



TRP1000-OD

Troposcatter C-Band Outdoor Amplifier Installation and Operation Manual

Part Number MN-TRP1000-OD
Revision 2

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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Revision History

Rev	Date	Description
0	6-2017	Initial Release.
1	7-2017	Revised Table 2-2.
2	7-2018	Added support for AC Line Monitor, which revised Customer Commands table in Section 5.5: Updated the following Customer Commands areas: <ul style="list-style-type: none">• Maximum Operating Points• Retrieve Alarm Status• Retrieve Maintenance Status• Read Next 5 Statistics

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Acronym List

Acronym	Description
EIA	Electronic Industries Association
FET	Field Effect Transistor
FTP	File Transfer Protocol
GaN	Gallium Nitrate
GUI	Graphics User Interface
LED	Light Emitting Diode
M&C	Monitor and Control
MCP	Monitor & Control Processor
MIB	Management Information Base
MTBF	Mean Time Between Failures
NMS	Network Management System
OID	Object Identifiers
RAS	Retrieve Alarm Status
RCS	Retrieve Configuration Status
RF	Radio Frequency
RMS	Retrieve Maintenance Status
SSPA	Solid State Power Amplifier
VSWR	Voltage Standing Wave Ratio

PREFACE

About this Manual

This manual provides installation and operation information for the Comtech EF Data TRP1000-4450 Troposcatter C-Band Outdoor Amplifier, also referred to as TRP1000-4450-OD, TRP1000-4450, and TRP1000-OD. This manual is an informational document intended for the persons responsible for the operation and maintenance of the amplifier.

Disclaimer

Comtech EF Data has reviewed this manual thoroughly in order to provide an easy-to-use guide to this 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 there are any questions regarding this equipment or the information in this manual, please contact the Comtech EF Data Customer Support Department shown in the **Get Help** section of the Preface.

Conventions and References

Patents and Trademarks

See all of Comtech EF Data's Patents and Patents Pending at <http://patents.comtechefdata.com>.

Comtech EF Data acknowledges that all trademarks are the property of the trademark owners.

Warnings, Cautions, and Notes



A WARNING informs you about a possible hazard that MAY CAUSE DEATH or SERIOUS INJURY.



A CAUTION informs you about a possible hazard that MAY CAUSE INJURY or PROPERTY DAMAGE.

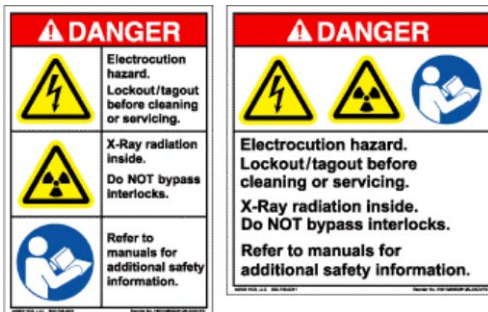


A NOTE gives you important information about a task or the equipment.



A REFERENCE directs you to additional information about a task or the equipment.

Examples of Multi-Hazard Notices



Recommended Standard Designations

The Electronic Industries Association (EIA) designations replace Recommended Standard (RS) Designations. References to the old designations may appear when depicting actual text (e.g., RS-232) as displayed on the Web Server pages or the Serial Interface for the unit. All other references in the manual address the EIA designations.

Metric Conversion

Metric conversion information is located on the inside back cover of this manual. Comtech EF Data furnishes this information to assist in the cross-referencing of non-Metric to Metric conversions.

Electrical Safety Notice



Neutral Fusing – Double pole/neutral fusing is used on the prime power supply input.

This equipment is 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.

Get Help



Review the Warranty Policy before contacting Comtech EF Data Technical Support or Customer Service.

Contact Comtech EF Data

Contact Comtech EF Data for:

- **Technical Support** – Product support or training.
- **Customer Service** – Information on returning an in-warranty or out-of-warranty product for upgrade or repair. **Be prepared to provide the product model number and its serial number.**

Contact Comtech EF Data Customer & Technical Support during normal business hours (Monday through Friday, 8 A.M. to 5 P.M Mountain Standard Time (MST)):

For:		Contact:
Technical Support and Service	Telephone	+ 1.866.472.3963 (toll free, USA and Canada)
		+ 1.240.243.1880 (outside USA and Canada)
	Email	techsupport@comtechefdata.com
Comtech EF Data Web Site	Main Page	http://www.comtechefdata.com
	Customer and Technical Support	http://www.comtechefdata.com/support.asp
	RMA (Return Material Authorization)	http://www.comtechefdata.com/rmaform.asp
Comtech EF Data Main Number		+1.480.333.2200
Mailing Address		2114 West 7th Street Tempe, Arizona 85281 USA

Return a Product for Upgrade or Repair

Step	Task
1	Go to the Comtech EF Data Home page (http://www.comtechedata.com). From the SUPPORT column at the bottom of the page, select the Service hyperlink, and read the Return Material Authorization section in its entirety.
2	<p>Request a Return Material Authorization Number:</p> <ul style="list-style-type: none"> • <i>On the Comtech EF Data Home page:</i> From the SUPPORT column at the bottom of the page, select the RMA Request hyperlink; <p><i>OR</i></p> <ul style="list-style-type: none"> • <i>On the Comtech EF Data Support page:</i> Click [Send RMA Request]; <p><i>OR</i></p> <ul style="list-style-type: none"> • <i>On the Comtech EF Data Service page:</i> Select the Return Material Authorizaion hyperlink; • Fill out the RMA form completely; • Click [Send Email]. <p><i>Alternately:</i></p> <ul style="list-style-type: none"> • Send an e-mail providing this same detailed information to Comtech EF Data Customer Service (service@comtechedata.com). • Contact Comtech EF Data Customer & Technical Support by phone or fax.
3	Pack the product in its original shipping carton and protective packaging.
4	Ship the product back to Comtech EF Data. Shipping charges should be prepaid.

Installation Guidelines Regarding Power Line Quality



Comtech EF Data has become familiar with the varying quality of the AC power grid around the world. Observing the following installation guidelines 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, as well as lightning strikes. The TRP1000 does **not** have built in surge suppression; therefore, regardless of power grid quality at the point of installation, Comtech EF Data recommends installation of additional power conditioning/surge suppression at the power junction box.

Grounding: The TRP1000 provides a grounding terminal. This is provided to allow grounding of the TRP1000 to the antenna's grounding network. All installed components 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 TRP1000 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 TRP1000. Depending on the severity of the strike, the external surge suppression may protect the TRP1000'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.

Chapter 1. INTRODUCTION

1.1 Overview



Before operation, read Section 1.4.6 “Important Information on Temperature and RF Overdrive.”

The compact, thermally efficient design and beneficial features of the Comtech EF Data TRP1000-4450-OD Troposcatter C-Band Outdoor Amplifier (Figure 1-1) – referred to throughout this manual as the TRP1000-4450, SSPA, TRP1000-OD, or amplifier – are the result of Comtech EF Data’s extensive experience in the design of outdoor RF amplifiers and transceivers.



Figure 1-1. TRP1000-4450-OD C-Band Outdoor Amplifier

1.2 Functional Description

Each TRP1000-4450 consists of a Comtech EF Data Solid-State Power Amplifier (SSPA) module, a Monitor/Control Processor (MCP), Forward, Reflected, and Input RF Power monitoring, a power supply, and thermal management system with heat sinks and cooling fans. The amplifier features a proprietary Comtech EF Data low-loss combining technique and MCP-based temperature-versus-gain compensation circuitry.

1.3 Features

1.3.1 The Solid-State Advantage

The TRP1000-4450 is constructed entirely with solid-state devices, including the latest, high reliability, high power density gallium nitride (GaN) transistors. SSPAs are known to exhibit much longer lifetimes or mean time between failures (MTBF) than their tube based counterparts, eliminating the frequent and expensive need for tube replacement and the associated out-of-service operation loss.

1.3.2 High Efficiency

The advances in GaN technology utilized in the active transistors mentioned above also allow for the best possible efficiency at these high power levels, reducing operating costs. Also, as the user lowers output power according to operation needs, dc power consumption is also reduced accordingly.

1.3.3 Enhanced Standard Features

The TRP1000-4450 comes equipped with useful features that other manufacturers offer only as options. Included are temperature compensation, output sample port, forward, reverse and power monitors, power factor corrected supply, and full remote monitor and control (M&C) capabilities (including Ethernet).

1.3.4 Monitor and Control via Ethernet or Serial Communications

A user can monitor and control all critical parameters of the SSPA by multiple methods. A user can use the Ethernet and the built in graphics user interface (GUI) interface, via serial communications commands and responses, or manually by the front panel light emitting diode (LED) interface menu and keypad.

1.3.5 Forward, Reverse, and Input Power Monitors

The TRP1000-4450 comes equipped with an output sample port, along with forward, reverse, and input power monitors. The unit will shut itself off in case of excessive reflected power.

1.3.6 Complete Temperature Testing

While others may imply temperature compliance, each TRP1000-4450 is fully tested over the specified operating temperature range. Corresponding test data is supplied, which ensures a reliable unit. The customer can have confidence and the knowledge that each unit has been tested and has passed critical specifications at the operating temperature extremes.

1.3.7 Data Logging Capability

The TRP1000-4450's built-in data logging capability greatly enhances system maintainability. By recording critical operational parameters such as temperature, output power, mute status, etc. at time stamped intervals, the user can quickly gather intelligence about not only the unit itself, but also the unit's operational environment.

1.4 Theory of Operation

As shown in the block diagram of Figure 1-2, the major components of the TRP1000-4450 SSPA are:

- The SSPA Module
- The Power Factor Corrected Power Supply
- Monitor & Control (M&C)
- The Cooling System

1.4.1 SSPA Block Diagram

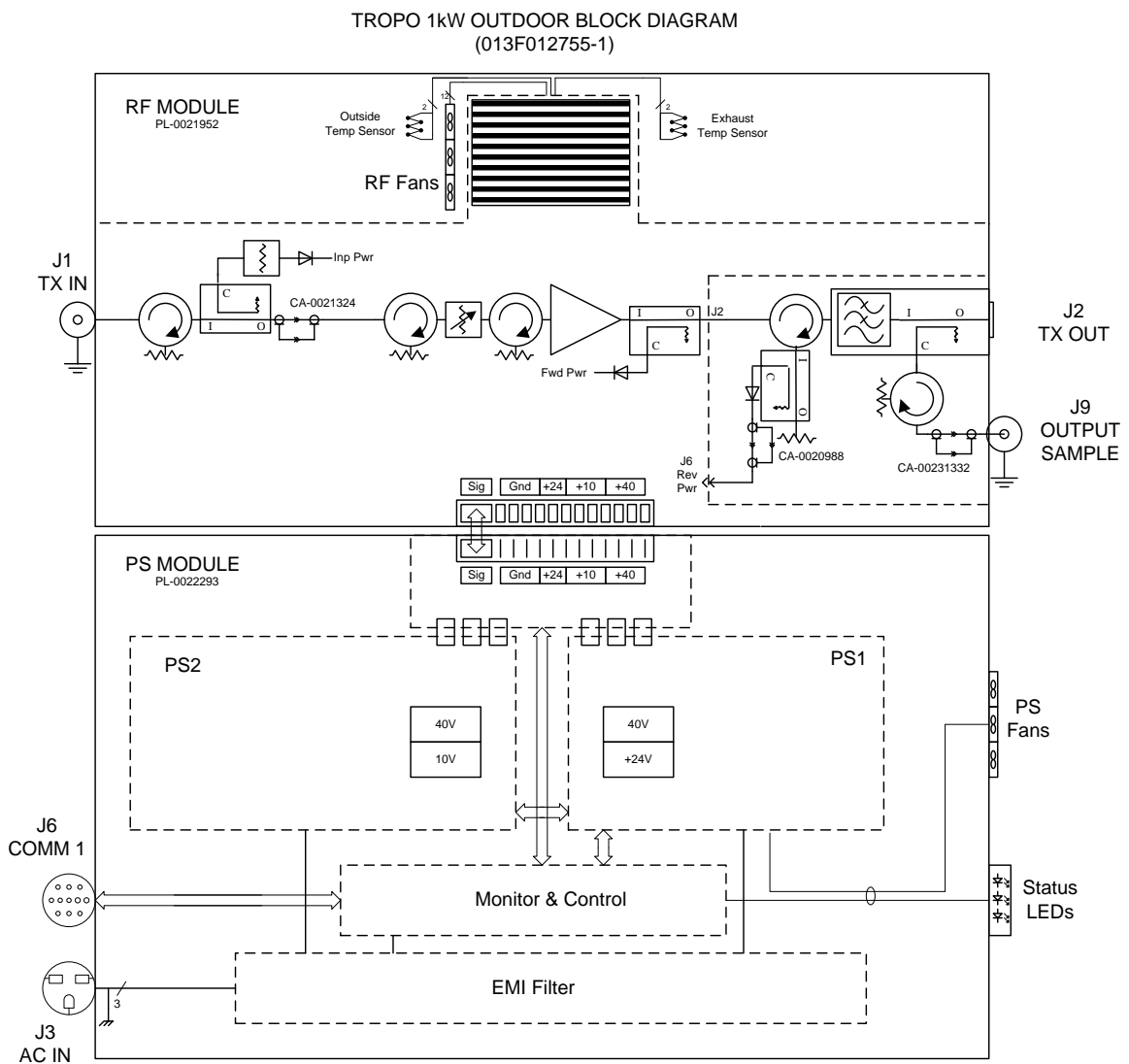


Figure 1-2. TRP1000-4450-OD Block Diagram

1.4.2 SSPA Module

The amplifier module performs the core function of the unit. An isolator is at the RF input to ensure good voltage standing wave ratio (VSWR). The RF signal then passes through the input power monitor and on to an electronically controlled attenuator that adjusts the overall attenuation according to the user input. This attenuator is automatically controlled via a look-up table to maintain the amplifier gain at a constant level over temperature variations.

The RF signal is then amplified by a multi-stage design that utilizes proprietary low-load combining techniques to meet the rated power requirements. The output circuitry contains a coupler to provide a sampled signal for monitoring purposes. A forward power detector circuit also is included and the reading can be accessed via remote communication. A high power circulator and load is located at the output to provide good VSWR and protection from external mismatch. A reverse power detector will shut down and protect the unit in case of excessive reflected power. A low pass filter provides harmonic rejection.

1.4.3 Power Supply

The SSPA features a power supply that is power factor corrected. It supplies several voltages necessary for the unit to operate:

The 10V and 40V power supplies output states are controlled by circuitry within the RF module. If the RF module does not have the -5.8V supply for any reason, it will not allow the 10/40V power supplies to turn on. This protects the power transistors within the RF module from failure due to improper power supply sequencing.

The +24V output powers the cooling fans and the M&C circuitry.

1.4.4 Monitor and Control (M&C)

The TRP1000-4450 includes a microprocessor-based system that provides monitoring and control of the essential parameters of the unit. The user interfaces with the unit through the M&C system via the remote control/discrete communications port. The unit is capable of EIA-232, EIA-485, or Ethernet remote communication. A discrete mute control and relay status output is also available.

The M&C system monitors and controls the fan speeds, unit temperature, all power supply voltages, power transistor currents, output power, etc. Should a critical monitored parameter fail, the unit will mute the RF signal and report a fault. The details of the fault can be accessed via remote communication.

1.4.5 Cooling System

The SSPA contains a robust and proprietary heat sink and thermal design to maintain a low operating temperature. There are three larger fans dedicated to the radio frequency (RF) heat sink, and three smaller fans dedicated to keeping the power supply cool. Each of the fans are monitored and speed controlled by the M&C board. The fans draw cool outside air in across the power supply and specialized RF heat sink.

The amplifier module temperature is monitored and, if for any reason the amplifier temperature exceeds a safe preset limit, the amplifier module supply is shut down to protect the unit from thermal failure.

The M&C also monitors a temperature sensor placed in the outside airstream, to give the user an indication of the “Outside” or ambient temperature the amplifier is operating in. An alarm is presented to the user if the outside temperature is 3°C more than the upper temperature rating. The unit will shut down to protect itself if it senses the outside temperature at 6°C above the rated upper limit.

The user should install the unit in such a way as to not impede adequate airflow (see Section 2 on Installation) and always operate the unit within the rated temperature specification. The heat sinks should be regularly cleaned as well to ensure adequate airflow and cooling (see Section 5 on Maintenance).

1.4.6 Important Information on Temperature and RF Overdrive



Read and understand this important section to ensure long time amplifier reliability.

