Harsen®

Manual

GU660A
Genset Controller

HM1023ER1

Interpretation of Symbols :

	**WARNING:** A WARNING indicates a potentially hazardous situation which, if not avoided, could result in death, serious personal injury or property damage.
	**CAUTION:** A CAUTION indicates a potentially hazardous situation which, if not avoided, could result in damage to equipment or property.
	**NOTE:** A NOTE provides other helpful information that does not fall under the warning or caution categories.

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.

CAUTION—BATTERY CHARGING
To prevent damage to a controller that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

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

Do not disassemble the rear back of controller and touch the components or conductors on a printed circuit board.

History

No.	Rev.	Date	Editor	Validation	Changes
1	HM1023ER1	2011.8.15	Chen	P.L	New

Contents

1 Description:

GU660A is a new designed sync controller with a high capability CPU, Large graphic LCD display, and easy to use front panel, to meet the higher requirements of the customer. The GU660A shares the Gensets running information via the J1939 communication port and can control maximum of 16 gensets in parallel.

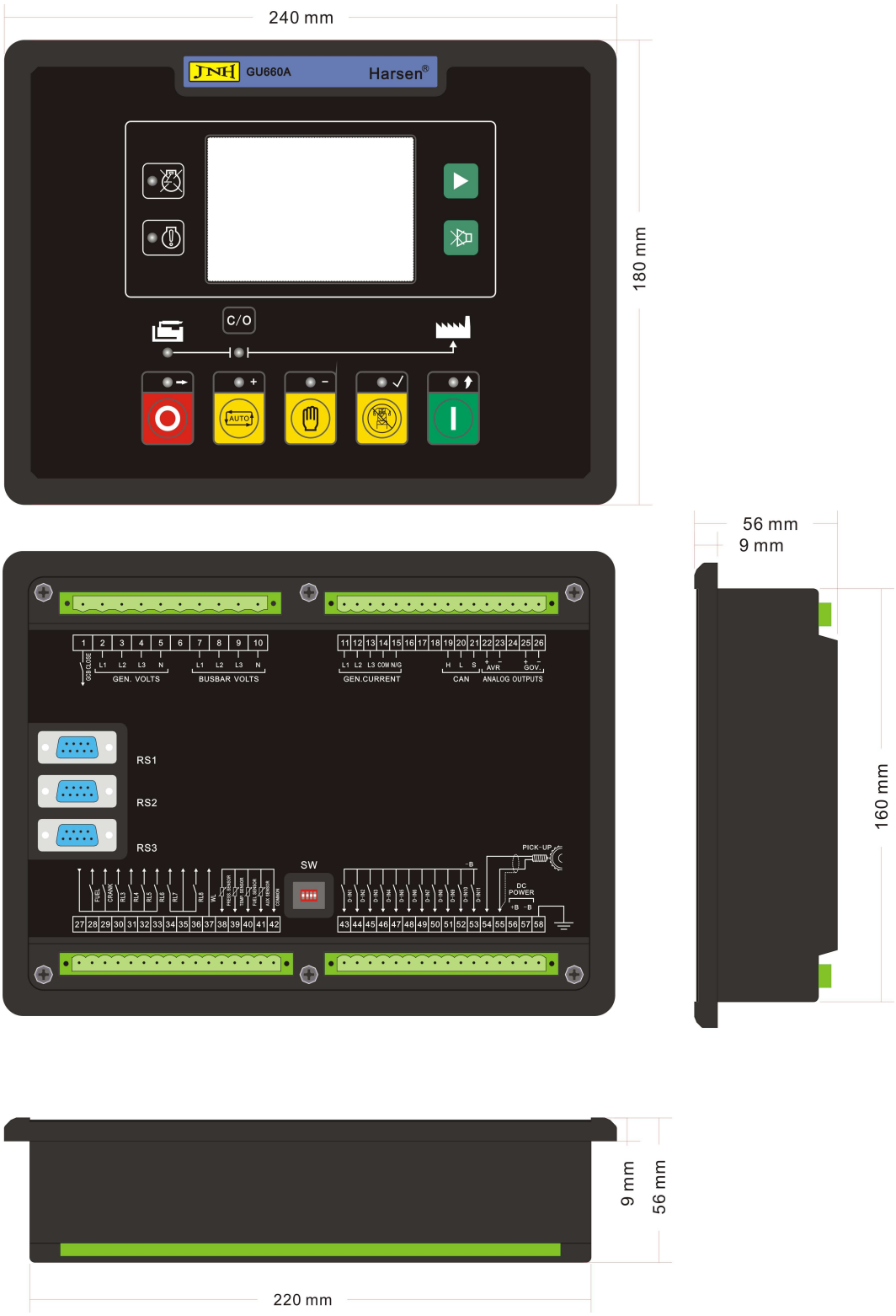
- True RMS measure of voltage and current, ensuring data is more accurate.
- 240 * 160 pixels graph large screen LCD display.
- Multi-language menu.
- With real-time calendar and clock.
- Recording operating data, status, and exceptional events.
- Exercise run schedule.
- Genset maintenance schedule.
- Optional sensors, parameters also can be configured by user.
- Max of 6 configurable auxiliary control relays outputs .
- Max of 11 configurable switch status inputs.
- 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.
- LCD display parameters and status.
- Optional CAN Bus J1939 communication port for Electronic Engines.
- With RS485, RS232 or USB port for remote monitoring and control
- All connections of the controller are by secure plug and socket, for ease and convenience to connect, move, maintain and replace the device.
- Optional ultra low temperature function, the ambient temperature is from -40 ℃ to 70 ℃.

This manual is only suitable for GU660A Automatic control module, user must carefully read this manual first.

2 The Outline Dimension Drawings and Controller Wiring:

2.1 Following Details:

Module Dimensions	W240mm×H180mm
Panel Cutout	W221mm×H161mm
Thickness	D56mm(without connection)



2.2 Terminal Connections:

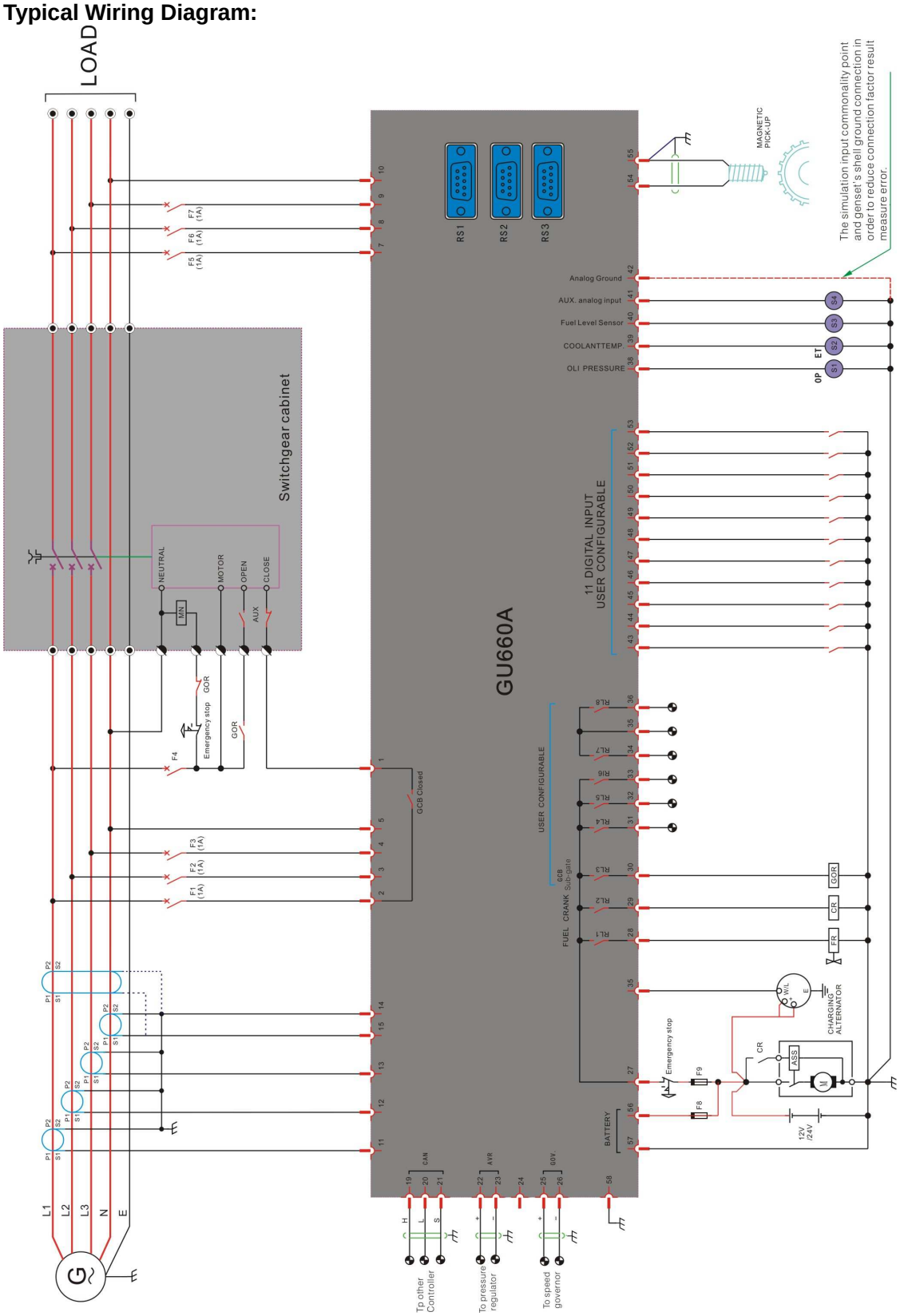
Pin no.	Function Description	Signal	Dim
1	GCB close/open	V_{L1-N} output,3A/250Vdc	1mm²
2	GEN. V_{L1-N} input	0-346Vac	1mm²
3	GEN. V_{L2-N} input	0-346Vac	1mm²
4	GEN. V_{L3-N} input	0-346Vac	1mm²
5	GEN. Neutral		1mm²
6	Not used		
7	BUSBAR V_{L1-N} input	0-346Vac	1mm²
8	BUSBAR V_{L2-N} input	0-346Vac	1mm²
9	BUSBAR V_{L3-N} input	0-346Vac	1mm²
10	BUSBAR Neutral		1mm²
11	L1 Gen current input (S1)	0-5A	2.5mm²
12	L2 Gen current input (S1)	0-5A	2.5mm²
13	L3 Gen current input (S1)	0-5A	2.5mm²
14	Comm. port for current inputs (S2)	0-5A	2.5mm²
15	Gen. Neutral/Ground current input (S1)	0-5A	2.5mm²
16	Not used		2.5mm²
17	Not used		
18	Not used		
19	CAN port H	must be connect 120Ω resistance which two side of H and L.	Twisted-pair cable
20	CAN port L		
21	CAN port S		
22	AVR output (+)		2*1mm²shielded
23	AVR output (-)		
24	Not used		
25	GOV speed output(+)		2*1mm²shielded
26	GOV speed output(-)		
27	Common port for relay outputs		2.5mm²
28	Fuel solenoid relay output	N.O. contact, 16A/30Vdc	2.5mm²
29	Start (Crank) relay output	N.O. contact, 16A/30Vdc	2.5mm²
30	Relay output 3	N.O. contact, 3A/30Vdc Relay 3	1mm²
31	Relay output 4	N.O. contact, 3A/30Vdc Relay 4	1mm²
32	Relay output 5	N.O. contact, 3A/30Vdc Relay 5	1mm²
33	Relay output 6	N.O. contact, 3A/30Vdc Relay 6	1mm²
34	Relay output 7	N.O. contact, 3A/30Vdc Relay 7	1mm²
35	Common port for relay outputs7&8		1mm²
36	Relay output 8	N.O. contact,3A/30Vdc Relay 8	1mm²
37	charger excitation power output	if not used, do not connect to negative	1mm²
38	Oil-P Monitoring	LOP sensor (<1KΩ)	2.5mm²
39	TEMP Monitoring	HET sensor (<1KΩ)	2.5mm²

40	Fuel level Monotoring	Resistance type/voltage type/current type sensor	2.5mm²
41	Auxiliary sensor input	Resistance type/voltage type/current type sensor	2.5mm²
42	Common port for sensor		2.5mm²
43	Configurable digital input signal 1	low level is active,configurable (1)	1mm²
44	Configurable digital input signal 2	low level is active,configurable (2)	1mm²
45	Configurable digital input signal 3	low level is active,configurable (3)	1mm²
46	Configurable digital input signal 4	low level is active,configurable (4)	1mm²
47	Configurable digital input signal 5	low level is active,configurable (5)	1mm²
48	Configurable digital input signal 6	low level is active,configurable (6)	1mm²
49	Configurable digital input signal 7	low level is active,configurable (7)	1mm²
50	Configurable digital input signal 8	low level is active,configurable (8)	1mm²
51	Configurable digital input signal 9	low level is active,configurable (9)	1mm²
52	Configurable digital input signal 10	low level is active,configurable (10)	1mm²
53	Configurable digital input signal 11	low level is active,configurable (11)	1mm²
54	Magnetic pick-up signal (+)	1-70Vac	2*1mm²shielded
55	Magnetic pick-up signal (-)	1-70Vac	
56	Battery supply (+B)	12V/24V (8-35Vdc continuous)	2.5mm²
57	Battery supply (-B)		2.5mm²
58	Ground		2.5mm²

NOTE:

- This only gives advice to the adopted wire diameter, you should also consider the relevant local electrical safety regulations in practical application.

2.3 Typical Wiring Diagram:



NOTE:

- Typical wiring diagram, the relay output 3 is defined as the GCB sub-gate, voltage input mode is three-phase four-wire.
- When the system is working ,usual will be installation resistances of 120Ω in the CAN bus terminal (H&L position).

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 screen with 240*160 pixels can display multi-line data at 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 illuminate, it 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 settings.

3.1 Control buttons and LEDs

Function Description	Tag
Scroll Button Scroll menu for parameters display / enter into or exit parameters setting by pressing and holding this button for 2sec.	
MUTE / Lamp Test Button When a failure occurs the alarm buzzer sounds. Pressing the mute button will mute the sound. LCD will display the mute icon. Press it again will clear the mute function, buzzer will continue to sound. Press and hold this button for 2sec, all LEDs will illuminate simultaneously.	
AUTO Mode Button / LED / "+" Value Increase The push button is used for selecting "auto mode". When the controller is running in AUTO mode, the LED above the button is illuminated. The activation and deactivation of the "remote start signal input" and "Mains Failure" controls the starting and stopping of the Genset. When in parameters setting mode, this button is used to increase value / scroll down menu.	
MAN Mode Button / LED / "-" Value Decrease The push button is used for selecting "manual mode". When the controller is running in MANUAL mode, the LED above the push button is illuminated. The Start and Stop push buttons control the starting of the Genset. When in parameters setting mode, this button is used to decrease value / scroll up menu.	
TEST Mode Button / LED / "√" Confirm Parameters Configure The push button is used for selecting "test mode". When controller is running in TEST mode, the LED above the push button is illuminated, the controller starts the Genset simulating Mains failure and the activation of "remote start signal". When in parameters setting mode, this button is used to enter into submenu / confirm modification.	

START Button / LED / Return The push button is used for manually start the Genset. When controller is running in MANUAL mode, press this button to start the Genset. When in parameters setting mode, this button is used to return.	
STOP / RESET Button / "→" Move Setting The Push button is used to manually stops the Genset. No matter what mode the controller is running, press and hold this button for 2sec to stop the Genset, the mode of the controller will be default to "MAN" mode automatically from "AUTO" or "TEST" mode and the Genset will be shut down after cool down period, during the cool down period if you press and hold this button for 2sec again, the Genset will be shut down immediately. If failure occurs, press this button, the shutdown alarm lockout can be cleared. When in parameters setting mode, this button is used to move to next parameters setting position.	
C/O Button It is used to close/open the GCB of Gen when controller is running in MANUAL mode.	
Shutdown Alarm (FAILURE) LED The LED will illuminate permanently when shutdown alarm occurs.	
Pre-alarm (WARNING) LED The LED will illuminate permanently when pre-alarm occurs.	
GEN. Normal LED Gen. normal LED will illuminate after both voltage and frequency of the Gen. reach loading voltage and frequency.	
GCB Closed LED LED will illuminate when GCB is closed and power supplied by Gen / Mains, LED will flash when GCB failure occurs.	

4 Parameter Settings

4.1 SYSTEM

NO.	Items	Value Range	Preset
1.1	Language	Chinese/ English	English
1.2	Date/ Time	YY-MM-DD HH:MM:SS	
1.3	Password	0000 to 9999	
1.4	Device number	1 to 32	1
1.5	Device priority	1 to 32	1
1.6	Number of network	1 to 32	1
1.7	MUC monitoring	0 NO/ 1 YES	NO
1.8	MUC ALM class	A1/A2/B1/B2/B3/ not used	A2
1.9	Comm. address	1 to 247	1
1.10	Engine ECU type	not used /1 to 20	not used
1.11	Startup mode	0 MAN/ 1 AUTO/ 2 the same as last time	MAN
1.12	PT Ratio	1.0:1 to 100.0:1	1.0:1
1.13	CT Ratio	5:5 to 15000:5	1000:5
1.14	Rated frequency	50/60 Hz	50 Hz
1.15	Rated ph-Voltage	45 to 15000 V	220 V
1.16	GEN. rated current	1 to 15000 A	1000 A
1.17	GEN. rated active power	1 to 16000 kW	200 kW
1.18	GEN. rated react.power	1 to 16000 Kvar	100 Kvar
1.19	Voltage input type	0 to 5	1
1.20	I4 current input	1 ground /2 neutral / not used	ground
1.21	CB close command	0 continuous/1 pulse	continuous
1.22	Auto scroll time	0 to 60S	not used
1.23	Display contrast	1 to 9	5
1.24	Test mode	0 without load / 1 with load	with load
1.25	Default settings		

Menu descriptions:

Language:

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

DATE / TIME:

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

Password:

- There are 3 levels of password (CL0/CL1/CL2) for different users.
- CL0 for the operator, who can read parameters, start and stop controller. The default setting is no password.
- CL1 for the technician, who has the authority of CL0 and can modify all parameters, the default setting is “2213”.
- CL2 for factory, who have the authority of CL1 and other permissions features（clear events log）, the default setting as “3132”.
- All passwords are automatically inactive 60 seconds after exiting menu.

Device number:
- In the same multi-device communication network (CANBUS) system, each controller has a unique device number;
- In the same multi-device communication network (CANBUS) system can have up to 32 units.

Device priority:
- In the same multi-device communication network (CANBUS) system, each controller has a unique priority;
- Low numerical values have higher priority than the numeric values .

Number of network:
- The number of the controller units, which is defined on the same multi-device communication network (CANBUS) system.

MUC monitoring:
- When the parameter is configured as "1 Yes", the controller will check other devices in the communication network, if the number of devices are found to be less than " Number of network ", the controller will warn or not work;
- When the parameter is configured as "0 No", the controller does not check for devices in the controller communication network.

MUC ALM class:
- When the multi-device network monitoring function is effective, if multi-device communication network is less than " Number of network ", such as choosing A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: MUC monitoring"; If you choose B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: MUC monitoring ".

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

Engine ECU type:
- Used to define the J1939 interface function and ECU type.
- There are several ECU types have been built in the controller.

Code	Description
1	Receive standard J1939 information
2	Standard J1939 information + specified VOLVO EMS2 information
3	Standard J1939 information + specified CUMMINS QSX15 information
4	CUMMINS(MODBUS) information

Startup mode:
- Used to configure the Startup mode of controller when it is powered up.
- When parameter is configured as “0”, the controller will be in Manual mode when it is powered up.
- When parameter is configured as “1”, the controller will be in Automatic mode when it is powered up.
- When parameter is configured as “2”, the controller will be in the mode which is the same as last time when it is powered up.

