The clarification of notation used within this manual:

	**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 over speed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The over speed 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.

Contents

1. Description

GU641B is a new generation Automatic Mains (Utility) Failure module for single Genset, which adopts bran-new outline configuration, focus on the requirements of customers, and perfectly improves the performance of controller. It fully meets the auto control requirements of different kinds of Genset for user or special assembly factory.

The module also monitors and protects the engine, indicating operational status, fault conditions and metering on the front panel LCD and LED.

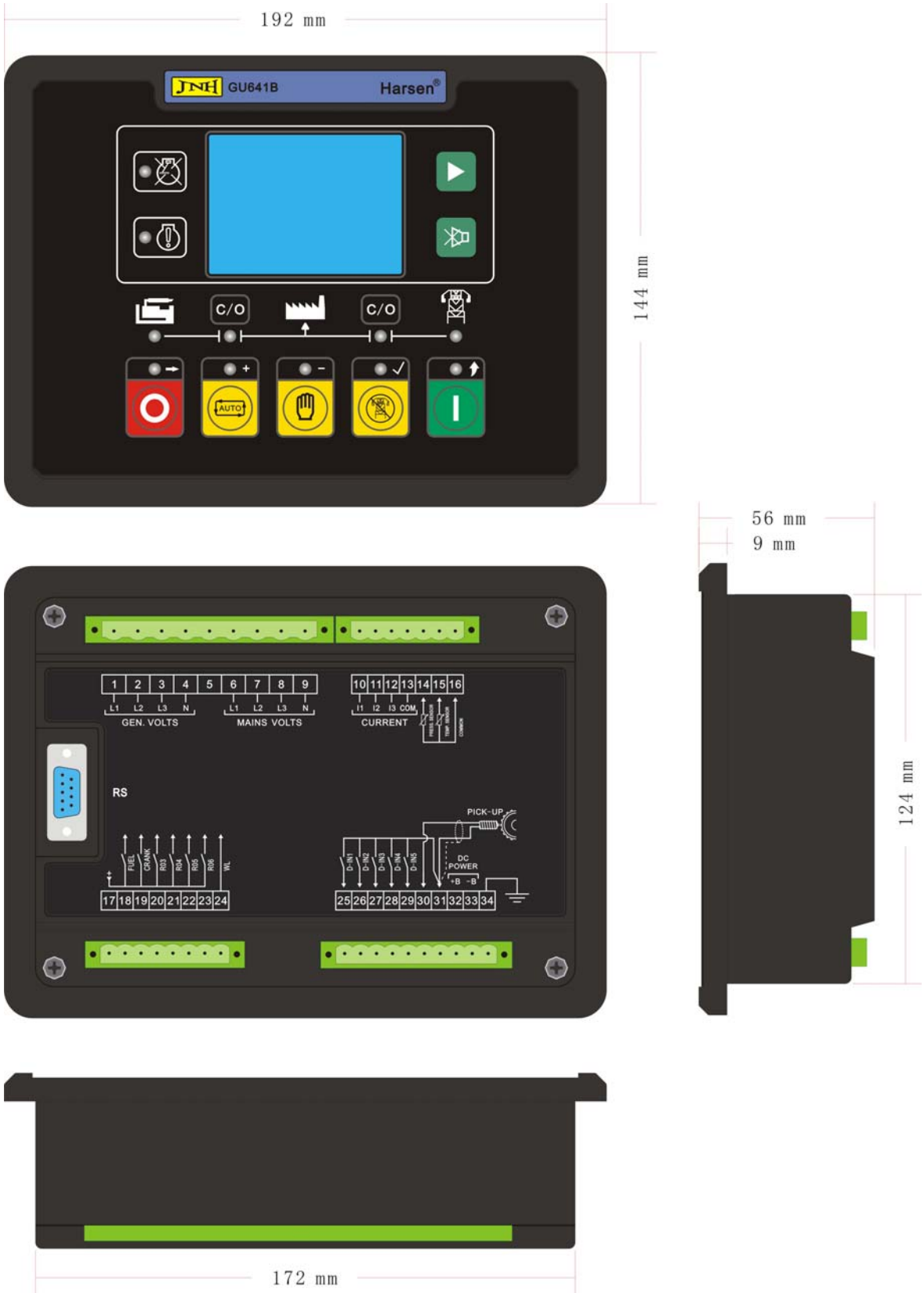
- True RMS measure of voltage and current.
- 2 analog inputs for kinds of optional built-in sensors, parameters also can be configured by user.
- More outputs of configurable auxiliary control relays.
- More configurable isolated digital inputs.
- Buttons on control panel are used for selecting control 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, and LCD displays each measuring parameter and status.
- Flexible equipped with RS485, RS232 and USB, realizing remote monitor; or communicated with PC, fully realizing functions of remote signaling, telemetering and remote control, can read and set the running parameters of controller.
- All connections of the controller are by secure plug and socket, for ease and convenience to connect, move, maintain and replace the device.

This manual is only suitable for GU641B Automatic control module, user must carefully read this manual first.

2. The Outline Dimension Drawings and Controller Wiring

2.1 Following Details:

Module Dimensions	W192mm×H144mm
Panel Cutout	W174mm×H126mm
Thickness	D56mm (without connection)



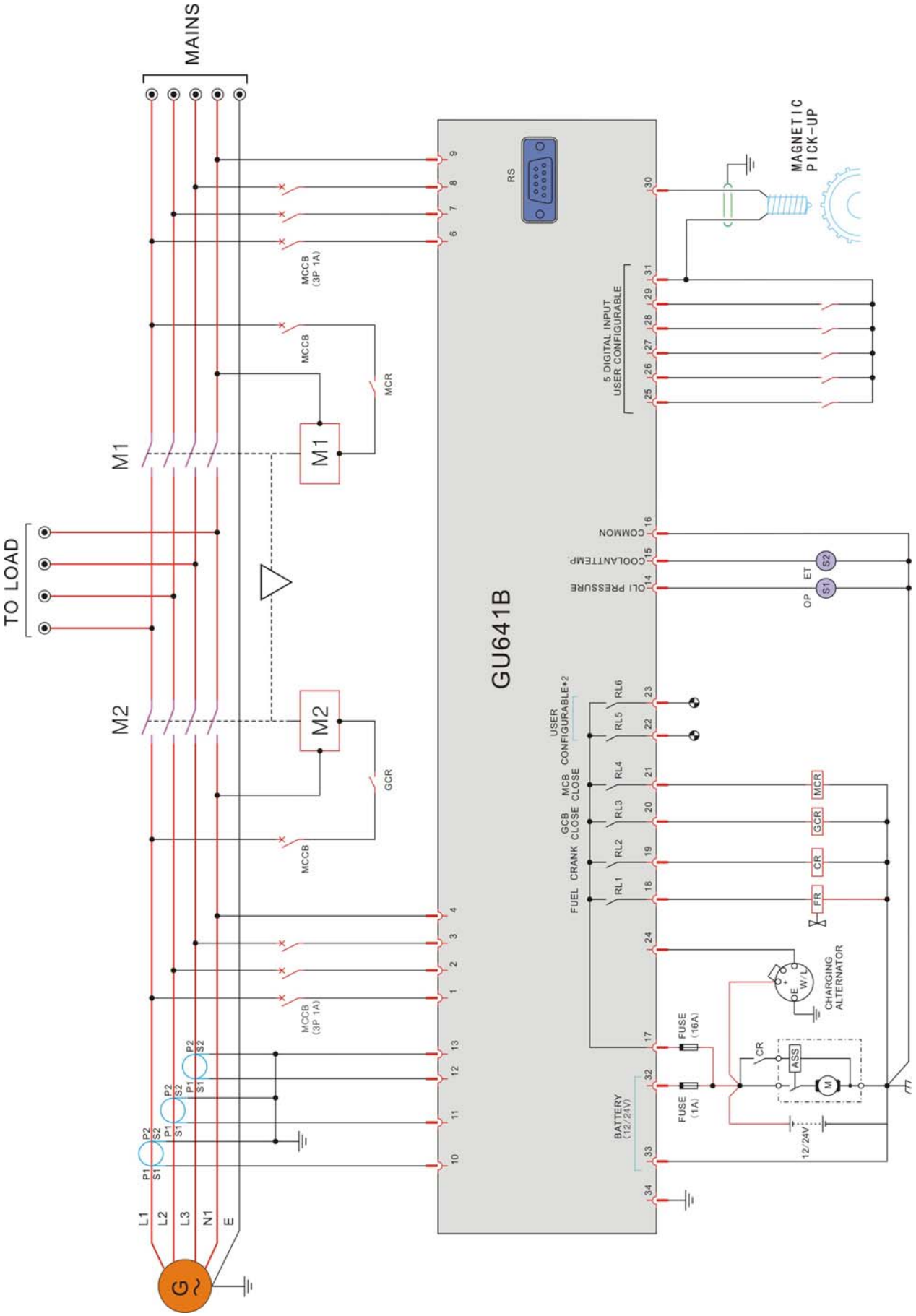
2.2 Terminal Connections:

Pin no.	Function Description	Signal	Dim
1	GEN. V_{L1-N} input	0-346Vac	1mm²
2	GEN. V_{L2-N} input	0-346Vac	1mm²
3	GEN. V_{L3-N} input	0-346Vac	1mm²
4	GEN. Neutral		1mm²
5	Not used		
6	MAINS V_{L1-N} input	0-346Vac	1mm²
7	MAINS V_{L2-N} input	0-346Vac	1mm²
8	MAINS V_{L3-N} input	0-346Vac	1mm²
9	MAINS Neutral		1mm²
10	I1 Gen current input (S1)	0-5A	2.5mm²
11	I2 Gen current input (S1)	0-5A	2.5mm²
12	I3 Gen current input (S1)	0-5A	2.5mm²
13	Common port for current inputs (S2)	0-5A	2.5mm²
14	LOP sensor	<1KΩ	2.5mm²
15	HET sensor	<1KΩ	2.5mm²
16	Common port for sensor		2.5mm²
17	Common port for relay outputs		2.5mm²
18	Fuel solenoid relay output	N.O. contact, 16A/30Vdc	2.5mm²
19	Start (Crank) relay output	N.O. contact, 16A/30Vdc	2.5mm²
20	Relay output 3 (GCB close/open)	N.O. contact, 3A/30Vdc, configurable (1)	1mm²
21	Relay output 4 (MCB close/open)	N.O. contact, 3A/30Vdc, configurable (2)	1mm²
22	Relay output 5	N.O. contact, 3A/30Vdc, configurable (3)	1mm²
23	Relay output 6	N.O. contact, 3A/30Vdc, configurable (4)	1mm²
24	charger excitation power output	if not used, do not connect to negative	1mm²
25	Configurable digital input signal 1	low level is active	1mm²
26	Configurable digital input signal 2	low level is active	1mm²
27	Configurable digital input signal 3	low level is active	1mm²
28	Configurable digital input signal 4	low level is active	1mm²
29	Configurable digital input signal 5	low level is active	1mm²
30	Magnetic pick-up signal (+)	1-70Vac	2 cores shielded
31	Common for configurable inputs and magnetic pick-up signal (-)		
32	Battery supply (+B)	12V/24V (8-35Vdc continuous)	2.5mm²
33	Battery supply {-B}		2.5mm²
34	Ground		2.5mm²

NOTE:

- Relay output 3 and 4 are respectively configured as GCB and MCB close/open relay when default setting, however both can be reconfigured by user if required.

2.3 Typical Wiring Diagram



A fuse with the rating of 1A shall be provided external to the equipment.

3. Panel Operation

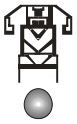
The operation panel consists of 3 sections: LCD display indicating measurement parameters, LED indicator for common failure, and push buttons for Genset and selection of control modes.

LCD can display 3-row data in the same time. LCD also has a backlight so that the operator can clearly read information day or night. After pressing any button the backlight will automatically turn off after a preset time.

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

3.1 Control buttons and LED

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 failure occurs, alarm buzzer sounds. Pressing mute button will mute the sound. LCD displays mute icon. Press it again will clean mute function, buzzer continues to sound. Press and hold this button for 2sec, all LEDs 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 generator 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 generator. When in parameters setting mode, this button is used to return.	

STOP / RESET Button / "→" Move Setting The Push button is used for manually stops the Genset. No matter what mode the controller is running, press and hold this button for 2sec to stop the generator, the mode of the controller will be default to "MAN" mode automatically from "AUTO" or "TEST" mode and the generator will be shut down after cool down period, during the cool down period if you press and hold this button for 2sec again, the generator 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 There are 2 C/O buttons respectively beside the Mains and Gen icons. They are used to close/open the switches of Mains and 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/MCB Closed LED LED will illuminate when GCB/MCB is closed and power supplied by Gen / Mains, LED will flash when GCB / MCB failure occurs.	
MAINS Normal LED Mains normal LED will illuminate after both voltage and frequency of the Mains reach the preset value range.	

4. Control and Operation Instruction

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

4.1 Operation Modes Setting:

Operation	Description
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.

4.2 AUTO Control Sequence:

The controller is running in “AUTO” mode.

When Mains (Utility) is normal, Mains is on load:

When Mains is normal, both voltage and frequency of Mains are within the range of preset value, the Mains Normal LED illuminates, the timer for **Mains ON delay** is activated, when it times out, the MCB close/open relay closes, the transfer switch switches on Mains, the Mains Aux. Switch’s contact feeds back the signal to a configurable input on our controller. The MCB closed LED illuminates.

