HMC6

POWER MANAGEMENT CONTROLLER

USER MANUAL

SMARTGEN (ZHENGZHOU) TECHNOLOGY CO.,LTD.

Chinese trademark

SmartGen English trademark

Smartgen – make your generator ***smart***
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Table 1 - Version history

Date	Version	Contents
2014-01-21	1.0	Original release.
2018-06-02	2.0	Updated controller functions and details optimizing.
2019-04-23	2.1	Fixed terminal structure description.
2019-12-25	2.2	Fixed back mask, changed analog frequency and voltage regulating port and running feedback input port to digital input ports, changed voltage rise, voltage drop, audible alarm output to digital output ports, changed GOV/AVR to transducer output and added other functions.
2020-05-20	2.3	Modified heavy consumer description, wiring diagram and added configuration items, etc.
2020-06-12	2.4	Added related operations and configurations of shaft genset.
2020-12-12	2.5	The original synchronization setting was divided into synchronization setting and synchronous calibration setting, added input and output functions.
2021-3-31	2.6	1. Modified the parameters of "Input/Out Ports Setting"; 2. Added missing contents of "Fault Finding".
2021-08-13	2.7	Added the fourth heavy consumer and other configurations.

This manual is suitable for HMC6 Power Management controller only.

Table 2 - Notation Clarification

Sign	Instruction
 NOTE	Highlights an essential element of a procedure to ensure correctness.
 CAUTION!	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
 WARNING!	Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.
X	Indicates the controller without this function.
●	Indicates the controller with this function.

CONTENTS

1 OVERVIEW

The HMC6 power management controller is a standard power management system for marine applications. The system carries out generator control, supervision and protection functions. The power management functions are calculated by all diesel generator units, making the system a true multi-master system. One of the diesel generator units is internally defined as the "command unit". This unit is the one where start priority and other power management-related functions are calculated.

The system can handle up to 16 diesel generators to automatic synchronization and load sharing. Should the command unit fails, the power management calculations will automatically be transferred to the next available unit. The internal communication between the units is carried out via internal CANBUS. This CANBUS is intended for internal communication use only and cannot be connected to other external CANBUS systems.

2 PERFORMANCE AND CHARACTERISTICS

- Dynamic synchronizing: detect the phase angle difference, voltage difference and frequency difference automatically to perform synchronization as soon as possible.
- Load sharing: schedule the start and stop of genset and share load equally automatically.
- Heavy consumer control: start the additional genset automatically if the power is not enough when the function is active.
- NEL trip: trip some non-essential load if over power condition occurs.
- Light load: the genset is still running if the load has fallen below the shutdown set value when the function is active.
- Multiple speed adjusting output ports, which including relay adjust speed output, voltage signal adjust speed output, and current signal adjust speed output;
- Multiple Voltage Adjusting output ports, which including relay adjust voltage output, voltage signal adjust voltage output, and current signal adjust voltage output;
- Fixed power output, which can be adjusted not only from the external voltage signal (±10V) for adjusting speed/voltage, but also from configuring fixed power output or fixed power factor output;
- Safety mode: reserve an additional unit running on load;
- Control engine to start/stop;
- Reserved running gensets: minimum number of loading gensets on the BUS bar;
- Limit the maximum number of units on the network and maximum number of units carried with load on the BUS bar;
- Suitable for 3-phase 4-wire, 3-phase 3-wire, 2-phase 3-wire and single phase systems with frequency 50/60Hz;
- PLC function: control logic can be defined by users as their requires;
- Selectable start mode: cyclic start; linear start; duty time start;
- Selectable scheduled start mode: it is can be chose according to the two ways including genset power percentage and left power;
- 3-class password protection: containing two user-defined passwords for protecting user-defined configuration parameters, which means users can configure parameters within the permission field;
- 480x272 LCD with backlight, multilingual interface (including English, Chinese and other languages) which can be chosen at the site, making commissioning convenient for factory personnel;

- Parameter setting: parameters can be modified and stored in internal FLASH memory and cannot be lost even in case of power outage; most of them can be adjusted using front panel of the controller and all of them can be modified using PC via USB or RS485 ports;
- Event Log：maximum 99 pieces of trip alarms, trip and stop alarms, start and stop, closing and opening events can be saved in chronological sequence in internal memory, which means that they will not be lost in case of power off.

3. FUNCTIONAL DESCRIPTION

3.1 OPERATION

- Diesel generators
- Load sharing between diesel generators
- Fixed power for diesel generator (asymmetrical load sharing)
- Heavy consumer control (fixed load)
- NEL (Non-essential Load) Trip
- Safety Mode (reserve an additional unit running on load)

3.2 ENGINE CONTROL

- Start/stop control
- GOV control: Relay outputs control, analog voltage control, analog current control

3.3 PROTECTIONS (ANSI)

- Overcurrent, 4 levels
- Reverse power, 2 levels
- Over power，2 levels
- Over voltage, 2 levels
- Under voltage, 3 levels
- Over and under frequency, 3 levels
- Unbalanced current
- Loss of excitation
- Close/Open Fail
- Digital inputs

3.4 DISPLAY

- Push-buttons for start and stop
- Push-buttons for auto/semi-auto mode transfer
- Push-buttons for breaker operations
- Push-buttons for highest priority
- Status, alarm and information text messages

3.5 POWER MANAGEMENT FUNCTIONS

Plant operation:

- Diesel generator supply (up to 16 generators)
- Shore power supply (all gensets are inhibit to start and take on load)

Power management functions:

- Blackout handling
- Load-dependent start/stop
- Auto start mode selection
  - ► Cyclic start
  - ► Linear start
  - ► Duty time start
- Auto scheduled start mode selection
  - ► Genset power percentage
  - ► Left power
- Priority Trip
- Heavy consumer
- Light consumer
- Reserved number of running gensets
- Safety stop, safety trip
- Safety mode (reserve an additional unit running on load)
- Limit network-connected gensets numbers
- Busbar breaking handle

4. SPECIFICATION

Table 3 – Specification Parameters

Parameter	Content
Working Voltage	DC8. 0V to 35. 0V, continuous power supply
Overall Consumption	<4W (Standby mode: ≤2W)
AC Input: 3 Phase 4 Wire 3 Phase 3 Wire 2 Phase 3 Wire Single Phase	 AC15V - AC360V (ph-N) AC30V - AC620V (ph-ph) AC15V - AC360V (ph-N) AC15V - AC360V (ph-N)
Alternator Frequency	50Hz/60Hz
Flexible Relay Output	8A AC250V volts free output
GOV	DC(-10~10)V/(-20~20)mA
AVR	DC(-10~10)V /(-20~20)mA
FREQ IN	DC(-10~10)V
VOLT IN	DC(-10~10)V
Case Dimensions	266mm x 182mm x 45mm
Panel Cutout	214mm x 160mm
CT Secondary Current	Rated 5A

Parameter	Content
Working Conditions	Temperature: (-25~+70)°C Humidity: (20~93)%RH
Storage Conditions	Temperature:(-25~+70)°C
Protection Level	IP65: when water-proof gasket installed between control panel and enclosure.
Insulation Intensity	Apply AC2.2kV voltage between high voltage terminal and low voltage terminal; The leakage current is not more than 3mA within 1min.
Weight	0.95kg

5. OPERATION

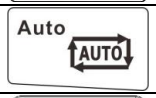
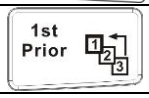
5.1 PANEL DISPLAY

TFT LCD: 4.3 inches with 480x272 resolutions, as follows:

Fig.1 – HMC6 Panel Drawing

5.2 PUSHBUTTONS

Table 4 – Push Buttons Description

Icons	Keys	Description
	Stop	Stop the running generators in Semi-auto mode. Lamp test (press at least 3s);
	Start	Start the standby generators in Semi-auto mode.
	Semi-auto mode	Press this key and controller enters **Semi-auto** mode.
	Auto Mode	Press this key and controller enters **Auto** mode.
	Priority selection	Place the generator at the highest priority and start the generator the earliest.
	Close	The unit will close the circuit breaker in **Semi-auto** mode.
	Open	The unit will open the circuit breaker in **Semi-auto** mode.
	Up/Increase	1. Screen scroll; 2. Up cursor and increase value in setting menu.
	Down/Decrease	1. Screen scroll; 2. Down cursor and decrease value in setting menu.
	Left	1. Screen scroll; 2. Left move cursor in setting menu.
	Right	1. Screen scroll; 2. Right move cursor in setting menu.
	Set/Confirm	1. Enter “Help” interface. 2. Press it more than 3s and enter parameter setting menu; 3. In setting menu, confirm the set value.
	Exit	1. Return to main menu; 2. Return to previous menu in setting menu.

5.3 PARAMETERS SETTING

Press  key for more than 3s to enter into user manual.

★Parameter

After entering the correct password (factory default password is 00318) you can enter parameter settings screen.

Password can be divided into 3 levels: one highest level and two user-defined levels. After entering highest level password, all configuration items can be set; after entering user-defined level password, users can only configure parameters within the permission field

Parameter setting including as following,

★Bus setting
★Timers setting
★Generator setting
★Generator load setting
★GB setting
★Digital inputs setting
★Relay outputs setting
★Module setting
★Synchronization setting
★Synchronous calibration
★Local module setting
★DIN16-1 setting
★DIN16-2 setting
★DOUT16-1 setting
★DOUT16-2 setting
★LA16-1 setting
★LA16-2 setting

Example:

Return Bus setting **Timers setting >** Generator setting Generator Load setting Breaker setting Input setting Output setting Module setting Synchronization setting Synchronous calibration	>Start Delay >Stop Delay >Start Output Delay >Stop Output Delay >Start Wait Delay >Stop Wait Delay >Onload Stable Delay >Transient Fault Delay >Heavy Consumer Delay >Alarm Start Delay >Trigger Start Delay	Form 1: Use  to scroll settings,  to enter settings (form 2),  to exit settings menu.

Return Bus setting **Timers setting >** Generator setting Generator Load setting Breaker setting Input setting Output setting Module setting Synchronization setting Synchronous calibration	> Start Delay > Stop Delay > Start Output Delay > Stop Output Delay >Start Wait Delay >Stop Wait Delay >Onload Stable Delay >Transient Fault Delay >Heavy Consumer Delay >Alarm Start Delay >Trigger Start Delay	Form 2: Use to scroll settings, Enter to enter settings, Esc to return to previous menu. (form 1)

Return Bus setting **Timers setting >** Generator setting Generator Load setting Breaker setting Input setting Output setting Module setting Synchronization setting Synchronous calibration	> Start Delay > Stop Delay > Start Output Delay > Stop Output Delay >Start Wait Delay >Stop Wait Delay >Onload Stable Delay >Transient Fault Delay >Heavy Consumer Delay >Alarm Start Delay >Trigger Start Delay	Form 3: Use to scroll settings, Enter to confirm settings (form 4), Esc to return to previous menu. (form 1)

> Start Delay > Stop Delay > Start Output Delay > Stop Output Delay >Start Wait Delay >Stop Wait Delay >Onload Stable Delay >Transient Fault Delay >Heavy Consumer Delay >Alarm Start Delay >Trigger Start Delay >Alarm Shutdown Delay	**00005**	Form 4： Press Enter to enter settings (form 5), Esc to return to previous menu. (form 4).

> Start Delay > Stop Delay > Start Output Delay > Stop Output Delay >Start Wait Delay >Stop Wait Delay >Onload Stable Delay >Transient Fault Delay >Heavy Consumer Delay >Alarm Start Delay >Trigger Start Delay >Alarm Shutdown Delay	**00005**	Form 5: Press ◀ ▶ to change cursor position, ▲ ▼ are used for changing cursor value, Enter to confirm setting and the setting will be stored in internal FLASH memory automatically; Esc to exit setting.

NOTE: Pressing Stop for a long time can exit setting directly during setting.

6. DG SYSTEM MODE DESCRIPTION

6.1 SYSTEM MODE

6.1.1 MANUAL MODE

When manual mode signal is active, the system will work through manual mode. In this mode, HMC6 controller can only monitor data and alarm information but cannot control switch or engine. In addition, GOV and AVR do not work but the manual governor IN, manual governor OUT, manual VOLT IN and manual VOLT OUT do work in this mode.

6.1.2 SEMI-AUTO MODE

Semi-auto mode is activated by pressing Semi Auto key; Semi-auto means that the unit will not initiate any sequences automatically, as is the case with the auto mode. It will only initiate sequences, if external signals are given.

An external signal may be given in three ways:

1. Push-buttons on the display are used
2. Digital inputs are used
3. Modbus commands are used

In semi-auto mode, all available diesel generator units can be started/stopped/synchronizing closed/unloaded open upon push-button commands on the front panels for each generator.

The system monitors that if the generators are overloaded. Should that be the case, the Non Essential Load (NEL) trip will activate to maintain power supply to the main busbar.

If a heavy consumer is requested, the system calculates the power needed. If the available power is insufficient, the heavy consumer connection will not be allowed.

Semi-auto Start:

a) Start command will be initiated by HMC6 after pressing button Start. The system enters into “Start Output Delay” while the start relay will activate;

b) When Start Output Delay is over, Start Wait Delay will be initiated. Fail to Start alarm will be initiated if the on-load requirement has Not been achieved after the Start Wait Delay has expired. The alarm type of Fail to Start is block which means users can restart the generator only when the alarm is acknowledged;

c) When Start Wait Delay is over, Load Stability Delay will be initiated. F/V Fault alarm will be initiated if the on-load requirement has Not been achieved after the Load Stability Delay has expired. The alarm type of F/V Fault is block which means users can restart the generator only when the alarm is acknowledged. However, it enters into "Normal Running" status if the onload requirement has been achieved;

d) If the switch is not closed during the normal running status and the voltage/frequency has not satisfied the on-load requirement suddenly, Transient Fault Delay will be initiated. F/V Fault alarm will be initiated if the on-load requirement has Not been achieved after the Transient Fault Delay has expired. The alarm type of F/V Fault is block which means users can restart the generator only when the alarm is acknowledged;

e) If the on-load requirement has been achieved (Generator normal light will illuminate), the genset will close and synchronize automatically after pressing the 

button;

f) In case of multi-set operation, the genset will share load automatically;

g) If there is trip or shutdown alarm occurs, then the system will open switch or stop and the alarm information will be displayed on the LCD;

Semi-auto Stop:

a) In breaker close status, press open button 

, in case of multi-set operation, first of all, the system will transfer load and open breaker; in case of single unit running, it will open breaker directly;

b) After breaker opened or in breaker open status, press stop button 

, system will enter into "Stop Output Delay" while the stop relay will activate;

c) After "Stop Output Delay", system will enter into "Wait for Stop" delay. If genset voltage and frequency signals disappeared during the delay, controller will judge that the genset stopped and in standby state; otherwise, if genset voltage and frequency signals still can be detected after the delay expired, controller will judge that the genset failed to stop;

d) After genset failed to stop, if voltage and frequency signals are disappeared, controller will judge that the genset stopped completely and entered into standby state.

6.1.3 AUTO MODE

Auto mode is activated by pressing 

key;

All available diesel generator units are controlled by the power management system and are started and stopped according to the start priority and the actual busbar load. Should a running generator develop an alarm, the system will start the next generator in line and synchronize its breaker before taking the failing generator out of service. At the same time, the system monitors that the generators are not overloaded. Should that be the case, the Non Essential Load (NEL) trip will activate to maintain power supply to the main busbar.

If a heavy consumer is requested, the system calculates the power needed and starts an additional generator if needed before allowing the heavy consumer to be connected.

Auto Start Rules

a) If the system detects that there is no voltage signal on busbar, then the available diesel generator units are started according to the start priority;

b) Should the generator units are started successfully, the system will start the next generator in line if the power is insufficient;
c) Should the generator units are in normal running, if a heavy consumer is requested, the system calculates the power needed and starts additional gensets to satisfy the requires;
d) If there trip and fault shutdown alarms occur, the corresponding number of units are automatically started to meet the load requirements;
e) Linear start mode: if generator's priority level changes, higher priority level standby genset will be started;
f) Duty time start mode: gensets will be started according to the duty-hour.

Auto Start

a) Generator enters into "start delay" as soon as "Auto Start" is active;
b) After the Start Delay has expired, the system enters into "Start Output Delay" while the start relay will activate;
c) When start delay is over, "Start Wait Delay" will be initiated. "Fail to Start" latched alarm will be initiated if the collected generator voltage and frequency can not meet with on-load requirement after the "Start Wait Delay" has expired;
d) If on-load requirement been satisfied in "Start Wait Delay", "Load Stability Delay" will be initiated. "F/V Fault" alarm will be initiated if the on-load requirement has Not been achieved after the "Load Stability Delay" has expired. The alarm type of "F/V Fault" is latched which means users can restart the generator only when the alarm is acknowledged. However, it enters into "Normal Running" status if the on-load requirement has been achieved;
e) If the switch is not closed during the normal running status and the voltage/frequency has not satisfy the on-load requirement suddenly, "Transient Fault Delay" will be initiated. "F/V Fault" latched alarm will be initiated if the on-load requirement has not been achieved after the "Transient Fault Delay" has expired. If the on-load requirement has been achieved within delay time, genset will enter into "Normal Running" state;
f) After controller entering into normal running state, and mean while on-load requirement has been achieved (generator normal light will illuminate), the genset will close and synchronize automatically;
g) In case of multi-set operation, the genset will share load automatically;
h) If there is trip alarm or shutdown alarm occurs, then the system will trip or shutdown and the alarm information will be displayed on the LCD.

Auto Stop Rules

a) In multiple gensets running system, if the system detects that the load power has fallen below the stop power, the controller will transfer load according to the start priority firstly and then open breaker and shutdown;
b) If there is trip alarm or shutdown alarm occurs, the fault genset breaker will be opened and shutdown;
c) If there is safe trip alarm or safe shutdown alarm occurs, the fault genset will be unloaded and open breaker to stop after new genset started up and on-load requirement of the busbar is satisfied;
d) Linear start mode: if generator's priority level changes, after higher priority level standby genset started up, in case of load power falls below shutdown power, genset will be unloaded and open breaker to stop;
e) Duty time start mode: gensets will be stopped according to the duty-hour.

Auto Stop

a) When stop input is activated in auto mode, system enters into "Stop Delay" state;
b) After "Stop Delay" is expired, in case of multi-set operation, genset will be opened after transferring the load;

c) After the switch is opened, the system enters into “Stop Output Delay” while the stop relay will activate;

d) After “Stop Output Delay” expired, system enters into “Wait for Stop Delay”, If genset voltage and frequency signals disappeared during the delay, controller will judge that the genset stopped and in standby state; otherwise, if genset voltage and frequency signals still can be detected after the delay expired, controller will judge that the genset failed to stop;

e) After genset failed to stop, if voltage and frequency signals are disappeared, controller will judge that the genset stopped completely and entered into standby state.

Table 5 - System Modes Description

System Mode	Start Condition & GOV/AVR Interface	Trip or Stop Condition
Manual Mode	Start the gensets externally, GOV input, GOV output, AVR input and AVR output are active; monitor all generator parameters.	Trip and stop the gensets externally.
Semi-auto Mode	Start the gensets by pressing the panel button, GOV input and AVR input are deactivated; The system will control GOV and AVR automatically.	Stop the gensets by pressing the “Stop” panel button or there is “trip and stop” alarm occurs.
Auto Mode	If the system detects that there is no voltage signal on busbar, the available diesel generator units are started according to the start priority or duty time (details please to see “Auto Start Rules”). GOV input and AVR input are deactivated; The system will control GOV and AVR automatically.	Stop the gensets when there is “trip and stop” alarm occurs. In multiple gensets running system, the system will shutdown if the load value has fallen below the minimum set value. In duty time start mode, genset will stop when duty time is up. (details please to see “Auto Start Rules”)

6.2 START MODE DESCRIPTION

Table 6 – Start Modes Description

Start Mode	Start Method	Stop Method	Auto Mode	Semi-auto Mode	Manual Mode
Linear Start	Start the gensets according to the set priority. The highest priority (the minimum number) will be started earliest; following the second highest priority will be started. E.g. the start sequence of 3 units: 1-2-3.	Stop the gensets according to the “Last in first out” sequence. E.g. the stop sequence of 3 units: 3-2-1.	•	X	X
Cyclic Start	Start the gensets according to the set priority and sequence. The highest priority (the minimum number) will be started earliest, following the second highest priority will be started. E.g. the start sequence of 3 units: 1-2-3.	Stop the gensets according to the “First in first out” sequence. E.g. the stop sequence of 3 units: 1-2-3.	•	X	X
Duty Time Mode	The gensets which has the shortest running hours will be started earliest. If the started genset runs for up to preset hours, then the additional genset which has the shortest running hours at this time will be started.	The gensets which has the longest running hours will be stopped earliest. Running hours will be stored in internal memory and cannot be lost even in case of power outage;	•	X	X

7. SG SYSTEM MODE DESCRIPTION

7.1 SG SYSTEM MODE

7.1.1 MANUAL MODE

When Manual mode signal is active, the system will work through manual mode. In this mode, HMC6 controller can only monitor data and alarm information but cannot control switch or engine. In addition, GOV and AVR do not work but the manual governor IN, manual governor OUT, manual VOLT IN and manual VOLT OUT do work in this mode.