1.4.6.1 Overview:

The TRP1000-4450 has firmware intended 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 can 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.

1.4.6.2 Over Temperature

As stated in the specifications, the amplifier is rated to operate up to ambient temperatures of 60°C. 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. 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 is $\geq 63^{\circ}\text{C}$, or other internally monitored temperatures exceed their threshold (such as the amplifier heat sink temperature, $\text{ATEMP} > 95^{\circ}\text{C}$), 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 $\geq 66^{\circ}\text{C}$ or $\text{ATEMP} \geq 66^{\circ}\text{C}$), the unit will declare an Over Temperature Shutdown fault and will turn off the power supplies to the critical RF transistors for protection purposes. (The Amplifier/Outside Temperature Alarm has a hysteresis of 5°C, while the Over Temperature Shutdown fault has a hysteresis of 10°C).

1.4.6.3 Over Drive (excessive RF input level)

As stated in the specifications, the amplifier is guaranteed to deliver at least 60 dBm of power at the rated output level. Note that 59 dBm is the rated output level where the spectral regrowth will not exceed -25 dBc. Although the unit may be capable, operating beyond this 60 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 EF Data 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. 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.

1.4.6.4 Maximum Operating Points

The Status webpage includes the maximum (and in some cases, minimum) operating points of key parameters as they are recorded by the unit over time. This helps the factory and the user ensure that the unit is being operated correctly, especially in regards to ambient temperature and user drive levels.

1.5 Summary of Specifications

1.5.1 RF Specifications (per 013F012755 RevC dated 10/28/15)

Table 1-1. RF Specifications

Para.	Description	Specification
1.5.1.1	Frequency Range	4.390– 5.010 GHz
1.5.1.2	Instantaneous 3 dB Bandwidth	620 MHz minimum
1.5.1.3	Amplifier Type	Class A or AB, Continuous Wave
1.5.1.4	Noise Figure (with RF Input Attenuator set for minimum attenuation)	18 dB maximum
1.5.1.5	Output Power	
1.5.1.5.1	Rated Power	+60.0dBm
1.5.1.6	Gain	
1.5.1.6.1	Small Signal Gain (small signal with RF Input Attenuator set for minimum attenuation)	+41 dB minimum
1.5.1.6.2	Gain Adjustment range	10 dB min
1.5.1.7	Input Power Without Damage	+35 dBm, minimum
1.5.1.8	Gain Variation at rated power over 620 MHz bandwidth	±1.6 dB maximum
1.5.1.9	Gain Variation at any output power over any 40 MHz bandwidth	±0.5dB maximum
1.5.1.10	Gain Slope	±0.02dB/MHz maximum
1.5.1.11	Gain Stability (constant drive and temperature) over 24 hours, -40°C to +60°C	±0.25 dB maximum/24 hours @ P ₁ dB (at +25°C) and +1 to -0.5 dB over the temperature range
1.5.1.12	Input Connector Marking:	Type-N, Female "J1 (TX In)"
1.5.1.13	Output Connector	Waveguide: Type CPR-187G, all threaded stainless steel inserts
1.5.1.14	Input VSWR (with RF Input Attenuator set for minimum attenuation)	1.25:1 maximum (19.1 dB return loss)
1.5.1.15	Load VSWR (maximum allowable)	1.5:1 for specification compliance 2:1 with no damage (continuous)
1.5.1.16	AM to PM Conversion	2.5 deg./dB at P _{Rated} – 1dB
1.5.1.17	Harmonic Output (dB below fundamental)	-60 dB below rated carrier
1.5.1.18	Group Delay (in any 40 MHz Band)	
1.5.1.18.1	Linear	0.04 nanoseconds/MHz
1.5.1.18.2	Parabolic	0.005 nanoseconds/MHz ²
1.5.1.18.3	Ripple	1.0 nanoseconds peak to peak maximum
1.5.1.19	Residual AM (in dB below rated single carrier output as measured in a 4 kHz band)	
1.5.1.19.1	f ₀ to 4 kHz	-35 dBc minimum

Para.	Description	Specification
1.5.1.19.2	4 kHz to 500 kHz	-20 (1.15 + log f), where f is in kHz
1.5.1.19.3	Above 500 kHz	-77 dBc maximum
1.5.1.20	Phase Noise	(IESS 308/309) -10dB
1.5.1.21	Noise & Spurious	-70 dBc The sum of the fundamental and each harmonic component of the alternating (AC) line frequency shall not exceed -40 dBc.
1.5.1.22	Intermodulation Products for two equal carriers anywhere in the Frequency Range spaced 3 MHz apart with each carrier set to the RF output power shown in paragraphs 1.5.1.22.1 to 1.5.1.22.2.	3 rd order IM products measured relative to either desired carrier at the RF output
1.5.1.22.1	Each carrier set 6 dB below rated power	-17 dBc
1.5.1.22.2	Each carrier set 9 dB below rated power	-25 dBc
1.5.1.23	Spectral re-growth @ QPSK +/- 1 to 1.5 Symbol Rate offset	-25 dBc minimum at any power up to 1 dB below rated output power
1.5.1.24	RF Output Power Monitor Coupling relative to RF Output: Front panel Connector: Front Panel Marking:	50 dB, nominal Type-N, Female "OUTPUT SAMPLE"

1.5.2 Prime Power Requirements

Table 1-2. Prime Power Requirements

Para.	Description	Specification
1.5.2.1	Type	Single phase, Three -wire
1.5.2.2	AC Voltage	200-250 VAC
1.5.2.3	Frequency	47 to 63 Hz
1.5.2.4	Power Consumption	4500 VA maximum @ 1.0 kW output
1.5.2.5	Inrush Current	144A peak
1.5.2.7	Ground Leakage Current	2 mA AC maximum
1.5.2.8	Power Interruption	20 msec min without performance degradation
1.5.2.9	EMC Conducted and Radiated	EN55022-Level A FCC Part 15 Class A

1.6 Dimensional Envelope

Note that all dimensions are in inches. Bracketed dimensions, where shown, are in metric units (mm).

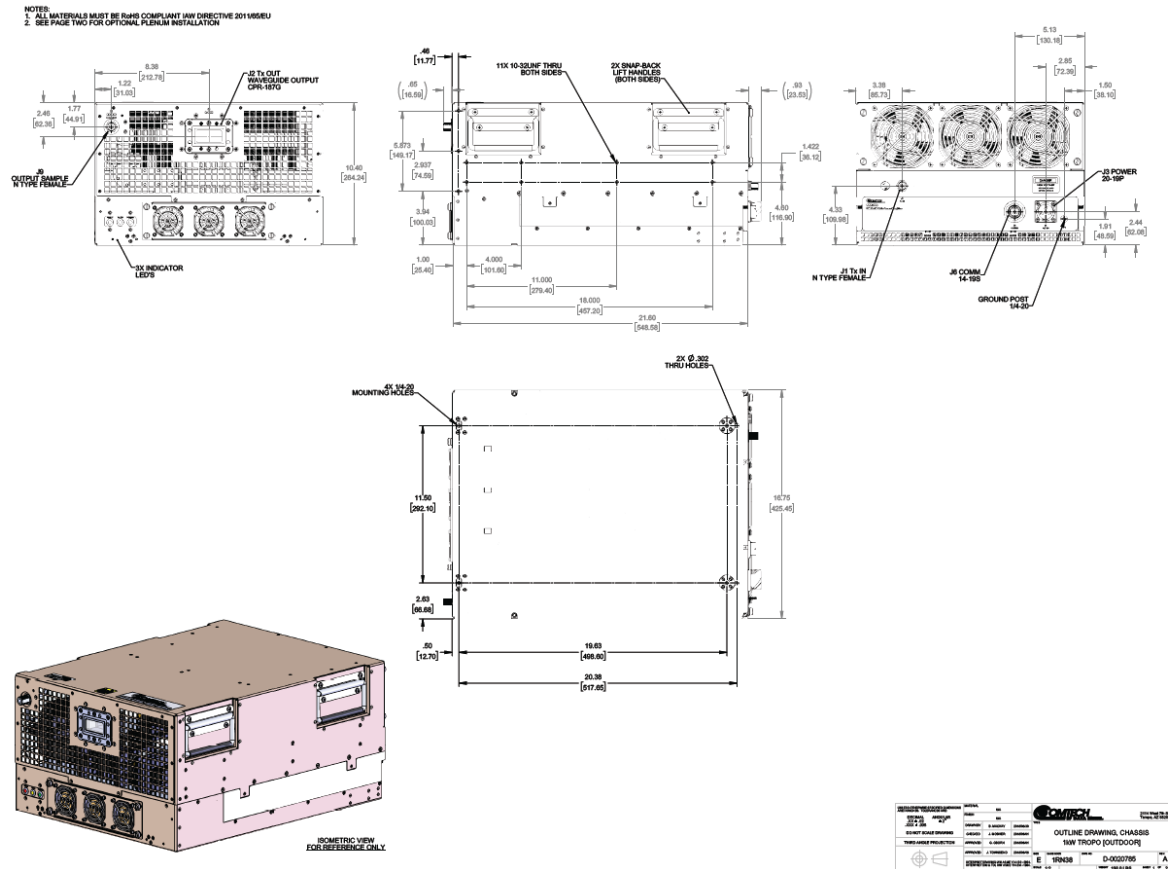


Figure 1-3. TRP1000-4450-OD Dimensional Envelope

Chapter 2. SYSTEM CONNECTIONS, INSTALLATION AND STARTUP

2.1 Overview

This chapter summarizes the connectors provided for all necessary external connections between the TRP1000-4450-OD Troposcatter C-Band Outdoor Amplifier and other equipment. Basic installation and operational startup information is provided in Sect.2.3 and Sect 2.4, respectively.

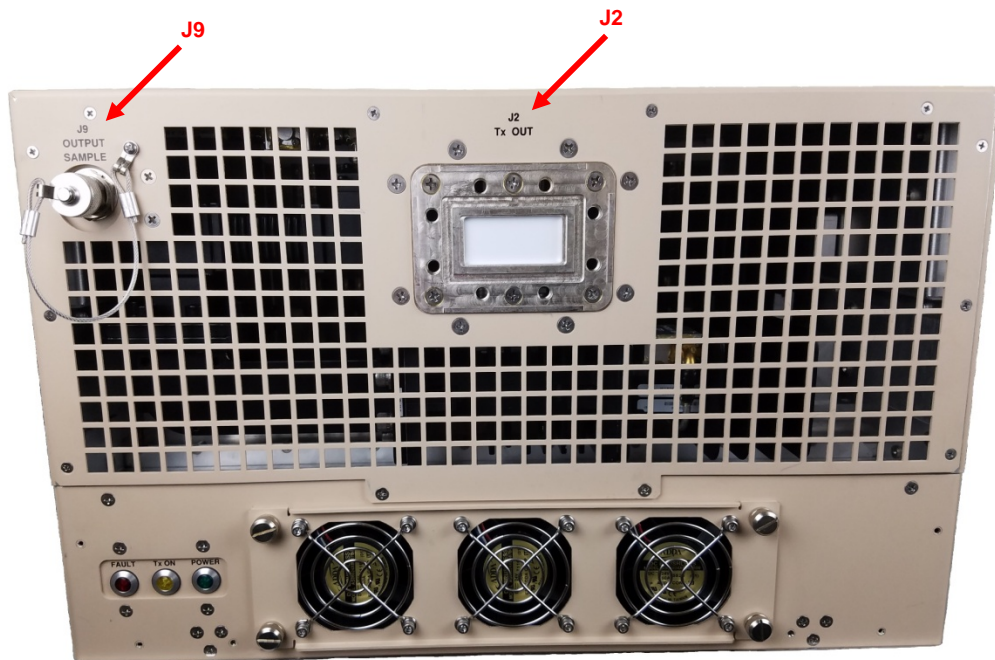


Figure 2-1. TRP1000-4450-OD Interface Connectors - Front



Figure 2-2. TRP-1000-4450-OD Interface Connectors - Back

2.2 Interface Connectors

2.2.1 TX (RF Input) Connector 'J1 | TX IN' (Type N-F)

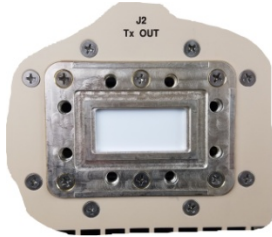


The 'J1 | TX IN' (RF Input) connector is a 50Ω Type 'N' female connector. Typical input levels (+0 dBm to ~ + 20 dBm) depend on desired output power. For example, if the unit has a gain of 45dB, then an input level of +10 dBm will result in an output of 55dBm. In general, RF input levels above those which result in output saturation (>> Prated) should be avoided and, to prevent damage to the TRP1000-4450, should never exceed +30 dBm (refer to Section 1.4.6).

2.2.2 RF Output Connector ‘J2 | RF OUT’



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 CPR187G waveguide flange interface. Be careful not to allow any unwanted material to enter the waveguide output while the interface is open. The opening is covered with a protective material during shipment. Assuming the mating flange is also a type CPR187G interface, use the supplied gasket 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 | AC IN’



The AC prime power input requirements for the TRP1000-4450 are as follows:

- 200-250 VAC
- 47 to 63 Hz

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

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

Table 2-1. Connector ‘J3 | AC IN’ Pin Assignments

Pin #	Description
A	GND
B	NEUTRAL (L2)
C	LINE (L1)

In order to meet the EMC standard(s) EN55022/EN55032/FCC Part 15 for radiated emissions, it is recommended adding the three ferrite beads, CEFD pn ID-0020718, included in the accessory kit, to the AC power cable built by the user, as shown in Figure 2-3 below.



Figure 2-3. Ferrite Beads added to AC Power Cable

2.2.4 Remote Communications/Discrete Control Port Connector 'J6 | COMM 1'



The 'J6 | COMM 1' Remote Communications/Discrete Control connector is a 19-pin circular connector, type MS3112E14-19S. It is the primary input for remote M&C of the SSPA.

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

Table 2-2. Connector ‘J6 | COMM 1’ Pin Assignments

Pin	Name	Description
A	RS485_+RX	
B	RS485_-RX	
C	RS485_+TX	
D	RS485_-TX	
E	RS232_RD	
F	ENET TX+	
G	RS232_TD	
H	ENET TX-	
J	Not Used	
K	Gnd	
L	SUM_FLT_In	Connecting this pin to Gnd (Pin K) will cause the SUM_FLT_Out relay to activate (i.e. connects Pin M to Pin K).
M	SUM_FLT_Out	When faulted, tied to Pin K, else open
N	Not Used	
P	Not Used	
R	Not Used	
S	System Mute Control	Only active in aux mute mode. System un-muted if shorted to Pin K. Mutes when open.
T	Gnd	
U	ENET RX-	
V	ENET RX+	

2.2.5 Output Sample Port Connector ‘J9’ (Type ‘N’ Female)



The output Sample Port connector is found on the left-hand side of the front chassis. It is a Type ‘N’ female connector that provides a nominal -50 dB sample of the output signal. A calibration label, provided near the connector, shows the actual coupling values vs. frequency.

2.2.6 Ground Connector



A #10-32 stud is provided at the location, shown in Figure 2-4, for connecting a common chassis ground among equipment.

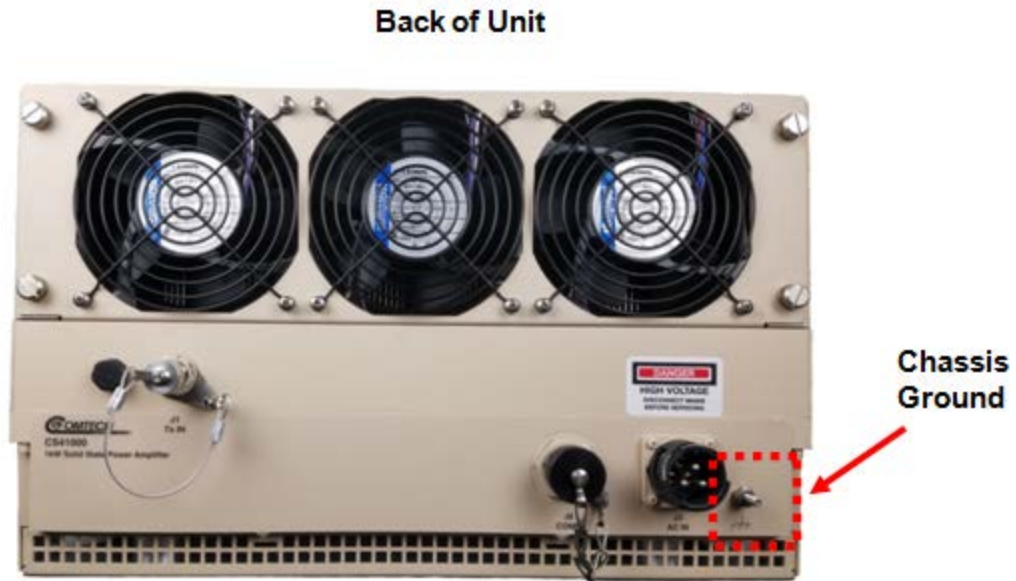


Figure 2-4. TRP1000-4450-OD Ground Connection

2.3 TRP1000-4450-OD Installation



To allow for proper cooling of the TRP1000-4450, keep any mounting obstructions least four inches away from the cooling fans and the end vents. Also, do not install the unit in such a way that would cause the hot exhaust air to return to the air inlet area.