WARNING:

- The Mains Normal LED illuminated means that both voltage and frequency of Mains are within the range of preset values; Mains Normal LED flashing means either voltage or frequency of Mains are over the range of preset values; Mains Normal LED does not illuminate means that the Mains voltage is lower than the measuring range.
- Do not assume the Mains is not available if Mains Normal LED does not illuminate.

Mains fail to load:

If MCB close/open relay is closed, the timer for MCB closing is activated, when it times out, if the controller does not receive the feed back signal from the Mains Aux. Switch’s contact, then Mains fail to load is activated.

NOTE:

- Above control procedure, assumes that one of configurable inputs has been configured as **Mains Aux. Switch Closed** and connects the switch’s N.O. Aux. contact to this port. If you do not configure an input as **Mains Aux. Switch Closed**, then the MCB closed LED illuminates is only an indication that the MCB close/open relay should have been closed, under this condition, the alarm for **Mains fail to load** is inactive, and the along function of start Genset is also inactive.

Generator Auto Start Sequence:

Controller implements following procedure when Mains voltage failure occurs (it means that the controller detecting either the voltage or the frequency of Mains is over the range of preset values and delay confirmed), or Mains fail to load, or remote start signal is active and Mains failure;

NOTE:
- To achieve remote start, one of configurable inputs must be defined as remote start signal.

The Start delay timer is activated, when it times out, the Preheat relay output is energised (if preheat function selected), the timer starts. When it times out, the fuel relay output is energised, and operates the fuel solenoid of the engine. After 300ms delay, the start relay 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 Generator is running normally, Gen. Normal LED illuminates, the timer for GEN. ON delay is activated, when it times out, GCB close/open relay closes, the transfer switch switches on Gen. The Gen Aux. Switch's contact feeds back a signal to a configurable input on the controller. GCB closed LED illuminates.

NOTE:
- If Mains fails to load, the start sequence is initiated without the start-delay timer.
- When Mains voltage failure and remote signal is active, the start-delay timer is activated, if remote start signal is inactive or Mains voltage resumes to normal during this period, the start delay timer terminates immediately, the controller terminates the starting procedure, and then recovers to the original standby status.
- During cranking or idle period, if the remote start signal is inactive or Mains voltage resumes to normal, the controller stops the start procedure, then recovers to the original standby status.
- Under any conditions, GEN. ON delay only can be started after Safety-on Delay times out.

NOTE:
- The start motor will power off while cranking if there are one of the following conditions occur:
  A. The AC generator's frequency reaches the preset value (configurable cranking cutout value);
  B. The AC Engine speed reaches **crank cutout value**;
  C. Generator's voltage reaches the **crank cutout value** (optional);
  D. Charger voltage reaches **crank cutout value** (optional);
  E. Cutout P-delay time's up (optional);
  F. Cranking time's up.

- Controller can not implement crank procedure in one of following conditions:
  A. The AC generator's frequency reaches the preset value (configurable cranking cutout value);
  B. The AC Engine speed reaches **crank cutout value**;
  C. Generator's voltage reaches the **crank cutout value** (optional);
  D. LOP switch is opened or oil pressure is higher than **crank cutout value** (optional).

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

NOTE:
Above control procedure, assumes that one of configurable inputs has been configured as **Gen Aux. Switch Closed** and connects the switch's N.O. Aux. contact signal to this port. If you do not configure an input as **Gen Aux. Switch Closed**, then the GCB closed LED illuminates is only an indication that the GCB close/open relay should have been closed.

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

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

Repeat Crank: During the crank period, if the engine can not ignite 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-engised. 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.

Mains return and generator shutdown sequence:

When Mains resumes to normal, Mains Normal LED illuminates, the **Mains ON delay** timer is activated, GCB close/open relay is de-energised after it times out, MCB Close/open relay is energised, transfer switch switches on Mains, the Mains Aux. Switch's contact feeds back the signal to a configurable input on our controller, MCB closed LED illuminates.

At the same time as the MCB close/open relay is energised, the timer for cool down is activated, when it times out, the fuel relay de-energises, generator stops and recovers to its standby status.

NOTE:
If you do not configure an input as **Mains Aux. Switch Closed**, then the MCB closed LED illuminates but is only an indication that the MCB close/open relay should have been closed.

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 generator 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.

Generator auto start conditions:

When the controller is in "AUTO" mode, it will auto start under the following 3 conditions:

- Mails voltage failure
- Remote start signal is active
- MCB failure

If you do not define one of the configurable inputs as Remote Start Signal, when the Mains fails, the controller will automatically initiate the start sequence.

If one of the configurable inputs has been defined as Remote Start Signal, when remote start signal is active and Mains fails, the controller will initiate start sequence. However if there is a Mains failure but remote start input is not active the controller will not initiate start sequence, but the Mains close/open relay will open.

If Genset has started since **Mains fail to load**, when failure is removed and controller unlocked by pressing reset button, GCB close/open relay opens, MCB close/open relay closes, transfer switch switches the load to Mains.

NOTE:
If no configurable input was defined as **Main Aux. Switch closed**, the alarm for **Mains fail to load** is inactive.

4.3 MAN control Sequence:

The controller is running in "MANUAL" mode.

Mains is normal, Mains is on load:

When Mains is normal means that both voltage and frequency of Mains are within the range of preset value, the Mains Normal LED illuminates, the MCB close/open relay will not close automatically.

Press the "C/O" button of Mains to close the Mains switch manually, then Mains is on load, the Mains Aux. Switch's contact feeds back the signal to a configurable input on our controller, MCB closed LED illuminates. Press the "C/O" button of Mains again to open the Mains switch manually, the Mains is off load, the MCB closed LED is turned off at the same time.

If you press the "C/O" button of Mains when Gen is on load, the GCB close/open relay will be opened first, then Gen is off load, the MCB close/open relay closes later, Mains is on load.

NOTE:
When the controller is running in "MANUAL" mode, Mains must be normal, or the "C/O" button of Mains will be disabled.

Generator starting sequence:

Pressing “START” button the fuel relay energises, and operates the fuel solenoid of 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.

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

Press the “C/O” button of Gen to close the Gen switch manually, Gen is on load, the Gen Aux. Switch’s contact feeds back the signal to a configurable input on our controller, GCB closed LED illuminates. Press the “C/O” button of Gen again to open the Gen switch manually, Gen is off load, the GCB closed LED is turned off at the same time.

If you press the “C/O” button of Gen when Mains is on load, the MCB close/open relay will be opened first, then Mains is off load, the GCB close/open relay closes later, Gen is on load.

NOTE:

- When the controller is running in “MANUAL” mode, the Gen must be normal, or the “C/O” button of Gen will be disabled.
- GCB and MCB close/open relays are electrically interlocked, they can’t be closed at the same time.

Generator stopping sequence:

Press “STOP” button, GCB close/open relay opens, the generator is without load, the cool down timer starts, when it times out, the fuel relay is de-energised, then the fuel solenoid opens immediately, generator stops and goes to standby status.

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

4.4 TEST Control Sequence:

When the Controller is running in “TEST” mode means it simulates Mains failure automatically. There are two kinds of “TEST” modes, one is “Test with load”, another is “Test without load”, and they can be selected through parameter setting.

Test with load: GCB close/open relay will be closed after the generator is started successfully and running normally, then Gen will be on load.

Test without load: GCB close/open relay will not be closed after the generator is started successfully and running normally, the Mains remain on load.

4.5 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.

4.6 Idle function:

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

Refer to the flow chart **4.9** for start and stop for **idle** control flows.

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

4.7 Preheat function:

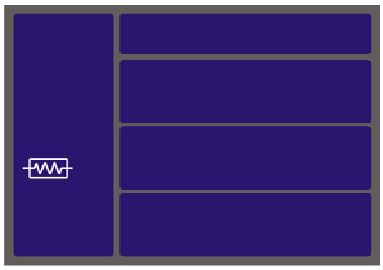
For **Preheat** function, configure one of the configurable outputs as **Preheat**, The controller has 4 selectable preheat control modes as below:
Mode 1 — during preheat time, preheat relay output energises.
Mode 2 — during preheat time, preheat relay output energises until the successful ignition.
Mode 3 — during preheat time, preheat relay output energises until safety-on delay times out.
Mode 4 — 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.

For preheat mode 1 to 3, please refer to the flow chart **4. 9** for start and stop for **Preheat** control flows.

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

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

LCD displays icon of preheat operating status when preheat relay output energises:

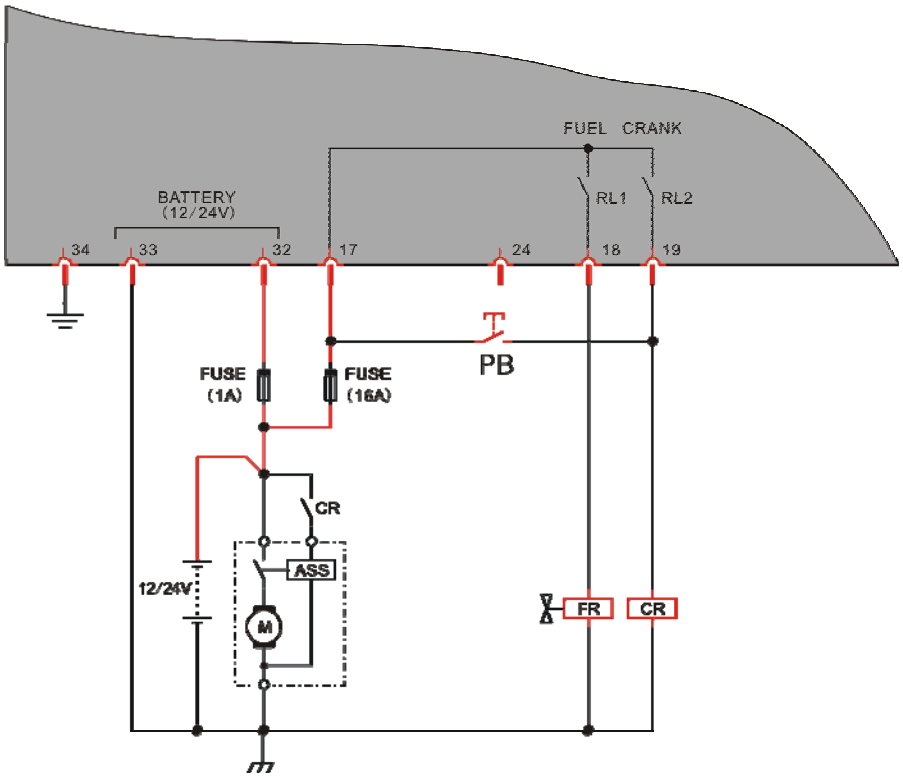


4.8 The function of forcing start

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

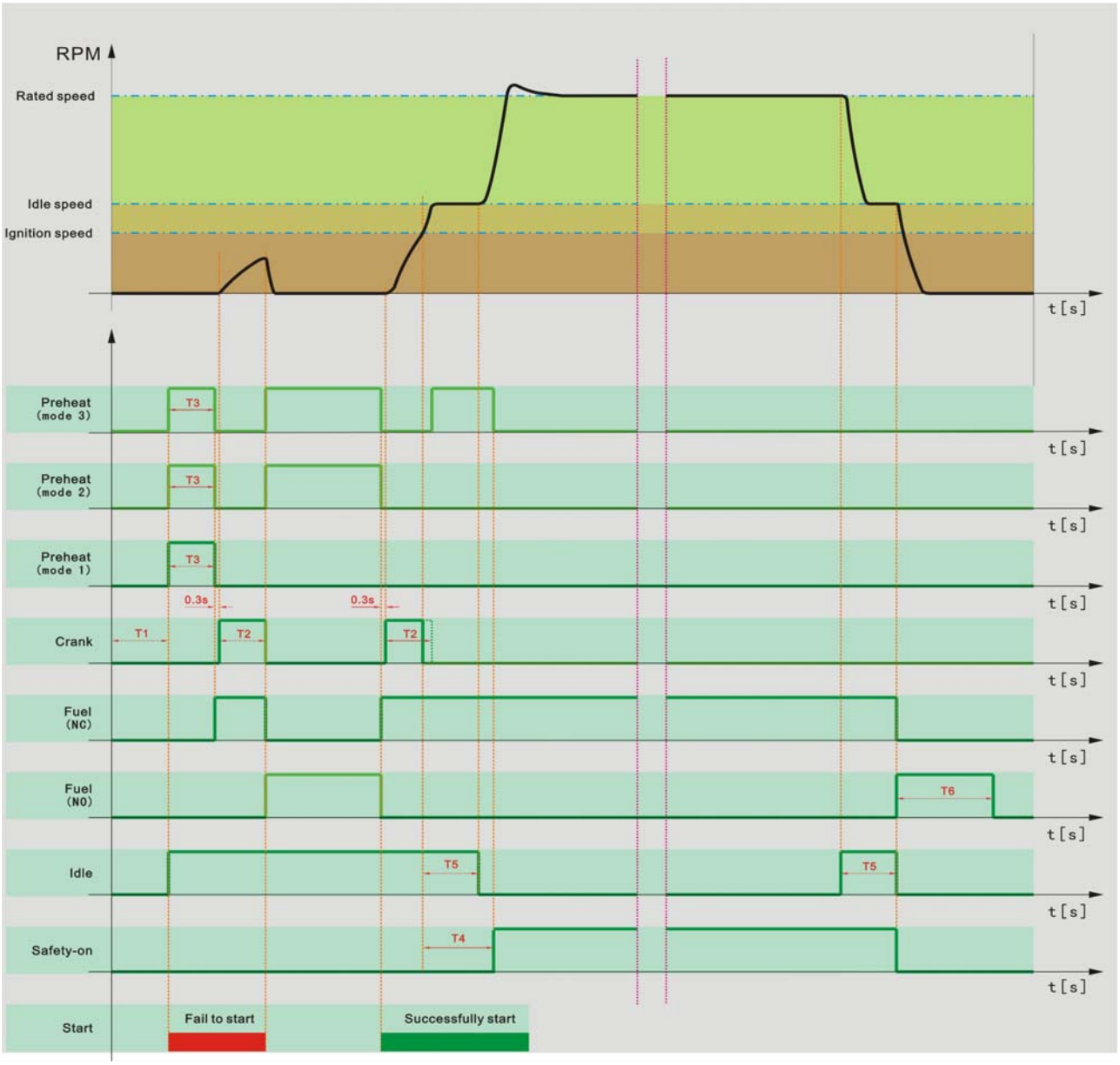
First method: when controller is running in “MANUAL” mode, normally the crank time will not exceed the pre-set value, but you can press “START” button and hold without changing the related parameters until it has started, the crank time depends on the holding time on the button. Safety-on timer begins after it has successfully started. The other processes and protections are the same as for a normal start.

