Powerterm L120C-D Dual Voltage PSU/Battery Charger

Model C2197B 120W 12/24Volt Power Supply/ Battery Charger

DATASHEET

- Supply both 12Vdc 1Amp and 24Vdc 3 Amps average power to loads in a single product.
- Ideal for RTU's, dataloggers, remote field instrumentation, alarm systems, etc. where 24Volts is required for instrumentation and 12Volts is required for radios etc.
- Battery Management Functions include Low Voltage Cut-out, temperature compensation and current limited dual mode battery charging.

Features

- **True 12/24Volt Split Battery Charge Equalisation**
- **Under-voltage cut-out to protect battery from deep discharge.**
- **AC detect output for mains monitoring.**
- **Temperature compensation for optimum battery float voltage in changing ambient temperatures.**
- **Universal 85-264Vac mains supply**
- **DIN Rail mounting with small panel footprint**

OVERVIEW

The Powerterm L120C-D is a combined Power Supply and Battery Charger for small uninterruptible instrument supply applications where 12Volts and 24Volts are required.

Providing both 24Volts and 12Volts in battery standby systems can be inconvenient and costly. While 12Volts is available in 24Volt battery systems by centre-tapping the two series connected 12Vdc batteries, this has been impractical to use until now because of the different charging requirements of the two batteries.

The unique PTL120C-D dual voltage charger now makes this possible by the provision of true split rail battery charging to provide balanced charging to both batteries even when 12Volts loads are tapped from the battery set.

The Powerterm L120C-D is the only charger component required for the system, reducing space and cost.

And unlike the use of 24V to 12V converters, the 12Volt load is connected to the battery, providing a low impedance supply required by some radio transmitters. This configuration also allows larger currents to be drawn intermittently from the 12Volts such as radio transmit currents which can be much larger than the average current required when receiving.

Applications include RTU's, dataloggers, remote field instruments and alarm systems where the requirement exists to power both 12Volt equipment (such as radios) and 24Volt instruments.

BATTERY MANAGEMENT

During prolonged power outages, the back-up batteries will eventually discharge. If the load remains connected, the batteries can enter their "deep" discharge phase, which can cause irreparable damage to the batteries, and reduce their capacity and life expectancy.

The PTL120C-D incorporates a low voltage cut-out that disconnects the loads when either battery voltage falls below its low voltage threshold.

The maximum float voltage necessary to ensure full charge, but not overcharge, is temperature dependent for lead-acid batteries. If the installation is in an environment with widely fluctuating temperature, then fixed voltage chargers will either under-charge or over-charge the batteries.

The PTL120C-D is provided with external temperature compensation so that the float voltage to the batteries is held at its optimum value at all times. Use Model C0003 Temperature probe (supplied separately).

DUAL MODE CHARGING

All sealed lead acid battery manufacturers specify a maximum charging current for the correct life and safe operation of sealed lead acid batteries. This maximum charging current for a battery is based upon the Ampere-hour capacity of the battery. Many conventional switch mode power supplies do not control their maximum delivered current and can cause batteries to be charged from flat with current levels that exceed the manufacturer's recommendation. The PTL120C-D provides dual-mode charging, with a well defined battery current limit, so that even when the batteries are discharged, the charging current will be controlled.

SYSTEM MONITORING

The PTL120C-D provides an AC OK contact output. This output can be used to detect power failures without the need for an additional mains detection relay.

BATTERY TESTING

Using the Test Input, the health of the batteries can be checked. This function can be included in programmable remote equipment for highest availability of the standby system.

