor Open	Action when oil temperature sensor is open circuit.
44.	High Oil Temperature Warn	Action when high oil temperature sensor warning alarm.
45.	High Oil Temperature Shutdown	Action when high oil temperature sensor shutdown alarm.
46.	Oil Pressure Sensor Open	Action when oil pressure sensor is open circuit.
47.	Low Oil Pressure Warn	Action when low oil pressure sensor warning alarm.
48.	Low Oil Pressure Shutdown	Action when low oil pressure sensor shutdown alarm.
49.	Aux. Sensor 1 Open	Action when aux. sensor 1 is open circuit.
50.	Aux. Sensor 1 Warn	Action when aux. sensor 1 warning alarm.
51.	Aux. Sensor 1 Shutdown	Action when aux. sensor 1 shutdown alarm.
52.	Aux. Sensor 2 Open	Action when aux. sensor 2 is open circuit.
53.	Aux. Sensor 2 Warn	Action when aux. sensor 2 warning alarm.
54.	Aux. Sensor 2 Shutdown	Action when aux. sensor 2 shutdown alarm.
55.	LA16 Com Fail	Action when the controller detects communication failure with LA16. (3s overtime)
56.	RPU560 Com Fail	Action when the controller detects communication failure with RPU560 safeguard module. (1s overtime)
57.	1 Way Power Fault	Security module output when 1 way power fault.
58.	2 Way Power Fault	Security module output when 2 way power fault.
59.	Rise Speed	When the controller is in idle mode and speed doesn't arrive at rated idle, it output when speed is rising and open automatically when speed arrives at rated idle. When the controller is running up and speed doesn't arrive at rated rotate speed, it output when speed is rising and open automatically when speed arrives at rated rotate

No.	Items	Description
		speed. Note: Active only when controller is in remote/auto mode.
60.	Drop Speed	When the controller is in idle mode and speed exceeds rated idle, it output when speed is dropping and open automatically when speed arrives at rated idle. When the controller is running up and speed exceeds at rated rotate speed, it output when speed is dropping and open automatically when speed arrives at rated rotate speed. Note: Active only when controller is in remote/auto mode.
61~100	Reserved	

9.3 SENSOR FUNCTIONAL CONFIGURATION
9.3.1 SENSOR CONFIGURATION

Table – 14 Sensor Configuration

No.	Settings	Contents	Remarks
1.	Sensor type	(0-3) 0：Not Used 1：Oil Pressure Sensor 2：Temperature Sensor 3：Fuel Level Sensor	Types such as Water Temperature Sensor, Oil Temperature Sensor, and Oil Pressure Sensor are not optional and are fixed temperature or pressure.
2.	Sensor curve	Curve types list	See 9.3.2/9.3.3/9.3.4 curve lists
3.	Alarm speed	(0-200)%	Alarm and test when the engine speed has exceeded the set value.
4.	Range	(0-6000)	Active when current of sensor is between 4~20mA. Corresponding unit of pressure sensor is kPa; Corresponding unit of level sensor is %
5.	Display Units	Temperature 0：℃ 1：ºF Pressure 0：kPa 1：Psi 2：bar	The units displayed on LCD. After selection of units, the displayed data will automatically convert according to units.
6.	High Shutdown Enable	(0-1) 0：Enable 1：Disable	
7.	High Shutdown Value	(0-6000)	
8.	High Shutdown Delay	(0-3600)s	
9.	Low Shutdown Enable	(0-1) 0：Enable 1：Disable	
10.	Low Shutdown Value	(0-6000)	
11.	Low Shutdown Delay	(0-3600)s	
12.	High Warn Enable	(0-1) 0：Enable 1：Disable	
13.	High Warn Value	(0-6000)	
14.	High Return Value	(0-6000)	