As shown in Figure 2-5, mounting holes are provided for rack or panel installation of the TRP1000-4450. Several holes are available on the flat (bottom) surface of the TRP1000-4450 for mounting/installation purposes. Contact Comtech EF Data if factory furnished mounting kits are desired.

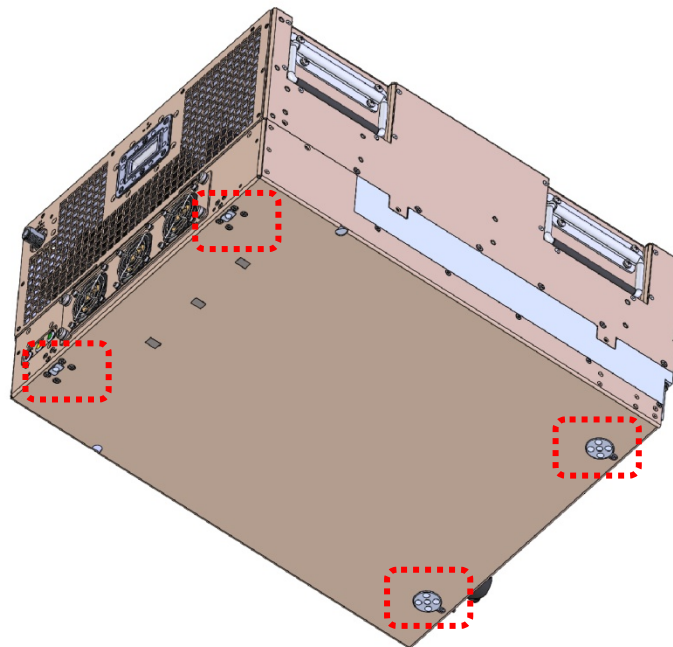


Figure 2-5. TRP1000-4450-OD Mounting

2.4 Power On the Unit



Never turn the unit ON without proper output termination on the 'J2 | RF OUT' port. Individuals can be exposed to dangerously high electromagnetic levels.

The TRP1000-4450 does not contain a 'Power On/Off' switch. The SSPA is powered ON by connecting the 'J3 | AC IN' power connector to the appropriate prime power source. The Mute or Transmit status of the SSPA will automatically come up in the factory default state (factory default = transmit off, not muted).

Chapter 3. UPDATING FIRMWARE

3.1 Introduction



To ensure optimal performance, it is important to operate the TRP1000-4450 with its latest available firmware.

Comtech EF Data's TRP1000-4450 Troposcatter C-Band Outdoor Amplifier is factory-shipped with the latest version of operating firmware. Firmware updates may be applied to a unit without having to remove it from operation. If a firmware update is needed, it can be acquired:

- By download from the Comtech EF Data Web site (www.comtechefdata.com)
- From Comtech EF Data Customer Support during normal business hours, via e-mail or on CD by standard mail delivery (refer to Preface).

The TRP1000-4450 Firmware Update process is as follows:

- Download the firmware update archive file via the Internet to a user-supplied Microsoft Windows®-compatible computer.
- Use the appropriate adapter cable to connect the unit's 'J6 | COMM 1' 19-pin port to a 9-pin serial port or Ethernet port of the user PC.
- Extract the firmware update files from the archive download file, and then transfer the files from the user PC to the unit via File Transfer Protocol (FTP):
 - For serial-based units, this is accomplished using the user terminal emulator program configured for serial operation and the provided CREFLASH.exe utility program.
 - For Ethernet-based units, this is accomplished using the FTP protocol and the user terminal emulator program configured for Telnet operation and the units Web Server Interface.

3.2 Getting Started: Prepare for the Firmware Download

1. Identify the firmware number and its version number.

User-supplied items needed:

- A Microsoft Windows-based PC, equipped with available serial and Ethernet ports; a compatible Web browser (e.g., Internet Explorer); and a terminal emulator program (e.g., Tera Term or HyperTerminal).
- An M&C adapter cable for connection between the unit's '**J6 | COMM 1**' port and the user PC using a 19-pin to 9-pin Serial Adapter Cable, or a 19-pin to RJ-45 Ethernet Adapter Cable.
 - a. Connect the Adapter Cable from the unit's '**J6 | COMM 1**' port to the pertinent port on the user PC.
 - b. On the PC – configure the terminal emulator program.



Refer to your terminal emulator program HELP feature or user guide for operating and configuration instructions.

- **19200 bps (Baud Rate)**
- **Parity = NO**
- **Local Echo = ON**
- **8 Data Bits**
- **Port Flow Control = NONE**
- **1 Stop Bit**
- **Display New line Rx/Tx: CR**

- c. Energize the TRP1000-4450.
- d. Obtain the firmware information via one of the following methods:
 - **Using Serial Remote Control or Telnet via the user PC terminal emulation program** – Log in to the TRP1000-4450, and then use '**FRW**' remote query to obtain, and make note of, the firmware information:
Type (without the quotes) "**<1/FRW?>**"**<cr>** at the command prompt to query the TRP1000-4450 for its Firmware Number.



See Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT for information and instructions on using Remote Commands and Queries.

2. Create a temporary folder (subdirectory) on the user PC for the firmware archive download.



- **Drive letter 'c:' is used in these examples. Any valid, writable drive letter can be used.**
- **Typical for all tasks: Type the command without quotes, and then press Enter to execute.**

There are several ways the user may use create a temporary folder on a Windows-based PC:

- a. Use the Windows Desktop to create and rename the temporary folder.
 - Right-click anywhere on the desktop to open the popup submenu, and then select **New > Folder** to create the temporary folder. The new folder will be created on the desktop.
 - Right-click on the new folder and then select **'Rename'** from the popup submenu. Rename this folder to **"temp"** or some other convenient, unused name.



Figure 3-1. Temporary Folder Setup using Windows Desktop

- b. Use Windows Explorer to create and rename the temporary folder.
 - Select **File > New > Folder** to create the temporary folder. The new folder will be created in the active folder.
 - Right-click the **'New Folder'** folder name, and then rename this folder to **"temp"** or some other convenient, unused name.

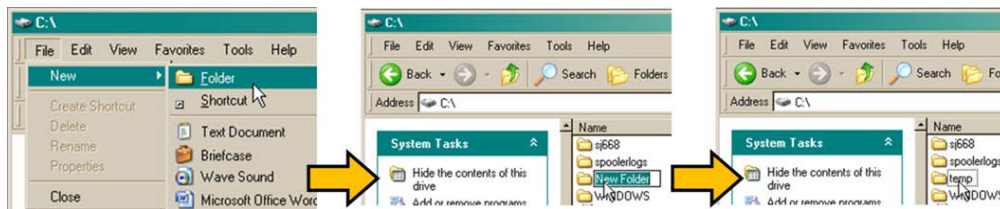


Figure 3-2. Temporary Folder Setup using Windows Explorer

- c. Use the 'Run' and 'Browse' windows to create and rename the temporary folder.
- Select **[Start]** on the Windows taskbar and then click the **Run...** icon. The 'Run' window will open.
 - Click **[Browse]** in the 'Run' window. The 'Browse' window will open.
 - Click the **Create New Folder** icon in the 'Browse' window. The new folder will be created.
 - Right-click the 'New Folder' folder name, and then rename this folder to "**temp**" or some other convenient, unused name.

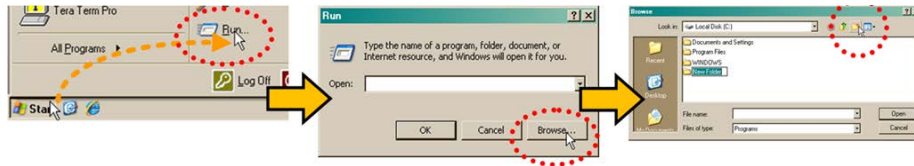


Figure 3-3. Temporary Folder Setup using 'Run' and 'Browse'

- d. Use Windows Command-line to create the temporary folder.
- **First**, click **[Start]** on the Windows taskbar, and then click the '**Run...**' icon (or, depending on Windows OS versions *prior* to Windows 95, click the '**MS-DOS Prompt**' icon from the Main Menu).
 - Next, open a Command-line window...
 - For Windows 95 or Windows 98 – Type "**command**".
 - For any Windows OS versions later than Windows 98 – Type "**cmd**" or "**command**".
 - Alternately, from [Start], select All Programs > Accessories > Command Prompt.
 - Finally, from the Command-line '**c:\>**' prompt, type "**mkdir temp**" or "**md temp**" (*mkdir* and *md* stand for *make directory*), and then click **[OK]**.

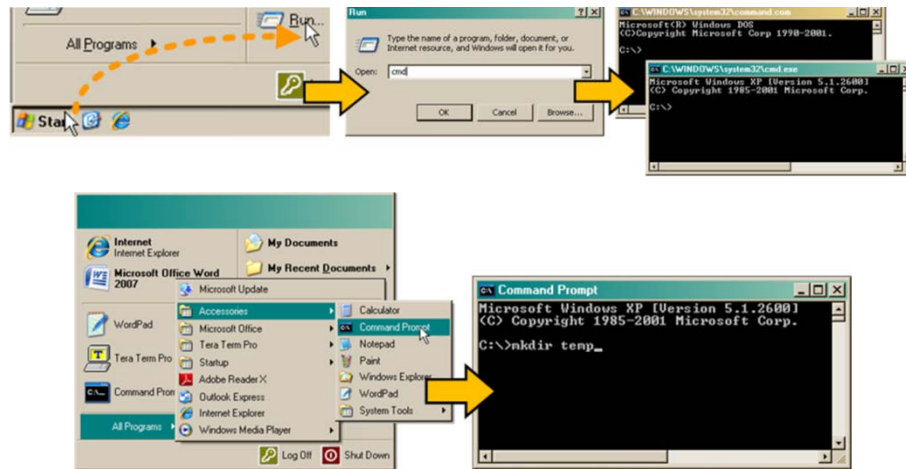


Figure 3-4. Temporary Folder Setup using Windows Command Line

There should now be a 'temp' folder created and available for placement of the firmware file download.

3.3 Download and Extract the Firmware Update

1. First, download the firmware update file from the Comtech EF Data Web site:
 - a. Go online to www.comtechefdata.com.
 - b. On the **Main** page – Under **Support Information** or the **Support** tab, select the **Software Downloads** hyperlink.
 - c. On the **Software Downloads** page – Click **Download Flash and Software Update Files**.
 - d. On the **Flash Updates Index** page – Select the appropriate (**Select a Product Line**) product hyperlink.
 - e. Select the appropriate firmware archive EXE or ZIP file download hyperlink.



- **About Firmware Numbers, File Versions, and Formats:** The Comtech EF Data Web site catalogues its firmware update files by product type (e.g., router, modem, etc.), the specific model, and optional hardware configurations.
- Note that 'X' denotes the revision letter, and '####' represents the firmware version (e.g., V111 = Version 1.1.1).
- **About File Archive Formats:** Comtech EF Data provides its downloadable files in two compressed archive formats: *.exe (self-extracting) and *.zip (compressed). The *.exe file does not require a file archiver and compression utility program such as PKZIP for Windows, WinZip, ZipCentral, etc. (PKZIP for DOS is not supported due to file naming conventions). **Comtech EF Data does not provide this utility program.**

*Some firewalls do not allow the download of *.exe files. Download the *.zip file instead, and extract the firmware files from the archive download with a user-supplied utility program. For detailed information on handling archived files, refer to the utility program Help documentation.*

- f. Download the archive file to the temporary folder.
 - Once the **EXE** or **ZIP** hyperlink is selected the '**File Download**' window opens and prompts selection of **[Open]** or **[Save]**:
 - Click **[Open]** to turn over file extraction to the user-supplied utility program. Be sure to extract the firmware files to the '**temp**' folder created earlier.
 - Click **[Save]** to open the '**Save As**' window. Be sure to select and **[Save]** the archive *.exe or *.zip file to the '**temp**' folder created earlier.
 - Otherwise, click **[Cancel]** to quit and exit the file download process.

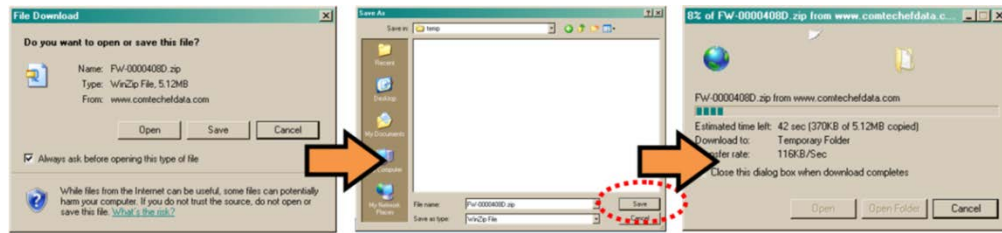


Figure 3-5. Download Firmware Archive File

2. Extract the firmware files from the archive file.
 - a. (If not already done with **File Download > [Open]**) Extract the firmware files from the downloaded ***.exe** or ***.zip** archive file with the user-supplied utility program:
 - b. Double-click on the archive file name, and then follow the prompts provided by the user-supplied utility program. Extract, at a minimum, three files:
 - The release notes PDF file.
 - **FW-#####x.bin** – Firmware file, where “XXXXXXX” is the firmware number, and “x” denotes the firmware revision letter.
 - The CREFLASH FTP utility program file.
3. Confirm availability of the firmware files in the temporary folder.

There are several ways the user may view the contents of the temporary folder on a Windows-based PC:

- a. From the Windows Desktop:
 - Double-left-click the **'temp'** folder saved to the Windows Desktop.
 - Use **Windows Explorer** to locate, and then double-left-click the **'temp'** folder.
 - Use the **'Browse'** window (**[Start] > ...Run > [Browse]**) to locate, and then double-click the **'c:\temp'** folder.
- b. Using Command-line:
 - Type **“cd c:\temp”** at the Command-line prompt to change to the temporary directory created earlier using Command-line.
 - Type **“dir”** to list the files extracted to the temporary directory from the downloaded archive file.

The firmware files have been successfully downloaded and are now available for transfer to the TRP1000-4450-OD.

3.4 Perform the FTP Upload Procedures

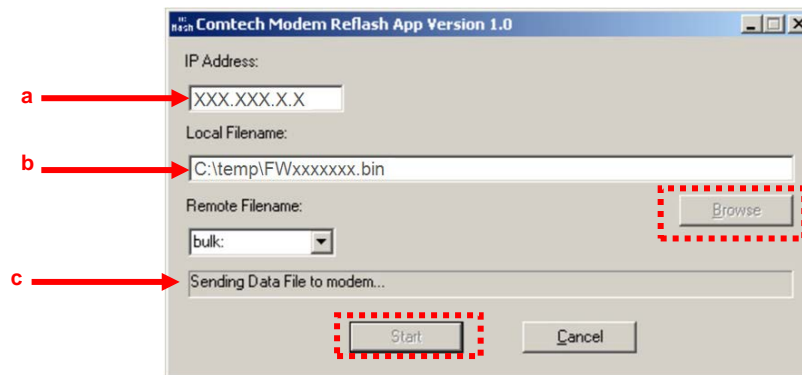


To proceed with the firmware update procedure, assumptions are made that:

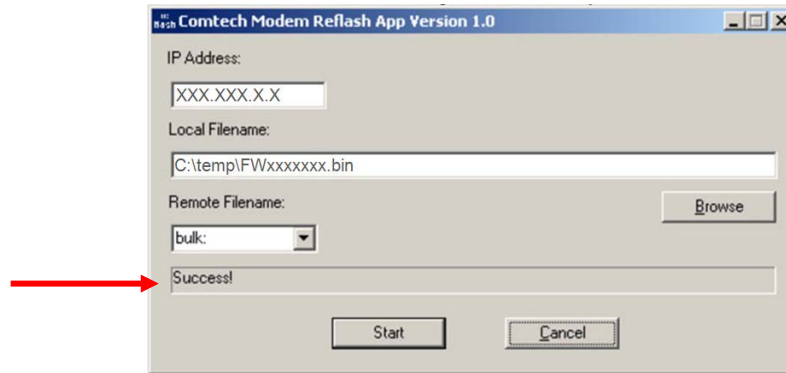
- The TRP1000-4450 'J6 | COMM 1' port is connected to the user-supplied, Windows-based PC serial port, and
- The PC is running a terminal emulation program (for operation of the TRP1000-4450 serial or Telnet interface).
- The latest firmware files have been downloaded or otherwise received from Comtech EF Data and are available on the user PC in an accessible temporary folder.

