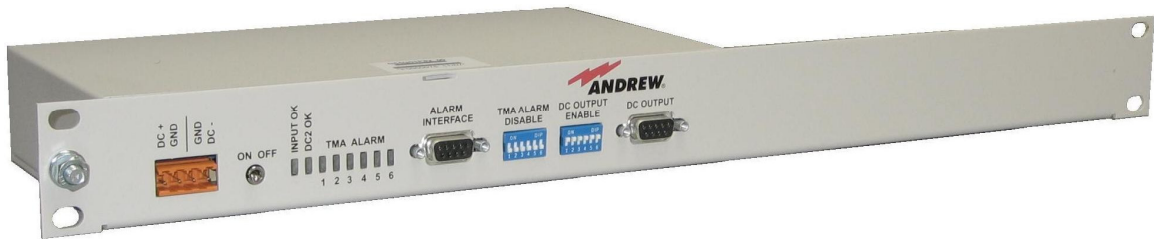




# Multimode Power Distribution Unit



## Installation and Operation User Guide

**24/5 Technical Support: (800) 279-8185 or +1 (703) 726-5556**



# Table of Contents

---

<b>1</b>	<b>INTRODUCTION</b> .....	<b>1</b>
1.1	Purpose and Intended User of this Manual.....	1
1.2	Scope.....	1
1.3	Glossary of Abbreviations.....	1
1.4	Reference Documents.....	1
<b>2</b>	<b>SAFETY</b> .....	<b>2</b>
2.1	Radio Frequency Radiation Hazard.....	2
2.2	High Current Hazard.....	2
2.3	Electrostatic Discharge (ESD).....	2
<b>3</b>	<b>SYSTEM INFORMATION</b> .....	<b>3</b>
3.1	Dual Band Systems.....	3
3.2	Single Band System.....	5
<b>4</b>	<b>PRODUCT DESCRIPTION</b> .....	<b>7</b>
4.1	General.....	7
4.2	Front Panel.....	7
4.3	Rear Panel.....	8
4.4	Power Cable.....	9
4.5	Alarm Cable.....	9
4.6	Bias Tee Harness.....	9
4.7	Rack Extender.....	10
<b>5</b>	<b>INSTALLATION</b> .....	<b>11</b>
5.1	Preparation.....	11
5.2	Tools and Supplies.....	11
5.3	Installation Procedure.....	11
5.4	Functional Test.....	15
<b>6</b>	<b>OPERATION</b> .....	<b>17</b>
6.1	Start-Up.....	17
6.2	Voltage Regulation.....	17
6.3	Current Monitoring.....	17
6.4	Short Circuit Protection.....	17
6.5	Alarm Indications.....	17
6.6	Resetting Alarms.....	18
6.7	Shut-Down.....	18
<b>7</b>	<b>TROUBLESHOOTING</b> .....	<b>19</b>
7.1	Instruments.....	19
7.2	Check Lists.....	19
7.3	Technical Support.....	20
	<b>APPENDIX A: TECHNICAL REFERENCE</b> .....	<b>21</b>
A.1	Functional Detail.....	21
A.2	Current Monitoring and Alarm.....	21
A.3	Alarm Interface.....	22
A.4	Connector Pin-Out.....	22
A.5	Mechanical Detail.....	23
	<b>APPENDIX B: PART NUMBER REFERENCE</b> .....	<b>24</b>
B.1	Identification.....	24
B.2	Part Number List.....	24
B.3	Model Numbers.....	25
	<b>APPENDIX C: MODE A &amp; MODE B OPERATION</b> .....	<b>26</b>
C.1	Description.....	26
C.2	Alarm Range Selector Setting.....	26
C.3	Operation.....	26

# Revision History

---

Revision	Date	Description of Changes
A	May 2007	Initial Release
B	Nov 2007	Updated System Information. Corrected description of LED indications and Alarm Interface operation in relation to DIP switch settings and DC Output condition. Clarified Alarm Cable connection. Added to Operation and Troubleshooting info. Updated Customer Technical Support info. Added Spare Parts to Appendix B. Added Appendix C. Other minor changes to layout and copy.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

# 1 INTRODUCTION

---

## 1.1 Purpose and Intended User of this Manual

This manual provides a complete description of the Multimode Power Distribution Unit (PDU) along with installation and operating instructions for its use in general purpose applications.

The intended user of this manual is an engineer or technician with adequate and specific experience in installing base transceiver station (BTS) and antenna line equipment such as base station antennas and tower mounted amplifiers (TMAs).

## 1.2 Scope

The manual covers the PDU and associated accessories, including Power Cable, Alarm Cable, Bias Tee Harness, and Rack Extender. See Appendix B for a complete parts list.

The user is encouraged to read the important information in the **Safety** section.

The **System Information** section covers a selection of TMA system configurations. The information is intended to familiarize the user with the application of the PDU together with other TMA system components.

In the **Product Description** section, the user is acquainted with the external features of the PDU and its accessories as they are identified and their functions described.

The **Installation** section provides all necessary information to correctly install and set up the PDU, and perform a functional test.

The **Operation** section is organized by the different functions and operating states. It provides the user with a general understanding of what the PDU does and how to perform various operations.

Should any problems occur with installation or operation, the user may find helpful information in the **Troubleshooting** section.

For the interested reader, more in-depth information about the design of the PDU has been placed in Appendix A.

Supplementary details on special purpose modes MODE A and MODE B are found in Appendix C. This information is not applicable to the general purpose use of the PDU that is the exclusive topic of the manual.

## 1.3 Glossary of Abbreviations

BTS	Base Transceiver Station
EAI	External Alarm Interface
OMC	Operations and Maintenance Center
PDU	Power Distribution Unit
TMA	Tower Mounted Amplifier

## 1.4 Reference Documents

PA-102050-EN      *Product Specifications: Multimode Power Distribution Unit*

## 2 SAFETY

All operations relating to the installation of the PDU must be executed in accordance with industry approved safety standards and practices. The installer shall also follow the safety practices recommended by the BTS provider to insure that the BTS operation is not compromised.

### 2.1 Radio Frequency Radiation Hazard

The BTS, antenna line equipment, and the antennas generate high frequency electric and magnetic fields when in operation. The high density energy can damage the eyes and certain tissues of the human body in persons exposed to radiation near the antenna.

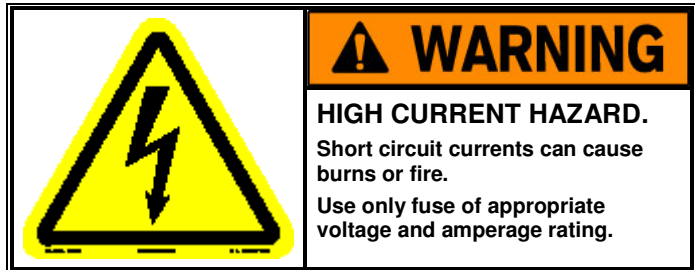
Shut down transmitters when work is performed on the transmitter antenna and antenna line equipment. Avoid remaining in the immediate vicinity of the antenna when the transmitter is in operation.



### 2.2 High Current Hazard

The BTS equipment contains circuits that generate high available short circuit currents. Unintentional short circuits can cause dangerous heating, fire, or equipment damage.

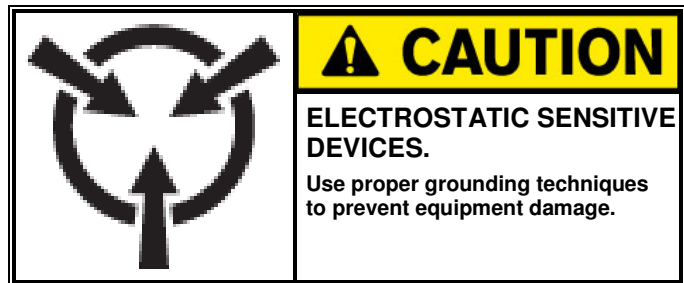
Turn off circuit breakers or remove fuses when work is performed on the power supply circuits. Install or replace fuses with appropriate voltage and amperage rating. Do not bypass or defeat overcurrent protection devices. Do not remove equipment covers.



### 2.3 Electrostatic Discharge (ESD)

ESD can damage the BTS equipment or the PDU during installation if proper precautions are not taken. The damage may cause an immediate failure of the device, or remain latent and lead to a failure some time in the future.

Discharge static build-up by touching the metal enclosure before making connections. Do not remove equipment covers.



### 3 SYSTEM INFORMATION

A typical TMA system consists of TMAs, Bias Tees, and PDU with accessories. For its function, the system also depends on the proper configuration of other antenna line equipment, including feeders and jumpers, surge arrestors, antennas, etc.

This section provides single sector illustrations of several RF path configuration examples. While frequency bands vary and variations can occur, the examples provide guidance for many common situations.

Contact your Andrew Corporation Sales Representative for recommendations on applicable system components.

#### 3.1 Dual Band Systems

##### 3.1.1 Conventional Diplexed TMA

Figure 1 shows a dual-band TMA system using shared feeders. Diplexers (crossband couplers) combine the bands at the BTS level. At the tower top, the TMA incorporates a diplexer at its BTS port.