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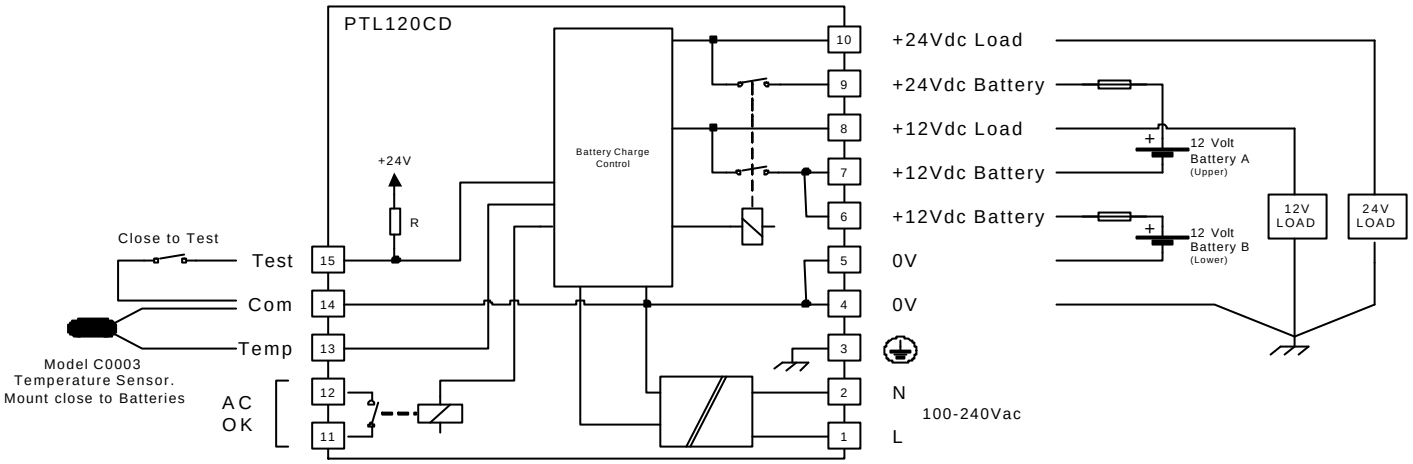
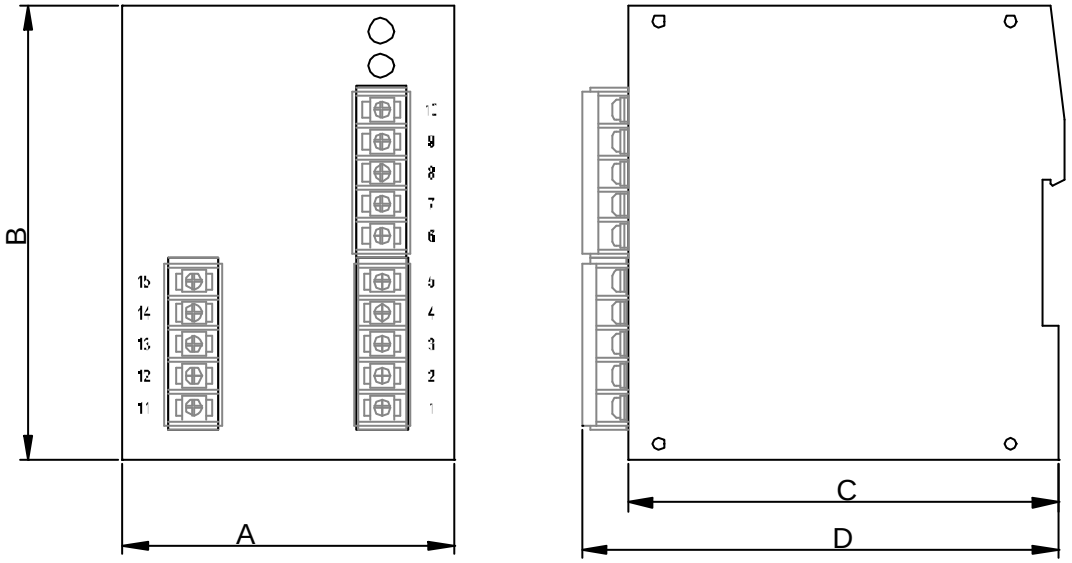
Typical System Connection Diagram



Mechanical Details



A	80mm
B	110mm
C	110mm
D	120mm

Powerterm L120C-D Dual Voltage PSU/Battery Charger

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Specifications

AC Input

AC input voltage range	85-264Vac
AC input frequency	47-63 Hz
Input current at full load	<2.2A rms at 115Vac <1.5A rms at 230Vac
Switch-on inrush current	8A for <10ms
Surge withstand	2.5kA 8/20us pulse 40 joules max.
Fast Transients	2 kV

