Introduction—Battery Back Up Unit for DC Power Management

Weidmuller's Battery Back Up Unit (BBU) is designed to be the heart of an uninterruptible DC power management system. The connectPower BBU combines with Weidmuller power supplies and a customer-supplied battery pack to form a scalable DC power system. This enables users to put together a system uniquely tailored to their needs.

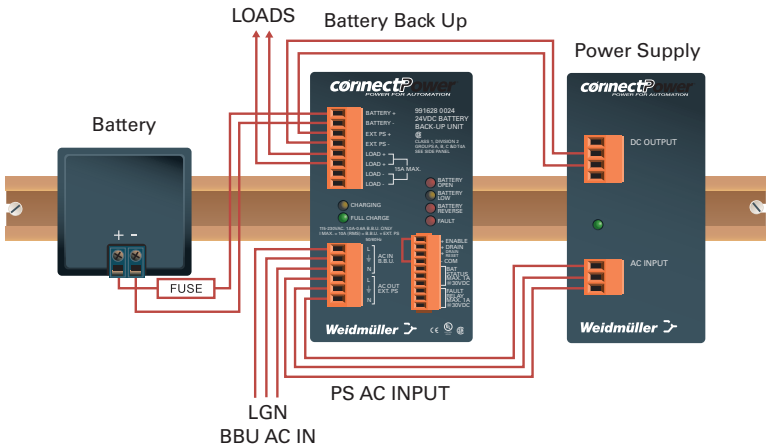
These full-featured units have all the diagnostics needed to monitor the status of the power system. These DC power management units interface with the DC power supplies in the control cabinet. In addition, they monitor the status of the DC loads and the DC batteries. If the AC is removed or experiences a voltage sag, the load is switched seamlessly to the batteries. When the AC line is restored, the batteries are recharged and maintained.

With the BBU Power Supply, 2A of battery charging current is available at 24 VDC, and 3A with the 12 VDC units. Extensive monitoring is provided via LEDs. Relay contacts provide battery status indication and fault indication.

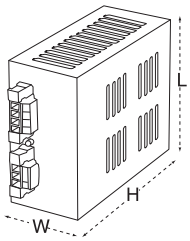
Battery Back Up Units:

- DC backup system that actively manages DC battery banks
- Increases system uptime by providing DC power to load in the event of an AC power failure
- If the input fails, the load is switched seamlessly to batteries
- Continuously monitors DC output voltage of power supply
- Extensive monitoring is provided via LEDs and outputs

Battery Back Up Unit for DC Power Management



connectPower
POWER FOR AUTOMATION



Approvals:

BBU
12 VDC Input

BBU
24 VDC Input

Ordering Data		Type	Order No.
		BBU 12 VDC	**9916280012**

Technical Data			
Input voltage	**Minimum**	**85 VAC**	**85 VAC**
	Typical	**115-230 VAC ± 10%**	**115-230 VAC ± 10%**
	Maximum	**265 VAC**	**265 VAC**
Input current	**at 115 VAC**	**0.8 A**	**1.0 A**
	at 230 VAC	**0.5 A**	**0.6 A**
Input protection	Fuse	2 A slow blow (internal, not user serviceable)	2 A slow blow (internal, not user serviceable)
	Input current	Thermistor 40 A maximum	Thermistor 40 A maximum
	Overvoltage	Varistor	Varistor
Output to Load	Voltage Nominal	12 VDC syst.	24 VDC syst.
	Load Current	15 A maximum	15 A maximum
	Surge Current from no load	20 A max for 300 mS	20 A max for 300mS
		30 A max for 100 mS	30 A max for 100mS
Load voltage		12-14 VDC	24-28 VDC
AC input current		10 A maximum	10 A maximum
Switching time from external PS to battery		< 0.5 mS	< 0.5 mS
Protection	Battery Polarity Protection	Limited by internal 4.0 A fuse	Limited by internal 4.0 A fuse
	Battery Overvoltage	16 V	32 V
	Battery Undervoltage	9.3 V	18.3 V
	BBU Over Temperature Shutdown	120°C (248°F) ±10%	120°C (248°F) +10%
	Charger Short Circuit	Continuous	Continuous
	Load Short Circuit	Continuous	Continuous
Temperature	Storage	-20°C…+85°C (-4°F…+185°F)	-20…+85°C (-4°F…+185°F)
	Operating	-20°C…+50°C (-4°F…+122°F)	-20…+50°C (-4°F…+122°F)
Humidity	Storage	20…90%	20…90%
	Operating	20…85% non-condensing	20…85% non-condensing
Galvanic Isolation	Input to output	3 KV	3 KV
	Input/output to rail	3 KV	3 KV
	Input to ground	1.5 KV	1.5 KV
	Output to ground	500 V	500 V
Wire Size	Power Connections	0.1…4 mm^2 (26…12 AWG)	0.1…4 mm^2 (26…12 AWG)
	Control inputs/relay outputs	0.5…1.5 mm^2 (28…14 AWG)	0.5…1.5 mm^2 (28…14 AWG)
Dimensions (L x W x H)		127.5 x 72.5 x 161 mm (5.02 x 2.85 x 6.34 in.)	127.5 x 72.5 x 161 mm (5.02 x 2.85 x 6.34 in.)
Weight		950 g (2.09 lbs.)	950 g (2.09 lbs.)
Control inputs	Enable	dry contact/open collector	dry contact/open collector
Status outputs	Drain	dry contact/open collector	dry contact/open collector
	Drain Reset	dry contact/open collector	dry contact/open collector
	Battery Status	Form C Relay and LED	Form C Relay and LED
	Fault	Form C Relay and LED	Form C Relay and LED
Battery Charger	Charge Current	3.0 A	2.0 A
	Full Charge	Regulates to 13.65 V	Regulates to 27.3V
	Battery Reverse	LED	LED
	Battery Open	LED	LED
	Battery Low	Yellow LED on below 11 V	Yellow LED on below 22 V
Battery Capacity	Minimum	4 AH	4 AH
	Maximum	scalable, see example on page 37	scalable, see example on page 37
Mounting position		Horizontal on mounting rail TS35 (optional direct panel mount)	Horizontal on mounting rail TS35 (optional direct panel mount)
Connections		plug and socket	plug and socket
Approvals/Certifications			
		CSA, UL 508 Listed, CE, CSA Class 1 Div. 2 and Zone 2	CSA, UL 508 Listed, CE, CSA Class 1 Div. 2 and Zone 2

