Operation manual

and

installation instructions

ENGLISH

Inverter - Battery charger

COMBI1512

COMBI1524

COMBI3012

COMBI3024

Combi-Gamma

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This product conforms to the EEC Directive requirements
89/336/EEC (EMC):
EN61000-6-3: 2001, EN61000-6-1: 2001, EN61000-4-2: 1995 + A1:1998 + A2:2000,
EN61000-4-3: 2002, EN61000-4-4: 1995 + A1: 2000, EN61000-4-6: 1996 + A1: 2000
EN55022: 1998, Class B (CISPR 22: 1993 + A1: 1995 + A2: 1996, Class B

73/23/EEC (Low voltage directive): EN60335-1.

Introduction

General

- Multi-functional Feature

  The “Combi-Gamma” is a powerful true sine wave inverter, a sophisticated battery charger that features adaptive charge technology and a high-speed AC Auto Transfer Switch (ATS) in a single compact enclosure. Besides these primary functions, however, the Combi-Gamma has several advanced features that provide a range of new applications as outlined below:

- Uninterrupted AC Power

  In the event of a grid failure, or shore or generator power being disconnected, the inverter within the Combi-Gamma is automatically activated and takes over supply to the connected loads. This happens so fast (less than 10 milliseconds) that computers and other electronic equipment will continue to operate without disruption.

- Parallel Operation

  Virtually unlimited power thanks to parallel operation up to 5 units can operate in parallel to achieve higher power output. Five COMBI3024 units, for example, provide 15kW of output power with 350A charging capacity.

- Three Phase Capability

  In addition to parallel connection, three units of the same model can be configured for three-phase output. But that’s not all: up to five sets of three units can be parallel connected for a huge 45kW inverter and 1050A charger!

- Power Control-Dealing with limited generator or shore connection

  The “Combi-Gamma” is a very powerful battery charger. It will therefore draw a lot of current from the generator or shore connection. A maximum generator or shore current can be set (B2-05). The “Combi-Gamma” will then take account of other AC loads and use whatever is extra for charging thus preventing the generator or shore supply from overload.

- Load Support-boosting the capacity of shore or generator power

  This feature takes the principle of Power Control to a further dimension allowing the “Combi-Gamma” to supplement the capacity of the alternative source. Where peak power is so often required only for a limited period; it is possible to reduce the size of generator needed or conversely enable more to be achieved from typically limited shore connection. When the load reduces, the spare power is used to recharge the battery.

Battery Charger

- Adaptive 4-stage charge characteristic: Bulk-Absorption-Float-Equalize

  The “Combi-Gamma” features a microprocessor controlled “adaptive” battery management system that can be preset to suit different types of batteries. The “adaptive” feature will automatically optimize the process relative to the way the battery is being used.

- The right amount of charge: Variable Absorption Time

  When only shallow discharges occur (a yacht connected to shore power for example), the absorption time is kept in order to prevent overcharging of the battery. After a deep discharge, the absorption time is automatically increased to make sure that the battery

is completely recharged.

- Preventing damage due to excessive gassing: The Battery Safe Mode

  If, in order to quickly charge a battery, a high charge current in combination with a high absorption voltage has been chosen. The “Combi-Gamma” will prevent damage due to excessive gassing by automatically limiting the rate of voltage increase once the gassing voltage has been reached.

- Less maintenance and aging when the battery is not in use: The Equalize Mode

  The equalize mode kicks in whenever the battery has not been subjected to discharge during 24 hours. In the equalize mode, float voltage is reduced to 2.2V/cell (13.2V for 12V battery) to minimize gassing and corrosion of the positive plate. Once a week, the voltage is raised back to absorption level to “equalize” the battery. This feature prevents stratification of the electrolyte and sulphation, a major cause of early battery failure.

- 2 outputs to charge 2 battery banks

  The “Combi-Gamma” features 2 outputs, of which 1 can carry the full output current. The second output, limited to approximately 4A and with a slightly lower output voltage, is intended to top up a starter battery.

- To increase battery life: Temperature Compensation

  Every “Combi-Gamma” can be equipped with a battery temperature sensor (BTS-3) when connected, charge voltage will automatically decrease with increasing battery temperature. This feature is especially recommended for sealed batteries and/or when important fluctuation of battery temperature is expected.

- Battery Voltage Sense

  In order to compensate for voltage loss due to cable resistance, the “Combi-Gamma” is provided with a voltage sense facility so that the battery always receives the correct charge voltage.

- Extensional Solar Charger

  Combi-Gamma also provides the availability of up to 10 sets of Solar Charger, SunStar-45 or SunStar-60 (optional) to be used with solar panel to charge the battery. Combi-Gamma sends the 4-stage charging command to extensional Solar Charger via port C (Extension Port) for the best quality of solar charging.

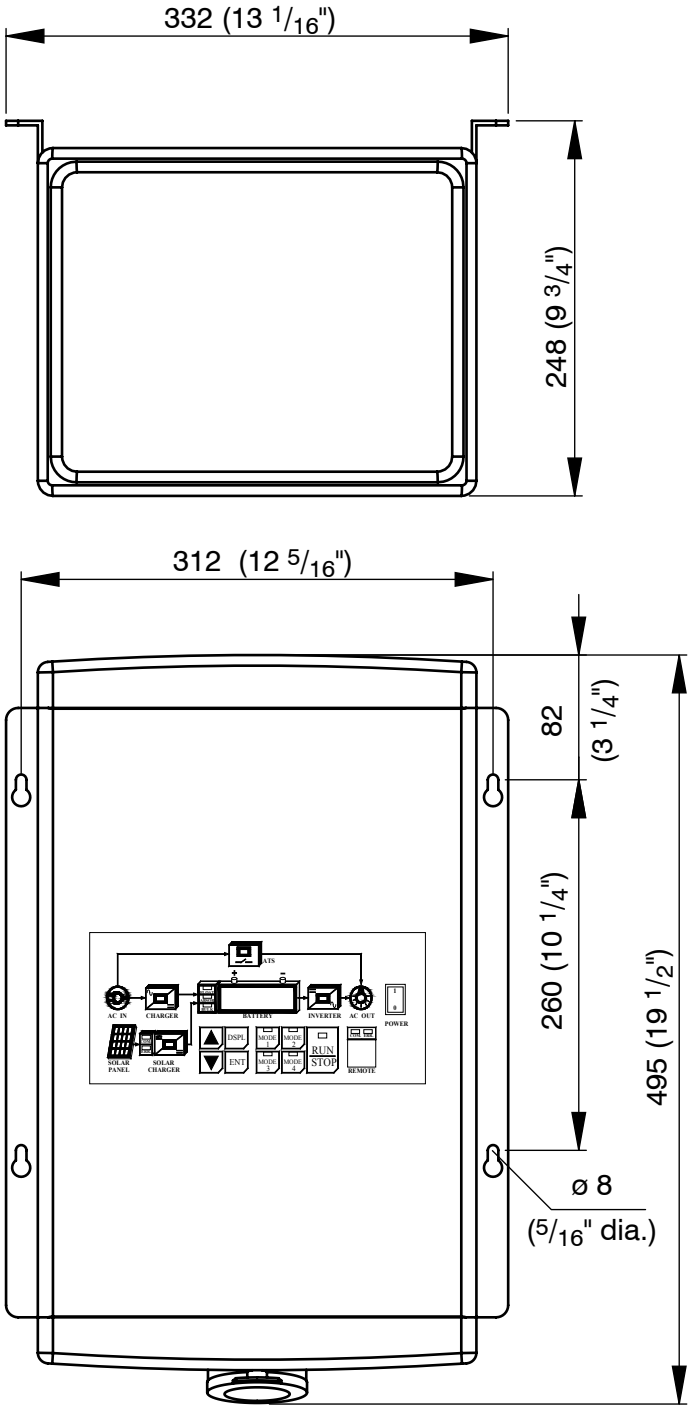
Specification

MODEL	12 Volt System 24 Volt System	COMBI1512 COMBI1524	COMBI3012 COMBI3024
GENERAL			
Ventilation		Forced cooling	Forced cooling
Temperature	– Operation – Storage	– 20°C ~ +70°C – 25°C ~ +80°C	– 20°C ~ +70°C – 25°C ~ +80°C
Protection			
	a. Output short circuit	✓	✓
	b. Over load	✓	✓
	c. Battery voltage too high	✓	✓
	d. Battery voltage too low	✓	✓
	e. DC voltage ripple too high	✓	✓
	f. Temperature Sensor		
	Transformer	✓(105°C)	✓(105°C)
	Electronic & Powerstage	✓(70°C)	✓(70°C)
	BTS-3	✓(50°C)	✓(50°C)
Humidity		0 ~ 95% (non condensing)	0 ~ 95% (non condensing)
Power control Function		✓	✓
Load Support Function		✓	✓
Uninterrupted AC power		✓(less than 10 msec)	✓(less than 10 msec)
Adaptive 4-stage charge		✓	✓
Two output to charge 2 battery banks		✓	✓
Auxiliary Relay		X3	X3
Parallel operation		✓(Max. 5 sets)	✓(Max. 5 sets)
3-phase capacity		✓	✓
Battery voltage sensor		✓	✓
Battery Temperature sensor (BTS-3)		✓	✓
Remote control port		✓	✓
Extension Port (Port C)		✓	✓
INVERTER			
Input Voltage Range (VDC)		9.5 – 16V / 19 – 32V	
Output Voltage (VAC)		185 ~ 240 VAC	
Output Frequency		50Hz /60Hz ± 0.1%	
Output Waveform		Pure sinewave	
Output Voltage THD		< 5%	
Power Factor (All Loads)		✓	
No linger load, crest factor		3: 1	
Cont. Power Output (W) Under 70°C (cosφ=1.0)		1500W (No derate)	3000W (No derate)
Cont. Power Output (W) Over 70°C (cosφ=1.0)		0W (Shutdown)	0W (Shutdown)
Maximum Power (W)		3000W	6000W
Maximum Efficiency (%)		82/84	84/86
Zero-load Power (W)		12W	18W

CHARGER			
Input Voltage Range (VAC)		200 ~ 250 VAC	
Input Frequency		45 – 55Hz / 55-65 Hz	
Power Factor		1	
Charge Characteristic		4-stage adaptive / Bulk-Absorption - Float - Equalize	
Maximum DC Voltage Ripple (Vrms)		< 1.25 V	
Charge Current House Battery (A)		70A / 40A	140A / 70A
Charge Current Starter Battery (A)		4A	
Absorption Voltage Default (VDC)		14.4V / 28.8V	
Float voltage Default (VDC)		13.8V / 27.6V	
Equalize Voltage default (VDC)		13.2V / 26.4V	
Output Charge Voltage (min ~ max)		8V ~ 16V / 11V ~ 32V	
Battery Temperature sensor		BTS - 3	
AC INPUT SWITCH			
AC IN Terminal Circuit Breaker		15A (230V)	15A (220V)
Switch-over Time			
	a. inverter to AC input	0 msec.	
	b. AC input to inverter	0 msec.	
Detection Time AC Input Fault		4 ~ 10 msec.	
Trip Level AC Input to Inverter		180 VAC	
Trip Level Inverter to AC Input		187 VAC	
Min. ~ Max. Frequency Range		45 - 55 Hz / 55-65 Hz	
Mechanical			
Cabinet / Protecting Class		Aluminum / IP20	
Dimension (HXWXD)		495 x 248 x 332 mm	630 x 248 x 332 mm
Weight (kgs)		30 kgs	35 kgs

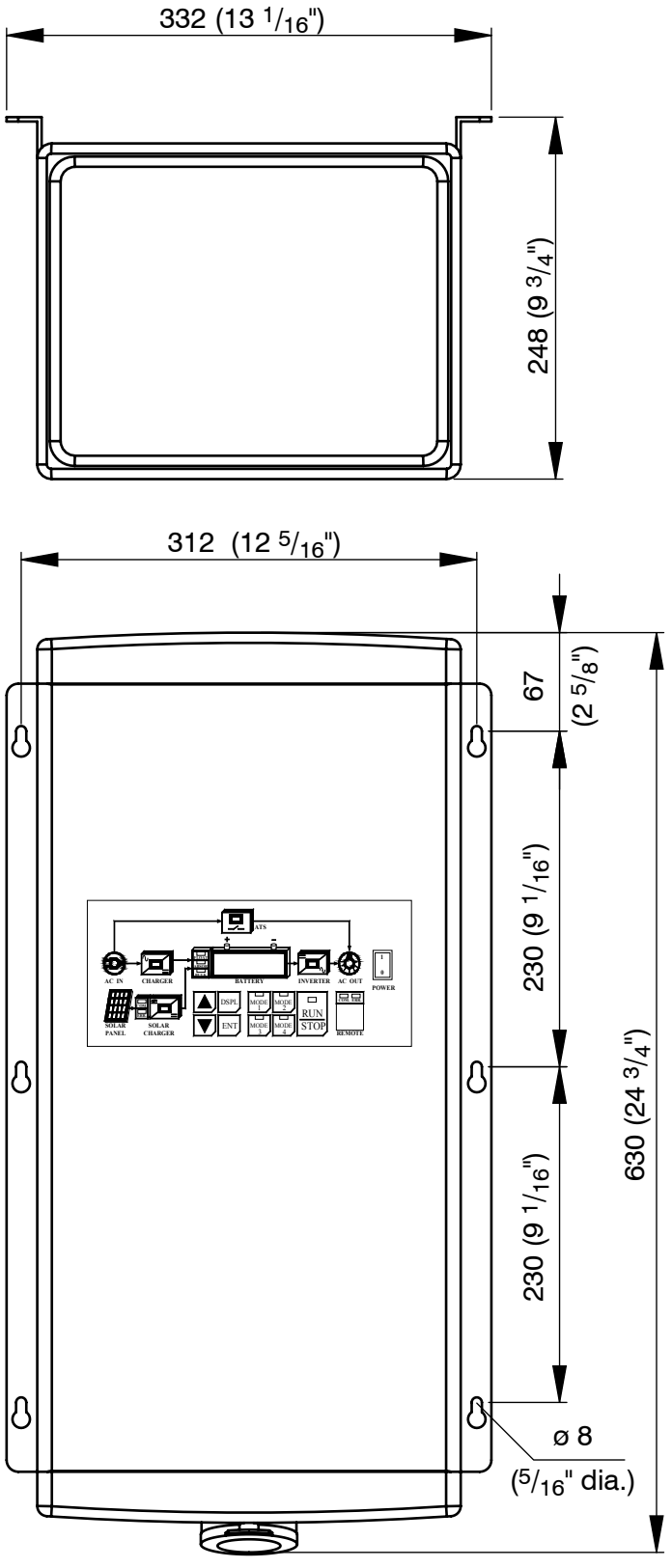
Dimensions

COMBI1512 / COMBI1524 Unit: mm (inches)



COMBI3012 / COMBI3024

Unit: mm (inches)



Chapter 1 Installation

⚠ This product should be installed by a qualified electrician.

1.1 Box Contents

- Combi Gamma
- Box Containing connection items, ie:
  - KTS battery connector(s).
  - CEE-form 230V connector
  - 230VAC AC-in cable with connector.

1.2 Location

The product must be installed in a dry and well-ventilated area, as close as possible to batteries. There should be a clear space of at least 20 cm around the appliance for cooling.

⚠ Excessively high ambient temperature will result in the following

- Reduced service life
- Reduced charge current
- Reduced peak capacity or shutdown of the inverter

Never position the appliance directly above the batteries.

The product is suitable for wall mounting. The back and the bottom of the enclosure has holes for wall mounting purposes, see Page 8 and 9.

The appliance can be mounted horizontally as well as vertically; vertical mounting is preferable. The vertical position offers optimum cooling.

⚠ The interior of the product must remain accessible after installation. Ensure the AC and DC input cables are fitted with fuses and circuit breakers. Try and keep the distance between the product and battery to a minimum in order to minimize cable voltage losses.

⚠ For safety purpose, this product should be installed in a heat-resistant environment if it is used with equipment where a substantial amount of power is to be converted. You should prevent the presence of e.g. chemicals, synthetic components, curtains or textiles, etc. in the immediate vicinity.

1.3 Requirements

- Crimping tool for cable connectors
- 2 or 4 battery cables (max. length 6 meters) Including battery terminals and cable ends.

1.4 Connection of Battery Cables

In order to fully utilize the full capacity of the product, batteries with sufficient capacity and battery cables with sufficient cross section should be used, please see table:

Item \ Model	COMBI1512	COMBI1524	COMBI3012	COMBI3024
Recommended battery capacity (Ah)	200~700	100~400	400~1200	200~700
Recommended cross section (0~6m)	**50 mm²**	**50 mm²**	**2 x 50 mm²**	**50 mm²**

Remark: Internal resistance is the important factor when working with low capacity batteries. Consult your supplier.

If the Combi is equipped with 2 DC connectors COMBI3012, connect both connectors to the battery cables (2 x Red, 2 x Black).

Procedure:

Proceed as follows to connect the battery cables:

Avoid shorting the battery cables.

- Crimp the uninsulated (+)and (-) connector to the battery cables.
- Mount the connectors in the plastic cover.
- Don't reverse the (+) and (-) in the cover. This may cause internal damage!
- Put the complete connector on the contra connector in the box.

The enclosure must be grounded for safety purpose. An earth screw has been fitted at the bottom side of the enclosure.

1.5 Connection of AC Cabling

The shore or the mains (AC IN) cable supplied with the unit must be connected to AC IN connector at the bottom, use the supplied three-wire cable.

Proceed as follows to connect the AC cables.

- The AC output cable can be connected directly to the blue CEE-form connector marked "AC OUT". The corresponding connector for each different country must be connected to the opposite side of the cable.

The current which is switched through to the output (AC OUT) is not fused. External fuses or current limiters have to be installed.

1.6 Optional Connections

A number of operational connections are possible at the black connection box at the bottom of the unit. Please remove the two screw to make them visible:

1.6.1 Second Battery

The “Combi-Gamma” has a connection for charging a starter battery.

For connection, see page 24.

1.6.2 Voltage Sense

Two sense wires may be connected to compensate possible battery cable losses during charging. Use wires of at least 0.75 mm^2. For connection, see page 24.

1.6.3 Battery Temperature Sensor (BTS-3)

The battery temperature sensor supplied with the product may be used for temperature compensated charging, see page 24.

The sensor is insulated and must be mounted on the batteries minus pole.

1.6.4 3 Sets of Auxiliary Relay (RY1, RY2, RY3) Output

The “Combi-Gamma” provides 3 sets of Auxiliary Relays for users to connect to other appliances or to output the alarm signals. 3 sets of relays can be programmed for respective function. (E Group Constants) and can be practically applied which is one of the greatest features.

1.6.5 Parallel Connection

The product can be connected in parallel using several **identical** modules, please see page 27. The batteries must be connected in accordance with page 27.This requires interconnecting the products with the package of a special box, parallel box, to be supplied by factory in conjunction with a connection diagram.

Parallel connection requires compliance with the following conditions:

1. No more than 5 units should be connected in parallel.
2. Only identical models should be connected in parallel.
3. Ensure sufficient battery capacity is available.

   For example : **12V: 20% inverter power** (3000W=600Ah)

   24V :10 % inverter power (3000W=300Ah)
4. Described cable cross sections (between battery and distribution point) must be multiplied with the number of Combi-Gamma to be connected in parallel.
5. Position the Combi-Gamma close to each other but ensure there is adequate clearance for ventilation minimum 20 cm.
6. The optional BTS, voltage sensor and optional remote control panel (RCP) must be connected to Master.
7. The cables for each appliance must be equal in length (AC and DC)

1.6.6 3-Phase Operation

The product can also be used in a 3-phase system, see page 28. The batteries must be connected in accordance with page 26. The following condition conditions should be complied with in the case of 3-1phase operation:

1. Only **identical** models should be used.
2. Ensure sufficient battery capacity is available.
3. Position the products close to each other but ensure there is adequate clearance for ventilation minimum 20 cm.
4. The BTS, voltage sensor should preferably be connected all three units (1 Master unit and 2 Follower units).
5. Only a single remote control can be connected.

1.7 Grounding

When the input voltage of the Combi-Gamma is not switched through, the neutral of “AC OUT” is connected to ground by means of a relay. This function can be disabled by constant B2-07 (B2-07=0 Disconnect)

1.8 Remote Control Panel (RCP-4)

The Combi-Gamma can be operated remotely from remote port with the aid of a remote control panel. For connection of a remote control panel, see page 24.

**Note*: The display panel and operation flow of the remote control panel is exactly the same as the upper-front display panel.

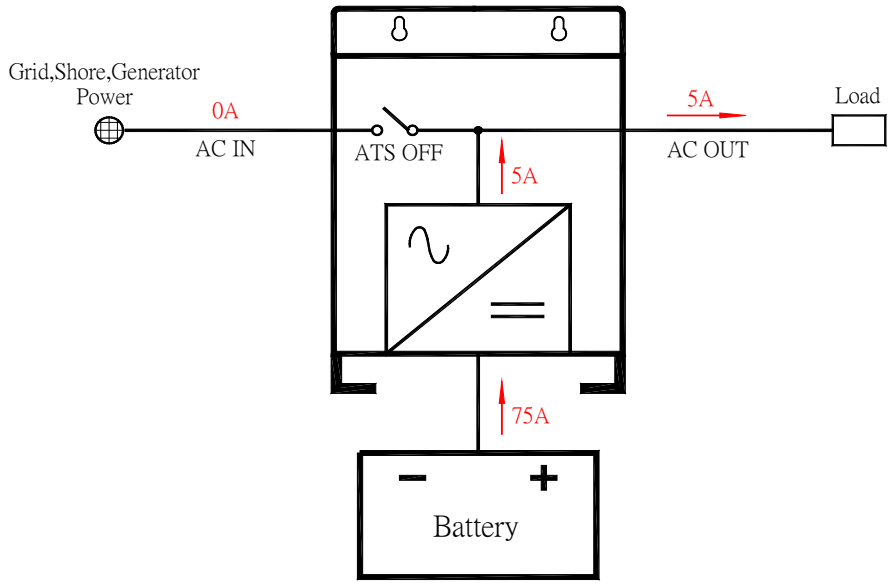
Chapter 2 Settings

2.1 Four Control Modes Applications

MODE 1: AC Power as Priority Support

1. INVERTER Mode:

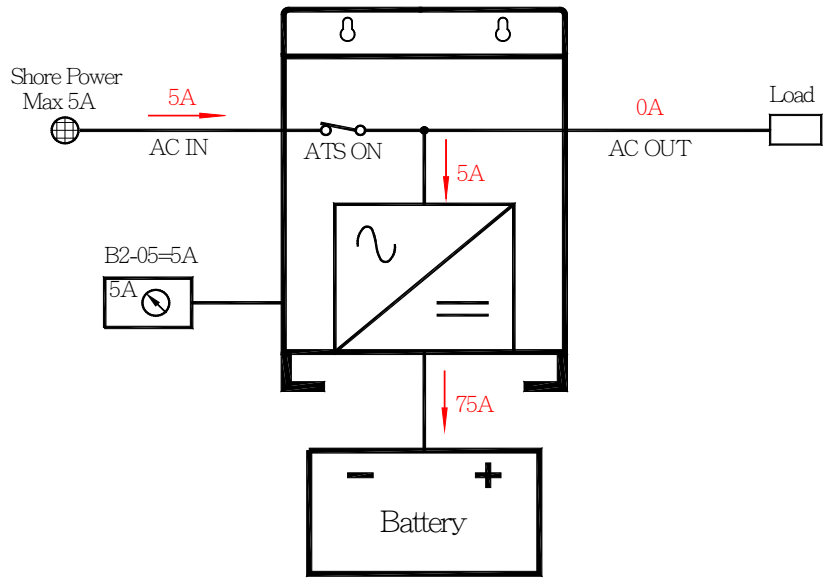
- When AC IN=0 A, AC OUT load is completely supplied by INVERTER. It goes to the inverter mode.



2. Power Control Mode (a)

- In this example:

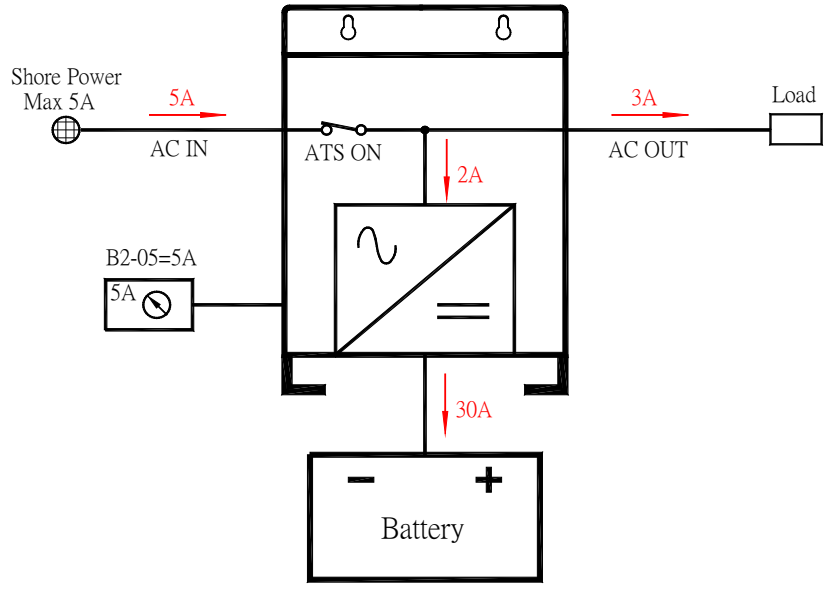
  All AC loads are off, with the “Combi-Gamma” constant B2-05=5A (AC IN Current Limit), the AC CHARGER will not take more than 5A with limits to battery charge current to 75A.