Second method: when controller is running in “MANUAL” mode, configure the “**EX. Crank permit**” as “**1**”, shown as schematic below, a PB switch is externally mounted to control cranking. Close PB switch, engine cranks, when the speed reaches 150RPM or generator voltage output is not less than AC 20V if magnetic pick-up is not used, then controller functions are triggered, the fuel relay output is energised, safety-on timer begins after the speed reaches crank cutout value, the other processes and protections are the same as normal start. If the speed falls below 150RPM within safety-on time, controller will be reset and return to standby status.



CAUTION	**CAUTION:** ● We normally don’t recommend using the second method to solve this condition. ● Pay attention to the installation of PB switch to avoid cranking when the Genset is running.

4.9 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

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.

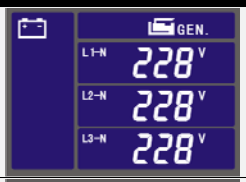
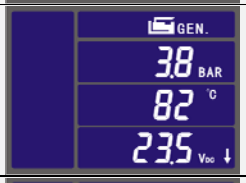
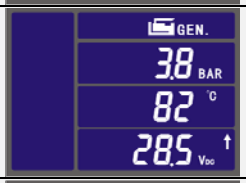
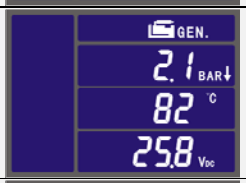
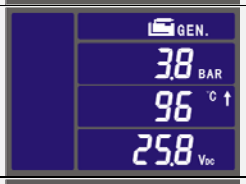
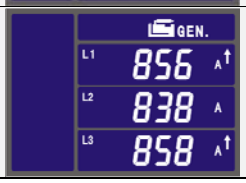
5. Measure and Display Data

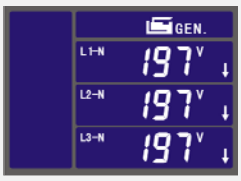
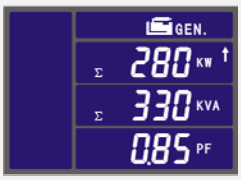
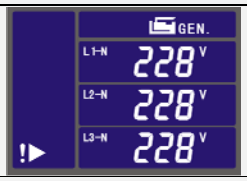
Mains 3 phases V_{Ph-N} **L1-N L2-N L3-N**
Mains 3 phases V_{Ph-Ph} **L1-L2 L2-L3 L3-L1**
Mains frequency **Hz (L1)**
Gen 3 phases V_{Ph-N} **L1-N L2-N L3-N**
Gen 3 phases V_{Ph-Ph} **L1-L2 L2-L3 L3-L1**
Gen frequency **Hz (L1)**
Gen 3 phases current **I1 I2 I3**
Gen total apparent power ∑**A**
Gen total active power ∑**P**
Gen power factor **PF (AV)**
Engine speed **RPM** (signal derived from magnetic pick-up or generator Hz)
Engine oil pressure **Bar** (signal from engine LOP sensor)
Engine coolant temperature ℃ (signal from engine HET sensor)
Battery voltage **Vdc**
Genset Running Hour **Hour**

6. Pre-alarm and Shutdown Alarm

6.1 Pre-alarm (warning)

(NOTE: Pre-alarms are non-critical failure conditions and do not affect the operation of the generator system, they serve for drawing the operators' attention to an undesirable condition so they can remove it to ensure continuous running of the system. When Pre-alarms occur, the Pre-alarm LED illuminates, but failure will not be locked out and the unit will not shutdown. Once the Pre-alarm failure is removed the Pre-alarm LED will automatically turn off.)

Pre-alarm / Description	LCD displays
CHARGE FAILURE: After safety-on times up, if the charging voltage from the excitation contact of alternator is lower than the "ALT. low preALM", the pre-alarm LED illuminates and the buzzer sounds, LCD displays:	
BATT. UNDER VOLT: If controller detects that battery voltage has fallen below the "Batt. Undervolt", pre-alarm LED illuminates and the buzzer sounds, LCD displays: For example, "Batt. Undervolt" preset as: 23.6V, when battery voltage falls below this value, LCD flashing low value icon.	
BATT. OVER VOLT: If controller detects that battery voltage has exceeded the "Batt. overvolt", the pre-alarm LED illuminates and the buzzer sounds, LCD displays: For example, "Batt. overvolt" preset as: 28.2V, when battery voltage exceeds this value, LCD flashing high value icon.	
LOW OIL PRESS: If controller detects that the engine oil pressure has fallen below the "Oil-P low preALM" after the safety-on timer expired, the pre-alarm LED illuminates and the buzzer sounds, LCD displays: For example, "Oil-P low preALM" preset as: 2.2BAR, when engine oil pressure falls below this value, LCD flashing low value icon.	
HIGH TEMP: If controller detects that engine coolant temperature has exceeded the "Coolant preALM", the pre-alarm LED illuminates and the buzzer sounds, LCD displays: For example, "Coolant preALM" preset as: 95℃, when engine coolant temperature exceeds this value, LCD flashing high value icon.	
OVER SPEED: If engine speed exceeds the "Over SP preALM", the pre-alarm LED illuminates and the buzzer sounds, LCD displays: For example, "Over SP preALM" preset as: 1600RPM, when engine speed exceeds this value, LCD flashing high value icon.	
UNDER SPEED: If engine speed falls below the "Under SP preALM" after the safety-on timer has expired, the pre-alarm LED illuminates and the buzzer sounds, LCD displays: For example, "Under SP preALM" preset as: 1440RPM, when engine speed falls below this value, LCD flashing low value icon.	
OVER CURRENT: configure "Overcurrent action" as "warning", if controller detects that any phase output current exceeds the "Overcurrent level" after the safety-on timer has expired, the pre-alarm LED illuminates and the buzzer sounds, LCD flashing high value icon.	

GEN. OVER VOLT: If controller detects that any phase voltage of generator has exceeded the "GEN-V over preALM" after the safety-on timer has expired, the pre-alarm LED illuminates and the buzzer sounds, LCD displays For example, "rating voltage" preset as: 220V, "GEN-V over preALM" preset as: 115%, when the generator output voltage exceeds this value, LCD flashing high value icon for corresponding phase.	
GEN. UNDER VOLT: If controller detects that any phase voltage of generator has fallen below the "GEN-V under preALM" after the safety-on timer has expired, the pre-alarm LED illuminates and the buzzer sounds, LCD displays: For example, "rating voltage" preset as: 220V, "GEN-V under preALM" preset as: 90%, when the generator output voltage falls below this value, LCD flashing low value icon for corresponding phase.	
OVERLOAD: If controller detects that the active power of generator has exceeded the "KW Overload preALM" after the safety-on timer has expired, the pre-alarm LED illuminates and the buzzer sounds, LCD displays: For example, "rating active power" preset as: 300KW, "KW Overload preALM" preset as: 90%, when the generator active power exceeds this value, LCD flashing icon for corresponding high value.	
D-INPUT: If one of Configurable D-inputs has been configured as pre-alarm, when D-input is active, the pre-alarm LED illuminates and the buzzer sounds, LCD flashing D-Input icon.	
GCB FAILURE: If GCB close/open relay is closed, the timer for GCB closing is activated, when it times out, if the controller does not receive the feed back signal from Gen Aux. Switch's contact, then Gen fail to load alarm is activated. The GCB closed LED flashes and the buzzer sounds.	
MCB FAILURE: If MCB close/open relay is closed, the timer for MCB closing is activated, when it times out, if the controller does not receive the feed back signal from Mains Aux. Switch's contact, then Mains fail to load alarm is activated. The MCB closed LED flashes and the buzzer sounds.	

NOTE:

- Controller continuously detects battery voltage during standby period and **Battery Under/Over Voltage** Pre-alarms are active.
- **Battery under Voltage** pre-alarm is inactive during cranking.

CAUTION:

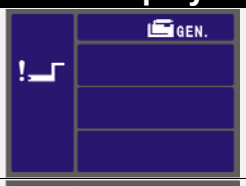
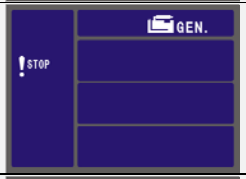
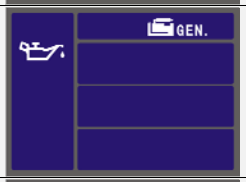
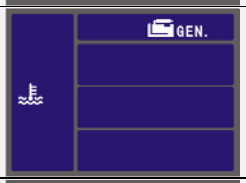
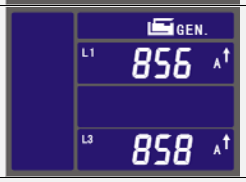
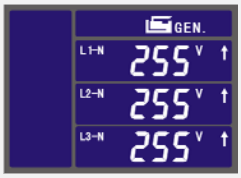
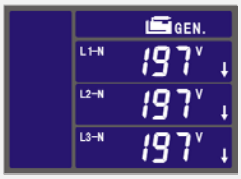
Under the period of safety-on delay, some pre-alarms (e.g.: under speed, under voltage, low oil pressure) are inactive, the safety-on time must be carefully and properly set to make Genset have full protection.

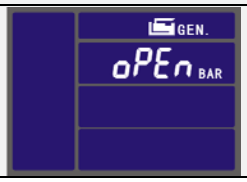
NOTE:

- To make the pre-alarm for **GCB/MCB FAILURE** active, please configure one of the configurable inputs as **Gen/Mains Aux. Switch Closed** and connects the switch's N.O. Aux. contact to this port. After pre-alarm occurred, the controller is locked out, you must press reset button to remove.

6.2 Shutdown Alarm

(NOTE: shutdown alarm failures immediately lock out the system and stop the Genset. The failure must be removed and the controller reset before restarting the Genset.)

Shutdown Alarm / Description	LCD displays
START FAILURE: if engine does not fire after the preset number of crank attempt has been made, the Shutdown alarm LED illuminates and buzzer sounds, LCD displays start failure icon:	
STOP FAILURE: if engine does not stop after the Stop delay expired, the Shutdown alarm LED illuminates and buzzer sounds, LCD displays stop failure icon:	
EMERGENCY STOP: Configure a configurable input as emergency stop, when the input signal is active, controller immediately stops all relay control outputs except alarm, Genset is shut down, the Shutdown alarm LED illuminates and buzzer sounds, LCD displays emergency stop icon:	
LOW OIL PRESS: if controller detects that the oil pressure level still falls below "Oil-P low Alarm" or LOP switch closes after the safety-on timer has expired, engine stops immediately, the Shutdown alarm LED illuminates and buzzer sounds, LCD displays low oil press icon:	
ENGINE HIGH TEMP: if controller detects that engine coolant temperature has exceeded the "Coolant Alarm" or HET switch closes, engine stops immediately, the Shutdown alarm LED illuminates and buzzer sounds, LCD displays engine high temp icon:	
OVER SPEED: if controller detects that engine speed exceeds the "Over SP Alarm", engine stops immediately, the Shutdown alarm LED illuminates and buzzer sounds, LCD displays over speed shutdown icon:	
OVER CURRENT: configure "Overcurrent action" as "shutdown", after safety-on delay times out, if controller detects that any phase output current is higher than "Overcurrent level", the Genset will be shut down immediately, the Shutdown alarm LED illuminates and buzzer sounds, LCD displays:	
GEN. OVER VOLT: After safety-on delay times out, If controller detects that any phase voltage of generator is higher than "GEN-V over Alarm", Genset stops, the Shutdown alarm LED illuminates and buzzer sounds, LCD displays: For example, "rating voltage" preset as: 220V, "GEN-V over Alarm" preset as: 115%, when any phase output voltage of generator exceeds this value, LCD displays high value icon for corresponding phase.	
GEN. UNDER VOLT: After safety-on delay times out, If controller detects that any phase voltage of generator is lower than "GEN-V under Alarm", Genset stops, the Shutdown alarm LED illuminates and buzzer sounds, LCD displays: For example, "rating voltage" preset as: 220V, "GEN-V under Alarm" preset as: 90%, when the generator output voltage falls below this value, LCD displays low value icon for corresponding phase.	

