



samlexpower®

**Battery
Back-up**

BBM-1225

**Owner's
Manual**

Please read this
manual **BEFORE**
installing your
inverter

OWNER'S MANUAL | Index

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SECTION 1 | Safety Instructions

1.1 PRECAUTIONS WHEN WORKING WITH BATTERIES

- Batteries contain very corrosive diluted Sulphuric Acid as electrolyte. Precautions should be taken to prevent contact with skin, eyes or clothing.
- Batteries generate Hydrogen and Oxygen during charging resulting in evolution of explosive gas mixture. Care should be taken to ventilate the battery area and follow the battery manufacturer's recommendations.
- Never smoke or allow a spark or flame near the batteries.
- Use caution to reduce the risk of dropping a metal tool on the battery. It could spark or short circuit the battery or other electrical parts and could cause an explosion.
- Remove metal items like rings, bracelets and watches when working with batteries. The batteries can produce a short circuit current high enough to weld a ring or the like to metal and thus cause a severe burn.
- If you need to remove a battery, always remove the ground terminal from the battery first. Make sure that all the accessories are off so that you do not cause a spark.

SECTION 2 | Layout and Dimensions

2.1 LAYOUT

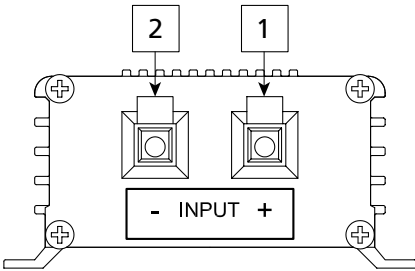


Fig. 2.1: Input Side

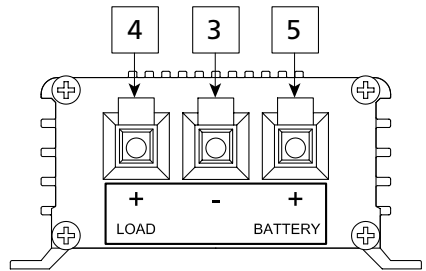


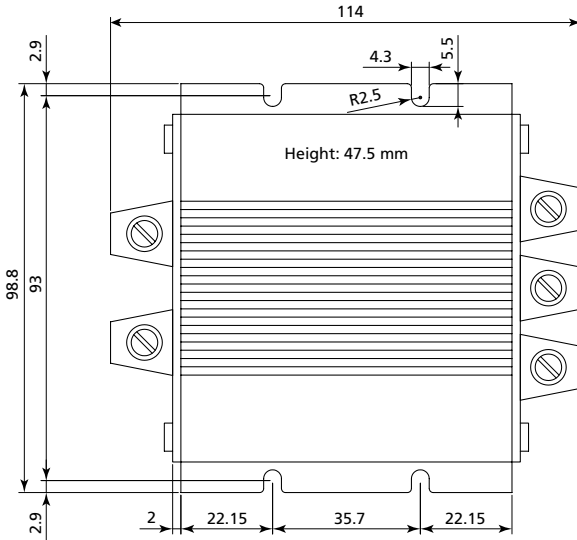
Fig. 2.2: Output Side

LEGEND:

- 1. Positive Input Terminal
- 2. Negative Input Terminal
- 3. Common Negative Output Terminal for Load and Battery
- 4. Positive Output Terminal for Load
- 5. Positive Output Terminal for Battery

NOTE: All input and output terminals: Hole size: 5mm / 0.2"; Set Screw: #10, 24 TPI, 5/16" long

2.1 DIMENSIONS



NOTE: All dimensions are in mm.

Fig. 2.3: Dimensions

SECTION 3 | Description and Principle of Operation

3.1 DESCRIPTION

This unit is used to allow any 12 VDC / 24 VDC power supply (with rated Current Limit value of up to 25A) to function as a DC Uninterrupted Power Source (UPS). This unit is a passive device and functions only as an interface between the external power supply, the battery and the DC load. As long as the power supply is operating normally, it will supply the load as well as float charge the battery.

