

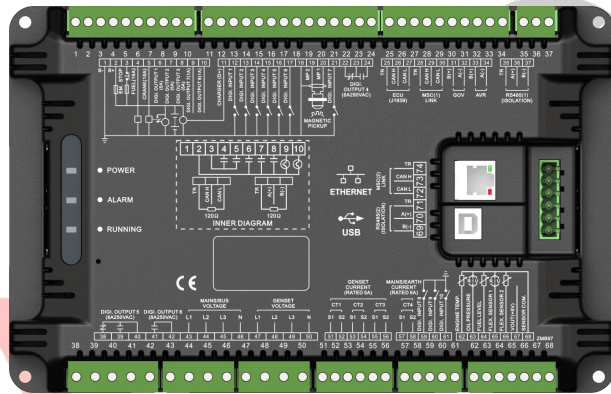


**SmartGen**  
ideas for power

# HMB9700

## Paralleled Genset Controller

# USER MANUAL



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

### 3 SPECIFICATION

**Table 3 Technical Specification**

Parameter	Details
Working Voltage	Range: DC8V - DC35V continuous, DC reverse connection protection Resolution: 0.1V Accuracy: 1%
Overall Consumption	<7W (Standby mode: ≤2.5W)
AC Voltage	Phase voltage Range: AC15V - AC360V (ph-N) Resolution: 0.1V Accuracy: 0.5%
	Wire voltage Range: AC30V - AC620V (ph- ph) Resolution: 0.1V Accuracy: 0.5%
AC Frequency	Range: 5Hz -75Hz Resolution: 0.01Hz Accuracy: 0.1Hz
AC Current	Rated: 5A Range: 0A – 10A Resolution: 0.1A Accuracy: 1%
Speed Sensor	Voltage Range: 1. 0 V - 24 V (RMS) Frequency Range: 5Hz – 10000Hz
Charger(D+) Voltage	Range: DC0V - DC60V continuous Resolution: 0.1V Accuracy: 1%
Analog Sensor	Resistor Input Range: 0Ω- 6000Ω Resolution: 0.1 Accuracy: 1Ω(below 300Ω)
	Voltage Input Range: 0 V - 5V Resolution: 0.001V Accuracy: 1%
	Current Input Range: 0 mA - 20mA Resolution: 0.01mA Accuracy: 1%
Fuel Output	16A DC24V DC power supply output(relay output)
Crank Output	16A DC24V DC power supply output(relay output)
Digital Output 1	8A DC30V DC power supply output (relay output)

Parameter	Details
Digital Output 2	8A DC30V DC power supply output (relay output)
Digital Output 3	8A DC30V DC power supply output (relay output)
Digital Output 4	8A AC250V volt-free output (relay output)
Digital Output 5	8A AC250V volt-free output (relay output)
Digital Output 6	8A AC250V volt-free output (relay output)
Digital Output 7	1A DC30V DC power supply output (transistor output)
Digital Output 8	1A DC30V DC power supply output (transistor output)
Digital Output 1-10	Low limit voltage is 1.2V; high limit voltage is 60V;
RS485	Isolated, half-duplex, 9600 baud rate, maximum communication length 1000m
Ethernet	Self-adapting 10/100Mbit
MSC CAN	Isolated, maximum communication length 250m; applying Belden 9841 cable or the equivalence;
EMC/CE Certification	EN 61326-1:2013
Vibration Test	5 - 8 Hz: $\pm 7.5$ mm 8 - 500 Hz: 2 g IEC 60068-2-6
Shock Test	50g, 11ms, half-sine, complete shock test from three directions, and 18 times shock for each test IEC 60068-2-27
Bump Test	25g, 16ms, self-sine IEC 60255-21-2
Production Compliance	According to EN 61010-1 installation category (over voltage category) III, 300V, pollution class 2, altitude 3000m
Case Dimensions	248 mm x 158 mm x 49 mm
Installation Method	35mm guide rail or screw mounting
Working Conditions	Temperature: (-25~+70) $^{\circ}$ C      Relative Humidity: (20~93)%RH
Storage Conditions	Temperature:(-30~+80) $^{\circ}$ C
Protection Level	Front Enclosure: IP65 when rubber-ring gasket is installed between the enclosure and the control screen Rear Enclosure: IP20
Insulation Intensity	Apply AC2.2kV voltage between high voltage terminal and low voltage terminal and the leakage current is not more than 3mA within 1min.
Weight	1.1kg

## 4 OPERATION

### 4.1 INDICATOR LAMP

Power indicator: always on when controller power is normal, and off when there is abnormal.

Alarm indicator description:

**Table 4 Alarm Indicator Description**

Alarm Type	Alarm Indicator
Warning	Slow flashing (1 time per second)
Block	Slow flashing (1 time per second)
Safety Trip	Fast flashing (5 times per second)
Safety Trip and Stop	Fast flashing (5 times per second)
Trip	Fast flashing (5 times per second)
Trip and Stop	Fast flashing (5 times per second)
Shutdown	Fast flashing (5 times per second)
No Alarm	Extinguished

Running indicator: normally illuminated after crank disconnection and before ETS stop; extinguished during other periods;

### 4.2 AUTO START/STOP OPERATION

Make controller in auto mode by input analogue button or communication.

