TRP500

Troposcatter C-Band Outdoor Amplifier
Installation and Operation Manual

Part Number MN-TRP500
Revision 1
November 12, 2010

IMPORTANT NOTE: The information contained in this document supersedes all previously published information regarding this product. Product specifications are subject to change without prior notice.

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Addendum A

Comtech EF Data Documentation Update to:

TRP500

Troposcatter C-Band Outdoor Amplifier

Installation and Operation Manual

Part Number MN-TRP500

Revision 1

Subject:	**Updates to Firmware for Over Temperature and Overdrive awareness.**	
Original Manual Part Number:	**MN-TRP500**	**Rev 1**
Addendum Number	**AD-TRP500-AA1**	

Collating Instructions

To update the manual, insert the pages as follows:

Insert
Insert Addendum A after the last page of the Preface

Overview:

New units, or units returned to the factory for repair or upgrades after August 2013, will have the firmware updated to help the user be more aware of potential over temperature and over drive conditions that could degrade the reliability of the amplifier. Furthermore, the user will be able to view recorded maximum and minimum values of important parameters as they have occurred over the operating history of the unit. These updates are explained below, and may supersede information in other sections of the manual.

Over Temperature:

As stated in the specifications, the amplifier is rated to operate up to ambient temperatures of 60C. Operating temperatures beyond this rating may degrade the performance and life of the amplifier. The unit has an internal sensor that monitors the temperature of the airflow across the cooling fans, and is very close to the actual ambient or outside temperature. This temperature can be monitored on the Status webpage, where it is labeled Outside Temperature (see Figure AD-1 below). It is also reported via the serial RMS command, and has the label of OTEMP. This temperature should be consistent with the expected ambient temperature in which the unit resides. If it is not, then the user should try and ensure that there are no obstructions blocking the cool air inlet or recirculating the hot air exhaust of the unit back into the inlet, that there is adequate clearance around the cool air inlet and exhaust areas, that all fans are working properly, etc.

If this Outside Temperature sensor rises above 65C, or other internally monitored temperatures exceed their threshold (such as Atemp>95C), an alarm or fault will be declared. The unit will not shut down but the condition causing the elevated temperature should be promptly remedied. If temperatures continue to rise (Outside Temp>70C or Atemp>100C), the unit will declare an Over Temperature Shutdown fault and will turn off the 10V supply to the critical RF transistors for protection purposes. Figures AD-2 and AD-3 show these conditions. (The Amplifier/Outside Temperature Alarm has a hysteresis of 5C, while the Over Temperature Shutdown fault has a hysteresis of 10C).

Over Drive (excessive RF input level):

As stated in the specifications, the amplifier is guaranteed to deliver at least 56.2 dBm of power at the P1dB compression point. Although the unit may be capable, operating much beyond this 56.2 dBm level is discouraged. As the input drive level is increased, output saturation will soon be reached where device currents and temperatures may rise very quickly to disconcerting levels, but without any effective or visual increase in overall unit output power.

Although the best protection against potentially degrading overdrive conditions is user attention and vigilance to the input and output levels as mentioned above, Comtech has implemented software updates that will *help* self-protect the unit and warn the user of *gross* overdrive conditions. This Overdrive alarm is visible on the Status webpage as shown in Figure AD-4. The unit begins adding attenuation at estimated excessive input levels and will eventually declare the visible alarm when this estimated level is at or above 1.2 dB. If this occurs, the user should reduce input power until the alarm clears and the estimated overdrive is 0 dB. (Note: Once the alarm is activated, for hysteresis purposes the input power must be reduced until the estimated overdrive is 0 before the alarm will clear. This reduction may need to be as much as double the amount of overdrive because the unit releases attenuation as the input power is decreased). Power Supply currents are also displayed (PS1 and PS2).

Maximum Operating Points:

The Status webpage has been updated to include the maximum (and in some cases, minimum) operating points of key parameters as they are recorded by the unit over time.

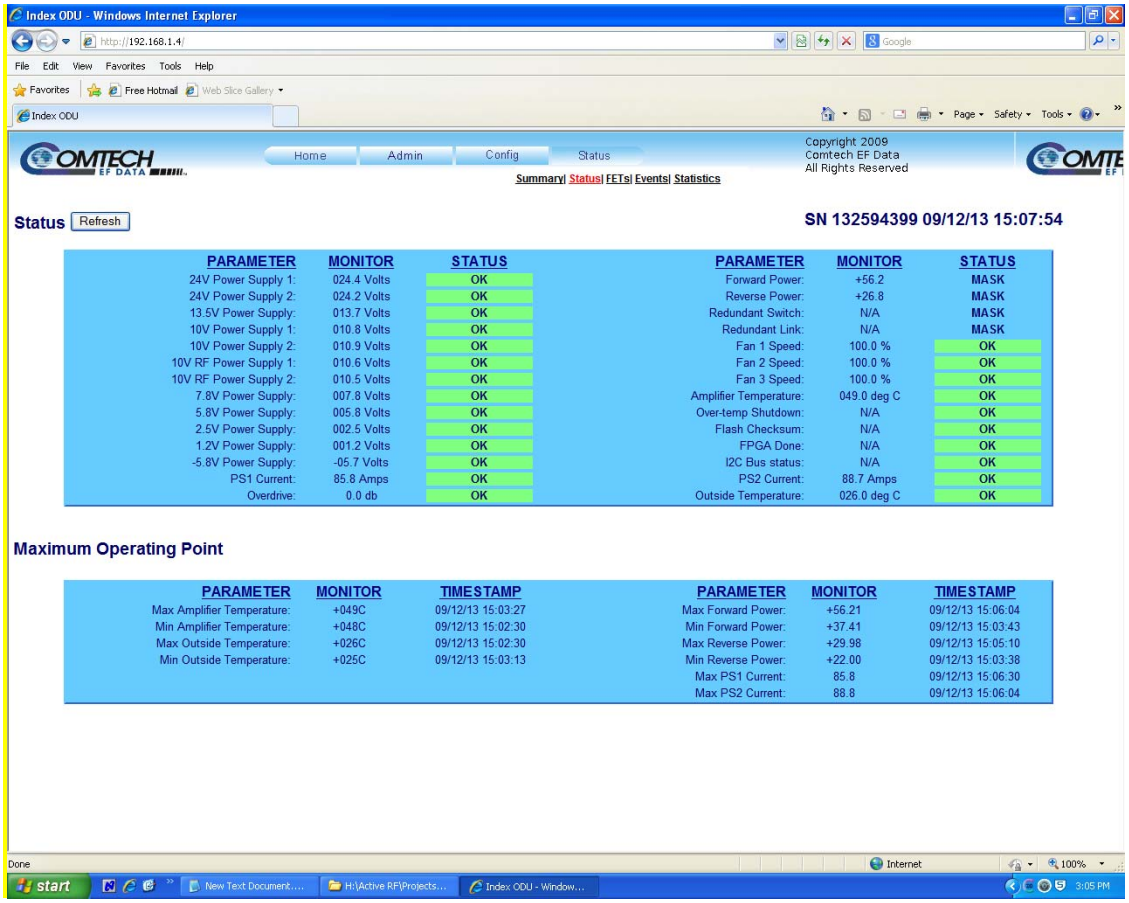

Figure AD- 1 Updated Status Page, Forward Power = 56.2 dBm, Outside Temp = 26C

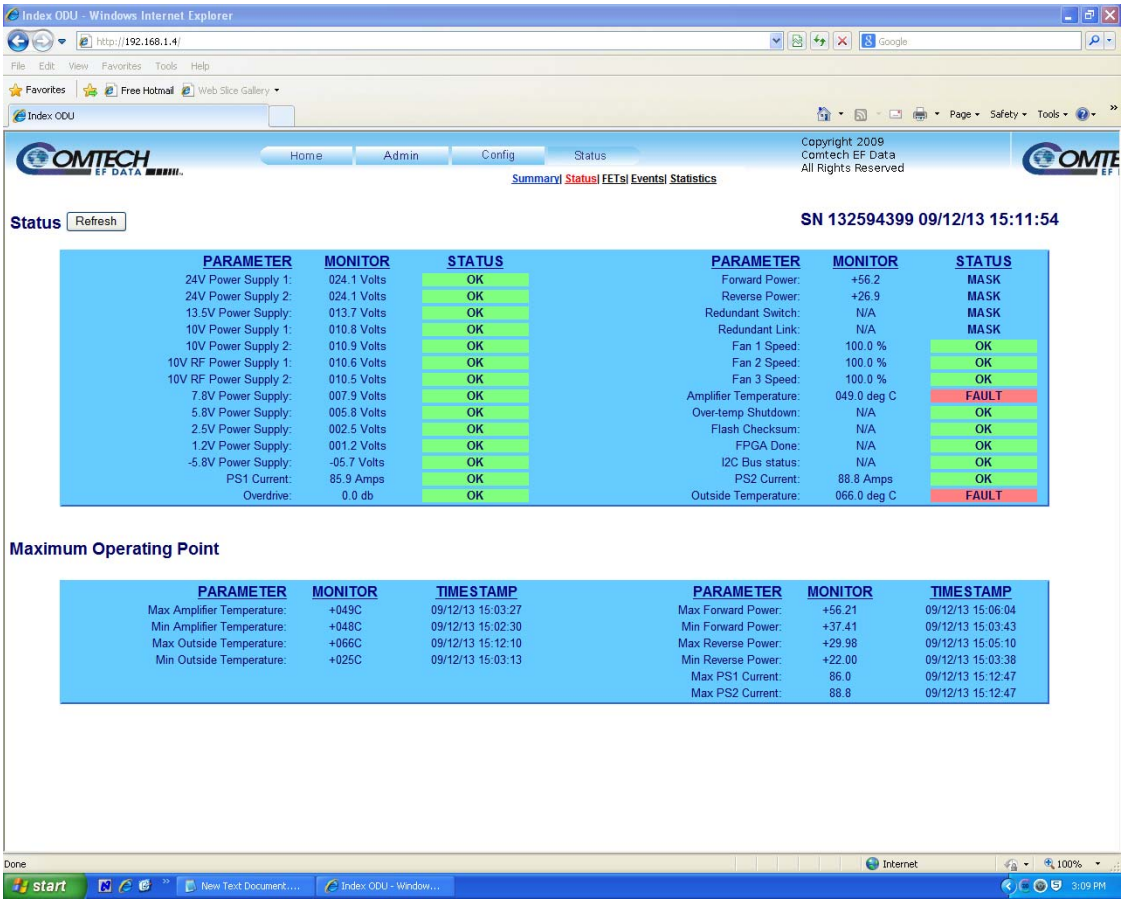

Figure AD- 2 Outside Temp causing Alarm (unit not shutdown)

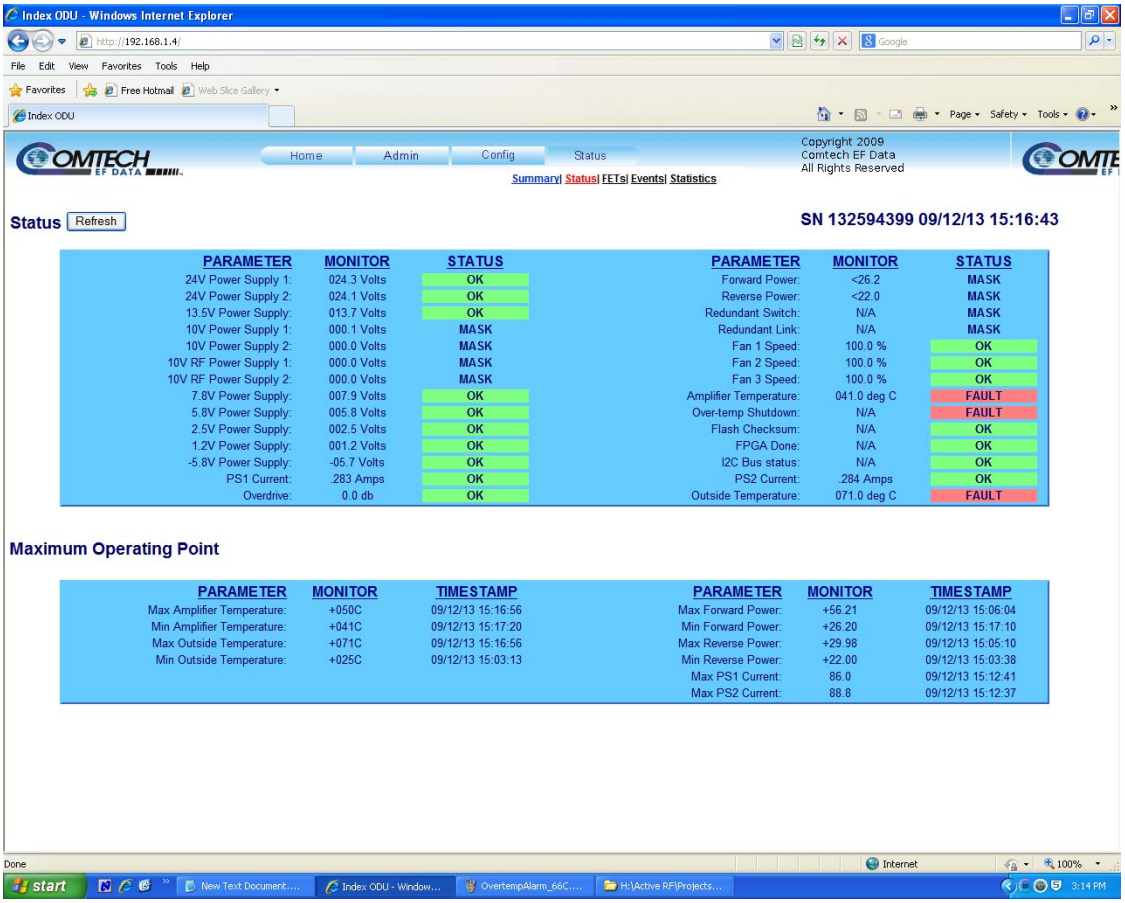

Figure AD- 3 Outside Temp causing Shutdown (not transmitting)

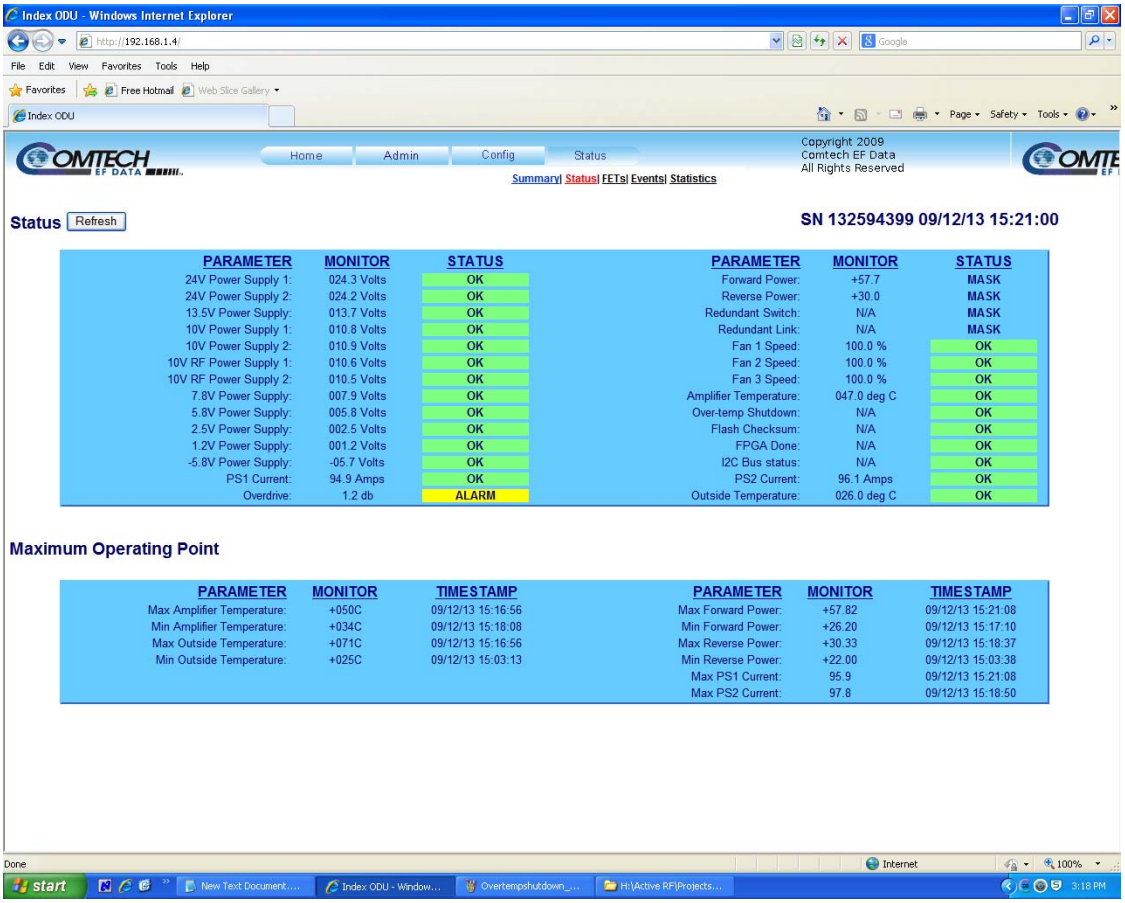

Figure AD- 4 Overdrive Alarm (Gross overdrive)

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PREFACE

About this Manual

This manual provides installation and operation information for the Comtech EF Data TRP500-4450 C-Band Outdoor Amplifier. This is a technical document intended for engineers, technicians, and operators responsible for the operation and maintenance of the amplifier.

Comtech EF Data has reviewed this manual thoroughly in order to provide an easy-to-use guide to your equipment. All statements, technical information, and recommendations in this manual and in any guides or related documents are believed reliable, but the accuracy and completeness thereof are not guaranteed or warranted, and they are not intended to be, nor should they be understood to be, representations or warranties concerning the products described. Further, Comtech EF Data reserves the right to make changes in the specifications of the products described in this manual at any time without notice and without obligation to notify any person of such changes.

If you have any questions regarding your equipment or the information in this manual, contact the Comtech EF Data Customer Support Department.

Reporting Comments or Suggestions Concerning this Manual

Comments and suggestions regarding the content and design of this manual will be appreciated. To submit comments, please contact the Comtech EF Data Technical Publications Department:

TechnicalPublications@comtechefdata.com

Conventions and References

Cautions and Warnings

WARNING ***indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.***

CAUTION ***indicates a hazardous situation that, if not avoided, may result in minor or moderate injury.*** **CAUTION** ***may also be used to indicate other unsafe practices or risks of property damage.***

IMPORTANT ***or*** **NOTE** ***indicates information critical for proper equipment function, or a statement that is associated with the task being performed.***

Recommended Standard Designations

Recommended Standard (RS) Designations have been superseded by the new designation of the Electronic Industries Association (EIA). References to the old designations are shown only when depicting actual text displayed on the screen of the unit (RS-232, RS-485, etc.). All other references in the manual will be shown with the EIA designations.

Trademarks

Other product names mentioned in this manual may be trademarks or registered trademarks of their respective companies and are hereby acknowledged.

Metric Conversion

Metric conversion information is located on the inside back cover of this manual. This information is provided to assist the operator in cross-referencing non-metric to metric conversions.

Electrical Safety Notice

This equipment has been designed to minimize exposure of personnel to hazards. For further information, contact Comtech EF Data, Customer Support Department. The operators and technicians must:

- Know how to work around, with, and on high voltage equipment.
- Exercise every precaution to ensure personnel safety.
- Exercise extreme care when working near high voltages.
- Be familiar with the warnings presented in this manual.

A Neutral Fusing - Double pole/ neutral fusing used on the prime power supply input.

Installation Guidelines Regarding Power Line Quality

Comtech EF Data has become familiar with the varying quality of the AC power grid around the world. The following offers some installation guidelines that should help ensure a reliable installation.

- **Surge suppression:** High voltage surges can cause failure of the power supply. These surges are typically caused by circuit switching on the main AC power grid, erratic generator operation, and also by lightning strikes. While the TRP500 does have built in surge suppression, if the unit will be installed in a location with questionable power grid quality, Comtech EF Data recommends installation of additional power conditioning/surge suppression at the power junction box.

- **Grounding:** The TRP500 provides a grounding terminal. This is provided to allow the user to ground the amplifier to the antenna's grounding network. All components installed at the antenna should be grounded to a common grounding point at the antenna.

- **Electrical welding:** If welding needs to take place at the antenna, disconnect all cables from the TRP500 except for the ground wire. Cap all RF connections with terminations. This will prevent damage to the input/output circuitry of the amplifier.

- **Lightning:** Lightning strikes on or around the antenna will generate extremely high voltages on all cables connected to the TRP500. Depending on the severity of the strike, the amplifier's internal surge protection combined with the recommended external suppression may protect the TRP500's power supply. However, if the installation will be in an area with a high probability of lightning strikes, Comtech EF Data recommends the installation of surge suppression on the RF and IF cables. One source of these suppressors is PolyPhaser (www.polyphaser.com).

Warranty Policy

Comtech EF Data products are warranted against defects in material and workmanship for a specific period from the date of shipment, and this period varies by product. In most cases, the warranty period is two years. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective. Repairs are warranted for the remainder of the original warranty or a 90 day extended warranty, whichever is longer. Contact Comtech EF Data for the warranty period specific to the product purchased.

For equipment under warranty, the owner is responsible for freight to Comtech EF Data and all related customs, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges only for return of the equipment from the factory to the owner. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

All equipment returned for warranty repair must have a valid RMA number issued prior to return and be marked clearly on the return packaging. Comtech EF Data strongly recommends all equipment be returned in its original packaging.

Comtech EF Data Corporation's obligations under this warranty are limited to repair or replacement of failed parts, and the return shipment to the buyer of the repaired or replaced parts.

Limitations of Warranty

The warranty does not apply to any part of a product that has been installed, altered, repaired, or misused in any way that, in the opinion of Comtech EF Data Corporation, would affect the reliability or detracts from the performance of any part of the product, or is damaged as the result of use in a way or with equipment that had not been previously approved by Comtech EF Data Corporation.

The warranty does not apply to any product or parts thereof where the serial number or the serial number of any of its parts has been altered, defaced, or removed.

The warranty does not cover damage or loss incurred in transportation of the product.

The warranty does not cover replacement or repair necessitated by loss or damage from any cause beyond the control of Comtech EF Data Corporation, such as lightning or other natural and weather related events or wartime environments.

The warranty does not cover any labor involved in the removal and or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for repair or replacement.

The warranty excludes any responsibility by Comtech EF Data Corporation for incidental or consequential damages arising from the use of the equipment or products, or for any inability to use them either separate from or in combination with any other equipment or products.

A fixed charge established for each product will be imposed for all equipment returned for warranty repair where Comtech EF Data Corporation cannot identify the cause of the reported failure.

