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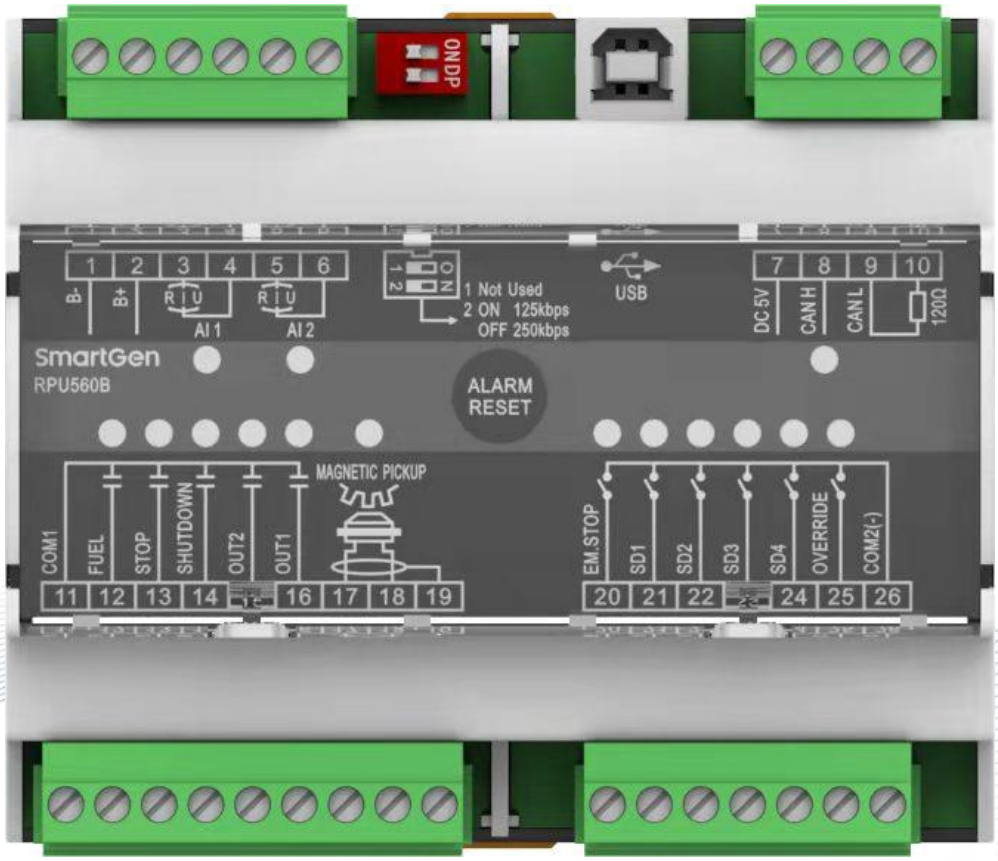
MAKING CONTROL SMARTER

RPU560B

REDUNDANT PROTECTION UNIT

USER MANUAL



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SmartGen 众智 **Chinese trademark**

SmartGen **English trademark**

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

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Table 1 - Software Version

Date	Version	Note
2022-09-10	1.0	Original Release

Table 2 - Clarification of notation used within this publication.

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 a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.

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1 OVERVIEW

RPU560B Redundant Protection Unit is a module that can independently maintain the engine running and protect it in the case of master control fault. The module is connected to HMC9000A/HMC9000S/HMC6000A via CONBUS. All data and shutdown alarms can be viewed on the master controller. It can be widely used in marine main propulsion units, main generator units, emergency units, and pumping units.

2 PERFORMANCE AND CHARACTERISTICS

——Speed sensor can accurately collect engine speed and protect the running engine;
——Optional working modes: one is synchronized with master controller to protect engine normal running; the other is to protect engine automatically when master controller failure occurs;
——4 digital fault shutdown inputs;
——5 relay outputs: stop output, fuel output, common stop output, auxiliary output 1~2;
——Emergency stop input port: after emergency stop is initiated, shutdown signal will be sent immediately;
——Override mode, in which only overspeed and emergency shutdown signals will be able to stop the unit;
——Two analog sensor inputs, the input signals of resistance, voltage and current are optional;
——Modular design, compact structure, small size and easy use.