7.1.2 SEMI-AUTO MODE

Semi-auto mode is activated by pressing 

key (or by semi-auto mode switch); Semi-auto means that the unit will not initiate any sequences automatically, as is the case with the auto mode. It will only initiate sequences, if external signals are given.

An external signal may be given in three ways:

1. Push-buttons on the display are used
2. Digital inputs are used
3. Modbus commands are used

In semi-auto mode, all available diesel generator units can be started/stopped/synchronizing closed/unloaded open upon push-button commands on the front panels for each generator.

The system monitors that if the generators are overloaded. Should that be the case, the Non Essential Load (NEL) trip will activate to maintain power supply to the main busbar.

If a heavy consumer is requested, the system calculates the power needed. If the available power is insufficient, the heavy consumer connection will not be allowed.

Semi-auto Start:

a) Press the start button 

, the controller firstly judges the feedback state of the shaft solenoid valve closing (if configured). If the state is not detected, the shaft solenoid valve closing outputs (if configured) and will be waited for the feedback state to be effective;

b) After the feedback signal of shaft solenoid valve closing is detected, HMC6 initiates a start command and the system enters the "start output" delay, during which the engine starts relay output;

c) When Start Output Delay is over, Start Wait Delay will be initiated. Fail to Start alarm will be initiated if the onload requirement has Not been achieved after the Start Wait Delay has expired. The alarm type of Fail to Start is block which means users can restart the generator only when the alarm is acknowledged;

d) When Start Wait Delay is over, Load Stability Delay will be initiated. F/V Fault alarm will be initiated if the onload requirement has Not been achieved after the Load Stability Delay has expired. The alarm type of F/V Fault is block which means users can restart the generator only when the alarm is acknowledged. However, it enters into “Normal Running” status if the onload requirement has been achieved;

e) If the switch is not closed during the normal running status and the voltage/frequency has not satisfied the on-load requirement suddenly, Transient Fault Delay will be initiated. F/V Fault alarm will be initiated if the on-load requirement has Not been achieved after the Transient Fault Delay has

expired. The alarm type of F/V Fault is block which means users can restart the generator only when the alarm is acknowledged;

f) If the on-load requirement has been achieved (Generator normal light will illuminate), the shaft genset will close and synchronize automatically after pressing the 

button;

g) It will judge whether the SG power can meet receiving all the DG power when closing in load receiving mode. If not, the controller will initiates an alarm and stop the closing operation. If it meets the requirements, the DG will open and stop after all the loads are received by the SG (DG is effective in auto mode); In a fixed power mode, the controller synchronously closes and operates at a fixed power and grid connection with DG;

h) If there is trip alarm occurs, then the system will open switch and the alarm information will be displayed on the LCD.

Semi-auto Stop：

a) Press open button 

in close status or input port of DG with load is effective, the system will dispatch the DG starting (DG is effective in auto mode), judging whether DG power will meet receiving all the SG power, if not, controller will initiate an alarm and stop operations, if it meets the requirements, soft unloading transferred and opened by SG first;

b) After breaker opened or in breaker open status, press stop button 

, system will enter into “Stop Output Delay” while the stop relay will activate;

c) After “Stop Output Delay”, system will enter into “Wait for Stop” delay. If genset voltage and frequency signals disappeared during the delay, controller will judge that the genset stopped and in standby state; otherwise, if genset voltage and frequency signals still can be detected after the delay expired, controller will judge that the genset failed to stop;

d) After genset failed to stop, if voltage and frequency signals are disappeared, controller will judge that the genset stopped completely and entered into standby state.

7.13 AUTO MODE

Auto mode is activated by pressing 

key (or by auto mode switch).

The start/stop, opening/closing sequence of auto mode is the same as the semi-auto mode, except for the automatic mode. The buttons on the panel have no effect and can only be operated through the input port.

When DG is loaded, SG will start and close automatically when the input of SG is effective with load, and DG will automatically unload and stop;

When SG is loaded, DG will start and close automaticlly when the input of DG is effective with load, and SG will automaticlly unload and stop;

In fixed power mode, SG will automatically start and connect to the grid with DG when the input of SG is effective with load;

In load sharing mode, SG will automatically start and connect to the grid with DG when the input of SG is effective with load;

7.2 WORKING MODE DESCRIPTION

Table 7– Working Mode

Working Mode	Description	Auto Mode	Semi-auto Mode	Manual Mode
Load Receiving Mode	After SG closing, all loads will be transferred to SG side, DG opens and stops; When SG opens, all loads will be transferred to DG side, SG opens and stops.	●	●	X
Fixed Power Mode	After SG closing, SG shares with parts of loads, DG shares the rest of power; When SG opens, all load will be transferred to DG side, SG opens and stops.	●	●	X
Load Sharing Mode	After SG closing, loads will be shared by SG and DG; When SG opens, all loads will be transferred to DG side, SG opens and stops.	●	●	X

Note: When in SG mode, outputs of GOV and AVR should be set as “none” if SG can not achive speed governing.

8. PROTECTION

Generator protection, busbar protection, current protection, power protection and switch protection can be provided by HMC6. Each kind of protection can configure one or more relays output.

Table 8 – Controller Alarm types

Alarm Type/Action	Buzzer	Display	Unload	Trip	Shutdown	Start
Block	●	●	X	X	X	X
Warn	●	●	X	X	X	●
Safety Trip	●	●	●	●	X	X
Safety Stop	●	●	●	●	●	X
Trip	●	●	X	●	X	X
Trip and Stop	●	●	X	●	●	X

Each alarm can be removed only when it is acknowledged and all alarm information will be cleared automatically if the data is beyond the alarm scope after acknowledged. Users also can remove the alarm by “Alarm Reset” auxiliary input port.

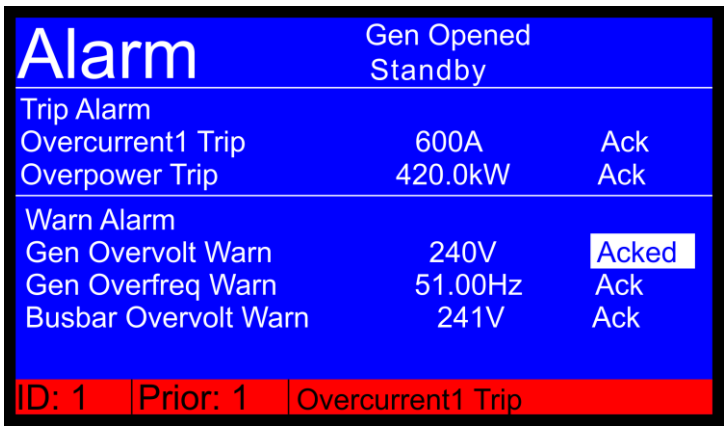


Fig.2 – Alarm Display Image

Press to select the alarm you are going to reply, and press Enter to acknowledge the alarm.

Table 9– HMC6 Alarms List

No.	Types	Description	Alarm Type
BUS Bar Protection			
1	Overvolt 1	When busbar voltage has exceeded the set value 1, it will initiate a warning alarm.	**Warn** Always active
2	Overvolt 2	When busbar voltage has exceeded the set value 2, it will initiate a trip alarm.	**Trip** Always active
3	Overvolt 3	When busbar voltage has exceeded the set value 3, it will initiate a trip alarm.	**Trip** Always active
4	Undervolt 1	When busbar voltage has fallen below than the set value 1, it will initiate a warning alarm.	**Warn** It is active after the switch has closed.
5	Undervolt 2	When busbar voltage has fallen below than the set value 2, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
6	Undervolt 3	When busbar voltage has fallen below than the set value 3, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
7	Overfreq 1	When busbar frequency has exceeded the set value 1, it will initiate a warning alarm.	**Warn** Always active
8	Overfreq 2	When busbar frequency has exceeded the set value 2, it will initiate a trip alarm.	**Trip** Always active
9	Overfreq 3	When busbar frequency has exceeded the set value 3, it will initiate a trip alarm.	**Trip** Always active
10	Underfreq 1	When busbar frequency has fallen below than the set value 1, it will initiate a warning alarm.	**Warn** It is active after the switch has closed.

No.	Types	Description	Alarm Type
11	Underfreq 2	When busbar frequency has fallen below than the set value 2, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
12	Underfreq 3	When busbar frequency has fallen below than the set value 3, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
13	Freq. Change	Alarm when rate of change is greater than the set value	**Warn** It is active after the switch has closed.
14	Vector Drift	Alarm when the change of phase angle is greater than the set value	**Warn** It is active after the switch has closed.
Generator Protection			
1	Fail To Start	After the "Start wait delay" has expired, if the genset doesn't reach on-load demands, it will initiate a warning alarm.	**Block** It is active after the genset is starting up.
2	Overfreq 1	When genset frequency has exceeded the set value 1, it will initiate a warning alarm.	**Warn** Always active
3	Overfreq 2	When genset frequency has exceeded the set value 2, it will initiate a trip alarm.	**Trip** Always active
4	Overfreq 3	When genset frequency has exceeded the set value 3, it will initiate a trip alarm.	**Trip** Always active
5	Underfreq 1	When genset frequency has fallen below than the set value 1, it will initiate a warning alarm.	**Warn** It is active after the switch has closed.
6	Underfreq 2	When genset frequency has fallen below than the set value 2, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
7	Underfreq 3	When genset frequency has fallen below than the set value 3, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
8	Overvolt 1	When genset voltage has exceeded the set value 1, it will initiate a warning alarm.	**Warn** Always active
9	Overvolt 2	When genset voltage has exceeded the set value 2, it will initiate a trip alarm.	**Trip** Always active
10	Undervolt 1	When genset voltage has fallen below than the set value 1, it will initiate a warning alarm.	**Warn** It is active after the switch has closed.
11	Undervolt 2	When genset voltage has fallen below than the set value 2, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.

No.	Types	Description	Alarm Type
12	Undervolt 3	When genset voltage has fallen below than the set value 3, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
13	Phase Sequence Wrong	When controller detects the reverse phase, it will initiate a trip alarm.	**Trip** Always active
14	Fail to Sync	The controller does not detect synchronization signal within the pre-set synchronization time, it will initiate a warning alarm.	**Warn** It is active after the switch has closed.
15	Loss of Excitation	When controller detects negative reactive power is greater than set value, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
16	Engine Fault	When controller detects that the engine fault signal is active, it will initiate a trip alarm.	**Trip** Always active
17	Feedback Fault	After the feedback function is selected and the system has started, if the voltage and frequency have reached the requirements but the feedback input is deactivate, it will initiate a warning alarm.	**Warn** It is active after the genset has started.
18	Freq/Volt Fault	Start the system, if the voltage and frequency have not reached the requirements after the on-load stable delay has expired, it will initiate a block alarm.	**Block** It is active after the genset has started.
19	Generating Freq. Change	Alarm when rate of change is greater than set value	**Warn** It is active after the switch has closed.
Current Protection			
1	Over Current 1	When controller detects the generator current has exceeded the set value 1, it will initiate a warning alarm.	**Warn** It is active after the switch has closed.
2	Over Current 2	When controller detects the generator current has exceeded the set value 2, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
3	Over Current 3	When controller detects the generator current has exceeded the set value 3, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
4	Over Current 4	When controller detects the generator current has exceeded the set value 4, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
5	Unbalanced Current	When the controller detects that negative phase current has exceeded the set value, it will initiate a warning alarm.	**Trip** It is active after the switch has closed.
Power Protection			

No.	Types	Description	Alarm Type
1	Reverse Power 1	When controller detects the reverse power value (power is negative) has fallen below than the set value 1, it will initiate a trip alarm.	**Warn** It is active after the switch has closed.
2	Reverse Power 2	When controller detects the reverse power value (power is negative) has fallen below than the set value 2, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
3	Over Power 1	When controller detects the power value (power is positive) has exceeded the set value 1, it will initiate a warning alarm.	**Warn** It is active after the switch has closed.
4	Over Power 2	When controller detects the power value (power is positive) has exceeded the set value 2, it will initiate a trip alarm.	**Trip** It is active after the switch has closed.
5	Non Essential Load 1 Trip	When controller detects the power value (power is positive) has exceeded the *Non Essential Load 1 Trip* set value, it will initiate a trip alarm.	**Warn** (Non Essential Load 1 Trip) It is active after the Non Essential Load switch 1 has closed.
6	Non Essential Load 2 Trip	When controller detects the power value (power is positive) has exceeded the *Non Essential Load 2 Trip* set value, it will initiate a trip alarm.	**Warn** (Non Essential Load 2 Trip) It is active after the Non Essential Load switch 2 has closed.
7	Non Essential Load 3 Trip	When controller detects the power value (power is positive) has exceeded the *Non Essential Load 3 Trip* set value, it will initiate a trip alarm.	**Warn** (Non Essential Load 3 Trip) It is active after the Non Essential Load switch 3 has closed.
8	Failed to Unload	When controller detects genset offload surpasses unload delay, it will initiate an alarm.	**Warn** It is active after it is closed.
9	Gen Capacity Insufficient	When controller detects all normal gensets are network connected and the remaining power cannot request power, it will initiate an alarm.	**Warn** It is active always.
10	Unbalanced Distribution of Active Power	When the controller detects the unbalanced distribution of active power percentage is greater than the set value, the unbalanced active power distribution outputs and alarms.	**Warn** It is active after unbalanced distribution of active power is enabled.
11	Unbalanced Distribution of Reactive Power	When the controller detects the unbalanced distribution of reactive power percentage is greater than the set value, the unbalanced reactive power distribution outputs and alarms.	**Warn** It is active after unbalanced distribution of reactive power is enabled.

No.	Types	Description	Alarm Type
12	SG & DG Parallel No. Out of Limit	When the controller detects that the number of DG in the network exceeds the limit when SG synchronizes, SG & DG parallel number exceeds the limit and alarms.	**Warn** It is active when it is SG mode
13	SG Insufficient Capacity	When the controller detects that SG capacity is unable to receive the total loads, SG capacity is insufficient to output and an alarm is given.	**Warn** It is active when it is SG mode
14	DG Insufficient Capacity	When the controller detects that SG capacity is unable to receive the total loads, DG & DG parallel number exceeds the limit and alarms.	**Warn** It is active when it is SG mode
15	Timeout of SG & DG Grid-connection	When the controller detects timeout of SG & DG grid-connection, it outputs and alarms.	**Warn** It is always active
Switch Protection			
1	Fail to Close	When controller detects that there is no *Close* signal after the Close delay has expired, it will initiate a trip alarm.	**Lock** It is active after the switch has closed.
2	Fail to Open	When controller detects that there is no *Open* signal after the Open delay has expired, it will initiate a trip alarm.	**Lock** It is active after the switch has opened.
3	Abnormal Trip of Main Switch	When the controller detects that the main switch abnormal trip input port is active, the controller initiates an alarm signal.	**Trip** It is active after it is closed.
4	External of Main Switch Open	When the controller is grid-connected in non-manual mode, it detects that the feedback input port of generation closing is inactive and the voltage, power and current are both 0, then the controller initiates an alarm signal.	**Trip** It is active after it is closed.
5	BUS Bar Breakdown Feedback Fault	When using BUS bar breaker, if the Bus bar breakdown input is active of other controllers on bus tie, but the current bus breakdown input is inactive, an alarm is given.	**Warn** It is active after Bus bar breakdown is enabled.
6	SG Solenoid Valve Fault	When the SG mode is enabled and the input port is configured with the shaft solenoid valve closing feedback is effective, alarm will be given if the feedback state of the shaft solenoid valve closing and opening is inconsistent with that of the controller.	**Warn** SG mode enables and input port configures with solenoid valve closing feedback is effective.
Module Protection			
1	Over Volt	When controller detects the power supply voltage has exceeded the set value, it will initiate a warning alarm.	**Warn** Always active

No.	Types	Description	Alarm Type
2	Under Volt	When controller detects the power supply voltage has fallen below than the set value, it will initiate a warning alarm.	**Warn** Always active
3	Input Port 1~9	When digital input port action selects "Alarm", controller sends corresponding alarm signal when the alarm is active.	Configurable alarm types It is active in set interval.
4	MSC Too Few Sets	When the controller detects fewer modules on the MSC link than the minimum number configured in the unit, it will initiate a warning alarm. There are 2 possible reasons: a) Communication line between the controllers disconnects, which interrupts communication. b) Other parallel gen-sets controllers have not been powered on.	**Warn** Always active
5	DIN1 Com Fail	When the controller detects DIN1 module communication failure, it will initiate a warning alarm.	**Warn** When DIN1 is enabled.
6	DIN2 Com Fail	When the controller detects DIN2 module communication failure, it will initiate a warning alarm.	**Warn** When DIN2 is enabled
7	DOUT1 Com Fail	When the controller detects DOUT1 module communication failure, it will initiate a warning alarm.	**Warn** When DOUT1 is enabled
8	DOUT2 Com Fail	When the controller detects DOUT2 module communication failure, it will initiate a warning alarm.	**Warn** When DOUT2 is enabled
9	LED1 Com Fail	When the controller detects LED1 module communication failure, it will initiate a warning alarm.	**Warn** When LA1 is enabled
10	LED2 Com Fail	When the controller detects LED2 module communication failure, it will initiate a warning alarm.	**Warn** When LA2 is enabled
11	HMP300 Com Fail	When the controller detects HMP300 module communication failure, it will initiate a warning alarm.	**Warn** When HMP300 is enabled

9. HARDWARE STRUCTURE

9.1 STRUCTURE DESCRIPTION

HMC6 terminals are standard configuration. Uses only can expand 16-channels discrete input module, 16-channels discrete output module or 16-channels LED lamp module via CANBUS (Expand) port to realize expansion.

Table 10 – HMC6 Terminals

Slot	Terminal	Remarks
Slot #1	1-6	Power supply; reply output port
Slot #2	7-15	Relay output port
Slot #3	16-23	Relay output port
Slot #4	24-35	CANBUS port; GOV analog speed regulator port; AVR analog voltage adjustment port.
Slot #5	36-39	Generator voltage input
Slot #6	40-43	Busbar voltage input
Slot #7	44-49	Generator current input
Slot #8	50-63	Digital input port, external frequency modulation, voltage adjustment port
Slot #9	64-67	Relay output port
Slot #10	68-70	RS485 COM port

9.2 TERMINAL DESCRIPTION

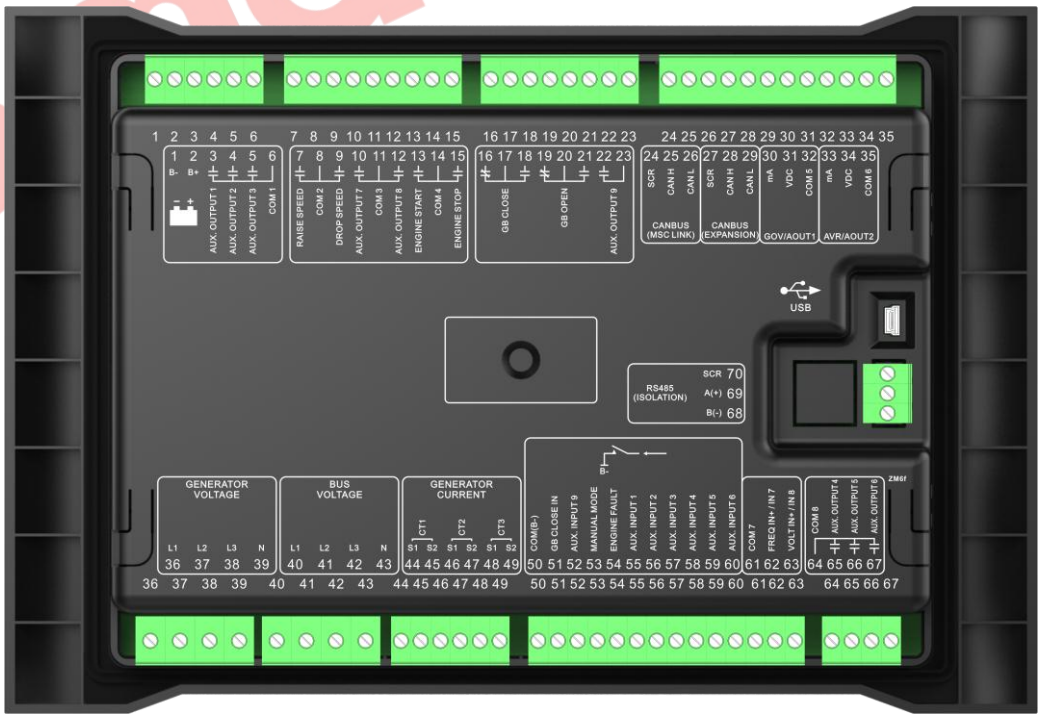


Fig.3 – HMC6 Terminal Drawing

Terminal description：NO means normally open; NC means normally close.