**Automatic Start Sequence:**

- 1) When 'remote start'(on-load) is active, 'start delay' timer is initiated;
- 2) When start delay is over, preheating relay is energized (if configured);
- 3) After the above delay, the fuel relay is energized, and then one second later, the start relay is engaged. During the 'start time', if the genset does not start, then fuel relay and start relay stops outputting, and enter 'crank rest time', waiting for next crank;
- 4) Should the start continue beyond the set attempts, the controller issues 'start failure' and stops the genset and at the same time alarm page on LCD displays 'start failure alarm';
- 5) If it starts during the attempts, it enters 'safety on time', and during this period Low Oil Pressure, High Temperature, Under speed and Charge Alternator Failure alarms are all inactive; After 'safety on time', it enters 'start idle delay' (if configured);
- 6) During 'start idle delay', under speed, under frequency, under voltage alarms are inhibited. When this delay is over, 'warming up delay' is initiated (if configured);
- 7) When one genset is running and 'warming up delay' is over, if generator status is normal, its indicator will be illuminated. If generator voltage and frequency have reached on-load requirements, then the generator close relay will be energized; the genset will take load and generator power indicator will be illuminated, and generator will enter normal running status. If voltage or frequency is abnormal, the controller will initiate alarm;
- 8) When the gensets are running in parallel and 'warming up delay' is over:
  - a) If busbar has not voltage signal, then the controller will issue a close status signal to other gensets waiting for combination in parallel. Then generator close relay will output, avoiding to close the breakers at the same time;

No	Type	Description
64	Ground Relay Open Fail	When controller detects that ground relay open fails, that is, breaker open input is inactive after ground relay open outputs, and then it will initiate an alarm signal. It is detected when ground relay is opening.