3.4.1 Perform the Automated Serial-Based FTP Upload Procedure (CReflash)

1. 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 unit.
 - b. Select the *firmware bulk image file*, as identified in Section 3.3. Type in the name, or select the file using [Browse].
 - c. Click [Start] to begin the flash upgrade procedure.



2. Check that the transfer completed successfully.



3. Verify the file transfer.
 - a. Reboot the unit:
 - Disconnect the power source from the TRP1000-4450.
 - Re-energize the TRP1000-4450. The unit will reboot using the updated firmware image.
 - b. To verify that the new file has loaded, use the firmware version verification procedure outlined in Section 3.2, Step 1.

The TRP1000 -4450 is now operating with its latest firmware. The serial-based firmware update process is now complete.

3.4.2 Perform the Ethernet-based FTP Upload Procedure

1. Use Command-line to send a “**PING**” command to confirm proper connection and communication between the user PC and the TRP1000-4450.
 - a. If the IP Address of the TRP1000-4450 is still not known:
 - **Via Telnet Remote Control** – Type the “<1/IPA?” remote query (without quotes) at the command prompt. The TRP1000-4450 returns the configured IP Address:
 >0001/IPA= xxx.xxx.xxx.xxx
 - **Via the TRP1000-4450 Web Server Interface** – View the *IP Address/Range* entry in the *Network Maintenance* section of the ‘Admin | Access’ page:



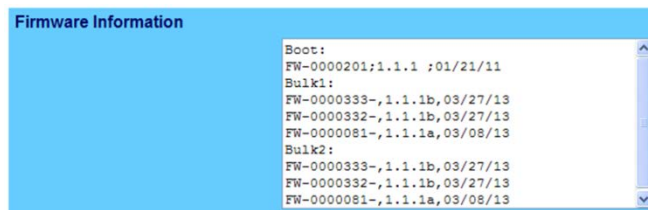
- b. Once the IP Address is known – use Command-line to PING:
 - Type “**ping xxx.xxx.xxx.xxx**” at the **Command-line** prompt (where ‘xxx.xxx.xxx.xxx’ denotes the TRP1000-4450 IP Address).
 - The response should confirm whether or not the TRP1000-4450 is properly connected and communicating.
2. Use Command-line to transfer (FTP) the files from the user PC to the TRP1000-4450:
 - a. Type “**ftp xxx.xxx.xxx.xxx**” (where ‘xxx.xxx.xxx.xxx’ is the TRP1000-4450 IP Address).
 - b. Type “**bin**” to set the binary transfer mode.
 - c. Type “**prompt**” and then “**hash**” to facilitate the file transfer.
 - d. Type “**put FW-#####x.bin bulk:**” (where ‘x’ denotes the revision letter) at the **Command-line** prompt, without quotes, to begin the file transfer. The destination “bulk” must be all lower case.

The process sequences through several blocks – this may take several minutes for the transfer to occur.



In the event you receive the “Connection closed by remote host.” message, wait another minute before continuing. The firmware update sometimes takes longer than the FTP client allows.

- e. Type “**bye**” to terminate the FTP session, and then close the **Command-line** window.
3. Use Telnet Remote Control or the TRP1000-4450 Web Server Interface to verify that the PC-to-Unit FTP file transfer was successful.
 - **Via Telnet Remote Control** – Type the “<1/FRW?” remote query (without quotes) at the command prompt. The unit will return the Bulk, MnC, and FPGA firmware load information.
 - **Via the TRP1000-4450 Web Server Interface** – Open the ‘**Config | Utility**’ page and review the Firmware Information section to verify that the PC-to-Unit FTP file transfer was successful.



```

Firmware Information
Boot:
FW-0000201;1.1.1 ;01/21/11
Bulk1:
FW-0000333-,1.1.1b,03/27/13
FW-0000332-,1.1.1b,03/27/13
FW-0000081-,1.1.1a,03/08/13
Bulk2:
FW-0000333-,1.1.1b,03/27/13
FW-0000332-,1.1.1b,03/27/13
FW-0000081-,1.1.1a,03/08/13
  
```

4. **Use the TRP1000-4450 Web Server Interface to select the boot image.** To select the desired boot Image, open the TRP1000-4450 Web Server Interface '**Config | Utility**' page. Use the **Next Reboot Image** drop-down list in the *Current Active Firmware Image #* section to select **1** or **2**, and then click [**Submit**].



5. Reboot the TRP1000-4450.
 - a. Disconnect the power source from the TRP1000-4450.
 - b. Re-energize the TRP1000-4450. The unit will reboot using the updated firmware image.
6. To update the other firmware image, repeat steps **1** through **5**.

The TRP1000-4450 is now operating with its latest firmware. The Ethernet-based firmware update process is now complete.

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Chapter 4. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

4.1 Overview

This chapter describes the functionality of the TRP1000-4450 100BaseT/10BaseTx Ethernet Management Interface. This interface is generally modeled after interface of Comtech EF Data's other Solid State Power Amplifier product lines.

Refer to the Remote Commands Specifications tables found in **Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT** for detailed descriptions of the configuration parameters featured on the individual web pages depicted in this section.

4.2 Ethernet Management Interface Protocols

The user PC facilitates access to Ethernet-based remote M&C of the TRP1000-4450 100BaseT/10BaseTx Ethernet Management Interface through two separately operated protocols:

- **Telnet Interface.** This requires use of the user PC's Command-line interface, or a user-supplied terminal emulation program such as HyperTerminal.
- **TRP1000-4450 Web Server (HTTP) Interface.** This requires a compatible user-supplied web browser such as Internet Explorer.
- **Simple Network Management Protocol (SNMP).** This requires a user-supplied Network Management System (NMS) and a user-supplied Management Information Base (MIB) File Browser.

4.3 Simple Network Management Protocol (SNMP) Interface

The SNMP is an Internet-standard protocol for managing devices on IP networks. The SNMP-managed network consists of three key components:

- **The managed device.** This includes the TRP1000-4450.
- **The SNMP Agent.** This is the software that runs on the TRP1000-4450. The TRP1000-4450 SNMP Agent supports both **SNMPv1** and **SNMPv2c**.
- The user-supplied NMS. This is the software that runs on the manager.

4.3.1 Management Information Base (MIB) Files

MIB files are used for SNMP remote management of a unique device. A MIB file consists of a tree of nodes called Object Identifiers (OIDs). Each OID provides remote management of a particular function. These MIB files should be compiled in a user-supplied MIB Browser or SNMP Network Monitoring System server. The following MIB files are associated with the TRP1000-4450:

MIB File/Name (where 'x' is revision letter)	Description
FW-0021006x.mib ComtechEFData Root MIB file TRP1000-4450 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: 1.3.6.1.4.1.6247.95 Full path: iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).comtechEFData(6247) Module: ComtechEFData MIB file consists of all of the OIDs for management of the amplifier functions
FW-0021007x.mib TRP1000-4450 Traps MIB file	Trap MIB file is provided for SNMPv1 traps common for TRP1000-4450.

4.3.2 SNMP Community Strings



In SNMP v1/v2c, the SNMP 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.

The TRP1000-4450 uses Community Strings as a password scheme that provides authentication before gaining access to the TRP1000-4450 agent's MIBs. They are used to authenticate users and determine access privileges to the SNMP agent.

Type the SNMP Community String into the user-supplied MIB Browser or Network Node Management software. You must define three Community Strings for SNMP access:

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



For proper SNMP operation, the TRP1000-4450 MIB files must be used with the associated version of the TRP1000-4450 Remote Router M&C. Refer to the TRP1000-4450 Firmware Release Notes for information on the required FW/SW compatibility.

4.3.3 SNMP Traps

The TRP1000-4450 supports both **SNMPv1** traps and **SNMPv2** notifications. The TRP1000-4450 has the ability to send out SNMP traps when certain events occur in the unit. A trap is sent both when a fault occurs and is cleared. You may configure which style of traps the TRP1000-4450 sends by using the TRP1000-4450 SNMPTrapVersion OID.

The following MIB2 SNMPv1traps and SNMPv2 notifications are supported by the TRP1000-4450:

MIB2 SNMPv1 trap: Authentication Failure	5
MIB2 SNMPv2 notifications: Authentication Failure	1.3.6.1.4.1.6247.95.1.3.1

The following Faults SNMPv1 traps and SNMPv2 notifications are supported by the TRP1000-4450.

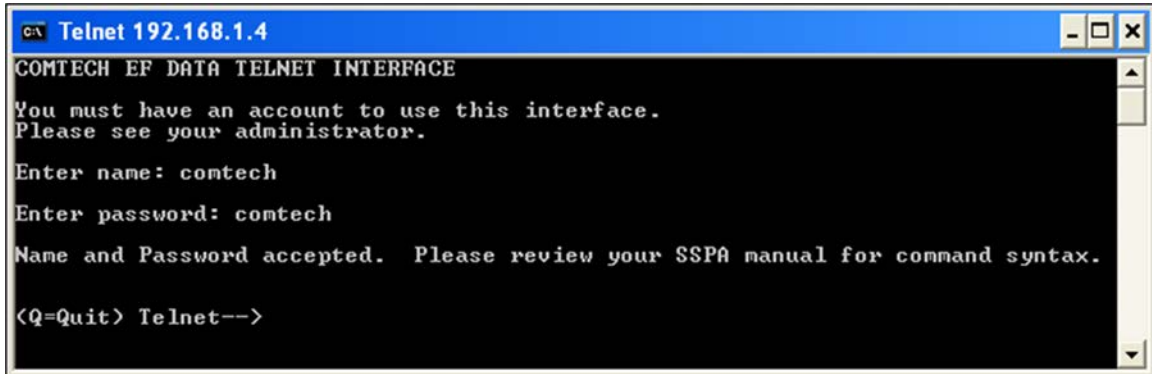
Faults SNMPv1 traps:	
tropoSystemSummaryFaultEventV1	62479501
tropoSystemInputPowerEventV1	62479502
tropoSystemForwardPowerEventV1	62479503
tropoSystemReversePowerEventV1	62479504
tropoSystemRFOverdrivenEventV1	62479505
tropoSystemOperatingAirTemperatureEventV1	62479506

tropoSystemInternalTemperatureEventV1	62479507
tropoRFPowerSupply24VEventV1	62479508
tropoRFPowerSupply13V5EventV1	62479509
tropoRFPowerSupply5V8EventV1	62479510
tropoRFPowerSupplyNeg5V8EventV1	62479511
tropoRFFan1EventV1	62479512
tropoRFFan2EventV1	62479513
tropoRFFan3EventV1	62479514
tropoPS40VEventV1	62479515
tropoPS10VEventV1	62479516
tropoPS40VCurrentEventV1	62479517
tropoPS10VCurrentEventV1	62479518
tropoPS24VCurrentEventV1	62479519
tropoPSFan1EventV1	62479520
tropoPSFan2EventV1	62479521
tropoPSFan3EventV1	62479522
tropoRFHeatSinkTemperatureEventV1	62479523
tropoRFExhaustTemperatureEventV1	62479524
tropoPS5V8EventV1	62479525
Faults SNMPv2 notifications:	
tropoSystemSummaryFaultEvent	1.3.6.1.4.1.6247.95.2.1.1
tropoSystemInputPowerEvent	1.3.6.1.4.1.6247.95.2.1.2
tropoSystemForwardPowerEvent	1.3.6.1.4.1.6247.95.2.1.3
tropoSystemReversePowerEvent	1.3.6.1.4.1.6247.50.2.1.4
tropoSystemRFOverdrivenEvent	1.3.6.1.4.1.6247.95.2.1.5
tropoSystemOperatingAirTemperatureEvent	1.3.6.1.4.1.6247.95.2.1.6
tropoSystemInternalTemperatureEvent	1.3.6.1.4.1.6247.95.2.1.7
tropoRFPowerSupply24VEvent	1.3.6.1.4.1.6247.95.2.1.8
tropoRFPowerSupply13V5Event	1.3.6.1.4.1.6247.95.2.1.9
tropoRFPowerSupply5V8Event	1.3.6.1.4.1.6247.95.2.1.10

tropoRFPowerSupplyNeg5V8Event	1.3.6.1.4.1.6247.95.2.1.11
tropoRFFan1Event	1.3.6.1.4.1.6247.95.2.1.12
tropoRFFan2Event	1.3.6.1.4.1.6247.95.2.1.13
tropoRFFan3Event	1.3.6.1.4.1.6247.95.2.1.14
tropoPS40VEvent	1.3.6.1.4.1.6247.95.2.1.15
tropoPS10VEvent	1.3.6.1.4.1.6247.95.2.1.16
tropoPS40VCurrentEvent	1.3.6.1.4.1.6247.95.2.1.17
tropoPS10VCurrentEvent	1.3.6.1.4.1.6247.95.2.1.18
tropoPS24VCurrentEvent	1.3.6.1.4.1.6247.95.2.1.19
tropoPSFan1Event	1.3.6.1.4.1.6247.95.2.1.20
tropoPSFan2Event	1.3.6.1.4.1.6247.95.2.1.21
tropoPSFan3Event	1.3.6.1.4.1.6247.95.2.1.22
tropoRFHeatSinkTemperatureEvent	1.3.6.1.4.1.6247.95.2.1.23
tropoRFExhaustTemperatureEvent	1.3.6.1.4.1.6247.95.2.1.24
tropoPS5V8Event	1.3.6.1.4.1.6247.95.2.1.25

4.4 Telnet Interface

The TRP1000-4450 provides a Telnet interface for the purpose of equipment M&C via the standard Remote Control protocol. The Telnet interface requires user login at the **Administrator** level and **Read/Write** level. An example of the login process is shown here:



```
COMTECH EF DATA TELNET INTERFACE
You must have an account to use this interface.
Please see your administrator.
Enter name: comtech
Enter password: comtech
Name and Password accepted. Please review your SSPA manual for command syntax.
<Q=Quit> Telnet-->
```

Once logged into the Telnet interface as the Administrator, you can access the standard remote control interface, defined in **Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT**, by typing in a pertinent remote command or query at the **Telnet -->** prompt.

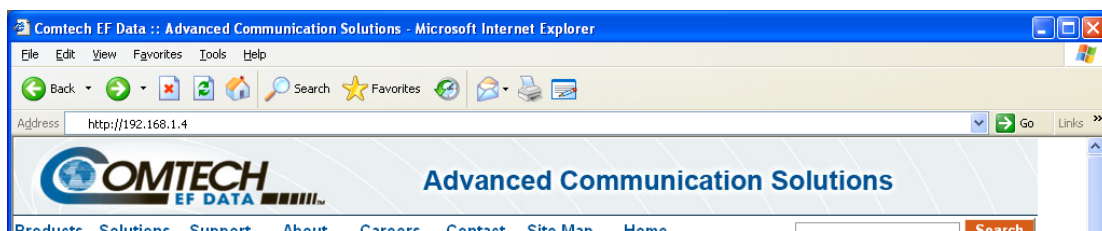
4.5 Web Server (HTTP) Interface

A user-supplied web browser allows the full M&C of the TRP1000-4450 from its Web Server Interface. This embedded web application is designed for, and works best with, Microsoft's Internet Explorer Version 5.5 or higher.

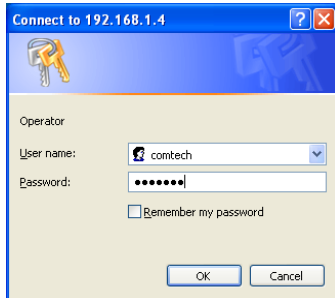
Refer to the Remote Commands and Queries specifications tables found in **Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT** for detailed descriptions of the configuration parameters featured on the individual web pages shown in this chapter.