9.2.1 SLOT #1 POWER SUPPLY AND RELAY OUTPUT PORT

Table 11 – Slot#1 Power Supply & Relay Output Port

Terminal	Function	Description	Remarks
1	B-	DC(8~35)V	Power supply input
2	B+		
3	AUX.OUTPUT1	Auxiliary output port 1	AC250V/8 A
4	AUX.OUTPUT2	Auxiliary output port 2	AC250V/8 A
5	AUX.OUTPUT3	Auxiliary output port 3	AC250V/8 A
6	COM1	COM port 3~5	

NOTE: In case of using battery as power source, make the controller connect to the battery directly instead of start battery or charging generator to ensure stable supply of HMC6.

9.2.2 SLOT #2, SLOT #3 RELAY OUTPUT PORT

Table 12 – Slot#2, Slot#3 Relay Output Port

Terminal	Function	Description	Remarks
7	RAISE SPEED	Raise speed output	AC250V/8 A
8	COM2	COM port 7,9	
9	DROP SPEED	Drop speed output	AC250V/8 A
10	AUX. OUTPUT 7	Default: Raise volt output	AC250V/8 A
11	COM3	COM port 10,12	
12	AUX. OUTPUT 8	Default: Drop volt output	AC250V/8 A
13	ENGINE START	Engine start	AC250V/8 A
14	COM4	COM port 13, 15	
15	ENGINE STOP	Engine stop	AC250V/8 A
16	GB CLOSE_NC	GB CLOSE output	AC250V/8 A
17	GB CLOSE _COM		
18	GB CLOSE _NO		
19	GB OPEN _NC	GB OPEN output	AC250V/8 A
20	GB OPEN _COM		
21	GB OPEN _NO		
22	AUX. OUTPUT 9	Default: Audible alarm output	AC250V/8 A
23			

9.2.3 SLOT #4 CANBUS PORT, GOV ANALOG PORT AND AVR ANALOG PORT

Table 13 – Slot#4 CANBUS Port, GOV Analog Port and AVR Analog Port

Terminal	Function		Description	Remarks
24	SCR (MSC LINK)		CANBUS COM port	Multi-sets communication MSC LINK port Used for data sharing between HMC6 controllers.
25	CANH (MSC LINK)			
26	CANL (MSC LINK)			
27	SCR (EXPANSION)		CANBUS COM port	Expand CANBUS port Used for data sharing between HMC6 controllers. Used for expand digital input module, digital output module or LED lamp module.
28	CANH (EXPANSION)			
29	CANL (EXPANSION)			
30	mA	(GOV/AOUT1)	Output -20mA ~20mA	GOV Output can output simultaneously -20mA~20mA and -10V~10V; Can be transducer AOUT1 output;
31	VDC		Output -10V~10V	
32	COM5		GOV COM Output	
33	mA	(AVR/AOUT2)	Output -20mA ~20mA	AVR Output can output simultaneously -20mA~20mA and -10V~10V; Can be transducer AOUT2 output;
34	VDC		Output -10V~10V	
35	COM6		AVR COM Output	

9.2.4 SLOT #5, SLOT #6, SLOT #7 GENERATOR VOLTAGE INPUT/BUSBAR VOLTAGE INPUT/GENERATOR CURRENT INPUT PORT

Table 14 – Slot#5, Slot#6, Slot#7 Gen/Busbar Voltage, Gen Current Input Ports

Terminal	Function	Description	Remarks
36	L1 (GENSET)	Genset A-phase voltage sensing input	Maximum input 360V
37	L2 (GENSET)	Genset B-phase voltage sensing input	Maximum input 360V
38	L3 (GENSET)	Genset C-phase voltage sensing input	Maximum input 360V
39	N (GENSET)	Genset N-phase voltage sensing input	
40	L1 (BUS)	Busbar A-phase voltage sensing input	Maximum input 360V
41	L2 (BUS)	Busbar B-phase voltage sensing input	Maximum input 360V
42	L3 (BUS)	Busbar C-phase voltage sensing input	Maximum input 360V
43	N (BUS)	Busbar N-phase voltage sensing input	
44	S1 (CT1)	Gen A-phase sensing input	Rated input 5A
45	S2 (CT1)		
46	S1 (CT2)	Gen B-phase sensing input	Rated input 5A
47	S2 (CT2)		
48	S1 (CT3)	Gen C-phase sensing input	Rated input 5A
49	S2 (CT3)		

9.2.5 SLOT #8 DIGITAL INPUT, EXTERNAL FREQUENCY/VOLTAGE MODULATION INPUTS

Table 15 – Slot#8 Digital Inputs, External Frequency/Voltage Modulation Inputs

Terminal	Function	Description	Remarks
50	B-	Digital input COM port	
51	GB CLOSE IN	Breaker close input	(B-) connected is active.
52	AUX.INPUT 9	Aux. input port 9 Default: engine running feedback	
53	MANUAL MODE	Manual mode input	
54	ENGINE FAULT	Engine fault input	
55	AUX INPUT 1	Digital input port 1	
56	AUX INPUT 2	Digital input port 2	
57	AUX INPUT 3	Digital input port 3	
58	AUX INPUT 4	Digital input port 4	
59	AUX INPUT 5	Digital input port 5	
60	AUX INPUT 6	Digital input port 6	
61	COM 7	COM port of frequency input port and voltage input port	
62	FREQ IN+/IN 7	External frequency (active power) adjust input; Can be reused for Aux. Input 7;	-10V~10V; active when input fixed power mode external adjust; When it is inactive, it can be used for Aux. input port and it can only choose one function; Short connection with Terminal 61 is active as aux. input port.
63	VOLT IN+/IN 8	External voltage (reactive power) adjust input; Can be reused for Aux. input 8;	

9.2.6 SLOT #9 RELAY OUTPUT PORT

Table 16 – Slot#9 Relay Output Port

Terminal	Function	Description	Remarks
50.	COM8	COM port of Terminal 65、66 and 67	
51.	AUX.OUTPUT4	Auxiliary output port 4	AC250V/8 A
52.	AUX.OUTPUT5	Auxiliary output port 5	AC250V/8 A
53.	AUX.OUTPUT6	Auxiliary output port 6	AC250V/8 A

9.2.7 SLOT #10 RS485 COMMUNICATION PORT

Table 17 – Slot#10 RS485 Communication Port

Terminal	Function	Description	Remarks
68	B(-)	RS485 communication port	Baud rate 9600bps Standard MODBUS protocol
69	A(+)		
70	SCR	RS485 shield port	Shielded wire single-end earthed.

9.3 CONNECTION

9.3.1 TYPICAL APPLICATION DIAGRAM

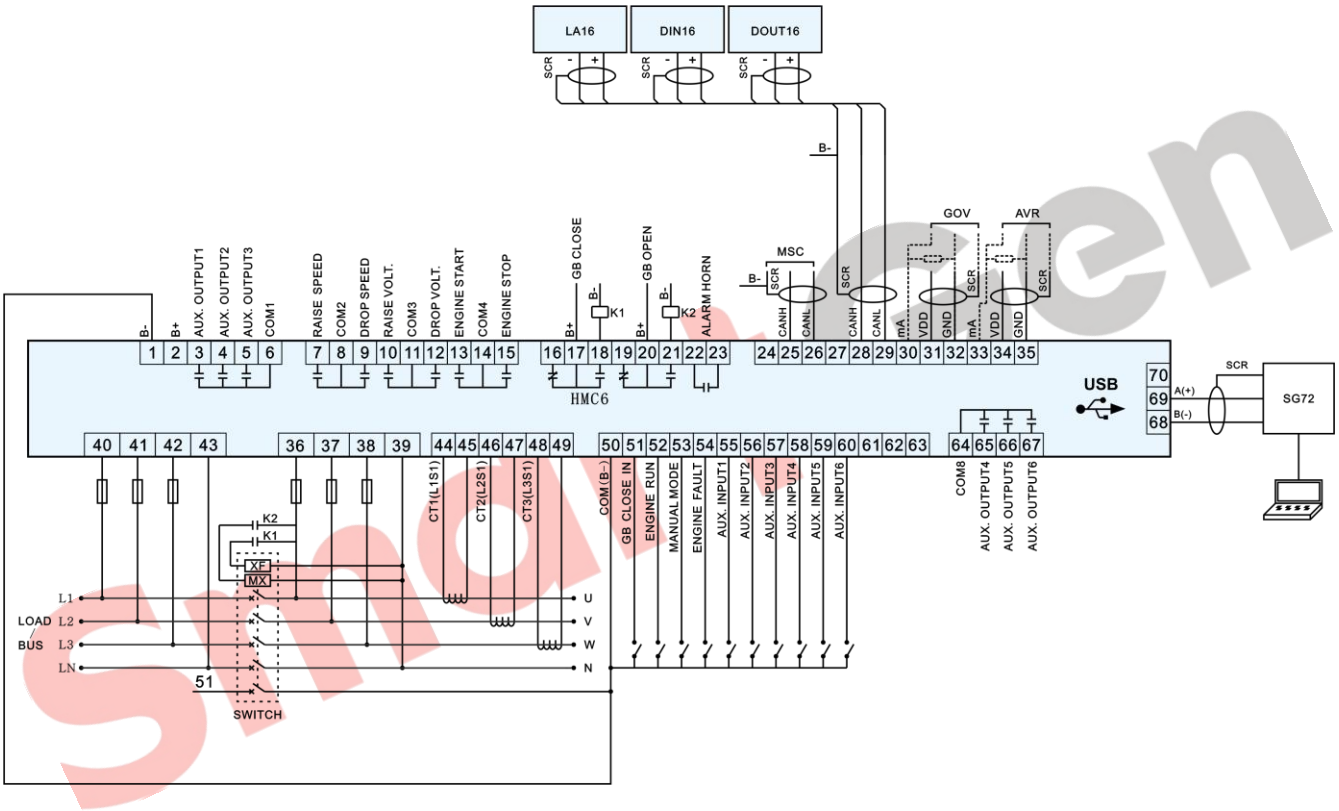


Fig. 4 – HMC6 Typical Diagram

9.3.2 AC WIRE CONNECTION (3 PHASE 3 WIRE)

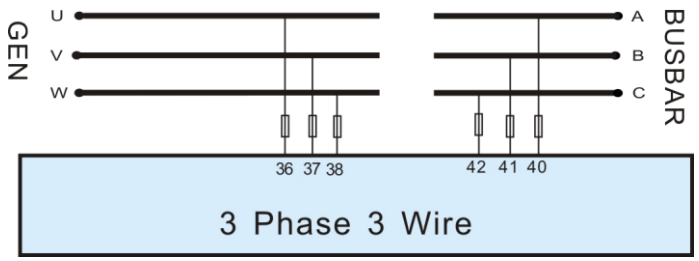


Fig. 5 – 3 Phase 3 Wire Connection

9.3.3 AC WIRE CONNECTION (SINGLE PHASE 2 WIRE)

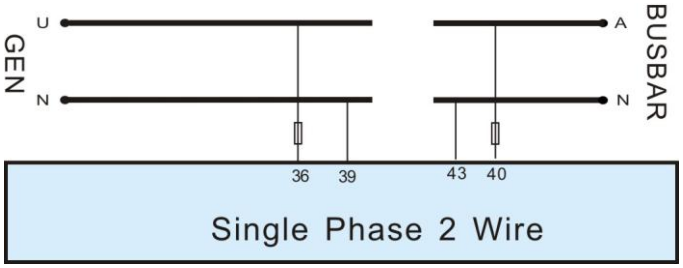


Fig.6 – Single Phase 2 Wire Connection

9.3.4 AC WIRE CONNECTION (2 PHASE 3 WIRE)

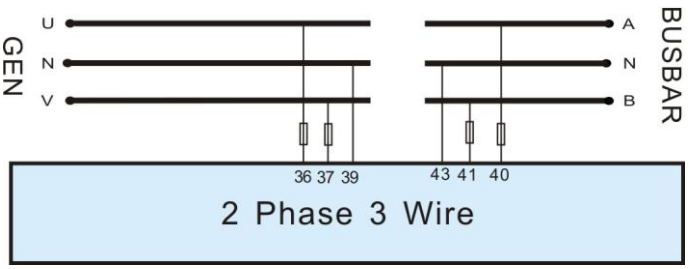


Fig.7 – 2 Phase 3 Wire Connection

9.3.5 ANALOG INPUT

HMC6 FREQ IN and VOLT IN ports support -10V~10V analog voltage input function. External power supply must be fitted when input signal.

Table 18 - FREQ IN and VOLT IN Function Description

Function	Description	External Setpoint Trigger Bar	Input Voltage
FREQ IN+	External frequency adjust	Single unit running or generator breaker is opened.	+/-10V DC
	External active power adjust	HMC6 is paralleled with shore power/shaft generator/busbar and need consistent power output.	+/-10V DC
VOLT IN+	External voltage adjust	Single unit running or generator breaker is opened.	+/-10V DC
	External reactive power adjust	HMC6 is paralleled with shore power/shaft generator/busbar and need consistent power output.	+/-10V DC

0~10V input connection：

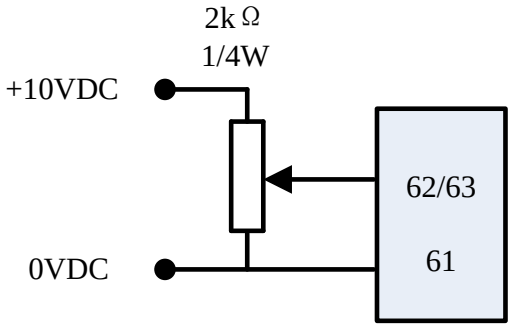


Fig.8 – 0~10V Input Connection Diagram

-10V~10V input connection：

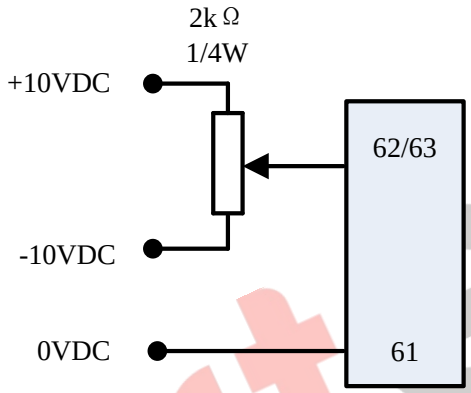


Fig.9 – -10V~10V Input Connection Diagram

9.3.6 MSC LINK PORT

Data sharing and data communication functions among HMC6 controllers are implemented via MSC LINK (CANBUS port). Detailed connection way is as following:

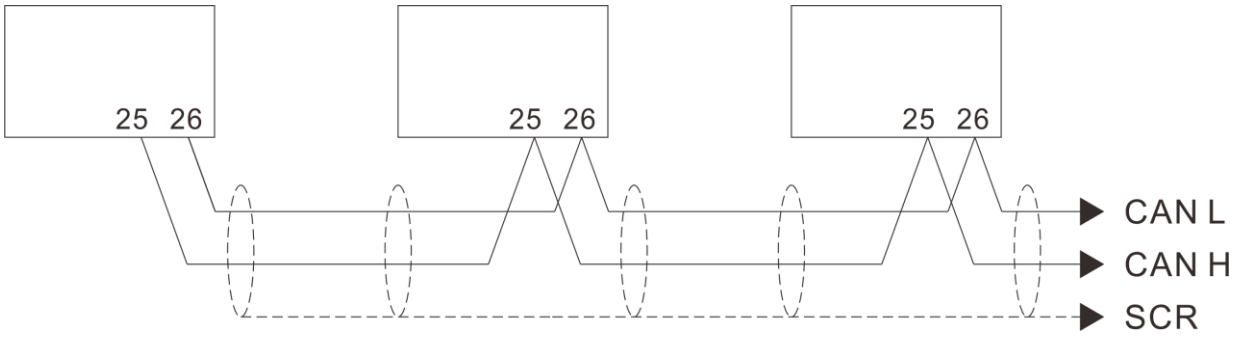


Fig.10 – HMC6 Module Communication Connection Diagram

9.3.7 MSC APPLICATION DIAGRAM

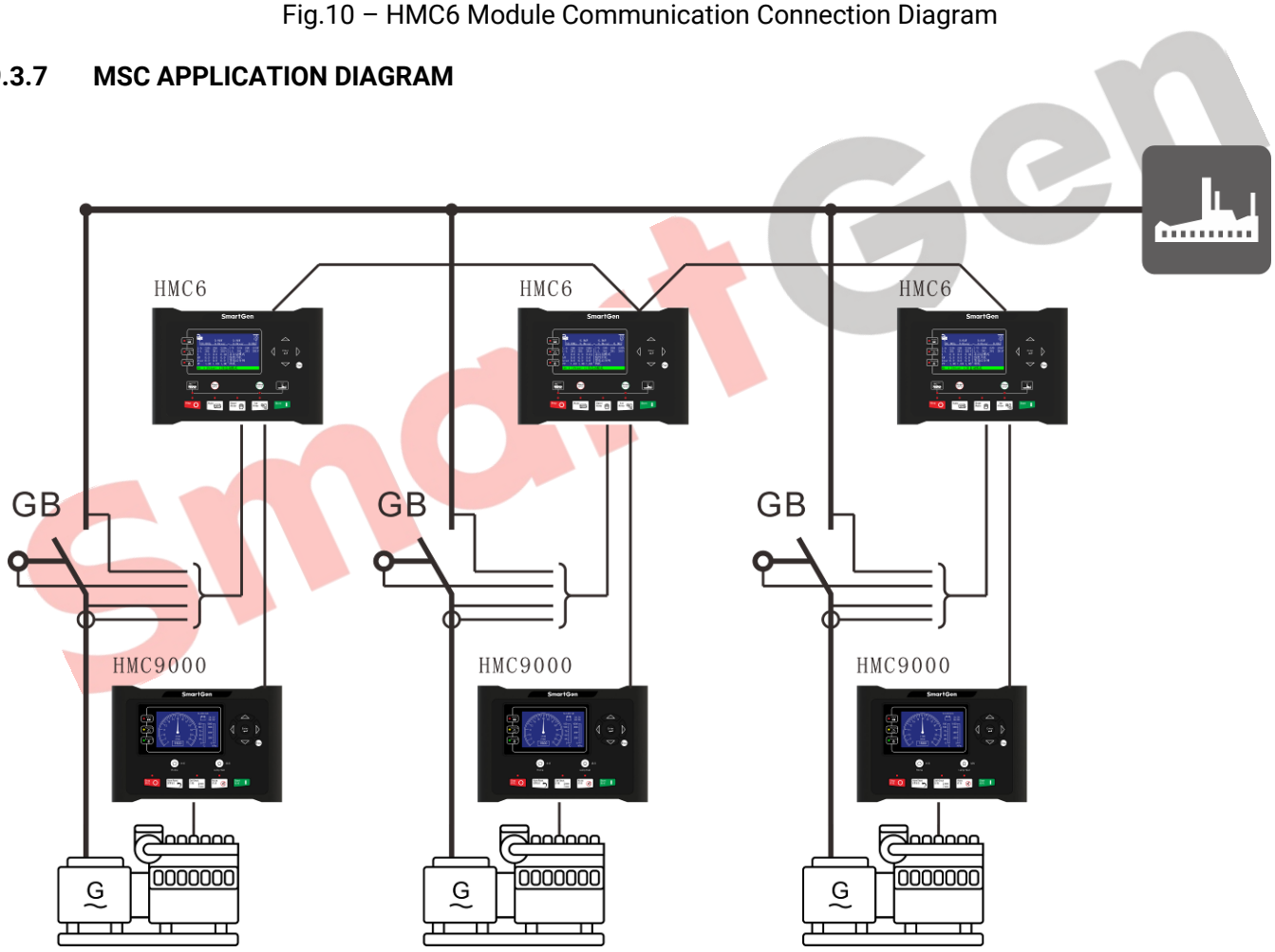


Fig.11 – MSC Application Diagram

10. POWER MANAGEMENT AND WORKFLOW CHART

There are two kinds of power management mode: Equal load sharing and Base load.

10.1 EQUAL LOAD SHARING

Equal load sharing is active both in auto mode and semi-auto mode. In both cases, load sharing is carried out via the internal CANbus line(s).