PT Ratio:
- The voltage is derived from PT on Gen.
- Used to detect frequency of Gen.
- Used to calculate for GEN or load: KVA, KW, KVAr, PF, KWhr, KVArhr.
- Used for shutdown alarm: over/under voltage, overload, etc.

CT Ratio:
- The current is derived from CT on Genset or load.
- Secondary current on CT is fixed at 5A.
- Used to calculate for GEN or load: KVA, KW, KVAr, PF, KWhr, KVArhr.
- Used for shutdown alarm: overcurrent, overload, etc.

Rated frequency:
- Used to define the power of the rated frequency;
- As the judgement of frequency limit and benchmark references of voltage measurement.

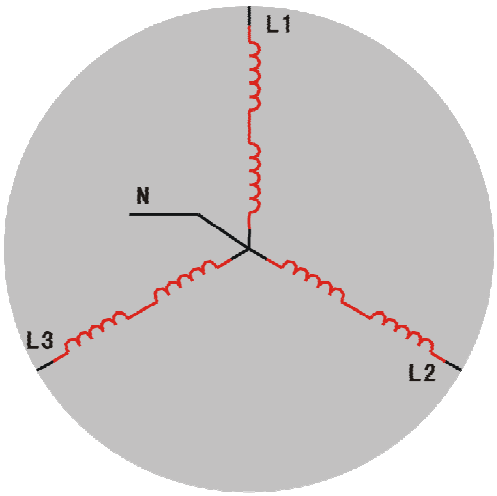
Rated ph-voltage:
- Used to define the power of the rated voltage (phase voltage), the rated line voltage = "nominal voltage" * 1.732;
- Used as the judgement of voltage limit and benchmark references of voltage control.

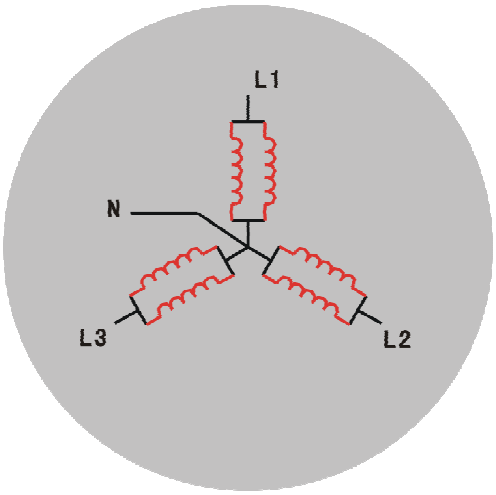
GEN. rated current:
- Definition of the Genset rated current .
- Used as benchmark references of current limit judgement.

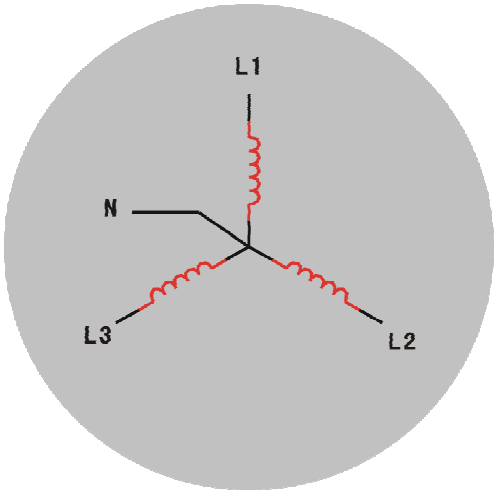
GEN. rated active power:
- Definition of the Genset rated active power
- Used as a limit to judge rated active power and benchmark references the control of rated active power.

GEN. rated react.power:
- The definition of Genset rated reactive power;
- Used as a limit to judge rated reactive power and benchmark references the control of rated reactive power.

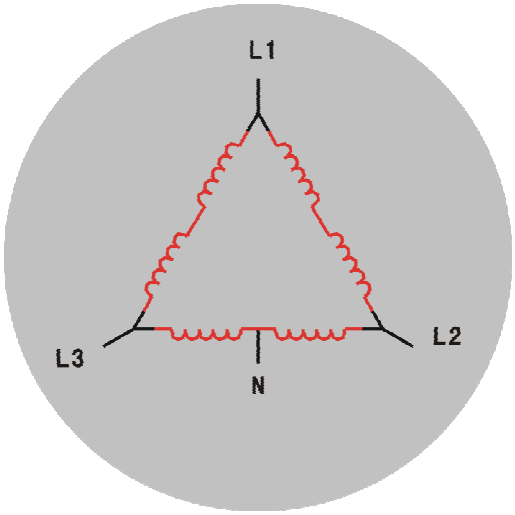
Voltage input type:
- There are 5 kinds of voltage type: “Y” 3P4W, “△” 3P4W, 3P3W, 1P3W, 1P2W.
- 1— “Y” 3P4W (3 phases 4 wires star):



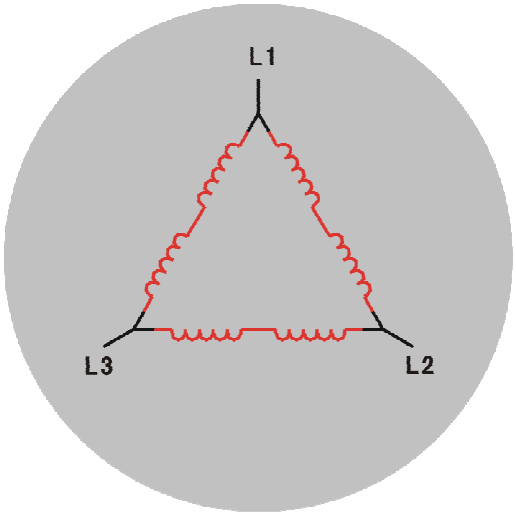


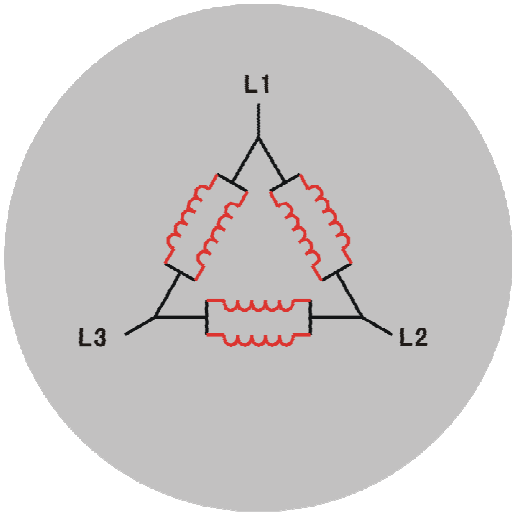


- 2—“△” 3P4W (3 phases 4 wires angle):

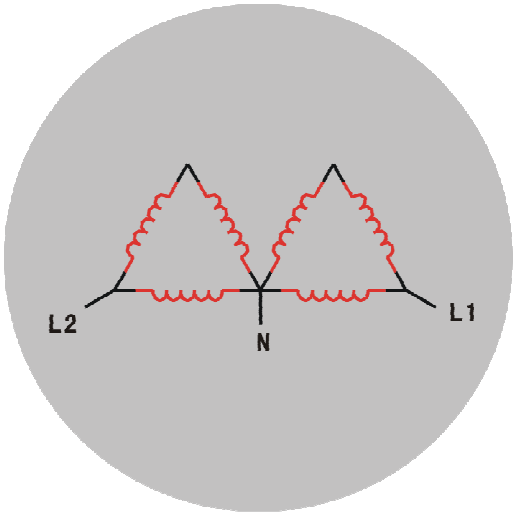


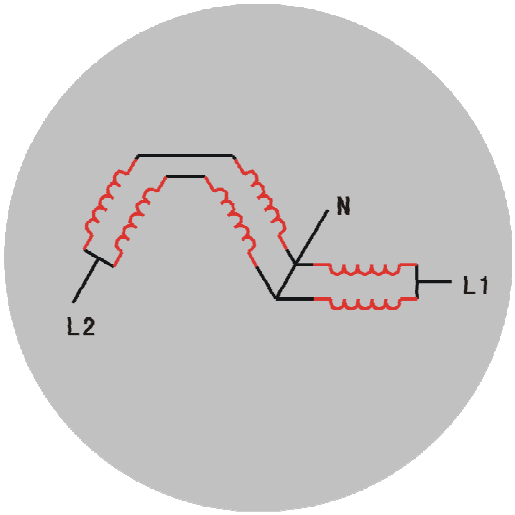
- 3— 3P3W (3 phases 3 wires):



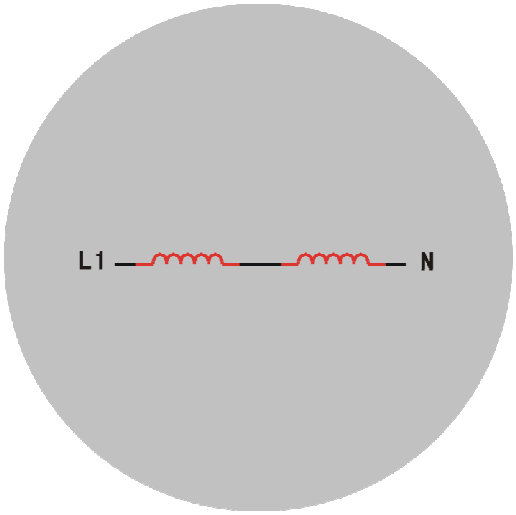


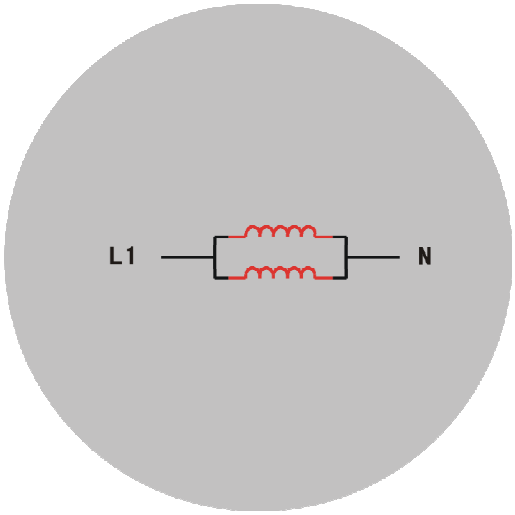
- 4— 1P3W (single phase 3 wires):





- 5— 1P2W (single phase 2 wires):





I4 current input:
- used to select the function of I4 current input;
- When you select "not used", I4 current input is invalid;
- When using the "1 ground ", I4 measure " ground " current, the measurement used to be as the basis for judging ground fault
- When using the "2 neutral ,", I4 used to measure neutral current.

CB close command:
- When the parameter is configured as "0 continuous ", the close relay of controller will continuously close output, unless there is a failure or sub-gate control command
- When the parameter is configured as "1 pulse ", the controller issues a close order, the close relay closes output, the close relay shuts down when the feedback of closed switch is effective.

Auto scroll time:
- Used to configure the cycle of page scroll.
- When parameter is configured as “not used”, manually scroll page via “▶” button.
- Will Start to scroll automatically 30 seconds after not pressing any button.

Display contrast:
- Used to adjust the display contrast of the LCD.

Test mode:
- Used to select a function of the controller in the test mode.
- There are two test modes, one is “0 without load”, to test the Genset without a load (the GCB close output will not be energised), another is “1 with load”, to test the Genset with load (the GCB close output will be energised).

Default settings:
- All parameters are resumed to default setting.

4.2 GENERATOR

NO.	Items	Value Range	Preset
2.1	**GEN-V under level1**		
	Monitoring	OFF/ON	ON
	Limit	20 to 200%	92%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
2.2	**GEN-V under level2**		
	Monitoring	OFF/ON	OFF
	Limit	20 to 200%	88%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	B1
2.3	**GEN-V over level1**		
	Monitoring	OFF/ON	ON
	Limit	20 to 200%	108%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
2.4	**GEN-V over level2**		
	Monitoring	OFF/ON	OFF
	Limit	20 to 200%	112%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	B1
2.5	**GEN-Hz under level1**		
	Monitoring	OFF/ON	ON
	Limit	10.0 to 100.0Hz	45.0Hz
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
2.6	**GEN-Hz under level2**		
	Monitoring	OFF/ON	OFF
	Limit	10.0 to 100.0Hz	42.0Hz
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	B1
2.7	**GEN-Hz over level1**		
	Monitoring	OFF/ON	1
	Limit	10.0 to 100.0Hz	55.0Hz
	Delay	1 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2

2.8	**GEN-Hz over level2**		
	Monitoring	OFF/ON	OFF
	Limit	10.0 to 100.0Hz	57.5Hz
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	B1
2.9	**GEN. Overcurrent level1**		
	Monitoring	OFF/ON	ON
	Limit	50 to 300%	110%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
2.10	**GEN. Overcurrent level2**		
	Monitoring	OFF/ON	OFF
	Limit	50 to 300%	115%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	B1
2.11	**Inverse-time overcurrent**		
	Monitoring	OFF/ Normal / Highly / Extremely	OFF
	Limit（IP）	50 to 300%	100%
	Delay（TP）	0.1 to 2.0S	1.0S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A1
	I-start	50 to 300%	100%
2.12	**Ground fault**		
	Monitoring	OFF/ON	OFF
	Limit	0 to 300%	10%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB1
	Alarm class	A1/A2/B1/B2/B3	A1
2.13	**KW Overload level1**		
	Monitoring	OFF/ON	ON
	Limit	20 to 200%	110%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
2.14	**KW Overload level2**		
	Monitoring	OFF/ON	ON
	Limit	20 to 200%	120%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	B1

2.15	**Reverse Power level1**		
	Monitoring	OFF/ON	ON
	Limit	-99 to 0%	-3%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
2.16	**Reverse Power level2**		
	Monitoring	OFF/ON	ON
	Limit	-99 to 0%	-5%
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	B1
2.17	**Phase rotation**		
	Monitoring	OFF/ON	OFF
	Phase rotation	CW(+)/CCW(-)	CW
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A1
2.18	**Lagging PF**		
	Monitoring	OFF/ON	OFF
	Limit	0.00 to 1.00	+0.90
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A1
2.19	**Leading PF**		
	Monitoring	OFF/ON	OFF
	Limit	-0.01 to -0.99	-0.90
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A1
2.20	Loading Voltage	20 to 200%	90%
2.21	Loading Frequency	10.0 to 100.0Hz	48.0Hz
2.22	Loading Delay	1 to 9999S	5S

Menu descriptions:
Alarm level:
Use the following alarm level configuraten controller functions:

Alarm Level	LCD Display	Public "warn"LED illuminates Sound the alarm	Load Switch off	Shut off Genset Public "Alarm"LED illuminates
（1）A1	Yes	No	NO	No
	This warning does not interrupt operation of the equipment, does not issue a public warning, the screen displays information, the alarm content, without any other control behavior. Related events are recorded in the event recorder.			
（2）A2	Yes	Yes	NO	NO
	Warning: This warning does not interrupt operation of equipment, public "warn"LED flashes and the sounds alarm, the screen displays information of the alarm content, without any other control behavior. Related events are recorded in the event recorder.			
（3）B1	Yes	Yes	Soft Uninstalling	Cooling time
	Shutdown Alarm: Public "Alarm"LED illuminates and buzzer sounds, the controller performs the uninstall program, sub-gate, Genset cools down, the screen displays information of the alarm content and information of procedure processes.Related events are recorded in the event recorder.			
（4）B2	Yes	Yes	Immediately	Cooling time
	Shutdown Alarm: Public "Alarm"LED illuminates and buzzer sounds, the controller performs the uninstall program, sub-gate, Genset cools down, the screen displays information of the alarm content and information of procedure processes. Related events recorded in the event recorder. Reset alarm after the confirmation of the alarm condition and then you can reoperate the unit.			
（5）B3	Yes	Yes	Immediately	Immediately
	Shutdown Alarm: Public "Alarm"LED illuminates and buzzer sounds, the controller perform the uninstall program, sub-gate, Genset cools down, the screen displays information of the alarm content. Related events recorded in the event recorder. Alarm resets after the confirming the alarm condition, and then you can reoperate the unit.			

NOTE:

- A1/A2 is a warning level. Warning is non-serious fault condition, does not constitute a hazard to the Genset system temporarily, only remind the operator of paying attention to condition which does not match the requirement and solve it immediately, and ensure continuous operation of the system. The warning indicator illuminatess, alarm is not locked; the unit is non-stop when a warn occurs, the warning discharges automatically once the alarm is eliminated.
- B1/B2/B3 is Shutdown Alarm Level, after confirming the alarm, locks the alarm condition; reset button and alarm lock can be cleared when the fault is eliminated.

GEN-V under level1&2:

Controller provides two levels of low-voltage limit monitoring for users to choose for the warn, shutdown alarm and control. If you choose A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: GEN-V under level 1 " or "Warn: GEN-V under level 2 "; If you choose B1/B2/B3 alarm levels, the protection function is triggered , LCD screen displays " Alarm: GEN-V under level 1 " or " Alarm: GEN-V under level 2. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define low-voltage protection threshold. When the power voltage is at or below this threshold, and the duration exceeds the delay time, the action which alarm level is defined as triggers at once.
Delay	If GEN-V under level exceeds the set delay time, alarm level triggers the action defined; such as low voltage is higher than the voltage limit before the delay times out the delay resets time to zero.
Delay Start Point	Defined monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

GEN-V over level1&2:

Controller provides two levels of high-voltage limit monitoring for users to choose for the warn, shutdown alarm and control. If you choose A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: GEN-V over level 1 " or "Warn: GEN-V over level 2"; If you choose B1/B2/B3 alarm levels, the protection function is triggered , LCD screen displays "Alarm: GEN-V over level 1 "or "Alarm: GEN-V over level 2. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define high-voltage protection threshold. When the power voltage is at or above this threshold, and the duration exceeds the delay time, the action which alarm level is defined as triggers at once.
Delay	If GEN-V over level exceeds the set delay time, alarm level triggers the action defined; such as over voltage is lower than the voltage limit before the delay times out the delay resets time to zero.
Delay Start Point	Defined monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

GEN-Hz under level1&2:

Controller provides two levels of monitoring low-frequency limit for the user to select for the warn, shutdown alarm and control. If you choose A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: GEN-Hz under level 1 " or "Warn: GEN-Hz under level 2 "; If you choose B1/B2/B3 alarm levels, the protection function is triggered, LCD Screen displays "Alarm: GEN-Hz under level 1"or "Alarm: GEN-Hz under level 2. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define GEN- Hz under level protection threshold. When Hz is at or below this threshold and the duration exceeds the delay time, the action which the alarm level is defined as triggers at once.
Delay	If GEN-Hz under level exceeds the set value of delay time, alarm levels triggers the action defined; if frequency is higher than the frequency limit before the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over, the start effective; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

GEN-Hz over level1&2:

Controller provides two levels of high-frequency limit monitoring for users to choose for the warn, shutdown alarm and control. If you choose A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: GEN-Hz over level 1 " or "Warn: GEN-Hz over level 2 "; If you choose B1/B2/B3 alarm levels, the protection function is triggered, LCD Screen displays "Alarm: GEN-Hz over level 1"or " Alarm: GEN-Hz over level 2 "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define GEN-Hz over level protection threshold. When the power voltage is at or above this threshold, and the duration exceeds the delay time, the action which alarm level is defined as triggers at once.
Delay	If GEN-HZ over level exceeds the set value of delay time, alarm levels trigger the action defined; if frequency is lower than the limit before the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

GEN Overcurrent level1&2:

Controller provides two levels of over-current limit monitoring for users to choose for the warn, shutdown alarm and control. If you choose A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: GEN Overcurrent level 1"or"Warn: GEN Overcurrent level 2 "; If you choose B1/B2/B3 alarm levels, the protection function is triggered, LCD Screen displays "Alarm: GEN Overcurrent level 1"or " Alarm: GEN Overcurrent level 2"

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define GEN overcurrent protection threshold. When the overcurrent level is at or above this threshold and the duration exceeds the delay time, the action which alarm level is defined as triggers at once.
Delay	If Alarm: GEN overvcurrent level exceeds delay time of the set value, alarm levels trigger the action defined; if current is lower than the current limit before the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over, the start effective; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Inverse-time overcurrent:

Controller detects an overcurrent condition, the alarm which confirms the time depends on the selected trigger characteristic curve and the measured current. After the trigger in the selected characteristic curve, the greater the measured current value, the shorter the time the trigger. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Inverse-time overcurrent"; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD displays "Alarm: Inverse-time overcurrent . "

According to IEC255 standard, there are three curves:

"Normal inverse" $$t = \frac{0.14}{(I / I_P)^{0.02} - 1} * t_p\,[s]$$

"Highly inverse" $$t = \frac{13.5}{(I / I_P) - 1} * t_p\,[s]$$

"Extremely inverse" $$t = \frac{80}{(I / I_P)^{2} - 1} * t_p\,[s]$$

Variable definition: t——Trigger Timing t p——Set timer value
I——Fault current measurement I p——Set current value

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Inverse time overcurrent Tp=	Used to define the time constant of inverse time overcurrent
Inverse time overcurrent Ip=	Used to define the time constant of inverse current overcurrent
Inverse time overcurrent I-start=	Inverse-time overcurrent protection is used to define the threshold, when the gen current is lower than this threshold, the protection function is not triggered. If the set value of the threshold is lower than Ip, Ip will be used to trigger the threshold.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over, the start effective; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller do. See alarm level form for details.

