CDD-564L

CDD-564L L-Band Quad Demodulator with IP Module Installation and Operation Manual

Part Number MN/CDD564L.IOM Revision 0

CDD-564L

Installation and Operation Manual

CDD-564L L-Band Quad Demodulator with IP Module

Comtech EF Data is an ISO 9001
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Preface

Customer Service

Contact the Comtech EF Data Customer Support Department for:

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

A Customer Support representative may be reached at:

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

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

or, E-Mail can be sent to the Customer Support Department at:
service@comtechefdata.com
Contact us via the web at www.comtechefdata.com.

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

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

For more information regarding the warranty policies, see p. xviii.

About this Manual

This manual provides installation and operation information for the Comtech EF Data CDD-564L L-Band Quad Demodulator with IP Module. The CDD-564L operates at L-band and includes support for externally connected LNBs. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the CDD-564L.

Conventions and References

Metric Conversion

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

Cautions and Warnings

Indicates information critical for proper equipment function.

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

Reporting Comments or Suggestions Concerning this Manual

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

Electrical Safety

The CDD-564L L-Band Quad Demodulator with IP Module has been shown to comply with the following safety standard:

- EN 60950: Safety of Information Technology Equipment, including electrical business machines

The equipment is rated for operation over the range 100 - 240 volts AC. It has a maximum power consumption of 140 Watts (when all four inputs are supplying DC to LNBs), and draws a maximum of 1.5 Amps.

The user should observe the following instructions:

Environmental

The CDD-564L must not be operated in an environment where the unit is exposed to extremes of temperature outside the ambient range 0 to 50°C, precipitation, condensation, or humid atmospheres above 95% RH, altitudes (non-pressurized) greater than 2000 meters, excessive dust or vibration, flammable gases, corrosive or explosive atmospheres.

Operation in vehicles or other transportable installations that are equipped to provide a stable environment is permitted. If such vehicles do not provide a stable environment, safety of the equipment to EN60950 may not be guaranteed.

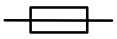
Installation

The installation and connection to the line supply must be made in compliance to local or national wiring codes and regulations.

The CDD-564L is designed for connection to a power system that has separate ground, line and neutral conductors. The equipment is not designed for connection to a power system that has no direct connection to ground.

The CDD-564L is shipped with a line inlet cable suitable for use in the country of operation. If it is necessary to replace this cable, ensure the replacement has an equivalent specification. Examples of acceptable ratings for the cable include HAR, BASEC and HOXXX-X. Examples of acceptable connector ratings include VDE, NF-USE, UL, CSA, OVE, CEBEC, NEMKO, DEMKO, BS1636A, BSI, SETI, IMQ, KEMA-KEUR and SEV.

International Symbols:

Symbol	Definition		Symbol	Definition
~	Alternating Current			Protective Earth
	Fuse			Chassis Ground

Telecommunications Terminal Equipment Directive

In accordance with the Telecommunications Terminal Equipment Directive 91/263/EEC, this equipment should not be directly connected to the Public Telecommunications Network.

EMC (Electromagnetic Compatibility)

In accordance with European Directive 89/336/EEC, the CDD-564L has been shown, by independent testing, to comply with the following standards:

Emissions: EN 55022 Class B - Limits and methods of measurement of radio interference characteristics of Information Technology Equipment.

(Also tested to FCC Part 15 Class B)

Immunity: EN 50082 Part 1 - Generic immunity standard, Part 1: Domestic, commercial and light industrial environment.

Additionally, the CDD-564L has been shown to comply with the following standards:

EN 61000-3-2	Harmonic Currents Emission
EN 61000-3-3	Voltage Fluctuations and Flicker
EN 61000-4-2	ESD Immunity
EN 61000-4-4	EFT Burst Immunity
EN 61000-4-5	Surge Immunity
EN 61000-4-6	RF Conducted Immunity
EN 61000-4-8	Power frequency Magnetic Field Immunity
EN 61000-4-9	Pulse Magnetic Field Immunity
EN 61000-4-11	Voltage Dips, Interruptions, and Variations Immunity
EN 61000-4-13	Immunity to Harmonics

In order that the equipment continues to comply with these standards, observe the following instructions:

- Connections to the transmit and receive IF ports (‘N’ type female connectors) should be made using a good quality coaxial cable - for example, RG213/U.
- All 'D' type connectors attached to the rear panel must have back-shells that provide continuous metallic shielding. Cable with a continuous outer shield (either foil or braid, or both) must be used, and the shield must be bonded to the back-shell.
- The equipment must be operated with its cover on at all times. If it becomes necessary to remove the cover, the user should ensure that the cover is correctly re-fitted before normal operation commences.

Warranty Policy

This Comtech EF Data product is warranted against defects in material and workmanship for a period of two years from the date of shipment. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective.

For equipment under warranty, the customer is responsible for freight to Comtech EF Data and all related custom, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges **only** for return of the equipment from the factory to the customer. 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.

Limitations of Warranty

The foregoing warranty shall not apply to defects resulting from improper installation or maintenance, abuse, unauthorized modification, or operation outside of environmental specifications for the product, or, for damages that occur due to improper repackaging of equipment for return to Comtech EF Data.

No other warranty is expressed or implied. Comtech EF Data specifically disclaims the implied warranties of merchantability and fitness for particular purpose.

Exclusive Remedies

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.

Disclaimer

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

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

Chapter 1. Introduction

Figure 1-1. CDD-564L

The CDD-564L (Figure 1-1) is a 4 channel / Quad L-Band Demodulator, intended for closed network applications.

- Four independent demodulators each programmable from 950 to 1950 MHz.
- Single 10/100 BaseT Ethernet interface.
- Variable data rates from 7.2 kbps to 4.72 Mbps, in QPSK mode.
- Turbo Product Coding is provided as Forward Error Correction (FEC).
- The CDD-564L IF frequency range covers 950 to 1950 MHz. and supports external low-noise block downconverters (LNBs). 10 MHz reference signals are available to drive the LNB. DC LNB power is standard.
- The CDD-564L is compact, 1RU high and 16 inches deep, and consumes only 75 Watts typical, not including LNB power supply.
- The unit has LEDs on the front panel and uses the 10/100 BaseT Ethernet interface for remote control and data traffic.
- A wide range of network-based management options, such as SNMP, HTTP (web server), and Telnet is provided.

1.1 Software – Flash Upgrading

The internal software is both powerful and flexible, permitting storage and retrieval of up to 10 different modem configurations. The modem uses ‘flash memory’ technology internally, and new firmware can be uploaded to the unit from an external PC. This simplifies software upgrading, and updates can be sent via the Internet (from Comtech EF

Data's Web server), e-mail, or on CD. The upgrade can be performed without opening the unit, by simply connecting the modem to a 10/100BaseT Ethernet port.