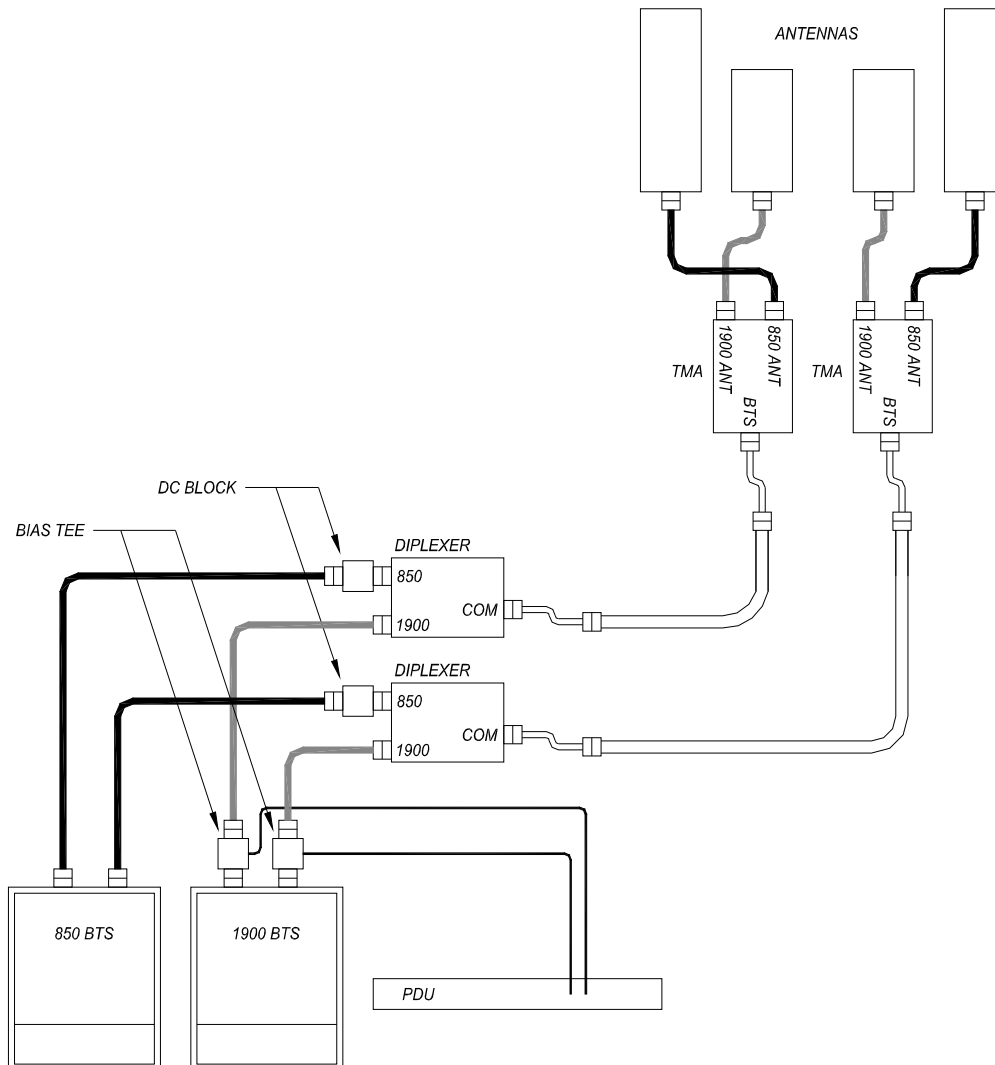


Figure 1: Conventional diplexed TMA system

Bias Tees are installed on the antenna ports of one of the base stations. The diplexers must pass DC through that branch. DC blocks must be present in the other branch, either integral to the diplexers or in external devices as shown.

### 3.1.2 OneBase™ Diplexed TMA

In Figure 2, dual-band, diplexed Andrew OneBase™ TMAs are used with shared feeders and shared antennas. OneBase™ diplexers at the BTS level incorporate DC redundancy circuitry, automatically routing the DC to the feeder and blocking the opposite branch.

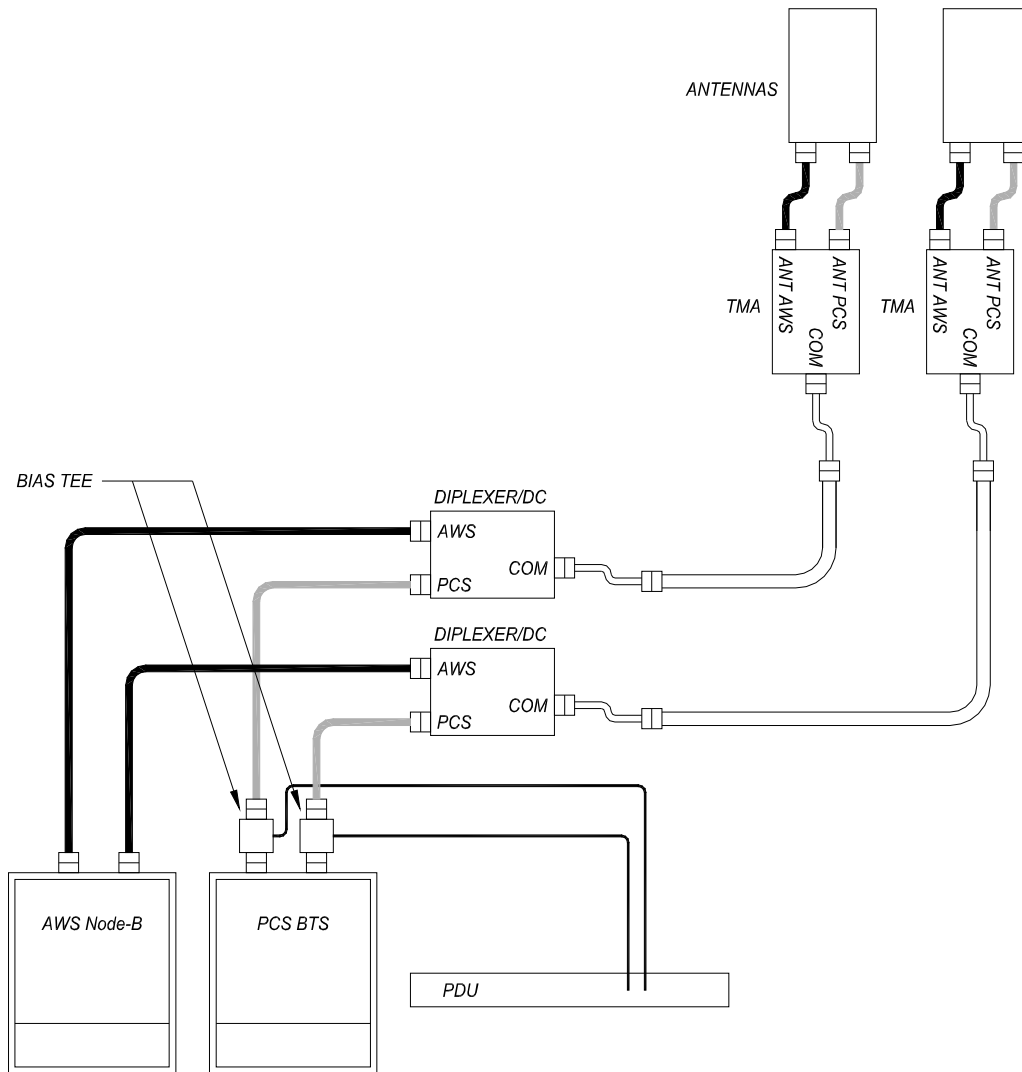


Figure 2: OneBase™ diplexed TMA system



### 3.1.3 OneBase™ Non-Diplexed TMA

Figure 3 shows a TMA system with Andrew OneBase™ TMAs and separate feeders for each band. The OneBase™ dual-band TMAs incorporate DC redundancy circuitry that allows DC supply for both bands to be provided to either BTS/Node-B port.

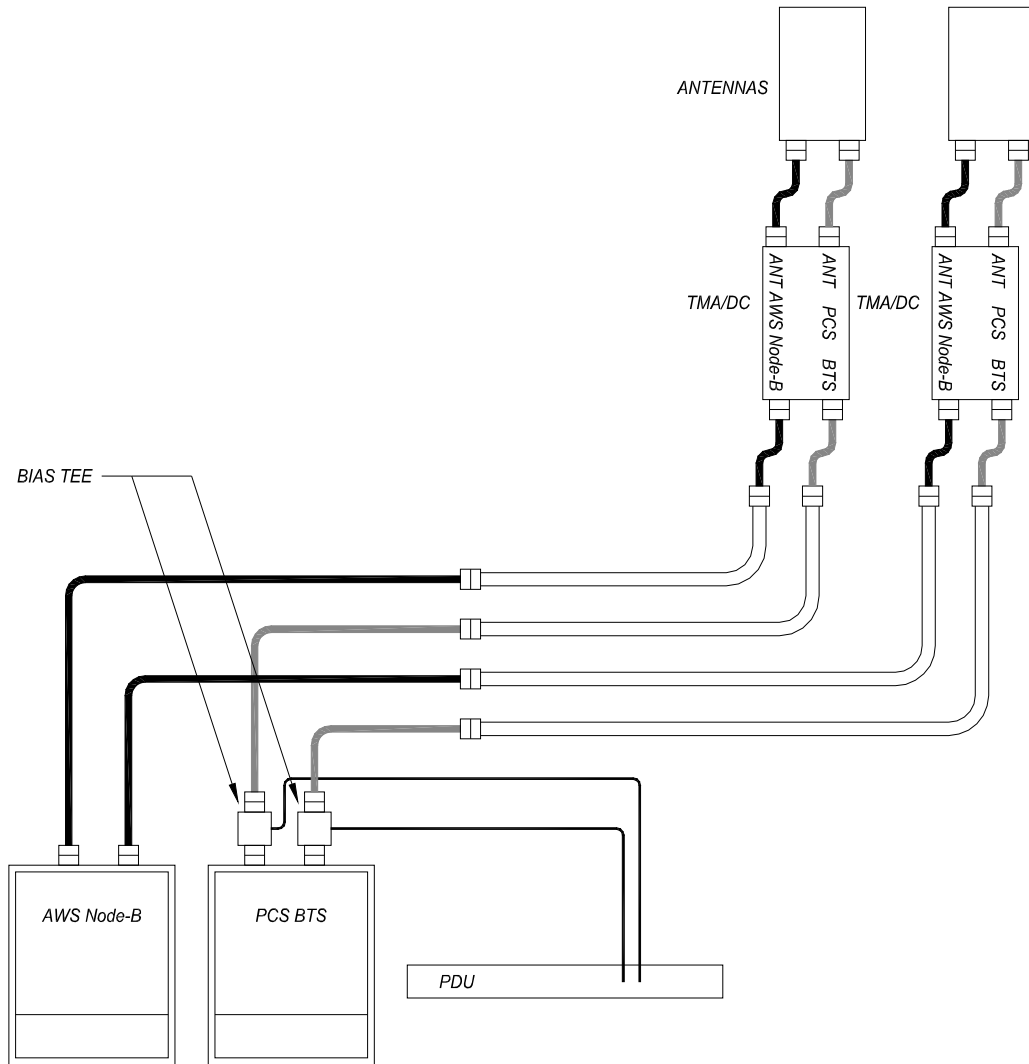


Figure 3: OneBase™ non-diplexed dual-band TMA system

## 3.2 Single Band System

A detailed connection diagram for a typical single-band TMA system is shown in Figure 4. The PDU receives DC input power from the BTS and outputs a summary alarm signal to the BTS. The Bias Tee Harness is connected from the PDU to up to six Bias Tees to provide +12 VDC power to the TMAs via the feeder cables. Embossed or engraved markings or labels are used to identify the ports of the Bias Tees and TMAs. All equipment should be properly grounded.

