

COTEK

SB Series

USER MANUAL

**PURE SINE WAVE INVERTER / CHARGER COMBI
WITH SHARING / SUPPORT / GENERATOR**



Contents

1	Important Safety Instructions	3
1-1	Warnings And Symbols.....	3
1-2	Use For Intended Purpose General Safety Precautions.....	3
1-3	Other Safety Notes And Installation Precautions.....	4
1-4	Warning Regarding The Use Of Batteries.....	4
2	Functional Characteristics Introduction	5
2-1	System.....	5
2-2	Electrical Performance.....	6
2-3	Mechanical Drawing.....	8
2-4	LCD Panel Mechanical Drawing.....	9
3	How It Works	9
3-1	Battery Charger Introduction.....	9
3-2	Inverter Introduction.....	12
3-3	Operation Modes.....	12
3-4	Equalization Batteries.....	19
4	Operation	24
4-1	Power “ON”	24
4-2	Power “OFF”.....	24
4-3	Selectable “CHR. Power ON” mode.....	24
4-4	Protections.....	24
5	Installation And Maintenance	24
5-1	Unpacking.....	25
5-2	Front Panel.....	25
5-3	Move the LCD Control Panel Place.....	34

5-4	Rear Panel.....	38
5-5	Installation Drawing.....	39
6	LCD Remote Control Panel – Display & Setup.....	40
6-1	LCD Panel Indications.....	40
6-2	LCD Rear View Introduction.....	43
6-3	Startup Sequence and Standby Status.....	46
6-4	Setup Menu – Operation and Instructions Entering Setup Menu.....	47
7	RS-232 Communication and Operation.....	53
7-1	Operation of RS-232 serial port.....	53
7-2	Example of the RS232 Operation.....	54
8	Trouble Shooting.....	63
8-1	Fault Indicator.....	63
8-2	Warranty.....	64

1 Important Safety Instructions

1.1 Warnings And Symbols

Safety instructions and warnings are marked in this manual by the following pictograms :



Supplementary information on operating the device.



CAUTION

Safety instruction: Failure to observe this instruction can cause material damage and impair the function of the device.



CAUTION

Safety instruction relating to a danger from an electrical current or voltage. Failure to observe this instruction can cause material damage and personal injury and impair the function of the device.



WARNING!

SAVE THESE INSTRUCTIONS – This manual contains important instructions that should be followed during installation and maintenance of the Combi unit.

1.2 Use For Intended Purpose General Safety Precautions

The Combi unit is constructed as per the applicable safety-technical guidelines.

- For the charging of lead acid batteries and the supply of users attached to these batteries, in permanent systems.
- For the conversion of a DC voltage from a battery to and AC voltage.
- Connected to a dedicated double pole circuit breaker and earth leakage switch.
- With a fuse, protection the wiring between Combi unit and battery.
- In a technical correct condition.
- Do not expose the Combi unit to rain, snow, spray or dust. To reduce the risk of fire hazard, do not cover or obstruct the ventilation openings and. do not install the Combi unit in a zero-clearance compartment.
- To avoid the risk of fire and electric shock, make sure that the existing wiring is in good electrical condition; and that the wire size is not undersized. Do not operate the Combi unit with damaged or substandard wiring.
- Depending on the use, the AC output of the Combi unit may require user installed breaker or fusing. For telecom use, a GFCI has not been provided. The Combi unit incorporates standard AC short circuit protection.
- The following precautions should be taken when working on the Inverter Charger:
 - Remove watches, rings, or other metal objects.
 - Use tools with insulated handles.
 - Wear rubber gloves and boots.

1.3 Other Safety Notes And Installation Precautions

- Upon receipt, examine the shipment box for damage. Notify the carrier immediately, before opening, if damage is evident.
- Do not operate near water or in excessive humidity.
- Do not open or disassemble the Combi unit, warranty may be voided.
- The DC and AC side connections should be firm and tight.
- Grounding: Reliable grounding of rack-mounted equipment should be maintained.
- Do not drop a metal tool on the battery. The resulting spark or short-circuit on the battery or on the other electrical part may cause an explosion.
- Wiring: Adequate input power must be supplied to the Combi unit for proper use; correct wiring sizes must be ensured.
- Do not operate the Combi unit close to combustible gas or open fire.
- Temperature: The Combi unit should be operated in an ambient temperature range of -20 to 40°C or else the output efficiency may be affected. Air flow to the Combi unit must not be restricted.
- In case of fire, you must use the fire extinguisher which is appropriate for electrical equipment.
- Short circuiting or reversing polarity will lead to serious damage to batteries, Combi unit and the wiring. Fuses between the batteries and the Combi unit can not prevent damage caused by reversed polarity and the warranty will be void.
- Do not work on Combi unit or system if it is still connected to a power source. Only allow changes in your electrical system to be carried out by qualified electricians.
- Check the wiring and connections at least once a year. Defects such as loose connections, burned cables etc. must be corrected immediately.
- Do not touch the equipment when wet or if your hands are clammy.
- The Combi unit products are not for applications in any medical equipment intended.



The cabinet of the Combi unit must not be opened. There are no serviceable parts inside the cabinet. Only qualified, authorized and trained electrician installers are authorized to open the connection compartment.

1.4 Warning Regarding The Use Of Batteries

Excessive battery discharge and/or high charging voltage can cause serious damage to batteries. Do not exceed the recommended limits of discharge level of your batteries. Avoid short circuiting batteries, as this may result in explosion and fire hazard. Installation of the batteries and adjustments of the Combi unit should only be undertaken by authorized personnel!

2 Functional Characteristics Introduction

2.1 System

The SB Series is a Combi inverter / charger system, designed with advanced power electronic and digital signal processor technology offering the following features:

- The Combi unit is equipped with a self diagnosis microprocessor that is able to identify and show all failure messages on the LED/LCD display, with associated visual/audio alarms.
- Can use parallel with the grid AC.
- Battery charger current 100A max. @12VDC / 50A max. @24VDC
- Pure sine wave output to operate higher-end electronic equipment 5A max second charger.
- Equalization function for the batteries.
- Built in 25A rated bypass switch
- Power sharing functions
- Intelligent software for power management
- Hard-wire connection model option
- Loading and temperature controlled cooling fan
- Fan aging, failure, disconnection and blockage alarm
- Local and remote management and control
- RS-232 and CAN Bus communication
- CAN Bus LCD remote control panel
- By a dry contact terminal
- Advanced protection features :
 - DC input over/under voltage protection
 - Internal over temperature, battery over temperature and heat sink over temperature
 - DC input reverse polarity protection (Fuse)
 - Inverter AC output overload protection
 - Inverter AC output short circuit protection
 - AC input short circuit protection: Breaker (30Amp)
 - AC input under voltage protection

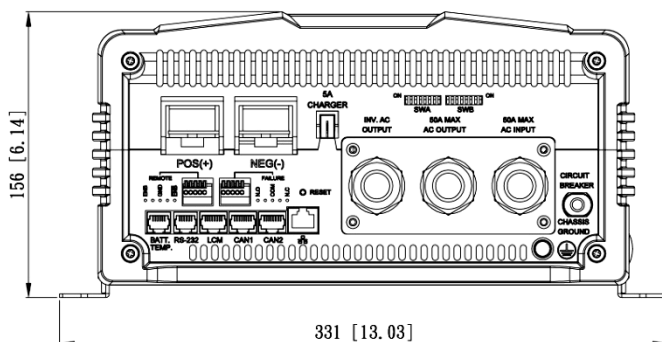
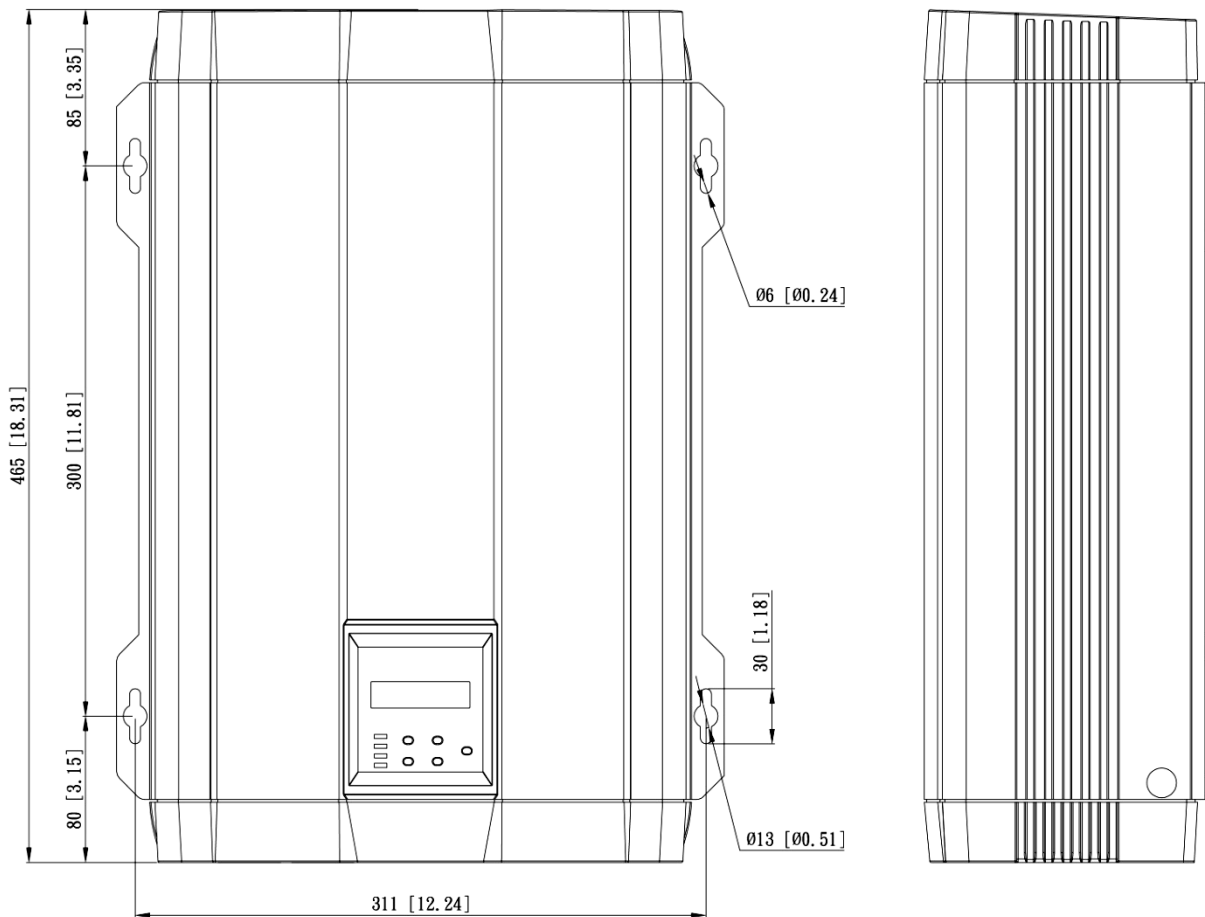
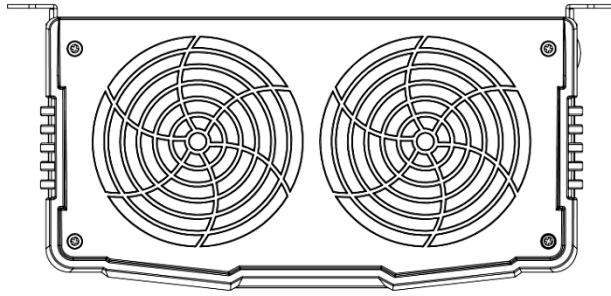
2.2 Electrical Performance

SB-2000 Inverter / Charger Specification

Electrical	Specification	Model No.			
		SB2000-112	SB2000-124	SB2000-212	SB2000-224
Input Characteristics	Item	SB2000-112	SB2000-124	SB2000-212	SB2000-224
	Nominal Voltage	12 VDC	24 VDC	12 VDC	24 VDC
	Input Voltage Range	10.5 ~ 16 VDC	21 ~ 32 VDC	10.5 ~ 16 VDC	21 ~ 32 VDC
	Input Over-Voltage Protection	15 ~ 16 VDC	30 ~ 32 VDC	15 ~ 16 VDC	30 ~ 32 VDC
	Input Under-Voltage Protection	10.5 ~ 11.5 VDC	21 ~ 23 VDC	10.5 ~ 11.5 VDC	21 ~ 23 VDC
	No Load Current	5 A	2.5 A	5 A	2.5 A
	Stand-By Current	1.5 A	0.75 A	1.5 A	0.75 A
Output Characteristics	Continuous Output Power(Resistive load)	2000 W			
	Surge Power (Resistive load)	Load 101%~115% (3 Min)			
		4000 W			
	Frequency	47 ~ 63 Hz +/- 0.01% (User-selectable)			
	Output Voltage	115 VAC (100~120 VAC)+/-5%		230 VAC (200~240 VAC)+/-3%	
	Efficiency (Full Load)	>84% (At DC 12V)	>86% (At DC 24V)	>85% (At DC 12V)	>88% (At DC 24V)
	Short-Circuit Protection	Yes , lpk			
Output Waveform	Pure Sine Wave (THD < 5%)		Pure Sine Wave (THD < 3%)		
AC Input / Output Terminal	AC Input	50 A MAX.			
	AC Output	50 A MAX.			
	INV. AC Output	25 A MAX.			
Protection	DC Input Protection	Over / Under Voltage, Reverse Polarity (Internal Fuse)			
	AC Output Protection	Short-Circuit, Overload			
	AC Input Protection	30 Amp Circuit Breaker			
	Temperature protection	Shutdown			
	Battery Temperature protection	By a RJ-11 connector to battery Temperature sensor			
AC Input Characteristics	Nominal Voltage / Frequency	115 VAC / 60Hz		230 VAC / 50Hz	
	Input Voltage Range	90 ~ 130 VAC		180 ~ 260 VAC	
	Input Frequency Range	47 ~ 63 Hz			
	Nominal Current	15A		7.4A	

Electrical	Specification	Model No.			
	Efficiency (Full Load)	>85%		>87%	
	Power Factor Correction(PFC)	>0.98 (40% Load)		>0.98 (40% Load)	
DC Output Characteristics	Charging Current Range	20 ~ 100A	10~50A	20 ~ 100A	10~50A
	Second Charger Output	5A , 3-Stage Battery Chargers			
	Max. Output Voltage	14.8 VDC	29.6 VDC	14.8 VDC	29.6 VDC
	Battery Temperature Compensation	-25 mV per °C	-50 mV per °C	-25 mV per °C	-50 mV per °C
	Bulk Voltage	14.4 V	28.8 V	14.4 V	28.8 V
	Absorption Voltage	14.4 V	28.8 V	14.4 V	28.8 V
	Float Voltage	13.5 V	27 V	13.5 V	27 V
	Note. Charger Voltage @Battery Type Setting "Standard", Temperature@ 25°C				
Equalization Characteristics	Max. output Voltage	16VDC	32VDC	16VDC	32VDC
	Max. output Current	10A	5A	10A	5A
Signal and Control	LCD Panel	2 Lines LCD Panel with keypad for navigation and Red / Orange / Green LED			
	Remote Control Terminal	Controls the inverter ON / OFF operation			
	Dry Contact Terminal	By a relay			
Bypass Relay	Relay Specification	25 Amp / 250 VAC			
Operating Temperature Range	Full Load	-25 °C ~ 40 °C			
	Power de-rating	50 W / °C, 41~60 °C			
	Storage	-30 °C ~70 °C			
Operating Humidity Range	0~93% Non-condensing				
Fan Operation and Indicator	Failure Indication	Buzzer alarm			
	Switches On/ Off	The fan does operate in load and internal temperature control related PWM variable speed control			
Power Sharing Function	Sharing Mode	Inverter mode / Charger mode / Power sharing (Generator mains support function / Power support) / Charger Sharing			
	AC Input Current	10 ~ 50A(User-selectable)		3 ~ 25A (User-selectable)	
Ground Relay	Ground relay included for connection of neutral of inverter to ground only at inverter mode. Standard disable				
Mechanical Specification	Size (W x H x D)	13.03"x6.14"x18.3" (331mmX156mmX465mm)			
	Weight	10.5 Kg (23.1 Lbs)			
Safety and EMS	Safety Standards	Meet EN60950-1			
	EMC Standards	FCC Class A	EN55022:1998+A1:2000+A2:2003 Class A EN55024:1997+A1:2001+A2:2003 EN61000-3-2:2006 Class A EN61000-3-3:1995+A1:2001		

2.3 Mechanical Drawings

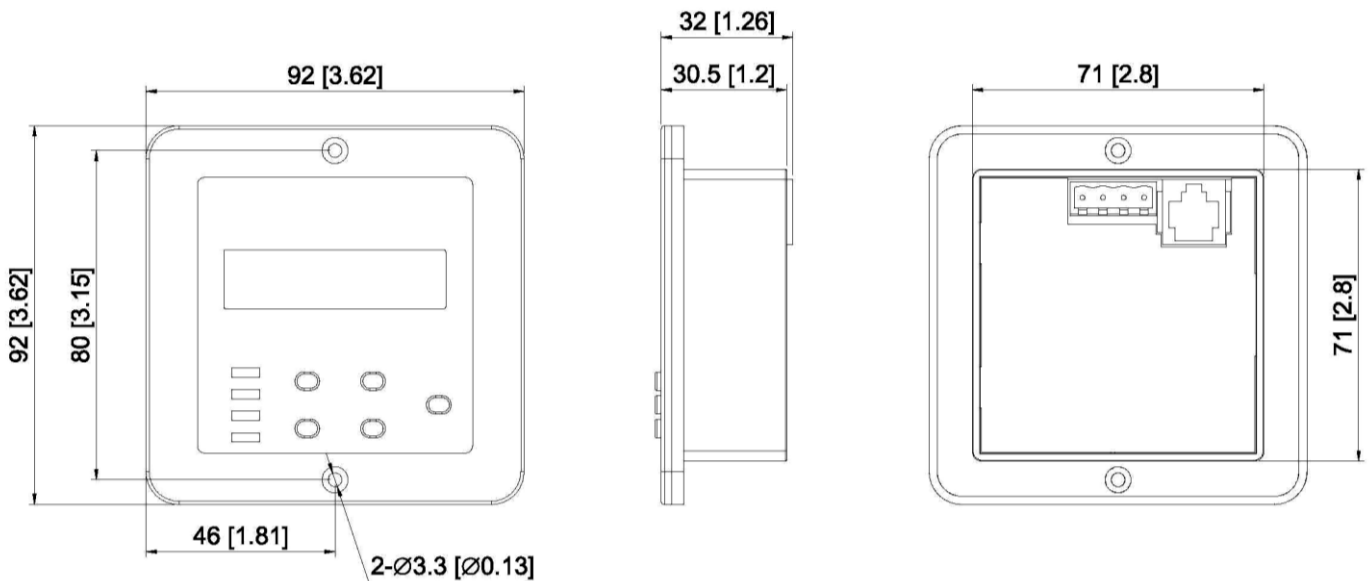


SB Series Inverter / Charger Combi Ordering Information

Model Number	Input Voltage	Output Voltage		Frequency Range	AC Input	Charger	
		Nominal	Range			Current Max.	voltage Max.
SB2000-112	12 VDC	110VAC	100~120 VAC	47~63 Hz	90 ~ 130 VAC	100A	14.8 VDC
SB2000-124	24 VDC	110VAC	100~120 VAC	47~63 Hz	90 ~ 130 VAC	50A	29.6VDC
SB2000-212	12 VDC	230VAC	200~240 VAC	47~63 Hz	180 ~ 260 VAC	100A	14.8 VDC
SB2000-224	24 VDC	230VAC	200~240 VAC	47~63 Hz	180 ~ 260 VAC	50A	29.6VDC

2.4 LCD Panel Mechanical Drawing:

UNIT : mm / inch



3 How It Works

This chapter describes the various applications of the Combi unit series from COTEK. The Combi unit is a battery charger, a pure sine wave inverter and an AC transfer system in one compact enclosure. The three-step Plus charging method guarantees that the batteries are always charged 100%. The pure sine wave inverter assures that the AC output voltage is perfectly reliable even when limited external AC power is available. External AC power can be supplied by a public grid or a generator. DC power can be delivered by charged batteries.

