Installation Manual and Operating Instructions

TRUE BLUE POWER

TS6

EMERGENCY BATTERY POWER SUPPLY

Manual Number
9019857

Revision A • August 24, 2023

FOREWORD

This manual provides information intended for use by people who, in accordance with current regulatory requirements, are qualified to install this equipment. If further information is required, please contact:

True Blue Power
c/o Mid-Continent Instrument Co., Inc.
Attn: Customer Service Dept.
9400 E. 34th St. N.
Wichita, KS 67226 USA
Phone 316-630-0101
Fax 316-630-0723
www.truebluepowerusa.com
www.mcico.com

We welcome your comments concerning this manual. Although every effort has been made to keep it free of errors, some may occur. When reporting a specific problem, please describe it briefly and include the manual part number, the paragraph/figure/table number, and the page number. Send your comments to:

True Blue Power
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REVISION HISTORY

Rev	Date	Detail	Approved
A	8/24/2023	Initial Release	CAS

SECTION 1 GENERAL DESCRIPTION

1.1 INTRODUCTION

The True Blue Power TS6 Emergency Battery Power Supply part number 6430006 is designed to supply DC power for emergency equipment after aircraft power failure occurs. During normal aircraft operation, the TS6 Emergency Battery Power Supply (EBPS) will utilize the aircraft's power to recharge or maintain existing charge at full capacity. The TS6 is a sophisticated power system that utilizes NiMH cell technology which provides improvements in performance, safety, life, and weight when compared to traditional or competing backup systems. Consideration given to key electrical and mechanical design principles yield compliance with regulatory standards and meet or exceed industry expectations. The TS6 is a complete EBPS that provides significant value and benefit to an aircraft designer, owner, and operator.

The TS6 requires professional use and maintenance to deliver maximum performance and value as designed. This manual contains information related to the specifications, installation, operation, storage, scheduled maintenance, and other related topics associated with the proper care and use of this product.

1.2 PHYSCIAL ATTRIBUTES

The TS6 consists of a rugged metal chassis with a DB9 style connector for electrical interface, and a permanently installed rechargeable battery. The unit is designed to be mounted with four 6-32 screws to the aircraft structure.

1.3 UNIT ARCHITECTURE

The unit has four primary functional features:

- Power pass through
- Internal cell charging.
- Cell state of charge gauging
- Consistent standby output voltage

The unit passes through normal 28V power, while maintaining internal power storage with internal battery charge and discharge control. The unit input provides a regulated 24V output in the event of loss of input power. Additional functions include analog state-of-charge, 80% capacity dispatch test, and discharge shutdown. All battery management functions are handled internally, including protection against safety considerations such as short circuit, over temperature, under voltage, and over voltage conditions.

1.4 TECHNICAL SPECIFICATIONS, 6430006

Electrical Attributes	
Power Input:	24.5 to 32 VDC; 0.5 A peak
Nominal Power Output	0.25 A @ 24 VDC Nominal
Max Current Output:	0.25 A
Battery Capacity:	6 Wh
Charge Time @ 28 VDC:	~2 hours for fast charge, majority of capacity ~2.5 hours to complete charge
Discharge Time: At 50ºC (122ºF) At 23ºC (73ºF) At -8ºC (18ºF)	 60 minutes @ 0.25A 60 minutes @ 0.25A 60 minutes @ 0.25A
Maintenance:	Perform capacity check every 1 year

Table 1.1

Electrical Functions

Physical Attributes	
Weight:	0.5 pounds
Dimensions: (see Figure 1.1) (without connector)	2.75 x 3.00 x 0.94 inches (LxWxH)
Mating Connector:	8017287
Mounting: (see Figure 1.1)	#6 Screws (4)

Table 1.2

Physical Characteristics

Qualifications	
Certification:	FAA TSO-C173a
Performance Qualification:	DO-293A Minimum Operational Performance Standards for Rechargeable Nickel-Metal Hydride (NiMH) Batteries and Battery Systems
Environmental Qualification:	RTCA DO-160G