### 3.2.1 Twin Single Band TMA

Twin TMAs include two identical RF paths (main and diversity). Conventional twin TMAs require DC supply to both BTS ports, similar to two single TMAs. Andrew OneBase™ Twin TMAs incorporate DC redundancy circuitry. DC supply for both RF paths can be provided to either BTS/Node-B port.

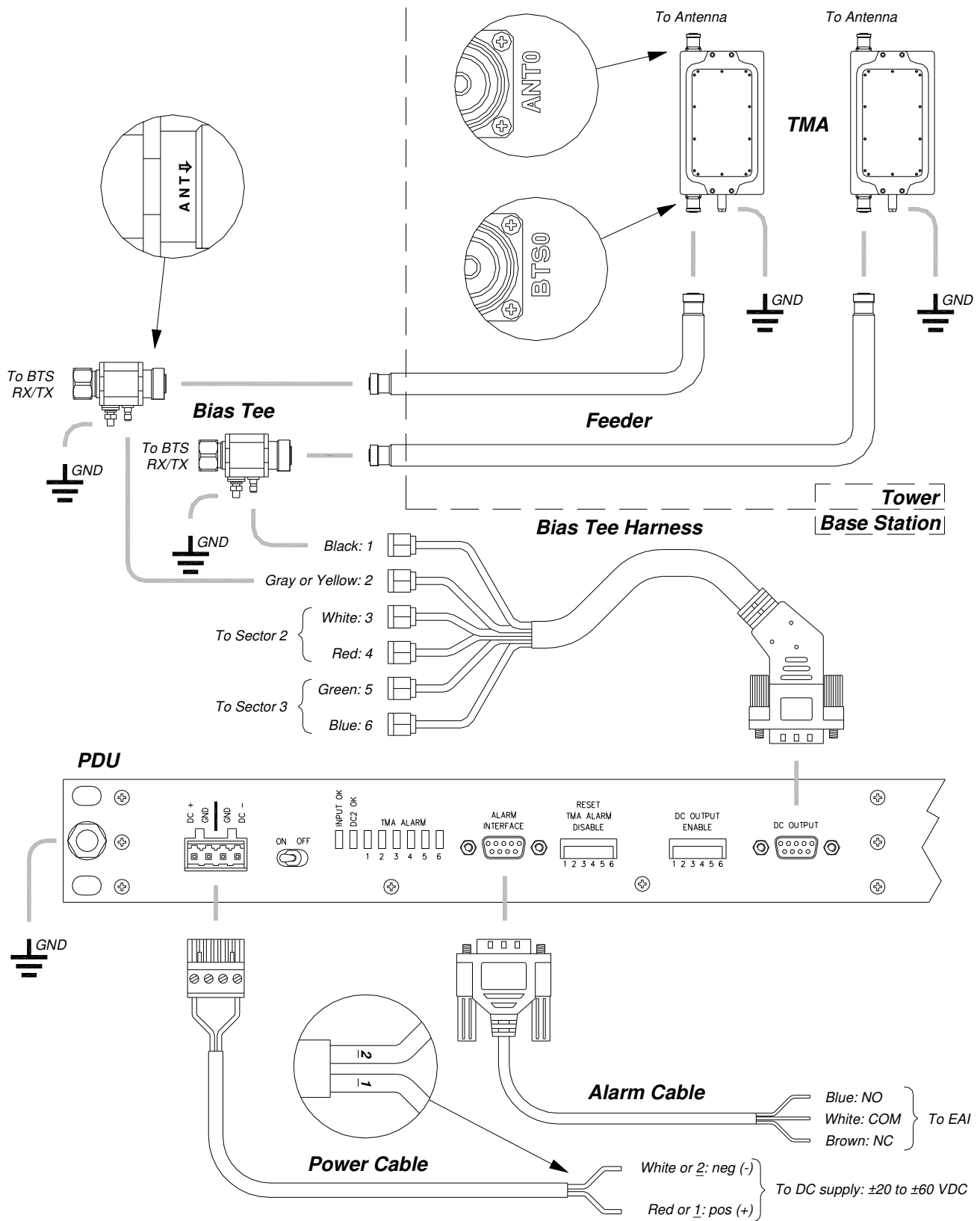


Figure 4: Single-band TMA system connection diagram

## 4 PRODUCT DESCRIPTION

### 4.1 General

The PDU provides DC power conversion, regulation, and distribution to power TMAs at a cell site. Each PDU can power up to six TMAs via six Bias Tees. Two different output current ranges are supported for compatibility with a variety of TMA types. A shunting block on the rear panel allows selection of the desired output current range.

The PDU monitors itself as well as each of the TMAs. The status of the PDU and each TMA output is displayed by a set of LED indicators on the front panel. Alarm conditions are indicated by the LEDs and also sent to the BTS EAI via the *Alarm Interface*.

The PDU is housed in a 1 rack unit tall, 19" rack mountable enclosure, designed for indoor installation. All connections are located on the front panel.

Supply power for the PDU is provided by the BTS. Positive or negative voltage in the range 20 – 60 VDC is accepted.

### 4.2 Front Panel

The front panel connections and controls are illustrated in Figure 5.

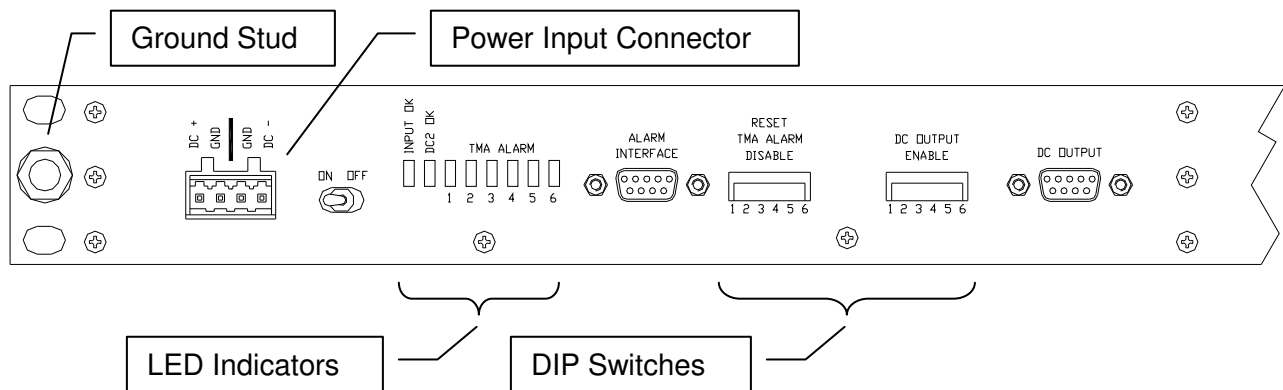


Figure 5: Front panel

#### 4.2.1 Ground Stud

A ground cable can be attached here and routed to the equipment ground point. The cable should be fitted with a 6mm (1/4") diameter ring terminal. A 10 mm wrench is used to tighten the connection securely.

#### 4.2.2 Power Input Connector

The Power Cable is connected here and routed to a supply point in the BTS providing 20 – 60 VDC, positive or negative supply. The supply voltage is connected to Pin 1 (at left) and pin 4 (at right), observing the polarity as marked on the panel. Pins 2 and 3 are not used. The Power Input is floating (insulated from ground) and reverse polarity protected.

#### 4.2.3 On/Off Switch

Controls the main power to the PDU. When power is turned off, delay timers and latched alarm indications are reset, and the *Alarm Interface* defaults to the ALARM state.

#### 4.2.4 Input OK LED

GREEN light indicates supply voltage is within specified range. DARK otherwise.

#### 4.2.5 DC 2 OK LED

GREEN light indicates internal voltage is within specified range. A DARK LED may indicate PDU malfunction or short circuits present at more than two outputs.

#### 4.2.6 TMA Alarm LEDs

GREEN light indicates voltage and current is within normal range for each output.

RED light indicates a fault condition, i.e., current is outside normal range (including when the output is disabled). The RED light is latched and the indication will persist until reset by the user.

A DARK LED indicates current monitoring is DISABLED.

#### 4.2.7 Alarm Interface Connector

The Alarm Cable is connected here and routed to the BTS EAI. A summary ALARM state is indicated if the PDU or any output is in a fault condition. The indication is automatically reset upon clearing the fault condition. With no supply power to the PDU, the default indication is the ALARM state. An insulated relay is used as the *Alarm Interface*.

#### 4.2.8 TMA Alarm DIP Switches

Flip down to ENABLE current monitoring for each output. Flip up to DISABLE. When DISABLED, the associated LED is DARK, a latched RED light is reset, and the *Alarm Interface* ignores the output.

#### 4.2.9 DC Output DIP Switches

Flip up to ENABLE and turn on voltage for each output. Flip down to DISABLE. When DISABLED, no voltage is present on the output. If current monitoring is ENABLED, the LED and *Alarm Interface* indicate a fault condition.

#### 4.2.10 DC Output Connector

The Bias Tee Harness is connected here and routed to up to six bias tees. Each of the six outputs is individually monitored and protected. Nominal voltage is +12 VDC.

### 4.3 Rear Panel

The rear panel control is illustrated in Figure 6.



Figure 6: Rear panel

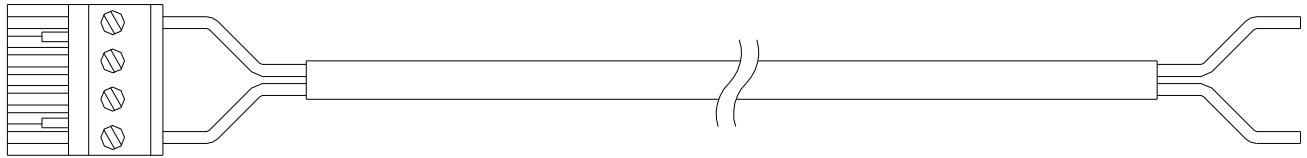
#### 4.3.1 Alarm Range Selector

With power switched off, a shunting block is positioned as shown to select LO CURRENT or HI CURRENT mode according to the type of TMA used. The factory default setting is LO CURRENT mode.