4.5.1 User Login

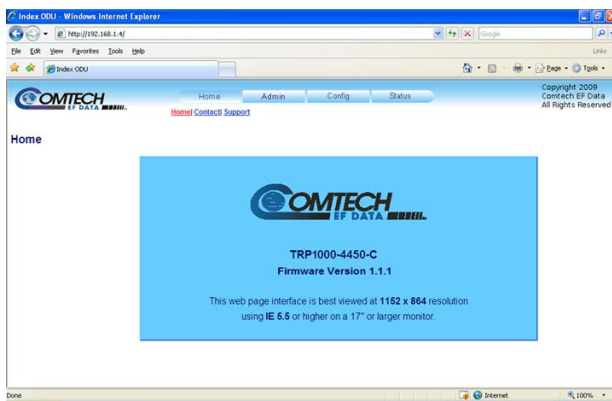
From the PC, type **http://192.168.1.4** (the default IP address for the TRP1000-4450) into the **Address** area of the browser:



The Login window will appear, similar to the example shown here. Type the **User name** and **Password**, and then click **[OK]**. The default User Name and Password are both **comtech**.



Once the valid User Name and Password is accepted, the TRP1000-4450 Web Server Interface “splash” page displays, as per the example shown to the right (note that the *Firmware Version* listed here is subject to change):



4.5.2 Web Server Interface – Operational Features

4.5.2.1 Navigation



The TRP1000-4450 Web Server Interface features navigation tabs located at the top of each page. After you click a navigation tab, you may click an available primary page hyperlink. In turn, any nested hyperlinks appear for further selection.

This manual uses a naming format for all web pages to indicate to you the depth of navigation needed to view the referenced page: “**Top Level Tab | Primary Page Hyperlink.**”

For example: “**Home | Contact**” is interpreted to mean “*first* click the top-level ‘**Home**’ navigation tab; *then*, click the ‘**Contact**’ page hyperlink.”

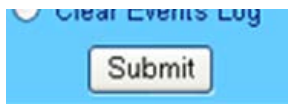
4.5.2.2 Page Sections



Each page features one or more sections. The title at the upper-left corner of each page or page section describes its operational features. Each section can feature editable fields, action buttons, and read-only displays for a specific function.

This manual explains the purpose and operation for each Web page on a **per-page, per-section** basis.

4.5.2.3 Execution Buttons



Action buttons are important in the Web Server Interface. Click an action button to do one of these tasks:

- Refresh the page with current data.
- Reset changed parameters to remove **unsaved** changes.
- Submit (permanently save) changes.



If you edit a field, make sure to click the action button before you leave the page. If you go to another page without first clicking the action button, your changes are not saved.

4.5.2.4 Drop-down Lists



A drop-down list lets you choose from a list of selections. Left-click the drop-down button to open the list. Then, left-click on an item to select that choice.

4.5.2.5 Text or Data Entry



Text boxes let you type data into a field. An action button may be associated with a single text box, or a group of text boxes.

For any text box, left-click anywhere inside the box, type the desired information into that field, and be sure to press **[ENTER]** when done.

Click the related action button to save the data.



If you edit any field, make sure to click the action button before you leave the page. If you go to another page without first clicking the action button, your changes are not saved.

4.5.3 Web Server Interface – Menu Tree

The TRP1000-4450 Web Server Interface provides access to four (4) navigation tabs (shown in blue):

Home	Admin	Config	Status
Home	Access	Amplifier	Summary
Contact	SNMP	Mask	Status
		Utility	FETs
			Events
			Statistics
			MOP

Beyond this top-level row of navigation tabs, the diagram illustrates the available primary (gray) page hyperlinks that afford you more specific functionality.

4.5.4 Web Server Page Descriptions

The sections and subsections that follow detail the pages accessible via hyperlink from the “Splash” page navigation tabs shown in **Section 4.5.4**:

Section 4.5.4.1 Home Pages

Section 4.5.4.2 Admin (Administration) Pages

Section 4.5.4.3 Config (Configure TRP1000-4450) Pages

Section 4.5.4.4 Status Pages

4.5.4.1 Home Pages

Select the **Home**, or **Contact** hyperlink to continue.

4.5.4.1.1 Home | Home

From any location within the Web Server Interface, click the **Home** top navigation tab and/or the nested hyperlink to return to this top-level page. Use this page to identify the product and its current operating firmware version.



Figure 4-1. Home | Home Page

4.5.4.1.2 Home | Contact

Use this page to reference basic contact information needed to reach Comtech EF Data Sales and Customer Support via phone, fax, or Web/e-mail hyperlinks.

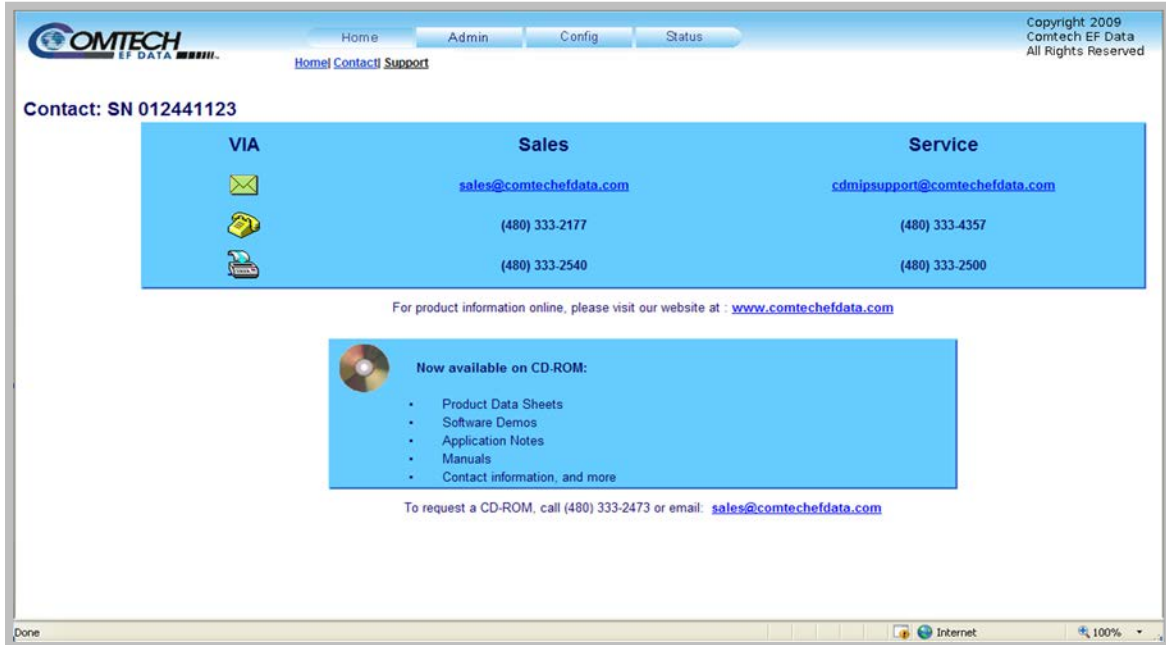


Figure 4-2. Home | Contact Page

4.5.4.2 Admin (Administration) Pages



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

Select the **Access** or **SNMP** hyperlink to continue.

4.5.4.2.1 Admin | Access

Use this page to set up and maintain user names, passwords, the e-mail server, and the host IP addresses to facilitate communication with the TRP1000-4450 Web Server.

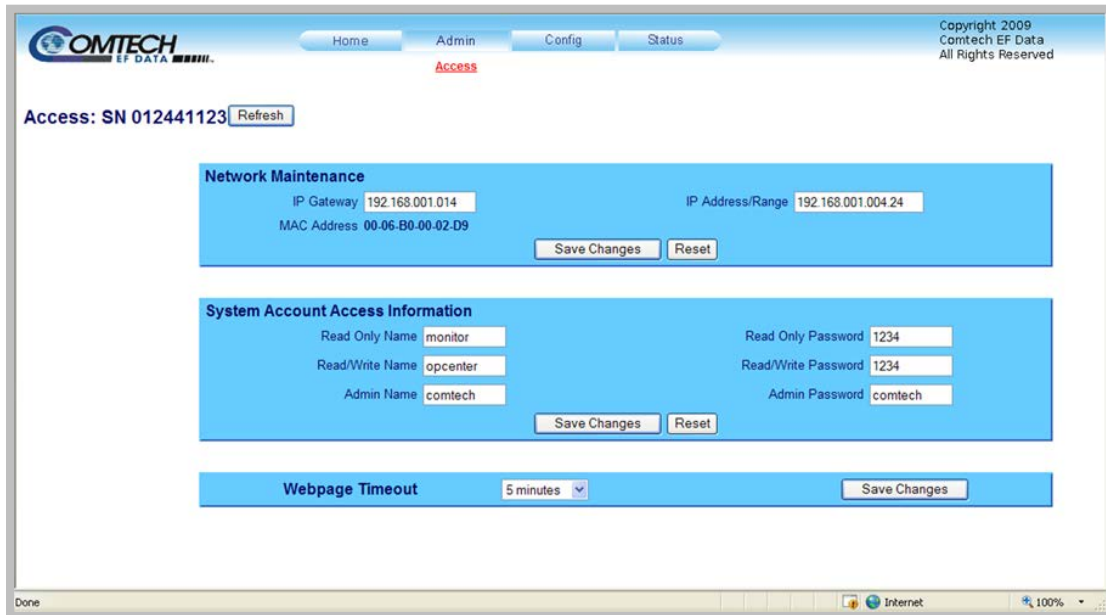


Figure 4-3. Admin | Access Page

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 you cannot modify.

Click **[Change IP Address]** to save. Otherwise, click **[Reset]** to revert to the previously assigned IP Gateway and IP Address/Range.

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.

Make the desired configuration settings in this section, and then click **[Change Access]** to save these changes. Otherwise, click **[Reset]** to revert to the previously assigned System Account Access Information.

Webpage Timeout

Use the drop-down list to select the desired time lapse before the TRP1000-4450 Web Server Interface pages time out as either five minutes or eight hours. The default timeout setting is five minutes. Click **[Submit]** when done.



The 'Status / Status' page (Sect. 4.5.4.4.2) will automatically refresh once every ten seconds, and will reset the timeout counter.

Click **[Refresh]** to update the page appearance to the current operating configuration.

4.5.4.2.2 Admin | SNMP

Use this page to set and returns administration information for the TRP1000-4450 SNMP feature.



Figure 4-4. Admin | SNMP Page

SNMP

Simple Network Management Operational Status: Use the drop-down list to 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*.

Enable Authentication Trap: Use the drop-down list to 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*.

Trap Version: Use the drop-down list to select the SNMP Trap Version as **SNMPv1** or **SNMPv2**.

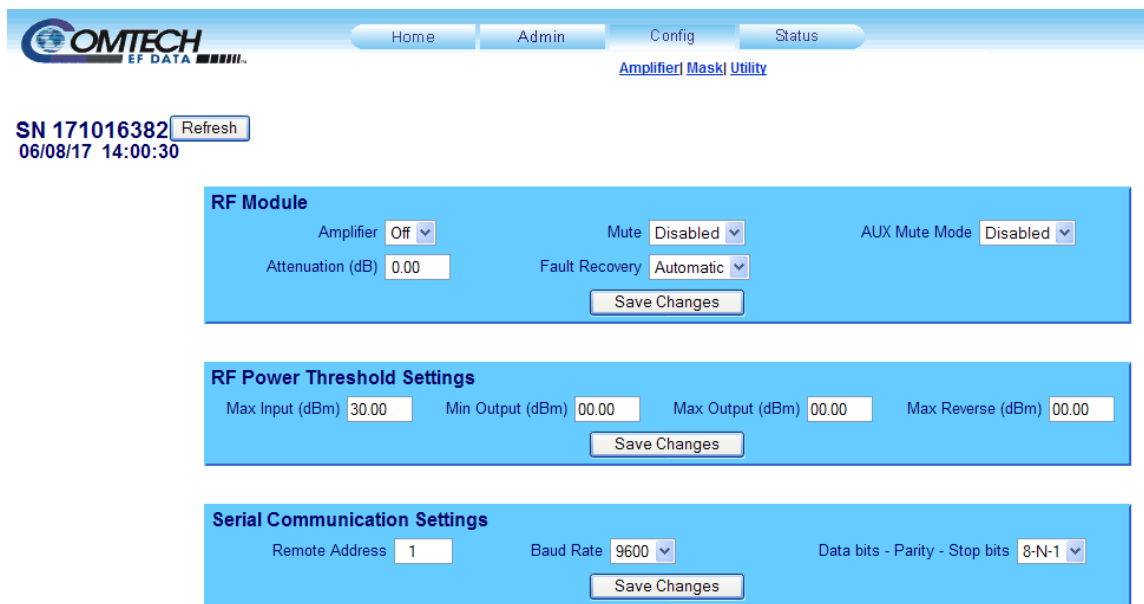
For details pertaining to the remaining configuration parameters available on this page, see **Section 6.3 SNMP INTERFACE**.

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

4.5.4.3 Config (TRP1000-4450 Configuration) Pages

Select the **Amplifier** or **Utility** hyperlink to continue.

4.5.4.3.1 Config | Amplifier



The screenshot shows the 'Config | Amplifier' page with the following settings:

- RF Module:** Amplifier: Off; Mute: Disabled; AUX Mute Mode: Disabled; Attenuation (dB): 0.00; Fault Recovery: Automatic.
- RF Power Threshold Settings:** Max Input (dBm): 30.00; Min Output (dBm): 00.00; Max Output (dBm): 00.00; Max Reverse (dBm): 00.00.
- Serial Communication Settings:** Remote Address: 1; Baud Rate: 9600; Data bits - Parity - Stop bits: 8-N-1.

Figure 4-5. Config | Amplifier Page

Use this page to configure the communications, operations, and alarms/faults handling for the amplifier.

To update the page to the current amplifier configuration: Click **[Refresh]**.

Serial

Remote Address – Enter a valid physical remote address from **0001** to **9999**.

Baud Rate – Use the drop-down list to select the operating baud rate as **2400**, **4800**, **9600**, **19200**, or **38400** baud

Data Bits - Parity - Stop Bits – Use the drop-down list to select the data bits, parity, and stop bits as **8-N-1**, **7-E-2**, or **7-O-2**. Default is **8-N-1**.

Click **[Save Changes]** to save.

Amplifier

Amplifier – Use the drop-down list to select the amplifier as either **On** or **Off**.

Mute – Use the drop-down list to select the Mute as either **Enabled** or **Disabled**.

Aux Mute – Use the drop-down list to select the Mute as either **Enabled** or **Disabled**.
Enabled allow the Mute signal on the communication connector to control the mute function.

Attenuation (dB) – Enter a valid attenuation level (**00.00** to **20.00** dB) in 0.25 dB steps.

Fault Recovery – Use the drop-down list to select Fault Recovery as either **Automatic** or **Manual**.

Click [**Save Changes**] to save.

Threshold Power Settings

- RF Input Threshold (dBm)
- RF Output Min Threshold (dBm)
- RF Output Max Threshold (dBm)
- RF Reverse Threshold (dBm)

Use the field to set the threshold value, in dBm, for each parameter. When the forward power monitor is set to **Alarm** or **Fault** instead of the factory default of **Mask**, and the forward power drops below the specified value, the alarm/fault is indicated.

Setting this parameter to the default value of 00.00 effectively disables the threshold.

Click [**Save Changes**] to save.

4.5.4.3.2 Config | Mask

Use this page to configure TRP1000-4450 mask parameters.



Figure 4-6. Config | Utility Page

Each pull down menu has three sections: MASKED, ALARM, FAULT.

- MASKED does not generate a ALARM or FAULT.
- ALARM may generate an Alarm (does not set the Summary Fault Relay).
- FAULT may generate an Fault (does set the Summary Fault Relay).

All Alarms and Fault are recorded in the Event log.

- RF Module Fan 1 Speed
- RF Module Fan 2 Speed
- RF Module Fan 3 Speed
- PS Module Fan 1 Speed
- PS Module Fan 1 Speed
- PS Module Fan 1 Speed
- High Input Power
- High Reverse Power
- Low Forward Power

Click **[Change Alarm Mask]** to save changes. Otherwise, click **[Reset]** to revert to the previously assigned Alarm Mask settings.

Click **[Refresh]** to update the page with the current viewing and operating configuration.

4.5.4.3.3 Config | Utility

Use this page to configure TRP1000-4450 operating parameters.