3. Power Control Mode (b)

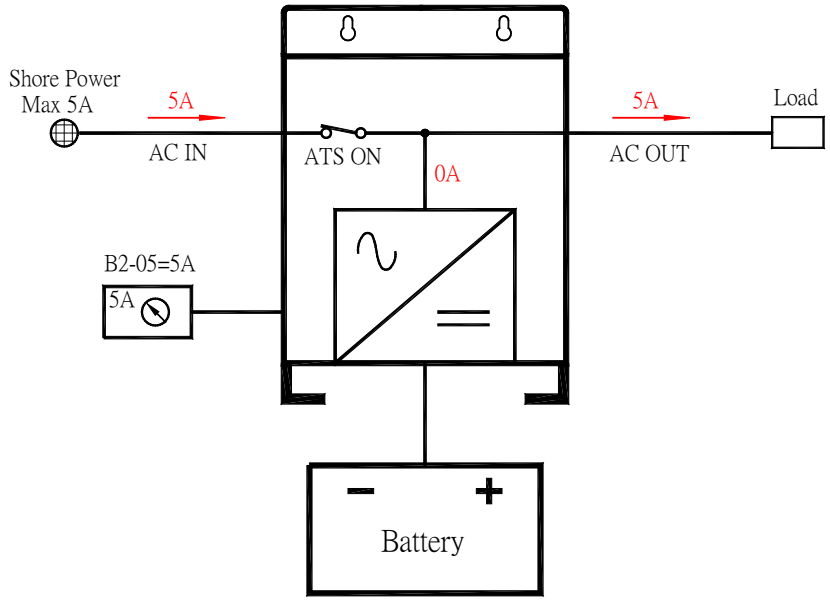
- Now some small loads are switched on and load increase to 3A. Only 5-3=2A is left to charge the batteries and charge current is reduced to about 30A.

  * *Note*: Shore current is automatically limited to 5A and the AC input circuit breaker will not trip!



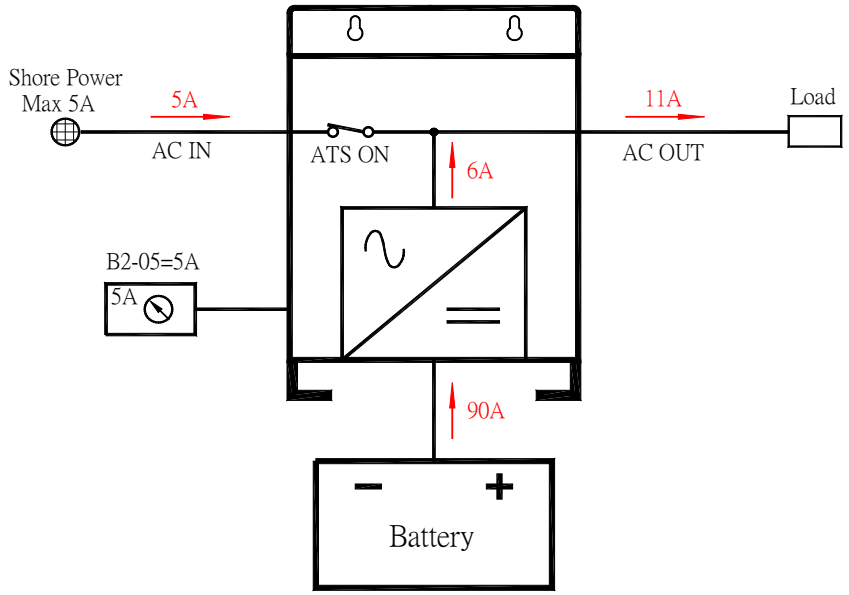
4. Power Control Mode (c)

- The load is switched on and current consumption increase to 5A. Nothing is left to charge the battery.
- The charge current is automatically reduced to 0A, and the AC input circuit breaker does not trip!



5. Load Support Mode

- And now the other load adds and switches on and the current increases to 11A. This is where Load Support is needed.
- The bidirectional converter starts operating as inverter to add 6A to the 5A that is available from the shore-side: Total 6+5=11A, and no overload on the AC supply.
- As soon as the load reduces to less than 5A, any current that is left over will be used to recharge the battery.

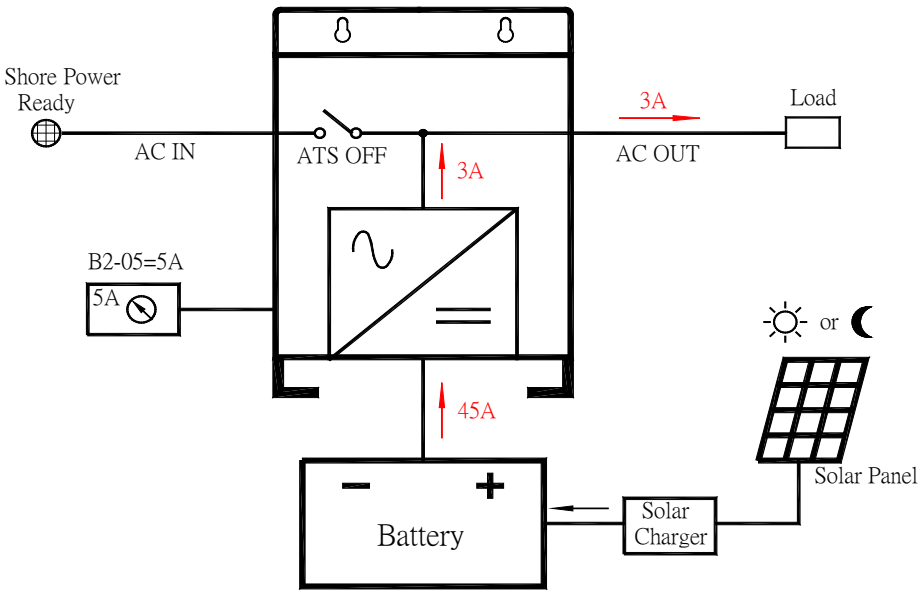


MODE 2: INVERTER as Priority Support

1. INVERTER Mode:

- When the battery voltage is not lower than (B2-10) voltage value, inverter mode takes priority to supply voltage to AC OUT for load consumption.

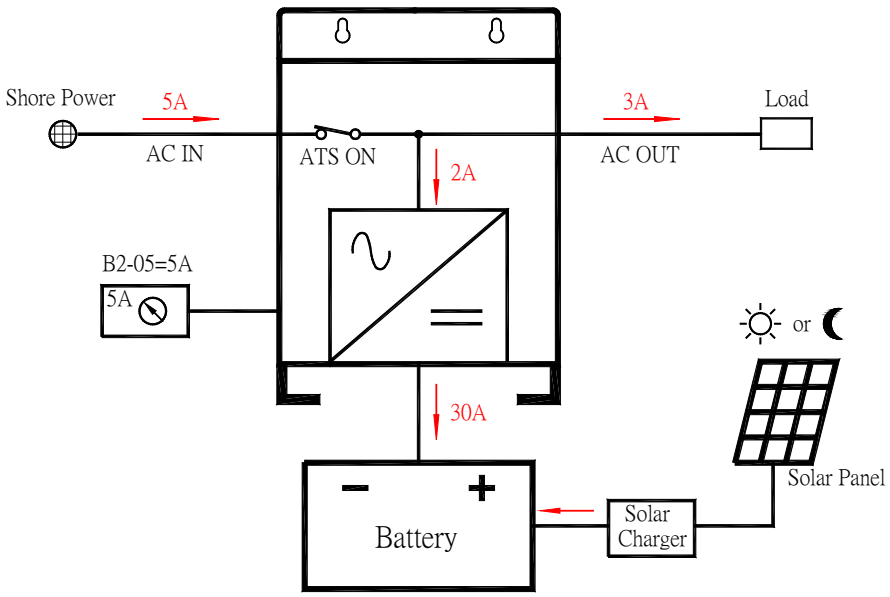
  (INVERTER ON+ ATS OFF + AC CHARGER OFF)



2. Power Control Mode:

- When AC IN power is ready, INVERTER is active and battery is about to be exhausted, battery voltage is lower than B2-10 voltage value and longer than the second time set in B2-11, ATS will be switched on to ensure AC OUT to continuously the load. At the moment, AC OUT will be supplied by AC IN power. At the same time, the power control mode is active and will supply the extra AC IN power to charge the battery!

  (INVERTER OFF + ATS ON + AC CHARGER ON + Power Control Mode ON)

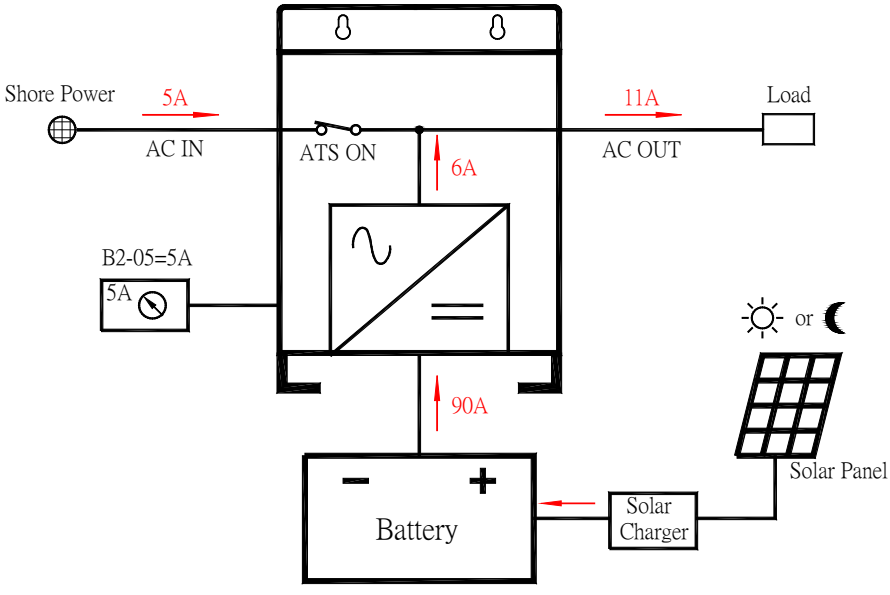


3. Load Support Mode

- And now the other load adds and the current increases to 11A. This is where Load Support function is needed!

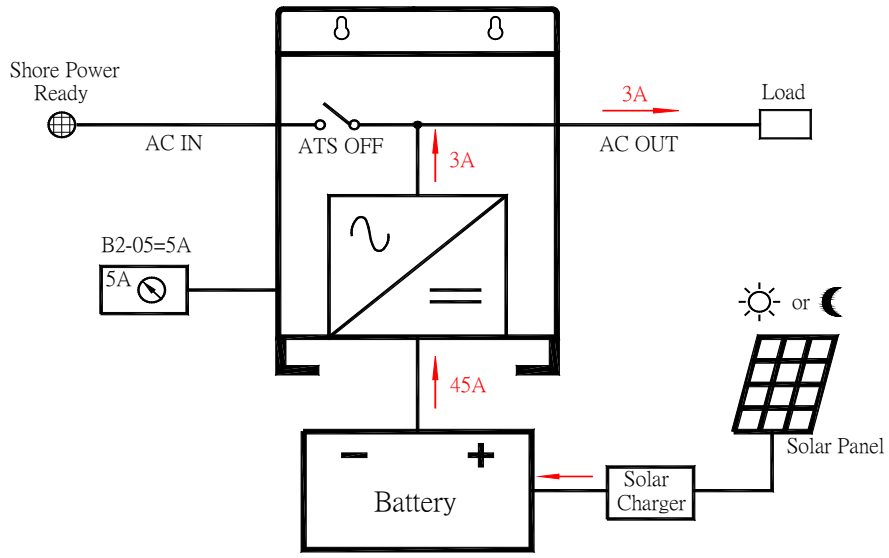
  (ATS ON + AC CHARGER OFF + INVERTER ON + Load Support Mode ON)

- As soon as the load reduces to less than 5A, any current that is left over will be used to recharge the battery.



4. “INVERTER Mode” Repeat

- When the battery voltage is higher than B2-12 voltage value and longer than second time set in B2-15, inverter mode takes priority to supply voltage to AC OUT again for load consumption.

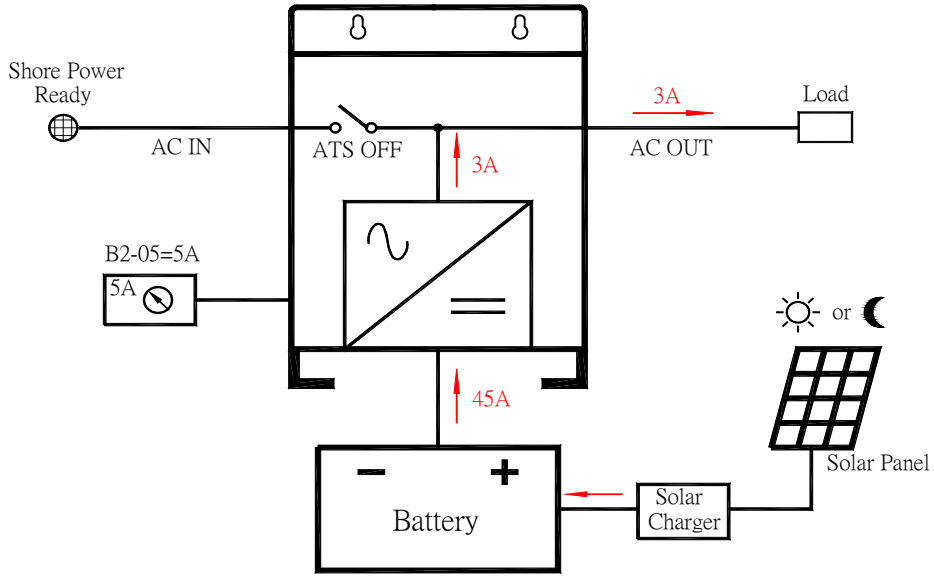


MODE 3: Green Power as Priority Support

1. INVERTER Mode:

- When the battery voltage is not lower than (B2-14) voltage value, inverter mode takes priority to supply voltage to AC OUT for load consumption.

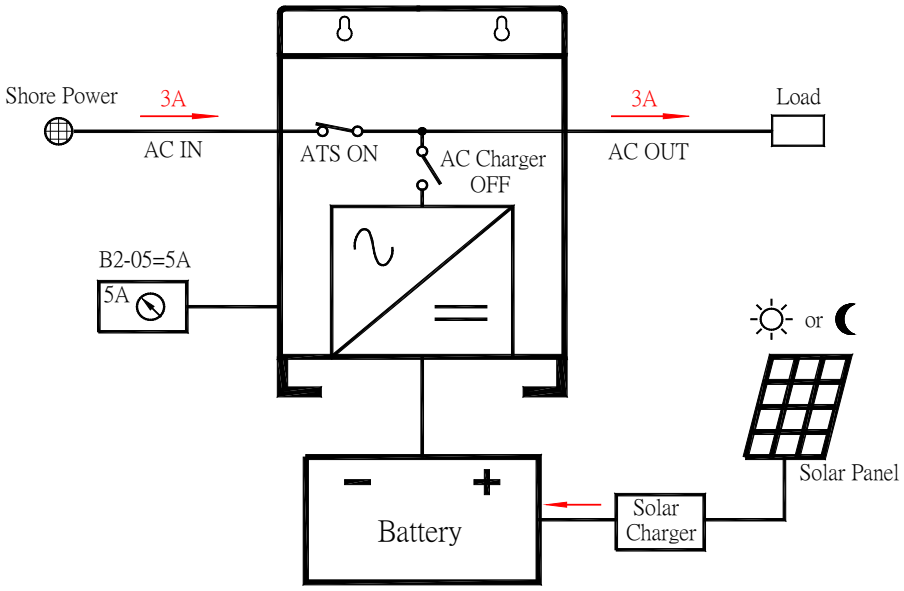
  (INVERTER ON+ ATS OFF + AC CHARGER OFF)



2. Power Control Mode

- When AC IN power is ready, INVERTER is active and battery voltage is lower than B2-14 voltage value and longer than the second time set in B2-15, ATS will be switched on to ensure AC OUT to continuously supply the load. At the moment, AC OUT will be supplied by AC IN power. At the same time, the battery is charged from AC IN power (AC CHARGER OFF) only by other wind charger or DC generator charger.
- The difference between MODE 3 and MODE 2 is that in MODE 3, when AC IN power is ready, AC CHARGER is off and the battery is charged by other renewable energy. This is why MODE 3 is called Green Power as Priority Support Mode

  (INVERTER OFF+ ATS ON + AC CHARGER OFF)

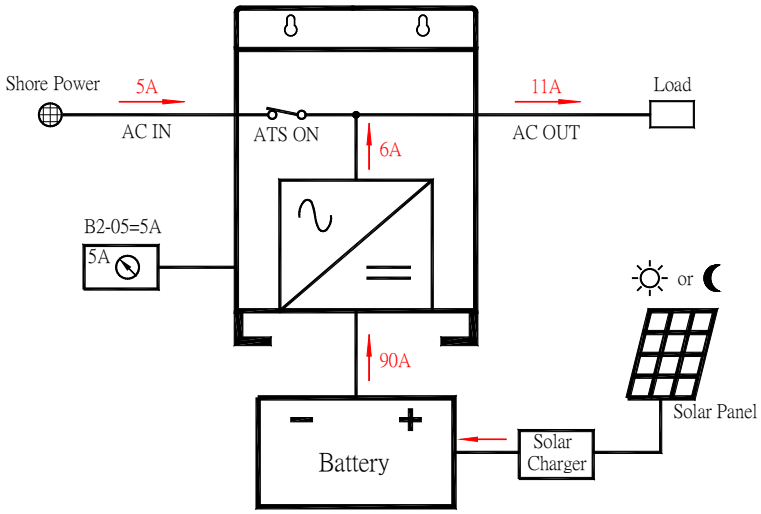


3. Load Support Mode

- And now the other load adds and the current increases to 11A. This is where Load Support function is needed!

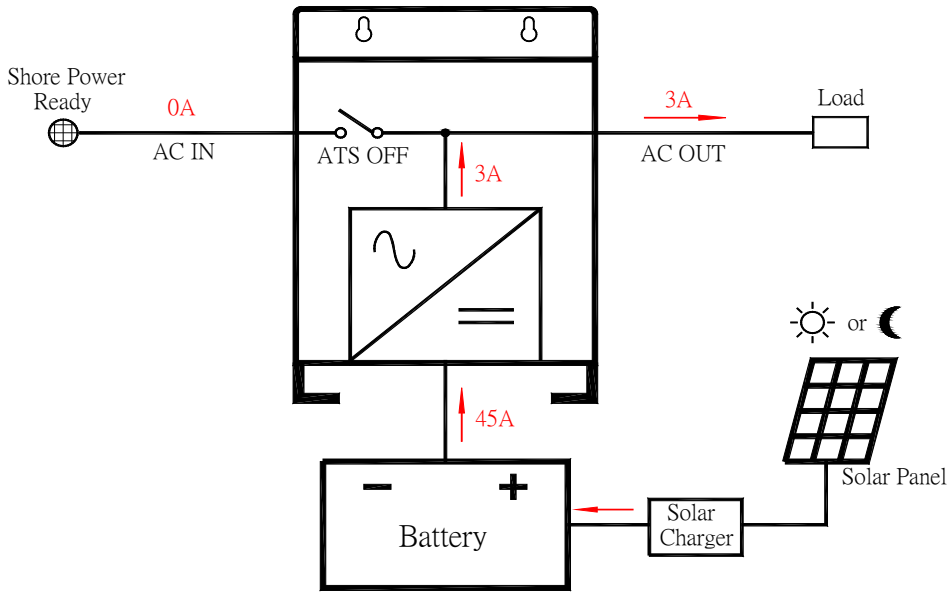
  (ATS ON + AC CHARGER OFF + INVERTER ON + Load Support Mode ON)

- As soon as the load reduces to less than 5A, Load Support function stops.



4. “INVERTER Mode” Repeat

- When the battery is recharged by other renewable energy source, battery voltage is higher than B2-14 voltage value and longer than second time set in B2-15, inverter mode takes priority to supply voltage to AC OUT again for load consumption.

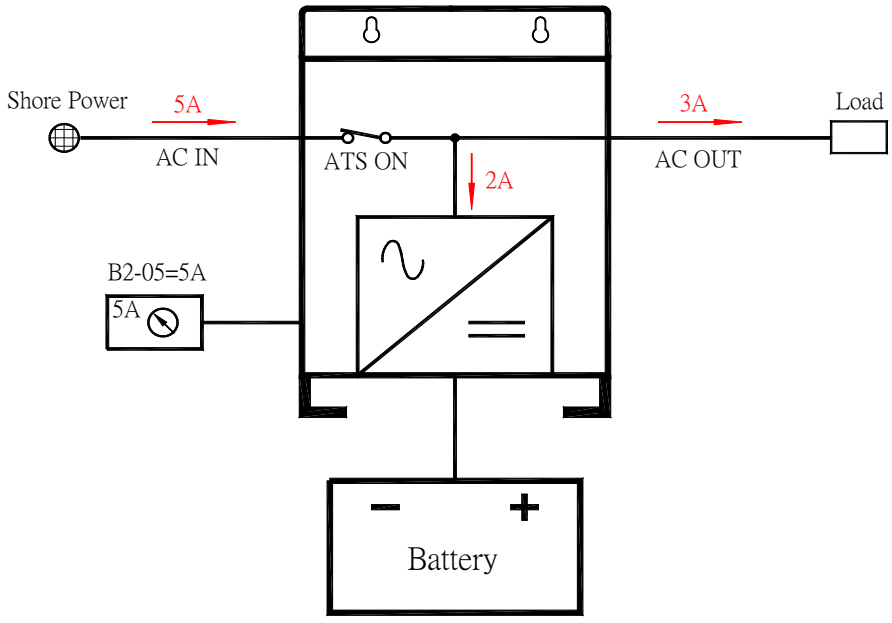


MODE 4: AC Power Charge

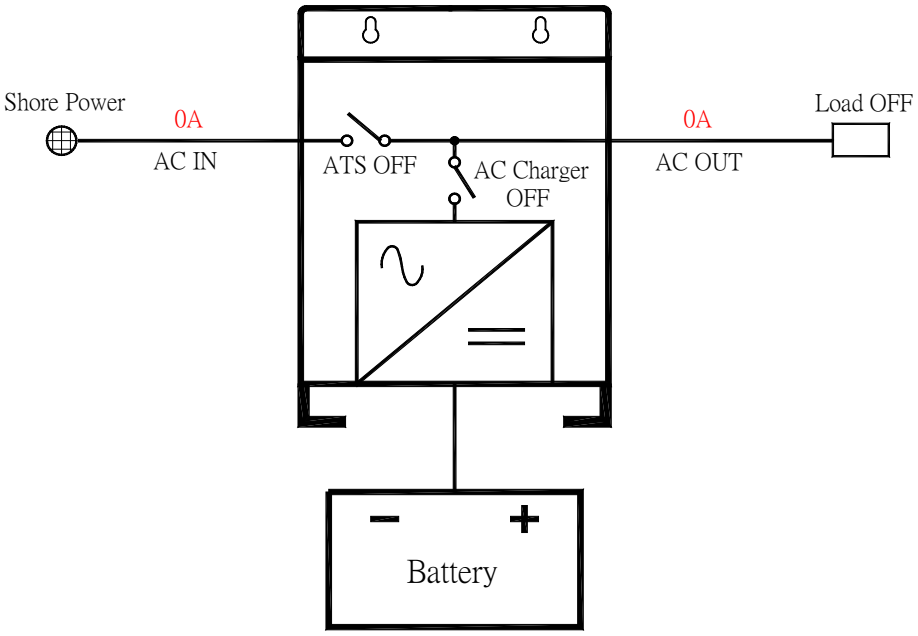
1. Power Control Mode

- When AC IN power is ready, ATS will be switched on and to ensure AC OUT continuously supply the load. At the moment, the AC CHARGER will charge battery with extra power at the same time. Power Control mode is active.

  (INVERTER OFF + ATS ON + AC CHARGER + Power Control Mode ON)

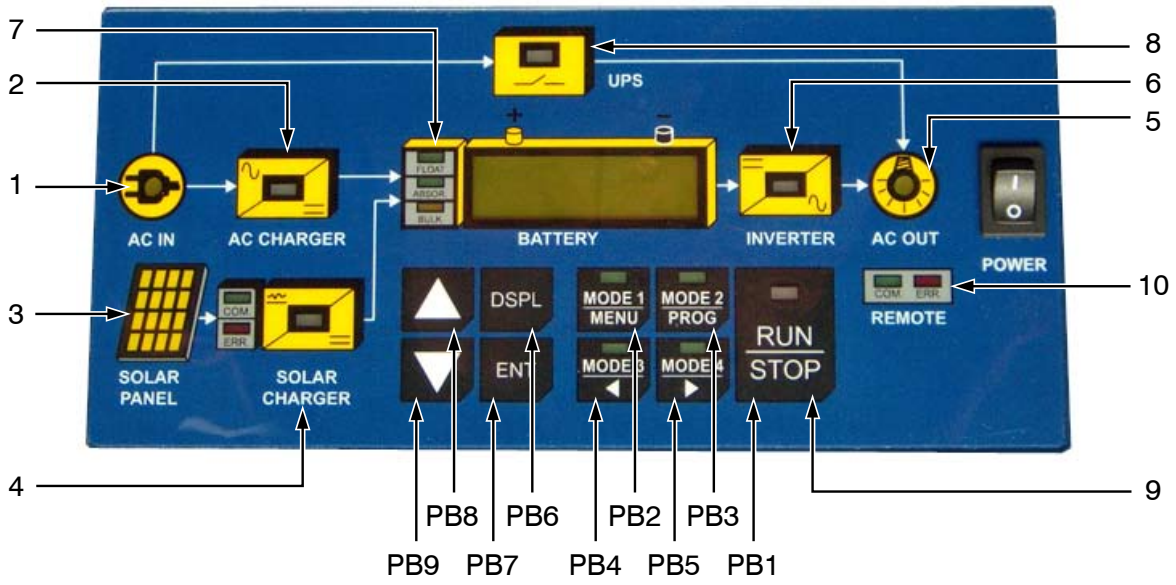


- When AC IN power is off, all the functions of ATS, AC CHARGER and INVERTER will be disabled.



