SmartGen

MAKING CONTROL SMARTER

HSC941

GENSET CONTROLLER

USER MANUAL

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Table 1 Software Version

Date	Version	Note
2023-10-12	1.0	Original release.
2023-11-20	1.1	Modify several parameter ranges; modify several Chinese descriptions; add parameter configuration items.

Table 2 Notation Clarification

Sign	Instruction
 NOTE	Highlights an essential element of a procedure to ensure correctness.
 CAUTION!	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
 WARNING!	Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.

1 OVERVIEW

HSC941 Genset Controller integrates the digital, intelligent and network technology for automation and monitoring system of single unit, realizes the engine speed adjustment, the genset automatic start/stop, data measurement, alarm protection and “three remotes” functions. It applies LCD display, optional interface operation with Chinese and English. It is simple to operate and reliable to run.

HSC941 Genset Controller adopts microprocessor technique to achieve precision measurement of various parameters, value adjustment, timing and threshold setting, etc. All the parameters can be configured from front panel, or adjusted and monitored via PC by USB interface or RS485 interface. Because of the characteristics of compact structure, simple wiring and high reliability, it can be widely used in all types of genset automatic systems.

2 CHARACTERISTICS

HSC941: used for automation of sigle unit by driving the stepping motor to adjust the throttle opening and then adjust the speed, to control genset automatic start/stop by remote signal;

Its main characteristics are as follows:

——LCD display with backlight, 132x64 size, simple Chinese and English display, push-button operation;

——Hard acrylic screen material with great wear-resisting and scratch-resisting performance, which are used to protect the screen;

——Silicone panel and push buttons, which can better adapt to extreme temperature environment;

——RS485 communication interface, which enables “three remotes” (remote control, remote measuring, remote communication) functions by MODBUS protocol;

——Suitable for 3P4W, 1P2W, 3P3W, 2P3W power supply 50Hz/60Hz systems;

——Collect and display generation 3-phase voltage, 3-phase current, frequency and power parameters;

Generator

Line Voltage	Uab, Ubc, Uca	
Phase Voltage	Ua, Ub, Uc	
Frequency	Hz	

Load

Current	Ia, Ib, Ic	Unit: A
Each phase and total active power	P	Unit: kW
Reactive Power	Q	Unit: kvar
Apparent Power	S	Unit: kVA
Power Factor	PF	
Accumulated Total Generator Power	W	Unit: kWh
Output Percentage with Loading	%	

——With Gen over/under voltage, over/under frequency, over current functions;

——Speed adjustment function (by driving a stepping motor);

——Precise measurement of various parameters of engine:

Speed	Unit: r/min
Temp.	Unit: °C/°F
Oil Pressure	Unit: kPa/psi/bar
Fuel Level	Unit: %

Battery Voltage	Unit: V
Charger D+ Voltage	Unit: V
Total Running Time	Up to 99999999 hours
Total Start Times	Up to 999999 times

——Control Protection: automatic start/stop of genset, open/close and perfect fault display and protection functions;

——With ETS, idle speed control, preheating control, speed drop/raise control, all of them are relay outputs;

——Parameter setting: allow users to modify and set parameters, meanwhile they shall be stored in the internal FLASH and will not be lost even in case of power outage; all of them can be adjusted from the front panel of the controller and also can be modified on PC via USB or RS485 interface;

——Two fixed analog sensors (temperature, oil pressure);

——A flexible analog sensor can be set as temperature, pressure or level sensor, or set as Aux. input 6 and used in different occasions;

——A variety of temperature, pressure, fuel level sensor curves can be used directly, and can be defined by users;

——Multiple conditions of crank disconnect (gen frequency, speed, oil pressure) are optional;

——Wide power supply range: DC (8~35)V, adapting to different starting battery volts;

——Scheduled start/stop functions (once for monthly/weekly/daily and can be set with or without load);

——All parameters apply digital adjustment, getting rid of conventional analog modulation of normal potentiometer, improving the reliability and stability of the whole device;

——Rubber seal designed between the shell and the screen with protection level IP65;

——Metal fixing clips are used to fix the controller;

——Modular structure design, anti-flaming ABS enclosure, pluggable connection terminals, built-in mounting with compact structure and easy installation.

Table 3 Data Collection

Type	Name	Symbol	Unit
Generator	Line Voltage	Uab，Ubc，Uca	V
	Phase Voltage	Ua、Ub、Uc	V
	Frequency	ƒ	Hz
	Phase Sequence	/	°
Load	Current	Ia、Ib、Ic	A
	Each Phase and Total Active Power	P	kW
	Reactive Power	Q	kvar
	Apparent Power	S	kVA
	Power Factor	λ（PF）	/
	Gen Total Power	W	kWh
Load Output Percentage= (Active Power/Rated Power) ×100%			

3 SPECIFICATION

Table 4 Performance Parameter

Item	Content
Working Voltage	DC8V ~ DC35V, continuous power supply
Overall Consumption	Standby≤2W, running<8W (stepping motor adjustment)
AC Voltage	Phase Voltage Range: AC15V ~ AC360V (ph-N) Resolution: 1V Accuracy: 1%
	Line Voltage Range: AC30V ~ AC720V (ph- ph) Resolution: 1V Accuracy: 1%
AC Frequency	Range: 50Hz/60Hz Resolution: 0.1Hz Accuracy: 0.1Hz
AC Current	Rated: 20mA Range: 0mA ~ 40mA Resolution: 0.1A (One Side Current) Accuracy: 1%
Speed Sensor	Voltage Range: 1.0V ~ 24V(RMS) Frequency Range: 100Hz ~ 10000Hz
Charger (D+) Voltage	Range: DC0V ~ DC60V Resolution: 0.1V Accuracy: 1%
Analog Sensor	Resistor Input Range: 0Ω ~ 6000Ω Resolution: 0.1Ω Accuracy: 1Ω (below 300Ω)
Fuel Relay Output	5A DC28V DC power supply output
Crank Relay Output	5A DC28V DC power supply output
Digital Output 1~4	5A DC28V DC power supply output
Digital Input 1~5	Low threshold voltage 1.2V, max. input voltage 60V
Steady Speed Change Rate	<1.5%
Steady Speed Fluctuation Rate	<0.5%
Instantaneous Speed Change Rate	Sudden decreased load <+10% Sudden increased load >-15%
Recovery Time	<5s
Stepping Motor Specification	2-phase hybrid type, driving current ≤1A
RS485 Interface	Isolation, max. communication distance is 1000m, impedance-120Ω shielding wire is recommended, its single-end connect with ground.
Vibration	5Hz~8Hz: ±7.5mm

Item	Content
	8Hz~500Hz: a ±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
Production Compliance	According to EN 61010-1 installation category (over voltage category) III, 300V, pollution class 2, altitude 3000m
Case Dimensions	135 mm x 110 mm x 46mm
Panel Cutout	116.5mm x 91.5mm
Working Temperature	(-25~+70)˚C;
Working Humidity	(20~95)%RH
Storage Temperature	(-25~+70)˚C;
Protection Level	IP65
Insulation	Apply AC2.2kV voltage between high voltage terminal and low voltage terminal. The leakage current is not more than 3mA within 1min.
Weight	0.36kg

4 OPERATION

4.1 KEYS FUNCTIONS

Table 5 Keys Descriptions

Icon	Key	Description
	Stop/Reset	Can stop the running genset in Manual/Auto mode; Can reset the shutdown alarm in genset alarm state; Press this key for more than 3s to test panel display and indicators are normal or not (lamp test) in stop mode; During stop process, press this key again to stop genset immediately.
	Start	Press this key to start the genset in Manual or Manual Test mode.
	Manual	Press this key and the controller goes in Manual mode. Press this key and up key (or down key) can adjust the LCD contrast.
	Auto	Press this key and controller goes in Auto mode.
	Close/Open	Press this key can control the switch close/open in manual mode.
	Set/Confirm	Press this key to enter the menu setting and can move the cursor and confirm the setttings in parameter setting.
	Up/Increase	Screen scroll, move up the cursor or increase value in parameter setting.
	Down/Decrease	Screen scroll, move down the cursor and decrease value in parameter setting.