There are two kinds of equal load sharing ways: kW load sharing and kVar load sharing.

a) kW load sharing: the equal load sharing of active power of each unit on busbar can be adjusted via GOV or relay output.

b) kVar load sharing: the equal load sharing of reactive power of each unit on busbar can be adjusted via AVR or relay output.

10.2 FIXED POWER OUTPUT

Each unit can be selected as running with fixed power. This can be done from the panel parameters or via a discrete input.

The unit selected for fixed power operation will automatically be set in SEMI-AUTO. Only one generator per independent busbar can run with base load.

Active power output value and reactive power output value can be set, in addition, power factor also can be set.

When the generator breaker is closed, the generator power will be increased to the fixed power setpoint.

The following figure shows the fixed power of SG mode and DG & SG on-load diagram:

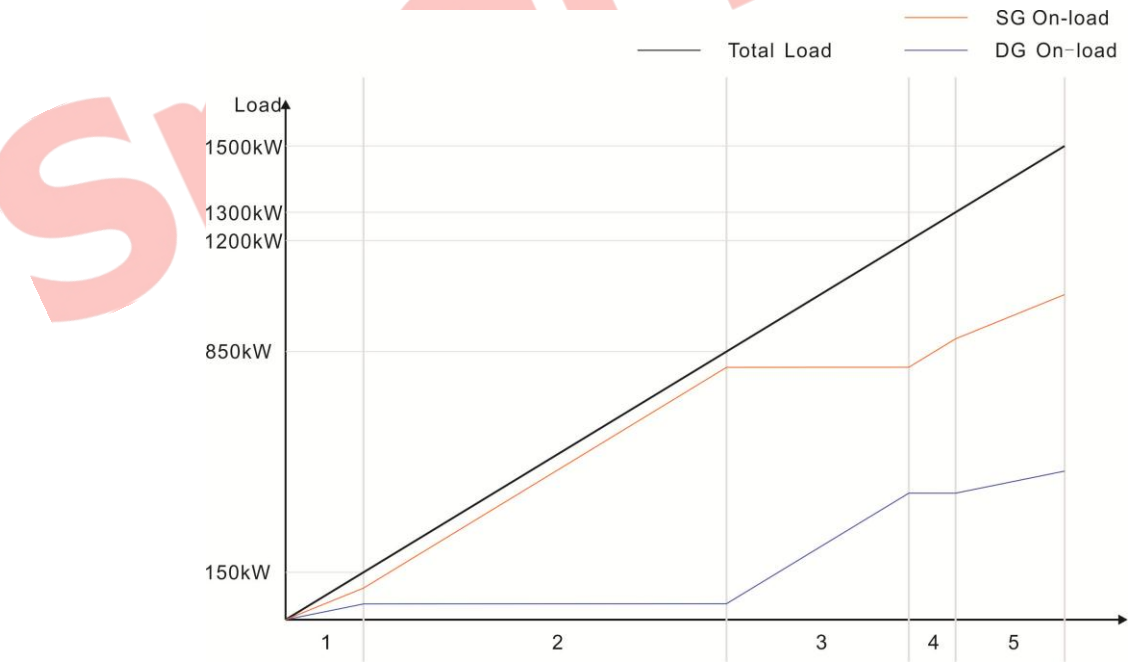


Fig.12– SG Fixed Power on-load Distribution Diagram

Suppose SG rated power is 1000kW, DG rated power is 500kW, the fixed min on-load percentage is 10%, the fixed max on-load percentage is 90% and the fixed output power percentage is 80%. According to the change of the total load, SG and SG on-load are as shown in the 5 parts of figure above:

The first part: (0-150)kW. SG and DG share the power;

The second part: (150-850)kW, DG on-load is 50Kw(10%), the rest is loaded with SG;

The third part: (850-1200)kW, SG on-load is 800kW(80%), the rest is loaded with DG;

The fourth part: (1200-1300) kW, SG on load is 400kW(80%), the rest is loaded with SG;

The fifth part: (1300-1500)kW, SG on-load is 900kW(90%)+sharing excess power (total load-1300 kW), DG on-load is 400kW(90%)+sharing excess power (total power-1300kW).

NOTE: If the fixed min on-load percentage is set to 0, DG will start with load only when SG on-load exceeds the fixed power percentage.

10.3 SYNCHRONISING

HMC6 controller adopts dynamic synchronizing because of its fast speed to close breakers. It is with 0.1Hz slip frequency, synchronizing can be finished in 10s and ramp on load immediately once generator closed.

During dynamic synchronizing, the unit which is going to synchronized is running at a different speed to busbar generator, and the speed difference between them is named as slip frequency. Generally, the synchronizing unit is running at a positive slip frequency which means it is relatively faster than busbar generator, so that the generator reverse power is avoided after synchronizing.

The aim of synchronization is reduce the phase angle between two systems (refer to 3-phase systems of generator and busbar).

Voltage difference, frequency difference and angle difference should be set during dynamic synchronizing. The breaker is going to closed if all of them meet the requirement.

10.4 HEAVY CONSUMERS

Each HMC6 controller is able to handle four Heavy Consumers (HC). Response priority for the same controller is HC1>HC2>HC3>HC4; while for the different controllers, controller's ID determines HC request's priority, which means first response to HC request from controller with small ID number.

When a heavy consumer is requested, the function for conditional connection of heavy consumers reserves the programmed HC requested value on the busbar, until sufficient predicted available power is present at the busbar.

10.4.1 HEAVY CONSUMER REQUESTS

Heavy consumer equipment should send a heavy consumer request before starting up. Only binary input can be handled by HMC6 and the request value must be fixed load value. Each heavy consumer request can set a corresponding request power value and rated power value.

10.4.2 HEAVY CONSUMER RESPONSE

If a heavy consumer is requested, the controller calculates the power needed according to the requested value of heavy consumer power. If the request is not satisfied, the controller will start the corresponding standby units, if satisfied, the controller will not reserve any power after the heavy consumer feedback is effective.

Example：

1) There is 60kW redundancy on busbar which is composed by two parallel running generators, then the heavy consumer request 1 is active (request power is 70kW).
2) An additional 100kW generator should be started if system calculates the power needed not meet the load starting.
3) There is 160kW redundancy on busbar after genset started and in parallel, then the acknowledged signal will be initiated.

If a heavy consumer is requested, the system calculates the power needed according to the requested value of heavy consumer power. If the request is not satisfied, the controller will start the corresponding standby units, if satisfied and the heavy consumer stability delays, then the acknowledged signal will be initiated, heavy consumer answer output delay ends, if the heavy consumer feedback inactive system is only heavy consumer includes its rated power, and the controller does not reserve any power after the heavy consumer feedback is effective.

Example：

1) There is 60kW redundancy on busbar which is composed by two parallel running generators, then the heavy consumer request 1 is active (request power is 70kW).
2) An additional 100kW generator should be started if system calculates the power needed.
3) There is 160kW redundancy on busbar after genset started and in parallel, then the acknowledged signal will be initiated.

10.4.3 HEAVY CONSUMER PERMISSION

If a heavy consumer is requested, the system calculates the power needed according to the requested value of heavy consumer power. If the request is not satisfied, the controller will start the corresponding standby units, if satisfied and the heavy consumer stability delays, then the acknowledged signal will be initiated and the signal is variable. If the current bus power is not enough, the heavy consumer permission signal will not output

10.4.4 HEAVY CONSUMER FEEDBACK

The feedback can be divided into switching signal and analog signal according to the type of heavy consumer (fixed power and variable power). Heavy consumer feedback signal is sent to the controller after the requested heavy consumer starts normally. If it is a fixed power one, the system will not reserve any power for the heavy consumer after the controller receives the switching feedback signal. If it is a variable power one, the controller receives an analog feedback signal >=2% of the rated power of heavy consumer, it is considered that the heavy load has been started, and the system reserves the remaining power of the rated power of heavy consumer (rated power of heavy consumer - current power of heavy consumer).

As the example below illustrates：

1) After the answer is active, the real power of the load is 30kW.
2) There is 130kW redundancy on busbar, if stop condition is satisfied, the additional generator will be stopped.

Switching quantity feedback is shown in the figure below:

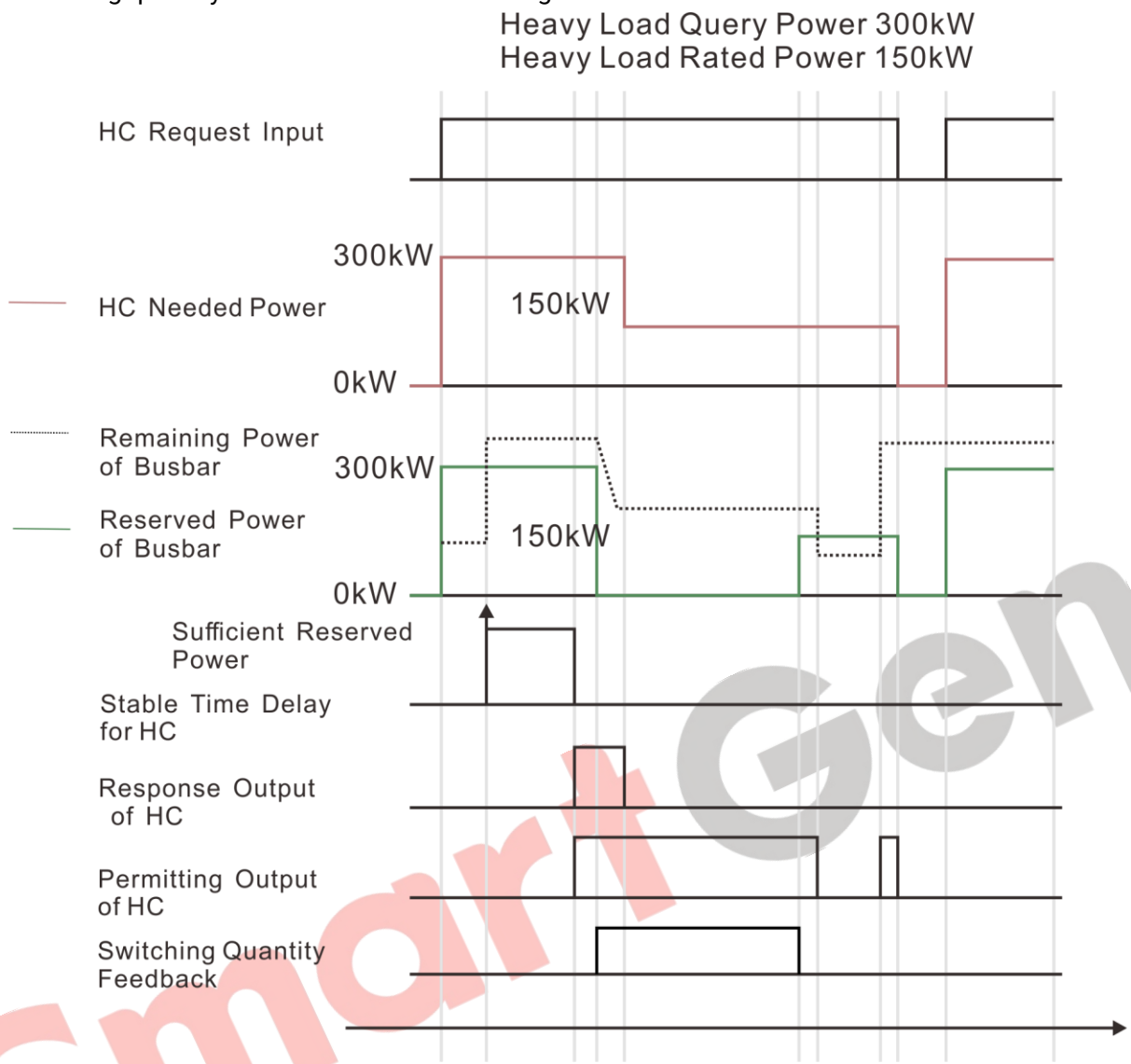


Fig.13–Fixed Heavy Consumer Sequence Diagram

Illustration for the fixed heavy load sequence diagram:

a) The HC1 heavy load requests for 300kW power, HC1 rated power is 150kW;

b) The bus bar reserves 300 kW for HC1;

c) The bus bar has enough redundant power and starts after heavy load stability delay;

d) After the heavy load stability delay, the controller starts to output the heavy load answer signal;

e) During or after the output delay of heavy load answer, the bus bar has different processing states for HC1 heavy load according to the different states of heavy load feedback and request signals;

f) If the heavy load feedback is active, the bus bar will no longer reserve any power for HC1;

g) If the heavy load feedback is inactive, the bus bar will only reserve the rated power for HC1 when heavy load request is active;

h) If the heavy load feedback is inactive, the bus bar will not reserve any power for HC1 when heavy load request is inactive;

Analog Quantity feedback is shown in the figure below:

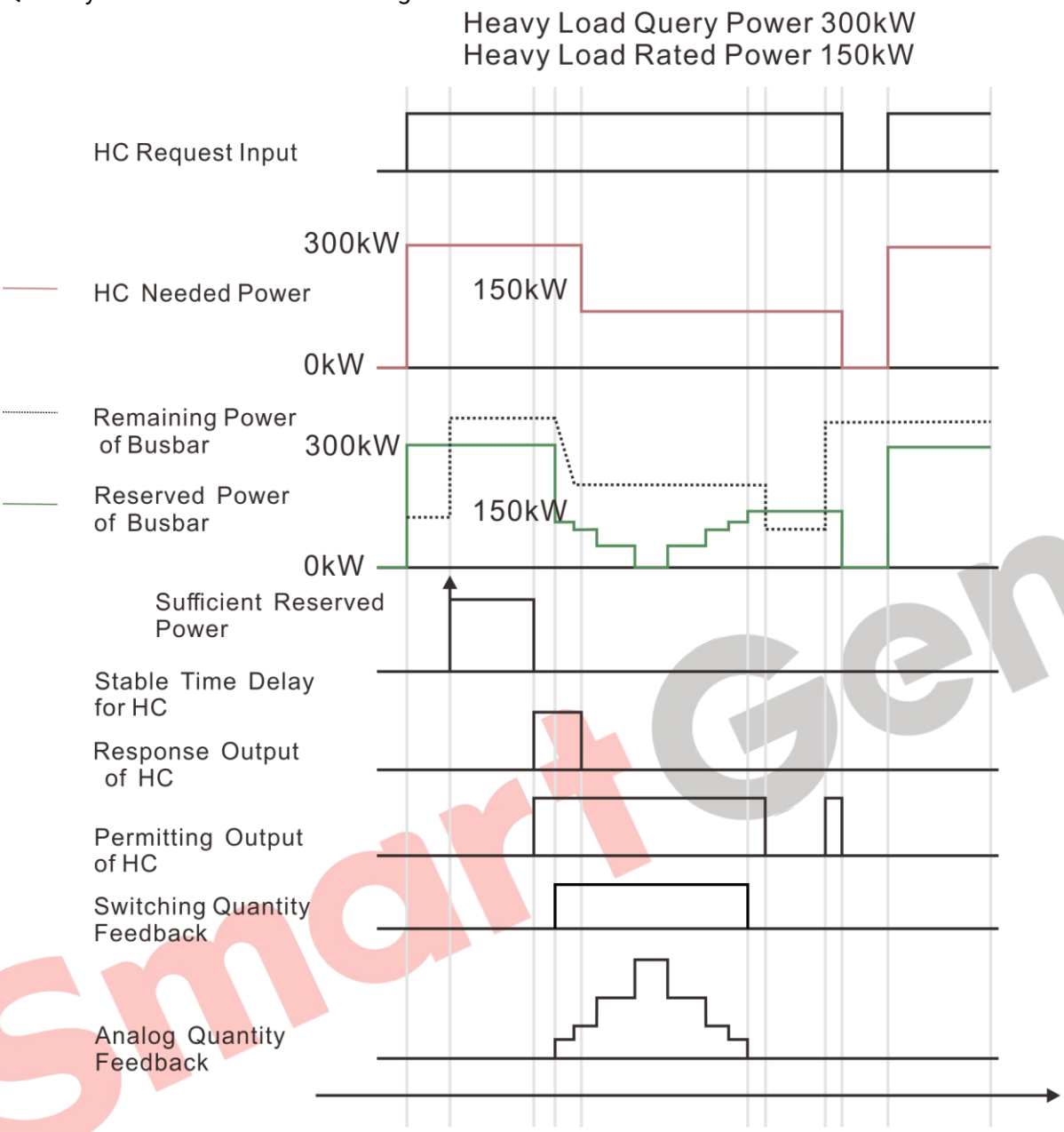


Fig. 14 – Analog Heavy Consumer Sequence Diagram

10.5 TRIP OF NON ESSENTIAL LOAD (NEL)

The trip of Non Essential Load (NEL) groups is carried out in order to protect the busbar. Each HMC6 controller is able to handle three non-essential load trip (NEL). Trip priority is: NEL1> NEL2> NEL3. If the active power or current has exceeded the set value, the corresponding NEL will trip after the trip delay, and the warning alarm will be initiated. NEL trip can be reuse after alarm response only.