No.	Settings	Contents	Remarks
15.	High Warn Delay	(0-3600)s	
16.	Low Warn Enable	(0-1) 0：Enable 1：Disable	
17.	Low Warn Value	(0-6000)	
18.	Low Return Value	(0-6000)	
19.	Low Warn Delay	(0-3600)s	
20.	First point X (Resistance)	Resistance type (not PT100）	Sensor curve is user-defined X axis: 8 Y axis: 8
21.	Second point X (Resistance)	Resistance type (not PT100）	
22.	Third point X (Resistance)	Resistance type (not PT100）	
23.	Fourth point X (Resistance)	Resistance type (not PT100）	
24.	Fifth point X (Resistance)	Resistance type (not PT100）	
25.	Sixth point X (Resistance)	Resistance type (not PT100）	
26.	Seventh point X (Resistance)	Resistance type (not PT100）	
27.	Eighth point X (Resistance)	Resistance type (not PT100）	
28.	First point Y (Value)	Resistance type (not PT100）	
29.	Second point Y (Value)	Resistance type (not PT100）	
30.	Third point Y (Value)	Resistance type (not PT100）	
31.	Fourth point Y (Value)	Resistance type (not PT100）	
32.	Fifth point Y (Value)	Resistance type (not PT100）	
33.	Sixth point Y (Value)	Resistance type (not PT100）	
34.	Seventh point Y (Value)	Resistance type (not PT100）	
35.	Eighth point Y (Value)	Resistance type (not PT100）	
36.	User-defined string	User-defined sensor names	only can be set via upper computer software.

9.3.2 TEMPERATURE CURVES

Table－15 Temperature Curves

No.	Contents	Remarks
0	Not Used	
1	PT100	
2	User-defined Curve	
3	VDO	
4	CURTIS	
5	VOLVO-EC	
6	DATCON	The input range of user-defined resistance is between 0-6000Ω. The factory defaults of water temperature sensor and oil temperature sensor are SGXs.
7	SGX	
8	SGD	
9	SGH	
10	Reserved	
11	Cu50	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	

⚠ **NOTE:** PT100 Resistance type temperature sensor division value is set as 0.385 (0.385Ω corresponds to 1℃).

9.3.3 RESISTANCE SENSORS PRESSURE CURVES

Table－16 Pressure Curves

No.	Contents	Remarks
0	Not Used	
1	4~20mA	
2	User-defined Resistance Curve	
3	VDO 10Bar	
4	CURTIS	
5	Voltage Type (0.5V-4.5V)	
6	DATCON 10Bar	
7	SGX	The input range of User-defined resistance is between 0-6000Ω. The factory defaults of oil pressure sensor is SGX
8	SGD	
9	SGH	
10	User-defined Volt Curve	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	

⚠ **NOTE:** There is no need to set curve type but range if the pressure sensor is current type.

9.3.4 LIQUID LEVEL CURVES

Table − 17 Liquid Level Curves

No.	Contents	Remarks
0	Not Used	
1	4~20mA	
2	User-defined Resistance Curve	
3	SGD	
4	SGH	
5	Reserved	
6	Reserved	
7	Reserved	The default of HMC6000 sensor type doesn't have lipuid level sensor. Please chose one of aux. sensor 1/2 to use if need to.
8	Reserved	
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	

△ **NOTE:** There is no need to set curve type but range if the pressure sensor is current type.

10 PARAMETER SETTING

Press the button (Enter) for 3 seconds after start the controller, and then enter into parameter setting menu which need to input correct password. The default password is 00318.

PARAMETER SETTING OF CONTROLLER

Please contact with manufacturer when forget the password or need to correct the resistance/current value.

10.1 MATTERS NEED ATTENTION

1) Please modify the controller internal parameters in standby mode(such as starting successfully condition selections，auxiliary inputs、output port configuration，time delay, etc)，otherwise the alarm stop or other abnormal phenomena may occur.

2) High sensor alarm threshold value must be bigger than the low alarm threshold, otherwise they will both alarm simultaneously.

3) Over speed threshold value must be bigger than under speed threshold, otherwise there will be either overspeed or underspeed simultaneously.

4) When setting the condition of successful start, the start speed threshold value is supposed to be set lower as possible for quick disconnection of starter.

5) Auxiliary input port 1-3 cannot be set to the same project, otherwise correct function cannot arrive.

10.2 SENSOR SETTINGS CLARIFICATION

1) When reselect the sensors, the standard value of the selected sensor will be selected. If tempertuare sensor default is set to SGH (120ºC resistance), sensor curve will be the curve of SGH(120ºC resistance). If it is set to SGD(120ºC resistance), sensor curve will be the curve of SGD.

2) If standard sensor curve is mismatching with sensor in using, "User-defined sensor"could be chosen, then input user-defined sensor curve.