Ground fault:

Controller provides a current I4 measurement input ports, which can be used for neutral current or ground current measurement, when it is used in ground current measurement, such as the value of measured current exceeds the fault the protection function is triggered. The users select for the warn, shutdown alarm and control. If you choose A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Ground fault"; If you choose B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: Ground fault. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define ground fault protection threshold. When the power voltage is at or below this threshold and the duration exceeds the delay time, the action which alarm level is defined as triggers at once.
Delay	If the ground current exceeds the set value of delay time the alarm levels triggers the action defined; if current delay is lower than the current limit before the the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

KW Overload level1&2:

Controller provides two levels of overload monitoring for users to choose for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: KW Overload level 1"or" Warn: KW Overload level 2 "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD Screen displays "Alarm: KW Overload Level 1"or "Alarm: KW Overload level 2. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	This Threshold is used to define the overload protection. When the power output is at or above the threshold assuming the time is longer than the delay time the alarm levels trigger the action defined.
Delay	If KW Overload level exceeds the set value of delay time, alarm levels trigger the action defined; if load power is lower than the current limit before the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Reverse Power level1&2:

Controller provides two levels of the reverse power monitoring for users to choose for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: reverse power level 1 " or "Warn: Reverse Power Level 2 "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD Screen displays " Alarm: Reverse Power Level 1"or "Alarm: reverse power level 2. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define the threshold of reverse power protection. When the power output is at or less than the threshold assumingthe time is longer than the delay time the alarm levels triggers the action defined.
Delay	If the load power exceeds the set value of delay time the alarm levels trigger the action defined; such as load power is lower than the current limit before the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Phase rotation:

During the period of installation, ensure that the controller's voltage input port must be correctly connected at both ends of the load if this is not done and the breakers are not synchronized, or phase rotation does not match the closure, it may result in damage of control equipment and / or damage of Genset equipment.

Voltage phase rotation is divided differently by clockwise and counterclockwise directions, clockwise for the "L1-L2-L3", to "CW" says; and counterclockwise for the "L1-L3-L2", to "CCW" said. Controller detects the phase rotation of the measured voltage, if the control sets phase rotation for clockwise and measures for counterclockwise, or sets phase rotation for counterclockwise and measures clockwise, the protection function is triggered, LCD screen displays "Alarm: phase rotation . "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Phase rotation	"0 CW" shows clockwise direction, the direction of the voltage sequence is "L1-L2-L3"; "1 CCW" shows the counter-clockwise, the direction of the voltage sequence is "L1-L3-L2".
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Lagging PF:

Controller detects the power factor of gen output, and provide a lagging (that is emotional) monitoring limits, which is for users to choose the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Lagging PF"; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: Lagging PF. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	The threshold is used to define lagging power factor protection. When gen power factor is at or behind the threshold assuming the time is longer than the delay time, alarm levels trigger the action defined.
Delay	If the gen power factor lags behind the threshold for the duration of the delay time and exceeds the set value, alarm levels trigger the action defined; if the power factor comes back within limits before the delay times out the delay time resets to zero .
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Leading PF:

Controller detects the power factor of output, and provides a leading (that is capacitive) monitoring limits which is for users to choose the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Leading PF "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: Leading PF. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define the threshold of leading power factor protection. When gen power factor is at or ahead of the threshold, sustaining time is longer than the delay time the alarm levels trigger the action defined.
Delay	If gen power facter is leading the threshold and the duration of the delay time exceeds the set value the alarm levels trigger the action defined; if the power factor lags the power factor limit before the delay times out the delay time resets to zero .
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Loading condition:

Controller detects the voltage and frequency of gen, when the voltage and frequency reach or exceed the set value of threshold at the same time andthe duration exceeds the set delay time it will allow the closeload switch to supply power.

Load Voltage	used to set the voltage threshold of power switch on power supply
Load Current	used to set the frequency threshold of power switch on power supply
Load Delay	Voltage and frequency reach or exceed the set threshold at the same time, the duration exceeds a set delay time, you can switch on power supply.

4.3 ENGINE

NO.	Items	Value Range	Preset
3.1	Engine rated speed	99 to 9999RPM	1500
3.2	MPU input	0NO/1YES	NO
3.3	Fly wheel teeth	5 to 300	120
3.4	Set pickup now		
3.5	Pair of poles	1 to 4	2
3.6	Fuel mode	0 N.C. / 1 N.O.	N.C.
3.7	Start delay	0 to 300S	10S
3.8	Crank attempts	1 to 10	3
3.9	Crank time	1 to 99S	5S
3.10	Start reset time	1 to 300S	10S
3.11	Crank cutout RPM	1 to 9999 RPM	300RPM
3.12	Crank cutout volt	1 to 100% /not used	85%
3.13	Crank cutout ALT-V	1.0 to 40.0 V /not used	not used
3.14	Crank cutout Oil-P	0.1 to 150.0 /not used	not used
3.15	Crank cutout P-Delay	1 to 60S /not used	not used
3.16	Idle time	1 to 9999S /not used	not used
3.17	Pre-heat mode	1 to 5	1
3.18	Pre-heat time	1 to 9999S /not used	3 S
3.19	Safety-on delay	0 to 600S	10 S
3.20	Cool down mode	0 full speed / 1 idle	full speed
3.21	Cool down time	0 to 9999S	300S
3.22	Stop time of engine	0 to 60S	10S
3.23	During emergency	NO/YES	NO
3.24	**Overspeed level1**		
	Monitoring	OFF/ON	ON
	Limit	1 to 9999 RPM	1850 RPM
	Delay	0 to 999S	1 S
	Delay by	DB0/DB1/DB2/DB3	DB1
	Alarm class	A1/A2/B1/B2/B3	A2
3.25	**Overspeed level2**		
	Monitoring	OFF/ON	ON
	Limit	1 to 9999 RPM	1900 RPM
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB1
	Alarm class	A1/A2/B1/B2/B3	B3
3.26	**Underspeed level1**		
	Monitoring	OFF/ON	ON
	Limit	0 to 9999 RPM	1300RPM
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2

3.27	**Underspeed level2**		
	Monitoring	OFF/ON	ON
	Limit	0 to 9999 RPM	1250 RPM
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	B1
3.28	**Start failure**		
	Monitoring	OFF/ON	ON
	Alarm class	A1/A2/B1/B2/B3	B3
3.29	**Stop failure**		
	Monitoring	OFF/ON	ON
	Alarm class	A1/A2/B1/B2/B3	A1
3.30	**Charge failure**		
	Monitoring	OFF/ON	ON
	Limit	8.0 to 42.0 V	8.0 V
	Alarm class	A1/A2/B1/B2/B3	A2
3.31	**Batt. Overvolt**		
	Monitoring	OFF/ON	ON
	Limit	1.0to 40.0 V	32.0 V
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
3.32	**Batt. Undervolt**		
	Monitoring	OFF/ON	ON
	Limit	1.0 to 40.0 V	8.0 V
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2

Menu descriptions:

Engine rated speed:

- Used to configure the Genset rated speed.
- A reference value for speed control.

MPU input:

- Used to configure whether magnetic pick-up is used or not.
- When parameter is configured as “1YES”, magnetic pick-up is used for the signal source of the engine speed. When parameter configured as “0NO”, the magnetic pick-up is not used, the engine speed is calculated from the frequency of the Genset.
- RPM = (Hz * 60) / Pair of Poles. For example: the frequency of Genset is 50Hz, when Pair of Poles configured as 2, RPM = (50*60)/2 = 1500 (RPM).

Fly wheel teeth:

- Used to configure there are how many teeth on the fly wheel.

Set pickup now:

- If user does not know the fly wheel teeth, to calculate the fly wheel teeth automatically via the measuring Gen frequency and MPU frequency.
- Fly wheel teeth = (f1 * Pair of Poles) / f2, {f1 is MPU frequency, f2 is Gen frequency}.
- Operating procedure:
  - Configure the parameter of "**MPU input**" as "0".
  - Start the Genset, choose "**Set pickup now**" from the menu after the Genset running normally, parameter is configured as "1" and then Confirm,the parameter of "fly wheel teeth" will be automatically calculated at that time.
  - Configure the parameter of "**MPU input**" as "1" to finish the setting.

NOTE:

- This function is only used for the debug of the controller.

Pair of Poles:

- Used to configure the poles of excitation winding of the alternator.
- Use to calculate the engine speed with the frequency when without MPU input.

Fuel mode:

- Used to configure the type of engine fuel valve (details refer to 5.7).
- 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:

- Used to configure the time delay from the remote start signal is active to crank output is energised.

Crank attempt:

- Used to configure how many times the controller repeat to crank the engine; this value is equal to the maximum crank times.

Crank time:

- Used to configure the maximum time permit of engine cranking.

Start reset time:

- The time between last crank and next crank.
- Engine only can be cranked again after the crank rest time has expired.

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-Delay:

- 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:

- The duration of engine idle running.
- Controller is in manual control mode, press the start button, time is calculated by idle time machine; when the test control mode is active, time is calculated by idle time machine; start delay time machine and it is over, when controller is in automatic control mode, time is calculated by idle time machine. In the idle time, the relay close output is defined as idle output, the relay recovery off state when it is over;
- When parameter is configured as “not used”, idle function is inactive.

Pre-heat mode:

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

Pre-heat time:

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

Safety-on delay:

- Used to configure the period from engine started successfully to Genset stable running.
- The protection of under speed, under voltage, under frequency, low oil pressure is disabled by the controller during safety-on time delay.

WARNING:

- As 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, or it may cause engine damage.

Cool down mode:

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

Cool down time

- The time permit for running without load before engine stop.
- 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 of engine:

- The maximum time permit for the engine stop.
- After the fuel relay output is de-energised (fuel relay output is energised for N.O. type fuel valve), fail to stop delay timer begins, when it time’s out if controller detects Genset’s voltage exceeds crank cutout voltage, or the speed exceeds crank cutout RPM, or LOP switch is open, or oil pressure exceeds crank cutout oil pressure, then stop failure occurs.
- If the fuel valve is N.O. type, the fuel relay output is de-energised after Stop delay has expired.

During emergency:

- Used to configure the external crank permit function.
- The controller shall be in MAN Mode to use this function .

Overspeed level1&2:

Controller provides two levels of speed monitoring for users to choose for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: overspeed level 1" or "Warn: overspeed level 2"; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen display "Alarm: overspeed level 1" or " Alarm: overspeed level 2."

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Threshold is used to define the overspeed protection. When the engine speed is at or above the threshold assuming time is longer than the delay time the alarm levels trigger the action defined.
Delay	If overspeed sustaining time exceeds the set value of delay time, alarm levels trigger the action defined; if the overspeed is lower than the overspeed limit before the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller do. See alarm level form for details.

Underspeed level1&2:

Controller provides two levels of underspeed monitoring for users to choose for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, such as the protection function is triggered, LCD screen displays "Warn: underspeed level 1" or "Warn: underspeed level 2"; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen display "Alarm: underspeed level 1" or " Alarm: underspeed level 2."

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Threshold is used to define underspeed protection. When the engine speed is at or below this threshold and the duration exceeds the delay time, alarm levels trigger the action defined
Delay	If underspeed sustaining time exceeds the set value of delay time, alarm levels trigger the action defined; if the underspeed is lower than the underspeed limit before the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Start failure:

If the engine starts reaches pre-set start times, and still can not run the Genset, this is start failure. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Start failure "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: Start failure. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Alarm Level	Used to define the protection triggered, what action does the controller does? See alarm level form in details. The default is that the alarm level of monitoring is B3.

Stop failure:

When the controller performs a stop command, the throttle control relay disconnects the output, the engine's timedown starts time, when it is over if the controller detects the voltage of Genset is larger than the cut voltage of crank, or faster than cut speed of crank, or the oil pressure switch is off, or greater than crank cut oil pressure, that is stop failure, If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Stop failure "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: Stop failure. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Alarm Level	Used to define the protection triggered, what action does the controller does. See alarm level form in details. The default is that the alarm level of monitoring is B3.

Charge failure:

Controller detects excitation contact voltage of auxiliary charger by "WL" port to determine whether the AC is working properly, when the detection voltage is lower than the set limit, the charge failure protection function is triggered. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Charge failure "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: Charge failure. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	The threshold is defined as charge failure protection. When the detection voltage is at or below this threshold and the duration exceeds the delay time the alarm levels trigger the action defined.
Alarm Level	Used to define the protection triggered, what action does the controller does. See alarm level form in details.

Batt. Overvolt:

Controller detects the battery voltage and provides a high-limit protection for the user to select for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Batt. Overvolt"; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: Batt. Overvolt . "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define the threshold of high-voltage protection. When the battery voltage is at or above this threshold and the duration exceeds the delay time the alarm levels trigger the action defined.
Delay	If the duration of the high voltage exceeds the set value of delay time, alarm levels trigger the action defined; If the voltage is lower than in the delay of high-voltage limit before the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Batt. Undervolt:

Controller detects the battery voltage and provides a low limit protection for the user to select for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Batt. Undervolt "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: Batt. Undervolt . "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define the threshold of low-voltage protection. When the battery voltage is at or below this threshold and the duration exceeds the delay time the alarm levels trigger the action defined.
Delay	If the duration of low voltage exceeds the set value of delay time the alarm levels trigger the action defined; If the voltage is higher than in the delay of low-voltage limit before the delay times out the delay timer resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

4.4 Configure Synchronizer

NO.	Items	Value Range	Preset
4.1	SYNC mode	0 off/1permissive/2check/3 run	run
4.2	CB hold time	0.1 to 30.0S	5.0S
4.3	CB close attempts	1 to 10	5
4.4	Reclose delay	1 to 1200S	30S
4.5	Reclose ALM class	A1/A2/B1/B2/B3	A1
4.6	SYNC time	0 to 1200S	100S
4.7	SYNC timeout ALM class	A1/A2/B1/B2/B3	A1
4.8	Voltage differential	0.5 to 20.0%	1.0%
4.9	Pos. freq. differential	0.02 to 0.49 Hz	0.18 Hz
4.10	Neg. freq. differential	-0.49 to 0.00 Hz	-0.10 Hz
4.11	Phase differential	0.0 to 10.0°	7.0°
4.12	Matching dwell time	0.0 to 60.0S	3.0S
4.13	CB Closing time	1 to 999 mS	80 mS
4.14	Dead bus closure	0NO/1YES	YES
4.15	Dead bus Max.volt	0 to 30%	10%

Menu descriptions:

SYNC mode

- used to set operation mode of Synchronizer
- When it's 0 it is Off, the synchronizer does not work;
- When it's 1 it is Permissive, the synchronizer is only as a synchronous 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 close command;
- When it's 2 it is Check , the synchronizer is only as a control device, by adjusting the speed or voltage to obtain synchronization, but synchronization conditions are met the controller will not issue orders breaker is closed;
- When it's 3 it is Run, synchronizer controls synchroniaztion and issues closed circuit breaker commands.

NOTE:

- synchronizer mode, you can define switch input to select.

CB hold time

- The maximum time is allowed between output and disconnection of closed breaker switch command, that is maintainance time of closed breaker output.
- During the output of closed breaker, if the controller receives feedback from the Genset breaker auxiliary closed switch, or if it no longer meets the synchronization condition it immediately stops closed action output.

CB close attempts

- used to set the maximum close attempts to close breaker;
- Once close condition is not available within 5 seconds, closes the attempt counter and resets to zero.

Reclose delay

- Repeated attempts time between the two close breaker attempts;
- The time is calculated from output stopping and not re-issuing a close command until the calculation is over.

Reclose ALM class:
If the number of breaker attempts reaches pre-set CB close attempts, and they did not still close or the controller did not receive effective feedback from the breaker switch this means reclose failure has occured. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Reclose ALM"; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: Reclose ALM "

SYNC time:
- Set the synchronizer's maximum work time;
- Start time when synchronization process is started;
- Parameter is configured as 0 second, the time limit is not valid simultaneously.

SYNC timeout ALM class:
If the synchronizer is within the synchronization time of the set, the circuit breaker can not be closed, that is, SYNC timeout ALM class. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Sync timeout"; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen displays "Alarm: Sync timeout";

Voltage differential:
- Define the allowable maximum voltage error between the Genset and bus;
- If the error over voltage range, controller will not send the breaker command.

Pos. freq. differential:
- Defined the allowed maximum frequency error between the Genset and bus, that is, allowing the power frequency range is higher than the bus frequency;
- If the error is more than the scope of the set the controller will not issue breaker close command.

Neg. freq. differential:
- Defined the allowed maximum negative frequency error between the Genset and the bus, that is, allowing the power frequency range is lower than the bus frequency,
- If the negative error is more than setting range the controller will not issue breaker close command.

Phase differential:
- Defined the maximum phase angle difference in the phase-matching conditions;
- If the phase angle between the bus and the Genset is over this range the controller will not issue breaker close command.

Matching dwell time:
- before the controller's close command is issued, the voltage and frequency differential and other synchronization conditions must meet dwell time;
- a longer matching dwell time will provide a remarkable stability for the close breaker switch;
- a short period of matching dwell time can reduce the time of genset's synchronization.

CB Closing time:
- the inherent circuit breaker close time corresponding to the leading time of controller issuing close command;
- Accurate setting command makes two current parallel and stabilize instantaneously.

Dead bus closure:
- When it is configured as "1 Yes", such as controller detects the voltage of public bus, which is below the set value, can issue close command.
- When it is configured as "0 No", and only meet all the conditions simultaneously it can issue close orders.

Dead bus Max.volt:
- Used to define the dead bus closure function effectively, public bus maximum voltage.