Accessories	Order No.	Order No.
Chassis Mounting Kit	**7920560000**	**7920560000**

Functional Outline

The BBU is at its basic level a scalable UPS for 12 VDC or 24 VDC power. It is the heart or center of the system with everything wired through it. In this way it can monitor the status of the AC mains, the AC to the power supply, the DC out of the power supply and the battery condition. The BBU does NOT have built-in batteries. The batteries are sized based on the current and time demand for the back-up power.

The typical system is comprised of the following: the BBU, the battery pack and the power supply. The power supply is sized as per normal requirements (how much current is needed). The batteries are sized based on the amount of back-up current and the length of time that the current is required. There is no upper limit to the size of the batteries; we do not recommend that a battery pack smaller then 4Ahr be used due to the bulk charge rates of the BBU (3A for the 12V version and 2A for the 24V version), as they may be damaged with a bulk charge at this level.

Under normal conditions the BBU operates as a battery charger. It trickles the batteries to a minimum voltage (if necessary) then bulk charges at a rate of 3A for the 12V version and 2A for the 24V version until the batteries reach 14.75V / 29.5V. At this point the BBU floats the batteries to 13.65V / 27.3V.

The BBU switches the output current from Power supply to Battery through an internal Mosfet. This allows the unit to switch over in milliseconds.

The BBU has two form C relays, one for Battery status and the other for Fault monitoring. There are three inputs as follows: Enable, Drain and Drain Reset. These I/O are explained in detail below.

Digital Inputs

Enable:
A connection between the “Enable” and “COM” terminals enables the BBU. If terminals are open circuit (Disabled), the BBU functions as a battery charger only. In the event of AC failure the batteries are not connected to the load via the BBU. The BBU is factory preset as Enabled.

Drain:
A temporary short between the “Drain” and “COM” terminals switches the load to the batteries until the battery voltage reaches 11/22V. At this point the AC power is returned to the power supply and the BBU starts recharging the batteries. The Drain cycle can also be reset / terminated by activating the “Drain Reset” input.

Drain Reset:
A temporary short between the “Drain Reset” and “COM” terminals disables the Drain cycle to the batteries.

Diagnostic LEDs

Full Charged LED (green):
On when battery voltage is 14.75/29.5V or greater.
Bat Status relay is energized.
Once fully charged the BBU drops the charge voltage to 13.65/27.3V (“float” voltage).

Battery Low LED (yellow):
On when battery voltage is <11/22 VDC.
Bat Status relay is off.
If the battery voltage drops below 9.7/18.7V the load is switched off.

Charging LED (yellow):
On when BBU is charging the batteries.
Off when the “Full Charged” LED is on.

Fault LED (red):
On when AC fails.
On when the external power supply voltage is <11V/21.5V.
On when the batteries are not connected.
On when the battery voltage is <9.7/18.7V.
Fault relay de-energizes for the above conditions.

Battery Reverse LED (red):
Batteries connected in reverse.
Fault relay de-energizes and fault LED turns on.
There is an internal fuse that will open to prevent damage to BBU or to the batteries.

