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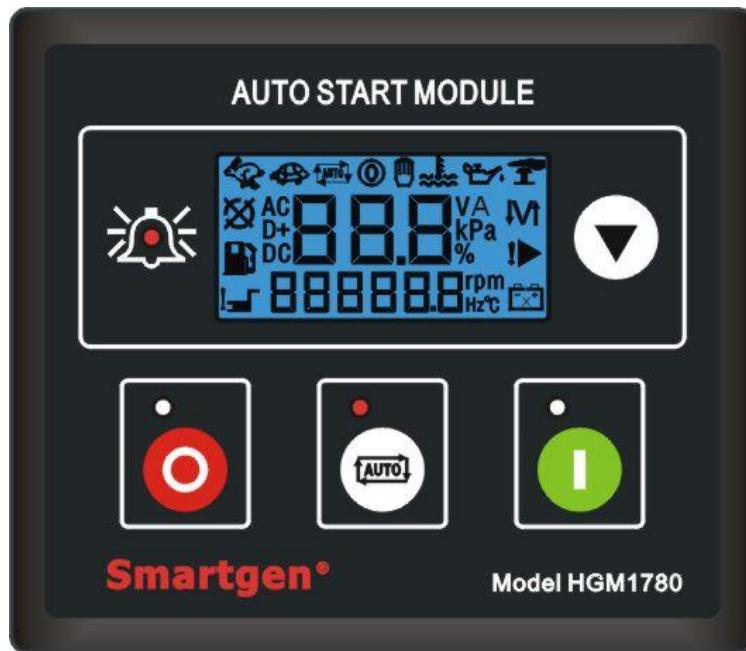
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HGM1780

Automatic Genset Controller

USER MANUAL



Smartgen Technology

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1. OVERVIEW

HGM1780 is a genset automatic start module with 3 working modes that can be selected from the front panel. It can detect one-phase generator voltage and current, can be started and stopped manually or via a remote start/stop signals. In case of faults (such as low oil pressure, high water/cylinder temperature, emergency stop alarm, over speed), HGM1780 can automatically disconnect fuel relay and close ETS electromagnet to stop the generator. Graphical LCD monitor on the front panel displays fault conditions and provides effective alarm signals.

2. PERFORMANCE AND CHARACTERISTICS

- ◆ Based on microprocessor, fitted with LCD screen with graphic icons and touch-buttons;
- ◆ Power supply range (8~35)VDC, compatibility with 12V or 24V starter batteries;
- ◆ Generator input port; speed, temperature, pressure, liquid level sensor input ports; digitalized electric quantity display.

Measured and displayed electric quantity:

Generator voltage	V
Generator frequency	Hz
Generator current	A
Engine temperature	°C
Oil pressure	kPa
Engine speed	rpm
Total running time	H
Battery voltage	V
Fuel level	%

- ◆ Generator voltage, battery voltage, engine speed, temperature, pressure, liquid level threshold value can be set.

Warnings and alarms are as following:

Low oil pressure
High water/cylinder temperature
Over/under speed
Emergency shutdown
Fail to start
Fail to stop
Generator over/under voltage
Generator over/under frequency
Battery over/under voltage
Load over current
Low fuel level

- ◆ Idle control and ETS function (must be configured);
 - ◆ 3 working modes: manual, auto, stop;
 - ◆ The controller can be set as an engine controller via software (generator voltage
-

input is deactivated) and used as water pump unit controller;

- ◆ Running status and alarm status are indicated by red LED on the panel;
- ◆ Compatibility with multiple temperature, pressure, fuel level sensors, which can be user-defined and used directly; temperature sensors, pressure sensors can be used in parallel with annunciator, providing digital data and increasing protection level at the same time;
- ◆ Multiple crank disconnect conditions to select (engine speed sensor, oil pressure, generator);
- ◆ 2 fixed relay outputs (fuel relay, start relay);
- ◆ 1 configurable output port which can be set as common alarm output, fail to stop output, preheat output or idle control output;
- ◆ Parameters can be set and modified by users and saved in internal FLASH storage, which means that they will not be lost in case of power off. All parameters of the controller can be modified using the front panel or through configurable LINK port via PC software (SG72 adapter, produced by our company must be used). All parameters can be set via computer using one USB port of the computer, which also allows to avoid batteries: power supply for the controller can come directly from the PC USB port.
- ◆ HGM1780 combines modular design, anti-flaming ABS plastic case, embedded installation, compact structure, small size, SCM control, stable performance and convenient operation.