In case the output of the power supply fails, the battery will start feeding the load immediately thus, ensuring uninterrupted DC power to the load. During this period, the battery will start discharging. Once the output of the power supply is resumed, the power supply will take over the load and will also re-charge the battery at its float voltage.

3.2 PRINCIPLE OF OPERATION



INFO

Explanation given below is based on use of external power supply with "Constant Current Limit" value of 25A. In a Constant Current Limit Power Supply, when the Current Limit value is reached, the output voltage will not be regulated and will drop.

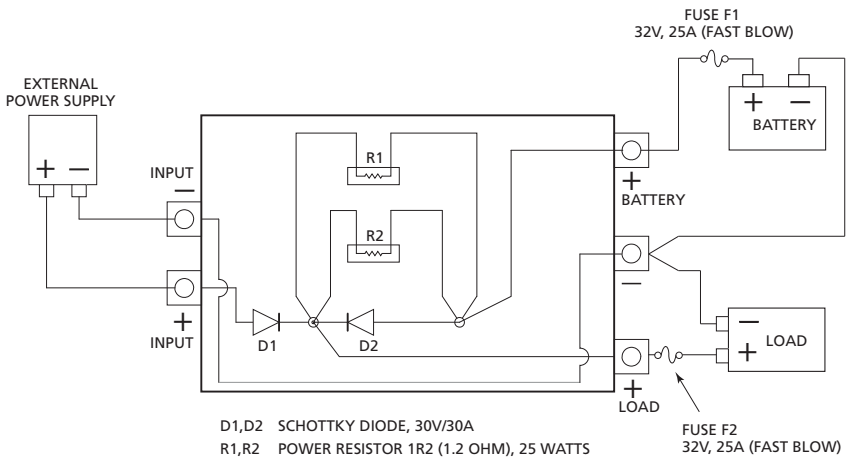


Fig. 3.1: Schematic and Installation Diagram

Please refer to the schematic and installation diagram at Fig. 3.1.

SECTION 3 | Description and Principle of Operation

External power supply is connected to the Positive and Negative input terminals. The battery is connected to the battery terminals through Fuse 1 and the load is connected to the load terminals through Fuse 2.

The voltage from the power supply is fed through the isolating Schottky Diode D1 to the load and to the battery through the charging current limiting resistors R1 and R2. Diode D1 provides isolation between the power supply and the battery to prevent the battery from feeding back into the power supply circuit. D1 has a forward voltage drop of up to 0.5V. Hence, the voltage available to the load and to the battery for float charging will be up to 0.5V lower than the output voltage of the power supply. **In a battery backup application, the battery will normally remain in a fully charged, standby condition most of the time. It will discharge to the load only when the power supply fails. Under this standby application, the battery should be charged at the recommended float voltage.** Assuming the standby float charging voltages of 12V / 24V Sealed Lead Acid (SLA) Batteries to be 13.5V to 13.8V and 27V to 27.6V (at 60°F to 77°F) respectively, **the output voltage of the power supply should be adjusted as follows:**

- **Power Supply Voltage for 12V SLA Battery Backup: Adjust to 14V**
The output voltage of this unit for the load and for float charging of the battery will be 14V minus drop of up to 0.5V across diode D1 i.e. around 13.5V.
- **Power Supply Voltage for 24V SLA Battery Backup: Adjust to 27.6V**
The output voltage for the load and for float charging of the battery will be 27.6V minus drop of up to 0.5V across diode D1 i.e. around 27.1V.

As long as the external power supply is operating normally, it will supply the load as well as charge the battery through resistors R1 and R2, each 1.2 Ohm, 25W (R1 and R2 are connected in parallel and will provide a net series resistance of 0.6 Ohm).

NOTE: As the external power supply is required to feed the load as well as charge the battery, the current rating of the power supply should be at least 20% more than the sum of the maximum load current and the maximum charging current (4A for 12V and 8A for 24V).

If the power supply fails, the load will be supplied by the battery through the Schottky Diode D2. As in the case of Schottky Diode D1, there will be a forward voltage drop of up to 0.5V across D2. Thus, when the battery is supplying the load, the voltage seen by the load will be up to 0.5V less than the battery voltage. Note that Schottky Diode D2 is connected in parallel with resistors R1 and R2 and is used to bypass resistors R1 and R2 when the battery is discharging through the load.