Exclusive Remedies

Comtech EF Data Corporation's warranty, as stated is in lieu of all other warranties, expressed, implied, or statutory, including those of merchantability and fitness for a particular purpose. The buyer shall pass on to any purchaser, lessee, or other user of Comtech EF Data Corporation's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech EF Data Corporation from any claims or liability of such purchaser, lessee, or user based upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Customer Support

Contact the Comtech EF Data Customer Support Department for:

- Product support or training
- Reporting comments or suggestions concerning manuals
- Information on upgrading or returning a product

A Customer Support representative may be reached at:

Comtech EF Data
Attention: Customer Support Department
2114 West 7th Street
Tempe, Arizona 85281 USA

480.333.2200 (Main Comtech EF Data number)
480.333.4357 (Customer Support Desk)
480.333.2161 FAX

To return a Comtech EF Data product (in-warranty and out-of-warranty) for repair or replacement:

- **Contact** the Comtech EF Data Customer Support Department. Be prepared to supply the Customer Support representative with the model number, serial number, and a description of the problem.
- **Request** a Return Material Authorization (RMA) number from the Comtech EF Data Customer Support representative.
- **Pack** the product in its original shipping carton/packaging to ensure that the product is not damaged during shipping.
- **Ship** the product back to Comtech EF Data. (Shipping charges should be prepaid.)

Online Customer Support

An **RMA number request** can be requested electronically by contacting the Customer Support Department through the online support page at **www.comtechefdata.com/support.asp**:

- **Click** on the "Service" hyperlink, then read the "Return Material Authorization" section for detailed instructions on our return procedures.
- **Click** on the "RMA Request Form" hyperlink, then fill out the form completely before sending.
- **Send e-mail** to the Customer Support Department at **service@comtechefdata.com**.

For information regarding this product's warranty policy, refer to the **Warranty Policy**, p. x.

Chapter 1. INTRODUCTION

1.1 Overview

Comtech EF Data's TRP500-4450 C-Band Outdoor Amplifier – is shown in **Figure 1-1** and referred to throughout this manual as the TRP500, SSPA, or "amplifier". Its compact, thermally efficient design and beneficial features are the result of Comtech EF Data's extensive experience in the design of outdoor RF amplifiers and transceivers.

Figure 1-1. Comtech EF Data TRP500-4450 C-Band Outdoor Amplifier

1.2 Functional Description

Each TRP500 consists of a CEFD Solid-State Power Amplifier (SSPA) module with a **M**onitor/**C**ontrol **P**rocessor (MCP), a power supply, and a fan assembly. The amplifier features a proprietary Comtech EF Data low-loss combining technique and MCP-based temperature-versus-gain compensation.

1.3 Features

1.3.1 The Solid-State Advantage

The TRP500 is constructed with highly reliable gallium arsenide field-effect transistors (GaAs FETs). Solid state devices are generally known to exhibit much better third-order intermodulation products than TWTs, and CEFD units can replace TWTs with saturated power levels of up to twice the TRP500's output. SSPAs are also considered to have longer lifetimes or mean time between failures (MTBF) than TWTs.

1.3.2 Enhanced Standard Features

The TRP500 comes equipped with useful features that other manufacturers offer only as options. Included are temperature compensation, output sample port, forward and reverse power monitors, power factor corrected supply, and full remote monitor and control (M&C) capabilities (including Ethernet and serial).

1.3.3 Complete Temperature Testing

While others may imply temperature compliance, each TRP500 amplifier is fully tested over the specified operating temperature range and corresponding test data is supplied. This ensures a reliable unit and the customer can have confidence and the knowledge that each unit has been tested and passed criticial specifications at the operating temperature extremes.

1.3.4 Reverse Power Monitor

The TRP500 contains a reverse power monitor to provide useful information to the user and also to protect the unit from excessive reverse power. The TRP500 has a built- in output isolator to provide good output VSWR and a level of protection against excessive reverse power. The isolator is rated to handle 53 dBm (200W) of reverse power. If the unit detects a reverse power monitor of greater than 52 dBm, the unit will automatically shut itself down for protection purposes. The user must clear the reason for the excessive reverse power, and then enable the "MUT" and "AMP" commands (see remote section of this manual).

The user may also adjust the reverse power monitor threshold to a level less than 52 dBm, and set it to be a Fault or Alarm condition. (Regardless of user setting, however, if the reverse monitor detects a level above 52 dBm, the unit will shut down). Although both the reverse and forward power monitors display a 30 dB range, reasonable judgment should be used in settings or readings in the lower end of the range. A datasheet is sent with the units showing the accuracy of

the power monitor as calibrated at the factory. Field grounding and noise conditions may affect the lower range readings.

1.3.5 Data Logging Capability

To greatly enhance system maintainability, the TRP500 includes a built-in data logging capability. By recording critical operational parameters (such as temperature, output power, mute status, etc.) at time stamped intervals, the user can quickly gather intelligence not only about the unit itself, but also the unit's operational environment.

1.4 Summary of Specification

1.4.1 Characteristics

Frequency		4.4 – 5.0 GHz
Output Power, P1dB		56.2 dBm min, 57 dBm (500W) typical
Gain, Small Signal		35 dB min, 39 dB typical
Gain Flatness, full band		± 1.6 dB
Gain Flatness, per any 40 MHz segment		± 0.5 dB
Gain Stability over temp		±.75 dB max, -40 to +60 °C
Gain Stability over 24 hrs at constant temp.		± 0.25 dB
Input Return Loss		19.1 dB min, (1.25:1 max VSWR)
Output Return Loss		19.1 dB min, (1.25:1 max VSWR)
Third-Order Intermodulation Levels		-25 dBc typical, -17 dBc max (3 dB Total Back off from rated P1dB, 2 tones, SCL=-6 dB, ∆f= 1 MHz)
		-34 dBc typical, -25 dBc max (6 dB Total Back off from rated P1dB, 2 tones, SCL=-9 dB, ∆f= 1 MHz)
		-45 dBc typical, -33 dBc max (10 dB Total Back off from rated P1dB, 2 tones, SCL=-13 dB, ∆f= 1 MHz)
Spectral Regrowth		-32 dBc typical, at 2 dB below rated power, QPSK, at 1.0-1.5 x symbol rate
AM/PM Conversion		2° typ., 3.5° max. @ Rated P1dB
Noise Figure		12 dB typical, 15 dB max
RF Mute Isolation	**"Mut=1" command**	-20 dBc min
	"Amp=0" command	>-80 dBc min
Spurious	**Line Related**	-45 dBc max. @ Prated
	Carrier Related	-70 dBc max. @ Prated
Group delay variation	**Linear**	± 0.03 nsec/MHz
	Parabolic	±0 .003 nsec/MHz2
	Ripple	± 1.0 nsec peak-to-peak
Max RF Input Level, no damage		+30 dBm
Power Requirements		180-264 Vac, 47-63 Hz
Power Dissipation		2.0 kW typical @ Prated; 2.7kW max.

Power Factor	> 0.95, typically 0.99
RF Power Monitor(s)	> 20 dB range
Data Logging Parameters	Non-Volatile RAM : Capacity 30 days @ 90 minute intervals. Includes: • RF Output Power • Mute Status • Heatsink Temperature • Alarm Status, etc.

1.4.2 Environmental

Temperature	**Operating**	-40º to 140ºF (-40º to 60ºC)
	Storage	-67º to 167ºF (-55º to 75ºC)
Humidity		100% condensing rain 2” per hour
Altitude		10,000 AMSL
Shock		Normal commercial shipping and handling

1.4.3 Physical

Weight		92 lbs Nominal
Dimensions (excluding connectors and optional ducting) (See Figure 1-2)		12” x 8” x 24 in.
Connectors	**RF Input**	Type ‘N’ female, 50 ohms
	RF Output	CPR 187G
	M&C / Ethernet / Redundancy Switches	19-pin MS style (single integrated cable assembly available, dependent upon configuration)
	AC Power	3-pin MS Style
	RF Power Monitor	Type ‘N’ female, 50 ohms, -50 dBc, nominal

1.5 Dimensional Envelope

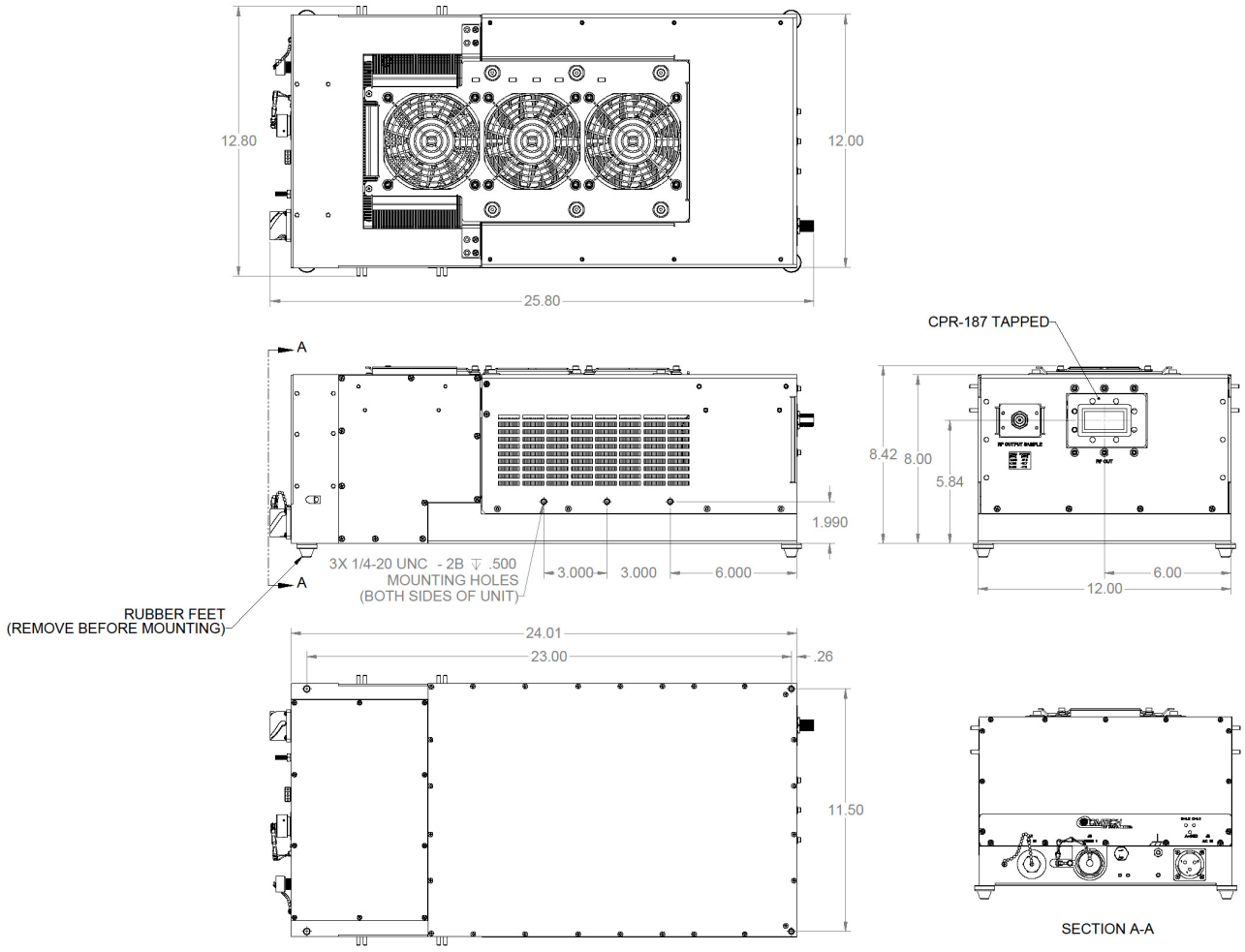


Figure 1-2. TRP500-4450 Dimensional Envelope

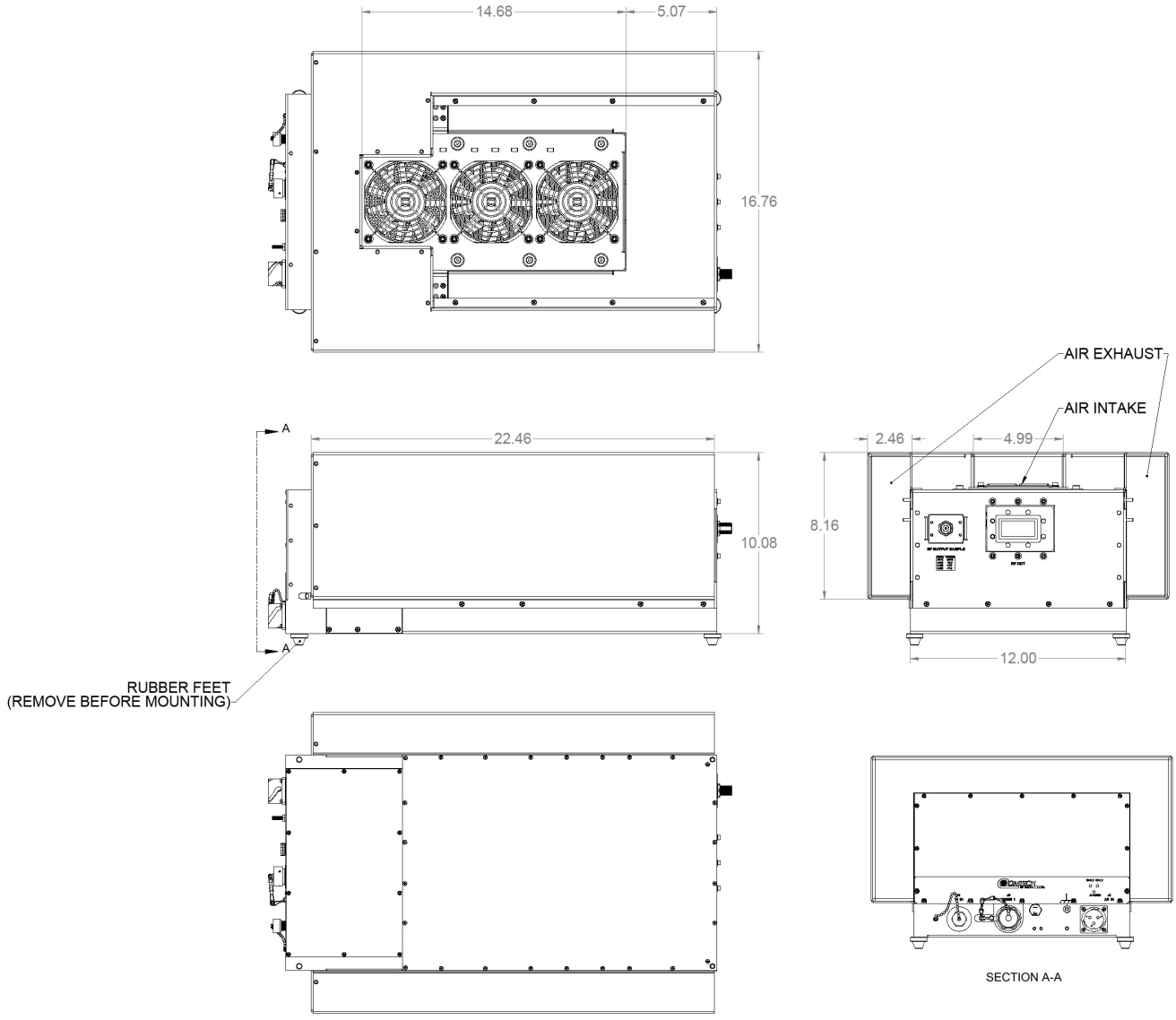


Figure 1-3. TRP500-4450 Dimensional Envelope with Ducting

Chapter 2. SYSTEM CONNECTIONS, INSTALLATION and OPERATION

2.1 Overview

This chapter summarizes the connectors provided for all necessary external connections between the TRP500, shown here in **Figure 2-1**, and other equipment. Basic installation and operational information is also provided in **Sect. 2.3**. For a detailed overview on the TRP500's operability via remote M&C commands or using the Web Server Interface, refer to **Chapter 4. ETHERNET MANAGEMENT** or **Appendix B. REMOTE CONTROL**.

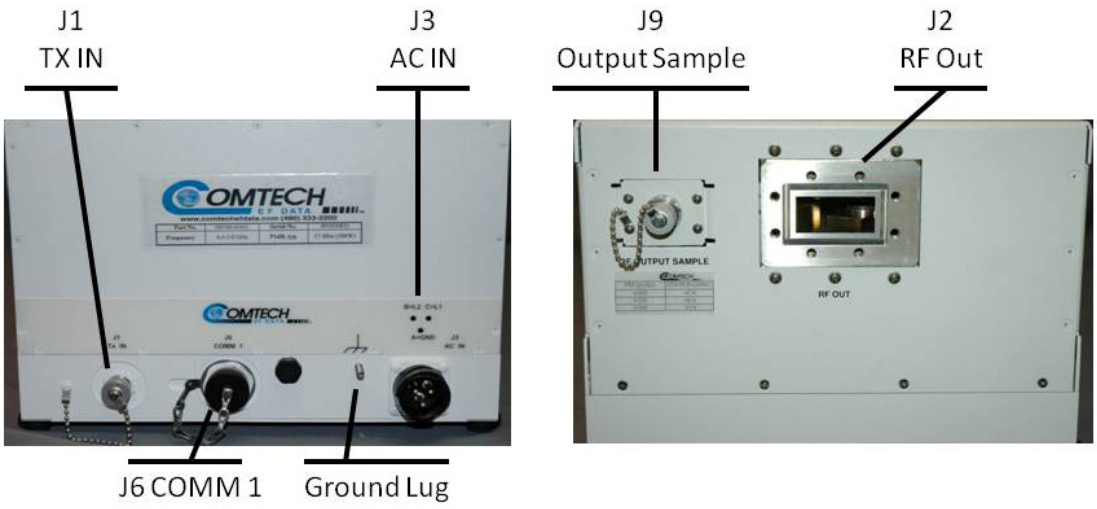


Figure 2-1. TRP500 Connectors

2.2 Interface Connectors

2.2.1 TX (RF) In Connector, J1

The J1 RF Input connector is a 50ohm Type 'N' female connector. Labeled "TX IN", typical input levels (+0 to ~ + 20 dBm) depend on desired output power. For example, if the unit has a gain of 40dB, then an input level of +15 dBm will result in an output of 55dBm. In general, RF input levels above those which result in output saturation (>> Prated) should be avoided and to prevent damge to the TRP500, should never exceed +30 dBm.

2.2.2 RF Out Connector, J2

For safety reasons, never look directly into the waveguide output. Also, never apply power to the unit without an appropriate termination/connection to the waveguide flange.

The J2 RF Out connector is a waveguide flange interface, as shown in **Figure 2-1**. The interface is CPR187G. Be careful to not allow any unwanted material to enter the waveguide output while the interface is open. The opening is covered with a protective material during shipment. Use the supplied gasket (assumed mating flange = CPR187G) to ensure a watertight connection, and make sure the screws used to secure the mating flange do not bottom out.

2.2.3 AC Power Main Connector, J3

The AC prime power input requirements for the TRP500 are as follows:

- 180-264 VAC
- 47 to 63 Hz

The power supply is power factor corrected. The total power required from the prime power supply is listed in the **Sect. 1.5 Summary of Specifications.**

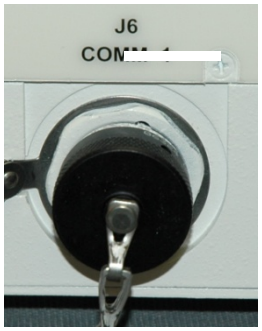
The mating connector specification and the pin assignments (**Table 2-1**) for the TRP500 AC power interface are as follows:

Mating Connector: CEFD PN CN/MS-STPG03F07 (Glenair ITS3106F20-19SF7).

Table 2-1. TRP500 J3 PWR IN (AC) Pin Assignments

Pin	TRP500 Assignment
A	GND
B	NEUTRAL (L2)
C	LINE (L1)

2.2.4 COMM 1 Connector J6 (Remote Communications/Discrete Cntrl Port)



The COM1/Discrete Control connector J6 is the primary input for controlling and monitoring the SSPA. It is a 19-pin circular connector, type MS3112E14-19S. The pinout specification is contained in **Table 2-2**.

Mating connector: ITT KPT06J14-19P or MS3116J14-19P.

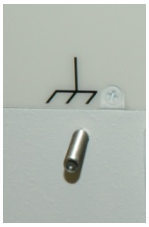
Table 2-2. Connector J6 Pinout

Pin	Name	Description
A	RS485_+RX	
B	RS485_-RX	
C	RS485_+TX	
D	RS485_-TX	
E	RS232_RD	Pin 3 of DB9 female connector
F	Ethernet TX+	Pin 3 of RJ45 female connector
G	RS232_TD	Pin 2 of DB9 female connector
H	Ethernet TX-	Pin 6 of RJ45 female connector
J	TX/RX Switch Drive 1 Pos	Not for customer use
K	Gnd	Ground (also Pin 5 of DB-9F connector)
L	SUMFLT In	Open when faulted, else tied to Pin K
M	SUMFLT Out	When faulted, tied to Pin K, else open
N	TX Switch Pos 1 Ind	Online/Offline indication
P	RX Switch Pos 1 Ind	Not for customer use
R	+24V	Not for customer use
S	System Mute Control	System muted if customer ties to Pin K
T	Switch Common	GND reference for Pin N
U	Ethernet RX-	Pin 2 of RJ45 female connector
V	Ethernet RX+	Pin 1 of RJ45 female connector

2.2.5 Output Sample Port Connector, J9

The Output Sample port connector is a Type 'N' female connector that provides a nominal -50 dB sample of the output signal. A calibration label is provided near the connector that shows the actual coupling values vs. frequency.

2.2.6 Ground Lug Connector



A #10-32 stud is provided at the location shown in **Figure 2-1** for connecting a common chassis ground among equipment.

2.3 Installation of the TRP500

As shown in Figure 1-2, several holes are available for mounting the TRP500, both on each side as well as on the (bottom/flat) surface. Contact Comtech if factory furnished mounting kits are desired.

To allow for proper cooling of the TRP500, please keep any mounting obstructions least 4 inches away from the cooling fans and the side vents.

2.4 Powering on the TRP500

Never turn the unit ON without proper waveguide termination on the J2 "RF OUTPUT" port. Individuals can be exposed to dangerously high electromagnetic levels.

The TRP500 does not contain a 'Power On/Off' switch. The SSPA is powered ON by connecting the J3 AC Power connector to the appropriate prime power source. The Mute or Transmit status of the SSPA will automatically come up in the last stored state (factory default = Transmit on, not muted).

Chapter 3. FLASH UPGRADING

3.1 Introduction

The Troposcatter Solid State Power Amplifier (referred to hereafter as 'the TRP500') uses 'Flash memory' technology, and new firmware can be uploaded to either unit from an external Microsoft Windows®-compatible computer. This makes software upgrading very simple, and upgrade files containing the current version of firmware are available over the Internet (**Figure 3-1**); via e-mail; or on CD.

This chapter outlines the complete upgrading process as follows:

- New firmware can be downloaded via the Internet to an external PC.
- The upgrade is accessible to the TRP500 by simply connecting the unit to the serial port of the external PC.
- The firmware upgrade is automatically transferred, via File Transfer Protocol (FTP), to the TRP500 using CEFD's CReflash utility application.