4.5 Real load control

NO.	Items	Value Range	Preset
5.1	Load control mode	0balance/1fixed	balance
5.2	Fixed load level	1 to 100%	50%
5.3	Load control gain	1 to 20	3
5.4	Proportional gain	0.1 to 100.0	10.0
5.5	Integral time	0.1 to 100.0	1.0S
5.6	Derivative time	0.0 to 100.0	1.0S
5.7	Deadband	0.02 to 9.99Hz	0.08 Hz
5.8	Time pulse minimum	0.1 to 2.0S	0.5S
5.9	Unload trip	1 to 100%	2%
5.10	Load control droop	0.0 to 10.0%	5.0%
5.11	Load time	1 to 300S	10S
5.12	Unload time	1 to 300S	10S
5.13	Speed raise rate	1 to 100%/S	2%/S
5.14	Speed lower rate	1 to 100%/S	2%/S
5.15	Real load high limit	10 to 150%	80%
5.16	Upper Freq. limit	45.0 to 65.0Hz	51.0Hz
5.17	Lower Freq. limit	45.0 to 65.0Hz	49.0Hz
5.18	S-Bias start value	-10.0 to 10.0V	3.0V
5.19	S-Bias range	-20.0 to +20.0V	3.0V

Menu descriptions:

Load control mode:

- When the parameter is configured as "0 balance", after the close breaker switched, Gensets and other parallel Gensets balance and take on the load together; when the parameter is configured as "1 fixed", the close breaker switched, the Genset always outputs constant and active power.

Fixed load level:

- Used to define the size of outputting constant and active power, when the controller selects “fixed” load control mode.

Load control gain

- This parameter setting according speed control module’s “Load control droop “ characteristic to correct input ,This data have effect on the effect of speed after parallel operation.

Proportional gain:

- used to define P part parameters of PID controller;
- Increase the proportional gain, the response will increase the range of speed control to adjust the target range, the greater the response actions, the larger timing error. If parameter is configured as large, may result in overshoot.

Integral time:

- used to define I part parameters of PID controller;
- Integration time automatically correct any offset, smooth control. Integral time constant must be greater than the derivative time constant. Such as integral time constant is too large, the unit will be a continuous oscillation; as too small, the unit takes a long time before they can enter the stable state.

Derivative time:

- used to define some D parameters of PID controller
- By increasing this value, increasing the stability of control system.

Deadband:

- The default between the frequency or load of Genset and theoretical value is this parameter range, the controller does not output down and up speed control signal.

NOTE:

- During the synchronization normal work time, the error of the Genset frequency and bus frequency is in the range of the set value of the " Deadband ", when duration is over 20 seconds and issues close breaker command, the controller adjusts speed actively.

Time pulse minimum:

- Used to define time duration minimum for adjusting control signal, that is to adjust time close minimum when the controller selects the frequency control mode of “relay”.

Unload trip:

- Defined in the uninstalling process, the controller issues a command of sub-gate and loaded value of the active power.

Load control droop:

- Defined in the rated load, the range of downward adjustment of rated speed.
- The speed control operation for the parallel operation of Genset in the same system, you must use load control droop. Each Genset in the system needs the same value to set load control droop, so that when the system is stable, all the Gensets will rate their active power and distribute active power by proportion.

Load time:

- The definition of Genset from no load to rated load time;
- After you close this parameter mainly affects the loading process, normal work is invalid.

Unload time:

- The definition of how much time does the Genset need from full load to no load;
- This parameter mainly affects the speed of unloaded in unloading process, normal work is invalid.

Speed raise rate:

- When a switch of the controller is preseted to " speed raise ", this parameter is used to define the effective ratio between the loading speed and the switch.

Speed lower rate:

- When a switch of the controller is presented to " speed lower ", this parameter is used to define the effective ratio between the loading speed and the switch.

Real load high limit:

- Define Genset’s the active power values of the maximum load at any time.

Upper Freq. limit:

- Defined in the normal load course, the change of upper frequency limit.

Lower Freq. limit:

- Defined in the normal load course, the change of lower frequency limit.

S-Bias start value:

- Used to set the controller’s speed to control analog output voltage
- After the controller is connected to the power supply, speed control analog output remains the starting value, when the safety monitoring device is over and the voltage and frequency of the Genset reach the set of load voltage and frequency, the controller will start to compare by frequency of measurement, load and the set paremeters, and then output the adjustable B-Bias voltage signal.

S-Bias range:

- Bias voltage signal takes the range on both sides of the beginning voltage center of the set of S-Bias range;
- Parameter has positive and negative value, when it is positive, the voltage output is proportional to the Genset’s frequency or active power; when it is negative, the voltage output is inversely proportional to the Genset’s frequency or active power.

4.6 Reactive load Control

NO.	Items	Value Range	Preset
6.1	Load control mode	0balance/1fixed	balance
6.2	VAR/PF mode	0 VAR/1PF	VAR
6.3	Fixed PF level	-0.99 to +1.00	1.00
6.4	Fixed VAR level	1 to 100%	10%
6.5	Load control gain	1 to 20	3
6.6	Proportional gain	0.1 to 100.0	10.0
6.7	Integral time	0.1 to 100.0	1.0S
6.8	Derivative time	0.0 to 100.0	1.0S
6.9	Deadband	0.1 to 9.9%	0.5%
6.10	Time pulse minimum	0.1 to 2.0S	0.5S
6.11	Volt droop	0.0 to 20.0%	0.0 %
6.12	Raise rate	1 to 100%/S	2%/S
6.13	Lower rate	1 to 100%/S	2%/S
6.14	Reactive load high limit	10 to 150%	80%
6.15	Upper volt limit	90 to 120%	105%
6.16	Lower volt limit	90 to 120%	95%
6.17	V-Bias start value	-10.0 to +10.0V	0.0V
6.18	V-Bias range	-20.0 to +20.0V	3.0V

Menu descriptions:

Load control mode

- When the parameter is configured as "0 balance", after the close breaker is switched the Gensets and other parallel Gensets balance and take on the load together; when the parameter is configured as "1 fixed", the close breaker switches and the Genset always outputs constant and active power.

VAR/PF mode:

- **VAR control:**In the "balance" load control mode, the juxtaposition of units subject to its reactive power rating, distribution of the reactive power load by the same percentage; In the "fixed" load control mode, the Genset always output a constant reactive power output.
- **PF control:**In the "balance" the load control mode, the parallel unit distribute reactive load by the same power factor;In the "fixed" load control mode, the Genset always load a constant power factor load.

Fixed PF level:

- The controller selects the "fixed" load control mode and the PF mode, and outputs the size of constant power factor.

Fixed VAR level:

- The controller selects the "fixed" the load control mode and the VAR mode, outputs the size of a constant reactive power.

Load control gain

- This parameter setting according voltage regulation control module's "Volt droop" characteristic to correct input ,This data have effect on the effect of speed after parallel operation.

Proportional gain:

- used to define the P part parameters of PID controller;
- increasing the proportional gain will increase the response rang of PF / VAR control, the greater the response action of adjustment to the target range is , the larger PF / VAR error will be. If parameter is configured too largethis may may result in overshoot.

Integral time:

- I used to define the I part parameters of PID controller;
- Integral time automatically corrects any offset, smooth control. Integral time constant must be greater than the differential time constant. Such as integral time constant is too large, the units will continuously oscillate, if too small the unit will take a long time before can it enter a stable state.

Derivative time:

- used to define D part parameters of PID controller
- by increasing the value of this parameter, PF / VAR control can increase the stability.

Deadband:

- Genset PF / VAR, and the pre-set value (theoretical value) of the error in this parameter range, the controller will not output a down and up speed control signal.

Time pulse minimum:

- Used to define time duration minimum of adjusting the control signal, that is to adjust time close minimum when the controller selects the frequency control mode of “relay”.

Volt droop:

- Defined in the rated load, the range of downward adjustment of rated voltage.
- The PF / VAR control operation for the parallel operation of Genset in the same system, you must use droop curve. Each Genset in the system needs the same value to set load control droop, so that when the system is stable, all the Gensets will rate their active power and distribute active power in proportion.

Raise rate:

- When a switch of the controller is presetted to " AVR up", this parameter is used to define the effective ratio between the loading voltage speed and the switch.

Lower rate:

- When a switch of the controller is preset to " AVR down ", this parameter is used to define the effective ratio between the step-down voltage speed and the switch.

Reactive load high limit:

- Define Genset’s the maximum load of reactive power values at any time.

Upper volt limit:

- defined in the normal load course, the change of the upper frequency limit.

Lower volt limit:

- defined in the normal load course, the change of the lower frequency limit.

V-Bias start value:

- Used to set the controller’s speed to control analog output voltage
- After the controller is connected to the power supply, speed control analog output remains the beginning value, when the safety monitoring device is over and the voltage and frequency of the Genset reach the set of load voltage and frequency, the controller starts to compare by frequency of measurement, load and the set paremeters, and then outputs the adjustable B-Bias voltage siganal.

V-Bias range:

- S-Bias voltage signal takes the range on both sides of the beginning voltage center of the set of V-Bias range;
- Parameters have positive and negative value, when positive, the voltage output and the Genset is proportional to the frequency or active power; when negative, the voltage output and is inversely proportional to the Genset frequency or active power.

4.7 Configure Auto sequencing

NO.	Items	Value Range	Preset
7.1	Auto sequencing	0NO/1YES	YES
7.2	Auto sequence delay	1 to 3600S /not used	30S
7.3	Minimum running time	1 to 3600S /not used	1800S
7.4	Remote stop delay	1 to 3600S /not used	not used
7.5	Max.Genset load	0 to 100%	60%
7.6	Min. Genset load	0 to 100%	30%
7.7	Add on delay	0 to 3600S	30S
7.8	Add on delay at rated load	0 to 3600S	5S
7.9	Add off delay	0 to 3600S	60S

Menu descriptions:

Auto sequencing:

- Select the controller's Auto Sequencing valid or invalid;
- Automatic operation mode is a prerequisite for automatic sequencing

Auto sequence delay:

- When the remote signal is effective and the detected public bus's voltage is higher than " Dead bus Max.volt " set value and then start timing;
- This time ensures all the genset on the same network have enough time to synchronize and close power, so the load system reaches a steady state before Auto sequence begins;.

Minimum running time:

- If the unit runs through the automatic sequence function, it continues to run for at least this amount of time;
- The timer start to work when the GCB switch is closed

Remote stop delay:

- When the remote signal fails, the timer will count down, all the units during this time work normally, GCB switch opens and the units cool down when timer is over.

Max.Genset load:

- the definition of the power load level value of Auto unit input;
- When all are on the same network, in the automatic condition, the percentage of all the units of the circuit breaker switch in the load sharing control mode is higher than this limit, then the input unit will start on the line and calculate for on-line.

Min. Genset load:

- the definition of the power load level value of Auto unit cut;
- When all is on the same network, in the automatic condition, the percentage of all the units of the circuit breaker switch in the load sharing control mode is lower than this limit, then the cut unit will start off the line and calculate for delay.

Add on delay:

- the definition of the on-line condition meets the confirmation time of unit's operation

Add on delay at rated load:

- When all in the same network are in the automatic mode and the percentage of all the units of the circuit breaker switch in the load sharing control mode is higher than the rated active power, the " Add on delay " preset is void, then the" Add on delay at rated load " start time counting and on the line .
- " Add on delay at rated load " is shorter than " Add on delay ", otherwise, " Add on delay at rated load " setting is invalid.

Add off delay:

- the definition of the add-off condition meets the confirmation time of units preparing to exit from the operation.

4.8 Analog INPUT

NO.	Items	Value Range	Preset
8.1	Pressure unit	0 Bar/1 psi	Bar
8.2	P-sensor type	1 to 15	4
8.3	**low Oil pressure level1**		
	Monitoring	OFF/ON	ON
	Limit	0.0 to 150.0 Bar/psi	1.4Bar
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
8.4	**low Oil pressure level2**		
	Monitoring	OFF/ON	ON
	Limit	0.0 to 150.0 Bar/psi	1.1Bar
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	B1
8.5	Temperature unit	0 ℃/1 ℉	℃
8.6	T-sensor type	1 to 15	3
8.7	**High temperature level1**		
	Monitoring	OFF/ON	ON
	Limit	50 to 320 ℃/℉	92℃
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
8.8	**High temperature level2**		
	Monitoring	OFF/ON	ON
	Limit	50 to 320 ℃/℉	105℃
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	B1
8.9	Coolant heater control on	-20 to 320 ℃/℉	50℃
8.10	Coolant heater control off	-20 to 320 ℃/℉	60℃
8.11	Coolant cooler control on	-20 to 320 ℃/℉	80℃
8.12	Coolant cooler control off	-20 to 320 ℃/℉	60℃
8.13	Fuel level sersor type	1 to 15	1
8.14	**Low fuel level1**		
	Monitoring	OFF/ON	ON
	Limit	0 to 100%	30
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2

8.15	**Low fuel level2**		
	Monitoring	OFF/ON	ON
	Limit	0 to 100%	10
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
8.16	Fuel pump control on	0 to 100%	20%
8.17	Fuel pump control off	0 to 100%	80%
8.18	AUX sensor use	1 Oil-P/2 temp /not used	Oil-P
8.19	AUX sensor type	1 to 15	4
8.20	**AUX Sensor low level1**		
	Monitoring	OFF/ON	OFF
	Limit	-99 to 9999	10
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
8.21	**AUX Sensor low level2**		
	Monitoring	OFF/ON	OFF
	Limit	-99 to 9999	10
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
8.22	**AUX Sensor high level1**		
	Monitoring	OFF/ON	OFF
	Limit	-99 to 9999	10
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2
8.23	**AUX Sensor high level2**		
	Monitoring	OFF/ON	OFF
	Limit	-99 to 9999	10
	Delay	0 to 999S	5S
	Delay by	DB0/DB1/DB2/DB3	DB3
	Alarm class	A1/A2/B1/B2/B3	A2

Menu descriptions:

Pressure unit:

- Used to define oil pressure unit which is displayed on the LCD.
- Transfer formula: P[psi] =P[bar]*14.503.

P-sensor type:

- Used to configure the type of LOP sensor.
- Optional kinds of built-in LOP sensors in controller.

Code	Mode	Note
1	close for low oil pressure	
2	open for low oil pressure	
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	

CAUTION:

- The LOP sensor is used to measure the oil pressure, its accuracy is very important to the protection of the Genset, so please match the right type of the sensor or configure the right curve of the senor. Otherwise it may cause engine damage.

- 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:

- "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.

Low Oil pressure level1&2:

Controller provides two levels of low oil pressure monitoring, for users to choose for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Low Oil pressure level 1 " or "Warn: Low Oil Pressure level 2 "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD Screen displays "Alarm: Low Oil Pressure level 1 "or "Alarm: Low Oil pressure level 2. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Low oil pressure protection is used to define the threshold. When the engine oil pressure is at or below this threshold and the duration exceeds the delay time the alarm levels trigger the action defined.
Delay	If the duration of the low oil pressure exceeds the set value of delay time the alarm levels trigger the action defined, if the oil pressure returns to normal levels before the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over. Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Temperature unit:

- Used to define temperature unit which is displayed on the LCD.
- Transfer formula: T[℉]=(T[℃]*1 .8)+32.

T-sensor type:

- Used to configure the type of HET sensor.
- Optional kinds of built-in HET sensors in the controller.

Code	Mode	Note
1	close for high temperature	
2	open for high temperature	
3	VDO 120℃	
4	VDO 150℃	
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:

- The HET sensor is used to measure the coolant temperature, its accuracy is very important to the protection of the Genset, so please match the right type of the sensor or configure the right curve of the senor. Otherwise it may cause engine damage.

- The parameters appendix of HET sensor:

VDO 120℃:

T(℃)	40	50	60	70	80	90	100	110	120	130	140
T(℉)	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℃:

T(℃)	50	60	70	80	90	100	110	120	130	140	150
T(℉)	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(℃)	40	50	60	70	80	90	100	110	120	130	140
T(℉)	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(℃)	40	50	60	70	80	90	100	110	120	130	140
T(℉)	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(℃)	-100	-50	0	20	40	60	80	100	150	200	300
T(℉)	-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(℃)	20	30	40	50	60	70	80	90	100	110	120
T(℉)	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(℃)	30	50	60	70	80	90	100	110	120
T(℉)	86	122	140	158	176	194	212	230	248
R(Ω)	980	400	265	180	125	90	65	50	38

Pre-set 3:

T(℃)	20	30	40	50	60	70	80	90	100	110	120
T(℉)	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(℃)	28	35	40	50	60	70	80	90	95	98
T(℉)	82	95	104	122	140	158	176	194	203	208
R(Ω)	579	404	342	250	179	136	103	77	67	63

NOTE:

- “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.

High temperature level1&2

Controller provides two levels of temperature monitoring for users to choose for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: High temperature level 1 " or "Warn: High temperature level 2 "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered, LCD screen display "Alarm: High temperature level 1 "or "Alarm: High temperature level 2. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Threshold is used to define the high-temperature protection. When the engine temperature is at or above this threshold and the duration exceeds the delay time the alarm levels trigger the action defined.
Delay	If the duration of high temperature exceeds the set the delay time the alarm levels trigger the action defined; if the temperature is lower than the high temperature limit before the delay times out the delay resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over; Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Coolant heater control

The controller provides automatic control for coolant heater of the engine, can ensure coolant's temperature of engine in a appropriate range.

Start value	when the coolant temperature is lower than this limit, the duration exceeds the delay time, the heating output starts.
Stop value	when the coolant temperature is above than this limit, the duration exceeds the delay time, the heating output stops.

Coolant cooler control:

The controller provides automatic control for coolant cooling of the engine, can ensure coolant's temperature of engine in a appropriate range.

Start value	when the coolant temperature is above than this limit, the duration exceeds the delay time, the heating output starts.
Stop value	when the coolant temperature is lower than this limit, the duration exceeds the delay time, the heating output stops.

Fuel level sersor type:

- Used to define the type of Fuel level sersor.
- Fuel level sersor type list.

Code	Type	Note
1	configurable 1	
2	configurable 2	

- Enter data according to the curve of the fuel sensor, configurable 1 only can be set through the software, configurable 2 can be set through both the push button on the front panel.

Low fuel level1&2:

Controller provides two low-level monitoring of the fuel for the user to select for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: Low fuel level 1 " or "Warn: Low fuel level 2 "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered , LCD screen displays "Alarm: Low fuel level 1"or "Alarm: Low fuel level 2. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define the threshold of Low fuel level protection. When the fuel level is at or below this threshold and the duration exceeds the delay time the alarm levels trigger the action defined.
Delay	If the duration of the low fuel level exceeds the set value of delay time the alarm levels trigger the action defined; if the fuel level is higher than low limit before the delay times out the delay resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over, Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Fuel pump control:

- The controller provides automatic control for fuel supplies of the engine, and ensures fuel level in a reasonable range.

Start value	When the fuel level is below this limit, the fuel pump starts to work.
Stop Value	When the fuel level is above this limit, the fuel pump stops working.

AUX sensor use:

- Used to define the type of AUX sensor use
- When it is configured as “Oil-P”, the port contacts pressure sensor for pressure detection and limits of protection and control; when it is configured as “temp”, the port contacts temperature sensor for temperature detection and limits of protection and control; when it is configured as “not used”, AUX sensor is invalid.

AUX sensor type:

- Used to define the type of AUX sensor
- When AUX sensor use is configured as “Oil-P”, controller would auto select the built-in list of oil pressure sensor, when AUX sensor use is configured as “temp” controller would auto select the built-in list of the temperature sensor.

AUX Sensor low level1&2:

Controller provides two levels lower limit of the auxiliary sensors to monitor, for users to choose for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: AUX Sensor low level 1 " or "Warn: AUX Sensor low level 2 "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered , LCD screen displays "Alarm: AUX Sensor low level 1"or "Alarm: AUX Sensor low level 2. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define the threshold of low protection. When the measured value is at or below this value and the duration exceeds the delay time the alarm levels trigger the action defined.
Delay	If the duration of low value exceeds the delay time set value the alarm levels trigger the action defined; if the measured value is higher than the low limit before the delay times out the delay timer resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over, Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

AUX Sensor high level1&2:

Controller provides two levels of auxiliary sensors to monitor the high limit for the user to select for the warn, shutdown alarm and control. If you choose to A1/A2 alarm levels, the protection function is triggered, LCD screen displays "Warn: AUX Sensor high level 1 " or "Warn: AUX Sensor high level 2 "; If you choose to B1/B2/B3 alarm levels, the protection function is triggered , LCD screen displays "Alarm: AUX Sensor high level 1 "or "Alarm: AUX Sensor high level 2. "

Monitoring	Select "1 Yes", the monitoring function is effective; Select "0 No ", the monitoring function is invalid.
Limit	Used to define the threshold of high-protection. When the measured value is at or above the threshold value and the duration exceeds the delay time the alarm levels trigger the action defined.
Delay	If the duration of the high level exceeds the set value of delay time the alarm levels trigger the action defined; if the measured value is higher than high limit before the delay times out the delay time resets to zero.
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over, Set (3) DB3: It is effective from running.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

NOTE:

- the detection of oil and auxiliary sensor can be sensor signal types for resistance, voltage or current;
- The selection of measurement signal type can be achieved by rear switch ‘s combination.
- input data curve actively by customizing sensor type according to different signal, the specific reference to the following table.