Maximum Battery Charging Current

Lead Acid Batteries should not be charged at very high charging current. The maximum recommended charging current of a battery is normally related to its Ah (Ampere Hour) capacity, designated as "C" (based on 20A Discharge Rate). The maximum charging current for an SLA battery is normally specified within a range of C/5 (0.2C) to C/10 (0.1C).

SECTION 3 | Description and Principle of Operation

Battery Backup Application Using 12V, 40-100 Ah Battery

This Battery Backup Unit has been preset for battery backup application for a 12V battery of approximately 40 to 100 Ah capacity with the maximum charging current limited to approximately 4A (At power supply voltage set at 14.0V and battery discharged to 11.1V).

Battery Backup Application Using 24V, 40-100 Ah Battery

When using this unit in the preset condition for 24V, 40-100 Ah battery backup application, the charging current will increase approx. two times to 8A (At power supply voltage set at 27.6V and battery discharged to 22.3V).

Calculating Maximum Battery Charging Current

Maximum battery charging current $I_b = \{(V_p - V_d) - V_b\}$ divided by R_s Equation 1

V_p = Output voltage of the power supply (14V for 12V battery and 27.6V for 24V battery)

V_d = Forward voltage drop across Schottky Diode D1 (up to 0.5V)

V_b = Battery voltage

R_s = Equivalent series resistance. In this case, R1 (1.2 Ohm) and R2 (1.2 Ohm) in parallel = 0.6 Ohm (See Fig 3.1).

Assuming the voltages of fully discharged 12 V and 24 V batteries to be 11.1V and 22.3V respectively (at Discharge Rate of around C/10 (0.1C) Amps), the maximum charging currents will be as follows as per Equation 1:

For 12 V battery backup = $(14V - 0.5V - 11.1V)$ divided by 0.6 Ohm = **4A**

For 24 V battery backup = $(27.6V - 0.5V - 22.3V)$ divided by 0.6 Ohm = **8A**

SECTION 4 | Installation

4.1 INSTALLATION DIAGRAM AND DIMENSIONS

Fig 3.1 shows the installation diagram. Dimensional details are given at Fig 2.3.

4.2 CABLE SIZING, TERMINATION AND FUSING

The size of the cables used to connect the power supply, the battery and the load to this unit will depend upon the maximum value of the current flow and the length of the cable run. Current flowing through a cable will produce an undesirable voltage drop along the length of the cable. The voltage drop is proportional to the resistance of the cable. Higher resistance produces higher voltage drop. The resistance of the cable increases as the cable becomes thinner. Similarly, the resistance increases with the length of the cable. It is desirable to limit the voltage drop to 2% which will be 0.24V for 12V battery and 0.48V for 24V battery.

SECTION 4 | Installation

A battery can supply very heavy current in case of short circuit in the path across its terminals. This can cause overheating of the cables / connected device(s) and consequent risk of melted insulation and possibility of fire. Hence, for safety, a fast acting fuse of appropriate current capacity should be connected in series with the Positive cable and should be placed within 7" of the Positive terminal of the battery. Automotive Blade Type of Fuses, Type ATO/ATC may be used.

The following Table gives the recommended sizes of cable and fuses for external power supply rated at 25A.

Current	Cable Length up to 3 ft	Cable Length up to 6 ft	Fuses F1, F2
25A	#12 AWG	#8 AWG	32V, 25A

The terminals have a tubular hole of diameter 5 mm with set screw for connecting the input and output cables. If the bare end of a multi-stranded cable is used directly, the set screw may not pinch all the strands firmly and will result in a loose connection which will cause voltage drop and excessive heating. **For a firm connection, the cable ends should be terminated with suitable pin type of terminal.**

4.3 ADJUSTING OUTPUT VOLTAGE OF EXTERNAL POWER SUPPLY

Before the external power supply is connected to this unit, it is to be ensured that the output voltage of the power supply is adjusted to the required voltage as explained under Section 3.2.

