SmartGen

MAKING CONTROL SMARTER

HGM501

GENSET CONTROLLER

USER MANUAL

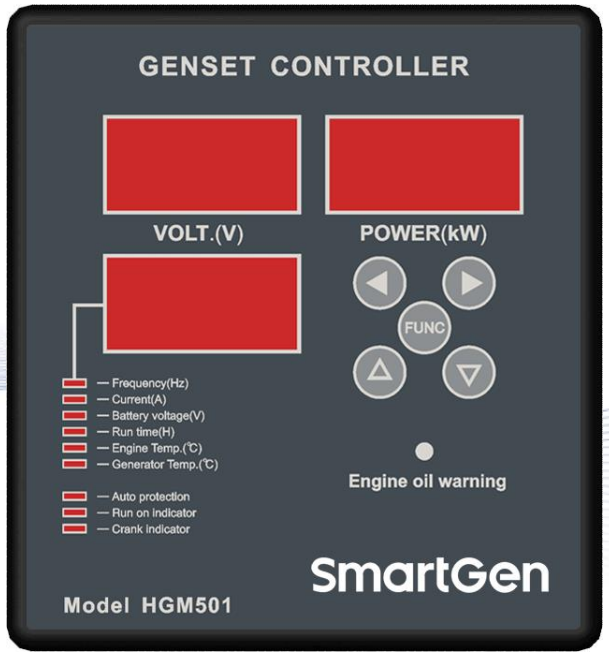

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Table 1- Version History

Date	Version	Details
2012-07-10	1.0	Original release
2017-02-13	2.0	Modify details, add functions and change CT secondary current from 5mA to 62.5mA.
2022-04-29	2.1	Update the format and font of the manual; update the logo of SmartGen.
2023-07-14	2.2	1. Add a new temperature sensor curve; 2. Add the high temperature limit setting process.

This manual is suitable for HGM501 series controllers only.

Clarification of signs used within this manual.

Sign	Explanation
Note	Concerns an operating procedure that needs highlighting.
Caution!	Indicates a procedure or practice, which, if not strictly observed, can result in damage of the equipment.
Warning!	Indicates a procedure or practice, which, if not strictly observed, can result in personal death, serious injury or significant property damage.

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1. OVERVIEW

HGM501 gen-set controller is smart digital controller for control and protection of single gen-set. It can carry out start/stop, data measurement, alarm indication, shutdown protection and other functions. The controller is fitted with LED indicators; it is reliable and easy to use.

HGM501 gen-set controller contains the microprocessor allows precise measurement of multiple parameters, which can be configured using controller front panel. With simple wiring, compact structure and high reliability, HGM501 can be widely used for data display and fault protection of a large number of diesel and petrol generator sets.

2. PERFORMANCE AND CHARACTERISTICS

1) Nixie tube displays: single phase voltage display and total active power voltage display (calculated using single phase power, taking load as balanced);
2) Multifunction nixie tube display that can be switched between single phase frequency, single phase current, battery voltage, total running time (max 999 hours), engine and generator temperature;
3) Under voltage, over voltage, under frequency, over frequency, over load, over temperature protection, starting with flashing lights alarm and followed by shutdown protection after alarm delay;
4) Low oil pressure digital input that immediately shuts down the generator in case of low oil pressure;
5) Displayed parameters can be selected using touch-buttons;
6) Wide selection of temperature sensor types in settings;
7) All the parameters can be set via front panel for easy and convenient operation;
8) Modular design, anti-flaming ABS plastic enclosure, compact structure, convenient embedded installation.

3. TECHNICAL DATA

Table 2 – Technical Data

Parameter	Details
Operating voltage	DC9.0V to 18V uninterrupted power supply - DC12V system used
Overall consumption	<2W (Standby mode ≤1W)
Alternator voltage inputs: Single phase 2-wire (L and N only) 2-phase 3-wire (L and N only) 3-phase 4-wire (L and N only)	 AC 30V - 360V (ph-N) AC 30V - 360V (ph-N) AC 30V - 360V (ph-N)
Alternator frequency	50/60Hz
Start relay output	7A DC12V power supply output
Fuel relay output	7A DC12V power supply output
Case dimensions	118 mm x 128 mm x 36 mm
CT Secondary current	Rated 62.5mA
Operating Temperature	(-25~+70)°C
Operating Humidity	(20~90)%RH
Storage Temperature	(-30~+80)°C
Protection level	IP42
Insulation strength	Apply AC1.5kV voltage between high voltage terminal and low voltage terminal; The leakage current is not more than 3mA within 1min.
Weight	0.216kg