10.6 WORKFLOW CHART

10.6.1 START UP

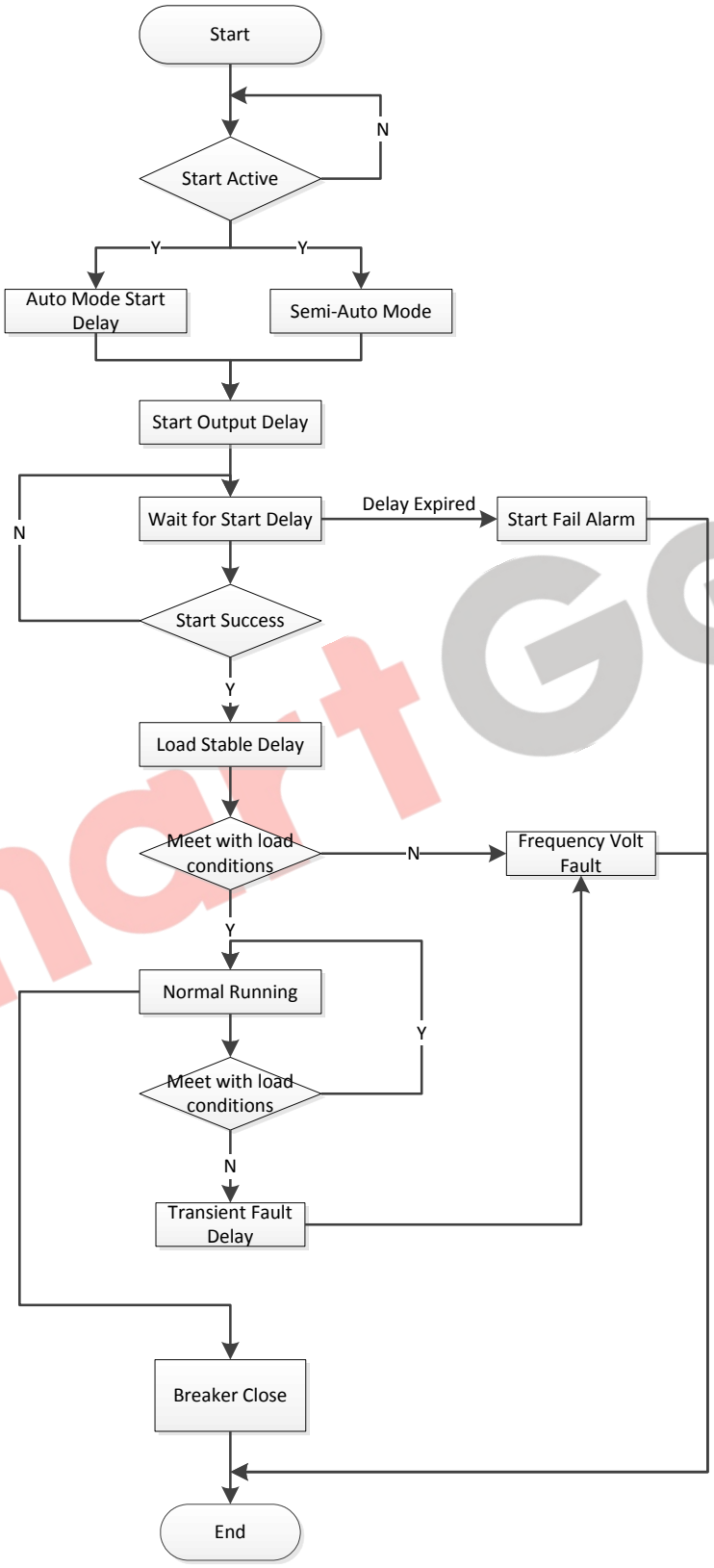


Fig.15 – System Start Workflow Chart

10.6.2 STOP

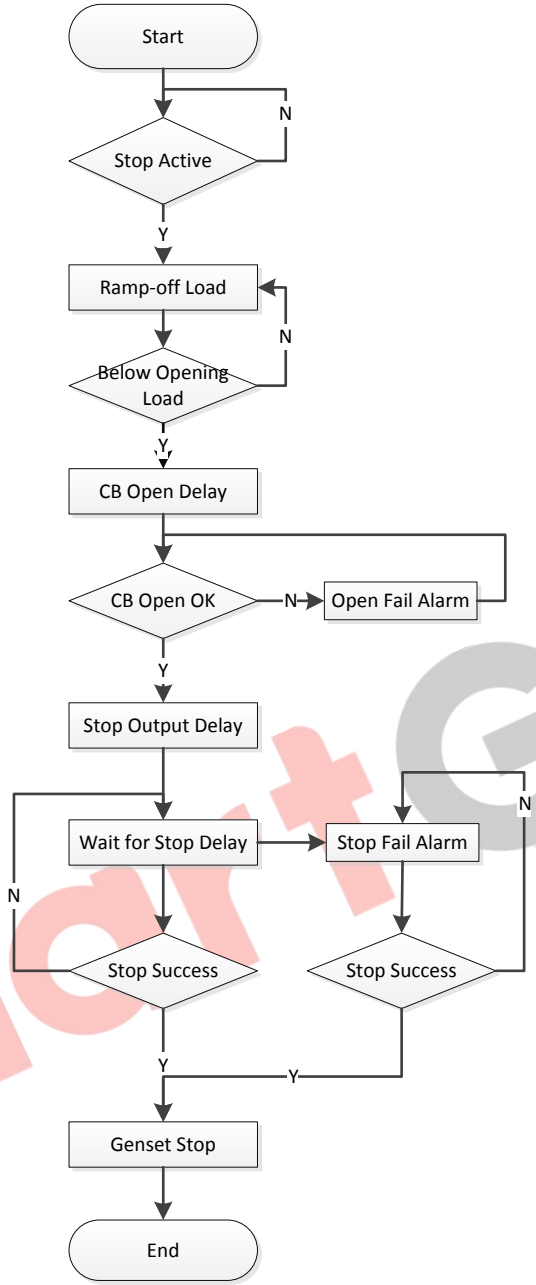


Fig.16 – System Stop Workflow Chart

10.6.3 CLOSE BREAKER

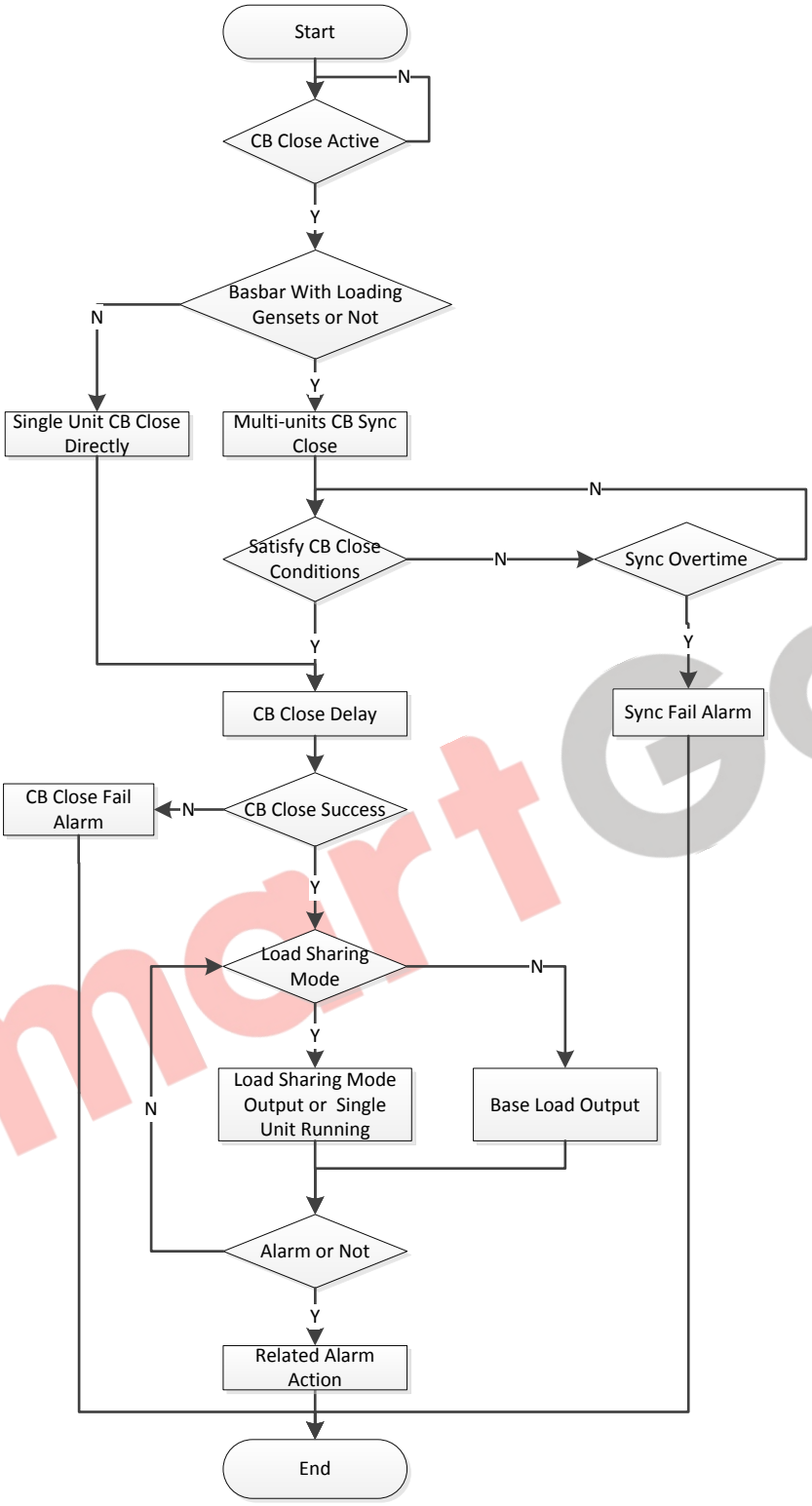


Fig.17 – System Breaker Close Workflow Chart

10.6.4 OPEN BREAKER

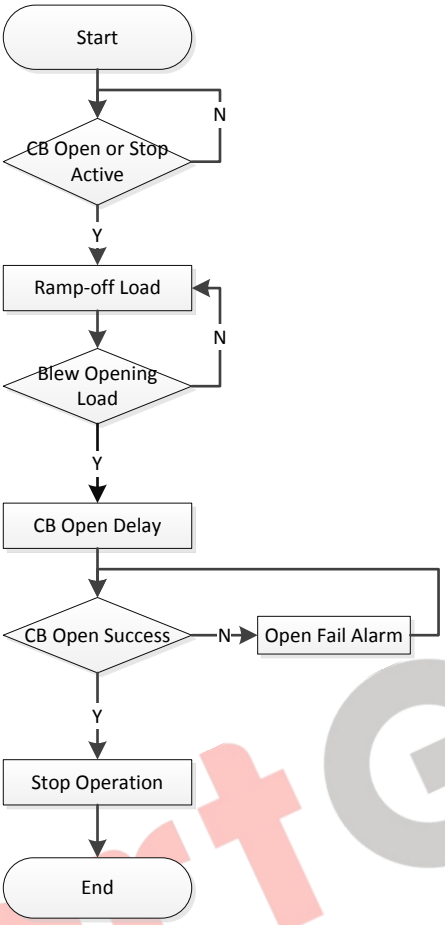


Fig.18 – System Breaker Open Workflow Chart

10.6.5 HEAVY CONSUMER

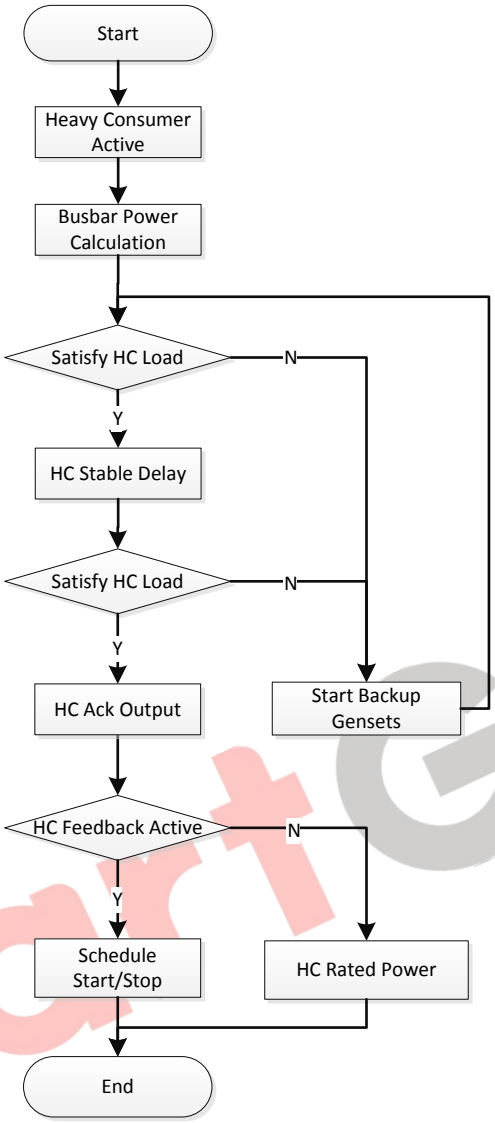


Fig.19 – Heavy Consumer Workflow Chart

10.6.6 LIGHT CONSUMER

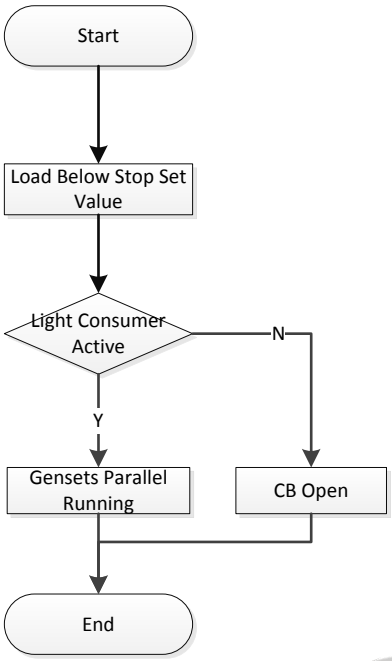


Fig.20 – Light Consumer Workflow Chart

11. SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

This part contains all controller parameters, in which partial parameters only can be configured by PC software.

11.1 BUSBAR SETTING

Table 19 – Busbar Parameter Settings

No.	Items		Parameter Range	Default	Description
Bus					
1	Rated Voltage		(30-30000)V	230	Standard for checking busbar over/under voltage. (It is primary voltage when using voltage transformer; it is line voltage when AC system is 3P3W while it is phase voltage when using other AC system).
2	Rated Frequency		(10.0-75.0)Hz	50.0	Standard for checking busbar over/under frequency.
3	Volt. Trans.(PT)	Action	(0-1) 0: Disable 1: Enable	0:Disable	Users can set the primary voltage and secondary voltage of the voltage transformer.
4		PT Primary	(30-30000)V	100	
5		PT Secondary	(30-1000)V	100	
6	Over Voltage 1 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	Setting value is busbar rated voltage's percentage, and both return value and delay value can be set.
7		Set value	(90-150)%	110	
8		Delay	(0.1-100.0)s	5.0	
9		Alarm Type	(0-5) 0: Block 1: Warn 2: Trip 3: Shutdown 4: Safety Trip 5: Safety Stop	1:Warning	
10	Over Voltage 2 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
11		Set value	(90-150)%	120	
12		Delay	(0.1-100.0)s	3.0	
13		Alarm Type	(0-5)	2:Trip	
14	Over Voltage 3 Set	Action	(0-1) 0: Disable	0:Disable	

No.	Items		Parameter Range	Default	Description
			1: Enable		
15		Set value	(90-150)%	130	
16		Delay	(0.1-100.0)s	1.0	
17		Alarm Type	(0-5)	2:Trip	
18	Under Voltage 1 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
19		Set value	(50-100)%	95	
20		Delay	(0.1-100.0)s	5.0	
21		Alarm Type	(0-5)	1:Warn	
22	Under Voltage 2 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
23		Set value	(50-100)%	80	
24		Delay	(0.1-100.0)s	3.0	
25		Alarm Type	(0-5)	2:Trip	
26	Under Voltage 3 Set	Action	(0-1) 0: Disable 1: Enable	0:Disable	
27		Set value	(50-100)%	70	
28		Delay	(0.1-100.0)s	2.0	
29		Alarm Type	(0-5)	2:Trip	
30	Over Frequency 1 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	Setting value is busbar rated frequency's percentage, return value and delay value can be set.
31		Set value	(100-130)%	105	
32		Delay	(0.1-100.0)s	5.0	
33		Alarm Type	(0-5)	1:Warn	
34	Over Frequency 2 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
35		Set value	(100-130)%	110	
36		Delay	(0.1-100.0)s	8.0	
37		Alarm Type	(0-5)	2:Trip	
38	Over Frequency 3 Set	Action	(0-1) 0: Disable 1: Enable	0:Disbale	
39		Set value	(100-130)%	120	
40		Delay	(0.1-100.0)s	6.0	
41		Alarm Type	(0-5)	2:Trip	
42	Under Frequency 1	Action	(0-1) 0: Disable	1:Enable	

No.	Items		Parameter Range	Default	Description
	Set		1: Enable		
43		Set value	(80-100)%	96	
44		Delay	(0.1-100.0)s	5.0	
45		Alarm Type	(0-5)	1:Warn	
46	Under Frequency 2 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
47		Set value	(80-100)%	93	
48		Delay	(0.1-100.0)s	10.0	
49		Alarm Type	(0-5)	2:Trip	
50	Under Frequency 3 Set	Action	(0-1) 0: Disable 1: Enable	0:Disable	
51		Set value	(80-100)%	92	
52		Delay	(0.1-100.0)s	8.0	
53		Alarm Type	(0-5)	2:Trip	
54	ROCOF Set	Action	(0-1) 0: Disable 1: Enable	0:Disable	
55		Set value	(0-1.00)Hz/s	0.20	When the controller detects that the busbar ROCOF has exceeded the set value, it will initiate an alarm signal and the alarm information will be displayed on LCD.
56		Delay	(0-20.0)s	0.1	
57		Alarm Type	(0-5)	1:Warn	
58	VECTOR SHIFT	Action	(0-1) 0: Disable 1: Enable	0:Disable	
59		Set value	(0-20.0)°	6.0	When the controller detects that the busbar VECTOR SHIFT has exceeded the set value, it will initiate a alarm signal and the alarm information will be displayed on LCD.
60		Delay	(0-20.0)s	0.1	
61		Alarm Type	(0-5)	1:Warn	

11.2 TIMER SETTING

Table 20 – Timer Parameter Settings

No.	Items	Parameter Range	Default	Description
Timers				
1	Start Delay	(0-3600)s	5	Time from start signal is active to start genset.
2	Stop Delay	(0-3600)s	30	Time from start signal is deactivated to genset stop.
3	Starting Output	(0-3600)s	8	Start relay output time. When it is 0, means output constantly.
4	Stopping Output	(0-3600)s	5	Stop relay output time. When it is 0, means output constantly.
5	Wait For Start	(0-3600)s	120	Time from start signal is active to on-load requirement is satisfied. If the requirement doesn't be satisfied but delay time is up, then the warning alarm will be initiated.
6	Wait For Stop	(0-3600)s	20	After the "Wait For Stop" delay, the genset is stopped successfully if the voltage and frequency are 0; while the warning alarm will be initiated if they are not 0.
7	Wait For Stable	(0-3600)s	5	Time from start signal is active to on-load requirement is satisfied. If the requirement is continue satisfied in on-load stable delay, synchronization is beginning. If the requirement doesn't be satisfied but delay time is up, then the warning alarm will be initiated.
8	Transient Fault	(0-100.0)s	2.0	After the on-load stable delay, If the voltage and frequency requirements are not satisfied after the transient fault delay has expired, then the Freq/Volt Fault alarm will be initiated.
9	Alarm Start Delay	(0-3600)s	1	Start delay caused by trip or shutdown alarm.
10	Operate Start Delay	(0-3600)s	1	Start delay caused by human triggered (e.g. manual transfer priority, high consumer request and etc.)
11	Alarm Stop Delay	(0-3600)s	1	Stop delay caused by the trip or shutdown alarms.

No.	Items	Parameter Range	Default	Description
12	Operate Stop Delay	(0-3600)s	1	Stop delay caused by human triggered (e.g. manual transfer priority, high consumer request and etc.)
13	Cooling Delay	(0-3600)s	0	High speed cooling time before stop output.
14	HC Stable Delay	(0-1000)s	5	After busbar retardant power meet with high consumer request, high consumer ACK output after this delay.
15	HC ACK Delay	(0-1000)s	5	After busbar retardant power meet with high consumer request, high consumer ACK output after "HC Stable Delay".

11.3 GENERATOR SETTING

Table 21 – Generator Parameter Settings

No.	Items	Parameter Range	Default	Description
Generator				
1	AC System	(0-3)	0: 3P4W	0: 3 phase, 4 wire (3P4W); 1: 3 phase, 3 wire (3P3W); 2: 2 phase, 3 wire (2P3W); 3: 1 phase, 2 wire (1P2W).
2	Rated Voltage	(30-30000)V	230	To offer standards for detecting of generator's over/under voltage. (It is primary voltage when using voltage transformer; it is line voltage when AC system is 3P3W while it is phase voltage when using other AC system).
3	Loading Voltage	(0-200)%	95	Setting value is percentage of generator rated voltage. Detect when controller prepare loading. When generator voltage under load voltage, won't enter into normally running.
4	Crank Success Volt	(0-200)%	30	To offer standards for detecting crank disconnect voltage is satisfied or not.
5	Rated Frequency	(10.0-75.0)Hz	50.0	To offer standards for detecting of over/under/load frequency.
6	Loading Frequency	(0-200)%	85	Setting value is percentage of generator rated frequency. Detect when controller prepare loading. When generator frequency under load frequency, it won't enter into normal running.
7	Crank Success Frequency	(0-200)%	65	To offer standards for detecting crank

No.	Items		Parameter Range	Default	Description
					disconnect frequency is satisfied or not.
8	Volt. Trans.(PT)	Action	(0-1) 0: Disable 1 :Enable	0:Disable	Primary/secondary voltage of voltage transformer can be set.
9		PT Primary	(30-30000)V	100	
10		PT Secondary	(30-1000)V	100	
11	Over Voltage 1 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	Setting value is percentage of generator rated voltage. Delay value and return value can be set.
12		Set value	(80-120)%	105	
13		Delay	(0.1-100.0)s	5.0	
14		Alarm Type	(0-5) 0: Block 1: Warn 2: Trip 3: Shutdown 4: Safety Trip 5: Safety Stop	1: Warn	
15	Over Voltage 2 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
16		Set value	(80-120)%	115	
17		Delay	(0.1-100.0)s	1.0	
18		Alarm Type	(0-5)	2:Trip	
19	Under Voltage 1 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
20		Set value	(50-100)%	95	
21		Delay	(0.1-100.0)s	5.0	
22		Alarm Type	(0-5)	1:Warn	
23	Under Voltage 2 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
24		Set value	(50-100)%	80	
25		Delay	(0.1-100.0)s	3.0	
26		Alarm Type	(0-5)	2:Trip	
27	Under	Action	(0-1)	0:Disable	

No.	Items		Parameter Range	Default	Description
	Voltage 3 Set		0: Disable 1: Enable		
28		Set value	(50-100)%	70	
29		Delay	(0.1-100.0)s	1.0	
30		Alarm Type	(0-5)	2:Trip	
31	Over Frequency 1 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	Setting value is percentage of generator rated frequency. Delay value and return value can be set.
32		Set value	(80-120)%	105	
33		Delay	(0.1-100.0)s	5.0	
34		Alarm Type	(0-5)	1:Warn	
35	Over Frequency 2 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
36		Set value	(80-120)%	107	
37		Delay	(0.1-100.0)s	3.0	
38		Alarm Type	(0-5)	2:Trip	
39	Over Frequency 3 Set	Action	(0-1) 0: Disable 1: Enable	0:Disable	
40		Set value	(80-120)%	110	
41		Delay	(0.1-100.0)s	1.0	
42		Alarm Type	(0-5)	2:Trip	
43	Under Frequency 1 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
44		Set value	(50-100)%	95	
45		Delay	(0.1-100.0)s	5.0	
46		Alarm Type	(0-5)	1:Warn	
47	Under Frequency 2 Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
48		Set value	(50-100)%	93	
49		Delay	(0.1-100.0)s	3.0	
50		Alarm Type	(0-5)	2:Trip	
51	Under	Action	(0-1)	0:Disable	