4.3 CONNECTIONS

Switch off the power supply. Connect the Positive and Negative output of the power supply to the input terminals of the unit marked "INPUT +" and "INPUT -" respectively (1,2 in Fig 2.1).

Connect the DC load to the terminals marked "LOAD +" and "LOAD -" (4, 3 in Fig 2.2)

Connect the battery to the terminals marked "BATTERY +" and "BATTERY -" (5,3 in Fig 2.2)



CAUTION!

Ensure correct polarity of all connections.

SECTION 5 | Operation and Protections

5.1 OPERATION



CAUTION!

Please ensure that the rated output current of the 12VDC or 24VDC power supply is only up to 25A.

As already stated at in Section 3.1, this unit is a passive device and functions only as an interface between the external power supply, the battery and the DC load.

Switch ON the external power supply to power on the load and also to start charging the battery. If the power supply fails or is switched OFF, the load will be immediately fed by the battery. When the load is supplied by the battery, the battery will start draining and its voltage will continue to drop. During this time, the voltage at the Load Terminals (4&3, Fig 2.2) will be up to 0.5V lower than the voltage at the Battery Terminals (5&3, Fig 2.2) due to the Forward Voltage Drop across the internal Schottky Diode D2.

5.2 PROTECTING THE BATTERY AGAINST DEEP DISCHARGE

For longer life, Lead Acid Batteries should not be allowed to discharge more than 80%. For example, a 12V / 24V loaded battery at load current of C/10 Amps (C is the Ah capacity) will be 100% discharged at around 11V / 22V and 80% discharged at 11.5V / 23V.

It is recommended that a suitable “Low Voltage Disconnect Device”, also called “Battery Guard”, may be used in series with Positive line of the load for protection against deep discharge of the battery. **Battery Guard, Model No. BG-40, made by Samlex America, Inc. may be considered.**

5.3 OVERLOAD AND SHORT CIRCUIT PROTECTION



INFO

Explanation given below is based on use of external power supply with “Constant Current Limit” value of 25A. In a Constant Current Limited Power Supply, when the Current Limit value is reached, the output voltage will not be regulated and will drop.

If the load tries to draw current higher than the current limit value of the external power supply (25A), the output voltage of the external power supply will not be regulated and the voltage at the Load Terminals (4&3, Fig 2.2) will drop. Portion of overload current beyond the current limit value of the external power supply (25A) will now be fed from the battery and the battery will start draining at this differential current. The voltage at the Battery Terminals (5&3, Fig 2.2) will start dropping and will be equal to the voltage corresponding to state of discharge of the battery. The voltage at the Load Terminals (4&3, Fig 2.2) will be up to 0.5V below the voltage at the Battery Terminals (5&3, Fig 2.2). External 25A Fuse (F2) on the load side will blow.

SECTION 5 | Operation and Protections

In case of short circuit on the load side, the external 25A Fuse (F2) on the load side will blow because of very high additional current supplied by the battery (Additional battery current supplied into the short circuit on the load side = Short circuit current minus 25A from the external power supply).



INFO

Over current protection provided by a fuse is determined by its Time versus Current Characteristic. For example, based on the Time Current Characteristics of 32V, 25A Blade Fuse Type ATC-25 from Cooper Bussmann, the fuse can pass extremely high currents for shorter durations as follows and will blow at 25A continuous for > 100 sec:

- 550A for 10 ms
- 170A for 100 ms
- 40A for 1 sec
- 25A continuous (for > 100 sec)

5.4 PROTECTION AGAINST REVERSE POLARITY OF BATTERY CONNECTION



CAUTION!

Please ensure that the polarity of battery / load connection is not reversed. This unit does not provide protection to the external power supply / load against reverse polarity connection. This protection has to be provided by the user in case the power supply / load do not have integral protection against reverse polarity. Damage to the external power supply / load due to reverse polarity of battery / load connection is not covered by warranty.