1.2 Data Interfaces

The CDD-564L includes, as standard, a 10/100 BaseT Ethernet interface.

1.3 FAST Options and Hardware Options

The CDD-564L is extremely flexible and powerful, and incorporates a number of optional features.

Standard features include:

- Integrated IP Module compatible with the optional IP Module available in the CDM-570/570L
- Integrated 2nd Generation Turbo FEC compatible with the CDM-570/570L

In order to permit a lower initial cost, the modem may be purchased with only the desired features enabled. If, at a later date, a user wishes to upgrade the functionality of a modem, Comtech EF Data provides FAST (**F**ully **A**ccessible **S**ystem **T**opology) which permits the purchase and installation of options through special authorization codes. The codes can be entered remotely.

The following table shows what other options are available:

Option	Description and Comments	Option Installation Method
Low Rate Variable	Data rate 2.4 kbps to 512 kbps	BASE UNIT
Mid-Rate Variable	Data rate 2.4 kbps to 2.048 Mbps	FAST
Full Rate Variable	Data rate 2.4 kbps to 4.72 Mbps	FAST
QPSK	Modulation Type	Standard
TPC Codec	Turbo Product Codec (IESS-315 compliant)	Standard
IP Module	10/100 BaseT Ethernet interface	Standard
3xDES Data Encryption	Uses NIST certified 3x core Software Version 1.4.0 and later	FAST
IP Header Compression	Software Version 1.4.0 and later	FAST
Payload Compression	Software Version 1.4.0 and later	FAST
Quality of Service (QoS)	Software Version 1.4.0 and later	Supported, performed at modulator

1.3.1 FAST Accessible Options

Comtech EF Data's FAST system allows immediate implementation of different options through any of the user interfaces. All FAST options are available through the basic platform unit.

1.3.2 FAST System Theory

FAST is an enhancement feature available in Comtech EF Data products, enabling on-location upgrade of the operating feature set without removing a unit from the setup. When service requirements change, the operator can upgrade the topology of the unit to meet those requirements within minutes after confirmation by Comtech EF Data. This accelerated upgrade can be accomplished because of FAST's extensive use of programmable logic devices incorporated into Comtech EF Data's products. A unique access code enables configuration of the available hardware. The access code can be purchased at any time from Comtech EF Data. Once obtained, the access code is loaded into the unit through user interfaces.

With FAST technology, operators have maximum flexibility for enabling functions, as they are required. FAST allows an operator to order a unit precisely tailored for the initial application, and then maintain the ability to adapt the features at a later date as the application evolves.

1.3.3 Implementation

FAST is factory-implemented in the modem at the time of order. Hardware options for basic modems can be ordered and installed either at the factory or in the field. The operator can select options that can be activated easily in the field, depending on the current hardware configuration of the modem. The activation procedure is described in Appendix C.

1.3.4 Hardware Options

There are no hardware options.

1.3.5 Supporting Hardware and Software Redundancy

There is no redundancy support.

1.4 Interoperability

The CDD-564L is interoperable with the CDM-570 and CDM-570L populated with the optional IP module. The CDD-564L supports the functions associated with receive side of the equipment.

Note: The CDD-564L is also fully backward compatible with the Comtech EF Data CDM-IP 550 and CDM-IP 300L in selected modes.

Chapter 2. Installation

2.1 Unpacking

Inspect shipping containers for damage. If shipping containers are damaged, keep them until the contents of the shipment have been carefully inspected and checked for normal operation.

The modem and manual are packaged in pre-formed, reusable, cardboard cartons containing foam spacing for maximum shipping protection.

Do not use any cutting tool that will extend more than 1 inch into the container. This can cause damage to the modem.

Unpack the modem as follows:

1. Cut the tape at the top of the carton indicated by OPEN THIS END.
2. Remove the cardboard/foam space covering the modem.
3. Remove the modem, manual, and power cord from the carton.
4. Save the packing material for storage or reshipment purposes.
5. Inspect the equipment for any possible damage incurred during shipment.
6. Check the equipment against the packing list to ensure the shipment is correct.
7. Refer to the following sections for further installation instructions.

2.2 Mounting

If the CDD-564L is to be mounted in a rack, ensure that there is adequate clearance for ventilation, particularly at the sides. In rack systems where there is high heat dissipation, forced air-cooling must be provided by top or bottom mounted fans or blowers. Under no circumstance should the highest internal rack temperature be allowed to exceed 50°C (122°F).

The CDD-564L CANNOT have rack slides mounted to the side of the chassis. Two cooling fans are mounted on the right-hand side of the unit. However, Comtech EF Data recommends that **an alternate** method of support within the rack be employed, such as rack shelves. If there is any doubt, please consult the Comtech EF Data Customer Support department.

Optional rear-mounting installation bracket

Install optional installation bracket (Figure 2-1) using mounting kit, KT/6228-2.

Optional: Mounting Kit , KT/6228-2

Quantity	Part Number	Description
2	FP/6138-1	Bracket, Rear Support
4	HW/10-32x1/2RK	Bolt, #10 Rack
2	HW/10-32HEXNUT	Nut, #10 Hex
4	HW/10-32FLT	Washer, #10 Flat
2	HW/10-32SPLIT	Washer, #10 Split
2	HW/10-32SHLDR	Screw, Shoulder #10

The tools required for this installation are a medium **Phillips™ screwdriver**, and a **5/32-inch SAE Allen™ Wrench.**

Refer to the following Figure and install the Modem rear support brackets as follows:

a) Install the rear support brackets onto the mounting rail of the rack. Fasten with the bracket bolts.

b) Mount the modem into the equipment rack ensuring that the shoulder heads engage into the modem slots of the rear support brackets.

c) Fasten the provided #10 **shoulder** head screws to the rear-side mounting slots on either side of the chassis modem and secure with #10 flat washers, **#10 split washers,** and #10 hex nuts.

