

Manual

GM861/GM862

Genset controller

TH152117ER1

The Interpretation of the symbol

**WARNING:**

A WARNING indicates a potentially hazardous situation which, if not avoided, could result in death, or equipment damage.

**NOTE:**

Provide the user's help is very useful information and tips or alert the operator to the correct operation.

History

No.	Rev.	Date	Editor	Validation	Changes
1	TH152117ER1	2017.4	P	C	NEW

**WARNING:**

Read this entire manual pertaining to the work to be performed before installing, operating, or servicing this controller. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

The engine or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An over temperature or low pressure shutdown device may also be needed for safety, as appropriate.

**WARNING:**

To prevent damage to a controller that uses an alternator or battery-charging device, make sure the power cable of charge or charger and controllers is turned off before disconnecting the battery from the system.

**WARNING:**

Controllers contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

During installation, care must be taken to prevent static electricity.

**CAUTION:**

The controller comes with the factory settings. As the factory settings may not fully meet the actual user needs, the generator settings must be checked before.

Contents

1 **Description 5**

2 **The Outline Dimension Drawings and Controller Wiring..... 7**

3 **Panel Operation..... 13**

4 **Control and Operation Instruction..... 15**

5 **Measure and display data..... 25**

6 **Pre-alarm and Shutdown Alarm 26**

7 **Parameters Setting..... 27**

8 **Installation Guide 104**

9 **LCD displays and Menu System 105**

10 **Technical Specification 112**

1. Description

GM861/GM862 Genset synchronizing controller, with a complete control, monitoring and protection functions for the unit and the unit of the synchronizing control. Between the controller through the J1939 CANBUS network, sharing data, up to 16 pcs of genset parallel:

- I True RMS measure of voltage and current
- I Multi-Language menu
- I 4.3 inch TFT LCD color display
- I The unit maintenance time preset and reminders
- I Multiple analog measurement inputs, and built sensor to selection, can also customize the parameters
- I Multiple configurable auxiliary control relay outputs
- I Multiple configurable D-input
- I Manually controlled fuel pump
- I Manual control of engine speed (only EFI engine has)
- I Grading unloading / loading function, grading add virtual load
- I Buttons on control panel are used for selecting control modes, starting and stopping the operating procedure, displaying data and modifying the parameters. LED indicators are used for indicating the operation mode of controller and the running status of Genset, and LCD displays each measuring parameter and status
- I USB communication port, and PC communication, can read and set the controller operating parameters
- I Optional CANbus communication port, the ECU engine parameters to read and control
- I Through with the terminal pin locked, for ease and convenience to connect, move, maintain and replace the device
- I Calendar and clock
- I Event logging and measurement parameter logging, with clock
- I Startup and shutdown of the scheduled time

Synchronizing control function:

- I Synchronous monitoring, control and display
- I Uninterrupted conversion
- I Active power control
- I Reactive power control
- I According to the load requirements of automatic sequential input or output control
- I Soft load function

Model Comparison:

Model	GM861-00	GM861-01	GM862-00	GM862-01
Number of digital inputs	8	8	10	10
Number of control relay output	8	8	10	10
Sensors	4	4	5	5
RS232 communication port	—	—	●	●
RS485 communication port	—	—	●	●
Measurement data record	—	—	●	●

“—” : without “●” : Standard configuration

Detailed model specification:**GM862 - 00**

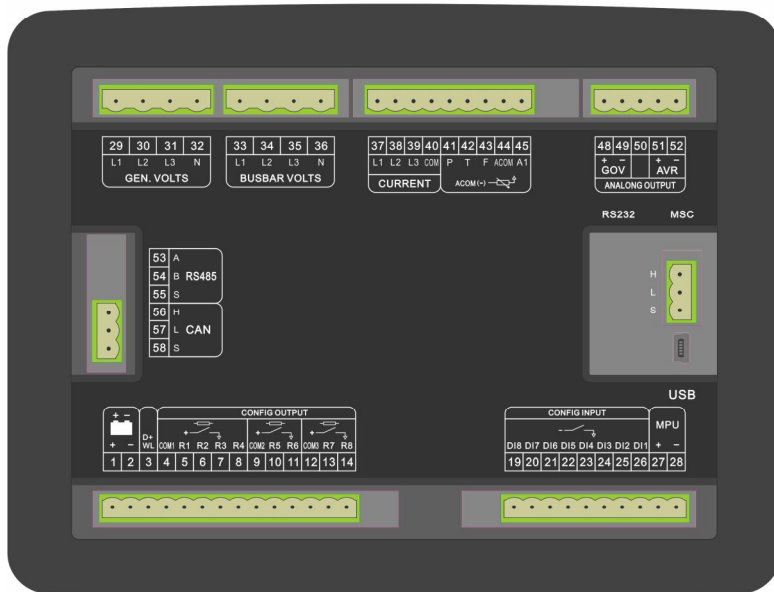
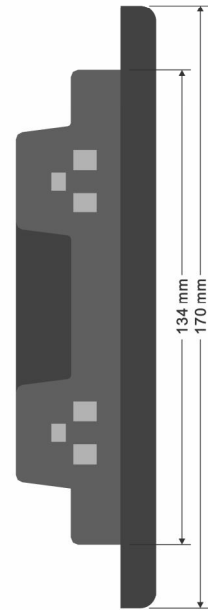
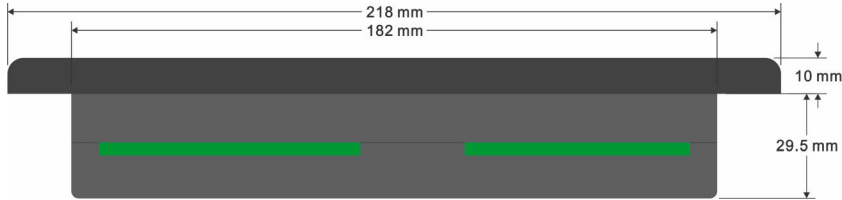
Product type 00 - Basic signal 01 – With CANBUS

2. The Outline Dimension Drawings and Controller Wiring

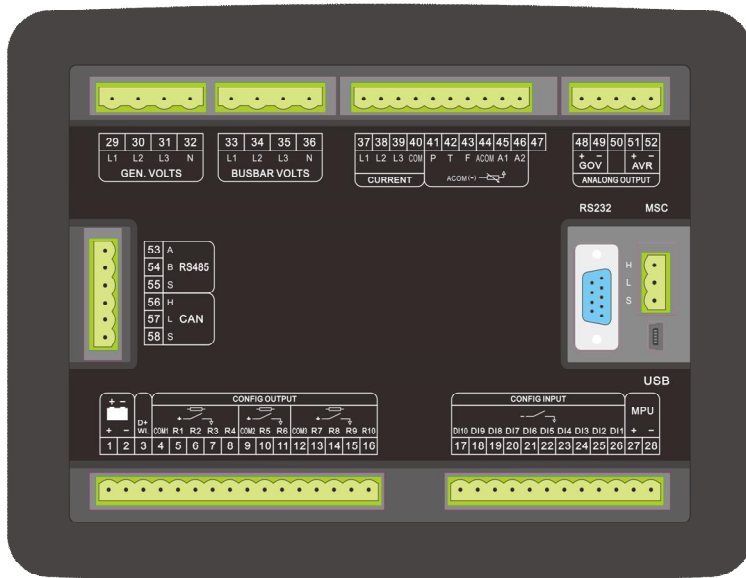
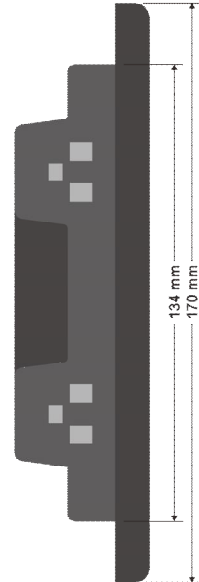
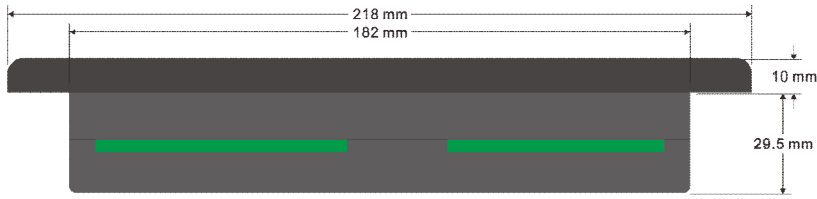
2.1 Details:

Module Dimensions	W218mm×H170mm
Panel Cutout	W183mm×H135mm
Thickness	D39.5mm

GM861



GM862



2.2 Terminal Connections:

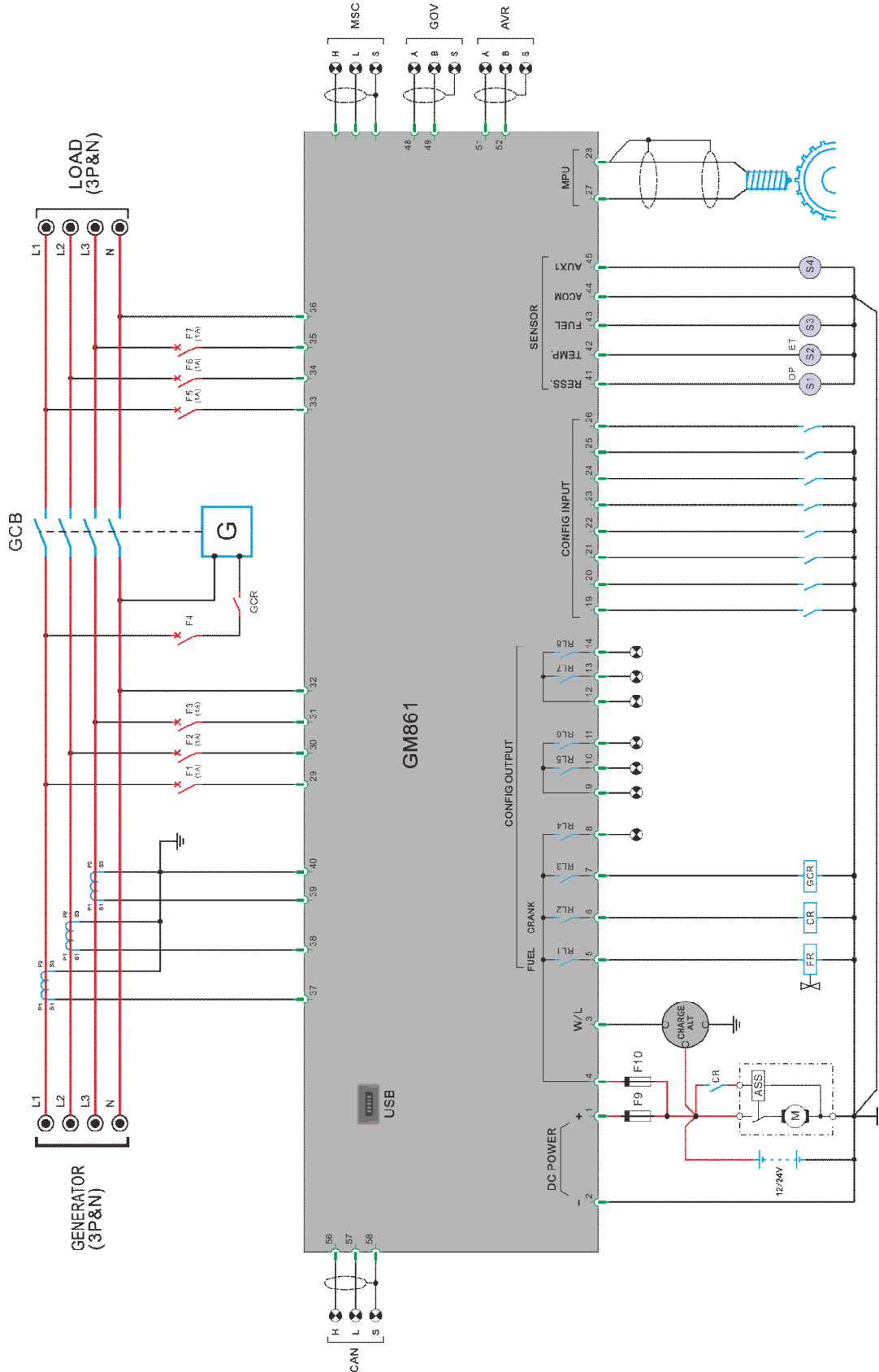
Pin	Function Description	Signal	Dim
1	Battery supply (+B)	12V/24V (9-35Vdc continuous)	2.5mm ²
2	Battery supply (-B)		2.5mm ²
3	Charger excitation power output	If not used, do not connect to negative	1mm ²
4	Relay output common point 1		2.5mm ²
5	Relay output 1	N.O. contact, 16A/30Vdc, defined (1)	2.5mm ²
6	Relay output 2	N.O. contact, 16A/30Vdc, defined (2)	2.5mm ²
7	Relay output 3	N.O. contact, 3A/30Vdc, defined (3)	1mm ²
8	Relay output 4	N.O. contact, 3A/30Vdc, defined (4)	1mm ²
9	Relay output common point 2		1mm ²
10	Relay output 5	N.O. contact, 3A/30Vdc, defined (5)	1mm ²
11	Relay output 6	N.O. contact, 3A/30Vdc, defined (6)	1mm ²
12	Relay output common point 3		1mm ²
13	Relay output 7	N.O. contact, 3A/30Vdc, defined (7)	1mm ²
14	Relay output 8	N.O. contact, 3A/30Vdc, defined (8)	1mm ²
15	Relay output 9	N.O. contact, 3A/30Vdc, defined (9)	1mm ²
16	Relay output 10	N.O. contact, 3A/30Vdc, defined (10)	1mm ²
17	D-Input 10	Defined (10)	1mm ²
18	D-Input 9	Defined (9)	1mm ²
19	D-Input 8	Defined (8)	1mm ²
20	D-Input 7	Defined (7)	1mm ²
21	D-Input 6	Defined (6)	1mm ²
22	D-Input 5	Defined (5)	1mm ²
23	D-Input 4	Defined (4)	1mm ²
24	D-Input 3	Defined (3)	1mm ²
25	D-Input 2	Defined (2)	1mm ²
26	D-Input 1	Defined (1)	1mm ²
27	Magnetic pick-up signal {+}	1-70Vac	Two-core shielded cable
28	Magnetic pick-up signal {-}		
29	GEN. VL1-N input	0-346Vac	1mm ²
30	GEN. VL2-N input	0-346Vac	1mm ²
31	GEN. VL3-N input	0-346Vac	1mm ²
32	GEN. Neutral		1mm ²
33	MAINS VL1-N input	0-346Vac	1mm ²
34	MAINS VL2-N input	0-346Vac	1mm ²
35	MAINS VL3-N input	0-346Vac	1mm ²
36	MAINS Neutral		1mm ²
37	I1 Gen current input (S1)	0-5A	2.5mm ²
38	I2 Gen current input (S1)	0-5A	2.5mm ²
39	I3 Gen current input (S1)	0-5A	2.5mm ²
40	Comm. port for current inputs (S2)	0-5A	2.5mm ²
41	LOP detection	Resistive pressure sensor (<1K Ω)	2.5mm ²
42	HET detection	Resistive temperature sensor (<1K Ω)	2.5mm ²
43	Fuel detection	Resistive temperature sensor (<1K Ω)	2.5mm ²
44	Sensor common point		2.5mm ²
45	Auxiliary sensor 1	Resistive sensor (<1K Ω)	2.5mm ²
46	Auxiliary sensor 2	Resistive sensor (<1K Ω)	2.5mm ²
47	No		

48	GOV speed output{+}		Two-core shielded cable
49	GOVspeed output {-}		
50	No		
51	AVR Regulated output {+}		Two-core shielded cable
52	AVR Regulated output {-}		
53	A	RS485 communication port	Two-core shielded cable
54	B		
55	S		
56	H	ECU CAN communication port	Two-core shielded cable
57	L		
58	S		
	H	Parallel MSC communication port	Two-core shielded cable
	L		
	S		

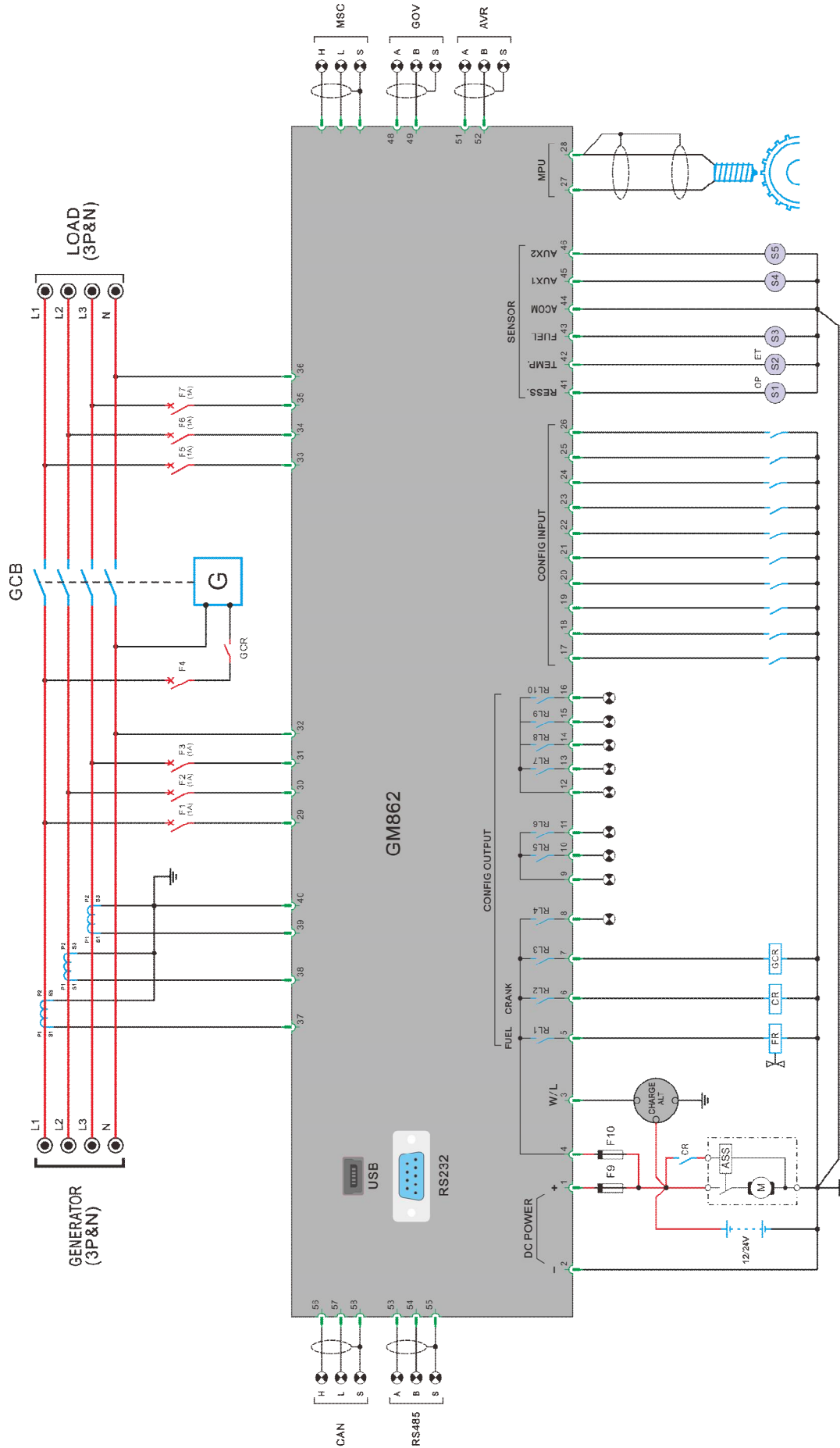
**Note :**

- I Some port functions may not be available on all models, depending on whether the hardware is supported or not.
- I Port 15#、16#、17#、18# only GM862 has.

2.3 Typical Wiring Diagram:
GM861



GM862









3. Panel Operation








The operation panel consists of 3 sections: LCD display indicating measurement parameters, LED indicator for common failure, and push buttons for Genset and selection of control modes.

LCD with 480*272 pixels can display multi-line data in the same time. LCD also has a backlight so that the operator can clearly read information day or night. After pressing any button the backlight will automatically turn off after a preset time.

The LCD display and its control push buttons provide a friendly operational interface for the operator to easily control the Genset, read information and parameter setting.

Buttons and LEDs


Function Description	Tag
<p>Scroll Button Scroll menu for parameters display Enter into or exit parameters setting by pressing and holding this button for 2sec</p>	
<p>Lamp Test Pass and hold this button, all lights on the control panel are bright, used to test the indicator whether work. When in parameters setting mode, the function of this button is displayed on the LCD.</p>	
<p>MUTE When failure occurs, alarm buzzer will sound. Pressing mute button will mute the sound. LCD will display mute icon. Press it again will clear the mute function, buzzer will continue to sound. When the mute function is effectively, LCD display mute symbols. When in parameters setting mode, the function of this button is displayed on the LCD.</p>	
<p>AUTO Mode Button This button controller operation mode, press this button repeatedly, can choose automatic mode and nonautomatic mode, when the LED indicator light on this button, the controller running in automatic mode. LCD display controller selected mode of operation.</p>	
<p>START Button The push button is used for manually start the Genset. When controller is running in MANUAL mode, press this button to start the generator.</p>	
<p>STOP / RESET Button The Push button is used for manually stops the Genset. If failure occurs, press this button, the shutdown alarm lockout can be cleared. No matter what mode the controller is running, the "Stop" button is valid. In the "automatic" or other mode of operation, press and hold this button for 2sec to stop the generator, the controller automatically from other modes to manual mode. When executing the program in a shutdown of the generator set, press the button again, immediate shutdown and the cessation of associated control output.</p>	


<p>GEN. C/O Button In manual mode, this button is used to closing and opening of the power load switch. When a definable relay is set to "GEN closing / opening", this button is valid. LED will be lights in two cases: when there is no definable digital inputs are defined as "power closed auxiliary contacts", the "GEN closing / opening" action, the indicator light; when a definable digital input is defined as " power closed auxiliary contacts", the "GEN closing / opening" action and the switching value is effective, the indicator light, such as "GEN closing / opening" action, but "power closed auxiliary contacts" switching value is invalid, the indicator flashes.</p>	
<p>Shutdown Alarm (FAILURE) LED The LED will illuminate when pre-alarm occurs. The LED will illuminate permanently when shutdown alarm occurs.</p>	
<p>GEN. Normal LED Gen. normal LED will illuminate after both voltage and frequency of the Gen. reach loading voltage and frequency.</p>	
<p>Battery Fault LED The LED will illuminate when the battery voltage is too low or too high.</p>	
<p>Low hydraulic fault LED The LED will illuminate when the oil pressure is too low.</p>	
<p>High water temp. fault The LED will illuminate when the tank temperature is too high.</p>	
<p>Overspeed fault LED The LED will illuminate when the speed is too high.</p>	

4. Control and Operation Instruction


The controller has a variety of control mode, the operator panel can be set to automatic mode and the non-automatic mode. Non-automatic mode there are two kinds of situations, such as no definable switch is set to "activate the test mode", for the manual operation mode; if a definable switch is set to "Enable Test Mode" and effective, then is test operation mode.