DC Ouput

Nominal Output Voltage	**12V**	**24V**
Output Voltage at 20°C	13.8±0.1V	27.6±0.2V
Voltage change from 20°C	-20mV/°C	-40mV/°C
Maximum load output voltage range over all conditions of battery, temperature and AC input.	10.6V -14.3V	21.2V –28.6V
Maximum Continuous Total Power	120 Watts from 12V and 24V combined at 60°C	
Rated Load current	1.2A Continuous	4A Continuous
Battery Charging Current (current limited in charger)	1 Amp min[1] 1.2 Amp typical	1.2A min[2] 1.5A typical
Total current capacity (Load + Battery)	1.2A typical	5.2A typical
Maximum Peak Load (drawn from the battery)	8A for 10s	8A for 10s

Charging Notes:

1. Total current available for 12V load and battery charging. The higher the load the longer battery recharging time.

2. 24V charge current is limited independently. Increasing load current up to 5A is permissible but it will reduce battery charging and increase charging time.

AC line regulation	0.5% max over 85-132 & 170-264Vac
Load Regulation	2% max over 10-100% of total load (output load + battery charge current)

Recommended Batteries (not included)

Quantity	2/24V ; 1/12V
Type	12 Volt Sealed Lead Acid
Minimum Battery Capacity	7Ah minimum recommended

Under-voltage cutout

Output	**12V**	**24V**
Cut out Voltage	10.5 +- 0.3 Volt	21 +-0.6 Volt
Battery drain when cut out	1mA max	1mA max

OK Output

Type	Normally open contact – closed when AC is ON and DC power is healthy.
Max. operating voltage	30V dc
Max. closed circuit current	1A

Temperature Sensor Input

Type	Model C0003 Temperature Sensor (order separately)
Temperature Accuracy	± 2 °C

TEST Input

Type	Connect Test Input to 0V to test.	
Max. open circuit voltage	30V dc	
Max. closed circuit current	5mA	
Test Voltage	12V max	24V max
Test Method	When the test input is closed, the charger float voltages are lowered to just above the cut-out voltages. If the battery terminal voltages are above these settings, the batteries will take over supply to the loads. By checking the terminal voltages over a short time interval, the health of the batteries can thus be checked.	

Indicator Lights

AC (Green)	ON when AC input is ON and charger is charging. (indicates OK output is on)
DC (Red)	ON when cut-out relays are closed and DC output is present.

Environment

Operating Temperature	0 to +60°C at continuous full load
Temperature derating	derate 24V load 0.1A/°C up to 70°C
Storage Temperature	-10°C – 70 °C (+14°F – 158°F)
Design Life at 50°C full load	50 000hours

Mechanical

Width	80mm
Height	110mm
Depth	120mm (including terminals)

Weight

Unpacked	750gm approx.
Packed	780gm approx.

Compliance to Standards

Safety	IEC950; EN60950:1995
Emissions	EN 55011:1997 Group I, Class A
Immunity – ESD	IEC 61000-4-2:2001, level 3
Immunity – RF Fields	IEC 61000-4-3:2003, level 3
Immunity – Fast Transients	IEC 61000-4-4:2004 2 kV – AC & DC power ports 1 kV – other input/output lines
Insulation Resistance (100% tested)	100Mohm at 500Vdc input to outputs to ground.
Insulation Breakdown (100% tested)	1500Vac input to earth for 1s 1000Vac output to earth for 1s

Ordering Information

ORDER CODE	**DESCRIPTION**
C2197A	Powerterm L120C-D Dual voltage 12/24Vdc PSU/Charger
C0003	Powerterm Temperature Sensor (with 500mm lead)

Powerterm L120C-D Dual Voltage PSU/Battery Charger

Model C2197B 120W 12/24Volt Power Supply/ Battery Charger

Application Notes

BATTERY CONSIDERATIONS

The PTL120C-D is designed to operate with sealed lead acid (SLA) type batteries also known as Valve Regulated Lead Acid (VRLA) batteries. This type of battery is sealed except for a valve that opens when the internal gas pressure exceeds safe limits. (That is why it is important not to overcharge SLA batteries). Generally, these batteries can be used in confined areas and can be mounted in any orientation. (see the specific manufacturer's data for details.)