Chapter 3 Display and wiring

3.1 Upper-Front Panel Display



Push Buttons

Push buttons	Name	Description	
PB1	RUN/STOP	Combi-Gamma RUN/STOP key	
PB2	MODE 1	AC Power as Priority Support	Before changing from one mode to another, it has to stop running and be in STOP mode
PB3	MODE 2	INVERTER as Priority Support	
PB4	MODE 3	Green Power as Priority Support	
PB5	MODE 4	AC Power Charge	
PB6	DSPL	Multi-display select key	
PB7	ENTER	Data write-in key	
PB8	UP (△)	△ Increment key	Press △ and ▽ keys at the same time to enable the cursor to move to the left digit from the current digit.
PB9	DOWN (▽)	▽ Decrement key	

Note:

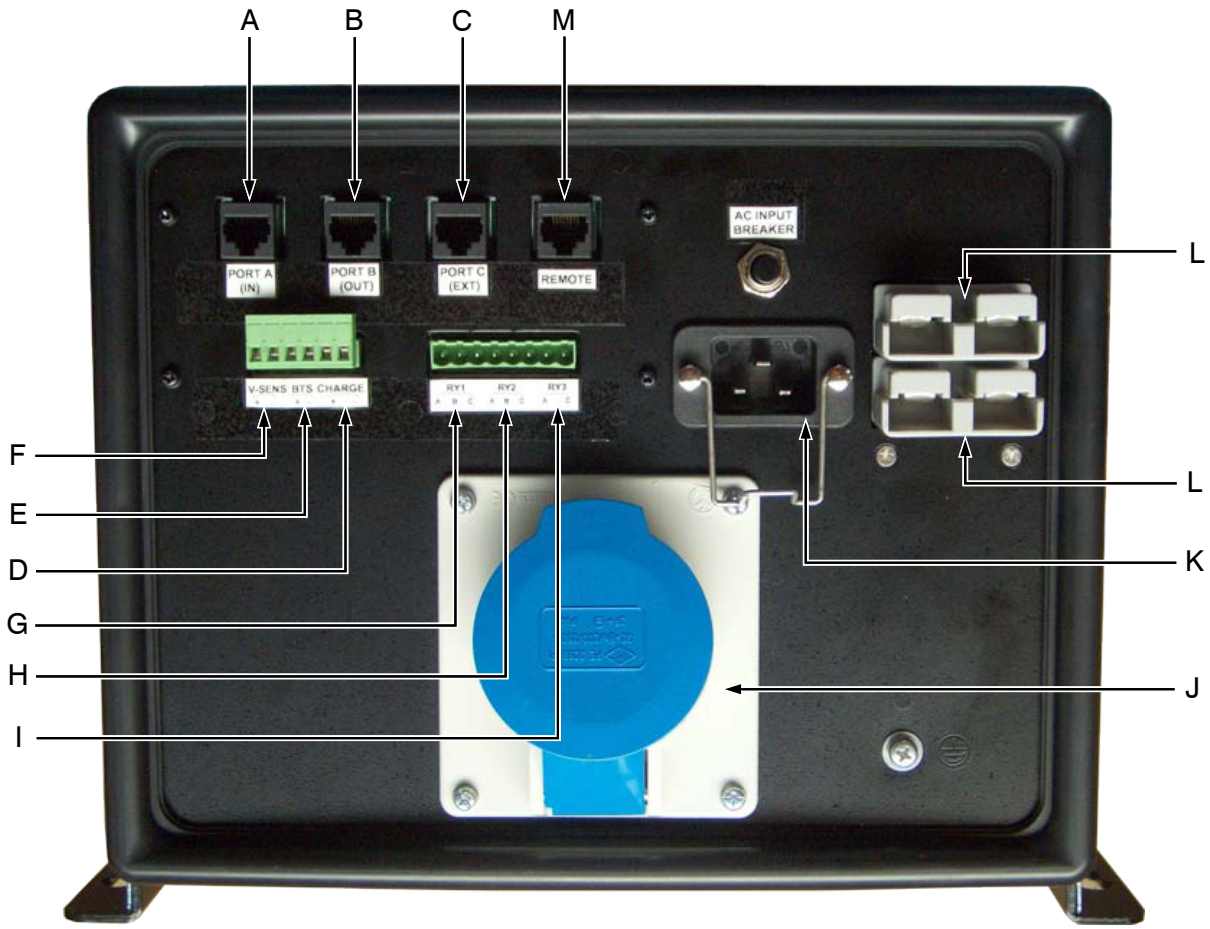
1. When pressing RUN/STOP key, the holding time to remain on the key has to be at least 2 seconds (initial setting) to activate the RUN or STOP function in order to avoid any accidental pressing on the RUN/STOP key. The second time can be adjusted in RUN/STOP KeyHoldTime (O2-07).
2. When changing any of four modes to another mode, Combi-Gamma has to STOP and then press the desired mode key (MODE 1, MODE 2, MODE 3 or MODE 4). Press **and hold** the mode key for at least 5 seconds (initial setting) to activate the mode change this in order to avoid a change of mode by accidental pressing on of the mode keys. The setting of the hold time can be adjusted in MODE Key Hold Time (O2-06).
3. The beep sound, when pressing a key, can be enabled or disabled in Key Pressed Beep Sel (O2-01)

4. When all the keys are not pressed at all for a certain time (O1-02), the display goes to idle mode. Once any key is pressed, the display will return to the LCD monitor selection value set in constant O1-01.
5. When all the keys are not pressed at all for a certain time (O2-09) the LCD Display and all the LED indicators, except the RUN/STOP indicator, will be switched off. The display idle function can save power.
6. Press △ key to increase the setting value and ▽ key to decrease the setting value. Press △ and ▽ keys at the same time to enable the cursor to move to the left digit from the current digit. For example, if the current digit stays in decimal, press △ and ▽ at the same time for the digit to move to centesimal.

LED Indicators

LED	Name	L ED ON	LED OFF
1	AC IN	1. Input voltage normal, and position > ”transfer Voltage Level” (150VAC～240VAC) 2. Input voltage frequency range in between(45～65Hz)	No input power
2	AC CHARGER	Green: Battery charger is working.	----------
3	SOLAR PANEL	Solar module is delivering energy.	1. Solar module isn’t connected or it is Night / (cloudy day)
4	SOLAR CHARGER	Solar charger is working	No external solar charger is connected.
5	AC OUT	There is voltage at the “AC OUT” terminal.	----------
6	INVERTER	Green: Inverter is working.	----------
7	BATTERY	FLOAT or ABSOR. Or BULK charge state of battery.	----------
8	ATS	Green: ATS switch is active AC IN voltage is being sent directly to AC OUT terminal	----------
9	RUN/STOP	Green: Combi-Gamma turn on. Red: Combi-Gamma turn off.	----------
		NOTE: Green Blink: Auto-Restart is in use	
10	COM./ERR.	Remote control port in communication/in error	

3.2 Bottom Panel Connection

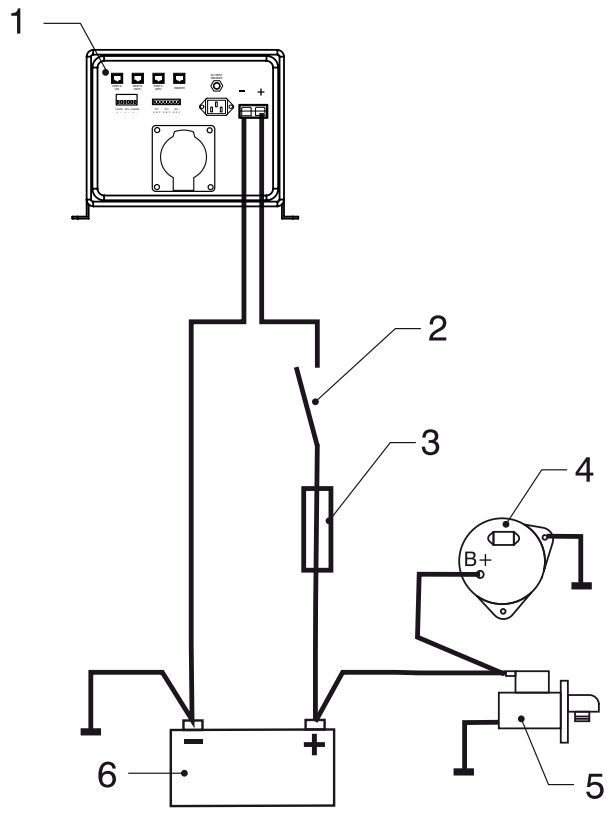


Connections / Lower-Front side		
A	PORT A (IN)	Connections for parallel power/3-phase power
B	PORT B (OUT)	Connections for parallel power/3-phase power
C	PORT C (EXT)	Connections for external solar/wind modules
D	CHARGE	Connecting terminal for starting battery of 4A
E	BTS (Battery temp. sensor)	Connecting terminal for temperature sensor.
F	Vsens + / – (Battery Voltage Sense)	Connecting terminal for Battery Voltage feedback
G	RY1 contact	Connecting terminal for auxiliary contact 1.
H	RY2 contact	Connecting terminal for auxiliary contact 2.
I	RY3 contact	Connecting terminal for auxiliary contact 3.
J	AC OUT	Connecting terminal for AC output
K	AC IN	Connecting terminal for AC input
L	Battery POS + / NEG –	Battery cables.
M	REMOTE	Connections for remote control panel

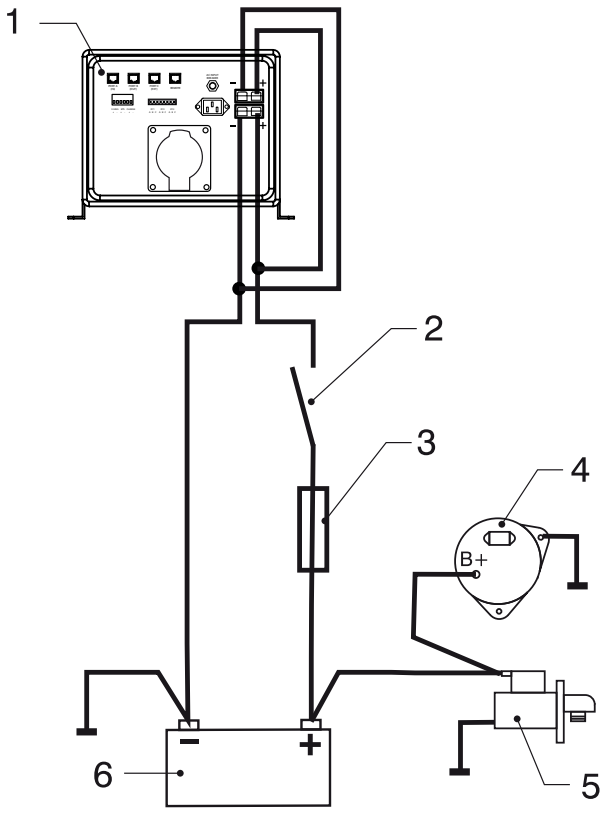
3.3 Battery Connection

COMBI 1500 W / 12 V
COMBI 1500 W / 24 V

COMBI 3000 W / 24 V



COMBI 3000 W / 12 V



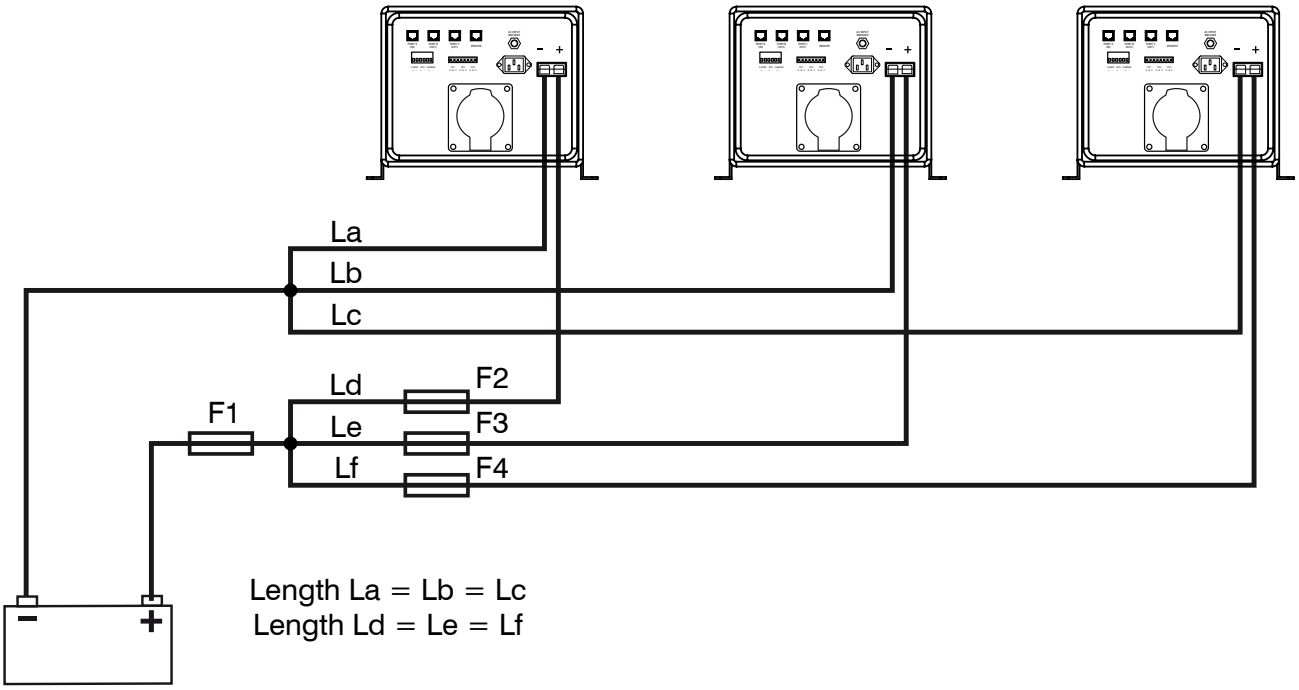
1. COMBI
2. Main switch
3. Fuse
4. Alternator
5. Starter motor
6. Battery

Care!

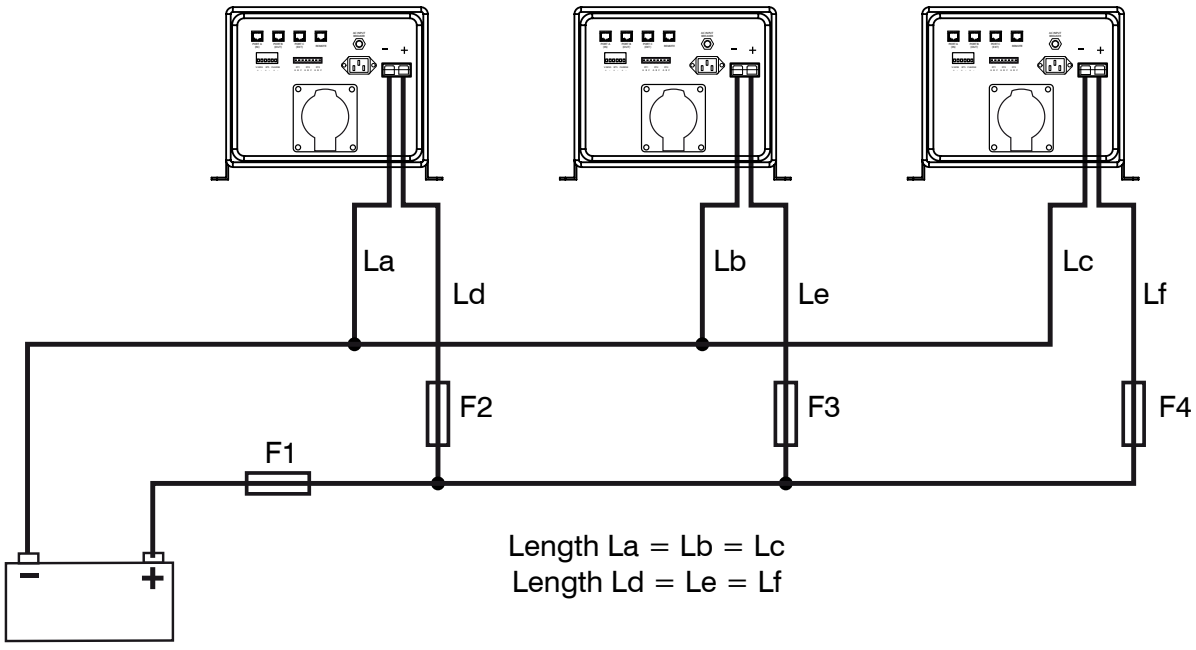
The COMBI 3000 W - 12 V requires that both battery connection points are to be connected to the battery!

Type	Continuous power	P30 power	Efficiency	Fuse
COMBI1512	1500W	1950W	82-84%	200A
COMBI1524	1500W	1950W	82-84%	125A
COMBI3012	3000W	3900W	84-86%	425A
COMBI3024	3000W	3900W	84-86%	200A

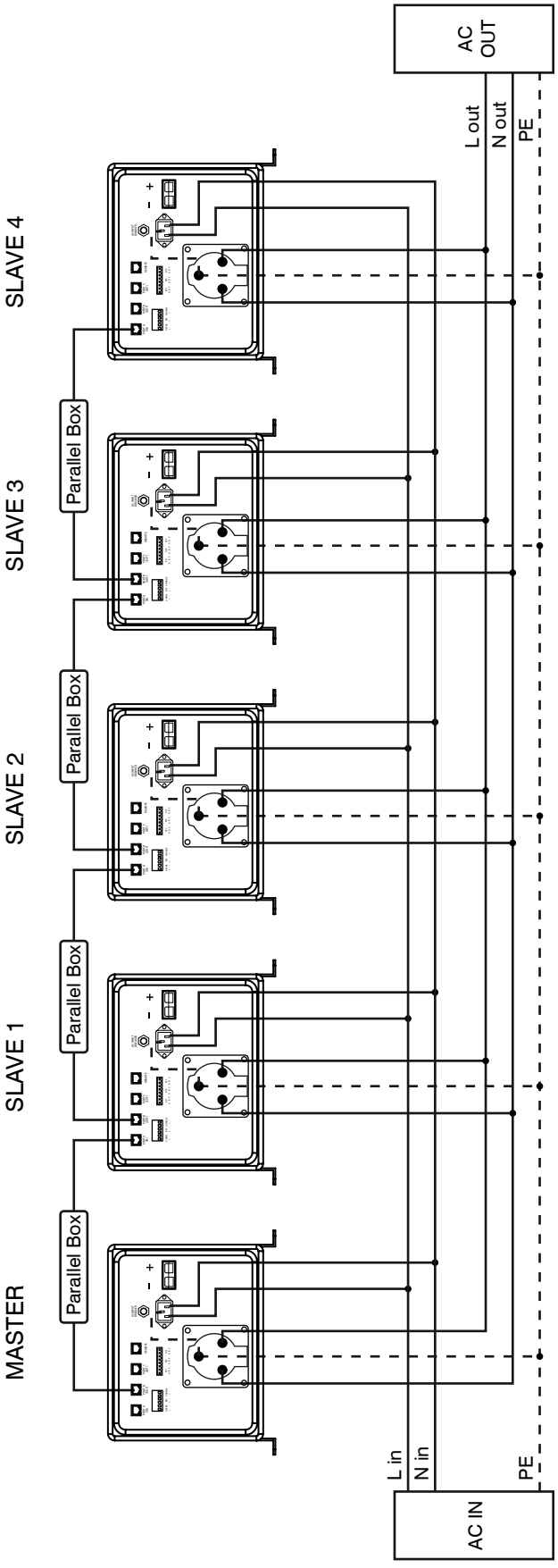
3.3.1 Star Connection Schematic Battery Connection



3.3. 2 Rail Connection Schematic Battery Connection



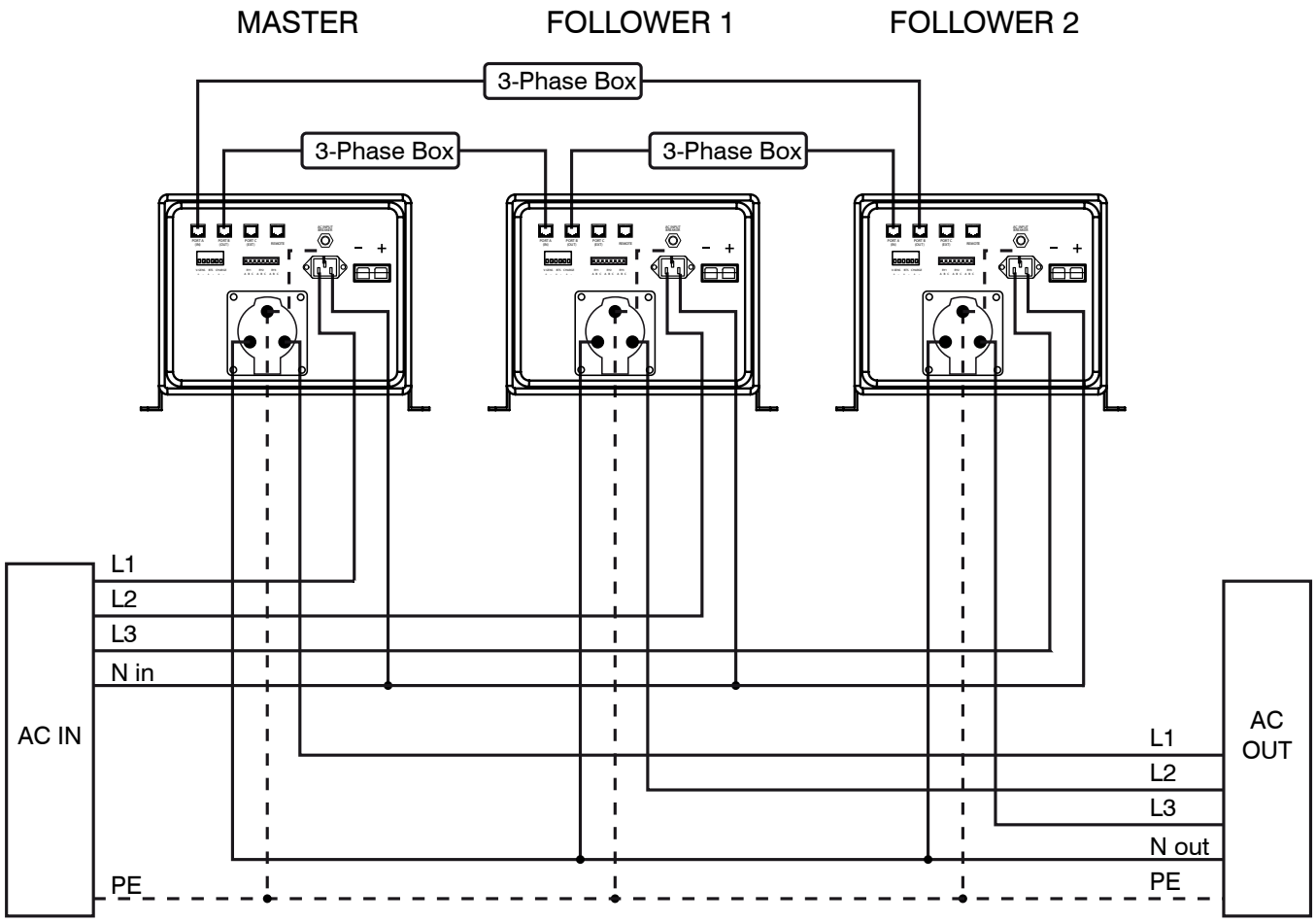
3.4 Parallel Connection Schematic



For the MASTER, constant B2-05 and B3-01 must be set.

For the SLAVE 1 and 2, constant settings are not required.

3.5 3-Phase Connection Schematic



MASTER	FOLLOWER 1	FOLLOWER 2
Constants setting:	Constants setting:	Constants setting:
B4-01=1	B4-01=1	B4-01=1
B4-02=0	B4-02=0	B4-02=0
B4-03=0	B4-03=0	B4-03=0

Chapter 4 User Constants

There are four “Macro Function” under the main menu of the “Combi-Gamma” and they are “Operation”, “Initialize”, “Programming” and “Modified Constants”. The functions and their contents are as below.