Table 1.3

Qualification Standards

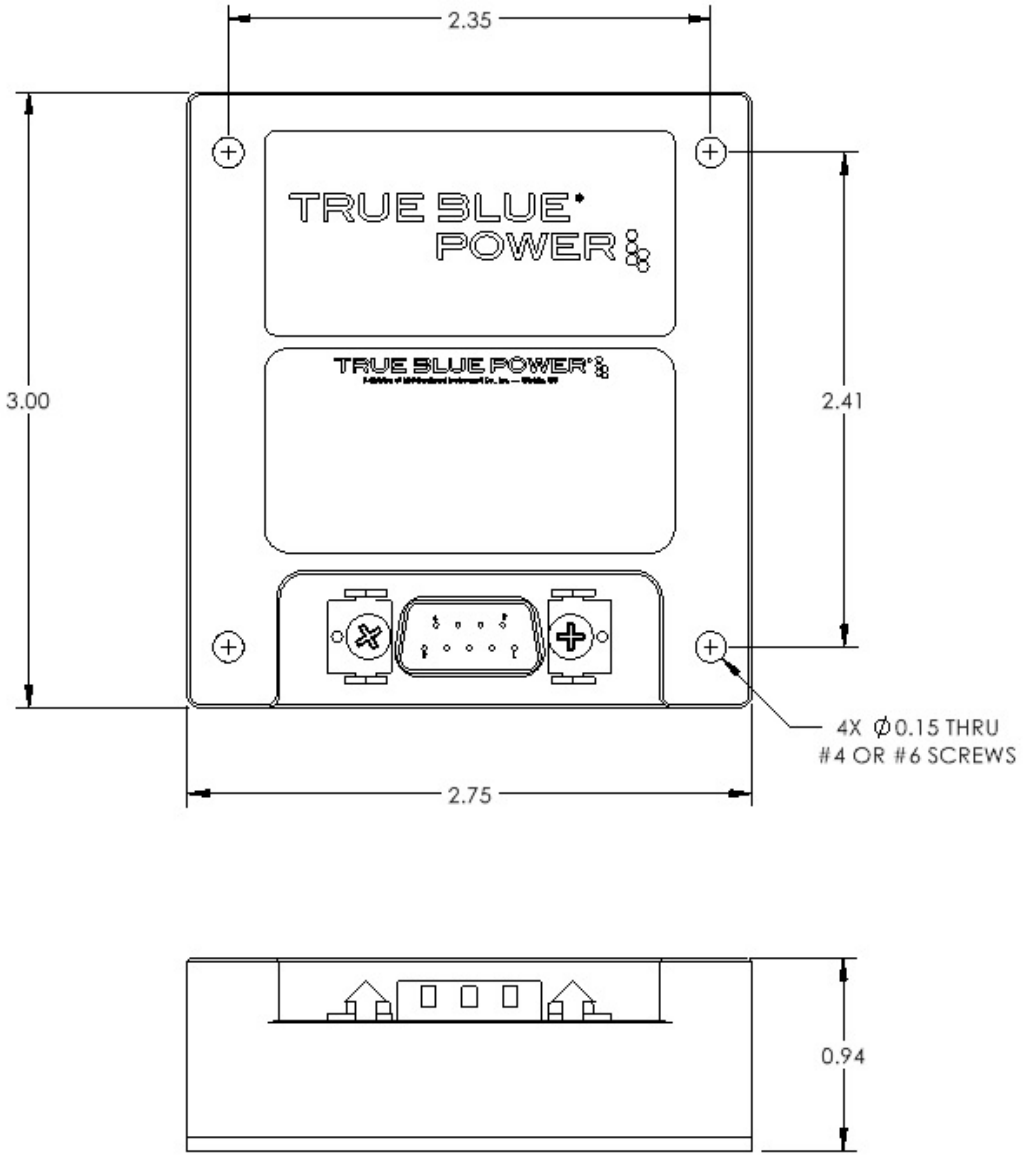


Figure 1.1

Outline Drawing

1.5 IMPORTANT SAFETY INFORAMTION

Read this safety information BEFORE maintaining or servicing the battery.

1.5.1 Symbol Definition

This section describes the precautions necessary for safe operations. The following safety symbols have been placed throughout the guide.

Warnings identify conditions or practices that could result in personal injury.

Cautions identify conditions or practices that could result in damage to the equipment.

1.5.2 Handling Precautions

Though the TS6 has short circuit protection, caution should always be used when working with battery powered products. It is recommended to wear safety glasses, fire retardant smocks, and use insulated tools when servicing the EBPS.

- Do not disassemble or modify the battery.
- The battery contains an alkaline electrolyte. This electrolyte may result in the loss of eyesight if it comes into contact with an eye. In such cases, do not rub the eye, but immediately wash the eye with clean water and then consult a doctor.
- Remove metal items such as rings, bracelets, and watches when working with batteries. A battery could produce a short circuit current that could harm a person.
- Ensure that the TS6 service area is properly ventilated and egress paths are unobstructed.
- Specialized breathing filters are not required under normal use.
- Always use insulated tools.
- Never smoke or allow a spark or flame near the TS6.

