HMC6 Protection and Power Management

USER MANUAL

ZHENGZHOU SMARTGEN TECHNOLOGY CO.,LTD

Chinese trademark

English trademark

Smartgen — make your generator *smart*

Smartgen Technology Co., Ltd.

No. 28 Jinsuo Road

Zhengzhou

Henan Province

P. R. China

Tel: +86-371-67988888/67981888

+86-371-67991553/67992951

+86-371-67981000(overseas)

Fax: 0086-371-67992952

Web: http://www.smartgen.com.cn

http://www.smartgen.cn

Email: sales@smartgen.cn

Version history

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2014-01-21	1.0	Original release

This manual is suitable for HMC6 Protection and Power Management controller only.

Clarification of notation used within this publication.

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 protection and 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 fail, 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.

➢ Suitable for 3-phase 4-wire, 3-phase 3-wire, single phase 2-wire, and 2-phase 3-wire systems with frequency 50/60Hz;

➢ Selectable start mode: Cyclic start; Linear start; Duty Time start;

➢ 480x272 LCD with backlight, multilingual interface (including English, Chinese or 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 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
- Emergency diesel generator
- Bus tie breaker
- Load sharing between diesel generators
- Load transfer from/to shaft generator/shore connection
- Fixed power/base load for diesel generator (asymmetrical load sharing)
- Heavy consumer control (fixed load)
- NEL (Non-essential Load) Trip

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
- Overload，2 levels
- Over and 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 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)

- Shaft generator supply (up to 2 shaft generators)

- Shore connection supply

- Split busbar operation (up to 8 tie breakers)

Power management functions:

- Blackout handling

- Load-dependent start/stop

- Priority selection

    ► Cyclic start

    ► Linear start

    ► Running hours

- Load-shedding (trip of non-essential load groups)

- Conditional connection of heavy consumers

4. SPECIFICATION

Parameter	Details
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 Single Phase 2 Wire 2 Phase 3 Wire	 AC15V - AC360V (ph-N) AC30V - AC620V (ph-ph) AC15V - AC360V (ph-N) AC15V - AC360V (ph-N)
Alternator Frequency	50Hz/60Hz
Flexible Relay Output 1~12	8A AC250V volts free output
GOV	DC(-10~10)V/-20mA~20mA
AVR	DC(-10~10)V /-20mA~20mA
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
Working Conditions	Temperature: (-25~+70)°C Humidity: (20~93)%RH
Storage Conditions	Temperature:(-25~+70)°C
Protection Level	IP55 Gasket
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

TFT LCD: 4.3 inches with 480x272 resolutions, as following:
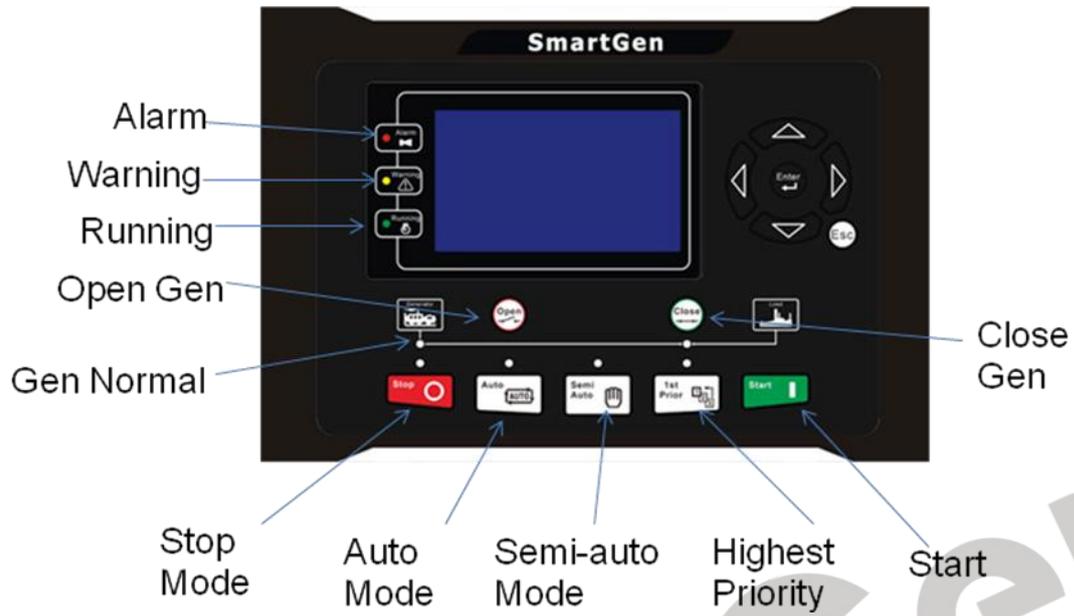
5.1 PUSHBUTTONS

Stop ⭕	Stop	Stop the running generators in Semi-auto mode. Lamp test (press at least 3 seconds);
Start ▮	Start	Start the running generators in Semi-auto mode.
Semi Auto ✋	Semi-auto mode	Press this key and controller enters in Semi-auto mode mode.
Auto ⟲AUTO⟳	Auto Mode	Press this key and controller enters in **Auto** mode.
1st Prior ▦	Priority selection	Press this key will place the generator at the highest priority and start the generator the earliest.
Close ⟜	Close	The unit will close the circuit breaker in **Semi-auto** mode.
Open ⟞	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.
Enter ↵	Set/Confirm	1) Press this key will enter into "Help" interface. 1) Pressing and holding for more than 3 seconds enters parameter setting menu; 2) In settings menu confirms the set value.
Esc	Exit	1) Return to main menu; 2) Return to previous menu in setting menu.

5.2 LCD DISPLAY

Main screen show pages; use ◀ ▶ to scroll the pages.

★**Main Screen**, including as below,
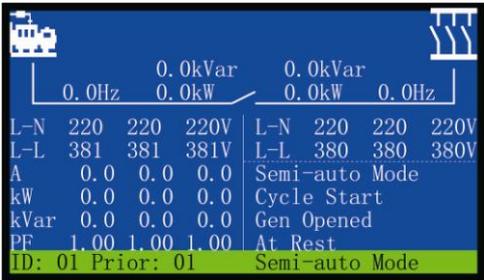
	First Screen	Left Screen ：Gen	Right Screen：Bus
	1st Line	Total Reactive Power	Total Reactive Power
	2nd Line	Frequency, Total Active Power	Total Active Power, Frequency
	3rd Line	Phase Voltage	Phase Voltage
	4th Line	Line Voltage	Line Voltage
	5th Line	Current	Semi-auto Mode
	6th Line	Active Power	Cycle Start
	7th Line	Reactive Power	Gen Opened
	8th Line	Power Factor	System Mode
	9th Line	Module ID, Priority	System Alarm Information or Mode

	Second Screen	Multi-set Data	
	1st Line	1# Total Active Power、ID、Breaker Status	
	2nd Line	1# Total Reactive Power、Priority、Alarm Status	
	3rd Line	2# Total Active Power、ID、Breaker status	
	4th Line	2# Total Reactive Power、Priority、Alarm Status	
	5th Line	3# Total Active Power、ID、Breaker status	
	6th Line	3# Total Reactive Power、Priority、Alarm Status	
	7th Line	4# Total Active Power、ID、Breaker status	
	8th Line	4# Total Reactive Power、Priority、Alarm Status	
	9th Line	Module ID, Priority, System Alarm Information or Mode	

	Third Screen	Gen	
	1st Line	Phase Voltage	Current
	2nd Line	Line Voltage	Active Power
	3rd Line	Phase Sequence Number	Reactive Power
	4th Line	Phase Angle	Apparent Power
	5th Line	Power Factor	Total Active Power
	6th Line	Average Power Factor, Frequency	Output Active Power Percentage, Target Active Power Percentage
	7th Line	Accumulated Active Energy, Accumulated	Total Reactive Power

		Reactive Energy	
	8th Line	Unbalanced Current	Output Reactive Power Percentage, Target Reactive Power Percentage
	9th Line	Module ID, Priority	System Alarm Information or Mode
	Fourth Screen	Left Screen : Bus-Sync	Right Screen : Synchronization
	1st Line	Phase Voltage	Volt Difference, "√" means it meets the requirements.
	2nd Line	Line Voltage	Freq Difference, "√" means it meets the requirements.
	3rd Line	Phase Sequence number	Angle Difference, "X" means it doesn't meet the requirements.
	4th Line	Phase Angle	GOV Output Percentage
	5th Line	Frequency	AVR Output Percentage
	6th Line	Multi-set Total Active Power	Quantity Module
	7th Line	Multi-set Total Reactive Power	All Module ID
	8th Line	Running Time	All Module Priority
	9th Line	Module ID, Priority	System Alarm Information or Mode
	Fifth Screen	Alarm Information	
	1st Line	Alarm Type：Warning Alarm	
	2nd Line	Alarm Name, Alarm Value, Acknowledged	
	3rd Line	Alarm Name, Alarm Value, Acknowledged	
	4th Line	Alarm Name, Alarm Value, Acknowledged	
	5th Line	Alarm Type：Trip Alarm	
	6th Line	Alarm Name, Alarm Value, Acknowledged	
	7th Line	Alarm Name, Alarm Value, Acknowledged	
	8th Line	None	
	9th Line	Module ID, Priority	System Alarm Information or Mode
	Sixth Screen	Left Screen ：Alarm Record	
	1st Line	Alarm Name, Alarm Value	
	2nd Line	Event Log Time	
	3rd Line	Alarm Name, Alarm Value	
	4th Line	Event Log Time	
	5th Line	Alarm Name, Alarm Value	
	6th Line	Event Log Time	
	7th Line	None	

	8th Line	None	
	9th Line	Module ID, Priority	System Alarm Information
	Seventh Screen	Event Log	
	1st Line	Event Log Name, Event Log Value	
	2nd Line	Event Log Time	
	3rd Line	Event Log Name, Event Log Value	
	4th Line	Event Log Time	
	5th Line	Event Log Name, Event Log Value	
	6th Line	Event Log Time	
	7th Line	None	
	8th Line	None	
	9th Line	Module ID, Priority	System Alarm Information

5.3 USER MENU AND PARAMETERS SETTING MENU

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.

Parameter setting including as following,

★Bus setting

★Timer settings

★Generator setting

★Generator Load settings

★Breaker settings

★Input port settings

★output port settings

★Module settings

★Synchronization settings

Example:

Return Bus setting **Timers setting >** Generator setting Generator Load setting Breaker setting Input setting Output setting Module setting Synchronization setting	>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	Form1: Use ⬆⬇ to scroll settings, ⏎ to enter settings (form 2), (Esc) to exit settings menu.

