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2405ST-U Intelligent Switch Mode Power Supply:

Designed for use as part of EN54-4

27.6Vdc 5A PSU with Intelligent Battery Charging, Monitoring and Remote Fault Signalling

Overview

The 2405ST-U is a fully featured Power supply module designed for use within EN54-4 approved products ideal for use in Fire Systems and Access control applications. Its regulated 27.6V dc output will supply up to 5A continuous into the load, in addition to providing up to 1.6A for charging the standby batteries. The power supply output features electronic short circuit protection under both mains and standby battery operation. Maximum battery life is assured through continuous active battery monitoring and the use of a three stage charger, comprising bulk, absorb and temperature compensated final float phase depending upon battery condition. Deep discharge protection prevents premature battery failure when operating from standby for extended periods. Two sets of volt free solid state relay fault output signal (i) loss of mains and (ii) battery fault, charger fault and loss of output.

- 5A current to load at 27.6V dc nominal regulated output
- Electronic overload protection shuts down output until overload or short circuit is removed
- Battery Monitor detects battery missing, low battery, short-circuit or reverse connection
- Battery charging circuit is energised only when a battery is correctly connected and the battery voltage is greater than 14V
- No loss of output during automatic connection of battery to load on loss of mains
- Deep discharge protection disconnects battery from load when battery voltage falls to 21V
- Automatic start-up on battery only
- Fault indicator LED (Red) flashes on detection of output fault, battery fault, charger fault and mains failure
- Mains indicator LED (green) showing mains present

Compliance

This power supply unit complies with the following European Directives:

Low Voltage 2006/95/EC EMC 2004/108/EC WEEE 2002/96/EC RoHs 2002/95/EC FCC Part 15: Class B (Pending)

This product is designed to meet the requirements of FCC Part 15 for EMC emissions and has been tested as a battery backed up PSU to meet those requirements, but is only tested as a compliant sub-assembly.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Features

Loss of Mains and Brown-out compensation

If the mains input has been lost for greater than 10s, a Loss of Mains condition is detected, an EPS Fault is signalled and the green Mains LED is extinguished. Short duration mains “brown-out” conditions are not signalled thus reducing nuisance alarms. The red Fault LED will show a heart-beat pulse indicating that the PSU is operating correctly in standby mode.

Standby Operation

When the mains input is lost, the power supply will automatically switch to the standby batteries and provide uninterrupted power the connected load whilst there is capacity in the standby batteries. The front panel Fault LED is pulsed periodically to indicate that the PSU is healthy and operating in standby mode.

During standby operation, the standby battery voltage is continually monitored. Once this drops below the Low Battery Voltage threshold (approximately 23V), a PSU Fault signal is generated and a Low Battery condition is signalled on the front panel LED.

Battery Management

The standby batteries are tested regularly. If a battery becomes disconnected, a PSU Fault signal will be generated within 20s of the disconnection.

If the impedance of the battery circuit connections increases above 500mΩ, for example due to corrosion or damage to the cabling, a PSU Fault signal will be generated within 60 minutes.

If the battery is unable to supply significant current to the load, for example due to cell degradation, a PSU Fault signal will be generated within 24 hours.

Battery Charging

The standby batteries are charged automatically when the mains is present. The PSU uses a fast bulk charge regime to quickly recharge the batteries to approximately 80% capacity followed by a reduced charging current to reach full capacity. The batteries are held at full capacity using a temperature compensated float regime. The battery temperature is measured at its terminals using a special sensing probe. An extended probe may be fitted for use with an external standby battery pack.

Note: if the batteries are disconnected the battery charger is switched off and there will be NO measurable voltage at the BATT terminals.

Battery Auto-Start

The power supply will self-start if a set of charged standby batteries are connected without any mains present. An EPS Fault signal will be generated under this condition.

Note: a pause of 5s must be observed between repeated battery connections and disconnections to guarantee an auto-start.

Specification

Input

Voltage	93Vac minimum, 264Vac maximum
Frequency	45Hz – 65Hz
Current	2.5A maximum for a 5A load and 1.6A battery charging
Inrush current	30A maximum @ 25 OC, 110Vac for 10ms
Mains input fuse	T3.15A 20mm, 250Vac HBC

Output

Voltage	26.0Vdc – 28vdc on mains power / 18Vdc – 26Vdc on battery standby
Load Current	0 - 5A
Ripple	100mV max over full rated mains voltage
Load output fuse	F5A 20mm, 250Vac glass
Overload	Electronic shutdown at 8A until overload or short circuit removed

Standby Battery

Battery Capacity	2 x 17Ah to 2 x 38Ah maximum (e.g. Yuasa NP17-12 or NP38-12) series connected. Larger battery capacities can be used, but a full re-charge will not complete within 48 hours.
Battery fuse protection	F5A 20mm glass
Battery Charging	Constant current (1.6A) bulk charging to 80% within 24 hours, float charging to 100% within 48 hours
Low Battery Threshold Voltage	23V nominal
Deep discharge protection	Battery disconnect at 21V nominal
Quiescent current - no load	25mA nominal
Quiescent current - battery cut off	<70µA