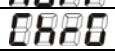
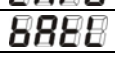
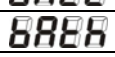
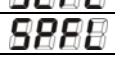
OVERLOAD: After safety-on delay times out, if controller detects the active power is higher than “KW Overload Alarm”, Genset stops, the Shutdown alarm LED illuminates and buzzer sounds: For example, “rating active power” preset as: 300KW, “KW Overload Alarm” preset as: 90%, when the generator active power exceeds this value, LCD displays icon for corresponding high value.	
LOP SENSOR OPEN: when controller detects that the resistance of LOP-sensor exceeds the range of measurement, it means LOP sensor is open, Genset stops, the Shutdown alarm LED illuminates and buzzer sounds, LCD displays:	

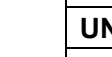
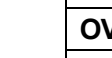
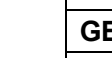
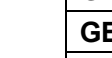
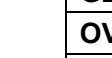
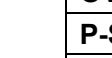
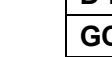
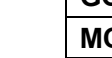
NOTE:
If engine speed signal is derived from generator output voltage frequency, it is used for control and failure protection parameters, for convenience of user, some data is expressed by RPM, RPM = Hz*60 / pair of poles.

NOTE:
While the Genset is running, if there is high coolant temperature, low oil pressure or over speed failure the controller will shutdown it immediately without delay. During the cool down period, if there is low oil pressure failure, the controller will shut down the Genset immediately without delay.

CAUTION:
During the period of safety-on delay, low oil pressure protection is inactive. To avoid starting an engine with no oil, you must make sure the oil levels are normal and the safety-on time shall be carefully and properly set for the first commissioning.

Code Table for Failure:

Name	Code
LOSS OF PICKUP	
CHARGE FAILURE	
BATT. UNDER VOLT	
BATT. OVER VOLT	
START FAILURE	
STOP FAILURE	
EMERGENCY STOP	
LOW OIL PRESS	
ENGINE HIGH TEMP.	
OVER SPEED	

Name	Code
UNDER SPEED	
OVER CURRENT	
GEN. OVER VOLT	
GEN. UNDER VOLT	
OVERLOAD	
P-SENSOR OPEN	
D-INPUT *	 *
GCB FAILURE	
MCB FAILURE	

7. Parameters Setting

7.1 SYSTEM:

NO.	Items		Preset	Value Range
1.1	CT Ratio		200	1 to 1200
1.2	VT Ratio		1.0	1.0 to 25.0
1.3	Rated ph-voltage		220	45 to 9999VAC
1.4	Rated current		1000	0 to 6000A
1.5	Rated active power		500	0 to 3000KW
1.6	Voltage Type		1	1 to 5
1.7	Comm. Address		1	1 to 247
1.8	Startup mode		0	0 MAN /1 AUTO /2 the same as last time
1.9	Auto scroll time		0s	1 to 60s / 0 Not used
1.10	Default settings			
1.11	Password			0000 to 9999
1.12	Firmware update			

Menu descriptions:

CT Ratio:

- The current is derived from CT on generator.
- Secondary current on CT is fixed at 5A.
- Used to calculate for GEN: KVA, KW and PF.
- Used for shutdown alarm: over current, overload, etc.

VT Ratio:

- The voltage is derived from VT on Gen and Mains.
- Used to detect frequency of Gen and Mains.
- Used to calculate for GEN: KVA, KW and PF.
- Used for shutdown alarm: over/under voltage, overload, etc.

Rated ph-voltage:

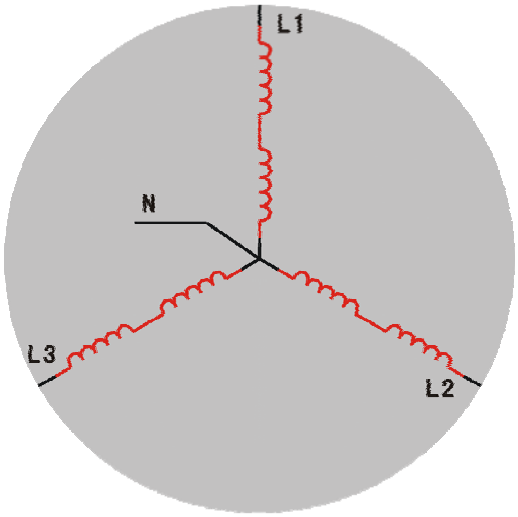
- Used to define the rated voltage (phase to neutral) of Gen and Mains, rated V_{Ph-Ph} = “Rated ph-voltage” * 1.732.
- Reference value for judging over/under voltage.

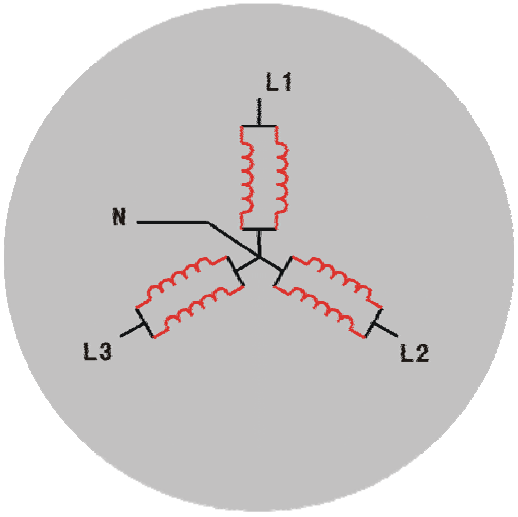
Rated current:

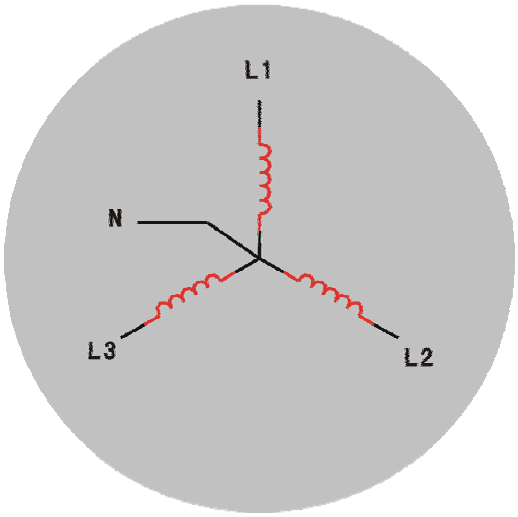
- Used to define the rated current of generator.
- Reference value for judging current.

Voltage type:

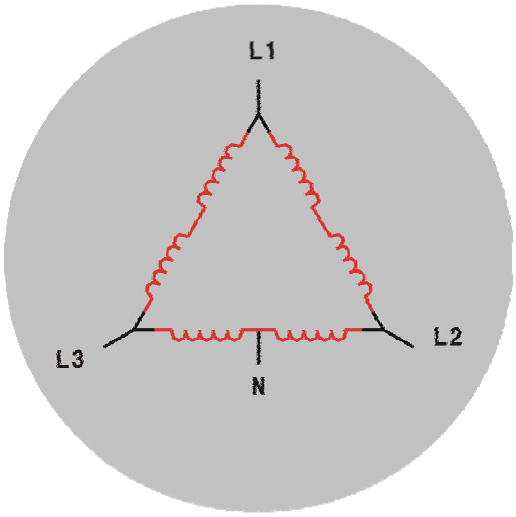
- There are 5 kinds of voltage input type: “Y” 3P4W, “△” 3P4W, 3P3W, 1P3W, 1P2W.
- 1— “Y” 3P4W (3 phases 4 wires star):



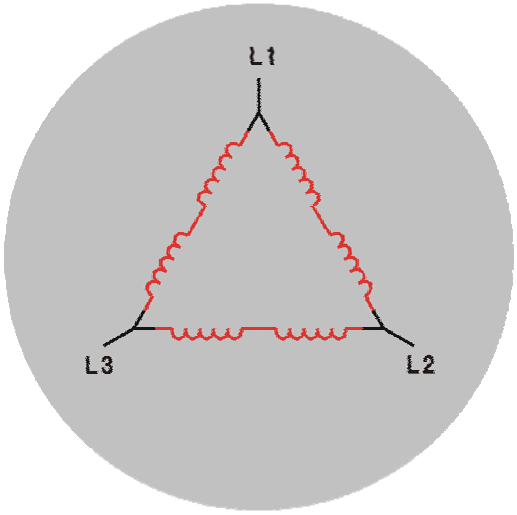


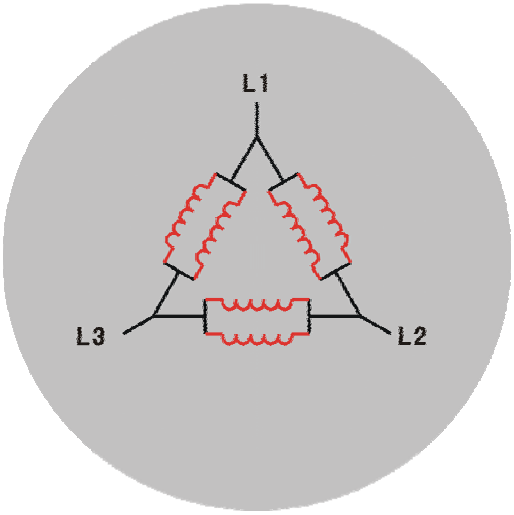


- 2— “△” 3P4W (3 phases 4 wires angle):

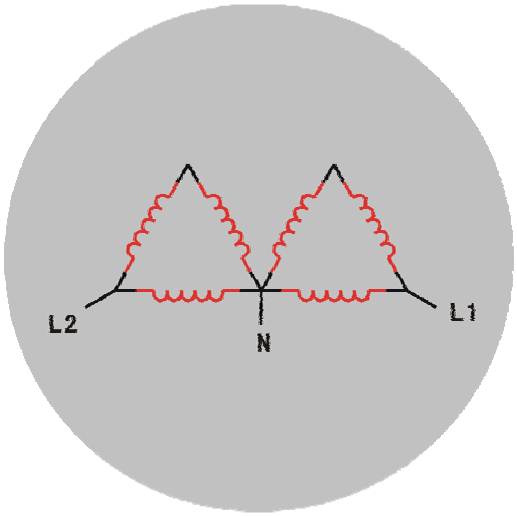


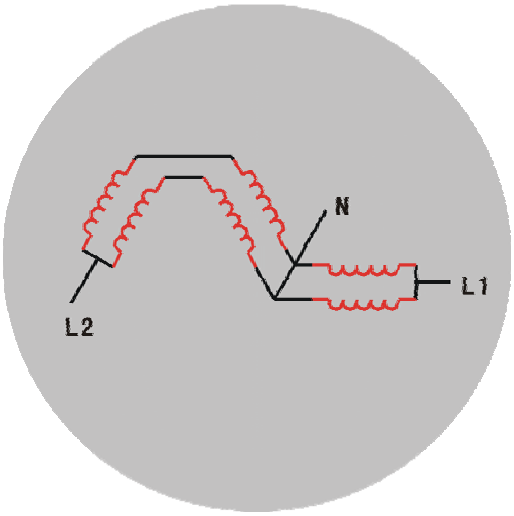
- 3— 3P3W (3 phases 3 wires):



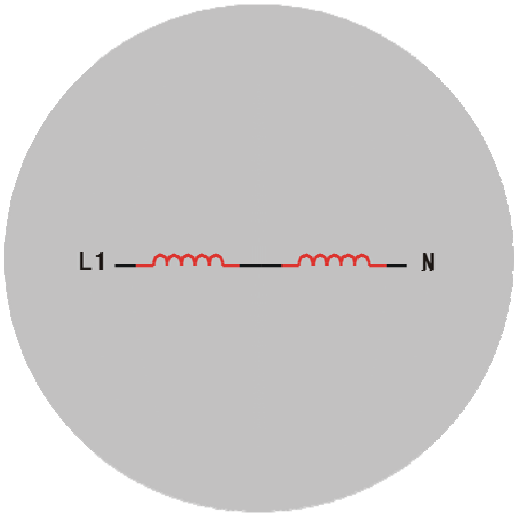


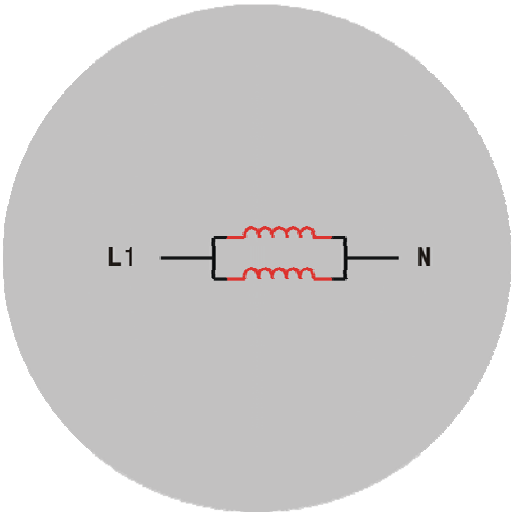
- 4— 1P3W (single phase 3 wires):





- 5— 1P2W (single phase 2 wires):





Comm. Address:

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

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.

Auto scroll time:

- Used to configure the cycle of page scroll.
- When parameter is configured as “0”, manually scroll page via “  ” button.
- Start to scroll automatically 30 seconds after not pressing any button.