3) When inputting sensor curve, X (resistance) must be input in accordance with the order of growing up, otherwise mistakes will occur.

4) When the selection of sensor is "None", the temperature, pressure and fuel level will display "- - -".

5) If there is no pressure sensor but only low pressure alarm switch, the pressure sensor must be set to "None", otherwise low oil pressure alarm may initiate.

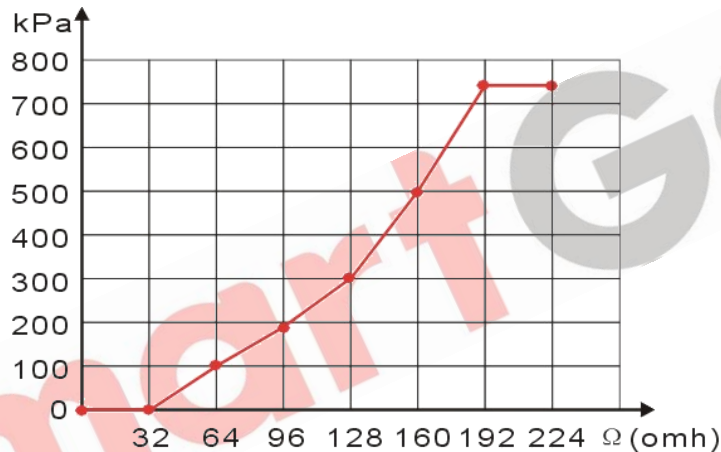6) Can set ordinate of front several points or last several points to the same. As shown in below:

Fig.2 − Sensor Setting Curve

Table − 18 Normal Pressure Unit Conversion

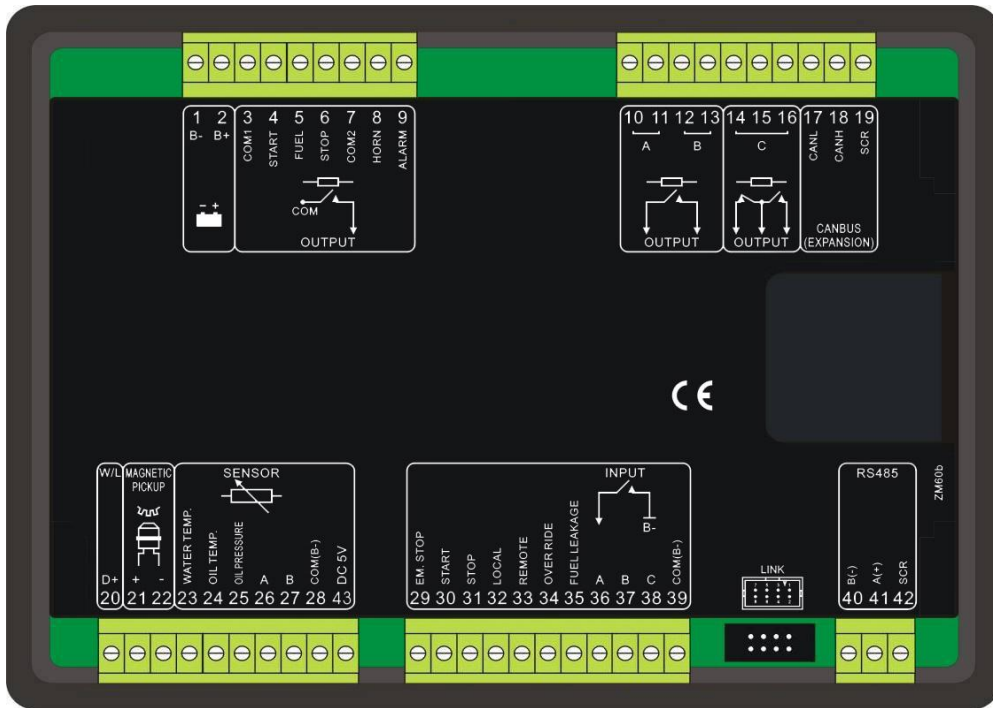|	N/m^2 Pa	kgf/cm^2	bar	psi
1Pa	1	1.02×10^{-5}	1×10^{-5}	1.45×10^{-4}
$1kgf/cm^2$	9.8×10^4	1	0.98	14.2
1bar	1×10^5	1.02	1	14.5
1psi	6.89×10^3	7.03×10^{-2}	6.89×10^{-2}	1