4.2 CONTROLLER PANEL

Fig.1 HSC941 Front Panel Indication

NOTE: Description for parts of indicators.

Table 6 Alarm Indicator Description

Alarm Type	Alarm Indicator
Warning	Slow flashing (once per second)
Shutdown	Fast flashing (5 times per second)

NOTE 1: Status Indicator: it will not be illuminated in standby state, flashes once for 1s during start or stop process, always be illuminated in normal running;

NOTE2: Gen normal indication: displays ● when power generation is normal, displays ○ when there is no power generation.

4.3 AUTO START/STOP OPERATION

4.3.1 ILLUSTRATION

Press the key and the indicator beside is illuminated, which means the genset is in Auto Start Mode.

4.3.2 AUTO START SEQUENCE

a) When remote start input is active, it enters “Start Delay”;
b) LCD displays “Start Delay” countdown;
c) When start delay is over, preheating relay is energized (if configured), “Preheat delay XXs” information will be displayed on LCD;
d) When preheating delay is over, the fuel relay outputs for 1s, the stepping motor drives the throttle to rotate the setting starting angle, and then the start relay outputs; if the genset doesn’t start successfully during the “Start Time”, the fuel relay and start relay will stop outputting and enters the “Crank Rest Time” to wait for next crank;
e) If the genset does not start successfully in setting attemps, the fifth line of LCD is black and displays “Start Failure” alarm;
f) If it starts during the attemps, it enters “Safety on time”, the stepping motor drives throttle to adjust the speed, and during this period, Low Oil Pressure, High Water Temperature, Under Speed, Charing Failure and Auxiliary Input (configured) alarms are all inactive; after “Safety on time”, it enters “Start Idle Delay” (if configured);
g) During “Start idle delay”, under speed, under frequency, under voltage alarms are inactive. When this delay is over, “Warming up delay” is initiated (if configured);
h) When “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 generator close relay will be energized, the genset will take load and generator power indicator will be illuminated, it will enter normal running status; If voltage or frequency is abnormal, the controller will initiate alarm and shut down (alarm information will be displayed on LCD).

NOTE: When remote start (off load) is applied to start, the procedure is the same as the above, only in h), the generator close relay is deactivated, and moreover, genset is off load.

4.3.3 AUTOMATIC STOP SEQUENCE

a) When remote start input is inactive, it enters “Stop Delay”;
b) When stop delay is over, “Stop Cooling Delay” is energized and gen close relay is deactivated, the gen supply indicator is exstinguished;
c) When it enters “Stop Idle Delay” (if configured), the idling speed relay is energized;
d) When it enters “ETS Solenoid Hold” (if configured), ETS relay is energized while fuel relay is de-energized;
e) When it enters “Wait for Gen-set Stop”, and complete stop is detected automatically;
f) When the generator stops completely, it enters gen standby status; and the controller alarms if genset cannot stop (the stop failure warning is displayed on LCD).

4.4 MANUAL START/STOP OPERATION

a) Press  key and controller enters “Manual Mode”, the indicator of manual mode is illuminated. Then press  key to start the genset, it can detect crank disconnect condition and generator accelerates to high-speed running automatically. If high water temperature, low oil pressure, abnormal voltage occurs during running, it can protect genset to stop quickly (See 4.3.2 of Auto start Sequence c~h). After the normal running with high-speed, controller will initiate a gen close signal.

b) Manual Stop: press  key to stop the running genset. (See 4.3.3 Auto Stop Sequence b~f).

5 GENSET SWITCH CONTROL PROCEDURES

5.1 HSC941 SWITCH CONTROL PROCEDURE

5.1.1 MANUAL CLOSE/OPEN PROCEDURE

When controller in Manual Mode, the switch control procedures will start through manual control procedure.

If manual close enables, press  key, if gen is off load, the gen close will output and when close delay is over, the indicator of close/open is illuminated; press  key, if gen is on-load, the gen open will output and when open delay is over, the indicator of close/open is exstinguished.

If manual close is disabled, the key of close/open is deactivated.

5.1.2 AUTO CLOSE/OPEN PROCEDURE

When controller is in Auto or Stop Mode, the switch control procedure will perform the automatic close/open procedure.

When genset is in normal running, gen and frequency reach the on-load conditions, the controller will excute close/open automatically; the gen off load changes to gen on-load, the gen close will output. When close delay is over, the indicator of close/open is illuminated; the gen on-load changes to gen off load, the gen open will output. When open delay is over, the indicator of close/open is extinguished.

NOTE 1: When input port is configured "Gen close status input", the close/open indicator is consistent only with the input status of input port. When input port is active, the close/open indicator is illuminated, which means that the current status is on-load; when input port is inactive, the close/open indicator is extinguished, which means that the current status is off load.

6 PROTECTIONS

6.1 WARNINGS

When controller detects the warning signal, it only issues warning but not shut down.

Table 7 Warning Alarms

No.	Type	Description
1	High Temp. (IN)	When it dectects that the temperature of input port is high and shutdown is not allowed, the controller will send a warning signal and displays it on LCD.
2	Low Oil Pressure (IN)	When it dectects that the oil pressure of input port is low and shutdown is not allowed, the controller will send a warning signal and displays it on LCD.
3	Fail to Stop	When “ETS Solenoid Hold”/”Wait for Genset Stop Delay” is over, if the genset does not stop completely, the controller will send a warning signal and displays it on LCD.
4	Charging Failure	When it detects that the charger voltage of genset is less than the set threshold, the controller will send a warning signal and displays it on LCD.
5	Battery Under Volt.	When it detects that the battery voltage is less than the set threshold, the controller will send a warning signal and displays it on LCD.
6	Battery Over Volt.	When it detects that the battery voltage is great than the set threshold, the controller will send a warning signal and displays it on LCD.
7	External Warn Input	When it detects that the external warning input is active, the controller will send a warning signal and displays it on LCD.
8	Loss of Speed Signal	When it detects that the genset speed is 0 and the loss of speed delay is set to 0, the controller will send a warning signal and displays it on LCD.
9	Low Coolant Level (IN)	When it detects that the low coolant level of input is active, the controller will send a warning signal and displays it on LCD.
10	Low Fuel Level (IN)	When it detects that the low fuel level of input is active, the controller will send a warning signal and displays it on LCD.
11	Gen Over Current	When it detects that the gen current is greater than the set threshold and the delay is not 0, the controller will send a warning signal and displays it on LCD.
12	Temp. Sensor Open	When the temperature sensor is open and the act is set as warning, the controller will send a warning signal and displays it on LCD.
13	OP Sensor Open	When the oil pressure sensor is open and the act is set as warning, the controller will send a warning signal and displays it on LCD.
14	Flex. Sensor Open	When the flexible sensor is set as temperature, oil presssrue or level sensor, the sensor is open and the act is set as warning, the controller will send a warning signal and displays it on LCD.

No.	Type	Description
15	High Temp.	When the sampling temperature is over than the set high warning threshold, or greater than the high shutdown threshold and shutdown is not allowed, the controller will send a warning signal and displays it on LCD.
16	Low Oil Pressure	When the sampling presssure of oil pressure sensor is greater than the low warning threshold, or sampling pressure is greater than the set low shutdown threshold and shutdown is not allowed, the controller will send a warning signal and displays it on LCD.
17	Flex. Sensor	When the flexible sensor is set as temperature, oil pressure or level sensor, the sampling value is greater or lower than the warning threshold, the controller will send a warning signal and displays it on LCD.