4. OPERATION

4.1. BUTTON DESCRIPTION

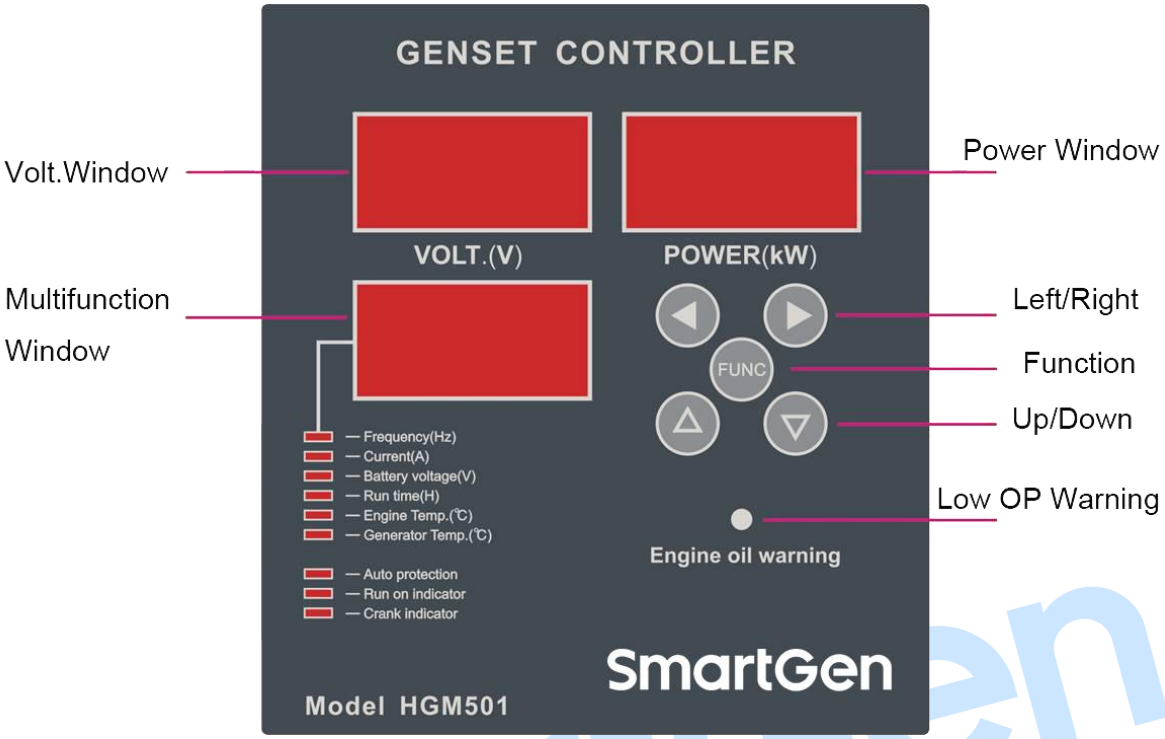

Fig.1 – HGM501 Front Panel

Table 3 – Key Functions

Icon	Function	Description
FUNC	FUNCTION	1. In configuration menu, pressing this button enters setting or confirms; 2. During normal operation, press this button to switch to frequency display; 3. In case of alarm shutdown, pressing and holding the button for 1 second will reset the alarm.
△	UP/SCROLL	1. During parameter configuration, pressing this button increases the set value; 2. During normal operation press this button to switch to the upper LED.
▽	DOWN/ SCROLL	1. During parameter configuration pressing the button decreases the set value; 2. During normal operation the button switches to the lower LED.
◀	LEFT	1. During parameter configuration pressing this button will return to the previous menu; 2. During normal operation press this button to switch to the next (upper) LED.
▶	RIGHT	1. During parameter configuration press this button to enter the next menu. 2. During normal operation the button switches to the lower LED.

4.2. START/STOP OPERATION

STARTING PROCEDURE

In stop mode turn the starter key from OFF to ON position to power on the controller, then change the starter key position to START to begin cranking; after the engine fires, release the starter key(crank disconnect condition is gen frequency>14.0Hz), then voltage, power and frequency windows will show the real measured values. Press  or  button to switchover between indicators 1#-6# and multifunctional window will show corresponding settings. Press  button to return to the frequency window.