Return Bus setting **Timers setting >** Generator setting Generator Load setting Breaker setting Input setting Output setting Module setting Synchronization setting	> 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	Form 2: Use ⬆⬇ to scroll settings, ⏎ 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	> 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	Form 3: Use ⬆⬇ to scroll settings, ⏎ 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	**00005**	Form 4： Press ⏎ 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	00005	Form 5: Press ◁ ▷ to change cursor position, ⬆ ⬇ are used for changing cursor value, ⏎ to confirm setting and the setting will be stored in internal FLASH memory automatically; (Esc) to exit setting.

⚠**NOTE:** Pressing [Stop O] for a long time can exit setting directly during setting.

6. 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, relay governor, 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 ⌷ 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

All available diesel generator units can be started/stopped/synchronized/closed/opened/unloaded upon push-button commands on the front panels for each generator.

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. If the available power is insufficient, the heavy consumer connection will not be allowed.

Semi-auto Start：

1 Start command will be initiated by HMC6 after pressing ⌷ button. The system enters into "Start Output Delay" while the start relay will activate.

2 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.

3 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.

4   If the switch is not closed during the normal running status and the voltage/frequency has not satisfy the onload requirement suddenly, Transient Fault Delay will be initiated. F/V Fault alarm will be initiated if the onload 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.

5   If the onload requirement has been achieved (Generator normal light will illuminate), the genset will close and synchronize automatically after pressing the (Close) button.

6   In case of multi-set operation, the genset will share load automatically.

7   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：

1.   Press stop button (Stop O), in case of multi-set operation, first of all, the system will transfer load.

2.   Open relay activate only when the load transfer is finished.

3.   After the switch is opened, the system enters into "Stop Output Delay" while the stop relay will activate.

4.   The system enters into standby status after the Stop Output Delay has expired.

6.1.3   AUTO MODE

Auto mode is activated by pressing (Auto AUTO) 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 synchronise 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

1.   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.

2. Should the generator units are started successfully, the system will start the next generator in line if the power is insufficient.

3. Should the generator units are in normal running, 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; then the system will output acknowledged signal if the request is satisfied.

Auto Start

1   Generator enters into "start delay" as soon as "Auto Start" is active.

2   After the Start Delay has expired, the system enters into Start Output Delay while the start relay will activate.

3   When start 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.

4   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.

5   If the switch is not closed during the normal running status and the voltage/frequency has not satisfy the onload requirement suddenly, Transient Fault Delay will be initiated. F/V Fault alarm will be initiated if the onload 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.

6   If the onload requirement has been achieved (Generator normal light will illuminate), the genset will close and synchronize automatically after pressing the ⊖(Close) button.

7   In case of multi-set operation, the genset will share load automatically.

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

Auto Stop Rules

1. 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.

2. Should the load is transferred completely, only then open relay activate.

3. Stop command will be initiated.

Auto Stop

1. Press stop button [Stop O], in case of multi-set operation, first of all, the system will transfer load.

2. Open relay activate only when the load transfer is finished.

3. After the switch is opened, the system enters into "Stop Output Delay" while the stop relay will activate.

4. The system enters into standby status after the Stop Output Delay has expired.

Start/Stop Condition Description：

System Mode	Start Condition	Stop Condition
Manual Mode	Start the gensets externally, GOV input, GOV output, AVR input and AVR output are deactivated; Monitor all generator parameters.	Stop the gensets externally or there is "trip and stop" alarm occurs.
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. 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.

6.2 START MODE DESCRIPTION

Start	Start Mode	Stop Mode	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
Running hours	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. 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 relay output.

Alarm types:

Alarm Type	Buzzer	Display	Unload	Trip	Shutdown	Start
Block	●	●	X	X	X	X
Warn	●	●	X	X	X	●
Trip	●	●	X	●	X	X
Trip and Stop	●	●	●	●	●	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.

Alarm display:

```
Alarm Info          Gen Opened
                    At Rest
Warn Alarm
Gen Overvolt        240V     Acked
Gen Overfreq        51.0Hz   Ack
Bus Overvolt        241V     Ack
Trip Alarm
Over Current 1      450A     Ack
Over Power          500kW    Ack

ID: 01 Prior: 01    Over Current 1
```

Press ⬆⬇ to select the alarm you are going to reply, and press ⏎ to acknowledge the alarm.

HMC6 Alarm types are as follows:

NO.	Types	Description	Info
Busbar Protection			
1	Overvolt 1	When basbar voltage has exceeded the set value 1, it will initiate a warning alarm.	Warn Always active
2	Overvolt 2	When basbar voltage has exceeded the set value 2, it will initiate a trip alarm.	Trip Always active
3	Overvolt 3	When basbar voltage has exceeded the set value 3, it will initiate a trip alarm.	Trip Always active

NO.	Types	Description	Info
4	Undervolt 1	When basbar 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 basbar 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 basbar 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 basbar frequency has exceeded the set value 1, it will initiate a warning alarm.	Warn Always active
8	Overfreq 2	When basbar frequency has exceeded the set value 2, it will initiate a trip alarm.	Trip Always active
9	Overfreq 3	When basbar frequency has exceeded the set value 3, it will initiate a trip alarm.	Trip Always active
10	Underfreq 1	When basbar frequency has fallen below than the set value 1, it will initiate a warning alarm.	Warn It is active after the switch has closed.
11	Underfreq 2	When basbar 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 basbar frequency has fallen below than the set value 3, it will initiate a trip alarm.	Trip 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.

NO.	Types	Description	Info
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.
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 onload stable delay has expired, it will initiate a block alarm.	Block It is active after the genset has started.
Current Protection			

NO.	Types	Description	Info
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.	Warn It is active after the switch has closed.
Power Protection			
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.	Trip (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.	Trip (Non Essential Load 2 Trip) It is active after the Non Essential Load switch 2 has closed.

NO.	Types	Description	Info
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.	Trip (Non Essential Load 3 Trip) It is active after the Non Essential Load switch 3 has closed.
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.	Trip 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.	Trip It is active after the switch has opened.
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
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	Digital Input 1~5	When digital input port action select "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

NO.	Types	Description	Info
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

8. HARDWARE STRUCTURE

HMC6 terminals are standard. Uses only can expand 16-channels digital input module, 16-channels digital output module or 16-channels LED lamp module via CANBUS (Expand) port. HMC6 terminals are as follows:

Slot	Terminal	Remarks
Slot #1	1-6	Power supply port; Auxiliary output port
Slot #2	7-15	Output port
Slot #3	16-23	Output port
Slot #4	24-35	CANBUS port; GOV; AVR
Slot #5	36-39	Generator voltage input
Slot #6	40-43	Busbar voltage input
Slot #7	44-49	Generator current input
Slot #8	50-64	Digital input
Slot #9	65-67	Frequency input; Voltage input
Slot #10	68-70	RS485 COM port

8.1 TERMINAL DESCRIPTION：
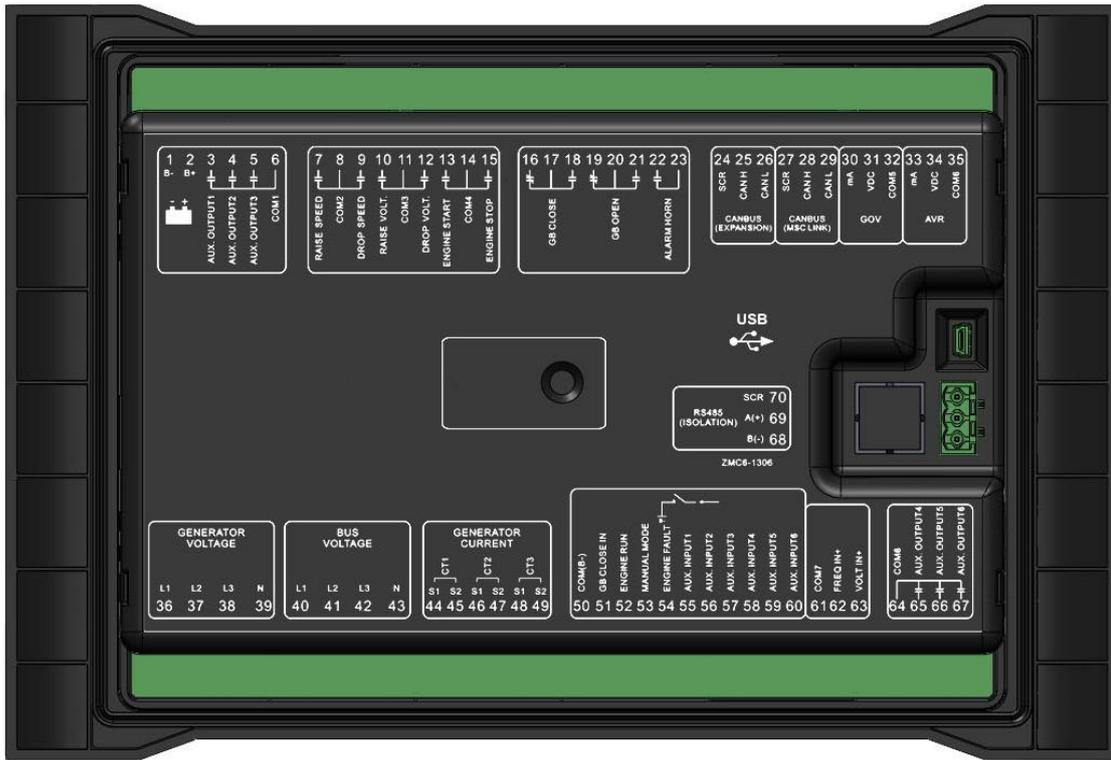
Terminal description：NO means normally open;

NC means normally close

8.1.1 SLOT #1 POWER SUPPLY PORT; AUXILIARY 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.

8.1.2 SLOT #2、SLOT #3 AUXILIARY 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	RAISE VOLT	RAISE VOLT OUTPUT	AC250V/8 A
11	COM3	COM port 10,12	
12	DROP VOLT	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		
17	GB CLOSE _COM	GB CLOSE OUTPUT	AC250V/8 A
18	GB CLOSE _NO		
19	GB OPEN _NC		
20	GB OPEN _COM	GB OPEN OUTPUT	AC250V/8 A
21	GB OPEN _NO		
22	ALARM HORN	DIGITAL OUTPUT	AC250V/8 A
23			