Mechanical

Case material	Die cut and pressed steel chassis enclosure
Size	314 x 145 x 60 mm

Environmental

Temperature	-10 to +40 ^{O}C (operating) 95% RH non-condensing -20 to +80 ^{O}C (storage)

Connections

O/P + and -	Voltage output to load
PSU Fault	Solid State Relay output contacts
EPS fault	Solid State Relay output contacts
Temp sensor	Connection to battery temperature sensor
BATT + and -	Connections to standby batteries
FAN + and -	No Connection

Operating Instructions

The module contains high voltages and should not be disassembled, it is the OEM installers responsibility to provide suitable operating instructions for the power supply when installed with the OEM equipment.

Maintenance

There is no regular maintenance required of the PSU as the microcontroller performs regular health checks of the battery and output voltage. ***However, reference should be made to the battery manufacturer's documentation to determine typical / expected battery life with a view to periodic replacement of the battery.***

If the output of the PSU fails the cause of the failure should be investigated e.g. short circuit load, connection of a deeply discharged battery. The fault should be rectified before restoring power to the PSU. The following fuses may need to be replaced. Ensure the correct fuse rating and type is used.

Load Output Fuse	F5A 20mm, 250Vac glass
Internal Mains Fuse	T3.15A 20mm, 250Vac HBC
Battery Fuse	F5A 20mm, 250Vac glass

CAUTION
Risk of explosion if battery is replaced by an incorrect type.
Dispose of used batteries according to the battery manufacturer's instructions and all local and national regulations

The packaging supplied with this product may be recycled.
Please dispose of packaging accordingly.

Specifications subject to change without notice.

Signalling

Fault Outputs: 100mA @ 60Vdc solid state relay (Open indicates fault condition)

EPS Fault	PSU Fault	Condition	Possible Cause	Action
CLOSED	CLOSED	Normal operation	Mains present Battery fully charged	None
OPEN	CLOSED	Standby Mode	Mains lost Battery driving load	Investigate loss of mains
CLOSED	OPEN	Fault Present	Blown fuses Battery fault Overload Internal fault	Investigate fault source using diagnostic LED Rectify fault where possible
OPEN	OPEN	PSU Shutdown	Mains lost Standby battery exhausted	Restore mains as soon as possible

Status Indicators

Red LED Fault	Green LED Mains	Condition	Possible Cause	Action
OFF	ON	Normal operation	Mains present Battery fully charged	None
FLASH CONTINUOUS	ON or OFF	Fault	Blown fuses Battery fault Overload Internal fault	Contact service engineer
1 PULSE	OFF	Standby Mode	Mains lost Battery driving load	Investigate loss of mains

Diagnostic Indicator - (D11)

Red LED Diagnostic	Green LED Mains	Condition	Possible Cause	Action
OFF	ON	Normal operation	Mains present Battery fully charged	None
	OFF	Standby Operation	Mains Lost. No faults present Battery driving load	Investigate loss of mains
ON CONTINUOUS	ON or OFF	Internal Fault	Software fault detected PSU running in Safe Mode	Return to manufacturer
FLASH CONTINUOUS	ON or OFF	No output	Output fuse blown Output overload Output short circuit	Check and replace output fuse Disconnect output load and test load
1 PULSE	ON	Battery Charging	No faults active Battery charging normally but < 90% of full charge	None
2 PULSES	ON	No Battery	Battery disconnected Battery fuse blown Battery heavily discharged	Check battery connections Check and replace battery fuse Check battery terminal voltage and replace if battery aged
	OFF	Low Battery Volts	Standby Mode Battery almost discharged	Restore mains as soon as possible
3 PULSES	ON or OFF	Battery Fault	High impedance in battery connection Battery internal fault	Check battery connections for damage e.g. corrosion. Replace battery if aged
4 PULSES	ON or OFF	Charger Fault	Internal failure of battery charger	Return to manufacturer
5 PULSES	ON or OFF	Battery Temperature Probe Fault	Battery temperature monitor disconnected or damaged PSU running in Safe Mode	Check temperature sensor connections and condition of sensor and cable Replace if suspect

Installation

This unit is only suitable for installation as permanently connected equipment. The PSU is NOT SUITABLE for external installation.

This unit must be fed from a mains power source having a separate (approved) disconnect device and fitted with a fuse or other over-current protection device rated at 3A maximum. Ensure that the disconnect device used has appropriate earth fault protection to the applicable standard.

Where the PSU is used to provide power to a fire alarm circuit, the mains isolation and disconnect device should be provided solely for this purpose and be suitably marked "FIRE ALARM – DO NOT TURN OFF". All cabling should meet national and local fire system installation regulations, e.g. FP200 type cable for high integrity installations.

Where the PSU is used for other applications, it should be installed according to all relevant safety regulations applicable to that application and region.

