

Installation Manual and Operating Instructions

# TRUE BLUE POWER

## TC2000 SERIES

STATIC ELECTRICAL  
POWER CONVERTER

Manual Number  
9019049



Revision D • May 7, 2020

## **FOREWORD**

This manual provides information intended for use by persons 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.  
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Wichita, KS 67226 USA  
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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**

<b>Rev</b>	<b>Date</b>	<b>Detail</b>	<b>Approved</b>
A	12/28/2017	Initial release	BAW
B	01/26/2018	Corrected formatting issues. Incorporated FAA comments.	BAW
C	03/08/2018	Changed paragraph 3.3.2.3 pin 'E' to pin 'A'. Added note page 5 on ground regulatory requirements.	JRC
D	05/07/2020	Updated style and brand to meet Marketing and Engineering guidelines.	DLR

## **SECTION 1    GENERAL DESCRIPTION**

### **1.1    INTRODUCTION**

The model TC2000 Series Static Electrical Power Converter is a lightweight power converter that translates an aircraft alternating current (AC) input of 115 volts at 360-800 Hertz to a 28 volt direct current (DC) output. Additionally the TC2000 can be bench operated on AC Mains with 115 or 230 volts at 47-65 Hz input and provide a 28 volt direct current (DC) output (see Note 1 below).

The wide input operating voltage and frequency make the TC2000 suitable for nearly any common business or commercial aircraft which provides 100-125 VAC between 360-800 Hertz. The output of 71 amps @ 28 VDC produces 2000 watts of power to supply avionics, instrumentation, seating, personal charging, lighting, and many other applications. The TC2000 Series Static Converter is FAA certified to TSO-C71 and tested to rigorous environmental standards and levels of RTCA DO-160G. The small size and light weight in conjunction with its installation flexibility (inside or outside the pressure vessel) make it an ideal choice for aircraft power needs while reducing the challenges associated with other similar products.

Highlighted features include short circuit protection, overload capability, low voltage shut-down, temperature monitoring, a self-resettable over-temperature disable and a remote on/off function. The TC2000 Series has a robust Military-rated circular connector, and the rugged extrusion that houses the unit is designed to help dissipate heat and provide mechanical strength against vibration or other possibilities of damage. Two independent fans allow for a smaller unit and quiet operation, and keep the internal components cool extending the life of the unit.

## 1.2 TECHNICAL SPECIFICATIONS

<b>Electrical Attributes</b>	
Input Voltage	Aircraft: 115VAC nominal, 360-800 Hz. AC Mains: 115VAC or 230VAC, 47 to 65 Hz. (Note 1)
Input Current (full load)	22 Amps nominal; 28 Amps max
Input Current (unit off)	2 Amps
Recommended Input Circuit Breaker	30 Amps (for 115VAC aircraft use)
Output Voltage	28VDC ± 0.5 VDC
Output Power	2000 watts (28VDC @ 71 Amps rated)
Efficiency	88% nominal

**Table 1.1**

<b>Physical Attributes</b>	
Weight:	9.9 lbs [4,49 kg]
Dimensions: (not including connector mate)	14.00 inches x 6.32 inches x 3.46 inches (LxWxH) [35,5 x 16,1 x 8,8 cm]
Mating Connector (and cable clamp):	MCI P/N 9018993-1 and 9018550-2
Mounting:	Base mount – orientation not critical

**Table 1.2**

Note 1: The TC2000 has not been tested to UL, CE, or other ground regulatory requirements. Powering from AC mains is intended for testing or temporary use only.

<b>Qualifications</b>	
Certification:	FAA TSO-C71
Environmental Qualification:	RTCA DO-160G Environmental Category; See Section 5.2
Altitude:	35,000 feet
Temperature:	-55°C to +70°C (-67°F to + 158°F)

**Table 1.3**

## **SECTION 2 PRE-INSTALLATION CONSIDERATIONS**

### **2.1 COOLING**

No external cooling is required. The unit is equipped with two internal DC fans that are thermostatically controlled. The fans normally run at a slow speed, but depending upon load and ambient temperature one or both fans may operate at a higher speed.