3.1 Battery Charger Introduction

The built-in battery charger is electronically controlled. It is designed for optimal recharging of both wet cell, gel cell and AGM deep cycle batteries. Battery charging is accomplished in three automatic stages: BULK, ABSORPTION and FLOAT. With an external AC source connected, the Combi unit charger also serves the functions of an AC to DC converter to supply DC loads which are connected to the battery. Simple, automatic operation is made possible by the microprocessor that is the brain of the inverter/charger Combination. In most cases, the unit is left on and no attention or maintenance is required.

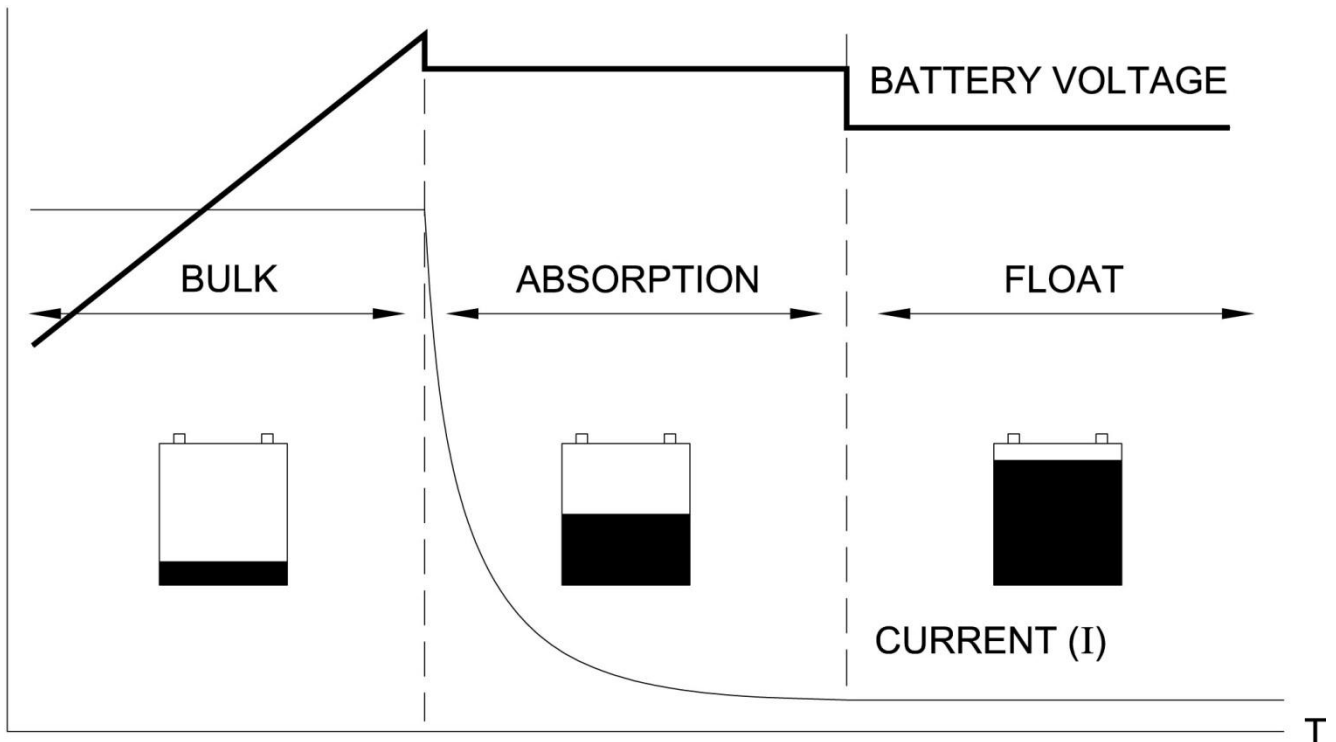


Fig 1: Three step charge system

3.1.1 Three step Plus charge system

See fig 1. The first step of the three step Plus charge system is the BULK phase, in which the output current of the charger is 100%, and the greater part of the capacity of the battery is rapidly charged. The current charges the batteries and gradually the voltage rises to the absorption voltage of 14.4V (12V models) or 28.8V (24V models) @ 25°C / 77°F.

The duration of this phase depends on the ration of battery to charger capacity, and naturally also on the degree to which the batteries were discharged to begin with.

The bulk phase is followed by the absorption phase. Absorption charging starts when the voltage on the batteries has reached 14.4V (12V models) / 28.8V (24V models) @ 25°C / 77°F, and ends when the battery is completely full. Battery voltage remains constant at 14.25V (12V models) / 28.5V (24V models) @ 25°C / 77°F throughout this stage, and the charge current depends on the degree to which the battery was initially discharged, the battery type, the ambient temperature, and so on. With a wet cell battery this stage lasts some four hours, with gel and AGM around three. Once the battery is 100% full, the charger automatically switches over to the float phase. (see Fig 12.)

During the float phase the Combi unit switches to 13.5V (12V models) or 27 (24V models) @ 25°C / 77°F and stabilizes this voltage to maintain the batteries in an optimum condition. Connected DC-loads are powered directly by the charger. If the load is higher than charger capacity, the required additional power comes from the battery, which will be progressively discharged until the charger

automatically switches back to the bulk phase. Once consumption decreases, the charger goes back to normal operation of the three-step charge system. As the Combi unit is equipped with a three-step Plus charge system, the batteries can also remain connected to the Combi unit in winter. One hour every 12 days the charger automatically switches to absorption to keep the battery running properly and prolong its life span. The three-step Plus charge system is also safe for all the connected equipment.

3.1.2 Temperature compensated charging

The Combi unit is delivered with a battery temperature sensor. By installing this battery temperature sensor the charge voltages are automatically adapted for deviating temperatures.

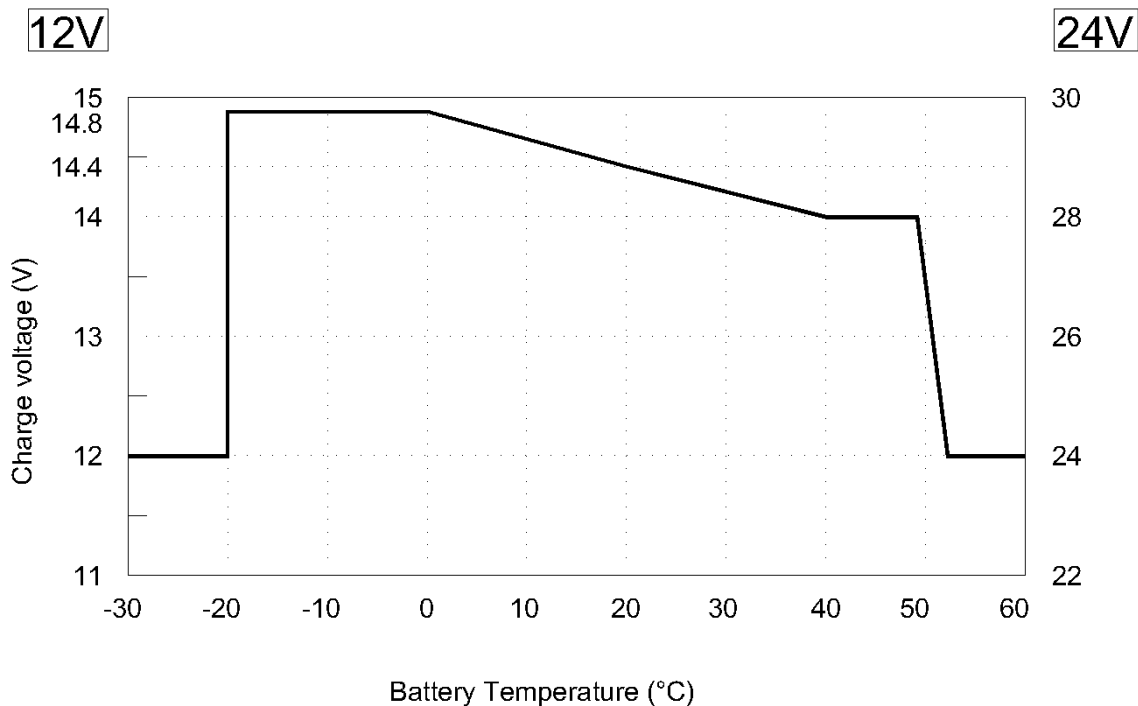


Fig 2 : Temperature compensated charging

See fig 2. When the battery temperature is low, the charge voltage increases. On the other hand, when the battery temperature is high, the charge voltage is decreased. Over charge and gassing are prevented this way. This will extend the life of your batteries.

3.1.3 Connection of a second battery

The Combi unit is equipped with second charge output which can be used to give a maintenance charge to a small battery set like a starter battery Maximum output current: 5 Amps.

Output voltage: 14.4V @ 12V Model , 28.8V @ 24V Model , three-step, user can set ON or OFF.

3.2 Inverter Introduction

3.2.1 General

The inverter provides voltage and frequency regulated AC power from a battery bank. Fast acting electronic circuits protect the inverter against extreme overloads, low and high battery voltage , overheating and short circuit of the inverter.

Considerable momentary surge power is available for starting-up electric motors. A built in power saving feature can reduce battery power consumption when the inverter is unloaded.

3.2.2 Power saving mode (selectable)

In the inverter mode the Combi unit has a built-in automatic power saving feature that reduces battery power consumption when no load is present on the “INV. AC output”. Response from idle is instant, eight modes can be set by means of DIP-switches or LCD remote control.

3.3 Operation Modes

The Combi unit is not just a Combination of an inverter and a battery charger. It has many additional features which can be used to increase the total available AC power, even when external AC power is limited.

3.3.1 Basic operation

When there is no external “AC input” power available, the inverter of the Combi unit provides AC power on the “INV. AC output” output from the batteries. There is no AC power available on the “AC output”. See fig 3

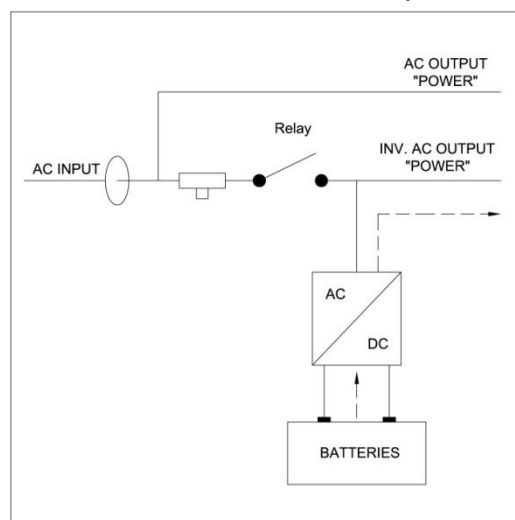


Fig 3 : Inverter mode

When external AC power comes available, the transfer relay switches on. See fig 4. Both outputs as well as the battery charger are supplied by the external AC power. The batteries are recharged now.

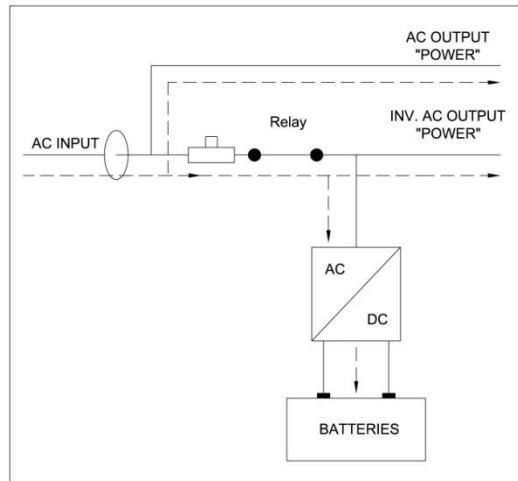


Fig 4 : Charger mode

3.3.2 Transfer Switch And Connector on The Front

The Combi unit has two AC-outputs available:

- INV. AC output: The “INV. AC output” output switches between the AC-input and the output of the inverter. The AC input has the highest priority. In principle, AC-power is always available on this output. However during a switchover the loads connected to this output are not supplied with AC-power for a very short period of time (short break). It is the ideal output for loads that need AC-power permanently like personal computers, interior lighting and the refrigerator.
- AC output: This output is always internally connected to the AC-input. It is therefore only available when an external AC-source like shore power, a generator or an outlet is present. Larger loads like a hot water boiler, electric cooking appliance or washing machine should be connected to this output . See fig 5.

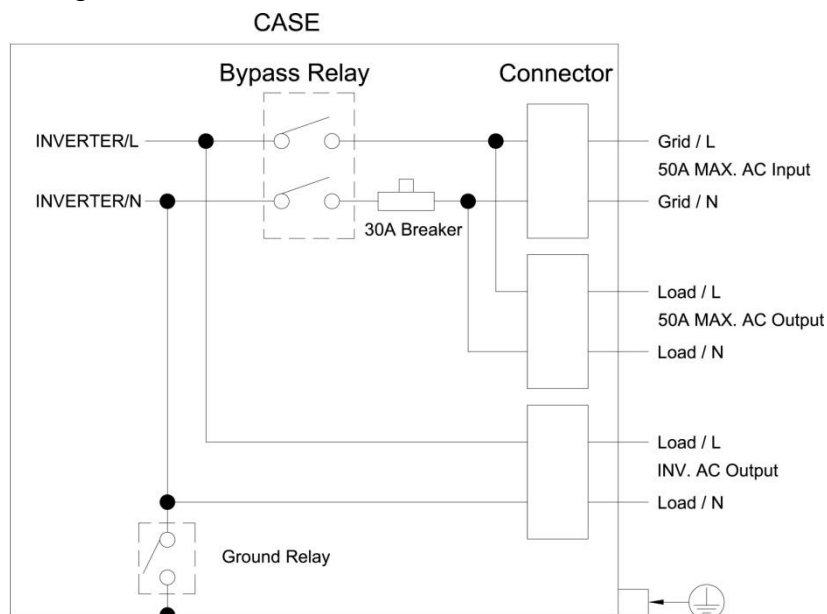


Fig 5 : AC Input / Output contact

3.3.3 Power sharing function (selectable)

If the available power at the AC-input is limited, and the load connected to the AC output increases, the external AC circuit breaker may trip if nothing is done. To avoid this, the Combi unit can automatically reduce the battery charger output, and thus the AC power consumption. This Power sharing feature constantly senses the incoming AC current which is used to supply both the battery charger and the appliances connected to the AC outputs.

The Power Sharing level should be set to match the value of the external circuit breaker, which protects the incoming AC power. For instance, when the external AC power is limited by a 10A circuit breaker or fuse, the Power Sharing level must be set to 10A.

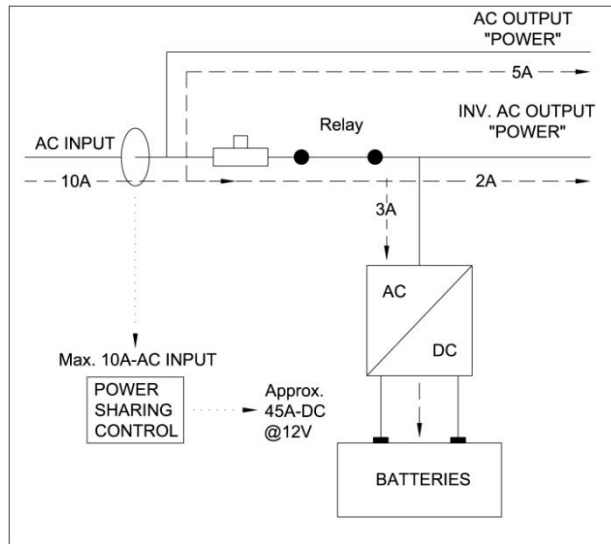


Fig 6 : Power Sharing Function I

Here the Power Sharing level is set to a 10 Amps while the AC outputs consume a total of $2 + 5 = 7$ Amps. This means that only $10 - 7 = 3$ Amps is left over for charging. With 12V batteries 230 VAC this will result in a maximum charge current of approx. 45A DC.

The Power Sharing level can be set by means of the DIP-switches or LCD remote control locally on the Combi unit

When the total connected AC load reaches the level of the Power Sharing setting (10A), there will be no power left over to charge the battery. This means that the charge current of the Combi unit will be reduced to 0A. See fig 7.

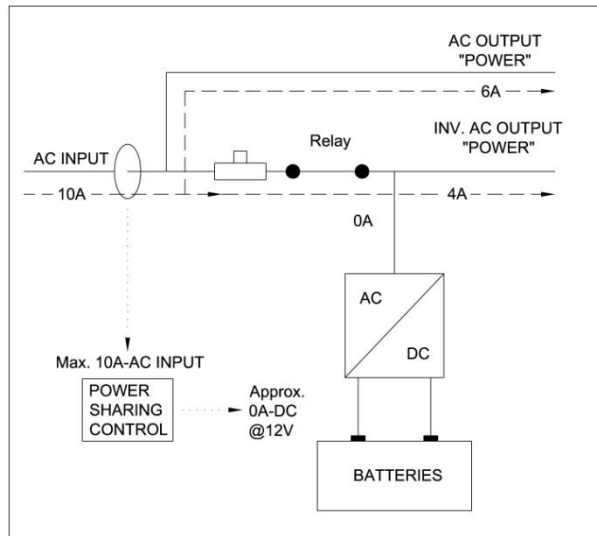


Fig 7 : Power Sharing Function II

3.3.4 Generator function (selectable)

If the demand for AC power still increases, the external AC circuit breaker may still trip if nothing is done. This problem can be solved by the Generator function. If the total demand for energy exceeds the maximum external power supply, energy can be added to the “AC outputs” and “INV.AC Output” by means of the inverter. This appliance can be automatically connected in parallel with the external power supply.