3 TECHNICAL PARAMETERS

Table 3 – Technical Parameters

Item	Contents
Working Voltage	DC18.0V~DC35.0V
Power Consumption	<2.5W
Speed Sensor	Voltage Range: 1.0V ~ 24V (RMS) Frequency Range: 5Hz ~ 10000Hz
Analog Sensor 1~2	Resistance Input Range: 0Ω ~ 6000Ω Resolution: 0.1Ω Accuracy: 1Ω (below 300Ω)
	Voltage Input Range: 0V ~ 5V Resolution: 0.01V Accuracy: 1%
	Current Input Range: 0mA ~ 20mA Resolution: 0.01mA Accuracy: 1%
Stop output	7A relay output, break wire detection function

Item	Contents
Fuel output	16A relay output, break wire detection function
Common stop output	7A relay output
Auxiliary output 1~2	7A relay output
Vibration	5Hz~8Hz：±7.5mm 8Hz~500Hz：±2g IEC 60068-2-6
Shock	50g, 11ms, half-sine, three consecutive shocks are applied in each of the three mutually perpendicular directions, i.e. a total of 18 times. IEC 60068-2-27
Bump	25g, 16ms, half-sine IEC 60255-21-2
Case dimension	107.6mm x 89.7mm x 60.7mm
Working Temperature	(-25~+70)°C
Working Humidity	(20~93)%RH
Storage Temperature	(-30~+80)°C
Weight	0.27kg

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4 WORKING PROCESS

——When master control is active (CANBUS communication is normal), if the engine speed has exceeded the fuel output speed, the fuel relay is energized. When the module detects there is shutdown alarm of the master controller or the module itself, the stop relay will output, fuel relay is disconnected, common stop relay will output. When the engine stops successfully, press the alarm reset button of master controller HMC9000A/HMC9000S/HMC6000A, or via the alarm reset button on the panel of RPU560B to reset the shutdown alarm.

——When master control is deactivated (CANBUS communication is failed), if overspeed shutdown or other shutdown signal is detected, the stop relay will output while the fuel relay is disconnected, then the common stop relay will output. When the engine stops successfully, users can reset the alarm by pressing reset button on the panel of RPU560B.

——In override mode, only overspeed shutdown and emergency stop signals will be able to stop the unit.

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5 PROTECTION

5.1 WARNINGS/ALARMS

Table 4 - Warnings

No.	Warning type	Detection range	Description
1	Sensor 1 Open	Always active	Active after sensor is enabled, when sensor alarms, the corresponding LCD indicator flashes.
2	Sensor 1 High		
3	Sensor 1 Low		
4	Sensor 2 Open		
5	Sensor 2 High		
6	Sensor 2 Low		
7	Input 1 BW Warn		When the detects wire disconnection of RPU560B module, the disconnection indicators begin to flash and the corresponding alarm information will be displayed on the LCD screen of the master controller. The corresponding LED indicator of input port is light up when the input function is active.
8	Input 2 BW Warn		
9	Input 3 BW Warn		
10	Input 4 BW Warn		
11	Override Input BW Warn		
12	Shutdown Output BW Warn		
13	Fuel Output BW Warn		
14	Speed Sensor BW Warn		
15	EM. Stop Wire Break Warn		

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5.2 SHUTDOWN ALARM

If shutdown alarm signal is detected, stop relay and common stop relay activates while fuel relay deactivates.

Table 5 – Shutdown Alarms

No.	Alarm Type	Detection range	Description
1	Emergency Shutdown	Always active	After alarm shutdown signal is initiated, shutdown relay and common stop relay are activated while fuel relay deactivates. When failure shutdown is active, the corresponding lamp will be always initiated.
2	Input 1 Shutdown	Active when exceeds the alarm speed	When failure shutdown input is active and engine speed has exceeded or been equal to the pre-set value, stop relay and common stop relay will output while fuel relay is disconnected. When failure shutdown is active, the corresponding indicator will be always illuminated.
3	Input 2 Shutdown		
4	Input 3 Shutdown		
5	Input 4 Shutdown		
6	Sensor 1 High Shutdown	Active when exceeds the alarm speed	When sensor is enabled, the module detects the sensor value meets the alarm condition and exceeds than the set alarm speed, it will send corresponding alarm information. At the same time, the stop relay will output, the common stop relay is energized and the fuel relay is disconnected.
7	Sensor 1 Low Shutdown		
8	Sensor 2 High Shutdown		
9	Sensor 2 Low Shutdown		

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6 PARAMETER CONFIGURATION

Parameter configuration can be connected to PC via USB interface of RPU560B and set by computer software.