11 BACK PANEL

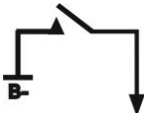Fig.3 – HMC6000 Controller Back Panel

Table − 19 Description of Terminal Connection

Icon	No.	Function	Cable Size	Description
	1.	DC input B-	2.5mm²	DC power supply negative input. Connected with negative of starter battery.
	2.	DC input B+	2.5mm²	DC power supply positive input. Connected with positive of starter battery.
	3.	COM1 Relay	1.5mm²	Connect to Com1 relay output
	4.	Fuel relay	1.5mm²	
	5.	Start relay	1.5mm²	
	6.	Stop relay	1.5mm²	
	7.	COM2 Relay	1.0mm²	Connect to Com2 relay output
	8.	Audio Alarm Relay	1.0mm²	
	9.	Common Alarm Relay	1.0mm²	
	10.	Aux. output 1(A)	1.0mm²	Free volts contact always open; Rated current: 7A; Contact output.
	11.		1.0mm²	
	12.	Aux. output 2(B)	1.0mm²	
	13.		1.0mm²	
	14.	Aux. output 3(C)	1.0mm²	Free volts contact always open; Rated current: 7A; Contact output.
	15.		1.0mm²	
	16.		1.0mm²	
CANBUS (EXPAN-SION)	17.	CAN(L) (EXPANSION)	0.5mm²	Used for connect to remote control and extended output module.
	18.	CAN(H) (EXPANSION)	0.5mm²	

Icon	No.	Function	Cable Size	Description
	19.	SCR (EXPANSION)	0.5mm²	
W/L	20.	D+ Charge input	1.0mm²	Charging generator D+ terminal input; Ground connected is not allowed.
	21.	MP1 (Magnetic pickup+)	0.5mm²	Connect to speed sensor; Using shielding wire is recommended.
	22.	MP1 (Magnetic pickup-)		
	23.	Water Temperature Sensor Input	1.0mm²	Water temperature sensor input(resistance)
	24.	Oil Temperature Sensor Input	1.0mm²	Oil temperature sensor input(resistance)
	25.	Oil Pressure Sensor Input	1.0mm²	Oil pressure sensor input(resistance/current)
	26.	Aux. Sensor 1	1.0mm²	User configure(resistance/current)
	27.	Aux. Sensor 2	1.0mm²	User configure(resistance/current)
	28.	COM(B-) input	1.0mm²	Connect to (B-) inside
	29.	Urgently Shutdown Input	0.5mm²	Controller shutdown urgently
	30.	Remote Start Input	0.5mm²	Start the engine in auto/remote mode.
	31.	Remote Stop Input	0.5mm²	Stop the engine in auto/remote mode.
	32.	Local Mode Input	0.5mm²	Transition will be forced to local mode when the input is active.
	33.	Remote Mode Input	0.5mm²	Transition will be forced to transition to remote mode when the input is active.
	34.	Over Ride Input	0.5mm²	Over ride mode will be active when the input is active.
	35.	Fuel Leakage Input	0.5mm²	Fuel leakage alarm will be initiated when the input is active.
	36.	Aux. input 1（A）	0.5mm²	User configure
	37.	Aux. input 2（B）	0.5mm²	User configure
	38.	Aux. input 3（C）	0.5mm²	User configure
	39.	COM(B-) input	1.0mm²	Connect to (B-) inside
RS485	40.	RS485-(B)	0.5mm²	PC programming and monitoring port (isolation type). Its single end earthed.
	41.	RS485+(A)	0.5mm²	
	42.	RS485	0.5mm²	
DC 5V	43.	DC 5V	1.0mm²	Supplies power to the voltage sensor.
LINK				Enables connection to PC monitoring software

⚠ **NOTE:** It is strictly prohibited to take out start battery when the engine is running. Failure to do so can create excessive DC input voltage and result in damage of destruction of equipment!

12   COMMUNICATION AND CONNECTION

12.1   RS485 AND LINK COMMUNICATION

HMC6000 gen-set controller has RS485 port and Link port which allows the controller to connect to open-type LAN. RS485 and Link applies ModBus communication protocol with the help of PC or DAS (Data Acquisition Systems) operational software provides easy to use marine engine monitoring system management scheme and enables remote control, remote measurement and remote communication.