4.1 Operation Mode Setting:

Description	Action
Press the "AUTO" button, the LED is illuminated, the controller is running in "AUTO" mode. Press the "AUTO mode" button again, the LED is off, the controller is running in non-automatic operation mode.	



NOTE:
Controller keeps the states for the previous mode when changing the operation mode, then implements the control procedure of the next mode according to the present states.



NOTE:
If a defined panel lock switch input will not change the operating mode of the controller.

4.2 AUTO Control Sequence

The controller is running in "AUTO" mode.

Generator Auto Start Sequence:

Generator in the standby mode, only in the following situations occur, generator start-up program began:

- l A defined as loading remote signal of definable input port is effective
- l The built-in scheduler was activated, a start-up request
- l Automatic sequence function is valid, the sets meets the add on request

The Start delay timer is activated, when it times out, the preheat relay output is energised (if preheat function selected), the timer starts. When it times out, the fuel relay output is energised, and operates the fuel solenoid of the engine. After 300ms delay, the start relay closed output, the start motor engages and begins to crank. When the engine speed reaches the crank cutout RPM, the start output is de-energised and the safety-on delay starts. When the safety-on times out, if the controller detects that the parameters of the Genset such as voltage, frequency, oil pressure, coolant temperature are normal, and no other failure is detected this indicates the Genset has successfully started and running normally. The LCD displays the Genset Measurement Parameters.

If you have selected idle function, the idle relay will be closed at the same time as the crank relay is closed, the idle timer will begin counting down after successful crank, when it times out, the idle relay opens, other procedure is the same as above.



NOTE:

- l When the engine is running at idle period, the controller does not detect the failure of low-voltage, low-frequency, low-speed and charging failure.
- l When no one input port as defined as remote start, the "remote start" signal is not as boot judgment condition.



NOTE:

The start motor will power off while cranking if there are one of the following conditions occur:

- l The generator's frequency reaches the preset value (configurable cranking cutout value);
- l The AC engine speed reaches crank cutout value;
- l Generator's voltage reaches the crank cutout value (optional);
- l Charger voltage reaches crank cutout value (optional);
- l Cutout P-delay time's up (optional);
- l Cranking time's up.

The controller can not implement crank procedure in one of the following conditions:

- l The generator's frequency reaches the preset value (configurable cranking cutout value);
- l The AC engine speed reaches crank cutout value;
- l Generator's voltage reaches the crank cutout value (optional);
- l Oil pressure switch is opened or oil pressure is higher than crank cutout value (optional).



Warning:

- l If the control system does not use the speed sensor, that is, the engine cut off the signal from the generator frequency, must ensure that the generator in the process of turning, the output voltage is greater than the controller measure the voltage to avoid damage to the motor.

Repeat Crank: During the crank period, if the engine can not ignite and controller will not output start signal during crank rest. Once crank rest timer times out the start relay energises once again and will attempt to start engine again. The above procedure will be repeated until engine successfully ignites or reaches the preset number of crank attempt.

If any shutdown alarm occurs during crank, controller will stop cranking immediately, and the Genset only can be restarted after clearing the failure and reset.

Start Failure: When the procedure above repeats again and again and reaches the preset number of crank attempt, the crank relay output is then de-energised. The failure LED illuminates and the LCD displays fail to start.



Warning:

- I If fail to start occurs, operator must check the whole Genset system to find out failure reason, only after clearing the failure can press “reset button to relieve fault lock out status, and restart the genet.

Power supply process:

When the generator running, the generator voltage and frequency reaches to the the generation load voltage and power generation with load frequency, power generation normal light, power generation delay timer is started, time’s up, the GCB relay closure outputs, the transfer switch power generation side switch is closed, the power generation side switch auxiliary contacts are closed, the GCB indicator illuminated , power supply.



NOTE:

- I No-load remote signal input port is valid, or the scheduling mode is set to no load, the generator only no load operation, not closing.
- I The power generation closing command must be issued after the safety monitoring delay time has elapsed .
- I If there is not a D-input port is defined as power generation closed auxiliary contact, this time, the power generation closing indicator light only shows the controller of the power closing relay closed output.

Generator unloading and shutdown process

Under the following conditions, the controller sends the generator uninstall command:

- I Remote start signal is invalid and confirmed; or automatic sequence function is valid, the sets meets the needs of add off.
- I Loading remote signal of definable input port is invalid.
- I The scheduling boot request is invalid.

After closing the load circuit breaker, cooling delay began to countdown , when it times out, the controller fuel relay action, immediately disconnect the fuel solenoid ,into standby generator.

Stop Failure: When cool down times out, the fuel relay action and the timer for stop delay begins. If the controller detects that the voltage of the generator is greater than the cutout values, or the speed is greater than the RPM, or the oil pressure switch is off, or the oil pressure is greater than the crank cutout oil pressure, the failure LED illuminates and the LCD displays **Fail to stop**.



NOTE:

- I After stop failure occurs and the generator can not be started unless it is removed and reset.

4.3 MAN control Sequence

The controller is running in “MANUAL” mode.

Generator starting sequence:

Pressing “START” button the fuel relay action, and open the fuel solenoid of engine. After 300ms delay, the start relay closed output, the start motor engages and begins to crank, When the engine speed reaches the crank cutout RPM, the controller output is de-energised and the safety-on delay starts. When the safety-on times out, if the controller detects that the parameters of the genset such as voltage, frequency, oil pressure, coolant temperature are normal, and no other failure is detected this indicates the Genset has successfully started and running normally. The LCD displays the Genset Measurement Parameters.

After both voltage and frequency of generator respectively reached the loading value, the Gen. Normal LED illuminates, the GCB relay will not be closed automatically.

Press the “power closing/opening” button, manually close the power generation side switch GCB, power supply, power generation side switch auxiliary contact closed, GCB closed LED illuminates. Press the “power closing/opening” button again, manually open the power side switch GCB, power generation side switch auxiliary contact is disconnected, the GCB closed LED is turned off.

**NOTE:**

- I When the controller is running in “MANUAL” mode, you need manually closing, power supply, power must be normal, otherwise the “C/O” button will be invalid

Generator opening and stopping sequence:

Press “STOP” button, GCB relay opens, the generator is unload, the cool down timer starts, when it times out , the fuel relay action, disconnect the fuel solenoid immediately, generator stops and goes to standby status.

If press “STOP” button again during cool down period, generator stops immediately without cool down time.

4.4 Start and stop sequence of engine whose fuel solenoid is N.O.type:

There are two kinds of fuel solenoids for an engine, one is N.C. type, the valve of this solenoid is closed when the engine is in standby and it can be opened by switching on power; another is N.O. type, the valve of this solenoid is opened when engine is in standby and it can be closed by switching on power. All control sequences above are for N.C. type.

Start control sequence for N.O. type:

During the starting sequence the fuel relay of controller will not energise, fuel solenoid is no power, fuel solenoid open by the fuel solenoid to no-activate.

Stop control sequence for N.O. type:

During the stop sequence, the fuel relay energises, fuel solenoid is on power, the fuel solenoid action, the solenoid closed and the engine begins to stop. After a delay (same as Stop delay) fuel relay disconnect, disconnecting the supply from the fuel solenoid.

Other control sequences are same as engine whose fuel solenoid is N. C. type.

4.5 Idle function:

For **idle** function set one of the configurable outputs as **idle**.

Refer to the flow chart for start and stop for idle control flows:



NOTE:

Controller will not detect under voltage, under frequency, under speed, and charge failure during idle period.

4.6 Preheat function:

For preheat function, one of the configurable outputs as **Preheat**, the controller has 7 type selectable preheat control modes as below:

Mode 1 — during preheat time, preheat relay closure output.

Mode 2 — during preheat time, preheat relay closure output until the successful ignition.

Mode 3 — during preheat time, preheat relay closure output until safety-on delay times out.

Mode 4 — one of the configurable inputs is defined as **Preheat**, preheat relay closure output when this configurable input is active, and disconnect when configurable input is inactive.

Mode 5 — the temperature measurement value from the T-sensor port is used as the preheat control signal. When the temperature measured by the controller is lower than the preheated Preheat ON value, the preheat relay closes the output until the temperature reaches the Preheat OFF value, the preheat relay is disconnected.

Mode 6 — the temperature measurement value from the A-sensor 1 port is used as the preheat control signal. When the temperature measured by the controller is lower than the preheated Preheat ON 1 value, the preheat relay closes the output until the temperature reaches the Preheat OFF 1 value, the preheat relay is disconnected.

Mode 7 — the temperature measurement value from the A-sensor 2 port is used as the preheat control signal. When the temperature measured by the controller is lower than the preheated Preheat ON 2 value, the preheat relay closes the output until the temperature reaches the Preheat OFF 2 value, the preheat relay is disconnected.

For preheat mode 1 to 3, please refer to the flow chart for start and stop for **Preheat** control flows.

For preheat mode 4 to 7, preheat function is active immediately when the controller is switched on power.

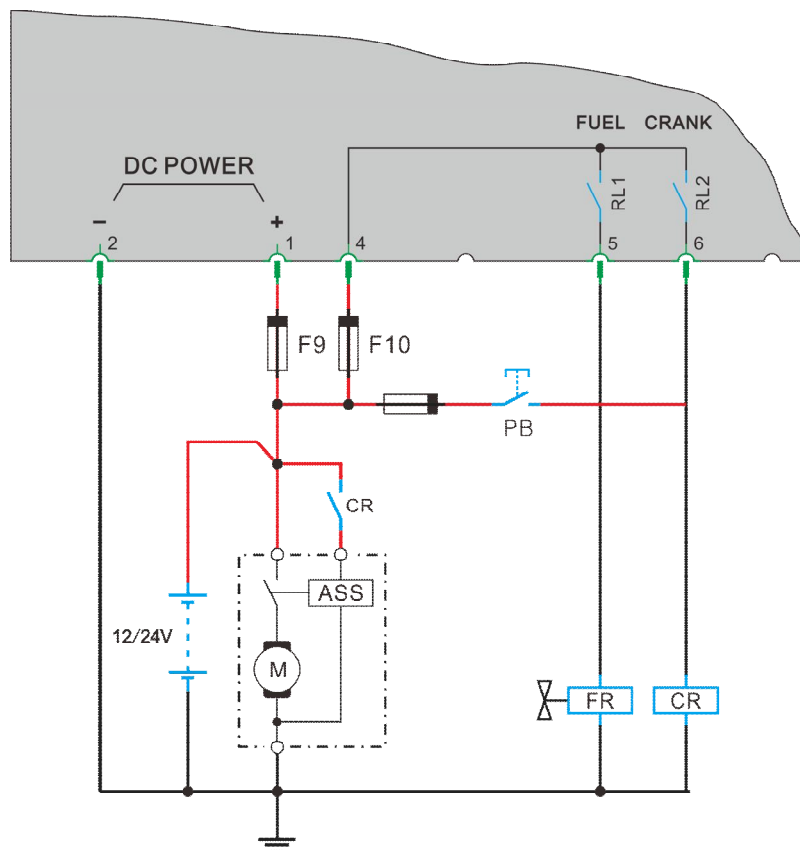
During crank period, the preheat relay output will not energise in any of above modes.


4.7 The function of forcing start:

Reason to add this function to the controller is that when the engine under abnormal conditions, e.g. the battery voltage is too low or ambient temperature is too low, or generator only outputs voltage at a high speed when magnetic pick-up is not used, the Genset cannot be started successfully when it implements the build-up cranking process of controller. There are 2 methods to solve these conditions in the controller:

Method 1: In manual mode, press the "Start" button, the controller crank relay closes output, the maximum closing time does not exceed the preset crank time. To extend the crank time, press the "Start" button continuously without changing the relevant parameters, depending on the duration of the hold button. After successfully crank, the safety monitoring delay time starts, and the procedure and protection is followed.

Method 2: In manual mode, set the parameter "EX. Crank permit" to "1" and add a switch PB to the control circuit as shown below. When the speed is up to 150RPM, the engine crank, if the speed sensor is not used, the generator voltage $\geq 20VAC$, the controller function is triggered, the throttle relay output, when the speed reaches the crank cutout RPM, the safety monitoring delay timer Start, after the procedures and protection is normal. If in the safety monitoring time, the engine speed is lower than 150RPM, the controller reset, re-enter the standby state.





Warning:

- I We normally don't recommend using the method 2;
- I In practical applications, pay attention to the installation of the PB switch, prohibit the running of the unit to crank.

4.8 Voltage control of the generator

The controller has the ability to control the voltage of the genset to achieve the following requirements for generator voltage regulation:

- I Manual voltage adjustment
- I Voltage matching during generator synchronization
- I Reactive load sharing among multiple sets on the same public busbar
- I Multiple sets on the same public busbar are connected in synchronizing, and their public busbar outputs a fixed value of reactive load

Implement the generator voltage regulation through the following two ways:

The controller outputs a voltage bias signal to the generator's automatic voltage regulator (AVR) to adjust the generator voltage. The maximum voltage range of the controller's bias signal is $\pm 10\text{Vdc}$ and the output span range can be set. The user can refer to the manual provided by the manufacturer of the automatic voltage regulator (AVR) to select the appropriate voltage regulation signal.

If the external control input signal of the automatic voltage regulator (AVR) is the discrete, the two configurable relay outputs are defined as the raise-V relay and the lower-V relay respectively, and the interface corresponding to the voltage regulator is connected to adjust the generator Voltage or reactive load. The rate of change in voltage can be set.



NOTE:

- I Normally, voltage bias signal of the controller so that the generator voltage does not change by more than 10%.

The controller does not allow manual adjustment of the voltage in the automatic control mode. In the parallel operation of the controller, to use the manual voltage regulator function, first set the controller to manual control mode, and to meet the following conditions:

- I The automatic voltage regulator (AVR) has a voltage drop characteristic.
- I Or set the "Voltage droop" parameter to the droop feature.

4.9 Frequency control of generators

The controller has the ability to control the engine speed, and thus control the generator frequency, to achieve the following needs of the generator frequency adjustment operation:

- I Manual frequency adjustment
- I Frequency matching during generator synchronization
- I An active load sharing or fixed value output between multiple sets on the same public busbar

Implement the generator voltage regulation through the following two ways:

The controller outputs a voltage bias signal to the engine's automatic governor (GOV) to adjust the engine speed. The maximum range of the controller's speed offset signal is $\pm 10\text{Vdc}$ and the output span range can be set. The user can refer to the manual provided by the automatic governor (GOV) manufacturer, select the appropriate speed adjustment signal.

If the automatic control (GOV) of the external control input signal is the discrete, the two configurable relay output were defined as the raise speed relay and lower speed relay, and the corresponding interface with the governor connection, the final adjustment of power generation machine frequency or active load. The rate of change in speed can be set.

**NOTE:**

- I Normally, speed bias signal of the controller so that the generator speed does not change by more than 10%.

The controller is not allowed to adjust the speed manually in the automatic control mode. In the parallel operation of the controller, to use the manual speed control function, first set the controller to manual control mode, and to meet the following conditions:

- I The automatic governor (GOV) has a speed droop feature.
- I Or set the "Speed droop" parameter to the droop feature.

4.10 Synchronous control

The controller's synchronizer measures the voltage of the Gen and the common busbar, and compares with the voltage waveforms, the outputs voltage bias signal and the speed offset signal are control the voltage and frequency respectively, to synchronize the two power supplies. Two power supply synchronization must meet the following conditions:

- I Phase sequence is the same
- I The voltage error is within the set limits
- I The frequency error is within the set limits
- I The phase error is within the set limits

After the normal operation of the genset, the power supply delay meter starts timing, time to up, the synchronizer to work.

Loss of power busbar closing

When the controller is in automatic operation mode, the parameter "No power busbar is closing" is active, the synchronizer starts to work, the detected busbar voltage is lower than the limit of the "no power busbar maximum voltage" setting, and the controller issues the closing command. In order to prevent two or more generators of the same busbar system from issuing a closing command at the same time, the controller passes the communication network and obtains from other controller permission before issuing the closing command.

Voltage matching

The voltage of the generator and the busbar voltage to be connected in parallel must be small, reduce itInstantaneous current shock of closing, reduce the circulation between the parallel generators, and provide the system efficiency.

If the rated power of the generator is much smaller than the total power of the public busbar, the voltage difference before the parallel does not change the voltage value of the common busbar. If the generator voltage is lower than the busbar voltage, reactive power will flow from the busbar. When the generator voltage is low to a certain extent, reactive power inflow can make the generator change to motor and cause the generator coil to be damaged.

From the above analysis we can see that the voltage matching before the parallel is very important.

After the synchronizer is operated, the controller detects the voltage across the generator and the public busbar and outputs the appropriate voltage bias signal, so that the automatic voltage regulator

(AVR) control the generator output voltage, slightly higher than the public busbar voltage, and within the matching error range.

Frequency matching

The error between the generator voltage and the busbar frequency must be small. If the generator with relatively low power is incorporated into the public busbar, the frequency difference before the parallel does not change the frequency of the public busbar. If the generator frequency is below the busbar frequency, the active power will flow from the busbar. When the generator frequency is low to a certain extent, active power inflow may damage the generator.

After the synchronizer is working, the controller detects the frequency of the generator and the public busbar, outputs the appropriate speed offset signal, the automatic governor (GOV) controls the speed, and makes the generator output frequency slightly higher than the public busbar frequency, and within the matching error range.

Phase matching

The controller does not directly adjust the phase, but adjust the frequency of the generator, so that the two power supply there is a suitable slip. When the generator frequency and busbar frequency error is large, the same phase time is short, when the error to a certain extent, does not meet the phase matching conditions. When the generator and busbar frequency error is very small, will cause the generator synchronization time lengthened, in normal, the smaller the slip, the longer the synchronization time; no slip, can not be synchronized. In general applications, such as slip is too small, in order to shorten the synchronization time, the controller will automatically increase the slip.

4.11 Automatic sequence function:

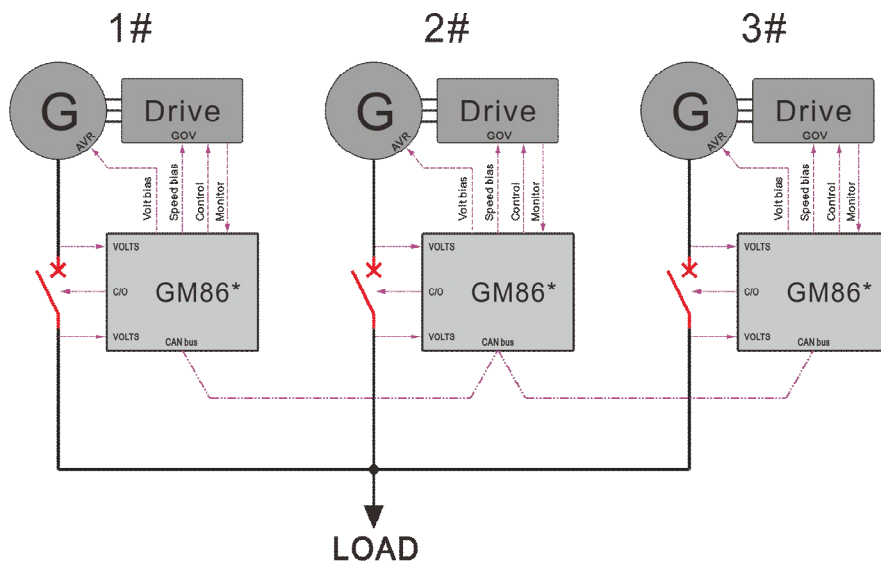
Automatic sequence function refers to the same network controller according to the priority order, according to the size of the total load, the generator set to automatically start and stop, so that the current generator to maintain a certain capacity of the active load operation.

The automatic sequence function of the controller under the same network is valid, then must be met:

- I Select automatic operation mode
- I The parameter "Auto Sequential" is set to "Yes"

When the remote signal is valid, the same network of the generator start running at the same time, and in accordance with a certain order of synchronous closing, according to the size of the total load, the genset to automatically stop and start.