8.1.3 SLOT #4 GOV, AVR

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

8.1.4 SLOT #5、SLOT #6、SLOT #7 GENERATOR VOLTAGE INPUT/BUSBAR VOLTAGE INPUT/GENERATOR CURRENT INPUT

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)	CT A-phase sensing input	Rated input 5A
45	S2 (CT1)		
46	S1 (CT2)	CT B-phase sensing input	Rated input 5A
47	S2 (CT2)		
48	S1 (CT3)	CT C-phase sensing input	Rated input 5A
49	S2 (CT3)		

8.1.5 SLOT #8 DIGITAL INPUT, FREQUENCY INPUT; VOLTAGE INPUT

Terminal	Function	Description	Remarks
50.	B-	Digital input COM port	
51.	GB CLOSE IN	Digital input port	(B-) connected is active.
52.	ENGINE RUN	Digital input port	
53.	MANUAL MODE	Digital input port	
54.	ENGINE FAULT	Digital input port	
55.	AUX INPUT 1	Digital input port	
56.	AUX INPUT 2	Digital input port	
57.	AUX INPUT 3	Digital input port	
58.	AUX INPUT 4	Digital input port	
59.	AUX INPUT 5	Digital input port	
60.	AUX INPUT 6	Digital input port	
61.	COM 7	COM port of frequency input port and voltage input port	
62.	FREQ IN+	External frequency (active power) adjust input	-10V~10V input
63.	VOLT IN+	External voltage (reactive power) adjust input	-10V~10V input

8.1.6 SLOT #9 AUXILIARY OUTPUT PORT

Terminal	Function	Description	Remarks
64.	COM8	COM port of frequency input port and voltage input port	
65.	AUX.OUTPUT4	Auxiliary output port 4	AC250V/8 A
66.	AUX.OUTPUT5	Auxiliary output port 5	AC250V/8 A
67.	AUX.OUTPUT6	Auxiliary output port 6	AC250V/8 A

8.1.7 SLOT #10 RS485 COMMUNICATION PORT

Terminal	Function	Description	Remarks
68	B(-)	RS485COM port	Baud rate 9600bps Standard MODBUS protocol
69	A(+)		
70	SCR	RS485 port	Shielded wire single-end earthed.

8.2 CONNECTION

8.2.1 3 PHASE 3 WIRE
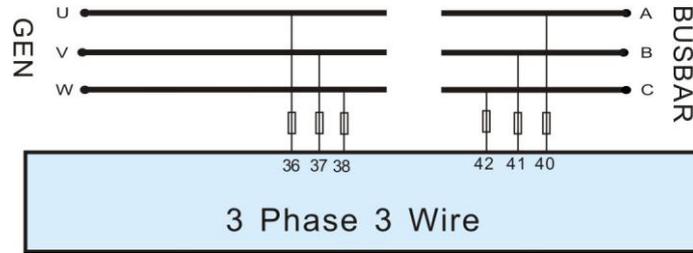
8.2.2 SINGLE PHASE 2 WIRE
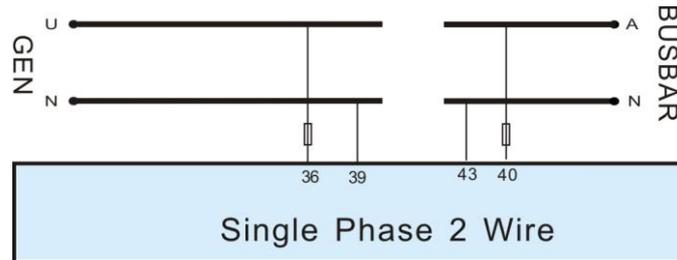
8.2.3 2 PHASE 3 WIRE
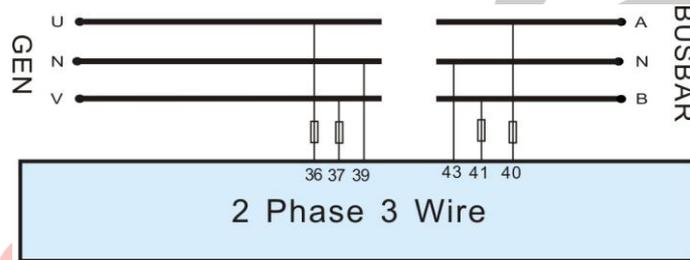
8.2.4 ANALOG INPUT

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

Function descriptions of FREQ IN and VOLT IN are as following:

Function	Description	Condition	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 connection/shaft generator	+/-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 connection/shaft generator	+/-10V DC

0~10V input connection：
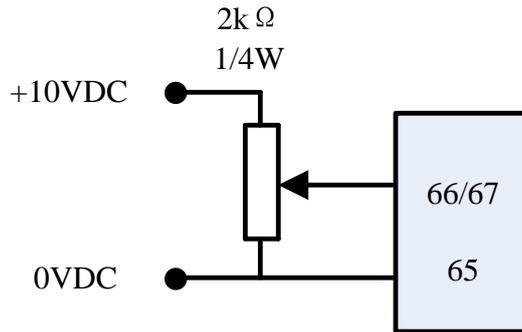
-10V~10V input connection：
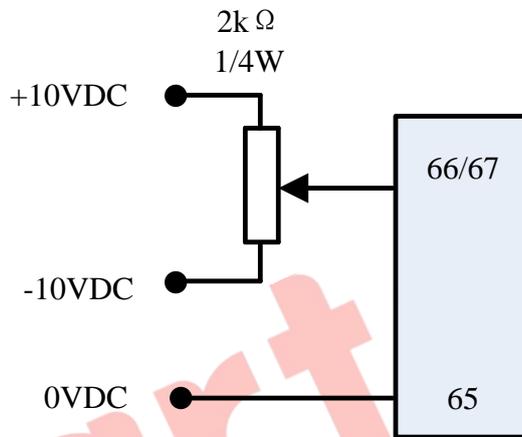
8.2.5 MSC LINK PORT

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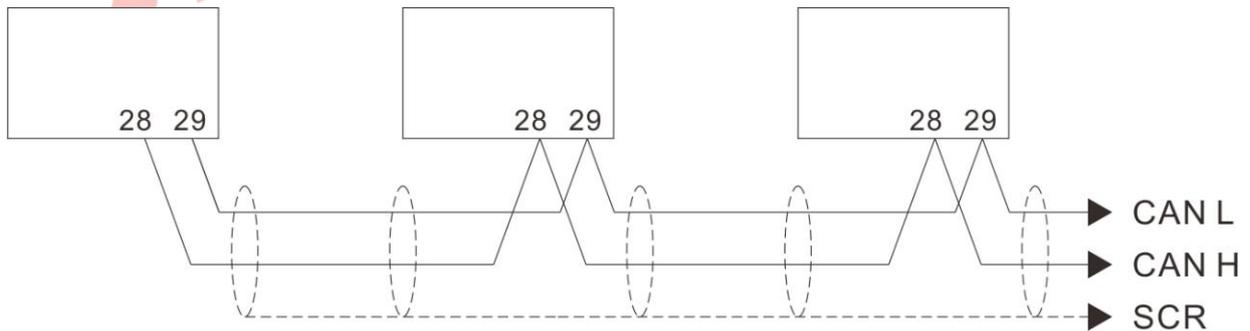
9. POWER MANAGEMENT AND WORKFLOW CHART

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

9.1 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.

1、 kW load sharing：The equal load sharing of active power of each unit on busbar can be adjusted via GOV.

2、 kVar load sharing：The equal load sharing of reactive power of each unit on busbar can be adjusted via AVR.

9.2 FIXED POWER

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

The unit selected for base load 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.

9.3 SYNCHRONISING

9.3.1 DYNAMIC SYNCHRONIZING

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.

9.3.2 STATIC SYNCHRONIZING

During static synchronizing, the unit which is going to synchronized is running at a near-unanimous speed to busbar generator, so that the phase angle between generator and busbar are matched exactly.

When synchronizing is started, the synchronizing controller is activated and the generator frequency is controlled towards the busbar frequency. The phase controller takes over when the frequency deviation is so small that the phase angle can be controlled.

⚠NOTE：We discourage you from using static synchronizing when adjust it using relay output because it respond slowly.

9.4 HEAVY CONSUMERS

Each HMC6 controller is able to handle three Heavy Consumers (HC).

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.
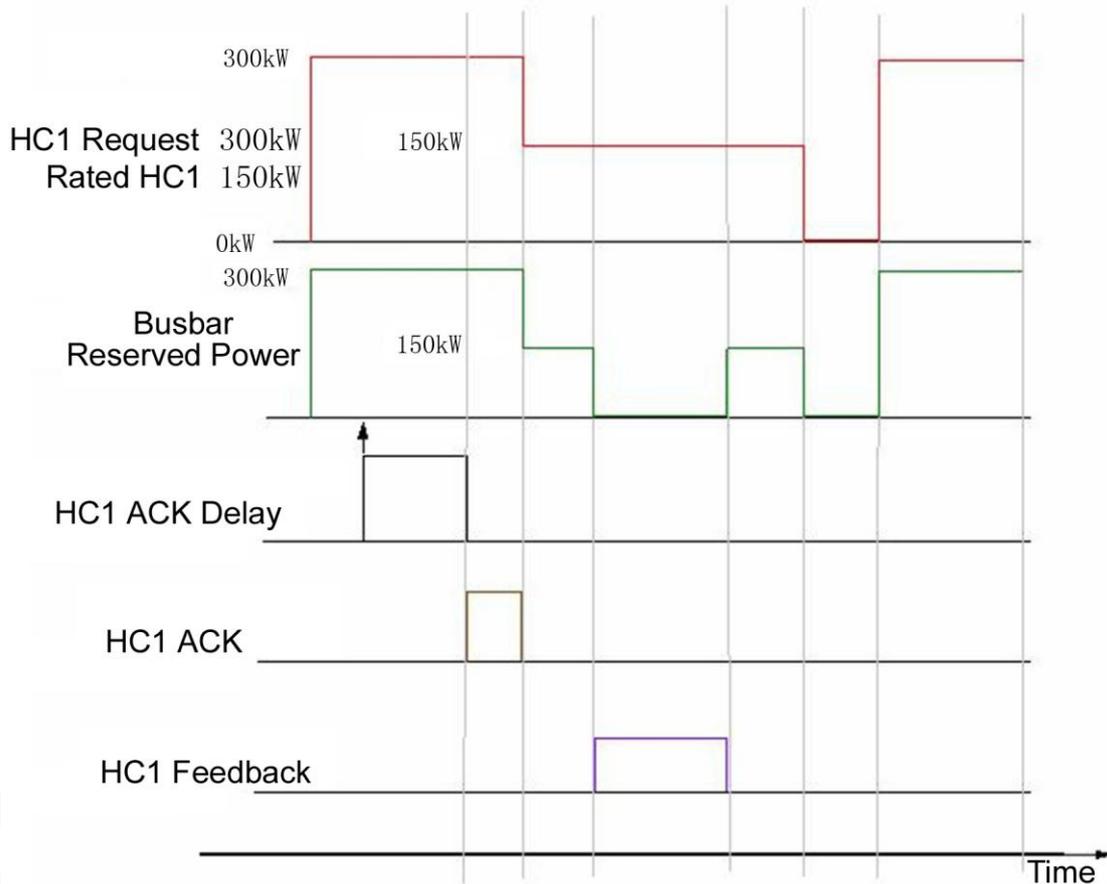
The picture above shows：

1、 HC1 request power is 300kW; HC1 rated power is 150kW;

2、 The busbar reserved 300kW for HC1;

3、 HC ACK Delay will be initiated if there is enough redundancy power on busbar.