12.2   CANBUS(EXPANSION) BUS COMMUNICATION

Various expansion modules can be connected to the controller via EXPANSION port.

1、   DOUT16A Digital output module：The module connects to the main controller via CANBUS port. Main controller transfers the output condition data of digital output module to module to handle via CANBUS. All parameters of digital output port can be configured via main controller.

2、   HMC6000RM Remote control module：Remote control module can achieve control operations such as starting engine, stopping engine,etc. All kinds of parameters and records of the engine real-time display on remote controller.

3、   LA16 LED Lamp Expansion Module：The module is connected to main controller via CANBUS port. The master controller send output status data of LED lamp module to process via CANBUS. All parameters of digital output port can be configured via master controller.

4、   RPU560 Security module: The module connects to the main controller via CANBUS port. If security module receives no signal from the main controller for more than 1 second and the main controller failure input deactivates, security module will take over engine control; after that the engine will be stopped only by shutdown input or in case of overspeed. Module input function, output function and overspeed alarm threshold are user-set.

⚠ NOTE: Remote control module can only be used in remote mode of the engine; in local mode remote control module only can check parameters and records but not control the engine.
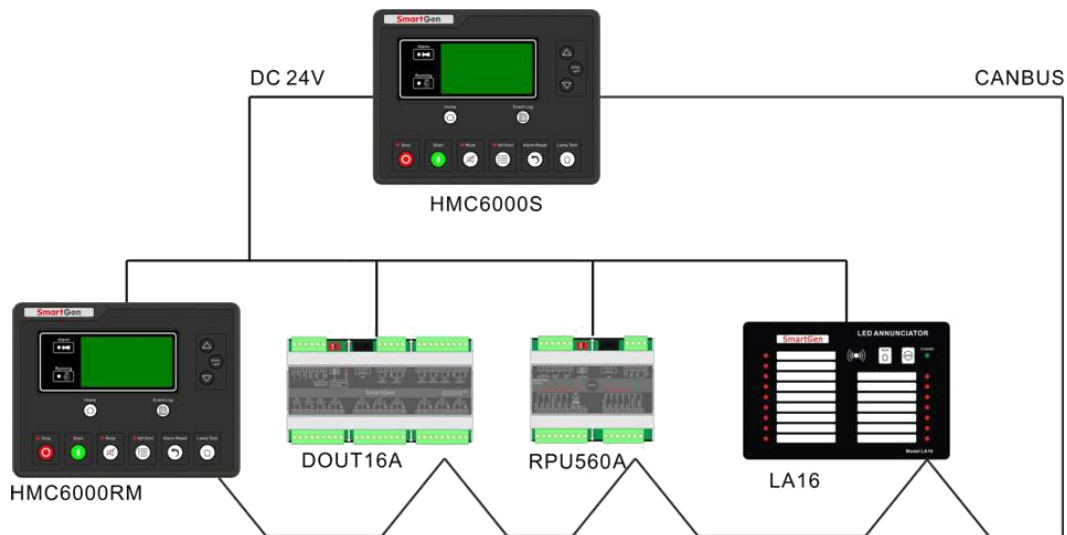
Fig.4 -   CANBUS Communication Diagram
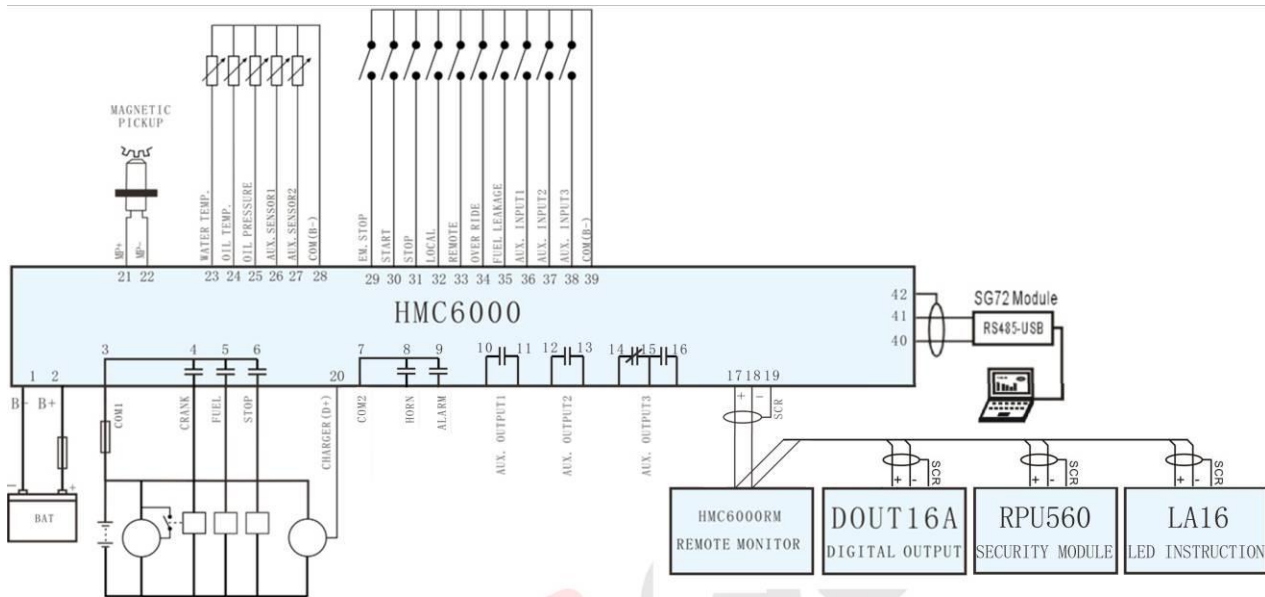
12.3   HMC6000 APPLICATION MAP