Example: There are a total of three units of the system, rated active power are 400KW, as shown:



The controller's automatic sequence parameters are set as follows:

NO.	Items	Preset		
		1#	2#	3#
12.1	Device number	1	2	3
12.2	Base priority	1	2	3
12.6	Auto sequencing	Y	Y	Y
12.10	Max.generator load	80%	80%	80%
12.11	Min. generator load	30%	30%	30%
12.12	Add on delay	30s	30s	30s
12.13	Add on delay at rated load	5s	5s	5s
12.14	Add off delay	60s	60s	60s

5. Measure and display data

Public busbar phase voltage L1-N L2-N L3-N

Public busbar voltage L1-L2 L2-L3 L3-L1

Public busbar frequency Hz (L1)

Gen 3 phases phase voltage L1-N L2-N L3-N

Gen 3 phases line voltage L1- L2 L2- L3 L3- L1

Gen frequency Hz (L1)

Gen 3 phases current I1 I2 I3

Gen 3 phases apparent power and total apparent power AL1 AL2 AL3 ΣA

Gen 3 phases active power and total active power PL1 PL2 PL3 ΣP

Gen 3 phases reactive power and total reactive power QL1 QL2 QL3 ΣQ

Gen 3 phases power factor and average power factor PFL1 PFL2 PFL3 PF(AV)

Gen active power (KWh) ΣE

Gen reactive power (KVArh) ΣE

Engine speed RPM (signal is from the generator speed sensor, the power voltage HZ or ECU)

Engine oil pressure Bar/PSI (signal is from engine LOP sensor or ECU)

Engine coolant temperature°C/°F (signal is from engine Temp. sensor or ECU)

Engine fuel % (signal is from engine fuel level sensor)

Auxiliary sensor 1

Auxiliary sensor 2 (**only GM862 has**)

Battery voltageVdc

Genset running time Hour

6. Pre-alarm and Shutdown Alarm

Controller to configure different levels of alarm, according to actual application requirements for each limit beyond the protection function is triggered and control procedures to be configured, different grade configuration table is as follows:

Alarm level	Screen display	"Warning" LED flash Sound sirens	Power load switch GCB disconnect	"Fault" LED illuminate Close generators
A1 Silence Warning	Y	N	N	N
	Warning: This warning is not to interrupt the operation of equipment, do not issue public alarm, the screen displays a warning content, except relay action is defined as trigger a warning, without any other control behavior. Related events recorded in the event log.			
A2 Voice and light Warning	Y	Y	N	N
	Warning: This warning is not to interrupt the operation of equipment, Public Warning "LED lights lit and sound the alarm, the screen displays a warning content, except is defined trigger a warning relay action, without any other control behavior. Related events recorded in the event log.			
A3 Unload Warning	Y	Y	Soft Uninstall	N
	Warning: Public "Warning" LED illuminate and sound the alarm, the controller performs the uninstall program, the screen displays a warning content and trigger a defined warning relay action generator without stopping the machine. Related events recorded in the event log.			
B1 Unload Shutdown	Y	Y	Soft Uninstall	Cooling timing
	Shutdown failure: public "fault" LED illuminate and sound the alarm rang, the controller performs the uninstall program, opening, the generator cooling down, the screen displays the content of the fault and the program process information. Related events recorded in the event log. Troubleshooting, fault reset, and can be re-operations unit.			
B2 Cooling Shutdown	Y	Y	Immediately	Cooling timing
	Shutdown failure: public "fault" LED illuminate and sound the alarm, real-time sub-gate generator cooling down, the screen displays the fault content and program process information. Related events recorded in the event log. Troubleshooting, fault reset, and can be re-operations unit.			
B3 Immediately Shutdown	Y	Y	Immediately	Immediately
	Shutdown failure: public "fault" LED illuminate and sound the alarm, real-time sub-gate, immediate shutdown generator, the screen displays the fault content. Related events recorded in the event log. Troubleshooting, fault reset, and can be re-operations unit.			
Control	N	N	N	N
	Control: only as a control condition to trigger related control command.			



NOTE:

- I Warning is a non-serious fault state, temporarily do not constitute a hazard to the generator system, but to remind the operator not to meet the requirements of the situation and timely solution to ensure continuous operation of the system. When the warning occurs, the warning indicator immediately, the fault is not locked, the unit does not stop, once the failure to remove the warning automatic release.
- I Genset shutdown after the shutdown failure, fault status locked when the fault is cleared, and then press the reset button, fault lock before lifting.

7. Parameters Setting

7.1 SYSTEM

NO.	Items	Setting Range	Preset
1.0	QUIT		
1.1	Language	0 to 5	0
1.2	Password	0000 to 9999	
1.3	Pressure unit	Bar/psi	Bar
1.4	Temperature unit	°C/°F	°C
1.5	Comm. address	1 to 247	1
1.6	Startup mode	Man/Auto/ Last	Man
1.7	CT ratio	5:5 to 30000:5	1000:5
1.8	PT ratio	1.0:1 to100.0:1	1.0:1
1.9	Rated voltage	45 to 30000 V	230 V
1.10	Rated current	1 to 30000 A	1000 A
1.11	Rated active power	1 to 16000 kW	500 kW
1.12	Rated reactive power	1 to 16000 Kvar	400 Kvar
1.13	Voltage type	1 to 5 / Not used	1
1.14	Auto scroll time	1 to 60s / Not used	Not used
1.15	Starting alarm	N/ Y	No
1.16	CB close pulse	0 Continuous / 1 Pulse	Continuous
1.17	Reset to MAN	N/Y	No
1.18	Clear event log		
1.19	Default settings		
1.20	Firmware Update		

Menu descriptions:

Language

- I Used to select the Language which is displayed on the LCD

Password

- I There are 3 levels of password (CL0/CL1/CL2) for different users.
- I CL0 for the operator, who can read parameters, start and stop controller. The default setting is no password.
- I CL1 for the technician, who has the authority of CL0 and can modify all parameters, the default setting is "1111".
- I CL2 for factory, who have the authority of CL1 and Firmware update, the default setting as "2222".
- I All passwords are automatically inactive 60 seconds after exiting menu.

Pressure unit

- I Used to define oil pressure unit which is displayed on the LCD. "0" stand for Bar, "1" stand for PSI.
- I Transfer formula: $P[\text{psi}] = P[\text{bar}] * 14.503$.

Temperature unit

- I Used to define temperature unit which is displayed on the LCD. "0" stand for °C, "1" stand for °F.
- I Transfer formula: $T[°F] = (T[°C] * 1.8) + 32$.

Comm. address

- I Used to configure ID address for MODBUS.
- I Each controller on the same MODBUS has a unique communication address.

Startup mode

- I Used to configure the Startup mode of controller when it is powered up.
- I When parameter is configured as "Man", the controller will be in Manual mode when it is powered up.
- I When parameter is configured as "Auto", the controller will be in Automatic mode when it is powered up.
- I When parameter is configured as "Last", the controller will be in the mode which is the same as last time when it is powered up.

CT Ratio

- I Define the primary and secondary ratio of the generator or load CT.
- I The secondary current is fixed at 5A.
- I Used to calculate for power or load: A, KVA, KW, KVA_r, PF, KWh, KVA_rh.
- I Used to set the limit trigger: overcurrent, overload , etc.

PT Ratio

- I Measure the input voltage value of generating voltage transformer.
- I Used to frequency detection for power generation.
- I Used to calculate for power or load: V, HZ, KVA, KW, KVA_r, PF, KWh, KVA_rh.
- I Used to set the limit trigger: high / low voltage, etc.

Rated voltage

- I Used to define the rated voltage (phase voltage), rated line voltage = "rated voltage" * 1.732;
- I As a reference value for voltage limit judgment and voltage control.

Rated current

- I Used to define the generator rated current;
- I As a reference value for overcurrent limit.

Rated active power

- I Used to define the generator rated active power.;
- I As a reference value for power active power and active power control.

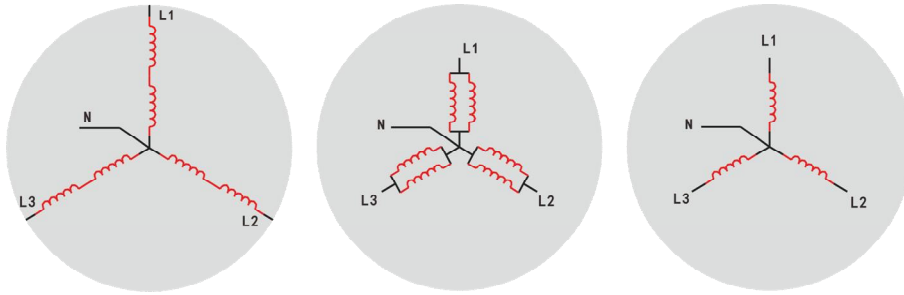
Rated reactive power

- I Used to define the generator rated reactive power;
- I As a reference value for power reactive power and reactive power control.

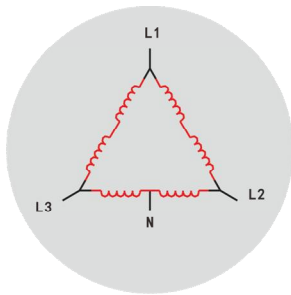
Voltage type

I There are 5 voltage types: “Y” 3P4W, “ Δ ” 3P4W , 3P3W, 2P3W, 1P2W.

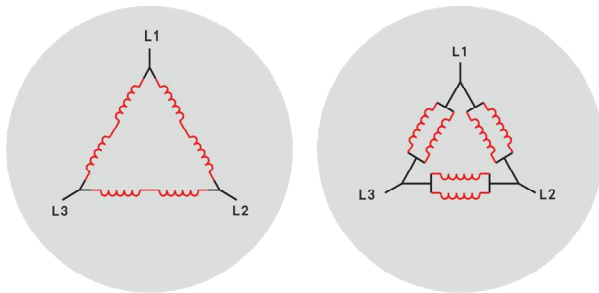
I “Y”3P4W (Star three-phase four-wire)



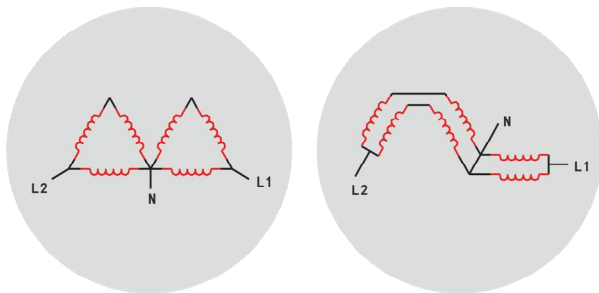
I “ Δ ”3P4W (Angle three-phase four-wire)



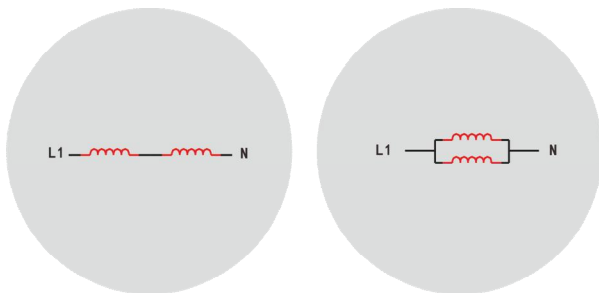
I 3P3W (Three-phase three-wire)



I 2P3W (Two-phase three-wire)



I 1P2W (single phase two-wire)



I When the parameter is set to " not use", the controller does not measure, not show the generation of electrical data.

Auto scroll time

- I Use to setting the interval of LCD screen display scroll page, any button will start auto scroll page after 30 seconds.
- I When the parameter is set to " not use", press manually scroll.

Starting alarm

- I When the parameter is set to "NO", the controller will not audible alarm before the generator set start.
- I When the parameter is set to "YES" in the automatic operation mode, to start the generator set during the start-up delay and the warm-up, an audible alarm.

CB close pulse

- I When the parameter is set to "continuous", the closing relay of the controller will continuously output ,unless controller failure or tripping command.
- I When the parameter is set to " pulse ", after the controller sends a close command , closing relay closure outputs, the timer starts, when the accumulated reaches to set the pulse time, closing relay disconnect.

Reset to MAN

- I When the parameter is set to "1", the controller shutdown fault, fault condition lock. When the fault is cleared, press the reset button on the panel, however the controller before in any control mode are automatically switched to manual operation mode.
- I When the parameter is set to "0", the controller shutdown fault, fault condition lock. When the fault is cleared, press the reset button on the panel, the controller keep before control mode.

**Warning:**

When the "reset to manual mode" parameter is set to "0" before is in automatic operation mode, press the fault reset key, in the case of other generators open condition is satisfied, generator sets may be started in no warning.

Clear event log

- I Used to clear events log that have been recorded by the controller.

Default settings

- I Parameters returned to the factory default.

Firmware Update

- I Used for the controller is set to online programming mode, after enter the 30 seconds will automatically exit if the upgrade not proceed.
- I Must enter CL2 (Factory) permission password is "2222".
- I Before electrify, press and hold the lamp button can quickly enter the mode.
- I After the upgrade you need to restart the controller.

7.2 GENERATOR

NO.	Parameter	Setting range	Preset
2.0	QUIT		
2.1	GEN V-monitor type	0 ph-ph/1 ph-n	1
2.2	GEN-V under 1		
	Function	0 N/1 Y	1
	Limit	20 to 200%	90%
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
2.3	GEN-V under 2		
	Function	0 N/1 Y	0
	Limit	20 to 200%	85%
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	3
2.4	GEN-V over 1		
	Function	0 N/1 Y	1
	Limit	20 to 200%	115%
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
2.5	GEN-V over 2		
	Function	0 N/1 Y	1
	Limit	20 to 200%	120%
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	3
2.6	GEN-Hz under 1		
	Function	0 N/1 Y	1
	Limit	10.0 to 100.0Hz	48.0Hz
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
2.7	GEN-Hz under 2		
	Function	0 N/1 Y	0
	Limit	10.0 to 100.0Hz	45.0Hz
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	3
2.8	GEN-Hz over 1		
	Function	0 N/1 Y	1
	Limit	10.0 to 100.0Hz	55.0Hz
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2

2.9	GEN-Hz over 2		
	Function	0 N/1 Y	1
	Limit	10.0 to 100.0Hz	57.0Hz
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	3
2.10	GEN-I over 1		
	Function	0 N/1 Y	1
	Limit	50 to 300%	110%
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
2.11	GEN-I over 2		
	Function	0 N/1 Y	1
	Limit	50 to 300%	115%
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0v6	3
2.12	GEN-KW over 1		
	Function	0 N/1 Y	1
	Limit	20 to 200%	110%
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
2.13	GEN-KW over 2		
	Function	0 N/1 Y	1
	Limit	20 to 200%	120%
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	3
2.14	Reverse Power 1		
	Function	0 N/1 Y	1
	Limit	-99 to -1%	-5%
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
2.15	Reverse Power 2		
	Function	0 N/1 Y	1
	Limit	-99 to -1%	-10%
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	5
2.16	Phase rotation		
	Function	0 N/1 Y	1
	Limit	0 CW/1 CCW	0
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	3

2.17	Lagging PF		
	Function	0 N/1 Y	0
	Limit	0.00 to 0.99	0.90
	Delay	0 to 999 秒	3
	Delay by	0 to 3	2
	ALM. class	0 to 6	3
2.18	Leading PF		
	Function	0 N/1 Y	0
	Limit	-0.99 to -0.01	-0.90
	Delay	0 to 999 秒	3
	Delay by	0 to 3	2
	ALM. class	0 to 6	5
2.19	GEN. loading Volt	20 to 200%	90%
2.20	GEN. loading Hz	10.0 to 100.0Hz	48.0Hz
2.21	GEN. on delay	0 to 9999s	5s
2.22	Test mode	0 unload /1 Load	0

Menu descriptions:**GEN V-monitor type**

- I Use to select a controller in **ph - ph** voltage or **ph - n** voltage as monitoring object..
- I n different voltage input type, select " **ph - ph** " or " **ph - n** " , monitoring voltage is different, specifically in the following table:

Parameter Voltage type	Ph - ph	Ph - N
“Y” 3P4W	$V_{L1-L2}, V_{L2-L3}, V_{L3-L1}$	$V_{L1-N}, V_{L2-N}, V_{L3-N}$
“△” 3P4W	$V_{L1-L2}, V_{L2-L3}, V_{L3-L1}$	$V_{L1-N}, V_{L2-N}, V_{L3-N}$
3P3W	$V_{L1-L2}, V_{L2-L3}, V_{L3-L1}$	
2P3W	V_{L1-L2}	V_{L1-N}, V_{L2-N}
1P2W		V_{L1-N}

GEN-V under 1&2

- I Controller provides two levels of low-voltage limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level, when the protection function triggered, LCD screen displays "! W: GEN-V under 1" or "! W: GEN-V under 2"; if select B1/B2/B3 alarm level, when protection function triggered, LCD screen displays "! A: GEN-V under 1" or "! A: GEN-V under 2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define low-voltage protection threshold. When the generated voltage reaches or falls below this threshold, lasts time longer than the delay time, the define operation of alarm levels are triggered.
Delay	If the generation low voltage exceeds the value of the delay time set, the define operation of alarm levels are triggered; if low voltage higher than the voltage limit in the delay before termination, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective; Set (3) DB3: after running, start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

GEN-V over 1&2

- I Controller provides two levels of high-voltage limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when the protection function triggered, LCD screen displays "! W: GEN-V over 1" or "! W: GEN-V over 2"; if select B1/B2/B3 alarm level when protection function triggered, LCD screen display "! A: GEN-V over 1" or "! A: GEN-V over 2"..

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define high voltage protection threshold. When the generated voltage reaches or falls below this threshold, lasts time longer than the delay time, the define operation of alarm levels are triggered.
Delay	If the generation high voltage exceeds the value of the delay time set, the define operation of alarm levels are triggered; if high voltage higher than the voltage limit in the delay before termination, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective;; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective; Set (3) DB3: after running, start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

GEN-Hz under 1&2

- I Controller provides two levels of low-frequency limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when the protection function triggered, LCD screen displays "! W: GEN-Hz under 1" or "!W:GEN-Hz under 2"; if select B1/B2/B3 alarm level when protection function triggered, LCD screen display "! A: GEN-Hz under 1 " or " ! A: GEN-Hz under 2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define low frequency protection threshold. When the generated voltage reaches or falls below this threshold, lasts time longer than the delay time, the define operation of alarm levels are triggered
Delay	If the generation low frequency exceeds the value of the delay time set, the define operation of alarm levels are triggered; if low frequency higher than the voltage limit in the delay before termination, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective;; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective;; Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

GEN-Hz over 1&2

- I Controller provides two levels of high-frequency limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when the protection function triggered, LCD screen displays "! W: GEN-Hz over 1" or "! W: GEN-Hz over 2"; if select B1/B2/B3 alarm level when protection function triggered, LCD screen display"! A: GEN-Hz over 1" or " ! A: GEN-Hz over 2 "

Function	Select "1", the monitoring function is active; Select "0", the monitoring function is invalid.
Limit	Used to define high frequency protection threshold. When the generated voltage reaches or falls below this threshold, lasts time longer than the delay time, the define operation of alarm levels are triggered.
Delay	If the generation high frequency exceeds the value of the delay time set, the define operation of alarm levels are triggered; if high frequency higher than the voltage limit in the delay before termination, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

GEN-I over 1&2

- I Controller provides two levels of overcurrent limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when the protection function triggered, LCD screen displays "! W: GEN-I over 1" or "! W:GEN-I over 2"; if select B1/B2/B3 alarm level when protection function triggered, LCD screen displays "! A: GEN-I over 1" or "! A: GEN-I over 2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define overcurrent protection threshold. When the generated voltage reaches or falls below this threshold, lasts time longer than the delay time, the define operation of alarm levels are triggered.
Delay	If the generation overcurrent exceeds the value of the delay time set, the define operation of alarm levels are triggered; if overcurrent higher than the voltage limit in the delay before termination, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective; Set (3) DB3: after running ,start effectively
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

GEN-KW over 1&2

- I Controller provides two levels of overload monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when the protection function triggered, LCD screen displays "! W: GEN-KW over 1" or "! W: GEN-KW over 2"; if select B1/B2/B3 alarm level when protection function triggered, LCD screen displays "! A: GEN-KW over 1" or "! A: GEN-KW over 2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define overload protection threshold. When the generated voltage reaches or falls below this threshold, lasts time longer than the delay time, the define operation of alarm levels are triggered.
Delay	If the generation overload exceeds the value of the delay time set, the define operation of alarm levels are triggered; if overload higher than the voltage limit in the delay before termination, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Reverse Power 1&2

- I Controller provides two levels of reverse power monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when the protection function triggered, LCD screen displays " ! W: GEN - reverse power 1" or " ! W: GEN - reverse power 2"; if select B1/B2/B3 alarm level when protection function triggered, LCD screen display " ! A: GEN - reverse power 1" or " ! A: GEN- reverse power 2".

Function	Select "1", the monitoring function is active; Select "0", the monitoring function is invalid.
Limit	Used to define reverse power protection threshold. When the power reaches or falls below threshold, lasts time longer than the delay time, the define operation of alarm levels are triggered.
Delay	If the load power exceeds the value of the delay time set, the define operation of alarm levels are triggered; If the load power lower than the voltage limit in the delay before termination, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective; Set (3) DB3: after running ,start effectively..
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Phase rotation

- I During the installation, make sure that the voltage input port of the controller must be properly connected to both ends of the load circuit breaker. If not done, the circuit breaker is not synchronized or the phase sequence does not matchclosed, that may cause damage to the control device and / or damage to the device of generator.
- I Voltage phase sequence according to clockwise and counterclockwise directions at different division, clockwise as "L1-L2-L3", to "CW" indicates; counterclockwise direction as "L1-L3-L2", to "CCW" indicates. The controller detects the voltage phase sequence measurement, if the control is set clockwise phase sequence and measured counterclockwise, or control settings and measured counterclockwise to clockwise, the protection function is triggered, LCD screen displays " failure: phase sequence mismatch ".

Monitor	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Phase sequence	"0 CW" clockwise, the voltage sequence direction is "L1-L2-L3"; "1 CCW" counterclockwise, the voltage sequence direction is "L1-L3-L2".
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Lagging PF

- I The controller detects the power factor of the power output and provides a lagging (ie, perceptual) limit monitoring for the user to select for warning, fault shutdown and control. If select A1 / A2 / A3 alarm level, the protection function is triggered, the LCD screen displays "! W: Lagging PF". If select B1 / B2 / B3 alarm level, the protection function is triggered, the LCD screen displays "! A: Lagging PF".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define the threshold for power factor lagging protection. When the power factor reaches or lags the threshold, the duration is longer than the delay time, the alarm level defines the action trigger.
Delay	If the power factor of the power lags the threshold, the duration exceeds the set delay time value, the action is triggered by the alarm level; if the power factor leading of the power factor limit before the delay terminates, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Leading PF

- I The controller detects the power factor of the power output and provides a leading (ie, capacitive) limit monitoring for the user to select for warning, fault shutdown and control. If selected A1 / A2 / A3 alarm level, the protection function is triggered, the LCD screen displays "! W: leading PF"; if selected B1 / B2 / B3 alarm level, the protection function is triggered, the LCD screen displays "! A: leading PF".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define the threshold for power factor leading protection. When the power factor reaches or leading the threshold, the duration is longer than the delay time, the alarm level is defined by the action trigger.
Delay	If the power factor of the power leading the threshold, the duration exceeds the set delay time value, the action is triggered by the alarm level ; if the power factor lagging of the power factor limit before the delay terminates, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

GEN. loading Volt

I Used to define the voltage threshold of GEN can closing power supply.

GEN. loading Hz

I Used to define the frequency threshold of GEN can closing power supply.

GEN. on delay

I Used to set the delay time of the GEN auto closing power supply from load conditions are satisfy.

Test mode

I Use for controller in the test mode, select the control function.

I When the parameter is set to "0", the controller is running in test mode, generator running, the transfer switch not convert, mains continue to supply, and the generator unload running; When the parameter is set to "1", the control runs in test mode, generator running, the transfer switch conversion, and power supply.