#### 4.4 Power Cable

The Power Cable is illustrated in Figure 7. Two color-coded or number-coded 18 – 24 AWG wires in a common jacket are attached to a pluggable terminal block on one end for connection to the PDU. The opposite end is unterminated.

Power Cables are available in a selection of lengths and can be trimmed to the desired length on site.

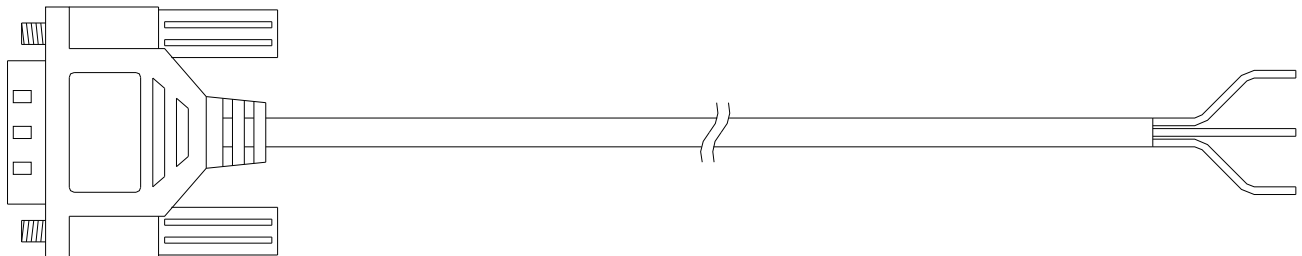


**Figure 7: Power Cable**

#### 4.5 Alarm Cable

The Alarm Cable is illustrated in Figure 8. Three color-coded 24 AWG wires in a common jacket are attached to a D-sub plug on one end for connection to the PDU. The opposite end is unterminated.

Alarm Cables are available in a selection of lengths and can be trimmed to the desired length on site.

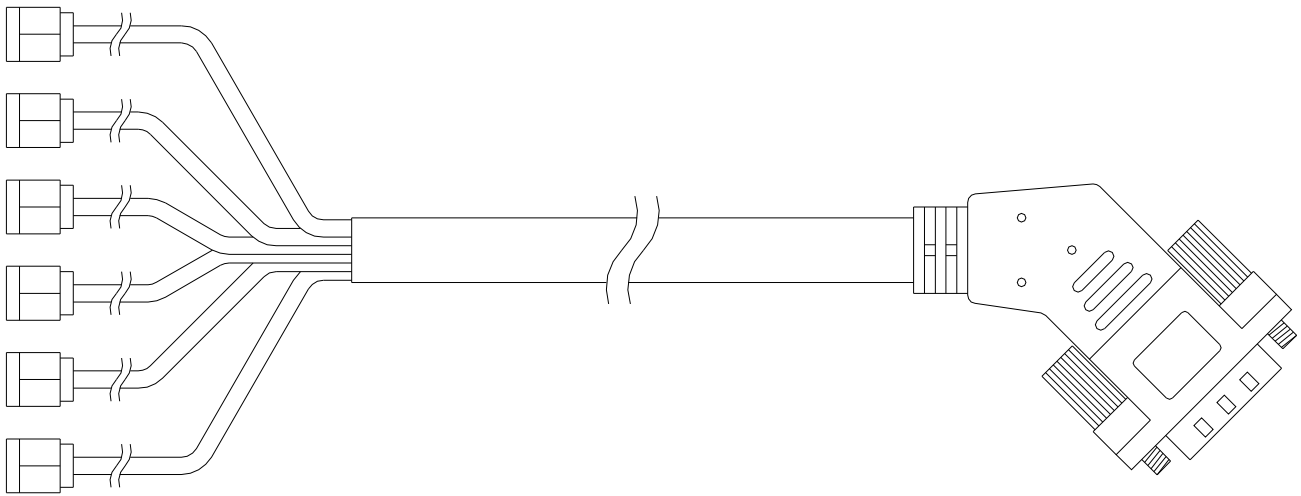


**Figure 8: Alarm Cable**

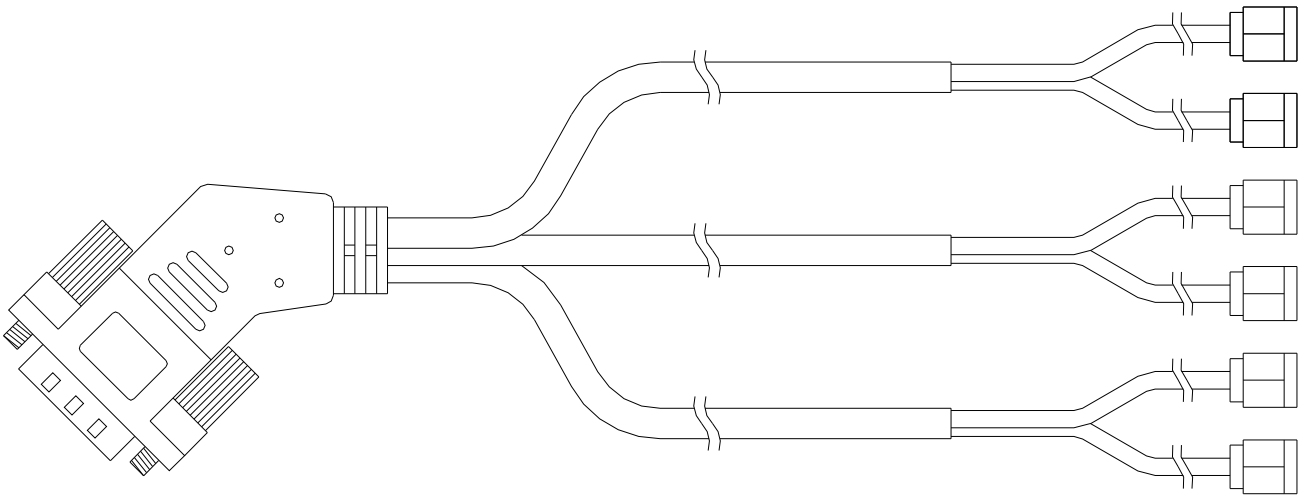
#### 4.6 Bias Tee Harness

Bias Tee Harnesses are available in two styles. The standard style is illustrated in Figure 9 and has six RG174 coaxial cables in a common jacket. The sector-split style (Figure 10) features three jackets, each with two cables. A single D-sub plug connects to the PDU while the opposite end splits to six SMA-male connectors to mate with Bias Tees. Individual cables are color-coded and may also be numbered 1-6, matching the numbered PDU outputs:

Bias Tee Harnesses are available in a selection of lengths.



**Figure 9: Standard Bias Tee Harness**



**Figure 10: Sector-split Bias Tee Harness**

#### 4.7 Rack Extender

A Rack Extender (see Figure 11) is used when installing the PDU in a standard EIA 23" rack. The extender plate is attached to the left or right side of the PDU using the enclosed hardware.



**Figure 11: Rack Extender**

## 5 INSTALLATION

### 5.1 Preparation

Select the installation location. The PDU installs in a standard 19" rack (or 23" rack using a Rack Extender) in a climate controlled environment. It can be mounted in any orientation. Ensure optimum airflow around the instrument for cool operation and maximum life expectancy.

Inspect the equipment. Ensure that all items are present, of the correct description, and without evident damage.

Locate connection points for supply power, alarm interface, and Bias Tees. Determine the routing of cables. Verify that the supplied cables are sufficient to reach these points. If not, relocate the PDU or obtain cables of alternate length or style.

### 5.2 Tools and Supplies

The following tools and supplies may be required to complete the installation:

- Rack screws and screwdriver
- Needle-nose pliers (if repositioning the *Alarm Range Selector*)
- Ground cable with terminals, fasteners, wrench (10 mm), and other required tools
- Terminals for Power and Alarm Cables, wire stripper, and other required tools
- Fuse or circuit breaker for BTS power panel (1 – 5 A recommended)
- Torque wrench, 7 – 10 in-lbs (0.8 – 1.1 Nm), 8 mm or 5/16"
- Weather-sealing materials (for Bias Tee connections if outdoors)
- Cable ties and marking materials

### 5.3 Installation Procedure

#### 5.3.1 Select Alarm Range

Determine the applicable alarm current range based on the type of TMA used. See the table below for supported TMA current consumption ranges.

Mode	Normal Range	Alarm Range
LO Current	23 – 158 mA	<17 mA or >168 mA
HI Current	180 – 301 mA	<170 mA or >323 mA

Verify that the shunting block is correctly positioned in the *Alarm Range Selector* on the rear panel of the PDU (Figure 12). To reposition, pull out the shunting block using needle-nose pliers and reinsert it in the desired position.

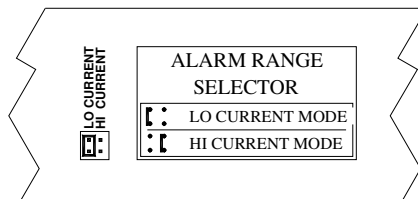


Figure 12: Alarm Range Selector

### 5.3.2 Attach Rack Extender (optional)

If installing the PDU in a 23" rack, first attach the Rack Extender to either side of the PDU using the included hardware. Tighten the fasteners securely.

### 5.3.3 Install PDU

Mount the PDU in the rack using four suitable rack screws (not included). Tighten securely.

### 5.3.4 Attach Ground Cable

The addition of a ground cable is recommended but may not be necessary in some installations. Using insulated copper wire in the AWG 5 – 10 (5 – 16 mm<sup>2</sup>) range, crimp a 6 mm (1/4") ring terminal to one end and attach to the PDU *Ground* stud (Figure 13). Tighten the nut to 6 Nm (4.5 ft-lbs) torque using a 10 mm wrench. Avoiding sharp bends, route the ground cable to the common frame or ground bar. Trim, and attach with suitable terminal and hardware.

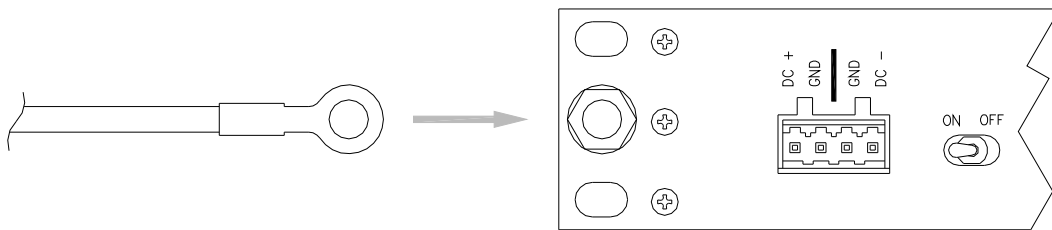


Figure 13: Ground cable attachment

### 5.3.5 Connect Power Cable

Make sure that the *On/Off* switch on the PDU is in the OFF position. Connect the Power Cable to the *Power Input* connector, pushing the connector firmly until it snaps in place. See Figure 14.