Function	Content
Operation	“Combi-Gamma” can monitor AC IN voltage and current, AC OUT voltage and current, battery voltage, battery current and ripple voltage in charging and discharging battery and other extension modules status. This is U (Monitor Group) constants.
Initialize	Operation Condition Setting Group A (Initialize) Group: Multi-language setting, constants initialization setting and constants modification allowed/prohibited setting.
Programming	Constant groups to program (modify) all the constants: B (General) Group, C (INVERTER) Group, D (AC CHARGER) Group, E (Aux-relay) Group F (Solar charger) Group, G (DC to DC charger) Group H (DC load control) Group and O (Operator) Group
Modified Constants	Operating the read-out and modification of the constants group setting which are different from initial setting. Users can program and modify constants

****

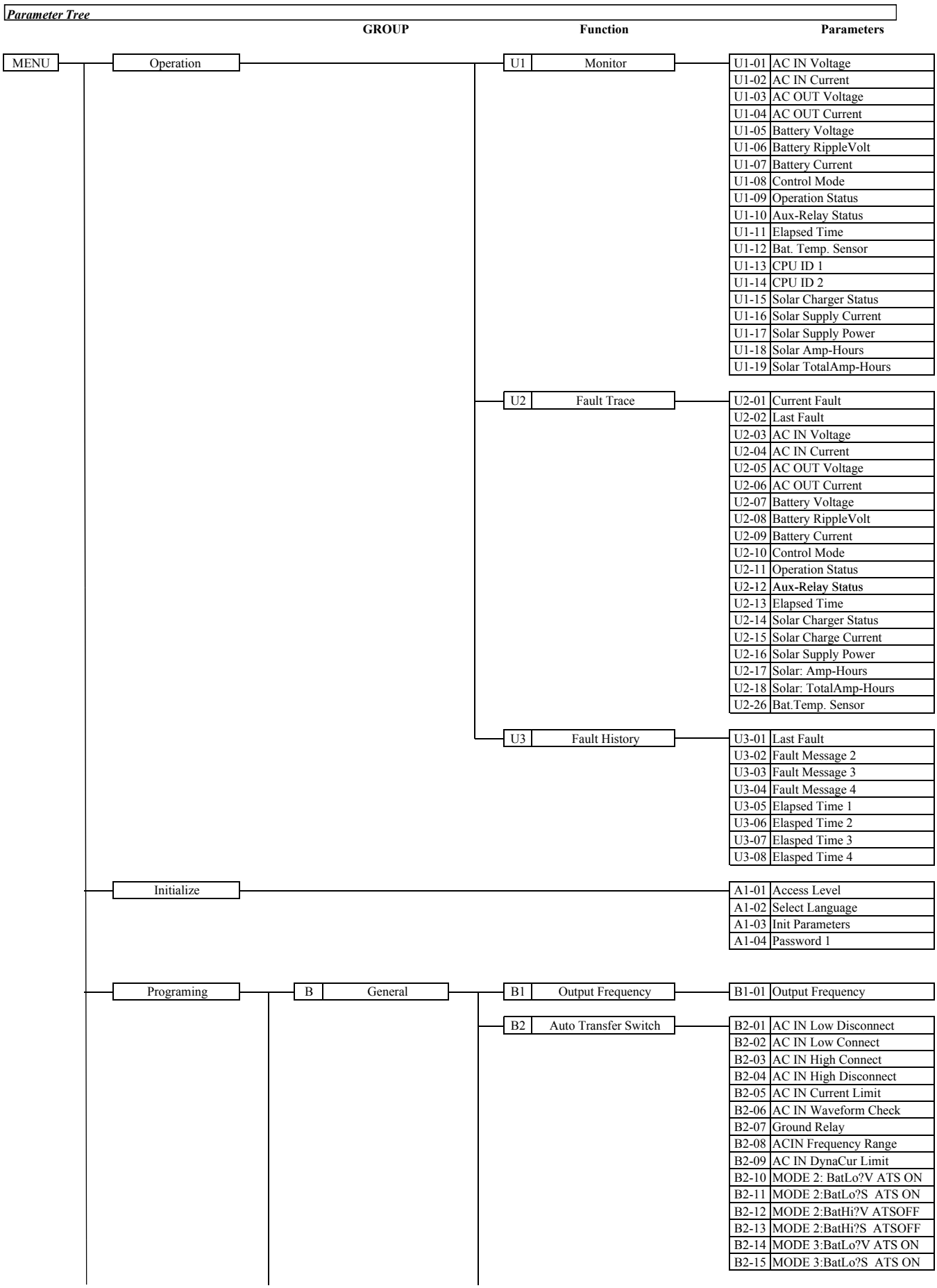
Operation of “Macro Function”

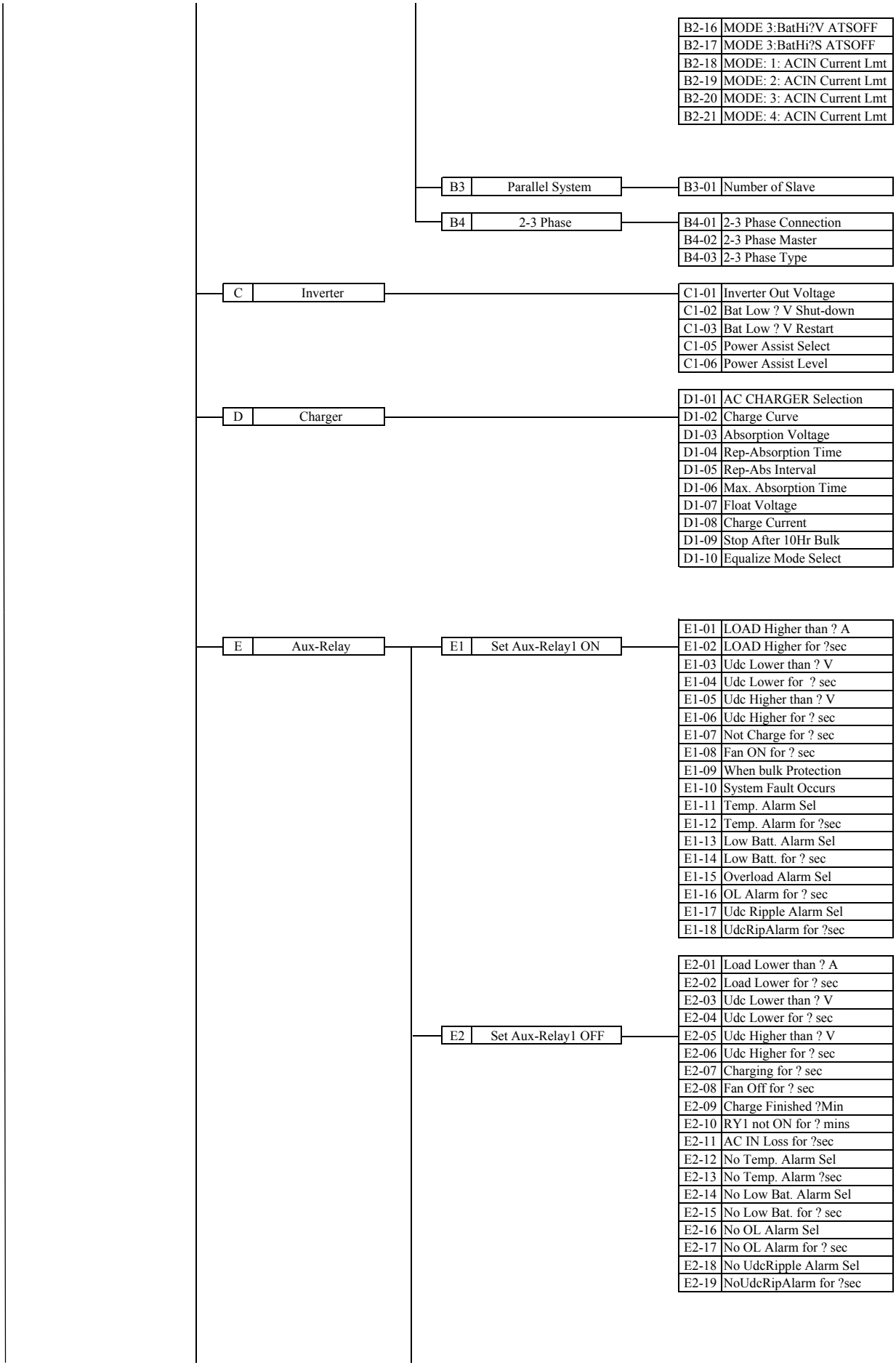
On any display screen, pressing DSPL key could have the effect just like ESC key to enable the display screen go back to previous any of four “Macro Function”

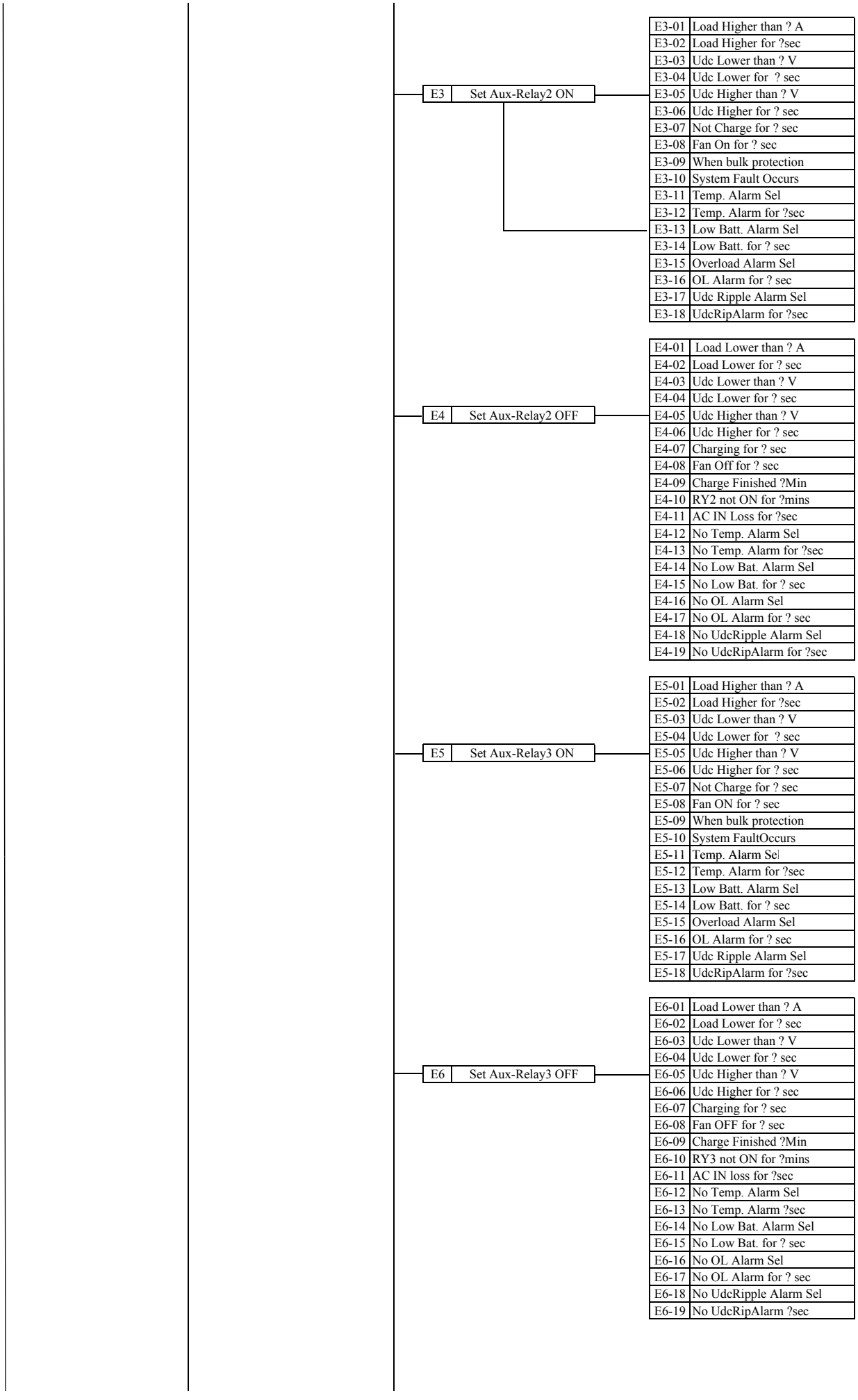
```
***  Main Menu  ***
     XXXXXXXX
```

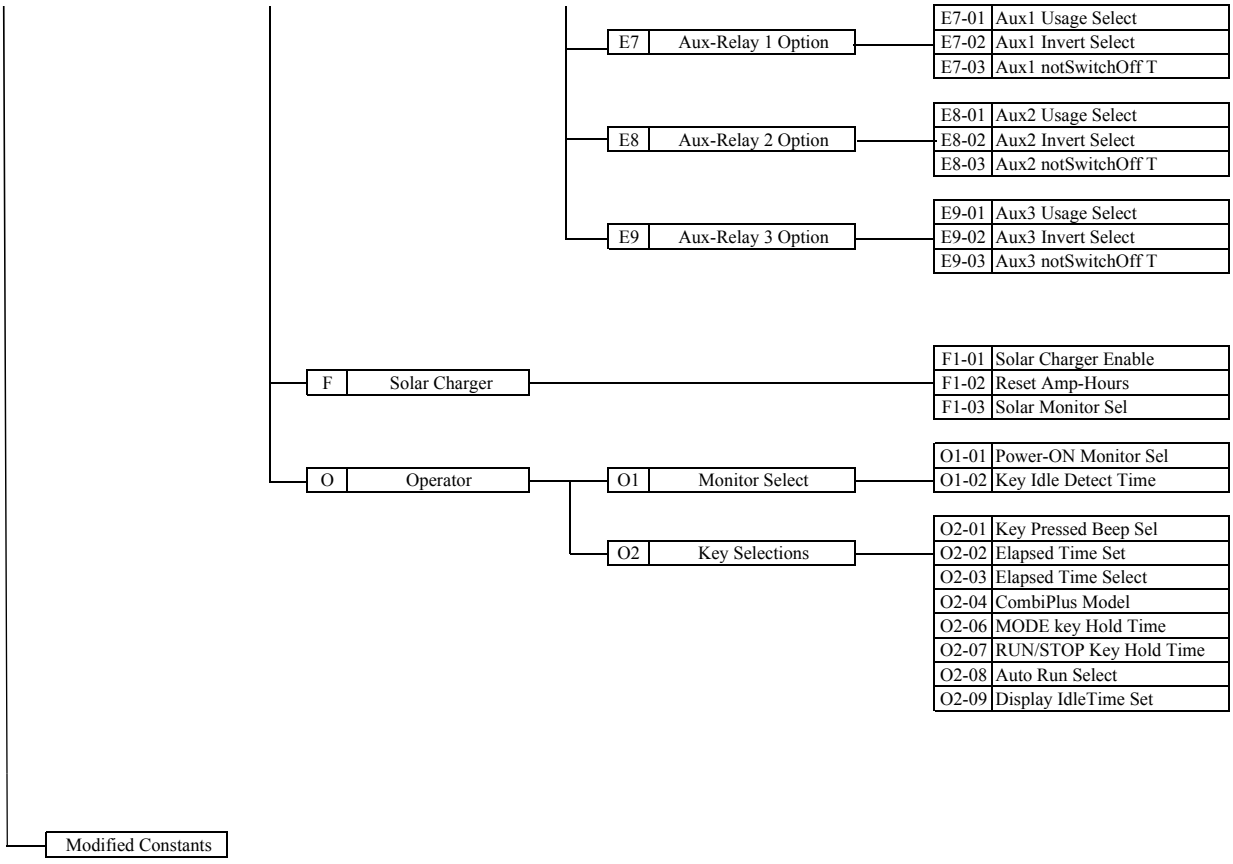
(XXXXXXXX can be either Operation or Initialize or Programming or Modified Constants.) And continue to press DSPL key to select “Macro Function”

4.1 The following is the structure of user constants.



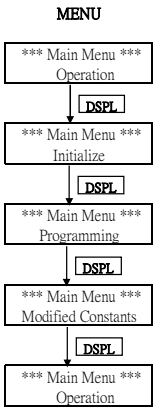

B2-16 MODE 3:BatHi?V ATSOFF
B2-17 MODE 3:BatHi?S ATSOFF
B2-18 MODE: 1: ACIN Current Lmt
B2-19 MODE: 2: ACIN Current Lmt
B2-20 MODE: 3: ACIN Current Lmt
B2-21 MODE: 4: ACIN Current Lmt
B3 Parallel System
B3-01 Number of Slave
B4 2-3 Phase
B4-01 2-3 Phase Connection
B4-02 2-3 Phase Master
B4-03 2-3 Phase Type
C Inverter
C1-01 Inverter Out Voltage
C1-02 Bat Low ? V Shut-down
C1-03 Bat Low ? V Restart
C1-05 Power Assist Select
C1-06 Power Assist Level
D Charger
D1-01 AC CHARGER Selection
D1-02 Charge Curve
D1-03 Absorption Voltage
D1-04 Rep-Absorption Time
D1-05 Rep-Abs Interval
D1-06 Max. Absorption Time
D1-07 Float Voltage
D1-08 Charge Current
D1-09 Stop After 10Hr Bulk
D1-10 Equalize Mode Select
E Aux-Relay
E1 Set Aux-Relay1 ON
E1-01 LOAD Higher than ? A
E1-02 LOAD Higher for ?sec
E1-03 Udc Lower than ? V
E1-04 Udc Lower for ? sec
E1-05 Udc Higher than ? V
E1-06 Udc Higher for ? sec
E1-07 Not Charge for ? sec
E1-08 Fan ON for ? sec
E1-09 When bulk Protection
E1-10 System Fault Occurs
E1-11 Temp. Alarm Sel
E1-12 Temp. Alarm for ?sec
E1-13 Low Batt. Alarm Sel
E1-14 Low Batt. for ? sec
E1-15 Overload Alarm Sel
E1-16 OL Alarm for ? sec
E1-17 Udc Ripple Alarm Sel
E1-18 UdcRipAlarm for ?sec
E2 Set Aux-Relay1 OFF
E2-01 Load Lower than ? A
E2-02 Load Lower for ? sec
E2-03 Udc Lower than ? V
E2-04 Udc Lower for ? sec
E2-05 Udc Higher than ? V
E2-06 Udc Higher for ? sec
E2-07 Charging for ? sec
E2-08 Fan Off for ? sec
E2-09 Charge Finished ?Min
E2-10 RY1 not ON for ? mins
E2-11 AC IN Loss for ?sec
E2-12 No Temp. Alarm Sel
E2-13 No Temp. Alarm ?sec
E2-14 No Low Bat. Alarm Sel
E2-15 No Low Bat. for ? sec
E2-16 No OL Alarm Sel
E2-17 No OL Alarm for ? sec
E2-18 No UdcRipple Alarm Sel
E2-19 NoUdcRipAlarm for ?sec


E3 Set Aux-Relay2 ON
E3-01 Load Higher than ? A
E3-02 Load Higher for ?sec
E3-03 Udc Lower than ? V
E3-04 Udc Lower for ? sec
E3-05 Udc Higher than ? V
E3-06 Udc Higher for ? sec
E3-07 Not Charge for ? sec
E3-08 Fan On for ? sec
E3-09 When bulk protection
E3-10 System Fault Occurs
E3-11 Temp. Alarm Sel
E3-12 Temp. Alarm for ?sec
E3-13 Low Batt. Alarm Sel
E3-14 Low Batt. for ? sec
E3-15 Overload Alarm Sel
E3-16 OL Alarm for ? sec
E3-17 Udc Ripple Alarm Sel
E3-18 UdcRipAlarm for ?sec
E4 Set Aux-Relay2 OFF
E4-01 Load Lower than ? A
E4-02 Load Lower for ? sec
E4-03 Udc Lower than ? V
E4-04 Udc Lower for ? sec
E4-05 Udc Higher than ? V
E4-06 Udc Higher for ? sec
E4-07 Charging for ? sec
E4-08 Fan Off for ? sec
E4-09 Charge Finished ?Min
E4-10 RY2 not ON for ?mins
E4-11 AC IN Loss for ?sec
E4-12 No Temp. Alarm Sel
E4-13 No Temp. Alarm for ?sec
E4-14 No Low Bat. Alarm Sel
E4-15 No Low Bat. for ? sec
E4-16 No OL Alarm Sel
E4-17 No OL Alarm for ? sec
E4-18 No UdcRipple Alarm Sel
E4-19 No UdcRipAlarm for ?sec
E5 Set Aux-Relay3 ON
E5-01 Load Higher than ? A
E5-02 Load Higher for ?sec
E5-03 Udc Lower than ? V
E5-04 Udc Lower for ? sec
E5-05 Udc Higher than ? V
E5-06 Udc Higher for ? sec
E5-07 Not Charge for ? sec
E5-08 Fan ON for ? sec
E5-09 When bulk protection
E5-10 System FaultOccurs
E5-11 Temp. Alarm Sel
E5-12 Temp. Alarm for ?sec
E5-13 Low Batt. Alarm Sel
E5-14 Low Batt. for ? sec
E5-15 Overload Alarm Sel
E5-16 OL Alarm for ? sec
E5-17 Udc Ripple Alarm Sel
E5-18 UdcRipAlarm for ?sec
E6 Set Aux-Relay3 OFF
E6-01 Load Lower than ? A
E6-02 Load Lower for ? sec
E6-03 Udc Lower than ? V
E6-04 Udc Lower for ? sec
E6-05 Udc Higher than ? V
E6-06 Udc Higher for ? sec
E6-07 Charging for ? sec
E6-08 Fan OFF for ? sec
E6-09 Charge Finished ?Min
E6-10 RY3 not ON for ?mins
E6-11 AC IN loss for ?sec
E6-12 No Temp. Alarm Sel
E6-13 No Temp. Alarm ?sec
E6-14 No Low Bat. Alarm Sel
E6-15 No Low Bat. for ? sec
E6-16 No OL Alarm Sel
E6-17 No OL Alarm for ? sec
E6-18 No UdcRipple Alarm Sel
E6-19 No UdcRipAlarm ?sec