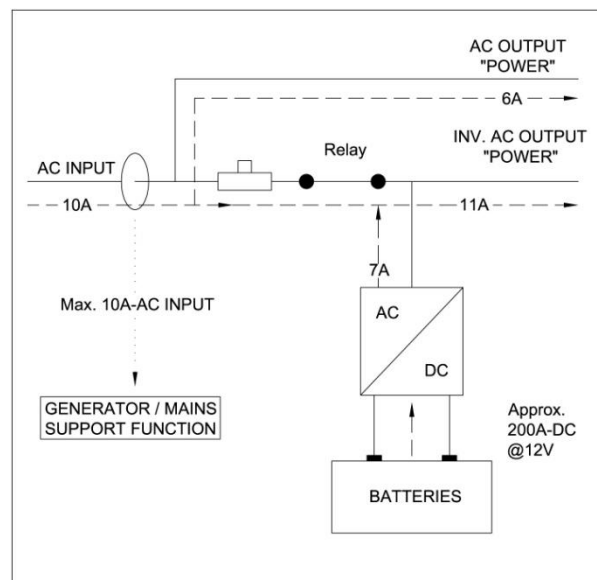


Fig 8 : Generator Function

See fig 8. Here the AC-input is still limited to 10 Amps. This is not enough to supply the total load ($6 + 11A = 17A$) connected to the AC outputs. When the Generator function is enabled, the inverter will supply the remaining $17 - 10 = 7A$. This means that the restricted amount of external AC power will be compensated by energy which is stored in the batteries. Later, when the AC load has dropped below the setting of the Power sharing

function again, the battery charger of the Combi unit will commence to recharge the batteries.



For safety unit the transfer relay is immediately switched off when incoming AC power fails in operation so that there will never be a high voltage on the shore cable inlet when it is not connected.

3.3.5 Support function (selectable)

As explained above, when the Generator function is enabled, the inverter will operate in parallel with the external AC power source. This means that energy from the batteries is added to the AC-output only. Under no circumstance AC power from the inverter can be fed back into the AC grid. This may mean that in some situations the use of the Generator / Support function is not allowed. Please acquaint yourself with local regulations on this issue. Never use the Generator function if this is not allowed!

Even if the use of the Generator function is not allowed, it is still possible to supply more energy than the external AC sourced can deliver This can be achieved by using the support function.

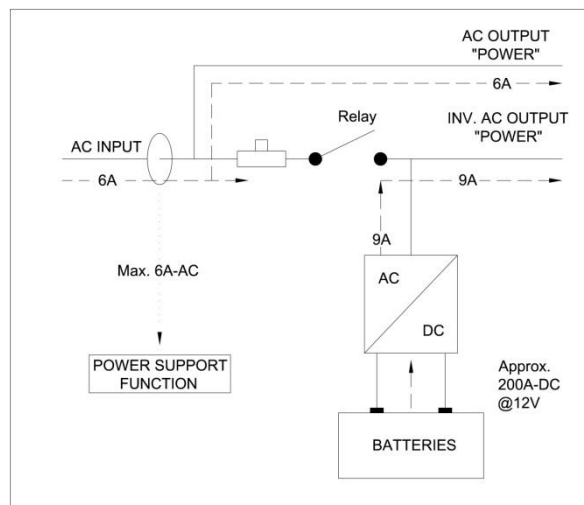


Fig 9: Support function

See fig 9. The AC input is still limited to 6Amps. This is not enough to supply the total load (6 + 9A = 15A) connected to the AC outputs.

Now when the support function is enabled, the transfer relay will open. When opened, the external power source will deliver 6Amps to supply the load connected to the “AC output” output only, while the inverter will deliver 9Amps for the load connected to the “INV. AC output” .



If the power consumption of the “AC output” output exceeds the setting of the support function, the external AC fuse or circuit breaker will still trip

3.3.6 Support and Generator function (selectable)

If user will support function and generator function both simultaneously enable. The Combi unit inverter will operate in parallel with the external AC power source, and when not enough to supply the total load connected to the “AC output” and “INV. AC output”. The transfer relay will open.

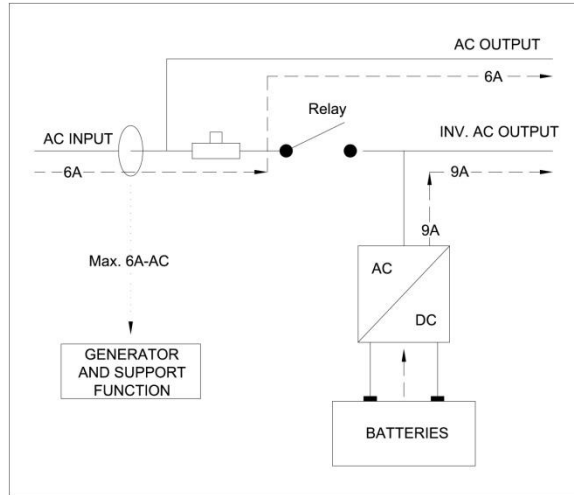


Fig 10 : Generator and support function

See fig 10. The AC input is still limited to 6 Amps. If the demand for AC power still increases, the external AC circuit breaker may still trip. The inverter will automatically be compensated by energy which is stored in the batteries. But when AC power still increases. This is not enough to the total load (7 + 9A = 16A) connected to the AC outputs. The transfer relay will open.

3.3.7 Charger sharing (selectable)

The Combi unit used “CHR.mode” startup. When external AC power comes available, the transfer relay switches ON. The Combi unit is constantly senses the AC power current which is used to supply both the battery charger and the load Connected to the AC output.

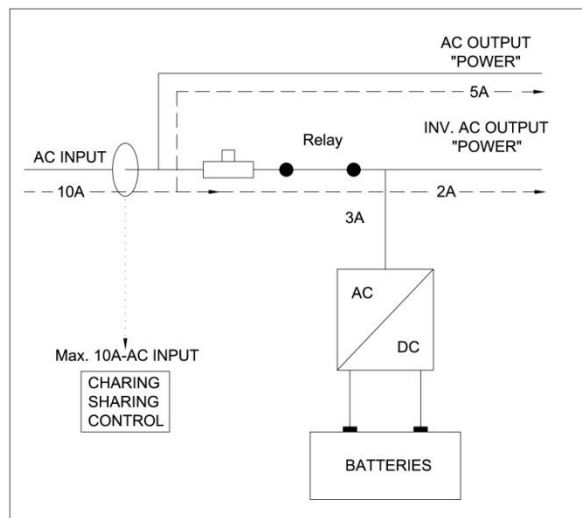


Fig 11 : Charger Sharing

Selectable Function				AC input		AC Output (LOAD)			Battery current (Approx.)		T Transfer	External AC
Sharing	Support	Generator	Charger	Synchronization	lac current	AC Output (I1)	INV. AC Output (I2)	Charge Current (I3)	Charge (Selectable)	Discharger	Relay	Circuit breaker
0	X	X	0	0	6 Amps	0A	9A	0A	0A	200A	OPEN	OK
				1	6 Amps	2A	4A	MAX.	20-100A	0A	CLOSE	NG (I1+I2+I3>6A)
1	0	0	0	0	6 Amps	0A	9A	0A	0A	200A	OPEN	OK
				1	6 Amps	1A	2A	3A	45A	0A	CLOSE	OK
				1	6 Amps	1A	5A	0A	0A	0A	CLOSE	OK
				1	6 Amps	1A	6A	0A	0A	0A	CLOSE	NG (I1+I2+I3>6A)
1	0	1	0	0	6 Amps	0A	9A	0A	0A	200A	OPEN	OK
				1	6 Amps	1A	2A	3A	45A	0A	CLOSE	OK
				1	6 Amps	6A	9A	0A	0A	200A	CLOSE	OK
				1	6 Amps	7A	9A	0A	0A	200A	CLOSE	NG (I1+I2+I3>15A)
1	1	0	0	0	6 Amps	0A	9A	0A	0A	200A	OPEN	OK
				1	6 Amps	1A	2A	3A	45A	0A	CLOSE	OK
				1	6 Amps	1A	9A	0A	0A	200A	OPEN	OK
				1	6 Amps	7A	9A	0A	0A	200A	OPEN	NG (I1>6A)
1	1	1	0	0	6 Amps	0A	9A	0A	0A	200A	OPEN	OK
				1	6 Amps	1A	2A	3A	45A	0A	CLOSE	OK
				1	6 Amps	6A	9A	0A	0A	200A	CLOSE	OK
				1	6 Amps	7A	9A	0A	0A	200A	CLOSE	OK
0	X	X	1	0	6 Amps	0A	9A	0A	0A	200A	OPEN	NG (I1>6A)
				1	6 Amps	2A	4A	MAX.	20-100A	0A	CLOSE	NG (I1+I2+I3>6A)
1	X	X	1	0	6 Amps	0A	9A	0A	0A	0A	OPEN	OK
				1	6 Amps	1A	2A	3A	45A	0A	CLOSE	OK
				1	6 Amps	6A	9A	0A	0A	0A	OPEN	OK
				1	6 Amps	7A	9A	0A	0A	0A	OPEN	NG (I1>6A)

Note. "0" is Disable / "1" is Enable / "X" is Don't care / Current @Batteries 12VDC , 230VAC Model

3.4 Equalization Batteries

3.4.1 Construction of Battery Cells: A Lead Acid battery consists of a number of 2 V nominal cells (actual voltage of the cell is 2.105 V) that are connected in series e.g. a 12 V nominal battery will have six, 2 V nominal cells in series (actual voltage of the 6 cells will be $2.105 \times 6 = 12.63$ V). Each 2 V nominal cell in this battery consists of an independent enclosed compartment that has Positive and Negative Plates (also called Electrodes) dipped in electrolyte that is composed of diluted Sulphuric Acid – solution of 33.5% v/v Sulphuric Acid and water. In a fully charged battery, the Positive Plate is in the form of Lead Dioxide, the Negative Plate is in the form of Sponge Lead and the Sulphuric Acid in the electrolyte has the maximum concentration of 33.5% v/v .

3.4.2 Electrical power in the Lead Acid Battery is produced by reversible electro-chemical reactions as follows:

- During discharging, the Sulphuric Acid in the electrolyte reacts with the Positive and Negative plates resulting in conversion of the active materials in both the two plates (Lead Dioxide on the Positive plate and Sponge Lead on the Negative plate) to soft Lead Sulfate crystals. At the same time, electrons are released that create the electrical current that flows to the load. The concentration of Sulphuric Acid in the electrolyte is reduced as the battery gets discharged (the electrolyte becomes pure water when the battery is fully discharged).
- During charging, reverse electrochemical reactions take place. Under the influence of the charging voltage fed to the battery by the external battery charger / charge controller, electrons are fed back to the battery and the soft Lead Sulfate crystals at the Positive and Negative Plates are converted back to Lead Dioxide at the Positive Plate and Sponge Lead at the Negative Plate and the concentration of Sulphuric Acid is restored (will revert to 33.5% v/v when the battery is fully charged).

3.4.3 Gassing during Charging: During charging, the battery is required to be charged in a controlled manner in the final Absorption Stage (2.4 V per cell at $25^{\circ}\text{C} / 77^{\circ}\text{F}$ or 14.4 V for a 12 V battery at $25^{\circ}\text{C} / 77^{\circ}\text{F}$) that restores the last 20% to 30% of the capacity. On successful completion of this stage of charging, the Lead Sulfate at the Positive and Negative Plates should have fully converted back to Lead Dioxide at the Positive Plate and Sponge Lead at the Negative Plate. Any further charging at this voltage or higher than this voltage results in electrolysis of water in the electrolyte to Hydrogen and Oxygen and this undesirable condition contributes to waste of energy. This process is known as "gassing". Gassing is also produced during the timed Equalization Stage when the battery is intentionally overcharged (2.5 to 2.7 V per cell / 15 to 16 V for 12 V batteries) to equalize the cells and remove stratification.

3.4.4 Necessity for Equalizing Batteries: For proper health and long life of a Lead Acid battery, it is required to undergo an Equalization Stage during the charging process to prevent / reduce the following undesirable effects:

- **Sulfation:** If the charging process is not complete due to the inability of the charger to provide the required voltage levels or if the battery is left uncharged for a long duration of time, the Lead Sulfate crystals on the Positive and Negative plates that are formed during discharging / self discharge are not fully converted back to Lead Dioxide on the Positive plate and Sponge Lead on the Negative plate and get hardened and are difficult to dislodge through normal charging. These crystals are non conducting and hence, introduce increased internal resistance in the battery. This increased internal resistance introduces internal voltage drop during charging and discharging. Voltage drop during charging results in overheating and undercharging and formation of more Lead Sulfate crystals. Voltage drop on discharging results in overheating and excessive voltage drop in the terminal voltage of the battery. Overall, this results in poor performance of the battery. To dislodge these hardened Lead Sulfate crystals, some chargers are designed to detect a sulfated condition at the start of the charging process and go through an initial De-sulfation Mode that sends high frequency, high voltage pulses at the natural oscillation frequency of the crystals to dislodge the hardened crystals. Sulfation may also be reduced partially by the stirring / mixing action of the electrolyte due to gassing and bubbling because of intentional overcharging during the Equalization Stage.

3.4.5 Electrolyte Stratification: Electrolyte stratification can occur in all types of flooded batteries. As the battery is discharged and charged, the concentration of acid becomes higher at the bottom of the cell and becomes lower at the top of the cell. The low acid concentration reduces capacity at the top of the plates, and the high acid concentration accelerates corrosion at the bottom of the plates and shortens the battery life. Stratification can be minimized by the Equalization Stage by raising the charging voltage so that the increased gassing and bubbling agitates / stirs the electrolyte and ensures that the electrolyte has uniform concentration from top to bottom. The stirring action also helps to break up any Lead Sulfate crystals, which may remain after normal charging.

3.4.6 Unequal charging of cells: During normal charging, temperature and chemical imbalances prevent some cells from reaching full charge. As a battery is discharged, the cells with the lower voltage will be drained further than the cells at the higher voltage. When recharged, the cells with the higher voltage will be fully charged before the cells with the lower voltage. The more a battery is cycled, the more cell voltage separation takes place. In a healthy battery, all the individual cells will have the same voltage and same specific gravity. If there is a substantial difference in the

cell voltages (0.2 V or more) and in the specific gravities (0.015 or more) of the individual cells, the cells will require equalization. Equalizing batteries helps to bring all the cells of a battery to the same voltage. During the Equalization Stage, fully charged cells will dissipate the charging energy by gassing while incompletely charged cells continue to charge.

3.4.7 Equalization Stage: Normally, only the vented / wet cell / flooded batteries are equalized. Some sealed AGM batteries may be equalized if recommended by the manufacturer (e.g. Life Line brand of sealed, AGM batteries). The Equalization Stage is carried out only after completion of the Bulk and Absorption Stages. During the Equalization Stage, the battery is intentionally held above the Gassing Voltage for a specified period of time that is normally proportional to the depth of discharge of the battery or to the AH capacity of the battery.

- Recommendations of the battery manufacturer are to be followed for equalizing the batteries as the equalization voltage, time and frequency will depend upon the specific design of the battery. The Equalization Voltage will normally be in the region of 2.5 to 2.7 V per cell at 25 ° C / 77 ° F e.g. 15 to 16 V for 12 V batteries and 30 to 32 V for 24 V batteries. As a guide, a heavily used flooded battery may need to be equalized once per month and a battery in light duty service, every two to four months.(See fig13)

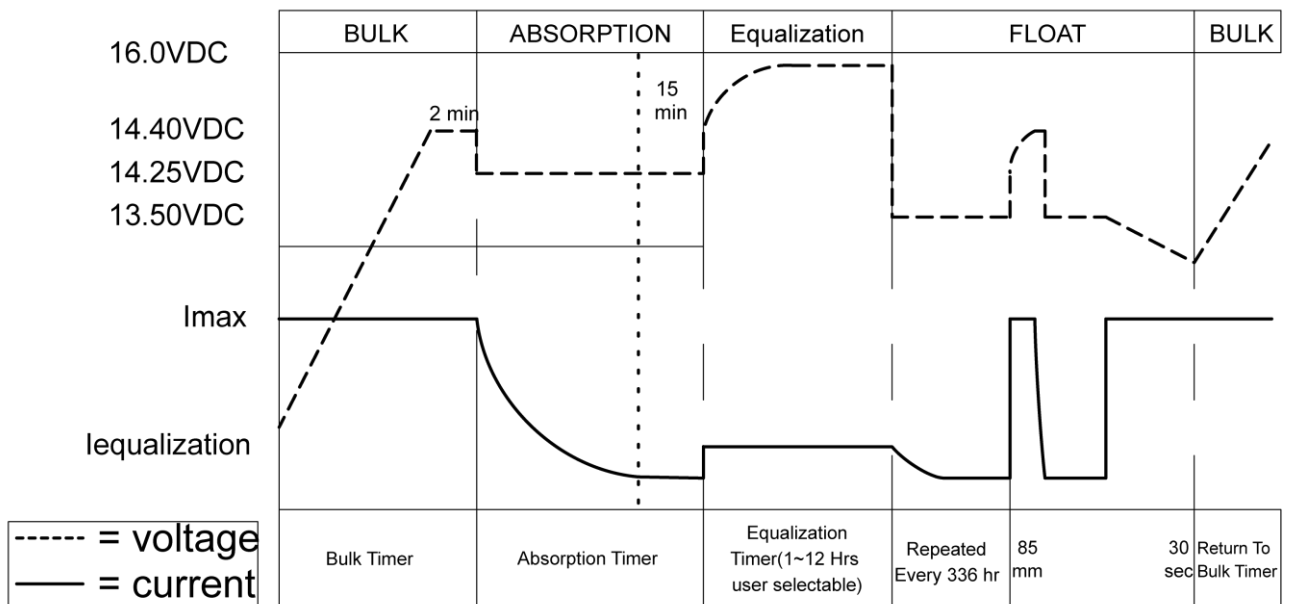


Fig 13. Equalization stage (@12V battery)

3.4.8 The Table below gives the Absorption, Float and Equalization voltage settings for common batteries used :

Battery Type	Inverter Voltage	Bulk Voltage	Absorption Voltage	Float Voltage	Equalization Voltage
Gel	12 VDC	14.1VDC	14.1VDC	13.6VDC	NOTE!
	24 VDC	28.2VDC	28.2VDC	27.2VDC	NOTE!
Flooded	12 VDC	14.6VDC	14.6VDC	13.4VDC	15.5VDC
	24 VDC	29.2VDC	29.2VDC	26.8VDC	31VDC
AGM 1 (Lifeline brand)	12 VDC	14.3VDC	14.3VDC	13.1VDC	15.5VDC
	24 VDC	28.6VDC	28.6VDC	26.2VDC	31VDC
AGM 2 (East Penn/Deka/ Discover/Trojan brand)	12 VDC	14.5VDC	14.5VDC	13.5VDC	NOTE!
	24 VDC	29VDC	29VDC	27VDC	NOTE!
Custom* (To be selected by the customer based on the manufacturers' recommendations, if available)	12 VDC	12~16VDC	12~16VDC	12~16VDC	12~16VDC
	24 VDC	24~32VDC	24~32VDC	24~32VDC	24~32VDC
*User can be setting the custom function voltage, but must use LCD Panel(See 6.4.4 for more information).					