No.	Items		Parameter Range	Default	Description
	Frequency 3 Set		0: Disable 1: Enable		
52		Set value	(50-100)%	90	
53		Delay	(0.1-100.0)s	1.0	
54		Alarm Type	(0-5)	2:Trip	
55	Loss Of Phase Set	Action	(0-1)	1: Enable	
56		Alarm Type	(0-5)	2: Trip	
57	Reverse Phase	Action	(0-1)	1: Enable	
58		Alarm Type	(0-5)	2: Trip	
59	Rate Of Frequency Change (ROCOF)	Action	(0-1) 0: Disable 1: Enable	0: Disable	When controller detects that the gen rate of frequency change (ROCOF) is greater than the set value, it will send alarm signal and the alarm information will be displayed on the LCD.
60		Set Value	(0-1.00)Hz/s	0.10	
61		Delay	(0-20.0)s	0.1	
62		Alarm Type	(0-5)	1: Warn	
63	Adjust Frequency Input Set	Adjust Frequency	(0-100)%	10	This function can be used when power mode is fixed and external adjust input is active. Adjust frequency before breaker close; for single unit, frequency can be adjusted after breaker is closed; for the multi-units, active power can be adjusted after breaker is closed.
64		Adjust Active Power	(0-100)%	50	
65		Minimum Adjust	(-10-10)V	-10	
66		Maximum Adjust	(-10-10)V	10	
67	Adjust Voltage Input Set	Adjust Voltage	(0-100)%	10	This function can be used when power mode is fixed and external adjust input is active. Adjust voltage before breaker close; for single unit, voltage can be adjusted after breaker is closed; for the multi-units, reactive power can be adjusted after breaker is closed.
68		Adjust Reactive Power	(0-100)%	50	
69		Minimum Adjust	(-10-10)V	-10	
70		Maximum Adjust	(-10-10)V	10	

11.4 GENERATOR LOAD SETTING

Table 22 – Generator Load Settings

No.	Items		Parameter Range	Default	Description
Load					
1.	CT Ratio		(5-6000)/5	500/5	The ratio of external CT.
2.	Full Load Rating		(5-6000)A	500	Generator's rated current.
3.	Rated Active Power		(5-20000)kW	276	Generator's rated active power.
4.	Rated Reactive Power		(5-20000)kvar	210	Generator's rated reactive power.
5.	Overload To Ask 1		(0-2000)kW	100	The request active power of busbar overload.
6.	Overload Rated 1		(0-2000)kW	60	The rated active power of busbar overload.
7.	Overload To Ask 2		(0-2000)kW	100	The request active power of busbar overload.
8.	Overload Rated 2		(0-2000)kW	60	The rated active power of busbar overload.
9.	Overload To Ask 3		(0-2000)kW	100	The request active power of busbar overload.
10.	Overload Rated 3		(0-2000)kW	60	The rated active power of busbar overload.
11.	Over Current 1 Set	Action	(0-1) 0:Diable 1:Enable	1:Enable	
12.		Set Value	(50-300)%	100	
13.		Delay	(0.1-999.9)s	20.0	
14.		Alarm Type	(0-5)	1:Warn	
15.	Over Current 2 Set	Action	(0-1) 0:Diable 1:Enable	1:Enable	
16.		Set Value	(50-300)%	110	
17.		Delay	(0.1-999.9)s	60.0	
18.		Alarm Type	(0-5)	2:Trip	
19.	Over Current 3 Set	Action	(0-1) 0:Diable 1:Enable	1:Enable	
20.		Set Value	(50-300)%	130	
21.		Delay	(0.1-999.9)s	30.0	
22.		Alarm Type	(0-5)	2:Trip	
23.	Over Current 4 Set	Action	(0-1) 0:Diable 1:Enable	1:Enable	

No.	Items		Parameter Range	Default	Description
24.		Set Value	(50-300)%	150	
25.		Delay	(0.1-999.9)s	10.0	
26.		Alarm Type	(0-5)	2:Trip	
27.	Overload 1 Protection	Action	(0-1) 0: Disable 1: Enable	1:Enable	
28.		Set Value	(80-200)%	120	
29.		Delay	(0.1-999.9)s	10.0	
30.		Alarm Type	(0-5)	1:Warn	
31.	Overload 2 Protection	Action	(0-1) 0: Disable 1: Enable	1:Enable	
32.		Set Value	(80-200)%	130	
33.		Delay	(0.1-999.9)s	5.0	
34.		Alarm Type	(0-5)	2:Trip	
35.	Reverse Power 1 Protection	Action	(0-1) 0: Disable 1: Enable	1:Enable	
36.		Set Value	(0-200)%	8	
37.		Delay	(0.1-999.9)s	5.0	
38.		Alarm Type	(0-5)	1: Warn	
39.	Reverse Power 2 Protection	Action	(0-1) 0: Disable 1: Enable	1:Enable	
40.		Set Value	(0-200)%	15	
41.		Delay	(0.1-999.9)s	2.0	
42.		Alarm Type	(0-5)	2:Trip	
43.	Unbalanced Current Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
44.		Set Value	(0-200)%	20	
45.		Delay	(0.1-999.9)s	5.0	
46.		Alarm Type	(0-5)	2:Trip	
47.	Loss of Field Set	Action	(0-1) 0: Disable 1: Enable	1:Enable	
48.		Set Value	(0-200)%	20	
49.		Delay	(0.1-999.9)s	10.0	
50.		Alarm Type	(0-5)	1:Warn	
51.	NEL 1 Trip	Action	(0-1) 0: Disable 1: Enable	1:Enable	External NEL 1 trip is active when the active power of any busbar genset has exceeded the set value.

No.	Items		Parameter Range	Default	Description
52.		Set Value	(50-200)%	100	
53.		Delay	(0.1-999.9)s	5.0	
54.	NEL 2 Trip	Action	(0-1) 0: Disable 1: Enable	1:Enable	External NEL 2 trip is active when the active power of any busbar genset has exceeded the set value.
55.		Set Value	(50-200)%	100	
56.		Delay	(0.1-999.9)s	8.0	
57.	NEL 3 Trip	Action	(0-1) 0: Disable 1: Enable	1:Enable	External NEL 3 trip is active when the active power of any busbar genset has exceeded the set value.
58.		Set Value	(50-200)%	100	
59.		Delay	(0.1-999.9)s	10.0	
60.	NEL 1 Current Trip	Action	(0-1) 0: Disable 1: Enable	1:Enable	External NEL 1 trip is active when current of any busbar genset has exceeded the set value.
61.		Set Value	(50-200)%	100	
62.		Delay	(0.1-999.9)s	10.0	
63.	NEL 2 Current Trip	Action	(0-1) 0: Disable 1: Enable	1:Enable	External NEL 2 trip is active when current of any busbar genset has exceeded the set value.
64.		Set Value	(50-200)%	100	
65.		Delay	(0.1-999.9)s	8.0	
66.	NEL 3 Current Trip	Action	(0-1) 0: Disable 1: Enable	1:Enable	External NEL 3 trip is active when current of any busbar genset has exceeded the set value.
67.		Set Value	(50-200)%	100	
68.		Delay	(0.1-999.9)s	10.0	
69.	Gen Capacity Insufficient		(0.1-999.9)s	1.5	Heavy load request, gen capacity insufficient judging delay;
70.	Unbalanced Distribution of Active Power	Action	(0-1) 0: Disable 1: Enable	1:Enable	Action when the unbalanced distribution percentage of active power is greater than the set value.
71.		Set Value	(0-100)%	20	
72.		Delay Value	(0-999.9)s	60.0	
73.		Alarm Types	(0-5)	1: Warn	
74.	Unbalanced Distribution of Reactive Power	Action	(0-1) 0: Disable 1: Enable	1:Enable	Action when the unbalanced distribution percentage of reactive power is greater than the set value.
75.		Set Value	(0-100)%	20	
76.		Delay Value	(0-999.9)s	60.0	
77.		Alarm Types	(0-5)	1: Warn	
78.	Heavy Consumer 1 Analog		(0-1)	0: Disable	Feedback of heavy load 1 obtains the

No.	Items	Parameter Range	Default	Description
	Feedback			real power of heavy load through the HMP300 module, and PMS will reserve the remaining power (rated power of heavy load - current power of heavy load) according to this power. This feature requires HMP300 module enabled.
79.	Overload To Ask 4	(0-2000)kW	100	The request active power of busbar overload.
80.	Overload Rated 4	(0-2000)kW	60	The request active power of busbar overload.

11.5 GB SETTING

Table 23 – GB Parameter Settings

No.	Item	Parameter Range	Default	Description
GB Settings				
1	Closing Time	(0-20.0)s	5.0	Pulse width of switch on. When it is 0, means output constantly.
2	Opening Time	(0-20.0)s	5.0	Pulse width of switch off, When it is 0, means output constantly.
3	Switch Failure Action	(0-5)	0: Lock	Action when switch closing and opening feedback is inconsistent with switch state.
4	Closing Time of Solenoid Valve	(0-20.0)s	5.0	Pulse width of switch on. When it is 0, means output constantly.
5	Opening Time of Solenoid Valve	(0-20.0)s	5.0	Pulse width of switch on. When it is 0, means output constantly.
6	Manually Open of Semi Auto Mode	(0-1)	0	0: Disable 1: Enable. When it enabled, in semi-auto mode, the open switch operation will no longer intelligently judge if it is allowed to open.

After the close signal is send out, warning alarm will be initiated if the controller does not detect the switch closing signal within the set delay; After the open signal is send out, warning alarm will be initiated if the controller does not detect the switch opening signal within the set delay.

11.6 MODULE SETTING

Table 24– Module Parameter Settings

No.	Items	Parameter Range	Default	Description
Module				
1.	Power On Mode	(0-2)	0	0: Semi Auto Mode; 1: Auto Mode; 2: Manual Mode.
2.	Module Address	(1-254)	1	Controller's address during remote sensing.
3.	Language	(0-2)	0	0: Simplified Chinese 1: English 2: Other.
4.	Password	(0-65535)	00318	For entering advanced parameters setting.
5.	Start Mode	(0-2)	0	0: Linear start; 1: Cycle start; 2: Duty Time Start
6.	Power Supply Rated Voltage	(10.0-50.0)V	24.0	To offer standards for detecting of power's over/under voltage.
7.	Power Supply Over Voltage Warn	(50-200)%	130	To offer standards for detecting of percentage of power's over voltage.
8.	Power Supply Under Voltage Warn	(1-100)%	80	To offer standards for detecting of percentage of power's under voltage.
9.	Extension Module DIN16-1 Enabled	(0-1) 0: Disable 1: Enable	0: Disable	Connect with extension module DIN16-1 when input ports of HMC6 are not enough; If still not enough, the external DIN16-2 is extended.
10.	Alarm Delay	(0.1~999.9)s	5.0	
11.	Extension Module DIN16-2 Enabled	(0-1) 0: Disable 1: Enable	0: Disable	
12.	Alarm Delay	(0.1~999.9)s	5.0	
13.	Extension Module DOUT16-1Enabled	(0-1) 0: Disable 1: Enable	0: Disable	Connect with extension module DOUT16-1 when input ports of HMC6 are not enough; If still not enough, the external DOUT16-2 is extended.
14.	Alarm Delay	(0.1~999.9)s	5.0	
15.	Extension Module DOUT16-2Enabled	(0-1) 0: Disable 1: Enable	0: Disable	
16.	Alarm Delay	(0.1~999.9)s	5.0	
17.	LED Display Extension Module 1 Enabled	(0-1) 0: Disable 1: Enable	0: Disable	2 Connect with extension module LA16-1 when LED lamps of HMC6 are not enough; If still not enough, the external LA16-2 is extended.
18.	Alarm Delay	(0.1~999.9)s	5.0	
19.	LED Display Extension Module 2 Enabled	(0-1) 0: Disable 1: Enable	0: Disable	
20.	Alarm Delay	(0.1~999.9)s	5.0	
21.	GOV Transducer	Transducer	0	One of GOV analog voltage regulating output

No.	Items	Parameter Range	Default	Description
	Configuration	Configuration (0-20) Output Minimum Output Maximum Configure Minimum Configure Maximum	2.0 10 0 500	and transducer output can only be chosen.
22.	AVR Transducer Configuration	Transducer Configuration (0-20) Output Minimum Output Maximum Configure Minimum Configure Maximum	0 2.0 10 0 500	One of AVR analog voltage regulating output and transducer output can only be chosen.
23.	HMP300 Enable	(0-1)	0: Disable	
24.		(0.1~999.9)s	5.0	Alarm delay.
25.	Self-check Abnormal Return to Manual	(0-1)	0: Disable	It forces the controller into manual mode if the self-check is abnormal.
26.	Engine Failure Action	(0-5)	0: Lock	Types of effective alarm action for engine fault input port.
27.	Controller Type	(0-1)	0	0: DG mode 1: SG mode
28.	SG Working Mode	(0-2)	0	0: Load receiving mode 1: Fixed power mode 2: Load sharing mode
29.	Restart During Shutdown	(0-1) 0：Disable 1：Enable	0: Disable	When it is enabled, it can restart the unit.
30.	T54 Is Ready	(0-1) 0：Disable 1：Enable	0: Disable	When it is enabled, the function of Terminal 54 will change from ‘ Engine Fault Input‘ to ‘Unit is Ready Input’.

Table 25 – Transducer Configuration Function List

No.	Item	Description
0.	Not Used	Transducer function is not used.
1.	Busbar Voltage	
2.	Busbar Frequency	
3.	Busbar Active Power	
4.	Busbar Inactive Power	
5.	Busbar Apparent Power	
6.	Reserved	
7.	Gen Voltage	
8.	Gen Frequency	
9.	Gen Active Power	
10.	Gen Inactive Power	
11.	Gen Apparent Power	
12.	Gen Power Factor	
13.	Gen Phase-A Current	
14.	Gen Phase-B Current	
15.	Gen Phase-C Current	
16.	Gen Max. Current	
17.	Busbar Surplus Power	
18.	Unit Surplus Power	
19.	Reserved	
20.	Reserved	

11.7 INPUT PORTS SETTING

Active type: Low-level; Response time> 500ms

Table 26 – Digital Input Ports Settings

No.	Items	Parameter Range	Default	Description
Digital Input Ports				
Fixed Input 1				
1.	Contents Setting	Fixed	Fixed	Close input
2.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Aux. Input 9				
3.	Contents Setting	(0-99)	49	Engine Run Feedback
4.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Fixed Input 3				
5.	Contents Setting	Fixed	Fixed	Manual Mode
6.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Fixed Input 4				
7.	Contents Setting	Fixed	Fixed	Engine Fault Input
8.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Programmable Input 1				
9.	Contents Setting	(0-99)	0	Not used
10.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Programmable Input 2				
11.	Contents Setting	(0-99)	0	Not used
12.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Programmable Input 3				
13.	Contents Setting	(0-99)	0	Not used
14.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Programmable Input 4				
15.	Contents Setting	(0-99)	0	Not used
16.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Programmable Input 5				
17.	Contents Setting	(0-99)	0	Not used
18.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Programmable Input 6				
19.	Contents Setting	(0-99)	0	Not used
20.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Programmable Input 7 (Multiplexing with frequency modulation FREQ IN+)				
21.	Contents Setting	(0-99)	0	Not used
22.	Active Type	(0-1)	0	0: Close activate 1: Open activate
Programmable Input 8 (Multiplexing with voltage modulation VOLT IN+)				
23.	Contents Setting	(0-99)	0	Not used
24.	Active Type	(0-1)	0	0: Close activate 1: Open activate

Table 27 – Digital Input Ports Function

No.	Name	Description	Auto Mode	Semi-auto Mode	Manual Mode
0.	Not Used	Invalid	X	X	X
1.	User Defined	User-defined controller actions when input port is active: 0：Warn 1：Shutdown 2：Trip 3：Block 4：Indicate 5：Safety Trip 6：Safety Stop User-defined active conditions of input port: 0：Before Gen Close 1：After Gen Close 2：Always Active 3：Invalid Input ports names can be downloaded into controller after defined using utility software or PC software.	●	●	●
2.	Speed Raise	Raise speed relay is active and GOV output raise speed signal when the input is active.	X	X	●
3.	Speed Drop	Drop speed relay is active and GOV output drop speed signal when the input is active.	X	X	●
4.	Volt Raise	Raise voltage relay is active and AVR output raise voltage signal when the input is active.	X	X	●
5.	Volt Drop	Drop Voltage relay is active and AVR output drop voltage signal when the input is active.	X	X	●
6.	HC 1 Request	Heavy consumer 1 request. Acknowledge signal is initiated if the requirements are satisfied. If not satisfied, standby gensets will be started to meet with the requirement.	●	●	X
7.	HC 1 Feedback	After breaker closing, feedback signal is send to controller to ensure the HC1 has loaded.	●	●	X
8.	HC 2 Request	Heavy consumer 2 request. Acknowledge signal is initiated if the requirements are satisfied. If not satisfied, standby gensets will be started to meet with the requirement.	●	●	X
9.	HC 2 Feedback	After breaker closing, feedback signal is send to controller to ensure the HC2 has loaded.	●	●	X
10.	HC 3 Request	Heavy consumer 3 request.	●	●	X

No.	Name	Description	Auto Mode	Semi-auto Mode	Manual Mode
		Acknowledge signal is initiated if the requirements are satisfied. If not satisfied, standby gensets will be started to meet with the requirement.			
11.	HC 3 Feedback	After breaker closing, feedback signal is send to controller to ensure the HC3 has loaded.	●	●	X
12.	Engine Fault	Engine fault feedback input.	●	●	X
13.	Alarm Inhibit	All alarms are inhibited after input is active.	●	●	●
14.	Alarm Mute	Mute the panel buzzer.	●	●	●
15.	Alarm Reset	Reset alarms.	●	●	●
16.	Alarm Ack	Acknowledge the current alarm.	●	●	●
17.	Lamp Test	Test all the LED lights.	●	●	●
18.	Light Load	The controller doesn't open breaker even if the system load has fallen below the set value.	●	●	X
19.	Constant Power IN	Fixed power output, when the "Constant Power input" is active, the active power and the reactive power can be adjusted via fixed power setting parameter, or when the external adjust input is active, the active power and the reactive power can be adjusted via external FREQ IN port and VOLT IN port.	●	●	X
20.	Cycle Start	Cycle start mode is carried out when the input is active.	●	X	X
21.	Linear Start	Linear start mode is carried out when the input is active.	●	X	X
22.	Duty Time Start	Duty time start mode is carried out when the input is active.	●	X	X
23.	Auto Mode Input	Auto mode is carried out when the input is active.	●	●	●
24.	Semi Auto Mode	Semi auto mode is carried out when the input is active.	●	●	●
25.	Remote Closing	Synchronization and closing process will be carried out when the input is active.	X	●	X
26.	Remote Opening	Opening process will be carried out when the input is active.	X	●	X
27.	Remote Start	The genset will be started and synchronized automatically when the input is active.	X	●	X
28.	Remote Stop	The genset will be stopped after unload when the input is active.	X	●	X
29.	Safe Mode	An additional genset will be started even if the power request is satisfied when the input is active.	●	X	X
30.	Ready OK	The signal output when the preparation work is done. If the function is selected, the engine will be	●	●	X

No.	Name	Description	Auto Mode	Semi-auto Mode	Manual Mode
		started when the input is active.			
31.	Remote Mode Input	The signal output when the controller is in remote mode. The engine is remote control status when the input is active.	●	●	X
32.	Opened Input	Open breaker feedback input signal; Fail to Open alarm will be initiated if the controller cannot detect the signal after the input is active.	●	●	X
33.	External Adjust	Simulate adjust voltage/frequency input is active only when the input port is active.	X	●	X
34.	Start Inhibit	Semi-start and auto start are inhibited.	●	●	X
35.	Short Circuit	External over current short circuit input trip.	●	●	X
36.	Override	Genset is inhibit to trip or shutdown except for over frequency and over current.	●	●	X
37.	Shutdown	Trip and stop immediately.	●	●	X
38.	1st Priority	Configure the priority of controller as the highest level.	●	●	●
39.	2nd Start Input	If it failed to start, this input is active and will issues start signal again.	●	●	●
40.	System Manual Mode Input	When input is active, all gensets on the busbar become manual mode.	●	●	●
41.	System Semi-auto Mode	When input is active, all gensets on the busbar become semi-auto mode.	●	●	●
42.	System Auto Mode Input	When input is active, all gensets on the busbar becomes auto mode.	●	●	●
43.	System Light Load Active	When input is active, all gensets on the busbar are light load.	●	●	X
44.	System Safety Mode Input	When input is active, all gensets on the busbar become safe mode.	●	●	X
45.	Semi-mode/Auto Transfer Input	When input is active, auto mode is active; When input is inactive, semi-auto mode is active.	●	●	●
46.	Prohibit Genset On-load Input		●	●	X
47.	Non-auto Mode HC Allowed	When input is active, in manual mode/semi-auto mode, if genset capacity meets heavy consumer request power, it will also output heavy consumer response, heavy consumer allowed signal.	●	●	●
48.	Limit Network Connected No.	When input is active, limit genset network connected number based on configuration (max. network connected number);	●	●	X
49.	Engine Running Feedback		●	●	X