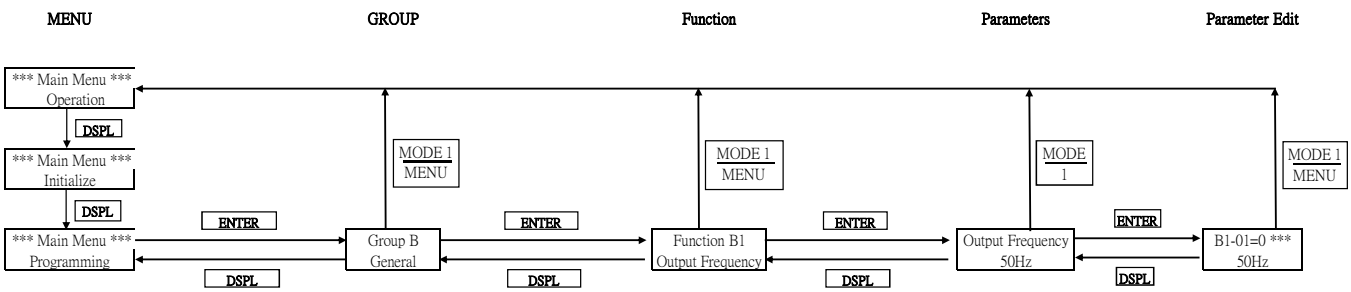


4.2 The following is the operation flow

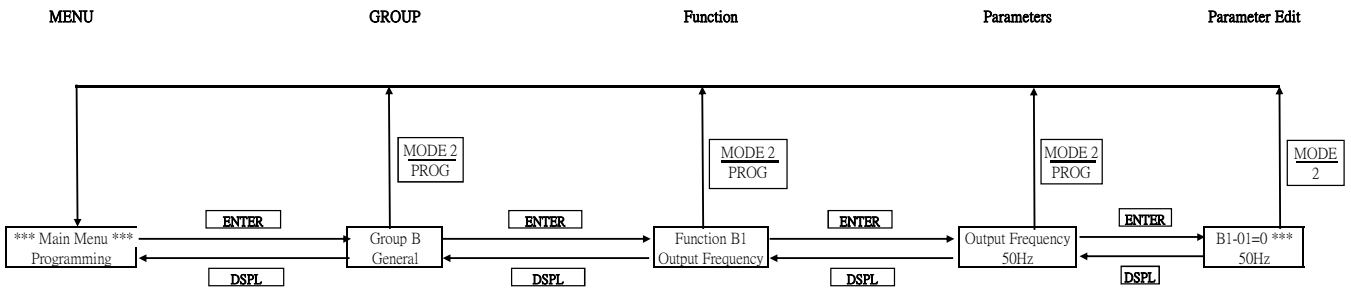
Main Menu



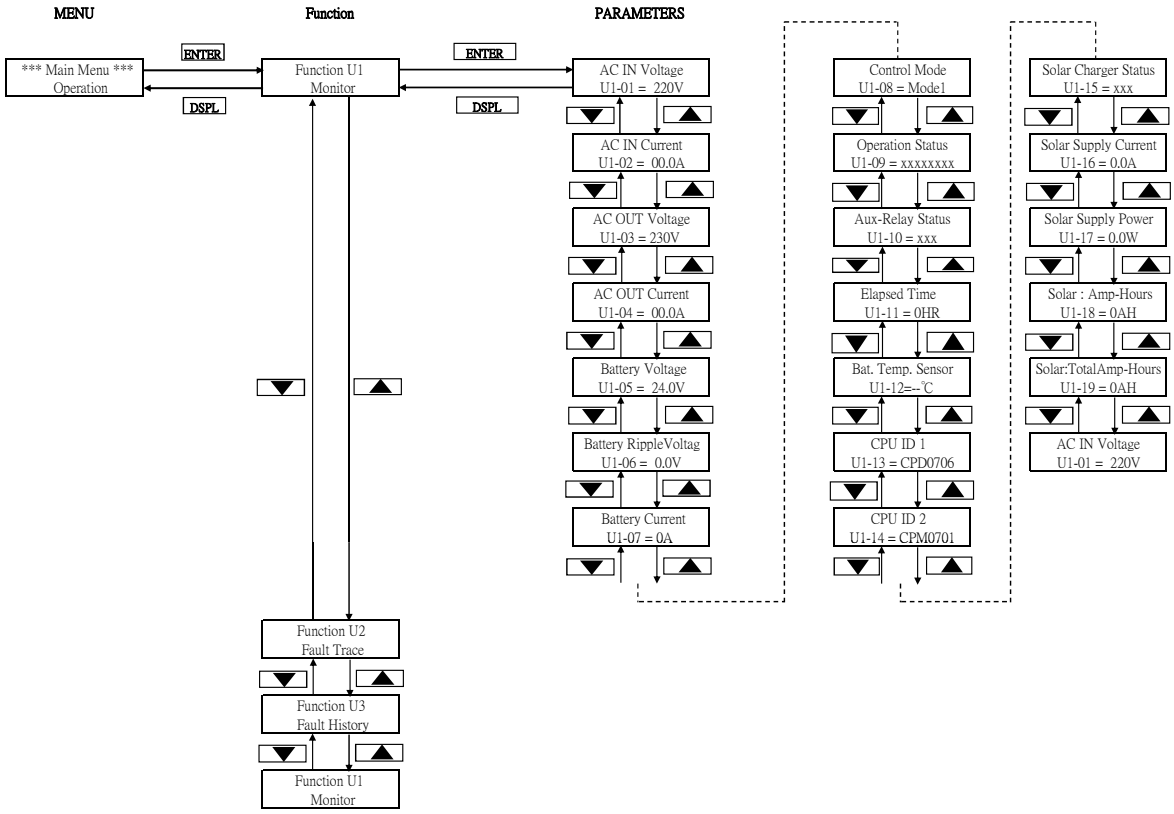
Quick Return Main Menu-Operation



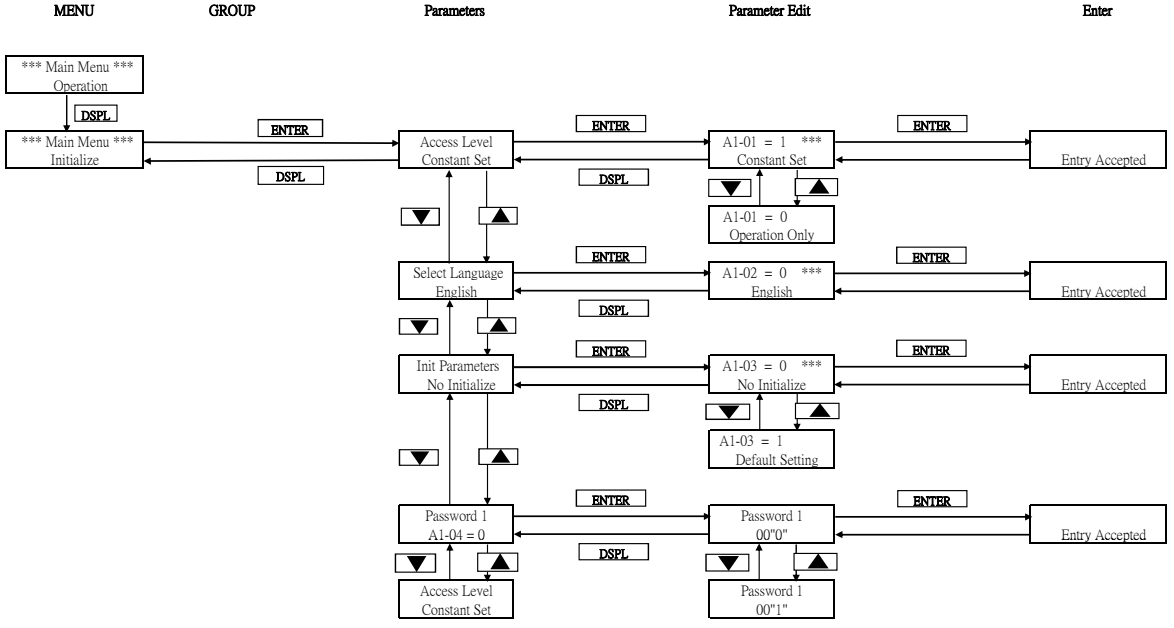
Quick Return Main Menu-Programming



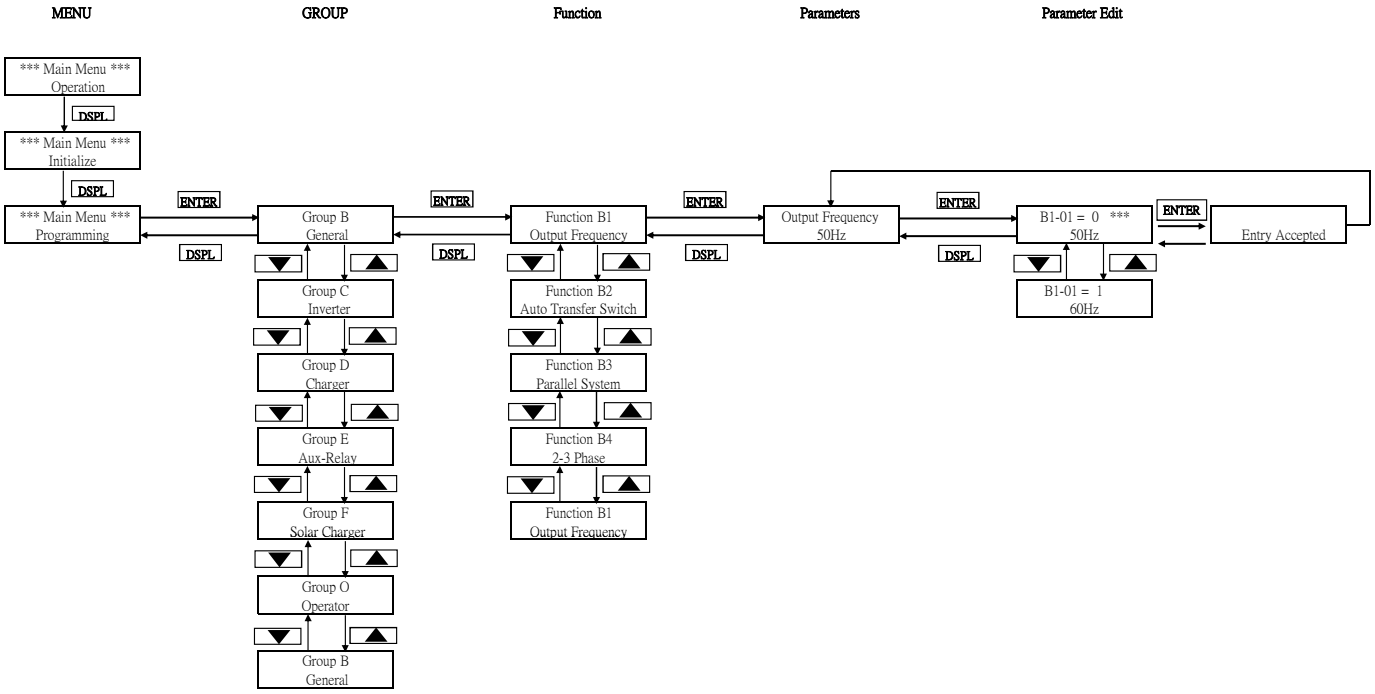
Main Menu : Operation



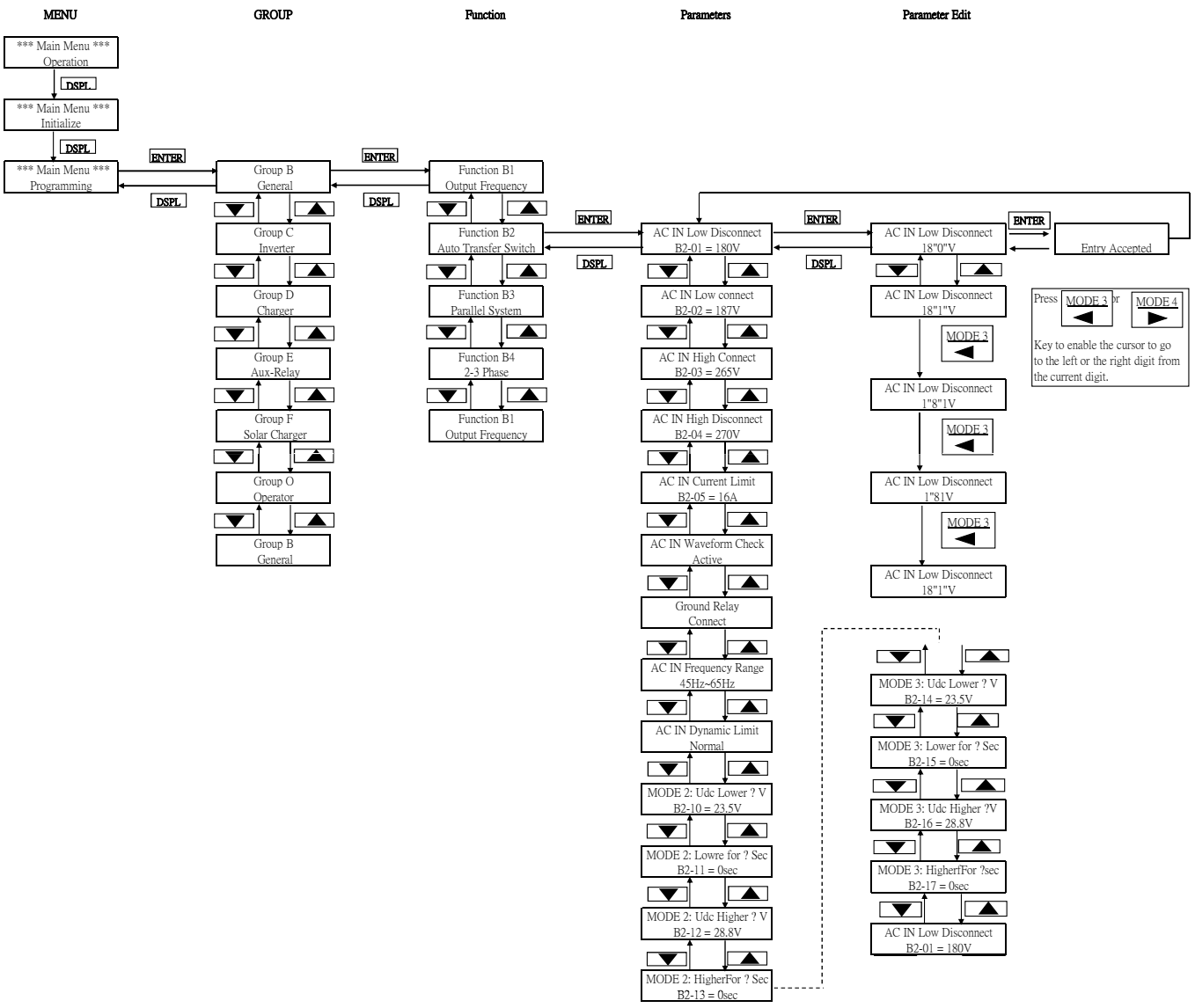
Main Menu : Initialize



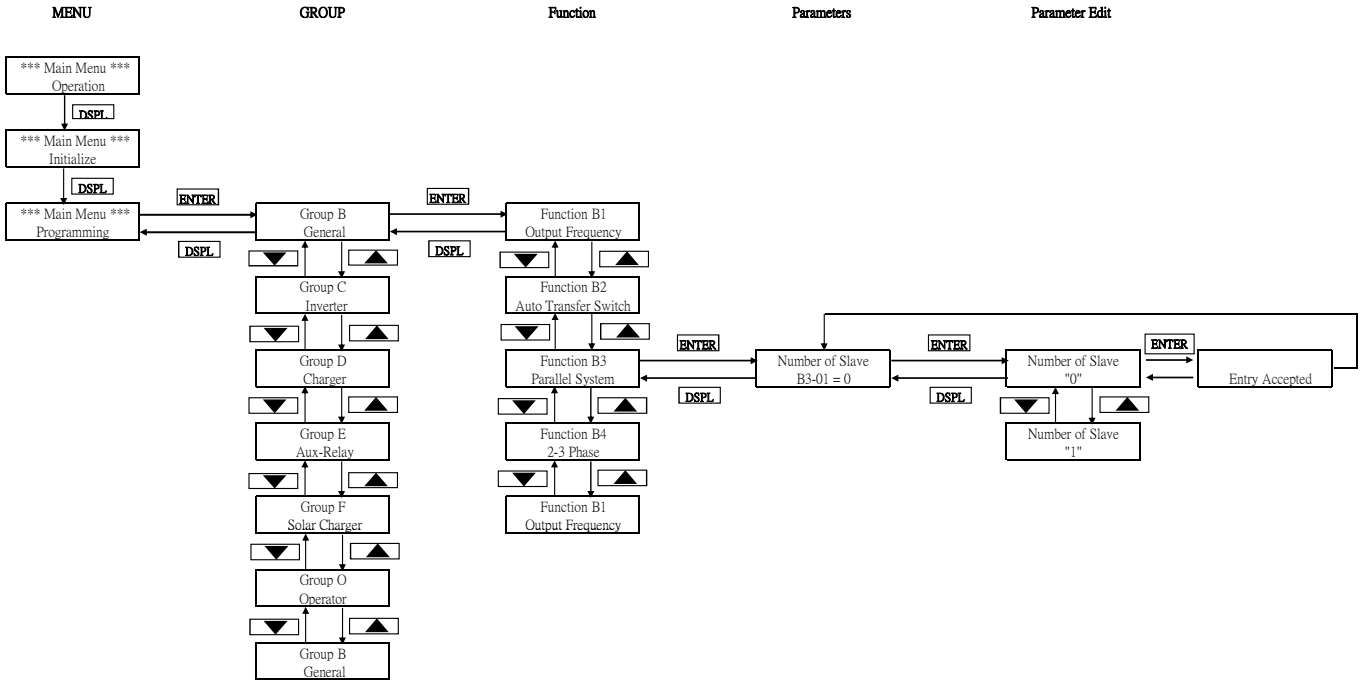
Main Menu : Programing - Function B1 - B1-01



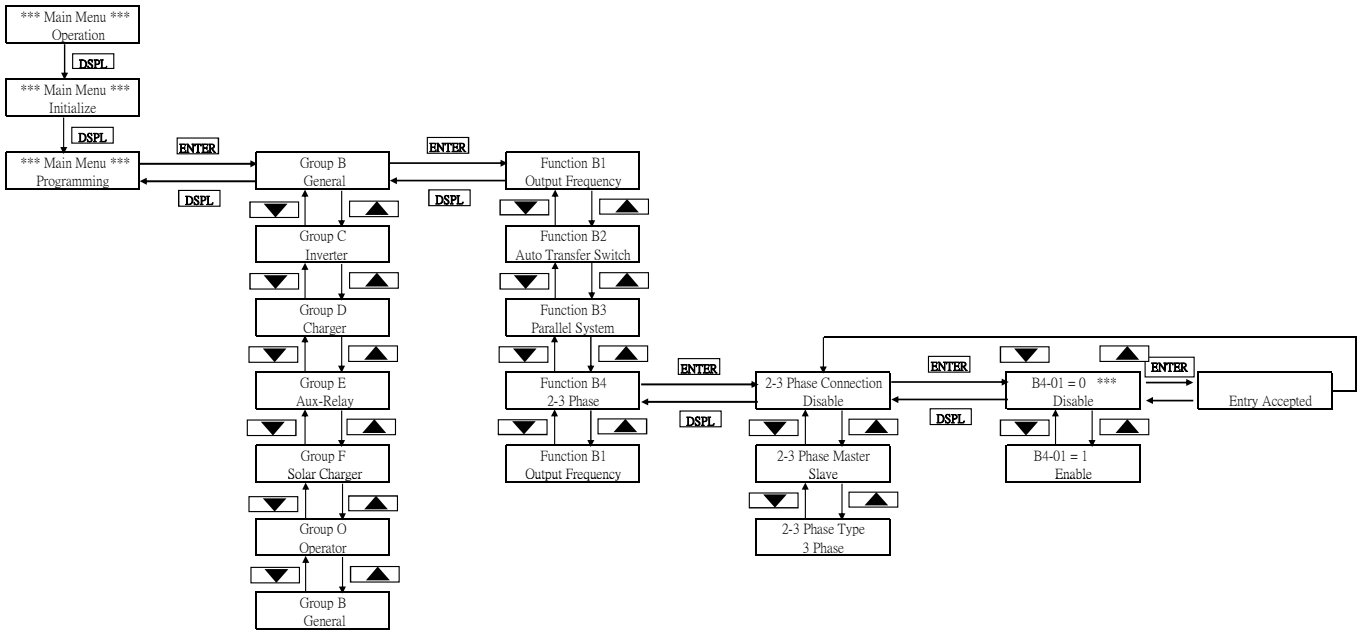
Main Menu : Programing - Function B2 - B2-01



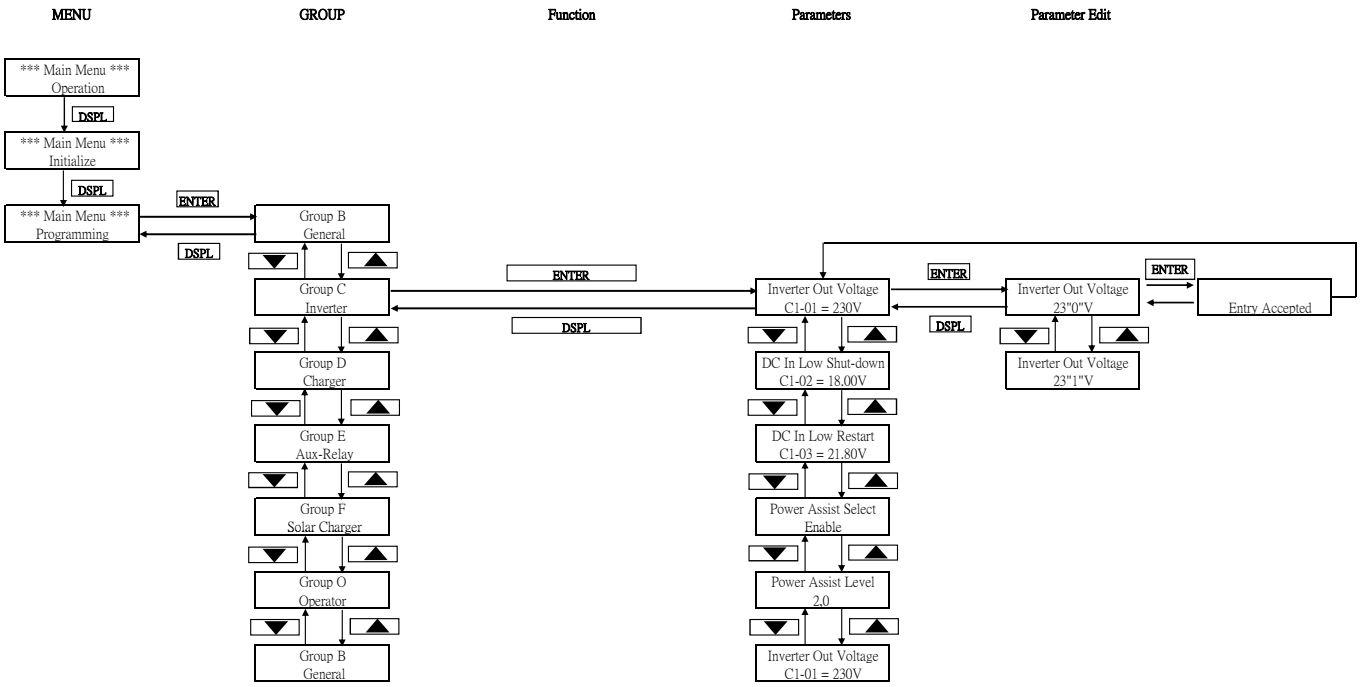
Main Menu : Programing - Function B3 - B3-01



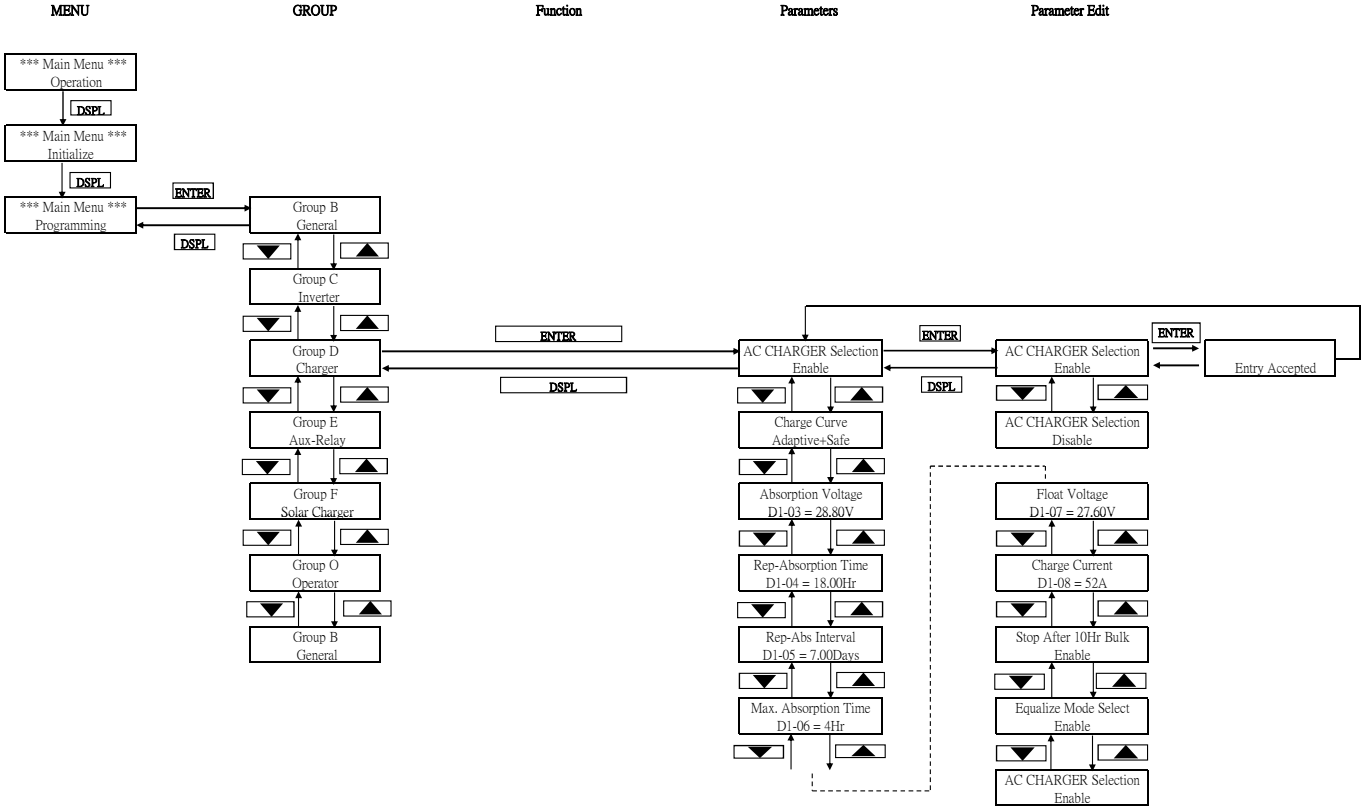
Main Menu : Programing - Function B4 - B4-01



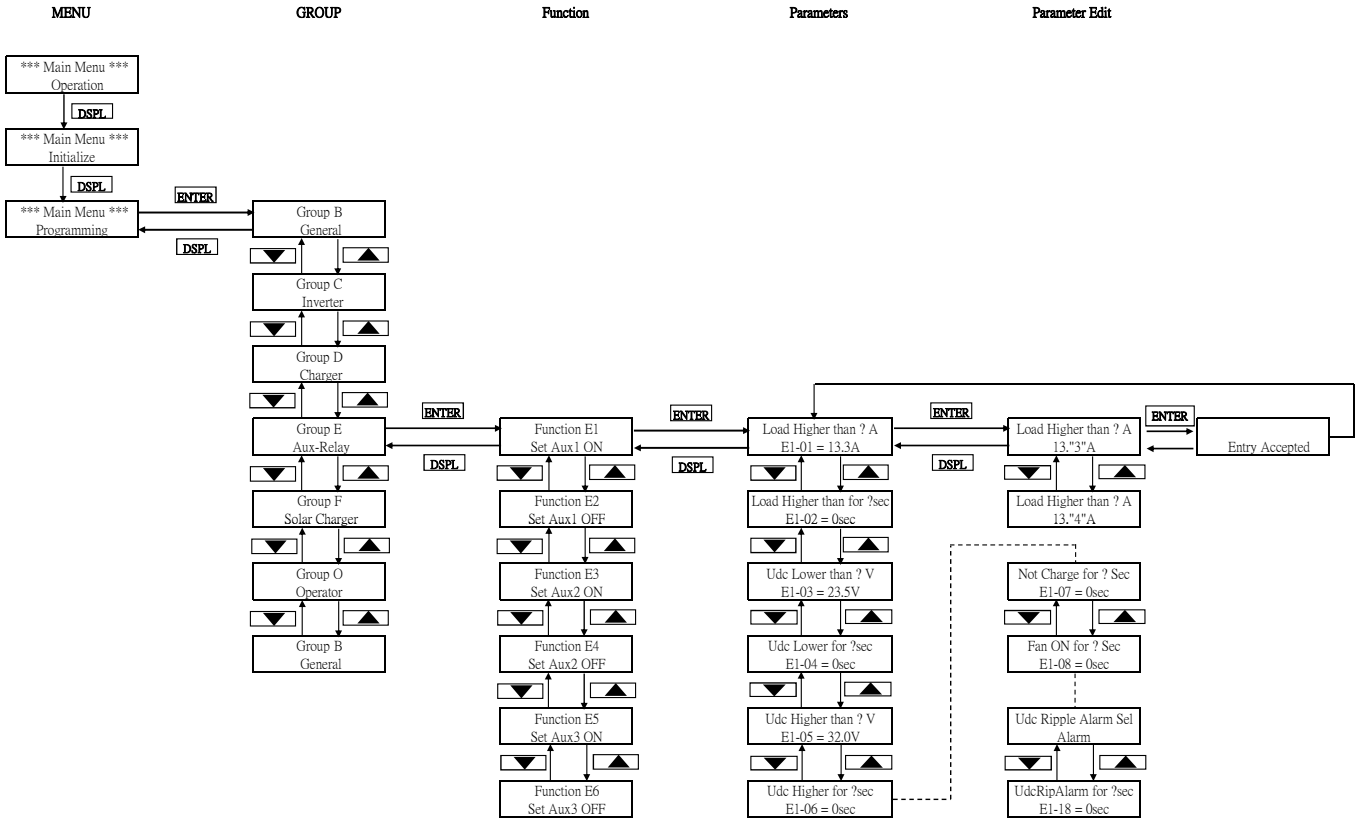
Main Menu : Programing - Function C1 - C1-01



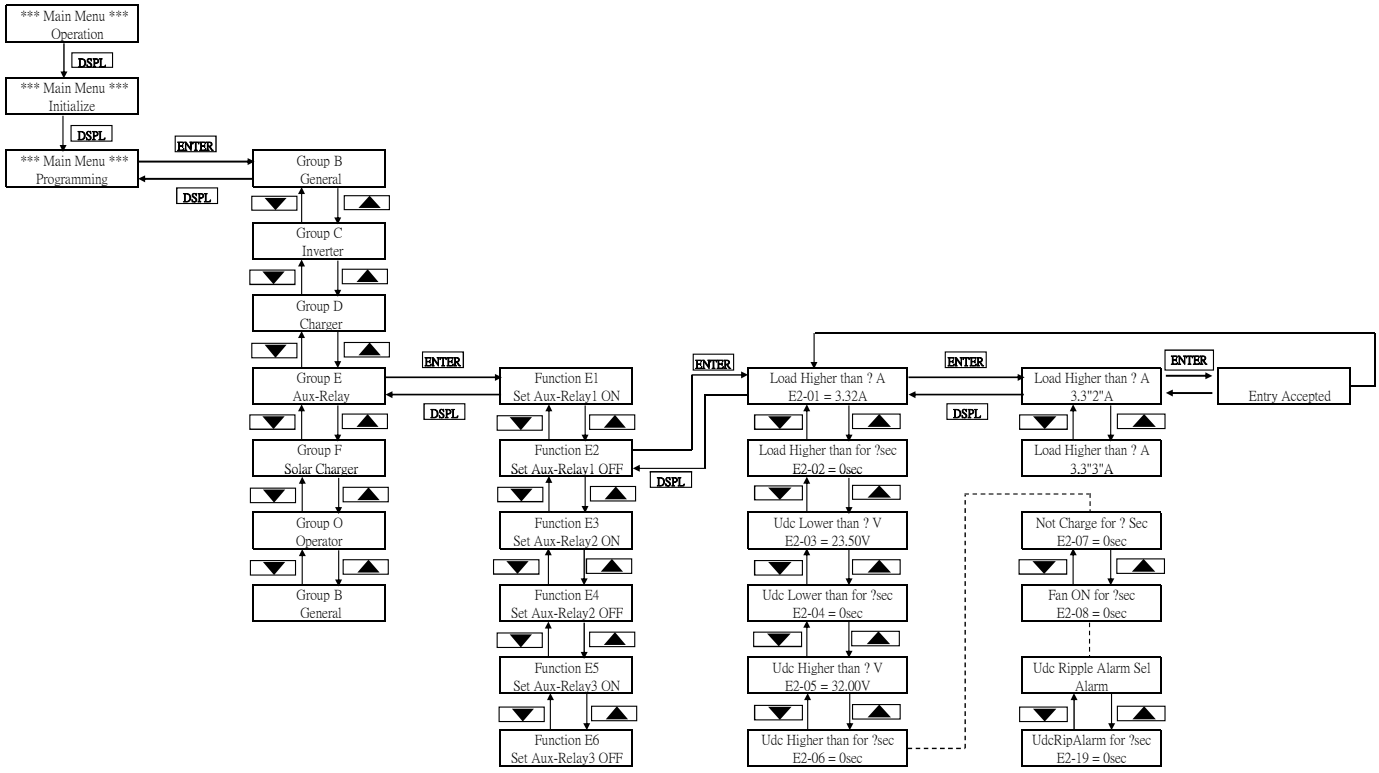
Main Menu : Programing - Function D1 - D1-01