1.5.3 Additional Precautions

The following design and operation factors are required for safe use.

- It is not acceptable to combine or use any battery cells or modules other than those approved by True Blue Power.

- Always use appropriate Electrostatic Discharge (ESD) protection while working with the TS6.
- There are no limitations in storing or using this TS6 in the vicinity of other battery chemistries. The TS6 does not emit or absorb any gas during storage, transportation or during normal operating conditions.
- Connector terminals must be covered with non-conductive protective devices to avoid any possibility of shorting during handling, shipping, or storage.

1.5.4 Shipping

Shipping complies with domestic and international shipping regulations.

SECTION 2 PRE-INSTALLATION CONSIDERATIONS

2.1 COOLING

No internal or external cooling of the unit is required. The unit is designed to operate over a wide temperature range and includes internal thermal monitoring and protection circuits. See Section 4 for more details.

2.2 EQUIPMENT LOCATION

The TS6 EBPS is designed to mount in a pressurized and temperature-controlled environment. Although not required, optimum performance and life can be achieved by mounting the TS6 in a temperature-controlled section of the aircraft that does not require operation below -8°C. The unit is designed to withstand high levels of condensing humidity. However, installation locations where the unit could be subject to standing or direct water exposure should be avoided. The unit has no limitations regarding mounting orientation.

The unit should not be installed in compartments where lines, tanks or equipment containing fuel, oil or other flammable fluids are present. Installation near potential sources of ignition should be avoided.

2.3 ROUTING OF CABLES

Avoid sharp bends in cabling and be cautious of routing near aircraft control cables. Also avoid proximity and contact with aircraft structures, avionics equipment, or other obstructions that could chafe wires during flight and cause undesirable effects. Cables should not run adjacent to heaters, engine exhausts, or other heat sources. The signal cable bundle wires are recommended to be no smaller than 22 gauge.

2.4 LIMITATIONS

The conditions and tests for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must receive additional installation approval prior to being operated on each aircraft. This article meets the minimum requirements of technical standard order (TSO) C173a. Installation of this article requires separate approval. The article may be installed only according to 14 CFR Part 43 or the applicable airworthiness requirements.

See Section 4.3 for Performance Specifications and potential limitations and ratings under various environmental and application installations. Also see Section 2.2 for limitations associated with equipment installation location.

2.5 MODIFICATION

This product has a nameplate that identifies the manufacturer, part number, description, certification(s) and technical specifications of the unit. It also includes the “MOD” or modification number representing notable changes in the hardware design of the unit.

Modification (MOD) 0 is the initial release of the product and is identified on the nameplate by the lack of marking on the MOD numbers 1 through 9 (i.e. 1-9 are visible). All subsequent modifications are identified on the nameplate by the marking/blacking out of that particular MOD number (i.e. for MOD 1, the number 1 is not visible and 2-9 are visible - see Figure 2.1 for examples). MODs do not have to be sequentially inclusive and may be applied independent of each other.

For additional details regarding specific changes associated with each MOD status refer to the product published Service Bulletins at www.truebluepowerusa.com.

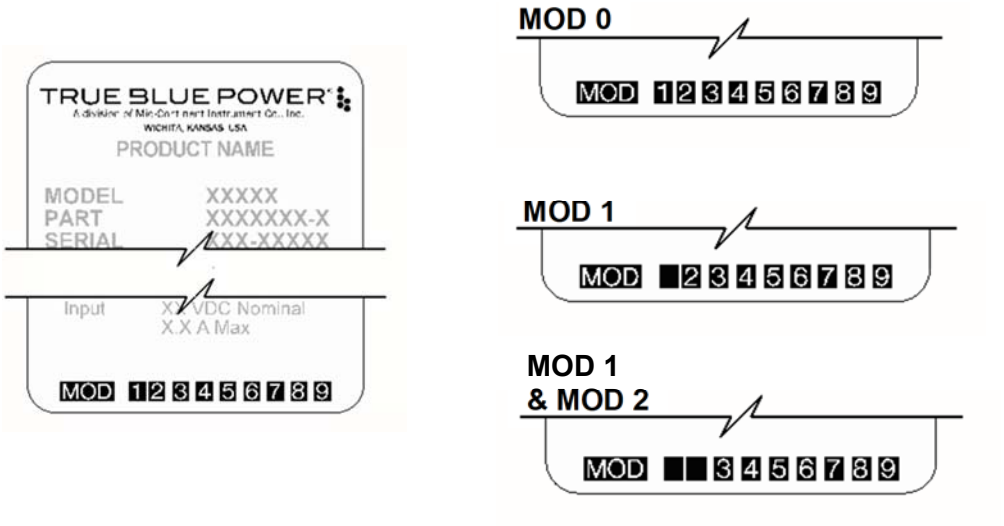


Figure 2.1

Nameplate and MOD Status Example

SECTION 3 INSTALLATION

3.1 GENERAL

This section contains mounting, electrical connections and other information required for installation. These instructions represent a typical installation and are not specific to any aircraft.