7.3 ENGINE

No.	Parameter	Setting range	Preset
3.0	QUIT		
3.1	Engine type	1 Diesel /2 ECU/3 Gas	1
3.2	ECU type	1 to 20	4
3.3	Engine rated speed	99 to 9999RPM	1500
3.4	MPU input	0 N/1 Y	0
3.5	Fly wheel teeth	5 to 300	120
3.6	Set pickup now		
3.7	Pair of poles	1 to 20	2
3.8	Fuel mode	0 N.C/1 N.O	0
3.9	Start delay	0 to 999S	10S
3.10	Crank attempts	1 to 10	3
3.11	Critical C-attempt	1 to 20 times	6 times
3.12	Crank time	1 to 99S	5S
3.13	Crank time add	1 to 99s / Not used	Not used
3.14	Crank pause time	1 to 300s	15s
3.15	Ignition speed	1 to 9999 RPM	200RPM
3.16	Ignition start DLY	1 to 999s	5s
3.17	Gas valve on DLY	0 to 999s	5s
3.18	Crank cutout RPM	1 to 9999 RPM	300RPM
3.19	Crank cutout volt	1 to 100% /Not used	85%
3.20	Crank cutout ALT-V	1.0 to 40.0 V /Not used	Not used
3.21	Crank cutout Oil-P	0.1 to 150.0 /Not used	2.2
3.22	Crank cutout P-DLY	1 to 60S /Not used	Not used
3.23	Idle time	1 to 9999S /Not used	Not used
3.24	Pre-heat mode	1 to 7	1
3.25	Pre-heat time	1 to 9999S /Not used	3 S
3.26	Safety-on delay	0 to 600S	10 S
3.27	Cool down mode	0 Full speed /1 Idle	Idle
3.28	Cool down time	0 to 9999S	300S
3.29	Stop time	0 to 60S	20S
3.30	EX. Crank permit	0 N/1 Y	NO
3.31	Charge failure		
	Function	0 N/1 Y	1
	Limit	1.0 to 40.0 V	8.0V
	ALM. class	0 to 6	2
3.32	Pickup signal		
	Function	0 N/1 Y	1
	Delay	0 to 999s	1s
	Delay by	0 to 3	1
	ALM. class	0 to 6	2

3.33	Overspeed level1		
	Function	0 N/1 Y	1
	Limit	1 to 9999 RPM	1600 RPM
	Delay	0 to 999s	1s
	Delay by	0 to 3	1
	ALM. class	0 to 6	2
3.34	Overspeed level2		
	Function	0 N/1 Y	1
	Limit	1 to 9999 RPM	1710 RPM
	Delay	0 to 999s	0s
	Delay by	0 to 3	1
	ALM. class	0 to 6	5
3.35	Underspeed level1		
	Function	0 N/1 Y	1
	Limit	1 to 9999 RPM	1440RPM
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
3.36	Underspeed level2		
	Function	0 N/1 Y	0
	Limit	1 to 9999 RPM	1350RPM
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	3
3.37	Start failure		
	Function	0 N/1 Y	1
	ALM. class	0 to 6	6
3.38	Stop failure		
	Function	0 N/1 Y	1
	ALM. class	0 to 6	3
3.39	Batt. Overvolt		
	Function	0 N/1 Y	1
	Limit	1.0 to 40.0 V	35.0 V
	Delay	0 to 999s	1s
	Delay by	0 to 3	0
	ALM. class	0 to 6	2
3.40	Batt. Undervolt		
	Function	0 N/1 Y	1
	Limit	0.0 to 40.0 V	8.0 V
	Delay	0 to 999s	1s
	Delay by	0 to 3	0
	ALM. class	0 to 6	2
3.41	Maintenance hours		
	Function	0 N/1 Y	1
	Limit	1 to 9999 hours	1000
	ALM. class	0 to 6	2

3.42	Maintenance days		
	Function	0 N/1 Y	0
	Limit	1 to 9999 days	2
	ALM. class	0 to 6	2
3.43	ECU Data fail		
	Function	0 N/1 Y	1
	Delay	0 to 999s	30s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
3.44	ECU Warning		
	Function	0 N/1 Y	1
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
3.45	ECU Shutdown		
	Function	0 N/1 Y	1
	Delay	0 to 999s	5s
	Delay by	0 to 3	3
	ALM. class	0 to 6	6
3.46	Water in fuel		
	Function	0 N/1 Y	0
	Delay	0 to 999s	30s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2

Menu description:**Engine type**

- I Used to select the controller controls the object type of engine.
- I When the parameter is set to "1", is a traditional diesel engine;
- I When the parameter is set to "2", is used ECU of the engine;
- I When the parameter is set to "3", is a conventional gas engine.
- I When the control object is ECU engine, the controller will be activated "ECU warning", "ECU fault shutdown", " ECU data failure" and "oil inlet water" protection function at the same time.

ECU type

- I Used to define J1939 interface functions of controller and ECU type;
- I The controller has built-in several common ECU type:

Code	Description
1	Cummins GCS / (MODBUS) information
2	Cummins CM570 / Cummins QSX15 information
3	Cummins CM2150
4	VOLVO EMS2
5	Iveco
6	MTU ADEC
7	Scania EMS S6
8	Ji Chai 140

Engine rated speed

- I Used to define the rated speed of engine running;
- I As a baseline reference value of speed control..

MPU input

- I Used to define the controller whether using the speed sensor;
- I When the parameter is set to "Yes", the controller uses the speed sensor as the engine speed measurement signal source; When the parameter is set to "No", the controller of the engine speed measurement value from the frequency signal of the generator , the conversion was calculated;
- I Speed (RPM) and frequency conversion formula: speed (RPM) = (Hz * 60) / pole-pairs. Example: the measurement frequency of the generator is 50Hz, when the pole-pairs is set to 2, the speed (RPM) = (50 * 60) / 2 = 1500 (RPM).

Fly wheel teeth

- I Used to define the engine per revolution of pulses / flywheel teeth.

Set pickup now

- I If user not know the engine per revolution pulse / flywheel teeth, by measuring the frequency of power frequency and speed sensor, to calculate, obtained the number of flywheel teeth.;
- I flywheel teeth and power frequency conversion formula: flywheel teeth= (f1* pole-pairs) /f2, {f1 is speed sensor frequency, f2 is generating frequency };
- I Operating procedures:
 - n "Speed sensor input "parameter is set to" 0. "
 - n Start the generator, and enter to the "set the sensor frequency" setting menu, select the parameter "1", then press to confirm, then the menu "flywheel teeth" parameters automatically modified;
 - n "Speed sensor input "parameter is set to" 1 ", complete the relevant settings of speed sensor.

**NOTE:**

- I This function is only used for debugging process of controllers and generators..

Pair of poles

- I Used to define the generator exciter poles;
- I Controller speed measurement value from the frequency signal of the generator, for the measurement operation of speed.

Fuel mode

- I Used to define the type of fuel (details refer to section 5.7) ;
- I N.C. type means the fuel channel is closed when fuel can not be used: N.O. type means the fuel channel is opened when fuel can not be used.

Start delay

- I Used to define the time from the remote control signal to the crank control output.

Crank attempts

- I The controller can repeatedly attempt to start the engine; the setting value is equal to the maximum crank times.

Critical C-attempt

- I When the critical mode is activated, the controller can repeatedly attempt to start the engine; the setting value is equal to the maximum crank times.

Crank time

- I Use to configure the time of duration of engine crank command issued.
- I This parameter is used in diesel engines, start to timing and the crank command issued at the same time; used on the gas engine, start to timing and the gas valve open command issued at the same time.

Crank time add

- I Used to adjust the time permit of the repeat cranking.
- I The second time of crank time is equal to the first crank time plus the extra time. For example: "crank time" set at 5s, "crank time add" set at 3s, then since the second crank, the maximum crank time permit is 8s.

**Caution:**

- | The maximum crank time permit can not exceed the range of the equipment safety.

Crank pause time

- | The time between last crank and next crank.
- | The time will be began in crank stop output, until the end of the time to re-issue the crank command.

Ignition speed

- | Used to define can be issue the minimum engine speed of Ignition command .
- | This parameter is valid only in the application of gas engine.

Ignition start DLY

- | Used to define the lag time of ignition output.
- | This parameter is only valid only on the application of the gas engine, crank command output and start to timing at the same time.

Gas valve on DLY

- | Used to define the lag time of gas valve open command issued.
- | This parameter is only valid only on the application of the gas engine from the ignition command issued and start to timing at the same time.

Crank cutout RPM

- | The crank cutout speed.

Crank cutout volt

- | The crank disconnect voltage.
- | Expressed by percentage, use “Rated ph-voltage” as factor.

Crank cutout ALT-V

- | The crank cutout charger voltage, signal is from the W/L terminal of charger;
- | When parameter is configured as “not used”, this function is inactive.

Crank cutout Oil-P

- | The crank cutout engine oil pressure, signal is from LOP-sensor.
- | When parameter is configured as “not used”, this function is inactive.

Crank cutout P-DLY

- | Used to configure the period from engine LOP-switch opened or oil pressure reaches oil Pressure Crank cutout value to crank disconnection.
- | When parameter is configured as “not used”, this function is inactive, also both being the condition of judging stop failure and can not implement crank process are inactive.

Idle time

- I The duration of engine idle running.
- I When controller in manual control mode, press the start button, the idle time timer starts to timing; when test control mode is valid, start delay timer end, idle time timer is beginning; when controller in the automatic control mode, the end of the start-up delay timer, idle time timer is started. Is defined within the idle time of idle output relay closed output ,time out, the relay restore the disconnected state.
- I When parameter is configured as “not used”, idle function is inactive.

Pre-heat mode

- I Used to configure the mode of preheat;
- I There are 5 pre-heat modes for selection, please read the description of preheat function for details.

Pre-heat time

- I The preheat duration before engine crank;
- I When parameter is configured as “not used”, pre-heat function is inactive.

Safety-on delay

- I Used to define the time from engine crank ignition successfully to Genset stable running;
- I The controller shielded low-speed, low voltage, low frequency, low oil pressure protection in the security monitoring delay time.

**CAUTION:**

- I Some of the protection are disabled during safety-on delay, so the safety-on delay should be set carefully and properly, this is very important, otherwise it may cause engine damage.

Cool down mode

- I Used to define the mode of cool down;
- I When parameter is configured as “0”, the engine will run at rated speed during cooling down. When parameter is configured as “1”, the engine will run in idle during cooling down.

Cool down time

- I The no-load run time allowed before the engine is stopped;
- I It is necessary to set cool down time, it can make the engine stop at a lower temperature after a long time running with load.

Stop time

- I The maximum time permit for the engine shutdown;
- I When the controller executes the stop command, that is, the fuel control relay is disconnected (the control relay closed output when the fuel is N.C). After the time out if the controller detects that the generator voltage is greater than the crank cutout voltage, or speed greater than the crank cutout speed, or oil pressure switch disconnected, or oil pressure is greater than the crank cutout oil pressure, then the shutdown failure;
- I In N.C fuel control, after the engine downtime time out, the fuel control relay disconnect output.

EX. Crank permit

- I Used to configure permit external crank to trigger the the normal controller monitoring, control and protection alarm function.
- I Refer to 4.8 for details.

Charge failure

- I Controller through the "WL" port detection auxiliary AC charger excitation voltage, to determine the AC charger whether working properly, when the detection voltage is lower than the set limit, charging failure protection function triggered. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W:Charge failure"; if select B1/B2/B3 alarm level when protection function triggered, LCD display "!W: Charge failure".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Use to defined charging failure protection threshold. When detection voltage reaches or falls below this threshold, the duration exceeds over than delay time, the define operation of alarm levels are triggered.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Pickup signal

- I When using the speed sensor, the controller can through speed signal monitoring, to determine the speed sensor whether there is. When the sensor signal is lost, if select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W:Pickup signal"; if select B1/B2/B3 alarm level when protection function triggered, LCD display "!A:Pickup signal".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Delay	If the speed signal loss time of duration longer than the delay time value set, the define operation of alarm levels are triggered; if the speed signal loss recovery before the time delay termination, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Overspeed level1&2

- I Controller provides two levels of speed monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when the protection function triggered, LCD displays "!W:Overspeed level1" or "!W:Overspeed level2"; If you select B1/B2/B3 alarm level when protection function triggered, LCD displays"!A:Overspeed level1 "or" !A:Overspeed level 2.

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define the overspeed protection threshold. when the engine speed is at or above this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the overspeed time of duration over than the set time delay value, the define operation of alarm levels are triggered; if overspeed under the overspeed limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Underspeed level1&2

- I Controller provides two levels of low-speed monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when the protection function triggered, LCD displays "!W:Underspeed level1" or "!W:Underspeed level2"; If you select B1/B2/B3 alarm level when protection function triggered, LCD display "!A:Underspeed level 1 "or" !A:Underspeed level 2.

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define the low-speed protection threshold. when the engine speed is at or under this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the low-speed time of duration over than the set time delay value, the define operation of alarm levels are triggered; if low-speed under the low-speed limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Start failure

- I If the engine number of start reaches a pre-set number of starts is still not running, which happened Startup Failure. If you select A1/A2/A3 alarm level when protection function triggered, LCD display "!W:Start failure"; if select B1/B2/B3 alarm level protection function triggered when LCD displays "!A:Start failure".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table. The default monitoring alarm level is B3.

Stop failure

- I When the controller executes the stop command, that is, the fuel control relay is disconnected (the control relay closed output when the fuel is N.C). After the time out if the controller detects that the generator voltage is greater than the crank cutout voltage, or speed greater than the crank cutout speed, or oil pressure switch disconnected, or oil pressure is greater than the crank cutout oil pressure, then the shutdown failure. If you select A1/A2/A3 alarm level when protection function triggered, LCD display "!W:Stop failure"; if select B1/B2/B3 alarm level when protection function triggered, LCD displays "!A:Stop failure".

Function	Select "Y", the monitoring function is active. Select "N", the monitoring function is invalid.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table. The default monitoring alarm level is B3.

Batt. overvolt

- I The controller detects the battery voltage, and provide a high limit protection for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when the protection function triggered, LCD displays "!W:Batt.Overvolt"; If select B1/B2/B3 alarm level when protection function triggered, LCD displays "!A:Batt.Overvolt".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define the high voltage protection threshold. when the battery voltage is at or over this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the high voltage time of duration over than the set time delay value, the define operation of alarm levels are triggered; if battery voltage under the high voltage limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Batt. undervolt

- I The controller detects the battery voltage to provide a low-limit value of the protection, for the user to select for warning, downtime and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD display "!W:Batt.Undervolt", If you select B1/B2/B3 alarm level when protection function triggered, LCD displays"!A:Batt.Undervolt".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define the low voltage protection threshold. when the battery voltage is at or over this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the low voltage time of duration over than the set time delay value, the define operation of alarm levels are triggered; if battery voltage over than the low voltage limit before delay stop, the delay time is set to zero..
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Maintenance hours

- I The controller can be provided on the running time of the generator to be accumulated, and the default parameters with this comparison, there is provided a protection unit maintenance time limit for the user to select for warning, downtime and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W: maintenance"; if select B1/B2/B3 alarm level protection function triggered, LCD display"!A: maintenance".

Function	Select "Y", the monitoring function is active. Select "N", the monitoring function is invalid.
Limit	Use to definition of the threshold value of the maintenance hour. When this parameter is set to the effective and start to accumulate the running time of the generator at the same time, when the cumulative time greater than this setting value, the define operation of alarm levels are triggered.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Maintenance days

I The controller can be provided on the running time of the generator to be accumulated, and the default parameters with this comparison, there is provided a protection unit maintenance time limit for the user to select for warning, downtime and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W: maintenance"; if select B1/B2/B3 alarm level protection function triggered, LCD display"!A: maintenance".

Function	Select "Y", the monitoring function is active. Select "N", the monitoring function is invalid.
Limit	Use to definition of the threshold value of the maintenance days. When this parameter is set to the effective and start to accumulate the running time of the generator at the same time, when the cumulative time greater than this setting value, the define operation of alarm levels are triggered.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

ECU Data fail

I Controller and the the ECU communication on the engine, the delay time controller to accept less than the normal data from the ECU, to trigger an alarm action. If you select A1/A2/A3 alarm level when protection function triggered, LCD display "!W: ECU data failure"; if select B1/B2/B3 alarm level when protection function triggered, LCD display"!A : "ECU data failure".

Function	Select "Y", the monitoring function is active. Select "N", the monitoring function is invalid.
Delay	If the low voltage duration exceeds the set delay time value, the define operation of alarm levels are triggered, if the voltage over than the low voltage limit before delay stop, the delay time is set to zero..
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.



NOTE:

- I When the engine shutdown, ECU closed, which means that is normal conditions, ECU no communication, but will not trigger fault protection.
- I This protection function effective when only choose the engine type "ECU".

ECU Warning

I When the engine ECU shutdown, this is a warning level of fault, the engine continues to run, engine manufacturers sometimes called the "yellow alert". After receiving this signal, the controller can trigger an alarm action. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W: ECU warning"; if select B1/B2/B3 alarm level when protection function triggered, LCD display "!A: ECU warning".

Function	Select "Y", the monitoring function is active. Select "N", the monitoring function is invalid.
Delay	If the low voltage duration exceeds the set delay time value, the define operation of alarm levels are triggered, if the voltage over than the low voltage limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.



NOTE:

- I ECU warning to the ECU itself is only a warning level of fault, the engine continues to run. If the controller uses this signal to trigger 4/5/6 alarm level, the control of the controller can turn off the engine.
- I This protection function effective when only choose the engine type "ECU".

ECU Shutdown

I When the engine ECU shutdown failure, the engine shutdown, engine manufacturers, sometimes called "red light alarm. After receiving this signal, the controller can trigger an alarm action. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W: ECU shutdown fault; if select B1/B2/B3 alarm levels when protection function triggered, LCD display "!A: ECU downtime failure".

Function	Select "Y", the monitoring function is active.; Select "N", the monitoring function is invalid..
Delay	If the low voltage duration exceeds the set delay time value, the define operation of alarm levels are triggered, if the voltage over than the low voltage limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Water in fuel

- I When the controller receives a signal from the ECU of oil influent, can trigger an alarm ation. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W: water in fuel "; if select B1/B2/B3 alarm levels when protection function is triggered, LCD displays“ !A: water in fuel.

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Delay	If the low voltage duration exceeds the set delay time value, the define operation of alarm levels are triggered, if the voltage over than the low voltage limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.



NOTE:

- I Controller received "water in fuel" of ECU signal, may also receive "ECU warning" or "ECU shutdown fault" signal at the same time.
- I This protection function effective when only choose the engine type "ECU".

7.4 Analog INPUT

No.	Parameter	Setting range	Preset
4.0	QUIT		
4.1	P-sensor type	1 to 15 / not used	4
4.2	Oil-P low level1		
	Function	0 N/1 Y	1
	Limit	0.0 to 150.0 Bar/PSI	1.4Bar
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.3	Oil-P low level2		
	Function	0 N/1 Y	1
	Limit	0.0 to 150.0 Bar/PSI	1.1Bar
	Delay	0 to 999s	0s
	Delay by	0 to 3	3
	ALM. class	0 to 6	6
4.4	T-sensor type	1 to 15 / not used	3
4.5	High temp. level1		
	Function	0 N/1 Y	1
	Limit	50 to 320°C/°F	92°C
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.6	High temp. level2		
	Function	0 N/1 Y	1
	Limit	50 to 320°C/°F	100°C
	Delay	0 to 999s	0s
	Delay by	0 to 3	3
	ALM. class	0 to 6	6
4.7	Heater on level	-20 to 320°C/°F	50°C
4.8	Heater off level	-20 to 320°C/°F	60°C
4.9	Cooler on level	-20 to 320°C/°F	80°C
4.10	Cooler off level	-20 to 320°C/°F	70°C
4.11	Fuel sensor type	1 to 15 / not used	3
4.12	Low fuel level1		
	Function	0 N/1 Y	0
	Limit	0 to 100%	20%
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.13	Low fuel level 2		
	Function	0 N/1 Y	0
	Limit	0 to 100%	10%
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2

4.14	High fuel level1		
	Function	0 N/1 Y	0
	Limit	0 to 100%	90%
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.15	High fuel level2		
	Function	0 N/1 Y	0
	Limit	0 to 100%	100%
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.16	Fuel pump ON	0 to 100%	20%
4.17	Fuel pump OFF	0 to 100%	70%
4.18	AUX sensor1 use	Not used / 1 oil / 2 temperature	1
4.19	AUX sensor1 type	1 to 15	4
4.20	AUX1 low P level1		
	Function	0 N/1 Y	0
	Limit	0.0 to 150.0 Bar/PSI	1.4Bar
	Delay	0 to 999s	0s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.21	AUX1 low P level2		
	Function	0 N/1 Y	0
	Limit	0.0 to 150.0 Bar/PSI	1.1Bar
	Delay	0 to 999s	0s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.22	AUX1 high P level1		
	Function	0 N/1 Y	0
	Limit	0.0 to 150.0 Bar/PSI	7.0Bar
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.23	AUX1 high P level2		
	Function	0 N/1 Y	0
	Limit	0.0 to 150.0 Bar/PSI	8.0Bar
	Delay	0 to 999 秒	1 秒
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.24	AUX1 low T level1		
	Function	0 N/1 Y	0
	Limit	-20 to 320°C/°F	60°C
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2

4.25	AUX1 low T level2		
	Function	0 N/1 Y	0
	Limit	-20 to 320°C/°F	50°C
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.26	AUX1 high T level1		
	Function	0 N/1 Y	0
	Limit	-20 to 320°C/°F	90°C
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.27	AUX1 high T level2		
	Function	0 N/1 Y	0
	Limit	-20 to 320°C/°F	100°C
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.28	Heater1 on level	-20 to 320°C/°F	50°C
4.29	Heater1 off level	-20 to 320°C/°F	60°C
4.30	Cooler1 on level	-20 to 320°C/°F	80°C
4.31	Cooler1 off level	-20 to 320°C/°F	70°C
4.32	AUX sensor2 use	Not used / 1 oil / 2 temperature	2
4.33	AUX sensor2 type	1 to 15	3
4.34	AUX2 low P level1		
	Function	0 N/1 Y	0
	Limit	0.0 to 150.0 Bar/PSI	1.4Bar
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.35	AUX2 low P level2		
	Function	0 N/1 Y	0
	Limit	0.0 to 150.0 Bar/PSI	1.1Bar
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.36	AUX2 high P level1		
	Function	0 N/1 Y	0
	Limit	0.0 to 150.0 Bar/PSI	7.0Bar
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.37	AUX2 high P level2		
	Function	0 N/1 Y	0
	Limit	0.0 to 150.0 Ba /PSI	8.0Bar
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2

4.38	AUX2 low T level1		
	Function	0 N/1 Y	0
	Limit	-20 to 320°C/°F	60°C
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.39	AUX2 low T level2		
	Function	0 N/1 Y	0
	Limit	-20 to 320°C/°F	50°C
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.40	AUX2 high T level1		
	Function	0 N/1 Y	0
	Limit	-20 to 320°C/°F	90°C
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.41	AUX2 high T level2		
	Function	0 N/1 Y	0
	Limit	-20 to 320°C/°F	100°C
	Delay	0 to 999s	1s
	Delay by	0 to 3	3
	ALM. class	0 to 6	2
4.42	Heater2 on level	-20v320°C/°F	50°C
4.43	Heater2 off level	-20v320°C/°F	60°C
4.44	Cooler2 on level	-20 to 320°C/°F	80°C
4.45	Cooler2 off level	-20 to 320°C/°F	70°C

Menu descriptions:**P-sensor type**

I Used to define the type of pressure sensor.