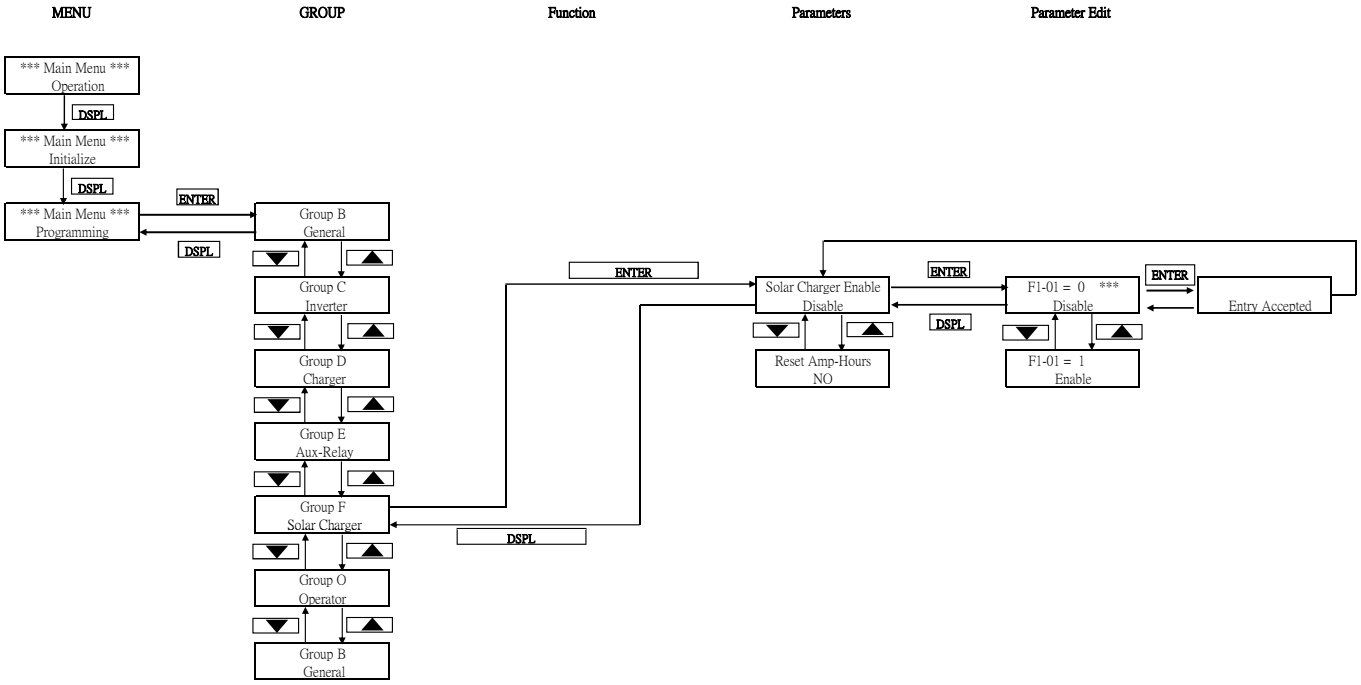
Main Menu : Programing - Group E - Function E1 - E1-01



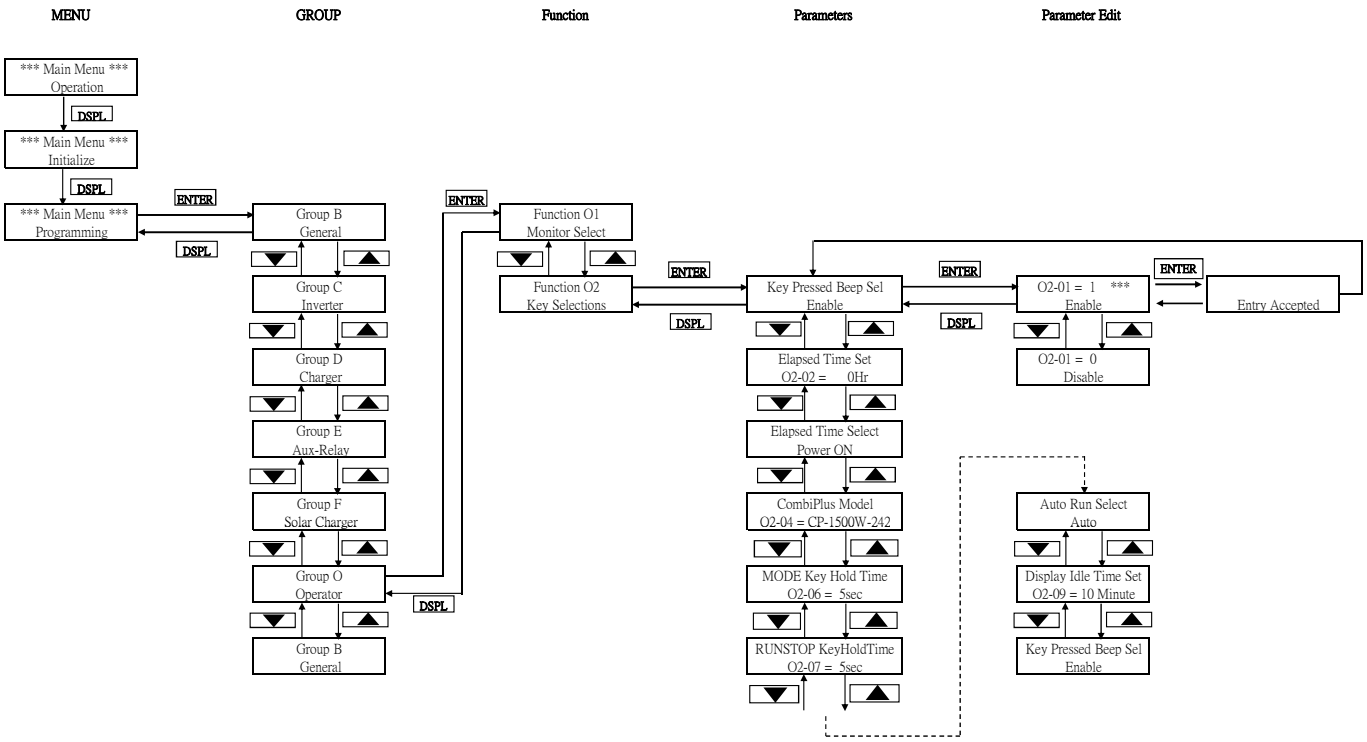
Main Menu : Programing - Group E - Function E2 - E2-01



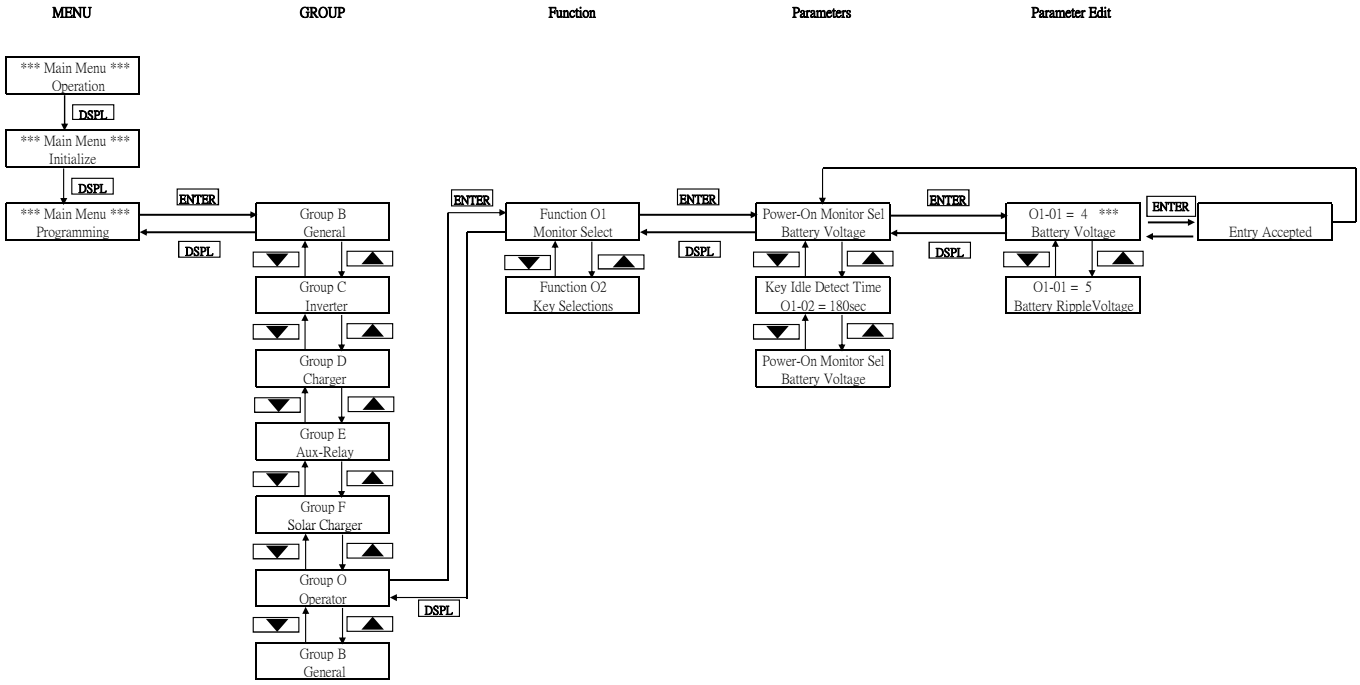
Main Menu : Programing - Function F1 - F1-01



Main Menu : Programing - Group O - Function O2 - O2-01



Main Menu : Programing - Group O - Function O1 - O1-01



Chapter 5 Constants List

Menu	Group		Function		Constant	LCD Display	Range	Unit	Factory Setting	Remark	Page
Operation	U	Monitor	U1	Monitor	U1-01	AC IN Voltage	-	0.1V	-		70
					U1-02	AC IN Current	-	0.1A	-		70
					U1-03	AC OUT Voltage	-	0.1V	-		70
					U1-04	AC OUT Current	-	0.1A	-		70
					U1-05	Battery Voltage	-	0.1V	-		70
					U1-06	Battery Ripple Volt	-	0.1V	-		70
					U1-07	Battery Current	-	0.1A	-		70
					U1-08	Control Mode	-	-	-		70
					U1-09	Operation Status	-	-	-	NOTE 1	70
					U1-10	Aux-Relay Status	-	-	-	NOTE 2	70
					U1-11	Elapsed Time	-	1hour	-		71
					U1-12	Bat.Temp.Sensor	-	1°C	-		71
					U1-13	CPU ID 1	-	-	-		71
					U1-14	CPU ID 2	-	-	-		71
					U1-15	Solar Charger Status	-	-	-	NOTE 5	71
					U1-16	Solar Supply Current	-	0.1A	-	NOTE 5	71
					U1-17	Solar Supply Power	-	1W	-	NOTE 5	71
					U1-18	Solar Amp-Hours	-	0.1AH	-	NOTE 5	71
					U1-19	Solar Total Amp-Hours	-	0.1AH	-	NOTE 5	71
Operation	U	Monitor	U2	Fault Trace	U2-01	Current Fault		-	-		-
					U2-02	Last Fault		0.1V	-		71
					U2-03	AC IN Voltage	-	0.1A	-		71
					U2-04	AC IN Current	-	0.1V	-		72
					U2-05	AC OUT Voltage	-	0.1A	-		72
					U2-06	AC OUT Current	-	0.1V	-		72
					U2-07	Battery Voltage	-	0.1V	-		72
					U2-08	Battery Ripple Volt	-	0.1A	-		72
					U2-09	Battery Current	-		-		72

Menu	Group		Function		Constant	LCD Display	Range	Unit	Factory Setting	Remark	Page
					U2-10	Control Mode	-		-	NOTE 1	72
					U2-11	Operation Status	-		-	NOTE 2	72
					U2-12	Aux-Relay Status	-		-		72
					U2-13	Elapsed Time	-	1hour	-		72
					U2-14	Solar Charger Status	-	-	-	NOTE 5	73
					U2-15	Solar Charge Current	-	0.1A	-	NOTE 5	73
					U2-16	Solar Supply Power	-	1W	-	NOTE 5	73
					U2-17	Solar : Amp-Hours	-	1AH	-	NOTE 5	73
					U2-18	Solar:TotalAmp-Hours	-	1AH	-	NOTE 5	73
					U2-26	Bat.Temp. Sensor	-	1°C	-		73
Operation	U	Monitor	U3	Fault History	U3-01	Last Fault	-	-	-		73
					U3-02	Fault Message 2	-	-	-		73
					U3-03	Fault Message 3	-	-	-		73
					U3-04	Fault Message 4	-	-	-		73
					U3-05	Elapsed Time 1	-	1hour	-		73
					U3-06	Elapsed Time 2	-	1hour	-		74
					U3-07	Elapsed Time 3	-	1hour	-		74
					U3-08	Elapsed Time 4	-	1hour	-		74
Initialize	A	Initialize	A1		A1-01	Access Level	0~1	1	1	0: Operation Only 1: Constant Set	53
					A1-02	Select Language	-	1	0	0:English	53
					A1-03	Init Parameters	0~1	1	0	0: No Initialize 1:Default Setting	53
					A1-04	Password 1	0~999	1	0		54
Programming	B	General	B1	Output Frequency	B1-01	Output Frequency	0~1	1	0	0: 50 Hz 1:60 Hz	54
Programming	B	General	B2	Auto Transfer Switch	B2-01	AC IN Low Disconnect	NOTE 3	1V	NOTE 3		55
					B2-02	AC IN Low Connect	NOTE 3	1V	NOTE 3		55
					B2-03	AC IN High Connect	NOTE 3	1V	NOTE 3		55
					B2-04	AC IN High Disconnect	NOTE 3	1V	NOTE 3		55
					B2-05	AC IN Current Limit	NOTE 3	0.1A	NOTE 3		55
					B2-06	AC IN Waveform Check	0~1	1	1	0: Ignore 1: Active	56

Menu	Group		Function		Constant	LCD Display	Range	Unit	Factory Setting	Remark	Page
					B2-07	Ground Relay	0~1	1	1	0: Disconnect 1: Connect	56
					B2-08	ACIN Frequency Range	0~1	1	1	0:50/60Hz+-5Hz 1:45Hz~65Hz	56
					B2-09	AC IN DynaCur Limit	0~1	1	0	0: Normal 1:Dynamic	56
					B2-10	MODE 2: BatLo?V ATS ON	0~32.00 0~16.00	0.01V	23.5V 11.75V		57
					B2-11	MODE 2: BatLo?S ATS ON	0~255	1 sec	10 sec		57
					B2-12	MODE 2: BatHi?V AT-SOFF	0~32.0 0~16.0	0.01V	28.8V 14.4V		57
					B2-13	MODE 2: BatHi?S ATSOFF	0~255	1 sec	60 sec		57
					B2-14	MODE 3: BatLo?V ATS ON	0~32.0 0~16.0	0.01V	23.5V 11.75V		57
					B2-15	MODE 3: BatLo?S ATS ON	0~255	1 sec	10 sec		57
					B2-16	MODE 3: BatHi?V ATSOFF	0~32.0 0~16.0	0.01V	28.8V 14.4V		57
					B2-17	MODE 3: BatHi?S ATSOFF	0~255	1 sec	60 sec		57
					B2-18	MODE 1: AC IN Current Lmt					58
					B2-19	MODE 2: AC IN Current Lmt					58
					B2-20	MODE 3: AC IN Current Lmt					58
					B2-21	MODE 4: AC IN Current Lmt					58
Programming	B	General	B3	Parallel	B3-01	Number of Slave	0~4	1	0		59
Programming	B	General	B4	2-3 Phase	B4-01	2-3 Phase Connection	0~1	1	0	0:Disable 1:Enable	59
					B4-02	2-3 Phase Master	0~1	1	0	0:Slave 1:Master	59
					B4-03	2-3 Phase Type	0~2	1	0	0:3 phase 1: Split phase 180 2: Two Leg phase 120	60
Programming	C	Inverter	C1	Inverter	C1-01	Inverter Out Voltage	NOTE 3	1V	NOTE 3		60
					C1-02	Bat Low ? V Shut-down	NOTE 3	1V	NOTE 3		60

Menu	Group		Function		Constant	LCD Display	Range	Unit	Factory Setting	Remark	Page
					C1-03	Bat Low ? V Restart	NOTE 3	1V	NOTE 3		60
					C1-05	Load Support Select	0~1	1	1	0: Disable 1: Enable	60
					C1-06	Load Support Level	1.0~3.5	0.1	2.0		61
Programming	D	Charger	D1	Charger	D1-01	AC CHARGER Selection	0~1	1	1	0:Disable 1:Enable	61
					D1-02	Charge Curve	1~3	1	3	1: Fixed 2: Adaptive 3: Adaptive+safe	61
					D1-03	Absorption Voltage	NOTE 3	1V	NOTE 3		62
					D1-04	Rep-Absorption Time	1~72	0.25hour	4	4x0.25=1 hour	62
					D1-05	Rep-Abs Interval	1~180	0.25day	28	28x0.25=7day	62
					D1-06	Max. Absorption Time	1~8	1hour	4hour		62
					D1-07	Float Voltage	NOTE 3	1V	NOTE 3		62
					D1-08	Charge Current	NOTE 3	1A	NOTE 3		62
					D1-09	Stop After 10Hr Bulk	0~1	1	1	0:Disable 1:Enable	63
					D1-10	Equalize Mode Select	0~1	1	1	0:Disable 1:Enable	63
Programming	E	Aux-Relay	E1	Set Aux-Relay 1 ON	E1-01	LOAD Higher than ? A	NOTE 3	0.01A	NOTE 3		63
					E1-02	LOAD Higher for ? sec	0~255	1sec	0sec		63
					E1-03	Udc Lower than ? V	NOTE 3	1V	NOTE 3		64
					E1-04	Udc Lower for ? sec	0~255	1sec	0sec		64
					E1-05	Udc Higher than ? V	NOTE 3	1V	NOTE 3		64
					E1-06	Udc Higher for ? sec	0~255	1sec	0sec		64
					E1-07	Not Charge for ? sec	0~255	1sec	0sec		64
					E1-08	Fan On for ? sec	0~255	1sec	0sec		64
					E1-09	When bulk Protection	0~1	1	0	0:Disable 1:Enable	64
					E1-10	System Fault Occurs	0~1	1	0	0:Disable 1:Enable	64
					E1-11	Temp. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	64
					E1-12	Temp. Alarm for ?sec	0~255	1sec	0sec		64
					E1-13	Low Batt. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	64
					E1-14	Low Batt. for ? sec	0~255	1sec	0sec		64

Menu	Group		Function		Constant	LCD Display	Range	Unit	Factory Setting	Remark	Page
					E1-15	Overload Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	65
					E1-16	OL Alarm for ? sec	0~255	1sec	0sec		65
					E1-17	Udc Ripple Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	65
					E1-18	UdcRipAlarm for ? sec	0~255	1sec	0sec		65
Programming	E	Aux-Relay	E2	Set Aux-Relay 1 OFF	E2-01	Load Lower than ? A		NOTE 3	0.01A	NOTE 3	
					E2-02	Load Lower for ? sec	0~255	1sec	0sec		65
					E2-03	Udc Lower than ? V	NOTE 3	1V	NOTE 3		65
					E2-04	Udc Lower for ? sec	0~255	1sec	0sec		65
					E2-05	Udc Higher than ? V	NOTE 3	1V	NOTE 3		65
					E2-06	Udc Higher for ? sec	0~255	1sec	0sec		65
					E2-07	Charging for ? sec	0~255	1sec	0sec		66
					E2-08	Fan Off for ? sec	0~255	1sec	0sec		66
					E2-09	Charge Finished ? Min	0~1000	1min	0		66
					E2-10	RY1 not ON for ? mins	0~1000	1min	0		66
					E2-11	AC IN Loss for ? sec	0~255	1sec	0sec		66
					E2-12	No Temp. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	66
					E2-13	No Temp. Alarm ? sec	0~255	1sec	0sec		66
					E2-14	No Low Bat. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E2-15	No Low Bat for ? sec	0~255	1sec	0sec		67
					E2-16	No OL Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E2-17	No OL Alarm for ? sec	0~255	1sec	0sec		67
					E2-18	No UdcRipple Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E2-19	No UdcRipple Alarm ?sec	0~255	1sec	0sec		67

Menu	Group		Function		Constant	LCD Display	Range	Unit	Factory Setting	Remark	Page
Programming	E	Aux-Relay	E3	Set AuxRelay 2 ON	E3-01	Load Higher than ? A		NOTE 3	0.01A	NOTE 3	
					E3-02	Load Higher for ?sec	0~255	1sec	0sec		67
					E3-03	Udc Lower than ? V	NOTE 3	1V	NOTE 3		67
					E3-04	Udc Lower for ? sec	0~255	1sec	0sec		67
					E3-05	Udc Higher than ? V	NOTE 3	1V	NOTE 3		67
					E3-06	Udc Higher for ? sec	0~255	1sec	0sec		67
					E3-07	Not Charge for ? sec	0~255	1sec	0sec		67
					E3-08	Fan On for ? sec	0~255	1sec	0sec		67
					E3-09	When bulk Protection	0~1	1	0	0:Disable 1:Enable	67
					E3-10	System Fault Occurs	0~1	1	0	0:Disable 1:Enable	67
					E3-11	Temp. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E3-12	Temp. Alarm for ?sec	0~255	1sec	0sec		67
					E3-13	Low Batt. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E3-14	Low Batt. for ? sec	0~255	1sec	0sec		67
					E3-15	Overload Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E3-16	OL Alarm for ? sec	0~255	1sec	0sec		67
					E3-17	Udc Ripple Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E3-18	UdcRipAlarm for ?sec	0~255	1sec	0sec		67
Programming	E	Aux-Relay	E4	Set Aux-Relay 2 OFF	E4-01	Load Lower than ? A		NOTE 3	0.01A	NOTE 3	67
					E4-02	Load Lower for ? sec	0~255	1sec	0sec		67
					E4-03	Udc Lower than ? V	NOTE 3	1V	NOTE 3		67
					E4-04	Udc Lower for ? sec	0~255	1sec	0sec		67
					E4-05	Udc Higher than ? V	NOTE 3	1V	NOTE 3		67
					E4-06	Udc Higher for ? sec	0~255	1sec	0sec		67
					E4-07	Charging for ? sec	0~255	1sec	0sec		67
					E4-08	Fan OFF for ? sec	0~255	1sec	0sec		67
					E4-09	Charge Finished ?Min	0~1000	1min	0		67

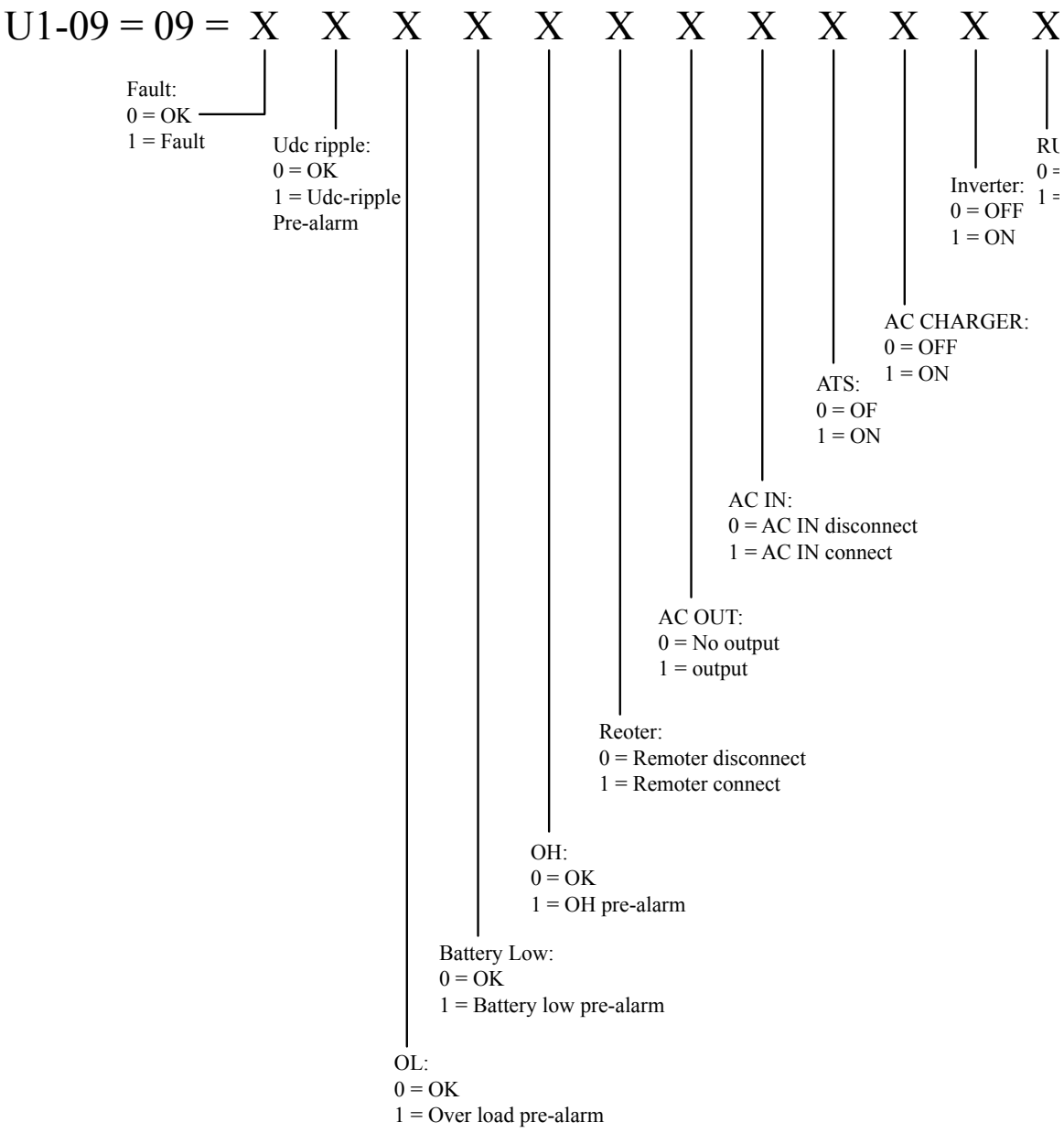
Menu	Group		Function		Constant	LCD Display	Range	Unit	Factory Setting	Remark	Page
					E4-10	RY2 not ON for ?mins	0~1000	1min	0		67
					E4-11	AC IN Loss for ?sec	0~255	1sec	0sec		67
					E4-12	No Temp. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E4-13	No Temp. Alarm ? sec	0~255	1sec	0sec		67
					E4-14	No Low Bat. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E4-15	No Low Bat for ? sec	0~255	1sec	0sec		67
					E4-16	No OL Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E4-17	No OL Alarm for ? sec	0~255	1sec	0sec		67
					E4-18	No UdcRipple Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E4-19	No UdcRipple Alarm ?sec	0~255	1sec	0sec		67
Programming	E	Aux-Relay	E5	Set Aux-Relay 3 ON	E5-01	Load Higher than ? A		NOTE 3	0.01A	NOTE 3	
					E5-02	Load Higher for ?sec	0~255	1sec	0sec		67
					E5-03	Udc Lower than ? V	NOTE 3	1V	NOTE 3		67
					E5-04	Udc Lower for ? sec	0~255	1sec	0sec		67
					E5-05	Udc Higher than ? V	NOTE 3	1V	NOTE 3		67
					E5-06	Udc Higher for ? sec	0~255	1sec	0sec		67
					E5-07	Not Charge for ? sec	0~255	1sec	0sec		67
					E5-08	Fan ON for ? sec	0~255	1sec	0sec		67
					E5-09	When bulk Protection	0~1	1	0	0:Disable 1:Enable	67
					E5-10	System Fault Occurs	0~1	1	0	0:Disable 1:Enable	67
					E5-11	Temp. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E5-12	Temp. Alarm for ?sec	0~255	1sec	0sec		67
					E5-13	Low Batt. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E5-14	Low Batt. for ? sec	0~255	1sec	0sec		67
					E5-15	Overload Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E5-16	OL Alarm for ? sec	0~255	1sec	0sec		67