3.2 PRE-INSTALLATION INSPECTION

Unpacking: Carefully remove the TS6 battery from the shipping container. The shipping container and packing are designed specifically for the transit of NiMH batteries and approved by international transportation agencies. These materials should be retained for use should the unit require future shipment.

Inspect for Damage: Inspect the shipping container and unit for any signs of damage sustained in transit. If necessary, return the unit to the factory using the original shipping container and packing materials. File any claim for damages with the carrier.

3.3 PARTS

3.3.1 Included Parts

A. TS6 Emergency Battery Power Supply	MCIA P/N 6430006-1
B. Installation and Operation Manual	MCIA P/N 9019857
C. Connector Kit	MCIA P/N 8017287

3.3.2 Installer Supplied Parts

A. Wires
B. Appropriate hold-down hardware

3.4 INSTALLATION

⚠ WARNING ⚠

The connector pins of the TS6 are always active and energized.
DO NOT SHORT CONNECTOR PINS AT ANY TIME!

Caution should be applied when handling and connecting to the unit.

3.4.1 Harness Preparation

Prepare aircraft wiring with mating connectors in accordance with the proper Wire Size and Type (Table 3.1), Unit Locations (Figure 3.1) and Pin Identification Diagram (Table 3.2). Recommended external connections to the aircraft can be seen in Figure 3.3.

Use of PTFE, ETFE, TFE, Teflon or Tefzel insulated wire is recommended for aircraft use. Recommended wire sizes and types are identified in Table 3.1 below.

Wire Size and Type			
Wire Gauge	Wire Type	Connector	Pins
18-22 AWG	Stranded Copper	9-pin	1-9

Table 3.1

Wire Size and Type

Figure 3.1

Unit Locations

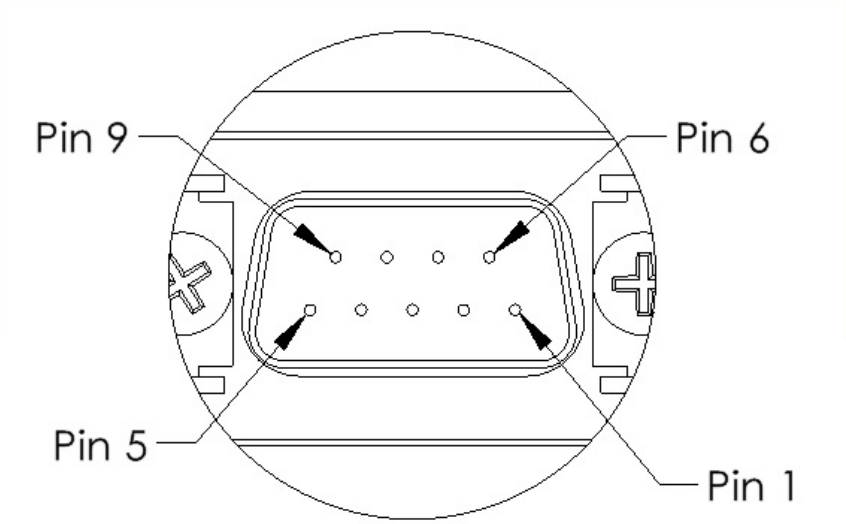


Figure 3.2

EBPS Connector

TS6 Connector (9-pin)	
Pin	**Function**
1	Reserved
2	Reserved
3	Ground
4	State of Charge
5	Dispatch
6	Shutdown
7	Power Output
8	Power Input
9	Ground