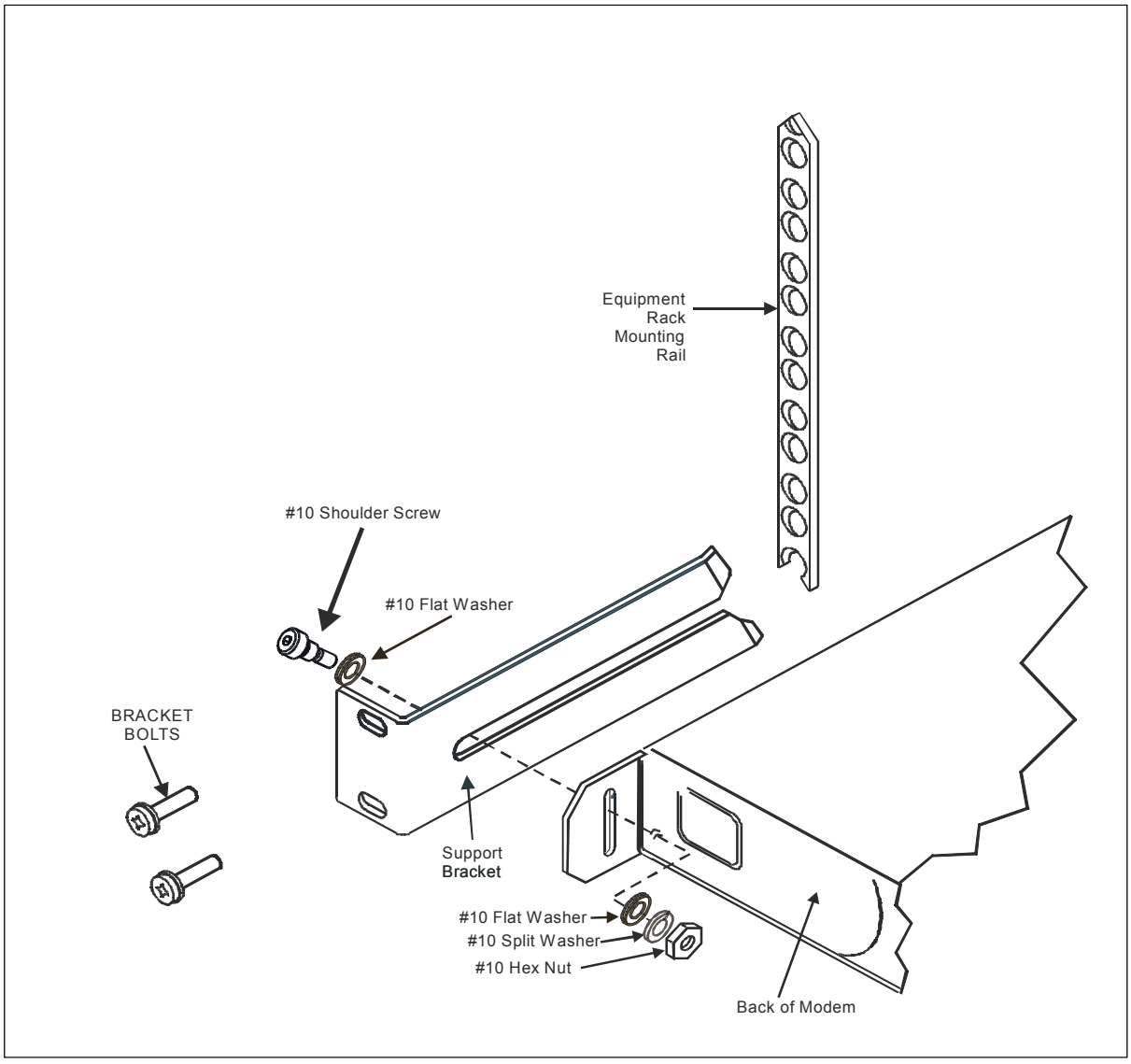


Figure 2-1. Installation of the Optional Mounting Bracket

2.3 Configuration

There are no internal jumpers to configure, no interface cards to install, and no other options to install. All configurations are carried out entirely in software. The unit should first be configured locally, using the RS-232 Console Interface. The unit will ship with a default 64 kbps, QPSK, Rate 3/4 configuration.

Note: The auto-sensing AC power supply does not require any adjustments. Simply plug in the supplied line cord, and turn on the switch on the rear panel.

2.4 Connect External Cables

Having entered the desired configuration, and proceed to connect all external cables. If difficulties occur, please call the factory for assistance.

Chapter 3. Functional Description

The CDD-564L has two fundamentally different types of interface - IF and data.

- The data interface is a bi-directional path, which connects with the customer's equipment. The interface is a 10/.100 BaseT Ethernet port where data flow is the combined output of 4 demodulator channels. Control and status information also enters this port.
- The 4 IF interfaces provide 4 independent unidirectional links (receive only) with the satellite via the downlink equipment.

In the CDD-564L, the Rx IF signal in the range 950 to 1950 MHz is translated to an intermediate frequency at around 465MHz, and from there further translated to baseband, using the carrier recovery VCO. This is a complex mix, resulting in the signal once more being split into an in-phase (I) and a quadrature (Q) component. An AGC circuit maintains the desired signal level constant over a broad range. Following this, the I and Q signals are sampled by high-speed (flash) A/D converters. All processing beyond this conversion is purely digital, performing the functions of Nyquist filtering, carrier recovery, and symbol timing recovery. The resultant demodulated signal is fed, in soft decision form, to the selected FEC decoder (Turbo). After decoding, the recovered clock and data pass to the IP Module where traffic is examined and processed for 4 channels before it is delivered to the Ethernet port.

The CDD-564L signal processing functions are performed in two, large Field-Programmable Gate Array (FPGA) , which permits rapid implementation of changes, additions and enhancements in the field. These signal processing functions are controlled and monitored by a 32-bit RISC microprocessor, which also controls all front panel indicators, serial and Ethernet interfaces.

Physically the CDD-564L is comprised of a single printed circuit card assembly, with integral Turbo FEC and IP Module as shown below:

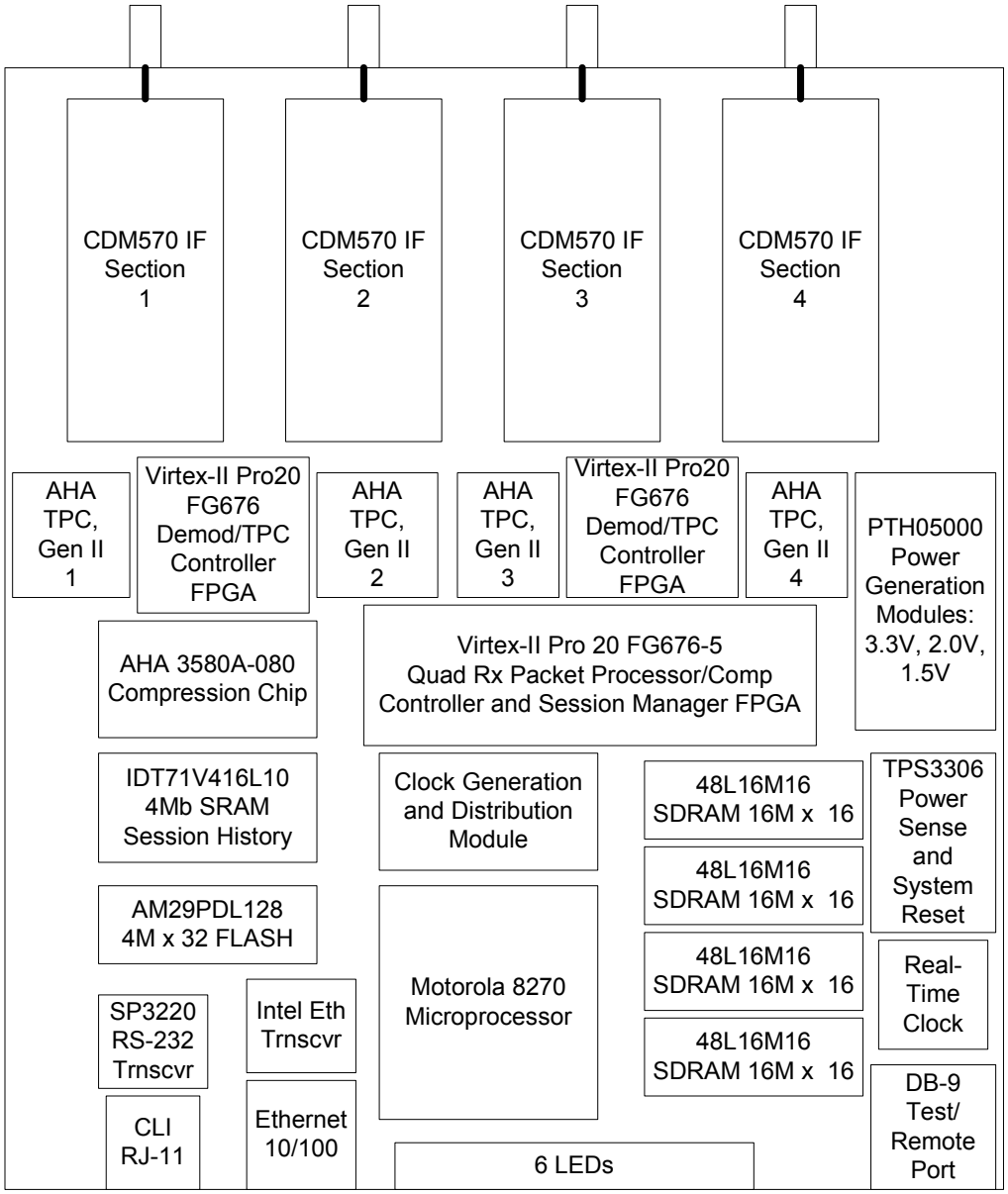


Figure 3-1. CDD-564L Block Diagram

Chapter 4. Physical Description

4.1 Introduction

The CDD-564L is constructed as a 1U high rack-mounting chassis, which can be freestanding if desired. Rack handles at the front facilitate removal from and placement into a rack. Figure 4-1 shows the front panel of the unit.

Figure 4-1. Front Panel

4.2 Front Panel

The front panel has eight LEDs indicating the status of the unit:

- Traffic Status for each of the four receive channels
- Overall Unit Status
- Stored Event
- Ethernet Activity
- Ethernet 10 BaseT or 100BaseT active

4.3 Rear Panel

Figure 4-2. Rear Panel - CDD-564L

External cables are attached to connectors on the rear panel of the CDD-564L. These comprise:

- IEC-320 AC line input connector with ON/OFF switch
- Rx IF connectors – four 'N' type female
- RJ45 Data interface connector – 10/100BaseT Ethernet
- RJ11 6-pin Async Serial Console port
- DB-9 factory test connector

4.3.1 IEC line input connector

The IEC line input connector contains the ON/OFF switch for the unit. It is also fitted with two fuses, one each for line and neutral connections (or L1, L2, where appropriate). These are contained within the body of the connector, behind a small plastic flap.

- For 120 / 230 volt AC operation, use T3.15 A, slow-blow 20mm fuses.
- For 48 volt DC (38 to 60 VDC) operation, use T8.0A, slow-blow 20mm fuses

IMPORTANT

For continued operator safety, always replace the fuses with the correct type and rating.

4.3.2 Rx IF Connectors

The IF port connectors are 50Ω 'N' type female. The return loss on these ports is typically better than 17dB, and if the user wishes to connect to a 75Ω system, an inexpensive 'N' to 'F' type adapter is available as an optional accessory. While there will be a reduction in return loss when doing this, the effect in most systems will be imperceptible.

4.3.3 Data Interface Connector: 10/100BaseT Ethernet

This is a standard RJ45 receptacle for connecting UTP cable to an Ethernet hub, router, switch, PC, etc. It is used for Ethernet traffic, management of CDD-564L functions via Telnet/HTTP/SNMP, as well as upgrading of CDD-564L software.

4.3.4 Serial Console Port

This is an RJ11 6-pin ASYNC RS-232 serial console port used for management of CDD-564L functions using a terminal emulator connected to the Console port with supplied adaptor cable.

4.3.5 Factory Test Connector

Note: This is NOT a standard EIA-232 interface.

The 9-pin ‘D’ type male (DB-9-M), labeled “Remote Control” is a Factory Test interface. This interface is **NOT** intended for customer use.

Please consult CEFD Customer Support before attaching any cable to this interface.