4、 The controller will output acknowledgement signal after the HC ACK Delay. After the acknowledgement has output, HC1 request power is equal to HC1 rated power, then the busbar only reserved the HC1 rated power.

5、 If the HC feedback is active, the busbar reserved 0% power for HC1.

6、 If the HC feedback is deactivated while the HC request is active, the busbar only reserved the HC1 rated power.

7、 If the HC feedback and the HC request both are deactivated, then the busbar reserved 0% power for HC1.

9.4.1 HEAVY CONSUMER REQUESTS

Heavy load 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 power value.

9.4.2 HEAVY CONSUMER ANSWER

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. If the request is satisfied, acknowledged signal will be initiated and the controller does not reserve any power.

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.

3：There is 160kW redundancy on busbar after the additional 100kW generator is started, then the acknowledged signal will be initiated.

9.4.3 HEAVY CONSUMER FEEDBACK

It is a binary input signal, heavy consumer feedback signal will be initiated if the request is satisfied.

As the example above illustrates：

1：After the answer is active, the real power of the load is 30kW, there is 130kW redundancy on busbar, stop condition is satisfied.

2：The additional 100kW generator will be stopped.

9.4 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 has exceed 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 reset only.

9.5 WORKFLOW CHART

9.5.1 MANUAL PARALLE

```
                    ┌─────────────┐
                    │    Start    │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │ Manual mode │
                    │ is active.  │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │ Collect data │◄──────┐
                    └─────────────┘        │
                           │               │
                           ▼               │
                    ┌─────────────┐        │
                    │ Monitoring  │      N │
                    │ and         │        │
                    │ protection  │        │
                    └─────────────┘        │
                           │               │
                           ▼               │
                        ◇ Trip ◇───────────┘
                           │
                         Y │
                           ▼
                    ┌─────────────┐
                    │     End     │
                    └─────────────┘
```

9.5.2 START UP

```
                    ┌─────────────┐
                    │    Start    │
                    └──────┬──────┘
                           │         ┌─N
                           ▼         │
                      ╱Start active╲─┘
                           │Y
                           ▼
                    ┌─────────────┐
                    │ Start delay │
                    └──────┬──────┘
                           ▼
                    ┌─────────────┐
                    │ Start wait  │
                    │   delay     │
                    └──────┬──────┘
                           ▼
    ┌─────────────┐   ╱ Start  ╲
    │Fail to start│◄─N╲ success ╱
    │   alarm     │        │Y
    └──────┬──────┘        ▼         ┌─N
           ▼               │         │
    ┌─────────────┐   ╱On-load   ╲   │
    │    Exit     │   ╲requirement╱──┘
    └──────┬──────┘   ╲is satisfied╱
           │               │Y
           │               ▼
           │        ┌─────────────┐
           │        │ Close Sync  │
           │        └──────┬──────┘
           │               ▼
           │          ╱  Load   ╲        ┌─N
           │          ╲ sharing  ╱───────┤
           │               │Y            │
           │               ▼             ▼
           │        ┌─────────────┐ ┌─────────────┐
           │        │  GOV/AVR    │ │ Fixed Power │
           │        │  Control    │ │   Output    │
           │        └──────┬──────┘ └──────┬──────┘
           │               │◄──────────────┘
           │               ▼
           │        ┌─────────────┐
           │        │  Parallel   │
           │        │  Running    │
           │        └──────┬──────┘
           │               ▼
           └──────────►┌─────────┐
                       │   End   │
                       └─────────┘
```

9.5.3 STOP

```
                    ┌──────────┐
                    │  Start   │
                    └────┬─────┘
                         │        ◄──── N
                         ▼        │
                    ╱ Stop Active ╲────┘
                    ╲             ╱
                         │
                         Y
                         ▼
                    ┌──────────┐ ◄──┐
                    │  Unload  │    │
                    └────┬─────┘    │
                         │          │ N
                         ▼          │
                    ╱ Less than ╲───┘
                    ╲ stop set  ╱
                    ╲  value   ╱
                         │
                         Y
                         ▼
                    ┌──────────┐
                    │Open delay│
                    └────┬─────┘
                         │
   ┌──────┐             ▼
   │ Fail │◄── N ──╱ Open Gen ╲
   │  to  │        ╲          ╱
   │ stop │             │
   └──┬───┘             Y
      │                 ▼
      │           ┌─────────────┐
      │           │Stop the unit│
      └──────────►└──────┬──────┘
                         │
                         ▼
                    ┌──────────┐
                    │   End    │
                    └──────────┘
```

9.5.4 OPEN BREAKER

Open Breaker

9.5.5 CLOSE BREAKER

```
                        ┌───────────┐
                        │   Start   │
                        └───────────┘
                              │   ◄──── N ──┐
                              ▼             │
                           ╱Close╲          │
                          ╱Breaker ╲────────┘
                          ╲ Active ╱
                           ╲     ╱
                              │ Y
                              ▼
                        ┌───────────┐
                        │   Sync    │
                        └───────────┘
                              │        ◄──────── N ──────────┐
                              ▼                              │
                          ╱ Close ╲                          │
                         ╱ breaker ╲        ╱Sync delay╲     │
                        ╱requirement╲─ N ─►╱ has expired ╲───┘
                        ╲is satisfied╱      ╲            ╱
                          ╲        ╱          ╲        ╱
                              │ Y                  │ Y
                              ▼                    ▼
                        ┌───────────┐      ┌────────────┐
                        │Close Delay│      │Fail to Sync│
                        └───────────┘      │   Alarm    │
                              │            └────────────┘
          ┌────────┐          ▼
          │  Fail  │      ╱ Close ╲
          │   to   │◄─ N ╱ Breaker ╲
          │ Close  │     ╲ Normal  ╱
          │ Alarm  │       ╲     ╱
          └────────┘          │ Y
                              ▼
                        ┌───────────┐
                        │    End    │
                        └───────────┘
```

9.5.6 HEAVY CONSUMER

```
                        ┌──────────┐
                        │  Start   │
                        └────┬─────┘
                             │
                             ▼
                      ┌──────────────┐
                      │  HC Active   │
                      └──────┬───────┘
                             │
                             ▼
                    ┌─────────────────┐
                    │ Busbar Power    │
                    │ Calculation     │
                    └────────┬────────┘
                             │
                             ▼
                        ◇─────────◇
                       ╱ HC load   ╲
          Y      ◇  requirement   ◇
         ┌───────   is satisfied.   
         │        ╲               ╱
         │         ◇─────────◇
         │              │ N
         │              ▼
         │       ┌─────────────┐
         │       │ Additional  │
         │       │ genset is   │
         │       │ started.    │
         │       └──────┬──────┘
         │              │
         │              ▼
         └──────▶┌─────────────┐
                 │  HC Dealy   │
                 └──────┬──────┘
                        │
                        ▼
                 ┌─────────────┐
                 │   HC ACK    │
                 └──────┬──────┘
                        │
                        ▼
                 ┌─────────────┐
                 │    End      │
                 └─────────────┘
```

9.5.7 LIGHT CONSUMER

```
        ┌──────────┐
        │  Start   │
        └────┬─────┘
             │
             ▼
      ┌──────────────┐
      │Less than stop│
      │  set value   │
      └──────┬───────┘
             │
             ▼
          ◇ Light ◇
         ◇Consumer ◇──── N
          ◇Active ◇      │
             │           │
             Y           ▼
      ┌──────────┐  ┌──────────┐
      │ Parallel │  │   Open   │
      │ Running  │  │ Breaker  │
      └────┬─────┘  └────┬─────┘
           │             │
           ◄─────────────┘
           ▼
        ┌──────────┐
        │   End    │
        └──────────┘
```
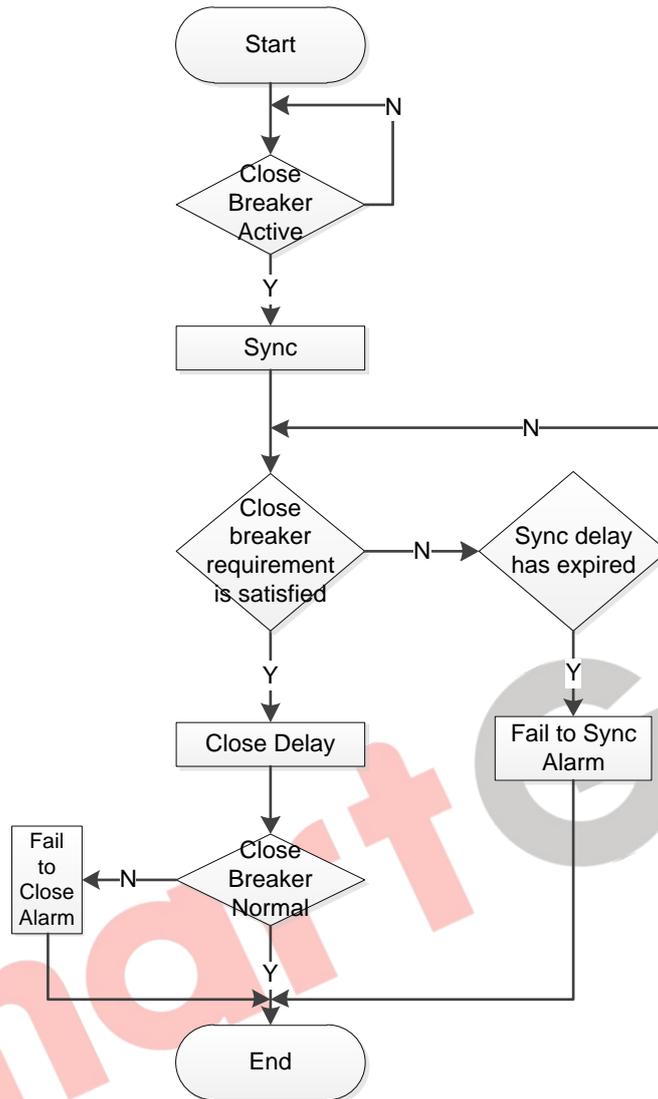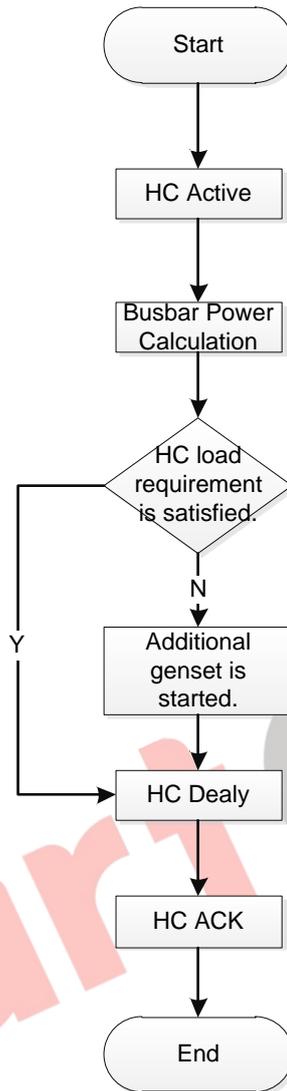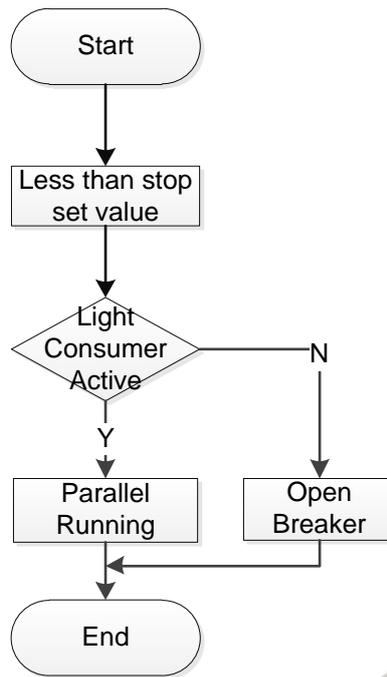
9 SCOPES AND DEFINITIONS OF PROGRAMMABLE PARAMETERS