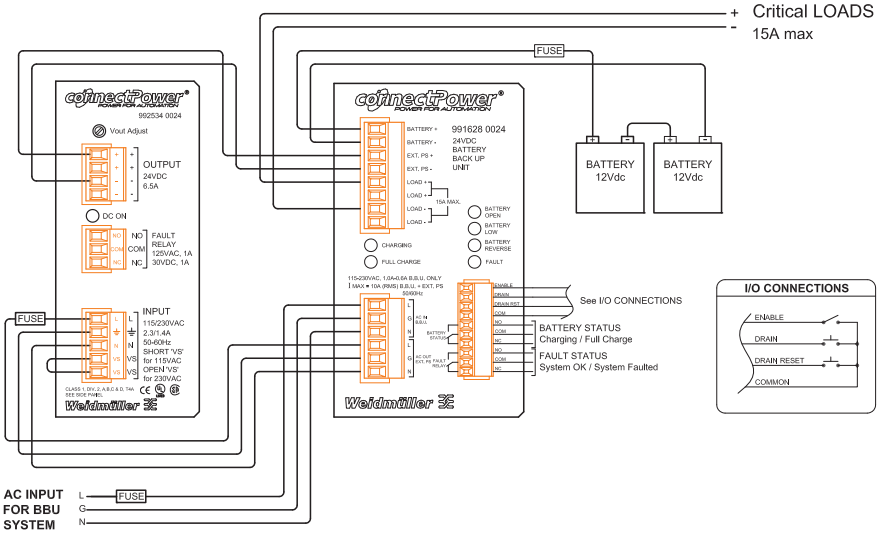
Battery Open LED (red):
No batteries connected – takes approx. 60 seconds to detect after turning on BBU.
Fault LED is on and Fault relay is de-energized.

Relay Outputs

Bat Status:
Battery status, this changes state based on whether the batteries are charging or fully charged.
See Diagnostic LEDs (Full Charge, Battery Low and Full Charge) for more detailed information.

Fault Relay:
De-energizes under a fault condition.
See Diagnostic LEDs (Fault LED, Battery Reverse, and Battery Open) for more detailed information.

Typical Schematic



- The 15A Critical Load limit is a limit of the BBU itself and not the power supply.
- This schematic is representative of a 24 VDC system. For a 12 VDC system use a 12 VDC battery pack, a 12 VDC power supply and a 12 V BBU, part number 991628 0012.
- The fuses may be replaced by another means of circuit protection, i.e. circuit breakers.
- It is recommended to monitor the power supply Fault/Status relay/output if available.
- The power supply shown is for illustration purposes only. The power supply needs to be chosen based on load requirements.

Recommendations for Operation

A drain cycle should be run as often as the application permits, six to twelve times per year is recommended. This allows the batteries to maintain their capacity, and it also allows you to validate their condition by monitoring the length of time that it takes to recharge. By knowing the capacity of the battery, you can calculate the **approximate** length of time that it will take to recharge by monitoring the “Bat Status” relay.

Example

30Ahr battery at 24 VDC
The 24 VDC BBU has a bulk charge current of 2A

The formula to calculate the time to recharge a dead battery is:
(30Ahr / 2A) x 2 = **30 hrs**

The formula to calculate the time to recharge after a drain cycle is:
((30Ahr / 2A) x 0.56) x 2 = **16.8 hrs**

The “x 2” in both formulas is because we overcharge the batteries so that they are fully charged—otherwise they only charge to just above 90%.

When running a drain cycle, the system only discharges the batteries to 22V / 11V. The batteries still have a fair bit of capacity left.

Please note that these formulas are NOT exact and are only approximations. This is due to variables such as actual battery capacity tolerance, temperature, voltage drop in cables, rate of discharge, etc.

It is recommended to use at least a 25% hysterisis on the calculated number of hours. Keep in mind that the battery capacity will decrease over time, and this is normal. **The best thing to do is to run a test on a known good set of batteries at room temperature and base the midpoint on the actual number of hours it takes to recharge after a drain cycle.**

In systems that run 24/7, there is never a good time to run the drain cycle. In these cases it is recommended to upsize the batteries as much as possible. It is still recommended to run drain cycles in these conditions. This is one of the key features of this product allowing you to validate the condition of the batteries. Please keep in mind that the batteries are NOT completely drained by running a drain cycle. The drain cycle runs the batteries to a voltage of 22V / 11V. In the worst case scenario, if you happen to lose power during a drain cycle, the drain cycle will reset at a battery voltage of 22V /11V. The BBU will continue to power the load until the batteries reach 18V / 9V. Then and only then it will shut down power to the load. Because of this, and assuming that the batteries are bigger than needed, you shouldn’t have a situation that leaves you without power.

We cannot stress how important it is to choose the batteries carefully for your application. The BBU is designed to work with many types of batteries, and works well with sealed lead acid, Gel cell and automotive / marine batteries. When selecting batteries keep in mind variables such as temperature extremes, cycle frequency (frequency of power outages) and many other environmental conditions. Many battery types can vent, creating a dangerous condition in a sealed panel. **Please consult the battery manufacturer for recommendations specific to your application.**

The temperature to which batteries are subjected is **very** important. Many manufacturers do not recommend recharging batteries if they are colder then 0°C (32°F) or hotter then 40°C (104°F). Again, please consult the battery manufacturer for recommendations.