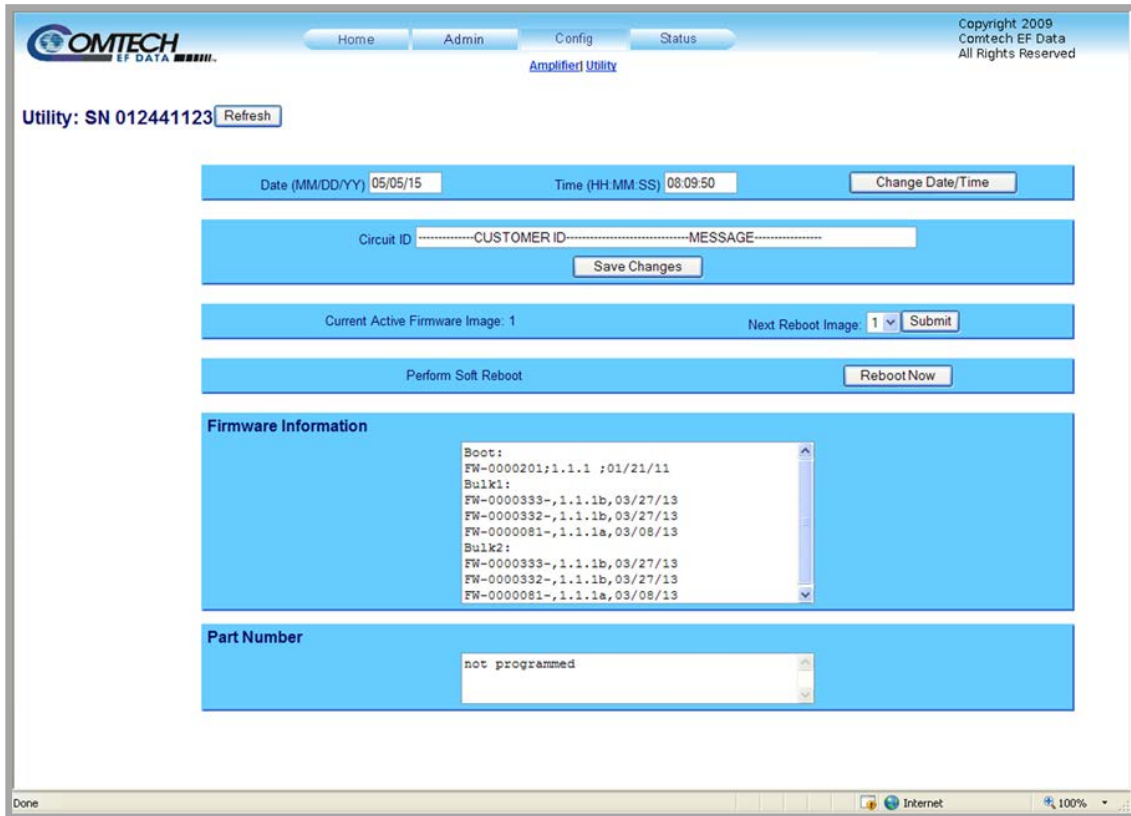


Figure 4-7. Config | Utility Page

Date and Time

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]).

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]).

Click **[Change Date/Time]** once the desired date and time have been entered in this section.

Circuit ID

Enter a Circuit ID string of up to 48 characters. Click **[Save Changes]** once the desired string is entered in this section.

Current Active Firmware Image (*read-only*)

The selected Current Active Firmware Image is identified here. In this example, Image 2 is the Current Active Firmware Image.

Next Reboot Image

Use the drop-down list to select **Reboot Image 1** or **2**. Press **[Submit]** when done.

Perform Soft Reboot

Click **[Reboot Now]** to reboot the TRP1000-4450 using the Current Active Firmware Image.

Firmware Information (*read-only*)

This *read-only* scrollable window provides information about the currently loaded Bootrom; for complete Bulk1 and Bulk2 information, scroll through all the constituent firmware blocks that make up the bulk.

Part Number (*read-only*)

This *read-only* scrollable window provides identifying part number information for the unit in use.

Click **[Refresh]** to update the page appearance to the current utility configuration.

4.5.4.4 Status Pages

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

Select the **Summary**, **Status**, **FETs**, or **Events** hyperlink to continue.

4.5.4.4.1 Status | Summary

Use this page to access summarized information about the TRP1000-4450.



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

Figure 4-8. Status | Summary Page

4.5.4.4.2 Status | Status

Use this page to review all pertinent information about the TRP1000-4450.



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

SN 171016382

06/08/17 14:26:17

SYSTEM		
PARAMETER	MONITOR	STATUS
System Input Power	<03.00 dBm	NA
System Forward Power	+34.05 dBm	NA
System Reverse Power	<25.00 dBm	NA
External Air Temperature	22.4 °C	OK
Internal Temperatures		OK
RF Overdrive	00.00 dB	OK

RF MODULE		
PARAMETER	MONITOR	STATUS
24V Power Supply:	24.1 Volts	OK
13.5V Power Supply:	13.6 Volts	OK
5.8V Power Supply:	+6.0 Volts	OK
-5.8V Power Supply:	-5.7 Volts	OK
Heat Sink Temperature:	23.7 °C	OK
Exhaust Temperature:	24.8 °C	OK
Fan 1 Speed:	72%	OK
Fan 2 Speed:	72%	OK
Fan 3 Speed:	71%	OK

PS MODULE		
PARAMETER	MONITOR	STATUS
40V Power Supply:	0.0 Volts	NA
10V Power Supply:	0.0 Volts	NA
40V Current:	0.0 Amps	OK
24V Current:	7.3 Amps	OK
10V Current:	0.0 Amps	OK
5.8V Power Supply:	5.8 Volts	OK
Fan 1 Speed:	68%	OK
Fan 2 Speed:	70%	OK
Fan 3 Speed:	68%	OK

Figure 4-9. Status | Status Page

4.5.4.4.3 Status | FETs

Use this page to review a **read-only** scrollable window that displays the operating currents of all FETs (Field Effect Transistors) installed in the RF amplifier.

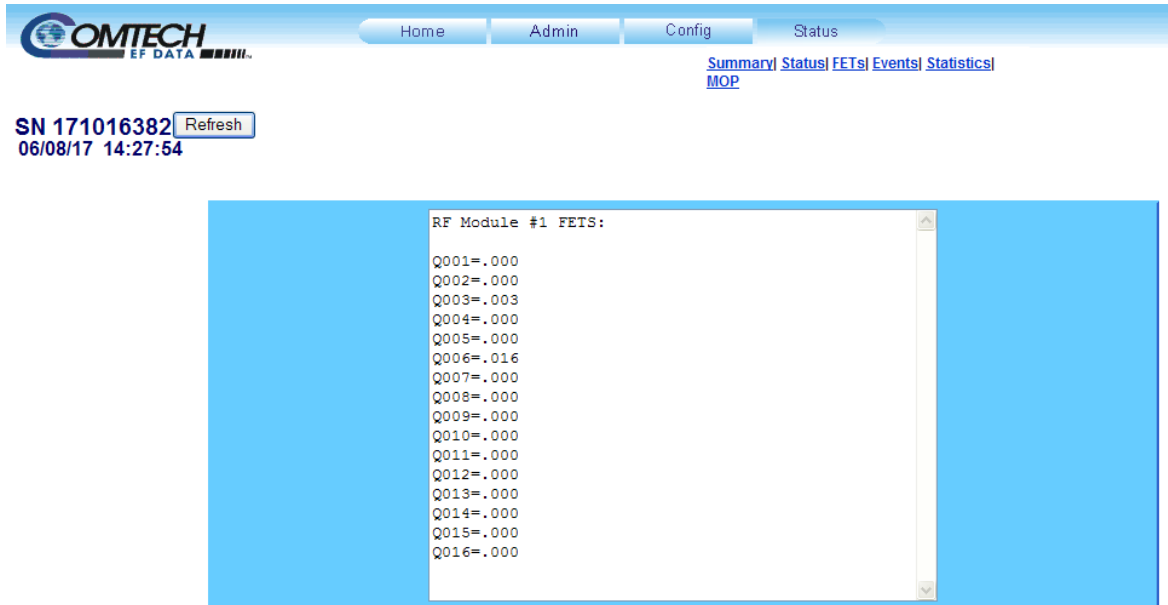


Figure 4-10. Status | FETs Page

Click **[Refresh]** to update the page with the most recent RF Power FET Current Status parameters.

4.5.4.4.4 Status | Events

Use this page to view with all pertinent information about stored events, and to define the TRP1000-4450 alarm parameters that determine how those events are triggered.



SN 171016382

06/08/17 14:29:06

Events Log:				<input type="button" value="Clear Log"/>
	Date	Time	Type	
1	12-31-20	18:28:48	Info - LOG Faults Cleared	
2	06-01-17	08:25:52	Info - LOG Unit Power Off	
3	06-08-17	08:01:23	Info - LOG Unit Power On	
4	06-08-17	08:11:15	Info - LOG Unit Power Off	
5	06-08-17	08:15:05	Info - LOG Unit Power On	
6	06-08-17	08:19:45	Info - LOG Unit Power Off	
7	06-08-17	12:55:22	Info - LOG Unit Power On	

Figure 4-11. Status | Events Page

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.

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.

Click [**Submit**] to execute the choice – the window will update according to the selection made.

4.5.4.4.5 Status | Statistics

Use this page to view with all pertinent information about stored statistics, and to define the TRP1000-4450 Statistics Interval and Statistics Averaging.

SN 171016382 Refresh
06/08/17 14:34:02

Statistics Configuration

Statistics Interval Statistics Averaging

Statistics:

	Date	Time	Amp	Mute	Flt	Attn	InPwr	FwPwr	RvPwr	OTEMP	40V	10V	40I	10I	ATMP	ETMP
1	02-17-12	10:47:56	1	0	0	00.00	-3.91	49.27	29.56	48.11	40.17	10.33	12.87	50.09	60.41	53.09
2	02-17-12	11:47:56	1	0	0	00.00	-3.91	49.27	29.56	48.11	40.17	10.33	12.81	49.82	60.49	53.15
3	02-17-12	12:47:56	1	0	0	00.00	-3.91	49.31	29.60	48.17	40.17	10.33	12.92	50.38	60.57	53.15
4	02-17-12	13:47:56	1	0	0	00.00	-3.91	49.35	29.66	48.17	40.17	10.32	12.89	50.04	60.57	53.21
5	02-17-12	14:47:56	1	0	0	00.00	-3.91	49.32	29.61	48.34	40.15	10.33	12.90	50.01	60.73	53.33
6	02-17-12	15:47:57	1	0	0	00.00	-3.91	49.33	29.61	48.17	40.15	10.32	12.86	50.02	60.57	53.20
7	02-17-12	16:47:56	1	0	0	00.00	-3.91	49.32	29.62	48.20	40.15	10.34	12.93	49.93	60.63	53.21
8	02-17-12	17:19:55	0	0	0	00.00	-3.91	40.84	29.29	46.73	00.00	00.00	00.10	00.02	48.95	49.94
9	02-17-12	17:49:55	0	0	0	00.00	-3.91	40.85	29.29	46.76	00.00	00.00	00.10	00.01	48.84	49.93
10	02-17-12	18:19:55	0	0	0	00.00	-3.91	40.83	29.27	46.58	00.00	00.00	00.06	00.02	48.73	49.76
11	02-17-12	18:49:55	0	0	0	00.00	-3.91	40.82	29.27	46.59	00.00	00.01	00.07	00.02	48.72	49.78
12	02-17-12	19:19:55	0	0	0	00.00	-3.91	40.83	29.26	46.49	00.00	00.00	00.07	00.00	48.68	49.70
13	02-17-12	19:49:56	0	0	0	00.00	-3.91	40.82	29.26	46.50	00.00	00.01	00.06	00.01	48.64	49.69
14	02-17-12	20:19:56	0	0	0	00.00	-3.91	40.84	29.27	46.55	00.00	00.01	00.06	00.02	48.67	49.74
15	02-17-12	20:49:56	0	0	0	00.00	-3.91	40.82	29.25	46.55	00.00	00.01	00.06	00.02	48.63	49.74
16	02-17-12	21:19:56	0	0	0	00.00	-3.91	40.83	29.27	46.49	00.00	00.01	00.06	00.02	48.60	49.66
17	02-17-12	21:49:55	0	0	0	00.00	-3.91	40.82	29.26	46.49	00.00	00.01	00.06	00.01	48.57	49.66
18	02-17-12	22:19:56	0	0	0	00.00	-3.91	40.81	29.26	46.45	00.00	00.01	00.06	00.02	48.55	49.63
19	02-17-12	22:49:56	0	0	0	00.00	-3.91	40.83	29.26	46.43	00.00	00.01	00.06	00.02	48.54	49.61
20	02-17-12	23:19:56	0	0	0	00.00	-3.91	40.83	29.27	46.43	00.00	00.01	00.06	00.02	48.50	49.61

Figure 4-12. Status | Statistics Page

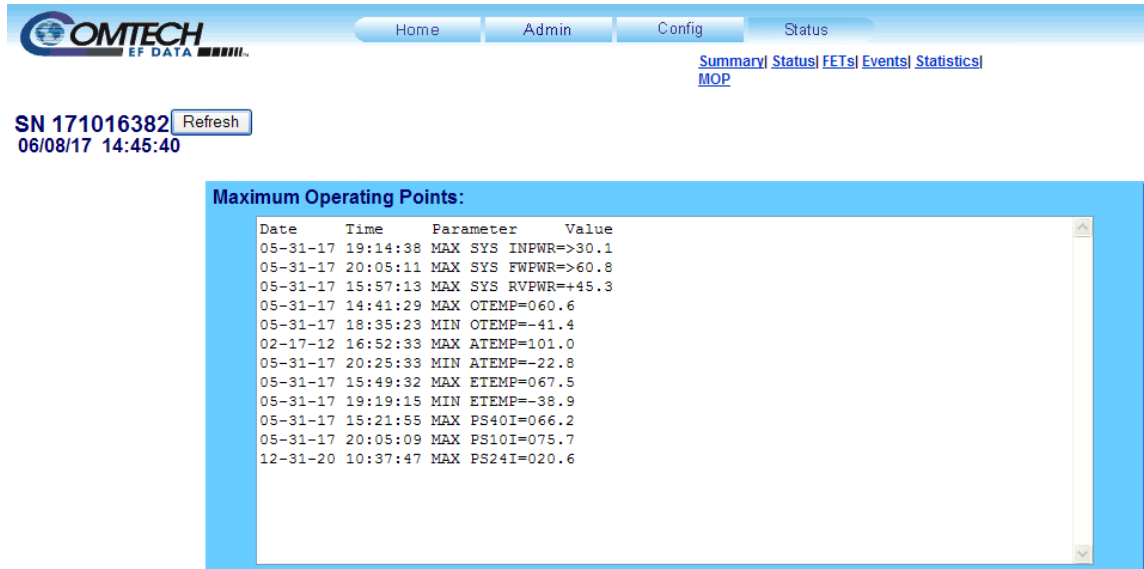
This *read-only* scrollable window displays the unread stored statistics log in sequential, date-stamped format. The unit returns and displays the oldest stored statistics in the statistics log.

Statistics Interval: indicates how often one statistical entry is made. Values range from 1 min to 99 min. Click [Submit] to execute the choice – the window

Statistics Averaging: indicates if averaging is used or not. Values range from Disable or Enable. Click [Submit] to execute the choice – the window

4.5.4.4.6 Status | MOP

Use this page to view some minimum and maximum values. Each entry has a Date and Time stamp.



SN 171016382

06/08/17 14:45:40

Maximum Operating Points:

Date	Time	Parameter	Value
05-31-17	19:14:38	MAX SYS INPWR=>	30.1
05-31-17	20:05:11	MAX SYS FWFWR=>	60.8
05-31-17	15:57:13	MAX SYS RVPWR=>	45.3
05-31-17	14:41:29	MAX OTEMP=	060.6
05-31-17	18:35:23	MIN OTEMP=	-41.4
02-17-12	16:52:33	MAX ATEMP=	101.0
05-31-17	20:25:33	MIN ATEMP=	-22.8
05-31-17	15:49:32	MAX ETEMP=	067.5
05-31-17	19:19:15	MIN ETEMP=	-38.9
05-31-17	15:21:55	MAX PS40I=	066.2
05-31-17	20:05:09	MAX PS10I=	075.7
12-31-20	10:37:47	MAX PS24I=	020.6

Figure 4-13. Status | MOP Page

This **read-only** scrollable window displays the unread stored statistics log in sequential, date-stamped format. The unit returns and displays the oldest stored statistics in the statistics log.