I The controller built-in a variety of pressure sensor types to choose,as follow:

Code	Mode	Note
0	Not used	
1	Low oil-P switch 1	Closed (low) is valid
2	Low oil-P switch 2	Open (high) is valid
3	VDO 5 bar	
4	VDO 10 bar	
5	Datcon 7 bar	
6	Murphy 7 bar	
7	Pre-set 1	
8	Pre-set 2	
9	Pre-set 3	
10	Pre-set 4	
11	Configurable 1	
12	Configurable 2	
13	Configurable 3	
14		
15		

CAUTION:

I The P-sensor is used to measure the pressure, the measured pressure value for the engine low oil pressure protection function, the measurement accuracy related to the controller of the normal control and protection function is valid or not, so the correct choice of pressure sensor type or configurable sensor parameters is very important. Otherwise, it may cause damage to the engine.

I The parameters appendix of LOP sensor:.

VDO 5 bar:

P(Bar)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5
P(PSI)	0	7.3	14.5	21.8	29.0	36.3	43.5	50.8	58.0	65.3	72.5
R(Ω)	11	29	47	65	82	100	117	134	151	167	184

VDO 10 bar:

P(Bar)	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
P(PSI)	0	14.5	29.0	43.5	58.0	72.5	87.0	101.5	116.0	130.5	145.0
R(Ω)	10	31	52	71	90	106	124	140	155	170	184

Datcon 7 bar:

P(Bar)	0.0	0.7	1.4	2.1	2.8	3.4	4.1	4.8	5.5	6.2	6.9
P(PSI)	0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
R(Ω)	240	200	165	135	115	95	78	63	48	35	25

Murphy 7 bar:

P(Bar)	0.0	0.7	1.4	2.1	2.8	3.4	4.1	4.8	5.5	6.2	6.9
P(PSI)	0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
R(Ω)	240	205	171	143	123	103	88	74	60	47	33

Pre-set 1:

P(Bar)	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
P(PSI)	0	14.5	29.0	43.5	58.0	72.5	87.0	101.5	116.0	130.5	145.0
R(Ω)	15	31	49	66	85	101	117	132	149	164	178

Pre-set 2:


P(Bar)	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
P(PSI)	0	14.5	29.0	43.5	58.0	72.5	87.0	101.5	116.0	130.5	145.0
R(Ω)	30	41	65	88	110	115	145	150	172	185	190

Pre-set 3:

P(Bar)	0	1.7	3.4	5.2	6.9	8.6	10.3				
P(PSI)	0	25	50	75	100	125	150				
R(Ω)	21	36	52	72	84	100	120				

Pre-set 4:

P(Bar)	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0		
P(PSI)	14.5	29.0	43.5	58.0	72.5	87.0	101.5	116.0	130.5		
R(Ω)	195	155	127	107	88	72	61	54	48		



NOTE:

- I “Configurable” means user can input the data manually according to the sensor parameter. Configurable 1 only can be set through the software; configurable 2 or 3 can be done through the push buttons on the front panel or software.
- I When configuring, please input the “resistance- measured value” from small to big one by one.

Oil-P low level 1&2

I Controller provides two levels of low oil pressure limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays " !W: Oil-P low level 1" or " !W: Oil-P low level 2"; if select B1/B2/B3 alarm levels, when protection function is triggered, LCD displays " !A: Oil-P low level 1" or " !A: Oil-P low level 2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define the engine oil pressure protection threshold. when the engine oil pressure is at or under this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the engine oil pressure time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the low oil pressure under than the low speed limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

T-sensor type

I Used to define the type of T-sensor .

I The controller built-in a variety of T-sensor types to choose,as follow:

Code	Mode	Note
0	Not used	
1	HET switch 1	Closed (low) is valid
2	HET switch 2	Disconnect (high) is valid
3	VDO 120°C	
4	VDO 150°C	
5	Datcon	
6	Murphy	
7	Pt100	
8	Pre-set 1	
9	Pre-set 2	
10	Pre-set 3	
11	Pre-set 4	
12	Configurable 1	
13	Configurable 2	
14	Configurable 3	

**Caution:**

I The T-sensor is used to measure the temperature, the measured temperature value for the engine high temperature protection function, the measurement accuracy related to the controller of the normal control and protection function is valid or not, so the correct choice of temperature sensor type or custom sensor parameters are very important. Otherwise, it may cause damage to the engine.

I The parameters appendix of P-sensor:

VDO 120°C:

T(°C)	40	50	60	70	80	90	100	110	120	130	140
T(°F)	104	122	140	158	176	194	212	230	248	266	284
R(Ω)	291	197	134	97	70	51	38	29	22	18	15

VDO 150°C:

T(°C)	50	60	70	80	90	100	110	120	130	140	150
T(°F)	122	140	158	176	194	212	230	248	266	284	302
R(Ω)	322	221	155	112	93	62	47	37	29	23	19

Datcon:

T(°C)	40	50	60	70	80	90	100	110	120	130	140
T(°F)	104	122	140	158	176	194	212	230	248	266	284
R(Ω)	900	600	400	278	200	141	104	74	50	27	4

Murphy:

T(°C)	40	50	60	70	80	90	100	110	120	130	140
T(°F)	104	122	140	158	176	194	212	230	248	266	284
R(Ω)	1029	680	460	321	227	164	120	89	74	52	40

PT100:

T(°C)	-100	-50	0	20	40	60	80	100	150	200	300
T(°F)	-148	-58	32	68	104	140	176	212	302	392	572
R(Ω)	60	81	100	108	116	123	131	139	157	176	212

Pre-set 1:

T(°C)	20	30	40	50	60	70	80	90	100	110	120
T(°F)	68	86	104	122	140	158	176	194	212	230	248
R(Ω)	900	600	420	282	152	113	86	62	48	40	30

Pre-set 2:

T(°C)	30	50	60	70	80	90	100	110	120
T(°F)	86	122	140	158	176	194	212	230	248
R(Ω)	980	400	265	180	125	90	65	50	38

Pre-set 3:

T(°C)	20	30	40	50	60	70	80	90	100	110	120
T(°F)	68	86	104	122	140	158	176	194	212	230	248
R(Ω)	805	540	380	260	175	118	83	58	42	30	21

Pre-set 4:

T(°C)	28	35	40	50	60	70	80	90	95	98
T(°F)	82	95	104	122	140	158	176	194	203	208
R(Ω)	579	404	342	250	179	136	103	77	67	63

NOTE:



- I "Configurable" means user can input the data manually according to the sensor curve. Configurable 1 only can be set through the software; configurable 2 or 3 can be done through the push buttons on the front panel or software.
- I When configuring, please input the "resistance-value" from small to big one by one.

High temp. level 1&2

- I Controller provides two levels of high-temperature limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W: High temp. level 1 " or "!W:High temp. level 2"; if select B1/B2/B3 alarm level when protection function triggered, LCD display"!A: High temp. level1 " or"!A: High temp. level 2.

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define high temp protection threshold. when the engine temperature is at or higher than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the high temp time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the high temperature under than this limit before delay stop, the delay time is set to zero.

Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Heater on level

- I This parameter is used to set the controller to select the preheat mode 5 is defined as a " preheat " relay action of the temperature low- limit, and set " preheat control" relay action of the temperature low limi.
- I To This parameter is valid, the temperature sensor type can not be set to " not use" and "switch".

Heater off level

- I This parameter is used to set the controller to select the preheat mode 5 is defined as a " preheat " relay stop action of the high-temperature limit, and set " preheat control" relay stop action of the high-temperature limit.
- I To This parameter is valid, the temperature sensor type can not be set to "not use" and "switch"..

Cooler on level

- I This parameter is used to set is defined as a "cooling control" relay action of high temperature limit..
- I To This parameter is valid, the temperature sensor type can not be set to " not use" and "switch".

Cooler off level

- I This parameter is used to set is defined as a "cooling control" relay stop action of low temperature limit.
- I To This parameter is valid, the temperature sensor type can not be set to " not use" and "switch"

Fuel sensor type

- I Used to define the type of the type of fuel sensor.
- I The controller built-in a variety of fuel sensor types to choose,as follow:

Code	Type	Remark
0	Not used	
1	L ow fuel switc1	Closed (low) is valid
2	L ow fuel switch 2	Disconnect (high) is valid
3	configurable 1	
4	configurable 2	
5		

Low fuel level 1&2

- I Controller provides two levels of low oil level limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W:Low fuel level1 " or "!W:Low fuel level2"; if select B1/B2/B3 alarm levels, when protection function is triggered, LCD displays " !A:Low fuel level1 or " !A:Low fuel level2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define engine low oil level protection threshold. When the oil level is at or higher than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the low oil level time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the low oil level over than this limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

High fuel level 1&2

- I The controller provides two levels of high oil level limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W: High fuel level1 " or "!W: High fuel level2"; if select B1/B2/B3 alarm levels, when protection function is triggered, LCD displays " !A: High fuel level1 or " !A: High fuel level2.

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define engine low oil level protection threshold. When the oil level is at or higher than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the low oil level time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the low oil level over than this limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Fuel pump ON

- I When the parameter of fuel sensor types is set to above "3" this parameter is set to be effective.
- I This parameter is used to set is defined as "fuel pump control" relays closed of the fuel level low limit.
- I The controller through fuel sensor detects oil level of engine daily fuel tank, when the fuel is lower than the set value, "pump control" relay closure outputs.

Fuel pump OFF

- I When the parameter of fuel sensor types is set to above "3" this parameter is set to be effective.
- I This parameter is used to set is defined as "fuel pump control" relays closed of the fuel level high limit.
- I The controller through fuel sensor detects oil level of engine daily fuel tank, when the fuel is higher than the set value, "pump control" relay closure outputs..

AUX sensor1 use

- I This parameter is used to set the auxiliary sensor port 1 function.
- I When the parameter is set to "0", this port is not used.
- I When the parameter is set to "1", this port connected P-sensor.
- I When the parameter is set to "2", this port connected temperature sensor..

AUX sensor1 type

- I Used to define the type of the auxiliary sensor 1..
- I As temperature sensor, the controller built a variety of T-sensor type to choose, refer the temperature sensor type table.
- I As P-sensor, the controller built a variety of P-sensor type to choose, refer the P-sensor type table.

AUX1 low P level 1&2

- I When the auxiliary sensor 1 uses parameter is set to "1", this parameter is set to be effective.
- I Controller for auxiliary 1 P-sensor provides two levels of the low- pressure limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W:AUX 1 low P level1" or "!W:AUX 1 low P level 2"; if select B1/B2/B3 alarm levels, when protection function is triggered, LCD displays "!A:AUX 1 low T level 1" or "!A:AUX 1 low P level 2.

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define auxiliary 1 P-sensor low limit protection threshold. When the pressure is at or lower than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the low pressure time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the pressure over than this limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

AUX1 high P level 1&2

- I When the auxiliary sensor 1 uses parameter is set to "1", this parameter is set to be effective.
- I Controller for auxiliary 1 P-sensor provides two levels of the high-pressure limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W:AUX 1 high P level1" or "!W:AUX 1 high P level 2"; if select B1/B2/B3 alarm levels, when protection function is triggered, LCD displays "!A:AUX 1 high P level 1" or "!A:AUX 1 high P level 2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define auxiliary 1 P-sensor low limit protection threshold. When the pressure is at or lower than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the high pressure time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the pressure over than this limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

AUX1 low T level 1&2

- I When the auxiliary sensor 1 uses parameter is set to "2", this parameter is set to be effective..
- I Controller for auxiliary 1 temperature sensor provides two levels of the low-temperature limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W:AUX 1 low T level1" or "!W:AUX 1 low T level 2"; if select B1/B2/B3 alarm levels, when protection function is triggered, LCD displays "!A:AUX1 low T level 1" or "!A:AUX1 low T level 2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define auxiliary 1 T-sensor low limit protection threshold. When the temperature is at or lower than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the low temperature time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the temperature over than this limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

AUX1 high T level 1&2

- I When the auxiliary 1 sensor uses parameter is set to "2", this parameter is set to be effective.
- I Controller to auxiliary 1 temperature sensor provides two levels of high-temperature limit monitoring for users to choose for a warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays " !W:AUX1 high T level1" or " !W:AUX1 high T level2"; if you select B1/B2/B3 alarm level when protection function is triggered, LCD displays !A:AUX1 high T level1" or "!A:AUX1 high T level2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define auxiliary 1 T-sensor high limit protection threshold. When the temperature is at or higher than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the high temperature time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the temperature under than this limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Heater1 on level

- I This parameter is used to set the controller to select the preheat mode 6 is defined as a " preheat " relay action of the temperature low limit, and set " preheat 1 control" relay action of the temperature low limit.
- I To this parameter effective, the auxiliary sensor 1 type can not be set to " not use" and "switch".

Heater1 off level

- I This parameter is used to set the controller to select the preheat mode 6 is defined as a " preheat " relay stop action of the temperature high limit, and set " heat 1 control" relay stop action of the temperature high limit..
- I To this parameter is effective, the auxiliary sensor 1 type can not be set to " not use" and "switch".

Cooler1 on level

- I This parameter is used for setting is defined as a "cooling 1 control "relay action of in the temperature high limit.
- I To This parameter is valid, auxiliary temperature sensor types can not be set to " not use" and "switch".

Cooler1 off level

- I This parameter is used to set is defined as a "cooling 1 control" relay to stop the action of temperature low limit.
- I To This parameter is valid, auxiliary temperature sensor types can not be set to " not use" and "switch".

AUX sensor2 use

- I This parameter is used to set the auxiliary sensor port 2 function.
- I When the parameter is set to "0", this port is not used.
- I When the parameter is set to "1", this port connected P-sensor.
- I When the parameter is set to "2", this port connected temperature sensor.

AUX sensor2 type

- I Used to define the type of the auxiliary sensor 2.
- I As temperature sensor, the controller built a variety of T-sensor type to choose, refer the temperature sensor type table.
- I As P-sensor, the controller built a variety of P-sensor type to choose, refer the P-sensor type table.

AUX2 low P level 1&2

- I When the auxiliary sensor 2 uses parameter is set to "1", this parameter is set to be effective.
- I Controller for auxiliary 2 P-sensor provides two levels of the low- pressure limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W:AUX 2 low P level1" or "!W:AUX 2 low P level 2"; if select B1/B2/B3 alarm levels, when protection function is triggered, LCD displays "!A:AUX 2 low T level 1" or "!A:AUX 2 low P level 2

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define auxiliary 2 P-sensor low limit protection threshold. When the pressure is at or lower than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the low pressure time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the pressure over than this limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

AUX2 high P level 1&2

- I When the auxiliary sensor 2 uses parameter is set to "1", this parameter is set to be effective.
- I Controller for auxiliary 2 P-sensor provides two levels of the high-pressure limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W:AUX 2 high P level1" or "!W:AUX 2 high P level 2"; if select B1/B2/B3 alarm levels, when protection function is triggered, LCD displays "!A:AUX 2 high P level 1" or "!A:AUX 2 high P level 2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define auxiliary 2 P-sensor low limit protection threshold. When the pressure is at or lower than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the high pressure time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the pressure over than this limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

AUX2 low T level 1&2

- I When the auxiliary sensor 2 uses parameter is set to "2", this parameter is set to be effective.
- I Controller for auxiliary 2 temperature sensor provides two levels of the low-temperature limit monitoring for users to choose for warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays "!W:AUX 2 low T level1" or "!W:AUX 2 low T level 2"; if select B1/B2/B3 alarm levels, when protection function is triggered, LCD displays "!A:AUX 2 low T level 1" or "!A:AUX 2 low T level 2".

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define auxiliary 2 T-sensor low limit protection threshold. When the temperature is at or lower than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the low temperature time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the temperature over than this limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

AUX2 high T level 1&2

- I When the auxiliary 2 sensor uses parameter is set to "2", this parameter is set to be effective.
- I Controller to auxiliary 2 temperature sensor provides two levels of high-temperature limit monitoring for users to choose for a warning, fault shutdown and control. If you select A1/A2/A3 alarm level when protection function triggered, LCD displays " !W: AUX 2 high T level1" or " !W: AUX 2 high T level 2"; if you select B1/B2/B3 alarm level when protection function is triggered, LCD displays !A: AUX1 high T level1" or "!A: AUX 2 high T level 2"

Function	Select "Y", the monitoring function is active; Select "N", the monitoring function is invalid.
Limit	Used to define auxiliary 2 T-sensor high limit protection threshold. When the temperature is at or higher than this threshold, time of duration over than delay time, the define operation of alarm levels are triggered.
Delay	If the high temperature time of duration over than the set time delay value, the define operation of alarm levels are triggered; if the temperature under than this limit before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, and what is the controller will do. Details refer to the alarm level configuration table.

Heater2 on level

- I This parameter is used to set the controller to select the preheat mode 7 is defined as a " preheat " relay action of the temperature low limit, and set " preheat 2 control" relay action of the temperature low limit.

To this parameter effective, the auxiliary sensor 1 type can not be set to " not use" and "switch".

Heater2 off level

- I This parameter is used to set the controller to select the preheat mode 7 is defined as a " preheat " relay stop action of the temperature high limit, and set " heat 2 control" relay stop action of the temperature high limit.
- I To this parameter is effective, the auxiliary sensor 1 type can not be set to " not use" and "switch",

Cooler2 on level

- I This parameter is used for setting is defined as a "cooling 2 control "relay action of in the temperature high limit.
- I To This parameter is valid, auxiliary temperature sensor 2 types can not be set to " not use" and "switch".

Cooler2 off level

- I This parameter is used to set is defined as a "cooling 2 control" relay to stop the action of temperature low limit.
- I To This parameter is valid, auxiliary temperature sensor 2 types can not be set to " not use" and "switch".

7.5 Discrete IN/OUT

No.	Parameter	Setting range	Preset
5.0	QUIT		
5.1	D-Input 1 config		
	Function	0 to 41	6
	Logic	0 Closed/1 Open	0
	Delay	0 to 999s	/
	Delay by	0 to 3	/
	ALM. class	0 to 6	/
5.2	D-Input 2 config		
	Function	0 to 41	2
	Logic	0 Closed/1 Open	0
	Delay	0 to 999s	/
	Delay by	0 to 3	/
	ALM. class	0 to 6	/
5.3	D-Input 3 config		
	Function	0 to 41	3
	Logic	0 Closed/1 Open	0
	Delay	0 to 999s	/
	Delay by	0 to 3	/
	ALM. class	0 to 6	/
5.4	D-Input 4 config		
	Function	0 to 41	4
	Logic	0 Closed/1 Open	0
	Delay	0 to 999s	/
	Delay by	0 to 3	/
	ALM. class	0 to 6	/
5.5	D-Input 5 config		
	Function	0 to 41	1
	Logic	0 Closed/1 Open	0
	Delay	0 to 999s	1s
	Delay by	0 to 3	0
	ALM. class	0 to 6	6
5.6	D-Input 6 config		
	Function	0 to 41	1
	Logic	0 Closed/1 Open	0
	Delay	0 to 999s	1s
	Delay by	0 to 3	0
	ALM. class	0 to 6	6
5.7	D-Input 7 config		
	Function	0 to 41	1
	Logic	0 Closed/1 Open	0
	Delay	0 to 999s	1s
	Delay by	0 to 3	0
	ALM. class	0 to 6	6

5.8	D-Input 8 config		
	Function	0 to 41	1
	Logic	0 Closed/1 Open	0
	Delay	0 to 999s	1s
	Delay by	0 to 3	0
	ALM. class	0 to 6	6
5.9	D-Input 9 config		
	Function	0 to 41	1
	Logic	0 Closed/1 Open	0
	Delay	0 to 999s	1s
	Delay by	0 to 3	0
	ALM. class	0 to 6	6
5.10	D-Input 10 config		
	Function	0 to 41	1
	Logic	0 Closed/1 Open	0
	Delay	0 to 999s	1s
	Delay by	0 to 3	0
	ALM. class	0 to 6	6
5.11	Relay 1 Config		
	Function	0 to 120	2
	Logic	0 N.O/1 N.C	0
5.12	Relay 2 Config		
	Function	0 to 120	1
	Logic	0 N.O/1 N.C	0
5.13	Relay 3 Config		
	Function	0 to 120	0
	Logic	0 N.O/1 N.C	0
5.14	Relay 4 Config		
	Function	0 to 120	0
	Logic	0 N.O/1 N.C	0
5.15	Relay 5 Config		
	Function	0 to 120	0
	Logic	0 N.O/1 N.C	0
5.16	Relay 6 Config		
	Function	0 to 120	0
	Logic	0 N.O/1 N.C	0
5.17	Relay 7 Config		
	Function	0 to 120	0
	Logic	0 N.O/1 N.C	0
5.18	Relay 8 Config		
	Function	0 to 120	0
	Logic	0 N.O/1 N.C	0
5.19	Relay 9 Config		
	Function	0 to 120	0
	Logic	0 N.O/1 N.C	0
5.20	Relay 10 Config		
	Function	0 to 120	0
	Logic	0 N.O/1 N.C	0

Menu descriptions:

D-Input * Config

I Used to define the D-input function.