Default settings:

- Some parameters are resumed to default setting.

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 Firmware update, the default setting as “3132”.
- All passwords are automatically inactive 60 seconds after exiting menu.

Firmware update:

- Used to load and update firmware for controller.
- It requires to key in CL2 password.

7.2 GENERATOR:

NO.	Items		Preset	Value Range
2.1	GEN-V under preALM		90%	20 to 200% / 0 not used
2.2	GEN-V under Alarm		0	20 to 200% / 0 not used
2.3	GEN-V over preALM		115%	20 to 200% / 999 not used
2.4	GEN-V over Alarm		999	20 to 200% / 999 not used
2.5	KW Overload preALM		999	20 to 200% / 999 not used
2.6	KW Overload Alarm		100%	20 to 200% / 999 not used
2.7	Alarm delay		5s	0 to 600s
2.8	Overcurrent level		100%	20 to 200% / 999 not used
2.9	Overcurrent delay		1s	1 to 20s
2.10	Overcurrent action		0	0 pre-alarm / 1 electrical trip / 2 shutdown
2.11	Loading Voltage		95%	20 to 200%
2.12	Loading Frequency		48.0Hz	10.0 to 100.0Hz
2.13	GEN. ON delay		5s	1 to 9999s
2.14	GCB closing time		5s	2 to 200s
2.15	Test mode		1	0 without load / 1 with load

Menu descriptions:

GEN-V under preALM:

- Used to configure Gen under voltage pre-alarm value, the GEN-V under preALM is inactive when parameter is configured as “0”.
- Expressed by percentage, = “**Rated Ph-N voltage**” x ?%.

GEN-V under Alarm:

- Used to configure Gen under voltage alarm value, the GEN-V under Alarm is inactive when parameter is configured as “0”.
- Expressed by percentage, = “**Rated Ph-N voltage**” x ?%.

GEN-V over preALM:

- Used to configure Gen over voltage pre-alarm value, the GEN-V over preALM is inactive when parameter is configured as “999”.
- Expressed by percentage, = “**Rated Ph-N voltage**” x ?%.

GEN-V over Alarm:

- Used to configure Gen over voltage alarm value, the GEN-V over Alarm is inactive when parameter is configured as “999”.
- Expressed by percentage, = “**Rated Ph-N voltage**” x ?%.

KW Overload preALM:

- Used to configure the over load pre-alarm value, the KW Overload preALM is inactive when parameter configured as “999”.
- Expressed by percentage, use “**Rated active power**” as factor.

KW Overload Alarm:

- Used to configure the over load alarm value, the KW Overload Alarm is inactive when parameter configured as “999”.
- Expressed by percentage, use “**Rated active power**” as factor.

Alarm delay:

- Use a timer for confirmation of the alarm or pre-alarm.

Overcurrent level:

- Used to configure the over current value of the Gen or the load, the overcurrent alarm is inactive when parameter configured as “999”.
- Expressed by percentage, use “**Rated current**” as factor.

Overcurrent delay:

- Use a timer for confirmation of overcurrent alarm.

Overcurrent action:

- Used to configure the action which is implemented after overcurrent alarm confirmed.
- 3 types of parameters can be configured: 0 pre-alarm (warning)/ 1 electrical trip/ 2 shutdown.
- When parameter is configured as “0”, the pre-alarm (warning) LED illuminates and buzzer sounds if over current happens, and LCD displays over current icon.
- When parameter is configured as “1”, the pre-alarm(warning) LED illuminates and buzzer sounds if over current happens, Genset will not shutdown, LCD displays over current icon.
- When parameter is configured as “2”, the Shutdown alarm LED illuminates and buzzer sounds if over current happens, the Genset will be shut down, LCD displays over current icon.

Loading Voltage:

- Used to configure the voltage trigger value of the GCB close.
- Expressed by percentage, use “**Rated ph-voltage**” as factor.

Loading Frequency:

- Used to configure the frequency trigger value of the GCB close.

GEN. ON delay:

- Use a timer for confirmation of voltage and frequency trigger value for Gen supply.

GCB closing time:

- Use a timer for confirmation of the Gen Aux. Switch’s contact has been closed.
- When the GCB output is energised, if the controller does not receive the feed back signal from the Gen Aux. Switch’s contact after the “GCB closing time” has expired, then means Gen fails to load.

Test mode:

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

7.3 ENGINE:

NO.	Items		Preset	Value Range
3.1	Rated speed	EGSP	1500RPM	99 to 9999 RPM
3.2	MPU input	MPUI	0	0 NO / 1 YES
3.3	Fly wheel teeth	EEEE	120	5 to 300
3.4	Set pickup now	SEEE		
3.5	Pair of Poles	PoLS	2	1 to 4
3.6	Fuel mode	FMod	0	0 N.C. / 1 N.O.
3.7	T-sensor type	tMod	3	1 to 15 / 0 not used
3.8	P-sensor type	PMod	4	1 to 15 / 0 not used
3.9	Start delay	SdLY	10s	0 to 300s
3.10	Crank attempt	CrEt	3 times	1 to 10 times
3.11	Crank time	CtIM	5s	1 to 30s
3.12	Crank time add	CtAd	0	1 to 30s / 0 not used
3.13	Crank rest	CrES	10s	1 to 300s
3.14	Crank cutout RPM	CdSP	300RPM	1 to 9999 RPM
3.15	Crank cutout volt	CdU	85%	1 to 100% / 999 not used
3.16	Crank cutout ALT-V	CdAt	99.9	1.0 to 40.0V / 99.9 not used
3.17	Crank cutout Oil-P	CdoP	1.0Bar	0.1 to 150.0 Bar / 999.9 not used
3.18	Cutout P-delay	CPdL	0	1 to 60s / 0 not used
3.19	Idle time	IdLE	0	1 to 9999s / 0 not used
3.20	Pre-heat mode	HMod	1	1 to 4
3.21	Pre-heat time	HEAt	3s	1 to 9999s / 0 not used
3.22	Safety-on delay	SAFd	10s	0 to 600s
3.23	Cool down mode	CLMd	0	0 full speed / 1 idle
3.24	Cool down time	CodL	300s	0 to 600s
3.25	Stop delay	StoP	20s	0 to 60s
3.26	Under SP preALM	SPLP	1440RPM	1 to 9999 RPM / 0 not used
3.27	Under SP Alarm	SPLA	0	1 to 9999 RPM / 0 not used
3.28	Over SP preALM	SPHP	1600RPM	1 to 9999 RPM / 9999 not used
3.29	Over SP Alarm	SPHA	1710RPM	1 to 9999 RPM / 9999 not used
3.30	Oil-P low preALM	oPLP	1.4Bar	0 to 150.0 Bar / 0.0 not used
3.31	Oil-P low Alarm	oPLA	1.1Bar	0 to 150.0 Bar / 0.0 not used
3.32	Coolant preALM	CLHP	92℃	50 to 320℃ / 9999 not used
3.33	Coolant Alarm	CLHA	100℃	50 to 320℃ / 9999 not used
3.34	Batt. Undervolt	bAtL	8.0V	1.0 to 40.0V / 0 not used
3.35	Batt. overvolt	bAtH	28.0V	1.0 to 40.0V / 99.9 not used
3.36	Alt. low preALM	ALtL	8.0V	1.0 to 40.0V / 0 not used
3.37	EX. Crank permit	oCrP	0	0 NO / 1 YES

Menu descriptions:

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 “1”, magnetic pick-up is used for the signal source of the engine speed. When parameter configured as “0”, the magnetic pick-up is not used, the engine speed is calculated from the frequency of the generator.
- RPM = (Hz * 60) / Pair of Poles. For example: the frequency of generator 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, 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 and Genset. Please do not implement this function when no RPM signal input.

Pair of Poles:

- Used to configure the poles of excitation winding of the alternator.
- Use to calculate PRM when the measured speed of controller is from the frequency signal of generator.

Fuel mode:

- Used to configure the type of engine fuel valve (details refer to 4.5).
- 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.

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	

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
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
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
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
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
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
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
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
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
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. It can be done only through the PC software.
When configuring, please input the "resistance-value" from small to big one by one.

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	

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
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
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
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
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
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
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
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
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. It can be done only through PC software.
When configuring, please input the "resistance- measured value" from small to big one by one.

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.

Crank time add:

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

CAUTION:
The maximum crank time permit can not exceed the range of the equipment safety.

Crank rest:

- 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.
- When parameter configured as "999", Crank cutout volt is inactive.

Crank cutout ALT-V:

- The crank cutout Charger voltage, signal is from the W/L terminal of charger.
- When parameter configured as "99.9", the Crank cutout ALT-V is inactive.

Crank cutout Oil-P:

- The crank cutout engine oil pressure, signal is from LOP sensor.

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 “0”, this function is inactive, and the conditions of judging stop failure and not implementing crank process are inactive.

Idle time:

- The duration of engine idle running.
- When you choose the idle mode, the configurable relay defined as idle output is energised, idle timer begins after start successfully, and the relay recovers to open after the idle time has expired.
- When parameter is configured as “0”, idle function is inactive.

Pre-heat mode:

- Used to configure the mode of preheat.
- Optional 4 pre-heat modes, details refer to the description of 4.7 preheat function.

Pre-heat time:

- The preheat duration before engine crank.
- When parameter is set as “0”, pre-heat function is inactive.

Safety-on delay:

- Used to configure the period from engine’s successful ignition to Genset stable running.
- The protected functions of under speed, under voltage, under frequency, low oil pressure are shielded by controller during safety-on delay.

	**CAUTION:** 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”, the engine will run at rated speed during cooling down. When parameter is configured as “1”, the engine will run in idle during cooling down.

Cool down time:

- 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 delay:

- 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 generator’s voltage exceeds crank cutout voltage, or the speed exceeds crank cutout speed, 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.

Under SP preALM:
- Used to configure the under speed pre-alarm value for the engine.
- When parameter is set as “0”, this function is inactive.

Under SP Alarm:
- Used to configure the under speed alarm value for the engine.
- When parameter is set as “0”, this function is inactive.

Over SP preALM:
- Used to configure the over speed pre-alarm value for the engine.
- When parameter is set as “9999”, this function is inactive.

Over SP Alarm:
- Used to configure the over speed alarm value for the engine.
- When parameter is set as “9999”, this function is inactive.

Oil-P low preALM:
- Used to configure the low oil pressure pre-alarm for the engine.
- The signal is derived form LOP sensor, this function would be inactive if do not use LOP sensor.
- This function is active after safety-on delay.
- When parameter is set as “0.0”, this function is inactive.

Oil-P low Alarm:
- Used to configure the under oil pressure alarm value for the engine.
- The signal is derived form LOP sensor, this function would be inactive if do not use LOP sensor.
- This function is active after safety-on delay.
- When parameter is set as “0.0”, this function is inactive.

Coolant preALM:
- Used to configure the high engine temperature pre-alarm value for the engine.
- The signal is derived form HET sensor, this function would be inactive if do not use HET sensor.
- When parameter is set as “9999”, this function is inactive.

Coolant Alarm:
- Used to configure the high engine temperature alarm value for the engine.
- The signal is derived form HET sensor, this function would be inactive if do not use HET sensor.
- When parameter is set as “9999”, this function is inactive.

Batt. Undervolt:
- Used to configure the low battery voltage pre-alarm.
- When parameter is set as “0”, this function is inactive.

Batt. overvolt:
- Used to configure the high battery voltage pre-alarm.
- When parameter is set as “99.9”, this function is inactive.

Alt. low preALM:
- Used to configure the low charger voltage value.
- Voltage signal is derived from the excitation winding of charger.
- When parameter is set as “0”, this function is inactive.

EX. Crank permit:

- Used to configure the permit of external crank.
- Refer to 4.8 for details.

7.4 Configurable Inputs and Outputs:

NO.	Items		Preset	Value Range
4.1	D-Input 1	EANA	5	1 to 20 / 0 not used
4.2	D-Input 2	E2NA	6	1 to 20 / 0 not used
4.3	D-Input 3	E3NA	7	1 to 20 / 0 not used
4.4	D-Input 4	E4NA	9	1 to 20 / 0 not used
4.5	D-Input 5	ESNA	11	1 to 20 / 0 not used
4.6	D-Input 1 delay	EAdE	0s	0 to 60s
4.7	D-Input 2 delay	E2dE	0s	0 to 60s
4.8	D-Input 3 delay	E3dE	0s	0 to 60s
4.9	D-Input 4 delay	E4dE	0s	0 to 60s
4.10	D-Input 5 delay	ESdE	0s	0 to 60s
4.11	User relay 1	ANA	20	1 to 80 / 0 not used
4.12	User relay 2	A2NA	19	1 to 80 / 0 not used
4.13	User relay 3	A3NA	2	1 to 80 / 0 not used
4.14	User relay 4	A4NA	3	1 to 80 / 0 not used

Menu descriptions:

D-Input*:

- There are 5 configurable digital inputs.
- Optional items as following:

Code	Optional Functions	Note
0	not used	
1	Pre-alarm (warning)	Low level is active. When it is active, pre-alarm LED illuminates and buzzer sounds.
2	Alarm	Low level is active. When it is active, generator stops, shutdown alarm LED illuminates and buzzer sounds.
3	Pre-alarm 1	Low level is active. When it is active after safety-on delay, pre-alarm LED illuminates and buzzer sounds.
4	Alarm1	Low level is active. When it is active after safety-on delay, generator stops, shutdown alarm LED illuminates and buzzer sounds.
5	LOP switch	low level is active
6	HET switch	low level is active
7	Emergency stop	low level is active
8	Emergency stop	high level is active (N.O. is active.)
9	Remote start signal	low level is active
10	Mains Aux. Switch closed	low level is active
11	Gen Aux. Switch closed	low level is active
12	Low fuel level switch	low level is active
13	Lamp test	low level is active
14	Reserved	
15	Reserved	
16	Air flap Aux. switch close	low level is active

17	Preheat	Low level is active. Used for preheat mode 4, as the condition of preheat relay output is energised or not.
18	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.