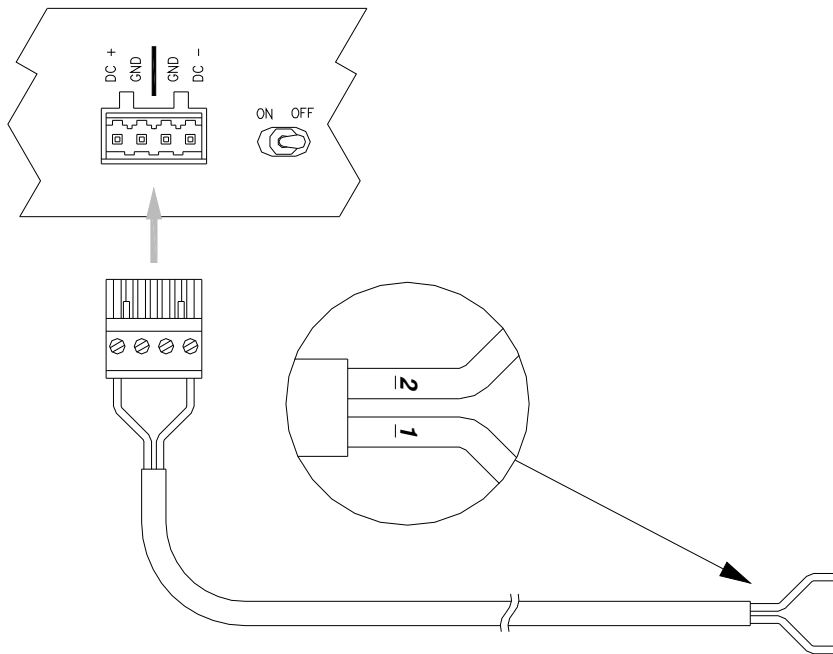


Figure 14: Power Cable connection

Route the Power Cable to the BTS power panel, trim, and attach with suitable terminals and hardware. Observe the color or number markings on the two wires as shown in the table below to determine correct polarity.

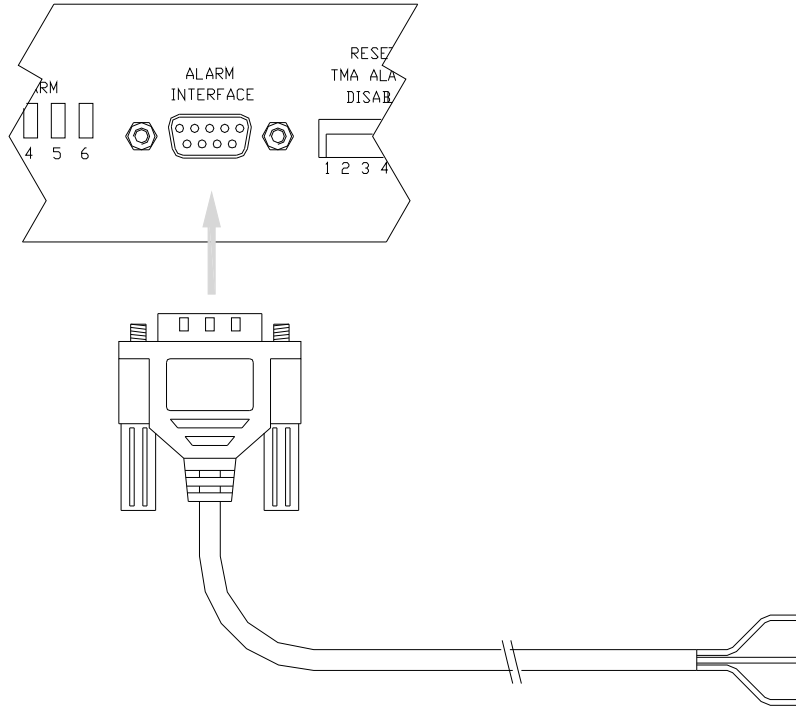


Color	Number	Connection (pos. supply)	Connection (neg. supply)
Red	1	Positive (+20 to +60 VDC)	Ground return
White	2	Ground return	Negative (-20 to -60 VDC)

Use a dedicated circuit for the PDU if the BTS power panel is so equipped. Install a fuse or circuit breaker with a rating in the 1-5 A range.

### 5.3.6 Connect Alarm Cable

Connect the Alarm Cable to the *Alarm Interface* connector and tighten the jackscrews (Figure 15).



**Figure 15: Alarm Cable connection**

Choose which relay terminals to use. Using the NO relay terminal is recommended because an alarm indication will be obtained also in case the Alarm Cable becomes disconnected. The BTS External Alarm Interface (EAI) should then be programmed to expect a closed circuit and to indicate alarm when an open circuit occurs. Connection to the EAI is made with the NO and COM wires of the Alarm Cable.

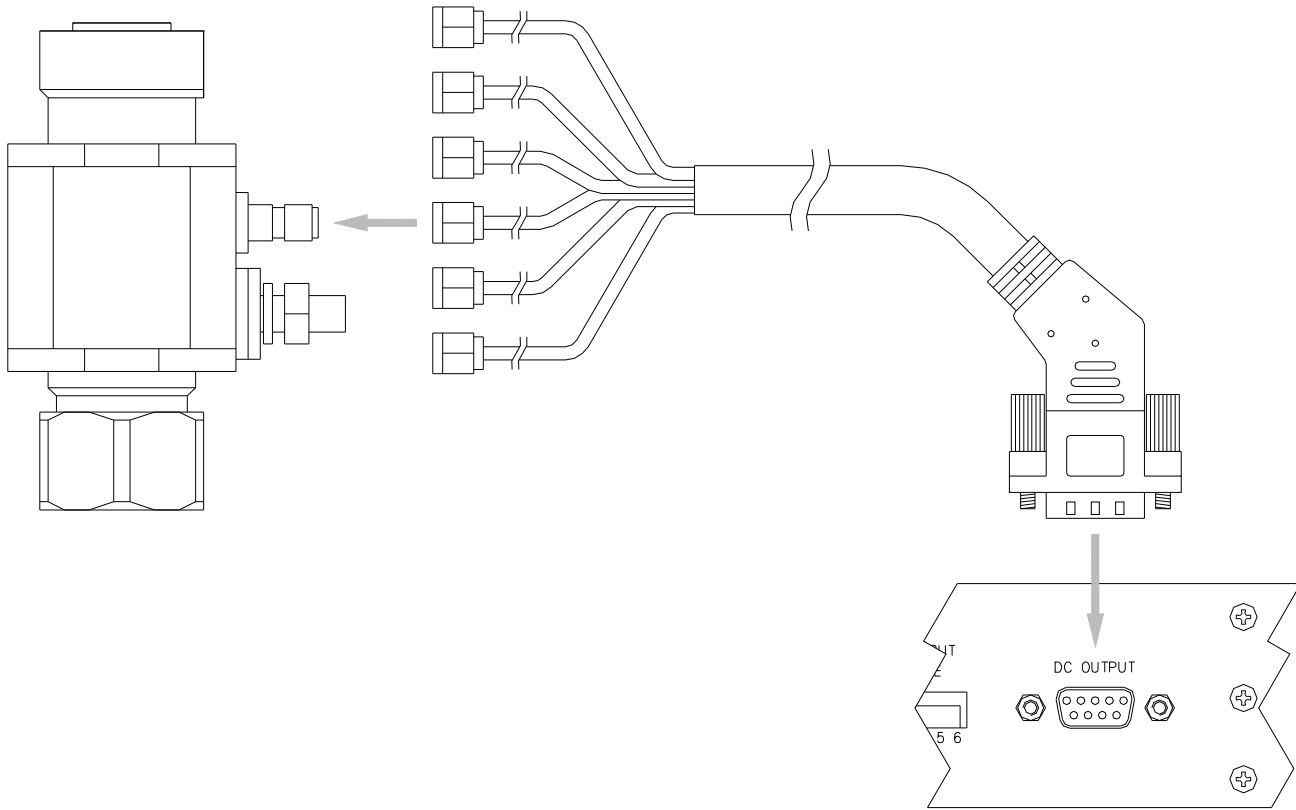
If the EAI expects an open circuit, use instead the NC and COM wires. The circuit will then close in the ALARM condition. Refer to the table below for the color coding of the Alarm Cable.

Color	Relay Terminal	No Alarm	Alarm
White	COM	Common return	Common return
Brown	NC	Open	Closed to COM
Blue	NO	Closed to COM	Open

Route the Alarm Cable to the EAI, trim, and attach with suitable terminals and hardware. Insulate and tie off the unused wire.

### 5.3.7 Connect Bias Tee Harness

Connect the Bias Tee Harness to the *DC Output* connector and tighten the jackscrews (Figure 16).



**Figure 16: Bias Tee Harness connection**

Route the Bias Tee Harness to the Bias Tees, attach the SMA connectors and tighten to 0.8 – 1.1 Nm (7 – 10 in-lbs) torque using an 8 mm (5/16”) wrench. Refer to the table below for color coding of the cables.

If TMA installation is not complete, leave the SMA connectors unattached until a Functional Test per Section 5.4 has been successfully completed.

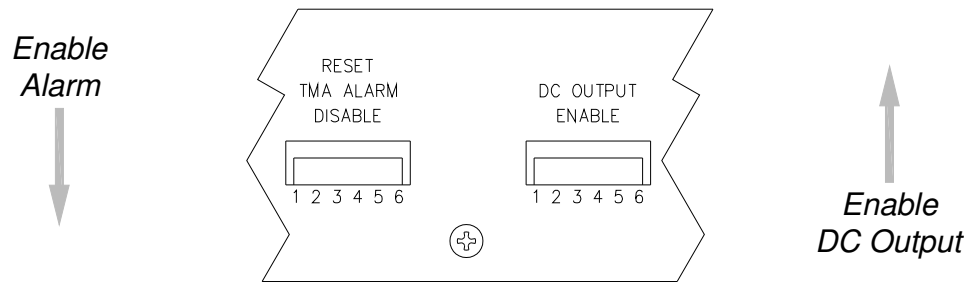
Color	DC Output #	Sector # (Split Style Harness)
Black	1	Sector 1
Gray or Yellow	2	
White	3	Sector 2
Red	4	
Green	5	Sector 3
Blue	6	

Weather-seal the SMA connections if the Bias Tees are in an unprotected location. Coil and stow any excess harness length. Do not attempt to cut or trim the Bias Tee Harness.