Table 6 – Parameter Configuration

Parameter	Range	Factory Default Value
1. Input 1 Delay	(0-20.0)s	2.0s
2. Input 1 BW Detection	(0-1)	0: Do not detect
3. Input 1 Alarm Speed	(0-200)%	0
4. Input 2 Delay	(0-20.0)s	2.0s
5. Input 2 BW Detection	(0-1)	0: Do not detect
6. Input 2 Alarm Speed	(0-200)%	0
7. Input 3 Delay	(0-20.0)s	2.0s
8. Input 3 BW Detection	(0-1)	0: Do not detect
9. Input 3 Alarm Speed	(0-200)%	0
10. Input 4 Delay	(0-20.0)s	2.0s
11. Input 4 BW Detection	(0-1)	0: Do not detect
12. Input 4 Alarm Speed	(0-200)%	0
13. Override Input BW Detection	(0-1)	0: Do not detect
14. EM. Stop Wire Break Detection Enable	(0-1)	0: Do not detect
15. Output 1 Set	(0-10)	1: Master Control Fail
16. Output 1 Type	(0-1)	0: Normally open
17. Output 2 Set	(0-10)	0: Not used
18. Output 2 Type	(0-1)	0: Normally open
19. Flywheel Teeth	(1-300)	118
20. Rated Speed	(0-5999) r/min	1500 r/min
21. Fuel Output Speed	(0-200)%	25%, the fuel relay is active when the speed has exceeded the default value while deactivated when the speed has fallen below the default value.
22. Over Speed Shutdown	(0-200)%	115%
23. Over Speed Delay	(0-3600)s	1s
24. Over Speed Warn	(0-200)%	110%
25. Sensor 1 Set		See Table 7
26. Sensor 2 Set		See Table 7

Table 7 – Sensor Setting List

No.	Setting Items	Contents	Note
1	Sensor Type	(0-3)	0
2	Curve Type (Resistance)	(0-15)	1
3	Alarm Speed	(0-200)%	80%
4	Range	(0-6000)	0
6	Upper Limit Shutdown Enable	(0-1)	1
7	Upper Limit Shutdown Value	(0-6000)	98
8	Shutdown Delay Time	(0-3600)s	5
9	Lower Limit Shutdown Enable	(0-1)	0
10	Lower Limit Shutdown Value	(0-4000)	0
11	Shutdown Delay Time	(0-3600)s	5
12	Upper Limit Warn Enable	(0-1)	1
13	Upper Limit Warn Value	(0-6000)	92
14	Upper Limit Warn Return Value	(0-6000)	88
15	Upper Limit Warn Delay	(0-3600)s	2
16	Lower Limit Warn Enable	(0-1)	0
17	Lower Limit Warn Value	(0-4000)	0
18	Lower Limit Warn Return Value	(0-4000)	0
19	Lower Limit Warn Delay	(0-3600)s	2
20~28	No.1~8 X (Resistance)	Resistance Type (non PT100)	
29~35	No.1~8 Y (Value)	Resistance Type (non PT100)	

7 OUTPUT PORT FUNCTION DEFINITION

Table 8 – Output Port Function Definition

No.	Contents	Description
0	Not used	
1	Master Control Fail	Active when the master control module is deactivated.
2	Common alarm	Active when there is warning or shutdown alarm.
3	Module Normal Working	Active when module is power on.
4	Overspeed Shutdown	Active when module detects overspeed shutdown.
5	EM Shutdown	Active when emergency shutdown alarms.
6	Output 1 Shutdown	Output when output 1 shutdown is activated.
7	Output 2 Shutdown	Output when output 2 shutdown is activated.
8	Output 3 Shutdown	Output when output 3 shutdown is activated.
9	Output 4 Shutdown	Output when output 4 shutdown is activated.
10	Sensor 1 High Shutdown	Output when sensor 1 is high and shutdown.
11	Sensor 1 Low Shutdown	Output when sensor 1 is low and shutdown.
12	Sensor 2 High Shutdown	Output when sensor 2 is high and shutdown.
13	Sensor 2 Low Shutdown	Output when sensor 2 is low and shutdown.
14	Sensor 1 High Warn	Output when sensor 1 is high and warn.

No.	Contents	Description
15	Sensor 1 Low Warn	Output when sensor 1 is low and warn.
16	Sensor 2 High Warn	Output when sensor 2 is high and warn.
17	Sensor 4 Low Warn	Output when sensor 2 is low and warn.