3. SPECIFICATION

Item	Content
Working Voltage	DC8.0V to 35.0V, Continuous Power Supply
Power Consumption	Standby mode: 12V: 0.3W, 24V: 0.4W Working mode: 12V: 1W, 24V: 1.1W
Alternator voltage Input	1P2W 15V AC ~ 360 V AC (ph-N)
Alternator Frequency	50/60Hz
Magnetic Pickup Voltage	1V to 24V (RMS)
Magnetic Pickup Frequency	Max. 10kHz
Max. accumulative run time	99999.9 hours (After decimal point there is 1/10 of an hour, and it changes every six minutes)
Start Relay Output	1Amp DC28V DC B+ power supply
Fuel Relay Output	1Amp DC28V DC B+ power supply
Programmable Relay Output	1Amp DC28V DC B+ power supply
Digital Input	Active when connected to B-
Case Dimensions	90mm x 78mm x 44mm
Panel Cutout	78mm x 66mm
Working conditions	Temperature: (-25~+70)°C Humidity: (20~90)%RH without condensation
Storage Condition	Temperature: (-30~+80)°C
Protection Level	IP55: When waterproof rubber gasket installed between the controller and panel fascia. IP42: When waterproof rubber gasket is not installed between the controller and panel fascia.
Insulation Intensity	Object: among input/output/power Quote standard: IEC688-1992 Test way: AC1.5kV/1min Leakage current: 1mA
Weight	0.15kg

4. OPERATION

4.1. PANEL KEYS

Key	Definition	Description
	Manual/Decrease	Pressing this button will start the generator manually and place it into its manual mode; in settings menu moves cursor down and decreases the set value.
	Auto/Increase	Pressing this button will place the module into its auto mode; in settings menu moves cursor up and increases the set value.
	Stop	Pressing this button in any situation will shut down the generator and place it into its standby mode; in case of alarm, pressing this button will clear alarms.
	Turn Page /Confirm	Using this button you can scroll pages of the LCD monitor; in settings menu press to move cursor and confirm.
	Alarm Indicator	This indicator will flash when an alarm occurs.

4.2. LCD ICONS

Icon	Definition	Icon	Definition
	High Temp. Alarm		Auto Mode
	Low Oil Pressure		Stop Mode
	Over Speed Alarm		Manual Mode
	Under Speed Alarm		Gens Volts Indication
	Emergency Stop		Battery Volts Indication
	Over Voltage		Speed Unit (Per Minute)
	Under Voltage		Oil Pressure Unit
	Fail to start		Voltage Unit
	Fail to stop		Fuel Level Unit (%)
	Voltage Abnormal		Temperature Unit
	Auxiliary Alarm		Frequency Unit
	Normal Run		Hours Count
	Fuel Level Low		Load Current

4.3. DISPLAY DESCRIPTION

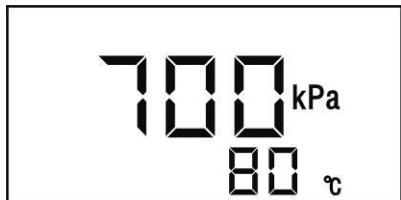
Generator: phase voltage Ua, frequency F