D-Input * delay:

- Used to configure the timer for confirmation of the configurable digital input, total 5 corresponding to 5 D-Inputs.

User relay * :

- There are 4 configurable output relays.
- Optional functions as following :

Code	Alarm mode defined
0	not used
1	Over current trip
2	Common alarm
3	Common pre-alarm (warning)
4	Idle relay N.C.
5	Preheat relay
6	Reserved
7	Reserved
8	Reserved
9	GEN. running
10	Auto mode
11	Test mode
12	Manual mode
13	Reserved
14	Idle relay N.O.
15	MCB failure
16	GCB failure
17	Start failure
18	Stop failure
19	MCB close/open
20	GCB close/open
21	KW overload pre-alarm
22	Charge failure
23	Over current pr-alarm
24	Battery Under voltage
25	Battery Over voltage
26	Reserved
27	Reserved
28	Low oil pressure pre-alarm
29	High engine temperature pre-alarm
30	Under speed pre-alarm
31	Over speed pre-alarm
32	GEN. under voltage pre-alarm
33	GEN. over voltage pre-alarm
34	Reserved
35	Reserved

36	Reserved
37	Reserved
38	Reserved
39	Reserved
40	Over current alarm
41	Reserved
42	Low oil pressure alarm
43	High engine temperature alarm
44	Under speed alarm
45	Over speed alarm
46	Reserved
47	Reserved
48	GEN. under voltage alarm
49	GEN. over voltage alarm
50	KW overload alarm
51	P-Sensor open alarm
52	Configurable D-input1 active
53	Configurable D-input2 active
54	Configurable D-input3 active
55	Configurable D-input4 active
56	Configurable D-input5 active
57	Reserved
58	Reserved
59	Buzzer sounds alarm
60	Air flap control
61	Reserved
62	Test without load mode
63	Test with load mode
64	Emergency stop
65	Mains failure
66	Cooling down

7.5 ATS CONTROL

NO.	Items		Preset	Value Range
5.1	Mains-V low Alarm		90%	20 to 200% / 0 not used
5.2	Mains-V High Alarm		115%	20 to 200% / 999 not used
5.3	Mains-Hz low Alarm		45.0Hz	10.0 to 100.0Hz / 0 not used
5.4	Mains-Hz High Alarm		57.0Hz	10.0 to 100.0Hz / 999.9 not used
5.5	Mains Alarm delay		5s	1 to 9999s
5.6	Mains ON delay		5s	1 to 9999s
5.7	MCB closing time		5s	2 to200s

Menu descriptions:

Mains-V low Alarm:

- Used to configure low Mains voltage alarm value, the Mains-V low Alarm is inactive when parameter configured as “0”.
- Expressed by percentage, use “**Rated ph-voltage**” as factor.

Mains-V High Alarm:

- Used to configure high Mains voltage alarm value, the Mains-V high Alarm is inactive when parameter configured as “999”.
- Expressed by percentage, use “**Rated ph-voltage**” as factor.

Mains-Hz low Alarm:

- Used to configure low Mains frequency alarm value, the Mains-Hz low alarm is inactive when parameter configured as “0”.

Mains-Hz High Alarm:

- Used to configure high Mains frequency alarm value, the Mains-Hz high Alarm is inactive when parameter configured as “999.9”.

Mains Alarm delay:

- Used a timer for the confirmation of Mains alarm.

Mains ON delay:

- Used a timer for confirmation of the Mains voltage and frequency trigger value for Mains supply.

MCB closing time:

- Used a timer for confirmation of the Mains Aux. Switch’s contact has been closed.
- When the MCB output is energised, if the controller does not receive the feed back signal from the Mains Aux. Switch’s contact after the “MCB closing time” has expired, then means Mains fails to load.

7.6 CALIBRATION MENU

NO.	Items		Preset	Value Range
6.1	GEN. V1 offset	CA01		-9.9% to 9.9%
6.2	GEN. V2 offset	CA02		-9.9% to 9.9%
6.3	GEN. V3 offset	CA03		-9.9% to 9.9%
6.4	Current I1 offset	CA11		-9.9% to 9.9%
6.5	Current I2 offset	CA12		-9.9% to 9.9%
6.6	Current I3 offset	CA13		-9.9% to 9.9%
6.7	MAINS V1 offset	CA21		-9.9% to 9.9%
6.8	MAINS V2 offset	CA22		-9.9% to 9.9%
6.9	MAINS V3 offset	CA23		-9.9% to 9.9%
6.10	Pressure offset	CA0P		-9.9% to 9.9%
6.11	Temperature offset	CA0C		-9.9% to 9.9%
6.12	Batt. V offset	CA0E		-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.

Mains V1 offset:

- Used to modify the measured value display of Mains Phase 1 Voltage.
- Reference to the Rated voltage.

Mains V2 offset:

- Used to modify the measured value display of Mains Phase 2 Voltage.
- Reference to the Rated voltage.

Mains V3 offset:

- Used to modify the measured value display of Mains Phase 3 Voltage.
- Reference to the Rated voltage.

Pressure offset:

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

Temperature offset:

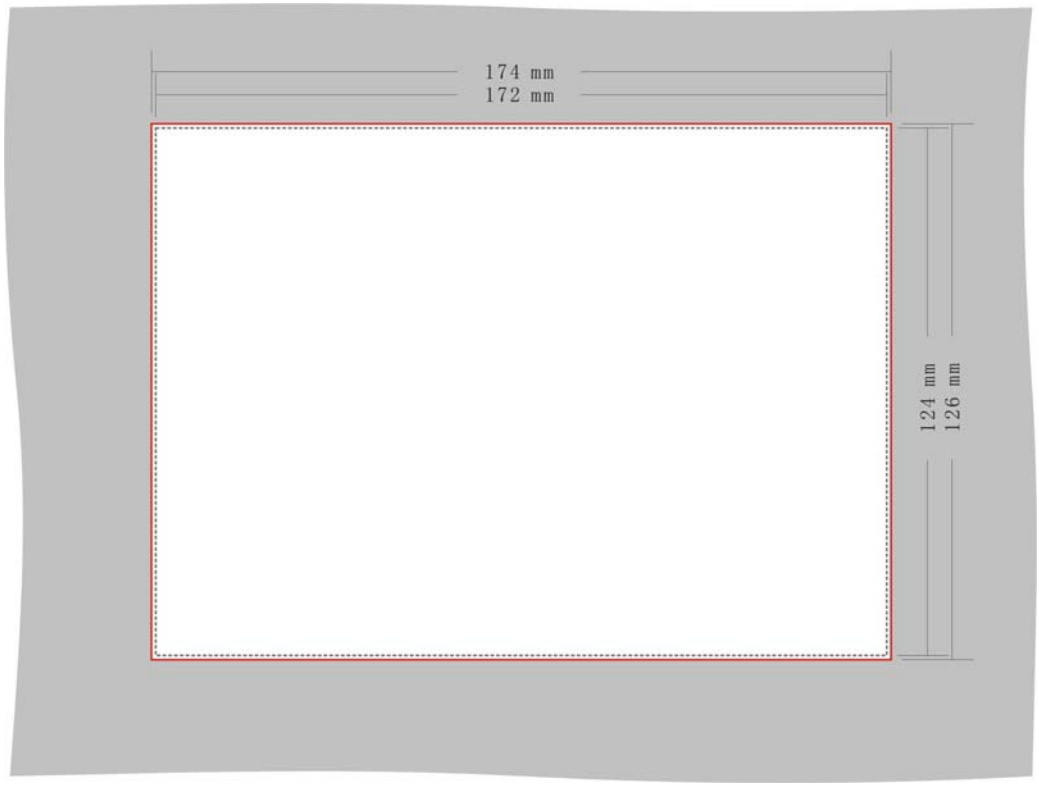
- Used to modify the measured value display of HET sensor.

Batt. V offset:

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

8. Installation Guide

8.1 The cutout dimensional drawing installed on panel as above follows:



Cutout dimension: 174mm (W) x 126mm (H).

The controller is fixed by 6 special fittings.

NOTE:

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

A readily accessible disconnect device shall be incorporated external to the equipment;

8.2 Wiring

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

8.2.1 Grounding Protection:

Make sure the connection between terminal #34 of controller and protective earth is good, the cross section area of cable should not be less than 2.5mm^2.

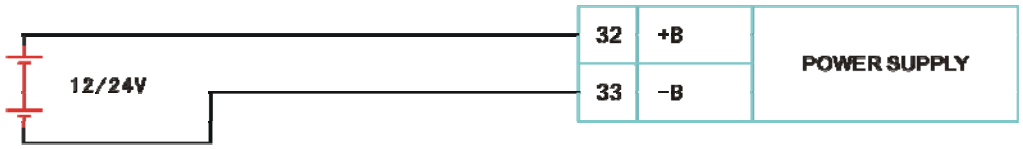
CAUTION

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

8.2.2 Power supply:

Power specification:

DC voltage range	8-35Vdc continuous
Max. operating current	@12V, 300mA; @24V, 150mA
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.

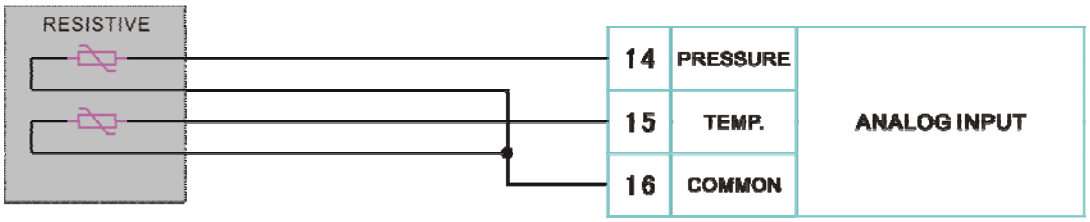


NOTE:

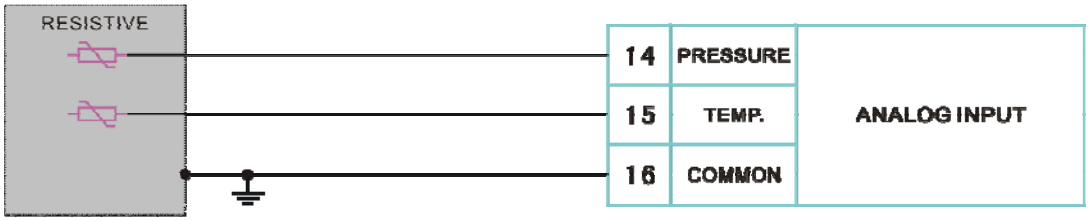
- A switch or fuse for over current protection between power supply and controller must be mounted, the recommended capacity is 1A.
- When powering, the controller will generate significant instantaneous peak current, the maximum instantaneous peak current is relative to the power impedance. You must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

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

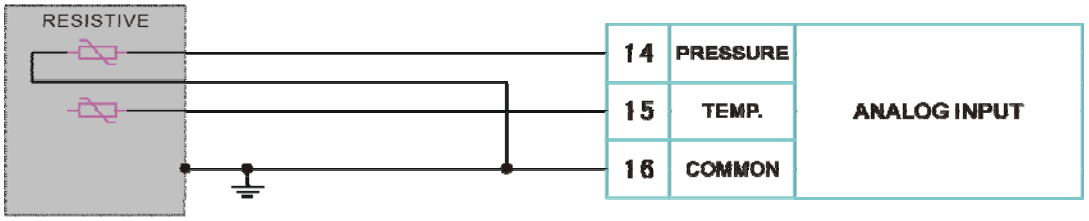
The connection for 2 poles sensor:



The connection for single pole sensor:



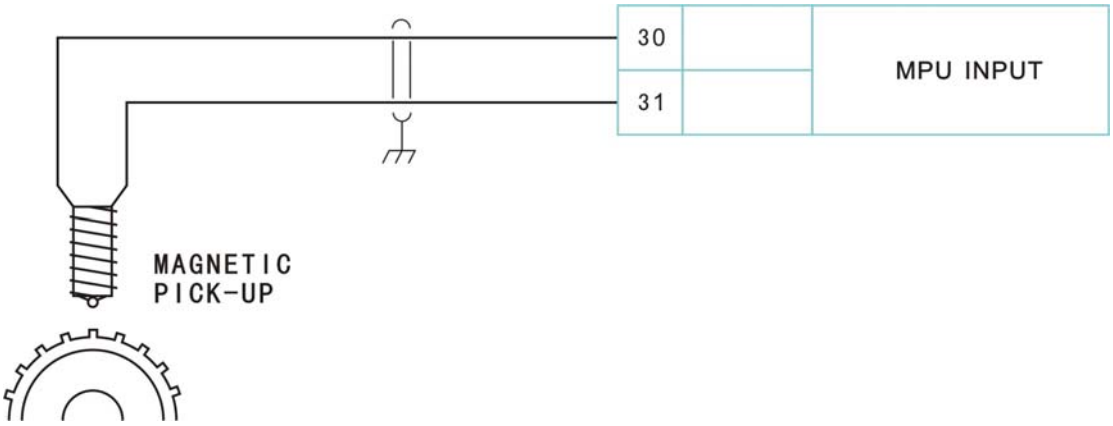
The connection for single pole / 2 poles sensor:



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 single pole sensor is used, the terminal #16 must be directly connected to the generator'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.