8 TERMINAL CONNECTIONS

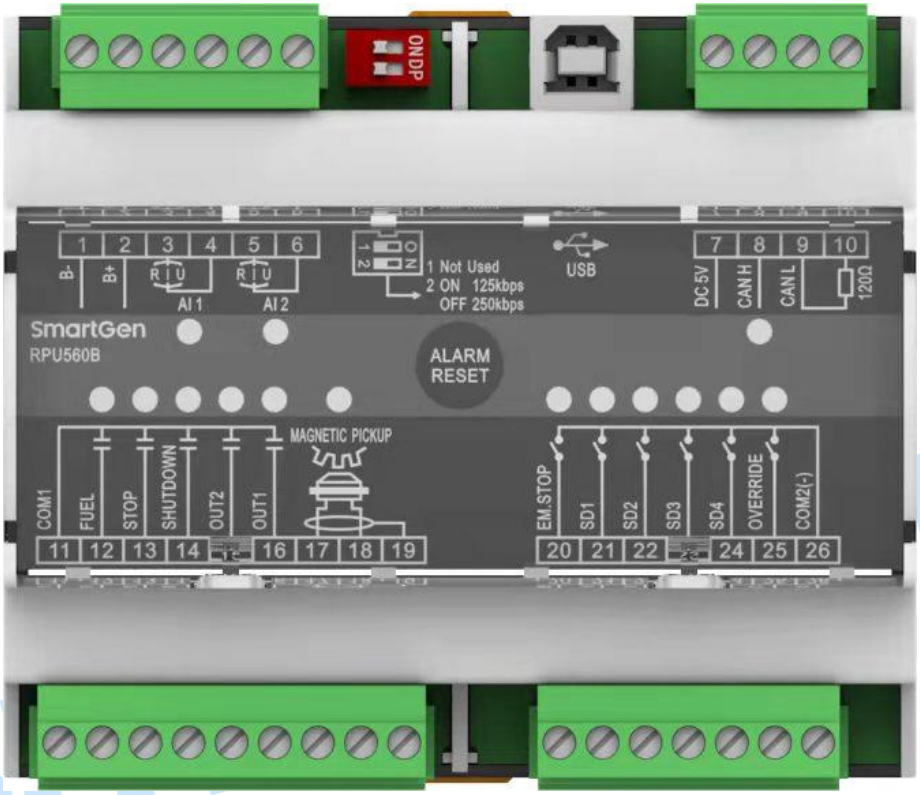

Fig.1 – Terminal Description Drawing

Table 9 – Terminal Description

Terminal	Function	Cable Size	Description
1.	B-	2.5mm^2	Power supply negative input.
2.	B+	2.5mm^2	Power supply positive input.
3.	Sensor 1 Input	0.5mm^2	Sensor 1 input, the resistance type, voltage type and current type are optional.
4.	Sensor 1 Com	0.5mm^2	It is sensor GND port, when sensor 1 is resistance type or voltage type, it is sensor common port input. When sensor 1 is current type, it is not used.
5.	Sensor 2 Input	0.5mm^2	Sensor 2 input, the resistance type, voltage type and current type are optional.
6.	Sensor 2 Com	0.5mm^2	It is sensor GND port, when sensor 2 is resistance type or voltage type, it is sensor common port input. When sensor 1 is current type, it is not used.
7.	DC 5V	0.5mm^2	The power supply port of voltage type sensor and outputs 5V.
8.	CAN(H)	0.5mm^2	Connect to the expansion CANBUS interface of