Fig. 5 – HMC6000 Application Diagram

13   COMMISSIONING

Doing the following check before the system starting to run formally is recommended:

1) Ensure all the connections are correct and wires diameter is suitable.

2) Ensure that the controller DC power has fuse, controller's positive and negative connected to start battery are correct.

3) Take proper action to prevent engine to crank success (e. g. Remove the connection wire of fuel valve). If checking is OK, make the start battery power on.

4) Make the local mode active and then the controller enter into local mode. Press the Start button and the engine will start. After the cranking times as setting, controller will send signal of Start Failure; then press "Reset" to reset controller.

5) Recover the action to prevent engine to crank success e. g. Connect wire of fuel valve), press start button again, and the engine will start. The engine will run from idle to formal if all works regularly. During this time, please watch the running status. If abnormal, stop engine and check all wires connection according to this manual.

6) If there is any other question, please contact Smartgen's service.

14 INSTALLATION
14.1 FIXING CLIPS

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

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

2) Pull the fixing clip backwards (towards the back of the module) ensuring two clips are inside their

    allotted slots.

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

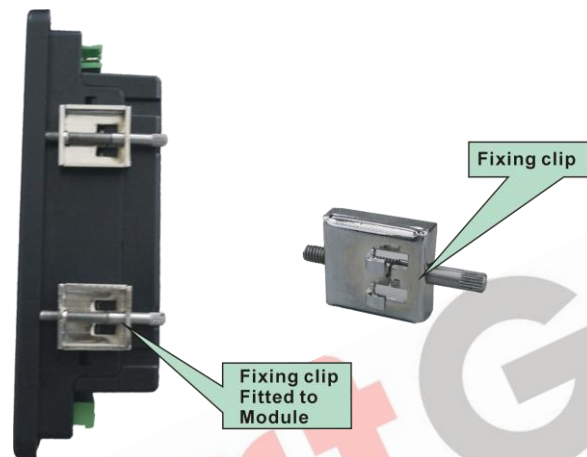▲ **NOTE:** Care should be taken not to over tighten the screws of fixing clips.