No.	Name	Description	Auto Mode	Semi-auto Mode	Manual Mode
50.	Shore Power Supply Input	This input is active when shore power supplies.	●	●	●
51.	Disconnector Open Input	When input port is active, divide a phase of busbar based on current busbar genset configuration; only the unit scheduled on this busbar is active.	●	●	X
52.	Capacity Insufficient Reduce Load Input	When heavy load is requesting, if all normal gensets are online and still cannot meet requested power; if this input is active, it will make NEL trip.	●	●	●
53.	Abnormal Trip of Main Switch	When the input port is active, the controller tripping alarms.	●	●	●
54.	Numbers of Running Units Reserved	When the input port is active, the units with load running in the network >= numbers of running units reserved.	●	●	●
55.	Forced Manual Mode		●	●	●
56.	No Power Loss of the Ship	No power loss of the ship when the input port is active.	●	●	X
57.	Forced Auto Mode		●	●	X
58	Reserved	Reserved			
59	SG Enabled	If module is not set as SG mode, the controller will work in SG mode when input port is effective.	●	●	X
60	SG/DG Switching	When input port is effective, DG starts on-load, otherwise, SG starts on-load.	●	●	X
61	SG Solenoid Valve Closing Feedback	When the controller works in SG mode and input port is effective, SG is allowed to start. Otherwise, SG is not allowed to start.	●	●	X
62	Drop Power Input	When input port is effective, the controller will limit the max. output power of the genset according to the set drop value.	●	●	X
63	SG On-load Input	When input port is active, SG starts on-load and selects load distribution according to load mode.	●	●	X
64	DG On-load Input	When input port is active, DG starts on-load and selects load distribution according to load mode.	●	●	X
65	DG Inactive Input	When input port is active, all DG are disconnected and the load is transferred to the other power supply units.	●	●	X
66	Busbar Outage Closing Input	When input port is active, DG controller detects that the busbar is outage then allows DG switch to close.	●	●	X

No.	Name	Description	Auto Mode	Semi-auto Mode	Manual Mode
67	Overload To Ask 4	Overload 4 starts the request input, if meets the required power, it will send answer signal, if not, the standby unit will be started to meet the required power.			
68	Overload To Answer 4	Overload 4 closes and sends the answer signal to controller to make sure it has taken load.			
69~99	Reserved	Reserved			

11.8 OUTPUT PORT SETTING

Table 28 – Output Ports Settings

No.	Items	Parameter Range	Default	Description
Relay Outputs				
Output 1				
1	Contents Setting	Fixed	Fixed	Speed Raise
2	Active Type	(0-1)	0	0: Open 1: Close
Output 2				
3	Contents Setting	Fixed	Fixed	Speed Drop
4	Active Type	(0-1)	0	0: Open 1: Close
Aux. output 7				
5	Contents Setting	(0-150)	3	Volt Raise
6	Active Type	(0-1)	0	0: Open 1: Close。
Aux. output 8				
7	Contents Setting	(0-150)	4	Volt Drop
8	Active Type	(0-1)	0	0: Open 1: Close
Output 5				
9	Contents Setting	Fixed	Fixed	Engine Start
10	Active Type	(0-1)	0	0: Open 1: Close
Output 6				
11	Contents Setting	Fixed	Fixed	Engine Stop
12	Active Type	(0-1)	0	0: Open 1: Close
Output 7				
13	Contents Setting	Fixed	Fixed	Close Gen
14	Active Type	(0-1)	0	0: Open 1: Close
Output 8				
15	Contents Setting	Fixed	Fixed	Open Gen
16	Active Type	(0-1)	0	0: Open 1: Close
Aux. output 9				
17	Contents Setting	(0-150)	8	Common Alarm
18	Active Type	(0-1)	0	0: Open 1: Close
Programmable Output 1				

No.	Items	Parameter Range	Default	Description
19	Contents Setting	(0-150)	0	Not Used
20	Active Type	(0-1)	0	0: Open 1: Close。
Programmable Output 2				
21	Contents Setting	(0-150)	0	Not Used
22	Active Type	(0-1)	0	0: Open 1: Close
Programmable Output 3				
23	Contents Setting	(0-150)	0	Not Used
24	Active Type	(0-1)	0	0: Open 1: Close
Programmable Output 4				
25	Contents Setting	(0-150)	0	Not Used
26	Active Type	(0-1)	0	0: Open 1: Close
Programmable Output 5				
27	Contents Setting	(0-150)	0	Not Used
28	Active Type	(0-1)	0	0: Open 1: Close
Programmable Output 6				
29	Contents Setting	(0-150)	0	Not Used
30	Active Type	(0-1)	0	0: Open 1: Close

Table 29 – Output Ports Function

No.	Name	Description	Remark
0.	Not Used	This port is invalid.	
1.	Speed Raise	Active when the generator is raising speed.	
2.	Speed Drop	Active when the generator is dropping speed.	
3.	Volt Raise	Active when the generator is raising voltage.	
4.	Volt Drop	Active when the generator is dropping voltage.	
5.	Close Gen	Active when the close generator requirements are reached.	
6.	Open Gen	Active when the open generator requirements are reached.	
7.	Generator OK	Active when the rated voltage and rated frequency are reached.	
8.	Common Alarm	Active when genset common alarm occurs.	
9.	Common Warning	Active when genset common warning alarm occurs.	
10.	Common Trip	Active when genset common trips alarm occurs.	
11.	Common Shutdown	Active when genset common trip and stop alarm occurs.	
12.	Engine Start	Active when genset is starting up.	
13.	Engine Stop	Active when genset is stopping.	
14.	Power Over Volt	Active when the power supply voltage has exceeded the set value.	
15.	Power Under Volt	Active when the power supply voltage has fallen below the set value.	

No.	Name	Description	Remark
16.	Input 1 Active	Active when input port 1 is active	
17.	Input 2 Active	Active when input port 2 is active	
18.	Input 3 Active	Active when input port 3 is active	
19.	Input 4 Active	Active when input port 4 is active	
20.	Input 5 Active	Active when input port 5 is active	
21.	Input 6 Active	Active when input port 6 is active	
22.	Input 7 Active	Active when input port 7 is active	
23.	Input 8 Active	Active when input port 8 is active	
24.	Input 9 Active	Active when input port 9 is active	
25.	Reserved	Reserved	
26.	Gen Over Frequency 1	Active when the generator over frequency 1 alarm occurs.	
27.	Gen Over Frequency 2	Active when the generator over frequency 2 alarm occurs.	
28.	Gen Over Frequency 3	Active when the generator over frequency 3 alarm occurs.	
29.	Gen Over Voltage 1	Active when the generator over voltage 1 alarm occurs.	
30.	Gen Over Voltage 2	Active when the generator over voltage 2 alarm occurs.	
31.	Gen Under Frequency 1	Active when the generator under frequency 1 alarm occurs.	
32.	Gen Under Frequency 2	Active when the generator under frequency 2 alarm occurs.	
33.	Gen Under Frequency 3	Active when the generator under frequency 3 alarm occurs.	
34.	Gen Under Voltage 1	Active when the generator under voltage 1 alarm occurs.	
35.	Gen Under Voltage 2	Active when the generator under voltage 2 alarm occurs.	
36.	Gen Under Voltage 3	Active when the generator under voltage 3 alarm occurs.	
37.	Gen Loss of Phase	Action when generator loss phase.	
38.	Gen Phase Sequence Wrong	Action when generator reverse phase.	
39.	Busbar Over Frequency 1	Active when the busbar over frequency 1 alarm occurs.	
40.	Busbar Over Frequency 2	Active when the busbar over frequency 2 alarm occurs.	
41.	Busbar Over Frequency 3	Active when the busbar over frequency 3 alarm occurs.	
42.	Busbar Under Frequency 1	Active when the Busbar under frequency 1 alarm occurs.	

No.	Name	Description	Remark
43.	Busbar Under Frequency 2	Active when the Busbar under frequency 2 alarm occurs.	
44.	Busbar Under Frequency 3	Active when the Busbar under frequency 3 alarm occurs.	
45.	Busbar Over Voltage 1	Active when the Busbar over voltage 1 alarm occurs.	
46.	Busbar Over Voltage 2	Active when the Busbar over voltage 2 alarm occurs.	
47.	Busbar Over Voltage 3	Active when the Busbar over voltage 3 alarm occurs.	
48.	Busbar Under Voltage 1	Active when the Busbar under voltage 1 alarm occurs.	
49.	Busbar Under Voltage 2	Active when the Busbar under voltage 2 alarm occurs.	
50.	Busbar Under Voltage 3	Active when the Busbar under voltage 3 alarm occurs.	
51.	Over Power 1	Active when controller detects generator over power 1 occurs.	
52.	Over Power 2	Active when controller detects generator over power 2 occurs.	
53.	Reverse Power 1	Active when controller detects generator have reverse power 1.	
54.	Reverse Power 2	Active when controller detects generator have reverse power 2.	
55.	Over Current 1	Active when generator over current 1 occurs.	
56.	Over Current 2	Active when generator over current 2 occurs.	
57.	Over Current 3	Active when generator over current 3 occurs.	
58.	Over Current 4	Active when generator over current 4 occurs.	
59.	Fail to Sync	Active when synchronization failure alarm.	
60.	Fail to Close	Active when close failure alarm.	
61.	Fail to Open	Active when open failure alarm.	
62.	Generator Load	Active when generator takes load while deactivate when generator off load.	
63.	HC 1 ACK Output	Active when the starting power requirement of heavy consumer 1 is satisfied.	
64.	HC 2 ACK Output	Active when the starting power requirement of heavy consumer 2 is satisfied.	
65.	HC 3 ACK Output	Active when the starting power requirement of heavy consumer 3 is satisfied.	
66.	Failure to Start	Active when start failure alarm.	
67.	Manual Mode	Active in Manual mode.	
68.	Semi-auto Mode	Active in Semi-auto mode.	
69.	Auto Mode	Active in Auto mode.	
70.	Light Load	Active when light load is output.	
71.	NEL 1 Trip	Active when non-essential load 1 trip occurs.	
72.	NEL 2 Trip	Active when non-essential load 2 trip occurs.	
73.	NEL 3 Trip	Active when non-essential load 3 trip occurs.	
74.	Engine Fault	Active when engine fault signal is output.	

No.	Name	Description	Remark
75.	Start Success	Active when the generator voltage and frequency have reached the requirement.	
76.	Synchronizing		
77.	Common Safety Trip		
78.	Common Safety Stop		
79.	Overload To Answer 4	Output when meets the start power of Overload 3.	
80.	Remote Control Output	The opening and closing of this output port can be controlled by PC software or ModBus protocol.	
81.	PLC Flag 1		
82.	PLC Flag 2		
83.	PLC Flag 3		
84.	PLC Flag 4		
85.	PLC Flag 5		
86.	PLC Flag 6		
87.	PLC Flag 7		
88.	PLC Flag 8		
89.	PLC Flag 9		
90.	PLC Flag 10		
91.	PLC Flag 11		
92.	PLC Flag 12		
93.	PLC Flag 13		
94.	PLC Flag 14		
95.	PLC Flag 15		
96.	PLC Flag 16		
97.	PLC Flag 17		
98.	PLC Flag 18		
99.	PLC Flag 19		
100.	PLC Flag 20		
101.	Busbar Voltage Abnormal		
102.	Busbar Frequency Abnormal		
103.	Busbar Voltage Frequency Abnormal		
104.	Lamp Alarm	When common alarm occurs, it outputs cyclically every 0.5 second; it keeps outputting after acknowledge.	
105.	Audible Alarm	Output at common alarms, close to output after acknowledge.	
106.	Failed to Unload		
107.	Unload Output		
108.	Gen Capacity Insufficient	When controller detects all normal gensets are online, and remaining power cannot request power, this outputs.	

No.	Name	Description	Remark
109.	HC 1 Allowed	When HC requests, and genset power is met, this outputs; when power is not met, it doesn't output.	
110.	HC 2 Allowed		
111.	HC 3 Allowed		
112.	Unbalanced Distribution of Active Power		
113.	Unbalanced Distribution of Reactive Power		
114.	Unbalanced Distribution of Load	Outputs when either active distribution unbalanced or reactive distribution unbalanced is effective.	
115.	Self-check Normal Output		
116.	Close Input Port Active	Outputs when closing input port is effective.	
117.	Manual Mode Input Active	Outputs when manual mode input port is effective.	
118	Reserved		
119	Reserved		
120	Reserved		
121	SG Solenoid Valve Closing	SG solenoid valve closes and outputs.	
122	SG Solenoid Valve Opening	SG solenoid valve opens and outputs.	
123	SG Capacity Insufficient	When the controller operates in SG mode and load receiving mode, if SG on-load is effective, but SG outputs when capacity is insufficient to receive the full load.	
124	DG Capacity Insufficient	When the controller operates in SG mode and load receiving mode, if DG on-load is effective, but SG outputs when capacity is insufficient to receive the full load.	
125	SG & DG Parallel No. Exceeds Limit	When SG and DG are on-grid at the same time or to synchronize, the DG switch number exceeds the set value and outputs.	
126	Busbar Freq. Change Abnormal	Output when the bus frequency change rate exceeds the set value and the delay value.	
127	Gen. Freq. Change Abnormal	Generating frequency change rate exceeds the set value and the delay value.	
128	Blackout	The controller outputs when it detects that the whole ship is black out.	
129	NEL 1 Pre-tripping	When controller detects that NEL condition is active and outputs while the delay is not due.	
130	NEL 2 Pre-tripping		
131	NEL 3 Pre-tripping		
132	DIN16-1 IN1 Active	Outputs when DIN16-1 module input is active.	
133	DIN16-1 IN2 Active		
134	DIN16-1 IN3 Active		
135	DIN16-1 IN4 Active		
136	DIN16-1 IN5 Active		

No.	Name	Description	Remark
137	DIN16-1 IN6 Active		
138	DIN16-1 IN7 Active		
139	DIN16-1 IN8 Active		
140	DIN16-1 IN9 Active		
141	DIN16-1 IN10 Active		
142	DIN16-1 IN11 Active		
143	DIN16-1 IN12 Active		
144	DIN16-1 IN13 Active		
145	DIN16-1 IN14 Active		
146	DIN16-1 IN15 Active		
147	DIN16-1 IN16 Active		
148	Grid Connection Overtime Of SG & DG	Output when the grid connection time of SG and DG is over the set value.	
149	Parallel Number Excessive Of SG & DG	when SG and DG are grid-connected running, output when the number of DG is over the set value.	
150	Overload To Permit 4	When overload 4 requests, output when the unit power meets the requirement, otherwise, it will not output.	

11.9 SYNCHRONIZATION SETTING

Table 30 – Synchronization Settings

No.	Items	Parameter Range	Default	Description
Synchronization Setting(Basic)				
1	Governor Output	(0-2)	1	0: Internal relay; 1: Internal analog; 2: None.
2	GOV Reverse Output Enable	(0-1)	0	0: Disable; 1: Enable.
3	GOV Loading Action	(0-2)	1	0: None; 1: Adjust raged frequency; 2: Adjust center point.
4	Voltage Regulator Output	(0-2)	1	0: Internal relay; 1: Internal analog; 2:None.
5	AVR Reverse Output Enable	(0-1)	0	0: Disable; 1: Enable.
6	AVR Loading Action	(0-2)	1	0: None; 1: Adjust raged voltage; 2: Adjust center point.
7	Load Ramp Rate	(0.1-100.0)%/s	3.0	Speed of genset ramp on/off load per second.
8	Load Ramp Rate Delay Percent	(0.1-40.0)%	10.0	Ladder point of genset ramp on/off load.
9	Load Ramp Rate Delay Value	(0-30)s	0	Delay time of per ladder point of genset ramp on/off load.
10	Multi-unit Communication Amount	(1-16)	2	The unit number of MSC bus.

No.	Items	Parameter Range	Default	Description
11	Communication Alarm Action	(0-2)	1	Alarm action when MSC bus detects that the modules is less than the set multi-unit communication amount.
12	MSC Communication Speed	(0-2)	1	MSC communication baud rate 0：500kbps；1：250kbps； 2：125kbps.
13	Starting Options	(0-2)	0	0: Linear start; 1: Cycle start; 2: Duty time start
14	Bus Fail Start Gens	(0-16)	0	Number of gensets started when busbar power dropout.
15	Bus Fail Gens Running	(0-3600)s	600	Gensets running time when busbar power dropout.
16	Running Gensets Number Reserved	(1-16)	1	Minimum on-load running gensets on the Busbar.
17	Blackout Inhibit	(0-1)	0	0: Disable; 1: Enable. In auto mode, enable “Blackout Inhibit”, loading gensets on the busbar are prohibited from opening due to factors other than over speed, over frequency, emergency trip and stop, and over-current, and the faulty units must be switched off after the other normal units are switched on.
18	Uninterrupted Power Supply	(0-1)	0	0: Disable; 1: Enable. In auto mode, enable “Uninterrupted Power Supply”, if loading gensets on the busbar with trip or shutdown alarms, the faulty units must be switched off after the other normal units are switched on; If voltage or frequency fault trip or shutdown, faulty units will wait for other normal units start and running normally to meet with loading conditions, and then switch off the faulty units and close the normal units.
19	Delay Priority Action	(0-1)	0	If enabled this function, gensets status on the busbar cannot change due to changes of the priority. it is active only when busbar need to calling more other gensets to start.
20	Highest Priority	(0-1)	0	If enabled this function, press button by highest priority, then current genset will become highest priority; other genset busbar priorities make order refresh. If disabled this function, it will make current genset priority become higher, but not change

No.	Items	Parameter Range	Default	Description
				current and other genset priority.
21	System Mode Transfer	(0-1)	0	If enabled this function, transfer any controller mode (button or input port) will change all genset controller modes on the busbar.
22	Safety Level Alarm Action	(0-1)	1	If enabled this function, in semi-auto mode, the safety trip and safety trip and stop alarm will perform the corresponding alarm action. If disabled this function, in semi-auto mode, the safety trip and safety trip and stop alarm will only alarm but not act.
23	Duty Running Hours	(0.1-100.0)h	5.0	If start mode set as “Duty Running Hours”, firstly, prior to start the unit with the least running time. When running the set to the pre-set duty value, the next unit with less running time starts up.
24	Call Gens Mode	(0-1)	0	0: Gen Power (%) 1: Available Power
25	Calling for More Sets	(0-100)%	80	Loading percentage of busbar that scheduled to start other units.
26	Calling for Less Sets	(0-100)%	20	Loading percentage of busbar that scheduled to stop other units.
27	Calling for Start Power	(0-20000)kW	50	Power left of busbar that scheduled to start other units.
28	Calling for Stop Power	(0-20000)kW	50	Power left of busbar that scheduled to stop other units.
29	Max. Network Connected Genset Number	(0-16)	16	The max. adjusting gensets of network connected on the current busbar;
30	Failed to Unload and Open	(0-1) (0-100.0) % (0-3600)s	0 10.0 180	If enabled this function, it will judge unload failure after genset unload delay 180s; and it will open when load is less than 10.0%, otherwise it will not open. If disabled this function, it will judge unload failure after genset unload delay 180s; and it is only alarm but not open.
31	Active Power Adjusting Limit	(0-50.0) %	30.0	The max. adjusting deviation of current power apart from target power value;
32	Inactive Power Adjusting Limit	(0-50.0) %	30.0	
33	Load (P) Feedback Factor	(0-100)%	10	The proportion of load frequency adjustment PID coefficient in the whole load active power adjustment coefficient.
34	Load (Q) Feedback	(0-100)%	10	The proportion of load voltage adjustment PID

No.	Items	Parameter Range	Default	Description
	Factor			coefficient in the whole reactive power adjustment coefficient.
35	Dead Bus Voltage	(10-50)V	30	It is considered bus no power when bus voltage is lower than dead Bus voltage.
36	Sync Voltage Difference	(0-30)V	3	It is considered voltage synchronization when the voltage difference between generator and bus is lower than synchronization voltage difference.
37	Sync Positive Frequency Difference	(0-2.0)Hz	0.2	It is considered frequency synchronization when the frequency difference between generator and bus is less than “Sync Voltage Difference” but more than “Sync Negative Frequency Difference”.
38	Sync Negative Frequency Difference	(0-2.0)Hz	0.1	
39	Sync Phase Difference	(0-20)°	10	It is considered phase angle synchronization when the initial phase difference between generator and bus is lower than “Sync Phase Angle Difference”.
40	Fail to Sync Delay	(5.0-300.0)s	60.0	When there is no sync signal been detected during “Fail to Sync Delay”, corresponding alarm will be initiated based on the “Fail to Sync Action”.
41	Fail to Sync Action	(0-5)	1	0: Block; 1: Warn; 2: Trip; 3: Shutdown; 4: Safety Trip; 5: Safety Stop.
42	Current Busbar Gensets	(0-0xFFFF)	0xFFFF	16-bit data; each bit represents a genset; 0 represents gensets are not on this busbar; 1 represents gensets are on this busbar; bit0 represents the gensets with 0 ID; bit15 represents the gensets with 15 ID.
43	Current Shaft of Busbar	(0-0x000F)	0x000F	Each number represents a unit, 0 represents SG unit but not in this busbar, 1 represents SG unit in this bus, bit0 represents the unit with ID 0, bit3 represents SG unit with ID 3.
44	Shutdown Percentage Rest	(0-1)	0	When it is enabled, the Min. Load Percentage= Current Power (Total Power- Power of Unit to Stop); When it is disabled, the Min. Load Percentage= Current Power/Total Power.