NOTE! Gel and the AGM 2 Group (East Penn/ Deka /Discover/Trojan brand) batteries are not equalized. Hence, their Equalization Voltages are same as the Absorption Voltages



When using the Custom setting, the Equalization voltage setting should not allow voltage lower than the Absorption Voltage setting. Also, the Equalization Voltage setting should not allow a setting higher than 2-volts (for 12V systems), or 4-volts (for 24V systems) above the Absorb Voltage setting.

3.4.9 Calculation of Equalization Charge Current: The Equalization Charge Current should be a relatively low current of around 1% of the charge current of the battery. Such a low current prevents an overcharge condition that results in excessive gassing and excessive loss of water. Also the equalization charge current should preferably be a variable value that is automatically set by the microcontroller as a function of the degree of charge of the battery.



NOTE! Equalization Current is related to the charge current capacity of the battery and is normally calculated at 1% of the charge current of the battery. Hence, We has provided for the user to input the charge current capacity of the battery being used.(See 6.4.4)

3.4.10 Calculation of Absorption and Equalization Times: Equalization is required to be carried out after completion of the Bulk and Absorption Stages. It is preferred that the time periods for the Absorption and Equalization Stages be proportional to the discharged state of the battery. A more discharged battery will take longer time in the Absorption and Equalization Stages. The discharged state of the battery will be proportional to the time the charger remains in the Bulk Stage. Hence, a software timer may be used to measure the time the charger is in the Bulk Stage and then calculate and set the Absorption Stage and Equalization Stage Timers. Let the time

taken in the Bulk Stage be designated by “Bulk Timer” and the calculated Absorption Time by “Absorption Timer and the Equalization time by “Equalization Timer”. One of the recommended logics for calculations is as follows(See Fig 13):

- Absorption Timer = 0.5 x Bulk Timer
- Equalization Timer = Absorption Timer + 1 Hour if $T_1 < 2$ Hours, or
- Equalization Timer = Absorption Timer + 2 Hours if $2 < T_1 < 4$ Hours, or
- Equalization Timer = Absorption Timer + 4 Hours if $T_1 > 4$ Hours

4 Operation

4.1 Power “ON”

You use the remote control panel, and press the ON / OFF button on the front.

After switching on expect a five till ten second delay before the Combi unit activated.

If AC power is available on the AC input and within the specified limits, the Combi unit will switch to Charger Mode and will commence to charge the batteries. At the same time the internal transfer relay will pass the AC power to the AC output “INV. AC output”.

If the AC power from the external AC-source is unavailable or outside the specified limits, the unit will come on as an inverter. Inverter overload protection, built-in idle mode circuitry, transfer switching, sharing and battery charger regulation will all function automatically.

4.2 Power “OFF”

Move the main switch to the “OFF” position to switch off the Combi unit. Or can you use remote control panel, press the on/off button delay three second on the remote control panel. The Combi unit stops and all the indicators go off. The “INV. AC output” is disconnected and will become powerless.



WARNING!

Power OFF the Combi unit not cut off the connection to the batteries or the AC-source. Therefore the “AC output” output is still active.

4.3 Selectable “CHR. Power ON” mode

When the main switch is set to the “ON” position, then to press LCD remote control panel “ON / OFF” button. You can to setting change the “CHR. Power ON” mode. The Combi unit is only able to work as a charger. This means that the inverter mode is disabled. This setting is useful if you want to keep your batteries charged and maintained in case you are away i.e. in the winter time. Now your batteries are spared when the incoming AC-source fails in operation. See Chapter 6 for detailed operation instructions of the remote panel.

4.4 Protections

The Combi unit is protected against overload, short circuit, overheating and under and over voltage. The user can detect failures from the remote control panels by means of the indicators .See chapter 8 for explanation of this readout.

5 Installation And Maintenance

During installation and commissioning of the Combi unit, the Safety Guidelines & Measures are applicable at all times. See chapter 1 of this manual.

5.1 Unpacking

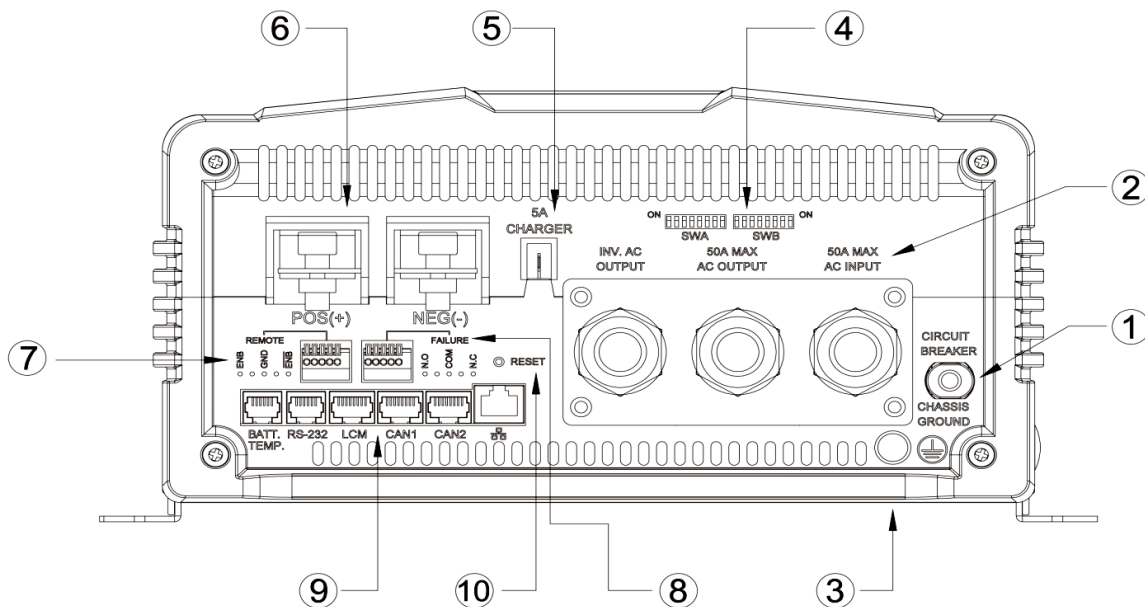
In addition to the Combi unit the delivery includes:

- a battery temperature sensor.
- user’s manual.

After unpacking, check the contents for possible damage. Do not use the product if it is damaged. If in doubt, contact your supplier.

Check from the identification label whether the battery voltage is the same as the DC-input voltage of the Combi unit (e.g. 24V battery set for a 24V input voltage). Also check that the AC output voltage and output power of the Combi unit satisfies loading requirements.

5.2 Front Panel



5.2.1 AC Input Breaker: (reference ①)

The AC input circuit breaker protects the Combi unit from overload. When an overload or short circuit condition occurs, the circuit breaker trips and disconnects the incoming AC power input. To reset it, push the circuit breaker button. The cause of tripping should be ascertained and corrected before the unit is reset.

5.2.2 Hard-Wire Installation (AC wiring connections terminal): (reference ②)

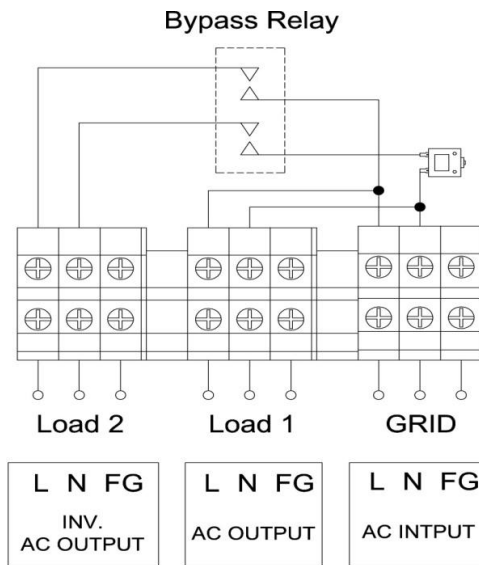
The AC wiring compartment is located on the front panel. Remove the AC wiring compartment cover to gain access to the AC terminal.



WARNING!

Before you connect AC wiring to the terminals of compartment cover, ensure to check the label in the compartment for correct connections. Wrong connection will damage the Combi unit.

- AC input and AC output terminal



- Connect AC output and AC input wiring to the inverter terminals
Please use the following information as your reference:

Terminal		Wire color	AC Current	inch	A.W.G
AC Output	Line (L)	Black	20~25A	2	14
	Neutral (N)	White	25~30A	3.5	12
AC Input	Line (L)	Brown	30~40A	5.5	10
	Neutral (N)	Blue	40~55A	8	8
INV. AC Output	Line (L)	Red	55~70	14	6
	Neutral (N)	Yellow			
Chassis Ground		Green / Yellow or Bare copper	26~32 feet / AWG# 12~14		



Note. Please double check and review all the connections to ensure that the wires are connected to the correct terminals and that the connections are tight.

5.2.3 Chassis Ground: (reference ③)



WARNING!

The ground wire offers protection only if the cabinet of the Combi unit is connected to the safety ground. Connect the chassis ground terminal to the hull or the chassis.

Refer to local regulations on these issues!

For safety purposes the neutral conductor (N) of the AC output must be connected to the earth (PE / GND) when the Combi unit is in inverter operation. When utility power is available on the AC input, and the Combi unit is in charger mode, this connection must be disabled again.

In some applications automatic connection between the neutral conductor (N) and earth (PE / GND) is not required or acceptable. Therefore the automatic connection between the neutral conductor (N) and earth (PE / GND) is disabled by default. (see fig 5.)

5.2.4 DIP Switch Setting: (reference④)

The Combi unit is provided with two groups of DIP-switches to adjust the apparatus according to the specifications of the electrical installation. The DIP-switches are located in the front panel.

SWA

A1	A2	A3	Setting	A4	Setting	A5	A6	Setting	A7	Setting	A8	Setting						
0	0	0	Disable	0	50Hz	0	0	100V	0	OFF	0	ON						
1	0	0	Pow40W	1	60Hz			200V	1	ON	1	ON						
0	1	0	Pow80W			1	0	110V										
1	1	0	Pow100W					220V										
0	0	1	Pow120W			0	1	115V										
1	0	1	Pow160W					230V										
0	1	1	Pow180W			1	1	120V										
1	1	1	Pow220W					240V										
Power Saving						Frequency		Output Voltage					Ground Relay		Reset			

Power Saving: If you want to setting the Combi unit to power saving mode, to reduction consumption from the batteries. This means when it detects a load that is above setting value, it output power automatically on. By adjust DIP switch SWA1,SWA2 and SWA3. Default is “Disable”.

Frequency: If you want to setting the Combi unit output power frequency of the inverter. By adjust DIP switch SWA4. Default is “60Hz”@110VAC Model / “50Hz”@230VAC Model .

Output Voltage: If you want to setting the Combi unit output power voltage of the inverter. By adjust DIP switch SWA5 and SWA6.

Ground Relay: The function allows you to connect the Neutral conductor of the Combi unit to the Safety Ground automatically when the Combi unit is working as an inverter. This means if you to set adjust the DIP switch SWA7 to “ON”. The internal Neutral of the inverter connected to the Safety Ground when the Combi unit is working as an inverter and disconnected when incoming AC input power is applied. Default is “OFF”.

Reset: If you want will the Combi unit reset to default set value of the DIP switch. By adjust DIP switch SWA8.

SWB

B1	Setting	B2	Setting	B3	B4	Setting		B5	Setting	B6	B7	Setting	B8	Setting
0	Disable	0	Disable	0	0	6A	10A	0	Disable	0	0	Gel	0	COMBI Mode
1	Enable	1	Enable	1	0	10A	15A	1	Enable	0	1	Flooded		
				0	1	16A	25A			1	0	AGM1	1	CHR Mode
				1	1	25A	30A			1	1	AGM2		
Support	Generator							0	@110VAC	Battery Type Selection			Power "ON" Mode Selection	
						@230VAC	@110VAC							
						Sharing Current Limit			Power Sharing					



DIP switch SWB3 and SWB4 to setting sharing current limit in 6A min. But user can to use LCD panel setting the current in 3A min.

Support: If you want to disable or enable the support function. See 3.3.5 for more information. Default is "Enable".

Generator: If you want to disable or enable the generator function. See 3.3.4 for more information. Default is "Enable".

Sharing Current Limit: If you want to setting limit the AC input current, Default is "6A"@230VAC Model / "10A"@110VAC Model. See 3.3.3 for more information.

Sharing : If you want to disable or enable power sharing function. Default is "Enable". See 3.3.3 for more information.

Battery Type Selection : The factory setting for the battery type is optimal for most installations. In some applications however, it is desirable to change this setting. Adjust the Combi unit to the applied batteries by adjusting DIP switches SWB6 and SWB7. Default is "Standard". . Wrong adjustment can cause damage to your batteries which is not covered by the warranty. The setting for traction battery should never be used with a battery bank that consists of 2V GEL cells!

Battery Type Stage	Gel		Flooded		AGM 1		AGM 2	
	@12VDC	@24VDC	@12VDC	@24VDC	@12VDC	@24VDC	@12VDC	@24VDC
Bulk Voltage	14.1VDC	28.2VDC	14.6VDC	28.2VDC	14.3VDC	28.6VDC	14.5VDC	29VDC
Absorption Voltage	14.1VDC	28.2VDC	14.6VDC	28.2VDC	14.3VDC	28.6VDC	14.5VDC	29VDC
Float Voltage	13.6VDC	27.2VDC	13.4VDC	26.8VDC	13.1VDC	26.2VDC	13.5VDC	27VDC

Power "ON" Mode Selection: If want to use "COMBI Mode" or "CHR Mode" to startup of the Combi unit. By adjusting DIP switches SWB8. Default is "COMBI Mode".



NOTE!

When after adjusting DIP switches must will the Combi unit re-start.

5.2.5 5A Charger: (reference ⑤)

The Combi unit has a second charge output switch can be used to give a maintenance charge to a small battery.

■ Characteristics introduction

Battery maximum charger current: 5Amps

Battery maximum charger voltage: 14.4VDC @ 12V / 28.8VDC @ 24V

Battery charger status: three – step

Charger enable / Disable user selectable

5.2.6 DC Input Connection: (reference ⑥)

Follow the instructions to connect the battery cables to the DC input terminals of the Combi unit. The cables should be as short as possible (less than 6 feet / 1.8 meters ideally) so that they can handle the required current in accordance with the Electrical Codes and Regulations. The size of the cable should be thick enough to limit the voltage drop to less than 2% when carrying the maximum input current to prevent frequent low-input voltage warnings, and shutdown. UVP (Under Voltage Protection) warning may result if there is excessive voltage drop across the DC cables between the batteries and the Combi unit. Increasing your DC cable size will help improve the situation.

Batteries are capable of providing very large currents in case of short circuit. In case there is a short circuit in the cable run between the batteries and the input terminals of the Combi unit, it will result in overheating / melting of the cables and consequent risk of fire and injury, To prevent possibility of this hazard, use Very Fast Acting DC Fuse in line with the positive cable. The fuse should be as close to the positive battery terminal as possible. Use Busman ANN series fuses (will also require Fuse Block 4164) or equivalent.

The following sizes of cables and fuses are recommended for up to 6 ft. distance between the batteries and the Combi unit. (Applies to both 120 VAC and 230 VAC versions):

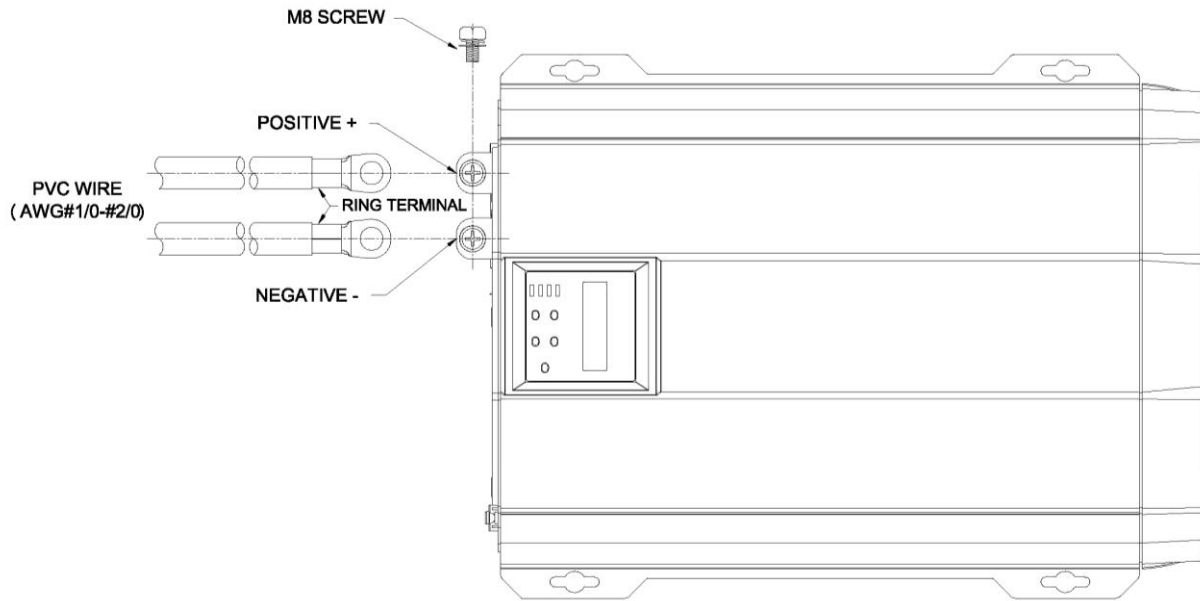
Model No	Wire AWG	Inline Fuse
SB2000-112 / 212	# 2 / 0	250 A
SB2000-124 / 224	# 1 / 0	125 A

- Connect DC input terminals to 12V / 24V battery or other DC power source. [+] is positive, [-] is negative. Reverse polarity connection can blow the internal fuse and may damage the Combi unit permanently.