Figure 3-1. Flash Upgrade via Internet

3.2 Ethernet FTP Upload Procedure

Step	Procedure
1	**Identify the reflashable product, firmware number, and version for download.** Using serial remote control, the firmware revision levels can be obtained with the following remote queries: *Abbreviated:* **<0/SWR?** *which returns basic Boot, Bulk1 and Bulk2 information.* **or:** *Detailed:* **<0/FRW?** *which returns complete Boot, Bulk1 and Bulk2 information.* For more information on commands/queries, see **Appendix B. REMOTE CONTROL.** Alternately, when using the Web Server Interface, the Bootrom, Image1 and Image2 firmware loads may be viewed using the **Utility** hyperlink (available under the **Config** page tab). For more information, refer to **Chapter 4.5 Web Server (HTTP) Interface**.
2	**Create** a temporary directory (folder) on an external PC: • ***Windows:*** Select **File > New > Folder**, then rename the New Folder to "temp" or another convenient, unused name. Assuming "temp" works, a "*c:\temp*" folder should now be created. NOTE ***While the drive letter C: is used in this example, any valid writable drive letter can be used.*** • ***CMD Prompt:*** At the command prompt (c:\>), type "**mkdir temp**" or "**MD temp**" without quotes (**mkdir** and **MD** stand for *make directory*). This is the same as creating a new folder from Windows. There should now be a "*c:\temp*" subdirectory created (where **c:** is the drive letter used in the example).
3	**Download the correct firmware file to the temporary folder.** As shown in **Figure 3-1**: • **Go online** to: www.comtechefdata.com; • **Click on**: **Support** tab; • **Click on**: **Software Downloads** drop-down or hyperlink from **Support** page; • **Click on: Download Flash and Software Update Files** icon; • **Click on the appropriate (Select a Product Line)** ***product*** **hyperlink**, then select the appropriate *firmware* hyperlink. **About Firmware Numbers, File Versions, and Formats:** The flashable files on the download server are organized by product prefix; firmware number (verify that the correct firmware number is known – see Step 1); revision letter, if applicable; and release version. The current version firmware release is provided. If applicable, one version prior to the current release is also available. Be sure to identify and download the desired version

The downloadable files are stored in two archived formats: *.exe (self-extracting) and *.zip (compressed). Some firewalls will not allow download of *.exe files. In this case, download the *.zip file instead.

For additional help with "zipped" file types, refer to the Help file for your particular product; online references are also available:

- For PKZIP for Windows: http://www.pkware.com/home_and_small_office/support/manuals/windows.php

PKZIP for DOS is not supported due to file naming conventions.

- For WinZip: http://www.winzip.com/winzip.htm

For ZipCentral: http://hemsidor.torget.se/users/z/zcentral/faq.html

4 **Extract the files into the temporary folder on the PC.** At least two files should be extracted:

- *The bulk image file*, FWxxxxxxx.bin, *where* "x" *is thefirmware number and revision;*
- *The release notes.*

5 **Confirm** that the files have been extracted to the specified temporary folder on the PC. In DOS, use "**cd c:\temp**" to change to the temporary directory created in Step 2, then use the "**dir**" command to list the files extracted from the downloaded archive file.

6 **Download and unzip** the **CReflash.zip** file to the temporary folder using the same procedures as previously described in Steps 3 through 5.

7 **Install** the **CReflash** application by double clicking on the **setup.exe** file. The default parameters for all boxes are generally acceptable.

8 **Connect the PC to the TRP500's J6 (COM1) port using the appropriate adapter cable.**

9 **Send a "ping" command** to the TRP500 to verify the connection and communication.

The IP address of the TRP500 can be found remotely using the **<0/IPA?** query.

Then**, using DOS to PING**: Click **[Start]** on the Windows toolbar, then click the [**Run...]** option. As an alternative, use the "**DOS Prompt**" or "**Command Prompt**" icons in the [**Start] Menu:**

- **Using Win95 or Win98:** Type "**command**".
- **Using WinNT, Win2K or WinXP:** Type "**cmd**".

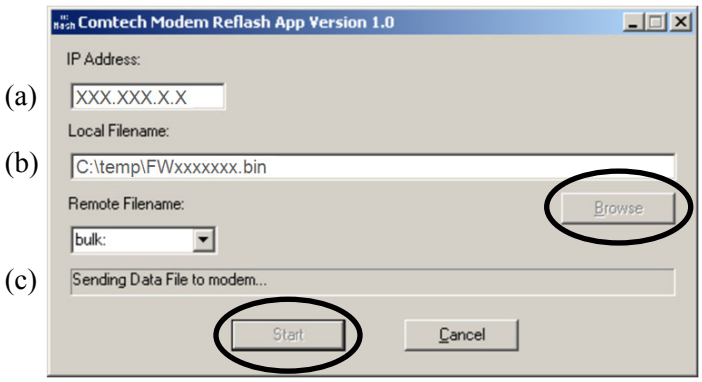
At the DOS prompt, type "**ping *xxx.xxx.xxx.xxx***" (where "*xxx.xxx.xxx.xxx*" is the TRP500 IP address). The results should confirm whether or not the unit is connected and communicating.

10 **Run the CReflash application** by either double clicking the application icon from the temporary folder (or Desktop), or by selecting the application from the **Program Files** menu:

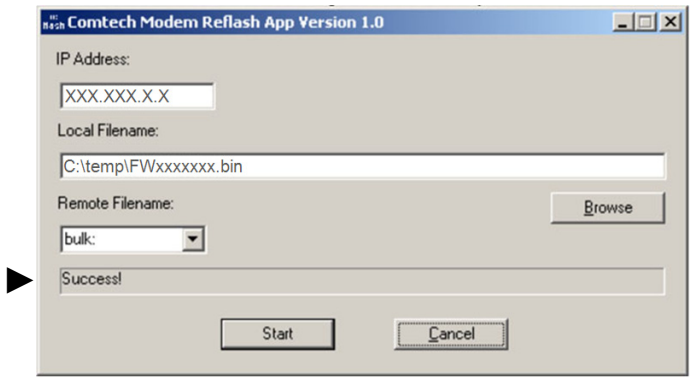
a) Type in the correct IP address of the TRP500.

b) Select the *firmware bulk image file* as identified in Step 3. Type in the name, or select the file using **[Browse]**.

c) Click **[Start]** to begin the flash upgrade procedure.



11 **Check that the transfer completed successfully:**



12 **Verify the file transfer.**

a) Reboot the unit.

b) To verify that the new file has loaded, use the firmware version verification procedure outlined in Step 1.

Chapter 4. TRP500 ETHERNET MANAGEMENT

4.1 Overview

This chapter describes the functionality of the Troposcatter Outdoor Ampifier (TRP500) Ethernet (HTTP) Interface. This interface is generally modeled after Comtech EF Data's other Solid State Power Amplifier product lines.

For detailed descriptions of the configuration parameters featured on the individual Web pages depicted in this section, refer to the REMOTE CONTROL Specifications tables found in **Appendix B. REMOTE CONTROL**.

4.2 Ethernet Management Interface Protocols

The TRP500 100BaseT/10BaseTx Ethernet Management Interface supports three (3) different management protocols:

- SNMP with public and private MIB
- Telnet interface for remote product M&C
- Web Server interface for complete product management

4.3 SNMP Interface

The *Simple Network Management Protocol* (SNMP) is an application-layer protocol designed to facilitate the exchange of management information between network devices. The TRP500 SNMP agent supports both SNMPv1 and v2c.

For proper SNMP operation, the TRP500 MIB files must be used with the associated version of the TRP500 M&C. Please refer to the TRP500 FW Release Notes for information on the required FW/SW compatibility.

4.3.1 Management Information Base (MIB) Files

MIB files are used for SNMP remote management and consist of Object Identifiers (OIDs). Each OID is a node that provides remote management of a particular function. A MIB file is a tree of nodes that is unique to a particular device.

The following MIB files are associated with the TRP500:

MIB File/Name	Description
FW-0000238-.mib ComtechEFData Root MIB file	ComtechEFData MIB file gives the root tree for ALL Comtech EF Data products and consists of only the following OID: Name: comtechEFData Type: MODULE-IDENTITY OID: 1.3.6.1.4.1.6247 Full path: iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).comtechEFData(6247) Module: ComtechEFData
FW-0000236- .mib TRP500 MIB file	MIB file consists of all of the OIDs for management of the amplifier functions
FW-0000237- .mib TRP500 Traps MIB file	Trap MIB file is provided for SNMPv1 traps common for TRP500.

These MIB files should be compiled in a MIB Browser or SNMP Network Monitoring System server.

Note: The SNMP agent supports both "**SNMPv1"** and "**v2c"**. The "**Traps"** file only needs to be compiled if "**SNMPv1"** traps are to be used.

4.3.2 SNMP Community Strings

The TRP500 uses community strings as a password scheme that provides authentication before gaining access to the TRP500 agent's MIBs.

In "**SNMP v1/v2c"**, the community string is sent unencrypted in the SNMP packets. Caution must be taken by the network administrator to ensure that SNMP packets travel only over a secure and private network if security is a concern. A packet sniffer can easily obtain the community string by viewing the SNMP traffic on the network.

The community string is entered into the MIB Browser or Network Node Management software and is used to authenticate users and determine access privileges to the SNMP agent.

The user defines three Community Strings for SNMP access:

- Read Community default = public
- Write Community default = private
- Trap Community default = comtech

4.3.3 SNMP Traps

The TRP500 has the ability to send out SNMP traps when certain events occur in the unit. The TRP500 sends out traps when a fault occurs in the unit. A trap is sent both when a fault occurs and is cleared.

The TRP500 supports both **SNMPv1** traps and **SNMPv2** notifications. Which style of traps the TRP500 sends can be configured by the user using the TRP500 SNMPTrapVersion OID.

The following are the MIB2 v1traps / v2 notifications that the TRP500 supports:

MIB2 SNMPv1 trap: Authentication Failure	5
MIB2 SNMPv2 notifications: Authentication Failure	1.3.6.1.6.3.1.1.5.5

The following tables are the Faults v1 traps / v2 notifications supported by the TRP500, excluding those denoted with ***italics ***.

Faults SNMPv1 traps:	
ODUPowerSupply24V1StatusV1	62474801
ODUPowerSupply24V2StatusV1	62474802
ODUPowerSupplyLNBStatusV1	62474803
ODUPowerSupply13VStatusV1	62474804
ODUPowerSupply10VStatusV1	62474805
ODURFPowerSupply10V1StatusV1	62474806
ODURFPowerSupply10V2StatusV1	62474807
ODUPowerSupply7V8TStatusV1	62474808
ODUPowerSupply5V8TStatusV1	62474809
ODUPowerSupply2V5TStatusV1	62474810
ODUPowerSupply1V2TStatusV1	62474811
ODUPowerSupplyNeg5V8TStatusV1	62474812
ODUFan1StatusV1	62474813
ODUFan2StatusV1	62474814
ODUTemperatureStatusV1	62474815
ODUShutdownStatusV1	62474816
ODUI2CStatusV1	62474817
ODUForwardPowerStatusV1	62474818
ODUChecksumStatusV1	62474819
ODUFPGADoneStatusV1	62474820

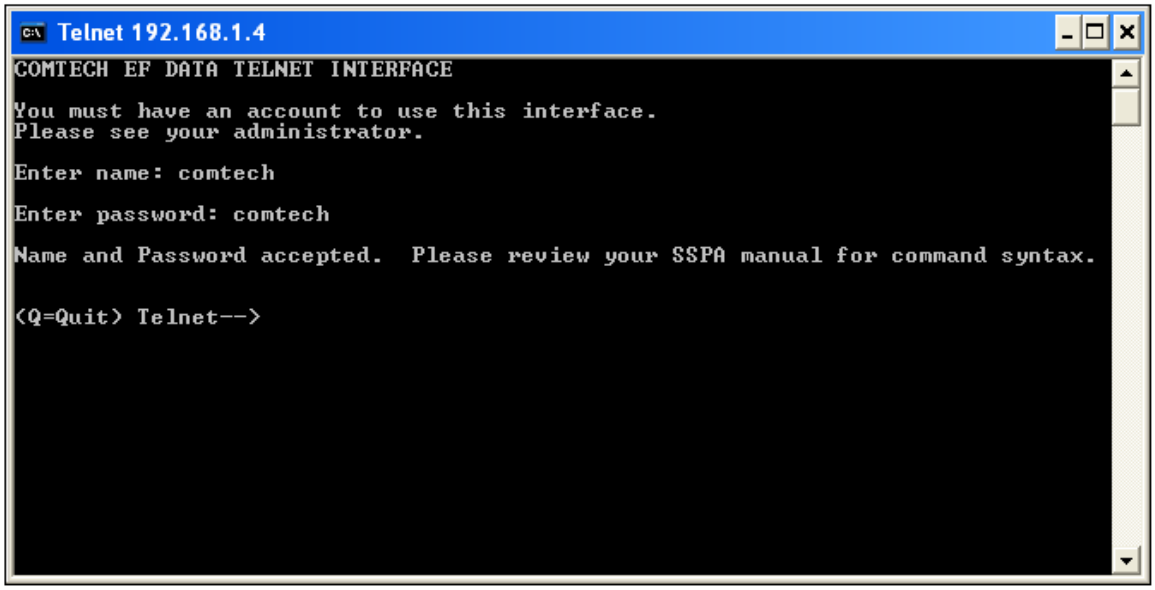
*** ODUBUCLockDetectStatusV1*	*62474821 ***
ODURefLockDetectStatusV1	62474822
*** ODULNBCSStatusV1*	*62474823 ***
ODUSwitchStatusV1	62474824
Faults SNMPv2 notifications:	
ODUPowerSupply24V1Status	1.3.6.1.4.1.6247.48.1.3.1.1
ODUPowerSupply24V2Status	1.3.6.1.4.1.6247.48.1.3.1.2
*** ODUPowerSupplyLNBStatus*	*1.3.6.1.4.1.6247.48.1.3.1.3 ***
ODUPowerSupply13VStatus	1.3.6.1.4.1.6247.48.1.3.1.4
ODUPowerSupply10VStatus	1.3.6.1.4.1.6247.48.1.3.1.5
ODURFPowerSupply10V1Status	1.3.6.1.4.1.6247.48.1.3.1.6
ODURFPowerSupply10V2Status	1.3.6.1.4.1.6247.48.1.3.1.7
ODUPowerSupply7V8TStatus	1.3.6.1.4.1.6247.48.1.3.1.8
ODUPowerSupply5V8TStatus	1.3.6.1.4.1.6247.48.1.3.1.9
ODUPowerSupply2V5TStatus	1.3.6.1.4.1.6247.48.1.3.1.10
ODUPowerSupply1V2TStatus	1.3.6.1.4.1.6247.48.1.3.1.11
ODUPowerSupplyNeg5V8TStatus	1.3.6.1.4.1.6247.48.1.3.1.12
ODUFan1Status	1.3.6.1.4.1.6247.48.1.3.1.13
ODUFan2Status	1.3.6.1.4.1.6247.48.1.3.1.14
ODUTemperatureStatus	1.3.6.1.4.1.6247.48.1.3.1.15
ODUShutdownStatus	1.3.6.1.4.1.6247.48.1.3.1.16
ODUI2CStatus	1.3.6.1.4.1.6247.48.1.3.1.17
ODUForwardPowerStatus	1.3.6.1.4.1.6247.48.1.3.1.18
ODUChecksumStatus	1.3.6.1.4.1.6247.48.1.3.1.19
ODUFPGADoneStatus	1.3.6.1.4.1.6247.48.1.3.1.20
*** ODUBUCLockDetectStatus*	*1.3.6.1.4.1.6247.48.1.3.1.21 ***
ODURefLockDetectStatus	1.3.6.1.4.1.6247.48.1.3.1.22
*** ODULNBCSStatus*	*1.3.6.1.4.1.6247.48.1.3.1.23 ***
ODUSwitchStatus	1.3.6.1.4.1.6247.48.1.3.1.24

4.4 Telnet Interface

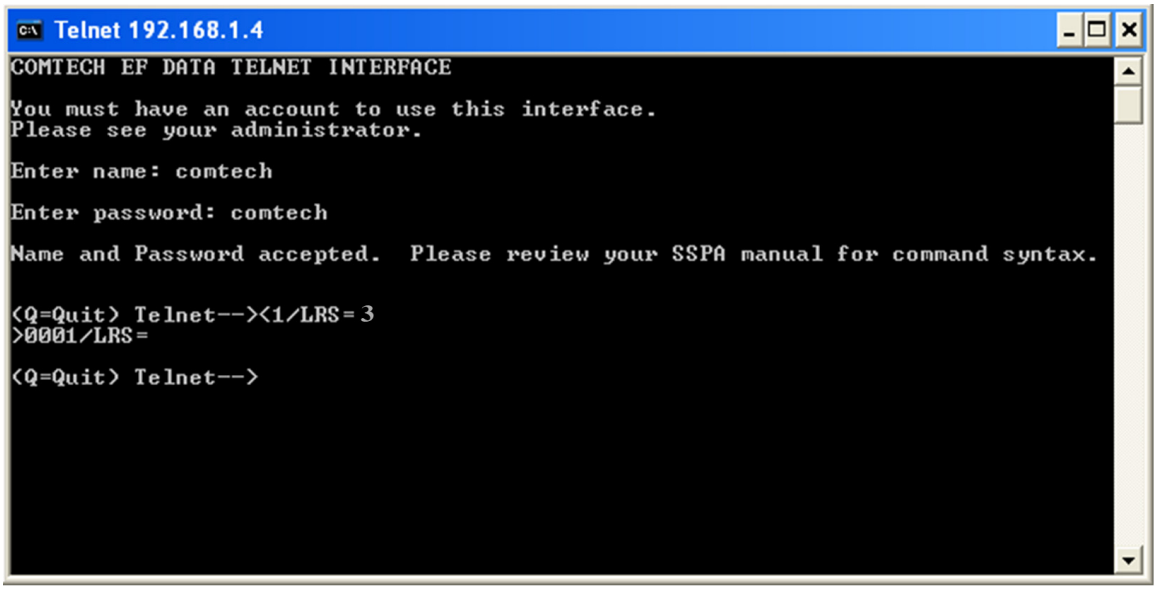
The TRP500 provides a Telnet interface for the purpose of Equipment M&C via the standard equipment Remote Control protocol.

The Telnet interface requires user login at the **Administrator** level and **Read/Write** level.

The screen capture below shows the login process:



Once logged into the Telnet interface as the Administrator, the user can access the standard remote control interface defined in **Appendix B. REMOTE CONTROL**, as shown in the following example:



4.5 Web Server (HTTP) Interface

The sections that follow describe the functionality of the TRP500 Web Server (HTTP) Interface. Please refer to the REMOTE CONTROL Specifications tables found in **Appendix B. REMOTE CONTROL** for detailed descriptions of the configuration parameters featured on the individual Web pages shown in this chapter.

4.5.1 Web Server Page Introduction

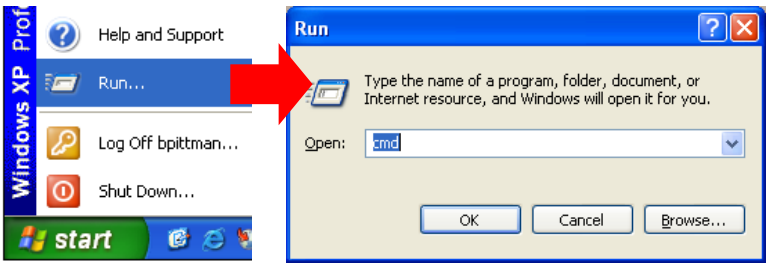
The embedded Web Server application provides the user with an easy to use interface to configure and monitor all aspects of the TRP500. These Web pages have been designed for optimal performance when using Microsoft's Internet Explorer Version 5.5 or higher (the examples shown use Internet Explorer Version 6.0).

The user can fully control and monitor base operations of the TRP500 from the Web Server Interface. By rolling the cursor over the navigation tabs located at the top of each page (right), the user can select from the available nested hyperlinks.

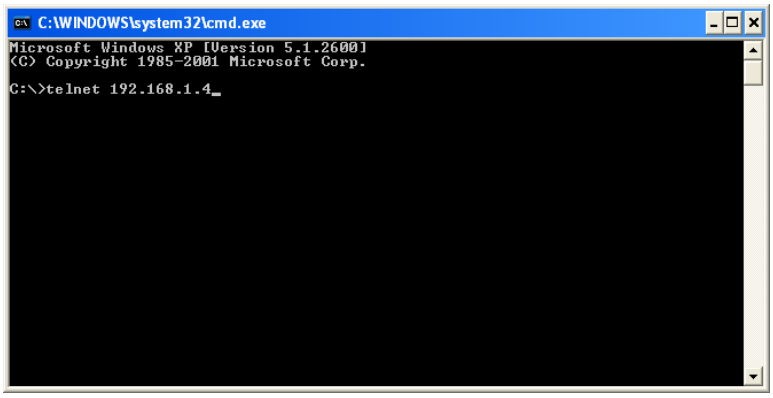
4.5.2 Enabling the Web Server Interface

To enable the Web Server Interface in the TRP500 using only a 100BaseTx remote interface (this assumes the user is running an Microsoft Windows OS):

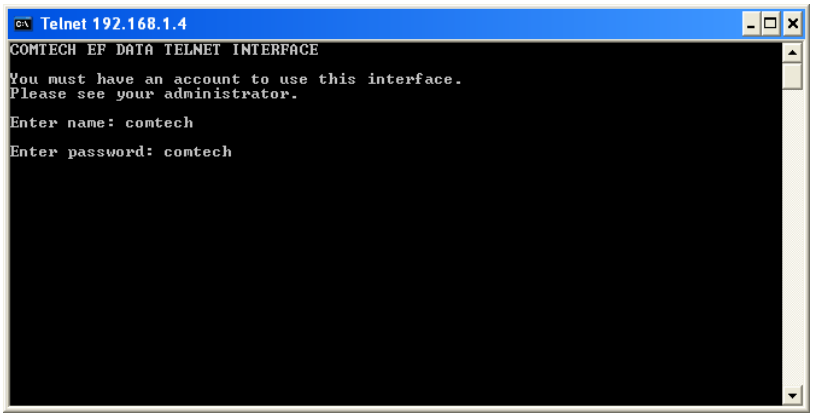
1. Select **Start**, then **Run**, then type "**cmd**" to open the command prompt window:



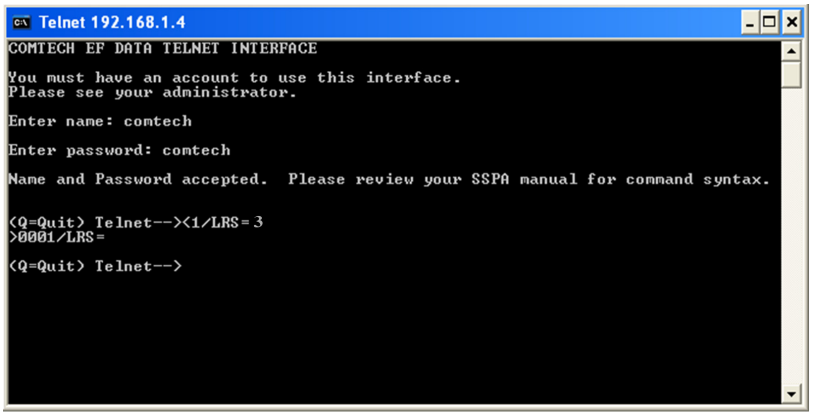
2. Start a Telnet session with the unit at the default IP address of **192.168.1.4**:



3. Enter the Telnet username and password (the default for both parameters is **comtech**):



4. Set the remote access parameter to accept Ethernet remote control using the **LRS** command.



   LRS=3, the default remote command, provides ***Serial + Ethernet control***, while remote command **LRS=2** provides ***Ethernet control only***.