There are two types of SLA batteries on the market: Absorbent Glass Mat (AGM) and Gel-Cell. This refers to the method used to immobilise the electrolyte in the battery. Either of these two types of battery may be used with these chargers.

CALCULATING AVERAGE LOAD

In many applications the load can vary significantly. A typical example is in the use of radios, where the radio would draw much more in Transmit mode, than in Receive Mode. In most installations it is not necessary to base the battery capacity on the worst case load, because the average can easily be calculated.

Example:
A 12Volt radio is used that consumes 300mA in receive mode, and 3 Amps in transmit mode.

The system design requires the radio to transmit for 10 seconds every 15 minutes.

In this case, the average load provided by the radio can be calculated as follows:

The radio would transmit for 10 seconds every 15 minutes = 1.1% of the time, and therefore the radio would be in receive mode for 100% - 1.1% = 98.9% of the time.

Average Load = 1.1/100 x 3Amps + 98.9/100 x 0.3A = 0.33 Amps.

The Powerterm L120C-D is well suited to this application, because the average load is well under the 1A maximum, and the peak load of 3 Amps is well under the 6Amp peak load specified for the L120C-D.

BATTERY SELECTION

In order to select the batteries for your application, follow these simple steps:

For each load – 12 Volts and 24 Volts:

1. Calculate the Ampere-hours (Ah) of standby time required, by multiplying the number of hours of standby required by the average load in Amps.
2. To take into account deterioration of battery capacity over the life of the battery (20% over 48 months typical), and residual charge remaining at cutoff (20% remaining) multiply this figure by 1.6 (This figure may vary from application to application)
3. If the battery is required to provide full standby time at temperatures lower than 20°C, then increase this capacity by a further 10% for each 10°C below 20°C.
4. An additional factor of 15% may be added to the battery capacity if the recharge time to required capacity from discharged state is an important factor of the design. (see section on Charging time).

This then gives a design minimum Ampere-Hour (Ah) rating for each load on standby. Batteries can then be chosen as follows:

When choosing a battery, select the next highest standard size available from your chosen manufacturer in each case.

Choose the 12Volt Battery 'B' to have capacity at least equal to the SUM of the capacities required for BOTH the 12Volt and 24Volt loads as a minimum. (This is because Battery 'B' is delivering current to both the 12Volt and 24Volt loads).

Choose the 24Volt Battery 'A' to have capacity at least equal to the 24Volt Ampere-Hour rating calculated above.

Example:

A standby time of 2 hours is required from a standby system that will operate over the temperature range 0 – 60 °C.

The average 12Volt load has been calculated at 0.33 Amps
This gives a required Ah rating for the 12Volts of:

$$0.33A \times 2h = 0.66\,Ah$$

The average 24Volt load has been given as 2.5 Amps
This gives a required Ah rating for the 24Volts of:

$$2.5A \times 2h = 5Ah$$

Taking into account the factors for battery life and the low temperature operation given above, these ratings are increased by the factor:

$$1.6 \times 1.2 = 1.92$$

Therefore:

24Volt Battery Size = 5 x 1.92 = 9.6Ah minimum

12Volt Battery Size = 0.66 x 1.92 +9.6Ah = 10.4Ah minimum

Two 12Volt 12Ah Sealed Lead Acid batteries would be suitable for this application.

SHUTDOWN TEST INPUT

Connecting terminal 15 to 0V (via pin 14 or another 0V connection) will reduce the charger float voltage to just above the battery cut-out voltage for the purpose of testing the battery. A healthy charged battery will be above this voltage, and will take over supply of the load during the test.