WARNING!

Make sure that all the DC connections are tight (torque to 9 – 10 ft-lbs, 11.7 - 13 Nm). Loose connections could result in overheating and can be a potential hazard.

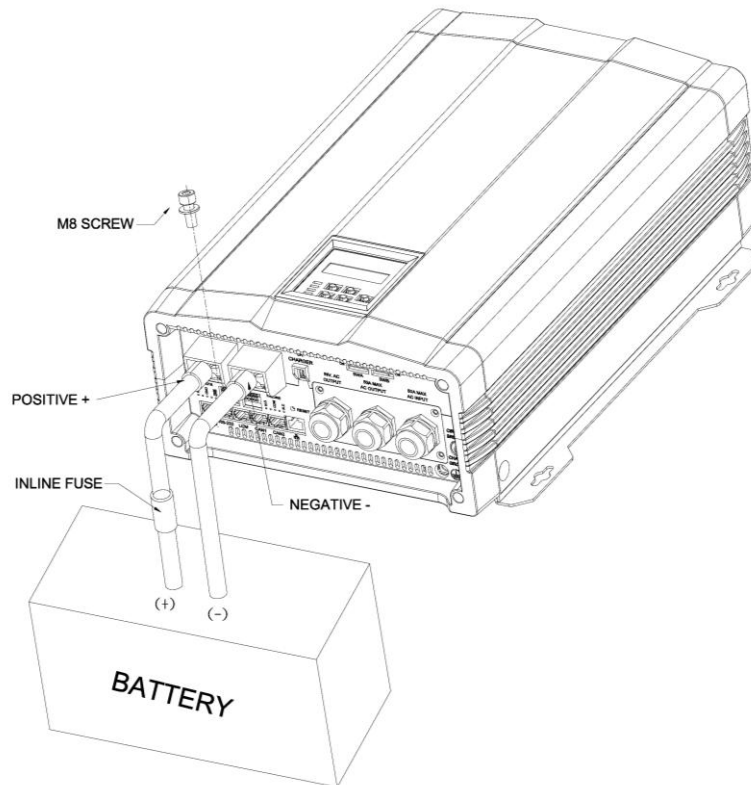


WARNING!



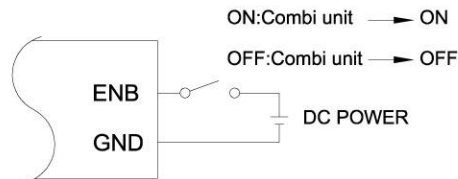
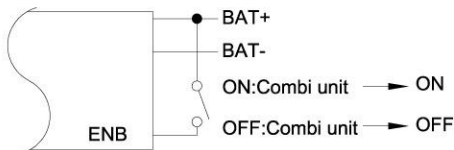
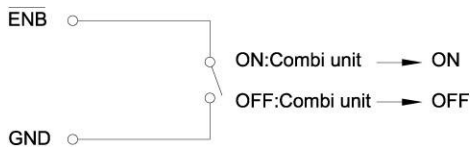
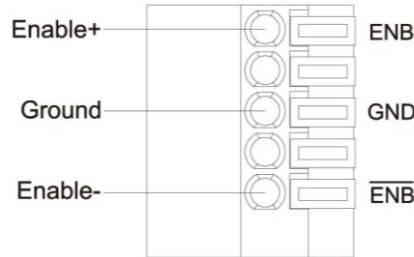
The recommended inline fuse should be installed as close to the battery positive terminal as possible. Failure to use a fuse on the “+” cable running between the Combi unit and battery may cause damage to the cable / Combi unit and will void warranty.

Also, only use high quality copper wire and keep the cable length short which is a maximum of 3 – 6 feet.



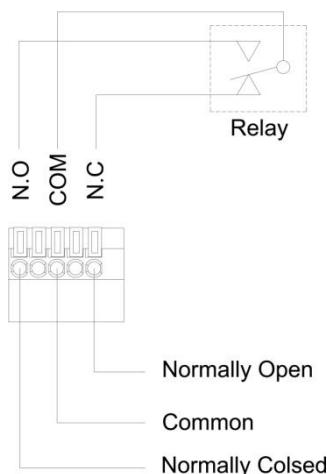
5.2.7 Remote control green terminal: (reference ⑦)

- 1.) Before installing the functions of the Combi unit, ensure the Combi unit to turn off.
- 2.) Use 20 ~ 24 #AWG wire to connect the remote control terminals.
- 3.) Remote control ON / OFF Combi unit setup status :



NOTE: At one time, only one remote function should used to control the Combi unit. The maximum voltage value is 60VDC in the ENB.

5.2.8 Dry Contact Green Terminal: (reference ⑧)

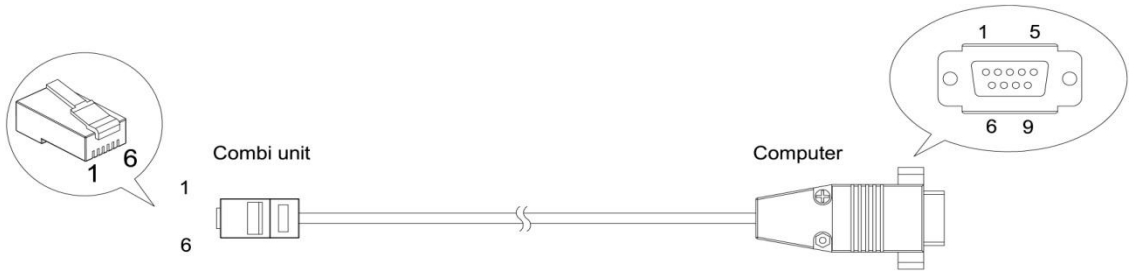


Dry contact terminals may be connected to a Form C relay for “FAULT” indication. When “FAULT” occurs are provided with two sets of alarm contacts.



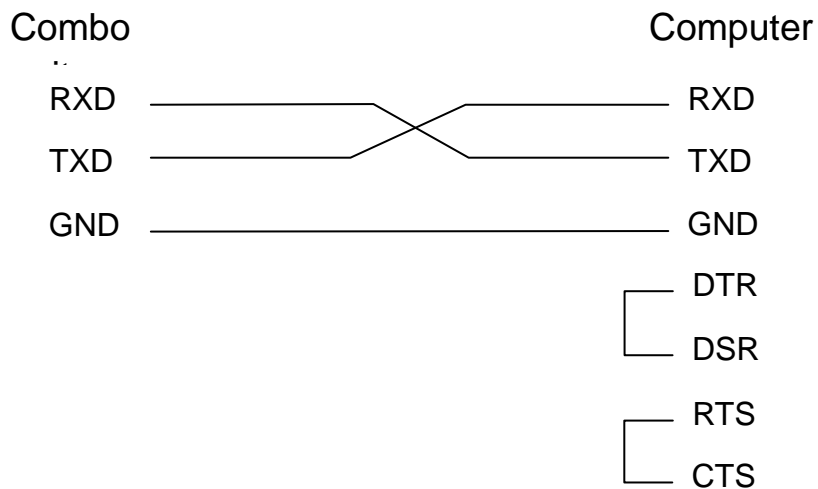
NOTE: Fault conditions include Input under/over voltage, Output Short Circuit, Over Temperature, Over-load and, Fan Failure.

2.) RS-232 Port : Serial port monitoring and control through computer interface.



Combi unit		Computer	
PIN Num.	Signal Description	Signal Description	PIN Num.
1	Not used	Not used	1
2	GND	RXD	2
3	RXD	TXD	3
4	TXD	DTR	4
5	Not used	GND	5
6	Not used	DSR	6
		RTS	7
		CTS	8
		Not used	9

■ The connection between this Combi unit and the computer is as follows :



3.) LCM Port : Connection for LCD remote control panel, can you setting and display the Combi unit operation status.




LCD Remote Control Panel		Combi unit	
PIN Num.	Signal Description	PIN Num.	
1	CANH	1	
2	CANL	2	
3	PON	3	
4	VCC-	4	
5	VCC+	5	
6	DIS	6	
7	5VS-	7	
8	5VS+	8	



The cables should be as short as possible (less than 32.8 feet / 10 meters) so that they can handle the signal.

4.) CAN I and CAN II Port : At present has not used, the reservation may make the parallel use in the future.

5.)  Ethernet Port : The user can use RJ-45 cable line to connect to this port to manage and control the COMBI unit through SNMP.



NOTE:
Ethernet function at user option and can be purchased upon request.

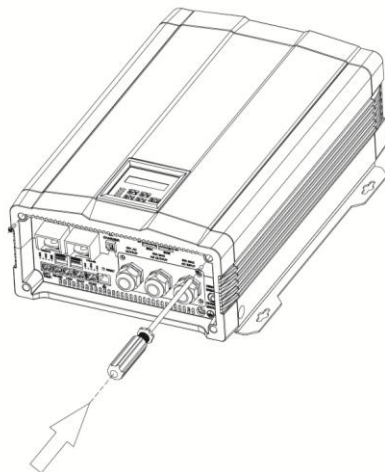
5.2.10 Reset : Press the reset button when the Ethernet is not working normally.

5.3 Move The LCD Remote Control Panel Place:

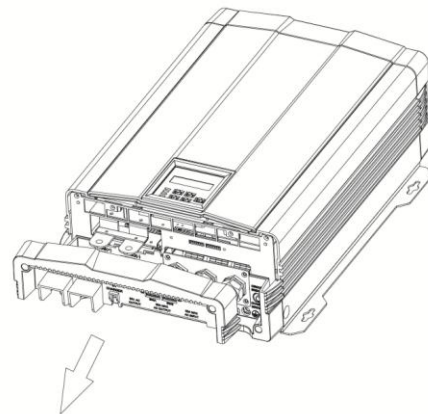
5.3.1 How remove the LCD remote control panel

User can remove LCD remote control panel on the Combi unit. And can fixed in the operation convenient place or is position. As follows fig.

Step 1. Loosening the screw in the front of the Combi unit, then will plastic pushes forward. Remove the front.

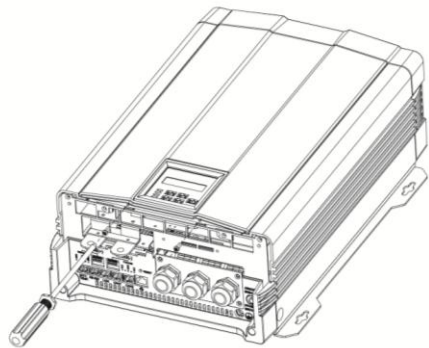


(1)

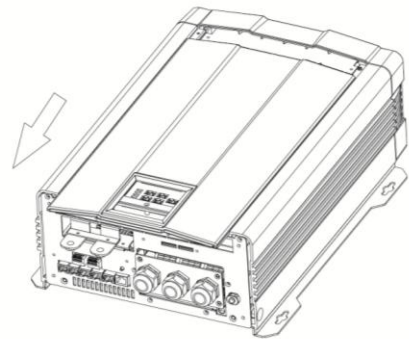


(2)

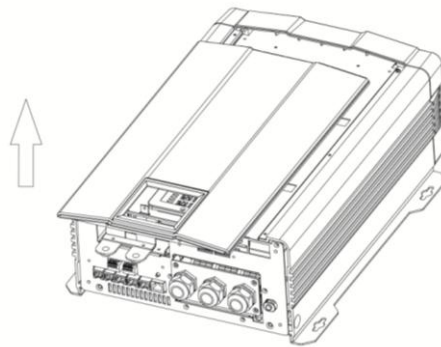
Step 2. Loosening the screw in the top of the Combi unit, then first will the top plastic push front way. Remove the top plastic.



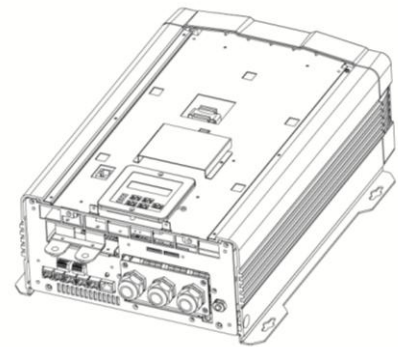
(1)



(2)

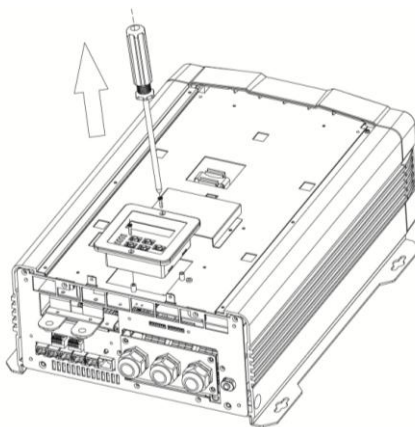


(3)

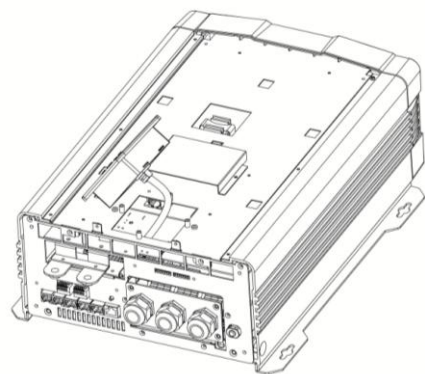


(4)

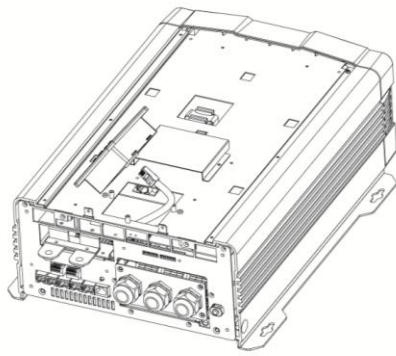
Step 3. Loosening the screw in the lcd remote control panel of the Combi unit, then remove the LCD remote control panel, and will the cable wire taking in the rear. The cable wire can fixed in the “RJ-45 fixed Position” connector.



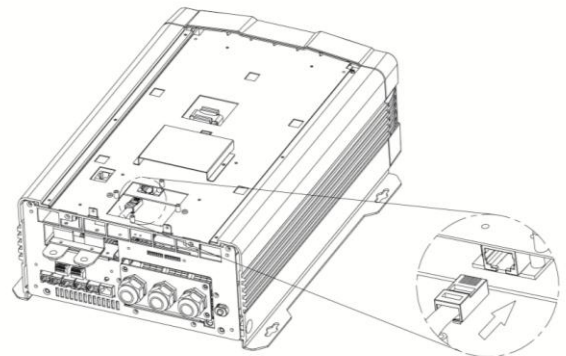
(1)



(2)



(3)

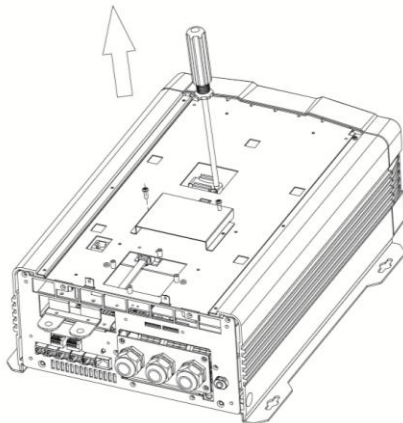


(4)

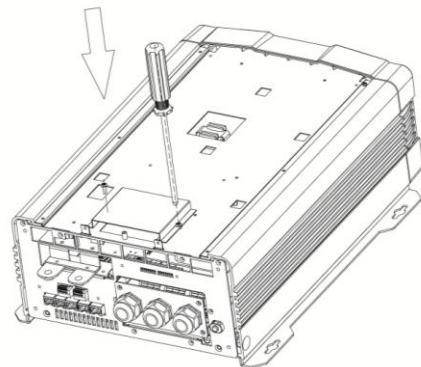
5.3.2 Combination the Combi unit

In remove LCD remote control panel after on the Combi unit. You must Combination the Combi unit. As follows fig.

Step 1. Will lock in the top head sheet iron takes down, and will the LCD remote control panel hole cap. Loosening the screw.

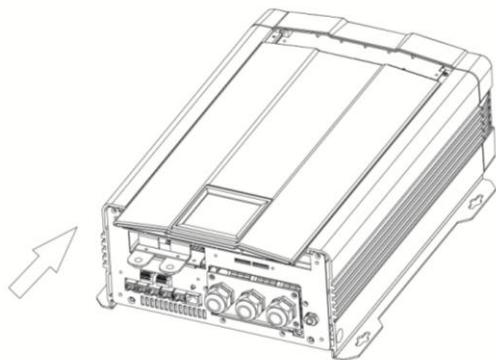


(1)

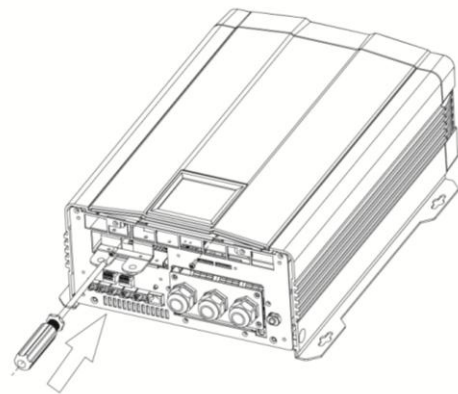


(2)

Step 2. Will the top plastic Combination in the Combi unit on the front, and make sure that all the screw are tight.