Restriction to airflow can cause overheating of the unit and limit performance or reduce the expected life of the product. Make sure to provide adequate clearance on both ends of the unit with the hexagonal openings to allow for proper circulation. In general, four to six inches of clearance on both ends of the unit should be acceptable. Mounting the unit to a metal surface can also help reduce the effects of temperature within the unit but is not required.

### **2.2 EQUIPMENT LOCATION**

The TC2000 Series is designed for mounting flexibility, allowing for installation inside or outside the pressure vessel with no requirement for temperature control within the temperature specifications. The unit is also 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 can be mounted in any orientation. Clearance should be provided for the mating connector and may require as much as five inches past the unit connector to allow for back shell access to the connector.

### **2.3 ROUTING OF CABLES**

The wires and cable bundle associated with the unit are heavy gauge wire and carry significant power. Be aware of routing cables near other electronics or with other wire bundles that may be susceptible to high energy flow.

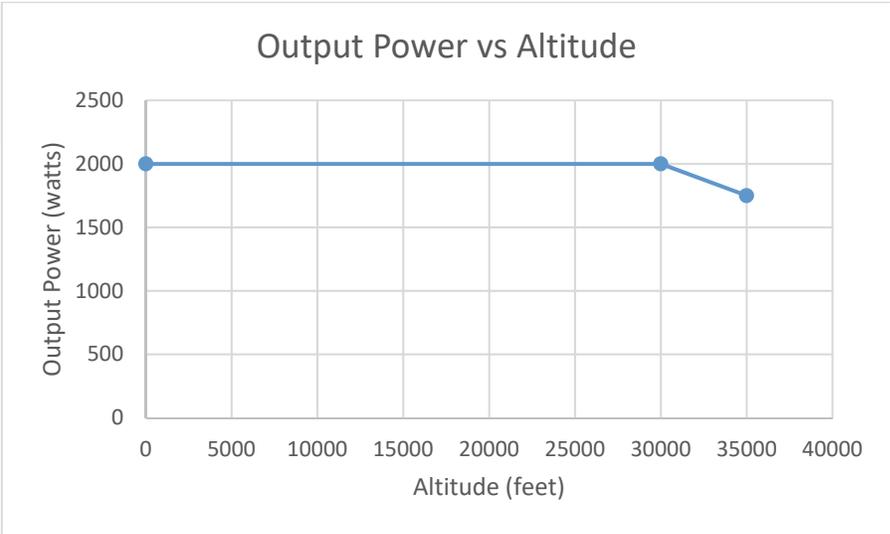
Avoid sharp bends in cabling and routing near aircraft control cables. Also avoid proximity and contact with aircraft structures, avionics equipment, or other obstructions that could chafe wires during flight and cause undesirable effects.

### **2.4 LIMITATIONS**

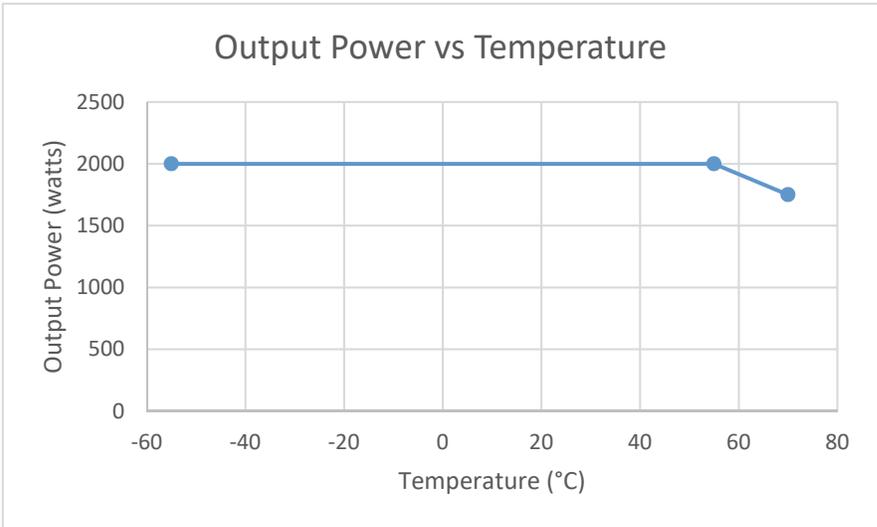
The TC2000 contains an internal DC-to-DC conversion function to produce the rated output as specified. This function meets the requirements of FAA TSO-C71. The TC2000 also creates an initial translation of an alternating current (AC) input to the intermediate DC voltage, which then gets converted to the rated output. This initial translation of AC-to-DC power is considered a non-TSO function. This is due to the lack of an available AC-to-DC Technical Standard Order. However, the AC-to-DC function is fully tested and verified per the equipment requirements and design as well as the stated environmental requirements. The data to support the non-TSO function has been submitted to and reviewed by the FAA along with the TSO-C71 requirements and functionality.