8.2.4 The installation of MPU:



NOTE:

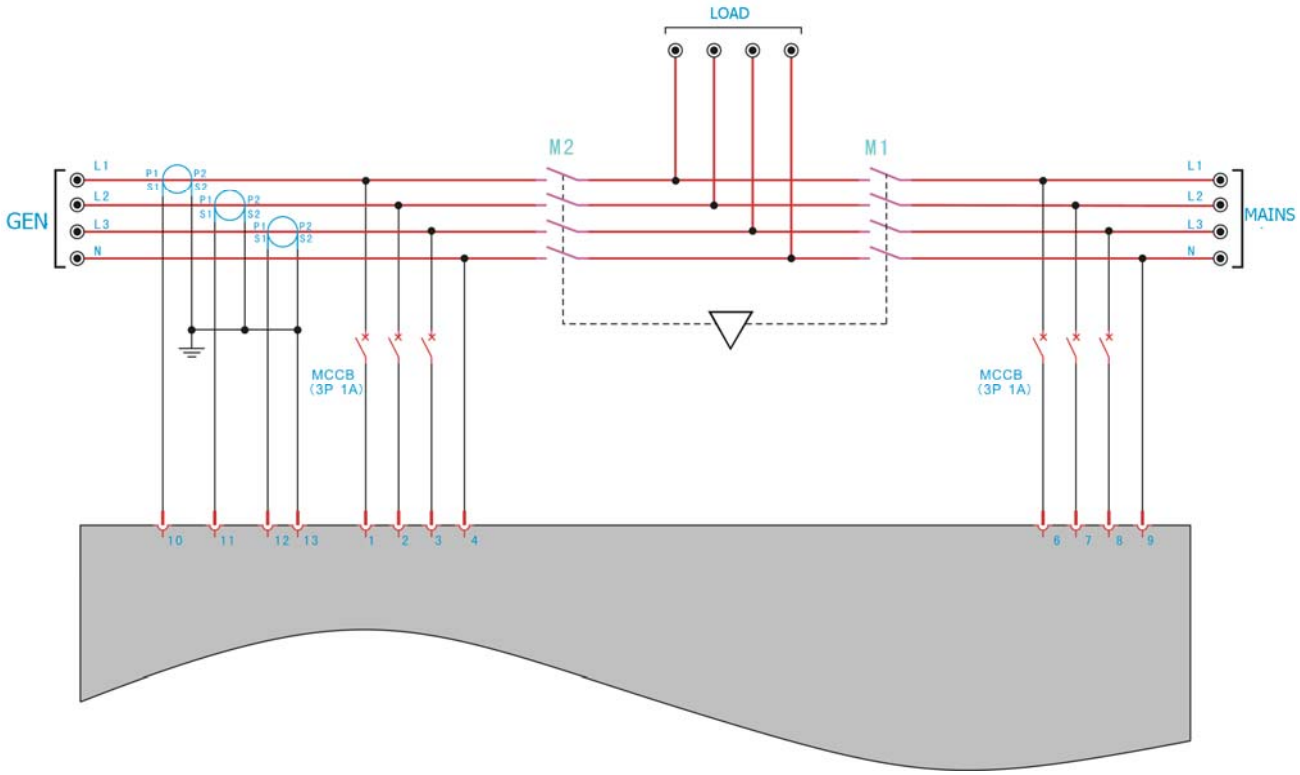
- The measuring accuracy of magnetic pick-up is related to fly wheel teeth:
  Accuracy= ± (120 / fly wheel teeth) RPM.
  As the above formula, more fly wheel teeth leads to higher measuring accuracy.

NOTE:

- Shield cable must be used for connection between controller and sensor, and the shield should be earthed.
- Please play attention that the terminal #31 is connected to negative of the power supply inside the controller.

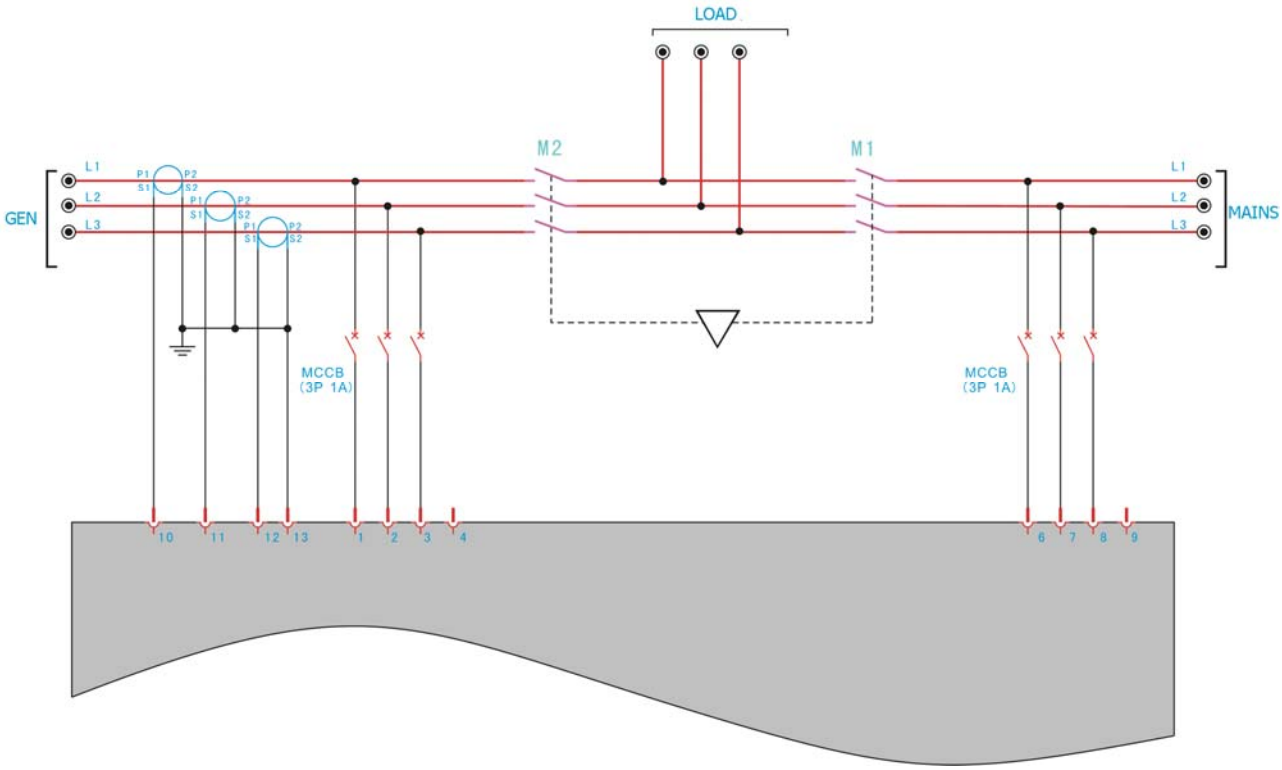
8.2.5 Typical connection for voltage input and current that corresponding to difference generator winding:

3P4W (3 phases 4 wires)



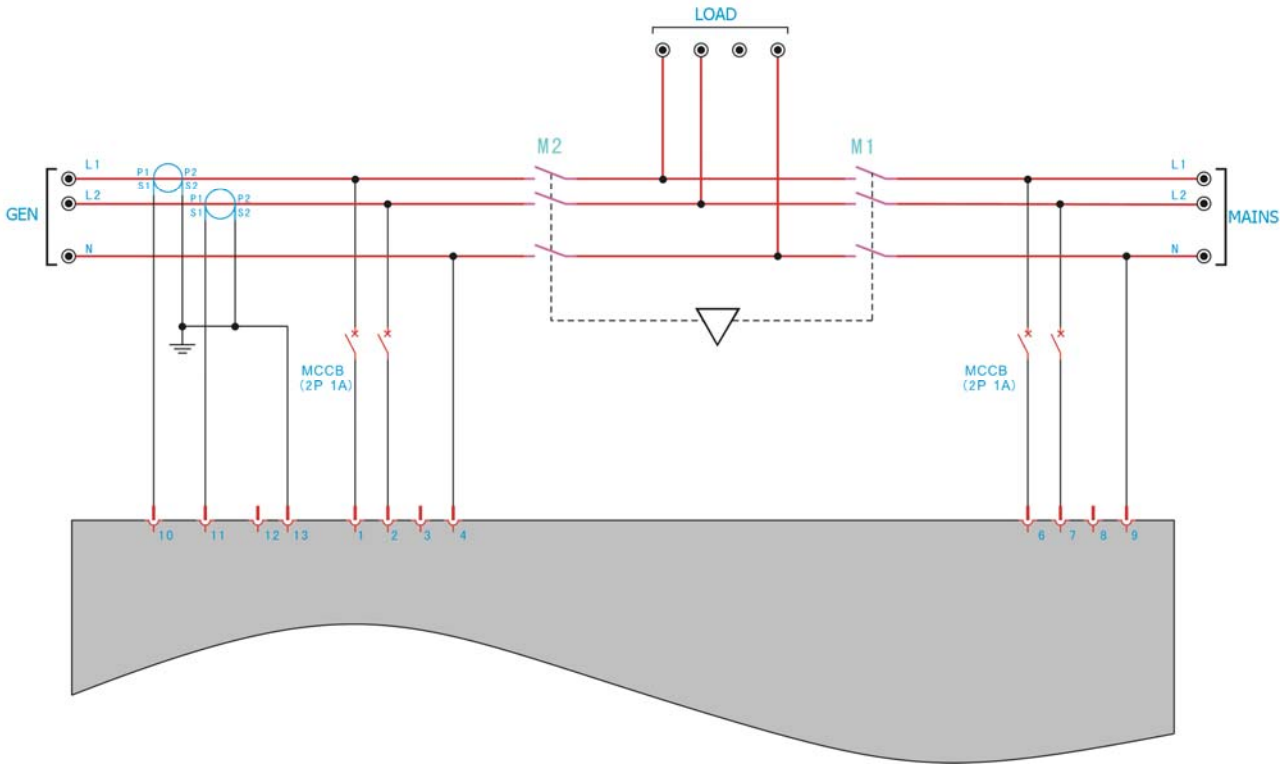
Measure and Display Data
Mains 3 phases V_{Ph-N} L1-N L2-N L3-N
Mains 3 phases V_{Ph-Ph} L1-L2 L2-L3 L3-L1
Mains frequency Hz (L1)
Gen 3 phases V_{Ph-N} L1-N L2-N L3-N
Gen 3 phases V_{Ph-Ph} L1-L2 L2-L3 L3-L1
Gen frequency Hz (L1)
Gen 3 phases current I1 I2 I3
Gen apparent power ∑A
Gen active power ∑P
Gen power factor PF

3P3W (3 phases 3 wires), CT measure at Gen side



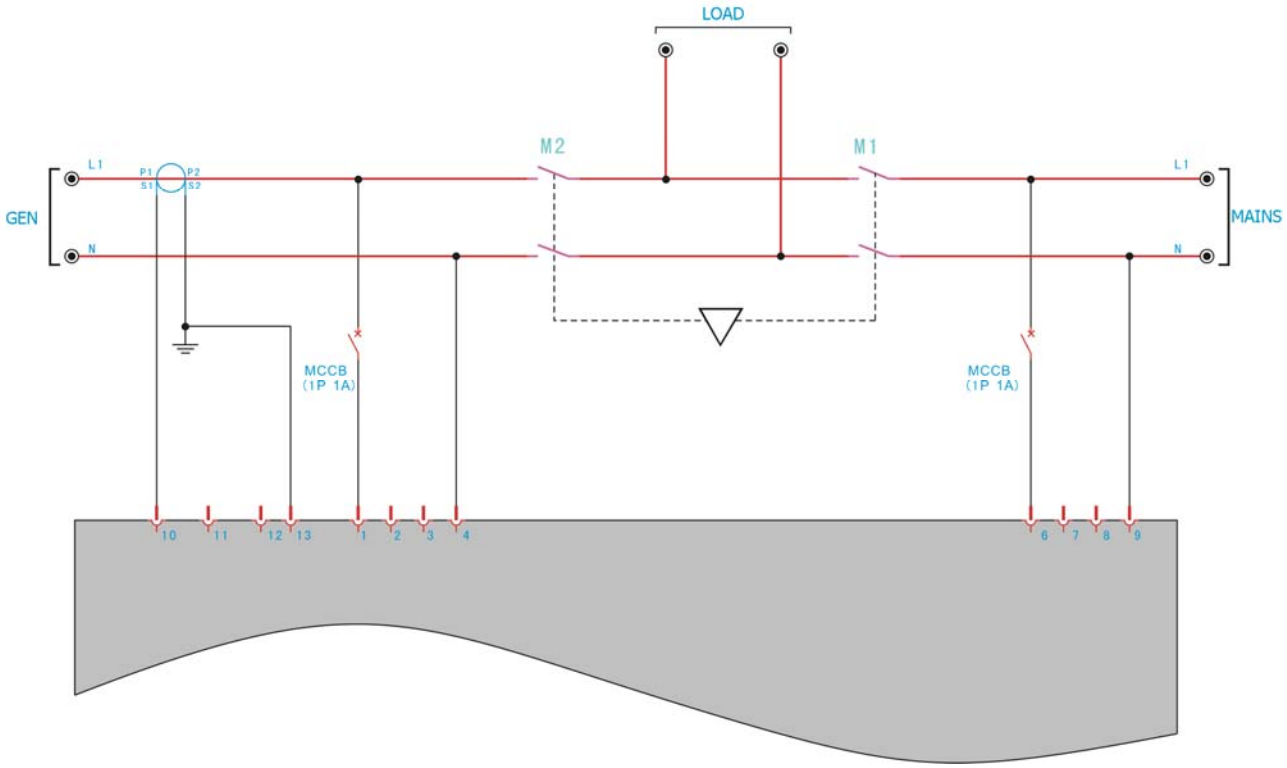
Measure and Display Data
Mains 3 phases V_{Ph-Ph} L1-L2 L2-L3 L3-L1
Mains frequency Hz (L1)
Gen 3 phases V_{Ph-Ph} L1-L2 L2-L3 L3-L1
Gen frequency Hz (L1)
Gen 3 phases current I1 I2 I3
Gen total apparent power ∑A
Gen total active power ∑P
Gen power factor PF