### 5.3.8 Set DIP Switches

If fewer than six outputs are used to supply TMAs, first determine which outputs are in use by observing the colors of the individual cables in the Bias Tee Harness.

For all outputs in use, set the *DC Output* DIP switches to ENABLE (up) and the *TMA Alarm* DIP switches to ENABLE (down). See Figure 17. For any unused outputs, set the corresponding *DC Output* and *TMA Alarm* DIP switches to DISABLE.



**Figure 17: TMA Alarm and DC Output DIP switches**

### 5.3.9 Finish

Check all connections and settings to ensure they are correct and secure. After passing the Functional Test (see Section 5.4), dress and tie the cables making sure they are not exposed to excess strain, crush, abrasion, heat, or accidental damage.

## 5.4 Functional Test

After completing the installation procedure, verify the installation by performing these tests. The Functional Test can be done also prior to installing TMAs and/or Bias Tees.

### 5.4.1 Check TMA System

The PDU will be fully functional only once all parts of the TMA system are installed and all connections made (complete system). To check the PDU installation before TMAs and/or Bias Tees are installed (incomplete system), ensure the Bias Tee Harness SMA connectors are left unattached during the Functional Test.

### 5.4.2 Perform Test – Complete System

Turn the PDU ON. Verify the following front panel indications:

- *Input OK* LED stays GREEN
- *DC2 OK* LED stays GREEN
- For all outputs where *DC Output* DIP switches are ENABLED and *TMA Alarm* DIP switches are ENABLED, the *TMA Alarm* LED stays GREEN.
- For all outputs where *TMA Alarm* DIP switches are DISABLED, the *TMA Alarm* LED stays DARK.
- The *Alarm Interface* relay indicates NO ALARM.
- Disconnect the Bias Tee Harness from the PDU.
- For all outputs where *DC Output* DIP switches are ENABLED and *TMA Alarm* DIP switches are ENABLED, the *TMA Alarm* LED turns RED in 5 s.
- The *Alarm Interface* relay indicates ALARM.
- Turn the PDU OFF.
- Reconnect the Bias Tee Harness.

### 5.4.3 Perform Test – Incomplete System

Turn the PDU ON. Verify the following indications:

- *Input OK* LED stays GREEN
- *DC2 OK* LED stays GREEN

- For all outputs where *DC Output* DIP switches are ENABLED and *TMA Alarm* DIP switches are ENABLED, the *TMA Alarm* LED is initially GREEN and turns RED in 5 s.
- For all outputs where *TMA Alarm* DIP switches are DISABLED, the *TMA Alarm* LED stays DARK.
- Ensure at least one *TMA Alarm* DIP switch is ENABLED and a *TMA Alarm* LED is lit RED.
- The *Alarm Interface* relay indicates ALARM.
- Flip all *TMA Alarm* DIP switches up to DISABLE.
- The *Alarm Interface* relay indicates NO ALARM.
- Restore all *TMA Alarm* DIP switches to their designated positions.
- Turn the PDU OFF.

#### **5.4.4 Evaluate**

If the Functional Test was passed, proceed to finish the installation per Section 5.3.9. If any problems were encountered, troubleshoot (see Section 7), and then redo the test.

## 6 OPERATION

---

Before operating, ensure all parts of the TMA system are installed and all connections completed. Also refer to instructions provided with other equipment.

### 6.1 Start-Up

Turn the PDU ON. Verify that all front panel LEDs stay GREEN. Only LEDs for outputs with *TMA Alarm* DISABLED shall be DARK. Observe the indications for 60 s to ensure they remain unchanged. The TMA system is now operating. No further action is needed.

If short circuit conditions are present on outputs, the PDU may fail to start up. This is more likely to occur with supply voltage in the lower part of the 20 – 60 VDC range. When failing, the PDU will repeat the start-up sequence indefinitely, visible as the front panel LEDs keep flashing on and off. Troubleshoot and correct the short circuit conditions per Section 7.

### 6.2 Voltage Regulation

The PDU provides six independent regulated-voltage outputs. The nominal output voltage is +12 VDC with minimal variation across the operating temperature range and output currents up to 400 mA per output (2.2 A total maximum, all outputs).

### 6.3 Current Monitoring

Output current is individually monitored for each output. Normal current is any current within the range determined by the setting of the *Alarm Range Selector*. Current below or above this range is considered a fault and will result in alarm indication.

### 6.4 Short Circuit Protection

Each TMA output is individually protected from over-current and short circuit conditions. Current in excess of 400 mA on any output will cause the output to go into SHORT CIRCUIT PROTECTION state. The output voltage is then turned off, the *TMA Alarm* LED turns RED, and the *Alarm Interface* goes into the ALARM state. After a brief interval, the PDU will attempt to re-apply the output voltage. Periodic attempts will continue until the over-current condition is cleared. At that time, the output automatically resumes operation and the *Alarm Interface* goes into the NO ALARM state. The *TMA Alarm* LED remains RED until reset by the user.

Up to two outputs can be in the SHORT CIRCUIT PROTECTION state while remaining outputs continue operating. If more than two outputs experience simultaneous over-current conditions, DC/DC converter protection may be activated, affecting the operation of all outputs.

### 6.5 Alarm Indications

#### 6.5.1 Supply Voltage

The supply voltage is internally monitored. Voltage outside the acceptable range will result in the *Input OK* LED turning DARK and the *Alarm Interface* going into the ALARM state. The indications will clear once the problem is corrected.

#### 6.5.2 DC/DC Converter

The operation of the internal DC/DC converter is monitored. Malfunction, overload, or other problem will result in the *DC2 OK* LED turning DARK and the *Alarm Interface* going into the ALARM state. The

indications will clear once the problem is corrected.

### **6.5.3 Output Current**

Each output is individually monitored. With associated *TMA Alarm* DIP switch ENABLED, current consumption outside the selected range is considered a fault condition. Once a persistent fault condition has existed on the same output for 5 s, the associated *TMA Alarm* LED turns RED and the *Alarm Interface* goes into the ALARM state. The *Alarm Interface* will return to the NO ALARM state after 1 s once the problem is corrected. As a means to facilitate troubleshooting of intermittent problems, the *TMA Alarm* LED will be latched and remain RED until reset by the user.

An output with its *DC Output* DIP switch DISABLED will supply no current. With the associated *TMA Alarm* DIP switch ENABLED, this is a fault condition resulting in alarm indication.

While the *Alarm Interface* is in the ALARM state, any additional fault conditions will be immediately indicated by the LEDs without a 5 s delay.

### **6.5.4 Alarm Interface**

The *Alarm Interface* relay has two states. In the NO ALARM state, the relay is energized and indicates trouble-free operation. The ALARM state (de-energized relay) is entered to indicate the presence of any fault condition. A fault condition on a TMA output is ignored when the associated *TMA Alarm* DIP switch is set to DISABLE. When the PDU is turned off, the *Alarm Interface* defaults to the ALARM state.

## **6.6 Resetting Alarms**

### **6.6.1 TMA Output Alarms**

To reset a TMA output alarm indicated by a RED *TMA Alarm* LED, flip the associated *TMA Alarm* DIP switch up to DISABLE. The LED will turn DARK. Flip the switch down to re-ENABLE current monitoring. If a fault is present, the LED will again turn RED.

### **6.6.2 All Alarms**

Turn the PDU OFF to reset all alarms. After turning back ON, any present or recurring fault will re-activate alarm indications.

## **6.7 Shut-Down**

Turn the PDU OFF. All alarms and delays are reset. The *Alarm Interface* defaults to the ALARM state.

## 7 TROUBLESHOOTING

---

Because the PDU supplies and monitors the entire TMA system, all system components should be considered when troubleshooting. The TMA system can include TMA, Bias Tee, surge arrester, diplexer (crossband coupler), and other devices in addition to RF and DC cables and connectors as well as the PDU itself.

### 7.1 Instruments

#### 7.1.1 Multimeter

A digital instrument is preferred, capable of measuring DC voltage, current, and resistance. When measuring current, use an unfused high-current input if a short circuit is suspected. For more accurate current consumption measurement, use a low-current input and suitable measuring range.

#### 7.1.2 RF Sweeper

A frequency-sweep instrument incorporating detector and tracking generator should be able to display return loss or VSWR at the operating frequencies of the TMA system. Always calibrate before measuring for best accuracy. Use Distance-to-Fault (DTF) measurement judiciously as results can be difficult to interpret due to the bandwidth limitation of the TMA.

### 7.2 Check Lists

Problems occurring the first time the TMA system is operated are often due to installation errors and oversights. Be sure to check all RF and DC connections, switch and shunting block settings. The check lists in this section may be helpful.

#### 7.2.1 TMA

- Check labeled or embossed port designators to ensure the BTS/Node-B port is connected to the feeder and the ANT port to the antenna.
- Some TMAs with more than one BTS/Node-B port accept DC supply on specific port(s) only.
- Tower-top jumpers may be mislabeled or cross-connected.
- Verify operating bands of TMA and antenna if high VSWR appears.
- Uplink band VSWR may be degraded if the TMA is measured without DC supply.
- The TMA, when detecting a malfunction in its circuitry, will raise or lower its current consumption to a value outside the PDU normal current range in order to report the TMA fault. This will lead to an alarm indication from the PDU.
- A TMA equipped with VSWR detector will report a fault when the measured VSWR exceeds the programmed limit. The VSWR detector requires TX power for its operation. Therefore, this type of fault indication will clear if all transmitters in that RF path are turned off.
- RF and DC operation of the TMA can be verified on the ground using a short jumper and known good termination load as needed.

#### 7.2.2 Bias Tee

- The Bias Tee ANT port must be connected in the direction of the tower feeder, not the base station. Connector genders vary by model.
- Ensure the Bias Tee is installed on the same feeder as the TMA.
- Verify that any Surge Arrester in the path between the Bias Tee and TMA is only of the DC passing type.
- Ensure there are no other devices in the path that inject, block, or shunt DC voltage.
- Verify the Bias Tee operating band if high VSWR appears.