SECTION 6 | Specifications

MODEL NO. BBM-1225	
INPUT	
INPUT VOLTAGE FROM EXTERNAL POWER SUPPLY	14VDC for 12V Battery / 27.6VDC for 24V Battery
INPUT CURRENT FROM EXTERNAL POWER SUPPLY	Up to maximum of 25A
OUTPUT	
OUTPUT VOLTAGE External Power Supply is ON and is supplying power to the Load and charging the Back Up Battery.	Load Terminals: Up to 0.5V less than Input Voltage Battery Terminals (Battery fully charged): Up to 0.5V less than Input Voltage Battery Terminals (Battery not fully charged): Voltage equivalent to State of Charge of the battery
OUTPUT VOLTAGE External Power Supply is OFF. Backup Battery is supplying the Load and is getting discharged.	Load Terminals: Up to 0.5V less than voltage on Battery Terminals Battery Terminals: Voltage equivalent to State of Charge of the battery
OUTPUT CURRENT External Power supply is ON and is supplying power to the Load and charging the Battery.	Load Terminals: • = Rated Amps of External Power Supply minus Battery Charging Current • Max limit = 25A Battery Terminals (Battery Fully Charged): Up to 0.1% of Ah capacity of Battery Battery Terminals (Discharged Battery): • 12V Battery: Up to 4A (at 11.1V) • 24V Battery: Up to 8A (at 22.3V)
OUTPUT CURRENT External Power Supply is OFF and External Battery is supplying power to the Load.	Load Terminals: Maximum limit = 25A
OTHER	
EXTERNAL BACK UP BATTERY	Lead Acid: 12V/24V, 40Ah to 100Ah
ENVIRONMENT	
OPERATING TEMPERATURE RANGE	0°C to 40°C / 32°F to 104°F
DIMENSIONS	
(W x D x H), MM	98.8 x 114 x 47.5
(W x D x H), INCHES	3.9 x 4.5 x 1.9
WEIGHT	
KG	0.3
LBS	0.7

NOTE: Specifications are subject to change without notice.

SECTION 7 | Warranty

2 YEAR LIMITED WARRANTY

The BBM-1225 are manufactured by Samlex America, Inc. (the "Warrantor") is warranted to be free from defects in workmanship and materials under normal use and service. The warranty period is 2 years for the United States and Canada, and is in effect from the date of purchase by the user (the "Purchaser").

Warranty outside of the United States and Canada is limited to 6 months. For a warranty claim, the Purchaser should contact the place of purchase to obtain a Return Authorization Number.

The defective part or unit should be returned at the Purchaser's expense to the authorized location. A written statement describing the nature of the defect, the date of purchase, the place of purchase, and the Purchaser's name, address and telephone number should also be included.

If upon the Warrantor's examination, the defect proves to be the result of defective material or workmanship, the equipment will be repaired or replaced at the Warrantor's option without charge, and returned to the Purchaser at the Warrantor's expense. (Contiguous US and Canada only)

No refund of the purchase price will be granted to the Purchaser, unless the Warrantor is unable to remedy the defect after having a reasonable number of opportunities to do so. Warranty service shall be performed only by the Warrantor. Any attempt to remedy the defect by anyone other than the Warrantor shall render this warranty void. There shall be no warranty for defects or damages caused by faulty installation or hook-up, abuse or misuse of the equipment including exposure to excessive heat, salt or fresh water spray, or water immersion.

No other express warranty is hereby given and there are no warranties which extend beyond those described herein. This warranty is expressly in lieu of any other expressed or implied warranties, including any implied warranty of merchantability, fitness for the ordinary purposes for which such goods are used, or fitness for a particular purpose, or any other obligations on the part of the Warrantor or its employees and representatives.

There shall be no responsibility or liability whatsoever on the part of the Warrantor or its employees and representatives for injury to any persons, or damage to person or persons, or damage to property, or loss of income or profit, or any other consequential or resulting damage which may be claimed to have been incurred through the use or sale of the equipment, including any possible failure of malfunction of the equipment, or part thereof. The Warrantor assumes no liability for incidental or consequential damages of any kind.

Samlex America Inc. (the "Warrantor")

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