DIP switch selection method:

Detection signal	Oil Detection		AUX sensor		Input Way of data curve
	1	2	3	4	
R	On	Off	On	Off	input signal R(<1KΩ) by resistance- data directly
V	Off	Off	Off	Off	make the signal V (0-3.5V) change into correspondence with the R= 200*V / (3.6-V), and then input it
I(mA)	Off	On	Off	On	make the signal I(0-20mA) change into correspondence with the R = 200*I / (36-I), and then input it

4.9 Discrete IN/OUT

NO.	Items	Value Range	Preset
9.1	**DI 1 Function**	1 to 20 /not used	7
9.2	**DI 1 user configure**		
	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.3	**DI 2 Function**	1 to 20 /not used	8
9.4	**DI 2 User configure**		
	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.5	**DI 3 Function**	1 to 20 /not used	2
9.6	**DI 3 user configure**		
	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.7	**DI 4 Function**	1 to 20 /not used	3
9.8	**DI 4 user configure**		
	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.9	**DI 5 Function**	1 to 20 /not used	4
9.10	**DI 5 user configure**		
	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.11	**DI 6 Function**	1 to 20 /not used	1
9.12	**DI 6 user configure**		
	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.13	**DI 7 Function**	1 to 20 /not used	1
9.14	**DI 7 user configure**		

	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB0/DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.15	**DI 8 Function**	1 to 20 /not used	6
9.16	**DI 8 user configure**		
	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.17	**DI 9 Function**	1 to 20 /not used	not used
9.18	**DI 9 user configure**		
	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.19	**DI 10 Function**	1 到 20 /not used	not used
9.20	**DI 10 user configure**		
	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.21	**DI 11 Function**	1 to 20 /not used	not used
9.22	**DI 11 user configure**		
	Operation	N.C. / N.O.	N.C.
	Delay	0 to 999S	1S
	Delay by	DB1/DB2/DB3	DB0
	Alarm class	A1/A2/B1/B2/B3	A2
9.23	Relay 3	1 to 80 /not used	70
9.24	Relay 4	1 to 80 /not used	2
9.25	Relay 5	1 to 80 /not used	3
9.26	Relay 6	1 to 80 /not used	not used
9.27	Relay 7	1 to 80 /not used	not used
9.28	Relay 8	1 to 80 /not used	not used

Menu descriptions:

DI * Function:

- There are 11 configurable digital inputs for condition monitoring.
- Optional items as following:

Code	Optional Functions	Note
0	Not used	
1	configurable	
2	LOP switch	low level is active
3	HET switch	low level is active
4	Emergency stop	low level is active
5	Emergency stop	high level is active
6	Remote start signal	low level is active
7	Reserve	
8	Gen Aux. Switch closed	low level is active
9	Low fuel level switch	low level is active
10	Lamp test	low level is active
11	Speed down	low level is active
12	Speed up	low level is active
13	Air flap Aux. Switch closed	low level is active
14	Preheat	Low level is active. Used for preheat mode 4, as the condition of preheat relay output is energised or not.
15	Crisis mode	Low level is active. In crisis mode, all shutdown alarms are changed to pre-alarm (warning), it means the Genset would not be shutdown when shutdown alarm occurs.
16	Synchronous mode " permissive"	high level is active
17	Synchronous mode "detection"	low level is active
18	AVR down	low level is active
19	AVR up	low level is active

DI * user configure:

When the controller provides available options, but could not meet requirement, the controller provide customizing function to meet customer’s requirement again.

Operation	Select "1 N.C.", the switch input is effective in the open Select "0 N.C.", the digital input is effective when it is in the closed (low)
Delay Start Point	Define monitoring function effective time range: Set (0) DB0: always effective; Set (1) DB1:starting from the crank, monitoring effectively at the same time; Set (2) DB2: after the safety monitoring delay time is over, Set (3) DB3: It is effective from running.
Delay	If the digital effective duration exceeds the set value of delay time the alarm levels trigger the action defined; if the effective digital input becomes invalid before the delay times out the delay time resets to zero.
Alarm Level	Used to define the protection triggered, what action the controller does. See alarm level form for details.

Relay * :

- Controller provides up to 8 intermediate relay output for control;
- Relay function built in the controller as follows.

Code	Definition of AlarmType
0	not used
1	Overcurrent trip
2	common alarm
3	common warnning
4	Idle relay N.C
5	Preheat relay
6	Speed raise
7	Speed lower
8	Fuel pump control
9	GEN. running
10	Auto mode
11	Test mode
12	Manual mode
13	Maintenance due preALM
14	Idle relay N.O
15	Reserve
16	GCB fail to close
17	Start failure
18	Stop failure
19	Reserve
20	GCB close
21	KW overload warn
22	Charge failure
23	Over current warn
24	Bat. Undervolt
25	Bat. Overvolt
26	Under freq. warn
27	Over freq. warn
28	Low oil press warn
29	Engine high temp.warn
30	Under speed warn
31	Over speed warn
32	MCB undervolt warn
33	GCB overvolt warn
34	Aux sensor1 under level
35	Aux sensor1 over level
36	Aux sensor2 under level
37	Aux sensor2 over level

38	ECU alarm
39	ECU shutdown
40	Over current alarm
41	ECU data fail
42	Low oil press. alarm
43	Engine high temp. alarm
44	under speed alarm
45	Over speed alarm
46	under freq. alarm
47	Over freq. alarm
48	GEN. undervolt alarm
49	GEN. overvolt alarm
50	KW overload alarm
51	P-Sensor open alarm
52	Config. D-input1 active
53	Config. D-input2 active
54	Config. D-input3 active
55	Config. D-input4 active
56	Config. D-input5 active
57	Config. D-input6 active
58	Config. D-input7 active
59	Audible alarm
60	Air flap control
61	Scheduled running
62	Test without load mode
63	Test with load mode
64	Emergency stop
65	Reserve
66	Cooling
67	Voltage raise
68	Voltage lower
69	Cooling output
70	GCB open
71	Fuel output
72	Config. D-input8 active
73	Config. D-input9 active
74	Config. D-input10 active
75	Config. D-input11 active

4.10 DEFINE SENSORS

NO.	Items	Value Range	Preset
10.1	PRES. Sensor 1		
10.2	PRES. Sensor 2		
10.3	TEMP. Sensor 1		
10.4	TEMP. Sensor 2		
10.5	Fuel Level Sensor		

Menu Descriptions:

PRES. Sensor 1:

- Corresponds to the “configurable 2” in the “P-sensor type”.

PRES. Sensor 2:

- Corresponds to the “configurable 3” in the “P-sensor type”.

TEMP. Sensor 1:

- Corresponds to the “configurable 2” in the “T-sensor type”.

TEMP. Sensor 2:

- Corresponds to the “configurable 3” in the “T-sensor type”.

Fuel Level Sensor:

- Corresponds to the “configurable 2” in the “Fuel level sersor type”.

NOTE:

- “define sensors” 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:

4.11 MAINTENANCE

NO.	Items	Value Range	Preset
11.1	Scheduler mode	0 without load /1 with load	without load
11.2	Start time	HH:MM	
11.3	Run duration	1 to 1440 minutes	60
11.4	Monday active	0 OFF / 1 ON	OFF
11.5	Tuesday active	0 OFF / 1 ON	OFF
11.6	Wednesday active	0 OFF / 1 ON	OFF
11.7	Thursday active	0 OFF / 1 ON	OFF
11.8	Friday active	0 OFF / 1 ON	OFF
11.9	Saturday active	0 OFF / 1 ON	OFF
11.10	Sunday active	0 OFF / 1 ON	OFF
11.11	Maintenance hours	1 to 9999 hours / not used	not used
11.12	Maintenance days	1 to 9999 days /not used	not used
11.13	Data log period	1 to 9999 hours / not used	not used
11.14	Clear event log		

Menu descriptions:

Scheduler mode:

- Used to select with load or without load when controller is running in the exercise run schedule.
- When parameter is configured as “0 without load”, the controller is running in test mode,then the Genset to run,the GCB close output will not be energized;When parameter is configured as “1 with load”, the controller is running in test mode,then the Genset to run,the GCB close output will be energized.

Start time:

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

Run duration:

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

Monday active:

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

Tuesday active:

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

Wednesday active:

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

Thursday active:

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

Friday active:

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

Saturday active:

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

Sunday active:

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

Maintenance hours:

- Used to configure the time for next maintenance request, it will be displayed on the LCD after the time has been configured.
- The timer will count down until 0.

Maintenance days:

- Used to configure the days for next maintenance request, it will be displayed on the LCD after the day has been configured.
- The days will count down until 0.

Data log period:

- Used to configure the data log period.

Clear data log:

- Used to clear the controller has been recorded measurement data and status signals .

4.12 ALARM LIST

- Used to view the historical record of the controller.
- Events include alarm or pre-alarm (warning) with time stamp.

Menu description:

NOTE: Events include alarm or pre-alarm (warning) with the time stamp. Press “+” or “-” to scroll page.	**[Alarm List]** #1 **ALARM: START FAILURE** 2010-08-07 15:20:05

4.13 CALIBRATION

NO.	Items	Value Range	Preset
13.1	GEN. V1 offset	-9.9% to 9.9%	
13.2	GEN. V2 offset	-9.9% to 9.9%	
13.3	GEN. V3 offset	-9.9% to 9.9%	
13.4	Current I1 offset	-9.9% to 9.9%	
13.5	Current I2 offset	-9.9% to 9.9%	
13.6	Current I3 offset	-9.9% to 9.9%	
13.7	Current I4 offset	-9.9% to 9.9%	
13.8	Busbar V1 offset	-9.9% to 9.9%	
13.9	Busbar V2 offset	-9.9% to 9.9%	
13.10	Busbar V3 offset	-9.9% to 9.9%	
13.11	Pressure offset	-9.9% to 9.9%	
13.12	Temperature offset	-9.9% to 9.9%	
13.13	Batt. V offset	-9.9% to 9.9%	
13.14	Fuel sensor offset	-9.9% to 9.9%	
13.15	AUX. sensor offset	-9.9% to 9.9%	

Menu descriptions:

GEN. V1 offset:
- Used to modify the measured value display of GEN Phase 1 voltage.
- Reference to the Rated ph-voltage.

GEN. V2 offset:
- Used to modify the measured value display of GEN Phase 2 voltage.
- Reference to the Rated ph-voltage.

GEN. V3 offset:
- Used to modify the measured value display of GEN Phase 3 voltage.
- Reference to the Rated ph-voltage.

Current I1 offset:
- Used to modify the measured value display of Phase 1 current.
- Reference to the Rated current.

Current I2 offset:
- Used to modify the measured value display of Phase 2 current.
- Reference to the Rated current.

Current I3 offset:
- Used to modify the measured value display of Phase 3 current.
- Reference to the Rated current.

Current I4 offset:
- used to correct the measurement show value of leakage current;
- Taking the rated current as basic value.

Busber V1 offset:
- used to correct the measurements show value of busher V1;
- Taking the rated pressure as basic value.

Busber V2 offset:
- used to correct the measurements show value of busher V2;
- Taking the rated pressure as basic value.

Busber V3 offset:
- used to correct the measurements show value of busher V3;
- Taking the rated pressure as basic value.

Pressure offset:
- Used to modify the measured value display of LOP sensor.

Temperature offset:
- Used to modify the measured value display of HET sensor.

Batt. V offset:
- Used to modify the measured value display of battery voltage.

Fuel sensor offset:
- Used to correct the measurements show value of Fuel sensor offset

AUX. sensor offset:
- Used to correct the measurements show value of AUX. sensor offse

5 Control and Operation Instructions

5.1 Operation Mode Setting:

The controller has 3 modes: AUTO, MANUAL and TEST.

Description	Operation
Press and hold the “AUTO” button for 2sec, the LED above the button is illuminated; the controller is running in “AUTO” mode.	
Press and hold the “MAN” button for 2sec, the LED above the button is illuminated; the controller is running in “MAN” mode.	
Press and hold the “TEST” button for 2sec, the LED above the button is illuminated; the controller is running in “TEST” mode.	

NOTE:
- Only 1 mode can be selected from above 3 modes.
- 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.

5.2 Genset start-up operation:

In any of the following conditions and actions, the controller immediately start the implementation process:
- In the automatic control mode, the remote start signal is valid and start delay confirmation; or automatic sequence functions is effective, and the unit meets needs of the on-line;
- Effective test mode offset;
- In manual control mode, press the "start" button.

Engine Cranks:
The fuel relay output is energised, and operates the fuel solenoid of the engine. After 300ms delay, the start relay output is energised, the start motor engages and begins to crank. When the engine speed reaches the crank cutout RPM, the start relay 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.

When Genset is running normally, Gen. Normal LED illuminates, the timer for GEN. ON delay is activated.

NOTE:
- During cranking or idle period, if the start condition is inactive or Mains voltage resumes to normal, the controller stops the start procedure, then recovers to the original standby status.

NOTE:
The start motor will power off while cranking if there are one of the following conditions occur:
- The Genset's frequency reaches the preset value (configurable cranking cutout value);
- The AC engine speed reaches Crank cutout RPM;
- Genset's voltage reaches the Crank cutout volt (optional);
- Charger voltage reaches Crank cutout ALT-V (optional);
- Cutout P-delay time's up (optional);
- Cranking time's up.

NOTE:
Controller can not implement crank procedure in one of following conditions:
- The Genset's frequency reaches the preset value (configurable cranking cutout value);
- The AC engine speed reaches Crank cutout RPM;
- Genset's voltage reaches the Crank cutout volt (optional);
- Oil pressure switch is opened or oil pressure is higher than Crank cutout Oil-P (optional).

CAUTION:
- If magnetic pickup is not used, to avoid damage to the start motor please make sure the Genset's voltage is higher than the measurable value of controller while cranking, since the crank cutout signal is sensed from the Genset voltage and frequency.

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.

CAUTION:
- If Fail to Start occurs, operator must check the whole Genset system to find out failure reason, only after clearing the failure can press "STOP / RESET" button to relieve fault lock out status, and restart the Genset.

5.3 Idle functions:

When one of the configurable outputs is defined as idle speed, the controller with idle control function. If idle function is pre-set, start relay close output simultaneously, and then close output of idle controller. when the crank is successful, idle delay timer start to time. Idle controller closes when time is over.
Idle speed control process reference starting shutdown alarm flow chart.

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

5.4 Genset Shut down

In any of the following conditions and actions, the controller immediately start the shut-down process:

- In the automatic control mode, the remote start signal is invalid and start delay confirmation; or automatic order functions effectively, the unit meets needs to the off-line;
- In manual control mode, press the "stop" button.

The Genset implement the following procedure before implementing shutdown command at load condition.

- Stand-alone operation of the unit, first disconnect the load circuit breakers;
- Multi-machine parallel, the first unloading, the standby power load group is lower than the level set, then disconnect the load circuit breakers;

Shutdown procedure:

- Combined load power breaker, start to countdown. Oil relay of the controller shut down the fuel solenoid valve immediately, Genset shut down and go into standby mode

.

Stop Failure: When cool down times out, the fuel relay opens and the timer for Stop delay begins. If the controller detects that the voltage of the Genset or oil pressure or the speed of engine is greater than the cutout values or LOP switch is open, when it times out, the failure LED illuminates and the LCD displays **Fail to stop**.

NOTE:

- After stop failure, the controller will not energise the crank relay output if the failure has not been removed and the controller reset.

5.5 The 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 off power, fuel solenoid is normally open so no signal required for fuel solenoid to activate.

Stop control sequence for N.O. type:

During the controller's stop sequence, the fuel relay energises, fuel solenoid is on power, the fuel solenoid closes the fuel valve and the engine begins to stop. After a delay (same as Stop delay) fuel relay de-energises, disconnecting the supply from the fuel solenoid.

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

5.6 Preheat function:

For **Preheat** function, configure one of the configurable outputs as **Preheat**, the controller has 5 selectable preheat control modes as below:

Mode1— during preheat time, preheat relay output energises.

Mode2— during preheat time, preheat relay output energises until the successful ignition.

Mode3— during preheat time, preheat relay output energises until safety-on delay times out.

Mode4— one of the configurable inputs is defined as **Preheat**, preheat relay output energises when this configurable input is active, and de-energises when configurable input is inactive.

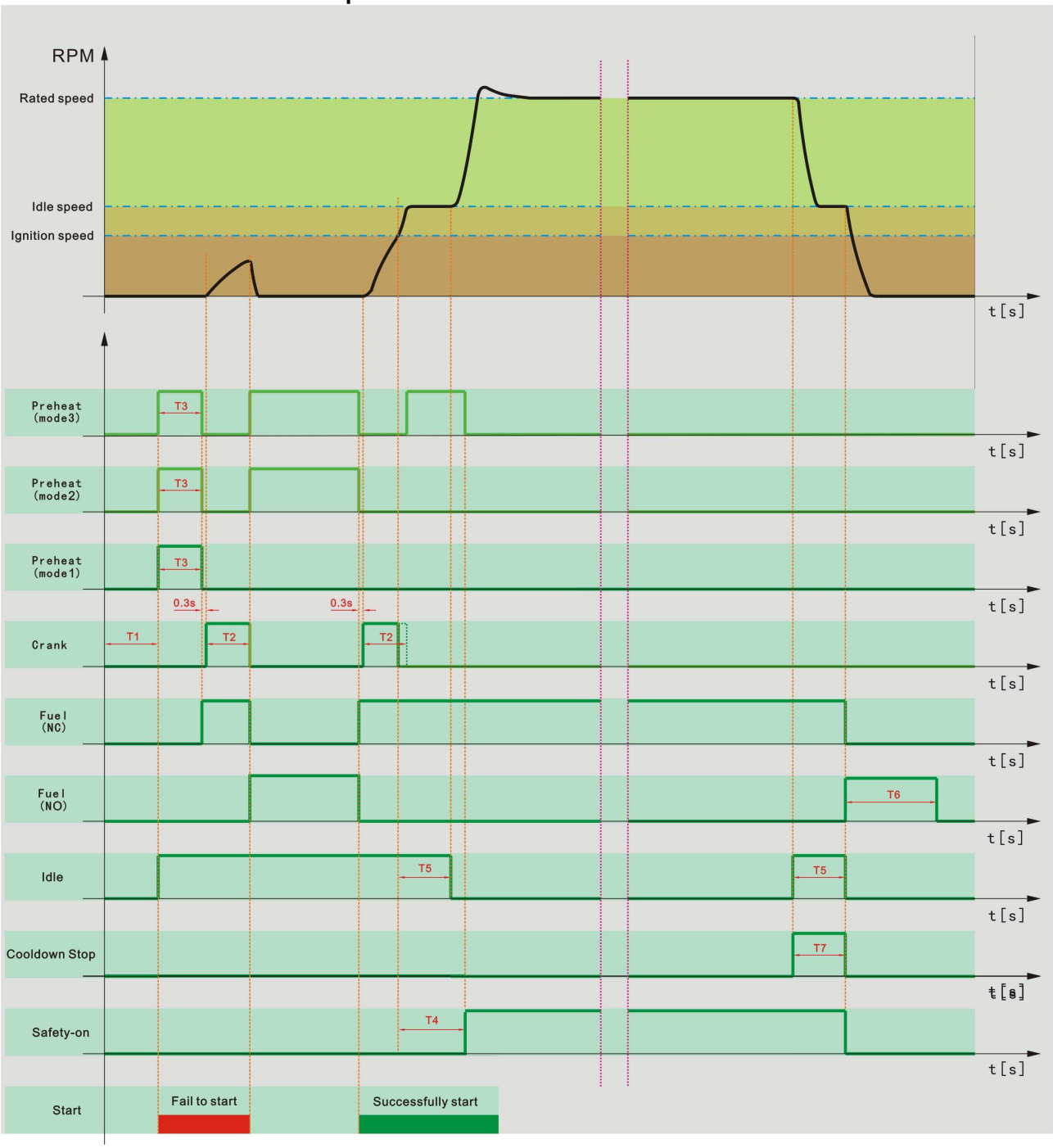
Mode5— the A-sensor 2 use is defined as **Preheat**, preheat relay output energises when the temperature falls below the **Preheat ON** value, and de-energises until the temperature reaches the **Preheat OFF** value.