4.4 Dimensional Envelope

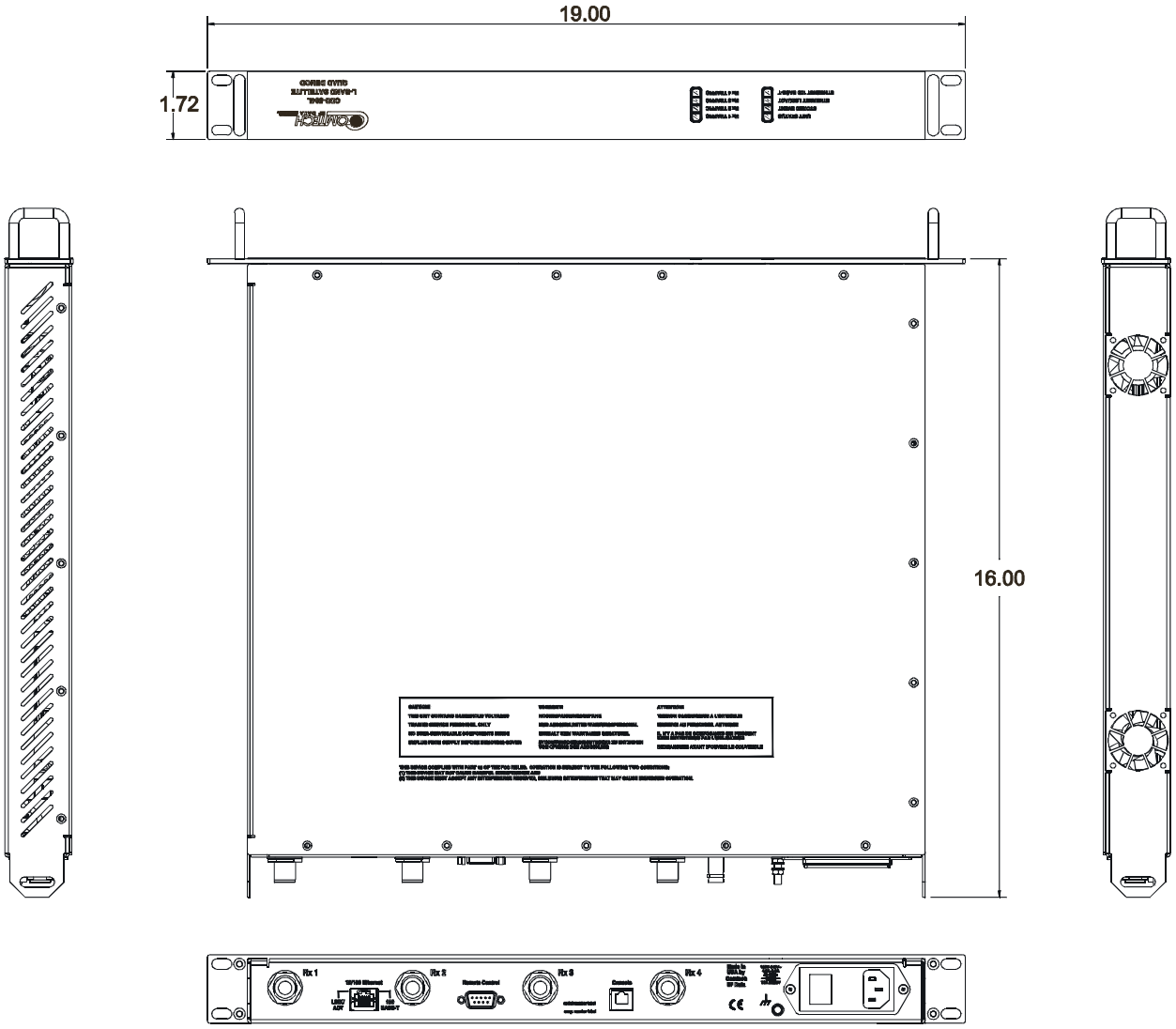


Figure 4-3. Dimensional Envelope

Chapter 5. Connector Pinouts

5.1 Connector Overview

The rear panel connectors (Figure 5-1) provide all necessary external connections between the unit and other equipment.

Figure 5-1. Rear Panel

Table 5-1. External Connections

Name	Connector Type	Function
Rx IF	'N' type (female) – 4 each	RF Input
Remote Control	9-pin D (male)	Serial Remote Interface (Factory Test)
Console	RJ-11	Serial Console Interface
10/100 Ethernet Traffic	RJ-45	Ethernet Traffic and M&C

5.2 Remote Control (Factory Test) Connector

The Factory test interface connection is a 9-pin male connector located on the rear panel of the unit. Refer to Table 5-2 for pin assignments.

This connector is NOT intended for customer use. Please contact CEFD Customer Support prior to connecting any equipment to this interface.

Table 5-2. Remote Control (Factory Test) Connector Pin Assignments

Pin #	Description	Direction
1	Ground	
2	EIA-232 Transmit Data (38.4k, 8N1 fixed)	Out
3	EIA-232 Receive Data (38.4k, 8N1 fixed)	In
4	Selected Demod I-Channel monitor	Out
5	Selected Demod Q-Channel monitor	Out
6	Selected Demod RS-422 Rx Data +	In
7	Selected Demod RS-422 Rx Data -	In
8	Selected Demod RS-422 Tx Clock +	Out
9	Selected Demod RS-422 Tx Clock -	Out

5.3 Async-Serial Console

The Console Connector is a RJ11-6 modulator jack located on the rear panel. The Async-Serial Console interfaces the IP Module Command Line Interface (CLI). This is a RS-232 DCE interface.

Table 5-3. ASYNC-Serial Console Connector

Pin #	Function
1	Ground
2	Rx
3	Tx
4	Ground
5	Not used
6	Not used

5.4 Ethernet Interface Connector (Traffic and M&C)

The 10/100BaseT Ethernet connector is a RJ45-8 modular jack. This interface is a Network Interface Card (NIC) pinout.

Table 5-4. Ethernet Interface Connector

Pin #	Function
1	Tx+
2	Tx-
3	Rx+
4	N/C
5	N/C
6	Rx-
7	N/C
8	N/C

5.5 AC Power Connector

A standard, detachable, non-locking, 3-prong power cord (IEC plug) supplies the Alternating Current (AC) power to the unit. Note the following:

AC Power Specifications	
Input Power	40W maximum, 20W typical
Input Voltage	100 - 240 volts AC, +6%/-10% - autosensing (total absolute max. range is 90 - 254 volts AC)
Connector Type	IEC
Fuse Protection	Line and neutral fusing 20 mm type fuses. See Physical Description Chapter for ratings

5.6 Ground Connector

A #10-32 stud on the rear panel of the unit is used for connecting a common chassis ground among equipment.

Note: The AC power connector provides the safety ground.

Chapter 6. Forward Error Correction

6.1 Introduction

As standard, the CDD-564L L-Band Quad Demodulator with IP Module is equipped with an integral Turbo Product Codec. Turbo Coding represents a very significant development in the area of FEC, and Comtech EF Data's Turbo Product Codec offers Rate 3/4 and 0.95 for QPSK. Turbo Product Coding provides the best of class Forward Error Correction technology currently available, along with modulation types that optimize link performance under any conditions.

6.2 Turbo Product Codec

6.2.1 Description

Turbo coding is an FEC technique developed within the last few years, which delivers significant performance improvements compared to more traditional techniques. Two general classes of Turbo Codes have been developed, Turbo Convolutional Codes (TCC), and Turbo Product Codes (TPC, a block coding technique). Comtech EF Data has chosen to implement an FEC codec based on TPC. A Turbo Product Code is a 2 or 3 dimensional array of block codes. Encoding is relatively straightforward, but decoding is a very complex process requiring multiple iterations of processing for maximum performance to be achieved.

Unlike the popular method of concatenating a Reed-Solomon codec with a primary FEC codec, Turbo Product Coding is an entirely stand-alone method. It does not require the complex interleaving/de-interleaving of the RS approach, and consequently, decoding delays are significantly reduced. Furthermore, the traditional concatenated RS schemes exhibit a very pronounced threshold effect. A small reduction in Eb/No can result in total loss of demod and decoder synchronization. TPC does not suffer from this problem. The

demod and decoder remain synchronized down to the point where output error rate becomes unusable. This is considered to be an advantageous characteristic in fading environment. Typically, in QPSK, TPC modes the demod and decoder can remain synchronized ***2 – 3 dB below*** the Viterbi/R-S or TCM cases.