- INPWR = Input Power (dBm)
- FWRWR = Forward Power (dBm)
- RVPWR = Reverse Power (dBm)
- OTEMP = Outside Temperature
- ATEMP = Heat Sink Temperature
- ETEMP = Exhaust Temperature
- PS40I = 40V current (Amps)
- PS10I = 10V current (Amps)
- PS24I = 24V current (Amps)

Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT

5.1 Overview

Serial-based remote product management of Comtech EF Data's TRP1000-4450 Troposcatter C-Band Outdoor Amplifier is available using the TRP1000-4450's 'J6 | COMM 1' port. Some key parameters and procedures and their associated remote commands and queries are summarized, followed by detailed instructions for use of the serial remote control communication command and query interface.

5.2 Key Operational Parameters

For detailed information about the remote commands and queries mentioned in this section, see **Section 5.4 Remote Commands and Queries** in this chapter.

5.2.1 Faults

The M&C system monitors certain key functions of the TRP1000-4450 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 that is outside its nominal value.
- Fan running less than 25% of maximum speed.
- I2C internal bus communications fault.

Thermal Shutdown – A temperature fault is indicated if the unit is greater than +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 or greater. For protection reasons, the unit will shut down the 10V supply to the power transistors at temperatures greater than +95°C.

5.2.2 Some Common Commands

A few of the most common commands and queries are:

- **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.

Full details for each of these are listed in **Section 5.4** of this chapter.

5.3 Remote Control Protocol and Structure

For legacy serial communication, the electrical interface is either a full-duplex EIA-485/EIA-422 multi-drop bus (for the control of many devices) or an EIA-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.

Additionally, the TRP1000-4450 also supports the serial command protocol over a Telnet session through the use of a 10/100Base-T Ethernet connection with the TRP1000-4450. The Ethernet communications interface also supports SNMP protocol, and provides a graphical user interface (GUI) through web pages that can be accessed using a web browser.

5.3.1 EIA-485

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

In full-duplex EIA-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.

EIA-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.

5.3.2 EIA-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 EIA-232 electrical levels, on one conductor, and Target-to-Controller data is carried in the other direction on the other conductor.

5.3.3 Basic Protocol

Whether in EIA-232 or EIA-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 EIA-485 mode.

5.3.4 Packet Structure

The exchange of information is transmitted, Controller-to-Target and Target-to-Controller, in 'packets'. Each packet contains a finite number of bytes consisting of printable ASCII characters, excluding ASCII code 127.

In this context, the Carriage Return and Line Feed characters are considered printable. With one exception, all messages from Controller-to-Target require a response – 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.

Controller-to-Target						
Start of Packet	Target Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
< ASCII code 60 (1 character)	(4 characters)	/ ASCII code 47 (1 character)	(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)		/ ASCII code 47 (1 character)		=, ?, !, or * ASCII codes 61, 63, 33, or 42 (1 character)	(From 0 thru n characters)	Carriage Return, Line Feed ASCII codes 13,10 (2 characters)

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

5.3.4.1 Start of Packet

The '<' and '>' characters indicate the start of packet. They may not appear anywhere else within the body of the message.

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

5.3.4.2 Target Address

Up to 9,999 devices can be uniquely addressed. In both EIA-232 and EIA-485 applications, the permissible range of values is 1 to 9999. It is programmed into a target unit using the remote control port.



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.

5.3.4.3 Address Delimiter

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

5.3.4.4 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 **I**P **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*).

5.3.4.5 Instruction Code Qualifier

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

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

Symbol	Definition
= (ASCII code 61)	The '=' code is used as the Assignment Operator (AO) and is used to indicate that the parameter defined by the preceding byte should be set to the value of the argument (s) which follow it. EXAMPLE: In a message from Controller-to-Target, MUT=1 would mean 'enable the mute function'.
? (ASCII code 63)	The '?' code is used as the Query Operator (QO) and is used to indicate that the Target should return the current value of the parameters defined by the preceding byte. EXAMPLE: In a message from Controller-to-Target, MUT? denotes 'return the current state of the mute function'.

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

Symbol	Definition
= (ASCII code 61)	The '=' code is used in two ways: <ol style="list-style-type: none"> If the controller sends a query code to a target, (EXAMPLE: MUT?, meaning 'is mute enabled or disabled?'), the target responds with MUT=x, where x represents the frequency in question, "1" being 'enabled' and "0" being 'disabled'. If the controller sends an instruction to set a parameter to a particular value, and, providing the value sent is valid, the target will acknowledge the message by replying with MUT=(with no message arguments).
? (ASCII code 63)	If the controller sends an instruction to set a parameter to a particular value, and, if the value sent 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)	If the controller sends an instruction code that 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)	If the controller sends an instruction to set a parameter to a particular value, and, if the value sent in the argument is valid, however, if the target is in the wrong mode, the modulator will not permit that particular parameter to be changed at this time, the target will acknowledge the message by replying, (for example), with MUT* (with no message arguments).
# (ASCII code 35)	If the controller sends an instruction code that the target cannot currently perform because of hardware resource issues, 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 figured. For example, if the operator issues commands to change both the frequency and the attenuation with less than 100 milliseconds between commands, and if the response # is returned, then the command was not accepted and the operator must resend the command.

5.3.4.6 Optional Message Arguments

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

5.3.4.7 End of Packet

Both of the following examples indicate the valid termination of a packet.

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

5.3.5 End-Of-Life Commands

Certain commands (denoted by an 'E' in the Parameter Type column in **Section 5.4 Remote Commands and Queries**) are marked as End-of-Life (EOL). 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.

5.4 Remote Commands and Queries

Table Indexes:

Notes:

- 1) **Index Columns** – Where Column ‘C’=Command, and Column ‘Q’=Query, columns marked ‘X’ designate the instruction code as *Command only*, *Query only*, or *Command or Query*. Where **CODE=XXX**, this indicates a priority command.
- 2) **In the tables that follow, the following codes are used in the ‘Response to Command’ column (per Sect. 8.5.5):**
 - = Message ok
 - # Message ok, but unit is not in **Remote** mode.
 - ? Received ok, but invalid arguments were found.
 - ~ Time out of a pass-through message, either to via EDMAC or to a local ODU.
 - ^ Message ok, but unit is in **Ethernet** mode.

Sect. 5.5 Customer Commands

CODE	C	Q	PAGE
AFR	X	X	5-10
AMP	X	X	5-10
APM	X	X	5-10
ATT	X	X	5-10
AUX	X	X	5-11
CAA	X	-	5-11
CAE	X	-	5-11
CID	X	X	5-11
DAT	X	X	5-12
DAY	X	X	5-12
ESA	X	X	5-12
FRW	-	X	5-13
HID	-	X	5-13

CODE	C	Q	PAGE
HPT	X	X	5-13
IEP	X	-	5-14
IMG	X	X	5-14
IPA	X	X	5-14
IPG	X	X	5-15
ISP	X	X	5-15
LAM	X	X	5-15
LNA	-	X	5-15
LPT	X	X	5-15
LRS	X	X	5-16
MAC	-	X	5-17
MOP	-	X	5-17
MSK	X	X	5-18

CODE	C	Q	PAGE
MUT	X	X	5-19
NUE	-	X	5-19
NUS	-	X	5-19
PNM	-	X	5-19
RAS	-	X	5-19
RBT	X	-	5-21
RCS	-	X	5-22
RET	-	X	5-22
RFS	-	X	5-23
RMS	-	X	5-23
RNE	-	X	5-25
RNS	-	X	5-26
RPT	X	X	5-26

CODE	C	Q	PAGE
RUS	-	X	5-26
SAS	-	X	5-27
SBR	X	X	5-27
SCN	X	X	5-29
SFS	-	X	5-27
SNA	X	X	5-27
SNM	X	X	5-28
SNO	-	X	5-28
SPA	X	X	5-28
SPB	X	X	5-28
SRC	X	X	5-28
SSC	X	X	5-29
SSI	X	X	5-29

CODE	C	Q	PAGE
SSL	X	X	5-29
STA	X	X	5-29
STB	X	X	5-29
STV	X	X	5-30
SWC	X	X	5-30
TIM	X	X	5-30
TMP	-		5-30
TNA	-	X	5-30
TNE	-	X	5-30

5.5 Customer Commands

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. Sets the automatic fault recovery mute mode. Where: 1 = Automatic fault recovery enabled (unit will automatically return to its pre-fault mute state after all fault conditions clear) 0 = Automatic fault recovery disabled (unit will remain muted until the user un-mutes the output using the MUT command) Example: <0001/AFR = 1'cr' >0001/AFR = 'cr"lf' Default Value: 1	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' Default Value: 0	AMP= AMP? AMP*	AMP?	AMP=x (Same format as command arguments)
Amplifier Power-up Mode	APM=	1 byte	Command or Query. Enables or disables the amplifier power-up mode. 0 = Disabled. Amplifier is always off at power-up. 1 = Enabled. Amplifier is set to the last user configured state at power-up (on or off depending on the AMP setting). Example: <1/APM = 1'cr' >0001/APM = 'cr"lf' Default Value: 0	APM= APM? APM*	APM?	APM=x (Same format as command arguments)
Attenuation	ATT=	5 bytes	Command or Query. Set the RF attenuation level from 0 to 10dB in 0.25dB steps. Example: <1/ATT = 10.00'cr' >0001/ATT = 'cr"lf' Default Value: 10.00 Default ATT Step: 0.25 dB	ATT= ATT? ATT*	ATT?	ATT=xx.xx (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	AUX=	1 byte	Command or Query. Enable or disable the auxiliary mute hardware control. Where: 1 = auxiliary mute enabled 0 = auxiliary mute disabled Example: <1/AUX = 'cr' >0001/AUX = 'cr''lf' Default Value: 0	AUX= AUX? AUX*	AUX?	
Clear All Stored Alarms	CAA=	None	Command only. Instructs the unit 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. Clear all Stored Events. This command takes no arguments. Example: <1/CAE = 'cr' >0001/CAE = 'cr''lf'	CAE= CAE*	N/A	N/A
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 an 80-byte field of data that is entered as one line, but it will be read back from the unit as two 40-byte lines of data. Examples: <1/CID = Station #001--SSPA #01--'cr' >0001/CID = <1/CID?'cr' >0001/CID = 'cr' Station #001--SSPA #01--'cr''lf' Default Value: -----CUSTOMER ID----- -----MESSAGE-----	CID= CID? CID*	CID?	CID=x...x (See description for details of arguments)
Clear Statistics Log	CSL=	N/A	Command only. Clears the statistics log. This command was changed to a factory command because we don't want the users clearing this information because it is useful for troubleshooting.	CSL= CSL?	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)
Set RTC (Real-Time-Clock) Date	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 yy = year, between 00 and 96 (1K OD to 2096) Example (date = April 24, 2003): <1/DAT = 042503'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 yy = year, between 00 and 99 (1K OD 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. Enable or disable statistics averaging. When statistics averaging is enabled all new entries in the statistics log are comprised of averaged measurements. Where: 0 = Disable 1 = Enable Example: <0001/ESA = 1'cr' >0001/ESA = 1'cr''lf' Default Value: 0	ESA= ESA? ESA*	ESA?	

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		<p>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</p> <p>Where: FW-AAAAAAA = the firmware part number B.B.BB = the version number DD/MM/YY = Day/Month/Year firmware released</p> <p>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</p>	FRW=	FRW?	FRW={CR}B oot:{CR}abc{ CR}Bulk1:{C R}abc{CR}ab c (See description for details of arguments)
Hardware ID	N/A	1 byte	<p>Query only: Returns the value of the Hardware ID byte.</p> <p>Example: <0001/HID?'cr' >0001/HID = 0'cr'lf'</p>	HID=	HID?	HID=x
High Power Threshold	HPT=	5 bytes	<p>Command or Query. This command allows the user to set the threshold for the high forward power alarm/fault. If the forward power rises above the specified value, the alarm/fault will be indicated. HPT=xx.xx, Where: xx.xx = a real number between 48.00 and 64.00 dBm.</p> <p>Example: <1/HPT=63.00'cr' >0001/HPT = 'cr'lf'</p>	HPT= HPT? HPT*	HPT?	High Power Threshold

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	<p>Command only. Resets internal pointer to allow RNE? Queries to start at the beginning of the stored events log.</p> <p>Example: <1/IEP = 'cr' >0001/IEP = 'cr'lf'</p>	IEP= IEP? IEP*	N/A	N/A
Software Image	IMG=	1 byte	<p>Command or Query. Current Active software image, Where: 1 = Bulk Image # 1 currently active 2 = Bulk Image # 2 currently active</p> <p>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)</p> <p>Note: If the user sends the IMG command, and then queries 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.</p>	IMG= IMG? IMG* IMG#	IMG?	IMG=x (See description for details of arguments)
IP Address	IPA=	18 bytes	<p>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)</p> <p>Example: <1/IPG = 192.168.001.004.24'cr' >0001/IPG = 'cr'lf'</p> <p>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 typed into the Telnet client software does not include the range parameter, so it would be: 192.168.1.4.</p> <p>Default Value: 192.168.001.004.24</p>	IPA= IPA? IPA* IPA#	IPA?	IPA= xx.xxx.xxx.xx x.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.x xx
Initialize Statistics Pointer	ISP=	None	Command only. Resets internal pointer to allow RNS? Queries to start at the beginning of the statistics log. Example: <1/ISP = 'cr' >0001/ISP = 'cr''lf'	ISP= ISP? ISP*	N/A	N/A
Lamp Test	LAM=	1 byte	Command or Query. Lamp test mode, Where: 0 = Disable 1 = Enable (all front panel LEDs are lit) Example: <0001/LAM = 1'cr' >0001/LAM = 1'cr''lf' Default Value: 0	LAM=	LAM?	LAM=x
Retrieve next 5 unread Stored Alarms	N/A	145 bytes	Query only. See RNE query.	LNA=	LNA?	See RNE query
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: <0001/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)
Input Power Threshold	IPT=	5 bytes	<p>Command or Query. This command allows the user to set the threshold for the input power alarm/fault. If the input power exceeds above the specified value, the alarm/fault will be indicated. Setting this parameter to 00.00 effectively disables the threshold</p> <p>Example: <0001/IPT = 00.00'cr' >0001IPT = 'cr''lf'</p> <p>Default Value: 00.00</p>	<p>IPT = IPT? IPT *</p>	IPT?	<p>IPT =xxx.x</p> <p>(Same format as command arguments)</p>
Local Remote State	LRS=	1 byte	<p>Command or Query. Set Local or Remote for Indoor SSPA. Always in remote mode for Outdoor SSPA.</p> <p>1 = Serial 2 = Ethernet 3 = Serial+Ethernet</p> <p>Example: <1/LRS = 3'cr' >0001/LRS = 'cr''lf'</p> <p>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. The web page GUI will refuse connections unless LRS is set to enable Ethernet remote control.</p> <p>Default Value: 3 (Serial+Ethernet)</p>	<p>LRS= LRS?</p>	LRS?	<p>LRS=x</p> <p>(Same format as command arguments)</p>