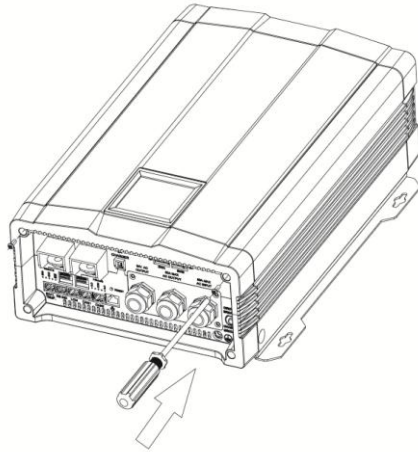


(1)



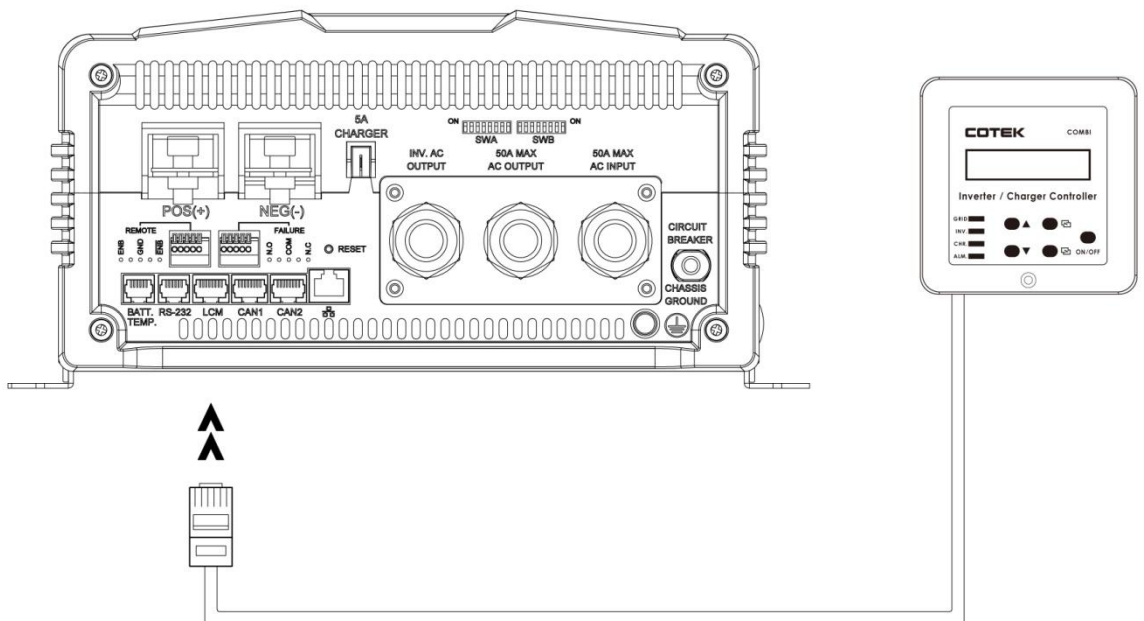
(2)

Step 3. Will the front plastic Combination in the Combi unit on the top, and make sure that all the screw are tight.



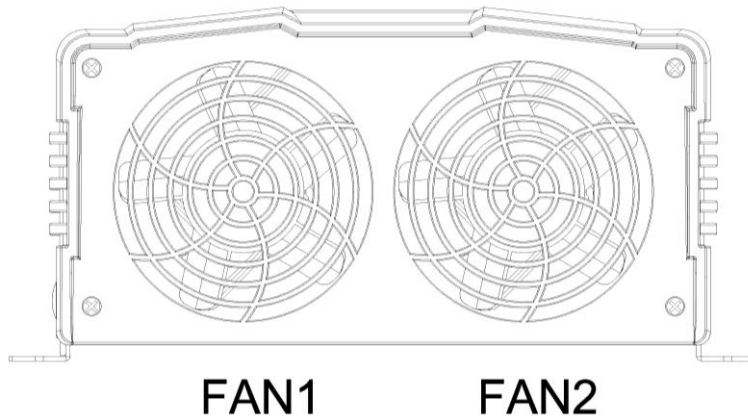
5.3.3 Installation LCD remote control panel

User can be installation the LCD remote control panel in anywhere, and you can using the LCD remote panel to control the Combi unit(see Chapter 6). The cable wire you can reference 5.2.9 of the LCM PORT(the wire less than 32.8 feet / 10 meters). As follows fig.



5.4 Rear Panel:

Rear Panel View

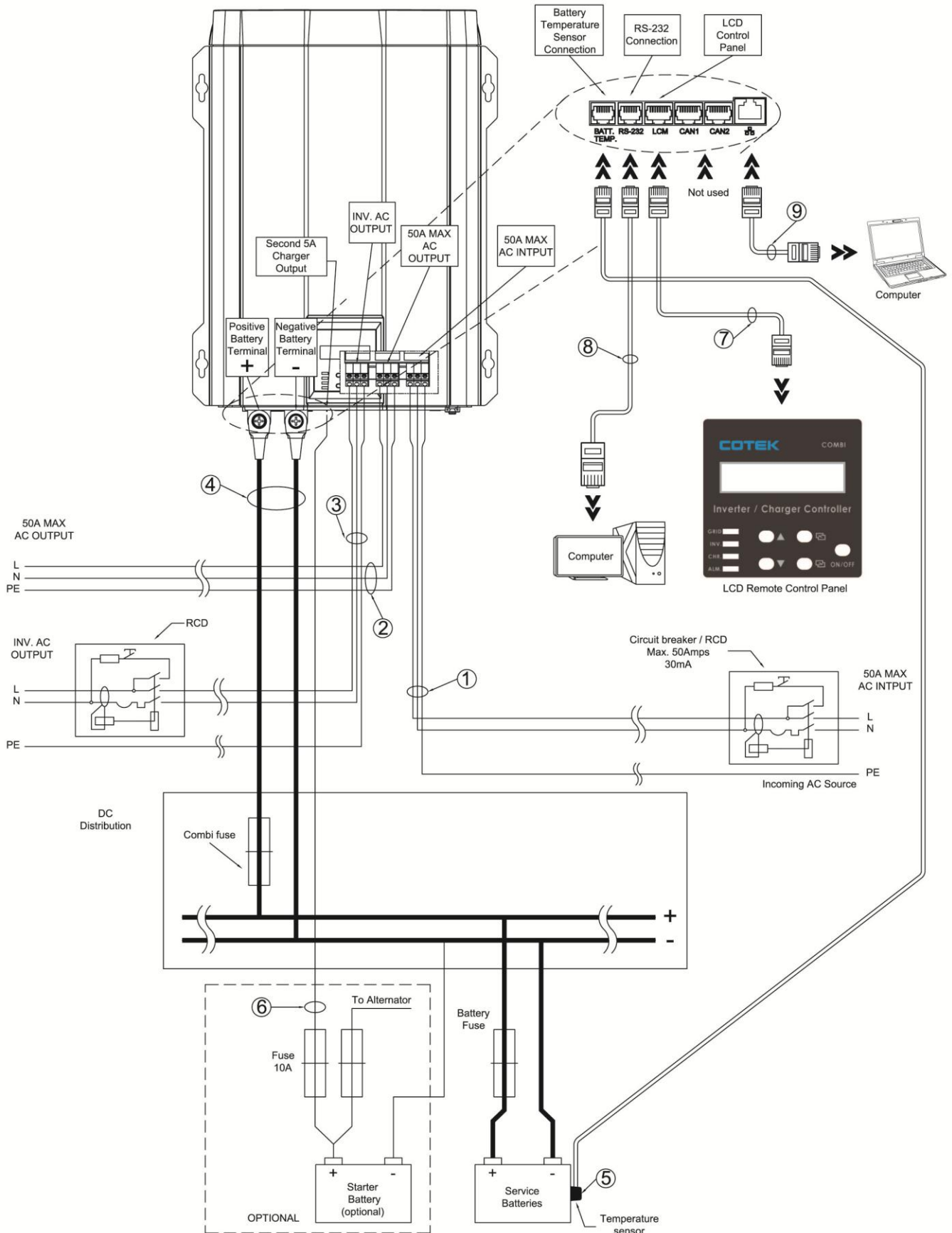


FAN ventilation grille (1) ~ (2): The fans behind the ventilation grilles provides cooling.
DOT NOT obstruct these vents!

- Maintenance:

- 5.4.1 Make sure that the fan vents are not blocked.
- 5.4.2 Use a vacuum cleaner to remove any dust from the fan area.
- 5.4.3 When cleaning the case or rear panel, use a soft, dry cloth, only. If the case or rear panel is very dirty, use a neutral, non-abrasive detergent. Do not use alcohol or ammonia based solutions.
- 5.4.4 Regular service, and relocation of the Combi unit, should be performed by a qualified service technician.
- 5.4.5 Avoid spilling liquid on the Combi unit.

5.5 Installation Drawing



This schematic is to illustrate the general placement of the Combi unit a circuit. It is not meant to provide detailed wiring instructions for any particular electrical installation.

Fig 14. Installation Drawing

5.5.1 Wiring instructions for one Combi unit (stand alone operation)

See fig 13.

- 1.) See reference ①. Connect the external AC-source to the AC-input of the Combi unit. Integrate a fuse (value depending on the used wire diameter with a maximum of 50Amps) and a Residual Current Device (RCD) into this wiring.
- 2.) See reference ②. Connect the AC-output POWER of the Combi unit to the power distribution group.
- 3.) See reference ③. Connect the INV. AC output of the Combi unit to the INV. AC output distribution group. Integrate a Residual Current Device (RCD) into this wiring.
- 4.) See reference ④. Run the DC-cables between the batteries and the Combi unit. Connect the red cable to the plus (+) connection, the black cable to the minus (-) connection.
- 5.) See reference ⑤. Attach the temperature sensor to the battery and run the cable into the Combi unit.
- 6.) Option: if you want to make use of the possibility to give a maintenance charge to a small battery set (like a starter battery), run a AWG14 red cable with a fuse holder between the positive pole of the starter battery and Combi unit. reference ⑥. Fix the cable with an insulated fasten to the “+5A” connection. Integrate a 10 Amps fuse in this wire. The negative pole of this battery must be connected to the negative pole of the service battery.
- 7.) See reference ⑦. If you want to install the LCD remote control panel, run the communication cable between the Combi unit and the panel.



NOTE!

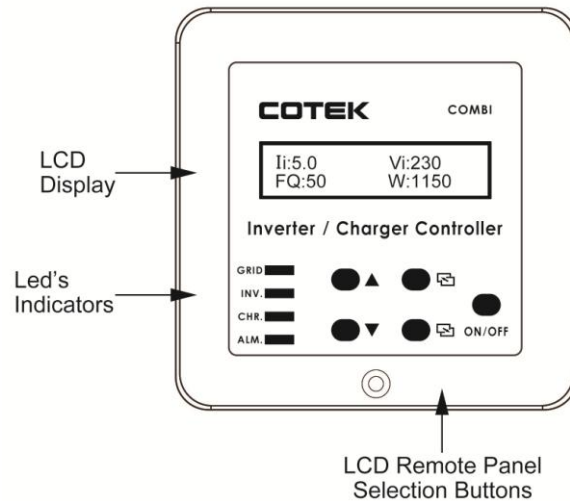
The Combi unit can also be operated without the LCD remote control panel connected.

- 8.) See reference ⑧. If you want to install a computer. To monitoring and control the Combi unit.
- 9.) See reference ⑨. The user can use RJ-45 cable line to connect to this port and manage it through remote to control the Combi unit.

6 LCD Remote Control Panel – Display & Setup

6.1 LCD Panel Indications

- 6.1.1 Press the ON / OFF button on the front. The Combi unit starts working normally. After switching on expect a five till ten second delay. The Combi unit will be operating in normal condition when either of the following messages are displayed on the LCD panel screen :



6.1.2 LED Indications :

- AC GRID: Displays incoming AC input status.

AC Input	LED Status
AC input ON	Green
AC input OFF	OFF

- Inverter: Displays the Combi unit working in the “Inverter mode” statues.

DC-AC Inverter	LED Status
Inverter AC Power OK	Green
Inverter AC Power Not Good	Red

- Charger: Displays the Combi unit working in the “Charger mode “ status.

Bypass	LED Status
Charger OK	Green
Charger Not Good	OFF

- ALARM: Displays the Combi unit status of the Failure Alarm.

Alarm	LED Status
Over / Under Alarm / FAN Alarm	Orange
Set alarm in the inverter to operate normally	OFF

NOTE. For instructions on setting the alarm, see details in Section 6.3.3

6.1.3 LCD Remote Control Panel Selection Buttons :

- Function of Various Buttons :



Function <Up>: You can use the “up” button to scroll through the menus. or to select the value for set up under setting mode.



Function <Down>: You can use the “Down” button to scroll through the menus or to select the value for set up under setting mode.



Function <Page Up>: You can use the “Page Up” button to scroll through the menus.



Function <Page Down>: You can use the “Page Down” button to scroll through the menus.

Function <Enter Setup Menu>: Press the button longer than 2 seconds, The Combi unit will change to “Select Menu” which appears on the LCD screen for the user to set functions.

Function <Enter>: Confirms a selection or value.

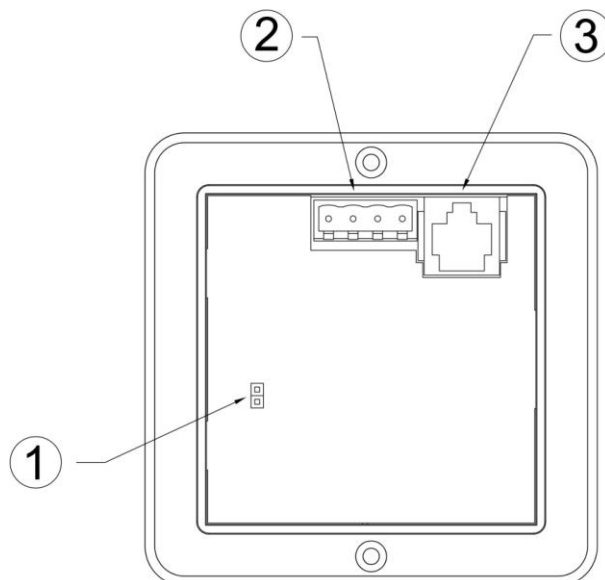


ON/OFF

Function <ON / OFF>: The Combi unit can be activated by the button. Press “ON / OFF” button, the Combi unit to startup. If you want to turn OFF the Combi unit. Press the “ON / OFF” button longer than 3 seconds.

6.1.4 LCD Display: Displays Combi unit operational status (See also section 6.3 for detailed).

6.2 LCD Rear View Introduction



6.2.1 Jump (reference ①)

The “J1 jump” is placed inside the remote controller and it is to indicate either “Return Override Function” or ‘Ignition Lockout Function”

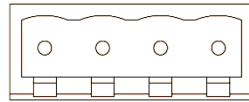
- J1 jump “open” – Return Override Function
- J2 jump “short” – Ignition Lockout Function



Note.
The “J1” jump default mode is “short”.

6.2.2 Green Terminal (reference ②)

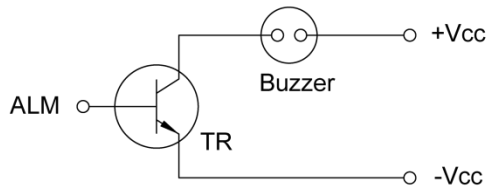
1 2 3 4



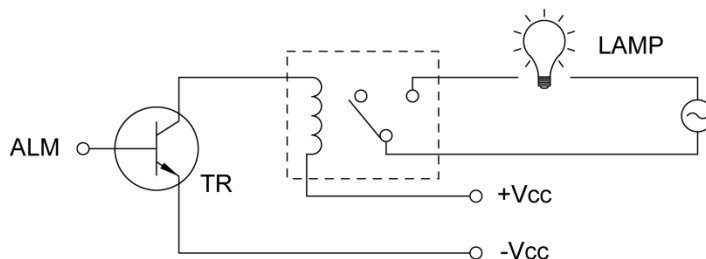
PIN	Function
1	ALM
2	CTL
3	-ENB
4	-VCC

- ALM (PIN1)

When the Combi unit has the warning or the protection produce, simultaneously this “ALM” pin will changing output to 5 Volt / 10mA control signal to provides the user.



ALM "HI" → Buzzer ON
ALM "LO" → Buzzer OFF



ALM "HI" → Lamp ON
ALM "LO" → Lamp OFF

● CTL (PIN2)

User can be use this “CTL” pin to force the Combi unit to turn ON or turn OFF, and the function must with the “J1” jump coordination use (see 6.2.1).

* J1 jump is “open” : Turn OFF the Combi unit. When have a power provision the “CTL” pin, then the Combi unit to turn ON. If the power havn’t provision the “CTL” pin, this time the Combi unit to turn ON. As follows shows :

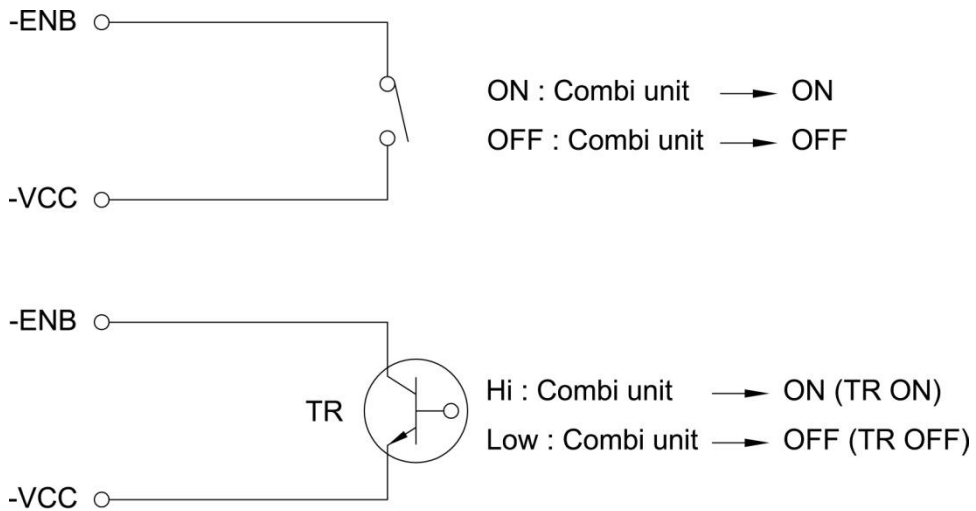
J1 Jump	“CTL” Input Voltage	Combi Unit
Open	5 ~ 60 VDC	Turn ON
	0 V	Turn OFF

* J1 jump is “short” : Turn ON the Combi unit. When have a power provision the “CTL” pin, then the Combi unit to turn OFF. If the power havn’t provisions the “CTL” pin, this times the Combi unit to turn ON. As follows shows :

J1 Jump	“CTL” Input Voltage	Combi Unit
Short	5 ~ 60 VDC	Turn OFF
	0 V	Turn ON

● -ENB (PIN3)

User can be this “-ENB” pin to control the Combi unit to turn ON or turn OFF.



WARNING!

To turn “ON” the combi unit by operating the –ENB function of LCD Panel, the combi inverter cannot be turn OFF by any others operations, only if to turn the MAIN SWITCH “OFF”.