6.2 SHUTDOWN ALARMS

When controller detects the shutdown alarm, it will open and stop immediately and display the alarm type.

Table 8 Shutdown Alarms

No.	Type	Description
1	Emergency Shutdown Alarm	When it detects that the input of emergency alarm, the controller will send an alarm signal and displays it on LCD.
2	High Temp. Shutdown Alarm (IN)	When it detects that the input of high temperature alarm and shutdown is allowed, the controller will send an alarm signal and displays it on LCD.
3	Low Oil Pressure Shutdown Alarm (IN)	When it detects that the input of low oil pressure alarm and shutdown is allowed, the controller will send an alarm signal and displays it on LCD.
4	Over Speed Shutdown Alarm	When it detects that the genset speed is over the set threshold, the controller will send an alarm signal and displays it on LCD.
5	Under Speed Shutdown Alarm	When it detects that the genset speed is under the set threshold, the controller will send an alarm signal and displays it on LCD.
6	Loss of Speed Signal	When it detects that the genset speed is 0 and the delay is not 0, the controller will send an alarm signal and displays it on LCD.
7	Gen Over Voltage	When it detects that the genset voltage is greater than the set threshold, the controller will send an alarm signal and displays it on LCD.
8	Gen Under Voltage	When it detects that the genset voltage is less than the set threshold, the controller will send an alarm signal and displays it on LCD.
9	Crank Disconnect Failure	Within the set start attemps, if the genset crank disconnect fails, the controller will send an alarm and displays it on LCD.
10	Gen Over Frequency	When it detects that the genset frequency is greater than the set threshold, the controller will send an alarm signal and displays it on LCD.
11	Gen Under Frequency	When it detects that the genset frequency is less than the set threshold, the controller will send an alarm signal and displays it on LCD.
12	No Generation Shutdown Alarm	When it detects that the genset frequency is 0, the controller will send an alarm signal and displays it on LCD.
13	Low Fuel Level	When it detects that the input of low fuel level shutdown is active, the controller will send an alarm signal and displays it on LCD.
14	Low Coolant Level (IN)	When it detects that the input of low coolant level is active, the controller will send an alarm signal and displays it on LCD.
15	Low Oil Level (IN)	When it detcts that the input of low oil level is active, the controller will send an alarm signal and displays it on LCD.
16	Temp. Sensor Open	When the temperature sensor is open and the act of parameter configuration is set as shutdown, the controller will send an alarm signal and displays it on LCD.

No.	Type	Description
17	Oil Pressure Sensor Open	When the oil pressusure sensor is open and the act of parameter configuration is set as shutdown, the controller will send an alarm signal and displays it on LCD.
18	Aux. Sensor Open	When the Aux. sensor is configured as temperature, oil pressure or level sensor and opens, the act of parameter configureation is set as shutdown, the controller will send an alarm signal and displays it on LCD.
19	High Temp. Shutdown Alarm	When sampling temperature is over than the set threshold and allowed to shut down, the controller will send an alarm signal and displays it on LCD.
20	Low Oil Pressure Shutdown Alarm	When the sampling oil pressure is less than the set threshold and allowed to shut down, the controller will send an alarm signal and displays it on LCD.
21	Aux. Sensor Shutdown Alarm	When the Aux. sensor is configured as temperature, oil pressure or level sensor, the sampling value is over or less than the shutdown threshold of Aux. sensor, and allow then Aux. sensor to shut down, the controller will send an alarm signal and displays it on LCD.

7 WIRING CONNECTION

The back panel of HSC941 controller is as follows:

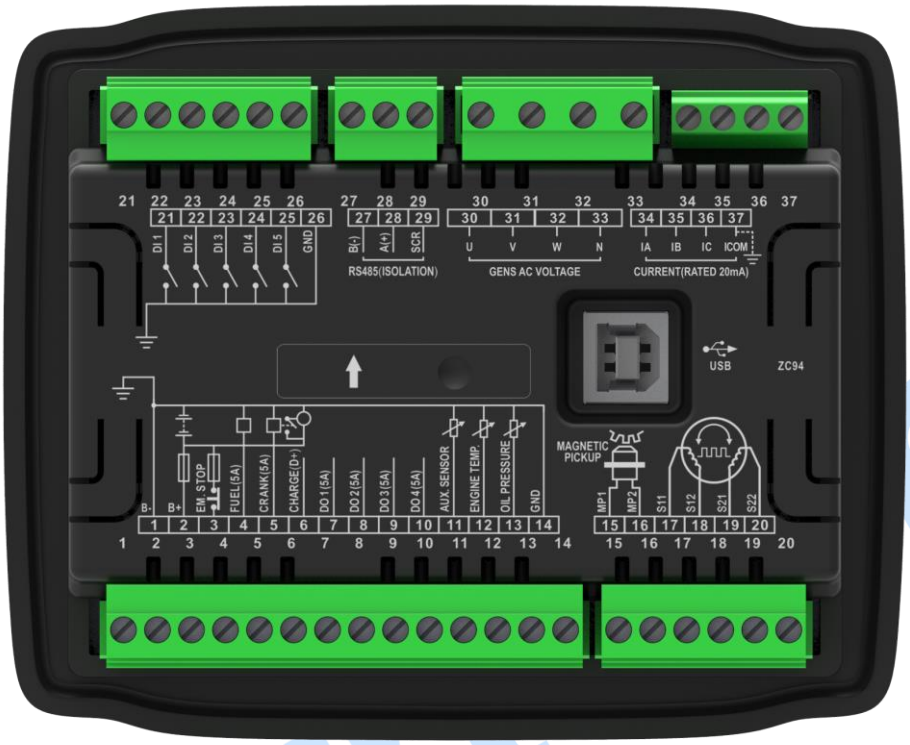


Fig.2- HSC941Controller Back Panel

Table 9 Terminal Connection Description

No.	Function	Cable Size	Remark
1	B-	2.5mm²	Connect with starter battery negative.
2	B+	2.5mm²	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	1.5mm²	Connect with B+ via emergency stop button.
4	Fuel Relay Output	1.0mm²	B+ is supplied by 3 points, rated 5A.
5	Crank Relay Output	1.0mm²	B+ is supplied by 3 points, rated 5A. Connect to starter coil.
6	Charger (D+) Input	1.0mm²	Connect with Charger D+ (WL) terminal. If this terminal doesn't exist, hang it in the air.
7	Flex. Relay Output 1	1.0mm²	B+ is supplied by 2 points, rated 5A.
8	Flex. Relay Output 2	1.0mm²	B+ is supplied by 2 points, rated 5A.
9	Flex. Relay Output 3	1.0mm²	B+ is supplied by 2 points, rated 5A.
10	Flex. Relay Output 4	1.0mm²	B+ is supplied by 2 points, rated 5A.
11	Aux. Sensor Input	1.0mm²	Used as Aux. sensor (temperature, pressure or level sensors are optional) or digital input port 6.
12	Temp. Sensor Input	1.0mm²	Used to connect the water/cylinder temperature resistance sensor.