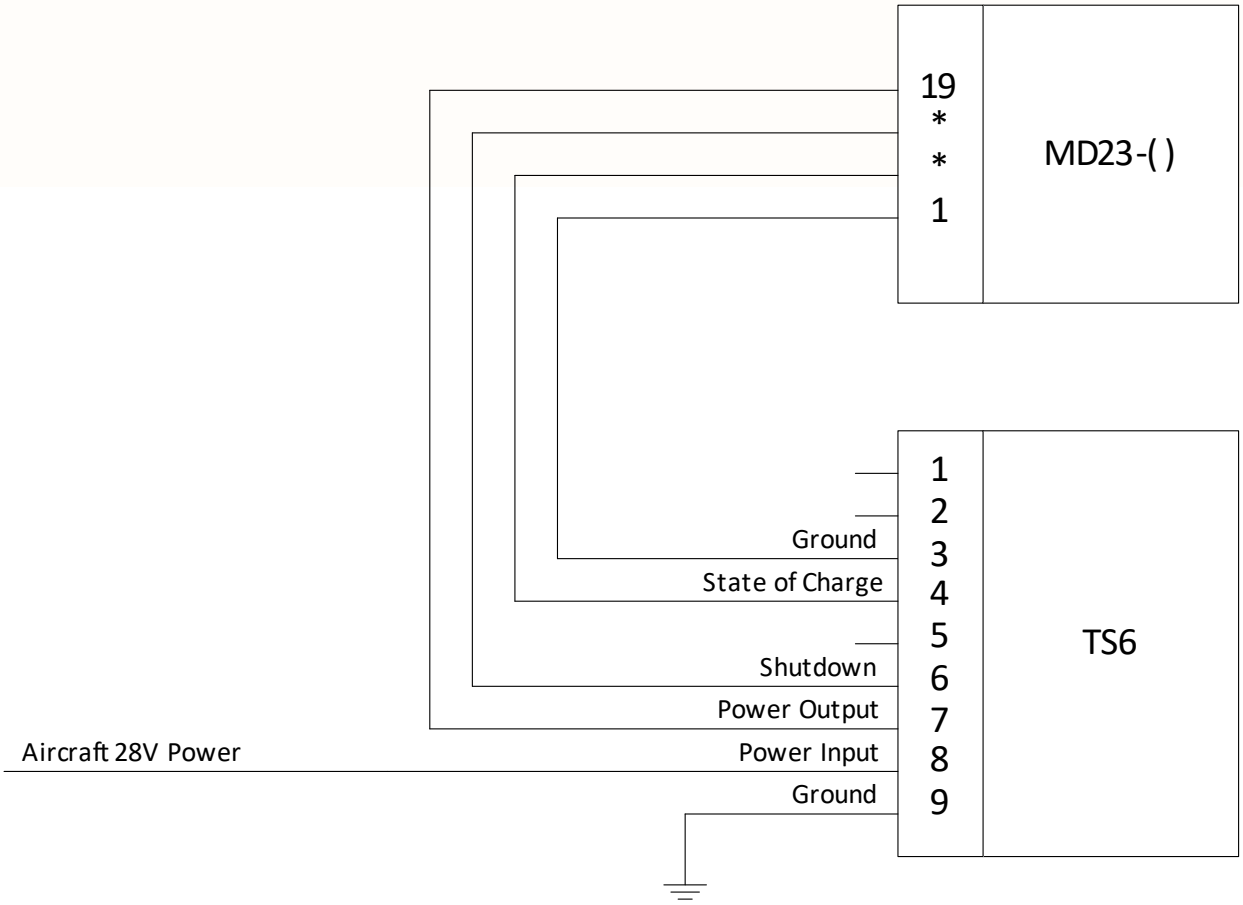
Table 3.2

Connector Pinout

3.4.2 Securing the Unit

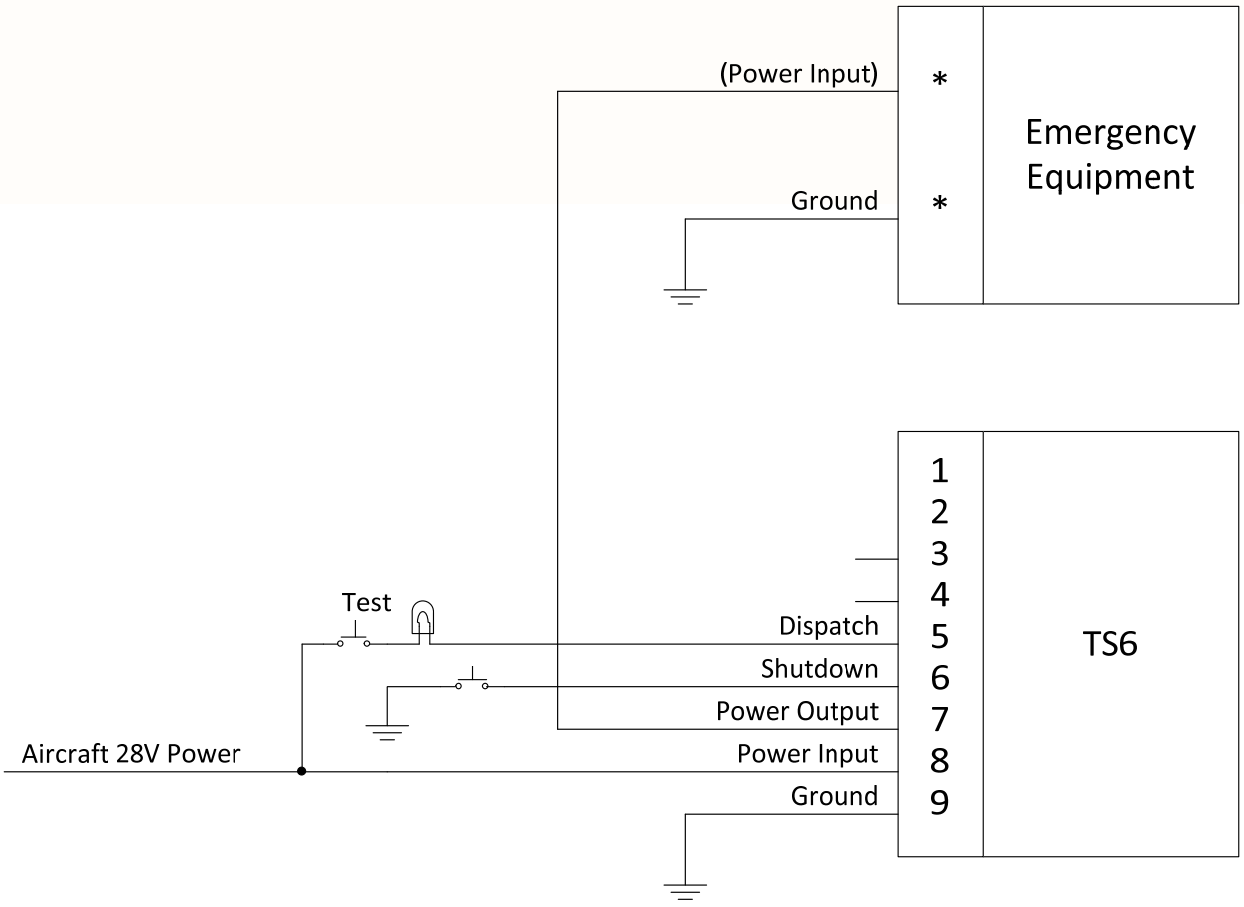
The TS6 is designed to be secured in the aircraft using four (4) #6 screws (or equivalent) as shown in Figure 1.1.

3.4.3 Installation and Wiring



* Device pins are installation-specific

Figure 3.3
MD23 FLEX Wiring Example



* Device pins are installation-specific

Figure 3.4
Generic Equipment Wiring Example

SECTION 4 OPERATION

4.1 DESCRIPTION

The True Blue Power TS6 Emergency Battery Power Supply (EBPS) is designed to supply DC power for an MD23 when aircraft power failure occurs. It utilizes rechargeable NiMH chemistry to provide output power. During normal aircraft operation, the TS6 EBPS will utilize the aircraft's primary power bus to recharge or maintain existing charge at full capacity. The TS6 will pass the 28V input voltage through to the output via an internal diode.

4.2 THEORY OF OPERATION

The TS6 Emergency Battery Power Supply system provides a minimum voltage output of 24V at a maximum current output of 0.25A. The units are designed to receive 24.5-32V input and to seamlessly switch to backup battery power if the input voltage drops below 24V. The unit includes two power return (GND) pins for installation convenience with only one being required for operation. Refer to Section 3.4.3 for external connection to aircraft system.

4.2.1 28V bus present

If the 28V bus is present, the unit will pass it through to the output and maintain or charge the backup batteries. When charging, the additional load on the aircraft system is approximately 0.25A during fast mode and 0.15A during trickle charge, falling under 0.1A when the cells are fully charged.

4.2.2 28V bus dropout

If the 28V bus drops out or is below 24V, the unit will continue to supply power through a diode circuit from the internal battery supporting a 24V output level. The unit constantly monitors a variety of internal conditions and applies protections by automatically disconnecting the EBPS from the charging source if any of the design thresholds are exceeded. These includes over-voltage and over-temperature.

4.2.3 Discharge

The TS6 provides an internally regulated 24V discharge whenever it is active. When input voltage drops below 24V, the output will be maintained at 24V. This unit is automatically activated when power is applied, and automatically will provide power to its connected load until exhaustion of the internal storage cells, or until the SHUTDOWN pin is momentarily connected to GND. Input power must be applied to re-enable the discharge output. Short circuit protection is provided internally as a 0.5A PTC self-resetting fuse on the output.