Additionally, there are limitations associated with a derating of the maximum continuous power available at the high end of the rated temperature and altitude specification. For more details, see Figures 2.1 and 2.2 below.

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. The article may be installed only according to 14 CFR Part 43 or the applicable airworthiness requirements.



**Figure 2.1 – Derated Output Power versus Altitude**



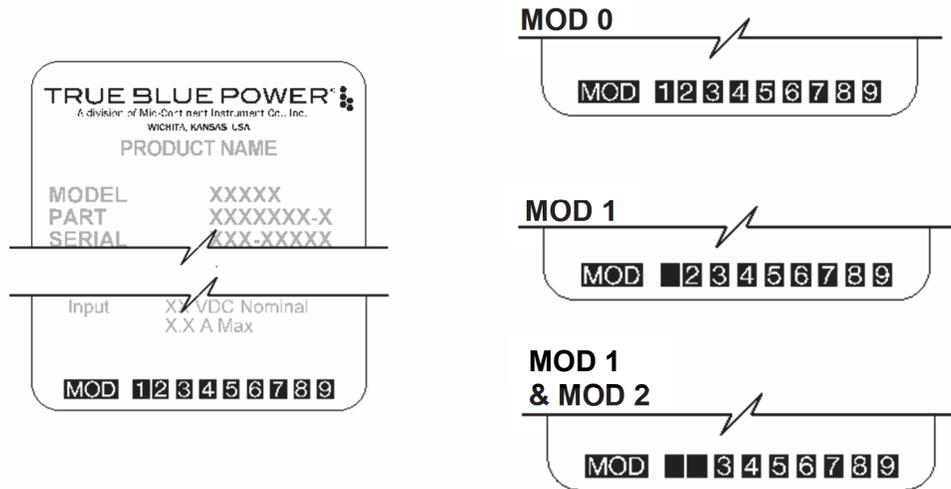
**Figure 2.1 – Derated Output Power versus Temperature**

## 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 2.2 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](http://www.truebluepowerusa.com).



**Figure 2.2**  
**Nameplate and MOD Status Example**

## SECTION 3 INSTALLATION

### 3.1 GENERAL INFORMATION

This section contains interconnect diagrams, mounting dimensions and other information pertaining to the installation of the TC2000 Series Static Converter. After installation of cabling and before installation of the equipment, ensure that power is applied only to the pins specified in the interconnect diagram.

### 3.2 UNPLACKING AND INSPECTING EQUIPMENT

When unpacking this equipment, make a visual inspection for evidence of any damage that may have incurred during shipment.

The following parts should be included:

- |                        |                    |
|------------------------|--------------------|
| A. Static Converter    | MCIA P/N 6432001-1 |
| B. Installation Manual | MCIA P/N 9019049   |

Available Equipment:

- |                                     |                                  |
|-------------------------------------|----------------------------------|
| A. Mating Connector (& cable clamp) | MCIA P/N 9018993-1 and 9018550-2 |
|-------------------------------------|----------------------------------|

Equipment not provided:

- |                       |   |
|-----------------------|---|
| A. Mounting Hardware  | four (4) ¼-20 pan head screws<br>¼" lock washers (optional) |
| B. Cable Harness Wire | See Section 3.3 for specifications                          |