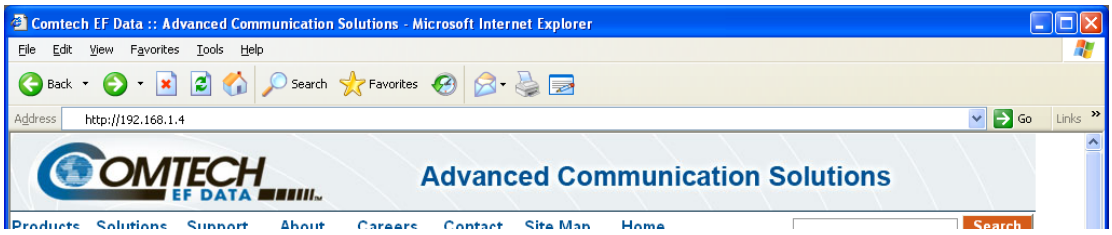
   Note: Each unit on the network must have its own unique IP address before it is connected to an existing network. The IP address may need to be changed to something other than the factory default setting by using the command **IPA=*xxx.xxx.xxx.xxx.yy***, where: ***xxx.xxx.xxx.xxx*** is a valid IP address on the network where the unit will be installed, and ***yy*** is the range (typically, ***yy*** = 24).

   Changing the **IPA** value will require the user to cycle power on the unit, and then start a new Telnet session using the new IP address.

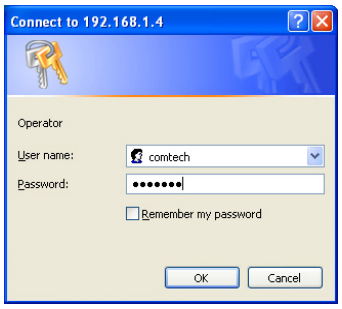
See **Appendix B. REMOTE CONTROL** for more information on the **LRS** and **IPA** commands.

4.5.3 Web Server Interface Access

1. From the PC, type **http://192.168.1.4** (the default IP address for the TRP500) into the **Address** area of the Web browser:



2. The Login window will appear, and the user is prompted to type a User Name and Password:

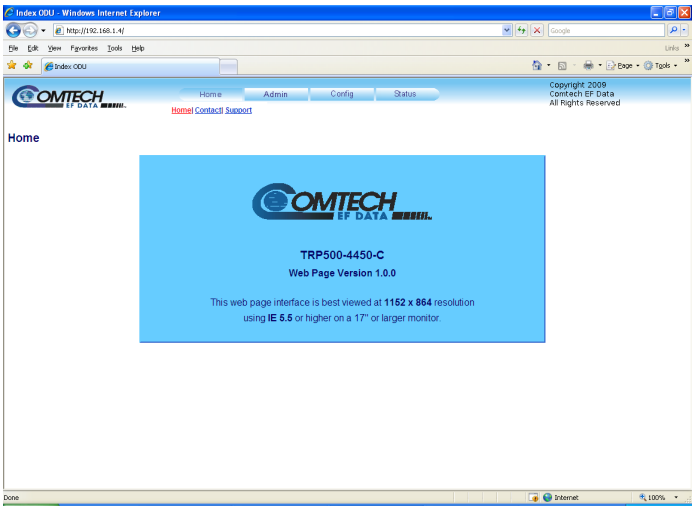


Default User Name – **comtech**
Default Password – **comtech**

Type the User Name and Password, then click **[OK].**

4.5.4 Web Server Interface "Splash" Page

Once the valid IP address and login information is entered, the TRP500 Web Server Interface "Splash" page will be displayed:



The pages available via the Web Server Interface are illustrated via the following menu tree:

Home	Admin	Config	Status
Home	Access	Amplifier	Summary
Contact	SNMP	Utility	Status
Support		Redundancy	FETs
			Events
			Statistics

4.5.5 Web Server Page Descriptions

The sections and subsections that follow detail the Web pages accessible via hyperlink from the "Splash" page navigation tabs shown in **Sect. 4.5.4**:

Sect. 4.5.5.1 Home Pages

Sect. 4.5.5.2 Admin (Administration) Pages

Sect. 4.5.5.3 Config (Configure TRP500) Pages

Sect. 4.5.5.4 Status Pages

4.5.5.1 Home Pages

4.5.5.1.1 Home | Home

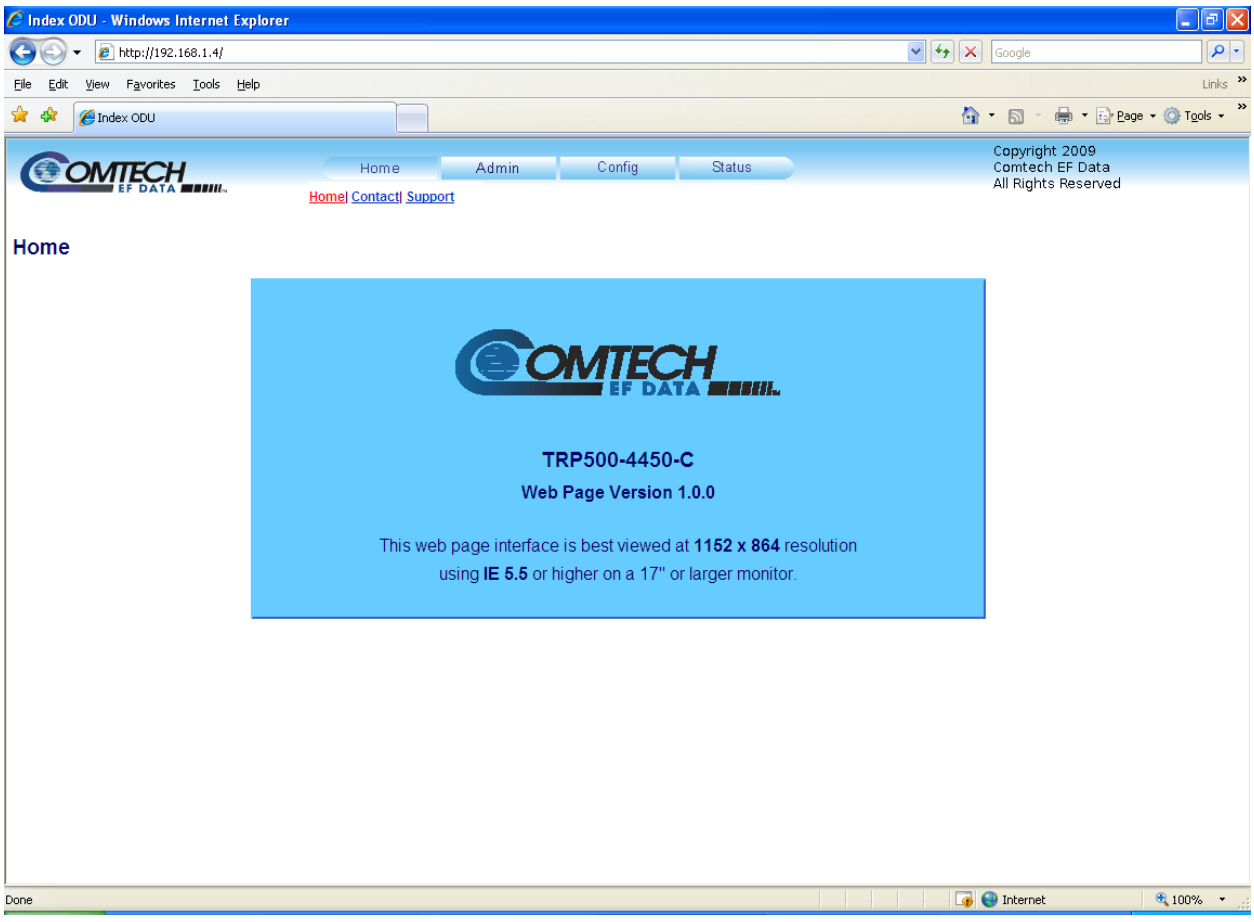


Figure 4-1. TRP500 Home | Home page

Select the **Contact** or **Support** hyperlinks from this top-level page. From any location within the Base Modulator Web Server Interface, the user can select the **Home** tab and/or hyperlink to return back to this page.

4.5.5.1.2 Home | Contact

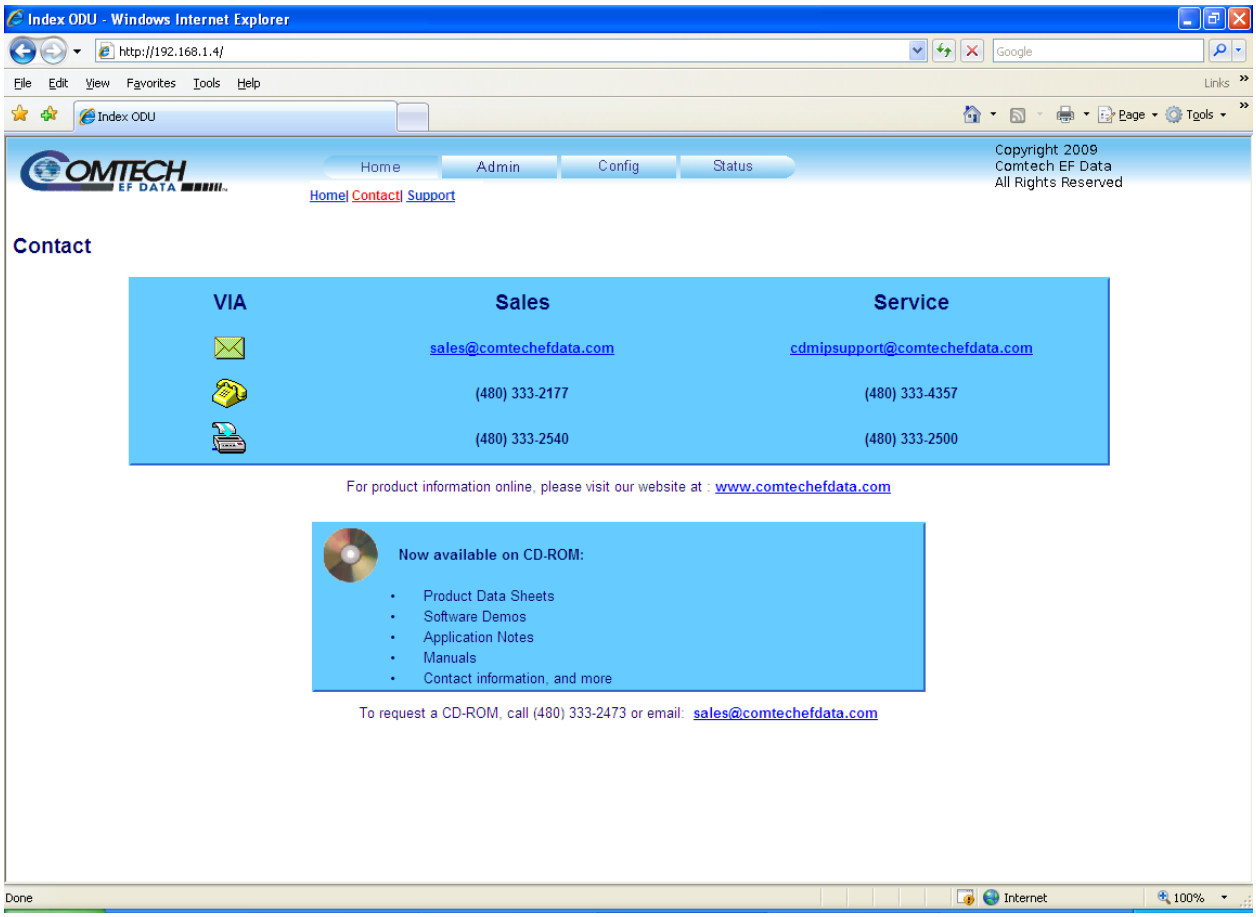


Figure 4-2. Home | Contact page

The **'Home | Contact'** page (**Figure 4-2**) provides basic contact information to reach Comtech EF Data Sales and Customer Support via phone or automated e-mail links.

4.5.5.1.3 Home | Support

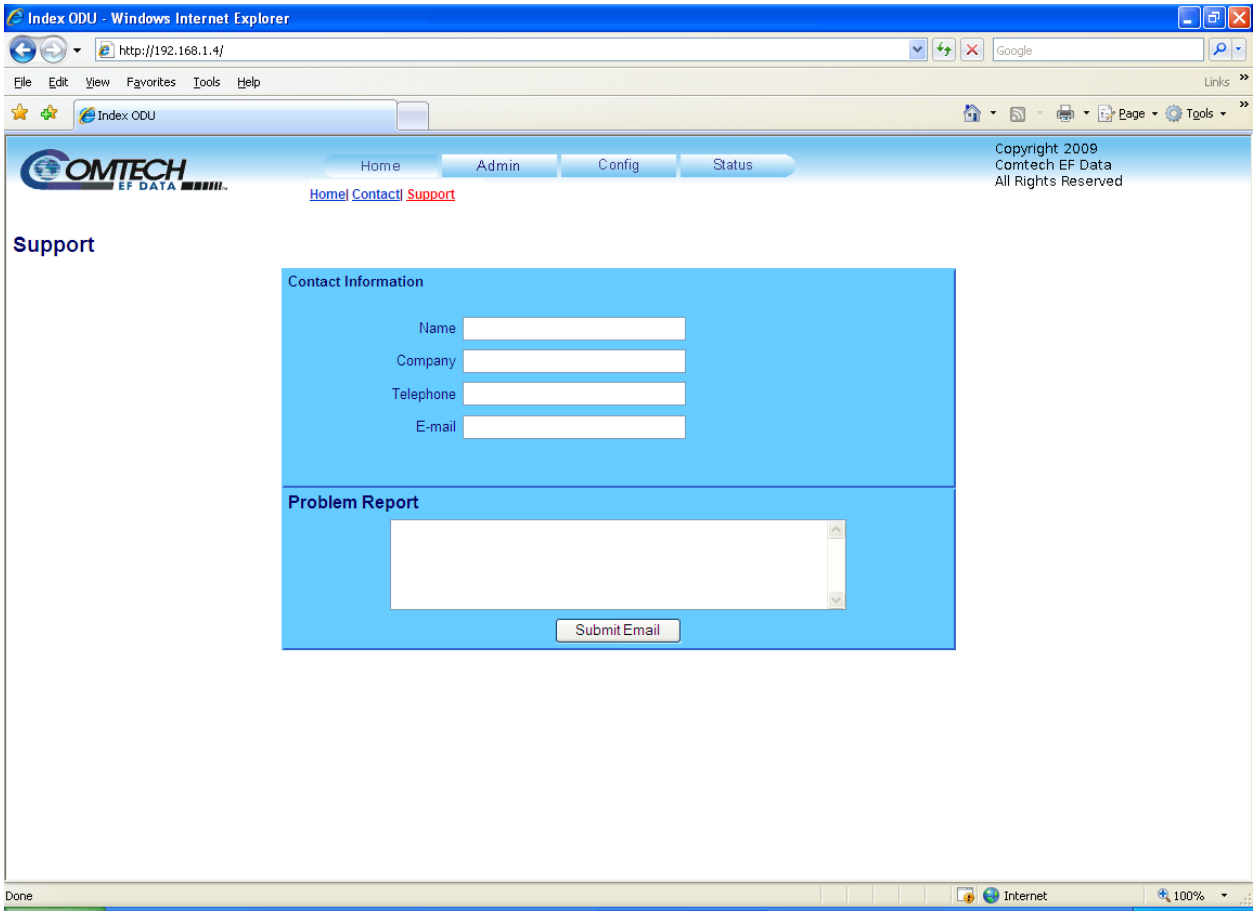


Figure 4-3. Home | Support page

The **'Home | Support'** page (**Figure 4-3**) allows the user to compose an e-mail message for questions or problems with the TRP500.

Fill in the appropriate user information as required under **Contact Information**; the **Problem Report** text window allows up to 256 characters maximum.

The TRP500 Support Web Page uses SMTP (Simple Mail Transport Protocol) to send e-mail to Comtech EF Data Modulator Support (cdmipsupport@comtechefdata.com).

IMPORTANT

For this page to operate correctly, the TRP500's administrator is required to specify the SMTP server, domain name, and destination on the* Admin | Access *page (see Sect. 4.5.5.2.1).

Once the **Contact Information** is entered and a message is composed in the **Problem Report** text window, click **[Submit Email]** to send the message.

4.5.5.2 Admin Pages

IMPORTANT

The Admin pages are available only to users who have logged in using the Administrator Name and Password.

4.5.5.2.1 Admin | Access

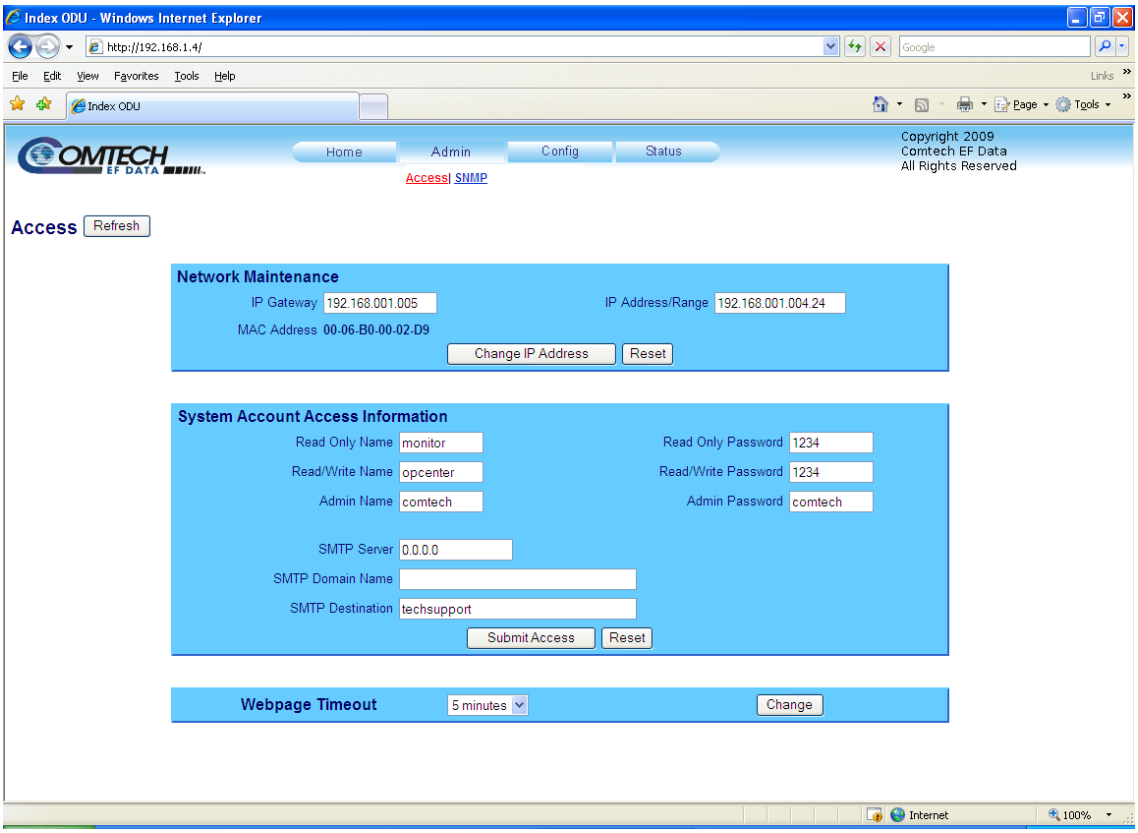


Figure 4-4. Admin | Access page

The '**Admin | Access'** page (**Figure 4-4**) provides the means to set up and maintain user names, passwords, the e-mail server, and the host IP addresses to facilitate communication with the TRP500 Web Server.

Network Maintenance

- **IP Gateway, IP Address/Range:** Enter the desired IP Gateway Address and IP Address/ Range in these text boxes.
- **MAC Address** *(read-only)***:** The MAC is set at the factory to a guaranteed unique address that cannot be modified by the user.

Once the desired configuration settings have been made in this section, the user should then click **[Change IP Address]** to save these changes. If it is desired to revert back to the previously assigned IP Gateway and IP Address/Range, the user should instead click **[Reset]**.

System Account Access Information

- **Admin, Read/Write, and Read Only Names and Passwords:**

  The factory defaults for these names/passwords are:

  - **Admin** comtech/comtech
  - **Read/Write** opcenter/1234
  - **Read Only** monitor/1234

  Note the following:

  - These **Name** fields can be any alphanumeric combination with a maximum length of 10 characters.
  - These **Password** fields can be any alphanumeric combination with a maximum length of 10 characters.

- **SMTP Server:** Specify the mail server IP address from where you want to send the e-mail.
- **SMTP Domain Name / Destination:** The Administrator can assign the SMTP Domain Name and Destination. This is required if the e-mail feature of the Support Page (**Sect. 4.5.5.1.3**) is to be used.
  - For **SMTP Domain Name**, specify the domain of the e-mail server (usually found to the right of the @ symbol in an e-mail address).
  - For **SMTP Domain Destination**, specify the e-mail recipient name (usually found to the left of the @ symbol in an e-mail address).

Once the desired configuration settings have been made in this section, the user should then click **[Change Access]** to save these changes. If it is desired to revert back to the previously assigned System Account Access Information, the user should instead click **[Reset]**.

Webpage Timeout

Using the drop-down menu, select the desired time lapse before the TRP500 Web Server Interface pages time out – the user may choose either five minutes or eight hours. The default timeout setting is five minutes. Click **[Submit]** when done.

NOTE: The '**Status | Status**' page (**Figure 4-10** in **Sect. 4.5.5.4.2**) will automatically refresh once every ten seconds, and will reset the timeout counter.

To update the page appearance to the current operating configuration, click **[Refresh]**.

4.5.5.2.2 Admin | SNMP

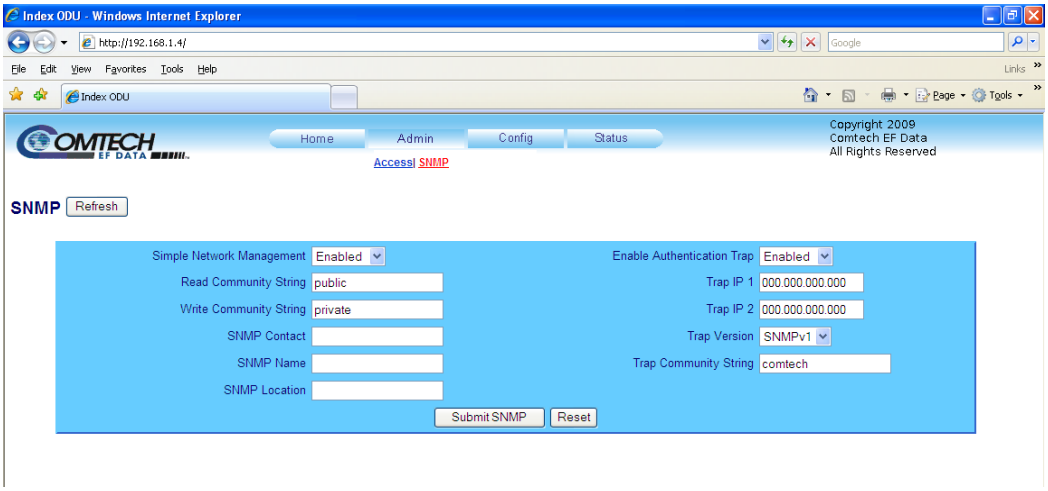


Figure 4-5. Admin | SNMP page

The '**Admin | SNMP'** page (**Figure 4-5**) sets and returns administration information for the TRP500 Simple Network Management Protocol (SNMP) feature.