1P3W (single phase 3 wires), CT measure at Gen side



Measure and Display Data
Mains V_{Ph-N} L1-N L2-N
Mains V_{Ph-Ph} L1-L2
Mains frequency Hz (L1)
Gen V_{Ph-N} L1-N L2-N
Gen V_{Ph-Ph} L1-L2
Gen frequency Hz (L1)
Gen phase current I1 I2
Gen apparent power ∑A
Gen active power ∑P
Gen power factor PF

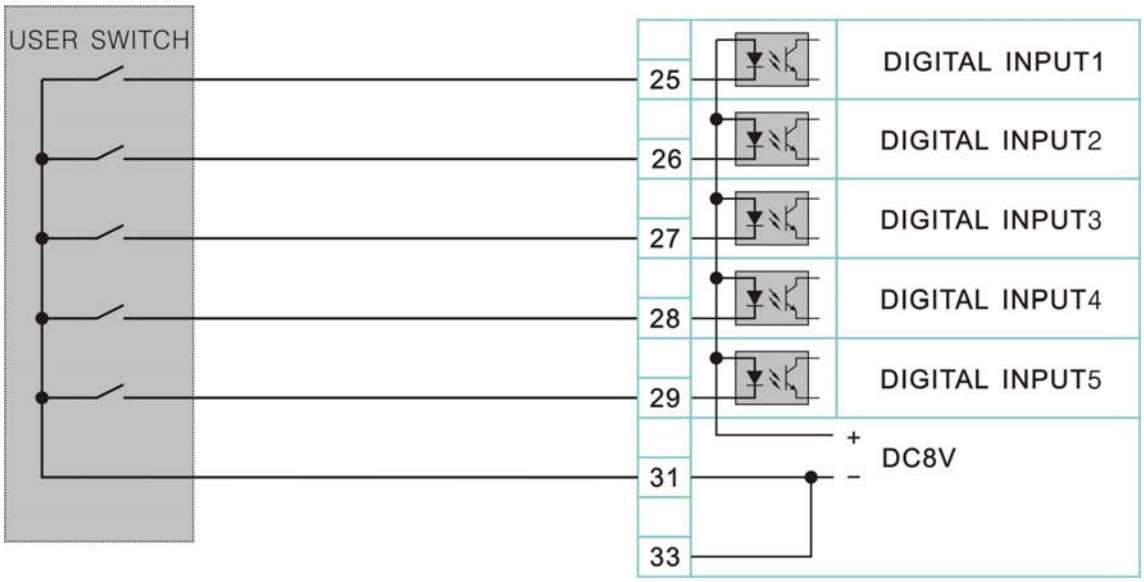
1P2W (single phase 2 wires), CT measure at Gen side



Measure and Display Data
Mains V_{Ph-N} L1-N
Mains frequency Hz (L1)
Gen V_{Ph-N} L1-N
Gen frequency Hz (L1)
Gen current I1
Gen phase apparent power A
Gen phase active power P
Gen power factor PF

8.2.6The connection of configurable digital inputs

There are 5 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:

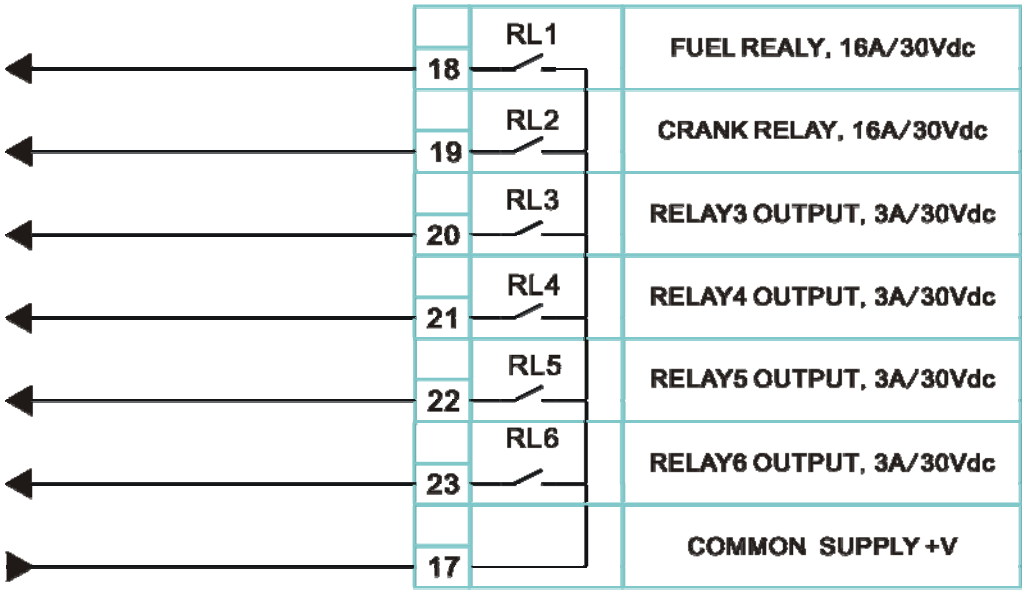
- The terminal #31 is the common port for the configurable inputs and it is short connected to power negative (terminal #33) inside the controller.
- The maximum acceptable resistance for each input is 10KΩ, it means whether the switch of loop circuit is closed or not, the status monitored by controller 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 on resistance in loop circuit, and total resistance must be less enough.

CAUTION

CAUTION:
Terminal #31 on controller should not be used as the negative input of battery.

8.2.7 Connection for the configurable output relays

There are 6 relay outputs, except fuel and crank relays which are fixed function, other relays' function all can be configured by user.



NOTE:

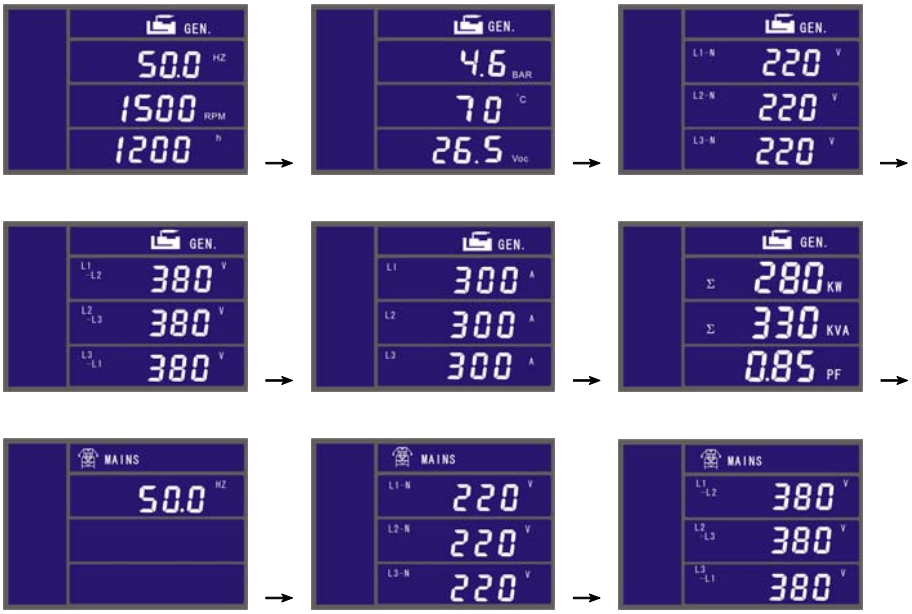
- Terminal #17 is the common port for RL1 to RL6, and it is connected to power positive.
- The output current for each relay can not exceed the rated current of respective relay; the total output current for 6 relays (from RL1 to RL6) can not exceed 16A.
- A switch or fuse for over current protection must be mounted between power and terminal #17, 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.

9. LCD displays and Menu System

9.1 LCD displays measuring parameters:

Use a back-light TN LCD to display data and information. Each page can display multi-row information simultaneously, and the corresponding icon displays each status and data clearly. Display all status data and information needs several pages. Press "▶" to scroll for viewing next page, it can be configured as auto scroll as well. When alarm occurs, the alarm status and the corresponding alarm icon are displayed on the LCD immediately.

Circularly displays each measuring parameter when generator is running:



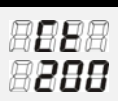
NOTE:

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

9.2 Setting running parameters

Press and hold "▶" button 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 1.11 "PASS" to key in password first, or select the required item, press "√" enter into modify mode, press "+" or "-", LCD displays 0 0 0 0 when prompted 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 "8" 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: (configure CT ration at 500/5, then CT should be configured as 100)

Operation	Description
Press and hold "▶" 2sec, enter into parameters setting menu, then LCD displays:	
Press "√" button, then LCD displays:	
Press "+" or "-" button, it prompted to key in password: 2213, (press "→" button to move to next digital).	
Press "+" or "-" to change parameters after the password is correct, change at 100, then LCD displays:	
Press "√" to confirm, then press "-", then LCD displays:	
Press " √ " or press and hold "▶" 2sec will quit parameter settings menu , then LCD displays:	

For example: (setting controller crank attempt at 2)

Operation	Description
Press and hold "▶" 2sec, enter into parameters setting menu, then LCD displays:	
Press"+" 36 times and then press "√", then LCD displays:	
Press "+" or "-" button, it prompted to key in password: 2213, (press "→" to move to next digital).	
Press "+" or "-" to change parameters after password was correct, change at 2:	
Press "√" button to confirm and then press "⏏" for exiting parameters setting:	

For example: (resume parameters of controller to factory defaults)

Operation	Description
Press and hold "▶" 2sec, enter into parameters setting menu, then LCD displays:	
Press "+" 9 times, then LCD displays:	
Press "√" button, it prompts to key in password, the password is 2213, (press "→", move to desired modify number).	
Press "√" button to confirm modification, then press "⏏" for exiting parameters setting:	

For example: (configure controller at online program mode)

Operation	Description
Press and hold "▶" 2sec, enter into parameters setting menu, then LCD displays:	
Press "+" 11 times, then LCD displays:	
Press "√" button, it prompts to key in password, the password is: 3132, (press "→", move to desired modify number).	
Press "√" again, enter into program mode. Use the communication cable and the software to program, please make sure the power supply is normal during programming, the controller will reset automatically after programming. Otherwise it will not exit this status until the power is off.	

10. Technical Specification

10.1 AC voltage:

Measurement	True RMS
Phase to Neutral	15 to 346VAC
Phase to Phase	25 to 600VAC
Max power wastage per line	<0.1W
Accuracy	1%
Display	0 to 9999V

10.2 AC voltage frequency:

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

10.3 Current (isolated):

Measurement	True RMS
Measuring current	5A
Accuracy	1%
Display	0 to 9999A
Max power wastage per line	<0.01W

10.4 Power supply:

Range	12V/24V (8-35V continuous)
Max. operating current	@12V 300mA, @24V 150mA
Max. standby current	@12V 90mA, @24V 45mA
Cranking dropouts	0V for 80ms, assuming dc supply was at least 10V before dropout and recovers to 5V
Accuracy	1%
Display	0 to 40V

10.5 Configurable digital inputs:

Number	5
Max. contact resistance	10KΩ
Type	Isolated
Max. contact current per line	1mA

10.6 Configurable relay outputs:

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

10.7 Charge failure input:

Range	0 to 35Vdc
Accuracy	1%
Max output current	@12V 120mA, @24V 240mA

10.8 Analog Inputs:

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

10.9 Magnetic pickup:

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

10.10 Ambient parameters:

Operating ambient temperature Standards	-20 to 70℃ IEC60068-2-1 and IEC60068-2-2
Storage ambient temperature Standards	-30 to 80℃ IEC60068-2-1 and IEC60068-2-2
Humidity Standards	60℃, 95%RH, 48 hours IEC60068-2-30
Electro Magnetic compatibility (EMC) Standards	 EN 61000-6-4 and EN 61000-6-2
Vibration Standards	 EN 60068-2-6
Shock Standards	 EN 60068-2-27
Electrical safety Standards	 EN 60950-1
Degrees of protection Standards	IP65 (front) IP20 (back) BS EN 60529

Version: 064B100312