With this release of the CDD-564L, Comtech EF Data now provides the best Forward Error Correction technology currently available, offering 3/4 and 0.95 TPC code rates using QPSK modulation.

6.2.2 TPC Modes Available in the CDD-564L

Table 6-1. Available TPC Modes

Code Rate/Modulation	Data Rate Range
Rate 3/4 QPSK	7.2 kbps to 3.75 Mbps
Rate 0.95 QPSK	9.1 kbps to 4.72 Mbps

6.2.3 End-to-End Processing Delay

In many cases, FEC methods that provide increased coding gain do so at the expense of increased processing delay. However, with TPC, this increase in delay is very modest. The table below shows, for the CDD-564L, the processing delays for the two TPC modes:

Table 6-2. Turbo Product Coding Processing Delay Comparison

FEC Mode (64 kbps data rate)	End-to-end delay, ms
Turbo Product Coding, Rate 3/4	**47**
Turbo Product Coding, Rate 0.95	**69**

Note that in all cases, the delay is inversely proportional to data rate, so for 128 kbps, the delay values would be half of those shown above.

6.2.4 Comparison of All TPC Modes (Contains Additional Information)

Mode	Eb/No at BER = 10^{-6} Guaranteed (Typical in parentheses)	Eb/No at BER = 10^{-8} Guaranteed (Typical in parentheses)	Spectral Efficiency	Symbol Rate	Occupied * Bandwidth for 1 Mbps Carrier
QPSK Rate 3/4 Turbo	3.8 dB (3.3 dB)	4.4 dB (4.0 dB)	1.50 bits/Hz	0.67 x bit rate	793 kHz
QPSK Rate 0.95 Turbo	6.4 dB (6.0 dB)	6.9 dB (6.5 dB)	1.90 bits/Hz	0.53 x bit rate	626 kHz
*8-PSK Rate 3/4 Turbo	6.2 dB (5.7 dB)	6.8 dB (6.3 dB)	2.25 bits/Hz	0.44 x bit rate	529 kHz
*8-PSK Rate 0.95 Turbo	9.3 dB (8.9 dB)	10.3dB (9.9 dB)	2.85 bits/Hz	0.35 x bit rate	377 kHz
*16-QAM Rate 3/4 Turbo	7.4 dB (7.0 dB)	8.2 dB (7.7 dB)	3.00 bits/Hz	0.33 x bit rate	396 kHz

* Future offering, firmware upgrade and FAST option.

The additional advantages of Turbo (lower delay, performance during fades, etc.) should also be considered.

Table 6-3. Turbo Product Coding Summary

FOR	AGAINST
Exceptionally good BER performance - significant improvement compared with every other FEC method in use today	Nothing!
No pronounced threshold effect - fails gracefully	
Exceptional bandwidth efficiency	
Coding gain independent of data rate (in this implementation)	
Low decoding delay	
Easy field upgrade in CDD-564L	

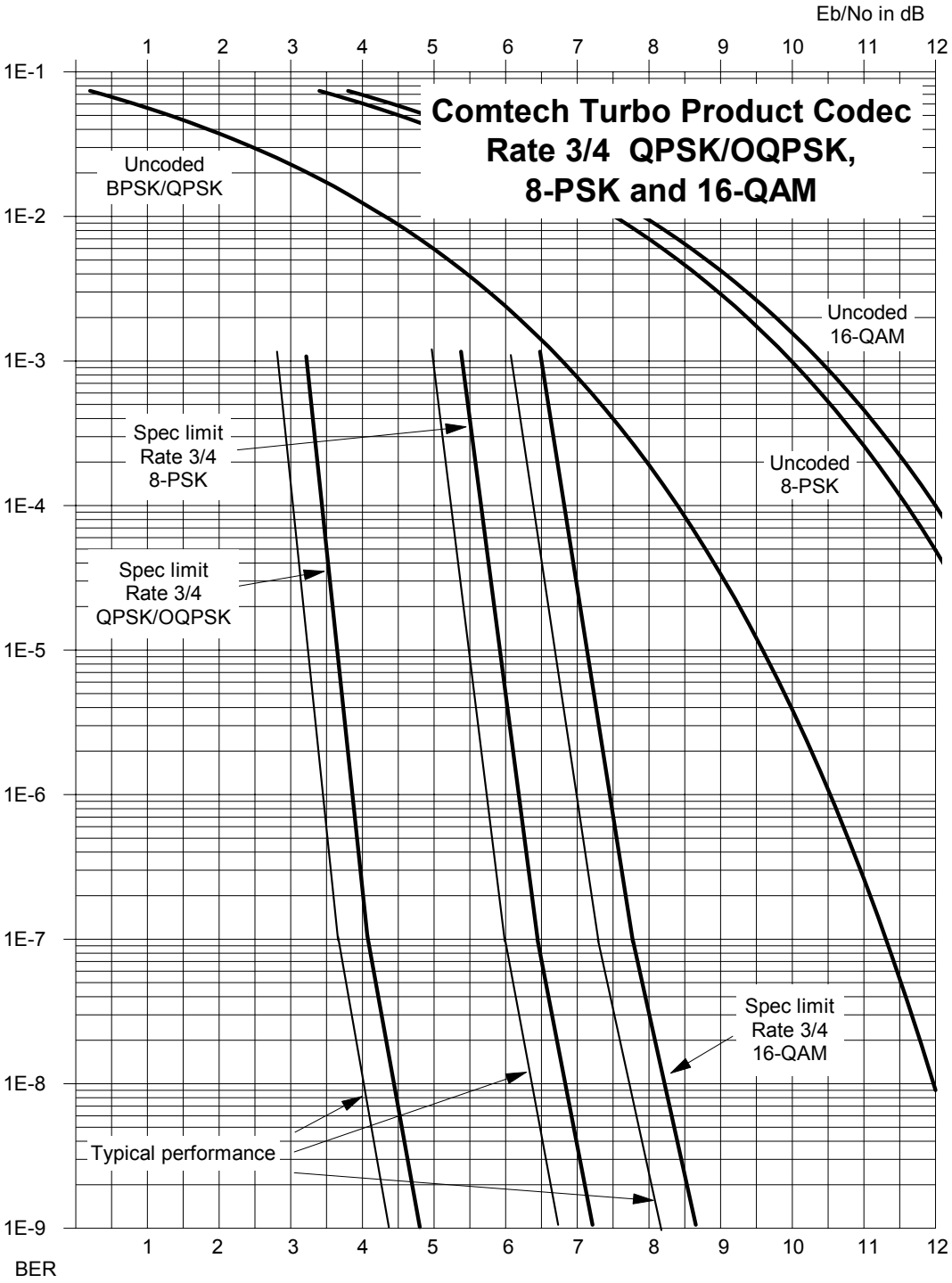


Figure 6-1. Comtech EF Data Turbo Product Codec
Rate 3/4 QPSK plus reference to OQPSK, 8-PSK AND 16-QAM