For preheat mode 1 to 3, please refer to the flow chart **5.7** start and stop for **Preheat** control flows.

For preheat mode 4 to 5, prehat 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.

5.7 Flow chart for start and stop



T1— start delay
T2— crank time
T3— pre-heat time
T4— safety-on delay
T5— idle time
T6—Stop delay
T7—cooling down time

NOTE:

- If T4 is longer than T5, oil pressure protection is ignored during T5.If T4 is shorter than T5, oil pressure protection becomes effective after T4 in T5.
- If cooling mode is configured as idle, the engine in the cooling down time runs at idle speed; if cooling mode is configured as full speed, the engine in cooling down time runs at rated speed.

5.8 Genset voltage control

Controller has the ability to control the voltage of Genset, Genset voltage regulation required to achieve the following operations:

- manual voltage adjustment.
- Genset voltage matching during synchronization.
- unloading share of multiple units in the same public bus.
- multiple parallel units in the same public bus, and its output has a fixed value of reactive load to the public bus.

To achieve Genset voltage regulator by the following two ways:
Controller outputs a voltage bias signal to the Genset's automatic voltage regulator (AVR) to adjust Genset voltage. Controller's the maximum voltage bias signal range is ± 10Vdc, can set output span range. Users can refer to the automatic voltage regulator (AVR) the manufacturer's instructions, select the appropriate voltage regulation signal.

If the automatic voltage regulator (AVR) of the external control input signal is digital, the two custom relay output relays are defined as the step-up and step-down relay, connect with the corresponding interface, and adjust Genset voltage or reactive power load. Voltage change rate can also be set.

NOTE:

- Typically, to the controller voltage bias signal of ± 100%, the Genset voltage's change does not exceed 10%.

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

- Automatic voltage regulator (AVR) with a voltage droop characteristics;Or set the " Volt droop "parameter in setup menu of the controller to droop characteristics.

5.9 Genset's frequency control

Controller has the ability to control the speed of Genset, and then control Genset power frequency, achieve the following operations by adjusting Genset's frequency.

- Manual frequency adjustment.
- Genset frequency match during synchronization.
- unloading share of multiple units in the same public bus.

To achieve Genset voltage regulator by the following two ways:
Controller outputs a voltage bias signal to the engine's automatic governor (GOV), adjust the engine speed. The controller's maximum speed bias signal range is ± 10Vdc, the output span range can be set. Users can refer to the automatic speed governor (GOV) the manufacturer's instructions, choose appropriate speed adjustment signal.
If the automatic speed governor (GOV) in the external control input signal is digital, the two custom relay output are defined as the step-up and step-down speed relay and the relay, and connect with the governor interface, and finally adjust the Genset frequency or the power load. Rate of change in speed can be set.

NOTE:

- Typically, to the controller speed bias signal of ± 100%, the Genset speed's change does not exceed 10%.

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

- Automatic Speed regulator (GOV) with a speed sag characteristics or set the " Load control droop " parameter in setup menu of the controller to sag characteristics.

5.10 Synchronous Control

Synchronizer of the controller is to measure power generation and common bus voltage, comparing the voltage waveform, output voltage offset signal and the speed bias signal control voltage and frequency, respectively, for the two power synchronization. Two power supplies must meet the following requirements simultaneously:

- The same phase sequence.
- Voltage error within the set limit.
- Frequency error within the set limit.
- Phase error within the set limits.

After Genset units operate normally, power delay timer starts to work, when it is over, synchronization starts to work.

Dead bus closure

Controller in automatic mode, the parameter "**Dead bus closure**" is effective, synchronization starts to work, the bus voltage is detected below the " Dead bus Max.volt " setting of limits, the controller issues a close order. To avoid the same bus system, two or more Gensets also issued close orders, before doing it, the controller through the communication network must get prior permission by other controller.

Voltage differential

The error between Genset voltage to be parallel and the bus voltage must be small to reduce the current impact of the close moments and the circulation between parallel Gensets, and provide system efficiency. If Gensets rated power relative to the total power of the public bus is much smaller, the voltage difference before the parallel does not change the public bus voltage. When the Genset voltage is low to a certain extent, reactive power flows can make the Genset into a motor and Genset coils may cause damage. From the analysis above, the voltage match is very important before the parallel.

After synchronizer works, the controller detects and compares Gensets and public bus voltage, output appropriate voltage offset signal, which makes the automatic voltage regulator (AVR) control the Genset output voltage, simultaneously higher than the public bus voltage, within the range of the match error.

freq. differential

The error between Genset voltage to be parallel and the bus frequency must be small. Relatively small power generating units are combined into the public bus, the frequency difference doesn’t change frequency of public bus.If the Genset frequency is lower than bus frequency, active power flows from the public bus. When the Genset frequency is low to a certain degree, active power flow may cause Genset damage.

After synchronizer works, the controller detects and compares the frequency of Genset and the public bus, outputs the appropriate speed bias signal, which makes the automatic speed governor (GOV) control the speed, and therefore the Genset output frequency is silluminatesly higher than the frequency of public bus and is within the range of the match error.

Phase differential

Controller does not directly adjust the phase, but the frequency of Genset, so that there is appropriate slip between two power. When the Genset frequency and bus frequency error is large, the phase time is short, when the error is to a certain extent, does not meet the phase matching conditions. When the Genset and bus frequency error is very small, which will generate longer synchronization time, under normal circumstances, the smaller the slip, the longer synchronized time, no slip and no sync. In general applications, if the slip is small and want to reduce synchronization time, the controller will automatically increase the appropriate slip.

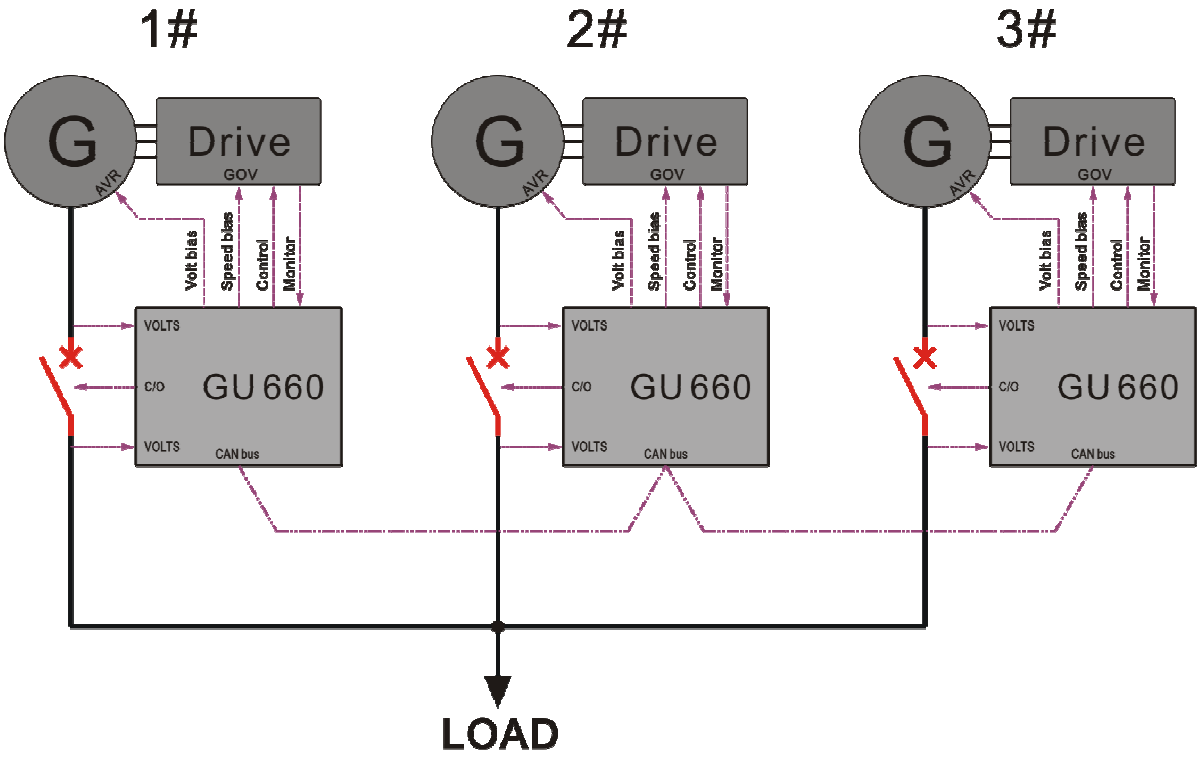
5.11 Automatic Order Function

Automatic sequence function is that the same network controller based on the order of priority, then based on the total size of the load, decides the Genset's automatical start and stop, and make line Genset maintain a certain power load operation.
If controller's automatic order function is effective under the same network, must comply with:

- selecting automatic operation mode
- parameter " Auto sequencing " set to"YES"

When the remote signal opens effectively, The Gensets of the same network starts and runs. According to a certain order synchronous closing, based on the total size of the load, then it decides to start and stop the Genset automatically.

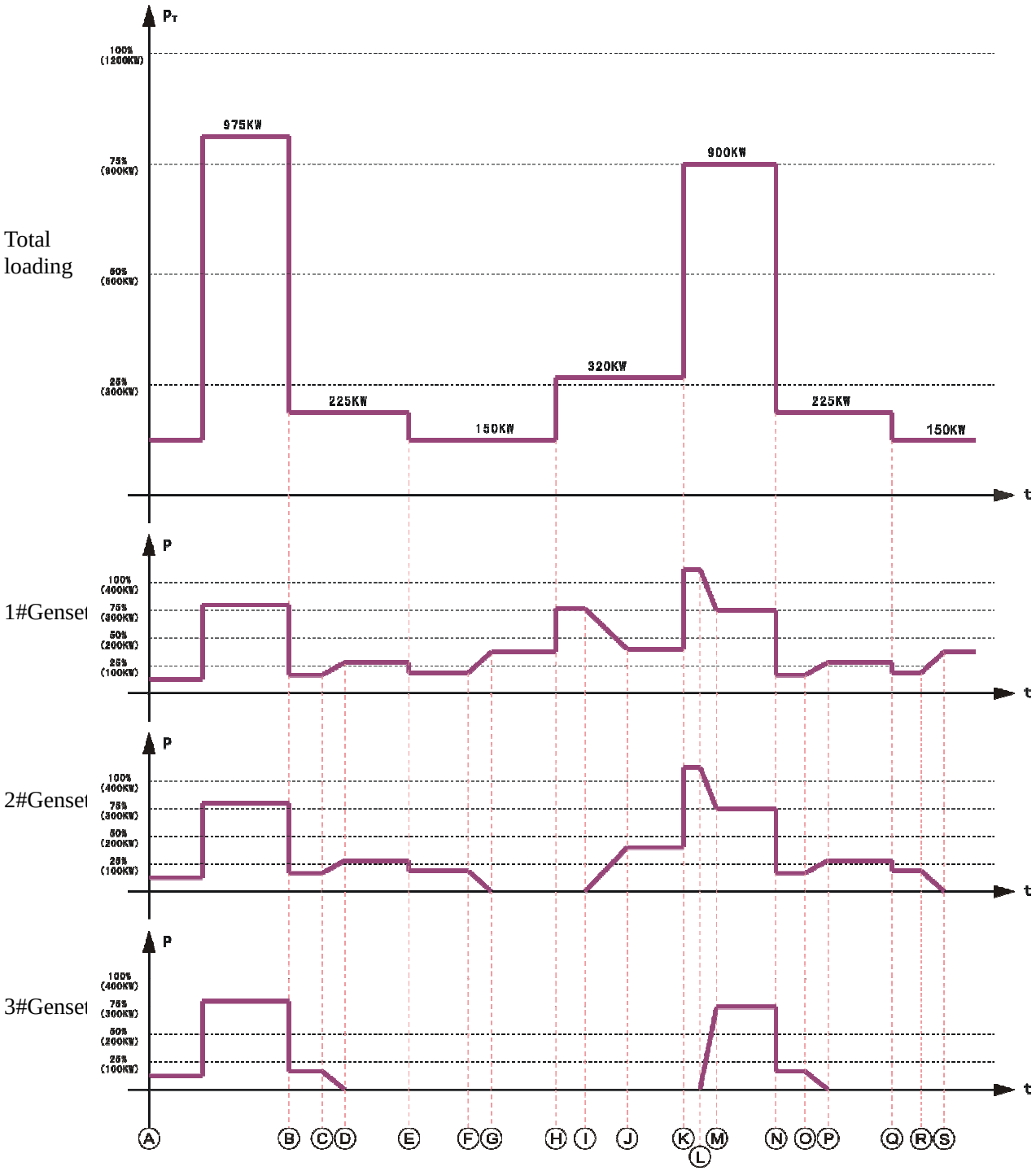
For example: There is a system total of three units, rated active power are 400KW, as show in Figure:



Automatic sequence controller parameters are as follows

Code	parameter	Setting data		
		1#	2#	3#
7.1	Auto sequencing	YES	YES	YES
1.4	Device number	1	2	3
1.5	Base priority	1	2	3
7.5	Max.Genset load	80%	80%	80%
7.6	Min. Genset load	30%	30%	30%
7.7	Add on delay	30s	30s	30s
7.8	Add on delay at rated load	5s	5s	5s
7.9	Add off delay	60s	60s	60s

System active load and single power load trends are as follows:



A point to B point:
Because of remote signal, three units remote signal is valid, automatically activated in parallel, load sharing.

B point to E point:
Decrease the total load, the load value of the three units were lower than the " Min. generator load " setting, " Add off delay " time is calculated from start time, time is over, three machines of the load values remain below the set value of " Min. generator load ", to the D point, the lowest priority rights of 3 #Unit starts unloading →sub-gate →cooling down, at the same time, 1 # and 2 # Units' load gradually increase, until all takes on all load.

F point to the G point:
Decrease the total load, the load value of the three units were lower than the " Min. generator load " setting, " Add off delay " time is calculated from start time, time is over, two machines of the load values remain below the set value of " Min. generator load ", to the F point, 2 #Unit starts unloading →sub-gate →cooling down, at the same time, 1 #Unit's load gradually increase, until all takes on all load.

H point to the J point:
Increase the total load, the load of 1 #were higher than " Max.generator load " setting, " Add on delay " time is calculated from start time, time is over, the load value of #1 machine higher than the set value of " Max.generator load", to the I point, 2 #Unit starts running→simultaneously closed → loading, at the same time, 1 #Unit's load gradually increase, then 1 #and 2 #Units, take on all load.

K point to the M points:
A sudden increase in the total load, 1# Unit and 2# Unit load values were higher than the " GEN. rated active power " setting value, " Add on delay at rated load " time is calculated from start time, at the end, the load value of two units maintain higher than the set value of " GEN. rated active power " , to the L point, #3 Unit starts running→simultaneously closed → loading, at the same time, 1 #and 2 #Units' load gradually decreases, all takes on all load.

N points to the P point:
Decrease the total load, the load value of the three units were lower than the " Min. generator load " setting, " Add off delay " time is calculated from start time, at the end, three units of the load values remain below the " Min. generator load "the set value, to the O point, the lowest priority rights of 3 #Unit starts unloading →sub-gate →cooling down, at the same time, 1 # and 2 # Units' load gradually increase, until all takes on all load.

Q point to the S point:
Decrease the total load, the load value of the three units were lower than the " Min. generator load " setting, " Add off delay " time is calculated from start time, time is over, two machines of the load values remain below the set value of " Min. generator load ", to the R point, 2 #Unit starts unloading →sub-gate →cooling down, at the same time, 1 #Unit's load gradually increase, until all takes on all load.

In practice, the Genset's rated power under the same network has a larger difference, although large rated power unit takes on a small percentage of active load, it can result in the load value of other online units higher than " Max.generator load "setting in their exit, while the offline units is back on line soon, the whole system will be unstable. To avoid this situation and the same network controller not only needs to monitor the load level, but also calculate the power load of the Gensets.

For example:

#1 Genset = 500 KW	#2 Genset = 1000 KW
Mainframe	Controlled Units
Maximum Genset load = 80%	
Minimum Genset load = 30%	

Two units are online

System load = 50%	No change
System load = 28%	No change

When it's 28%, 2 # Genset don't off the assembly line reasons:

- 28%, 1 # unit has a load of 140KW, 2 # unit has a 280KW load, the total load is 420KW.
- If 2 #generator is off line, the 1 #generator must be under 420KW, system load = 84%, so 2 # generator can not be off line.
- When the total load is lower than 80% the rated active powerof 1 # Unit, can meet off line condition.