No.	Function	Cable Size	Remark
13	Oil Pressure Sensor Input	1.0mm²	Used to connect oil pressure resistance sensor.
14	COM GND	1.5mm²	Connect with B- internally.
15	Speed Sensor Input	1.0mm²	Connect with speed sensor, and shielding line is recommended.
16	Speed Sensor Input	1.0mm²	Controller inside has been connected to battery negative. Connect with speed sensor, and shielding line is recommended.
17	S11	1.0mm²	Externally connected with stepping motor, S11 and S12 are one phase, S21 and S22 are the other phase.
18	S12	1.0mm²	
19	S21	1.0mm²	
20	S22	1.0mm²	
21	Aux. Digi. Input 1	1.0mm²	Ground connected is active (B-).
22	Aux. Digi. Input 2	1.0mm²	Ground connected is active (B-).
23	Aux. Digi. Input 3	1.0mm²	Ground connected is active (B-).
24	Aux. Digi. Input 4	1.0mm²	Ground connected is active (B-).
25	Aux. Digi. Input 5	1.0mm²	Ground connected is active (B-).
26	Input Port COM	1.0mm²	Connect with B- externally.
27	RS485-	0.5mm²	Impedance-120Ω shielding wire is recommended, and the single-end shall be earth connected.
28	RS485+	0.5mm²	
29	RS485 COM GND	/	
30	Generator U-phase Voltage Input	1.0mm²	Connect to U-phase of generator (2A fuse is recommended).
31	Generator V-phase Voltage Input	1.0mm²	Connect to V-phase of generator (2A fuse is recommended).
32	Generator W-phase Voltage Input	1.0mm²	Connect to W-phase of generator (2A fuse is recommended).
33	Generator N-Wire Input	1.0mm²	Connect to N-Wire of generator (2A fuse is recommended).
34	CT A-phase Input	1.0mm²	Externally connect to secondary coil of current transformer (rated 20mA).
35	CT B-phase Input	1.0mm²	Externally connect to secondary coil of current transformer (rated 20mA).
36	CT C-phase Input	1.0mm²	Externally connect to secondary coil of current transformer (rated 20mA).
37	CT COM	1.0mm²	Common grounded, connect to starter battery negative.

NOTE 1: USB ports on the back panel are configurable parameter ports, and users can directly program the controller on PC.

Cable requirements: Power supply B+, B-, emergency input, 2.5mm²;

AC current input, 1.0mm²;

Digital input, analog input, D+, AC voltage sampling input, 1.0mm²;

Output ports are based on the current of relay output, 10-16A（2.5mm², 5-10A（1.5mm²）, below 5A（1.0mm²）, RS485 using 0.5mm².

8 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

8.1 CONTENTS AND SCOPES OF PARAMETERS SETTING

Table 10 Contents and Scopes of Parameters Setting

No.	Items	Parameters	Defaults	Description
1	Start Delay	(0-3600)s	1	Time from active remote start signal to unit start.
2	Stop Delay	(0-3600)s	1	Time from inactive start signal to unit stop.
3	Start Attemps	(1-10)times	3	When engine start fails, the max. start attemps. When reaches to the set start attemps, the controller will send a start failure signal.
4	Pre-heating Time	(0-300)s	0	Time for pre-powering the heat plug before starter is powered up.
5	Chock On Time	(0-300)s	0	Time for chock is powered on.
6	Cranking Time	(3-60)s	8	Time for starter is powered on each time.
7	Crank Rest Time	(3-60)s	10	The waiting time before the second power up when engine start fails.
8	Safety On	(1-60)s	10	Alarms for low oil pressure, high water temperature, under speed, under frequency, under voltage, charing failure are inactive.
9	Start Idle Time	(0-3600)s	0	Running time for genset idling speed when the genset is starting.
10	Warming Up Time	(0-3600)s	10	Warming up time between generator switch on and high speed running.
11	Cooling Time	(3-3600)s	10	Cooling time before genset stops, after it unloads.
12	Stop Idle Time	(0-3600)s	0	Running time for genset idling speed when the genset stops.
13	ETS Solenoid Hold	(0-120)s	20	Time for the stop electromagnet energization as the genset is stopping.
14	After Stop Time	(0-120)s	0	Time after “idle delay” is over before the complete stop when “ETS Solenoid Hold” is set “0”; time after “ETS Solenoid Hold” delay is over before the complete stop when it is set other than “0”.
15	Switch On Dealy	(0-10)s	5.0	The width of gen close pulse, which means continuous output when it is 0.

No.	Items	Parameters	Defaults	Description
16	Engine Flywheel Teeth	(1-300)	118	Teeth number of the engine, for judging of starter separation conditions and inspecting of engine speed. See the installation instructions.
17	Generator Poles	(2-32)	4	
18	Gen Abnormal Delay	(0-20.0)s	10.0	The alarm delay for high/low Gen voltage.
19	Gen Over Volt. Threshold (Shutdown)	(30-620)V	264	When the Gen voltage is higher than this value and the set “Gen Abnormal Delay” continues, it is considered as high Gen voltage and sends a Gen abnormal shutdown alarm. When set to 620V, the high voltage signal is not detected.
20	Gen Under Volt. Threshold (Shutdown)	(30-620)V	88	When the sampling voltage is lower than this value and the set “Gen Abnormal Delay” continues, it is considered as low Gen voltage and sends a sginal of Gen abnormal shutdown alarm. When set to 30V, the low voltage signal is not detected.
21	Under Speed Threshold (Shutdown)	(0-6000)r/min	1000	When engine speed is lower than this value and lasts for 10s, it is considered as under speed and send a signal of under speed shutdown alarm.
22	Over Speed Threshold (Shudown)	(0-6000)r/min	4200	When engine speed is over than this value and lasts for 2s, it is considered as over speed and send a signal of over speed shutdown alarm.
23	Gen Under Frequency Threshold (Shutdown)	(0-75.0)Hz	45.0	When generator frequency is less than this value (not 0) and lasts for 10s, it is considered as under frequency and send a signal of under frequency shutdown alarm.
24	Gen Over Frequency Threshold (Shutdown)	(0-75.0)Hz	68.0	When generator frequency is over than this value and lasts for 2s, it is considered as over frequency and send a signal of over frequency shutdown alarm.
25	Loss of Speed Signal Delay	(0-20.0)s	5.0	When set the loss of speed signal shutdown delay as 0, it will only warn not stop.

No.	Items	Parameters	Defaults	Description
26	Charging Failure Threshold (Warn)	(0-30)V	6.0	During the normal running of genset, when D+(WL) voltage is less than this value and lasts for 5s, it will send a shutdown alarm.
27	Battery Over Volt. Threshold (Warn)	(12-40)V	33.0	When battery voltage is higher than this value and lasts for 20s, it will send an abnormal signal of battery voltage, it will only warn not stop.
28	Battery Under Volt. Threshold (Warn)	(4-30)V	8.0	When battery voltage is less than this value and lasts for 20s, it will send an abnormal signal of battery voltage, it will only warn not stop.
29	Aux. Output 1	(0-17)	15	Default: Chock on control.
30	Aux. Output 2	(0-17)	2	Default: ETS hold control.
31	Aux. Output 3	(0-17)	3	Default: Idle speed control.
32	Aux. Output 4	(0-17)	5	Default: Gen close.
33	Aux. Input 1 Set	(0-16)	1	Default: High temperature alarm input.
34	Aux. Input 1 Active	(0-1)	0	Default: Close.
35	Aux. Input 1 Delay	(0-20.0)s	2.0	Time from detecting active input to confirmation.
36	Aux. Input 2 Set	(0-16)	2	Default: Low oil pressusre alarm input.
37	Aux. Input 2 Active	(0-1)	0	Default: Close.
38	Aux. Input 2 Delay	(0-20.0)s	2.0	Time from detecting active input to confirm.
39	Aux. Input 3 Set	(0-16)	10	Default: Remote start input.
40	Aux. Input 3 Active	(0-1)	0	Default: Close.
41	Aux. Input 3 Delay	(0-20.0)s	2.0	从检测输入口有效到确认的时间。 Time from detecting active input to confirm.
42	Aux. Input 4 Set	(0-16)	11	Default: Low fuel level warning input.
43	Aux. Input 4 Active	(0-1)	0	Default: Close.
44	Aux. Input 4 Delay	(0-20.0)s	2.0	Time from detecting active input to confirm.
45	Aux. Input 5 Set	(0-15)	3	Default: External warning input.
46	Aux. Input 5 Active	(0-1)	0	Default: Close.
47	Aux. Input 5 Delay	(0-20.0)s	2.0	Time from detecting active input to confirm.
48	Start Status Select	(0-2)	0	0: Stop mode 1: Manual mode 2: Auto mode.
49	Controller Add.	(1-254)	1	The communication address of controller.
50	Password Set	(0-9999)	1234	See Note 6.