Menu	Group		Function		Constant	LCD Display	Range	Unit	Factory Setting	Remark	Page
					E5-17	Udc Ripple Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E5-18	UdcRipAlarm for ?sec	0~255	1sec	0sec		67
Programming	E	Aux-Relay	E6	Set Aux-Relay 3 OFF	E6-01	Load Lower than ? A		NOTE 3	0.01A	NOTE 3	
					E6-02	Load Lower for ? sec	0~255	1sec	0sec		67
					E6-03	Udc Lower than ? V	NOTE 3	1V	NOTE 3		67
					E6-04	Udc Lower for ? sec	0~255	1sec	0sec		67
					E6-05	Udc Higher than ? V	NOTE 3	1V	NOTE 3		67
					E6-06	Udc Higher for ? sec	0~255	1sec	0sec		67
					E6-07	Charging for ? sec	0~255	1sec	0sec		67
					E6-08	Fan OFF for ? sec	0~255	1sec	0sec		67
					E6-09	Charge Finished ?Min	0~1000	1min	0		67
					E6-10	RY3 not ON for ?mins	0~1000	1min	0		67
					E6-11	AC IN Loss for ?sec	0~255	1sec	0sec		67
					E6-12	No Temp. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E6-13	No Temp. Alarm ? sec	0~255	1sec	0sec		67
					E6-14	No Low Bat. Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E6-15	No Low Bat for ? sec	0~255	1sec	0sec		67
					E6-16	No OL Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E6-17	No OL Alarm for ? sec	0~255	1sec	0sec		67
					E6-18	No UdcRipple Alarm Sel	0~1	1	0	0:Alarm 1:Pre-alarm	67
					E6-19	No UdcRipple Alarm ?sec	0~255	1sec	0sec		67
Programming	E	Aux-Relay	E7	Aux-Relay 1 Option	E7-01	Aux1 Usage Select	0~1	1	0	0:Do not use Aux 1: Use Aux	67
					E7-02	Aux1 Invert Select	0~1	1	0	0: Normal 1: Invert switch	68
					E7-03	Aux1 notSwitchOff T	0~1000	1 min	0		68

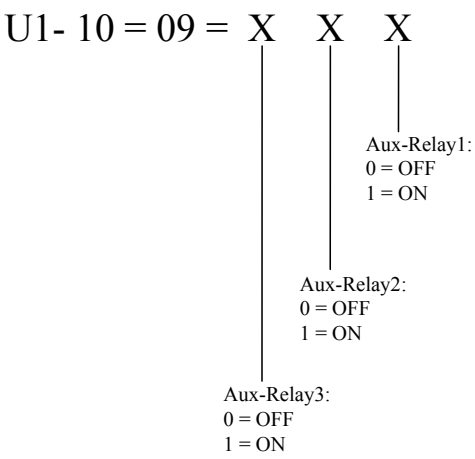
Menu	Group		Function		Constant	LCD Display	Range	Unit	Factory Setting	Remark	Page
Programming	E	Aux-Relay	E8	Aux-Relay 2 Option	E8-01	Aux2 Usage Select	0~1	1	0	0:Do not use Aux 1: Use Aux	68
					E8-02	Aux2 Invert Select	0~1	1	0	0: Normal 1: Invert switch	68
					E8-03	Aux2 notSwitchOff T	-	-	-		68
Programming	E	Aux-Relay	E9	Aux-Relay 3 Option	E9-01	Aux3 Usage Select	0~1	1	0	0:Do not use Aux 1: Use Aux	68
					E9-02	Aux3 Invert Select	0~1	1	0	0: Normal 1: Invert switch	68
					E9-03	Aux3 notSwitchOff T	-	-	-		68
Programming	F	Solar Charger	F1	Solar Charger	F1-01	Solar Charger Enable	0~1	1	1	0: Disable 1: Enable NOTE 5	-
					F1-02	Reset Amp-Hours	0~1	1	0	0: No 1: Yes NOTE 5	-
					F1-03	Solar Monitor Sel	0~10	1	0	0: Sum of display 1~10: independent display NOTE 5	-
Programming	O	Operator	O1	Monitor Select	O1-01	Power-ON Monitor Sel	0~26	1	4	NOTE 4	68
					O1-02	Key Idle Detect Time	10~600	1sec	180 sec		68
Programming	O	Operator	O2	Key Selections	O2-01	Key Pressed Beep Sel	0~1	1	1		68
					O2-02	Elapsed Time Reset	0~60000	1hour	0		69
					O2-03	Elapsed Time Select	0~1	1	0	0:Power ON 1: Run Time	69
					O2-04	Combi-Gamma Model	-	-	-		69
					O2-06	MODE Key Hold Time	2~10	1sec	5 sec		69
					O2-07	RUN/STOP KeyHold-Time	2~10	1sec	2 sec		69
					O2-08	Auto Run Select	0~1	1	1	0: Manual 1: Auto	69
					O2-09	Display IdleTime Set	0~60	1min	10 min		69

NOTE 1:

Operation Status



NOTE 2:



NOTE 3:

Constant / Model	B2-01	B2-02	B2-03	B2-04	B2-05	C1-01	C1-02	C1-03	D1-03	D1-07
COMBI1512	180V	187V	265V	270V	16.0A	230V	9.3V	10.9V	14.4V	13.8V
COMBI3012	180V	187V	265V	270V	16.0A	230V	9.3V	10.9V	14.4V	13.8V
COMBI1524	180V	187V	265V	270V	16.0A	230V	18.6V	21.8V	14.4V	13.8V
COMBI3024	180V	187V	265V	270V	16.0A	230V	18.6V	21.8V	14.4V	13.8V

Constant / Model	D1-08	E1-01	E1-03	E1-05	E2-01	E2-03	E2-05
		E3-01	E3-03	E3-05	E4-01	E4-03	E4-05
		E5-01	E5-03	E5-05	E6-01	E6-03	E6-05
COMBI1512	35A	6.65A	11.75V	16.0V	1.66A	11.75V	16.0V
COMBI3012	70A	13.3A	11.75V	16.0V	3.32A	11.75V	16.0V
COMBI1524	17A	6.65A	23.5V	32.0V	1.66A	23.5V	32.0V
COMBI3024	35A	13.3A	23.5V	32.0V	3.32A	23.5V	32.0V

NOTE 4:

Parameter	Setting	LCD Display
O1-01 =	0	AC IN Voltage
	1	AC IN Current
	2	AC OUT Voltage
	3	AC OUT Current
	4	Battery Voltage
	5	Battery Ripple Volt
	6	Battery Current
	7	Control Mode
	8	Operation Status
	9	Aux-Relay Status
	10	Elapsed Time
	11	Bat.Temp.Sensor
	12	CPU ID 1
	13	CPU ID 2
	14	Solar Charger Status
	15	Solar Supply Current
	16	Solar Supply Power
	17	Solar Amp-Hours
	18	Solar Total Amp-Hours
	19	DC Generator Status

NOTE 5:

The constants marked with NOTE 5 are only visible when extension port (Port C) is connected. After power on, the Combi-Gamma will start to scan each built-in module and extension module. The constants marked with NOTE 5 will be visible only when the extension port (Port C) is connected with extension module.

Chapter 6 Programming Constants

A Group (Initialize):

A1 Group (Initialize)

A1-01: Access level

- Use constant A1-01 to select the user constant access level.

  This level determines which user constants can be changed and displayed.

Setting	Function
A1-01=0	This setting allows the “operation” and “initialize” to be changed or displayed. Use this setting to prevent user constant settings from being changed.
A1-01=1 (Initial setting)	This setting allows all user constants to be changed or displayed.

A1-02: Select Language

- Use constant A1-02 to select the language displayed by the Combi-Gamma. A value of 0 set English and values of others set other language.
- This user constant is not returned to factory setting when constants are initialized. It must be manually reset to factory setting.

Setting	Function
A1-02=0 (Initial setting)	English language
A1-02=1	Reserved, under development
A1-02=2	Reserved, under development
A1-02=3	Reserved, under development
A1-02=4	Reserved, under development
A1-02=5	Reserved, under development
A1-02=6	Reserved, under development

A1-03: Init Parameters

- Use constant A1-03 to initialize the user constants.
- When initialized, the user constants will return to their factory preset values. You should normally record the setting of any constants that are changed from factory presets.

Setting	Function
A1-03=0 (Initial setting)	Returns to initialize Display without initializing any user constants.
A1-03=1	Initializes the user constants to factory settings.

A1-04: Init Password 1

- This constant is reserved for the factory to test and set the functions.
- Users are not allowed to set this constant.

Lock the constants setting (A1-01=1)

1. Finish setting all the programmable parameters to the desired values.
2. Change A1-01=0 (Operation only), factory setting is A1-01=1 (Constant set).
3. Go to A1-04 and press RUN/STOP key and UP key at the same time till A1-05 parameter occurs.
4. Enter the desired password (max. 4 digits)
5. Press UP key to leave A1-05

   Above procedure completes locking the constants setting and no more programming selection would appear. A1-01 would only display 0 (Operation only) and would not display 1 (Constants set).

Unlock the constants setting

1. Enter the password in A1-04 to be exactly the same as the one earlier set in A1-05
2. When the password in A1-04 matches the one earlier set in A1-05, the unlocking is completed. A1-01=1 (Constants set) would appear again for programming.

B Group (General):

B1 Group (Output Frequency)

B1-01: Output frequency

- B1-01 is used to set the output frequency at INVERTER AC output

Setting	Function
B1-01=0 (Initial setting)	50Hz at INVERTER AC output
B1-01=1	60Hz at INVERTER AC output

- B2-08: AC IN Frequency Range

Setting	Function
B2-08=0	When B1-01=0: Acceptable AC input frequency is 50Hz ±5Hz (45~55Hz)
	When B1-01=1: Acceptable AC input frequency is 60Hz ±5Hz (55~65Hz)
B2-08=1 (Initial setting)	Accept wide AC input frequency range between 45~65Hz

B2 Group (Auto Transfer Switch)

B2-01: AC IN Low Disconnect

- Use constant B2-01 to determine the AC IN voltage below which level the ATS (Auto Transfer Switch) will switch off.
- This voltage level will always lie below the AC IN Low Connect (B2-02) level. In fact, changing this level will also change the AC IN Low Connect (B2-02) level.

B2-02: AC IN Low Connect

- This setting forms a pair with AC IN Low Disconnect (B2-01). With this setting, one determines the AC IN low voltage at which level the ATS will switch on. This should lie above AC IN Low Disconnect (B2-01) level to prevent continuous switching off the ATS when the voltage is fluctuating around the level.
- In fact, the parameter which is changed is the difference between AC IN Low Disconnect (B2-01) and AC IN Low Connect (B2-02).
- The result of this is that when changing B2-01 level, this level (B2-02) also changes.

  * Note: B2-02 can be ignored for a short time when AC IN Waveform Check (B2-06) is disabled (B2-06=0)

- When the AC IN voltage drops due to the increasing charge current, the AC CHARGER will take care that the voltage does not drop below this level.
- B2-02=B2-01+offset voltage

B2-03: AC IN High Connect

- This setting forms a pair with AC IN High Disconnect (B2-04). With this setting, one determines the AC IN high voltage at which level the ATS will switch on. This should lie below the AC IN High Disconnect (B2-04) level to prevent continuous switching of the ATS when the voltage is fluctuating around that level.
- In fact, the parameter which is changed is the difference between AC IN High Disconnect (B2-04) and AC IN High Connect (B2-03).
- The result of this is that when changing B2-04 level, this level (B2-03) also changes.
- B2-03=B2-04–offset voltage

B2-04: AC IN High Disconnect

- Use constant B2-04 to determine the AC IN voltage above which level the ATS will switch off.
- This voltage level will always lie above the AC IN High Connect (B2-03) level. In fact, changing this level will also change the AC IN High Connect (B2-03) level.

B2-05: AC IN Current Limit

- Use constant B2-05 to set the specific maximum AC input current. This value is very important for both battery charger and inverter output load support.
- When using constant B2-05, the values determine the actual AC current limit.

* Note: With Load Support enabled, there is a minimum value for the AC input current limit. Please see the note at Load Support (page 60).

B2-06: AC IN Waveform Check

- Use constant B2-06 to enable/disable the fast detection of input voltage wave shape.

Setting	Function
B2-06=0 (Ignore)	• By disabling AC IN waveform check, AC IN Low Disconnect (B2-01) is ignored. When the load current is higher 1.5 times than AC In Current Limit (B2-05), this is used to prevent unnecessary switching to INVERTER due to voltage drop when a high load is connected.
B2-06=1 (Initial setting) (Active)	• This detection checks the wave shape, if it is not sinusoidal within certain limits, the AC input voltage is rejected. • However, certain generator or very weak mains supply have an ill shaped sinusoidal output especially when the load suddenly changes. The fast detection will detect a failure in such a case. • This will result in a slightly longer transfer time.

B2-07: Ground Relay

- Used to enable/disable the internal ground relay functionality. The ground relay is useful when an earth-leakage circuit-breaker is part of the installation.
- When ATS (Auto Transfer Switch) is open (INVERTER mode), the Neutral of the inverter is connected to “Ground” terminal.
- When ATS closes (AC IN is transferred to AC OUT), the Neutral is first disconnected from “Ground” terminal.

Setting	Function
B2-07=0	The internal ground relay is open with “G” terminal.
B2-07=1 (Initial setting)	The internal ground relay is closed with “G” terminal.

B2-08: AC IN Frequency Range

Refer to (B1-01)

B2-09: AC IN Dynamic Current Limit

- This setting is an expansion of the AC IN Current Limit (B2-05) mechanism.

Setting	Function
B2-09=0 (Initial setting)	• The AC current limit is specified by the AC IN Current Limit (B2-05) setting

B2-09=1	• The effective AC input current limit depends on the load history. When the load is lower than the AC IN Current Limit (B2-05), the effective AC input current limit is also lower but slightly above the load. • When the load increase, the effective current limit also increases with a delay. The thought behind this is that when a generator is running at a low load, it can't switch to full load immediately and it needs some time to increase the power.

***** An example:

- We have a 2KVA generator.
  We adjust the AC IN Current Limit (B2-05) setting to 8A and we enable Load Support (C1-05=1). We have no load connected and the batteries are fully charged. Therefore, no current from the generator is drawn.
- At this moment, we connect a load of 7A to the Combi-Gamma with this setting (B2-09) disabled, the Combi-Gamma would not react because the load is below the AC IN Current Limit (B2-05) setting. The result is that the full load is connected to the generator which will drop in voltage because it can't deliver that current instantly which could result in switching to the INVERTER.
- If however we had this setting (Dynamic Current Limit) enabled, the effective AC input current limit would be far lower than 8A because the load was zero. So connecting a load of 7A will result in Combi-Gamma starting to Load Support and no voltage drop is being examined on the AC OUT. The generator starts to supply the load and the effective AC input current limit will increase to 8A slowly. At the moment, the Combi-Gamma will stop Load Support and the full load is on the generator.
- This is a powerful option in combination with Load Support but also without Load Support, it can prevent unnecessary switching to the INVERTER because the charge current will reduce when the AC input current becomes higher than the effective AC input current limit.

B2-10: MODE4: Bat Lo?V ATS ON
B2-11: MODE4: Bat Lo?S ATS ON
B2-12: MODE4: Bat Hi?V ATSOFF
B2-13: MODE4: Bat Hi?S ATSOFF
B2-14: MODE3: Bat Lo?V ATS ON
B2-15: MODE3: Bat Lo?S ATS ON
B2-16: MODE3: Bat Hi?V ATSOFF
B2-17: MODE3: Bat Lo?S ATSOFF

- B2-10～B2-13 are used to set the condition of ATS to be ON/OFF in MODE4
- B2-14～B2-17 are used to set the condition of ATS to be ON/OFF in MODE3
- When Combi-Gamma is in either MODE4 or MODE3, the INVERTER mode takes priority to supply voltage to the AC OUT for load consumption. When AC IN power is ready, the INVERTER is active and the battery is about to be exhausted, ATS will be switched on to ensure the AC OUT will continuously supply the load. At the moment, AC OUT will be supplied by the AC IN power. At the same time, the battery can be charged by other renewable energy such as a solar charger, wind charger or a DC generator charger (MODE3) which is normally the solar house application in no need of an AC CHARGER. The battery can be charged by AC IN (AC CHARGER) or other renewable energy such as a solar charger, wind charger or DC generator charger (MODE4) which is normally the application requesting both AC charging and DC charging.

- When the battery charger slowly reaches a certain level, this means the battery will be fully charged soon and the ATS will be switched off for the INVERTER to take over the ongoing supply to AC OUT for load.
- B2-10 and B2-11 are used to set ATS to be “ON” when the battery voltage is lower than B2-10 voltage value and longer than the second time set in B2-11 in MODE4

  (INVERTER OFF+ATS ON+AC CHARGER ON)
- B2-12 and B2-13 are used to set ATS to be “OFF” when the battery voltage is higher than B2-12 voltage value and longer than the second time set in B2-13 in MODE4.

  (INVERTER ON+ATS OFF+AC CHARGER OFF)
- B2-14 and B2-15 are used to set ATS to be “ON” when the battery voltage is lower than B2-14 voltage value and longer than the second time set in B2-15 in MODE3.

  (ATS ON+INVERTER OFF+AC CHARGER ON)
- B2-16 and B2-17 are used to set ATS to be “OFF” when the battery voltage is higher than B2-16 voltage value and longer than the second time set in B2-17 in MODE3.

  (INVERTER ON+ATS OFF+ AC CHARGER OFF)

B2-18: MODE1: ACIN Current Lmt

- Use constant B2-18 to set the set the specific maximum AC input current in MODE 1. This value is very important for both battery charger and inverter output Load-Support.
- When using constant B2-18, the values determine the actual AC current limit.

B2-19: MODE2: ACIN Current Lmt

- Use constant B2-19 to set the set the specific maximum AC input current in MODE 2. This value is very important for both battery charger and inverter output Load-Support.
- When using constant B2-19, the values determine the actual AC current limit.

B2-20: MODE3: ACIN Current Lmt

- Use constant B2-20 to the specific maximum AC input current in MODE 3. This value is very important for both battery charger and inverter output Load-Support.
- When using constant B2-20, the values determine the actual AC current limit.

B2-21: MODE4: ACIN Current Lmt

- Use constant B2-21 to set the set the specific maximum AC input current in MODE 4. This value is very important for both battery charger and inverter output Load-Support.
- When using constant B2-21, the values determine the actual AC current limit.

B3 Group (Parallel System)

B3-01: Number of Slaves

- A parallel system is built with 1 master and up to 4 slaves with this setting, one can specify the number of slaves in the system. This setting has only to be done in the master. It is not required to specify the number of slaves. The system will work just fine without this setting being specified.
- This setting is added for convenience of the end-user when the AC IN power is larger than the total of B2-05* the number of the Combi-Gamma (Master + Slaves) when B3-01=0. The only effect of this setting is on the scaling of AC IN Current Limit (B2-05). If B3-01=0, one must divide the available AC current by the number of Combi-Gamma (Master + Slaves) and set the limit accordingly. So an example of setting the B2-05-=10A in a parallel system with 3 Combi-Gamma would result in a limit of 3*10A=30A
- If however in this system the number of slaves is set to 2 (B3-01=2), then the division is done internally and the setting of the AC IN Current Limit to 10A (B2-05=10) will result in 10A for the whole system and this is shared by the Master and Slaves. This system is often applied when the AC IN power is limited for example by a generator of small capacity.

B4 Group (2-3 Phase)

B4-01: 2-3 Phase Connection

- All the Combi-Gamma in a multi-phase system must have 2-3 phase enabled. Use this setting to perform this function.
- If more Combi-Gamma per phase are connected in parallel, then only the masters of the parallel system must have 2-3 phase enabled.

Setting	Function
B4-01=0 (Initial setting)	2-3 Phase connection disabled.
B4-01=1	2-3 Phase connection enabled.

B4-02: 2-3 Phase Master

- In a multi-phase system, there is always one (and only one) master. The Combi-Gamma at the other phases are called slaves.
- Use this setting to designate one of the Combi-Gamma as the master.
- If this parameter is set (B4-02=0), the Combi-Gamma becomes a slave.

Setting	Function
B4-02=0 (Initial setting)	2-3 Phase system. This setting for Slave
B4-02=1	2-3 Phase system. This setting for Master

B4-03: 2-3 Phase Type

- Use setting B4-03 to determine the kind of multi-phase required.

Setting	Function
B4-03=0 (Initial setting)	3 Phase type: Three Combi-Gamma are required. Output is 3-phase with a 120° phase shift.
B4-03=1	Split Phase 180° type: Two Combi-Gamma are required. Output is 2-phase with a 180° phase shift
B4-03=2	Two Leg 3 Phase 120° type: Two Combi-Gamma are required. Output is 2-phase of a normal 3-phase system (two phases with 120° phase shift).

C Group (INVERTER):

C1 Group (INVERTER)

C1-01: INVERTER Output Voltage

- Use constant C1-01 to change the RMS output voltage of the INVERTER.

C1-02: Bat Low - V Shut-down

- With this setting, one can determine the battery voltage at which level the INVERTER will switch off. This can be useful to prevent drawing too much current from an exhausted battery.
- This voltage level will always lie below the Bat Low - V Restart (C1-03) level. In fact, changing this level will also change the Bat Low - V Restart (C1-03) level.
- C1-03=C1-02+offset voltage

C1-03: Battery Low ? V Restart

- This setting forms a pair with Bat Low - V Shut-down (C1-02). With this setting, one determines the battery voltage at which level the INVERTER will switch on.
- In fact, the parameter which is changed is the difference between Bat Low ? V Shut-down (C1-02) and Bat Low ? V Restart (C1-03). The result of this is that when changing the Bat Low ? V Shut-down (C1-02) level, this level also changes.

C1-05: Load Support Select

- Using this constant C1-05, the Load Support feature can be enabled or disabled. Use Load Support to prevent an external circuit breaker to trip when the load on the Combi-Gamma is too high.
- If the load exceeds the AC IN Current Limit (B2-05), the Combi-Gamma will start inverting and will provide the extra current needed.

  * Note: When Load Support is enabled. C1-05=1 (Initial setting), there is a minimum AC input current limit of approximate 2-3 Amps. Setting a lower limit (B2-05) than this

minimum value will result in the minimum limit. (Note: In a parallel system, this limits per Combi-Gamma!)

Setting	Function
C1-05=0	Load Support Function is disabled.
C1-05=1 (Initial setting)	Load Support Function is enabled.

C1-06: Load Support Level

- This setting is a special setting for load support mode when the Combi-Gamma is charging and due to a sudden load, the AC IN current exceeds the AC IN Current Limit (B2-05), the Combi-Gamma will switch to load support mode (when C1-05=1)
- At that moment, the current need is unknown. The Combi-Gamma makes an assumption of the magnitude of this current. This assumption is equal to AC IN Current Limit (B2-05) multiplied by this Load Support Level (C1-06). The default factor is two.
- This will prevent the circuit breaker from tripping because current provided by the INVERTER minus the current drawn by the load is always lower than the rating of the circuit breaker. This happens, of course, when the AC IN Current Limit (B2-05) is correctly adjusted on the circuit breaker.
- If for instance in a generator application, the circuit breaker has a higher value than the AC IN Current Limit (B2-05)(Normal load of generator is lower than maximum peak load) and one knows that the load which is switched on always draws a certain current, one can consider to increase this factor (C1-06) to achieve better results with sudden load changes.