6 Measure and Display Data

BUSBAR 3 phases V_{Ph-N} L1-N, L2-N, L3-N

BUSBAR 3 phases V_{Ph-Ph} L1- L2, L2- L3, L3- L1

BUSBAR frequency Hz（L1）

BUSBAR Phase rotation

GEN. 3 phases V_{Ph-N} L1-N, L2-N, L3-N

GEN. 3 phases V_{Ph-Ph} L1- L2, L2- L3, L3- L1

GEN. frequency Hz（L1）

GEN. frequency

GEN. 3 phases current I1 I2 I3

Neutral current I4

GEN. 3 phases apparent power AL1 AL2 AL3 ∑A

GEN. 3 phases active power PL1 PL2 PL3 ∑P

GEN. 3 phases reactive power QL1 QL2 QL3 ∑Q

GEN. 3 phases power factor PFL1 PFL2 PFL3 PF(AV)

Gen total active energy **(KWhr) ∑E**

Gen total reactive energy **(KVArhr) ∑E**

Engine speed **RPM** (signal derived from magnetic pick-up or Genset Hz)

Engine oil pressure **Bar / PSI** (signal from engine LOP sensor)

Engine coolant temperature **℃/℉** (signal from engine HET sensor)

Fuel level sensor %

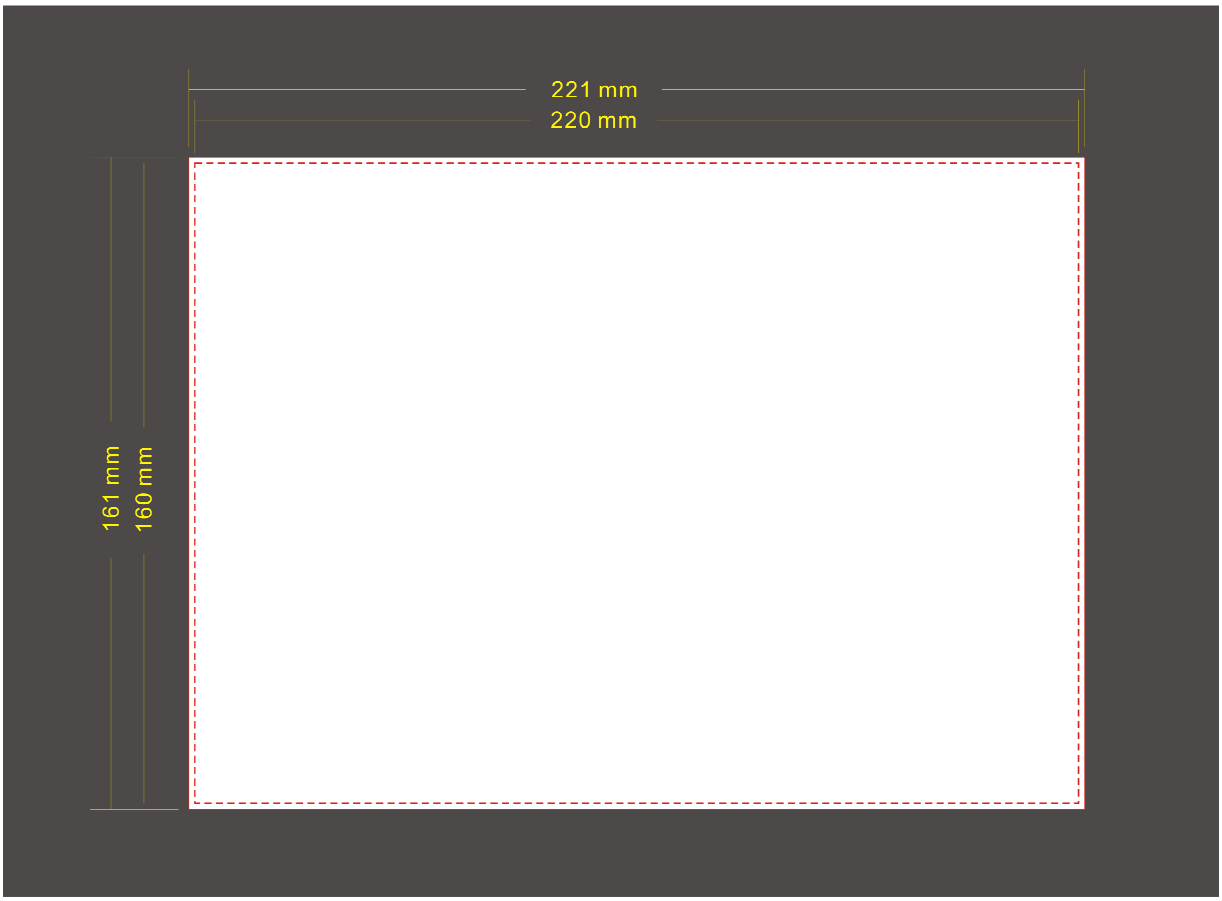
AUX. analog input

Battery voltage **Vdc**

Genset Running hour **Hour**

7 Installation Guide

7.1 The cutout dimensional drawing installed on panel as follows:



Cutout dimension: 221mm(W) x 161mm(H).

The controller is fixed by 8special fittings.

NOTE:

- Shock-proof equipment must be mounted if the enclosure is mounted on Genset or other heavly vibrating device.
- In order to ensure the degrees of protection of the mounted controller meet IP65, the cutout dimension on the panel must be correct.

7.2 Wiring

Please refer to the above 2.3 Typical Wiring Diagram for connection.

7.3 Grounding Protection:

Make sure the connection between terminal #58 of controller and protective earth is good, the cross section area of cable should not be less than 2.5mm^2.

WARNING

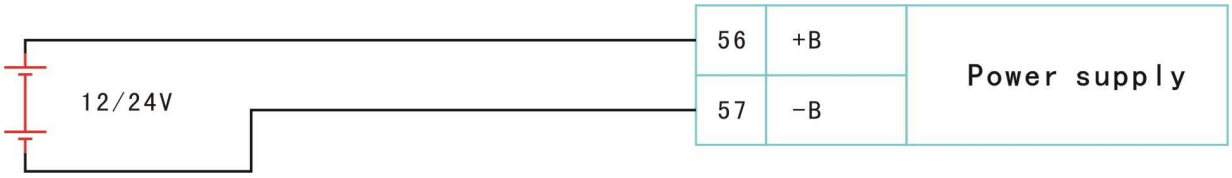
WARNING:

- A good ground is very important for operation of controller, otherwise it will impact the electrical measurement and even damage the controller.

7.4 Power supply:

Power specification:

DC voltage range	8-35Vdc continuous
Max. operating current	@12V 600 mA, @24V 300mA
Cranking dropouts	0V for 80ms, assuming dc supply was at least 10V before dropout and recovers to 5V, controller can be normally operated dispenses with additional aux. power.

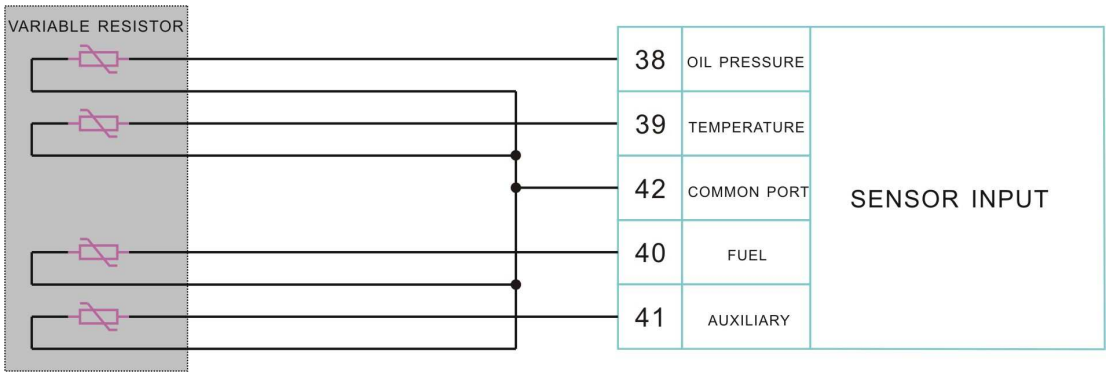


NOTE:

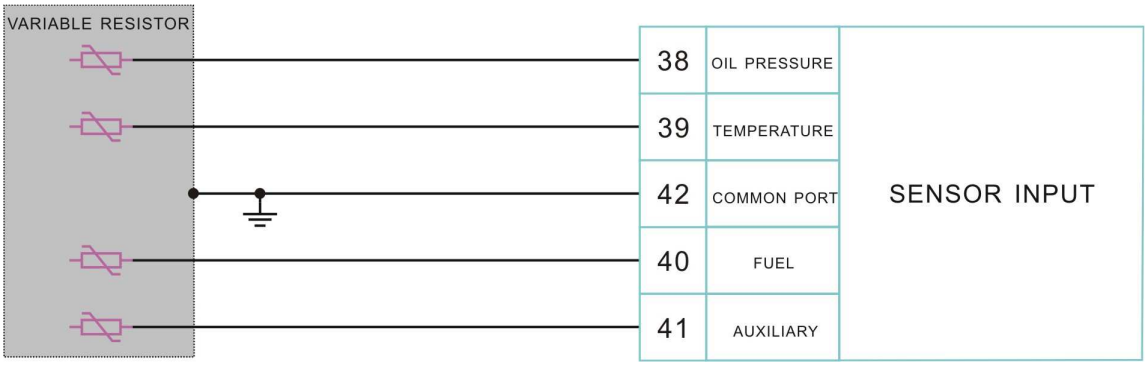
- A switch or fuse for over current protection between power supply and controller must be mounted, the recommended capacity is 1A.
- When powering, the controller will generate significant instantaneous peak current, the maximum instantaneous peak current is relative to the power impedance. You must consider the peak current when choosing a switch or fuse for over current protection.

7.5 The installations of LOP sensor, HET sensor, and Auxiliary sensor:

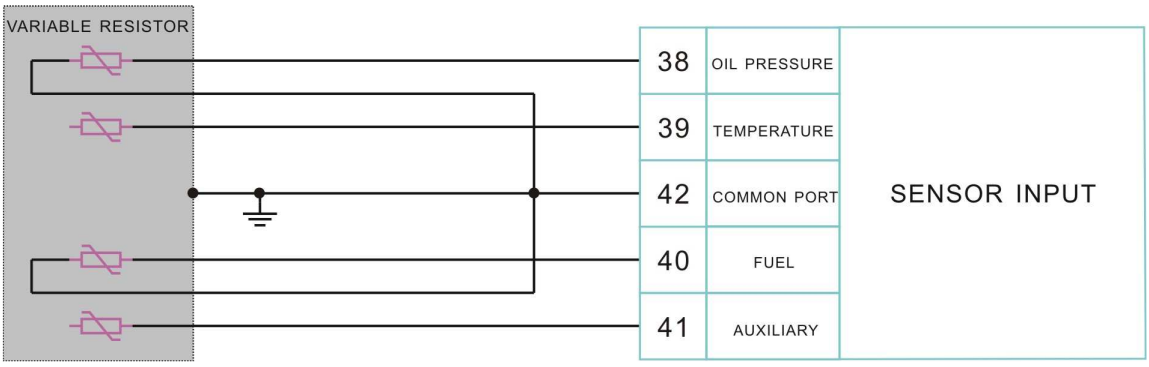
The connection for 2 poles sensor:



The connection for single pole sensor:



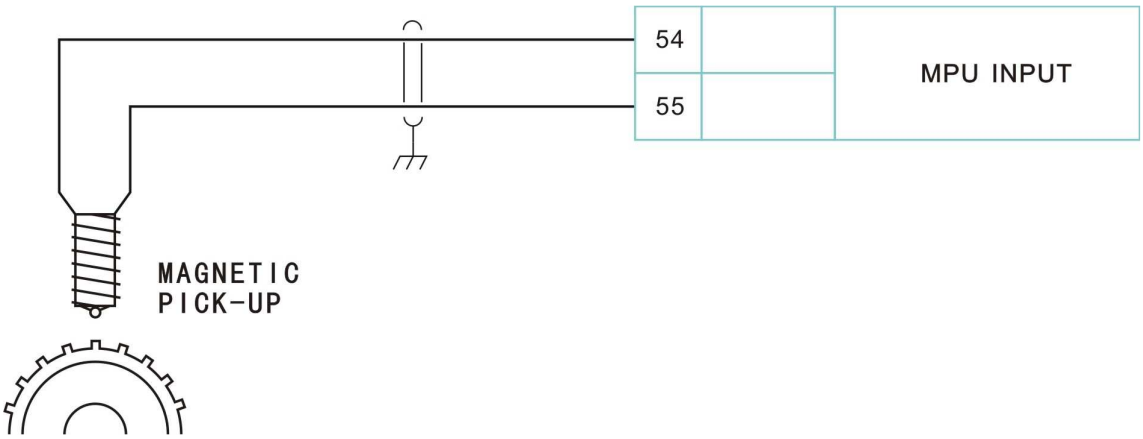
The connection for single pole / 2 poles sensor:



NOTE:

- For ensuring the accuracy of sensor please reduce the cable resistance between controller and sensor as much as possible, the cross section area of cable should not be less than 2.5mm^2.
- When a single pole sensor is used, the terminal #42 must be directly connected to the Genset's earth point, but not to the control panel or other earth point. It will impact the accuracy of sensor if the common port is connected to the power supply negative.
- The sensor shell and engine must be well connected and do not use insulated material on sensor screw thread when installing single pole sensor.

7.6 The installation of MPU:



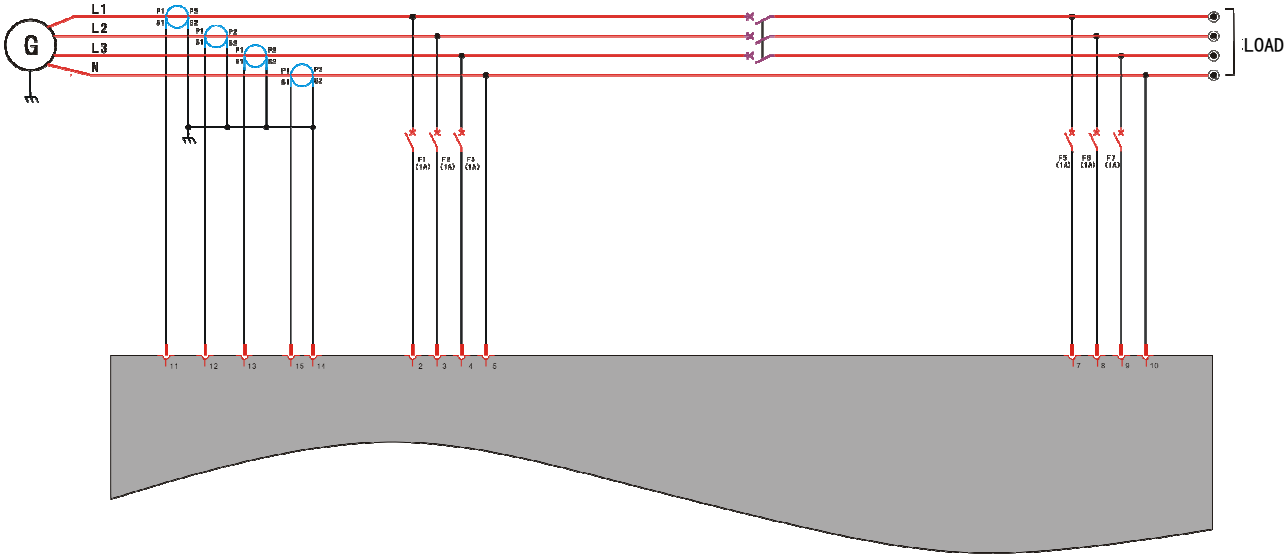
NOTE:

- The measuring accuracy of magnetic pick-up is related to fly wheel teeth: Accuracy= ± (120 / fly wheel teeth) RPM.
- As the above formula, more fly wheel teeth leads to higher measuring accuracy.

NOTE:

- Shielded cable must be used for connection between controller and sensor, and the shield should be earthed.
- Please play attention that the terminal #55 is connected to negative of the power supply inside the controller.

7.7 Typical connection for voltage input and current that corresponding to difference Genset winding: 3P4W (3 phases 4 wires)

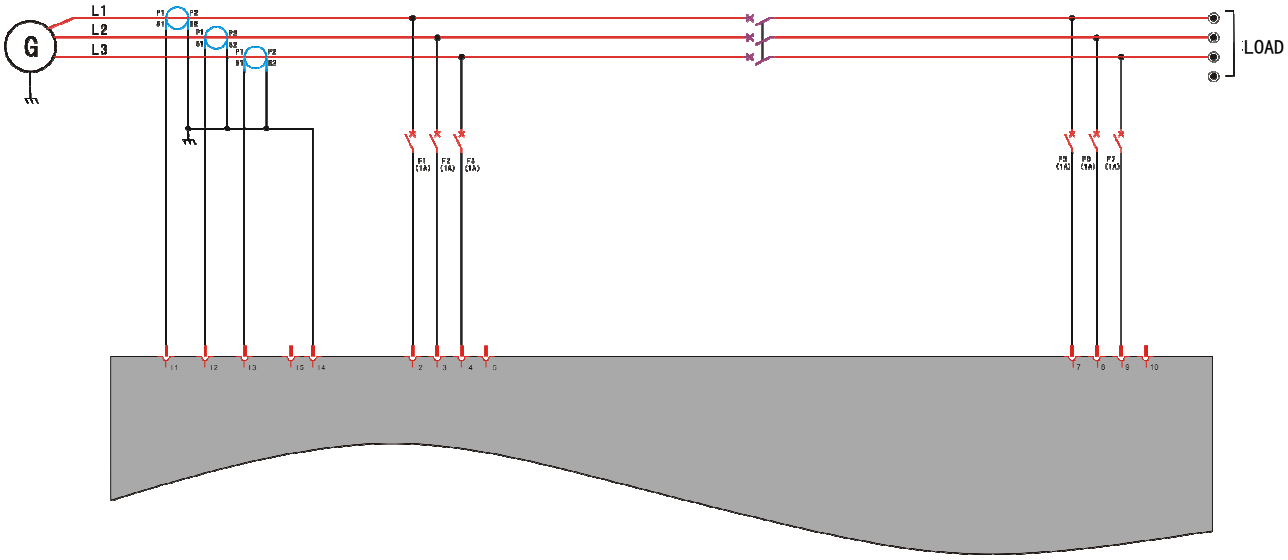


Measure and Display Data	
"Y" 3P4W (3 phases 4 wires star)	"Y" 3P4W (3 phases 4 wires star)
3 phases V_{Ph-N} L1-N L2-N L3-N 3 phases V_{Ph-Ph} L1-L2 L2-L3 L3-L1 frequency Hz (L1) 3 phases current I1 I2 I3 Neutral current I4 3 phases apparent power AL1 AL2 AL3 ∑A 3 phases active power PL1 PL2 PL3 ∑P 3 phases reactive power QL1 QL2 QL3 ∑Q 3 phases power factor PFL1 PFL2 PFL3 PF active energy (KWhr) ∑E reactive energy (KVArhr) ∑E	3 phases V_{Ph-N} L1-N L2-N L3-N 3 phases V_{Ph-Ph} L1-L2 L2-L3 L3-L1 frequency Hz (L1) 3 phases current I1 I2 I3 Neutral current I4 active power ∑P reactive power ∑Q power factor PF active energy (KWhr) ∑E reactive energy (KVArhr) ∑E

NOTE:

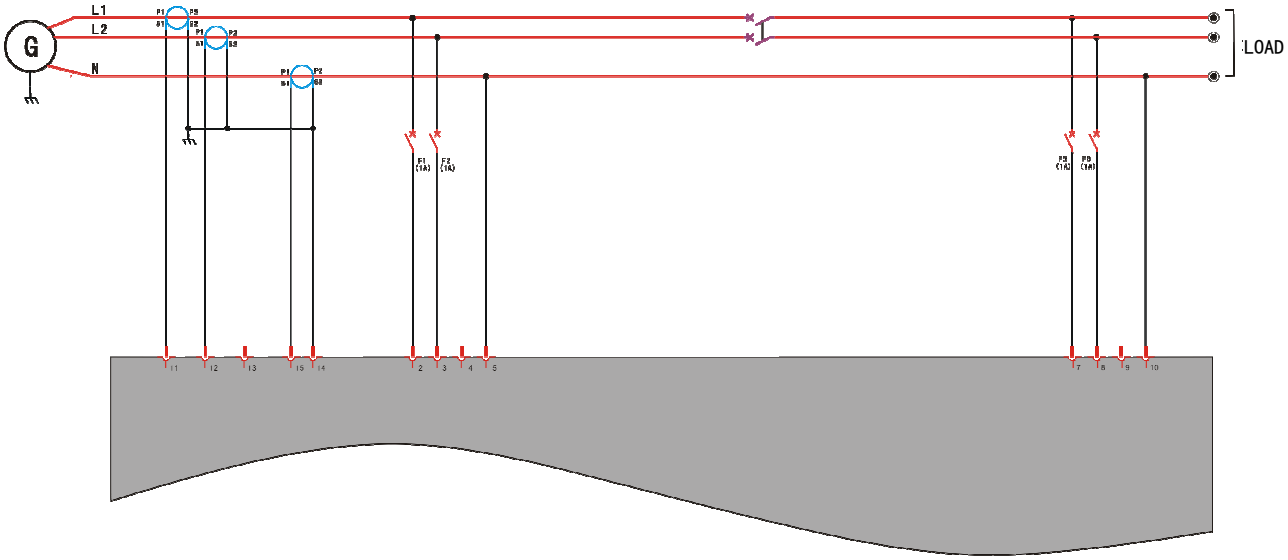
- If you do not install the zero line current transformer, the controller does not measure and display the zero line current, and grounding protection controller will not work.