## 6 WIRING CONNECTION

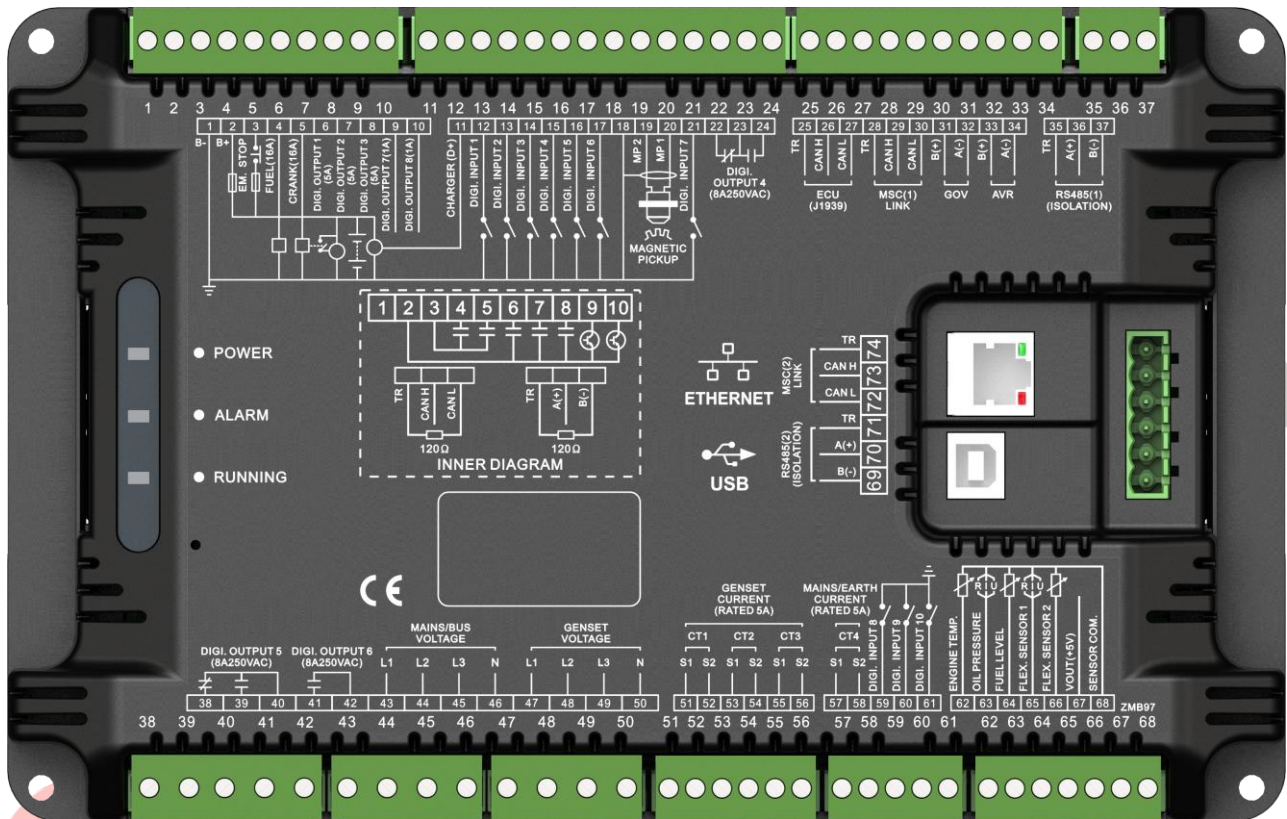


Fig. 1 HMB9700 Controller Rear Panel

Table 13 Terminal Connection Description

No.	Functions	Cable Size	Remark
1	B-	2.5mm <sup>2</sup>	Connect with starter battery negative.
2	B+	2.5mm <sup>2</sup>	Connect with starter battery positive. If wire length is over 30m, it's better to double wires in parallel. Max. 20A fuse is recommended.
3	Emergency stop	2.5mm <sup>2</sup>	Connect with B+ via emergency stop button.
4	Fuel relay	1.5mm <sup>2</sup>	B+ is supplied by 3 points, rated 16A.
5	Crank relay	1.5mm <sup>2</sup>	B+ is supplied by 3 points, rated 16A. Connect to starter coil.
6	Digi. output 1	1.5mm <sup>2</sup>	B+ is supplied by 2 points, rated 5A.
7	Digi. output 2	1.5mm <sup>2</sup>	B+ is supplied by 2 points, rated 5A.
8	Digi. output 3	1.5mm <sup>2</sup>	B+ is supplied by 2 points, rated 5A.
9	Digi. output 7	1.5mm <sup>2</sup>	B+ is supplied by 2 points, rated 1A.
10	Digi. output 8	1.5mm <sup>2</sup>	B+ is supplied by 2 points, rated 1A.





No.	Items	Parameters	Defaults	Description
	Delay			
4.	Heavy Load 1 ACK Delay	(0-3600)s	5	
5.	Heavy Load 2 Request Load	(0-6000)kW	400	
6.	Heavy Load 2 Rated Load	(0-6000)kW	200	
7.	Heavy Load 2 Stable Delay	(0-3600)s	5	
8.	Heavy Load 2 ACK Delay	(0-3600)s	5	
<b>Sync Calibration</b>				
MSC				
1.	MSC ID	(0-31)	1	It is the ID in the MSC communication network, which indicates that the MSC ID in the entire communication network should be unique.
2.	Module Priority	(0-31)	0	Smaller the value, higher priority.
Sync Control				
1.	Slip Freq	(0-1.00)Hz	0.10	Adjust generator frequency so that gen frequency is greater than slip frequency. Phase synchronization adjustment is conducted when the sync difference frequency is set to 0.
2.	Sync Freq(Volt)	(0-500)%	20	Gain (P)
		(0-2000)%	20	Stability (I)
		(0-2000)%	0	Rate of change (D)
3.	Sync Freq(Relay)	(0.25-4.00)Hz	1.20	Response
		(0.05-1.60)s	0.20	Stability
		(0-100)%	10	Gain
		(0-10.0)%	1.0	Dead area
4.	Sync Volt(Volt)	(0-500)%	20	Gain(P)
		(0-2000)%	20	Stability(I)
		(0-2000)%	0	Rate of change (D)
5.	Sync Volt(Relay)	(0.25-4.00)Hz	1.20	Response
		(0.05-1.60)s	0.20	Stability
		(0-100)%	10	Gain
		(0-10.0)%	1.0	Dead area
6.	Sync Phase(Stable Time)	(0.1-20.0)s	2.0	Sync. confirmation time during phase sync adjustment
7.	Sync Phase(Volt)	(0-500)%	20	Gain(P)
		(0-2000)%	20	Stability(I)



No.	Items	Parameters	Defaults	Description
		(0-2000)%	0	Rate of change (D)
8.	SyncPhase(Relay)	(0.25-4.00)Hz	1.20	Response
		(0.05-1.60)s	0.20	Stability
		(0-100)%	10	Gain
		(0-10.0)%	1.0	Dead area
<b>Load Control</b>				
1.	kW Control(Volt)	(0-500)%	20	Gain(P)
		(0-2000)%	20	Stability(I)
		(0-2000)%	0	Rate of change (D)
2.	kWControl(Relay)	(0.25-4.00)Hz	1.20	Response
		(0.05-1.60)s	0.20	Stability
		(0-100)%	10	Gain
		(0-10.0)%	1.0	Dead area
3.	kvar Control(V)	(0-500)%	20	Gain(P)
		(0-2000)%	20	Stability(I)
		(0-2000)%	0	Rate of change (D)
4.	kvar Control(R)	(0.25-4.00)Hz	1.20	Response
		(0.05-1.60)s	0.20	Stability
		(0-100)%	10	Gain
		(0-10.0)%	1.0	Dead area
<b>Load</b>				
1.	Load Minimum	(0-100.0)%	1.0	It is the load percentage when the soft unload is opened.
2.	Load Mode	(0-2)	0	0: Gen; 1: Mains; 2: Takeover; 3: Load Control.
3.	Export Mode(W)	(0-1)	0	0: Fixed Power; 1: Frequency-Power. It is active when load mode is Gen control mode.
4.	Export Mode(var)	(0-1)	0	0: Fixed Power; 1: Voltage-Power. It is active when Load mode is Gen control mode.
5.	Export Power(W)	(0-100.0)%	30.0	It is used to load control.
6.	Export Power Opt	(0-1)	0	0: kvar Reactive Power Control; 1: PF Power Factor Control.
7.	Export Power(var)	(0-100.0)%	8.0	It is used to load control.
8.	Analogue Adjust(W)	(0-1)	0	0: Disable; 1:Enable. When it is enabled, flexible sensor 1 is used as analog input. It is active when active power output mode is configured as Fixed Power.
9.	Analogue Adjust(var)	(0-1)	0	0: Disable; 1: Enable. When it is enabled, flexible sensor 2 is used