11.10 SYNCHRONOUS CALIBRATION

Table 31 – Synchronous Calibration List

No.	Item		Range	Default	Description
Synchronous Calibration					
1	MSC ID		(0-15)	1	ID in the MSC communication network. The MSC ID should be unique throughout the whole communication network.
2	Priority		(0-15)	1	The smaller of the number, the higher of the priority.
3	GOV SW1		(0-10.0)	0	Default central voltage is 0V.
4	GOV SW2		(0-10.0)	2.0	Default voltage range is (-2.5~+2.5)V.
5	AVR SW1		(0-10.0)	0	Default central voltage is 0V.
6	AVR SW2		(0-10.0)	2.0	Default voltage range is (-2.5~+2.5)V.
7	Frequency Sync				
	Frequency Difference		(0-1.00)Hz	0.10	Adjusting generator frequency to make it greater than the difference value of bus frequency, that is the sliding frequency difference of dynamic sync.
	Voltage Control	Gain	(0-500) %	20	The internal analog voltage is adjusted to control the engine speed before parallel connection.
		Stability	(0-2000) %	20	
	Relay Control	Response	(0.1-4.00)Hz/s	1.20	The internal relay is adjusted to control the engine speed before parallel connection.
		Stability	(0.01-1.60)s	0.20	
		Gain	(0-30000)%	10	
		Dead Band	(0-10.0)%	1.0	
8	Voltage Sync				
	Voltage Control	Gain	(0-500) %	20	The internal analog voltage is adjusted to control the generator voltage before parallel connection.
		Stability	(0-2000) %	20	
	Relay Control	Response	(0.1-4.00)Hz/s	1.20	The internal relay is adjusted to control the generator voltage before parallel connection.
		Stability	(0.01-1.60)s	0.20	
		Gain	(0-30000)%	10	
		Dead Band	(0-10.0)%	1.0	
9	Active Power Control				
	Voltage Control	Gain	(0-500) %	20	The internal analog voltage is adjusted to control the engine speed after parallel connection.
		Stability	(0-2000) %	20	
	Relay Control	Response	(0.1-4.00)Hz/s	1.20	The internal relay is adjusted to control the engine speed after parallel connection.
		Stability	(0.01-1.60)s	0.20	
		Gain	(0-30000)%	10	
		Dead Band	(0-10.0)%	1.0	

No.	Item		Range	Default	Description
10	Reactive Power Control				
	Voltage Control	Gain	(0-500) %	20	The internal analog voltage is adjusted to control the generator voltage after parallel connection.
		Stability	(0-2000) %	20	
	Relay Control	Response	(0.1-4.00)Hz/s	1.20	The internal relay is adjusted to control the generator voltage after parallel connection.
		Stability	(0.01-1.60)s	0.20	
		Gain	(0-30000)%	10	
		Dead Band	(0-10.0)%	1.0	
11	Load Parallel Ramp Minimum		(0-100.0)%	1.0	The active power percentage of the unit from soft unloaded to the opening.
12	Fixed Active Power%		(0-100.0)%	30.0	The percentage of active power output in fixed power mode.
13	Fixed Reactive Power Mode		(0-1)	0	0: Power Percentage; 1: Power Factor
14	Fixed Reactive%		(0-100.0)%	8.0	The percentage of reactive power output in fixed power mode.
15	SG-DG Grid Connection Time		(0-999.9)s	60.0	The maximum grid connection time of SG and DG.
16	Fixed Min. On-load%		(0-100.0)%	0.0	When the controller works in both SG mode and fixed power mode, if the total load is lower than the active power of fixed output of SG, the maximum percentage value of DG, and the remaining power is carried by SG. If this value is 0, when the total power is lower than the fixed active power output of SG, DG does not start with load.
17	Fixed Max. On-load%		(0-100.0)%	100.0	When the controller works in both SG mode and fixed power mode, if the total load is greater than the fixed active power percentage of SG and DG, DG will be loaded to the fixed active power percentage, the remaining power will be loaded by SG as much as possible and the maximum load will be the setting value. If the total load is even greater, it will be balanced by SG and DG.
18	Max. Load% of SG Receiving		(0-100.0)%	100.0	When the controller works in both SG mode and load-receiving mode, if SG on-load mode is effective, the load must be lower than receiving rated power percentage(the setting value) before SG is closing.
19	DG Stop% When SG		(0-100.0)%	50.0	When the controller works in both SG mode

No.	Item	Range	Default	Description
	Receiving			and load-receiving mode, if SG on-load is effective, when SG on-load is greater than the setting value of the total load, DG will start unloading and stopping and DG will stop soft loading.
20	Max. No. of SG & DG Sync.	(1-16)	16	When SG is synchronized, the current limit number of DG in the network is higher than the setting value, closing and grid connection of SG is not allowed.
21	Drop Power Setting	(0-100)%	70	Percentage of maximum output power when drop power input is effective.

11.11 LOCAL SETTING

Table 32 – Local Parameter Settings

No.	Items	Parameter Range	Default	Description
Local Setting				
1	Local Modules Type	(0-5)	0	0: None; 1: HMC6000S; 2: HMC6000E; 3: HMC6000A; 4: HMC6000ED; 5: HMC6000EG;

11.12 DIN16 SETTING

HMC6 can expand with two DIN16 modules (digital input expansion module), which has the same input functions with HMC6.

Table 33 – DIN16 Parameter Settings

No.	Items	Parameter Range	Default	Description
Input Port 1				
1.	Contents Setting	(0-99)	0	Not used
2.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 2				
3.	Contents Setting	(0-99)	0	Not used
4.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 3				
5.	Contents Setting	(0-99)	0	Not used
6.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 4				
7.	Contents Setting	(0-99)	0	Not used
8.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 5				

No.	Items	Parameter Range	Default	Description
9.	Contents Setting	(0-99)	0	Not used
10.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 6				
11.	Contents Setting	(0-99)	0	Not used
12.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 7				
13.	Contents Setting	(0-99)	0	Not used
14.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 8				
15.	Contents Setting	(0-99)	0	Not used
16.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 9				
17.	Contents Setting	(0-99)	0	Not used
18.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 10				
19.	Contents Setting	(0-99)	0	Not used
20.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 11				
21.	Contents Setting	(0-99)	0	Not used
22.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 12				
23.	Contents Setting	(0-99)	0	Not used
24.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 13				
25.	Contents Setting	(0-99)	0	Not used
26.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 14				
27.	Contents Setting	(0-99)	0	Not used
28.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 15				
29.	Contents Setting	(0-99)	0	Not used
30.	Active Type	(0-1)	0	0: close activate;1: open activate.
Input Port 16				
31.	Contents Setting	(0-99)	0	Not used
32.	Active Type	(0-1)	0	0: close activate;1: open activate.

Note: input port functions please reference to Input port function setting.

11.13 DOUT16 SETTING

HMC6 can expand with two DOUT16 modules (digital output expansion module), which has the same output functions with HMC6.

Table 34 – DOUT16 Parameter Settings

No.	Items	Parameter Range	Default	Description
Output Port 1				
1.	Contents Setting	(0-150)	0	Not Used
2.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 2				
3.	Contents Setting	(0-150)	0	Not Used
4.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 3				
5.	Contents Setting	(0-150)	0	Not Used
6.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 4				
7.	Contents Setting	(0-150)	0	Not Used
8.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 5				
9.	Contents Setting	(0-150)	0	Not Used
10.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 6				
11.	Contents Setting	(0-150)	0	Not Used
12.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 7				
13.	Contents Setting	(0-150)	0	Not Used
14.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 8				
15.	Contents Setting	(0-150)	0	Not Used
16.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 9				
17.	Contents Setting	(0-150)	0	Not Used
18.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 10				
19.	Contents Setting	(0-150)	0	Not Used
20.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 11				
21.	Contents Setting	(0-150)	0	Not Used
22.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 12				
23.	Contents Setting	(0-150)	0	Not Used
24.	Active Type	(0-1)	0	0: open; 1: close.

No.	Items	Parameter Range	Default	Description
Output Port 13				
25.	Contents Setting	(0-150)	0	Not Used
26.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 14				
27.	Contents Setting	(0-150)	0	Not Used
28.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 15				
29.	Contents Setting	(0-150)	0	Not Used
30.	Active Type	(0-1)	0	0: open; 1: close.
Output Port 16				
31.	Contents Setting	(0-150)	0	Not Used
32.	Active Type	(0-1)	0	0: open; 1: close.

Note: output port functions please reference to Output port function list in item11.8.

11.14 LA16 SETTING

HMC6 can expand with two LA16 modules (LED display expansion module), which has the same configure content with HMC6.

Table 35 – LA16 settings

No.	Items	Parameter Range	Default	Description
Output 1				
1	Contents Setting	(0-150)	0	Not used
2	Active Type	(0-1)	0	0: open; 1: close.
3	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 2				
4	Contents Setting	(0-150)	0	Not used
5	Active Type	(0-1)	0	0: open; 1: close.
6	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 3				
7	Contents Setting	(0-150)	0	Not used
8	Active Type	(0-1)	0	0: open; 1: close.
9	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 4				
10	Contents Setting	(0-150)	0	Not used
11	Active Type	(0-1)	0	0: open; 1: close.
12	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 5				
13	Contents Setting	(0-150)	0	Not used
14	Active Type	(0-1)	0	0: open; 1: close.
15	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 6				
16	Contents Setting	(0-150)	0	Not used
17	Active Type	(0-1)	0	0: open; 1: close.
18	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 7				
19	Contents Setting	(0-150)	0	Not used
20	Active Type	(0-1)	0	0: open; 1: close.
21	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 8				
22	Contents Setting	(0-150)	0	Not used
23	Active Type	(0-1)	0	0: open; 1: close.
24	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 9				
25	Contents Setting	(0-150)	0	Not used
26	Active Type	(0-1)	0	0: open; 1: close.
27	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.

No.	Items	Parameter Range	Default	Description
Output 10				
28	Contents Setting	(0-150)	0	Not used
29	Active Type	(0-1)	0	0: open; 1: close.
30	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 11				
31	Contents Setting	(0-150)	0	Not used
32	Active Type	(0-1)	0	0: open; 1: close.
33	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 12				
34	Contents Setting	(0-150)	0	Not used
35	Active Type	(0-1)	0	0: open; 1: close.
36	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 13				
37	Contents Setting	(0-150)	0	Not used
38	Active Type	(0-1)	0	0: open; 1: close.
39	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 14				
40	Contents Setting	(0-150)	0	Not used
41	Active Type	(0-1)	0	0: open; 1: close.
42	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 15				
43	Contents Setting	(0-150)	0	Not used
44	Active Type	(0-1)	0	0: open; 1: close.
45	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.
Output 16				
46	Contents Setting	(0-150)	0	Not used
47	Active Type	(0-1)	0	0: open; 1: close.
48	LED Color	(0-2)	0	0: Red; 1: Green; 2: Yellow.

Note: output port functions please reference to Output port function list in item 11.8.

11.15 USER-DEFINED PROTOCAL SETTING

This item can only be set by the upper computer.

In order to facilitate users' remote monitoring and reduce the pressure on the system communication bus, a user-defined data area with addresses 3500-3749 is created. The user-defined data address is configured by the host computer, and users can read user-defined data sequence through addresses 3500-3749.

Table 36– User-defined Protocol

Address	Item	Instruction	Number of bytes
3500	User-defined		2Bytes
3501	User-defined		2Bytes
3502	User-defined		2Bytes
3503	User-defined		2Bytes
3504	User-defined		2Bytes
3505	User-defined		2Bytes
3506	User-defined		2Bytes
3507	User-defined		2Bytes
3508	User-defined		2Bytes
3509	User-defined		2Bytes
3510	User-defined		2Bytes
3511	User-defined		2Bytes
3512	User-defined		2Bytes
3513	User-defined		2Bytes
3514	User-defined		2Bytes
3515	User-defined		2Bytes
3516	User-defined		2Bytes
3517	User-defined		2Bytes
3518	User-defined		2Bytes
3519	User-defined		2Bytes
3520	User-defined		2Bytes
3521	User-defined		2Bytes
3522-3749	User-defined		2*N Bytes

12. COMMISSIONING

12.1 STEP 1. SINGLE UNIT DEBUGGING

a) Check the parameter configuration of the controller;
b) Check the gen-set connections and MSC CAN connection lines between the units. (E.g. if 3 generators are correctly connected, SYNC screen will display Module Number: 3).
c) Start the genset in semi-auto mode, check if engine and generator data is normal;
d) Start the genset in semi-auto mode, check if switch opens and closes normally;
e) Start the genset in semi-auto mode, after closing the breaker, check if generator frequency can be adjusted to the rated frequency (e.g. set the rated frequency as 52Hz/48Hz);
f) Start the genset in semi-auto mode, after closing the breaker, check if generator voltage can be adjusted to the rated voltage (e.g. set the rated voltage as 240V/220V)
g) Start the genset in semi-auto mode, after closing the breaker, check if power factor, active power and reactive power are normal; if negative value occurs, check generator voltage and current phase sequence, current transformer incoming line direction, current transformer secondary current dotted terminal;

12.2 STEP 2: SEMI-AUTO PARALLEL OPERATION OFF-LOAD

a) Semi-Auto close parallel sets, check that the units synchronization is balanced and breaker close impulse current is not too high;
b) During parallel operation off load, check that there is no high circumfluence on HMC6 current screen;
c) During parallel operation off load, check if the output of active and reactive power is equal to zero; if it is not, then check if there is power oscillation; if there is, adjust the gain and stability values of engine, or adjust engine GOV or generator AVR gain and stability potentiometer to avoid active and reactive power oscillation; output close to 0.

12.3 STEP 3: SEMI-AUTO PARALLEL OPERATION ON-LOAD

a) Semi-Auto close parallel sets, perform on-load test and check if active and reactive power is evenly distributed between all the gensets
b) Semi-Auto close parallel sets, perform ramp on-load test to see if there is high overshoot or power oscillation during this period; if there is, regulate Load Ramp via PC software.
c) Semi-Auto close parallel sets, perform ramp off-load test to see if gen-set breaker opens after reaching minimum set value (%);
d) Semi-Auto close parallel sets, perform impact load test and damp load test to check if there is power oscillation

12.4 STEP 4: AUTOMATIC PARALLEL OPERATION

When the controller is in auto status, if there is no power on busbar, it will carry out automatic parallel, start and stop operation.

a) Start the genset which has the highest priority or shortest running time according to the start mode.
b) The genset which has the second highest priority or second shortest running time will be started if the load has exceeded the set value or the HC request has exceeded the set value.
c) After the genset has started up, synchronization, parallel and share load process will beginning.

d) The genset will be stopped according to the preset sequence if the load has fallen below the set value (light load input deactivates.)

13. INSTALLATION

Controller is panel built-in design; it is fixed by clips when installed. The controller's overall dimensions and cutout dimensions for panel, please refers to as following,

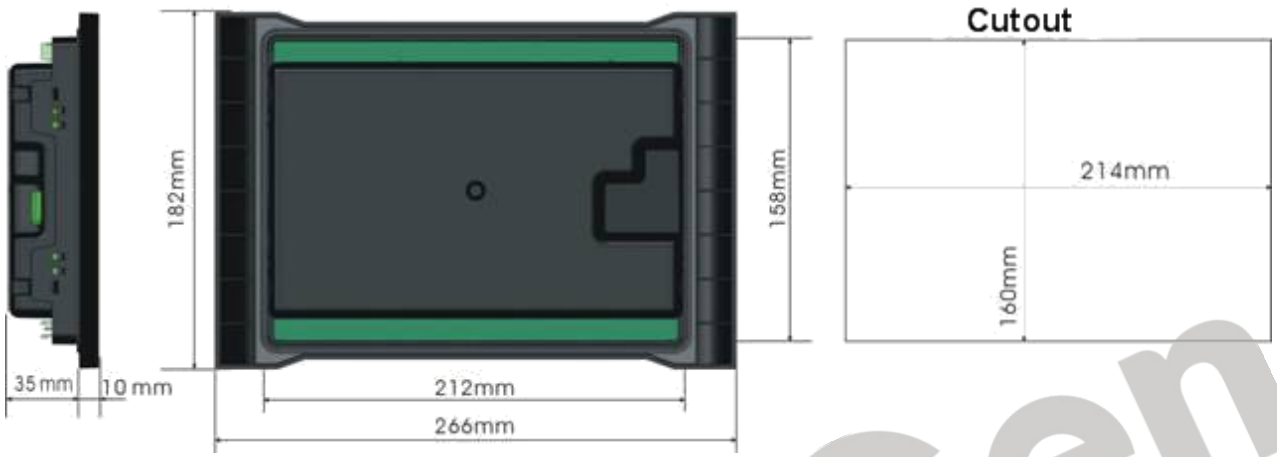


Fig.21 - Installation Dimensions

1) Battery Voltage Input

NOTE: HMC6 controller can suit for widely range of battery voltage (8~35) VDC. The wire's diameter must be over 1.5mm^2 and which is connected to B+ and B- of controller power.

2) FREQ IN, VOLT IN

NOTE: FREQ IN and VOLT IN are work only when external adjust is active. Range: -10V~10V.

3) Output And Expand Relays

NOTE: All outputs of controller are voltage free output (rated capacity is 8A). If need to expand the relays, please add freewheel diode to both ends of expand relay's coils (when coils of relay has DC current) or, increase resistance-capacitance return circuit (when coils of relay has AC current), in order to prevent disturbance to controller or others equipment.

4) AC Input

Current input of controller must be connected to outside current transformer. And the current transformer's secondary side current must be 5A. At the same time, the phases of current transformer and input voltage must correct. Otherwise, the current of collecting and active power maybe not correct.

NOTE: Dotted terminal must be connected to negative pole of battery.

WARNING! When there is load current, transformer's secondary side prohibit open circuit.

5) Withstand Voltage Test

CAUTION! When controller had been installed in control panel, if need the high voltage test, please disconnect controller's all terminal connections, in order to prevent high voltage into controller and damage it.

14 FAULT FINDING

Table 37 – Fault Finding

Symptoms	Possible Solutions
Controller no response with power.	Check starting batteries; Check controller connection wirings; Check DC fuse.
Controller adjust speed/voltage relay no response	Check whether or not GOV, AVR output select as internal relay output.
Controller GOV, AVR output error	Check setting of Central point SW1 and range SW2; Check whether or not GOV, AVR output select as internal analog output.
Impact current is too large while synch closing Single unit breaker switch back and forth	Adjust load controlling parameters; Debug every single unit based on the commissioning process.
Paralleling units cannot raise power or drop power, or just can little raise/drop power	When the internal analog speed control, set SW1 wrong, or adjust the speed control board; When the internal relay speed control, check whether the potentiometer is in the middle position.
Shutdown alarm in running	Check related switch and its connections according to the information on LCD;
Genset is running while switch is not operating	Check if the output signal of the controller is matched with switch signal; Check the connections between switch and controllers.
MSC modules too few	Check MSC LINK communications. Detect if the MSC LINK communication is normal.
RS485 communication is abnormal	Check connections; Check setting of COM port is correct or not; Check RS485's connections of A and B is reverse connect or not; Check RS485 transfer model whether damage or not; Check communication port of PC whether damage.