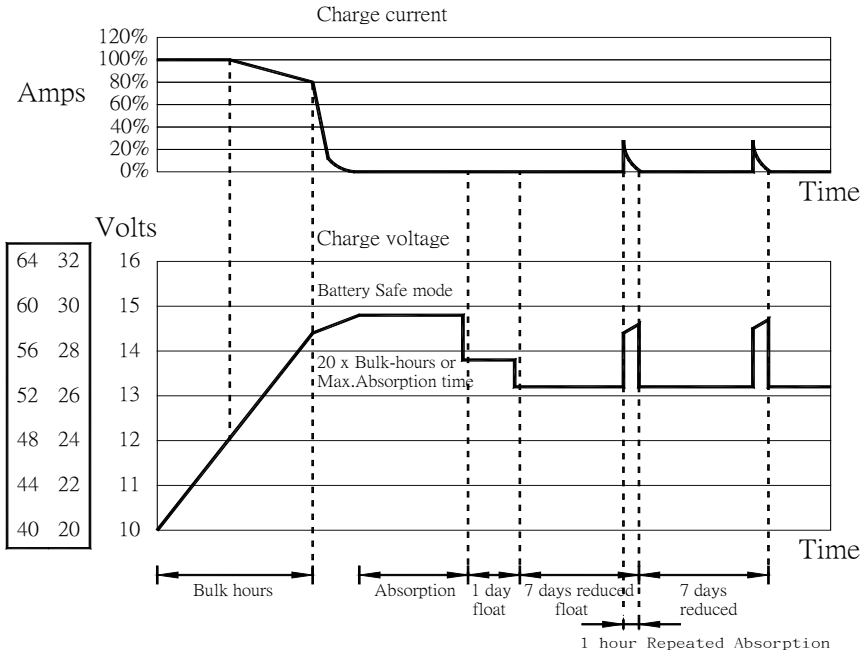
D Group (AC CHARGER):

D1 Group (Charger)

D1-02: Charge Curve

Setting	Function
D1-02=1	Fixed
D1-02=2	Adaptive
D1-02=3 (Initial setting)	Adaptive + Battery safe

- The Fixed (D1-02=1) charge curve will have a fixed Absorption Time (D1-06).
- The Adaptive (D1-02=2) and Adaptive +Battery safe (D1-02=3) curve derive the Absorption time from the Bulk time. The maximum Absorption time of these charge curves is determined by Absorption Time (D1-06) setting.
- The Adaptive + Battery safe (D1-02=3) curve has a special regulation in the absorption phase. The absorption phase will start when the battery voltage reaches 14.4V(for 12V batteries) regardless of the specified Absorption Voltage (D1-03). During the absorption phase, the voltage will increase with a fixed ramp until the voltage reaches the absorption voltage or the calculated absorption time is over in the latter case, the absorption phase will end before the absorption voltage is reached.



D1-03: Absorption Voltage

- Use this setting to specify the absorption voltage.

D1-04: Repeated Absorption Time

- Use this setting to specify the duration of the repeated absorption “pulses”.

D1-05: Repeated Absorption Interval

- Use this setting to specify the interval between repeated absorptions.

D1-06: Maximum Absorption Time

- If the Charge Curve is fixed (D1-02=1), then this setting is used to determine the absorption time.
- In all other cases, this setting determines the maximum absorption time.

D1-07: Float Voltage

- Use this setting to specify the float voltage.

D1-08: Charge Current

- Use this setting to specify the current with which the battery is charged in the bulk phase.

  * Note: The actual charge current depends on other conditions also. Therefore, under certain circumstances, it is possible that the actual charge current is lower than this setting. This can, among others, be due to:

- A low AC IN Current Limit (B2-05) in combination with a high load.
- A high environmental temperature
- A too high ripple voltage due to improper cabling.

D1-09: Stop After 10Hr Bulk

- This is a safety setting. When the bulk phase lasts more than 10 hours, this can be indication that a battery cell is damaged.
- The absorption voltage (or the 14.4V for battery when Battery Safe (D1-02=3) mode is used) will never be reached in that case and the other cells will be over-charged resulting in the production of an explosive gas.
- Therefore, the charger is disabled if the bulk phase lasts more than 10 hours.
- This setting can be disabled because it does not always indicate a problem when the bulk phase lasts very long. The charge current can be very low due to limited AC input current and/or AC loads. Also, DC loads can “steal away” part of the charge current. In that case, the bulk phase will need more time to complete and this setting must be disabled.

  *** Note: When this setting is disabled, there is no safety check to protect against over-charging.**

Setting	Function
D1-09=0	Stop After 10Hr Bulk setting is disabled
D1-09=1 (Initial setting)	Stop After 10Hr Bulk setting is enabled

D1-10: Equalize Mode Select (Storage Mode Select)

- This setting is used for enabling/disabling the Equalize Mode.
- In this mode, the voltage setpoint is 13.2V (for 12V battery). If Equalize mode is disabled, then the normal float voltage will be used.

Setting	Function
D1-10=0	Equalize mode is disabled
D1-10=1 (Initial setting)	Equalize mode is enabled

E Group (Auxiliary Relay):

E1 Group (Setting Aux-Relay 1 ON Condition)

E1-01: LOAD Higher than ? Amps
E1-02: LOAD Higher for ? sec

- Use these settings to switch the Aux-Relay 1 ON. When the actual AC OUT load is above a certain value (E1-01) for a certain time (E1-02).
- The corresponding Aux-Relay 1 OFF condition is

  E2-01: Load Lower than ? Amps and

  E2-02: Load Lower for ? sec.

  * Note: If setting E1-02=0 sec (Initial setting). Then the E1-01 is ignored.

  * Note: If setting E2-02=0 sec (Initial setting). Then the E2-01 is ignored.

E1-03: Udc Lower than ? Voltage
E1-04: Udc Lower for ? sec

- Use these settings to switch the Aux-Relay 1 ON. When battery voltage becomes lower than a certain limit (E1-03) for a certain time (E1-04).

  * Note: If E1-04=0 sec (Initial setting), then E1-03 is ignored.

E1-05: Udc Higher than ? Voltage
E1-06: Udc Higher for ? sec

- Use these settings to switch the Aux-Relay 1 ON when battery voltage becomes higher than a certain limit (E1-05) for a certain time (E1-06).

  * Note: If E1-06=0 sec (Initial setting), then E1-05 is ignored.

E1-07: Not Charge for ? sec

- Use this setting to switch on the Aux-Relay 1 when the AC CHARGER is not charging for a certain time (E1-07).
- Normally used for generating an alarm situation.

E1-08: Fan ON for ? sec

- This will switch the Aux-Relay 1 ON when the internal fan switches on. This can be used together with the E2-08: Fan OFF for ? sec setting to drive an external fan.

E1-09: When bulk protection is activated.

- This will set the Aux-Relay1 ON when the “bulk protection” (D1-09=1) is activated. This condition will remain valid as long as the AC CHARGER is disabled due to that safety mechanism. One can use this setting to generate an alarm.

E1-10: System Fault Occurs

- This will switch on the Aux-Relay 1 when the Combi-Gamma switches off due to an internal alarm situation.

E1-11: Temp. Alarm Select (When E1-12=0, ignore this setting)
E1-12: Temp. Alarm for ? sec

- If you want to switch on the Aux-Relay 1 when there is a over temperature alarm, this setting (E1-11) can be used to choose between pre-alarm or normal alarm.
- As with other Aux-Relay 1 settings, a delay value (E1-12) must be specified also. This can be done with Delay value for set Aux-Relay 1 ON when over temperature alarm (E1-12) setting.

E1-13: Low Batt. Alarm Select (When E1-14=0, ignore this setting)
E1-14: Low Batt. Alarm for ? sec

- If you want to switch on the Aux-Relay 1 when there is a low battery alarm, this setting

(E1-13) can be used to choose between pre-alarm or normal alarm.

- As with other Aux-Relay 1 settings, a delay value (E1-14) must be specified also. This can be done with Delay value for set Aux-relay 1 ON when low battery alarm (E1-14) setting.

E1-15: OverLoad Alarm Select (When E1-16=0, ignore this setting)
E1-16: OverLoad Alarm for ? sec

- If you want to switch on the Aux-Relay 1 when there is a overLoad alarm, this setting (E1-15) can be used to choose between pre-alarm or normal alarm.
- As with other Aux-Relay 1 setting, a delay value (E1-16) must be specified also. This can be done with Delay value for set Aux-Relay 1 ON when overload alarm (E1-16) setting.

E1-17: Udc Ripple Alarm Select (When E1-18=0, ignore this setting)
E1-18: OverLoad Alarm for ? sec

- If you want to switch on the Aux-Relay 1 when there is a battery voltage ripple alarm. This setting (E1-17) can be used to choose between pre-alarm or normal alarm.
- As with other Aux-Relay 2, setting a delay value (E1-18) must be specified also. This can be done with Delay value for set Aux-Relay 1 ON when battery voltage ripple alarm (E1-18) setting.

E2 Group (Setting Aux-Relay 1 OFF Condition)

E2-01: Load Lower than ? Amps
E2-02: Load Lower for ? sec

- Use these settings to switch Aux-Relay 1 OFF. When the actual AC OUT Load is below a certain value (E2-01) for a certain time (E2-02).
- The corresponding Aux-Relay ON condition is

  E1-01: Load Higher than ? Amps and

  E1-02: Load Higher for ? sec.

  * Note: If setting E2-02 (E1-02)=0 sec (Initial setting), then the E2-01 (E1-01) is ignored.

E2-03: Udc Lower than ? Voltage
E2-04: Udc Lower for ? sec

- Use these settings to switch off the Aux-Relay 1 when battery voltage becomes lower than a certain limit (E2-03) for a certain time (E2-04)

  * Note: If E2-04=0 sec (Initial Setting), then E2-03 is ignored.

E2-05: Udc Higher than ? Voltage
E2-06: Udc Higher for ? sec

- Use these settings to switch off the Aux-Relay 1 when battery voltage becomes higher than a certain limit (E2-05) for a certain time (E2-06)

  * Note: If E2-06=0 sec (Initial setting), then E2-05 is ignored.

E2-07: Charging for ? sec

- This setting switches the Aux-Relay 1 OFF when the AC CHARGER started for a certain time (E2-07). This can be useful when the Aux-Relay 1 is for instance used a low battery alarm.
- Use the Set Udc Lower than ? Voltage (E1-03) setting to start the alarm and use this setting (E2-07) to stop it.

  * Note: As along as the battery voltage is lower than the specified limit (E1-03), the alarm will be active.

E2-08: Fan OFF for ? sec

- This will switch the Aux-Relay 1 OFF when the internal fan switches off. This can be used together with the E1-08: Fan ON for ? sec setting to drive an external fan.

E2-09: Charge finished for ? Min (When E2-09=0, ignore this setting)

- This condition becomes active when the charge bulk phase is finished for a certain time (E2-09).
- For the charge curve, take a look at for instance the Charge Current (D1-08) setting.
- This is useful when the Aux-Relay 1 is used to start a generator. Once started, one might want to keep the generator on until the batteries are more or less charged.

E2-10: Aux-Relay 1 not ON for ? minutes (When E2-10=0, ignore this setting)

- If one does not need special off condition, one can use this setting and the Aux-Relay 1 will switch off automatically when there has been no ON condition for a certain time (E2-10).

E2-11: AC IN loss for ? sec (When E2-11=0, ignore this setting)

- This setting will switch off Aux-Relay1 if the RMS value of AC IN voltage is too low for a certain time (E2-11).
- This AC level is determined by the AC IN Low Disconnect (B2-01) setting.
- Use this setting (E2-11) to disable re-starting of a generator which is switched off by hand when the Aux-Relay 1 is used to generate a start signal for that generator.

E2-12: No Temp. Alarm Select (When E2-13=0, ignore this setting)
E2-13: No Temp. Alarm for ? sec

- If you want to switch off the Aux-Relay 1 when there is no over temperature alarm, this setting (E2-12) can be used to choose between pre-alarm or normal alarm.
- As with other Aux-Relay 1 setting, a delay value must be specified also. This can be done with the Delay value for set Aux-Relay 1 OFF when No Overtemperature Alarm

(E2-13) setting.

E2-14: No Low Batt. Alarm Select (When E2-15=0, ignore this setting)
E2-15: No Low Batt Alarm for ? sec

- If you want to switch off the Aux-Relay 1 when there is no low battery alarm, this setting (E2-14) can be used to choose between pre-alarm or normal alarm.
- As with other Aux-Relay 1 setting, a delay must be specified also. This can be done with the Delay value for set Aux-Relay 1 OFF when No Low Battery Alarm (E2-15) setting.

E2-16: No OverLoad Alarm Select (When E2-17=0, ignore this setting)
E2-17: No OverLoad Alarm for ? sec

- If you want to switch off the Aux-Relay 1 when there is no OverLoad alarm, this setting (E2-16) can be used to choose between pre-alarm or normal alarm.
- As with other Aux-Relay 1 setting, a delay must be specified also. This can be done with the Delay value for set Aux-Relay 1 OFF when No OverLoad Alarm (E2-17) setting.

E2-18: No Udc Ripple Alarm Select (When E2-19=0, ignore this setting)
E2-19: No Udc Ripple Alarm for ? sec

- If you want to switch off the Aux-Relay 1 when there is no battery voltage ripple alarm, this setting (E2-18) can be used to choose between pre-alarm or normal alarm.
- As with other Aux-Relay 1 setting, a delay must be specified also. This can be done with the Delay value for set Aux-Relay 1 OFF when No Battery voltage Ripple Alarm (E2-19) setting.

E3 Group (Setting Aux-Relay 2 ON Condition)

E4 Group (Setting Aux-Relay 2 OFF Condition)

E5 Group (Setting Aux-Relay 3 ON Condition)

E6 Group (Setting Aux-Relay 3 OFF Condition)

* Note: The functions and the settings of E3, E4, E5 and E6 Groups are exactly the same as those of E1 and E2 Group so please refer to above E1 and E2 Group description and setting for E3, E4, E5 and E6 Groups.

E7 Group (Aux-Relay 1 Option)

E7-01: Aux-Relay 1 Usage Select

Setting	Function
E7-01=0 (Initial setting)	Auxiliary Relay 1 is not allowed to be active (Idle).
E7-01=1	Auxiliary Relay 1 is allowed to be active.

E7-02: Aux-Relay 1 Invert Select

Setting	Function
E7-02=0 (Initial setting)	Auxiliary Relay 1 function is normal.
E7-02=1	Auxiliary Relay 1 function is inverted.

- This is used to invert the Aux-Relay 1 So ON becomes OFF and OFF becomes ON. In the program, the labels are adapted to reflect this inversion.

E7-03: Aux1 not Switch Off Time (Aux-Relay 1 do not switch off with certain period)

- Use constant E7-03 to determine the minimum ON time.
- The Aux-Relay 1 will not be switched off within the time specified here measured from the moment that all on condition are inactive.

  * Note: OFF conditions with a delay of 0 minute, ignore this setting.

E8 Group (Aux-Relay 2 Option)
E9 Group (Aux-Relay 3 Option)

* The functions and the settings of E8 and E9 Groups are exactly the same as those of E7 Group so please refer to above E7 Group description and setting for E8 and E9 Groups.

O Group (Operator):
O1 Group (Monitor Select)

O1-01: Power ON LCD Monitor Select

- After start up of the Combi-Gamma, the monitor selections will be visible on the LCD Display, U1-05 Battery Voltage is the initial value shown in the display.
- All the constants in U1 Group can be programmed (U1-01～U-26).

O1-02: Key Idle Detect Time

- Use constant O1-02 to set the idle time when the keyboard is not operated and once any key is pressed, the display will return to the LCD monitor selection value set in constant O1-01.
- Initial Setting=180 sec, setting range: 10～600 sec.

O2 Group (Key Selections)

O2-01: Key Sounds

Setting	Function

O2-01=0	When the keys are pressed, the beeper will not be heard.
O2-01=1 (Initial setting)	When the keys are pressed, the beeper will sound.

O2-02: Elapsed Time Reset

- Use constant O2-02 to reset elapsed time.

O2-03: Elapsed Time Select

Setting	Function
O2-03=0 (Initial setting)	The elapsed time started to be counted after power is on.
O2-03=1	The elapsed time started to be counted after RUN.

O2-04: Combi-Gamma Model

- This is the serial number of the Combi-Gamma.

O2-06: MODE Key Hold Time

- Use constant O2-06 to set the time it takes to press MODE key to transfer from one of fours modes to another mode. (This has to be done in STOP mode)
- Initial setting=5 sec, setting range: 2~10 sec.

O2-07: RUN/STOP Key Hold Time

- Use constant O2-07 to set the time it takes to press RUN/STOP key to activate its function.
- Initial setting=2 sec, setting range: 2~10 sec.

O2-08: Power ON Auto Run Select

- Use constant O2-08 to select to auto run manually or automatically.

Setting	Function
O2-08=0	Auto Run is active when pressing Run/STOP key
O2-08=1 (Initial setting)	Auto Run is active when the power is on.

O2-09: LCD Display Idle Time Set

- When O2-09=0, the Display Idle Function is disabled.
- Use constant O2-09 to set the idle time when the keypad is not operated. If set all the LCD Display and LED Indicators of the Combi-Gamma will switch off after the set time.
- Only the RUN/STOP indicator is active.

- Once a key on the panel is pressed, it will return to the display as it was before the Idle status.
- Initial setting=10 min, setting range: 0~60 min.

U Group (Monitor):

U1 Group (Monitor)

U1-01: AC IN Voltage

- Use U1-01 to monitor the voltage value of AC IN power in steps of 0.1V.

U1-02: AC IN Current

- Use U1-02 to monitor the current value of AC IN power in steps of 0.1A.

U1-03: AC OUT Voltage

- Use constant U1-03 to monitor AC OUT voltage value in steps of 0.1V.

U1-04: AC OUT Current

- Use constant U1-04 to monitor AC OUT current value in steps of 0.1A .

U1-05: Battery Voltage

- Use constant U1-05 to monitor the battery voltage in steps of 0.1V.

U1-06: Battery Ripple Voltage

- Use constant U1-06 to monitor the battery ripple voltage in steps of 0.1V.

U1-07: Battery Current

- Use constant U1-07 to monitor battery current value in steps of 0.1A.

U1-08: Control Mode

- Use constant U1-08 to monitor the current control mode (MODE 1, MODE 2, MODE 3 or MODE 4)

U1-09: Operation Status

- There are 12 digits to account for each operation status. Please see NOTE 1 in Chapter 5.

U1-10: Aux-Relay Status

- Use constant U1-10 to monitor the ON/OFF status of 3 sets of Aux-Relay (RY1, RY2, RY3). Please see NOTE 2 in Chapter 5.

U1-11: Elapsed Time

- Use constant U1-11 to monitor the elapsed running hours after power ON (O2-03=0) or after RUN (O2-03=1).

U1-12: Battery Temperature Sensor

- Use constant U1-12 to monitor the temperature that has been detected by the Battery Temperature Sensor (BTS-3) in unit of 1°C.

U1-13: CPU ID1

- Use constant U1-13 to check the software version 1.

U1-14: CPU ID2

- Use constant U1-14 to check the software version 2.

U1-15: Solar Charger Status

- Use constant U1-15 to monitor the solar charger status after the solar module is connected to the extension port (Port C).

U1-16: Solar Supply Current

- Use constant U1-16 to monitor the solar supply current value in units of 0.1A.

U1-17: Solar Supply Power

- Use constant U1-17 to monitor the solar supply power value in units of 1W.

U1-18: Solar Amp-Hours

- Use constant U1-18 to monitor the solar Amp-Hours value in units of 1Ah.

U1-19: Solar Total Amp-Hours

- Use constant U1-19 to monitor the solar total Amp-Hours value in units of 1Ah.

U2 Group (Fault Trace)

U2-01: Current Fault

- Use constant U2-01 to monitor the current fault that results in “Combi-Gamma” stopping operating.

U2-02: Last Fault

- Use constant U2-02 to monitor the last fault that has been recorded.

U2-03: AC IN Voltage

- Use constant U2-03 to monitor the AC input voltage value in units of 0.1V when the current fault occurs.

U2-04: AC IN Current

- Use constant U2-04 to monitor the AC input current value in units of 0.1A when the current fault occurs.

U2-05: AC OUT Voltage

- Use constant U2-05 to monitor the AC output voltage value in units of 0.1V when the current fault occurs.

U2-06: AC OUT Current

- Use constant U2-06 to monitor the AC output current value in units of 0.1A when the current fault occurs.

U2-07: Battery Voltage

- Use constant U2-07 to monitor the battery voltage value in units of 0.1V when the current fault occurs.

U2-08: Battery Ripple Volt

- Use constant U2-08 to monitor the battery ripple voltage in units of 0.1V when the current fault occurs.

U2-09: Battery Current

- Use constant U2-09 to monitor the battery current value in units of 0.1A when the current fault occurs.

U2-10: Control Mode

- Use constant U2-10 to monitor what the control mode (MODE 1, MODE 2, MODE 3 or MODE 4) is when the current fault occurs.

U2-11: Operation Status

- Use constant U2-11 to monitor 12 digits which account for each operation status when the current fault occurs. Please see NOTE 1 in Chapter 5.

U2-12: Aux-Relay Status

- Use constant U2-12 to monitor the ON/OFF status of 3 sets of Aux-Relay (RY1, RY2, RY3) when the current fault occurs. Please see NOTE 2 in Chapter 5.

U2-13: Elapsed Time

- Use constant U2-13 to monitor the elapsed time after power ON (O2-03=0) or after RUN (O2-03=1) in unit of 1 hour when the current fault occurs.

U2-14: Solar Charger Status

- Use constant U2-14 to monitor solar charger status when the current fault occurs. This constant is only visible when the extension port is connected to the solar module.

U2-15: Solar Charge Current

- Use constant U2-15 to monitor the solar charge current value, in units of 0.1A when the current fault occurs.

U2-16: Solar Supply Power

- Use constant U2-16 to monitor the solar supply power value, in units of 1W when the current fault occurs.

U2-17: Solar Amp-Hours

- Use constant U2-17 to monitor solar Amp-Hours value, in units of 1Ah when the current fault occurs.

U2-18: Solar Total Amp-Hours

- Use constant U2-18 to monitor solar total Amp-Hours value, in units of 1Ah when the current fault occurs.

U2-26: Battery Temperature Sensor

- Use constant U2-26 to monitor the current temperature that has been detected by Battery Temperature Sensor (BTS-3) in unit of 1°C when the current fault occurs.

U3 Group (Fault History)

U3-01: Last Fault

- Use constant U3-01 to monitor the latest fault stored in the software.

U3-02: Fault Message 2

- Use constant U3-02 to monitor the most recent second fault stored in the software.

U3-03: Fault Message 3

- Use constant U3-03 to monitor the most recent third fault stored in the software.

U3-04: Fault Message 4

- Use constant U3-04 to monitor the most recent fourth fault stored in the software.

U3-05: Elapsed Time 1

- Use constant U3-05 to monitor the elapsed time before the latest fault occurs.

U3-06: Elapsed Time 2

- Use constant U3-06 to monitor the elapsed time before the most recent second fault occurs.

U3-07: Elapsed Time 3

- Use constant U3-07 to monitor the elapsed time before the most recent third fault occurs.

U3-08: Elapsed Time 4

- Use constant U3-08 to monitor the elapsed time before the most recent fourth fault occurs.

Chapter 7 Trouble Shooting Table

- Proceed as follows for a quick detection of common faults.
- DC loads must be disconnected from the batteries and the AC loads must be disconnected from the INVERTER before the INVERTER and/or battery charger (AC CHARGER) is tested.
- Consult your Vetus dealer if the fault cannot be resolved.

Problem or Error message	Cause	Solution
The “Combi-Gamma” fails to operate when power on.	The battery voltage is too high or too low.	Ensure that the battery voltage is within the correct value range.
‘Udc-UV’ Battery under volt ‘ ’: blink	The battery voltage is low.	Charge the battery or check the battery connections.
Udc-UV Battery under volt	The “Combi-Gamma” cuts out because the battery voltage is too low.	Charge the battery or check the battery connections.
‘OL’ Inverter OverLoad ‘ ’: blink	The load on the inverter of “Combi-Gamma” is higher than the normal load.	Reduce the load.
‘OL’ Inverter OverLoad	The INVERTER of “Combi-Gamma” cuts out due to excessive load.	Reduce the load.
‘OH’ Heatsink Max Temp ‘ ’: blink	The ambient temperature is too high, or the load is excessive.	Place the “Combi-Gamma” in a cool and well-ventilated room, or reduce the load.
OH Heatsink Max Temp	The ambient temperature is too high, or the load is excessive.	Place the “Combi-Gamma” in a cool and well-ventilated room, or reduce the load.

‘Udc-ripple’ Volt Ripple Exceeds ‘ ’: blink	Voltage ripple on the DC input exceeds 1.25Vrms	Check the battery cables and terminals. Check the battery capacity; increase it if necessary.
Udc-ripple Volt Ripple Exceeds	The INVERTER of “Combi-Gamma” cuts out as a result of excessive voltage ripple on the DC input	Install batteries with a higher capacity. Use shorter and/or thicker battery cables and reset the Combi-Gamma (Power OFF and ON again).
‘Udc-OV’ Battery over voltage. ‘ ’: blink	Battery charger is not in normal charging status to cause battery voltage too high.	Replace the “Combi-Gamma”.
Udc-OV Battery over voltage.	Incorrect battery voltage connection (12V system but connected to 24V battery)	Recheck if the Combi-Gamma and the battery voltage is matched.
‘Idc-OC’ Over current. ‘ ’: blink	The actual charge current is 1.5 times larger than the set current value (D1-08) when AC CHARGER is operating.	Stop the Charge mode of the “Combi-Gamma”.
Idc-OC Over current.		Repair or replace the “Combi-Gamma”.
‘Bat-NG’ Battery Fault ‘ ’: blink	The charging time of AC CHARGER has been over 10 hours and remains in Bulk Charge mode.	Replace the battery banks.
Bat-NG Battery Fault	(D1-09=1) shows the battery is at fault.	

The charger is not functioning	The AC IN voltage or frequency is out of range.	Ensure that the AC IN voltage is within the range 220V system: 180VAC～260VAC And that the frequency matches the setting.
	“Combi-Gamma” internal circuit breaker has tripped.	Reset the internal circuit breaker.
The battery is not being charged fully.	Incorrect charging current.	Set the charging current at between (0.1～0.2) × battery capacity.
	A defective battery connection.	Check the battery terminals.
	The absorption voltage has been set an incorrect value.	Adjust the absorption voltage to the correct value.
	The float voltage has been set to an incorrect value.	Adjust the float voltage to the correct value.
	The internal DC fuse is defective	“Combi-Gamma” is damaged.
The battery is overcharged.	The absorption voltage has been set to an incorrect value.	Adjust the absorption voltage to the correct value.
	The float voltage has been set to an incorrect value.	Adjust the float voltage to the correct value.
The battery is overcharged.	The battery is too small.	Reduce the charging current or use a battery with a higher capacity.
	A defective battery.	Replace the battery.
	The battery is too hot.	Connect a Battery Temperature Sensor (BTS-3)
Battery charge current drop to 0 A when the absorption voltage is reached.	Battery overtemperature (> 50°C)	1. Allow battery to cool down. 2. Place battery in a cool environment. 3. Check for shorted cells.
	Battery Temperature Sensor (BTS-3) is faulty	1. Unplug Battery. Temperature Sensor (BTS-3) from Combi-Gamma” and power off the “Combi-Gamma” then wait 5 seconds and power on again. 2. If the “Combi-Gamma” AC CHARGE normally, the BTS-3 is faulty and needs to be replaced.

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