LED indicators state:

1#	Frequency (Hz)	
2#	Current (A)	
3#	Battery voltage (V)	
4#	Run time (H)	
5#	Engine temp.(℃)	
6#	Generator temp.(℃)	
7#	Auto protection	If on, auto protection is enabled; if not, it is disabled.
8#	Run on indicator	Fuel relay output indicator
9#	Crank indicator	Start output indicator
10#	Engine oil warning	Low oil pressure indicator

⚠NOTE: Before starting the engine please make sure that all the parameter settings are correct.

⚠NOTE"Engine oil warning"indicator operates according to the oil pressure switch. Before the start of the gen-set, the light must be on; if it is not, it means that oil pressure switch or its return circuit is faulty; in this case please do not proceed before clearing up the problem.

STOPPING PROCEDURE

1) Auto stop

If auto protection condition occurs, the system will be stopped automatically;

During normal running of the gen-set, if low oil pressure signal is detected an last for over 2s, the set will be stopped.

2) Manual stop

Under any circumstances, if starter key is turned from ON to OFF position, it will lead to shutdown.

5. AUTO PROTECTION

In auto protection mode, except for low oil pressure protection, all the other protections (voltage, frequency, overload, temperature) are active.

1) Voltage protection
   When the limits of rated voltage are exceeded by ±10%, Voltage LED starts flashing; after 7 seconds delay in case of under voltage or 3 seconds delay in case of over voltage, alarm shutdown is initiated. After that voltage LED continues to flash and shows pre-alarm value.
2) Frequency protection
   50Hz：(45~55)Hz
   60Hz：(55~65)Hz
   When the set value is exceeded, frequency LED starts flashing; after 7 seconds delay in case of under frequency and 3 seconds delay in case of over frequency, alarm shutdown is initiated. After that frequency LED continues to flash and shows pre-alarm value.
3) Overload protection
   If the set value is exceeded by 5% or less, alarm will not be initiated;
   If the set value is exceeded by more than 5%, power LED will start flashing;
   If the set value is exceeded by 5%-7.5% and continuous for more than 3 hours, then alarm shutdown will be initiated;
   If the set value is exceeded by 7.5%-10% and continues for more than 1 hour, alarm shutdown will be initiated;
   If the set value is exceeded by more than 10%, and continues for more than pre-set over power delay value, alarm shutdown will be initiated (defult: 30s);
   After alarm shutdown is initiated power LED continues to flash and shows pre-alarm value.
4) Low oil pressure protection
   Irrespective of whether auto protection mode is enabled or not, genset will shutdown if low oil pressure occurs and last for more than 2s.
5) High engine temperature protection
   If engine temperature exceeds pre-set high temperature threshold, LED window starts flashing; after 7 seconds delay, protection begins; LED window continues to flash and shows pre-protection value (for air-cooled engine);
6) High generator temperature protection
   When generator temperature exceeds 95℃, LED window starts flashing; after 7 second delay, protection begins; LED window continues to flash and shows pre-protection value;
7) Battery voltage protection
   Battery voltage protection is enabled irrespective of whether auto protection mode is enabled or not and whether gen-set is running. If battery voltage value is lower than 8V or higher than 16.5V, Nixie tube or LED display starts flashing, but shutdown protection is not initiated.

⚠NOTE: During Safety On delay, protection is disabled; after Safety On Delay, when voltage, frequency, overload, high temperature protection is initiated, fuel output deactivates.