● -Vcc (PIN4)

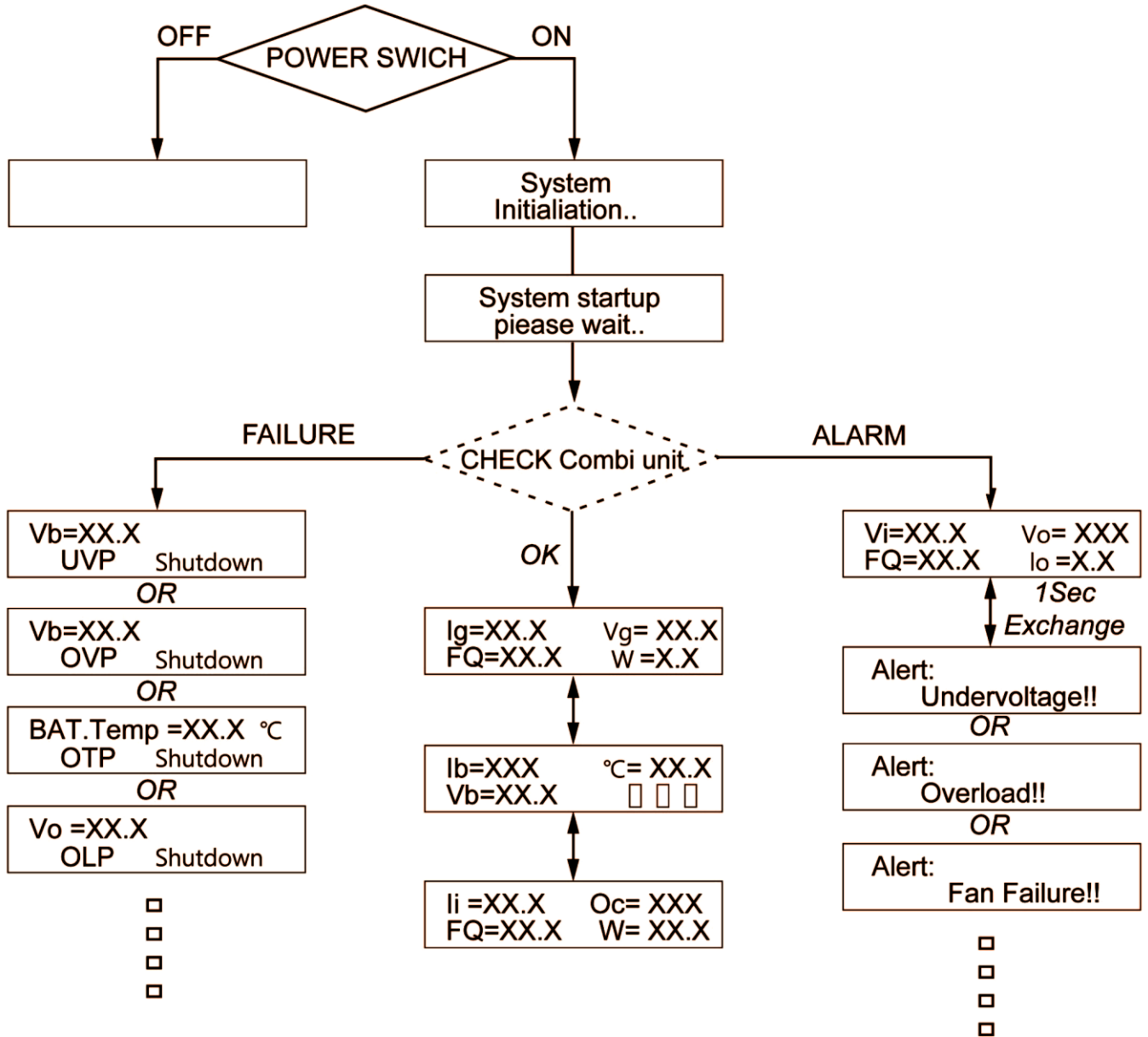
This is LCD remote control panel ground




This is LCD remote control panel ground, and with battery negative (-) is different.

6.3 Startup Sequence and Standby Status

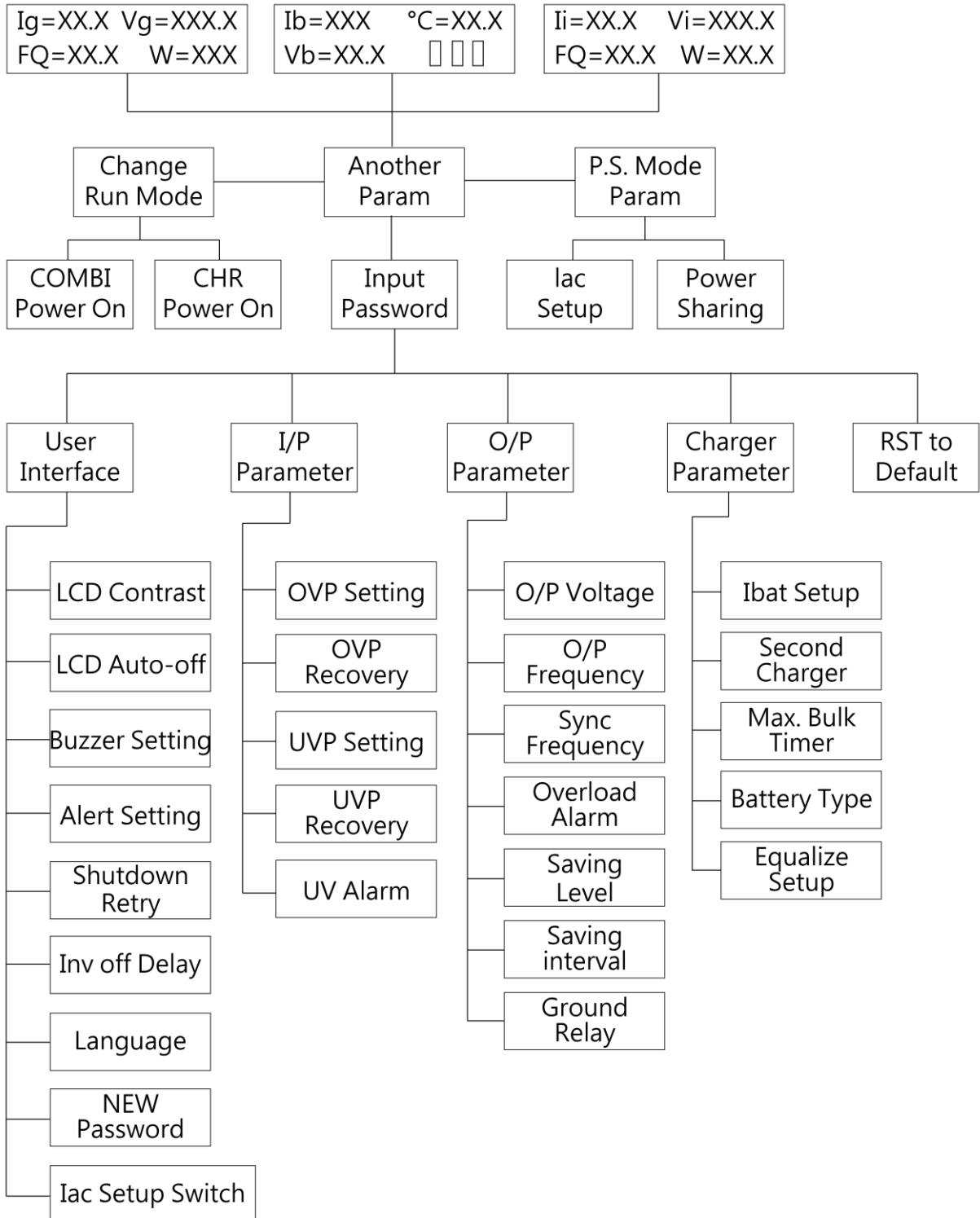
6.3.1 Once turn on the Combi unit. The LCD display shows “System startup please wait”, then checks the Combi unit. Status flow is as follows:





6.4 Setup Menu – Operation and Instructions Entering Setup Menu:

Press  Button longer than 2 seconds. The Combi unit, enters the select Menus consisting of four layers:

- (1) Select Menu Heading: (2) Select Menu :
- (3) Select Menu Item: (4) Setting Value:



6.4.1 Select Menu Heading:

The manual is used to show the status of the running Combi unit. The user can make selections by switching on  <UP> or  <DOWN>

- | | |
|---------|----------|
| Ig=XX.X | Vg=XXX.X |
| FQ=XX.X | W=XXX |

Ig = xx.x → Display the Grid O/P current.
 Vg = xxx.x → Display GRID O/P voltage
 FQ = xx.x → Display the Grid frequency
 W = xxx → Display the Grid O/P Power.

- | | |
|---------|--|
| Ib=XXX | °C= XX.X |
| Vb=XX.X | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |

Ib = xxx → Display the current status of Battery :
 “Ib = -xxx” to indicate the value of discharging current in discharge mode.
 ”Ib = xxx ” to indicate the value of charging current in charge mode.

°C = xx.x → Display “BAT. Temp.” to indicate the ambient temperature.

Vb = xx.x → Display the charge or discharge voltage of the battery.

- Displays the status of charging cycle: BULK, ABSORPTION or FLOAT
- : BULK Phase.
- : ABSORPTION Phase.
- : FLOAT Phase.

- | | |
|---------|----------|
| Ii=XX.X | Vi=XXX.X |
| FQ=XX.X | W= XX.X |

Ii = xx.x → Display the INV output current.
 Vi = xxx.x → Display the INV output voltage.
 FQ = xx.x → Display the INV frequency.
 W = xx.x → Display the INV output power.

6.4.2 Change Run Mode :

Combi / Charger mode control, when the Combi unit there is no external AC power available, the inverter will provides AC power, and when there is external AC power available, the Combi unit can constantly senses the incoming AC current which is used to supply both the battery charger and the appliances connected the AC output. This functions on the setting of “Combi power ON”.
 (See also section 3.3.3 for detailed)

If you want to charge you batteries only and you do not want to start the inverter function when incoming AC fails. Then the function must be setting of “CHR power ON”. (Charger See also section 3.3.7 for detailed)

6.4.3 P. S. Mode Param

Power sharing mode parameter control. Setting the Combi unit “ Sharing / Support / Generator “ function of the enable or disable, and setting the AC input current limited.

- lac setup : Setting the available power at the AC input current limited. To protect the incoming AC input current from overload.
Default : 10A @ 110VAC model / 3A @ 230VAC model
Setting range : 10 ~ 50A @ 110VAC model / 3 ~ 25A @ 230 VAC model
- Power sharing : Setting the Combi unit “Sharing / Support / Generator “ function of the enable or disable. When set the function have display on the LCD screen. Mean the function enable. When no have appears on the LCD screen is disable.
Default = Disable.
Setting range: Disable / GEN. / SUPP. / SUPP. GEN. / SHAR. / SHAR. GEN. / SHAR. SUPP. / SHAR. SUPP. GEN.

6.4.4 Another Parm :

Press  button before of enters, the “Another Parm” menus.

To access the settings menu contents a level password must be provided. For increased protection certain sensitive parameters are protected by a level password than an authorized operator must provide.

- User interface
 1. LCD contrast : Sets the LCD screen contrast.
Default = 50%
Setting range = 0% ~ 100%
 2. LCD Auto-off : Sets the LCD screen backlight auto off timer.
Default = 120 seconds
Setting range = 0 ~ 250 seconds.
 3. Buzzer setting : Sets the LCD remote control panel internal buzzer sound ON / OFF. When set the function have appears on the LCD screen. The buzzer will occurs “Beep” sounds.
Default = MSG, Alert, SHDN
Setting range = Disable / SHDN / Alert / Alert, SHDN / MSG / MSG, SHDN / MSG, Alert / MSG, Alert, SHDN

Menu	Status	Buzzer
MSG	Power on or push keypad	ON
Alert	Fan fail or UV alarm or overload alarm or OT alarm	ON
SHDN	OVP or UVP or OLP or OTP	ON
Disable	Any	OFF

- Alert Setting: When alert occurs, the Combi unit internal dry contact relay will open / close. (see details in section 5.2.8)
 Default = Alert, SHDN
 Setting Range = Disable / SHDN / Alert / Alert, SHDN

Menu	Status	Relay
Alert	Fan fail or UV alarm or Overload alarm	ON
SHDN	OVP or UVP or OLP or OTP	ON
Disable	Any	OFF

- Shutdown retry: when the Combi unit occurs OVP shutdown or UVP shutdown or overload or short circuit shutdown, anyway. The Combi unit can be automatically restart, and should according to setting value.
 Default = 5
 Setting range: Disable ~ 15
- INV. OFF delay: When external AC power incoming available, the transfer relay switch turn ON. If the external AC power cutoff, the transfer relay will open. When opened, the external power source the supply the load connected to the "AC output " only, the inverter will deliver current for the load connected to the "INV. AC power". However this time will to consumption by energy switch is stored in the batteries. So, when external AC power cutoff. The Combi unit can be automatically power OFF, and should according the setting timing.
 Default = Disable
 Setting range: Disable ~ 10Min
- Language : The Combi unit have different language be provided selectable.
 Default = English
 Setting: English / Italian / Spanish / French / German
- New password: This option allows to change the current password. To set the new password digits use the <Up> and <Down> keys.
 Maximum password length = 4 word
 Factory setting = 0000
- Iac setup switch: when the External AC power is connected, the system will automatically constrain at the lowest value of AC input current, at the same time, the LCD display will show "Iac setup: xxA" message on the screen so that the Users may change the constrained value of AC current randomly . The system allows the Users to set up the value within 60 sec. if the time passed, the system will resume automatically and back to the system previous setting.
 Default = Disable
 Setting: Enable / Disable

■ I/P Parameter :

1. OVP Setting: Setting Combi unit the Over Voltage Protection (OVP) and shutdown on the inverter operate.
Default = 16 VDC @ 12V Model, 32 VDC @ 24V Model

Model	Setting value range
12 V	15 VDC ~ 16 VDC
24 V	30 VDC ~ 32 VDC

2. OVP Recovery: When the dc input voltage is higher than the OVP setting, the Combi unit shuts-down; once the input voltage falls below the set OVP value, the Combi unit will automatically restart.
Default = 14.5 VDC @ 12V Model, 29 VDC @ 24V Model

Model	Setting value range
12 V	13.5 VDC ~ 14.5 VDC
24 V	27 VDC ~ 29 VDC

3. UVP Setting: Setting the Combi unit Under Voltage Protection (UVP) and Shutdown on the inverter operate.
Default= 10.5 @ 12V Model, 21 VDC @ 24V Model

Model	Setting value range
12 V	10.5 VDC ~ 11.5 VDC
24 V	21 VDC ~ 23 VDC

4. UVP Recovery: When the DC input voltage is below the set UVP value The Combi unit shuts-down; Once the input voltage rises Above the set UVP value, the Combi unit will automatically Restart.
Default= 12.5VDC @ 12V Model, 25 VDC @ 24V Model

Model	Setting value range
12 V	12.5 VDC ~ 13.5 VDC
24 V	25 VDC ~ 27 VDC

5. UV Alarm: Setting Under Voltage (UV) alarm. When the input voltage is lower than the set value, the Combi unit will sound “beep” to remind that the unit is going to shutdown. At the meantime, the contact in the internal Dry Contact Relay will open / close. -(See details in Section 5.2.8)
Default= 10.5 VDC @ 12 V Model, 21 VDC @ 24 V Model

Model	Setting value range
12 V	10.5 VDC ~ 11.5 VDC
24 V	21 VDC ~ 23 VDC

NOTE!



The value of voltage set for the “UV Alarm” should be equal to or higher than the value set for “UVP” or else the unit will shutdown without any audible warning.

■ O/P Parameters:

1. O/P Voltage: Setting the Combi unit output voltage on the inverter operate.
Default= 110 VAC @110 V Model, 230 VAC @ 230 V Model

Model	Setting value range
110 V	100 VAC ~ 120 VAC
230 V	200 VAC ~ 240 VAC

2. O/P Frequency: Setting the Combi unit output frequency on the inverter operate.
 Default= 60 Hz @ 110 V Model, 50 Hz @ 230 V Model.

Model	Setting value range
110 V	47 Hz ~ 63 Hz
230 V	47 Hz ~ 63 Hz

3. Sync Frequency: If a generator with distorted. Output waveform (too low frequency) is used as AC source. The allowed frequency window for the incoming AC power can be enlarged.
 Example1: AC input = 230 VAC / 50Hz, User setting Value= 7Hz
 When the Combi unit “Output frequency” is within The Range of 43 Hz~57 Hz, the internal transfer relay will close. When the output frequency is less than 43 Hz or more than 57 Hz, the internal transfer relay will still open.
 Example2: When user setting Value= Disable,the Combi unit “Output frequency” is within The Range of 47 Hz~63 Hz, the internal transfer relay will close.
 Default= 7Hz

Model	Setting value range
110 V	Disable ~ 7 Hz
230 V	Disable ~ 7 Hz

4. Overload Alarm: Sets the overload alarm. When the Combi unit output power is higher than the set value, the Combi unit will sound “beep” to remind that the unit is going to shutdown. At the same time, the internal Dry Contact Relay will open/close. (See details in Section 5.2.8)
 Default= 100%
 Setting range= 50%~110%
5. Saving Level: Setting the Combi unit to power saving to reduction consumption from the batteries.(level setting refer See 5.2.10)
 Default = Disable
 Setting range = Disable ~ 7
6. Saving Interval: When the Combi unit in working for the power saving mode. And the Combi unit must to sensitive. This time the Combi unit must to AC output (LOAD) sensitive load. When the load increases more than set value of the power saving level, the Combi unit of awaking on the output power automatically. However, to the load sensitive time. The Combi unit can be adjust on the power saving interval.
 Default = 2.0 Seconds
 Setting range = 0.1S ~ 2.0S
7. Ground Relay: Setting the Combi unit ground relay allows you to connect the Neutral. (See details in section 5.2.3)
 Default = OFF
 Setting range = ON / OFF

■ Charge parameter :

1. Ibat setup: When external AC power comes available. The battery charger are supplied by the external AC power. The batteries are recharged now. However, the charger current can be adjust on the “Ibat setup”.
Default = 50.0 A @12V model / 25.0A @24V model

Model	Setting value range
12 V	20.0A ~ 100A
24 V	10.0A ~ 50.0A

2. Second charger : The Combi unit can be used to give a maintenance charge to a small battery.
 - The second charger output current 5A maximum.
 - Users can be set turn ON or turn OFF on the charger power output.
Default = ON
Setting range = ON / OFF
3. Max. Bulk timer: The Combi unit is a three – step plus charging method and guarantees that the batteries are always charged 100%. This three automatic stages: BULK, ABSORPTION and FLOAT. The first step of the three plus charge system is the BULK phase. The Combi unit can be adjust on the phase timer.(See details in fig 12)
Default = 8 hours
Setting range = 8 ~ 18 hours
4. Battery type: Users can be setting for the battery type.
(see details in section 5.2.10)
Default = Gel
Setting range = Gel / Flooded / AGM 1 / AGM 2 / Customer.
be used with a battery bank that consists of 2V GEL cells!