No.	Items	Parameters	Defaults	Description
				as analog input. It is active when reactive power output mode is configured as Fixed Power.
10.	Export Curve(W)			Configure gen frequency-active power curve. It is active when active power output mode is configured as Frequency-Power.
11.	Export Curve(var)			Configure gen voltage-reactive power curve. It is active when active power output mode is configured as Voltage-Power.
<b>GOV/AVR</b>				
1.	GOV SW1	(0-20.00)	0	Center voltage, default 0V.
2.	GOV SW2	(0-10.00)	2.00	Voltage range, default (-2.5~+2.5V).
3.	AVR SW1	(0-20.00)	0	Center voltage, default 0V.
4.	AVR SW2	(0-10.00)	2.0	Voltage range, default (-2.5~+2.5V).
<b>Mains Split Setting</b>				
1.	AC System	(0~3)	0	0: 3P4W; 1: 3P3W; 2: 2P3W; 3: 1P2W.
2.	Rated Voltage	(30~30000)V	230	Offer standards for detecting mains' over/under voltage. It is primary voltage when voltage transformer is used; it is line voltage when AC system is 3P3W while it is phase voltage when other AC system is used.
3.	Mains Rated Frequency	(10.0~75.0)Hz	50.0	Offer standards for detecting over/under frequency.
4.	Volt. Trans.(PT)	(0-1)	0	0: Disable ; 1: Enable
5.	Mains Split Action	(0-1)	0	0: Trip and Stop; 1: Aux. Mains Fail.
6.	Mains Over Voltage	(0-1) (0-200.0)% (0-20.0)s	110.0 0.1	Set value is percentage of mains rated volt.
7.	Mains Under Voltage	(0-1) (0-200.0)% (0-20.0)s	1 90.0 0.1	
8.	Mains Over Frequency	(0-1) (0-200.0)% (0-20.0)s	1 101.0 0.1	
9.	Mains Under Frequency	(0-1) (0-200.0)% (0-20.0)s	1 99.0 0.1	Set value is mains rated frequency's percentage.
10.	ROCOF	(0-1) (0-1.00)Hz/s	1 0.20	Set value is frequency change rate of mains (ROCOF).



No.	Items	Parameters	Defaults	Description
		(0-20.0)s	0.1	
11.	Vector Shift	(0-1) (0-20.0)° (0-20.0)s	1 6.0 0.1	Set value is phase angle's change rate of mains voltage waveform (VECTOR SHFT).
<b>Expansion Module</b>				
1.	Expand DIN16	(0-1)	0	0: Disable ; 1: Enable
2.	Expand DOUT16	(0-1)	0	0: Disable ; 1: Enable
3.	Expand AIN24 1	(0-1)	0	0: Disable ; 1: Enable
4.	Expand AIN24 2	(0-1)	0	0: Disable ; 1: Enable

## 7.2 ENABLE DEFINITION OF PROGRAMMABLE OUTPUT PORTS

### 7.2.1 DEFINITION OF DIGITAL OUTPUT PORTS

**Table 15 Definition of Digital Output Ports**

No.	Type	Description
0	Not Used	
1	Custom Period 1	Details of function description please see the following description.
2	Custom Period 2	
3	Custom Period 3	
4	Custom Period 4	
5	Custom Period 5	
6	Custom Period 6	
7	Custom Combined 1	
8	Custom Combined 2	
9	Custom Combined 3	
10	Custom Combined 4	
11	Custom Combined 5	
12	Custom Combined 6	
13	Reserved	
14	Reserved	
15	Gas Choke On	Act in cranking. Action time is the preset time for it.
16	Gas Ignition	Act when genset is starting, and disconnect when engine is stopped.
17	Air Flap Control	Act on over speed shutdown and emergence stop. Air inflow can be closed to stop the engine quicker.
18	Audible Alarm	Act on warning, shutdown, and trips. An annunciator can be connected externally. If 'alarm mute' configurable input port is active, this is prohibited.
19	Louver Control	Act when genset is starting and disconnect when genset is stopped completely.
20	Fuel Pump Control	It is controlled by limit values of level sensor fuel pump.
21	Heater Control	It is controlled by heating limit values of temperature sensor.
22	Cooler Control	It is controlled by cooler limit values of temperature sensor.

## 9 SENSOR SETTING

1) When sensors are reselected, the sensor curves will be transferred into the standard value. For example, if temperature sensor is SGX (120°C resistor type), its sensor curve is SGD (120°C resistor type); if select the SGH (120°C resistor type), the temperature sensor curve is SGH curve.