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 MAC Address	N/A	17 bytes	Query only. MAC address of the unit, reported in hexadecimal. Example: <0001/MAC?'cr' >0001/MAC = 00-06-B0-00-D2-A7'cr"lf'	MAC=	MAC?	MAC=xx-xx-xx-xx-xx-xx-xx-xx (See description for details of arguments)
Maximum Operating Points	N/A	1 bytes (command) 810 bytes (response)	Query only. Used to view or clear maximum operating points Where: MAX is Maximum MIN is Minimum INPWR = Input Power FWPWR = Forward Power RVPWR = Reverse Power OTEMP = Outside Temperature ATEMP = Exhaust Temperature ETEMP = Exhaust Temperature AC Volt = AC Vrms AC Curr = AC Irms AC Vpeak = AC Vpeak AC WATT = AC power in Watts AC LINE = AC Line Frequency PS40I = 40V PS current PS10I = 10V PS current PS24I = 24V PS Example: <1/mop? >1/MOP= 05-15-17 14:46:25 MAX SYS INPWR=<03.0 05-15-17 14:46:25 MAX SYS FWPWR=<33.0 05-15-17 14:46:25 MAX SYS RVPWR=<25.0 05-15-17 14:46:25 MAX OTEMP=019.2 05-15-17 14:46:27 MIN OTEMP=019.2 05-15-17 14:46:25 MAX ATEMP=022.3 05-15-17 14:46:25 MIN ATEMP=022.3 05-15-17 14:46:25 MAX ETEMP=022.7 05-15-17 14:46:27 MIN ETEMP=022.7 05-15-17 14:46:25 MAX FTEMP=022.1 05-15-17 14:46:25 MIN FTEMP=022.1 05-15-17 14:46:25 MAX AC Volt=207.7	MOP= MOP*	MOP?	MOP=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)
Maximum Operating Points (Continued)			(continued) 05-15-17 14:46:27 MIN AC Volt=000.7 05-15-17 14:46:25 MAX AC Curc=03.62 05-15-17 14:46:27 MIN AC Curr=000.7 05-15-17 14:46:25 MAX PS40I=000.0 05-15-17 14:46:25 MAX PS10I=000.0 05-15-17 14:46:25 MAX PS24I=007.2 05-15-17 14:46:27 MIN AC Curr=000.7 05-15-17 14:46:25 MAX AC VPEAK=379.8 05-15-17 14:46:27 MIN AC VPEAK=024.7 05-15-17 14:46:25 MAX AC WATT=705.0 05-15-17 14:46:27 MIN AC WATT=000.0 05-15-17 14:46:25 MAX AC LINE=76.0 05-15-17 14:46:27 MIN AC LINE=005.0 05-15-17 14:46:25 MAX PS40I=000.0 05-15-17 14:46:25 MAX PS10I=000.0 05-15-17 14:46:25 MAX PS24I=007.2 05-15-17 14:46:25 MAX PS40I=000.0 05-15-17 14:46:25 MAX PS10I=000.0 05-15-17 14:46:25 MAX PS24I=007.2			
Unit Alarm Mask	MSK=	9 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 set the summary fault relay. If the mask value is set to masked, then the fault will never be reported to the user. Form of: abcdefghij Where: 0 = Fault 1 = Alarm 2 = Masked a = Module1 Fan1 Speed b = Module1 Fan2 Speed c = Module1 Fan3 Speed d = Sealed PS Fan1 Speed e = Sealed PS Fan2 Speed f = Sealed PS Fan3 Speed g = High Input Power h = High Reverse Power i = Low Forward Power j=High Forward Power	MSK= MSK? MSK*	MSK?	MSK=abcdef ghi (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 (Continued)			(Continued) Example: <0001/MSK=222222222'cr' >0001/MSK='cr''lf' Default Value: 222222222			
Mute State	MUT=	1 byte	Command or Query. Mute the unit, Where: 0 = Disable (Not Muted) 1 = Enable (Muted) 2 = Aux Mute (Muted) [Query Only, AUX] Example: <1/MUT = 1'cr' >0001/MUT = 1'cr''lf' Default Value: 0	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 =1 26'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
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 = TRP0.0000000200'cr''lf'	PNM= PNM? PNM *	PNM?	PNM=x....x (See description for details of return string)
Retrieve Alarm Status	N/A	Variable # bytes	Query only. The unit returns the alarm state for the following sections:. RAS? The Alarm status of the unit, Where: OK = no fault condition FT = faulted AL = alarm MS = masked	RAS=	RAS?	RAS=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 Alarm Status (Continued)			(Continued) System Alarm Status where: SYS-INPWR = System Input Power SYS-FWPWR = System Forward Power SYS-RVPWR = System Reverse Power SYS-OTEMP = Outside Temperature SYS-INTEMP = Internal Temperatures Module 1 Alarm Status where: RF1-PS24V = 24 Volt Power Supply RF1-PS13V = 13.5 Volt Power Supply RF1-P5V8T = +5.8 Volt Power Supply RF1-N5V8T = -5.8 Volt Power Supply RF1-ATEMP = Heat Sink Temperature RF1-ETEMP = Exhaust Temperature RF1-RFAN1 = Module Fan 1 Speed RF1-RFAN2 = Module Fan 2 Speed RF1-RFAN3 = Module Fan 3 Speed Note: ETEMP-OTEMP < 30C is Okay. Power Supply Alarm Status where: PS1-PS40V = 40V PS PS1-PS10V = 10V PS PS1-PS40I = 40V PS Current PS1-PS24I = 24 Volt PS current PS1-PS10I = 10 Volt PS current PS1-P5V8T = +5.8 Volt Power Supply PS1-PFAN1 = Module Fan 1 Speed PS1-PFAN2 = Module Fan 2 Speed PS1-PFAN3 = Module Fan 3 Speed PS1-AC V = AC Vrms (too high or too low) PS1-ACFRQ = AC Line Frequency (too high or too low) Example: <1/RAS?'cr' >1/RAS=cr' SYS-INPWR = NA SYS-FWPWR = NA SYS-RVPWR = NA SYS-OTEMP = OK SYS-INTMP = OK SYS-RFOVR = OK RF1-PS24V = OK RF1-PS13V = OK RF1-P5V8T = OK			

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 (Continued)			(continued) RF1-N5V8T = OK RF1-ATEMP = OK RF1-ETEMP = OK RF1-RFAN1 = OK RF1-RFAN2 = OK RF1-RFAN3 = OK PS1-PS40V = NA PS1-PS10V = NA PS1-PS40I = OK PS1-PS24I = OK PS1-PS10I = OK PS1-P5V8T = OK PS1-PFAN1 = OK PS1-PFAN2 = OK PS1-PFAN3 = OK PS1-AC V = OK PS1-ACFRQ = OK			
Reboot	RBT=	1 byte	Command only. Soft Reboot 1 = Reboot System Example: <1/RBT=1	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		<p>Query only. Used to query the configuration status of the unit.</p> <p>Where: AMP = RF Power Amplifier State 0 = OFF 1 = ON MUT = RF Mute State 0 = Un-muted 1 = Muted 2 = Aux Muted AFR = Auto Fault recovery 0 = Manual 1 = Auto LRS = see LRS command.</p> <p>Example: RCS = 'cr' AMP = '1'cr' MUT = '1'cr' AFR = '1'cr''lf' LRS = '3'cr''lf'</p>	RCS=	RCS?	RCS=x....x (See description for details of arguments)
Retrieve Equipment Type	N/A	22 bytes	<p>Query only. The unit returns a string indicating the Model Number and the version of the M&C firmware installed in the unit.</p> <p>Example: <1/RET?'cr' >0001/RET = TRP1000-4450-C VER: 1.1.1'cr''lf'</p>	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: <0001/RFS? >0001/RFS= Q01 = .000 Q02 = .000 Q03 = .000 Q04 = .000 Q05 = .000 Q06 = .000 Q07 = .000 Q08 = .000 Q09 = .000 Q10 = .000 Q11 = .000 Q12 = .000 Q13 = .000 Q14 = .000 Q15 = .000 Q16 = .000	RFS=	RFS?	RFS=x....x (See description of arguments)
Retrieve Maintenance Status	N/A	Varies depending on hardware	Query only. The unit returns the maintenance status as follows: RMS?X Where: X = 'cr', 1'cr' 'cr' = Power Supply 1 = RF Module Where: Power Supply: PFAN1 = PS Fan #1 Speed in Percent PFAN2 = PS Fan #2 Speed in Percent PFAN3 = PS Fan #3 Speed in Percent AC_V = AC Vrms AC_I = AC Irms AC_PK = AC Vpeak AC_WT = AC Power in Watts AC_PF = AC Power Factor AC_FQ = AC Line Frequency PS40V = +40V Power Supply PS40I = +40V Current PS24I = +24V Power Supply	RMS= 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 Maintenance Status (Continued)			(Continued) PS10V = +10V FET Voltage PS10I = +10V FET Current P5V8T = +5.8V Voltage RF Module: PS24V = +24V Fan Voltage PS13V = +13.5V Voltage RP5V8 = +5.8V Power Supply RN5V8 = -5.8V Power Supply RFAN1 = RF Fan #1 Speed in Percent RFAN2 = RF Fan #2 Speed in Percent RFAN3 = RF Fan #3 Speed in Percent FWPWR = Module RF Forward Power in dBm INPWR = System RF Input Power in dBm RVPWR = System RF Reverse Power in dBm ATEMP = Module Heatsink Temperature in deg C OTEMP = Outdoor Temperature in deg C ETEMP = Exhaust Temperature in deg C PS10I = 097.0 P5V8T = 005.8 <1/RMS?1 >1/RMS= Example: <1/RMS? >1/RMS= >1/RMS= >1/RMS= PFAN1 = 094.0 PFAN2 = 095.0 PFAN3 = 096.0 AC_V = 202.2 AC_I = 003.5 AC_PK = 292.2 AC_WT = 094.3 AC_PF = 0.4826 AC_FQ = 060.0 PS40V = 039.9 PS40I = 067.0 PS24I = 022.0 PS10V = 010.1 PS24V = 024.0 PS13V = 013.5 RP5V8 = 005.8			

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 (Continued)			(Continued) RN5V8 = -05.8 RFAN1 = 095.0 RFAN2 = 096.0 RFAN3 = 097.0 FWPWR = >6200.00 INPWR = +25.00 RVPWR = +30.00 ATEMP = 030.0 OTEMP = 020.0 ETEMP = 035.0			
Retrieve Next 5 unread stored Events	N/A	xx 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{CR}Sub-body, Where: Sub-body = ddmmyyhhmmssABCC: A being the fault type Where: 1 = System 2 = RF Module 1 3 = PS Module 1 B being the fault/clear indicator. F = Fault C = Clear I = Info CC is Fault or Alarm description: Example: <1/RNE? >1/RNE= 06-22-15 11:57:50 RF1 FLT +13.5V PS 06-22-15 11:57:50 RF1 ALM Heat Sink Temp 06-22-15 11:57:50 RF1 ALM Exhaust Temp 06-22-15 11:57:51 RF1 FLT +24V PS	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)
Read Next 5 Statistics	N/A	436 bytes, alpha-numeric	<p>Query only. Returns the next five unread statistics stored in the statistics log. Returns 5 lines with the following format: mm-dd-yy;HH:MM:SS;a;b;c;ddd.d;eee.e;fff.f;ggg.g;hhh.h;ii.i;jjj.j;kkk.k;lll.l; mmm.m;nnn.n;ooo.o;ppp.p;qqq.q;rrr.r</p> <p>Where: mm-dd-yy = entry date HH:MM:SS = entry time a = amplifier enable state b = mute enable state c = summary fault state ddd.d = RF attenuation eee.e = input power monitor fff.f = forward power monitor ggg.g = reverse power monitor hhh.h = outside temp ii.i = system 40V rail jjj.j = RF 10V rail kkk.k = RF 40I current ll.l = RF 10I current mmm.m = heatsink temp nnn.n = exhaust temp ooo.o = Vrms ppp.p = Irms qqq.q = Watt rrr.r = Freq</p>	RNS=	RNS?	RNS=x....x (See description for details of arguments)
Reverse Power Threshold	RPT=	5 bytes	<p>Command or Query. Sets the power threshold used to generate a reverse power threshold alarm or fault condition (depending on the MSK state) Format xx.xx, Where: xx.xx = the reverse power threshold level in dBm</p>	RPT=	RPT?	RPT=xx.xx
Retrieve Utility Status	N/A	23 bytes, alpha-numeric	<p>Query only. Used to Query the utility status of the unit. Where: ADR = the serial address BDR = the serial baud rate FMT = the serial format VFD = the VFD brightness setting</p>	RUS=	RUS?	RUS=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)
Summary Alarm Status	N/A	1 byte	Query only. Indicates if there are any active alarm conditions. SAS=x, Where: 0 = no active alarms 1 = at least one active alarm Example: <1/SAS? >0001/SAS = 0'cr'lf'	SAS=	SAS?	SAS=x (See description for details of arguments)
Remote Baud Rate	SBR=	5 bytes	Command or Query. Set remote baud rate as follows: 02400 = 2400 baud 04800 = 4800 baud 09600 = 9600 baud 19200 = 19200 baud 38400 = 38400 baud Examples: <0001/SBR = 9600'cr' >0001/SBR = 'cr'lf' <0001/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: 09600	SBR= SBR? SBR*	SBR?	SBR=xxxxx (Same format as command arguments)
Summary Fault Status	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)
SNMP Authentication Trap Enable	SNA=	1 byte	Command or Query. SNMP Authentication Trap Enable 0 = Disabled 1 = Enabled Example: <1/SNA = 0	SNA= SNA?	SNA?	SNA=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)
SNMP Enable	SNM=	1 byte	Command or Query. SNMP Enable. 0 = Disabled 1 = Enabled Example: <1/SNM = 0	SNM= SNM?	SNM?	SNM=x (See description for details of arguments)
Serial Number	N/A	9 bytes	Query only. Used to Query the unit's nine-digit serial number in the form of SNO=xxxxxxxx, Where: xxxxxxxx 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=xxxxxx xxx (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=xxxx (Same format as command arguments)
Set Serial Format	SPB=	3 bytes	Command or Query. Set the Serial Data Bits, Parity, and Stop Bits. Format: XYZ with valid combinations of 8N1, 7E2, and 7O2. Where: X = Serial Data Bits (7 or 8) Y = Parity (N = None, E = Even, O = Odd) Z = Stop Bits (1 or 2) Example: <1/SPB = 7E2'cr' >0001/SPB = 'cr''lf' Default Value: 8N1	SPB= SPB?	SPB?	SPB=XYZ (Same format as command arguments)
SNMP Read Community	SRC=	16 bytes, characters, no spaces	Command or Query. SNMP read community string. Empty string is not allowed. Example: <1/SRC=public	SRC = SRC!	SRC?	SRC =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)
SNMP System Contact	SSC=	255 bytes, characters	Command or Query. SNMP System Contact string. Example: <1/SSC = Joe Net Admin If not configured, it returns empty string: <1/SSC=	SSC = SSC!	SSC?	SSC =x [1..128] (See description of 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)
SNMP System Location	SSL=	255 bytes, characters	Command or Query. SNMP System Location string Example: <1/SSL = Upstairs back right If not configured, it returns empty string. <1/SSL=	SSL = SSL!	SSL?	SSL =x [1..128] (See description of arguments)
SNMP Unit Name	SCN=	16 bytes, characters	Command or Query. SNMP System Name string Example: <1/SCN = Remote1 If not configured, it returns empty string. <1/SCN=	SCN = SCN!	SCN?	SCN =x [1..128] (See description of arguments)
SNMP Trap Destination IP Address 1	STA=	15 bytes, Numerical	Command or Query. Used to set the IP address of the first SNMP Trap destination IP Address 1 Where traps will be sent in the form: xxx.xxx.xxx.xxx is the IP addresss Example: <1/STA = 010.006.030.001 When not configured, returns >0001/STA = 0.0.0.0	STA = STA!	STA?	STA=xxx.xxx .xxx.xxx (See description of arguments)
SNMP Trap Destination IP Address 2	STB=	15 bytes, Numerical	Command or Query. Used to set the IP address of the first SNMP Trap destination IP Address 2 Where traps will be sent, in the form: xxx.xxx.xxx.xxx is the IP addresss Example: <1/STB = 010.006.030.001 When not configured, returns >0001/STB = 0.0.0.0	STB = STB!	STB?	STB=xxx.xxx .xxx.xxx (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)
SNMP Trap Version	STV=	1 byte	Command or Query. SNMP Trap Version that will be used to send traps. 1 = SNMP Trap Version 1 2 = SNMP Trap Version 2 Example: <1/STV = 0	STV = STV!	STV?	STV =x (See description of arguments)
SNMP Write Community	SWC=	16bytes, characters, no spaces	Command or Query. SNMP write community string. Empty string is not allowed. Example: <1/SWC = private	SWC = SWC!	SWC?	SWC =x (See description of 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	7 bytes	Query only. Returns the specified temperature. Where: 0 = RF Module #1 Heatsink Temp 1 = RF Module #1 Inlet Temp 2 = RF Module #1 Exhaust Temp Example: <1/TMP?0'cr' >0001/TMP = +052.27'cr'lf	TMP=	TMP?	TMP=x (See description for details of arguments)
Retrieve Number of unread Stored Alarms	N/A	2 bytes	Query only. Returns the number of stored events, which remain unread in the alarm log. Example reply: <1/TNA? 'cr' >0001/TNA = 14'cr'lf	TNA=	TNA?	TNA=xx (See description for details of arguments)
Total Number of Events	N/A	2 bytes	Query only. Returns the number of unread entries in the stored events log. Example: <1/TNE? 'cr' >0001/TNE = 14'cr'lf	TNE=	TNE?	TNE=xx (See description for details of arguments)