### 3.3 CABLE HARNESS

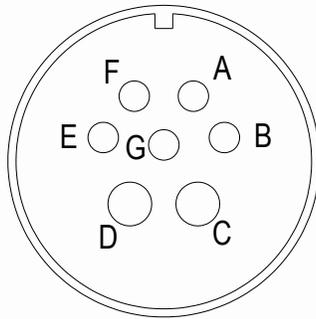
Construct the cable harness with regards to the instructions below, and using Figures 3.3 – 3.5, and Wiring Diagram of Table 3.3.

Refer to Section 2: Pre-Installation Considerations in regards to routing precautions.

#### 3.3.1 Wire Gauge Selection

Use of PTFE, ETFE, TFE, Teflon, or Tefzel insulated wire is recommended for aircraft use. Use the following wire gauges for each of the pins in the connector. For the higher current input and output wires, use the larger wire size listed if the wire run is long to avoid voltage drop.

- Pins C and D – 4 to 6 AWG stranded wire
- Pins B and E – 8 to 10 AWG stranded wire
- Pins A, G, and F – 16-22 AWG stranded wire



MS3102A32-10P Connector Pinout	
A	Enable
B	AC IN Line
C	+28 VDC Output
D	28VDC Return
E	AC IN Neutral
F	Parallel
G	Chassis Ground

**Figure 3.3**  
Pinout View of Unit Connector

**Table 3.3**  
Connector Pinout

### 3.3.2 Pin Assignment Information

#### 3.3.2.1 Converter Input Power:

AC Line input – Pin B – 115 VAC. Connect to the aircraft 115 VAC bus using a 30 Amp circuit breaker.

AC Neutral input – Pin E – Connect to the aircraft 115VAC Return Bus.

#### 3.3.2.2 Converter DC Output:

The TC2000 DC Output is isolated from the incoming 115VAC and the inverter chassis. This allows the TC2000 to provide 28V DC output independent and isolated from other aircraft DC power sources if desired.

DC +28V Output – Pin C – Positive 28 volt output from the converter. Use of one or more circuit breakers is optional.

DC -28V Output – Pin D – Negative 28 volt output from the converter. In typical aircraft, the negative 28V is connected to the airframe. However with the TC2000 converter the 28V negative can be connected to an isolated return bus if it is desirable to have a 28V DC bus independent and isolated from the aircraft DC bus.

**Note: Use of a circuit breaker on the DC output is optional. For the full output of 2000W, a single circuit breaker current of 75 Amp maximum is recommended. If multiple branching circuits are connected to the output, then the total rating of all circuit breakers should not exceed 75 Amps.**

#### 3.3.2.3 Converter Remote Enable Control: (see section 4.2.1)

Remote ENABLE (ON/OFF Control) – Pin A – Connecting this pin to the converter DC -28V Output turns-ON the 28V output of the Converter. If the Converter DC-28V Output is connected to the airframe then a remote ENABLE switch only needs to connect this pin to the airframe to turn ON the output of the converter. When unconnected (output is OFF) this pin will have approximately 28 VDC present, internally limited to a few milliamps. If the Converter is to be enabled at all times, pin A is to be connected to pin D.

### 3.3.2.4 Converter Chassis Ground

Chassis Ground – Pin G – Typically the converter chassis is grounded when the converter is mounted to the aircraft structure. This pin provides an additional chassis ground connection independent from the mounting. It is recommended that a wire of less than 18 inches in length be connected to this pin to provide additional grounding for the Converter.

