TYPE 3 POWER SUPPLY UNIT

INSTRUCTION MANUAL

I N D E X

IMPORTANT NOTE

When using the Power Supply Type 3 with internal batteries, ventilation must be provided so that, in the event of the nominally sealed battery venting, possible flammable gases can escape to atmosphere. This action makes void the Lloyd's Register of Shipping and Department of Transport approvals. Installation engineers should advise clients of this situation, and reach agreement before the equipment is put into service. The alternative is to place the batteries external to the Power Supply Type 3, and maintain the integrity of the enclosure. Venting the enclosure renders invalid the Salt Mist Test, which may not be a problem where the Power Supply Type 3 is mounted within environmentally protected spaces.

INSTALLATION INSTRUCTION FOR POWER SUPPLY TYPE 3

IMPORTANT NOTES:

1. **THE EQUIPMENT MUST BE SERVICED BY COMPETENT PERSONNEL ONLY.**

2. **THE EQUIPMENT MUST NOT BE MODIFIED, SINCE ANY SUCH CHANGE MAY INVALIDATE BOTH LLOYD'S AND DEPARTMENT OF TRANSPORT (MSA) APPROVALS.**

FACILITIES

1) **Current limit at 5.5A.**

2) **Low voltage detection at 22V (24V), 11V (12V) which can be varied on request.**

3) **Automatic battery disconnection with front panel visual indication, when thermal shut-down occurs.**

4) **Low battery fault detection, with front panel visual and internal audio alarm.**

5) **Main and Emergency supply status, with visual alarm and extension.**

6) **Battery over voltage detection and protection in fault conditions.**

GENERAL:

The Power Supply Type 3 is a linear unit using closely matched transformer windings, to allow high efficiency without the RFI problems associated with switched mode devices! The d.c. output voltage may be pre-set over the range 12V – 28V, while having a maximum current capacity of 5A.

The unit is fully approved by the UK Department of Transport Marine Department, and also by Lloyd's Register of Shipping, with approvals to 1990 ENV1, 2 and 3 Standards. Full details of tests successfully completed are given in the full specification below.

The Power Supply Type 3 also complies with the term 'adequate precautions,' as laid down in BASEEFA regulations for the powering of intrinsically safe equipment within the voltage range specified. To this end, isolation is ensured by a combination of HBC input fuses, and minimum insulation requirements within the transformer. The insulation is safeguarded by the addition of an automatically resettable temperature switch connected in the primary circuit.

Input supply ratings 100, 120, 220, 230, 240V, 50/60Hz. Current output at nominal 12 or 24V d.c. (for sealed lead acid battery charging 13.8V and 27.6V respectively) 5 amps at 40°C ambient reducing to 4A at 70°C.

ENCLOSURE: **Dimensions:** **317mm Wide**
317 mm High
190mm Deep, including lock.

Weight: **10 kg. approximately**

Stove enamelled steel, bulk head fixing.
Internal battery capacity 24V, 12 AH or 12V, 24AH.

EQUIPMENT SPECIFICATION:

In pursuit of LRS and UK DTp approval, the following environmental tests were successfully accomplished.

INSULATION RESISTANCE:	**Greater than 100 Mohm at 500V and greater than 10 Mohm after humidity, low temperature and salt mist tests (see below)**
POWER SUPPLY PERMANENT:	**± 10% voltage variation, combined with ± 5% frequency variation.**
POWER SUPPLY TRANSIENT:	**± 20% voltage variation for 1.5 seconds and ± 10% frequency variation for 5 seconds.**
POWER SUPPLY FAILURE:	**3 power interruptions with a minimum breaktime of 30 seconds.**
INCLINATION STATIC:	**22.5° on either side of the vertical in all planes.**
INCLINATION DYNAMIC:	**22.5° either side of the vertical, with a roll period of 10 seconds.**
VIBRATION:	**2-13.2 Hz @ ± 1.5mm displacement 13-100 Hz @ ± 1.0g acceleration 100-13 Hz @ ± 1.0g acceleration 13-2 Hz @ ± 1.5mm displacement**
HUMIDITY CYCLIC:	**5.5 ± 2°C @ 95% RH ± 5%.**
SALT MIST:	**Exposure to standard salt solution at 35°C 95% RH for 28 days.**
DRY HEAT:	**70°C.**
LOW TEMPERATURE:	**-25°C.**
HIGH VOLTAGE:	**2,000V a.c.**
ELECTROSTATIC DISCHARGE:	**8KV direct to enclosure**