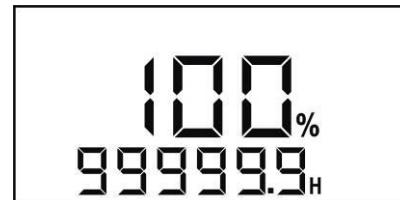
Loading: current Ia, engine speed



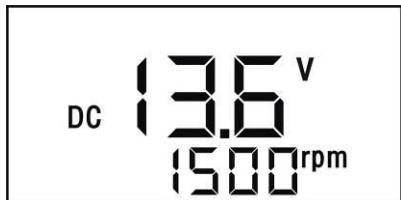
Oil pressure, water temperature



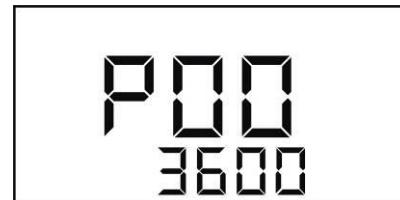
Liquid level %, accumulated run time



Battery voltage, engine speed



Parameters setting



4.4. OPERATION INSTRUCTION

The module has three working modes: stop mode (○), manual mode (●) and auto mode (○_{AUTO}).

● Manual Start (●)

After pressing Manual Start button (●) and holding it for at least one second, the indicator next to the button will be illuminated. Preheating output will be activated firstly and preheat delay begins. One second before it is finished, fuel output will be activated for one second and after that preheat output will be deactivated; starter is energized to output and engine cranks. When generator frequency reaches the pre-set value, the starter motor will be deactivated and generator will start. Then, safety delay will start, after it is finished, idle delay will start, and when it is finished idle relay will be closed and the generator will start working at normal speed.

- Auto Mode (

- ◆ After pressing and holding  button for at least one second, the indicator next to the button will be illuminated and the module will be placed into its automatic mode. If remote start signal is active (remote start input port is connected to B-), after start delay the genset will start. Preheating output will be activated firstly and preheat delay begins. One second before it is finished, fuel output will be activated for one second and after that preheat output will be deactivated; then starter is energized to output (engine will try to start according to the pre-set number of times; if one of the attempts is successful, the start process will be completed, otherwise fail to start alarm will be initiated: fail to start indicator on the panel will be illuminated and common alarm indicator will flash). After start delay and idle delay, idle relay will be deactivated and the generator will start working at normal speed.

▲ Note: During crank rest time, fuel output is deactivated; three seconds after the beginning of the delay, preheat and ETS outputs will be activated; after the end of the delay, ETS output will be deactivated and fuel relay output; preheat output will be deactivated before the beginning of crank.

- ◆ When remote start signal is deactivated, after stop delay, the generator enters idle state and the idle relay is deactivated. After idle delay, fuel relay deactivates, ETS relay output activates, and the genset automatically stops. After complete stop, ETS relay deactivates.

- Stop (

- ◆ After pressing and holding  for at least one second during normal operation of the genset (in manual or auto modes), the light indicator near the button will be illuminated and idle operation will begin. When idle relay deactivates and after idle delay, fuel relay is deactivated and ETS output is energized. When complete stop of the generator, ETS is deactivated.

- ◆ In case of fault alarm, pressing and holding the button for one second will clear alarms. Holding it for more than one second will illuminate all indicators on the panel (light test function).
 - ◆ Pressing this button for more than one second in stop mode will lead to activation of ETS output and illumination of all the indicators on the panel (light test function). Releasing the button will immediately deactivate ETS output and light test function.
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- ◆ When in stop mode, the module will only react to emergency stop signal.
 - ▲ **Note:** Configurable output ports can be set as one of the following functions: “ETS output”, “Idle output” or “Preheat output” via PC. Therefore, all three functions can not be active at the same time; the above-mentioned is only to describe the logical course of action of the controller in case all three functions are active.