No.	Items	Parameters	Defaults	Description
51	Crank Disconnect Condition Select	(0-3)	1	The conditions for starter separation, such as speed, Gen frequency and oil pressure. The purpose is to separate the starter motor and the engine as soon as possible. See Table 14.
52	Engine Speed for Crank Disconnect	(0-3000)r/min	360	When engine speed is over than this value, it is considered as crank disconnect, the starter will separate.
53	Generator Frequecny for Crank Disconnect	(0.0-30.0)Hz	14.0	When generator frequency is over than this value during starting process, it is considered as crank disconnect and the starter will separate.
54	Oil Pressure for Crank Disconnect	(0-400)Kpa	200	When the engine oil pressure is over than this value during starting process, it is considered as crank disconnect and the starter will separate.
55	High Temp. Inhibit Shutdown	(0-1)	0	Default: high temperature shutdown and see Note 1 for functions.
56	Low Oil Preesure Shutdown	(0-1)	0	Default: low oil pressure shutdown and see Note 2 for functions.
57	Volt. Input	(0-3)	0	0: 3P4W; 1: 2P3W; 3: 1P2W; 3: 3P3W. See Note 3 for functions.
58	Rated Speed	(0-6000) r/min	1500	Provide standard for rated speed adjustment.
59	Idling Speed	(0-6000) r/min	900	Provide standard for idling speed adjustment.
60	Idle Slope	(0-6000)	10	The speed raising rate when idling speed changes to rated speed.
61	Idle Gain	(1-1000)	150	The speed adjusts the gain duiring engine idling running.
62	Starting Angle	(0-90)°	45	The throttle opening before engine starting.
63	Crank Disconnect Angle	(0-90)°	35	The start opening of throttle after crank disconnect.
64	Proportional Gain	(1-3000)	1100	The speed adjusted gain during rated speed running.
65	Integral Gain	(1-3000)	20	
66	Differential Gain	(1-3000)	1	
67	Overall Gain	(1-1000)	100	
68	Gain Window	(1-1000)	1	
69	Window Gain	(1000-3000)	1950	
70	Position Gain	(0-1000)	0	
71	Compensation Gain	(0-100)	0	
72	Scheduled Start Enable	(0-1)	0	Default: Disable.

No.	Items	Parameters	Defaults	Description
73	Scheduled Start On-load	(0-1)	0	Default: Off load.
74	Scheduled Start Cycle Set	(0-2)	0	Default: 0 Monthly.
75	Scheduled Start Date Set	(1-31)	1	The scheduled start date.
76	Scheduled Start Weekly Set	(0-6)	0	Default: 0 Sunday
77	Scheduled Start Hour Set	(0-23)	0	The scheduled start hour.
78	Scheduled Start Minute Set	(0-59)	0	The scheduled start minute.
79	Scheduled Start Running Time	(0-9999)min	0	The continuous running time after automatic started.
80	Temperature Sensor Select	(0-12)	8	SGX See Table 13.
81	Pressure Sensor Select	(0-12)	8	SGX See Table 13.
82	Reuse Aux. Sensor Select	(0-3)	0	0: Aux. input 6 Set 1: Temp. Sensor 2: Pressure Sensor 3: Level Sensor Details see Note 4.
83	Aux. Sensor Curve	(0-12) (0-12) (0-7)	8 8 3	Corresponding to the temperature, pressure, level sensor curve function settings.
84	Aux. Sensor Inhibit Shutdown	(0-1)	0	Default: when Aux. sensor is higher or lower than the setting threshold (high/low is up to sensor type), it will stop and alarm.
85	Temp. Sensor Open	(0-2)	1	0: Indication; 1: Warn; 2: Shutdown Alarm Indication means display “+++” on LCD of corresponding sensor.
86	Oil Pressure Sensor Open	(0-2)	1	
87	Aux. Sensor Open	(0-2)	1	
88	High Water Temp. Shutdown Threshold	(0-300)℃	98	When the temperature of external connected temperature sensor is over than this value, it will send a high temperature signal. This value only be judged when safety delay is over and only for the external temperature sensor of input port. When the setting value is 300, it will not send a high temperature signal (only for temperature sensor, not include the digital input port.)

No.	Items	Parameters	Defaults	Description
89	Low Oil Pressure Shutdown Threshold	(0-1000)kPa	103	When the pressure of external connected pressure sensor is less than this value, it will start the delay of low oil pressure. This value only be judged when safety delay is over. When the setting value is 0, it will not send a signal of low oil pressure (only for pressure sensor, not include the digital input port).
90	Aux. Sensor Shutdown Threshold	(0-300)°C (0-1000)kPa (0-100)%	98	Corresponding to the shutdown threshold setting of temperauture, pressure, level sensor.
91	High Water Temp. Warn Threshold	(0-300)℃	95	When the temperature of external connected temperature sensor is over than this value, it will send a high temperature signal. This value only be judged when safety delay is over, only for external connected temperature sensor of input port.
92	Low Oil Pressure Warn Threshold	(0-1000)kPa	124	When the pressure of external connected pressure sensor is less than this value, it will start the low oil pressure delay. This value only be judged when safety delay is over. When the setting value is 0, it will not send a signal of low oil pressure (only for pressure sensor, not include the digial input port).
93	Aux. Sensor Warn Threshold	(0-300)°C (0-1000)kPa (0-100)%	95	Corresponding to the warning threshold setting of temperature, pressure and level sensor.
94	Aux. Input 6 Set	(0-16)	0	Default: Not used.
95	Aux. Input 6 Active	(0-1)	0	Default: Closed.
96	Aux. Input 6 Delay	(0-20.0)s	2.0	Time from detecting active input port to confirmation.
97	CT Change	(5-6000A)/20 mA	50	The change for external connected current transformer.
98	Full-load Current	(5-6000) A	100	The rated current of generator, used for calculation of load overcurrent.
99	Over Current Percentage	(50-130)%	120	When load current is over than the setting value, it is considered as over current. It will not send a warning alarm if the value is 0.

No.	Items	Parameters	Defaults	Description
100	Over Current Delay	(0-3000)s	30	When the generator current is higher than the shutdown threshold and lasts for the delay time, it is considered as high generator current shutdown.
101	Rated Power	(0-6000kW	66	The rated power of unit.
102	Manual Close Enable	(0-1)	1	0: Disable 1: Enable; When it enables, close/open by manually press the key; while disables, it will close/open automatically.
103	Cooling Fan Open Temp.	(0-255)℃	60	When an output port is configured as cooling fan output, it will control the open/close of cooling fan.
104	Cooling Fan Close Temp.	(0-255)℃	40	
105	Custom Sensor Curve	(0-2)	0	0: Custom temperature sensor; 1: Custom pressure sensor; 2: Custom Aux. sensor; Select the sensor to be set, and then enter the resistance value of each point on the curve and corresponding value. 8 points need to be entered.

⚠NOTE 1: If set the parameter as "High Temp. Inhibit Shutdown", or set the prommable input port as "High Temp. Inhibit Input" and it is active, when the temperature is over than the setting value of ""High Temp. Inhibit Shutdown" or the signal of "High Temp. Alarm Input" is active, the controller will only send a warning signal but not stop the unit.

⚠NOTE 2: If set the parameter as "Low Oil Pressure Inhibit Shutdown", or set the prommable input port as "Low Oil Pressure Inhibit Input" and it is active, when the oil pressure is less than the setting value of "Low Oil Pressure Inhibit Shutdown" or the signal of "Low Oil Pressure Alarm Input" is active, the controller will only send a warning signal but not stop the unit.

⚠NOTE 3: If set the parameter as 3P3W, the max. threshold value of Gen over voltage shutdown maybe 620V; when set as others, the max. value only be 360V.