6. TERMINAL

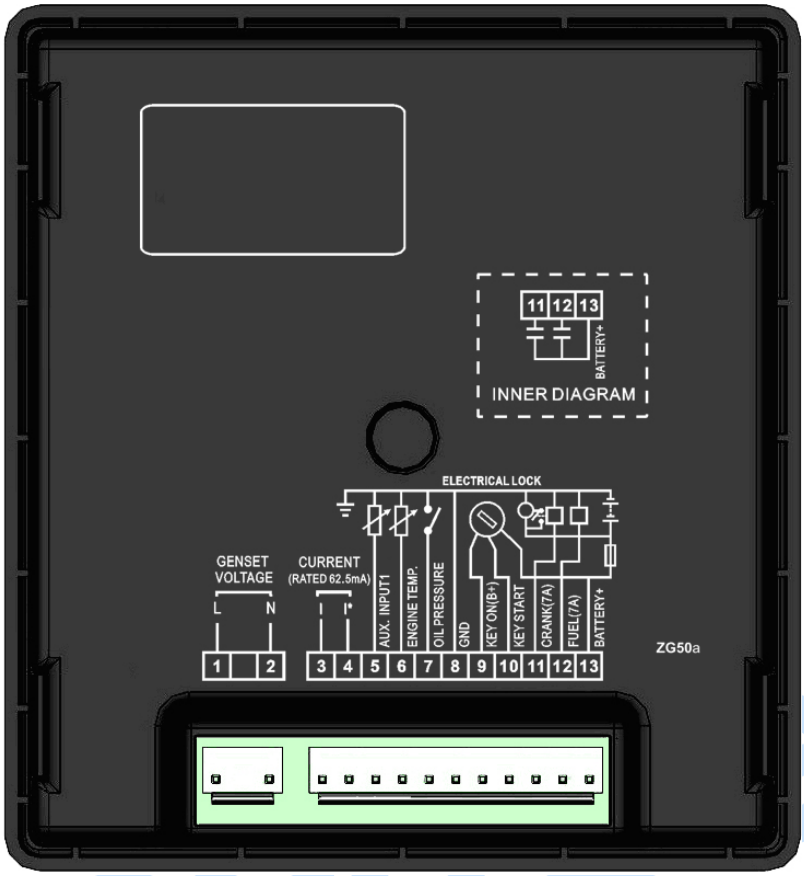

Fig.2 – HGM501 Back Panel

Table 4 -Terminal Connections Description

Terminal	Function	Wire size	Remarks
1	Generator Voltage L	1.0mm^2	
2	Generator Voltage N	1.0mm^2	
3	Load CT Secondary I (out)	1.0mm^2	Current Transformer Secondary max current 62.5mA
4	Load CT Secondary I* (in)	1.0mm^2	
5	Aux. Input1	1.0mm^2	Can be configured as programmable digital input port(active connect to B-); Also can be configured as generator temp. sensor.
6	Engine Temperature Sensor Input	1.0mm^2	
7	Low Oil Pressure Input	1.0mm^2	Low oil pressure digital or sensor signal input port; must be connected to B-
8	Battery Negative Input B-	1.5mm^2	Controller power supply input B-
9	Electric Lock ON Signal Input B+	1.5mm^2	Controller power supply input B+ and fuel relay output (activates when Electric key is turned to ON position)

Terminal	Function	Wire size	Remarks
10	Electric Lock START Input	1.5mm^2	Hand-turn start, start relay output (Output activates when electric lock key is turned to START position)
11	Start Relay Output	1.5mm^2	Rated current 7A; power supplied by terminal 13
12	Fuel Relay Output	1.5mm^2	Rated current 7A; power supplied by terminal 13
13	Fuel/Start Relay Common Port	2.5mm^2	Fused and connected to start battery positive

NOTE: Controller within the LINK port, which connect to SmartGen's SG72 adapter. It is can be set or check genset's real time data via PC software.

7. CONFIGURABLE PARAMETERS

7.1. CONFIGURABLE PARAMETERS TABLE

Table 5 – Configurable Parameters

No	Parameter	Range	Default	Description
1	AC system	1P 2P 3P 4P	1P	1P：1P2W 2P：2P3W 3P：3P4W 4P：Double Rated Volts
2	Rated voltage	110 V 115 V 120 V 130 V 220 V 230 V 240V	220	Generator rated voltage value selection
3	Rated frequency	50Hz 60Hz	50	Generator rated frequency selection
4	Rated power	(0.0-99.9)kw	5.0	Generator rated Active power
5	Enable Auto protection	Enable Disable	Enable	Irrespective of whether gen-set auto protection is enabled
6	CT Ratio	(0-999)/62.5	50/62.5	Unit: A/62.5mA (Must correspond to the used current transformer)
7	Engine temperature sensor type	L-0 L-1 L-2 L-3 L-4	L-4	L-0：Not used L-1：TE1(SGX Sensor) L-2：TE2(SGD Sensor) L-3：TE3(PT100 Sensor) L-4：TE4 (See TE4/TG4 Sensor

No	Parameter	Range	Default	Description
		L-5		Curve) L-5: TE5 (Mingzhihui SGD_NPT Sensor) Select this according to the used sensor.
8	Generator temperature sensor type	L-0 L-1 L-2 L-3 L-4 L-5	L-0	L-0：Not used L-1：TG1(SGX Sensor) L-2：TG2(SGD Sensor) L-3：TG3(PT100 Sensor) L-4：TG4(See TE4/TG4 Sensor Curve) L-5: TG5 (Mingzhihui SGD_NPT Sensor) Select this according to the used sensor.