Simple Network Management Operational Status: Using the drop-down menu, select the Simple Network Management operational setting as **Enabled** or **Disabled**.

The **SNMP Read** and **Write Community String** fields can be any combination of characters and a length of 0 - 20 characters:

- The factory default for the **Read Community String** parameter is ***public***.
- The factory default **Write Community String** is ***private***.

Authentication Trap Operational Status: Using the drop-down menu, select the Enable Authentication Trap operational setting as **Enabled** or **Disabled**.

The Administrator can assign up to two **SNMP Trap IP** addresses and one **SNMP Trap Community String.** The **SNMP Trap Community String** field can be any combination of characters and a length of 0 - 20 characters:

- The factory default for the **Trap Community String** is ***comtech***.

For details pertaining to the remaining configuration parameters available on this page, refer to **Sect. 4.3 SNMP INTERFACE**.

Once the desired SNMP assignations have been made on this page, the user should then click **[Submit SNMP]** to save these changes.

If it is desired to revert back to the previously assigned SNMP designations, the user should instead click **[Reset]**.

To update the page appearance to the current operating configuration, click **[Refresh]**.

4.5.5.3 Config Pages

4.5.5.3.1 Config | Amplifier

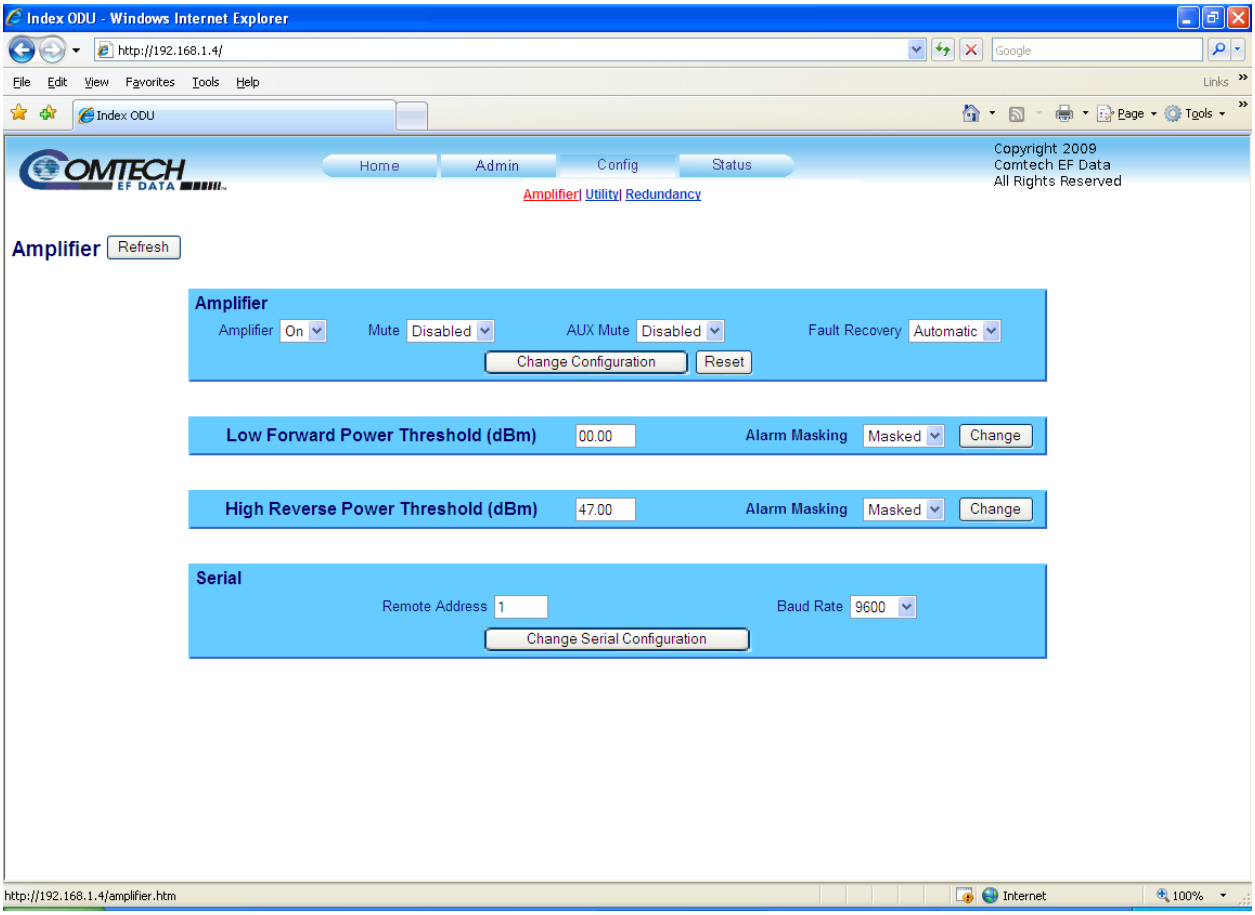


Figure 4-6. Config | Amplifier page

The '**Config | Amplifier**' page (**Figure 4-6**) provides the means to configure the serial communications, operations, and alarms/faults handling for the amplifier.

Amplifier

- **Amplifier:** Using the drop-down menu, select the amplifier as either **On** or **Off**.
- **Mute:** Using the drop-down menu, select the Mute function as either **Enabled** or **Disabled**.
- **AUX Mute:** Using the drop-down menu, select the Auxiliary Mute Mode as either **Enabled** or **Disabled**.
- **Fault Recovery:** Using the drop-down menu, select Fault Recovery as either **Automatic** or **Manual**.

Once the desired configuration settings have been made in this section, the user should then click **[Change Configuration]** to save these changes. If it is desired to revert back to the previously assigned Amplifier settings, the user should instead click **[Reset]**.

Low Forward Power Threshold (dBm)

Use this field to set the threshold value, in dBm, for the low forward power alarm/fault. If the forward power drops below the specified value, the alarm/fault will be indicated if the forward power monitor is set to **Alarm** or **Fault** instead of the factory default of **Mask**. Setting this parameter to the default value of 00.00 effectively disables the threshold.

- **Alarm Masking:** Using the drop-down menu, select the alarm mask as **Fault, Alarm, or Masked**.

Once the desired configuration setting has been made in this section, the user should then click **[Change]** to save this change.

To update the page appearance to the current operating configuration, click **[Refresh]**.

High Reverse Power Threshold (dBm)

Use this field to set the threshold value, in dBm, for the high reverse power alarm/fault. If the reverse power rises to the specified value, the alarm/fault will be indicated if the reverse power monitor is set to **Alarm** or **Fault** instead of the factory default of **Mask**. Setting this parameter to the default value of 00.00 effectively disables the threshold.

- **Alarm Masking:** Using the drop-down menu, select the alarm mask as **Fault, Alarm, or Masked**.

Once the desired configuration setting has been made in this section, the user should then click **[Change]** to save this change.

To update the page appearance to the current operating configuration, click **[Refresh]**.

Serial

- **Remote Address:** Enter a valid physical remote address between **0001** to **9999**.
- **Baud Rate:** Using the drop-down menu, select the operating baud rate as **2400**, **4800**, **9600**, **19200**, or **38400** baud

Once the desired configuration settings have been made in this section, the user should then click **[Change Serial Configuration]** to save these changes.

4.5.5.3.2 Config | Utility

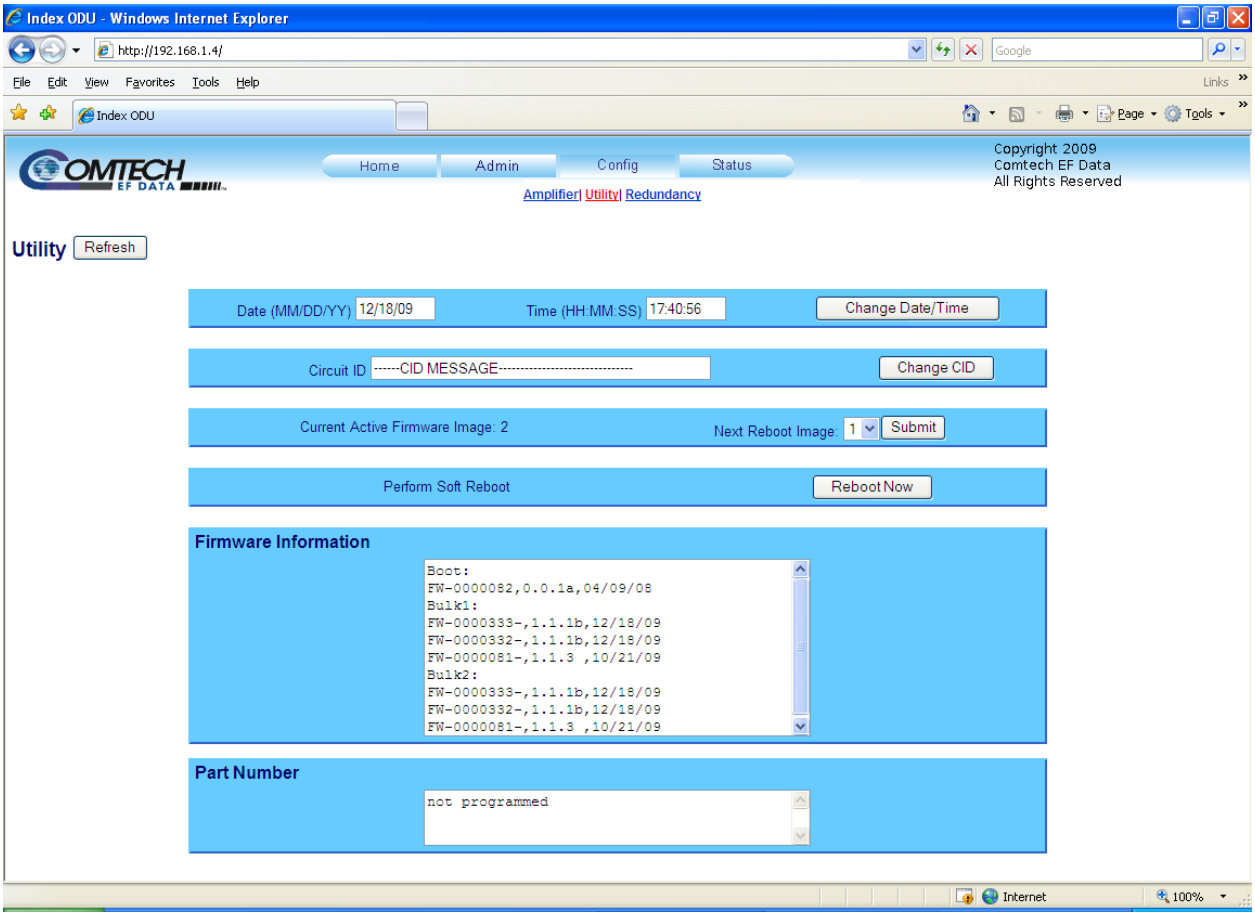


Figure 4-7. Config | Utility page

The '**Config | Utility**' page (**Figure 4-7**) is used to configure TRP500 operating parameters.

Date and Time

- The user may enter a date using international format in the form DD/MM/YY (where DD = day [01 to 31], MM = month [01 to 12], and YY = year [00 to 99]).
- The user may enter a time using HH:MM:SS format (where HH = hour [00 to 23], MM = minutes [00 to 59], and SS = seconds [00 to 59]).

Once the desired date and time have been entered in this section, the user should then click **[Change Date/Time]** as needed to save these changes.

Circuit ID

The user may enter a Circuit ID string of up to 48 characters. Once the desired string had been entered in this section, the user should then click **[Enter Circuit ID]** as needed to save this change.

Current Active Firmware Image *(read-only)*

Identifies the selected **Current Active Firmware Image**. In this example, **Image 2** is the **Current Active Firmware Image**.

Next Reboot Image

Using the drop-down menu, select **Reboot Image 1** or **2**. Press **[Submit]** when done.

Perform Soft Reboot

Click **[Reboot Now]** to reboot the TRP500 using the **Current Active Firmware Image**.

Firmware Information *(read-only)*

Provides the user with a ***read-only*** scrollable window to view information about the currently loaded Bootrom; for Bulk1 and Bulk2, the user can scroll through information of all the constituent firmware blocks that make up the bulk.

Part Number *(read-only)*

Provides the user with a ***read-only*** scrollable window to view identifying part number information for the unit in use.

To update the page appearance to the current utility configuration, click **[Refresh]**.

4.5.5.3.3 Config | Redundancy

IMPORTANT

***For information about 1:1 Redundant operations, see* Appendix A. 1:1 REDUNDANCY.**

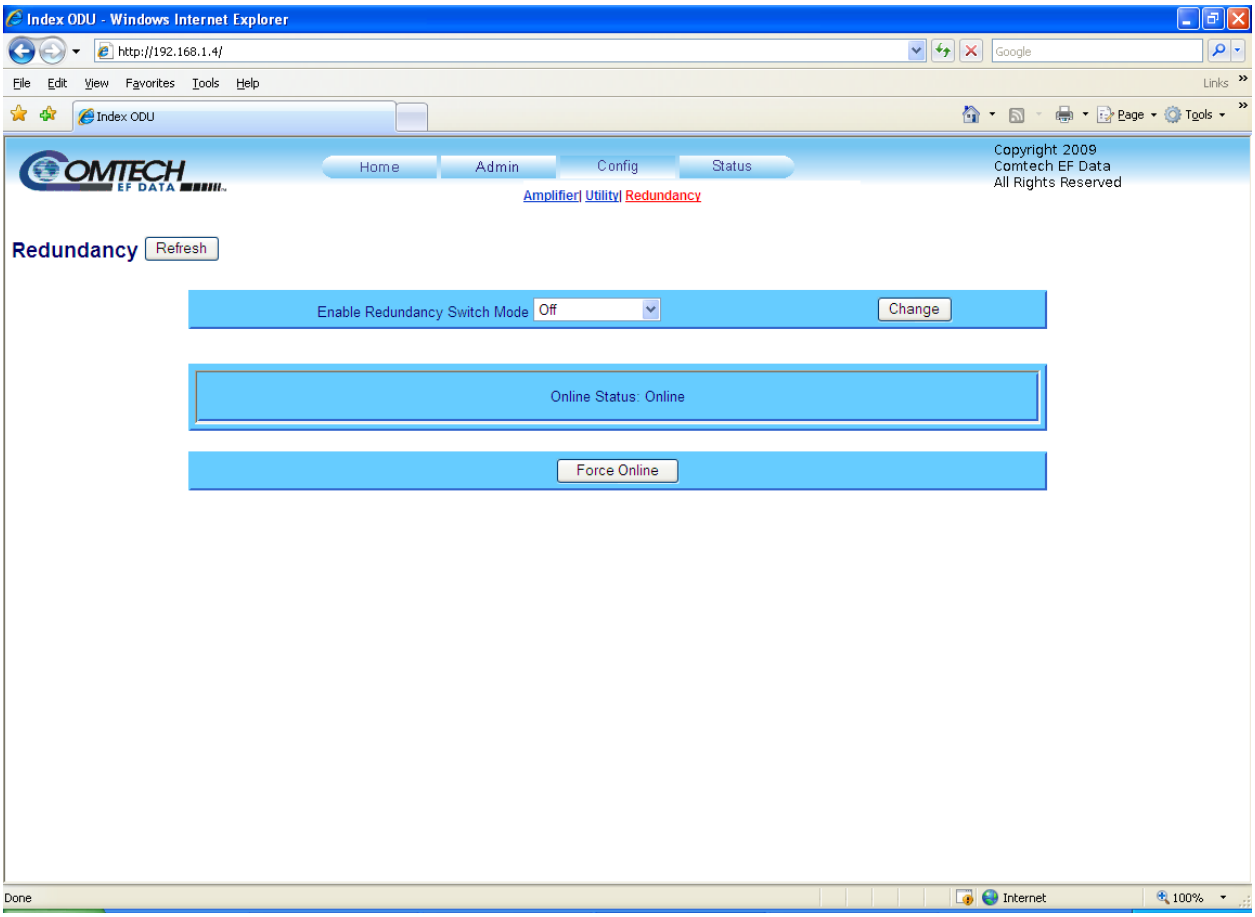


Figure 4-8. Config | Redundancy page

The '**Config | Redundancy'** page (**Figure 4-8**) is used to configure the TRP500's Redundancy Switch Mode.

Using the drop-down menu, select the Switch Mode as follows:

- **Off:** Disables redundancy.
- **1:1 Red TX:** Enables 1:1 redundancy with transmit switch control.
- **1:1 Red TX+RX:** Enables 1:1 redundancy with transmit and receive switch control.
- **Manual:** Enables manual redundancy mode.

Once the desired mode selection has been made, click **[Change]** to execute the choice.

To force a unit to go active (online), click **[Force Online]**.

To update the page to the current redundancy configuration, click **[Refresh]**.

4.5.5.4 Status Pages

The hyperlinks available under the '**Status**' tab provide the user access to event logging, operational statistics, status, and FET windows.

4.5.5.4.1 Status | Summary

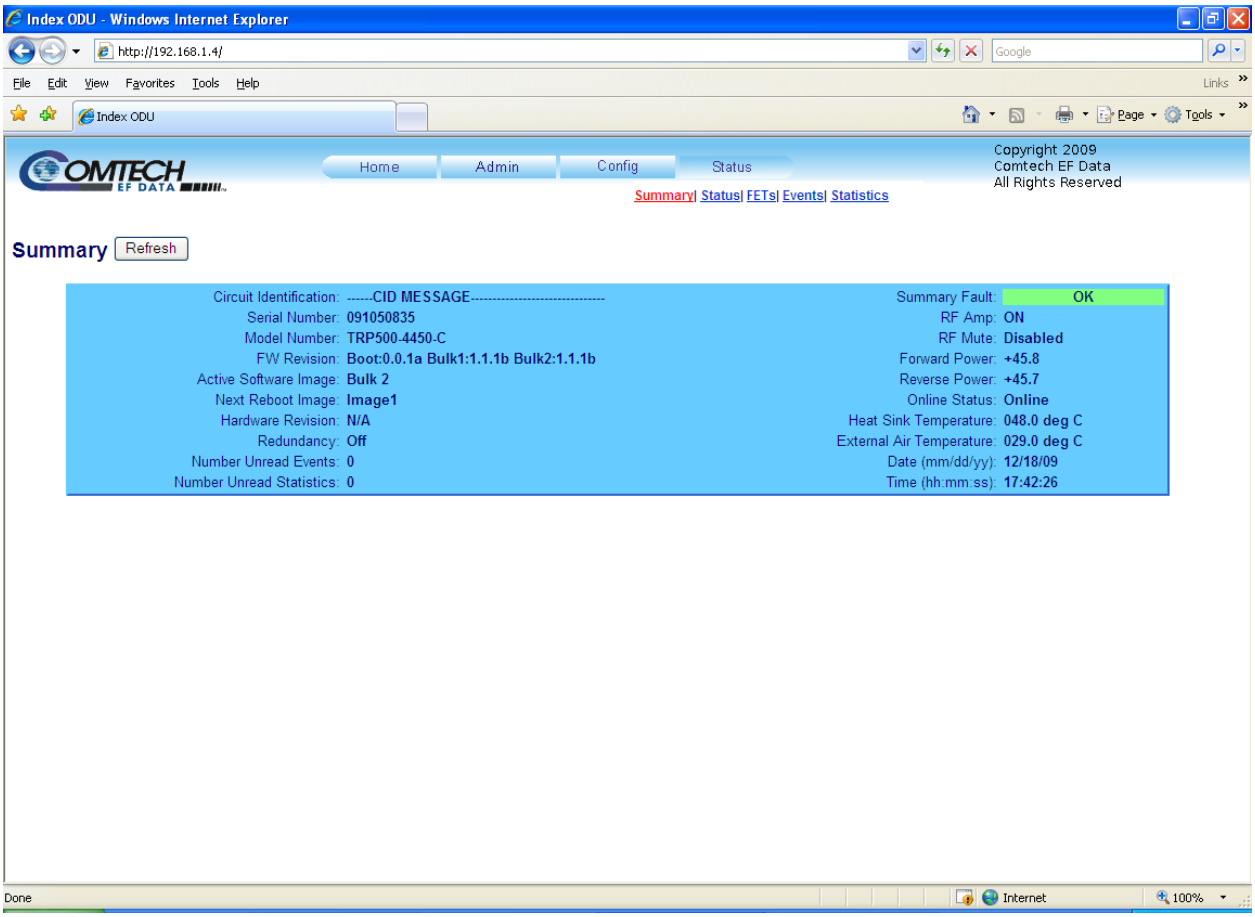


Figure 4-9. Status | Summary page

The **'Status | Summary'** page **(**Figure 4-9**)** provides the user with all pertinent summarized information about the TRP500.

Note: Unlike the remaining Web Server pages available through this interface that refresh/update only when manually selected by the user, the **'Status | Summary'** page automatically updates once every 10 seconds. Even with this automatic refresh function, the user may click **[Refresh]** to update the operational status parameters found on this page.

4.5.5.4.2 Status | Status

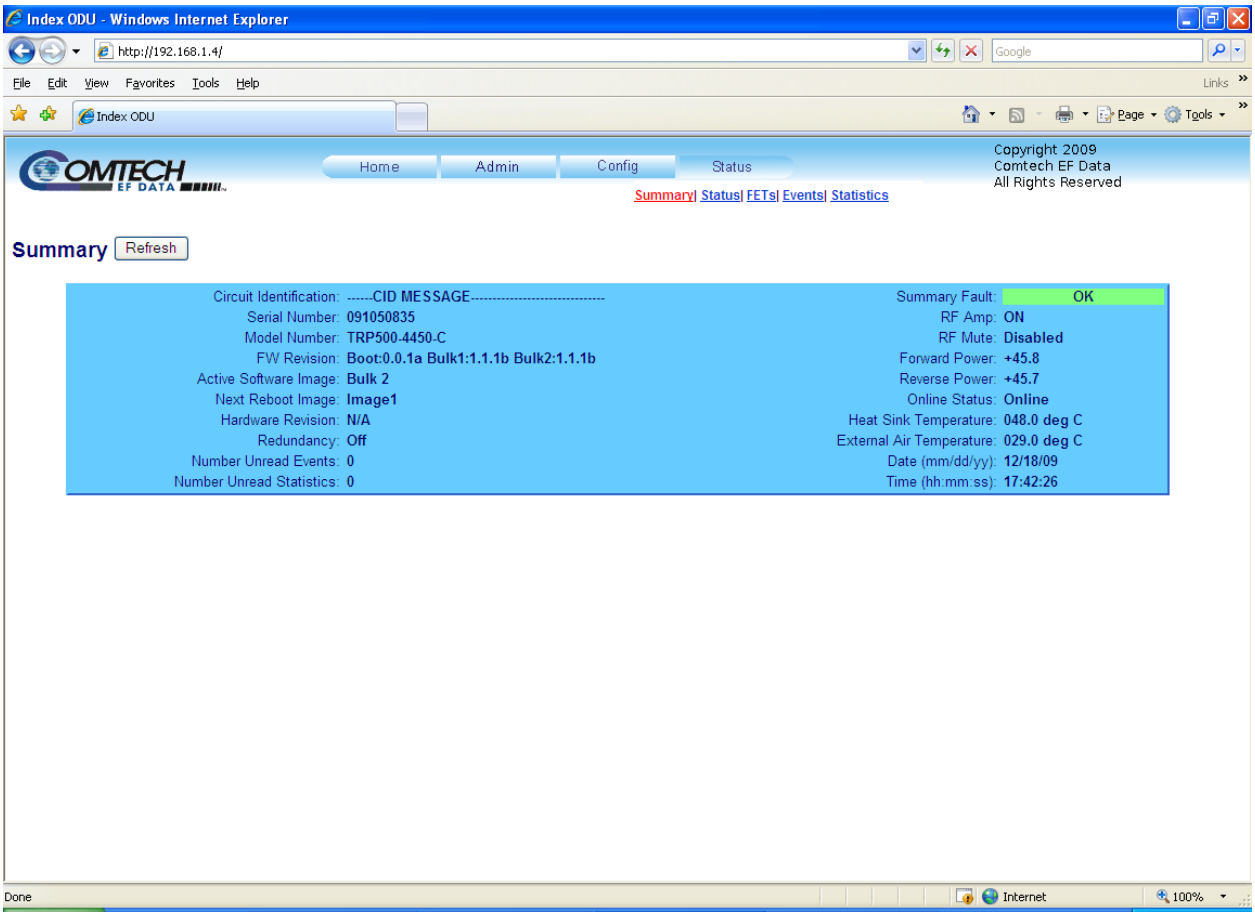


Figure 4-10. Status | Status page

The **'Status | Status'** page (**Figure 4-10**) provides the user with detailed monitor and status information about the TRP500.