5. PROTECTION

- 1) **Low Oil Pressure:** detection begins after safety delay; if low oil pressure lasts for 2s, shutdown is initiated.
 - 2) **High Temperature:** detection begins after safety delay; if high temperature lasts for 2s, shutdown is initiated.
 - 3) **Low Fuel Level:** if fuel level stays below the pre-set level for 10 seconds, low fuel level warning signal is sent. Only warning and not shutdown.
 - 4) **Over Speed:** detection begins after start; When speed over the preset for 2s, shutdown is initiated.
 - 5) **Under Speed:** detection begins after idle delay; if under speed lasts for 15s, shutdown is initiated.
 - 6) **Fail to Start:** if after a pre-set number of crank attempts, the gen-set has not started, shutdown is initiated.
 - 7) **Fail to Stop:** if the generator has not stopped after stop delay, fail to stop warning is initiated, without latching.
 - 8) **High Battery Voltage:** if battery voltage stays above the pre-set value for 20 seconds, high battery voltage warning signal is sent. Only warning and not shutdown.
 - 9) **Low Battery Voltage:** if battery voltage stays below the pre-set value for 20 seconds, low battery voltage warning signal is sent. Only warning and not shutdown.
 - 10) **Emergency Shutdown:** if emergency shutdown input is activated, ETS output is immediately energized while fuel, preheat and crank signals are deactivated and emergency shutdown alarm is initiated.
 - 11) **Generator Over Voltage:** if it is detected that voltage is above the pre-set level for 5 seconds, generator over voltage signal is sent and shutdown alarm is initiated.
 - 12) **Generator Under voltage:** if it is detected that voltage is below the pre-set level for 5 seconds, generator under voltage signal is sent and shutdown alarm is initiated.
 - 13) **Load Over Current:** if load current stays above the pre-set value for a pre-set delay time, the controller will initiate over current alarm signal and **A** indicator will start flashing.
 - 14) **Common Alarm:** in case of over speed, under speed, high temperature, low oil pressure, emergency shutdown, fail to start and fail to stop alarms, high battery voltage, low battery voltage, load over current or common alarm indicator flashing and common alarm output is activated
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6. PARAMETER RANGE AND DEFINITION

6.1 PARAMETERS CONFIGURATION (TABLE 1)

No.	Parameter	Range	Default value	Description
P00	Start Delay	(0-3600)s	1	Time from remote start signal is active to start genset.
P01	Stop Delay	(0-3600)s	1	Time from remote start signal is deactivated to genset stop.
P02	Start Attempts	(1-9) times	3	The maximum number of crank attempts. If none of them is successful, the controller will initiate fail to start alarm.
P03	Preheat Time	(0-300)s	0	Time of pre-powering heat plug before starter is powered up.
P04	Cranking Time	(3-60)s	8	The time of powering up the starter for every crank attempt.
P05	Crank Rest Time	(3-60)s	10	The waiting time before second power up when engine start fail.
P06	Safety On Delay	(1-60)s	10	Alarms for low oil pressure, high temperature, under speed, under frequency /voltage, charge fail are inactive.
P07	Start Idle Time	(0-3600)s	0	Idle running time of genset when starting.
P08	Warming Up Time	(3-3600)s	10	Warming time between genset switch on and normal running.
P09	Cooling Time	(3-3600)s	10	Radiating time before genset stop, after it unloads.
P10	Stop Idle Time	(0-3600)s	0	Idle running time when genset stop.
P11	ETS Solenoid Hold	(0-120)s	20	The time of powering up the electromagnet during stop procedure.
P12	Fail to Stop Delay	(0-120)s	0	Time between ending of genset idle delay and stopped when “ETS time” is set as 0; Time between ending of ETS hold delay and stopped when “ETS Hold output time” is not 0.
P13	Flywheel Teeth	(10-300)	118	Tooth number of the engine, for judging of crank disconnect conditions and inspecting of engine speed. See the installation instructions.
P14	Power-on Mode	(0-2)	0	Default: Stop Mode.
P15	Generator	(0-20.0)s	10.0	Alarm delay for generator over and