### 7.2.3 Diplexer

If DC passes through a diplexer (crossband coupler) at the base or tower top:

- Ensure the device is designed to pass DC through the intended branch and in the intended direction.
- Ensure that (external or internal) DC blocking is present in the other branch(es).
- Do not attempt to supply DC from multiple sources to the same feeder.
- Verify operating bands of each branch if VSWR problems are encountered.

### 7.2.4 PDU

- Remember to reset alarms after changing any connections.
- Ensure all connectors are firmly engaged and secured.
- Check DIP switch settings. Cycle the switches to make sure they are fully positioned in the desired direction. Ensure no debris is obstructing travel of the levers.
- Review marking and color coding of the Bias Tee Harness, especially where not all outputs are used.
- Review color coding of the Alarm Cable and the logic of the *Alarm Interface* and EAI.
- Ensure the *Alarm Range Selector* is correctly set for the type of TMA used.
- DISABLE all outputs and alarms. Turn the PDU ON, then ENABLE one output/alarm at a time to locate offending outputs.
- If all front panel LEDs keep flashing on and off as the PDU is turned ON, this indicates failure to start up due to multiple short circuits on outputs. DISABLE all outputs to allow the PDU to start up normally and then proceed with steps above.

## 7.3 Technical Support

Technical support is available 24 hours a day, five days a week through the Andrew Customer Technical Support center (CTS). Between the hours of 11 pm Friday and 8 am Monday, immediate support is available for any critical issue causing a service outage while other support requests will be scheduled for the next business day.

Support Engineers provide guidance for installation and operation issues as well as interactive help with troubleshooting. They can also assist with returning and replacing defective equipment. Contact CTS by phone at the following numbers:

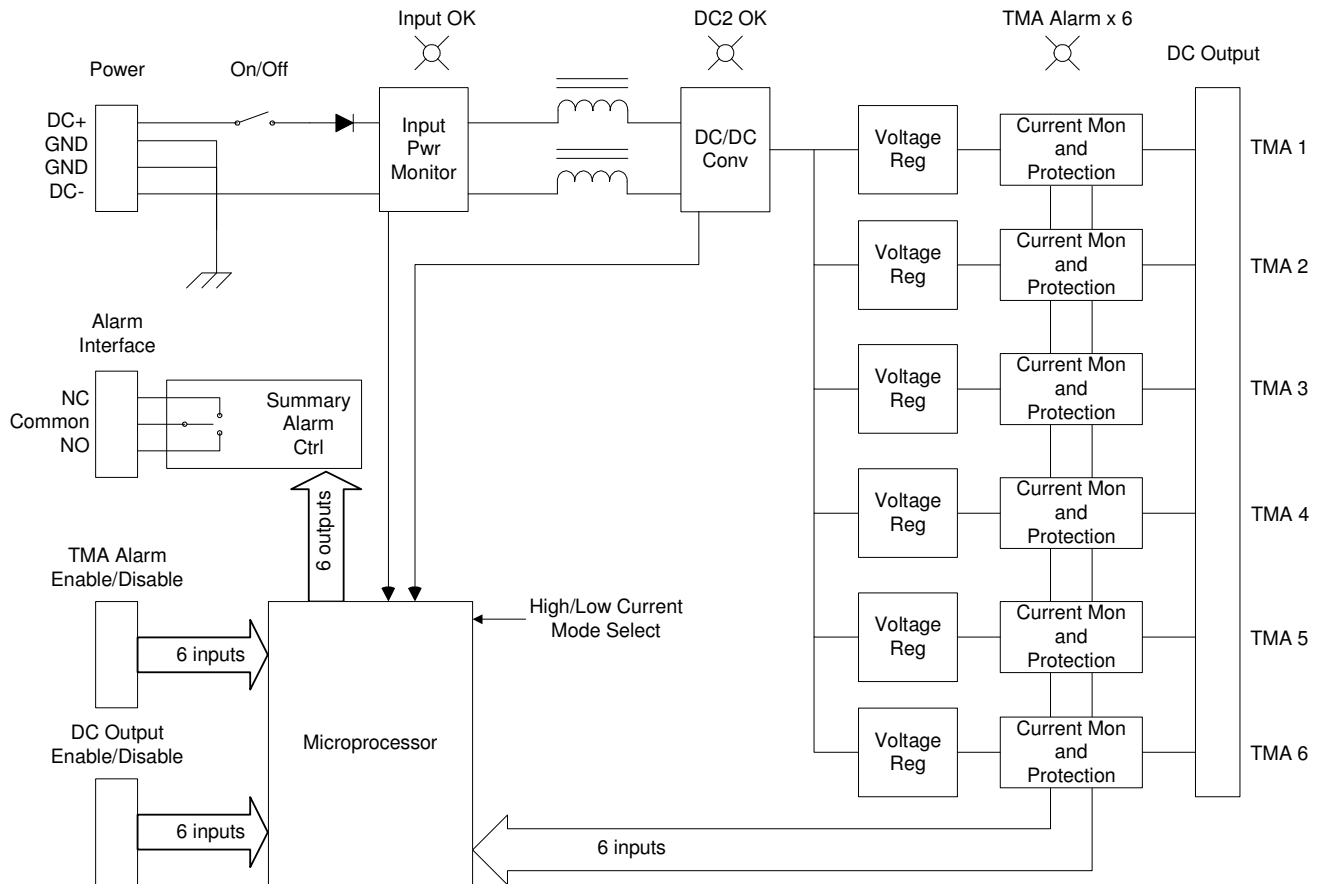
**24/5 Technical Support:  
(800) 279-8185 (North America)  
+1 (703) 726-5556 (International)**



# APPENDIX A: TECHNICAL REFERENCE

## A.1 Functional Detail

A functional block diagram of the PDU is shown in Figure A-1.



**Figure A-1: PDU Block Diagram**

The input DC voltage (20 – 60 VDC) is converted to an intermediate voltage level by the DC/DC converter. The intermediate voltage bus is then split into 6 output channels. Each channel is individually regulated down to +12 VDC. A current monitoring circuit at the output of each voltage regulator provides TMA alarm monitoring and short circuit protection. Each output can be individually enabled or disabled.

The TMA alarm lines are OR-ed together to form a summary alarm signal which is presented for monitoring by the BTS.

High/Low current alarm range can be selected by a shunting block to match the current consumption of the TMA.

All inputs and outputs are protected from surges and electrostatic discharge.

## A.2 Current Monitoring and Alarm

The PDU measures the current delivered from each output and compares it to a programmed normal range of current consumption which depends on the selected mode. The Multimode PDU supports multiple modes selectable by the *Alarm Range Selector*.

Current consumption below or above the normal range will result in alarm if alarming is enabled.

Andrew TMAs are equipped with internal fault monitoring and will raise or lower their current consumption as a means to signal a fault condition to the PDU. Abnormal current consumption can also result from other problems in the DC path from PDU to TMA.

The table below summarizes the behavior of the PDU in the LO CURRENT and HI CURRENT modes:

Output Current	LO Current Mode (mA)	HI Current Mode (mA)	Alarm LED <sup>1</sup>	DC Output	Alarm Interface <sup>1</sup>
Disabled	0	0	Red	Off	Alarm
Below range	<17	<170	Red	On	Alarm
Normal range	23 - 158	180 - 301	Green <sup>2</sup>	On	No Alarm
Above range	>168	>323	Red	On	Alarm
Short circuit	>400	>400	Red	SCP <sup>3</sup>	Alarm

<sup>1</sup> Applies when the *TMA Alarm* DIP switch is ENABLED.

<sup>2</sup> If an alarm has previously occurred, the *TMA Alarm* LED will be latched RED until reset by the user.

<sup>3</sup> SHORT CIRCUIT PROTECTION state (see below).

Beginning with revision 02, the PDU also supports special purpose modes MODE A and MODE B. Refer to Appendix C for further information.

When in the SHORT CIRCUIT PROTECTION state, the *DC Output* is turned off. At intervals of 200 ms, the output is turned on in attempts to recover. If the short circuit condition persists, the output is immediately turned off again. Output duty cycle in the SHORT CIRCUIT PROTECTION state is 10%. In the event the short circuit condition clears, the output will stay on following the next recovery attempt.

### A.3 Alarm Interface

The *Alarm Interface* is a form C, insulated dry contact relay. It is energized in the NO ALARM state and therefore defaults to the ALARM state in the event the PDU loses supply voltage. Figure A-2 shows the relay connections and terminal designators.

Maximum current rating is 1 A at 24 VDC or 0.5 A at 120 VAC.

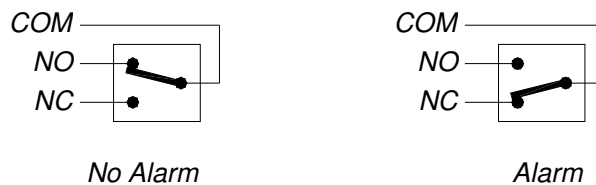


Figure A-2: Alarm Interface relay

### A.4 Connector Pin-Out

Pin-out for the *Alarm Interface* and *DC Output* connectors are shown in Figure A-3 and table below.