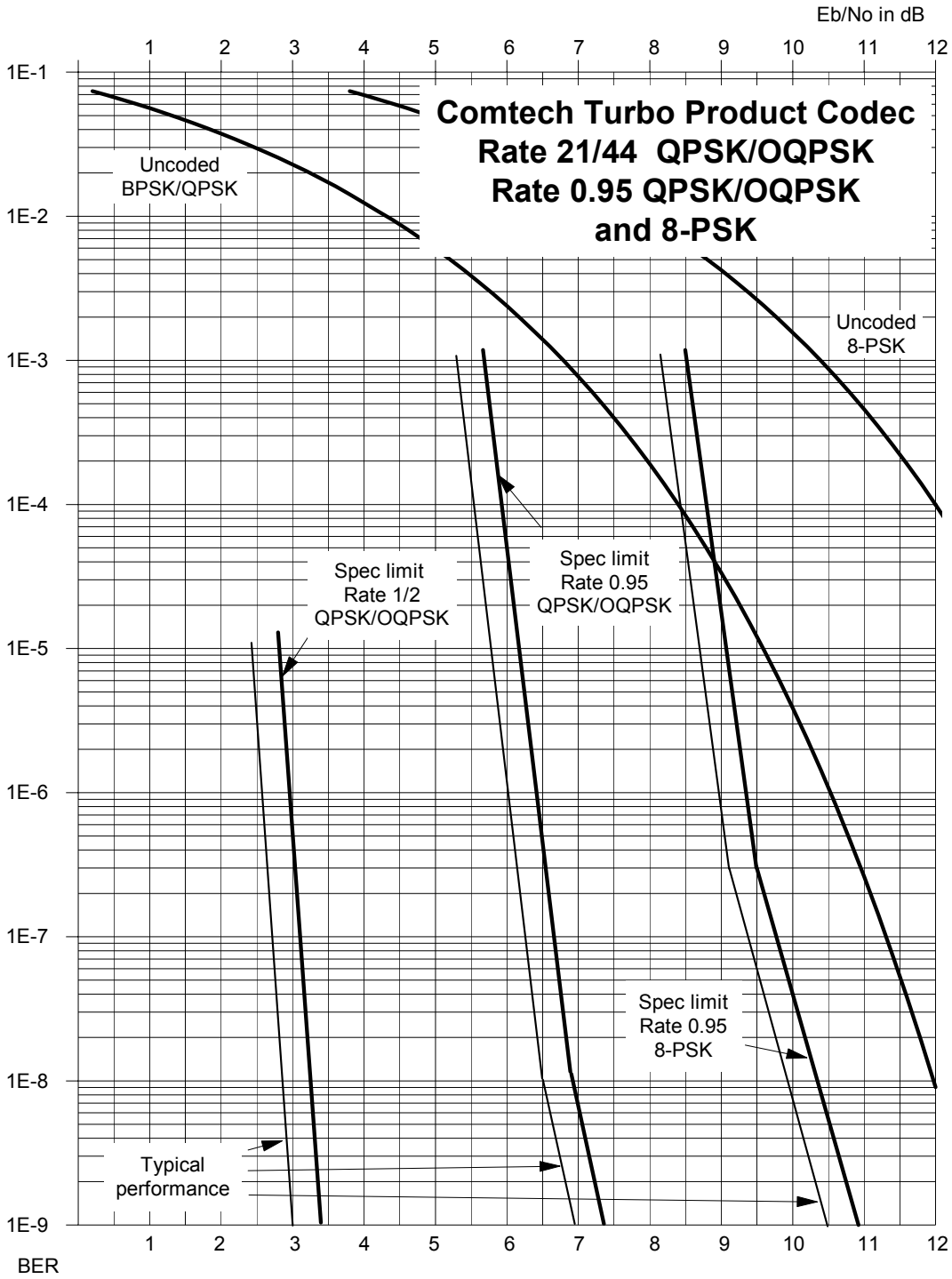


Figure 6-2. Comtech EF Data Turbo Product Codec
Rate 0.95 QPSK plus reference to Rate 21/44 QPSK, and Rate 0.95 8-PSK

Notes:

Chapter 7. Summary Of Specifications

7.1 Demodulator

Data rate range, operating modes, de-scrambling, input impedance/return loss etc., as per Modulator.

Modulation	QPSK			
Symbol rate range	4.8 kbps to 2.5 Mbps			
Data rate range	See Section 7.3			
Operating modes	Turbo Product Codec: * Rate 3/4 QPSK • Rate 0.95 QPSK (exact Code Rate is actually 0.944)			
Scrambling	Turbo Product Code mode - externally frame synchronized - proprietary			
FEC	**Turbo Product Codec** Rate 3/4 QPSK - 2 dimensional Rate 0.95 QPSK - 2 dimensional eTPC (exact Code Rate is actually 17/18, or 0.944)			
Operating frequency	950 - 1950 MHz, 100 Hz resolution Stability ±0.06 ppm (±6 x 10^{-8}) 0 to 50°C (32 to 122 °F)			
IF connector	Type N female			
Input power range	-130 + 10 log (Symbol Rate) to -90 + 10 log (Symbol Rate) +40 dBm maximum composite, up to -10 dBm, absolute max.			
Acquisition range	±1 to ±200 kHz, 1kHz increments, for symbol rates above 625 ksymbols/sec			
Acquisition time	Highly dependent on data rate, FEC rate, and demodulator acquisition range. **Examples:** 120 ms average at 64 kbps, R3/4 QPSK, ±10 kHz acquisition sweep range, 6dB Eb/No			
Clock tracking range	± 100 ppm min			
TURBO PRODUCT CODEC Rate 3/4 QPSK (With two adjacent carriers, each 7 dB higher than the desired carrier)	For: BER=10^{-6} BER=10^{-7} BER=10^{-8}	**Rate 3/4 (Q, OQ)** Guaranteed Eb/No: (typical value in parentheses) 3.8dB (3.4dB) 4.1dB (3.7dB) 4.4dB (4.0dB)		