Terminal	Function	Cable Size	Description
			HMC9000A/HMC9000S/HMC6000A. Impedance-120Ω shielded wire with its one end connected to SCR is recommended. CANH' internal connects to 120Ω, and after external and 120Ω are short connected, 120Ω resistance can be added between CANH and CANHL.
9.	CAN(L)	0.5mm^2	Common port of output.
10.	120Ω	0.5mm^2	
11.	COM1	2.5mm^2	
12.	FUEL	1.0mm^2	Output as working indication when the module detects engine speed exceeded preset "fuel output speed", deactivate when shutdown, and possess break wire detection function.
13.	STOP	1.0mm^2	Output when the module detects a stop alarm, connect to shutdown electromagnet, and possess break wire detection function.
14.	SHUTDOWN	1.0mm^2	Output when the module detects a warning alarm, alarm status will be locked to save, and it can be reset by pressing reset button.
15.	OUT2	1.0mm^2	It can be configured by users; output after it is energized.
16.	OUT1	1.0mm^2	It can be configured by users; output after it is energized.
17.	MAGNETIC PICKUP	0.5mm^2	Speed sensor input with break wire detection function.
18.		0.5mm^2	
19.		0.5mm^2	
20.	EM.STOP	0.5mm^2	Emergency shutdown input port (connect to COM2(-) to activate) Note: Break wire detection function can be configured; it need to connect COM2(-) port with a 10kΩ resistance.
21.	SD1	0.5mm^2	Failure shutdown input port (connect to COM2(-) to activate); It can control engine to stop when it is active. Note: Break wire detection function can be configured; it need to connect COM2(-) port with a 10kΩ resistance.
22.	SD2	0.5mm^2	
23.	SD3	0.5mm^2	
24.	SD4	0.5mm^2	
25.	OVERRIDE	0.5mm^2	Override mode (connect to COM2(-) to activate); In

Terminal	Function	Cable Size	Description
			this mode, only Emergency shutdown and Over speed shutdown can stop the engine in case of master controller deactivate.
26.	COM2(-)	0.5mm^2	Common port of output.
	ALARM RESET		Pressing this button can reset the alarm.
Note: When the communication of CAN interface and HMC9000A/HMC9000S/HMC6000A is normal, then CAN indicator will flash, otherwise it will be distinguished.			