Note: Unlike the remaining Web Server pages available through this interface that refresh/update only when manually selected by the user, the **'Status | Status'** page automatically updates once every 10 seconds. Even with this automatic refresh function, the user may click **[Refresh]** to update the operational status parameters found on this page.

4.5.5.4.3 Status | FETs

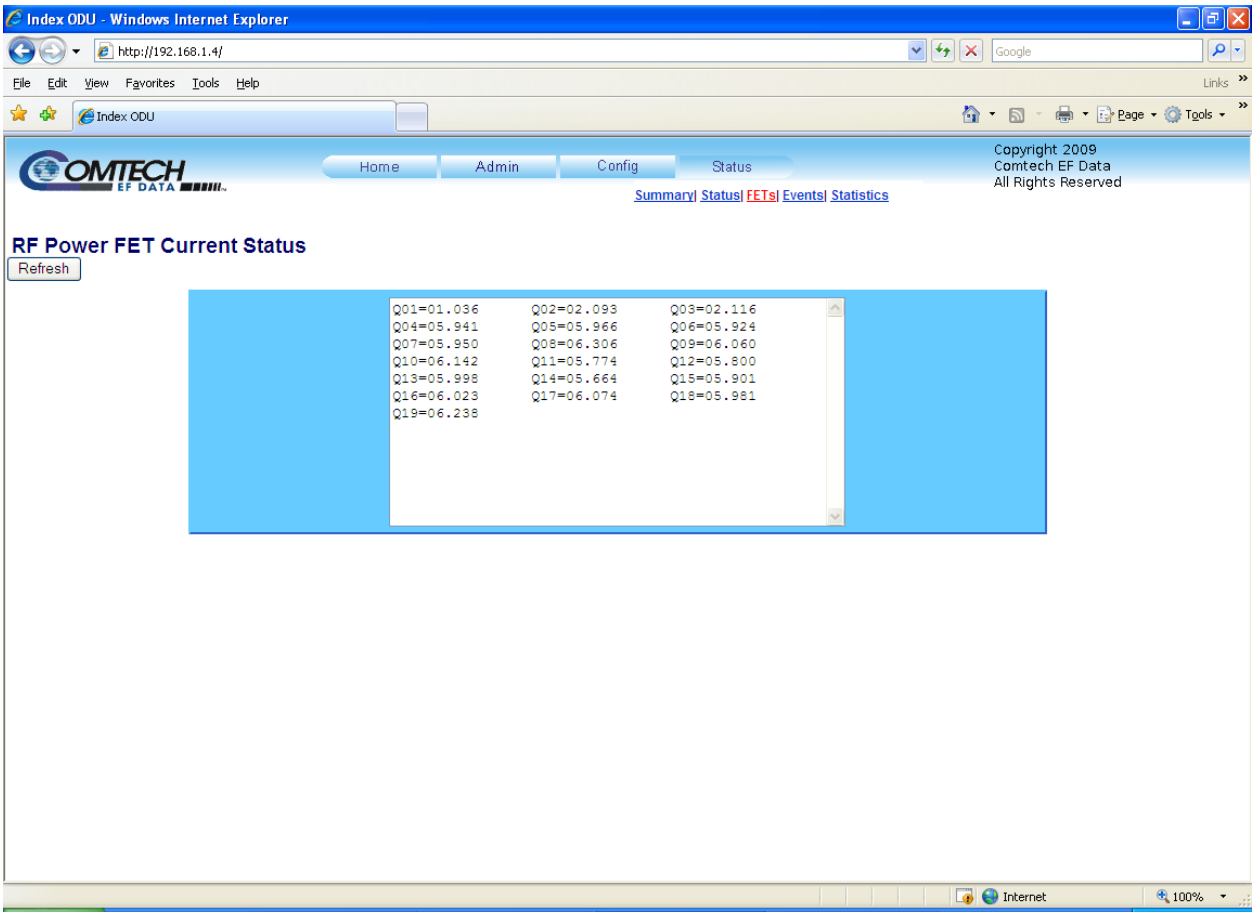


Figure 4-11. Status | FETs page

The '**Status| FETs'** page (**Figure 4-11**) features a ***read-only*** scrollable window that displays the operating currents of all FETs (**F**ield **E**ffect **T**ransistors) installed in the RF amplifier.

4.5.5.4.4 Status | Events

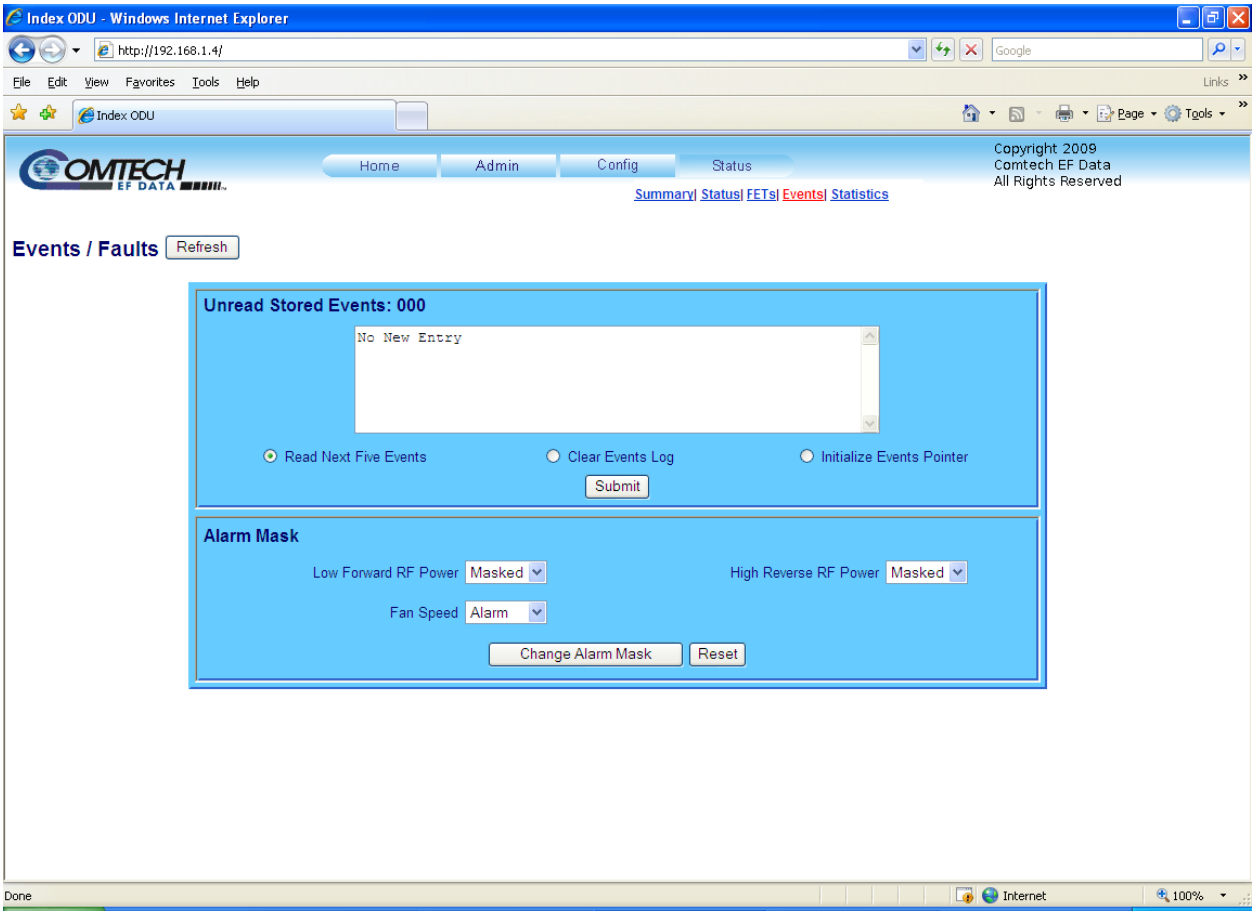


Figure 4-12. Status | Events page

The **'Status | Events'** page (**Figure 4-12**) provides the user with all pertinent information about stored events, and provides the user with a means to define the TRP500 alarm parameters which determine how those events are triggered.

Unread Stored Events

This ***read-only*** scrollable window displays the unread stored events log in sequential, date-stamped format. A running tally of the number of unread stored events is displayed in the window header. The unit returns and displays the five oldest stored events in the alarm log, All events that are read from the log are also automatically removed from the log.

The user has the ability to manage the Unread Stored Events window as follows:

- **Read Next Five Events:** Select to display the next five unread stored events in the log.
- **Clear Events Log:** Select to clear all stored events from the log.
- **Initialize Events Pointer:** Select to reset the internal pointer to allow queries to start at the beginning of the stored events log.

Once a selection has been made, click **[Submit]** to execute the choice – the window will update according to the selection made.

Alarm Mask

Using the drop-down menus, select each alarm as either **Fault**, **Alarm** or **Masked** for:

- **Low Forward RF Power**
- **High Reverse RF Power**
- **Fan Speed**

Once the desired configuration settings have been made in this section, the user should then click **[Change Alarm Mask]** to save these changes. If it is desired to revert back to the previously assigned Alarm Mask settings, the user should instead click **[Reset]**.

To update the page with the current viewing and operating configuration, click **[Refresh]**.

4.5.5.4.5 Status | Statistics

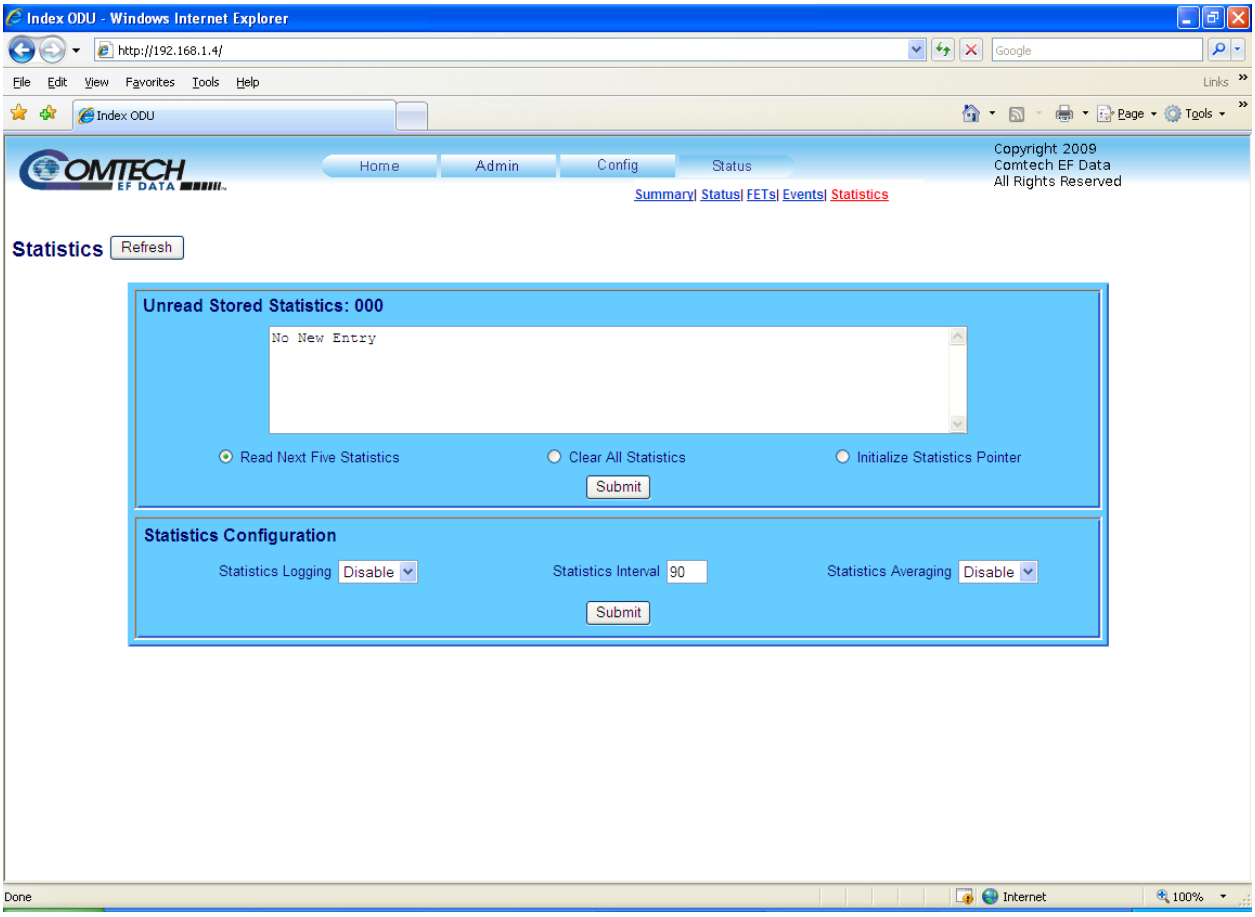


Figure 4-13. Status | Statistics page

The **'Status | Statistics'** page (

Figure 4-13) provides the user with all unread (stored) statistics, and provides the means to configure how statistics are handled and displayed by the TRP500.

Unread Storage Statistics:

This ***read-only*** *s*crollable window displays the unread stored statistics log in sequential, date-stamped format. A running tally of the number of unread stored statistics is displayed in the window header. The unit returns and displays the five oldest stored statistics; all events that are read from the log are also automatically removed from the log.

The user has the ability to manage the Unread Stored Statistics window as follows:

- **Read Next Five Statistics:** Unit returns the oldest five unread stored statistics which have not yet been read in the log. If there are less than five events to be retrieved, the remaining positions are padded with zeros. If there are no new events, the counter in the header reads **000**.
- **Initialize Statistics Pointer:** Resets the internal pointer to allow queries to start at the beginning of the statistics log.

Once the statistics viewing selection has been made, click **[Submit]** to execute the choice – the window will update according to the selection made.

Statistics Configuration

- **Statistics Logging:** Using the drop-down menu, select either **Enable** or **Disable** to set the Statistics Logging function.
- **Statistics Interval**: Enter the interval, in minutes, at which statistics are logged. Minimum resolution is 1 minute (001); maximum is 99 minutes (099). Default is 90 minutes (090).
- **Statistics Averaging:** Using the drop-down menu, select either **Enable** or **Disable** to set the Statistics Averaging function When **Enabled**, statistics data is averaged at a rate of once per second for 10 seconds. If **Disabled**, burst values will be logged instead of averaged values.

Once the statistics configuration parameters have been defined, click **[Submit] t**o execute the choice.

To update the page with the current viewing and operating configuration, click **[Refresh]**.

Notes:

Chapter 5. MAINTENANCE

5.1 Scheduled Maintenance

Once a year (or more often depending upon environmental conditions), the SSPA should be checked for proper operation.

- Verify the fans and vents are free of debris or anything that would impede the airflow to cool the amplifier.
- Verify connections have remained sealed and appear to be watertight.
- Disconnect power from the SSPA.
- Remove the fan assembly (see procedure below).
- Using compressed air, blow through the SSPA heatsinks to remove any foreign objects or debris that may have accumulated. This will help maintain heatsink efficiency.
- Re-install the fan assembly.

5.2 Fan Removal

The fans utilized by the TRP500 are designed for long life even in a harsh environment. They are still mechanical devices subject to wear and may need replacement after several years. In dusty environments, their removal facilitates clearing the heat sink of accumulated dust. To remove the fan assembly:

- Disconnect power from the SSPA
- Loosen the 8 fasteners (6 shoulder screws and 2 pan head screws) holding the fan assembly to the amplifier (See Figure 5-1).
- Carefully remove the fan assembly far enough to gain access to the 3 circular fan connectors.
- Disconnect the circular fan connectors and remove the fan assembly.
- Replace the faulty fan(s) as necessary. (Replacements are available from Comtech).
- To re-assemble, use care to ensure that the connectors are properly engaged and that the fan cables are not pinched.

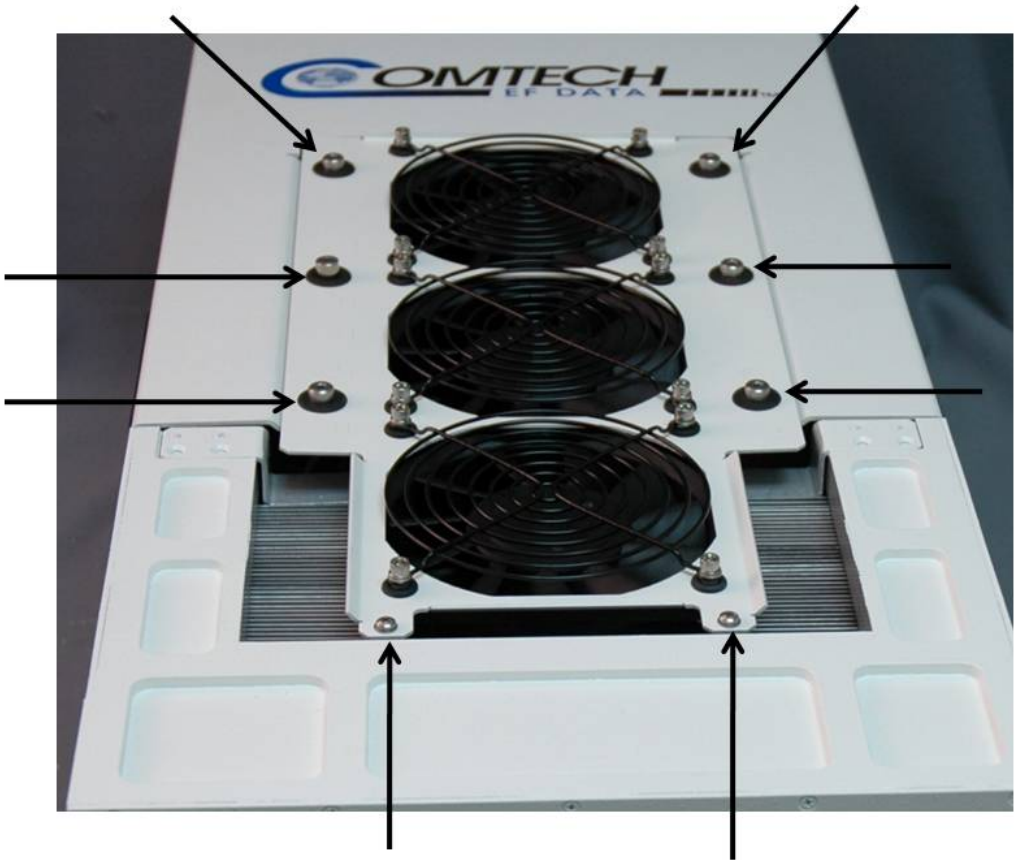


Figure 5-1. Fan Assembly Removal

Appendix A. 1:1 REDUNDANCY

A.1 Introduction to Redundancy Operation

Comtech has a long history and is experienced in delivering redundant amplifier configurations for communication needs. The TRP500 contains all the necessary logic and M&C control for a 1:1 configuration, without the addition of an external controller. Contact the factory for futher details.

Notes:

Appendix B. REMOTE CONTROL

B.1 Introduction

This appendix describes the operating features of the Troposcatter Outdoor Amplifier (TRP500). A few key parameters and procedures are summarized, followed by detailed instructions of remote control communication commands. The remote commands for the TRP500 closely match Comtech EF Data's other SSPA (Solid State Power Amplifier) product lines.

B.1.1 RF Input Level

The required RF input level to reach the full rated output power of the SSPA is determined by the individual amplifier maximum gain and power rating. For example, if the test data of a SSPA rated for 250W (54 dBm) indicated a gain of 40 dB, then a signal of **54 dBm – 40 dB = 14 dBm** would approximately give the rated output power. Increasing input power beyond this level would result in an output signal with increasingly higher levels of distortion. The maximum input level should never exceed 30 dBm, or permanent damage to the unit may occur.

B.1.2 Gain Control

The TRP500 is temperature compensated to maintain its gain over the unit's specified temperature range.

B.1.3 Mute Control

The TRP500 may be muted via software or discrete control. Exercising the **MUT=1** command will "software" mute the unit. The TRP500 also may be "hardware" muted by pulling Pin 'S' on the J6 (COM1) Discrete control connector to ground (See **Chapter 2. SYSTEM CONNECTIONS, INSTALLATION AND OPERATION**).

The Mute command provides over 30 dB of RF on/off isolation. However, the Mute command only turns off the first stage of the amplifier, the high power stages remain on. By allowing the higher power transistors to stay on, the TRP500 remains in a more thermally stable state should the mute condition be removed.

If the user desires to completely turn off the bias to the entire amplifier (perhaps to conserve energy in a redundant system), both the **MUT=1** and **AMP=0** commands should be executed. For normal transmit operation, **MUT=0** and **AMP=1** are required.

B.1.4 Faults

The M&C system monitors certain key functions of the TRP500 for proper operation. Should any of these parameters exceed predetermined limits, the M&C system will declare a fault. The conditions that trigger a fault are:

- Any power supply more than ± 10% outside its nominal value.
- Fan less than 25% of maximum speed.
- I2C internal bus communications fault.
- Thermal Shutdown – A temperature fault is indicated if the unit is +>90°C. This creates a summary fault and will cause the unit to mute itself and switch to the back-up unit (if in a redundant system). However, the 10V supply to the FET transistors will remain on until the unit reaches the thermal shutdown temperature of ≥ >95°C. For protection reasons, the unit will shut down the 10V supply to the power transistors at temperatures >95°C.
- High RF reflected power shutdown – When the reflected power reaches +52dBm the unit will enable the mute, and switch off the amplifier bias voltage in order to prevent damage to the unit.
- Firmware checksum error at power up.
- FPGA done indicator error at power up.
- Redundant waveguide switch position fault (applies to redundant mode operation only).
- Redundant inter-unit link fault (applies to redundant mode operation only).