4.2.4 State of Charge (PIN 4)

The State of Charge signal represents an estimated SOC for the internal cells with 0-10V representing 0-100% SOC respectively. This signal is active when aircraft power is available making the unit active, and while the unit is still active following a loss of input.

4.2.5 Dispatch (PIN 5)

The Dispatch signal asserts GND when the SOC is above 80%. This signal is open when SOC is below 80%. Dispatch is intended to drive a lamp/LED or discrete input to another system to indicate that the battery is charged. Figure 3.4 shows how a momentary switch and lamp can be wired for a manual test. This signal is active when aircraft power is available making the unit active, and while the unit is still active following a loss of input.

4.2.6 Shutdown (PIN 6)

To preserve the state-of-charge, extend the life of the unit, and maintain immediate usefulness for its next mission the unit should be deactivated after loss of power when its use is not further required. This is done by momentarily grounding the Shutdown pin.

4.2.7 Software and Complex Hardware

No software or complex hardware is incorporated in the design of this product.

4.3 BATTERY PERFORMANCE AND CAPACITY

In comparing the benefits of Nickel-Metal Hydride (NiMH) cell technology with Nickel Cadmium (NiCad) cell technology, it is clear that NiMH is a superior choice.

NiMH cell technology offers significant advantages over NiCad. NiCad batteries suffer from a memory effect, which reduces their capacity. On the other hand, modern NiMH batteries show little to no memory effect, allowing for more flexible charging and discharging patterns without negatively impacting their overall capacity. In our testing and qualification process we have not seen any memory effect in our NiMH packs.

NiMH batteries possess a higher energy density compared to NiCad batteries. This means they can store more energy in a given space, making them suitable for applications where weight and size are crucial factors. Additionally, they have a much lower self-discharge rate than NiCad batteries. This means they can retain their stored energy for longer periods without requiring frequent recharging. NiMH batteries are better suited for applications that demand extended periods of standby or intermittent use. NiMH batteries also tend to have a much longer cycle life as compared to NiCad.

Unlike NiCad batteries, NiMH batteries do not contain toxic cadmium, making them more environmentally friendly and safer for disposal. NiMH batteries are considered a more sustainable choice due to their reduced environmental impact.

NiMH cell technology presents a superior alternative to NiCad. With its environmental friendliness, higher energy density, reduced memory effect, lower self-discharge rate, and enhanced safety, NiMH batteries offer a compelling choice for various applications and provide an overall improved user experience.

For specific capacity and EBPS discharge time, refer to Section 1.4.

Note that this battery does not contain an internal heater. Capacity will not be available for charging or discharging at temperatures below -8°C.

4.4 MAINTENANCE

Because the cells are designed to maintain their charge-holding capability over time, True Blue Power is recommending a two-year maintenance cycle. The two-year check includes a full charge, discharge, and recharge while evaluating the discharge time against minimum requirements. Additionally, at any time when the capacity of the unit is in question or after being utilized in an in-flight emergency situation, True Blue Power recommends conducting this procedure.

SECTION 5 CONFORMANCE

5.1 DISPATCH VERIFICATION AND IN-FLIGHT MONITORING

The TS6 serves to provide power to an MD23 or other critical equipment upon loss of aircraft power. Typical installation will include monitoring through the MD23 application-specific user interface. For general installation without MD23, see the appropriate aircraft flight manual.

5.2 ROUTINE MAINTENANCE

The TS6 requires scheduled maintenance based on calendar life of the EBPS. Maintenance as described in this section shall be conducted every 24 months from date of original aircraft delivery or subsequent new battery installation. The EBPS battery shall be recharged every 6 months if it is uninstalled.

⚠ WARNING ⚠

The connector pins of the TS6 should always be treated as if it were active and energized.

5.2.1 Visual Inspection

A. Remove the unit from the aircraft. Visually inspect the exterior of the EBPS casing for signs of damage or wear. Verify that no damage has occurred which would prevent the EBPS from functioning. If any wear is apparent which has not compromised the case, inspect the EBPS area of the aircraft for any signs of improper installation.

B. Visually inspect the connector. Verify that it isn't loose and there are no signs of damage, wear, or corrosion.

C. If any of the above conditions are present, the unit must be evaluated and tested for repair or replacement by an authorized repair facility.

5.2.2 Charging and Capacity Check

A. To charge the battery, apply 28V to PIN 8 and GND to PIN 9. Charging will occur automatically, continuing until the input current drops below 0.1A.
B. Discharge the battery by connecting a 0.25A load (96 ohms) between PIN 7 and PIN 9, and disconnecting input power. The unit should supply power (24V) on the output for at least 60 minutes.