ELECTRO-MAGNETIC INTERFERENCE:

CONDUCTED LF:	**10% of input voltage to the fifteenth harmonic, decreasing to 1% at the hundredth harmonic.**
	Input supply frequency 50 Hz to 10 kHz.
CONDUCTED HF:	**10 kHz to 50 MHz modulated 30% at 1 kHz, with a carrier level of 1V.**
SPATIAL RFI:	**30 kHz to 500 MHz amplitude modulated.**
	30% at 1 kHz, with an electric field strength of 10V/m.
POWER LINE TRANSIENTS:	**One kV amplitude 50 ns, rise time 5 ns at a PRF of 5,000 p/s.**
	One kV amplitude width 50 micro seconds, rise time 1.2 micro seconds at a PRF of 1 p/s.

CIRCUIT OPERATION:

Drawing No. T3PSUCT shows the theoretical circuit of the power unit which, with the addition of certain switching facilities, is a standard linear supply. The input mains supply is connected to Terminals L, N and E and thence via the 3.15A HBC fuse F1 to the primary of the mains transformer. The thermal trip TT1 will open circuit the transformer primary if the temperature exceeds 100°C. When the transformer cools, the thermal trip will reset, and hence the power supply will periodically cycle, but heat damage is avoided. TT1 is within the transformer and is accessible for maintenance.

LP1 is PCB mounted to warn servicing technicians that the mains is still connected. The front panel mounted MAIN LED indicates that the voltage output of the PSU is high, and hence the main a.c. supply is connected. BR1 provides a d.c. supply to operate the 12V mains detection relay RL1. It is connected across the primary tappings which allows adjustment between 220V and 240V operation. The main primary windings are connected in series for 220V/240V operation and in parallel, as shown, for 110V/120V operation. If the mains supply fails the contacts RL1/1 change over, thus disconnecting the charging voltage, and allowing the batteries to supply full load current. RL1/2 provides indication of mains failure via the EMERGENCY LED and terminal 4, thus allowing alarm extension if required.

The transformer secondary windings are connected in series for nominal 24V outputs and in parallel, for nominal 12V operation.

BR2 and reservoir capacitor C2 provide smoothed d.c. to both the main regulator and the 3-terminal 5V regulator, which provides the reference voltage.

The error voltage necessary for correct operation of the low drop out regulator is derived from the potential divider chain R2, R3 and the variable Resistor RV1. This pre-set is the only adjustable device within the power supply, and should not normally require alteration. However, a competent technician should be able to adjust the output voltage if the need arises.

Diode D1, in conjunction with Fuse F2, provides crow bar protection to the regulator should the SLA battery be inadvertently reverse connected.

ZD1 and F2, again crowbar protection, prevent the batteries receiving over-voltage should the regulator fail. Fuse F3 restricts the output current under normal conditions to 3.15A. If a higher than normal load current is requested, the regulator operating temperature may be exceeded. In this event, the batteries are disconnected, but the equipment is still supplied. When the temperature decreases, the batteries will be automatically reconnected.

Note: The temperature of the series pass transistor in the Low Dropout Regulator is sensed by a thermistor epoxy potted into the main heatsink near to the transistor mounting bolts.

The automatic current limit circuitry allows a maximum of 5.5A, which is divided between the load and the battery. Under normal ambient temperature conditions, this current will be maintained indefinitely. However if, for any reason, the regulator overheats, the batteries will be disconnected, the regulator will cool and, when at a safe temperature, the supply will be reinstated. In the meantime, the load is fed directly from the regulator.

When the mains is connected, RL1 will operate. Contacts RL1/1 then connect the output of the regulator to output Terminals 5, 6 and 9. RL1/2 connects a positive supply to Terminal 5 to indicate that the mains supply is available and removes the positive supply from Terminal 4, thus indicating that the power supply is not operating off batteries. If the mains supply fails, Terminal 4 will be energised, so that suitable audible and/or visual alarms can be connected as appropriate. Terminals 7 and 8 provide the common return of the supply, i.e. 0V.