The following parameters can be user defined to report an alarm condition, a fault condition, or the parameter can be ignored completely by masking it:

- RF amplifier low output power (user adjustable value)
- High RF reflected power (user adjustable value)

B.1.5 Forward RF Power Detector

A power detector is provided to monitor the output power. It has a useful range of over 20 dB, referenced to the unit's rated P1dB point, and its value can be read by exercising the **RMS** command. The test data supplied with each unit gives an indication of the excellent accuracy and flatness of the power monitor over the frequency band of operation.

B.1.6 Reverse RF Power Detector

A power detector is provided to monitor the reflected RF power. It has a useful range of over 20 dB, referenced to 52dBm (fault threshold value), and its value can be read by exercising the **RMS** command. The test data supplied with each unit gives an indication of the excellent accuracy and flatness of the power monitor over the frequency band of operation.

B.1.7 Some Common Commands

A few of the most common commands and queries are listed below. Full details for each of these are listed at the end of this section.

- **RMS:** Retrieve Maintenance Status. Displays voltages, fan speeds, Heatsink temperature, output power monitor reading, etc.
- **RCS:** Retrieve Configuration Status. Displays current attenuation, mute, amplifier, online, etc. status.
- **RAS:** Retrieve Alarm Status. Displays current alarm or fault status.

B.2 Remote Control Protocol and Structure

This section describes the protocol and message command set for remote monitor and control of the Tropo.

The electrical interface is either an RS-485 multi-drop bus (for the control of many devices) or an RS-232 connection (for the control of a single device), and data is transmitted in asynchronous serial form, using ASCII characters. Control and status information is transmitted in packets, of variable length, in accordance with the structure and protocol defined in later sections.

B.2.1 RS-485

For applications where multiple devices are to be monitored and controlled, a full-duplex (or 4-wire) RS-485 is preferred. Half-duplex (2-wire) RS-485 is possible, but *is not preferred*.

In full-duplex RS-485 communication there are two separate, isolated, independent, differential-mode twisted pairs, each handling serial data in different directions. It is assumed that there is a 'Controller' device (a PC or dumb terminal), which transmits data, in a broadcast mode, via one of the pairs. Many 'Target' devices are connected to this pair, which all simultaneously receive data from the Controller. The Controller is the only device with a line-driver connected to this pair – the Target devices only have line-receivers connected.

In the other direction, on the other pair, each Target has a Tri-Stateable line driver connected, and the Controller has a line-receiver connected. All the line drivers are held in high-impedance mode until one (and only one) Target transmits back to the Controller.

Each Target has a unique address, and each time the Controller transmits, in a framed 'packet' of data, the address of the intended recipient Target is included. All of the Targets receive the packet, but only one (the intended) will reply. The Target enables its output line driver, and transmits its return data packet back to the Controller, in the other direction, on the physically separate pair.

RS-485 (Full Duplex) Summary:

Two differential pairs	One pair for Controller to Target, one pair for Target to Controller.
Controller-to-Target pair	Pair has one line driver (Controller), and all Targets have line-receivers.
Target-to-Controller pair	Pair has one line receiver (Controller), and all Targets have Tri-State drivers.

B.2.2 RS-232

This is a much simpler configuration in which the Controller device is connected directly to the Target via a two-wire-plus-ground connection. Controller-to-Target data is carried, via RS-232 electrical levels, on one conductor, and Target-to-Controller data is carried in the other direction on the other conductor.

B.2.3 Basic Protocol

Whether in RS-232 or RS-485 mode, all data is transmitted as asynchronous serial characters, suitable for transmission and reception by a UART. The character format should be 8N1 (8 data bits, no parity, 1 stop bit). The baud rate may vary between 2400 and 38400 baud.

All data is transmitted in framed packets. The Controller is assumed to be a PC or ASCII dumb terminal, which is in charge of the process of monitor and control. The Controller is the only device that is permitted to initiate, at will, the transmission of data. Targets are only permitted to transmit when they have been specifically instructed to do so by the Controller.

All bytes within a packet are printable ASCII characters, less than ASCII code 127. In this context, the Carriage Return and Line Feed characters are considered printable.

All messages from Controller-to-Target require a response – with one exception. This will be either to return data that has been requested by the Controller, or to acknowledge reception of an instruction to change the configuration of the Target. The exception to this is when the Controller broadcasts a message (such as Set time/date) using Address 0, when the Target is set to RS-485 mode.

B.2.4 Packet Structure

Controller-to-Target						
Start of Packet	**Target Address**	**Address Delimiter**	**Instruction Code**	**Code Qualifier**	**Optional Arguments**	**End of Packet**
< ASCII code 60 (1 character)	0-9 ASCII codes 48-57 (4 characters)	/ ASCII code 47 (1 character)	A-Z, a-z ASCII codes 65-90, 97-122 (3 characters)	= *or* ? ASCII codes 61 or 63 (1 character)	 (n characters)	Carriage Return ASCII code 13 (1 character)

Example: <0412/MUT=1{CR}

Target-to-Controller						
Start of Packet	**Target Address**	**Address Delimiter**	**Instruction Code**	**Code Qualifier**	**Optional Arguments**	**End of Packet**
> ASCII code 62 (1 character)	0-9 ASCII codes 48-57 (4 characters)	/ ASCII code 47 (1 character)	A-Z, a-z ASCII codes 65-90, 97-122 (3 characters)	=, ?, !, *or* * ASCII codes 61,63,33 or 42 (1 character)	 (From 0 to n characters)	Carriage Return, Line Feed ASCII codes 13,10 (2 characters)

Example: >0412/MUT=1{CR}{LF}

B.2.4.1 Start of Packet

- **Controller-to-Target:** This is the character '<' (ASCII code 60).
- **Target-to-Controller:** This is the character '>' (ASCII code 62).

Because this is used to provide a reliable indication of the start of packet, these two characters may not appear anywhere else within the body of the message.

B.2.4.2 Target Address

Up to 9,999 devices can be uniquely addressed. In RS-232 applications this value is set to 0. In RS-485 applications, the permissible range of values is 1 to 9999.

The Controller sends a packet with the address of a Target – the destination of the packet. When the Target responds, the address used is the same address, to indicate to the Controller the source of the packet. The Controller does not have its own address.

B.2.4.3 Address Delimiter

This is the “forward slash” character ' / ' (ASCII code 47).

B.2.4.4 Instruction Code

This is a three-character alphabetic sequence that identifies the subject of the message. Wherever possible, the instruction codes have been chosen to have some significance. **For example: GAC** for **G**lobal **A**mplifier **C**onfiguration; **IPA** for **IP A**ddress, etc. This aids in the readability of the message, should it be displayed in its raw ASCII form. Both upper case and lower case alphabetic characters may be used (A-Z *and* a-z, ASCII codes 65-90 *and* 97-122).

B.2.4.5 Instruction Code Qualifier

This single character further qualifies the preceding instruction code. Code Qualifiers obey the following rules:

1. From **Controller-to-Target**, the only permitted values are:

= **(ASCII code 61**	The **=** (ASCII code 61) is used as the **assignment** operator, and is used to indicate that the parameter defined by the preceding byte should be set to the value of the argument(s) that follow it. **For example:** In a message from Controller-to-Target, **MUT=1** would mean 'enable the Mute function'.
? **(ASCII code 63)**	The **?** (ASCII code 63) is used as the **query** operator, and is used to indicate that the Target should return the current value of the parameter defined by the preceding byte. **For example:** In a message from Controller-to-Target, **SWR?** would mean 'returns the value of the internal software revision installed in the unit'.

2. From **Target-to-Controller**, the only permitted values are:

= **(ASCII code 61)**	The **=** code is used in two ways: **First**, if the Controller has sent a query code to a Target (**for example: MUT?**, meaning '*is the Mute enabled or disabled?*'), the Target would respond with **MUT=x**, where **x** represents the state in question: 1 being 'enable' and 0 being 'disable'. **Second**, if the Controller sends an instruction to set a parameter to a particular value, and if the value sent in the argument is valid, then the Target will acknowledge the message by replying with **MUT=** (with no message arguments).
? **(ASCII code 63)**	The **?** code is only used as follows: If the Controller sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is not valid, the Target will acknowledge the message by replying, for example, with **MUT?** (with no message arguments). This indicates that there was an error in the message sent by the Controller.
! **(ASCII code 33)**	The **!** code is only used as follows: If the Controller sends an instruction code which the Target does not recognize, the Target will acknowledge the message by echoing the invalid instruction, followed by the ! character. **Example: XYZ!**
***** **(ASCII code 42)**	The ***** code is only used as follows: If the Controller sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is valid, BUT the Target is in the wrong mode (e.g., standby mode in redundancy configuration) and will not permit that particular parameter to be changed at that time, the Target will acknowledge the message by replying, for example, with **MUT*** (with no message arguments).
# **(ASCII code 35)**	The **#** code (Target-to-Controller) is only used as follows: If the Controller sends an instruction code which the Target cannot currently perform because of hardware resource issues, then the Target will acknowledge the message by echoing the invalid instruction, followed by the # character. This response can only occur if the operator sends two or more 'hardware configuration' type commands without allowing adequate time between commands for the hardware to be configured. For example, if the operator issued commands to change both the frequency and the attenuation with less than 100 milliseconds between commands, and if this response is returned, then the command has not been accepted and the operator must resend the command.

B.2.4.6 Optional Message Arguments

Arguments are not required for all messages. Arguments are ASCII codes for any printable character.

B.2.4.7 End of Packet

Controller-to-Target: This is the 'Carriage Return' character (ASCII code 13).

Target-to-Controller: This is the two-character sequence 'Carriage Return' (ASCII code 13), and 'Line Feed' (ASCII code 10).

Both indicate the valid termination of a packet.

B.2.4.8 End-of-Life Commands

Certain commands/queries are being marked as End-of-Life (EOL). As noted in the format <*description*>^{E} in the **Parameter Type** field (in the Remote Commands and Queries tables in Sect. 3.3), while these commands are fully supported in this product it is highly recommended that the equivalent new commands be used for new implementations. The new commands will generally follow the outdated commands:

EOL-designated Command/Query (Page #)	New Command/Query (Page #) / Comment
CAA (3-10)	CAE (3-10)
CUS (3-14)	Functionality not included in any other remote command/query
DAT (3-14)	DAY (3-14)
LNA (3-18)	RNE (3-26)
RET (3-24)	PNM (3-20) New query provides more exact unit hardware information
RSN (3-27)	SNO (3-29)
SFS (3-29)	Functionality not included in any other remote command/query
TNA (3-30)	TNE (3-30)

B.3 Remote Commands and Queries

Column 'C' = Command; **Column 'Q'** = Query; columns marked '**X**' designate instruction code as *Command only*, *Query only*, or *Command/Query*.

- Where an Instruction Code is noted XXX^E this denotes a command/query designated as **EOL**. See **Sect. 3.2** for more information.
- Where an Instruction Code is noted XXX^O this denotes a command/query that is available only when a reference oscillator is installed.

CODE	C	Q	PAGE
A			
AFR	**X**	**X**	B-9
AMP	**X**	**X**	B-9
AUX	**X**	**X**	B-10
C			
CAA^E	**X**		B-10
CAE	**X**		B-10
CAS		**X**	B-11
CCS		**X**	B-12
CFS		**X**	B-12
CID	**X**	**X**	B-12
CMS		**X**	B-13
CSL	**X**		B-13
CUS^E		**X**	B-14
D			
DAT^E	**X**	**X**	B-14
DAY	**X**	**X**	B-14
E			
ESA	**X**	**X**	B-14
ESL	**X**	**X**	B-15
ESW	**X**	**X**	B-15
F			
FRW		**X**	B-15

CODE	C	Q	PAGE
G			
GAC	**X**	**X**	B-16
I			
IEP	**X**		B-17
IMG	**X**	**X**	B-17
IPA	**X**	**X**	B-17
IPG	**X**	**X**	B-18
ISP	**X**		B-18
L			
LNA^E		**X**	B-19
LPT	**X**	**X**	B-19
LRS	**X**	**X**	B-20
M			
MAC		**X**	B-20
MSK	**X**	**X**	B-21
MUT	**X**	**X**	B-22
N			
NUE		**X**	B-22
NUS		**X**	B-22
O			
OFM	**X**	**X**	B-23
ONL	**X**	**X**	B-23

CODE	C	Q	PAGE
P			
PNM		**X**	B-23
R			
RAS		**X**	B-24
RBT	**X**		B-24
RCS		**X**	B-25
RED	**X**	**X**	B-25
RET^E		**X**	B-25
RFS		**X**	B-26
RMS		**X**	B-27
RNE		**X**	B-28
RNS		**X**	B-29
RPT		**X**	B-29
RSN^E		**X**	B-29
RUS		**X**	B-30
S			
SBR	**X**	**X**	B-30
SFS^E		**X**	B-30
SNO	**X**	**X**	B-31
SPA	**X**	**X**	B-31
SSI	**X**	**X**	B-31

CODE	C	Q	PAGE
T			
TIM	**X**	**X**	B-31
TMP		**X**	B-31
TNA^E		**X**	B-32
TSC		**X**	B-32

Note: The following codes are used in the '**Response to Command**' column:

CODE	MEANING
=	Message OK
?	Received OK, but invalid arguments found
*	Message OK, but not permitted in **Current** mode
#	Message OK, but only permitted in **Remote** mode
!	Unknown command

Note: Where **Parameter Type** is in the format <*description*>^{E}, while the underlying command will remain, the specific functionality will be obsolete and should not be used for new implementations. There generally will be a different command elsewhere that encapsulates the marked functionality.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Auto Fault Recovery	AFR=	1 byte	Command or Query. If auto fault recovery is enabled, it will cause the output return to its pre-fault mute condition if all faults are cleared. If disabled, the output will remain muted even if all faults are cleared. **Example:** <1/AFR=1'cr' >0001/AFR='cr''lf' **Note:** these faults can be user defined as faults, alarms, or masked (see MSK command for more info). **Default Value:** 1	AFR= AFR? AFR*	AFR?	AFR=x (Same format as command arguments.)
RF Power Amplifier State	AMP=	1 byte	Command or Query. Turns ON or OFF the RF power amplifiers. 0 = Off 1 = On **Example:** <1/AMP=1'cr' >0001/AMP='cr''lf' **Note**: turning the amplifier off will disable the +10V supply, and mask it during fault checking. **Default Value:** 0	AMP= AMP? AMP*	AMP?	AMP=x (Same format as command arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Auxiliary Mute Enable	AUX=	1 byte	Command or Query. Enables or disables the auxiliary mute mode. 0=Disabled 1=Enabled **Example** (AUX Mute Enabled): <1/AUX=1'cr' >0001/AUX='cr''lf' **Note:** When enabled, the mute control input on the remote com connector must be grounded to UN-MUTE the unit. Otherwise, the unit will be muted, and if a mute query is given (MUT?) the response will be MUT=2 to indicate a hardware controlled mute is present. Aux mute is one of several hardware mute states that can cause a MUT=2 to be reported. See the MUT command for more info on mute states. Auxiliary mute supersedes the user mute state so if the command MUT=1 is sent, then AUX=1 is sent, and the user shorts Pin K to Pin S on the discrete control connector then the RF mute will be disabled (MUT=0). **Default Value:** 0	AUX= AUX? AUX*	AUX?	AUX=x (Same format as command arguments.)
Clear All Stored Alarms	CAA=	None	Command only. Instructs the SPOD to clear all Stored Alarms. This command takes no arguments. **Example:** <1/CAA='cr' >0001/CAA='cr''lf'	CAA= CAA*	N/A	N/A
Clear All Stored Events	CAE=	None	Command only. Instructs the SSPA to clear all Stored Events. This command takes no arguments. **Example:** <1/CAE='cr' >0001/CAE='cr''lf'	CAE= CAE*	N/A	N/A

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Concise Alarm Status	N/A	44 bytes	Query only. Used to Query the Alarm status of the unit, response is semicolon delimited. This is the concise version of the RAS command. **Example:** CAS=a;b;c;d;e;f;g;h;i;j;k;l;m;n;o;p;q;r;s;t;u;v;w;x;y;'cr''lf' where: a thru z = 0, 1, 2, 3, 4, or 5 0 = FT, 1 = OK, 2 = AL, 3 = NO, 4 = YS, 5 = MS a = +24V Power Supply b = +24V Switch Power Supply c = +13.5V Power Supply d = +10V Power Supply 1 e = +10V Power Supply 2 f = +10V1 Amplifier Power Supply g = +10V2 Amplifier Power Supply h = +7.8V Power Supply i = +5.8V Power Supply j = +2.5V Power Supply k = +1.2V Power Supply l = -5.8V Power Supply m = Fan#1 State n = Fan#2 State o = Fan#3 State p = Heatsink Temp q = Overtemp Shutdown r = IIC Status s = Forward Power Alarm t = Reverse Power Alarm u = Flash Checksum v = FPGA Done w = Redundant Switch Condition x = Redundant Link Status y = Terminal Status Change	CAS=	CAS?	CAS=x….x (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Concise Configuration Status	N/A	26 bytes	Query only. Used to query the configuration status of the unit. This is the concise version of the RCS command. **Example:** CCS=a;b;c;d;e;'cr''lf' Where: a = RF power amplifier state, 0 = Off, 1 = On (AMP) b = mute state, 0 = un-muted, 1 = muted (MUT) c = online status (ONL) d = redundancy state and mode (ESW) e = auto fault recovery mode (AFR)	CCS=	CCS?	CCS=x….x (See description for details of arguments)
Concise RF Power FET Current Status	N/A	Variable length depending on the number of FETs installed in the amplifier	Query only Concise version of RFS. **Example:** CFS=.xxx;.xxx;xx.x;x…….;xx.x;	CFS=	CFS?	CFS=x…..x (See description of RFS. Note that each argument is separated by a semicolon delimiter.)
Circuit Identification	CID=	48 bytes	Command or Query. CID is a user-defined string of data that may be used to identify or name the unit or station. The CID is a 48-byte field of data that is entered as one line, but it will be read back from the unit as two 24-byte lines of data. **Examples:** <1/CID= Station #001--SSPA #01--'cr' >0001/CID= <1/CID?'cr' >0001/CID='cr' Station #001'cr' --SSPA #01--'cr''lf' **Default Value:** ----------	CID= CID? CID*	CID?	CID=x…x (See description for details of arguments.)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Concise Maintenance Status	N/A	95 bytes	Query only. Used to Query the Maintenance status of the unit in a concise format. The response is semicolon delimited. This is the concise version of the RMS command. **Example:** <1/CMS? >0001/CMS=aaa.a;bbb.b;ccc.c;ddd.d;eee.e;fff.f; ggg.g;hh.h;iii.i;jjj.j;kkk.k;lll.l;mmm.m; nnn.n;ooo.o;ppp.p;qqq.q;rrr.r;sss.s;'cr''lf' Where: aaa.a = P24V1 bbb.b = P24V2 ccc.c = P13VT ddd.d = P10V1 eee.e = P10V2 fff.f = A10V1 ggg.g = A10V2 hhh.h = P7V8T iii.i = P5V8T jjj.j = P2V5T kkk.k = P1V2T lll.l = N5V8T mmm.m = FANR1 nnn.n = FANR2 ooo.o = FANR3 ppp.p = FWPWR qqq.q = RVPWR rrr.r = ATEMP sss.s = OTEMP	CMS=	CMS?	CMS=x….x (See description for details of arguments)
Clear Statistics Log	CSL=	1 byte	Command only. Used to clear the statistics log entries. **Example:** <1/CSL=1'cr' >0001/CSL='cr''lf'	CSL= CSL? CSL*	N/A	CSL=

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Concise Utility Status [E]	N/A	15 bytes	Query only. Used to Query the Maintenance status of the unit, response is comma delimited. **Example:** <1/CUS?'cr' >0001/CUS=aaaa;bbbbb;'cr''lf' Where: aaaa = Remote Unit Address bbbbb = Remote Baud Rate	CUS=	CUS?	CUS=x….x (See description for details of arguments)
Set RTC (Real-Time-Clock) Date [E]	DAT=	6 bytes	Command or Query. A command in the form **mmddyy**, where; dd = day of the month, between 01 and 31, mm = month of the year, between 01 and 12 and yy = year, between 00 and 96 (2000 to 2096) **Example** (date = April 24, 2003): <1/DAT=042403'cr' >0001/DAT='cr''lf'	DAT= DAT? DAT*	DAT?	DAT=xxxxxx (Same format as command arguments)
Set RTC (Real-Time-Clock) Date	DAY=	6 bytes	Command or Query. A command in the form **ddmmyy**, where; dd = day of the month, between 01 and 31, mm = month of the year, between 01 and 12 and yy = year, between 00 and 99 (2000 to 2099) **Example** (date = April 24, 2003): <1/DAY=240403'cr' >0001/DAY='cr''lf'	DAY= DAY? DAY*	DAY?	DAY=xxxxxx (Same format as command arguments)
Enable Statistics Averaging	ESA=	1 byte	Command or Query. Enables or Disables averaging of statistics data at a rate of once per second for 10 second. If Disabled, burst values will be logged instead of averaged values. 0 = Disable 1 = Enable **Example:** <1/ESA=0'cr' >0001/ESA='cr''lf' **Default Value:** 0	ESA= ESA? ESA*	ESA?	ESA=x (Same format as command arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Enable Statistics Logging	ESL=	1 byte	Command or Query. Enables or Disables the statistics logging function. 0 = Disable 1 = Enable **Example:** <1/ESL=1'cr' >0001/ESL='cr''lf' **Default Value:** 0	ESL= ESL? ESL*	ESL?	ESL=x (Same format as command arguments)
Enable Redundancy Switch Mode	ESW=	1 byte	Command or Query. Turns ON or OFF the redundancy state, where: 0 = Off 1 = 1:1 Redundancy TX (Only TX switch installed) 2 = 1:1 Redundancy TX + RX (TX and RX switch installed) 5 = 1:1 Manual redundancy mode (used for debugging, or redundant system setup). Manual redundancy does not support automatic switching, and the offline unit will not poll the online unit to update its configuration. **Example:** <1/ESW=1'cr' >0001/ESW='cr''lf' **Default Value:** 0	ESW= ESW? ESW *	ESW?	ESW=x