Function	Defined the function of discrete input, controller built-in a variety of functions for user to choose, as follows "definable D-input function menu.
logic	Select "0", the discrete input is active in close (low level); Select "1", the discrete input is active in open circuit.
Delay	If the discrete input is valid duration time over than the set delay time value, the define operation of alarm levels are triggered; if the discrete input change to invalid before delay stop, the delay time is set to zero.
Start point	Defined time range of effective monitoring function: Set (0) DB0: always effective; Set (1) DB1: starting from crank, monitoring effectively at the same time; Set (2) DB2: from safety supervision delay time over, start effective Set (3) DB3: after running ,start effectively.
Alarm levels	Used to define the protection is triggered, the controller action. Details see the alarm level table.



NOTE:

I Only in the function is set to "1", that is, when the discrete input function user-defined parameters of the delay, start point and alarm level is set to be effective.

I Configure D-input menu is as follows:

code	Function	Note
0	Not used	
1	User configured	When you select this function, the user can use the discrete input user- configured menu to configuration this function of discret.
2	Oil pressure switch	Select this function of discrete input port external one mounted pressure switch which is on the engine, and through this limit action switch to trigger the engine low oil pressure protection. The controller allows the oil pressure switch as a low oil pressure protection and the pressure sensor is measured as an engine low oil pressure protection simultaneously. Low oil pressure triggered by the alarm level, according to the low oil pressure alarm level 2 configuration table has been defined function to choose.
3	Temp. high switch	Select this function of discrete input port external one mounted temperature switch which is on the engine, and through this limit action switch to trigger the engine high temperature protection. The controller allows the temperature switch as a high temperature protection and the temperature sensor is measured as an engine high temperature protection simultaneously. High temperature triggered by the alarm level, according to the high temperature alarm level 2 configuration table has been defined function to choose.

4	Emergency stop	Select this function of discrete input port external an emergency stop switch, when this input valid, the controller close all control output, trigger the alarm level "6", the engine shutdown immediate.
5	Remote off load	This input is active, the generator start-up, power generation does not issue a closing command after normal operation, has been unload operation until the input signal becomes invalid. This signal is only valid in auto .
6	Remote with load	For GM861 controllers, this input is active, the generator starting, after normal operation, power generation issue a closing command, and has been maintained until the input signal becomes invalid. For GM862 controllers, this input is active, the generator start running normal, if the mains normal load, the controller not issue closing command;, if the mains not normal and opening, the controller sends power generation close command.
7	Reserve	
8	GEN closed aux.	Select this function of discrete input port connected to the GCB auxiliary contacts of mains load switch, for monitoring the status of the closing or opening of the GCB
9	Low fuel switch	Select this function of discrete input port connected to the fuel tank of the engine oil level switch for monitoring the fuel tank low oil level.
10	Lamp test	Select this function of discrete input signal is active, the indicator light on the controller operation panel all illuminate. The function equivalent to the control panel "lamp test" button.
11	Speed lower	Select this function of discrete input signal is active, the controller issues a speed lower signal..
12	Speed raise	Select this function of discrete input signal is active, the controller issues a speed raise signal.
13	Air-flap Closed	Select this function of discrete input port connected to the auxiliary contacts on the engine ventilation door, and through the limit actions of switch to determine the ventilation door working conditions.
14	Pre-heat switch	Select this function of discrete input port connected to the temperature switch which is mounted on the engine preheater, and through the limit action of switch to stop preheat relay output. Only for the Preheat mode 4
15	Critical mode	In critical mode, all the shutdown fault change to warning, that is when the unit in shutdown fault, only alarm not to shutdown. LCD display critical mode.
16	Alarm mute	When selecting this digital input signal of function is active, the alarm buzzer of controller will stop sound, one is defined as "sound alarm" relay output will be closed. The functionality of input signal is equivalent to the the "mute" button on the controller panel.
17	Alarm reset	Select this function discrete input signal is active, the controller shutdown fault lock will unlock.
18	Reserve	
19	Reserve	

20	Panel lock	When selecting this digital input signal of function is active, you can not modify the operating parameters on the operation panel of the controller, can not select the operating mode of the controller. LCD display panel lock information.
21	Activate AUTO mode	When selecting this digital input signal of function is active, the controller change to auto operation mode, which provides users with a remote button to select auto operation mode. This operating mode selection function is not affected by panel lock.
22	Activate MAN mode	When selecting this digital input signal of function is active, the controller change to manual operation mode, which provides users with a remote button to select manual operation mode. This operating mode selection function is not affected by panel lock.
23	Activate TEST mode	When selecting this digital input signal of function is active, the controller change to test operation mode, which provides users with a remote button to select test operation mode. This operating mode selection function is not affected by panel lock.
24	Stop button	Select this function, the discrete input signal function is equivalent to control panel "stop" button, it provides users with a remote stop buttons.
25	Start button	Select this function, the discrete input signal function is equivalent to control panel "start" button, it provides users with a remote start buttons.
26	Half load	Select this function of discrete input signal is active, as a fixed control mode, the active fixed load level is halved.
27	Permissive	Select this function of discrete input signal is valid whether to perform the synchronization mode stop and enable, input valid is the stop mode, the permit mode is invalid.
28	Detection	The synchronous mode detection is performed when select this function of discrete input signal is valid.
29	Voltage lower	Select this function of discrete input signal is active, the controller issues a voltage lower signal.
30	Voltage raise	Select this function of discrete input signal is active, the controller issues a voltage raise signal.
31	Reserve	
32	User1	The first user to customize the input content

I User configured input method:

- Each code can be arbitrarily written in Chinese and English discrete display content, the length allowed to enter 10 Chinese characters or 30 alphanumeric characters;
- Using the computer to write UTF8 format Chinese characters (letters for the ASCII code), each takes 32 bytes, not enough bytes to make up 0x00, write data distribution address from 0x22B0 +32 * (N-1) (N for a way define the code);

Relay * config

I Use to configure the relay function selection.

Function	Define the role of the relay output, controller built-in a variety of functions for the user to choose, as follows " configure relay output menu".
Logic	Select " 0", the monitoring function is active; Select " 1", the monitoring function is invalid.

I Configure relay output function table:

code	Function	Note
0	Not used	
1	Crank	Select this function of the output relay is used to control the engine starter motor, when need the engine crank, its running, stop in crank cutout conditions are satisfy.
2	Fuel	Select this function of the output relay is used to control the diesel engine throttle electromagnet, when need to start the engine, its running, stop in crank cutout conditions are satisfy.
3	Gas valve	Select this function of the output relay is used to control the gas engine fuel valve closed or open, when need to start the engine, its running, stop in crank cutout conditions are satisfy.
4	Ignition	Select this function of the output relay is used to control the gas engine ignition system provides power or signal, when to achieve ignition conditions, its running, stop running in ignition stop delay timing over.
5	Shutdown alarm	Select this function of the output relay running when occurrence of one or more of shutdown fault, after fault clearance and press the fault reset, then its stop.
6	Warning	Select this function of the output relay running when occurrence of one or more of warning, after fault clearance, its stop.
7	Idle	Select this function of the output relay action, in controller internal idle time timing period, stop working in the end of timing.
8	Preheat output	Select the function of the output relay action, please refer to the description of preheating function.
9	Speed raise	Select this function of the output relay, when the engine speed running speed is lower than the rated speed will be action, this is a pulse speed control signal.
10	Speed lower	Select this function of the output relay, when the engine speed running speed is higher than the rated speed will be action, this is a pulse speed control signal.
11	Fuel pump control	Select this function of output relay action when the fuel level is lower than the setting of lower limit of the pump open level value, and keep until the setting of high limit of fuel level reaches the pump stop level value.
12	Genset running	Select this function of the output relays action when the generator is normal running, that is the engine speed, oil pressure, temperature, etc., and the electrical parameters of the generator have reached the limits of the normal setting.

13	Auto mode	output relay action, when controller running in the auto operation mode.
14	Test mode	output relay action, when controller running in the test operation mode.
15	Man mode	output relay action, when controller running in the manual operation mode.
16	Maintenance due	Select this function of output relay, the accumulation time of engine reaches the time limit value of maintenance parameter set, it s action, and stopping action in the re-set maintenance time or press the reset button.
17	Reserve	
18	GCB fail to close	Output relay action, after the generator closing failure occurred .
19	Fail to start	The crank attempts of engine reaches the setting have been not successful ignition, the output relay action.
20	Fail to stop	The engine is still running after the end of the downtime timing set, the output relay action.
21	Reserve	
22	GEN close/open	The output relay is used to control the power generation load switch GCB closing and opening action, when the controller commands power generation supply, its action, and not need the power generation supply, its stop working.
23	Audible alarm	When you need on the basis of the controller built-in alarm buzzer add a warning sound, the output relay action be equal to built-in alarm buzzer.
24	Cooling down	output relay action, in timing of the cooling time.
25	ECU data fail	At the end of the safety monitoring time timing has not receive the data from engine ECU, choose this function of the output relay action.
26	ECU warning	The output relay operation of select this function when receive the warning signal from ECU
27	ECU alarm	The output relay operation of select this function when receive the fault signal from ECU
28	Charge failure	When charging failure occurs, the output relay action.
29	Batt over volt	When the controller detects that the battery voltage is higher than the set value, its action.
30	Batt under volt	When the controller detects that the battery voltage is lower than the set value, its action.

31	Underspeed level1	When the engine speed is lower than the setting of under speed level 1 while delay confirm, its action.
32	Underspeed level 2	When the engine speed is lower than the setting of under speed level 2 while delay confirm, its action.
33	Overspeed level1	When the engine speed is higher than the setting of overspeed level 1 while delay confirm, its action.
34	Over speed level2	When the engine speed is higher than the setting of over speed level 2 while delay confirm, its action.
35	Oil-P low level1	When the engine oil pressure lower than the setting of low oil level 1 while delay confirm, its action..
36	Oil-P low level2	When the engine oil pressure lower than the setting of low oil level 2 while delay confirm, its action..
37	High temp. level1	When the cooling temperature of engine is higher than the setting of high temperature level 1 while delay confirm, its action.
38	High temp. level 2	When the cooling temperature of engine is higher than the setting of high temperature level 2 while delay confirm, its action.
39	Fuel low level1	When the engine fuel level lower than the setting of low oil level 1 while delay confirm, its action.
40	Fuel low level2	When the engine fuel level lower than the setting of low oil level 2 while delay confirm, its action.
41	GEN-V under 1	When the generator voltage is lower than the setting of the power generation of low voltage level 1 while delay confirm, its action.
42	GEN-V under 2	When the generator voltage is lower than the setting of the power generation of low voltage level 2 while delay confirm, its action.
43	GEN-V over 1	When the generator voltage is higher than the setting of power generation of high-voltage level 1 while delay confirm, its action.
44	GEN-V over 2	When the generator voltage is higher than the setting of power generation of high-voltage level 2 while delay confirm, its action.
45	GEN-Hz under 1	When the generator frequency is lower than the setting of power generation of low-frequency level 1 while delay confirm, its action.
46	GEN-Hz under 2	When the generator frequency is lower than the setting of power generation of low-frequency level 2 while delay confirm, its action.
47	GEN-Hz over 1	When the generator frequency is higher than the setting of power generation of high-frequency level 1 while delay confirm, its action.
48	GEN-Hz over 2	When the generator frequency is higher than the setting of power generation of high-frequency level 2 while delay confirm, its action.

49	GEN-I over 1	When the generator current is higher than the setting of current level 1 while delay confirm, its action.
50	GEN-I over 2	When the generator current is higher than the setting of current level 2 while delay confirm, its action.
51	GEN-KW over 1	When the active load of engine is higher than the setting of power generation overload level 1 while delay confirm, its action.
52	GEN-KW over 2	When the active load of engine is higher than the setting of power generation overload level 2 while delay confirm, its action.
53	Idle 1	Select this function of output relay, for 1 second after the end of the idle time in the controller,
54	Idle 2	Select this function of output relay, for 1 second after the start of the cooling time in the controller,
55	Reserve	
56	Reserve	
57	Reserve	
58	Reserve	
59	Reserve	
60	Reserve	
61	Oil-P sensor open	Select this function of the output relays action after the controller detect oil pressure sensor. The triggered alarm level is defined by the low oil pressure alarm level 2.
62	Loss of pickup	When select the speed sensor as the engine speed control signal, in crank command is issued, undetectable speed sensor signal, the function of the output relay action.
63	Scheduled run	Select this function if the output relay is valid in regularly run, its action.
64	Blinds control	Select this function of output relay at the beginning of the start time delay, its action, and stop after the engine stops running. This output is connected to the electric shutter of engine cooling air duct, control the blinds open and close.
65	Cooler control	Select this function of output relay, when the cooling temperature of engine is higher than the lower limit of cooling open level value of setting, its action, and keep until the cooling temperature lower than the high limit of the preheat stop level of setting, its stop.

66	Cooler1 control	Select this function of output relay, when from auxiliary temperature sensor 1 measuring the temperature is higher than the low limit of cooling 1 open level level value of setting, its action, and keeping until the temperature is lower than the high limit of cooling 1 stop level value of setting, its stop action.
67	Cooler2 control	Select this function of output relay, when from auxiliary temperature sensor 1 measuring the temperature is higher than the low limit of cooling 2 open level level value of setting, its action, and keeping until the temperature is lower than the high limit of cooling 2 stop level value of setting, its stop action.
68	Heater control	Select this function of output relay, when the cooling temperature of engine is below the lower limit of preheat open level value of setting, its action, and keep until the cooling temperature higher than the high limit of the preheat stop level of setting, its stop
69	Heater1 control	Select this function of output relay, when from auxiliary temperature sensor 1 measuring the temperature is lower than the low limit of preheat 1 open level level value of setting, its action, and keeping until the temperature is higher than the high limit of preheat 1 stop level value of setting, its stop action.
70	Heater2 control	Select this function of output relay, when from auxiliary temperature sensor 1 measuring the temperature is lower than the low limit of preheat 2 open level level value of setting, its action, and keeping until the temperature is higher than the high limit of preheat 2 stop level value of setting, its stop action.
71	GCB open	This output relay is connected to the shut excitation coil of generate power load switch MCB, when controller command of generate power to outage, stopped working after the switch opening.
72	Reserve	
73	Reserve	
74	Reserve	
75	Reserve	
76	Reserve	
77	Reserve	
78	Reserve	
79	Reserve	

80	Soft unload	When soft unloading time start timing action, stop action at the end of timing.
81	Off load	Its action when the controller is in the closed load
82	Reserve	
83	Reserve	
84	Emergency stop	When this function is active, the generator is emergency stop fuel output.
85	Reserve	
86	Reserve	
87	Reserve	
88	Reserve	
89	AUX1 low level1	When the generator auxiliary 1 sensor value is lower than the setting value of the auxiliary 1 sensor low value 1 and the delay is action when confirmed.
90	AUX1 low level2	When the generator auxiliary 1 sensor value is lower than the setting value of the auxiliary 1 sensor low value 2 and the delay is action when confirmed.
91	AUX1 high level1	When the generator auxiliary 1 sensor value is higher than the setting value of the auxiliary 1 sensor higher value 1 and the delay is action when confirmed.
92	AUX1 high level2	When the generator auxiliary 1 sensor value is higher than the setting value of the auxiliary 1 sensor higher value 2 and the delay is action when confirmed.
93	AUX2 low level1	When the generator auxiliary 2 sensor value is lower than the setting value of the auxiliary 2 sensor low value1 and the delay is action when confirmed.
94	AUX2 low level2	When the generator auxiliary 2 sensor value is lower than the setting value of the auxiliary 2 sensor low value 2 and the delay is action when confirmed.
95	AUX2 high level1	When the generator auxiliary 2 sensor value is higher than the setting value of the auxiliary 2 sensor higher value 1 and the delay is action when confirmed.
96	AUX2 high level2	When the generator auxiliary 2 sensor value is higher than the setting value of the auxiliary 2 sensor higher value 2 and the delay is action when confirmed.
97	ECU water in fuel	The generator action when detects ECU oil into the water.
98	D-Input 1 alarm	D-input 1 is set to "1 user configured", when a warning or fault input is active.
99	D-Input 2 alarm	D-input 2 is set to "1 user configured", when a warning or fault input is active
100	D-Input 3 alarm	D-input 3 is set to "1 user configured", when a warning or fault input is active

101	D-Input 4 alarm	D-input 4 is set to "1 user configured", when a warning or fault input is active
102	D-Input 5 alarm	D-input 5 is set to "1 user configured", when a warning or fault input is active
103	D-Input 6 alarm	D-input 6 is set to "1 user configured", when a warning or fault input is active
104	D-Input 7 alarm	D-input 7 is set to "1 user configured", when a warning or fault input is active
105	D-Input8 alarm	D-input 8 is set to "1 user configured", when a warning or fault input is active
106	D-Input 9alarm	D-input 9 is set to "1 user configured", when a warning or fault input is active
107	D-Input 10 alarm	D-input 10 is set to "1 user configured", when a warning or fault input is active
108-111	Reserve	
112	Voltage raise	Select this function of the output relay, when the generator AC voltage is lower than the rated voltage will active, this is a pulse voltage control signal
113	Voltage lower	Select this function of the output relay, when the generator AC voltage is higher than the rated voltage will active, this is a pulse voltage control signal
114	Reserve	
115	Reserve	
116	Reserve	
117	Reserve	
118	Reserve	
119	Fuel high level1	When the generator oil level is higher than the set value of fuel high level 1 and the delay is action when confirmed.
120	Fuel high level2	When the generator oil level is higher than the set value of fuel high level 1 and the delay is action when confirmed

7.6 DEFINE SENSORS

No.	Parameter	Setting range	Preset
6.0	QUIT		
6.1	PRES. Sensor 1		
6.2	PRES. Sensor 2		
6.3	TEMP. Sensor 1		
6.4	TEMP. Sensor 2		
6.5	Fuel Level Sensor		

Menu descriptions:

PRES. Sensor 1

I Corresponds to the “configurable 2” in the “LOP Sensor type”.

PRES. Sensor 2

I Corresponds to the “configurable 3” in the “LOP Sensor type”.

TEMP. Sensor 1

I Corresponds to the “configurable 2” in the “HET Sensor type”.

TEMP. Sensor 2

I Corresponds to the “configurable 3” in the “HET Sensor type”.

Fuel Level Sensor

I Corresponds to the “configurable 2” in the “Fuel level sensor selection”.



NOTE:

I “Configurable sensor data” means user can input the data manually according to the sensor curve. When configuring, please input the “resistance - measured value” from small to big one by one as following

PRES. Sensor 1

Fix Point	1	2	3	4	5	6	7	8	9	10
Resistance	228.6	261.9	285.7	309.5	338.1	366.7	395.2	419.0	447.6	476.2
Measured	0.0	0.5	1	1.5	2	2.5	3	3.5	4	4.5

PRES. Sensor 2

Fix Point	1	2	3	4	5	6	7	8	9	10
Resistance	152	273	456	638	759	881	1002	1124	1245	1367
Measured	0.0	0.6	1.5	2.4	3.0	3.6	4.2	4.8	5.4	6.0

TEMP. Sensor 1

Fix Point	1	2	3	4	5	6	7	8	9	10
Resistance	7.0	17.0	24.0	30.0	40.0	58.0	80.0	110.0	140.0	210.0
Measured	140	120	110	100	90	80	70	60	50	40

TEMP. Sensor 2

Fix Point	1	2	3	4	5	6	7	8	9	10
Resistance	15.6	18.9	23.1	30.0	43.7	65.0	110.0	160.0	240.0	240.0
Measured	120	113	105	95	85	75	60	50	40	40

Fuel Level Sensor

Fix Point	1	2	3	4	5	6	7	8	9	10
Resistance	1.7	7.0	12.0	17.0	24.0	30.0	38.0	50.0	63.0	106.0
Measured	100	90	80	70	60	50	40	30	20	1

7.7 SCHEDULER

No.	Parameter	Setting range	Preset
7.0	QUIT		
7.1	DATE/ TIME	YY-MM-DD HH:MM:SS	
7.2	Scheduler period	1 to 52 week	1
7.3	1st Scheduler mode	0 Unload/1 load	Unload
7.4	1st Start time		HH:MM
7.5	1st Run duration	1 to 1440 min	60
7.6	1st MON active	0 N/1 Y	0
7.7	1st TUE active	0 N/1 Y	0
7.8	1st WED active	0 N/1 Y	0
7.9	1st THU active	0 N/1 Y	0
7.10	1st FRI active	0 N/1 Y	0
7.11	1st SAT active	0 N/1 Y	0
7.12	1st SUN active	0 N/1 Y	0
7.13	2nd Scheduler mode	0 Unload/1 load	Unload
7.14	2nd Start time		HH:MM
7.15	2nd Run duration	1 to 1440 min	60
7.16	2nd MON active	0 N/1 Y	0
7.17	2nd TUE active	0 N/1 Y	0
7.18	2nd WED active	0 N/1 Y	0
7.19	2nd THU active	0 N/1 Y	0
7.20	2nd FRI active	0 N/1 Y	0
7.21	2nd SAT active	0 N/1 Y	0
7.22	2nd SUN active	0 N/1 Y	0
7.23	Data log period	1 to 9999 min / not used	not used

Menu descriptions:

DATE/TIME

- I Used to configure the date / time: YY-MM-DD HH:MM:SS.
- I The date displayed on LCD, the pre-alarm (warning) and alarm events with time stamp.

Scheduler period

- I Used to set the controller of the scheduling function effective time period.
- I "Weeks" as a unit.

Scheduler mode

- I Used for the controller in the scheduling model was activated, what kind of the control function to choose;
- I When you select "unload" controller running in test mode, the generator start running, transfer switch does not convert, that mains continue to supply, generator unload operation; if choose "load" controller running in test mode, the generator start running, the transfer switch is converted, that is power generation supply power.

Start time

- I Used to configure the start time when controller is active in exercise run scheduler.

Run duration

- I Used to configure the duration when controller is active in exercise run schedule, the scheduler mode will be reset after run duration has expired

MON active

I The cycle of exercise run scheduler is one week. This menu is used to configure the exercise run schedule on Monday active or not.

TUE active

I Used to configure the exercise run schedule on Tuesday active or not.

WED active

I Used to configure the exercise run schedule on Wednesday active or not.

THU active

I Used to configure the exercise run schedule on Thursday active or not.

FRI active

I Used to configure the exercise run schedule on Friday active or not.

SAT active

I Used to configure the exercise run schedule on Saturday active or not.

SUN active

I Used to configure the exercise run schedule on Sunday active or not.

Data log period




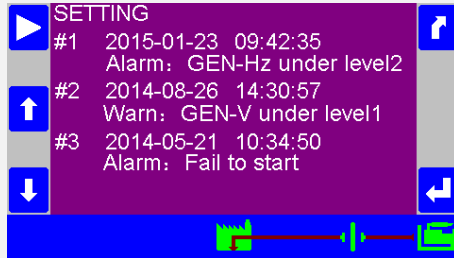
I Controller on a regular basis recorded controller all the measurement data and state signals, this parameter is used to set the data records of cycle.