5.2.3 Return to Service

A. Recharge the unit with 28V supply until input current drops below 0.1A. This should take roughly 2 hours for a full charge.

5.3 COMPONENT MAINTENANCE

The cells, electronics, and other components that comprise the TS6 Emergency Battery Power Supply are not field-serviceable items. Please contact the manufacturer for service.

5.4 STORAGE INFORMATION

In normal use, the TS6 utilizes the aircraft power to maintain the proper charge voltage and sustain the battery cells at peak capacity. Although the chemistry of the cells used in the TS6 maintain an extremely low relative self-discharge rate, all batteries will slowly self-discharge if left unused for long periods. In addition, self-discharge rates are directly related to the storage temperature. Higher storage temperatures will result in faster self-discharge rates.

Rechargeable NiMH batteries should be stored in a dry, well-ventilated area. They must not be kept in the same area as highly flammable materials. The unit can be stored in the same area as other battery chemistries. The TS6 does not emit or absorb any gas during storage, transportation, or during normal operating conditions.

CAUTION

SHELF LIFE: Per domestic and international shipping requirements, NiMH batteries may be shipped as low as 00% state of charge (SOC). Therefore, the EBPS is required to be fully recharged upon receipt. Units that are stored shall be fully recharged at a minimum every 3 months, following the procedure set forth in Section 5.2.2.

STORAGE TEMPERATURE: Exposure to temperatures above 30°C (86°F) for sustained periods of time is possible, but may increase the self-discharge rate or result in some permanent loss of capacity. Storage temperatures above 50ºC (122°F) are to be avoided.

5.5 END OF LIFE

The following conditions will help maintain or extend the life and performance of your product:

- Avoid significant exposure to high temperatures (above 30°C/86°F) during operation or storage

End of life is represented by the inability of the unit to meet the minimum capacity requirement of the aircraft as tested during capacity verification per Section 5.2.3. In the event that the unit exhibits failure, insufficient capacity or expired life, contact True Blue Power for repair, exchange or replacement. Visit www.truebluepowerusa.com for more information.

5.6 DISPOSAL

NOTE: All NiMH batteries are classified by the United States government as non-hazardous waste and are safe for disposal as normal municipal waste. However, this EBPS does contain recyclable materials and a lead soldered circuit board so recycling options available in your local area should be considered when disposing of this product. Dispose of NiMH batteries in accordance with local and federal laws and regulations. Do not incinerate.

5.7 ENVIRONMENTAL QUALIFICATION STATEMENT

MODEL NUMBER: TS6 **PART NUMBER:** 6430006-( )

NOMENCLATURE: NiMH Backup Power Supply

CERTIFICATION: FAA TSO-C173a

MANUFACTURER: True Blue Power division of Mid-Continent Instrument Co., Inc.

ADDRESS: 9400 E. 34th St. North, Wichita, KS 67226, USA.

SPECIFICATION: Test Specification (TS) 802, Test Data Sheet (TDS) 802

STANDARD: RTCA/DO-160, Rev G, dated 12/08/10 & RTCA/DO-293, Rev A, dated 12/02/09

CONDITIONS	SECTION	DESCRIPTION OF TEST
Temperature and Altitude	4	Category F1
Temperature Variation	5	Category S2
Humidity	6	Category A
Operational Shock and Crash Safety	7	Category B (5R)
Vibration	8	Category R[C,C1] & U[G]
Explosive Atmosphere	9	Category H
Waterproofness	10	Category Y
Fluids	11	Category F
Sand and Dust	12	Category X
Fungus	13	Category F
Salt Fog	14	Category X
Magnetic Effect	15	Category Y
Power Input	16	Category B(XX)
Voltage Spike	17	Category A
Audio Frequency Conducted Susceptibility	18	Category B
Induced Signal Susceptibility	19	Category AC(E)
Radio Frequency Susceptibility	20	Category RR
Emission of Radio Freq Energy	21	Category M
Lightning Induced Transient Susceptibility	22	Category X
Lightning Direct Effects	23	Category X
Icing	24	Category X
ESD	25	Category A
Fire, Flammability	26	Category C

REMARKS:

Section 4: Category F1 with the following parameters:

- Ground Survival Low Temp = -55°C
- Survival High Temp = +85°C
- Short-Time & Operating High Temp = +70°C
- Short-Time & Operating High Temp = +70°C
- Altitude (ft.) = +55k
- Rapid Decompression = 8k ft. to 55k ft.

Section 13: Category F by analysis.

Section 26: Category C by analysis.