No.	Parameter	Range	Default value	Description
	Abnormal Time			under voltage states.
P16	Generator Over Voltage	(30-360)V	264	When generator voltage exceeds this value and stays so for the time of 'Generator Abnormal Time', it is regarded as over voltage and Generator Over Voltage shutdown alarm is initiated. If the voltage value is 360V, over voltage signal is not initiated.
P17	Generator Under Voltage	(30-360)V	196	When detected voltage falls below this value and stays so for the time of 'generator abnormal state delay', it is regarded as under voltage and generator abnormal state shutdown alarm is initiated. If the voltage value is 30V, under voltage signal is not initiated.
P18	Engine Under Speed	(0-6000)RPM	1200	When engine speed falls below this value and stays so for 10 seconds, this is regarded as under speed and under speed alarm shutdown signal is sent.
P19	Engine Over Speed	(0-6000)RPM	1710	When engine speed exceeds this value and stays so for 2 seconds, this is regarded as over speed and over speed alarm shutdown signal is sent.
P20	Under Frequency	(0-75.0)Hz	45.0	When generator frequency falls below this value and stays so for 10 seconds, it is regarded as under frequency and under frequency alarm shutdown is initiated.
P21	Over Frequency	(0-75.0)Hz	57.0	When generator frequency exceeds this value and stays so for 2 seconds, it is regarded as an over frequency and over frequency alarm shutdown is initiated.
P22	High Temperature	(80-140)°C	98	When the temperature value of the external temperature sensor exceeds this threshold, high temperature signal is sent. Detection starts after safety delay and only concerns external temperature sensor which connected to the temperature sensor input port. If the set value is 140, high temperature signal will

No.	Parameter	Range	Default value	Description
				not be sent (this only concerns temperature sensor, not high temperature signal via config. input port).
P23	Low Pressure Oil	(0-400)kPa	103	When the external pressure sensor value falls below this threshold, low oil pressure delay begins. Detection begins after safely on delay. If the set value is 0, low oil pressure signal is not sent (this only concerns pressure sensor and does not concern low oil pressure warning signal via configurable input port)
P24	Low Level Liquid	(0-100)%	10	When the liquid level of the external sensor falls below this value and stays so for 10 seconds, low liquid level signal is send and warning without shutdown is initiated.
P25	Poles	(2-16)	4	Numbers of generator pole,
P26	Battery Over Volts	(12-40)V	33.0	When battery voltage exceeds this value and stays so for 20 seconds, Battery Over Volts signal is send and warning without shutdown is initiated.
P27	Battery Under Volts	(4-30)V	8.0	When battery voltage falls below this value and stays so for 20 seconds, Battery Under Volts signal is send and warning without shutdown is initiated.
P28	Current Trans.	(5-6000)/5	500	The ratio of external CT. Default value: 500:5.
P29	Full Current Rating	(5-1900)A	500	Generator's rated current; used to estimate load over current.
P30	Over Current Percentage	(50-130)	120	When load current exceeds full current value multiple by this value, over current delay begins.
P31	Over Current Delay	(0-3600)s	1296	When load current exceeds this threshold and stays so for the pre-set time, the situation is regarded as over current.
P32	Relay Output	(0-6)	1	Default: Common Alarm
P33	Digital Input	(0-6)	4	Default: Auxiliary shutdown; if the set value is 0, fuel level sensor type can be selected.
P34	Digital Input Delay	(0-20.0)s	2.0	Active delay time for digital input ports

No.	Parameter	Range	Default value	Description
P35	Module Address	(1-254)	1	Communication address
P36	Crank Disconnect Condition	(0-5) See table 5.	1	Starter motor disconnection condition. There are 3 conditions of disconnecting starter with engine. Each condition can be used alone and simultaneously to separating the start motor and genset as soon as possible.
P37	Disconnect Engine Speed	(0-3000) RPM	360	When generator speed higher than the set value, starter will be disconnected.
P38	Disconnect Generator Freq	(10-30) Hz	14.0	When generator frequency higher than the set value, starter will be disconnected.
P39	Disconnect Oil Pressure	(0-400) kPa	200	When generator oil pressure higher than the set value, starter will be disconnected.
P40	Temperature Sensor	(0-10)	06	SGD (120°C resistor type)
P41	Oil Pressure Sensor	(0-10)	06	SGD (10Bar resistor type)
P42	Fuel Level Sensor	(0-7)	0	Not used. (If fuel level sensor is used, then the digital input port must be set as 'not used'.
P43	Over Current Action	(0-2)	0	0: Warn; 1: Shutdown; 2:Trip