### 3.3.2.5 Converter Parallel Operation

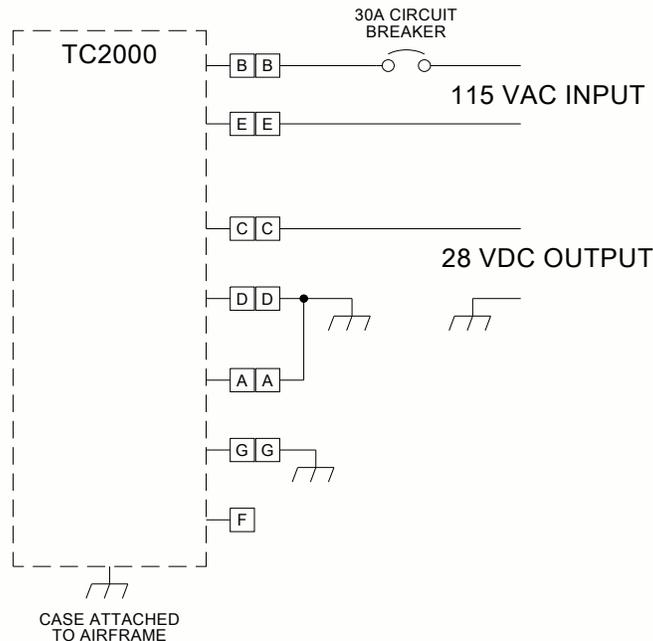
Parallel – Pin F – More than one TC2000 can be connected in parallel to provide more than 2000 Watts of power conversion to 28 VDC. Contact Mid-Continent Instruments, True Blue Power for additional information on this feature. If the parallel operation feature is not being used, this pin should remain unconnected.

### 3.3.3 Example Wiring Diagrams

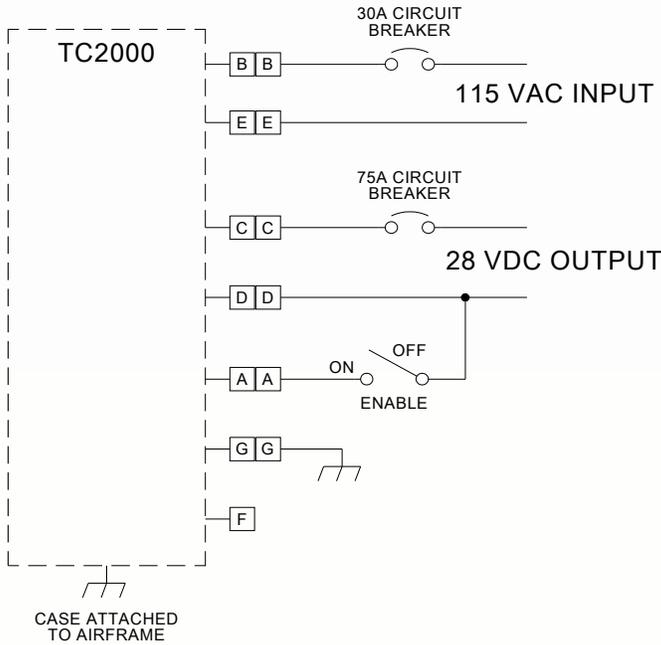
See Figures 3.4 and 3.5 for examples of potential wiring diagram options for installation purposes.

### 3.3.4 Harness Verification

With the TC2000 Series Static Converter disconnected, activate the aircraft power bus that supplies the unit and use a multi-meter to verify that aircraft power and ground with appropriate voltage is on the pins within the mating harness.