By checking the battery voltage while in the test mode, the charge state of the battery can be estimated. If this voltage is monitored for droop over a short time interval (upwards of 15 seconds), then the health of the battery can also be established. This enables the batteries to be checked even when the AC supply is present. This can be done automatically, for example, in remote RTU applications where regular system checks are necessary to ensure availability of the standby batteries when the ac mains fails.

AC DETECT OUTPUT

A contact output across terminals 11 and 12 is provided to detect the presence of the AC supply, and the correct operation of the charger.

A closed contact confirms that the AC supply is present, and that the charger is successfully charging. The contact will open when the AC supply fails, or the charger is not able to charge for any reason.

A green light labelled 'AC' on the front of the PTL120C-D is a visual indication of the state of this contact and the AC supply. When this light is on, then the AC Supply is present, and the contact is closed.

Note: It is normal for this contact to open then close again momentarily during a power failure as the battery takes over from the AC supply.

LOW VOLTAGE CUTOUT

When either battery voltage drops during discharge to its preset cut-off point, the cut-off relay in the PTL120C-D will disconnect both batteries from the loads. This prevents the batteries from entering into a state of deep-discharge, protecting them from permanent damage.

When the AC supply returns, the cut-out relay will automatically reconnect the batteries.

A red light labelled 'DC' on the front of the PTL120C-D when on, indicates that there is DC supply to the load. During battery backup, the Green lamp will be off and the Red lamp will be on. After the battery has been disconnected by the cut-out, both lamps will be off.

These states are shown in this table below:

AC	DC	STATE
ON	ON	Batteries are connected and AC is on.
OFF	ON	Mains has failed & load is powered from batteries.
OFF	OFF	Mains has failed and batteries are flat.
ON	OFF	Charger Malfunction.

USE OF TEMPERATURE COMPENSATION

A Lead Acid Battery is constructed of a series string of cells of approx. 2.3 volts each when fully charged. A 12 Volt battery has 6 such cells. This fully charged voltage varies by approximately –3.3mV/°C per cell. This does not sound much but, over 12 cells in a 24Volt application, this amounts to a change of 0.4V over a 10°C temperature swing.

If the float voltage of the charger does not compensate for this change, then it is possible to over-charge the battery at high temperatures and under-charge the battery at low temperatures.

These PSU/Chargers are supplied from the factory with a resistor fitted to the temperature sensor terminals to fix the float voltage for 25°C operation. Over a normal ambient working range of 15 to 35°C this is considered quite satisfactory, and no further temperature compensation is required.

If the ambient temperature is fixed but outside of this range, then this resistor may be changed to simulate this environment. See the chart below for the correct resistor to use in this case.

If the ambient temperature is likely to swing by more than 20°C then it is strongly recommended that the external Powerterm Temperature Sensor be purchased and fitted in place of this resistor. This temperature sensor is fitted with a 500mm extension lead to allow it to be mounted near to the batteries, to best measure the ambient temperature of the batteries.

Temperature	Resistor	Float (12V)	Float(24)	Tolerance
0°C	33k	14.25V	28.5V	+/- 250mV
5°C	27k	14.22V	28.45V	
10°C	22k	14.18V	28.35V	
15°C	15k	14.05V	28.10V	
20°C	12k	13.97V	27.95V	
25°C	10k	13.90V	27.80V	(default)
30°C	8.2k	13.80V	27.60V	
35°C	6.8k	13.70V	27.40V	
40°C	5.6k	13.60V	27.20V	
45°C	4.7k	13.50V	27.00V	
50°C	3.9k	13.36V	26.72V	

CHARGING TIME

The PTL120C-D is a dual-mode charger. This means that the batteries are charged in two phases. When the AC power returns after the battery has been on load, and requires recharging, the charger will enter into "boost" mode charging. The charger then switches into "float" charge mode, and the voltage is reduced to its "float" voltage, where the battery can remain indefinitely.

The boost mode charge rate is chosen to ensure that the battery reaches 85-95% charge in the shortest time within the constraints of the battery specifications. The remaining 5-15% charge is then topped up more slowly during the float charge cycle.