6.2 DEFINITION OF RELAY OUTPUTS (TABLE 2)

No.	Items	Description
0	Not used	Output is not active.
1	Common Alarm	Includes all shutdown alarms and warning alarms. Warning alarms are not self-latching, while shutdown alarms are and will not disappear until they are reset.
2	Energized to Stop	Suitable for the genset with stop electromagnet. The electromagnet closes when stop idle is over. And opens when EST delay is over.
3	Idle control	Used for machines that have idle mode. Closes during cranking, disconnects during warming up, closes during stop idle delay, disconnects after complete stop.
4	Preheat control	It closes before starting and opens before starter is power on.
5	Closing Gens	During normal operation of the generator, closes the breaker
6	Reserved	

6.3 DEFINITION OF DIGITAL INPUTS (ACTIVE WHEN CONNECT TO GND (B-)) (TABLE 3)

No.	Description		Notes
0	Digital Inputs	Not Used	
1		High Temperature Input	If these signals are activated after crank disconnect, shutdown alarm will be immediately initiated.
2		Low OP Warning Input	
3		Reserved	Only warning and not stops if this input is active.
4		Auxiliary Shutdown	Shutdown alarm will be immediately initiated if this input is active.
5		High Temperature Stop Input	When the gen-set is working normally and this signal is activated, if there is a high temperature situation, the controller will first cool down the generator and then stop it; if the signal is deactivated and a high temperature situation occurs, the controller will shut down the gen-set without cooling down.
6		Reserved	
7		Reserved	
8	Fuel Level Sensor		See Table 4.

6.4 SENSOR SELECTION (TABLE 4)

Items	Content	Remark
Temperature Sensor	0 Not used 1 Digital closed 2 Digital open 3 User defined resistor type 4 VDO 5 SGH (yellow river sensor) 6 SGD (Dongkang sensor) 7 CURTIS 8 DATCON 9 VOLVO-EC 10 SGX 120 DEGREE	Digital closed and Digital open both are digital signal; low or high electrical level can be selected to be active, connecting to earth point will mean that low electrical level is selected, hang in air means high electrical level is selected; can not be connected to power supply positive. The range of user-defined resistor type sensor is 0-999.9 Ohm, by default SGD sensor is selected.
Oil pressure Sensor	0 Not used 1 Digital closed 2 Digital open 3 User defined resistor type 4 VDO 5 SGH (yellow river sensor) 6 SGD(Dongkang sensor) 7 CURTIS 8 DATCON 10Bar 9 VOLVO-EC 10 SGX 10Bar	Digital closed and Digital open both are digital signal; low or high electrical level can be selected to be active, connecting to earth point will mean that low electrical level is selected, hang in air means high electrical level is selected; can not be connected to power supply positive. The range of user-defined resistor type sensor is 0-999.9 Ohm, by default SGD sensor is selected.
Fuel Level Sensor	0 Not used 1 Digital closed 2 Digital open 3 User defined resistor type 4 SGH (yellow river sensor) 5 SGD (Dongkang sensor) 6 Reserved 1 7 Reserved 2	Digital closed and Digital open both are digital signal; low or high electrical level can be selected to be active, connecting to earth point will mean that low electrical level is selected, hang in air means high electrical level is selected; can not be connected to power supply positive. The range of user-defined resistor type sensor is 0-999.9 Ohm, by default "Not used" is selected Before selecting fuel level sensor type, digital input type must be set as 0.