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Retrieve Firmware Number	N/A		Query only Returns the firmware type(s) loaded into the unit. The firmware information is returned in the following format: FW-AAAAAAA B.B.BB DD/MM/YY Where: FW-AAAAAAA = the firmware part number B.B.BB = the version number DD/MM/YY = Day/Month/Year firmware released **Example:** <1/FRW?'cr' >0001/FRW= Boot: FW-0000082 0.0.1a 04/09/08 Bulk1: FW-0000078 0.0.1a 04/09/08 FW-0000080 0.0.1a 04/09/08 FW-0000081 0.0.1a 04/09/08 Bulk2: FW-0000078 0.0.1a 04/09/08 FW-0000080 0.0.1a 04/09/08 FW-0000081 0.0.1a 04/09/08	FRW=	FRW?	FRW={CR}Boot:{CR}abc{CR}Bulki:{CR}abc{CR}abc (See description for details of arguments)
Global Amplifier Configuration	GAC=	43 bytes	Command or Query. Used to set up and query the global status of the SSPA with a semicolon delimited string of data. **Example** (set GAC): GAC=a;b;c;ddd;e;ff;g;h;i;j;'cr' Where: a = redundancy mode (ESW) b = online status (ONL) c = Auto Fault Recovery (AFR) ddd = Unit Alarm Mask (MSK) e = Enable Statistics Averaging (ESA) ff = Set Statistics Interval (SSI) g = Enable Statistics Logging (ESL) h = Auxiliary Mute (AUX) i = user mute state (MUT) j = RF power amplifier state (AMP)	GAC= GAC* GAC? GAC#	GAC?	GAC=x….x (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Initialize Events Pointer	IEP=	None	Command only. Resets internal pointer to allow RNE? Queries to start at the beginning of the stored events log. **Example: <1/**IEP='cr' >0001/IEP='cr''lf'	IEP= IEP? IEP*	N/A	N/A
Firmware Image	IMG=	1 byte	Command or Query. Current Active software image, where: 1=Bulk Image # 1 currently active 2=Bulk Image # 2 currently active **Examples:** <1/IMG=1'cr' (instructs the unit to load firmware from image #1 at the next reset / power up). <1/IMG?'cr' (queries the image number that the firmware loaded during bootup) **Note**: if you send the IMG command, and then query the IMG value the numbers may not be equal because the command tells the firmware which image to boot from at the next bootup, and the query reports the image that the firmware booted from on the last bootup.	IMG= IMG? IMG* IMG#	IMG?	IMG=x (See description of arguments)
IP Address	IPA=	18 bytes	Command or Query. Used to set the IP address and network prefix for the 10/100 BaseT Ethernet management port, in the format: xxx.xxx.xxx.xxx.yy, where: xxx.xxx.xxx.xxx is the IP address, and yy is the network prefix (8-30) **Example: <1/IPG=**192.168.001.004.24'cr' >0001/IPG='cr''lf' **Note**: Changing the IP address through the Telnet interface requires the user to power cycle the unit, and then restart a new Telnet session with the new IP address. The IP address that you type into the Telnet client software does not include the range parameter so it would be: 192.168.1.4 **Default Value:** 192.168.001.004.24	IPA= IPA? IPA* IPA#	IPA?	IPA= xx.xxx.xxx.xxx.yy (See description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Gateway Address	IPG=	15 bytes	Command or Query. Used to set the Gateway IP address for the 10/100 Base Tx Ethernet management port, in the format: xxx.xxx.xxx.xxx, where: xxx.xxx.xxx.xxx is the IP address **Example: <1/**IPG=192.168.001.005'cr' >0001/IPG='cr''lf' **Default Value:** 192.168.001.005	IPG= IPG? IPG*	IPG?	IPG = xxx.xxx.xxx.xxx
Initialize Statistics Pointer	ISP=	None	Command only. Resets internal pointer to allow RNS? Queries to start at the beginning of the stored statistics log. **Example: <1/**ISP='cr' >0001/ISP='cr''lf'	ISP= ISP? ISP*	N/A	N/A

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
List next 5 unread Stored Alarms [E]	N/A	145 bytes	Query only. The unit returns the five oldest stored events in the alarm log, and if there are no events in the log the unit will reply with LNA*. All events that are read from the log are also automatically removed from the log. **Reply format:** YYYYYYYYYY ZZ mmddyy hhmmss'cr' YYYYYYYYYY ZZ mmddyy hhmmss'cr' YYYYYYYYYY ZZ mmddyy hhmmss'cr' YYYYYYYYYY ZZ mmddyy hhmmss'cr' YYYYYYYYYY ZZ mmddyy hhmmss'cr''lf' **Where:** YYYYYYYYYY is the fault description. ZZ is one of the event types listed below: FT = Fault OK = Clear IF = Information The rest of the string is a date / time stamp. **Example:** <1/LNA?'cr' >0001/LNA='cr' LOG CLR IF 175503 052307'cr' FAN #1 FT 175504 052307'cr' OVR TMP FT 175504 052307'cr' FAN #1 OK 175504 052307'cr' IIC BUS FT 175504 052307'cr''lf'	LNA=	LNA?	LNA=YY..ss (See description for details of arguments)
Low forward Power Threshold	LPT=	5 bytes	Command or Query. This command allows the user to set the threshold for the low forward power alarm/fault. If the forward power drops below the specified value, the alarm/fault will be indicated. Setting this parameter to 00.00 effectively disables the threshold **Example:** <1/LPT=00.00'cr' >0001LPT='cr''lf' **Default Value:** 00.00	LPT = LPT? LPT *	LPT?	LPT =xxx.x (Same format as command arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Local/Remote State	LRS=	1 byte	Command or Query. Set Local or Remote for Indoor SSPA. Always in remote mode for Outdoor SSPA 0 = Local, 1=Serial, 2=Ethernet, 3=Serial+Ethernet **Example: <1/**LRS=3'cr' >0001/LRS='cr''lf' **Note:** The user will always have query access in any mode. Also, the LRS command is available in all modes as a means of acquiring control. The intent of this command is to limit changes from being made on multiple interfaces at the same time. Units without a front panel will treat an entry of 0 as reserved, and will refuse the command by returning a mode error. The web page GUI will refuse connections unless LRS is set to enable Ethernet remote control. **Default Value:** 3 (Serial+Ethernet)	LRS= LRS?	LRS?	LRS=x (Same format as command arguments)
Unit MAC Address	N/A	17 bytes	Query only. MAC address of the unit, reported in hexadecimal. **Example: <1/MAC?'cr'** **>0001/**MAC=00-06-B0-00-D2-A7'cr''lf'	MAC=	N/A	MAC=xx-xx-xx-xx-xx-xx (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Unit Alarm Mask	MSK=	5 bytes	Command or Query. Alarm mask conditions. If the mask value for a certain parameter is set to fault then a fault condition will be registered if specified hardware conditions are not met. If the mask value is set to alarm then a fault condition will only appear to be an alarm that will not trigger a switchover in a redundant system. If the mask value is set to masked then the fault will never be reported to the user. **Example:** MSK=abc'cr''lf' Where: a = Low Forward RF Power b = Fan Speed c = High Reverse RF Power Each parameter can be an integer from 0 to 2. 0 = Fault, 1 = Alarm, 2 = Masked **Default Value:** 212	MSK= MSK? MSK*	MSK?	MSK=abcde (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Mute State	MUT=	1 byte	Command or Query. Mute the unit, where: 0 = Disable (Not Muted) 1 = Enable (Muted) 2 = Unit muted due to AUX mute signal. This value is only shown in the response to a query, and cannot be given as a command. When MUT returns a 2 it indicates that one of the "hardware" mute conditions is present. For example an auxiliary mute could be present if the auxiliary mute has been enabled, and the signal to unmute the unit is not provided. Additionally, certain faults can generate a hardware mute such as the BUC lock detect, the LNB current draw (if enabled by the user), or the LNB voltage (if enabled by the user). If MUT returns an unexpected value of 2 then check the active faults, and the status of the auxiliary mute. **Example:** <1/MUT=1'cr' >0001/MUT=1'cr''lf' **Default Value:** 1	MUT= MUT? MUT*	MUT?	MUT=x (Same format as command arguments)
Number of Unread stored Events	N/A	3 bytes	Query only. Unit returns the Number of stored Events, which remain Unread in the form of xxx. **Example:** <1/NUE?'cr' >0001/NUE=126'cr''lf'	NUE=	NUE?	NUE=xxx
Number of Unread stored Statistics	N/A	3 bytes	Query only. Unit returns the Number of stored Statistics, which remain Unread in the form of xxx. **Example:** NUS=126	NUS=	NUS?	NUS=xxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Offline Mute	OFM=	1 byte	Command or Query. Mute the unit when it is offline, where: 0 = Disable (Not Muted) 1 = Enable (Muted) Unit will automatically mute its RF output when it is offline if OFM is enabled. Otherwise, the unit will remain at its previous mute state regardless of online / offline status. **Example:** <1/OFM=1'cr' >0001/OFM=1'cr''lf' **Default Value:** 1	OFM= OFM? OFM*	OFM?	OFM=xxx
Online Status	ONL=	1 byte	Command or Query. Online status (applies only to redundancy), where: 0 = Offline (Query only) (see **Note**) 1 = Online The ONL query always returns an online response if the unit is not running in redundant mode. If redundancy is enabled then the query will indicate the position of the Tx waveguide switch that enables one of the units to be connected to the antenna. **Example:** <1/ONL=1'cr' >0001/ONL='cr''lf' **Note:** sending ONL=0 will not generate a syntax error; however setting ONL to zero will not cause the unit to go offline. The online status is determined by the TX waveguide redundant switch position, and only the offline unit may drive the switches. Instead of sending ONL=0 to the online unit the ONL=1 command should be sent to the offline unit to generate a redundant switchover.	ONL= ONL? ONL*	ONL?	ONL=x
Part Number	N/A	96 bytes alphanumeric	Query Only The PNM query will return the DOTCODE string that was loaded into the unit. Example: <1/PNM? >0001/PNM=HPODC0.350WRSW00'cr''lf'	PNM= PNM? PNM *	PNM?	PNM=x….x (see description for details of return string)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Retrieve Alarm Status	N/A	168 bytes	Query only. Used to Query the Alarm status of the unit, where: OK = no fault condition, FT = faulted, AL = alarm, YS = Yes, NO = No, MS = masked. **Example:** <1/RAS?'cr' >0001/RAS='cr' P24V1=OK'cr' +24V power supply P24V2=OK'cr' +24V switch pwr supply P13VT=OK'cr' +13.5V power supply P10V1=OK'cr' +10V power supply 1 P10V1=OK'cr' +10V power supply 2 A10V2=OK'cr' +10V1 RF supply A10V2=OK'cr' +10V2 RF supply P7V8T=OK'cr' +7.8V power supply P5V8T=OK'cr' +5.8V power supply P2V5T=OK'cr' +2.5V power supply P1V2T=OK'cr' +1.2V power supply N5V8T=OK'cr' -5.8V power supply FANR1=OK'cr' Fan 1 speed FANR2=OK'cr' Fan 2 speed FANR3=OK'cr' Fan 3 speed ATEMP=OK'cr' Amplifier temperature SHTDN=OK'cr' Over-temp shutdown IICST=OK'cr' I2C bus status FWPWR=OK'cr' Forward power in dBm RVPWR=OK'cr' Reverse power in dBm CHKSM=OK'cr' Flash checksum FPGAD=OK'cr' FPGA done status SWITC=OK'cr' Waveguide switch position status RDLNK=OK'cr' Redundant link status TRMST=YS'cr''lf' Terminal Status	RAS=	RAS?	RAS=x….x (See description for details of arguments)
Reboot	RBT=	1 byte	Soft Reboot 1 = Reboot System	RBT = RBT? RBT*	N/A	RBT=x (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Retrieve Configuration Status	N/A	45 bytes	Query only. Used to Query the configuration status of the unit **Example:** RCS=’cr’ AMP=1’cr’ MUT=1’cr’ ONL=1’cr’ ESW=1’cr’ AFR=1’cr’’lf’ Where: AMP= RF power amplifier state, 0=OFF, 1=ON MUT=RF mute state, 0=un-muted, 1=muted RED=Online status for redundancy ESW=Redundancy state and mode, states: 0=OFF, 1=ON Tx only, 2=ON Tx & Rx AFR= auto fault recovery, 0=manual, 1=auto	RCS=	RCS?	RCS=x….x (See description for details of arguments)
Online Status	RED=	1 byte	Command or Query. Online status (applies only to redundancy), where: 0 = Offline 1 = Online **Note**: this command is functionally identical to the ONL command. **Example:** <1/RED=1’cr’ >0001/RED=’cr’’lf’	RED= RED? RED*	RED?	RED=x
Retrieve Equipment Type	N/A	22 bytes	Query only. The unit returns a string indicating the Model Number and the version of the M&C firmware installed in the unit. **Example:** <1/RET?’cr’ >0001/RET=CPA-300 VER: 1.0.3’cr’’lf’	RET=	RET?	RET=x….x (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
RF Power FET Current status	N/A	variable length depending on the number of FETs installed in the RF amplifier	Query only. Used to display all the FET currents. **Example:** <1/RFS? 'cr' >0001/RFS='cr' Q01=.xxx'cr' Q02=.xxx'cr' Q03=xx.x'cr' Q04=xx.x'cr' Q05=xx.x'cr' Q06=xx.x'cr' Q07=xx.x'cr' Q08=xx.x'cr' Q09=xx.x'cr' Q10=xx.x'cr' Q11=xx.x'cr' Q12=xx.x'cr' Q13=xx.x'cr' Q14=xx.x'cr' Q15=xx.x'cr' Q16=xx.x'cr''lf' **Note:** If the value is one amp or greater the format is xx.x, and if the value is less than one amp then the format is .xxx	RFS=	RFS?	RFS=x….x (See description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Retrieve Maintenance Status	N/A	213 bytes, alpha-numeric	Query only. Where: P24V1 = +24V power supply P24V2 = +24V switch power supply P13VT = +13.5V power supply P10V1 = +10V1 power supply P10V2 = +10V2 power supply A10V1 = 10V1 on RF Module A10V2 = 10V2 on RF Module P7V8T = +7.8V power supply P5V8T = +5.8V power supply P2V5T = +2.5V power supply P1V2T = +1.2V power supply N5V8T = -5.8V power supply FANR1 = Fan 1 speed in percent FANR2 = Fan 2 speed in percent FANR3 = Fan 3 speed in percent FWPWR = Forward power in dBm RVPWR = Reverse power in dBm ATEMP = Heatsink temperature in Celsius OTEMP = Outdoor temperature in Celsius **Example:** <1/RMS?'cr' >0001/RMS='cr' P24V1=024.1'cr' P24V2=024.1'cr' P13VT=013.4'cr' P10V1=010.1'cr' P10V2=010.1'cr' A10V1=010.1'cr' A10V2=010.1'cr' P7V8T=007.8'cr' P5V8T=005.8'cr' P2V5T=002.5'cr' P1V2T=001.2'cr' N5V8T=-05.7'cr' FANR1=100.0'cr' FANR2=100.0'cr' FANR3=100.0'cr' FWPWR=+56.2'cr' RVPWR=<22.0'cr' ATEMP=+40.0'cr' OTEMP=+25.0'cr'	RMS=	RMS?	RMS=x….x (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Retrieve Next 5 unread stored Events	N/A	75 bytes	Query only. Unit returns the oldest 5 Stored Events which have not yet been read over the remote control. Reply format: {CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where Sub-body= ABCCddmmyyhhmmss: A being the fault/clear indicator. F=Fault C=Clear I=Info B being the fault type where: 1=Unit 2=RF 3=Log CC is Fault Code numbers, as in RAS? or Info Code, which is: 0=Power Off 1=Power On 2=Log Cleared 3=Global Config Change 4=Redundancy Config Change RAS fault codes map as follows: 1) P24V1 2) P24V2 3) LNBVT 4) P13VT 5) A10V1 6) A10V2 7) 10VPS 8) P5V8T 9) P2V5T 10) P1V2T 11) N5V8T 12) P7V8T 13) FANR1 14) FANR2 15) ATEMP 16) SHTDN 17) IICST 18) FWPWR 19) CHKSM 20) FPGAD 21) BUCLD 22) REFLD 23) LNBCS 24) SWITC If there are less than 5 events to be retrieved, the remaining positions are padded with zeros. If there are no new events, the response is RNE*. A Global Config Change is defined as any time a command is successfully executed. A query does not set the status change flag. The status change flag is cleared after being read. No other events toggle a status change.	RNE=	RNE?	RNE={CR}ABCCddmmyyhhmmss{CR}ABCCddmmyyhhmmss{CR}ABCCddmmyyhhmmss{CR}ABCCddmmyyhhmmss{CR}ABCCddmmyyhhmmss (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Retrieve Next 5 unread stored Statistics	N/A	75 bytes	Query only. Unit returns the oldest 5 Stored Statistics entries which have not yet been read over the remote control. Reply format: {CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where: Sub-body= ddmmyyhhmmssaaa.abbb.bccc.cdd.ddefghhh.hiii.i ddmmyy = day/month/year hhmmss = hour:minute:second aaa.a = Operating Temperature (I.E. +40.0) bbb.b = Amp Temperature (I.E. +40.0) ccc.c = RF Power output dd.dd = Attenuation Setting e = Amp On/Off f = Mute On/Off g = Online/Offline Status hhh.h = LNB Current (mA) iii.i = BUC Tuning Voltage If there are less than 5 entries to be retrieved, the remaining positions are padded with zeros. If there are no new entries, the response is RNS*.	RNS=	RNS?	RNS={CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body (See description for details of arguments)
High Reverse Power Threshold	RPT=	5 bytes	Command or Query. This command allows the user to set the threshold for the high reverse power alarm/fault. If the reverse power is above the specified value, the alarm/fault will be indicated. Setting this parameter to 00.00 effectively disables the threshold **Example:** <1/RPT=00.00'cr' >0001/RPT='cr''lf' **Default Value:** 00.00	RPT = RPT? RPT *	RPT?	RPT =xxx.x (Same format as command arguments)
Serial Number	N/A	9 bytes	Query only. Used to Query the unit's 9 digit serial number in the form of RSN=xxxxxxxxx, where: xxxxxxxxx is the unit's 9-digit serial number. **Example:** <1/RSN?'cr' >0001/RSN=072282040'cr''lf'	RSN=	RSN?	RSN=xxxxxxxxx (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Retrieve Utility Status	N/A	23 bytes, alpha- numeric	Query only. Used to Query the utility status of the unit. **Example:** <1/RUS='cr' >0001/RUS='cr' ADR=0001'cr' BDR=09600'cr''lf' Where: ADR = Remote Unit Address BDR = Remote Baud Rate	RUS=	RUS?	RUS=x….x (See description for details of arguments)
Serial Baud Rate	SBR=	4 bytes	Command or Query. Set serial baud rate as follows: 2400 = 2400 baud 4800 = 4800 baud 9600 = 9600 baud 19K2 = 19200 baud 38K4 = 38400 baud **Examples:** <1/SBR=9600'cr' >0001/SBR=9600'cr''lf' <1/SBR?'cr' >0001/SBR=09600'cr''lf' **Note:** When changing baud rates remotely the response to the command will be returned using the same baud rate as that used to send the command. **Default Value:** 9600	SBR= SBR? SBR*	SBR?	SBR=xxxxx (Same format as command arguments)
Summary Fault Status [E]	N/A	1 byte	Query only. Indicates the condition of the summary fault relay. Where: 0 = Not Faulted (SumFLT_COM J6 pin K is not connected to SumFLT_NC J6 pin M) 1 = Faulted (SumFLT_COM J6 pin K is connected to SumFLT_NC J6 pin M) **Example:** <1/SFS? >0001/SFS=0'cr''lf'	SFS=	SFS?	SFS=x (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Serial Number	N/A	9 bytes	Query only. Used to Query the unit's nine-digit serial number in the form of SNO=xxxxxxxxx, where: xxxxxxxxx is the unit's nine-digit serial number. **Note**: this command is functionally identical to RSN. **Example:** <1/SNO?'cr' >0001/SNO=072282040'cr''lf'	SNO=	SNO?	SNO=xxxxxxxxx (See description for details of arguments)
Remote Address	SPA=	4 bytes	Command or Query. Set Physical Address-between 0001 to 9999. Resolution 0001 **Example:** <1/SPA=0412'cr' >0001/SPA='cr''lf' **Default Value:** 0001	SPA= SPA? SPA*	SPA?	SPA=xxxx (Same format as command arguments)
Set Statistics Interval	SSI=	2 bytes	Command or Query. Sets the interval at which statistics are logged. Minimum resolution is 1 minute, maximum is 99 minutes. **Example:** <1/SSI=90'cr' >0001/SSI='cr''lf' **Default Value:** 90	SSI= SSI?	SSI?	SSI=xx (Same format as command arguments)
Set RTC Time	TIM=	6 bytes	Command or Query. A command in the form **hhmmss**, indicating the time from midnight, where hh = hours, between 00 and 23; mm = minutes, between 00 and 59, and ss = seconds, between 00 and 59 **Example** (time = 23 hours, 12 minutes and 59 seconds since midnight): <1/TIM=231259'cr' >0001/TIM='cr''lf'	TIM = TIM? TIM *	TIM?	TIM=xxxxxx (Same format as command arguments)
Temperature	N/A	5 bytes	Query only. Returns the temperatures of the Heatsink in the form of a sign byte followed by 4 bytes for the temperature. **Example:** TMP=+26.0	TMP=	TMP?	TMP=sxxx (See description for details of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes between 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Retrieve Number of unread Stored Alarms[E]	N/A	2 bytes	Query only. Returns the number of stored events, which remain unread in the alarm log. A maximum of 255 events may be stored in the alarm log. Numbers over 99 will be reported as 99. **Example reply:** <1/TNA? 'cr' >0001/TNA=14'cr''lf'	TNA=	TNA?	TNA=xx (See description for details of arguments)
Terminal Status Change	N/A	1 byte	Query only. Indicates if there has been a change in the configuration since the last time the command was given. A value of 0 indicates no status change, and a value of 1 indicates there has been a status change. A status change is defined as any time a parameter is changed. Such as when command is successfully executed that changes a value. A status change also results when there is a redundant switchover, or a fault condition. A query does not set the status change flag. The status change flag is cleared after being read. **Example:** <1/TSC?'cr' >0001/TSC=0'cr''lf'	TSC=	TSC?	TSC=x (See description for details of arguments)

METRIC CONVERSIONS

Units of Length

Unit	Centimeter	Inch	Foot	Yard	Mile	Meter	Kilometer	Millimeter
1 centimeter	—	0.3937	0.03281	0.01094	6.214×10^{-6}	0.01	—	—
1 inch	2.540	—	0.08333	0.2778	1.578×10^{-5}	0.254	—	25.4
1 foot	30.480	12.0	—	0.3333	1.893×10^{-4}	0.3048	—	—
1 yard	91.44	36.0	3.0	—	5.679×10^{-4}	0.9144	—	—
1 meter	100.0	39.37	3.281	1.094	6.214×10^{-4}	—	—	—
1 mile	1.609×10^{5}	6.336×10^{4}	5.280×10^{3}	1.760×10^{3}	—	1.609×10^{3}	1.609	—
1 mm	—	0.03937	—	—	—	—	—	—
1 kilometer	—	—	—	—	0.621	—	—	—

Temperature Conversions

Temperature	° Fahrenheit	° Centigrade
Water freezes	32	0
Water boils	212	100
Absolute 0	-459.69	-273.16

Formulas
° C = (F - 32) * 0.555
° F = (C * 1.8) + 32

Units of Weight

Unit	Gram	Ounce Avoirdupois	Ounce Troy	Pound Avoirdupois	Pound Troy	Kilogram
1 gram	—	0.03527	0.03215	0.002205	0.002679	0.001
1 oz. avoir.	28.35	—	0.9115	0.0625	0.07595	0.02835
1 oz. troy	31.10	1.097	—	0.06857	0.08333	0.03110
1 lb. avoir.	453.6	16.0	14.58	—	1.215	0.4536
1 lb. Troy	373.2	13.17	12.0	0.8229	—	0.3732
1 kilogram	1.0×10^{3}	35.27	32.15	2.205	2.679	—

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