10.1 BUSBAR SETTING

No.	Items	Parameters	Defaults	Alarm Types	Description
Busbar Setting					
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)	(0-1) 0: Disable 1: Enable	0: Disable		Users can set the primary voltage and secondary voltage of the voltage transformer.
4.	Overvolt 1	(0-1) 0: Disable 1: Enable	1: Enable		
5.	Overvolt 1 Set	(0-1000)%	110%	Warn	
6.	Overvolt 1 Delay	(0-100.0S	5.0S		
7.	Overvolt 2	(0-1) 0: Disable 1: Enable	1: Enable		Setting value is busbar rated voltage's percentage, and return value and delay value can be set.
8.	Overvolt 2 Set	(0-1000)%	120%	Trip	
9.	Overvolt 2 Delay	(0-100.0S	3.0S		
10.	Overvolt 3	(0-1) 0: Disable 1: Enable	0: Disable		
11.	Overvolt 3 Set	(0-1000)%	130%	Trip	
12.	Overvolt 3 Delay	(0-100.0S	1.0S		

No.	Items	Parameters	Defaults	Alarm Types	Description
13.	Undervolt 1	(0-1) 0: Disable 1: Enable	1: Enable		
14.	Undervolt 1 Set	(0-1000)%	95%	Warn	
15.	Undervolt 1 Delay	(0-100.0S	5.0S		
16.	Undervolt 2	(0-1) 0: Disable 1: Enable	1: Enable		
17.	Undervolt 2 Set	(0-1000)%	80%	Trip	
18.	Undervolt 2 Delay	(0-100.0S	3.0S		
19.	Undervolt 3	(0-1) 0: Disable 1: Enable	0: Disable		
20.	Undervolt 3 Set	(0-1000)%	70%	Trip	
21.	Undervolt 3 Delay	(0-100.0S	2.0S		
22.	Overfreq 1	(0-1) 0: Disable 1: Enable	1: Enable		
23.	Overfreq 1 Set	(0-1000)%	105%	Warn	
24.	Overfreq 1 Delay	(0-100.0S	5.0S		
25.	Overfreq 2	(0-1) 0: Disable 1: Enable	1: Enable		Setting value is busbar rated frequency's percentage, return value and delay value can be set.
26.	Overfreq 2 Set	(0-1000)%	110%	Trip	
27.	Overfreq 2 Delay	(0-100.0S	8.0S		
28.	Overfreq 3	(0-1) 0: Disable 1: Enable	0: Disable		
29.	Overfreq 3 Set	(0-1000)%	120%	Trip	

No.	Items	Parameters	Defaults	Alarm Types	Description
30.	Overfreq 3 Delay	(0-100.0S	6.0S		
31.	Underfreq 1	(0-1) 0: Disable 1: Enable	1: Enable		
32.	Underfreq 1 Set	(0-1000)%	96%	Warn	
33.	Underfreq 1 Delay	(0-100.0S)	5.0S		
34.	Underfreq 2	(0-1) 0: Disable 1: Enable	1: Enable		
35.	Underfreq 2 Set	(0-1000)%	93%	Trip	
36.	Underfreq 2 Delay	(0-100.0S	10.0S		
37.	Underfreq 3	(0-1) 0: Disable 1: Enable	0: Disable		
38.	Underfreq 3 Set	(0-1000)%	92%	Trip	
39.	Underfreq 3 Delay	(0-100.0)S	8.0S		
40.	ROCOF	(0-1) 0: Disable 1: Enable	0: Disable		
41.	ROCOF Set	(0-1.00)Hz/s	0.20	Trip	When the controller detects that the busbar ROCOF has exceeded the set value, it will initiate a trip alarm and the alarm information will be displayed on LCD. Active when parallel with Shaft generator or shore connection.
42.	ROCOF Delay	(0-100.0S	1.0S		
43.	VECTOR SHIFT	(0-1) 0: Disable 1: Enable	0: Disable		

No.	Items	Parameters	Defaults	Alarm Types	Description
44.	VECTOR SHIFT Set	(0-20.0)°	6.0	Trip	When the controller detects that the busbar VECTOR SHIFT has exceeded the set value, it will initiate a trip alarm and the alarm information will be displayed on LCD. Active when parallel with Shaft generator or shore connection.
45.	VECTOR SHIFT Delay	(0-100.0S	1.0S		When the controller detects that the vector change of shaft generator/shore connection has exceeded the set value, it will initiate a trip alarm and the alarm information will be displayed on LCD. Active when parallel with Shaft generator or shore connection.

10.2 TIMER SETTING

No.	Items	Parameters	Defaults	Description
Timer Setting				
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.	Start Output Delay	(0-3600)s	8	Start relay output time. When it is 0, means output constantly.
4.	Stop Output Delay	(0-3600)s	5	Stop relay output time. When it is 0, means output constantly.
5.	Start Wait Delay	(0-3600)s	120	Time from start signal is active to onload requirement is satisfied. If the requirement doesn't be satisfied but delay time is up, then the warning alarm will be initiated.
6.	Fail to Stop	(0-3600)s	20	After the Fail to 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.	Onload Stable Delay	(0-3600)s	5	Time from start signal is active to onload requirement is satisfied. If the requirement is continue satisfied in onload 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 Delay	(0-100.0)s	2.0	After the onload 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.	HC Answer Delay	(0-1000)s	5	If the busbar redundancy power is meet the HC request, then the HC answer output after the HC answer delay.

9.3 GENERATOR SETTING

NO.	Items	Parameters	Defaults	Alarm Types	Description
Generator Setting					
1.	AC System	(0-3)	0		0: 3P4W; 1: 3P3W; 2: 2P3W; 3: 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.	Generator Voltage	(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.	Generator Frequency	(0-200)%	65%		To offer standards for detecting crank disconnect frequency is satisfied or not.
8.	Volt. Trans.(PT)	(0-1)	0		0: Disable; 1:Enable
9.	Over Volt. 1	(0-1) 0: Disable	1: Enable		Setting value is percentage of generator rated voltage. Delay

					value can be set.
		1: Enable			
10.	Over Volt. 1 Set	(0-200)%	105%	Warn	
11.	Over Volt. 1 Delay	(0-100.0S	5.0S		
12.	Over Volt. 2	(0-1) 0: Disable 1: Enable	1: Enable		
13.	Over Volt. 2 Set	(0-200)%	115%	Trip	
14.	Over Volt. 2 Delay	(0-100.0S	1.0S		
15.	Under Volt. 1	(0-1) 0: Disable 1: Enable	1: Enable		
16.	Under Volt. 1 Set	(0-200)%	95%	Warn	
17.	Under Volt. 1 Delay	(0-100.0S	5.0S		
18.	Under Volt. 2	(0-1) 0: Disable 1: Enable	1: Enable		
19.	Under Volt. 2 Set	(0-200)%	80%	Trip	
20.	Under Volt. 2 Delay	(0-100.0S	3.0S		
21.	Under Volt. 3	(0-1) 0: Disable 1: Enable	0: Disable		
22.	Under Volt. 3 Set	(0-200)%	70%	Trip	
23.	Under Volt. 3 Delay	(0-100.0S	1.0S		
24.	Over Freq. 1	(0-1) 0: Disable 1: Enable	1: Enable		Setting value is percentage of generator rated frequency. Delay value can be set.
25.	Over Freq. 1 Set	(0-200)%	105%	Warn	
26.	Over Freq. 1 Delay	(0-100.0S	5.0S		
27.	Over Freq. 2	(0-1)	1:		

		0: Disable 1: Enable	Enable		
28.	Over Freq. 2 Set	(0-200)%	107%	Trip	
29.	Over Freq. 2 Delay	(0-100.0S	3.0S		
30.	Over Freq. 3	(0-1) 0: Disable 1: Enable	0: Disable		
31.	Over Freq. 3 Set	(0-200)%	110%	Trip	
32.	Over Freq. 3 Delay	(0-100.0S	1.0S		
33.	Under Freq. 1	(0-1) 0: Disable 1: Enable	1: Enable		
34.	Under Freq. 1 Set	(0-200)%	95%	Warn	
35.	Under Freq. 1 Delay	(0-100.0S	5.0S		
36.	Under Freq. 2	(0-1) 0: Disable 1: Enable	1: Enable		
37.	Under Freq. 2 Set	(0-200)%	93%	Trip	
38.	Under Freq. 2 Delay	(0-200)%	3.0S		
39.	Under Freq. 3	(0-1) 0: Disable 1: Enable	0: Disable		
40.	Under Freq. 3 Set	(0-200)%	90%	Trip	
41.	Under Freq. 3 Delay	(0-200)%	1.0S		