6.5 CONDITIONS OF CRANK DISCONNECT (TABLE 5)

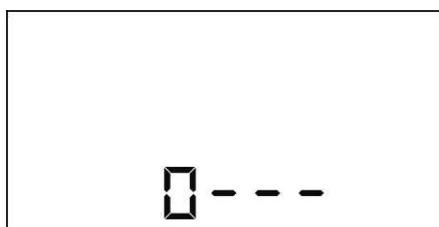
No	Content
0	Magnetic Pickup
1	Generator Frequency
2	Magnetic Pickup + Generator Frequency
3	Magnetic Pickup + Oil pressure
4	Generator Frequency + Oil pressure
5	Generator Frequency + Magnetic Pickup+ Oil pressure

1. There are 3 conditions to make starter separate with engine, magnetic pickup, generator frequency can be used separately while oil pressure must be used together with magnetic pickup and generator frequency. The aim is to disconnect the starter motor as soon as possible.
2. Magnetic pickup is the magnetic equipment which be installed in starter for detecting flywheel teeth.
3. When set as magnetic pickup, must ensure that the number of flywheel teeth is as same as setting, otherwise, “over speed shutdown” or “under speed shutdown” may be caused.
4. If genset without magnetic pickup, please don’t select corresponding items, otherwise, “start fail” or “loss speed signal” maybe caused.
5. If genset without oil pressure sensor, please don’t select corresponding items.
6. If not select generator frequency in crank disconnect setting, controller will not collect and display the relative power quantity (can be used in water pump set); if not select magnetic pickup in crank disconnect setting, the rotating speed displayed in controller is calculated by generator signal.

7. PARAMETER SETTING

- 1) Pressing  and  simultaneously in generator standby mode will lead to the password interface (as shown below); when the first digit is blinking, enter the password 0318;
- 2) Press  button to increase the value of the blinking digit and  to decrease the value; when the first digit is set, press  to move the cursor;
- 3) Repeat the same procedure to set the digits from 2nd to 4th;
- 4) If the password is right, enter into the parameter configuration interface (as shown below) which including the serial number of the set items and their parameters; press  to scroll up and  to scroll down;
- 5) Press  to set the current item, and when the first digit starts blinking, use the same way that is used for password to enter the set value.

Password:



Parameter Setting:



Attention:

- 1) Please change the controller parameters when generator is in standby mode only (e.g. Crank disconnect conditions selection, configurable input, configurable output, various delay), otherwise, shutdown and other abnormal conditions may happen.
- 2) The value of each parameter can be set only within a certain range.
- 3) Over voltage set value must be higher than under voltage set value, otherwise over voltage and under voltage condition may occur simultaneously.
- 4) Over speed set value must be higher than under speed set value, otherwise over speed and under speed condition may occur simultaneously.
- 5) Please set the generator frequency value as low as possible when cranking, in order to make the starter be separated quickly as soon as crank disconnect.
- 6) Consult the table 1 for serial numbers of the parameters.
- 7) Before selecting fuel level sensor type, it is necessary to set a configurable input port type as 0.