Where the PSU Fault and EPS Fault outputs are used, they should only be connected to circuits having voltages less than 60V dc.

The module is provided as a part of a system and it is the integrators responsibility to ensure that the product is installed in line with local safety and wiring standards. Care should be taken to ensure that any metal enclosure that the unit is installed within is safety earthed correctly. Where the terminals on the modules are the primary connection to the power source and the Primary earth connection, then the spade connector and supplied earth lead can be used to earth the enclosure.

Cable Sizing

1) Mains input cable must be to the applicable standard with a 3A or greater current capacity, i.e. 0.5mm^2 nominal conductor area, having a minimum operating voltage of 300/500 Vac.
2) The low voltage output cable must be sized to carry the rated load current to the devices connected to the PSU.
3) Mains input and low voltage output cables should be routed to use different entry / exit holes in the case. Bushes should be used to protect cable sheaths from chafing. Ensure that these bushings are correctly sized (i.e. close fitting with respect to cable sizing). Note that the bushes should meet a minimum flammability specification of UL94 HB.
4) All cabling should be securely fastened in position using a cable tie through the saddles provided.

Mounting

5) The module is designed to be installed within a cabinet (providing suitable ventilation and heat dissipation of the module and any associated batteries) to limit access to trained service personnel only. Particular care should be taken to ensure that any operator or installer is protected from any live parts.

Commissioning

Mains Power Up

1) With no external connections made to the PSU, connect the mains input wires to the terminal block, ***ensuring that the mains isolator (disconnect device) is open***. Fasten wiring in place with cable tie to saddle. ***Note: Equipment must be earthed.***
2) Apply mains input. Ensure that the green Mains LED illuminates and that the red Fault LED flashes after approximately 20s (indicating a disconnected battery).
3) Disconnect the mains power.

Load Output and Remote Signalling

4) Connect the EPS and PSU Fault outputs to the appropriate inputs of control equipment if remote fault monitoring is required.
5) Loop the load (output) wiring through the supplied ferrite EMC suppressor as shown in Figure. 1. Cable tie or secure the Ferrite sleeve within the enclosure to ensure that it cannot put strain on any connector.

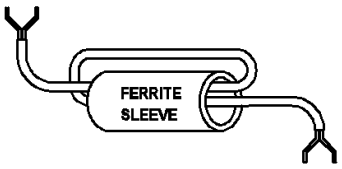
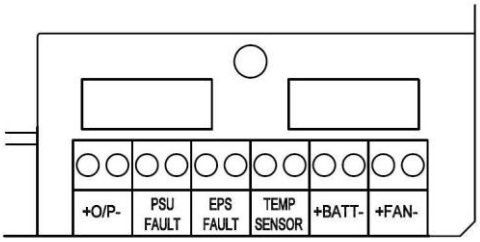


Figure 1 - Ferrite EMC suppressor



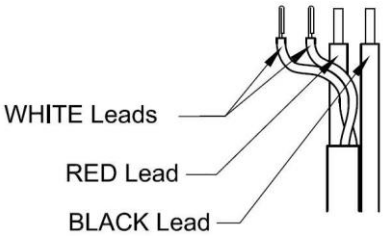


Figure 2 – Connection of battery leads and temp sensor to terminal block.

6) Re-apply mains. Verify that the green Mains LED illuminates and the red Fault LED flashes after approximately 20s (disconnected battery).
7) If connected, verify that the EPS Fault monitor shows a *closed* contact and the PSU Fault monitor shows an *open* contact.
8) Perform a full functional test of system including full alarm condition.

Standby Battery

9) Connect the two 12V standby batteries in series using the single cable provided. Connect the *negative* of one battery to the *positive* of the other. ***DO NOT CONNECT*** the other two battery terminals to each other.
10) Connect the free Positive and Negative terminals of the batteries to the PCB terminals Batt+ and Batt - using the cables provided. See Figure 2.
11) If the batteries are housed remotely, replace the battery lead assembly (including battery temperature sensor) with an extended length assembly (Part BAT-LD-T-24-300), Ensure the temperature sensor and battery connections are made according to figure 2.
12) Verify that the red Fault LED stops flashing after about 20s (battery connection detected). Verify that the remote PSU Fault monitor shows a *closed* contact.
13) Disconnect the mains power. Verify that the green Mains LED extinguishes and the red Fault LED starts to pulse (indicating that the PSU is running from its standby batteries).
14) If connected, verify that the EPS Fault monitor shows an *open* contact and the PSU Fault monitor shows a *closed* contact.
15) Perform a full functional test of system including full alarm condition. Verify that the standby batteries can support the system load. Note: ensure batteries have sufficient charge.

Final

16) Reconnect the mains. Verify that the green Mains LED illuminates and the red Fault LED extinguishes.
17) If connected, verify that the EPS Fault monitor shows a *closed* contact and the PSU Fault monitor shows a *closed* contact.
18) Close cover and secure using fastening screws provided.