**Figure 3.4: Typical TC2000 Aircraft Wiring Installation – Constant On**

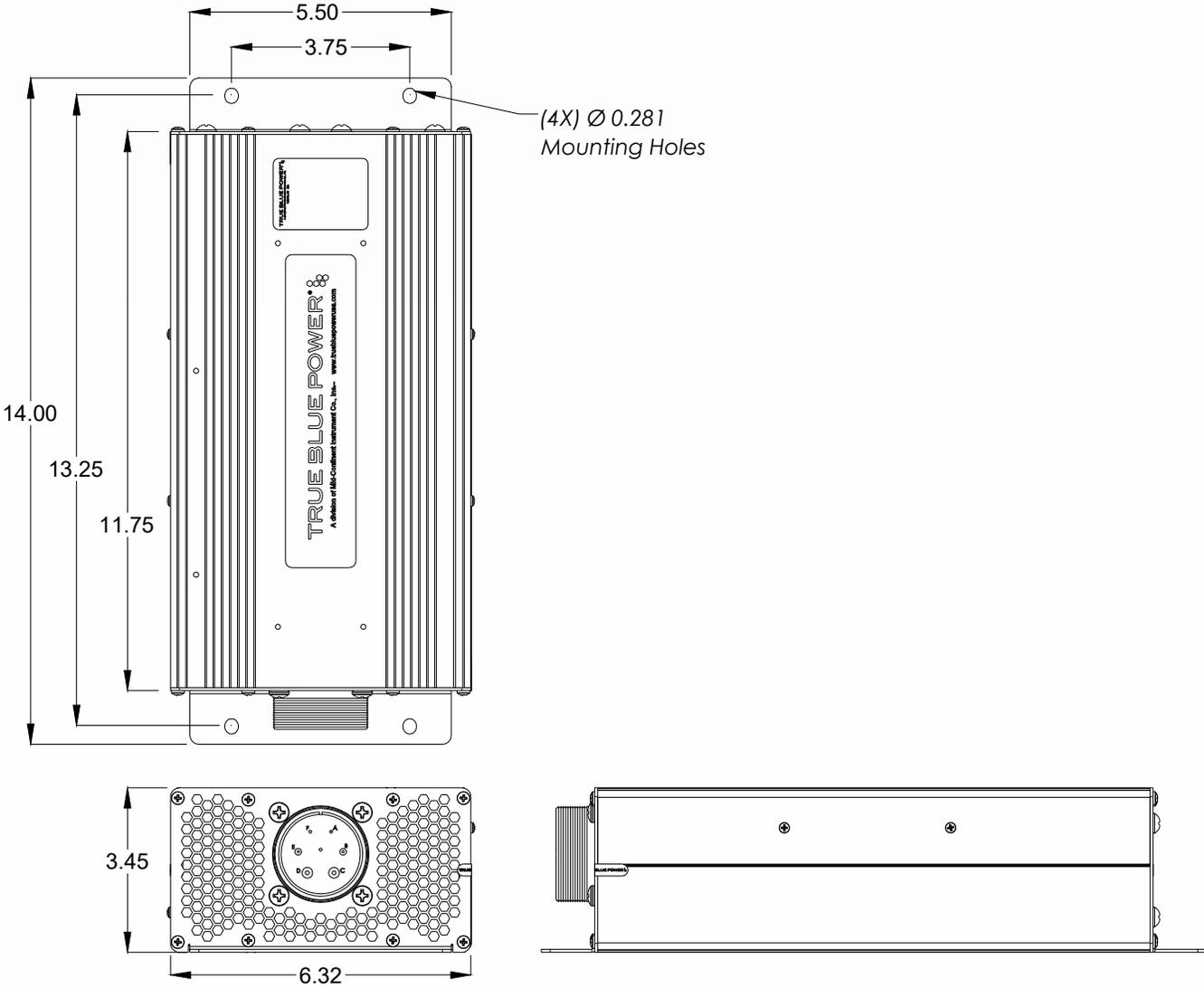


**Figure 3.5: Typical TC2000 Aircraft Wiring Installation – Remote On/Off**

**3.4 MOUNTING**

Refer to Section 2: Pre-Installation Considerations in regards to equipment location.

The TC2000 Series Static Converter is designed for base mounting only (in any orientation). Four 1/4-20 mounting holes should be provided in the aircraft in accordance with Figure 3.6. Secure the unit with four 1/4-20 pan head screws, or equivalent. A lock-washer under the head of each screw is recommended.



**Figure 3.6**  
**TC2000 Series Static Converter Outline Drawing**

### 3.5 INSTALLATION COMPLETION



Prior to operating the unit in the aircraft, it is recommended to verify the output and functionality of the unit. In order to prevent accidental damage to other systems, it is best not to attach the output to other equipment or power busses prior to verification. Verify the output of the unit at the terminating end of the cable with a multi-meter to ensure proper voltage and polarity. Once verified, installation can be completed and functionality of the remote on/off feature (if used) should be checked.