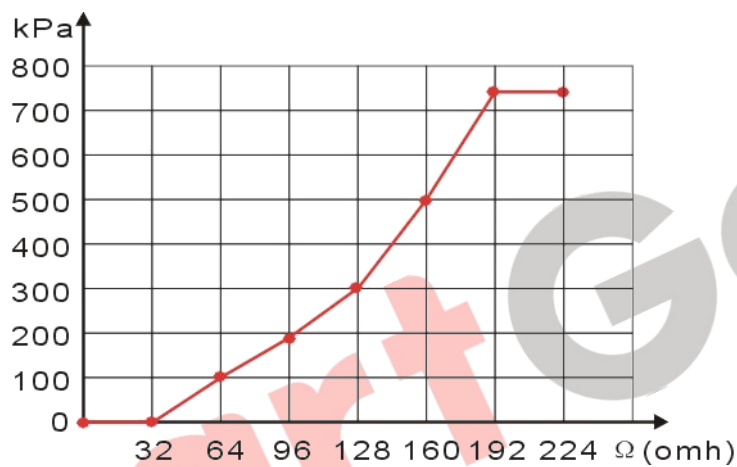
2) When there is difference between standard sensor curve and used sensor curve, users can adjust it in the “sensor curve type”.

3) When the sensor curve is inputted, x value (resistor) must be inputted from small to large, otherwise, mistake occurs.

4) If sensor type is selected as “none”, sensor curve is not working.

5) If the corresponding sensor has alarm switch only, users must set this sensor as “none”, otherwise, shutdown or warning may occur.

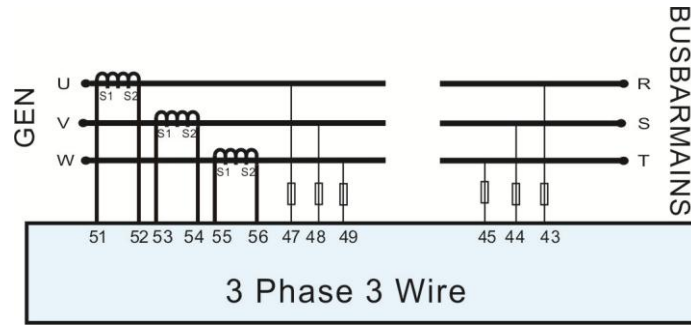
6) The headmost or backmost values in the vertical coordinates can be set as the same as below.



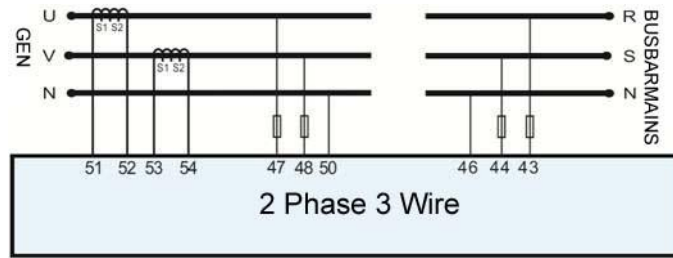
**Fig. 2 Sensor Curve Diagram**

**Table 19 Normal Pressure Unit Conversion Form**

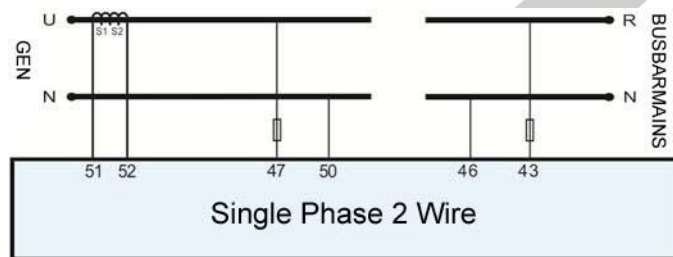
	pa	kgf/cm <sup>2</sup>	bar	psi
1Pa	1	1.02x10 <sup>-5</sup>	1x10 <sup>-5</sup>	1.45x10 <sup>-4</sup>
1kgf/cm <sup>2</sup>	9.8x10 <sup>4</sup>	1	0.98	14.2
1bar	1x10 <sup>5</sup>	1.02	1	14.5
1psi	6.89x10 <sup>3</sup>	7.03x10 <sup>-2</sup>	6.89x10 <sup>-2</sup>	1