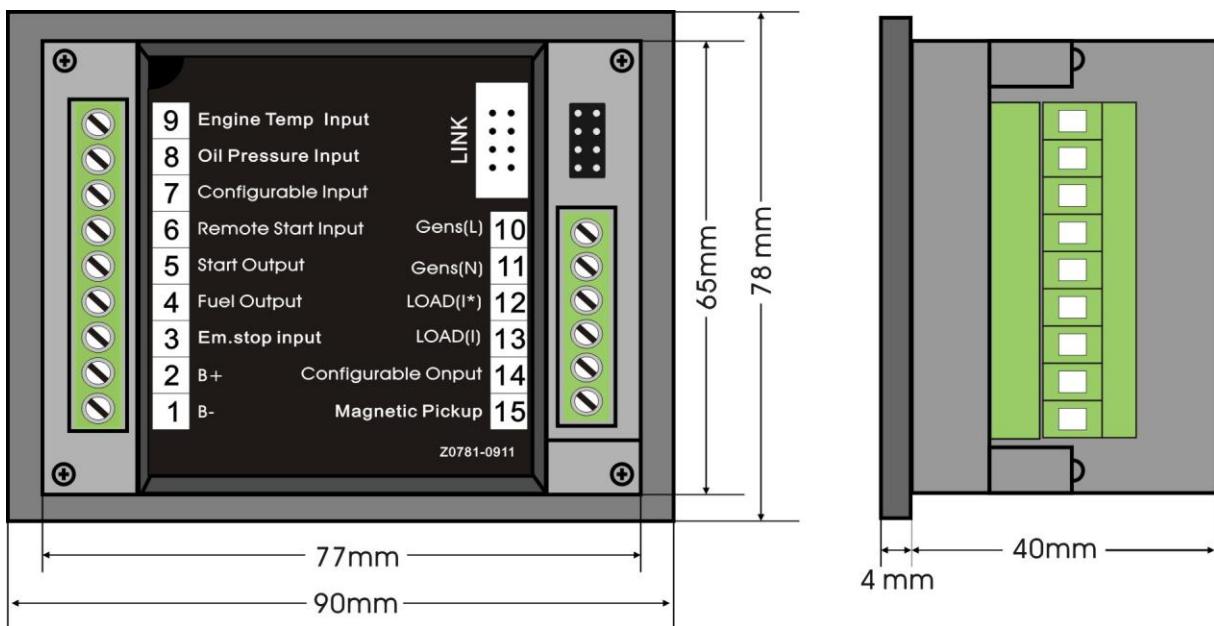
* **Remark 1:** Pressing  button during parameter setting will immediately exit the set parameter.

* **Remark 2:** If the generator is in manual mode and crank disconnect condition is set as 2 (magnetic pickup + generator frequency) or 5 (generator frequency + magnetic pickup + oil pressure) and generator frequency and speed are NOT equal to zero, pressing and holding  and  for 0.5 seconds will lead to the controller automatically adjusting the flywheel teeth number according to generator frequency and generator poles number.

8. CONNECTIONS

- ◆ Terminal 1 (B-): Connect to the negative of the start battery.
- ◆ Terminal 2 (B+): Connect to the positive of the start battery.
- ◆ Terminal 3 (Em. stop input): Emergency stop input (active when connect to B+), external connect to emergency shutdown normally closed button.
- ◆ Terminal 4 (Fuel Output): Fuel output port (output B+), external connect to fuel relay, contactor capacity 1A.
- ◆ Terminal 5 (Start Output): Start output port (output B+), external connect to start relay, contactor capacity 1A.
- ◆ Terminal 6 (Remote Start Input): Remote start input, active when connected to B-.
- ◆ Terminal 7 (Configurable Input): Configurable input port, can be configured as digital signal or fuel level sensor signal; digital input active when connected to B-.
- ◆ Terminal 8 (Oil Pressure Input): Low oil pressure or sensor signal input port, active when connected to B-.
- ◆ Terminal 9 (Engine Temp Input): High water/cylinder temperature or sensor input port, active when connected to B-.
- ◆ Terminals 10 (L), 11(N): External connect to generator voltage signal to judge successful start and provide over and under speed protection.
- ◆ Terminal 12 (Load(I^*)): Load current (inlet wire).
- ◆ Terminal 13 (Load(I)): Load current (outlet wire).
- ◆ Terminal 14 (Configurable Output): Configurable output port (output B+), can be configured via PC, contactor capacity 1A.
- ◆ Terminal 15 (Magnetic pickup): Magnetic pickup signal input, shielded wire is recommended.
- ◆ PC configurable socket (LINK): Connect to SG72 module and PC via USB port for parameter setting.

9. OVERALL DIMENSIONS (PANEL CUTOUT 78MMX66MM)



10.TYPICAL APPLICATION