### 3.6 INSTALLATION CAUTION



Do not connect the output of the TC2000 Series Static Converter to the output of any other Converter or damage will result. Under no circumstance allow the output of the Converter to be connected to ground utility AC power or damage will result.

## SECTION 4 OPERATION

### 4.1 ELECTRICAL PERFORMANCE

The TC2000 Series Static Converter converts an alternating current (AC) voltage input to a regulated VDC output. See Table 4.1 specific output and input frequency.

Model	Input	Frequency	Output
TC2000	115 VAC	360-800 Hz	28 VDC

**Table 4.1**

#### **TC2000 Series Electrical Performance**

The unit is capable of providing 2000 watts to power a variety of aircraft accessories including lights and onboard systems.

### 4.2 PROTECTIVE FEATURES

#### 4.2.1 Remote On/Off

The TC2000 Series Static Converter incorporates a remote on/off feature that allows the user to enable or disable the output of the unit. By providing a ground on the appropriate pin (See Table 3.3) the user, via a remote mounted switch, can enable the output of the unit. The unit can be similarly disabled by removing the ground signal (open circuit) to the same pin.

#### 4.2.2 Over-Temperature

The TC2000 Series Static Converter incorporates an internal temperature sensing device that continually provides monitoring and feedback to the control circuits. When the unit senses an internal condition that exceeds maximum temperature ratings, the output is disabled and the internal cooling fans cease to operate. The unit output will be enabled when the temperature returns to within acceptable limits. This over-temperature reset occurs automatically without external intervention required.

#### 4.2.3 Short Circuit and Over-Current

The TC2000 Series Static Converter is capable of surviving a short circuit or over-current event without permanent damage or effect to long-term reliability. Under standard conditions, the unit can provide over its rated power output up to 2200 watts for over 5 minutes (until over-temperature shutdown occurs).

**SECTION 5 CONFORMANCE**

**5.1 INSTRUCTIONS FOR CONTINUED AIRWORTHINESS**

No periodic scheduled maintenance or calibration is necessary for continued airworthiness of the TC2000 Series Static Converter. If the unit fails to perform to specifications, the unit must be removed and serviced by Mid-Continent Instruments and Avionics or their authorized designee.

**5.2 ENVIRONMENTAL QUALIFICATION STATEMENT**

**MODEL NUMBER:** TC2000 **PART NUMBER:** 6432001-( )  
**DESCRIPTION:** Static Electrical Power Converter **CERTIFICATION:** FAA TSO-C71  
**MANUFACTURER:** True Blue Power, a division of Mid-Continent Instrument Co., Inc.  
**ADDRESS:** 9400 E. 34<sup>th</sup> St. North, Wichita, KS 67226, USA.  
**SPECIFICATION:** Test Specification (TS) 714 Test Data Sheet (TDS) 714  
**STANDARD:** RTCA DO-160, Rev G, dated 12/08/10

CONDITIONS	SECTION	DESCRIPTION OF TEST
Temperature and Altitude	4	Category C3
Temperature Variation	5	Category S2
Humidity	6	Category B
Operational Shock and Crash Safety	7	Category B
Vibration	8	Category R; Curve C, C1
Explosion	9	Category X
Waterproofness	10	Category X
Fluids	11	Category X
Sand and Dust	12	Category X
Fungus	13	Category X
Salt Spray	14	Category X
Magnetic Effect	15	Category A
Power Input	16	Category A(CF)
Voltage Spike	17	Category A
Audio Frequency Conducted Susceptibility	18	Category R(CF)
Induced Signal Susceptibility	19	Category X
Radio Frequency Susceptibility	20	Category X
Emission of Radio Frequency Energy	21	Category B
Lightning Induced Transient Susceptibility	22	Category X
Lightning Direct Effects	23	Category X
Icing	24	Category X
ESD	25	Category A
Flammability	26	Category X

Remarks:  
 Section 4: Category C3 with excursions as declared by the manufacturer:

- 4.5.1 Ground Survival and Short-Time Operating Low Temp: -55°C
- 4.5.3 Ground Survival and Short-Time Operating High Temp: +70°C
- 4.5.4 Operating High Temp: +70°C