9.4 GENERATOR LOAD SETTING

NO.	Items	Parameters	Defaults	Alarm Types	Description
Generator Load Setting					
1.	Current Trans.	(5-6000)/5	500		The ratio of external CT
2.	Full Current Rating	(5-6000)A	500		Generator's rated active power.
3.	Rated Active Power	(0-6000)kW	276		Generator's rated reactive power.
4.	Over Current 1	(0-1) 0: Disable 1: Enable	1: Enable		The setting of over current 1.
5.	Over Current 1 Set	(0-200)%	100%	Warn	
6.	Over Current 1 Delay	(0-300.0)S	20.0S		
7.	Over Current 2	(0-1) 0: Disable 1: Enable	1: Enable		The setting of over current 2.
8.	Over Current 2 Set	(0-200)%	110%	Trip	
9.	Over Current 2 Delay	(0-300.0)S	60.0S		
10.	Over Current 3	(0-1) 0: Disable 1: Enable	1: Enable		The setting of over current 3.
11.	Over Current 3 Set	(0-200)%	130%	Trip	
12.	Over Current 3 Delay	(0-300.0)S	30.0S		
13.	Over Current 4	(0-1) 0: Disable 1: Enable	1: Enable		The setting of over current 4.
14.	Over Current 4 Set	(0-200)%	150%	Trip	
15.	Over Current 4 Delay	(0-300.0)S	10.0S		
16.	Over Power 1	(0-1) 0: Disable 1: Enable	1: Enable		Setting value is percentage of generator rated full load power. Delay value can be set.
17.	Over Power 1	(0-200)%	120%	Warn	

NO.	Items	Parameters	Defaults	Alarm Types	Description
	Set				
18.	Over Power 1 Delay	(0-300.0)S	10.0S		
19.	Over Power 2	(0-1) 0: Disable 1: Enable	1: Enable		
20.	Over Power 2 Set	(0-200)%	130%	Trip	
21.	Over Power 2 Delay	(0-300.0)S	5.0S		
22.	Reverse Power 1	(0-1) 0: Disable 1: Enable	1: Enable		
23.	Reverse Power 1 Set	(0-200)%	8%	Warn	
24.	Reverse Power 1 Delay	(0-300.0)S	5.0S		Setting value is percentage of generator rated full load power. Delay value can be set.
25.	Reverse Power 2	(0-1) 0: Disable 1: Enable	1: Enable		
26.	Reverse Power 2 Set	(0-200)%	15%	Trip	
27.	Reverse Power 2 Delay	(0-300.0)S	2.0S		
28.	Unbalanced Current	(0-1) 0: Disable 1: Enable	1: Enable		Setting value is percentage of rated current. Delay value can be set.
29.	Unbalanced Current Set	(0-200)%	20%	Warn	
30.	Unbalanced Current Delay	(0-300.0)S	5.0S		
31.	Loss of Excitation	(0-1) 0: Disable 1: Enable	1: Enable		
32.	Loss of Excitation Set	(0-200)%	20%	Warn	Setting value is percentage of rated voltage. Delay value can be set.
33.	Loss of Excitation Delay	(0-300.0)S	10.0S		
34.	Heavy	(0-1000)kW	100		The request power setting of

NO.	Items	Parameters	Defaults	Alarm Types	Description
	Consumer 1 Request Power				Heavy Consumer 1.
35.	Heavy Consumer 1 Rated Power	(0-1000)kW	60		The rated power setting of Heavy Consumer 1.
36.	Heavy Consumer 2 Request Power	(0-1000)kW	100		The request power setting of Heavy Consumer 2.
37.	Heavy Consumer 2 Rated Power	(0-1000)kW	60		The rated power setting of Heavy Consumer 2.
38.	Heavy Consumer 3 Request Power	(0-1000)kW	100		The request power setting of Heavy Consumer 3.
39.	Heavy Consumer 3 Rated Power	(0-1000)kW	60		The rated power setting of Heavy Consumer 3.
40.	NEL 1 Trip	(0-1) 0: Disable 1: Enable	1: Enable	Warn	NEL 1 trip is active when the active power has exceeded the set value.
41.	NEL 1 Over Power	(0-200)%	100%		
42.	NEL 1 Trip Delay	(0.1~999.9)s	5.0		
43.	NEL 2 Trip	(0-1) 0: Disable 1: Enable	1: Enable	Warn	NEL 2 trip is active when the active power has exceeded the set value.
44.	NEL 2 Over Power	(0-200)%	100%		
45.	NEL 2 Trip Delay	(0.1~999.9)s	8.0		
46.	NEL 3 Trip	(0-1) 0: Disable 1: Enable	1: Enable	Warn	NEL 3 trip is active when the active power has exceeded the set value.
47.	NEL 3 Over Power	(0-200)%	100%		
48.	NEL 3 Trip Delay	(0.1~999.9)s	10.0		

10.5 SWITCH SETTING

NO.	Items	Parameters	Defaults	Description
Switch Setting				
1	Close Time	(0-20.0)s	5.0	Pulse width of switch on. When it is 0, means output constantly.
2	Open Time	(0-20.0)s	5.0	Pulse width of switch off.

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.

10.6 MODULE SETTING

NO.	Items	Parameters	Defaults	Description
Module Setting				
1.	Power on Mode	(0-1)	0	0：Semi-auto Mode； 1：Auto Mode
2.	Module Address	(1-254)	1	Controller's address during remote sensing.
3.	Language	(0-1)	0	0: Simplified Chinese 1: English
4.	Password	(0-9999)	00318	For entering advanced parameters setting.
5.	Start Mode	(0-2)	0	0：Cyclic start; 1：Linear start; 2：Running hours
6.	Power Supply Rated Voltage	(0-50.0)V	24.0	To offer standards for detecting of generator' over/under voltage.
7.	Power Supply Over Voltage	(0-200)%	130%	To offer standards for detecting of generator' over voltage.
8.	Power Supply Under Voltage	(0-200)%	80%	To offer standards for detecting of generator' under voltage.
9.	Expand DIN 1	(0-1) 0：Disable 1：Enable	0：Disable	Used for expansion connect DIN module 1 when the HMC6 input ports are used out.
10.	Alarm Delay	(0.1~999.9)s	5.0	
11.	Expand DIN 2	(0-1) 0：Disable 1：Enable	0：Disable	Used for expansion connect DIN module 2 when the HMC6 input ports are used out.
12.	Alarm Delay	(0.1~999.9)s	5.0	
13.	Expand DOUT 1	(0-1) 0：Disable 1：Enable	0：Disable	Used for expansion connect DOUT module 1 when the HMC6 output ports are used out.
14.	Alarm Delay	(0.1~999.9)s	5.0	
15.	Expand DOUT 2	(0-1) 0：Disable 1：Enable	0：Disable	Used for expansion connect DOUT module 2 when the HMC6 output ports are used out.
16.	Alarm Delay	(0.1~999.9)s	5.0	
17.	Expand LED 1	(0-1) 0：Disable 1：Enable	0：Disable	Used for expansion connect LED module 1 when the HMC6 LED lamps are used out.
18.	Alarm Delay	(0.1~999.9)s	5.0	
19.	Expand LED 2	(0-1) 0：Disable	0：Disable	Used for expansion connect LED module 2 when the HMC6 LED lamps

NO.	Items	Parameters	Defaults	Description
		1：Enable		are used out.
20.	Alarm Delay	(0.1~999.9)s	5.0	

10.7 FLEXIBLE INPUT PORTS

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

NO.	Items	Parameters	Defaults	Description
Input Port				
Input Port 1				
1.	Contents Setting	Fixed	Fixed	Close input
2.	Active Type	(0-1)	0	0: Closed to active 1: Open to active
Input Port 2				
3.	Contents Setting	Fixed	Fixed	Engine Run
4.	Active Type	(0-1)	0	0: Closed to active 1: Open to active
Input Port 3				
5.	Contents Setting	Fixed	Fixed	Manuel Mode
6.	Active Type	(0-1)	0	0: Closed to active 1: Open to active
Input Port 4				
7.	Contents Setting	Fixed	Fixed	Engine fault input
8.	Active Type	(0-1)	0	0: Closed to active 1: Open to active
Flexible Input Port 1				
9.	Contents Setting	(0-50)	0	Not used
10.	Active Type	(0-1)	0	0: Closed to active 1: Open to active
Flexible Input Port 2				
11.	Contents Setting	(0-50)	0	Not used
12.	Active Type	(0-1)	0	0: Closed to active 1: Open to active
Flexible Input Port 3				
13.	Contents Setting	(0-50)	0	Not used
14.	Active Type	(0-1)	0	0: Closed to active

NO.	Items	Parameters	Defaults	Description
				1: Open to active
Flexible Input Port 4				
15.	Contents Setting	(0-50)	0	Not used
16.	Active Type	(0-1)	0	0: Closed to active 1: Open to active
Flexible Input Port 5				
17.	Contents Setting	(0-50)	0	Not used
18.	Active Type	(0-1)	0	0: Closed to active 1: Open to active

INPUT PORT FUNCTION LIST

NO.	Type	Description	AUTO MODE	Semi-auto Mode	Manual Mode
0	Not Used	Invalid	X	X	X
1.	Custom Function	0：Block 1：Warn 2：Trip 3：Trip and Stop Input ports names can be downloaded into controller after defined using utility software or PC software.	●	●	●
2.	Speed Raise Input	Raise speed relay is active and GOV output raise speed signal when the input is active.	X	X	●
3.	Speed Drop Input	Drop speed relay is active and GOV output drop speed signal when the input is active.	X	X	●
4.	Volt Raise Input	Raise voltage relay is active and AVR output raise voltage signal when the input is active.	X	X	●
5.	Volt Drop Input	Drop Voltage relay is active and AVR output drop voltage signal when the input is active.	X	X	●
6.	HC 1 Inquirer	Heavy consumer 1 request. Acknowledge signal is initiated if the requirements are satisfied.	●	●	X
7.	HC 1 Feedback	After breaker closing, feedback signal is send to controller to ensure the HC1 has loaded.	●	●	X