4.8 Event Log

I Used to view the history of events that have occurred on the controller.

I The record includes fault or warning, as well as the detailed date and time that occurred.

Menu descriptions:

	<p>NOTE:</p> <p>The record includes fault or warning, as well as the detailed date and time that occurred.</p> <p>Press “” or “” Scroll to view other event records:</p>	 <p>SETTING</p> <ul style="list-style-type: none"> #1 2015-01-23 09:42:35 Alarm: GEN-Hz under level2 #2 2014-08-26 14:30:57 Warn: GEN-V under level1 #3 2014-05-21 10:34:50 Alarm: Fail to start
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7.9 Configure Synchronizer

No.	Parameter	Setting range	Preset
9.0	QUIT		
9.1	SYNC mode	Stop / Allow / Detect / Run	Run
9.2	CB hold time	0.1 to 30.0S	5.0S
9.3	CB close attempts	1 to 10	5
9.4	Reclose delay	1 to 1200S	30S
9.5	Reclose ALM class	0 to 6	1
9.6	SYNC time	0 to 1200S	100S
9.7	SYNC timeout ALM class	0 to 6	2
9.8	Voltage differential	0.5 to 20.0%	5.0%
9.9	Pos. freq. differential	0.02 to 0.49 Hz	0.20 Hz
9.10	Neg. freq. differential	-0.49 to 0.00 Hz	-0.10 Hz
9.11	Phase differential	0.0 to 10.0°	10.0°
9.12	Matching dwell time	0.0 to 60.0S	0.3S
9.13	CB Closing time	1 to 999 mS	80 mS
9.14	Dead bus closure	0 N/1 Y	Yes
9.15	Dead bus Max.volt	0 to 30%	10%
9.16	ECU SA	0 to 255	0

Menu descriptions:**SYNC mode**

- I Used to set the operating mode of the synchronizer
- I "Off ", the synchronizer does not work
- I "Permissive", the synchronizer is only used as a synchronization detection device, does not adjust the speed or voltage to obtain synchronization, but if the synchronization conditions are met, the controller will issue a breaker closure command.
- I "Check", the synchronizer is only as a control device, by adjusting the speed or voltage to obtain synchronization, but the synchronization conditions are met and the controller does not issue a breaker closure command.
- I "Run" , the normal operation mode, synchronizer control synchronization and issue a breaker close command.
- I The operating mode can be selected by configurable discrete input.

CB hold time

- I Breaker closing command closed output to the maximum allowable time between the opening, that is, closing output to maintain the time.
- I During the closing operation output, if the controller receives the generator breaker auxiliary switch closing feedback, or if the synchronization condition is no longer met, stop output immediately.

CB close attempts

- I Used to set the maximum number of times the breaker can try to close.
- I If the breaker closing is reached to the number of pre-set switch closures, it can not be closed, and the closing condition is no longer required, the closed attempt counter is zero.

Reclose delay

- I The time between two closing attempts
- I The time starts from the closing stop output until the time has stopped reissue the closed command.

Reclose ALM class

- I If the breaker closing number of attempts to achieve pre-set closing switches, still cannot closed, that is, the controller does not receive the effective feedback of the breaker closing, the reclosing failure occurs. If selected A1 / A2 / A3 alarm level and the protection function is triggered, the LCD screen displays "!W: reclosing"; if selected B1 / B2 / B3 alarm level and the protection function is triggered, the LCD screen displays "!A:reclosing".

SYNC time

- I Set the maximum allowable time for the allowed synchronizer to work.
- I The timers start when the synchronizer starts.
- I When the parameter is set to 0, the synchronization limit time is invalid.

SYNC timeout ALM class

- I If the synchronizer is in the set synchronization time, the breaker can not be closed, then synchronous timeout fault occurs. If selected A1 / A2 / A3 alarm level and the protection function is triggered, the LCD screen displays "!W: Synchronous timeout". If selected B1 / B2 / B3 alarm level and the protection function is triggered, the LCD screen displays "!A: synchronous timeout".

Voltage differential

- I Defines the maximum voltage error between the generator and the busbar.
- I If the error exceeds the voltage difference range, the controller will not issue a circuit breaker closing command.

Pos. freq. differential

- I Define the maximum permissible pos. freq. differential between the generator and the busbar, allow the power frequency amplitude is higher than the busbar.
- I If the pos. freq. differential exceeds the setting range, the controller will not issue breaker closing command.

Neg. freq. differential

- I Define the maximum permissible neg. freq. differential between the generator and the busbar, allow the power frequency amplitude is higher than the busbar.
- I If the neg. freq. differential exceeds the setting range, the controller will not issue breaker closing command.

Phase differential

- I Defines the maximum phase angle difference allowed under phase matching conditions.
- I If the phase angle between the generator and the busbar exceeds this range, the controller will not issue breaker closing command.

Matching dwell time

- I Before the controller closing command is issued, the difference between the voltage difference and the frequency difference is keep the time.
- I Longer matching hold time will provide a significant stability after the breaker is closed.
- I Shorter match hold time reduces the time taken by the unit to synchronize.

CB Closing time

- I The inherent breaker closing time corresponds to the lead time for the controller to issue a closing command.
- I Accurate setting so that the two power supply parallel smooth.

Dead bus closure

- I When setting "Yes", if the voltage of the public busbar detected by the controller is lower than the set value, the closing command can be issued;
- I When setting "No", only meet all the conditions of synchronization, then can issue a closing command.

Dead bus Max.volt

- I Used to define the maximum voltage of the public busbar when the electrical busbar closing function is active.

ECU SA

I When using J1939 speed adjustment according to the different ECU type set the correct address, as shown in the following table part:

ECU type	Cummins CM570	Scania S6	Deutz EMR2	Volvo EMS2	MTU ADEC	Woodward
Source address	7	39	3	17	128	234
ECU type	YCECU					
Source address	3					

7.10 Real load control

No.	Parameter	Setting range	Preset
10.0	QUIT		
10.1	Load control mode	Balanced / fixed	Balanced
10.2	Fixed load level	1 to 100%	50%
10.3	Load control gain	0.1 to 20.0	3.0
10.4	Proportional gain	0.1 to 100.0	2.0
10.5	Integral time	0.1 to 100.0	5.0S
10.6	Derivative time	0.0 to 100.0	0.0S
10.7	Deadband	0.01 to 9.99Hz / not used	0.10Hz
10.8	Time pulse minimum	0.1 to 2.0S	0.5S
10.9	Unload trip	1 to 100%	2%
10.10	Load control droop	0.0 to 10.0%	0.0%
10.11	Load time	1 to 300S	30S
10.12	Unload time	1 to 300S	30S
10.13	Speed raise rate	1 to 100%/S	2%/S
10.14	Speed lower rate	1 to 100%/S	2%/S
10.15	Real load high limit	10 to 150%	100%
10.16	Upper Freq. limit	45.0 to 65.0HZ	53.0HZ
10.17	Lower Freq. limit	45.0 to 65.0HZ	49.0HZ
10.18	S-Bias start value	-10.0 to 10.0V	3.0V
10.19	S-Bias output range	-20.0 to +20.0V	3.0V
10.20	S-Bias control range	0.1 to 20.0% / not used	5.0%
10.21	auto setup		

Menu descriptions:

Load control mode

- I When the parameter is set to "balance" the breaker is closing and the generator is balanced share the load together with other parallel generator; the parameter is set to "fixed", the generator will always output a constant active power when the breaker is closing.

Fixed load level

- I Used to define the size of the constant active power output when the controller selects "fixed" load control mode.

Load control gain

- I This parameter is set according to the speed control module load control drop characteristics of the correct input, this data affects the speed of the synchronous.

Proportional gain

- I Used to define the P part of the PID controller parameters.
- I Increasing the proportional gain will increase the response range of the speed control, the greater the response to the target range adjustment, the greater the speed error will be. If the parameter setting is too large, it may cause overshoot.

Integral time

- I Used to define the I part of the PID controller parameters.
- I Integral time automatically corrects any offset, smooth control. The integral time constant must be greater than the derivative time constant. If the integration time constant is too large, the unit will oscillate continuously; if too small, the crew takes a long time to enter the steady state.

Derivative time

- I Used to define the D part parameter of the PID controller.
- I By increasing this parameter value, the stability of the speed control system increases.

Deadband

- I The error of the generator's frequency or load and preset value (theoretical calculation value) is within the range of this parameter, and the controller does not output the speed control signal.

**NOTE:**

- I During the normal operation of the synchronizer, the generator frequency and the busbar frequency error are within the range of the "dead zone" setting value, the duration is over 20 seconds without issuing the closing command, the controller will auto Speed control and increase the error value.

Time pulse minimum

- I Used to define the minimum maintenance time for the speed control signal output, when the controller to choose "relay" frequency control mode, taht the minimum closing time of the speed control relay.

Unload trip

- I Defines the active power value of the load when the controller issues opening command during the unloading process.

Load control drop

- I Defines the magnitude of the rated speed drop at rated load.
- I In the same system parallel operation of the generator speed control operation, you must use the drop characteristic curve. Each generator of the system requires the same value to set the drop curve so that when the system is stable, all generators will distribute the active power in proportion to their rated active power.

Load time

- I Define the time required for the generator from unload to rated load.
- I This parameter mainly affects the loading process after closing and is not valid after normal operation.

Unload time

- I Define the time required for the generator from full load to unload.
- I This parameter mainly affects the speed of unloading in the uninstal process and is not valid after normal operation.

Speed raise rate

- I When a switch of the controller is preset to "raise speed", this parameter is used to define the ratio of the load speed and the switching active time.

Speed lower rate

- I When a switch of the controller is preset to " lower speed", this parameter is used to define the ratio of the unload speed and the switching active time.

Real load high limit

- I Defines the active power value of the generator at any time at maximum load.

Upper Freq. limit

- I Defines the high limit of frequency variation during normal load.

Lower Freq. limit

- I Defines the lower limit of frequency variation during normal load.

S-Bias start value

- I Used to set the controller to control the start voltage of the analog output.
- I When the controller on the power supply, the speed control analog output remains at the set start value. When the safety monitoring time is stopped and the generator voltage and frequency are respectively reach to the setting load voltage and load frequency, the controller starts according to the measured frequency, load and setting parameter comparison, and then output the adjusted speed offset voltage signal.

S-Bias output range

- I Used to define the speed offset voltage signal to the speed of the bias voltage range set by the starting voltage value as the center of the two sides of the range.
- I The positive and negative values of the parameters, when the positive value, the voltage output and the generator frequency or active power is proportional; when negative, the voltage output and the generator frequency or active power is inversely proportional.

S-Bias control range

- I Used to define the range in which the speed can be controlled on the basis of the "speed bias start value" according to the "S-Bias control range" setting value.

7.11 Reactive load control

No.	Parameter	Setting range	Preset
11.0	QUIT		
11.1	Load control mode	0 balance / 1 fixed	Balanced
11.2	VAR/PF mode	0VAR /1PF	VAR
11.3	Fixed PF level	-0.99 to +1.00	1.00
11.4	Fixed VAR level	1 to 100%	10%
11.5	Load control gain	0.1 to 20.0	3.0
11.6	Proportional gain	0.1 to 100.0	2.0
11.7	Integral time	0.1 to 100.0	5.0S
11.8	Derivative time	0.0 to 100.0	0.0S
11.9	Deadband	0.1 to 9.9% / not used	0.5%
11.10	Time pulse minimum	0.1 to 2.0S	0.5S
11.11	Volt droop	0.0 to 20.0%	0.0 %
11.12	Raise rate	1 to 100%/S	2%/S
11.13	Lower rate	1 to 100%/S	2%/S
11.14	Reactive load high limit	10 to 150%	100%
11.15	Upper volt limit	90 to 120%	115%
11.16	Lower volt limit	90 to 120%	95%
11.17	V-Bias start value	-10.0 to +10.0V	0.0V
11.18	V-Bias output range	-20.0 to +20.0V	3.0V
11.19	V-Bias control range	0.1 to 20.0% / not used	5.0%
11.20	auto setup		

Menu descriptions:

Load control mode

- I When the parameter is set to "balance" the breaker is closing and the generator is balanced share the load together with other parallel generator; the parameter is set to "fixed", the generator will always output a constant reactive power when the breaker is closing.

VAR/PF mode

I VAR control

In the "balanced" load control mode, the parallel of the unit with its rated reactive power prevail, the reactive load is distributed by the same percentage.

In the "fixed" load control mode, the generator always outputs a constant reactive power.

I PF control

In the "balanced" load control mode, the parallel of the units distributed the reactive power with the same power factor.

In the "fixed" load control mode, the generator is always loaded with a constant power factor.

Fixed PF level

- I Used to define the outputs constant power factor when the controller selects "fixed" load control mode and PF mode.

Fixed VAR level

- I Used to define the outputs constant reactive power when the controller selects "fixed" load control mode and VAR mode

Load control gain

- I This parameter is set according to the speed control module load control drop characteristics of the correct input, this data affects the speed of the synchronous.

Proportional gain

- I Used to define the P part of the PID controller parameters.
- I Increasing the proportional gain will increase the response range of the PF/VAR control, the greater the response to the target range adjustment, the greater the PF/VAR error will be. If the parameter setting is too large, it may cause overshoot.

Integral time

- I Used to define the I part of the PID controller parameters.
- I Integral time automatically corrects any offset, smooth control. The integral time constant must be greater than the derivative time constant. If the integration time constant is too large, the unit will oscillate continuously; if too small, the crew takes a long time to enter the steady state.

Derivative time

- I Used to define the D part parameter of the PID controller.
- I By increasing this parameter value, the stability of the PF/VAR control system increases.

Deadband

- I The error of the generator's PF/VAR and preset value (theoretical calculation value) is within the range of this parameter, and the controller does not output the voltage control signal.

Time pulse minimum

- I Used to define the minimum maintenance time for the voltage control signal output, when the controller to choose "relay" frequency control mode, that the minimum closing time of the voltage control relay.

Volt drop

- I Defines the magnitude of the rated voltage drop at rated load.
- I In the same system parallel operation of the generator PF/VAR control operation, you must use the drop characteristic curve. Each generator of the system requires the same value to set the drop curve so that when the system is stable; all generators will distribute the reactive power in proportion to their rated reactive power, or distribute the reactive load with an equivalent power factor.

Raise rate

- I When a switch of the controller is preset to "raise voltage ", this parameter is used to define the ratio of the load speed and the switching active time.

Lower rate

- I When a switch of the controller is preset to "lower voltage ", this parameter is used to define the ratio of the unload speed and the switching active time.

Reactive load high limit

- I Defines the reactive power value of the generator at any time at maximum load.

Upper volt limit

- I Defines the high limit of frequency variation during normal load.

Lower volt limit

- I Defines the lower limit of frequency variation during normal load.

V-Bias start value

- I Used to set the controller to control the start voltage of the analog output.
- I When the controller on the power supply, the speed control analog output remains at the set start value. When the safety monitoring time is stopped and the generator voltage and frequency are respectively reach to the setting load voltage and load frequency, the controller starts according to the measured frequency, load and setting parameter comparison, and then output the adjusted speed offset voltage signal.

V-Bias output range

- I Used to define the speed offset voltage signal to the voltage of the bias voltage range set by the starting voltage value as the center of the two sides of the range.
- I The positive and negative values of the parameters, when the positive value, the voltage output and the generator frequency or active power is proportional; when negative, the voltage output and the generator frequency or reactive power is inversely proportional.

V-Bias control range

- I Used to define the range in which the speed can be controlled on the basis of the "voltage bias start value" according to the "V-Bias control range" setting value.

7.12 Configure Auto sequence

No.	Parameter	Setting range	Preset
12.0	QUIT		
12.1	Device number	1 to 16	1
12.2	Device priority	1 to 16	1
12.3	Number of network	1 to 16	1
12.4	MUC monitoring	N / Y	No
12.5	MUC ALM class	0 to 6	2
12.6	Auto sequencing	N / Y	No
12.7	Auto sequence delay	1 to 3600S /not used	5S
12.8	Minimum running time	1 to 3600S /not used	not used
12.9	Remote stop delay	1 to 3600S /not used	not used
12.10	Max. generator load	0 to 100%	78%
12.11	Min. generator load	0 to 100%	30%
12.12	Add on delay	0 to 3600S	30S
12.13	Add on delay at rated load	0 to 3600S	5S
12.14	Add off delay	0 to 3600S	60S
12.15	Starting option	All / stand-alone	ALL
12.16	SYNC and Load control	Manual / Auto	AUTO

Menu descriptions:**Device number**

- I In the same multi-device communication network (CANBUS) system, each unit controller has a unique device number.
- I In the same multi-device communication network (CANBUS) system, up to 16 units.

Device priority

- I In the same multi-device communication network (CANBUS) system, each unit controller has a unique priority.
- I Small digital value has a higher priority than big digital value.

Number of network

- I Defines the number of unit controllers in the same multi-device communication network (CANBUS) system.

MUC monitoring

- I When the parameter is set to "Yes", the controller checks the other controllers on the multi-device communication network. If the number of discovered devices is less than the number of "network devices", the controller warns or fault.
- I When the parameter is set to "No", the controller does not check the number of controllers on the multi-device communication network.

MUC ALM class

- I When the multi-device network monitoring function is valid, if the multi-device communication network is found to be less than the number of "network devices", if selected A1 / A2 / A3 alarm level and the protection function is triggered, the LCD screen displays "!W: multi-device network monitoring; If select B1 / B2 / B3 alarm level, the protection function is triggered, the LCD screen displays "!A: multi-device network monitoring".

Auto sequencing

- I Selecting the automatic sequencing function of the controller is valid or invalid.。
- I Automatic operation mode is a prerequisite for automatic sequencing.

Auto sequence delay

- I When the remote signal is active and the voltage of the public busbar is detected higher than the setting value of "no electrical busbar maximum voltage".
- I This time ensures that all the generating units on the same network have sufficient time to synchronize and close the power supply, so that before the system automatically sequence the system load to a steady state.
- I Only in automatic sequence is active.

Minimum running time

- I If the unit is running through the automatic sequence function, it continues to run for at least this time.。
- I This timer starts after the GCB switch is closed.。

Remote stop delay

- I When the remote signal is invalid, the timer starts, all the unit normal operation during the time, after the timer stop, GCB switch opening, unit cooling shutdown.

Max. generator load

- I Defines the level of active load for automatic sequencing units.
- I When all on the same network, in automatic conditions, the percentage of the active load on all units of the circuit breaker closing in the load sharing control mode is higher than this limit, and the unit will be put on the line delay time and ready to add on.

Min. generator load

- I Defines the level of the active load that the automatic sequencer cuts out;
- I When all on the same network, in automatic conditions, the percentage of the active load on all units of the circuit breaker closing in the load sharing control mode is lower than this limit, and the unit will be put on the line delay time and ready to add off.

Add on delay

- I Define the add on condition to match the confirmation time for the unit to start the run.

Add on delay at rated load

- I When all on the same network, in automatic conditions, lthe percentage of the active load on all units of the circuit breaker closing in the load sharing control mode is higher than the rated active power, "add on delay" set the time is invalid, the add on delay start, ready to go add on.
- I "Add on delay of rated load" is shorter than "add on delay", otherwise, "add on delay of rated load" setting is invalid.

Add off delay

- I Define the add off condition to match the confirmation time for the unit to stop the run.

Starting options

- I This parameter is valid when Auto sequence is set to "Yes".
- I When "all" is selected: When the power remote is valid, all the online units are activated and synchronized load. Then, according to the size of the load, the unit will be shut down in sequence;
- I When "stand-alone" is selected: when the power remote is valid, the highest priority genset to start running, synchronized with load, and then according to the size of the load, determine the unit in sequence on the line with the load;

SYNC and Load control

- I Used to define the controller in the manual control mode, the synchronization and load control mode.
- I When "manual" is selected, the gensets are operated and controlled by the keys on the controller panel or the corresponding switch to control the raise/lower speed and the raise/lower speed , closing/opening and load/unload of closing.
- I When "Auto" is selected, the controller automatically synchronizes and automatically loads after the generator is running.

7.13 Send SMS

No.	Parameter	Setting range	Preset
13.0	QUIT		
13.1	Telephone 1 NO.	000000000000 / Not used	Not used
13.2	Telephone 2 NO.	000000000000 / Not used	Not used
13.3	Telephone 3 NO.	000000000000 / Not used	Not used
13.4	Power up SMS	0 N/1 Y	0
13.5	Engine start SMS	0 N/1 Y	0
13.6	Engine stop SMS	0 N/1 Y	0
13.7	Warn reset SMS	0 N/1 Y	0
13.8	Alarm reset SMS	0 N/1 Y	0
13.9	F-pump ON SMS	0 N/1 Y	0
13.10	F-pump OFF SMS	0 N/1 Y	0
13.11	Shutdown alarm SMS	0 N/1 Y	1
13.12	Warn SMS	0 N/1 Y	1
13.13	Maintenance SMS	0 N/1 Y	0
13.14	Alarms SMS count	1 to 999 times	3
13.15	Alarms SMS period	1 to 999 min	5
13.16	Warn SMS count	1 to 999 times	3
13.17	Warn SMS period	1 to 999 min	5

Menu descriptions:**Telephone 1 NO.**

- I Used to define the mobile phone number which the Text Message will be sent to.
- I There are total 3 mobile phone numbers can be configured.

Telephone 2 NO.

- I With the above.

Telephone 3 NO.

- I With the above.

Power up SMS

- I Used to define the controller in the power-on operation, whether need to SMS to inform changes of state.
- I When the parameter is set to "Yes", the controller is connected to working power, control GPRS module send SMS to inform this state change; When the parameter is set to "No", the controller is connected to working power, not control the GPRS module send to SMS..

Engine start SMS

- I Used to define the controller in the engine start command is issued, whether need to SMS to inform changes of state.
- I When the parameter is set to "Yes", the controller in the engine start command is issued, control GPRS module send SMS to inform this state change; When the parameter is set to "No", controller in the engine start command is issued, not control the GPRS module to send SMS.

Engine stop SMS

- I Used to define the controller in the engine stop command is issued, whether need to SMS to inform changes of state.
- I When the parameter is set to "Yes", the controller in the engine stop command is issued, control GPRS module send SMS to inform this state change; When the parameter is set to "No", controller in the engine stop command is issued, not control the GPRS module to send SMS.