⚠NOTE 4: Reuse input port to select digital input or sensor, and confure it to be one of them and active. For instance, reuse the input port 6 and configure it as digital input port, the related configurations are active; if configure it as Aux. sensor, the related options of temperature, pressusre or level sensor are active.

⚠NOTE 5：When setting parameter via PC, the default password (1234) will not be entered without change. If the password is changed or be firstly written into configuration via PC, the password should be entered into the module.

⚠NOTE 6: After entering into the correct password and before the LCD backlight dimmed, entering into the password window again, the parameter setting interface may be entered directly by inputting the serial number.

8.2 DEFINABLE CONTENTS OF PROMMABLE OUTPUT PORT

Table 11 Definable Contents of Programmable Output Port 1~4

No.	Item	Description
0	Not Used	It will not output when select this item.
1	Common Alarm	It includes all the shutdown alarms and warnings, when there is only warning alarm input, this alarm will not latch; while shutdown alarm occurs, this alarm will latch until the alarm reset.
2	ETS Solenoid Control	It is used for the genset with ETS solenoid. Pull-in acts when stop idle is over, opening acts when the setting "ETS Solenoid Hold" is over.
3	Idle Control	It is used for unit with idling speed. Pull-in acts during starting, opening acts when entering into high-speed warming up. Pull-in acts in stop idle and opening acts in unit stop.
4	Preheat Control	Closing acts before starting, while opening acts before starter is powered on.
5	Gen Close	When closing time is set to 0, it is continuous closing.
6	Excitation Output	Output when starts, and output for 2s when there is no generation frequency in high-speed warming up.
7	Gen Open	It is without this function when close time is set as 0.
8	Speed Up Control	Pull-in acts when entering the high-speed warming up and the pull-in time is the delay time for high-speed warming up. It opens when speed up auxiliary input is active.
9	Speed Down Control	Pull-in acts when entering stop idle process or ETS solenoid hold and the pull-in time is the delay time for stop idle. It opens when speed down auxiliary input is active.
10	Genset Running Output	Output when genset is normal running, it opens when speed is less than the speed of crank disconnect.
11	Fuel Pump Control	Pull-in acts when fuel level is lower than the set fuel pump open threshold or low fuel level warning input is active; it opens when fuel level is higher than the set fuel pump close threshold and low fuel level warning input is inactive.
12	High-speed Control	Output when entering the high-speed warming up, it opens after high-speed cooling.
13	System in Auto Mode	The controller is operating in automatic mode.
14	Fuel Relay Output	It controls fuel relay output.
15	Choke On Control	Output when starts, and output the setting time during safety running.
16	Cooling Fan Output	Output when water temperature is higher than the cooling fan open threshold during genset normal running, while it opens when the water temperature is lower than the cooling fan close threshold.
17	Reserved	

8.3 DEFINABLE CONTENTS OF DIGITAL INPUT PORT

Table 12 Definable Contents of Digital Input Port 1~6 (GND (B-)

No.	Item	Description
0	Not Used	
1	High Temp. Alarm	When safety running delay is over, if this signal is active, genset will alarm and stop immediately.
2	Low Oil Pressure Alarm	
3	External Warning	If this signal is active, it only warn but not stop.
4	External Shutdown Alarm	If this signal is active, the genset will alarm and stop immediately.
5	Cooling Shutdown	When this signal is active and genset is in normal running, if high temperature occurs, the controller will stop after high-speed cooling; when this signal is inactive, if high temperature occurs, the controller will stop in high-speed directly.
6	Gen Close Status	Connect with auxiliary point on power generation on-load switch.
7	60Hz Active	If this signal is active, the controller uses a speed control parameter of 60Hz.
8	High Temp. Shutdown Inhibit	If this signal is active, high temperature shutdown will be inhibited. See parameter configuration Table 10 Note 1.
9	Low Oil Pressure Shutdown Inhibit	If this signal is active, low oil pressure shutdown will be inhibited. See parameter configuration Table 10 Note 2.
10	Remote Start Input	In auto mode, when input is active, can start genset automatically and the genset will take load after normal running. When input is inactive, can stop the genset automatically.
11	Low Fuel Level Warning	Connect with digital input of sensor, the controller will send a warning alarm when input is active.
12	Low Coolant Level Warning	
13	Low Fuel Level Shutdown	Connect with digital input of sensor, the controller will send a shutdown alarm when input is active.
14	Low Coolant Level Shutdown	
15	Auto Start Inhibit	In auto mode, if this signal is active, no matter if there is a remote start input signal or not, genset will not start; if genset has been already in normal running, the genst will not execute stop operation. When this signal is inactive, genset will execute start or stop operation automatically.
16	Low Oil Level Alarm	Connect with digital input, the controller will send a shutdown alarm when input is active.

8.4 SENSOR SELECTION

Table 13 Sensor Selection

No.	Sensor	Curve Type	Remark
1	Temperature Sensor	00 None 01 Custom Res Curve 02 VDO 03 SGH 04 SGD 05 CURTIS 06 DATCON 07 VOLVO-EC 08 SGX 09 Custom (4-20)mA curve 10 Custom (0-5)V curve 11 Reserved 12 Reserved	Defined resistance's range is (0~1)kΩ. Factory default is SGX sensor.
2	Oil Pressure Sensor	00 None 01 Custom Res Curve 02 VDO 03 SGH 04 SGD 05 CURTIS 06 DATCON 07 VOLVO-EC 08 SGX 09 Custom (4-20)mA curve 10 Custom (0-5)V curve 11 Reserved 12 Reserved	Default as resistance, defined resistance's range is (0~1)kΩ. Factory default is SGX sensor.
3	Level Sensor	00 None 01 Custom Res Curve 02 SGH 03 SGD 04 Custom (4-20)mA curve 05 Custom (0-5)V curve 06 Reserved 07 Reserved	Defined resistance's range is (0~1)kΩ.

8.5 CONDITIONS OF CRANK DISCONNECT SELECTION

Table 14 Crank Disconnect Conditions

No.	Setting Description
0	Speed
1	Speed + Gen Frequency
2	Speed + Oil Pressure
3	Speed + Gen + Oil Pressure

NOTE 1: There are 3 conditions to make starter disconnected with engine, that is, speed, generator frequency and engine oil pressure, among which the speed is required;

NOTE 2: Speed sensor is the magnetic equipment installed in starter for detecting flywheel teeth;

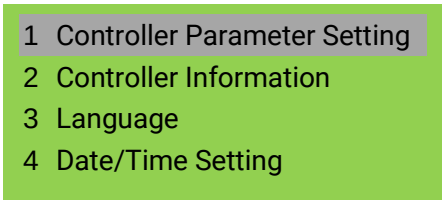
NOTE 3: When speed is selected, users must ensure that the number of flywheel teeth is the same with setting, otherwise, "over speed stop" or "under speed stop" may be caused;

NOTE 4: If gen frequency is not selected in crank disconnected setting, the related power will not be collected and displayed by controller (can be applied to pump units)

9 PARAMETER SETTING

9.1 MENU

Press  key to enter parameter setting menu after controller starting, the menu items are as follows:



9.2 PARAMETER SETTING

Input the correct password (factory default:1234) to set all the items of Table 10. When more items are needed, such as voltage calibration, please contact with manufacturer.

Notes:

a) Please modify the controller parameters (crank disconnect conditions selection, programmable input, output port configuration, various delays) in standby mode, otherwise alarm shutdown or other abnormal conditions may occur.

b) The over voltage threshold value must be greater than the under voltage threshold, otherwise there will be both over voltage and under voltage.

c) The over speed threshold value must be greater than the under speed threshold, otherwise, there will be both over speed and under speed.

d) The generator frequency should be set as lower value as possible when crank disconnect, so that the starter motor can separate as soon as possible.

e) The Aux. input port 1~6 cannot be set as the same item, otherwise, the incorrect function may occur. While the Aux. output port 1~4 can be set as the same.

f) If the shutdown after the high temperature cooling, please set a selection of “High Temperature Cooling Shutdown” in any Aux. input port, and it should be grounded.