Remark:

1) Parts of parameters only can be configured via PC software, e.g. digital input port1.

2) AC system selected "Double Rated Volts" means generator can output two kinds of rated voltage.

TE4/TG4 sensor curve as bellow,

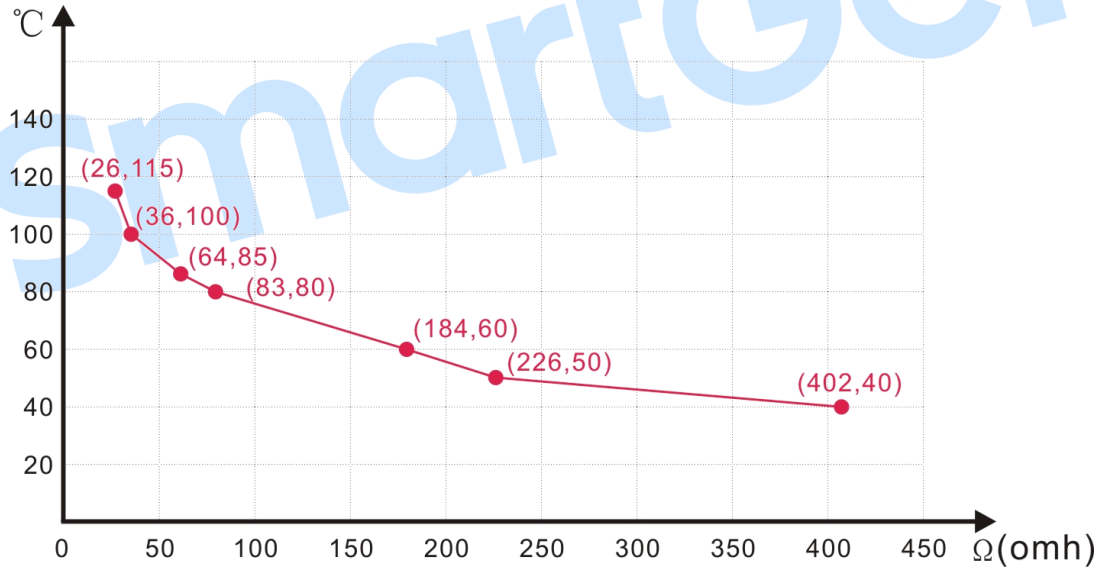

Fig.3 – TE4/TG4 Sensor Curve

7.2. PARAMETER CONFIGURATION

Before using controller for the first time, parameters must be configured: rated voltage, rated frequency, rated power set values must comply with the used generator, set C.T. ratio value should comply to the used current transformer.

1) When the controller is disconnected, press FUNC button, then change start key position from OFF to ON; after the controller is powered on release FUNC button and all the three windows (voltage window, frequency window and multifunctional window will show set parameters; at the same time voltage window will start flashing showing four choices (1P/2P/3P/4P) which mean 1P2W, 2P3W, 3P4W and Double Rated Volts respectively. Use △ and ▽ to choose AC wire type and FUNC to confirm and automatically enter the next menu item;

2) Rated voltage value settings: there are 7 possible variants of voltage (110/115/120/130/220/230/240V), use △ and ▽ to switchover between them (each pressing will increase/decrease the value for one step). When the screen shows the needed value, press FUNC to confirm and enter the next menu item;

3) Rated power settings: power LED window first digit will start flashing; use △ and ▽ to choose a value from 0 to 9, then press FUNC to confirm and enter next settings; power window second digit will start flashing, use △ and ▽ to choose a value from 0 to 9 and FUNC to confirm; power window third digit will start flashing, use △ and ▽ to choose a value from 0 to 9 and FUNC to confirm and enter the next menu item;

4) Rated frequency setting: frequency LED indicator illuminates, multifunctional window starts flashing; press △ and ▽ to choose frequency value (there are 2 choices: 50 and 60Hz), every time you press the button the value will change; when the needed value is displayed, press FUNC to confirm and automatically enter the next setting;