INSTALLATION

N.B. Installation should only be carried out with the mains supply disconnected.

The Power Supply Type 3 should be mounted in as cool a position as possible. In particular, avoid close proximity to other heat generating apparatus. Drawing No. T3ILO shows the internal layout of the power supply unit. The mains transformer and associated regulator etc. are mounted at the top of the enclosure, leaving clear space for SLA batteries to be placed in the bottom of the enclosure. The unit should be attached to a bulkhead using the four pre-drilled holes on the rear face of the enclosure. Suitable sealing compound and/or washers may be used to preserve moisture integrity.

The enclosure may also be mounted using optional brackets, thus avoiding interference with the interior.

Cable entries should be made via suitable glands positioned most appropriately for the particular installation, preferably on the underside. Every effort should be made to prevent moisture or dust ingress.

The mains input should be connected to the terminals mounted on the bottom of the printed circuit board marked L, N and E, and care must be taken to ensure that isolation from the adjacent terminal blocks is maintained.

Low voltage terminations are made via the adjacent terminal block numbered 1 to 9, and should be in accordance with circuit diagram Drawing No. T3PSUCT and the special connections to Fire Detectors, type 820, 816 and 832 on page 9.

Under normal circumstances, the voltage adjustment potentiometer to the right hand side of the terminal block should not be touched, but a competent technician will find a range of voltage adjustment, to enable particular applications to be satisfied.

NOTES:

1) With the mains supply disconnected the state of the batteries is indicated, using visual and audio alarms, by the low volt detection circuit.

2) The thermal shutdown circuit is also operational when the batteries are connected.

INPUT VOLTAGE ADJUSTMENT

The equipment should normally be ordered from Electronic Devices Limited, with the input voltage specified, so that the correct connections can be factory-made. However, a competent technician can adjust the input voltages, in the range given within the specification, using the connections shown in Table 1.

TABLE 1

	220V	240V	110V/120V
16	Blue	Blue	Blue & Orange
17	Yellow	Yellow	NC
18	Orange	Orange	NC
19	Brown	Red	Brown
20	Red	Brown	Red / Yellow

The thermal switch is always connected to Terminals 14 and 15

INSTALLATION INSTRUCTIONS FOR POWER SUPPLY TYPE 3 WITH FIRE DETECTION SYSTEMS ED816, ED832 AND ED820

The Power Supply Type 3 may be connected in different ways to suit the installation requirement. It may use internal sealed lead acid batteries, which are kept float charged by the power supply, and will produce a maintained output, which will meet the regulations of the classification societies. In this instance, the 2-wire connection for the nominal +24V and its 0V line are connected between Terminal 6 (+24V) and Terminal 7 (0V). If this is undesirable, link between the input power supply positive and the emergency supply positive on the fire detector. In addition, for ED816/832 the emergency 0V terminal on the fire detector should be connected to Terminal 7 on the PSU Type 3. For ease of installation, this may be accomplished at the fire detector terminal block.

If the PSU Type 3 is only being used to provide the main power supply, and the emergency supply required by the regulations is being obtained from an alternative source, e.g. ship's 24V batteries, then the maintained supply from Terminal 6 is still connected to the main supply input terminals of the fire detector, and the common 0V is also as before. The emergency supply is taken, as is normal, to the emergency input terminals of the fire detector. In this instance, it is important that backup batteries are not fitted, and that no attempt is made to charge external batteries from the PSU Type 3.

TYPE 3 POWER SUPPLY UNIT COMPONENT LIST

Designation	Value	Rating
LPI	NEON	
F1	3.5A HBC	
F2	5A Q/B	
F3	3.15A Q/B	
T1	100°C THERMAL TRIP	
BR1	4 X IN4005	
BR2	KBP808 OR EQUIVALENT	
C2	2 X 4700µF	63V
C3	0.1µF	63V
C4	0.1µF	63V
+5	LM340T5	
R1	0.5 ohms	25W
R2	2K2	0.25W
R3	180 ohms	0.25W
RV1	220 ohms	0.25W
D1	IN4005	
LED1	GREEN	
LED2	RED	
LED3	RED	
LED4	RED	