8.	HC 2 Inquirer	Heavy consumer 2 request. Acknowledge signal is initiated if the requirements are satisfied.	●	●	X
9.	HC 2 Feedback	After breaker closing, feedback signal is send to controller to ensure the HC2 has loaded.	●	●	X
10.	HC 3 Inquirer	Heavy consumer 3 request. Acknowledge signal is initiated if the requirements are satisfied.	●	●	X
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	Only display but active when there is alarm occurs.	●	●	●
14.	Alarm Mute	Mute the panel buzzer.	●	●	●
15.	Alarm Reset	Reset alarm	●	●	●
16.	Alarm Ack	Acknowledge the current alarm.	●	●	●
17.	Lamp Test	Test all the LED lights.	●	●	●
18.	Light Load Input	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 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	X	●	X

		synchronized automatically when the input is active.			
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 Go	The signal output when the preparation work is done. If the function is selected, the engine will be started when the input is active.	●	●	X
31.	Remote Mode	The signal output when the controller is in remote mode. The engine is remote control status when the input is active.	●	●	X
32.	Open Breaker	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 Input	Simulate adjust voltage/frequency input is active only when the input port is active.	X	●	X
34~49	Reserved	Reserved			

10.8 OUTPUT PORT SETTING

NO.	Items	Parameters	Defaults	Description
Output Port				
Output Port 1				
1	Contents Setting	Fixed		Raise speed output
2	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Output Port 2				
3	Contents Setting	Fixed		Drop speed output
4	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Output Port 3				
5	Contents Setting	Fixed		Raise voltage output
6	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Output Port 4				
7	Contents Setting	Fixed		Drop voltage output
8	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Output Port 5				
9	Contents Setting	Fixed		Engine start
10	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Output Port 6				
11	Contents Setting	Fixed		Engine stop
12	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Output Port 7				
13	Contents Setting	Fixed	52	Close Gen output
14	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Output Port 8				
15	Contents Setting	Fixed	53	Open Gen output
16	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Output Port 9				
17	Contents Setting	Fixed	4	Audible alarm output
18	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Flexible Output Port 1				
19	Contents Setting	(0-100)	0	Not used
20	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Flexible Output Port 2				
21	Contents Setting	(0-100)	0	Not used
22	Active Type	(0-1)	0	0:Normally open; 1:Normally close

NO.	Items	Parameters	Defaults	Description
Flexible Output Port 3				
23	Contents Setting	(0-100)	0	Not used
24	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Flexible Output Port 4				
25	Contents Setting	(0-100)	0	Not used
26	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Flexible Output Port 5				
27	Contents Setting	(0-100)	0	Not used
28	Active Type	(0-1)	0	0:Normally open; 1:Normally close
Flexible Output Port 6				
29	Contents Setting	(0-100)	0	Not used
30	Active Type	(0-1)	0	0:Normally open; 1:Normally close

OUTPUT PORT FUNCTION LIST

NO.	Type	Description	Remarks
0	Not used	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 Output	Active when the close generator requirements are reached.	
6	Open Gen Output	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 Warn	Active when genset common warning alarm occurs.	
10	Common Trip	Active when genset common trips alarm occurs.	
11	Common Trip and Stop	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 Supply Overvolt	Active when the power supply voltage has exceeded the set value.	
15	Power Supply Undervolt	Active when the power supply voltage has fallen below the set value.	
16	Digital Input 1 Active	Active when input port 1 is active	

17	Digital Input 2 Active	Active when input port 2 is active	
18	Digital Input 3 Active	Active when input port 3 is active	
19	Digital Input 4 Active	Active when input port 4 is active	
20	Digital Input 5 Active	Active when input port 5 is active	
21	Digital Input 6 Active	Active when input port 6 is active	
22	Reserved		
23	Reserved		
24	Reserved		
25	Reserved		
26	Gen Overfreq 1	Active when the generator over frequency 1 alarm occurs.	
27	Gen Overfreq 2	Active when the generator over frequency 2 alarm occurs.	
28	Gen Overfreq 3	Active when the generator over frequency 3 alarm occurs.	
29	Gen Overvolt 1	Active when the generator over voltage 1 alarm occurs.	
30	Gen Overvolt 2	Active when the generator over voltage 2 alarm occurs.	
31	Gen Underfreq 1	Active when the generator under frequency 1 alarm occurs.	
32	Gen Underfreq 2	Active when the generator under frequency 2 alarm occurs.	
33	Gen Underfreq 3	Active when the generator under frequency 3 alarm occurs.	
34	Gen Undervolt 1	Active when the generator under voltage 1 alarm occurs.	
35	Gen Undervolt 2	Active when the generator under voltage 2 alarm occurs.	
36	Gen Undervolt 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 Overfreq 1	Active when the busbar over frequency 1 alarm occurs.	
40	Busbar Overfreq 2	Active when the busbar over frequency 2 alarm occurs.	
41	Busbar Overfreq 3	Active when the busbar over frequency 3 alarm occurs.	
42	Busbar Underfreq 1	Active when the Busbar under frequency 1	

		alarm occurs.	
43	Busbar Underfreq 2	Active when the Busbar under frequency 2 alarm occurs.	
44	Busbar Underfreq 3	Active when the Busbar under frequency 3 alarm occurs.	
45	Busbar Overvolt 1	Active when the Busbar over voltage 1 alarm occurs.	
46	Busbar Overvolt 2	Active when the Busbar over voltage 2 alarm occurs.	
47	Busbar Overvolt 3	Active when the Busbar over voltage 3 alarm occurs.	
48	Busbar Undervolt 1	Active when the Busbar under voltage 1 alarm occurs.	
49	Busbar Undervolt 2	Active when the Busbar under voltage 2 alarm occurs.	
50	Busbar Undervolt 3	Active when the Busbar under voltage 3 alarm occurs.	
51	Over Power 1	Active when controller detects generator over power occurs.	
52	Over Power 2	Active when controller detects generator over power 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	HC1 ACK Output	Active when the starting power requirement of heavy consumer 1 is satisfied.	
64	HC2 ACK Output	Active when the starting power requirement of heavy consumer 2 is satisfied.	
65	HC3 ACK Output	Active when the starting power requirement of heavy consumer 3 is satisfied.	
66	Fail 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 NEL 1 trip occurs.	
72	NEL 2 Trip	Active when NEL 2 trip occurs.	
73	NEL 3 Trip	Active when NEL 3 trip occurs.	
74	Engine Fault	Active when engine fault signal is output.	
75	Crank Success	Active when the generator voltage and frequency have reached the requirement.	
76~ 100	Reserved	Reserved	

10.9 SYNC SETTING

NO.	Items	Parameters	Defaults	Description
Sync Setting -Basic				
1	Dead Bus Volt	(10-50)V	30	It is considered Bus no power when Bus voltage is lower than dead Bus voltage.
2	Voltage Difference	(0-20)V	3	It is considered voltage synchronization when the voltage difference between Generator and Bus is lower than synchronization voltage difference.
3	Positive Freq Difference	(0-2.0)Hz	0.2	It is considered frequency synchronization when the frequency difference between Generator and Bus is less than Check Up Freq but more than Check Low Freq .
4	Negative Freq Difference	(0-2.0)Hz	0.1	
5	Phase Angle Difference	(0-20)°	10	It is considered Phase Angle Sync when the initial phase difference is lower than synchronization phase difference.
6	Slip Frequency	(0-1.00)Hz	0.10	Adjust generator frequency and enable it greater than Bus frequency.
7	MSC ID	(0-16)	1	It is the ID mark of the MSC communication internet. All the MSC ID should be unique.
8	MSC Priority	(0-16)	1	Smaller values represent higher priorities.
9	Full kW rating	(0-20000)kW	276	Genset full load active power.
10	Full kVar rating	(0-20000)kvar	210	Genset full load reactive power.
11	Baud Rate	(0-2)	1	0：125kbps；1：250kbps； 2：3755kbps；
12	Scheduled Run PCT	(0-100)%	80	Schedule the load value of other genset when start on demand.
13	Scheduled Stop PCT	(0-100)%	20	Schedule the load value of other genset when start on demand.
14	Load Ramp Rate	(0-100.0)%	3.0	Speed rate(%/s) of genset upload/unload
15	Fixed output kW PCT	(0-100)%	30%	It is the active power and rated power percentage when the fixed power mode is active.
16	Fixed output Power Factor	(0-1.00)	0.80	It is the power factor target when the fixed power mode is active.
17	Starting Options	(0-2)	1	0：Linear Start；1：Cycle Start；

NO.	Items	Parameters	Defaults	Description
				2：Duty Time Start
18	Duty Time Set	(1-1000.0)h	5.0	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.
19	Running Mode	(0-1)	0	0：Load Sharing；1：Fixed Power Output
20	Sync Options	(0-1)	0	0：Dynamic synchronizing；1：Static synchronizing
21	Fail to Sync Delay	(5-300)s	60	When the controller detects no Sync signal during the preset delay, it will send corresponding alarm signal according to the action type.
22	FREQ IN	(1-100)%	10	The frequency range of FREQ IN accounts for -10%~10% of rated range.
23	FREQ IN Active Power	(1-100)%	50	The active power of FREQ IN accounts for 1%~50% of rated power.
24	FREQ IN Minimum Value	(-10~+10) V	-10V	The minimum active power of FREQ IN accounts for 1% of rated power, and it is -10V.
25	FREQ IN Maximum Value	(-10~+10) V	+10V	The minimum active power of FREQ IN accounts for 100% of rated power, and it is 10V.
26	VOLT IN	(1-100)%	10	The reactive power of VOLT IN accounts for -10%~10% of rated power.
27	VOLT IN Reactive Power	(1-100)%	50	The reactive power of VOLT IN accounts for 1%~50% of rated active power.
28	VOLT IN Minimum Value	(-10~+10) V	-10V	The minimum active power of VOLT IN accounts for 1% of rated power, and it is -10V.
29	VOLT IN Maximum Value	(-10~+10) V	+10V	The minimum active power of VOLT IN accounts for 100% of rated power, and it is 10V.
Sync Setting - GOV				
1	Output Type	(0-1)	1	0：Internal Relays；1：Internal Analogue
2	Output Reverse	(0-1)	0	0：Disable；1：Enable.
3	Action	(0-2)	1	0：None；1：Adjust to Rated Frequency；2：Adjust to Center Point
4	Center Voltage	(0-10.0)	0	Default central voltage: 0V.