Warn reset SMS

- I Used to define the controller to warning status return to normal, whether need to SMS to inform changes of state.
- I When the parameter is set to "Yes", the controller in the warning status return to normal, control GPRS module send SMS to inform this state change; When the parameter is set to "No", controller in the warning status return to normal, not control the GPRS module to send SMS.

Alarm reset SMS

- I Used to define the controller to shutdown fault status return to normal, whether need to SMS to inform changes of state.
- I When the parameter is set to "Yes", the controller in the shutdown fault status return to normal, control GPRS module send SMS to inform this state change; When the parameter is set to "No", controller in the shutdown fault status return to normal, not control the GPRS module to send SMS.

F-pump ON SMS

- I Used to define the controller in a defined as pump control relay closure outputs, whether need to SMS to inform changes of state.
- I When the parameter is set to "Yes", the controller in a defined as pump control relay closure outputs, control GPRS module send SMS to inform this state change; When the parameter is set to "No", controller in a defined as pump control relay closure outputs, not control the GPRS module to send SMS.

F-pump OFF SMS

- I Used to define the controller in a defined as pump control relay from closure become open outputs, whether need to SMS to inform changes of state.
- I When the parameter is set to "Yes", the controller in a defined as pump control relay from closure become open outputs, control GPRS module send SMS to inform this state change; When the parameter is set to "No", controller in a defined as pump control relay from closure become open outputs, not control the GPRS module to send SMS.

Shutdown alarm SMS

- I Used to define the controller in shutdown failure occurred, whether need to SMS to inform changes of state.
- I When the parameter is set to "Yes", the controller in shutdown failure occurred, control GPRS module send SMS to inform this state change; When the parameter is set to "No", controller in shutdown failure occurred, not control the GPRS module to send SMS.

Warn SMS

- I Used to define the controller in warning occurred, whether need to SMS to inform changes of state.
- I When the parameter is set to "Yes", the controller in warning occurred, control GPRS module send SMS to inform this state change; When the parameter is set to "No", controller in warning occurred, not control the GPRS module to send SMS

Maintenance SMS

- I sed to define the controller in trigger the maintenance alarm limit protection, whether need to SMS to inform changes of state.

Alarms SMS count

- I Used to define the controller in shutdown fault occurred , the number of times message send.

Alarms SMS period

- I Used to define the controller in shutdown fault, the time interval of per twice message send.
- I When the shutdown fault counts parameter is set to "1", this parameter is useless.

Warn SMS count

- I Used to define the controller in warning occurred , the number of times message send.

Warn SMS period

- I Used to define the controller in warning, the time interval of per twice message send.
- I When the warning message counts parameter is set to "1", this parameter is useless.

7.14 CALIBRATION

No.	Parameter	Setting range	Preset
14.0	QUIT		
14.1	GEN. V1 offset	-9.9% to 9.9%	
14.2	GEN. V2 offset	-9.9% to 9.9%	
14.3	GEN. V3 offset	-9.9% to 9.9%	
14.4	Current I1 offset	-9.9% to 9.9%	
14.5	Current I2 offset	-9.9% to 9.9%	
14.6	Current I3 offset	-9.9% to 9.9%	
14.7	Busbar V1 offset	-9.9% to 9.9%	
14.8	Busbar V2 offset	-9.9% to 9.9%	
14.9	Busbar V3 offset	-9.9% to 9.9%	
14.10	Pressure offset	-9.9% to 9.9%	
14.11	Temperature offset	-9.9% to 9.9%	
14.12	Fuel level offset	-9.9% to 9.9%	
14.13	Batt. V offset	-9.9% to 9.9%	
14.14	AUX. sensor1 offset	-9.9% to 9.9%	
14.15	AUX. sensor2 offset	-9.9% to 9.9%	

Menu descriptions:**GEN. V1 offset**

- I Used to modify the measured value of GEN Phase 1 voltage.
- I Reference to the Rated ph-voltage.

GEN. V2 offset

- I Used to modify the measured value of GEN Phase 2 voltage.
- I Reference to the Rated ph-voltage.

GEN. V3 offset

- I Used to modify the measured value of GEN Phase 3 voltage.
- I Reference to the Rated ph-voltage.

Current I1 offset

- I Used to modify the measured value of Phase 1 current.
- I Reference to the Rated current.

Current I2 offset

- I Used to modify the measured value of Phase 2 current.
- I Reference to the Rated current.

Current I3 offset

- I Used to modify the measured value of Phase 3 current.
- I Reference to the Rated current.

Busber V1 offset

- I Used to modify the measured value of Mains V1 voltage.
- I Reference to the Rated ph-voltage.

Busber V2 offset

- I Used to modify the measured value of Mains V2 voltage.
- I Reference to the Rated ph-voltage.

Busber V3 offset

- I Used to modify the measured value of Mains V3 voltage.
- I Reference to the Rated ph-voltage.

ressure offset

- I Used to modify the measured value of LOP sensor.

Temperature offset

- I Used to modify the measured value of HET sensor.

Fuel sensor offset

- I Used to modify the measured value of fuel sensor.

Batt. V offset

- I Used to modify the measured value of battery voltage.

AUX. sensor1 offset

- I Used to modify the measured value of auxiliary sensor #1.

AUX. sensor2 offset

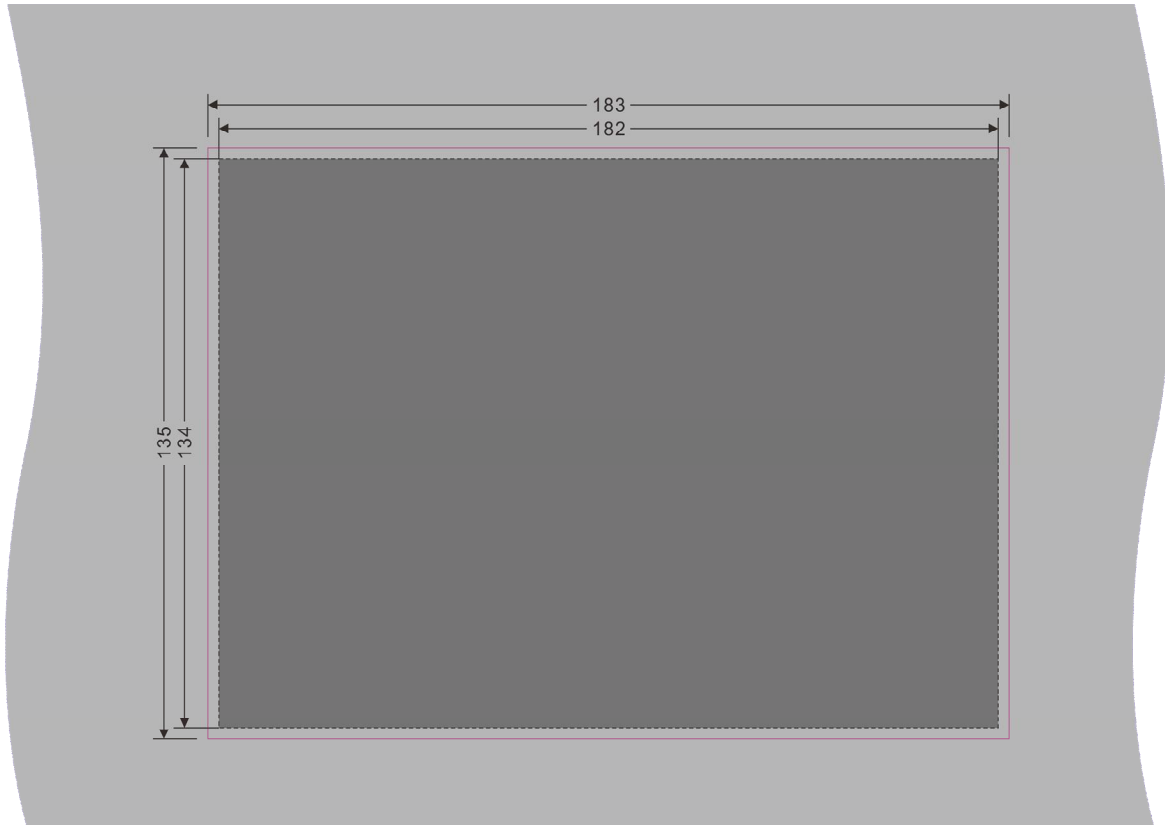
- I Used to modify the measured value of auxiliary sensor #2.

**NOTE:**

- I This parameter is only GM862 has.

8. Installation Guide

8.1 The cutout dimensional drawing installed on panel as follows:




Cutout dimension: 183mm(W) *135mm(H) . Dashed box dimensions for the controller.
The controller is fixed by 4 special fittings.


**NOTE:**

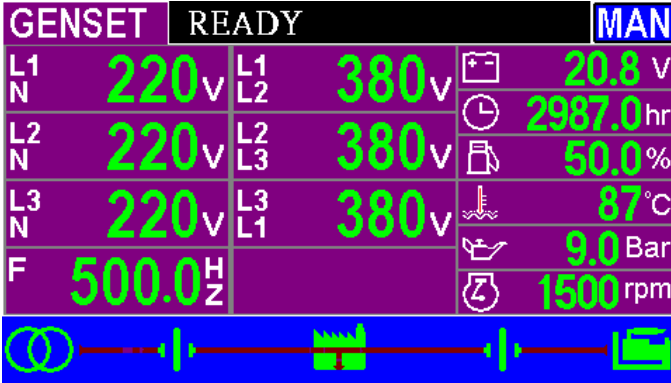
- I If the installation of the controller installed directly on the chassis of the generator or other violent vibration of the device, must be installed shock absorber.
- I To ensure that the degree of protection of the installation controller is IP65, the required panel mounting hole size must be strictly enforced.

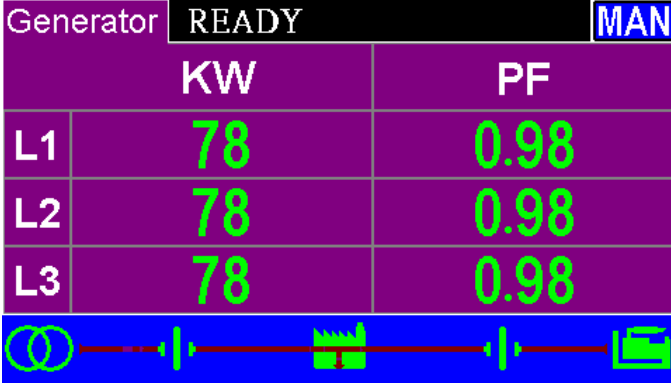
9. LCD displays and Menu System

9.1 LCD displays measuring parameters:

Use a back-light graphic LCD to display data and information. Each LCD screen can display simultaneously plurality of data, uppermost is state information, all the status data nformation displayed by multiple screens, press “” can scroll the screen to view the information, the controller can also be set to auto scroll, the timing auto switch the various display screen, when failure occurs, the LCD immediately shows the fault information in the status bar.

Frist page	Description
	<ul style="list-style-type: none"> Average line voltage Total active power Frequency Average power factor

Second page	Description
	<ul style="list-style-type: none"> Generator phase voltage, line voltage and frequency.

Third page	Description
	<ul style="list-style-type: none"> Three-phase active and power factor

Four page		Description
		<ul style="list-style-type: none"> Three-phase reactive power and apparent power
L1	0	
L2	0	0
L3	0	0

Five page		Description
		<ul style="list-style-type: none"> Total active power, total apparent power, total reactive power Average power factor
KW		
0.0		0.0
KVA		KVAr
0.0		0.0

Six page		Description
		<ul style="list-style-type: none"> Active power and reactive power
Active-Energy		
98 KWH		
Reactive-Energy		
90 KVArH		

Seven page		Description
		<ul style="list-style-type: none"> Two auxiliary sensors Number of starts
Engine		
AUX. Sensor1		AUX. Sensor2
0.0 Bar		0.0 Bar
		Number starts
		98

Eight page	Description
	<p data-bbox="1069 174 1228 212">Description</p> <ul style="list-style-type: none"> <li data-bbox="869 336 1133 369">I Maintenance data <li data-bbox="869 369 1420 459">I When the monitoring function is set to "No", the corresponding contents are not displayed

Nine page	Description
	<p data-bbox="1069 633 1228 672">Description</p> <ul style="list-style-type: none"> <li data-bbox="869 761 1420 851">I These parameters from the engine ECU, that the engine type is not set as "ECU", ECU shows automatically hidden <li data-bbox="869 851 1404 952">I Display parameters the ECU necessary support, otherwise it does not show the parameters.

Ten page	Description
	<p data-bbox="1069 1093 1228 1131">Description</p> <ul style="list-style-type: none"> <li data-bbox="869 1299 1149 1332">I Parallel information

Eleven page	Description
	<p data-bbox="1069 1552 1228 1590">Description</p> <ul style="list-style-type: none"> <li data-bbox="869 1769 1244 1803">I Convergence busber data















Twelfth page	Description
	<ul style="list-style-type: none"> Manual speed generation data interface. In non-manual mode, manual control is invalid.

Thirteen page	Description
	<ul style="list-style-type: none"> Display the D-input status of the controller The state of the relay output.

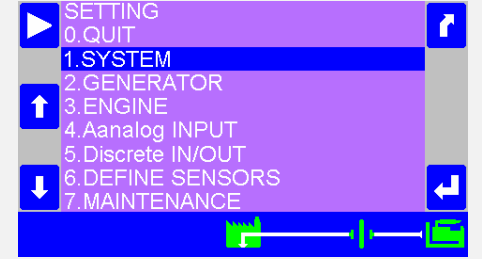



Fourteen page	Description
	<ul style="list-style-type: none"> Latest Event Log page, total of two pages

Fifteen page	Description
	<ul style="list-style-type: none"> This page displays information such as the controller version

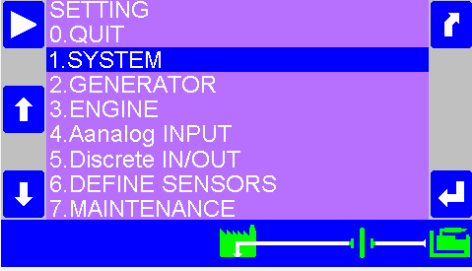
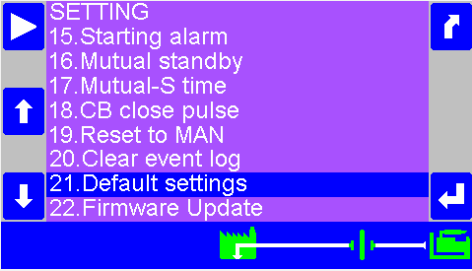
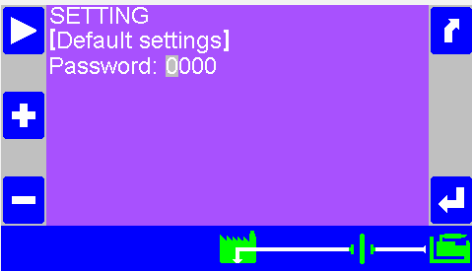
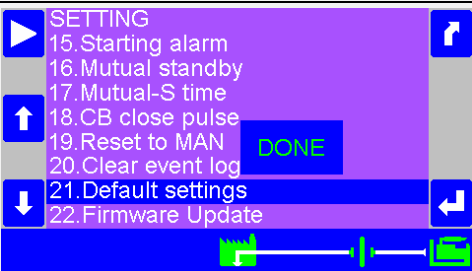
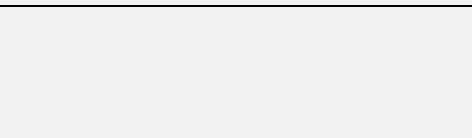
9.2 Setting running parameter

Parameter settings are modified by increment or decrement, press and hold on any page  button 2sec to enter into setting state, then press  or  to scroll page in the same menu list, press  enter into submenu, press  return to the previous menu, need to modify the parameters first enter to menu 1.2 "password" enter the permission password to modify; or select the items to be modified, press  enter to menu to modify mode, press  or  to changes, when prompted for password 0000, At this time can press  or  enter the password, press  To modify the contents of the low shift, the modified value will be displayed as "*", set the password value to 1111 and then press  confirm entry, modify the parameters. Otherwise re-prompt for a password. After changing the parameters, press and hold  for 2sec  to quit parameter settings mode.

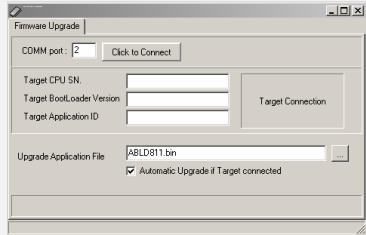
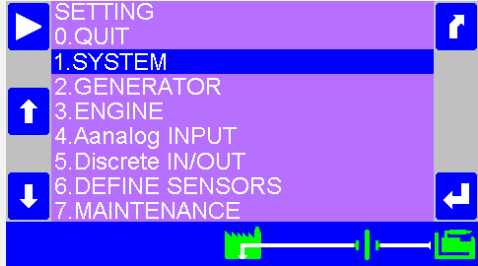
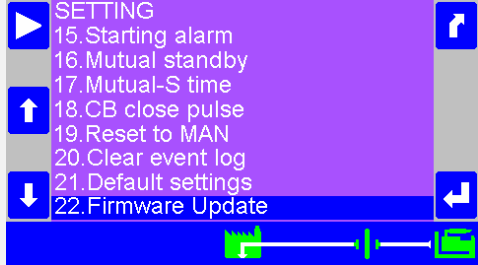
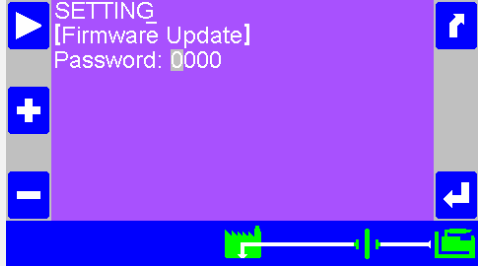
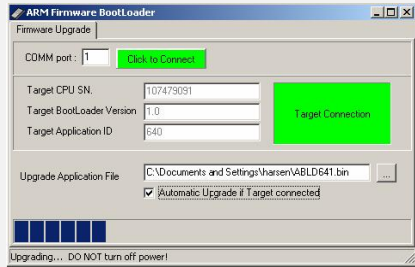
FOR EXAMPLE: (SETTING CT RATIO AT 500: 5, THEN CT SHOULD BE CONFIGURED AS 500)

Operation	Description
Press and hold  2sec, enter into parameters setting menu, then LCD displays	
Press  once, press  6 times again, then press  once, LCD displays:	
Press  or  prompted enter password, the modify password is: 1111, press  or  button to modify:	
Press  or  to change parameters, this time modified to 500, LCD then display:	
Press  to confirm, then press  button to return, or press and hold  2sec quit settings mode.	(This row does not have a corresponding screenshot as it describes the exit action.)

Example: (the parameters of the controller reverts to the factory default values)

Operation	Description
<p>Press and hold "▶" 2sec, enter into parameters settings menu, then LCD displays:</p>	
<p>Press "↵" once, then press "↑" 3 times, then LCD displays:</p>	
<p>Press "↵" button to enter, press "+" or "-" to enter password: 1111, press "▶" or "↵" to modify:</p>	
<p>Press "↵" to confirm after entering password, then LCD displays:</p>	
<p>Then press "↵" to return, or press and hold "▶" 2sec quit settings mode.</p>	

Example: (CONFIGURE CONTROLLER AS ONLINE PROGRAM MODE)

Operation	Description
<p>Open the programming software "ABLDs.exe" on your computer, such as the right to import the upgrade process, the controller connected to the computer via cable Minu USB, the computer will recognize the serial port software to fill "COMM port", but do not open the serial port, as following methods to enter programming</p>	
<p>Press and hold "▶" 2sec, enter into parameters settings menu, then LCD displays:</p>	
<p>Press "◀" once, then press "▲" 2 times, LCD displays:</p>	
<p>Press "◀" button to enter, press "+" or "-" enter password: 2222, press "▶" or "◀" to modify</p>	
<p>Press "◀" to confirm enter the programming mode, then the controller LCD disappears, later click computer software "ABLDs.exe" serial port "Click to Connect", then it will automatically upgrade. In this mode it must ensure that the normal power supply, communication line connection will not be interrupted, restart the controller to work after a successful upgrade program.</p>	

10. Technical Specification

10.1. AC voltage:

Type	True RMS
Phase voltage	15 to 346VAC
Line voltage	25 to 600VAC
Max power wastage per line	<0.1W
Accuracy	1%
Display	0 to 600KV

10.2. AC voltage frequency:

Frequency	3 to 70Hz (voltage \geq 15VAC)
Accuracy	0.1%
Display	0 to 100Hz

10.3. Current (isolated):

Measurement	True RMS
Measuring current	5A
Accuracy	1%
Display	0 to 30000A
Max power wastage per line	<0.01W

10.4. Power supply:

Voltage range	12V/24V (8-35V) continuous
Max. operating current	@12V 400mA, @24V 200mA
Max. standby current	@12V 150mA, @24V 75mA
Cranking drop outs	As before cranking voltage \geq 10V, can be maintained 50ms at 0V, after the voltage is restored, the controller can work without to install additional auxiliary power.
Accuracy	1%
Display	0 to 40V

10.5. D-input:

Quantity	8
Max. contact resistance	5K Ω
Max. contact current per line	1mA

10.6. Configurable relay outputs

Relay	16A/30Vdc, total of 2
Relay	3A/30Vdc, total of 6

10.7. Charge failure input

Voltage range	0 to 35Vdc
Accuracy	1%
Max output current	@12V 200mA , @24V 400mA

10.8. Analog Inputs

Number	4
Sensor type	Resistance
Resolution	10 bits
Range	0 to1 KΩ
Accuracy	2% When full scale, except for sensor error

10.9. Speed sensor

Voltage range	1 to 70V
Max. frequency	10000Hz
Fly wheel teeth	5 to 300

10.10. Environmental parameters

Operating ambient temperature Standards	-20 to 70°C IEC60068-2-1 和 IEC60068-2-2
Storage ambient temperature Standards	-30 to 80°C IEC60068-2-1 和 IEC60068-2-2
Humidity Standards	40°C, 93%RH, 96 hour IEC60068-2-30
Electro Magnetic compatibility (EMC) Standards	EN 61000-6-4 and EN 61000-6-2
Vibration Standards	EN 60068-2-6
Shock Standards	EN 60068-2-27
Electrical safety Standards	EN 60950-1
Degrees of protection Standards	IP65(front) IP20 (back) BS EN 60529