5) Auto protection setting: when auto protection light indicator is on, press FUNC to confirm and auto protection will continue to be enabled; use △ or ▽ to make indicator flashing and press FUNC to disable auto protection. When the light indicator is off, it means that auto protection is disabled. Enabling this function is recommended;

6) C.T setting: current LED indicator illuminates; multifunctional window first digit will start flashing; use △ and ▽ to choose a value from 0 to 9, then press FUNC to confirm and enter next settings; multifunctional window second digit will start flashing, use △ and ▽ to choose a value from 0 to 9 and FUNC to confirm; multifunctional window third digit will start flashing, use △ and ▽ to choose a value from 0 to 9 and FUNC to confirm and enter the next menu item;

7) Engine temperature sensor type setting: when engine temperature indicator is on,

multifunctional window will start flashing: use  and  to select temperature sensor type (there are six choices: L-0，L-1，L-2，L-3，L-4. L-5. L-0 stands for 'no temperature sensor used'). Every time you press the button, the temperature sensor type will change; when the needed type is displayed, press  button to confirm and automatically enter the next setting;

8) Generator temperature sensor type setting: the same as 7.

9) High temperature shutdown limit setting: engine temperature indicator illuminates, multifunctional window first digit will start flashing, use  and  to choose a value from 0 to 9 and  to confirm; multifunctional window second digit will start flashing, use  and  to choose a value from 0 to 9 and  to confirm; multifunctional window third digit will start flashing, use  and  to choose a value from 0 to 9 and  to confirm and enter the next setting automatically; the range of temperature setting is 1-600℃ and it is invalid when outside this range.

10) Turn the start key from ON to OFF position to finish configuration.

⚠NOTE: during configuration use  button to enter the next menu item and  to return to the previous.

⚠CAUTION: Please change inner controller parameters (rated generator voltage, generator frequency etc.) only in standby mode, otherwise in can lead to shutdown or other abnormal condition.

8. COMMISSIONING

It is recommended that the following checks are made before starting the system:

1) Check that all the connections are correct and wire sizes are suitable.
2) Ensure all parameters are configured correctly and oil pressure light is on.
3) Ensure the controller DC power supply is fused and correctly connected to the positive and negative of starter battery.
4) Take proper measures to prevent the engine from starting (e. g. unplug fuel valve wire). After checking that there are no faults, connect the starter battery, change start key position from OFF to ON, and the controller will carry out the procedure.
5) Then change start key position to START to start cranking. After the engine is fired, remove start key; voltage, frequency and power windows will show true collected values.
6) For further information please contact SmartGen services.

9. TYPICAL WIRING DIAGRAM

Typical wiring diagram is shown below:

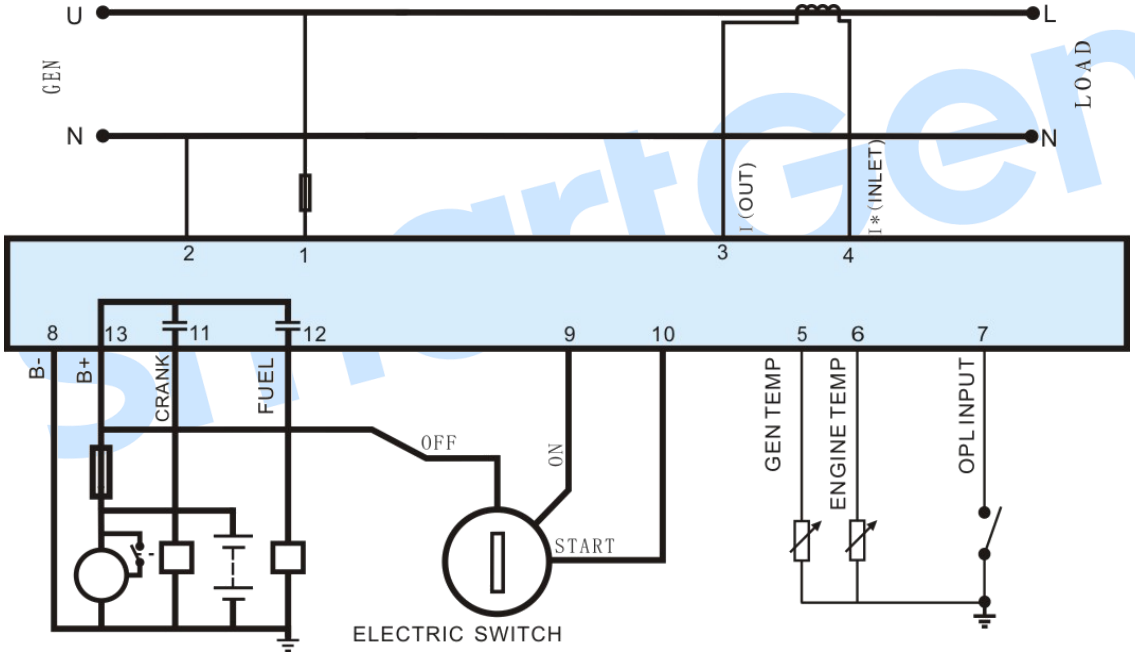

Fig.4 – HGM501 Typical Application Diagram

10. INSTALLATION

The controller is designed for panel mounting, it is held with the help of fixing clips. Overall and cutout dimensions can be seen below (unit: mm)

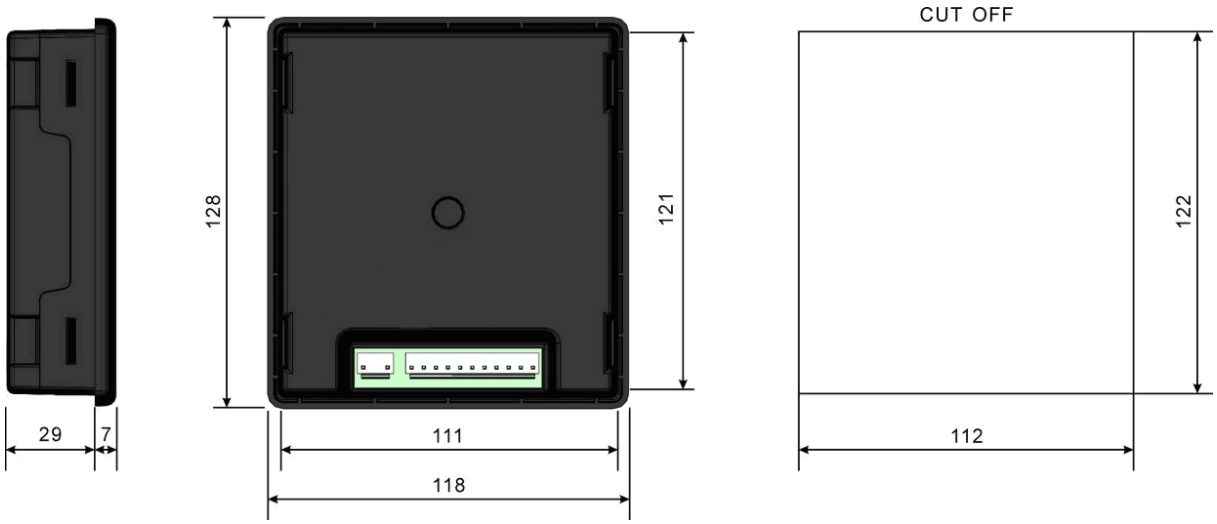

Fig.5 – Overall Dimensions and Panel Cutout

1) Battery Voltage Input

NOTE: HGM501 controller is suitable for 9-18 VDC battery voltage. Battery negative must be reliably connected to the enclosure of the engine. The controller power supply B+ and B- must be connected to battery positive and negative, and the wire size must not be less then 1.5mm2. In case of floating charger connect charger output to battery positive and negative directly, then, connect battery positive and negative poles to controller positive and negative power supply input port using single lines to prevent charger interference into normal operation of the controller.

WARNING: When the engine is running, start battery must not be removed.

2) AC input

Current transformer with rated secondary current 62.5mA must be externally connected to the controller current input.

WARNING! When generator is on-load, C. T. secondary must not be open circuit.

3) Withstanding voltage test

CAUTION: If withstanding voltage test is conducted after the controller has already been installed onto the control panel, please unplug all controller terminal connections in order to prevent high voltage from damaging it.

11. TROUBLESHOOTING

Table 6 - Troubleshooting

Problem	Possible solution
Controller does not respond on power on	Check start battery. Check wiring to the controller Check DC fuse
Low oil pressure alarm after crank disconnect	Check oil pressure sensor and its wiring.
Alarm shutdown during running	Check corresponding switch and wiring in accordance with the information on the display
Fail to start	Check fuel return circuit and wiring Check start battery Consult engine manual
Starter motor does not respond	Check the wiring to the starter Check start battery