Battery Type Stage	Gel		Flooded		AGM 1		AGM 2	
	@12VDC	@24VDC	@12VDC	@24VDC	@12VDC	@24VDC	@12VDC	@24VDC
Bulk Voltage	14.1VDC	28.2VDC	14.6VDC	28.2VDC	14.3VDC	28.6VDC	14.5VDC	29VDC
Absorption Voltage	14.1VDC	28.2VDC	14.6VDC	28.2VDC	14.3VDC	28.6VDC	14.5VDC	29VDC
Float Voltage	13.6VDC	27.2VDC	13.4VDC	26.8VDC	13.1VDC	26.2VDC	13.5VDC	27VDC

Battery Type Stage	Customer	
	@12VDC	@24VDC
Vbulk CTM	14.0 ~ 15.0VDC	28.0 ~ 30.0VDC
Vabs CTM	14.0 ~ 15.0VDC	28.0 ~ 30.0VDC
Vfloat CTM	13.0 ~ 14.0VDC	26.0 ~ 28.0VDC



To be selected by the customer on the manufacturers’ recommendations, if available.

5. RST to default: The Combi unit you can restore all the factory settings. Select the items “RST to default “ and press <Enter> .The screen “ON” appears on the display. press <Enter> to restore the factory settings.

7 RS-232 Communication and Operation

7.1 Operation of RS-232 serial port :

- 7.1.1 See reference 5.2.9. If you want to install a the computer, run the communication cable between Combi unit and the computer. Connect the RS-232 port to front on the Combi unit. However you can be remote control and monitoring to the Combi unit.
- 7.1.2 The RS232 interface of this unit employs ASCII code to implement the asynchronous serial transmission control.
The byte structure is START-BIP – 8 BIT DATA-STOP BIT.
Baud rate: 9600.
- 7.1.3 Coupled with PC software application port. Operation is as detailed in Section 7-2.

7.2 Example of the RS232 Operation:

7.2.1 RS-232 command:

Command format:

This unit uses high-level language commands with a CR (0DH) as the end of the command. The system would interpret and execute the command only after these two characters are received. After the unit execute the command, it would send a response string to the computer. The response string is as follows:

= > CR : Command executed successfully

? > CR : Command error, not accepted

! > CR : Command correct but execution error (e.g. parameters out of range).

If the command needs any information from the unit, the unit would send the information back to the computer (with CR) and then send the response string to the computer.

7.2.2 Command format:

This unit supports the following command format.

There should always be a CR (0DH) appended to the command while sending the command to this unit.

- 1.) Users can be the command to control the Combi unit to turn ON or turn OFF.
Format : Power <value>
Example : A space (ASCII code 20H) is needed between power and <value>
<value> can be one of the following.
"0" : Power OFF
"1" : Power ON
- 2.) Users can be the command to query the Combi unit output frequency of the inverter.
Format : FRQ?
After "Enter", the unit's "Output Frequency" appears on the PC screen.

- 3.) Users can be the command to query the Combi unit output voltage of the inverter.
Format: VINV?
After “Enter”, the unit’s “Output Voltage” appears on the PC screen.
- 4.) Users can be the command to query the Combi unit output current of the inverter.
Format: IINV?
After “Enter”, the unit’s “Output Current” appears on the PC screen.
- 5.) Users can be the command to query the Combi unit status.
Format: STA?
After “Enter”, the unit’s working status will appears on the PC screen. As follows status on behalf of the Combi unit

Bit	Binary code	ASC II Code	Status on behalf
S	0	0	Power turn off
	1	128	Power turn on
T	0	0	Battery no high voltage
	1	64	Battery high voltage
U	0	0	Battery no low voltage
	1	32	Battery low voltage
V	0	0	Temperature normal
	1	16	Temperature failure
W	0	0	Fan normal
	1	8	Fan failure
X	0	0	No power saving
	1	4	power saving mode
Y	0	0	No overload or short circuit
	1	2	overload or short circuit
Z	0	0	Battery no under voltage alarm
	1	1	Battery under voltage alarm

- 6.) Users can be the command to query the Combi unit AC input of the grid power.
Format: VGRID?
After “Enter”, the unit’s “AC input voltage” appears on the PC screen.
- 7.) Users can be the command to query the Combi unit AC input of the grid current.
Format: IGRID?
After “Enter”, the unit’s “AC input current” appears on the PC screen.
- 8.) Users can be the command to query the Combi unit DC input voltage of the battery.
Format: VBAT?
After “Enter”, the unit’s “DC input voltage” appears on the PC screen.
- 9.) Users can be the command to query the Combi unit DC input current of the battery.
Format: IBAT?
After “Enter”, the unit’s “DC input voltage” appears on the PC screen.

- 10.) Users can be the command to query the Combi unit contact temperature sensor on the battery.
Format: TBAT?
After “Enter”, the unit’s “Battery Temperature” appears on the PC screen.
- 11.) Users can be the command to query the Combi unit internal temperature.
Format: TENIR?
After “Enter”, the unit’s “Internal Temperature” appears on the PC screen.
- 12.) Users can be the command to query the Combi unit output power of the inverter.
Format: PINV?
After “Enter”, the unit’s “Output Power” appears on the PC screen.
- 13.) Users can be the command to query the Combi unit AC input of the grid power.
Format: PGRID?
After “Enter”, the unit’s “AC input power” appears on the PC screen.
- 14.) Users can be the command to query the Combi unit model number.
Format: Model?
After “Enter”, the unit’s “Model Number” appears on the PC screen.
- 15.) Users can be the command to reset default the Combi unit .
Format: RST?
After “Enter”, the unit’s will reset to default.

7.2.3 Command for accessing Setup Menus and adjusting values:

- 1.) Select the Setup Menus with the help of Function Codes:
Format : FUNC <Function Code>
After “Enter”, the Setup Menu for the Function Code will be called.
The <Function Code>= 0~33, as follows:

Function Code	Setting Menu	Function Code	Setting Menu
0	LCD_Contrast	18	OVP Setting
1	LCD_Auto-off	19	OVP Recovery
2	Not used	20	UVP Setting
3	Buzzer Setting	21	UVP Recovery
4	Alert Setting	22	UV Alarm
5	Shutdown Retry	23	O/P Voltage
6	Sync Frequency	24	O/P Frequency
7	Battery Type	25	Ibat Setup
8	Saving Level	26	EE_SWLed
9	Ground Relay	27	SN[0]
10	Second Charger(5A)	28	SN[1]
11	Change Run Mode	29	Not use
12	Power Sharing Mode Parameter	30	EE_Vbulk_CTM
13	Inv Off Delay	31	EE_Vabs_CTM
14	Overload load Alarm	32	EE_Vfloat_CTM
15	Saving Interval	33	EE_Veq_CTM
16	Iac Setup	34	EE_Teq_CTM
17	Max. Bulk Timer	35	EnEq

1. Command to query the functions No :
Format: FUNC?
After “Enter”, the unit’s “Function Code” appears on the PC screen.
2. Command to query the set value of the function :
Format: SETT?
After “Enter”, the existing set value of the function appears on the PC screen.
3. Command to set or adjust the value of the function :
Format: SETT <value>
After “Enter”, the new value of the function is set choose the <value> of the function as follows:

FUNC 0: LCD Contrast

SETT <Value>	Default
0 ~ 100	50%

FUNC 1: LCD Auto-off

SETT<Value>	Default
0 ~ 250	120 S

FUNC 3: Buzzer Setting

SETT <Value>	Buzzer (Beep sound)	Default
0	Disable	7
1	SHDN	
2	Alert	
3	Alert , SHDN	
4	MSG	
5	MSG , SHDN	
6	MSG , Alert	
7	MSG , Alert , SHDN	

FUNC 4: Alert Setting

SETT <Value>	Alert	Default
0	Disable	3
1	SHDN	
2	Alert	
3	Alert, SHDN	

FUNC 5: Shutdown Retry

SETT <Value>	Default
0 ~ 15	5

FUNC 6: Sync Frequency

SETT <Value>	Default
Disable ~ 70 @10=1Hz	7.0Hz <70>

FUNC 7: Battery Type

SETT <Value>	Type	Default
0	Gel	0
1	Flooded	
2	AGM 1	
3	AGM 2	

FUNC 8: Saving Level

SETT <Value>	LOAD	Default
0	Disable	0
1	>40W	
2	>80W	
3	>100W	
4	>120W	
5	>160W	
6	>180W	
7	>220W	

FUNC 9: Ground Relay

SETT <Value>	Relay	Default
0	OFF	0
1	ON	

FUNC 10: Second Charger

SETT <Value>	5A Output	Default
0	OFF	1
1	ON	

FUNC 11: Change Run Mode

SETT <Value>	Mode	Default
0	CHR. Power ON	3
3	COMBI Power ON	

FUNC 12: P. S. Mode Parameter

SETT <Value>	Power Sharing Mode	Default
0	Disable	0
1	GEN.	
2	SUPP.	
3	SUPP. , GEN.	
4	SHAR.	
5	SHAR. , GEN.	
6	SHAR. , SUPP.	
7	SHAR. , SUPP. , GEN.	

FUNC 13: Inv Off Delay

SETT<Value>	Default
0 ~ 100 @10=1 min	5.0 min <50>

FUNC 14: Overload Alarm

SETT<Value>	Default
50 ~ 110	100%

FUNC 15: Saving Interval

SETT <Value>	Default
1 ~ 20 @10=1 sec	2.0 sec <20>

FUNC 16: Iac Setup

SETT <Value>	Default	Model
100 ~ 500 @10=1 A	10.0A <100>	SB2000-112
		SB2000-124
30 ~ 250@10=1 A	3.0A <30>	SB2000-212
		SB2000-224

FUNC 17: Max. Bulk Timer

SETT <Value>	Default
8 ~ 180 @10=1 Hour	8.0 Hr <80>

FUNC 18: OVP Setting

SETT <Value>	Default	Model
1500 ~ 1600 @100=1V	16.0V <1600>	SB2000-112
		SB2000-212
3000 ~ 3200 @100=1V	32.0V <3200>	SB2000-124
		SB2000-224

FUNC 19: OVP Recovery

SETT <Value>	Default	Model
1350 ~ 1450 @100=1V	14.5V <1450>	SB2000-112
		SB2000-212
2700 ~ 2900 @100=1V	29.0V <2900>	SB2000-124
		SB2000-224

FUNC 20: UVP Setting

SETT <Value>	Default	Model
1050 ~ 1150 @100=1V	10.5V <1050>	SB2000-112
		SB2000-212
2100 ~ 2300 @100=1V	21.0V <2100>	SB2000-124
		SB2000-224

FUNC 21: UVP Recovery

SETT<Value>	Default	Model
1250 ~ 1350 @100=1V	12.5V <1250>	SB2000-112
		SB2000-212
2500 ~ 2700 @100=1V	25.0V <2500>	SB2000-124
		SB2000-224

FUNC 22: UV Alarm

SETT <Value>	Default	Model
1050 ~ 1150 @100=1V	10.5V <1050>	SB2000-112
		SB2000-212
2100 ~ 2300 @100=1V	21.0V <2100>	SB2000-124
		SB2000-224

FUNC 23: O/P Voltage

SETT <Value>	Default	Model
1000 ~ 1200 @100=1V	110V <1100>	SB2000-112
		SB2000-124
2000 ~ 2400 @100=1V	230V <2300>	SB2000-212
		SB2000-224

FUNC 24: O/P Frequency

SETT <Value>	Default	Model
470 ~ 630 @10=1Hz	60Hz <600>	SB2000-112
		SB2000-124
470 ~ 630 @10=1Hz	50Hz <500>	SB2000-212
		SB2000-224

FUNC 25: Ibat Setup

SETT <Value>	Default	Model
200 ~ 1000 @10=1A	50.0A <500>	SB2000-112
		SB2000-212
100 ~ 500 @10=1A	25.0A <250>	SB2000-124
		SB2000-224

FUNC 26: After “Enter”, will the combi unit dip switch (on the front) set value appears on the PC screen.

FUNC 27: After “Enter”, will the combi unit series number [0] appears on the PC screen.

FUNC 28: After “Enter”, will the combi unit series number [1] appears on the PC screen.

FUNC 30: Bulk-stage voltage setting

SETT <Value>	Default	Model
1400 ~ 1500 @100=1V	14.5V <1450>	SB2000-112
		SB2000-212
2800 ~ 3000 @100=1V	29.0V <2900>	SB2000-124
		SB2000-224

FUNC 31: Absorption-stage voltage setting

SETT <Value>	Default	Model
1400 ~ 1500 @100=1V	14.5V <1450>	SB2000-112
		SB2000-212
2800 ~ 3000 @100=1V	29.0V <2900>	SB2000-124
		SB2000-224

FUNC 32: Float-stage voltage setting

SETT <Value>	Default	Model
1300 ~ 1400 @100=1V	13.5V <1350>	SB2000-112
		SB2000-212
2600 ~ 2800 @100=1V	27.0V <2700>	SB2000-124
		SB2000-224

FUNC 33: Equalization-stage voltage setting

SETT <Value>	Default	Model
1400 ~ 1600 @100=1V	14.5V <1450>	SB2000-112
		SB2000-212
2800 ~ 3200 @100=1V	29.0V <2900>	SB2000-124
		SB2000-224

FUNC 34: Equalization-stage timer setting

SETT<Value>	Default
10 ~ 1200 @100=1 Hr	8 Hr <80>

FUNC 35: Equalization-stage Enable / Disable setting

SETT <Value>	Power Sharing Mode	Default
0	Disable	0
1	Enable.	

- 2.) Select the “REHTY Menus” with the help of Function Codes:
 Format : FUNC <Function Code>
 After “Enter”, the Setup Menu for the Function Code will be called.
 The <Function Code>= 0~17, as follows:

Function Code	REHTY Menu	Function Code	REHTY Menu
0	Power output W/H	9	Short time
1	Power output Time	10	Heat sink temp. fail time
2	Power input W/H	11	Environment temp. fail time
3	Power input Time	12	Battery Max. voltage
4	Charging AH	13	Battery Min. voltage
5	Charging Time	14	Battery OVP time
6	DisCharging AH	15	Battery UVP time
7	DisCharging Time	16	Battery OTP time
8	OLP time	17	Charging cycle

1. Users can be the command to query the Functions No:
 Format : FUNC?
 After “Enter”, the unit’s “Function Code” appears on the PC screen.
2. Users can be the command to query the Combi unit history data :
 Format : REHTY
 After “Enter”, the Combi unit history data of the function appears on the PC screen.
- 3.) Select the “REUDF/WRUDF Menus” with the help of Function Codes:
 Format : FUNC <Function Code>
 After “Enter”, the Setup Menu for the Function Code will be called.
 The <Function Code>= 0~31, as follows:

Function Code	Setting Menu	Function Code	Setting Menu
0	UserDef[0]	16	UserDef[16]
1	UserDef[1]	17	UserDef[17]
2	UserDef[2]	18	UserDef[18]
3	UserDef[3]	19	UserDef[19]
4	UserDef[4]	20	UserDef[20]
5	UserDef[5]	21	UserDef[21]

6	UserDef[6]	22	UserDef[22]
7	UserDef[7]	23	UserDef[23]
8	UserDef[8]	24	UserDef[24]
9	UserDef[9]	25	UserDef[25]
10	UserDef[10]	26	UserDef[26]
11	UserDef[11]	27	UserDef[27]
12	UserDef[12]	28	UserDef[28]
13	UserDef[13]	29	UserDef[29]
14	UserDef[14]	30	UserDef[30]
15	UserDef[15]	31	UserDef[31]

- Users can be the command to query the Functions No :
Format: FUNC?
After “Enter”, the unit’s “Function Code” appears on the PC screen.
- Users if want to read the Combi unit set value. This setting value defers to the user meaning to do set. can be the command to read the Combi unit set value:
Format: REUDF
After “Enter”, the existing set value will appears on the PC screen.
- Users if want to set a word to the Combi unit by means. can be the command to set value of the Function:
Format: WRUDF <value>
The value maximum is two words only.
After “Enter”, the new value will save of the Combi unit.

8. Trouble Shooting

8.1 Fault Indicators



WARNING:

Do not open or disassemble the Combi unit. Attempting to service the unit may cause risk of electrical shock or fire. If a failure occurs, the origin of the failure is displayed by means of the LCD remote control panel LEDs and display.

Mode	Problems and Symptoms	Possible Cause	Solutions
XX	No output and LCD none Illuminating		
	a. The Combi unit not working	The Combi unit power switch turn off	Check the on/off switch of the LCD panel
	b. DC input battery error	Damage or voltage error of the battery	Check and Confirmation of the voltage to the battery
	c. DC input terminal none voltage of the Combi unit	DC fuse is blown	Investigate the cause of the failure and replace the fuse.
	LCD panel “Alarm LED” Indicators red lamp		
	a. LCD panel appears “Overload alert”	The Combi unit is load with than 100%, but the inverter still on.	Reduce the connected load by switching off some equipment.
b. LCD panel appears	The battery voltage is	Check the batteries.	

	“UV alert”	running too low, but the inverter still on.	The inverter will switch off if the battery voltage stays low.
Combi	No AC power output		
	a. LCD panel appears “OLP shutdown” and “Inverter LED” solid red.	Short circuit , wiring error. over loading.	Check AC wiring for short circuit . Reduce load.
	b. LCD Panel appears “OVP Shutdown” and “Inverter LED” solid red.	Over dc input voltage (OVP)	Check dc input voltage and reduce the voltage
	c. LCD Panel appears “UVP Shutdown” and “Inverter LED” solid red.	Low dc input voltage. (UVP)	Recharge to the battery. Check connections and cables wire.
	d. LCD Panel appears “ENIR TEMP. shutdown” or “H.S. TEMP. shutdown” or “BAT. TEMP. shutdown” and “Inverter LED” solid red.	Over Thermal shutdown. (OTP)	Improve ventilation. Make sure ventilation, grilles / slots of the Combi unit are not obstructed. Lower ambient temperature.
Charger	No charge current to the batteries		
	a. LCD panel display none charge current.	Bypass relay not to close	Check frequency of the Combi unit setting and AC input both same
	b. LCD panel “Charger LED” and “ AC Grid LED” not illuminating.	Not AC input power	Check AC input terminal connections, and to the make sure external AC input or AC circuit breaker is OK.
	c. To restart the Combi unit always.	DC input terminal no connections to the batteries	Check the DC input terminal.

8.2 Warranty

We guarantee this product against defects in materials and workmanship for a period of 24 months from the date of purchase and will repair or replace any defective Combi units if you directly returned them to us with postage paid.

Please note that Cotek is only responsible for ensuring our products are operational before delivering. This warranty will be considered void if the unit has been misused, altered, or accidentally damaged. Cotek is not liable for anything that occurs as a result of the user’s fault.



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