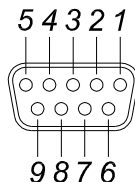
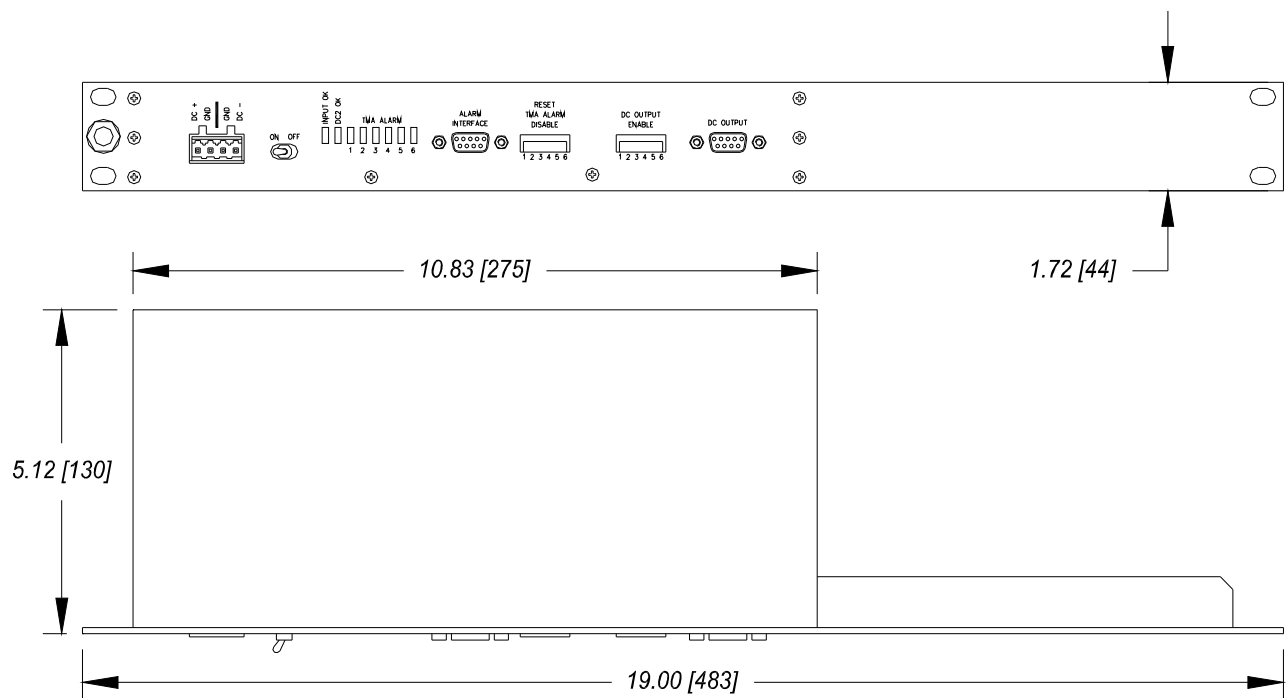


Figure A-3: Connector pin-out

Pin	Alarm Interface	DC Output
1	COM	TMA 1+
2	NC	TMA 2+
3	NO	TMA 3+
4	—	TMA 4+
5	—	TMA 5+
6	—	TMA 6+
7	—	GND
8	—	GND
9	—	—

### A.5 Mechanical Detail

PDU dimensions are shown in Figure A-4. The weight of the PDU without accessories is 1.1 kg.



**Figure A-4: Mechanical dimensions, in (mm)**

## APPENDIX B: PART NUMBER REFERENCE

### B.1 Identification

The PDU and its accessories are each identified by a part number and revision code, typically found on a label affixed to the item and/or its individual packaging. A label as in Figure B-1 is affixed to the PDU.

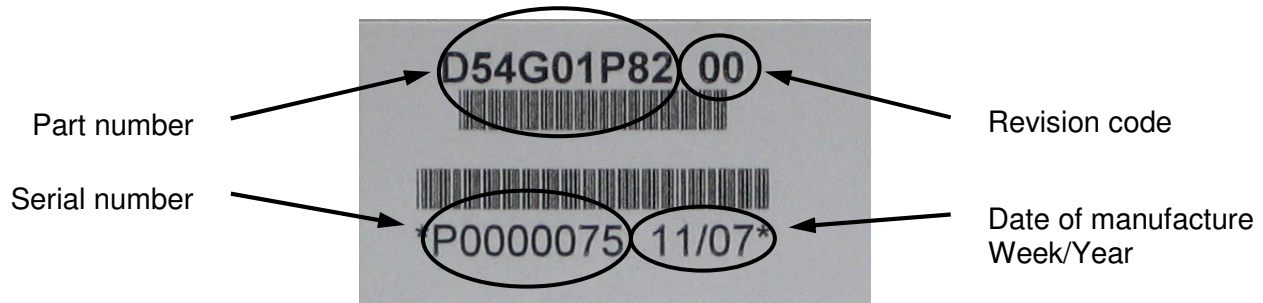


Figure B-1: Part number label

The part number and revision code should be verified to ensure the applicable Installation and Operation User Guide is used and should also be referenced when contacting Andrew Customer Technical Support.

### B.2 Part Number List

The following part numbers are included in the scope of this Installation and Operation User Guide:

#### B.2.1 PDU

Part No.	Revision	Alarm Ranges Supported
D54G01P82	00 - 01	LO Current & HI Current
D54G01P82	02	LO Current & HI Current Mode A & Mode B

#### B.2.2 Power Cable

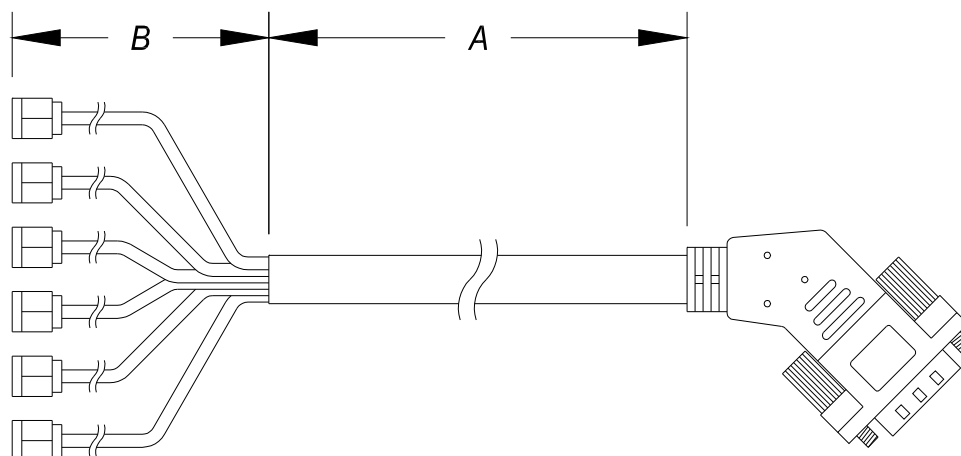
Part No.	Revision	Length
C61B01P32	All	5 m
C61B01P38	All	15 m

#### B.2.3 Alarm Cable

Part No.	Revision	Length
C61B01P31	All	7 m
C61B01P37	All	15 m

## B.2.4 Bias Tee Harness

Part No.	Revision	Style	Length A	Length B
C61L01P01	All	Standard	5.5 m	0.5 m
C61L01P37	All	Standard	15 m	0.5 m
C61L01P38	All	Standard	10 m	0.5 m
C61L01P45	All	Sector Split	9.5 m	0.5 m



## B.2.5 Rack Extender

Part No.	Revision	Description
19-8730-1	All	19" to 23" EIA 1 HU

## B.2.6 Spare Parts

Part No.	Revision	Description
ECNNJ-11200	All	Shunting Block for Alarm Range Selector

## B.3 Model Numbers

Model numbers provide a convenient way to order the PDU as a kit, including a defined set of accessories. The model number is found on a label affixed to the packaging of the kit and should be referenced when placing an order with Andrew Customer Care.

The table below lists model numbers currently issued and their configurations. Additional model numbers may be issued based on demand and customer requests.

Model No.	PDU Rev.	Power Cable	Alarm Cable	Bias Tee Harness	Rack Extender
D54G01P83	Any	C61B01P32	C61B01P31	C61L01P01	–
EPD3603-DCS6	Any	C61B01P32	C61B01P31	C61L01P01	–
EPD3603-DCSP	Any	C61B01P32	C61B01P31	C61L01P45	–

Availability for ordering of a particular model number varies in different regions of the world.

## APPENDIX C: MODE A & MODE B OPERATION

### C.1 Description

Beginning with revision 02, the Multimode PDU supports special purpose modes MODE A and MODE B in addition to the LO CURRENT and HI CURRENT modes, which are supported by all revisions.

MODE A and MODE B are intended for use in specific site configurations not described herein. The user will need additional information if using MODE A and MODE B in these intended configurations.

Included here is a full description of Mode A and Mode B operation as it applies to the Multimode PDU.

### C.2 Alarm Range Selector Setting

To select MODE A, position two shunting blocks as shown in Figure C-1. Only one shunting block is included with the PDU. A second block can be obtained from another PDU operating in MODE B, or ordered separately. To select MODE B, remove shunting blocks from the *Alarm Range Selector*.



Figure C-1: Shunting block positioning

### C.3 Operation

The specific characteristics of MODE A and MODE B operation are summarized in the table below. All other characteristics remain as described above for the LO CURRENT and HI CURRENT modes.

Output Current (mA)	Mode A	Mode B (outp 1-3)	Mode B (outp 4-6)
Disabled	0	0	0
Below range	<130	<130	<170
Normal range	135 - 180	135 - 180	180 - 301
Above range	>190	>190	>323
Short circuit	>425	>425	>425
Alarm Delay (s)	60	60	60

#### C.3.1 Current Monitoring

The normal and short circuit current ranges apply as shown in the table. In MODE B, different normal current ranges apply to outputs 1-3 and to outputs 4-6.

#### C.3.2 Alarm Delay

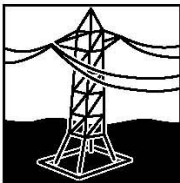
A fault condition must persist for 60 s before the associated *TMA Alarm* LED turns RED and the *Alarm Interface* goes into the ALARM state.



### **NOTICE**

The installation, maintenance, or removal of this equipment requires qualified, experienced personnel. Andrew installation instructions are written for such installation personnel. Antenna line systems should be inspected once a year by qualified personnel to verify proper installation, maintenance, and condition of equipment.

Andrew disclaims any liability or responsibility for the results of improper or unsafe installation practices.



Do not install near power lines. Power lines, telephone lines, and guy wires look the same. Assume any wire or line can



Do not install on a wet or windy day or when lightning or thunder is in the area. Do not use metal ladder.



Wear shoes with rubber soles and heels. Wear protective clothing including a long-sleeved shirt and rubber gloves.



**Andrew Corporation**  
**Base Station Subsystems**  
2601 Telecom Parkway  
Richardson, Texas 75082 USA

**Andrew Corporation**  
3 Westbrook Corporate Center  
Suite 900  
Westchester, Illinois 60154 USA

**Customer Support Center**  
**U.S.A., Canada, Mexico:**  
Tel: 1-800-255-1479  
Intl: +1-779-435-6500

**U.K.:** 0800 250055  
**Other Europe:** +44 592 782 612  
**Internet:** [www.andrew.com](http://www.andrew.com)

All designs, specifications, and availabilities of products and services presented in this bulletin are subject to change without notice.

Bulletin II-102051-EN Revision B (11/07)  
© 2007 Andrew Corporation, Westchester, IL 60154 USA