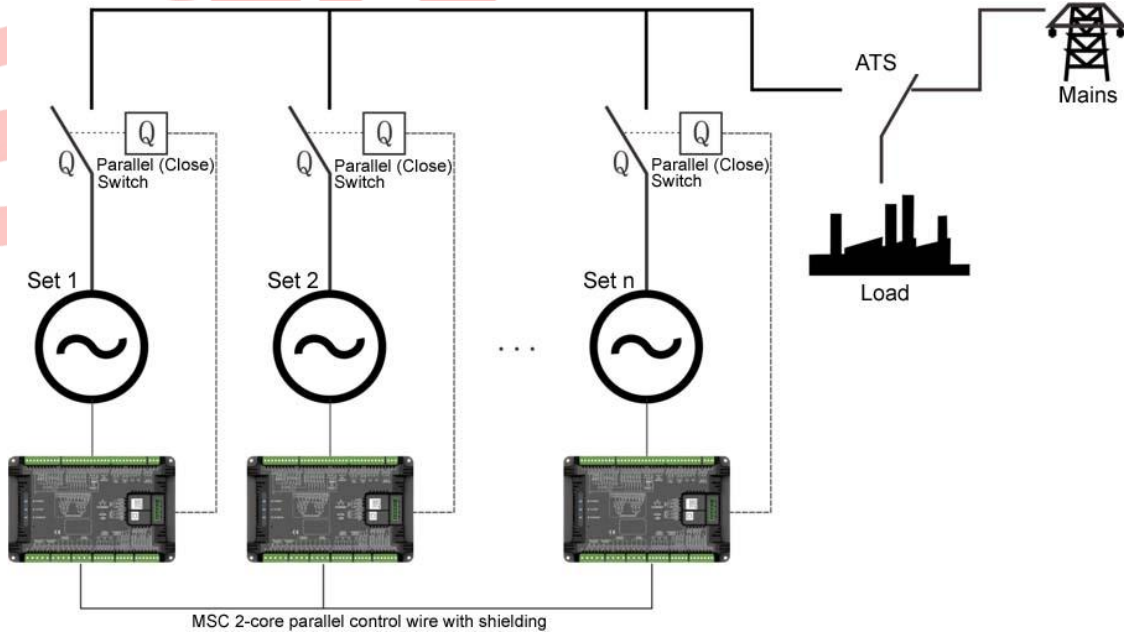
**Fig. 4 - 3-Phase 3-Wire Typical Application Diagram**