9.3 CONTROLLER INFORMATION

a) The interface can display the development information of controller, such as software version, hardware version, release date;

b) Press key to display the status of digital input port and output port;

9.4 LANGUAGE SELECTION

Simplified Chinese and English are displayed on this interface.

9.5 DATE/TIME SETTING

Calibrate the date and time of controller by the setting item.

NOTE: Press key at any time can immediately stop the current parameter setting, and return to previous setting menu.

10 SENSOR SETTING

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

When there is difference between standard sensor curves and used sensor curves, users can select “custom sensor “and input the custom sensor curve;

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

If sensor type is selected as “none”, sensor curve is not working;

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

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

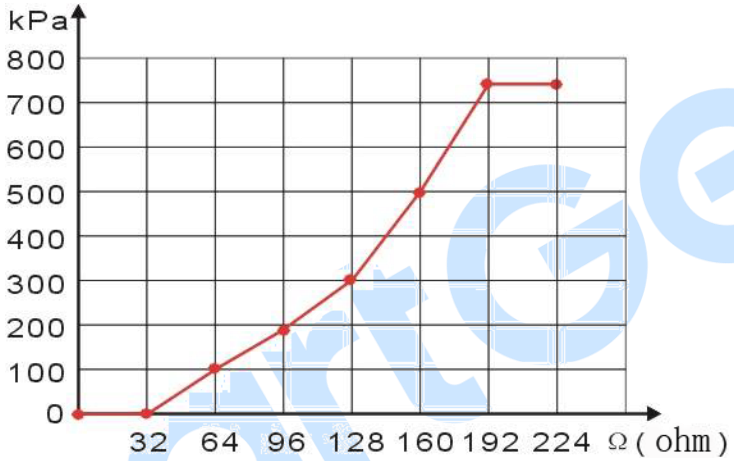


Fig. 3 Sensor Curve Diagram

Table 15 Normal Pressure Unit Conversion Form

Item	N/m^2 Pa	kgf/cm^2	bar	psi
1Pa	1	$1.02x10^{-5}$	$1x10^{-5}$	$1.45x10^{-4}$
$1kgf/cm^2$	$9.8x10^4$	1	0.98	14.2
1bar	$1x10^5$	1.02	1	14.5
1psi	$6.89x10^3$	$7.03x10^{-2}$	$6.89x10^{-2}$	1

11 COMMISSIONING

It is recommended to perform the following checks before running the system:

——Ensure that all the wiring connections are correct and the cable diameter is suitable;

——Ensure that the controller DC power has fuse, controller's positive and negative connected to starter battery;

——Take proper action to prevent engine to crank disconnect (e.g. remove the connection wire of fuel valve.) If checking is OK, connect the starter battery and select manual mode, controller will execute the routine;

——Set controller under manual mode, press "Start" key, genset will start. If start fails after pre-set start attempts, controller will send signal of start failure, then press "Stop" to reset controller;

——Recover the action of stopping enging start (e.g. connection wire of fuel valve), press start key again, genset will start. If everything goes well, genset will go to normal running after idle running (if idle running is set). During this time, please observe engine's running situations, AC generator's voltage and frequency and DC generator voltage. If something abnormal occurs, stop genset running and check all wires connection according to this manual;

——Select the auto status from front panel, and then connect to remote start signal. The genset will automatically enter to normal running status and send a Gen close command;

——Disconnect the remote start signal, the genset will enter the stop status automatically, and send a Gen open command. If not like this, please refer to the manual to check the switch control wirings;

——If there is any other question, please contact SmartGen's service.

12 TYPICAL APPLICATION

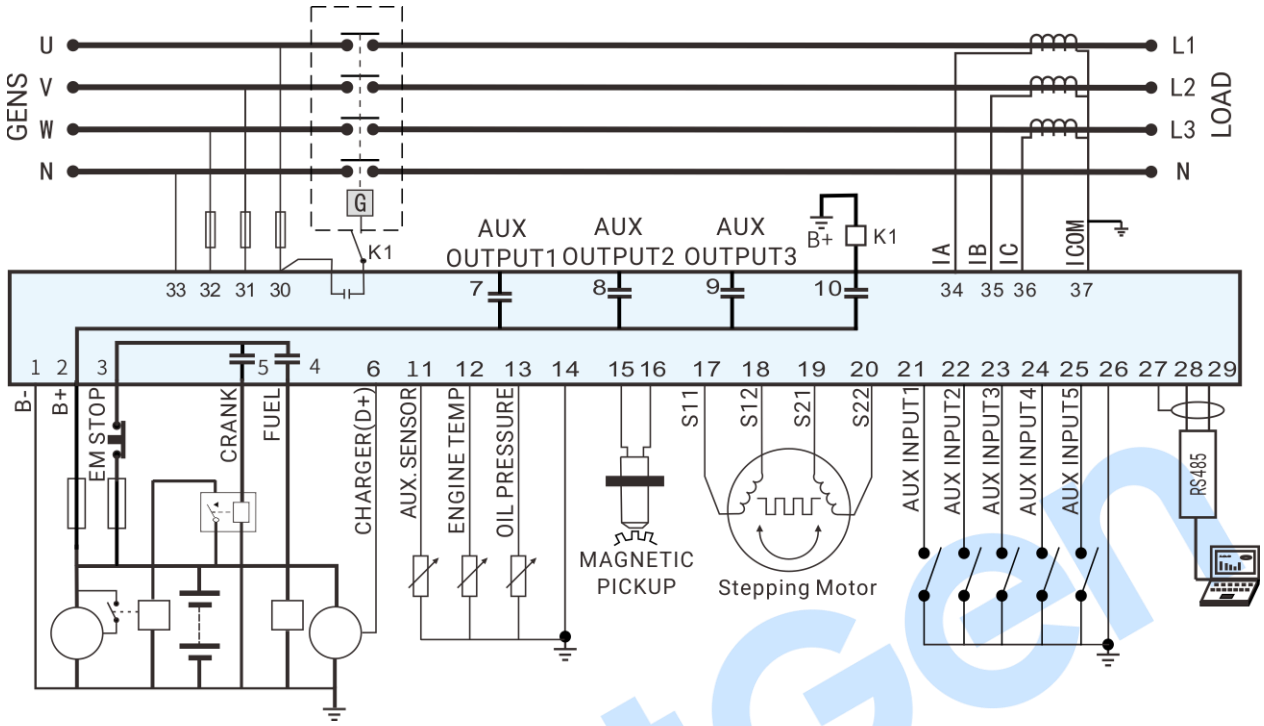


Fig. 4 HSC941Typical Application Diagram

⚠CAUTION: The starting and fuel output ports should be extended with large capacity relays;

⚠CAUTION: The Gen closing output port must be extended with relay externally while using.