3P3W (3 phases 3 wires)



Measure and Display Data
3 phases $V_{Ph\text{-}Ph}$ L1-L2 L2-L3 L3-L1
frequency Hz (L1)
3 phases current I1 I2 I3
Gen apparent power ∑A
total active power ∑P
total reactive power ∑Q
power factor PF
active energy (KWhr) ∑E
reactive energy (KVArhr) ∑E

1P3W (single phase 3 wires)

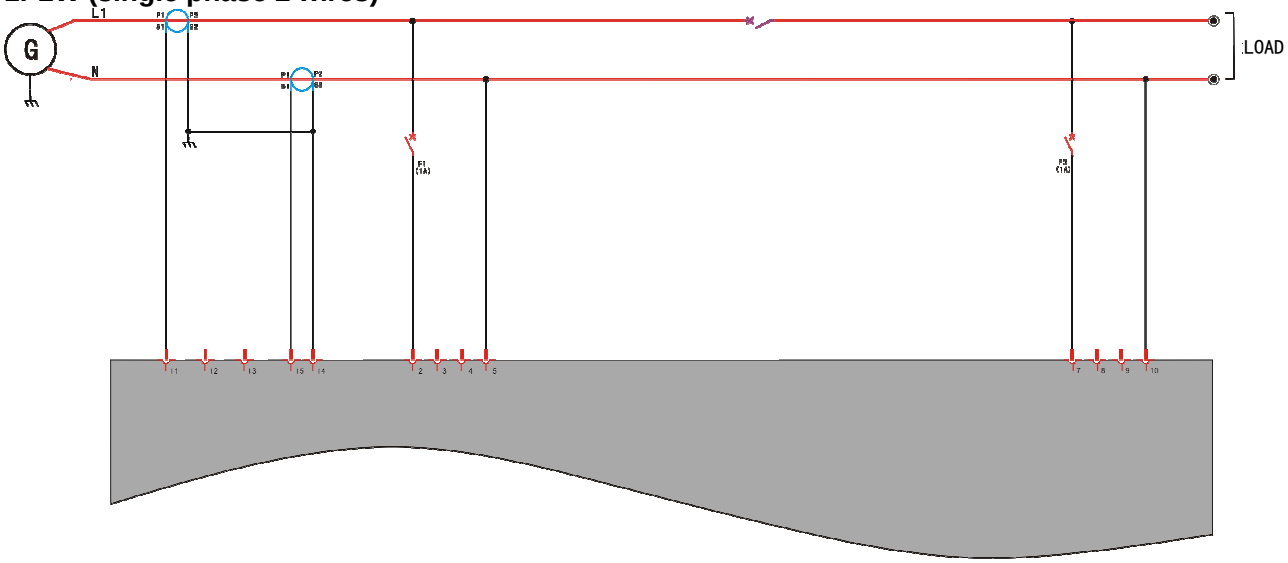


Measure and Display Data
V_{Ph-N} L1-N L2-N V_{Ph-Ph} L1-L2 frequency Hz current I1 I2 Neutral current I4 apparent power A active power P reactive power Q power factor PF active energy (KWhr) ∑E reactive energy (KVArhr) ∑E

NOTE:

- If you do not install the neutral current transformer, the controller does not measure and display the neutral current, and grounding protection controller will not work.

1P2W (single phase 2 wires)



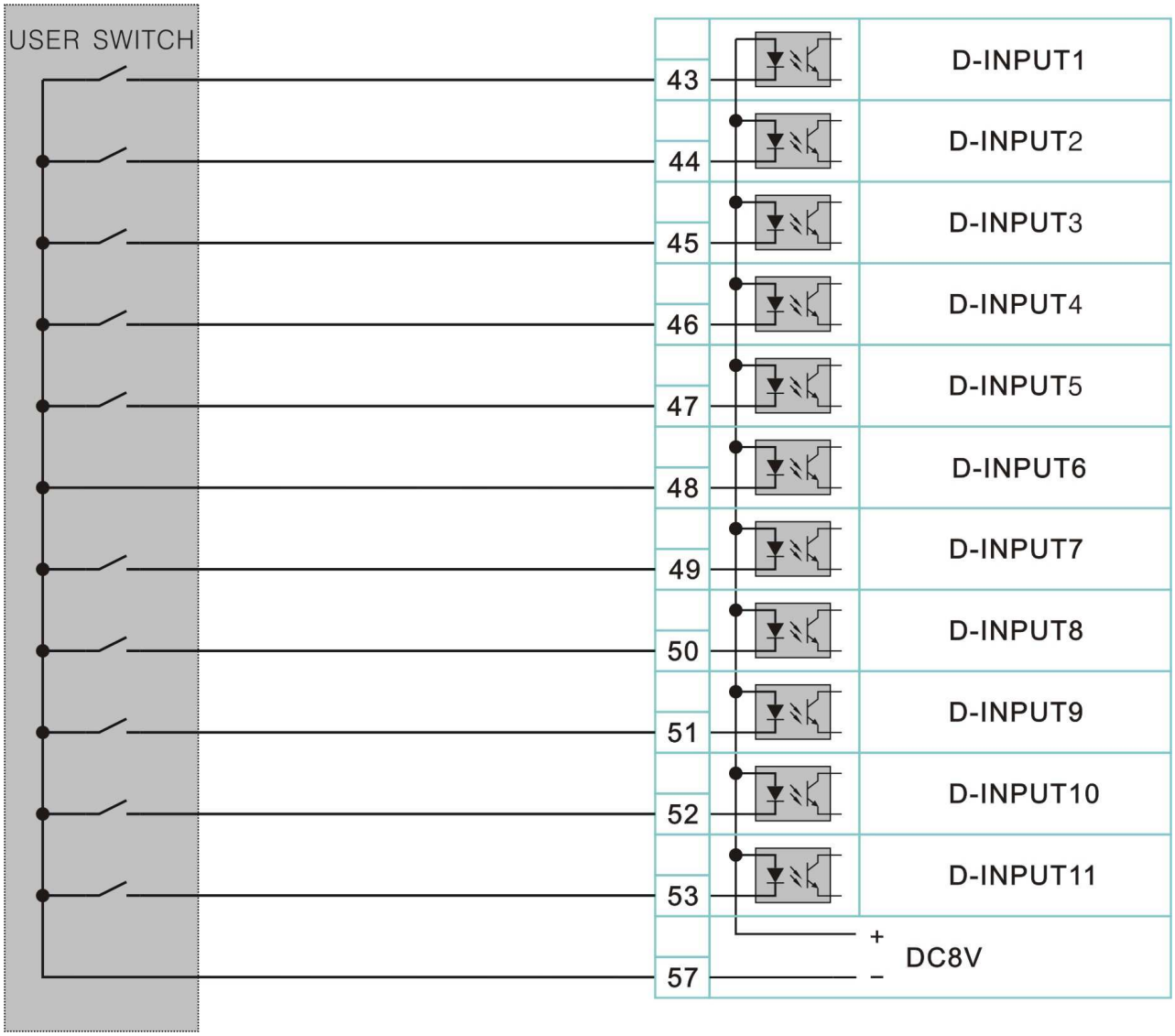
Measure and Display Data
V_{Ph-N} L1-N frequency Hz (L1) current I1 Neutral current I4 apparent power A active power P reactive power Q power factor PF active energy (KWhr) ∑E reactive energy (KVArhr) ∑E

NOTE:

- If you do not install the neutral current transformer, the controller does not measure and display the neutral current, and grounding protection controller will not work.

7.2.1 The connection of configurable digital inputs

There are 11 configurable Inputs, which used for monitoring and control status, all of the inputs adopt electrical isolation, and controller internal provides 8vdc power supply, no need an additional power.

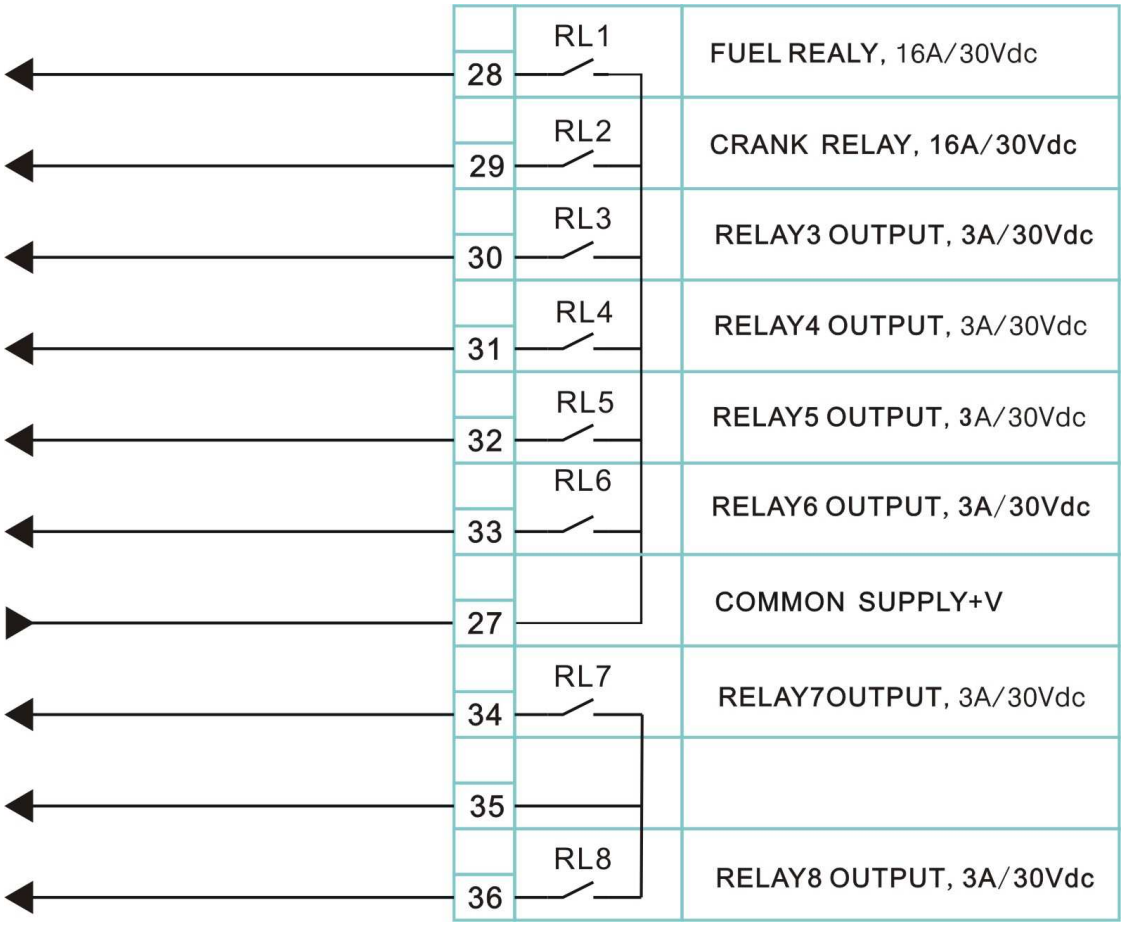


NOTE:

- The terminal #57 is the common port for the configurable inputs , and shares with the power supply negative .
- The maximum acceptable resistance for each input is 10KΩ, it means whether the switch of loop circuit is closed or not, the status monitored by controller are all open when the resistance in loop circuit exceeds 10KΩ, status monitored by controller are all close when the resistance in loop circuit falls below 10KΩ. To avoid error monitoring of switch status, do pay attention to the wiring resistance and switch in resistance loop circuit, and total resistance must be less.

7.2.2 Connection for the configurable output relays

There are 9 relay outputs, except fuel and crank relays which are fixed function, other relays' function all can be configured by user.



NOTE:

- Terminal #27 is the common port for RL1 to RL6, and it is connected to power positive.
- The output current for each relay can not exceed the rated current of respective relay; the total output current for 6 relays (from RL1 to RL6) can not exceed 16A.
- A switch or fuse for over current protection must be mounted between power and terminal 27#, the recommended capacity is 16A.
- In practical application, controller output will generate instantaneous peak current, you must consider the peak current when choosing a switch or fuse for over current protection.

8 LCD displays and Menu System

8.1 LCD displays measuring parameters:

Use's a back-light graphic LCD to display data and information. Each page can display multi-row information simultaneously, the above 3 rows display measuring data, the last row displays status information, press "▶" to scroll for viewing next page, it can be configured as auto scroll as well. When alarm occurs, the alarm status is displayed on the LCD immediately.

When controller is configured to use LOP sensor and HET sensor but not connected:

	Engine	
	Speed	**Oil-Pressure**
	0 rpm	**OPEN**
	Coolant	**Battery**
	OPEN	**0 V**
	Fuel	**AUX**
	OPEN	**OPEN**
	Ready	

NOTE:

- When HET sensor or LOP sensor is set as "not used", LCD will not display the related data.

When Genset is running ,LCD circularly displays each measuring data:

	Engine	
	Speed	**Oil-Pressure**
	0 rpm	**0 BAR**
	Coolant	**Battery**
	0 ℃	**0 V**
	Fuel	**AUX**
	0 %	**0**
	Ready	
	Run Hour	**COUNTERS**
	0 hr	**0**
	Day-to-maint.	**Hrs-to-maint.**
	ALT	
	0 V	
	Ready	

	Generator	
	avg. U L-L 0 V Active-power 0 KW Power Factor 1.00 Ready	avg. current 0 A Frequency 0. 0 Hz I4 0 A
	V1 0 V U12 0 V Active-power1 0 KW Ready	I1 0 A PF1 1.00 Reactive-power1 0 KVAr
	V2 0 V U23 0 V Active-power2 0 KW Ready	I2 0 A PF2 1.00 Reactive-power2 0 KVAr
	V3 0 V U31 0 V Active-power3 0 KW Ready	I3 0 A PF3 1.00 Reactive-power3 0 KVAr
	Active-energy 0 Reactive-energy 0 Apparent-power 0 KW Ready	Reactive-power 0 KVA

	Bus Bar		
	Frequency		**avg. U L-L**
	0. 0 Hz		**0** V
	V1	**V2**	**V3**
	0 V	**0** V	**0** V
	U12	**U23**	**U31**
	0 V	**0** V	**0** V
	Ready		

	Online Data
	ID:1
	ID:2
	ID:3
	Ready

	Discrete IO
	Relay Output
	R1 R2 R3 R4 R5 R6 R7 R8 R9 R10
	Discrete Input
	D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11
	Ready

8.2 Setting running parameters

Press and hold the "▶" button for 2sec to enter into parameter settings menu, then use "+" or "-" to scroll page in the same menu list, press "√" enter into submenu, press "↑" can return to upper menu, go to menu 1.3 "**password**" to enter password first, or select the required item, press "√" enter into modify mode, press "+" or "-", the LCD displays 0 0 0 0 when prompted to enter password, then use "+" or "-" to modify the first digital value, press "→" move to modify next digital value, the first digital value will be displayed as "*" after moving to next digital value, press "√" to confirm after the password is set as 2213, then you can modify parameters. Otherwise it will prompt to key in password again. Press and hold "▶" for more than 2sec or press "↑" to quit parameter settings mode after finishing configuration.

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:	**[SETTING]** **0. QUIT** **1.SYSTEN** **2. GENSET** **3. ENGINE**
Press "√" button ,then Press "+" 12 times and then press "√", then LCD displays:	**[CT ratio]** **1000:5**
Press "+" or "-" button, prompted enter password (2213), press "√" button to confirm after entering password.	**[CT ratio]** **Password:0000**
Press "+" or "-" to change parameters, change at 500, then LCD displays:	**[CT ratio]** **500:5**
Press "√" to confirm,then press "↑" to return , then LCD displays:	**[SETTING]** **0. QUIT** **1.SYSTEN** **2. GENSET** **3. ENGINE**
Press "↑" again or press and hold "▶" 2sec will quit parameter settings menu , then LCD displays:	**Ready**

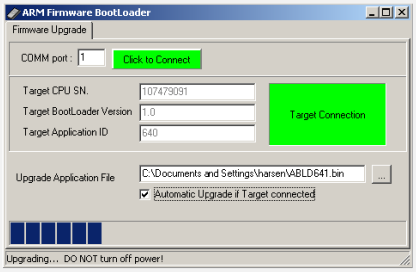
For example: (setting controller crank attempt at 2)

Operation	Description
Press and hold "▶" 2sec, to enter into parameters settings menu, then LCD will display:	**[SETTING]** **0. QUIT** **1. SYSTEM** **2. GENSET** **3. ENGINE**
Press "+" 2 times and then press "√", then LCD displays:	**[ENGING]** **0. QUIT** **1. Rated speed** **2. MPU input** **3. Fly wheel teeth**
Press "+" 7 times and then press "√", then LCD displays:	**[Crank attempt]** **3**
Press "+" or "-" button, prompted enter password (2213), press "√" button to confirm after entering password.	**[Crank attempt]** **Password:0000**
Press "+" or "-" to change parameters, change at 2.	**[Crank attempt]** **2**
Press "√" button to confirm, and then press "↑" or press and hold "▶" 2sec will quit parameter settings menu.	**Ready**

For example: (reset parameters of controller to factory default)

Operation	Description
Press and hold "▶" 2sec, enter into parameters settings menu, then LCD displays:	**[SETTING]** **0. QUIT** **1. SYSTEM** **2. GENSET** **3. ENGINE**
Press "√" button and then press "-" 2times, then the LCD displays:	**[SYSTEM]** 22. Auto scroll time 23. Display contrast 24. Test mode **25. Default settings**
Press "√" button, prompted enter password (2213), press "√" button to confirm after entering password.	**[Default settings]** **Password:0000**
Press "√" button to recover default, and then press "↑" or press and hold "▶" 2sec this will quit the parameter settings menu.	**[SYSTEM]** **DONE**

For example: (configure controller as online program mode)

Operation	Description
Disconnect the controller's supply power and connect the controller to the computer by the USB communication line correctly. And then open the programming software "ABLDs.exe" in the computer. As the picture on the right, open the serial port and import upgrade procedure. Resume the power and then the procedure will upgrade automatically. If the operation fails, you can disconnect the power and try again.	

9 Technical Specification

9.1 AC voltage:

Measurement type	True RMS
Phase to Neutral	15 to 346VAC
Phase to Phase	25 to 600VAC
Max power consumption per path	＜0.1W
Accuracy	1%
Display	0 to 600KV

9.2 AC voltage frequency:

Measuring frequency	3 to 70Hz（voltage≥15VAC）
Accuracy	0.1%
Display	0 to 100Hz

9.3 Current (isolated):

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

9.4 Power supply:

Range	12V/24V (8-35V continuous)
Max. operating current	@12V 600mA , @24V 300mA
Max. standby current	@12V 480mA , @24V 240mA
Cranking dropouts	0V for 80ms, assuming dc supply was at least 10V before dropout and recovers to 5V.
Accuracy	1%
Display	0 to 40V

9.5 Configurable digital inputs:

Number	11
Max. contact resistance	10KΩ
Type	Isolated
Max. contact resistance per path	1mA

9.6 Configurable relay outputs:

Fuel relay	16A/30Vdc
Crank relay	16A/30Vdc
Aux relay	3A/30Vdc

9.7 Charge failure input:

Voltage range	0 to 40Vdc
Accuracy	1%
Max output current	@12V 120mA , @24V 240mA

9.8 Analog Inputs:

Number	4
Sensor type	resistance
Resolution	10 bits
Range	0 to 1 KΩ
Accuracy	2% When full scale, except for sensor error

9.9 Magnetic pickup:

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

9.10 Ambient parameters

Operating temperature range Standards	-20 to 70℃ IEC60068-2-1 and IEC60068-2-2
Storage temperature range Standards	-30 to 80℃ IEC60068-2-1 and IEC60068-2-2
Humidity Standards	60℃,95%RH,48 hours IEC60068-2-30
Electro magnetic compatibility 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

Service Hotline

4008883388

More technical support,
Please browse our website: www.jnhharsen.com