**Fig. 5 – 2-Phase 3-Wire Typical Application Diagram**



**Fig. 6 - Single Phase 2-Wire Typical Application Diagram**

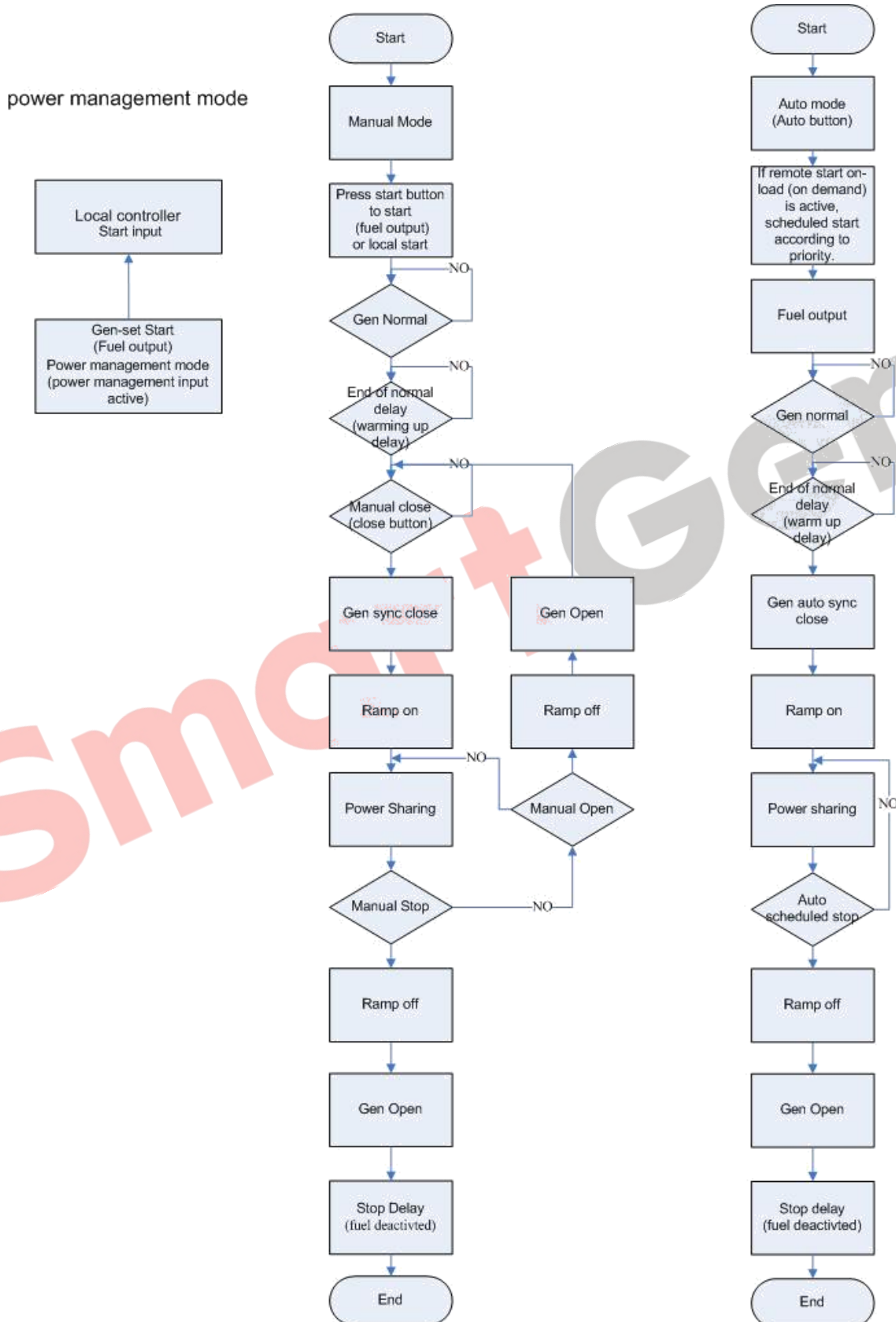


**Fig. 7 - HMB9700 Multi-genset Parallel Application Graph**

**NOTE:** Mains parallel function for HMB9700 controller can be selected via configurable input port. In mains parallel mode, generator will run in parallel with mains and it will only be able to output a fixed amount of power. (Set load mode as Gen control mode).

## 12 POWER MANAGEMENT MODE

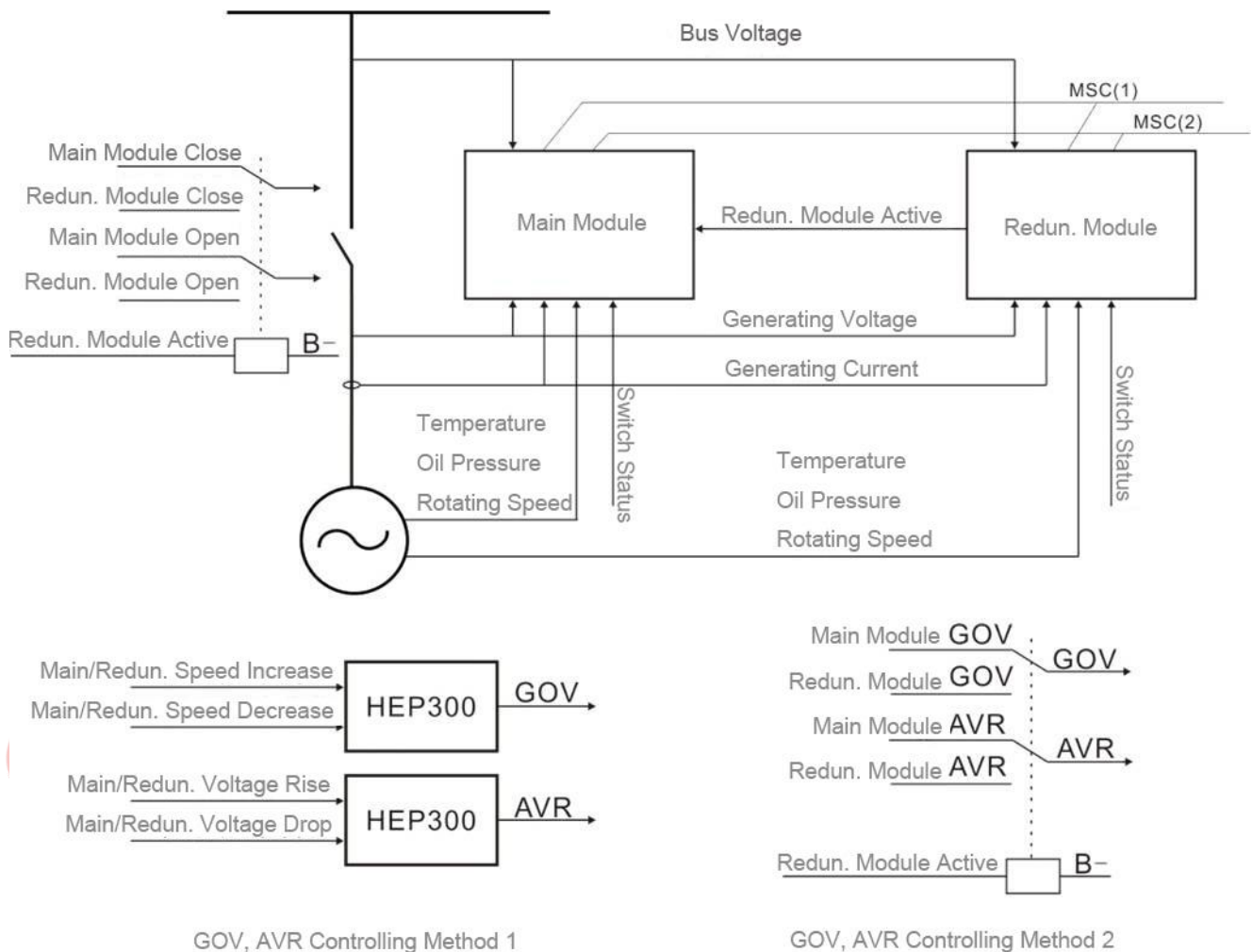
Power management mode is to be selected via a digital input port.



## 20 CONTROLLER REDUNDANCY

Controller redundancy system is consisted of two modules. They are set as the same MSC ID. Redundancy modules shall be enabled in the module setting.

When the redundancy controllers detect the main module breakdown (redundancy modules do not receive data frames from the main controller in MSC communication, or the redundancy modules receive active redundancy output messages from the main controller.), they will take over the genset controlling, and output redundancy module active messages to the main controller and meanwhile change over controlling messages.