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9 APPLICATION DIAGRAM

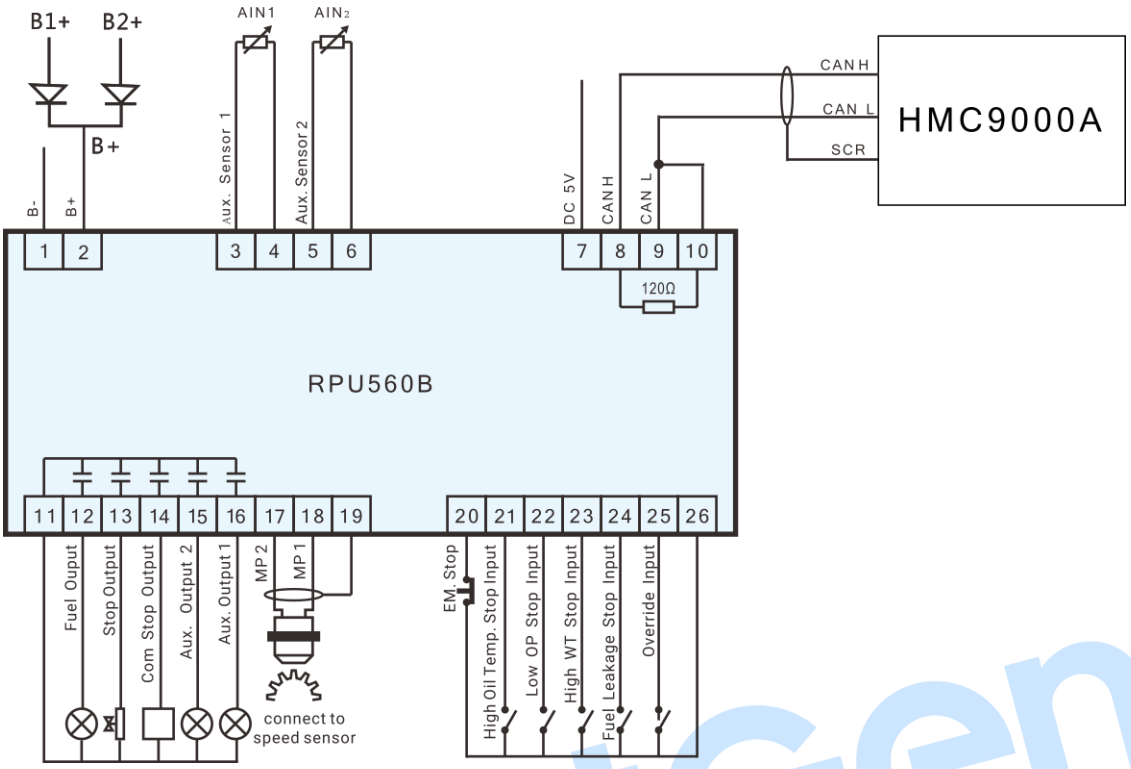

Fig.2 – Typical Application Diagram of Resistance Type Sensor

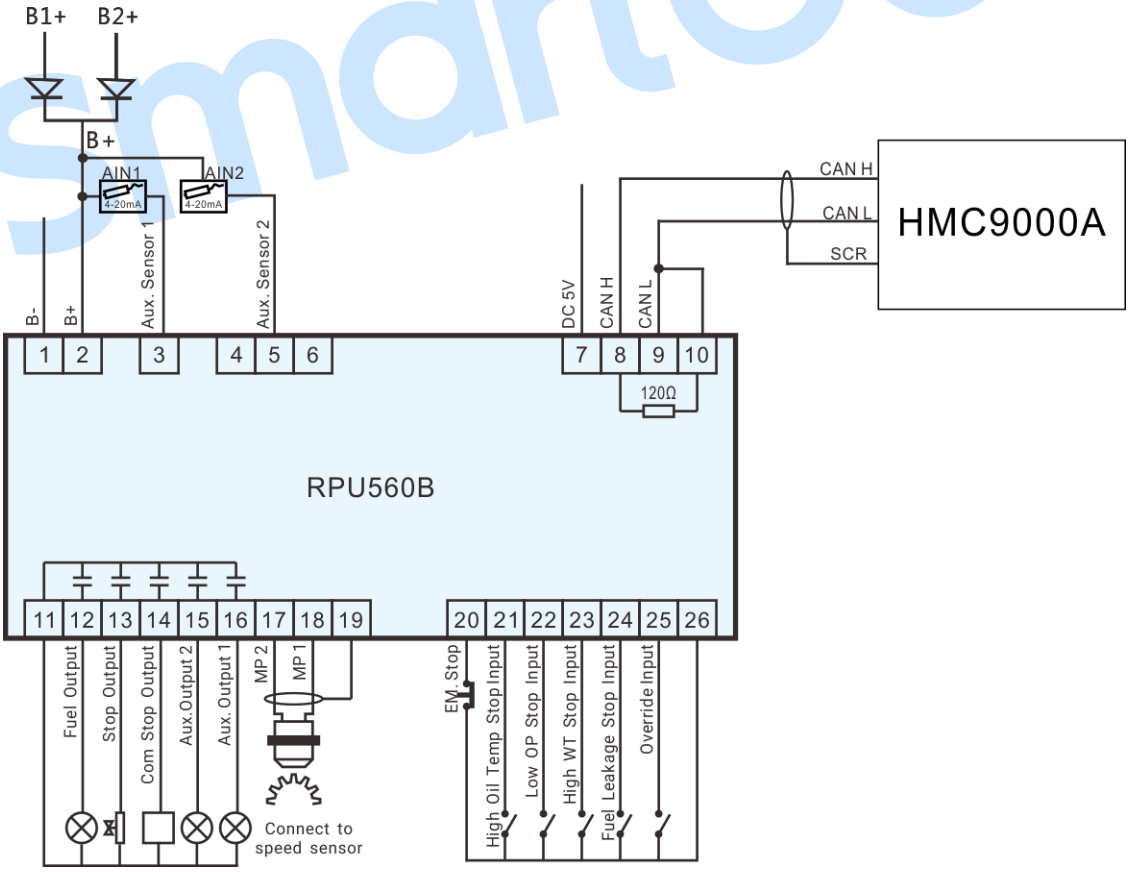

Fig.3 – Typical Application Diagram of Current Type Sensor

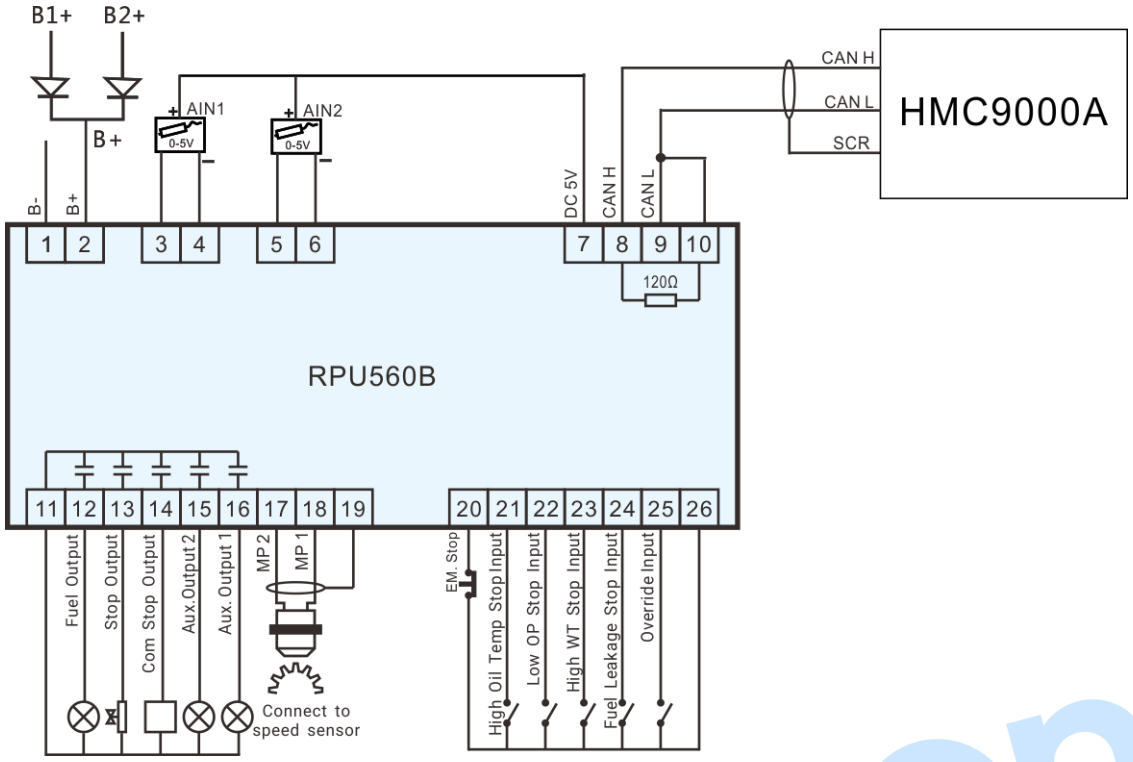

Fig.4 – Typical Application Diagram of Voltage Type Sensor

10 INSTALLATION

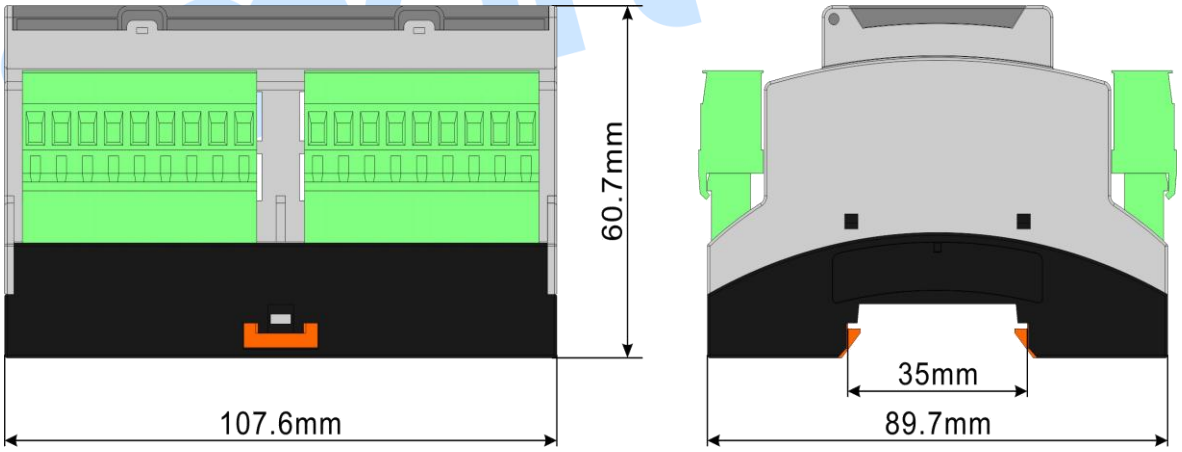

Fig.5 – Case Dimensions

11 TROUBLESHOOTING

Problem	Possible Solution
Controller no response with power.	Check start batteries; Check controller connection wirings;
Sensor data incorrect	Check whether the wirings of controller are correct, check whether the input sensor type is consistent with selected.
CANBUS communication failure	Check if CANBUS wires are connected in the opposite way; Check if 120Ω resistance is connected; Check if Baud rate of the dial switch is correct.

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