NO.	Items	Parameters	Defaults	Description
	SW1			
5	Voltage Range SW2	(0-10.0)	2.0	Default volt. range: (-2.5~+2.5)V
6	Sync Gain	(0-100)	20	Adjust and control before paralleling.
7	Sync Stability	(0-100)	20	Adjust and control before paralleling.
8	Load Gain	(0-100)	20	Adjust and control after paralleling.
9	Load Stability	(0-100)	20	Adjust and control after paralleling.
Sync Setting - AVR				
1	Output Type	(0-1)	1	0: None 1：Internal Relays；2：Internal Analogue
2	Output Reverse	(0-1)	0	0：Disable；1：Enable.
3	Action	(0-2)	1	0：None；1：Adjust to Rated Frequency；2：Adjust to Center Point
4	Center Voltage SW1	(0-10.0)	0	Default central voltage: 0V.
5	Voltage Range SW2	(0-10.0)	2.0	Default volt. range: (-2.5~+2.5)V
6	Sync Gain	(0-100)	20	Adjust and control before paralleling.
7	Sync Stability	(0-100)	20	Adjust and control before paralleling.
8	Load Gain	(0-100)	20	Adjust and control after paralleling.

10 COMMISSIONING

STEP 1. SINGLE UNIT DEBUGGING

1) Check the parameter configuration of the controller;

2) 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).

3) Start the genset in semi-auto mode, check if engine and generator data is normal;

4) Start the genset in semi-auto mode, check if switch opens and closes normally;

5) 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);

6) 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)

7) 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;

STEP 2: SEMI-AUTO PARALLEL OPERATION OFF-LOAD

1) Semi-Auto close parallel sets, check that the units synchronization is balanced and breaker close impulse current is not too high;

2) During parallel operation off load, check that there is no high circumfluence on HMC6 current screen;

3) 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.

STEP 3: SEMI-AUTO PARALLEL OPERATION ON-LOAD

1) Semi-Auto close parallel sets, perform on-load test and check if active and reactive power is evenly distributed between all the gensets

2) 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.

3) Semi-Auto close parallel sets, perform ramp off-load test to see if gen-set breaker opens after reaching minimum set value (%);

4) Semi-Auto close parallel sets, perform impact load test and damp load test to check if there is power oscillation

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.

1) Start the genset which has the highest priority or shortest running time according to the start mode.

2) 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.

3) After the genset has started up, synchronization, parallel and share load process will beginning.

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

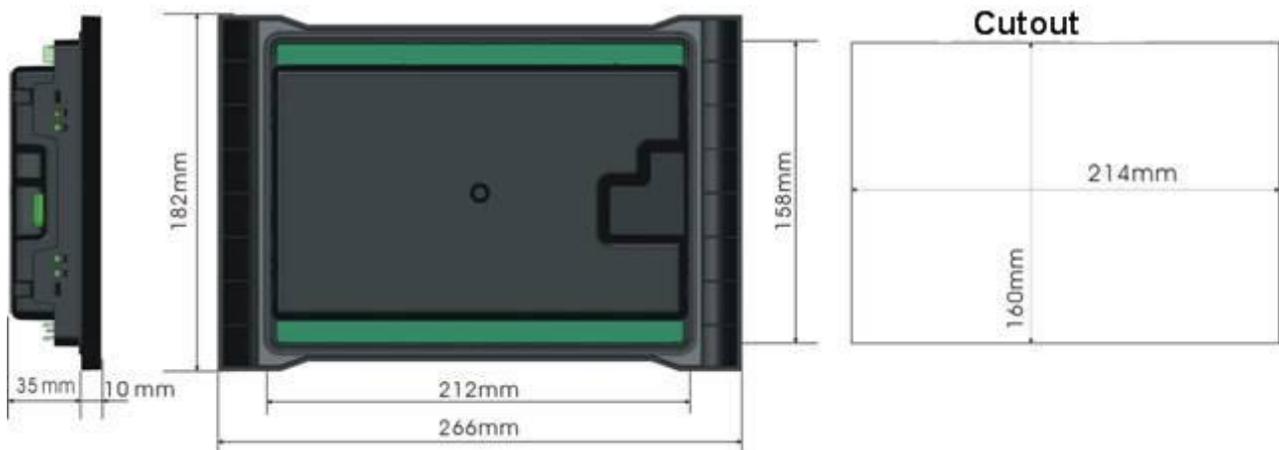HMC6 multi-set typical application diagram
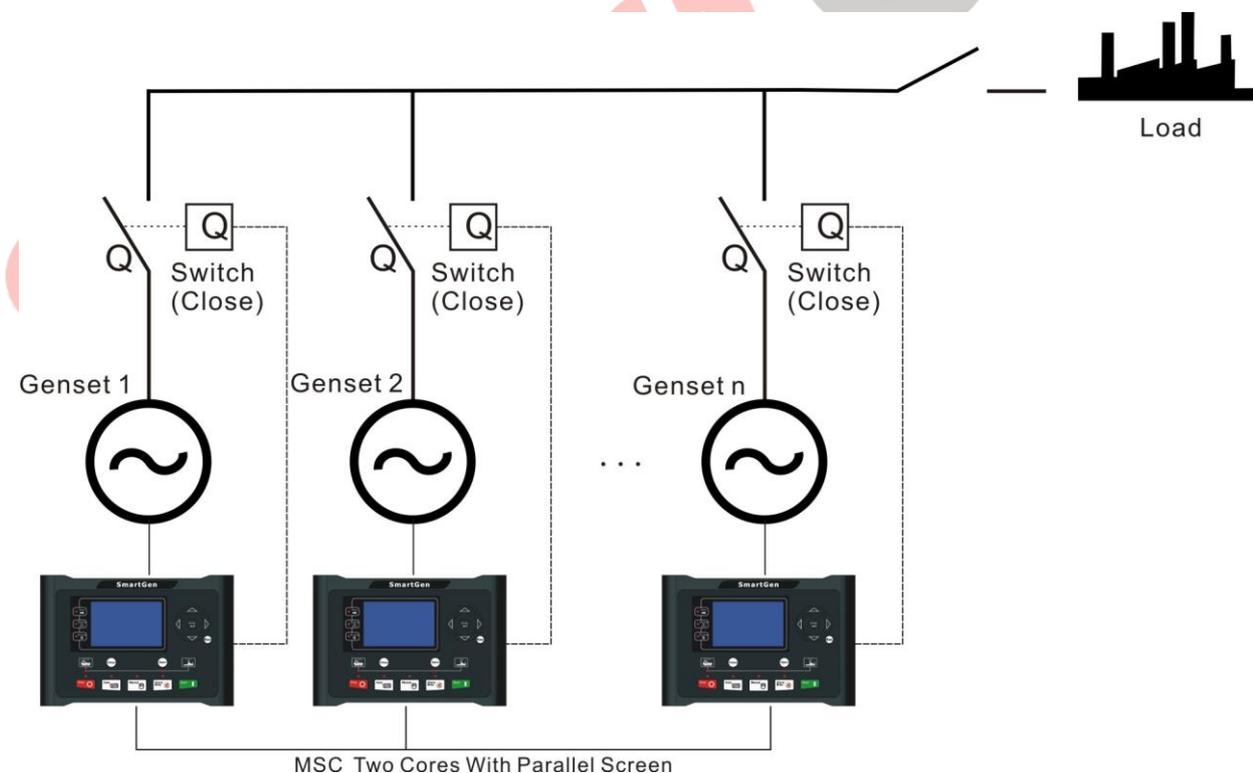
HMC6 Single Unit Typical Application Diagram
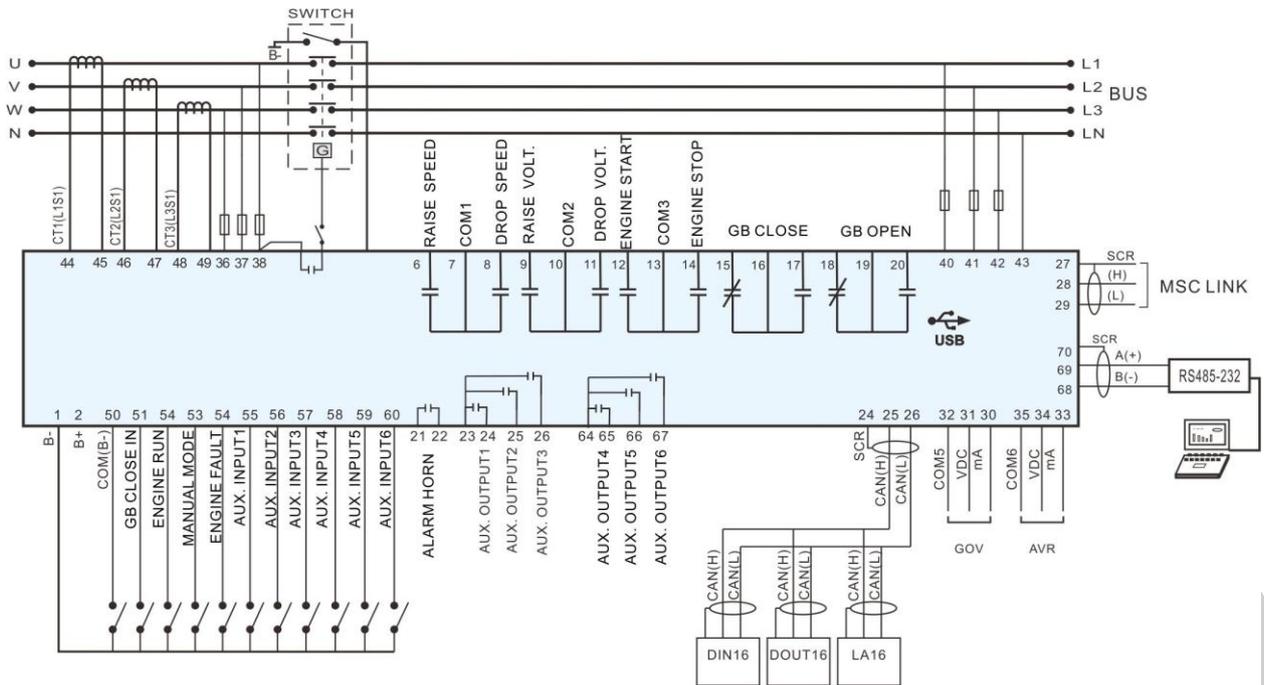
11 INSTALLATION

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,

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.

12 FAULT FINDING

Symptoms	Possible Solutions
Controller no response with power.	Check starting batteries; Check controller connection wirings; Check DC fuse.
Genset shutdown	Check auxiliary input port; Check the alarm information on LCD.
Shutdown Alarm in running	Check related switch and its connections according to the information on LCD;
Genset running while ATS not transfer	Check ATS; Check the connections between ATS and controllers.
MSC modules too few	Check MSC LINK communications.
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.