**Fig. 14 Redundancy Controller Connection**

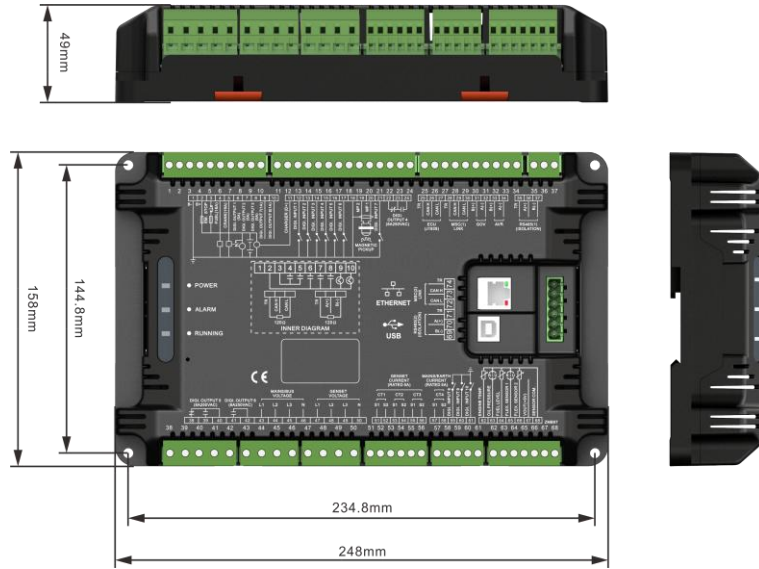
Two methods of GOV, AVR controlling:

Method 1: Using electronic potentiometer HEP300. Main module and redundancy module are connected to the digital input ports of speed increase/decrease (voltage rise/drop) in the HEP300, and then analog signal outputs of HEP300 are connected to the speeder (voltage regulator). By using this method when the main module and the redundancy module are switching, the voltage signal outputs to the speeder (voltage regulator) shall not be intercepted and the genset will change over to be controlled by the redundancy controller smoothly.

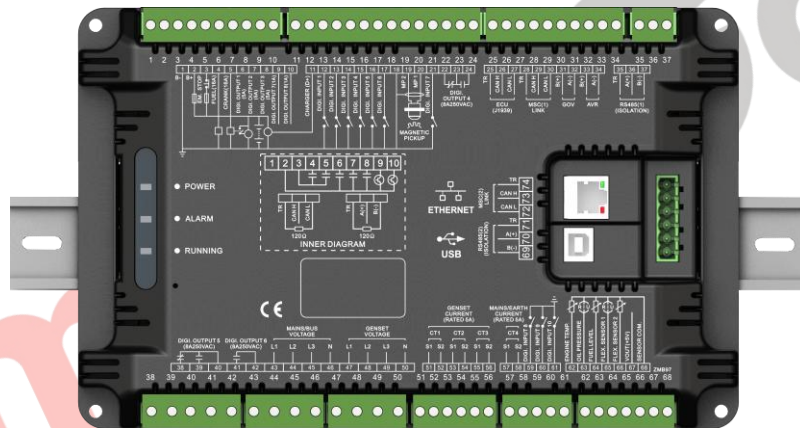
Method 2: Using a relay to directly switch two controllers' GOV, AVR controlling outputs. Its circuit is simple, but when the main module and the redundancy module are switching, the voltage signal outputs to the speeder could be interrupted and it may arise fluctuation on parts of the genset.

**21 INSTALLATION**

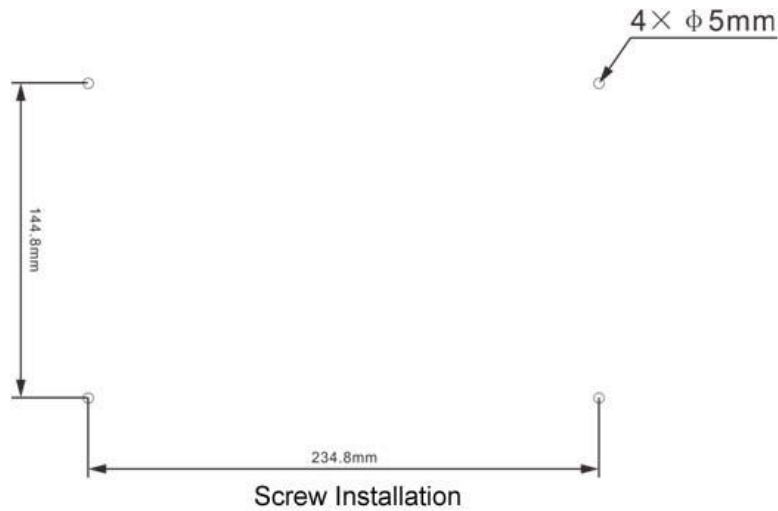
The controller is panel built-in design; it is 35mm guide rail installation or screw mounting.



**Fig. 13 Case Dimensions**



**Fig. 14 Guide Rail Installation**



**Fig. 15 Screw Installation**