Fig.6 -   Fixing Clips Installation
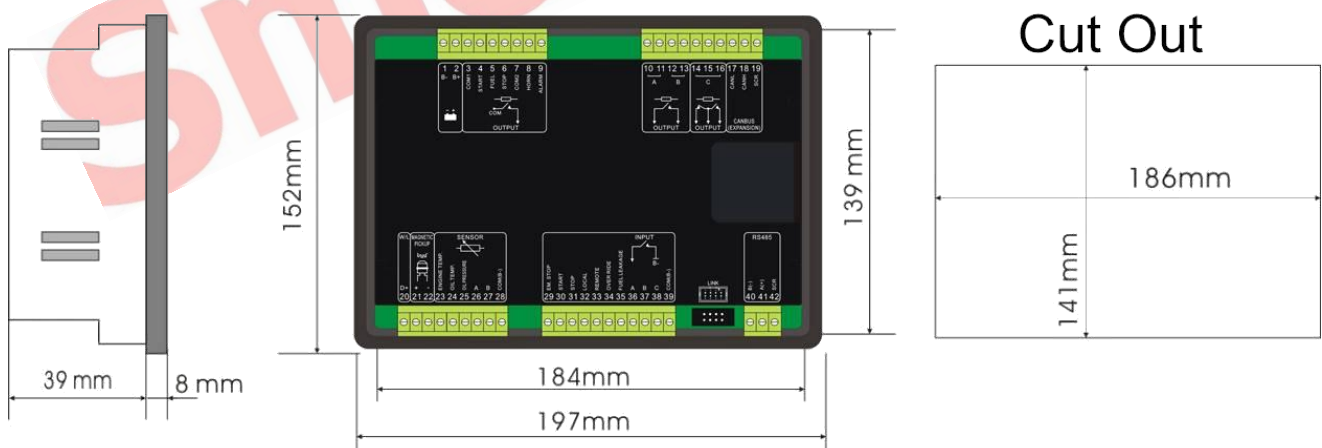
14.2 OVERALL DIMENSIONS AND CUTOUT DIMENSIONS

Fig.7 − Overall Dimensions and Cutout

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15 NOTES FOR INSTALLATION

15.1 BATTERY VOLTAGE INPUT

HMC6000 controller can suit for widely range of battery voltage DC(8~35)V. Negative of battery must be connected with the engine shell. The diameter of wire which is from power supply to battery must be over 2.5mm². 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 positive and negative input ports in order to prevent charge disturbing the controller's normal working.

15.2 SPEED SENSOR INPUT

Speed sensor is magnetic equipment which is installed on engine body for testing flywheel teeth number. 2 core shielding wire is used for the connection of the sensor and controller. The wire is supposed to be connected to 22 terminal of controller with one end and the other end hanging in the air. The other two signal lines connect separately to 21,22 terminal. Speed sensor output voltage is supposed to be at (1-24)VAC(virtual value) when it is in full speed range, and 12VAC(when in rated rotate speed) is recommened. When install the speed sensor, screw it to contact the flywheel firstly, inverse it with 1/3 circle, and then tighten the nut finally.

15.3 OUTPUT AND EXPANSION RELAY

All outputs of controller are relay contact output type. If expansion relays are needed, please add freewheel diode to both ends of expansion 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 charge disturbing the controller or others equipment.

15.4 SENSOR INPUT

All oil pressure sensor, auxiliary sensor1 and auxiliary sensor2 of HMC6000 series can be configured to current sensor. Only need to contact with manufactures in advance to confirm accessed signal. Water temperature sensor and oil temperature sensor are fixed resistance sensor.

15.5 WITHSTAND VOLTAGE TEST

When controller has been installed in control panel, if need the high voltage test, please disconnect controller's all terminals in order to prevent high voltage into controller and damage it.

Table 20 - Troubleshooting

Problem	Possible Solution
Controller no response with power.	Check starting batteries; Check controller connection wirings; Check DC fuse.
Genset shutdown	Check the water/cylinder temperature is too high or not.
Emergency shutdown	Check emergency shutdown button function;
Low oil pressure alarm after engine has fired.	Check oil pressure sensor and wiring.
High water temperature alarm after engine has fired.	Check water temperature sensor and its wiring.
Shutdown alarm when engine is running	Check relevant switch and its wiring according to the information on LCD. Check auxiliary digital input port.
Fail to start	Check fuel return circuit and its wiring. Check starting battery. Check speed sensor and its wiring. Consult engine manual.
Starter no respond	Check starter wiring; Check start battery
RS485 communication failure	Check wiring; Check if COM port setting is right; Check if RS485 A and B wires are connected in the opposite way; Check if PC communication port is damaged. Putting a 120Ω resistance between RS485 A and B is recommended.
CANBUS communication failure	Check wiring; Check if CANBUS CANH and CANL wires are connected in the opposite way; Check if CANBUS CANH and CANL wires at both ends are connected in the opposite way; Putting a 120Ω resistance between CANBUS CANH and CANL is recommended.

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