13 CONNECTION OF CONTROLLER AND ENGINE

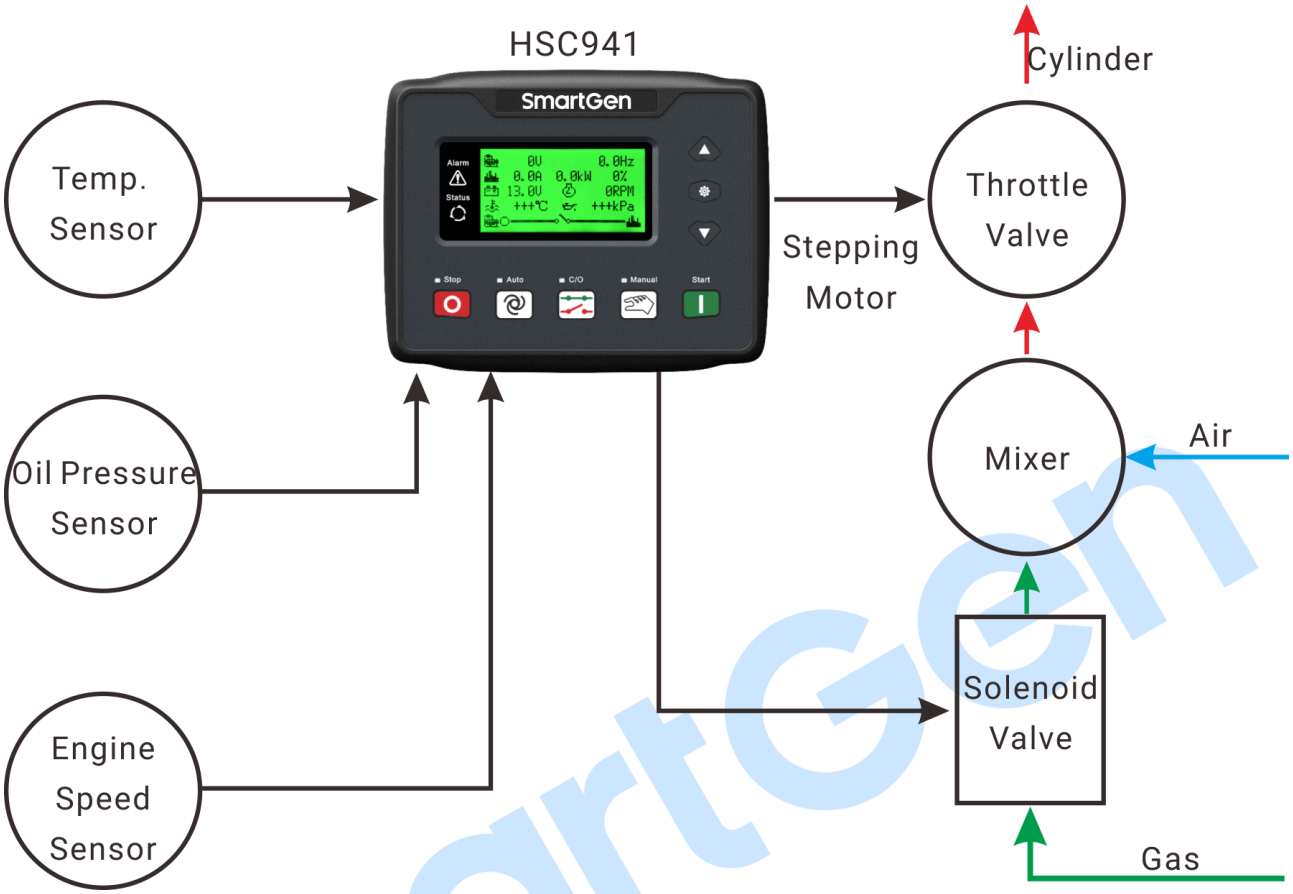


Fig. 5 Controller and Engine Connection Diagram

14 INSTALLATION

14.1 FIXING CLIPS

——Controller is panel built-in design; it is fixed by clips when installed;
——Withdraw the fixing clip screw (turn anticlockwise) until it reaches proper position;
——Pull the fixing clip backwards (towards the back of the controller) and ensure that the four clips are inside their allotted slots;
——Turn the fixing clips screws clockwise until they are fixed on the panel;
——Care shoud be taken not to over tighten the screws of fixing clips.

14.2 OVERALL DIMENSIONS AND PANEL CUTOUT

Unit:mm

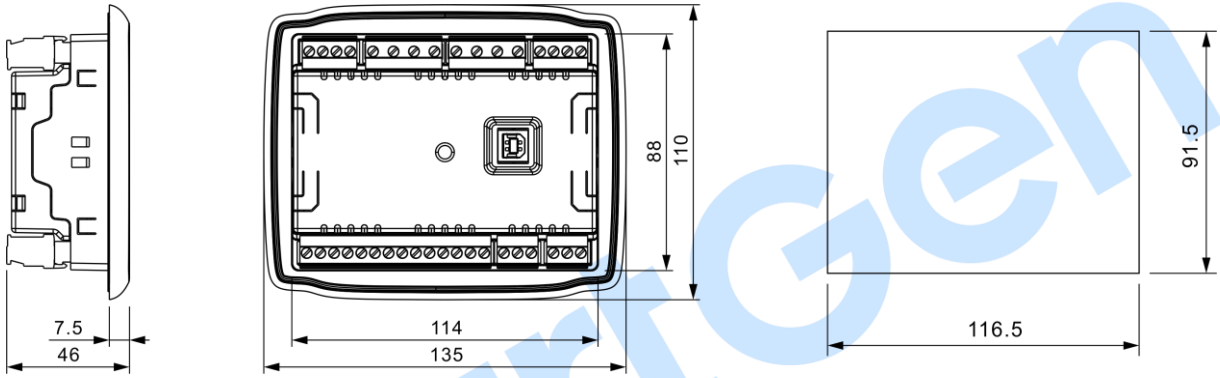


Fig. 6 Overall and Panel Cutout Dimensions

——**Battery Voltage Input:**

HSC941 controller can suit for wide range of battery voltage DC(8~35)V. Negative of battery must be connected with the engine shell. Diameter of wire that connects from power supply B+ and B- to battery positive and negative must be over 2.5mm^2. If floating charger is 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 terminals in order to prevent charger disturbing the controller's normal working.

——**Speed Sensor Input:**

Speed sensor is the magnetic equipment installed in engine body to detect flywheel teeth. Its connection wires to controller should apply 2-core shielding line. The shielding layer should connect to No. 14 terminal in controller while another side is hanging in air. The other two signal wires are connected to No.15 and No.16 terminals of controller. The output voltage of speed sensor should be within AC(1~24)V (RMS) at full speed. AC12V is recommended (at rated speed). When installs the speed sensor, let the sensor spun to contacting flywheel first, then, port out 1/3 lap, and lock the nuts of sensor at last.

——**Output and Expand Relays:**

All outputs of controller are relay contact output type. If it needs to expand the relays, please add freewheel diode to both ends of expand relay's coils (when coils of relay have DC current) or, increase resistance-capacitance return circuit (when coils of relay have AC current), in order to prevent disturbance to controller or other equipment.

——**AC Input:**

Current input of HSC941 controller must be connected to outside current transformer. And the current transformer's secondary side current must be 20mA. At the same time, the phases of current transformer and input voltage must be correct. Otherwise, the collected current and active power may not be correct

——**Withstand Voltage Test:**

When controller has been installed in control panel, if it needs voltage withstand test, please disconnect controller's all terminal connections, in order to prevent high voltage entering controller and damaging it.

NOTE 1: ICOM terminal must be connected to battery negative;

NOTE 2: When there is load current, transformer' secondary side is prohibited to open circuit.

15 TROUNBLESHOOTING

Table 16 Troubleshooting

Symptoms	Possible Solutions
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; Check the genset AC voltage; Check DC fuse.
Low oil pressure alarm after crank disconnect	Check the oil pressure sensor and its connections.
High water temp. alarm after crank disconnect	Check the temperature sensor and its connections.
Shutdown alarm in running	Check related switch and its connections according to the information on LCD; Check programmable inputs.
Crank not disconnect	Check fuel circuit and its connections; Check starting batteries; Check speed sensor and its connections; Refer to engine manual.
Starter no response	Check starter connections; Check starting batteries.
Stepping motor reverses	Cross the stepping motor S11 and S12; Or cross the stepping motor S21 and S22; Or change the configuration by PC (motor reduction direction)
Loss of speed control	Check the voltage of magnetic sensor cannot be lower than 2V when starting; Check whether S11, S12, S21 and S22 of stepping motor are in good contact.