TURBO PRODUCT CODEC Rate 0.95 QPSK **BER (With two adjacent carriers, each 7 dB higher than the desired carrier)**	For: BER=10^{-6} BER=10^{-7} BER=10^{-8}	**Rate 0.95 (Q, OQ)** Guaranteed Eb/No: (typical value in parentheses) 6.4 dB (6.0 dB) 6.7 dB (6.3 dB) 6.9 dB (6.5 dB)		
Monitor Functions	Eb/No estimate, 2 to 16 dB (± 0.25 dB accuracy) Corrected Bit Error Rate, 1E-3 to 1E-9 Frequency offset, ± 200 kHz range, 100 Hz resolution Buffer fill state, in percent Receive signal level (-20 to –90 dBm, accuracy is ± 2.5 dB)			

7.2 Data and miscellaneous Interfaces

Factory Test	Proprietary	9-pin D-sub (male)
Console	RS-232 control and monitoring	RJ11
Ethernet	10/100 Base Tx for HTTP, SNMP and Telnet interfaces	RJ45

7.3 Data Rate Ranges

FEC Type	Modulation	Code Rate	Data Rate Range	EDMAC limited?
Turbo	QPSK	Rate 3/4	7.2 kbps to 3.75 Mbps	Yes – see note below
Turbo	QPSK	Rate 0.95	9.1 kbps to 4.72 Mbps	Yes – see note below
Important Note: Where noted in the table above, if EDMAC framing is employed, the upper data rate will be reduced by 5% for data rates up to 2.048 Mbps, and by 1.5% for data rates above 2.048 Mbps, where EDMAC2 framing is used, or for Rate 21/44 BPSK/QPSK Turbo, or Rate 5/16 BPSK Turbo.				

7.4 Miscellaneous

Front panel	8 LED Indicators
Ethernet	10/100 Base Tx for HTTP: SNMP and Telnet interfaces
Dimensions	1U high, 16 inches (406 mm) deep
Weight	7 lbs (3.2 kgs)
AC consumption	75 Watts (typical) 140 Watts (maximum – powering 4 LNBs)
Operating voltage	100 - 230 volts AC, +6%/-10% - auto sensing (Total absolute max. range is 90 - 254 volts AC)
Operating temperature	0 to 50°C (32 to 122°F)

7.5 Approvals

"CE" as follows:	EN 55022 Class B (Emissions) EN 50082-1 (Immunity) EN 60950 (Safety)	EN 61000-3-2 EN 61000-3-3 EN 61000-4-2 EN 61000-4-4 EN 61000-4-5	EN 61000-4-6 EN 61000-4-8 EN 61000-4-9 EN 61000-4-11 EN 61000-4-13
FCC	FCC Part 15 Class B		

Chapter 8. IP Module Ethernet Interface Overview

8.1 Introduction

The integral IP Module Ethernet Interface is a high-performance, low-cost, IP-Centric interface well suited for closed network Single Channel Per Carrier (SCPC) links. It concentrates traffic from 4 independent demodulators into a single Ethernet port making it ideal for networked VSAT applications. A CDD-564L with the integral IP Module can also be utilized in a ViperSat satellite bandwidth management sytem. The following chapters focus on the CDD-564L IP Module capabilities and operation. Refer to the ViperSat Operational Manual, for more specific information on the CDD-564L IP Module operation when deployed in a ViperSat system.

8.2 CDD-564L Standard Features

- 10/100BaseT Ethernet Interface
- Powerful network management
  - Web Server interface for complete product management
  - SNMP with public and private MIB
  - Telnet interface for remote product M & C
  - Console Port interface for local network management
- Remote software/firmware upgrade via FTP
- Configuration backup and restore via FTP
- Event Logging to capture all IP Module activity
- Detailed Statistics of IP traffic
- IGMP support for multicast
- Static IP routing for unicast and multicast

8.2.1 10/100BaseT Ethernet Interface

In Router Mode operation, the 10/100BaseT Ethernet Interface is used for routing IP traffic to be transmited over the satellite or routed to another device on the local LAN. In easyConnect™ Mode, the Ethernet Interface is used to forward IP and non-IP traffic over the satellite. Local or remote management of all CDD-564L and IP Module functions is also available via Telnet, HTTP, or SNMP.

8.2.2 Powerful Network Management

The CDD-564L IP-Enabled Quad Demodulator may be configured, operated and monitored using any of the following methods:

User Interface	Connection	Demod Functions	IP MODULE Functions	Reference
Serial Command Line Interface (CLI)	Local - Serial RS-232 via Console Port	ALL	ALL	Chapter 10
Telnet	Local or remote - Ethernet via 10/100 BaseT Traffic interface	ALL	ALL	Chapter 10
Web Server	Local or remote - Ethernet via 10/100 BaseT Traffic interface	ALL	ALL	Chapter 11
SNMP	Local or remote - Ethernet via 10/100 BaseT Traffic interface	ALL	ALL	Chapter 12

8.2.3 Remote Software/Firmware Upgrade via FTP

The CDD-564L uses ‘flash memory’ technology internally, and new firmware can be uploaded to or from an external PC by FTP. This makes software upgrading very simple, and updates can now be sent via the Internet, E-mail, or on disk. The upgrade can be performed without opening the unit or having to be in the same physical location.

8.2.4 Configuration Backup and Restore via FTP

All CDD-564L IP configuration parameters are stored in a simple text file. The parameter file can easily be retrieved locally or remotely by FTP. The file can then be used to quickly configure a replacement unit if needed.

8.2.5 Event Logging to Capture All CDD-564L Activity

All CDD-564L activity can be stored into an easy-to-read Event Log. This file can also be retrieved locally or remotely by FTP.

8.2.6 Detailed Statistics of IP Traffic

IP traffic statistics are continuously updated and allow detailed performance analysis or can be used to identify traffic problems. The statistics are available through the Serial Console locally, or can be gathered remotely by Telnet, HTTP, or SNMP.

8.2.7 IGMP Support for Multicast

IGMP is a standard feature in the CDD-564L. If enabled as an IGMP client, it responds to IGMP queries for the configured multicast routes. If enabled as an IGMP server, it generates IGMP queries and transmits multicast traffic per IGMP clients' request. If there are no active IGMP clients on the LAN, it will stop forwarding the multicast traffic (received from the satellite) to the LAN.

8.2.8 Static IP Routing for Unicast and Multicast

Up to 256 static routes can be entered into the CDD-564L to direct IP traffic over the satellite or to another device on the local LAN.

8.3 CDD-564L Features

Enhancing the CDD-564L performance is easy. Additional features can be added quickly on site, using the FAST access code purchased from Comtech EF Data. To enable these features, simply enter the code at the front panel.

- 3xDES Data Encryption
- IP Header Compression
- Payload Compression

8.3.1 3xDES Encryption with Ability to Change Keys

The CDD-564L optionally supports 3xDES-128 (using NIST certified 3x core) decryption for the highest-level security. For link encryption, each unit supports eight decryption keys.

8.3.2 IP Header Compression

Header Compression is also an optional feature of the CDD-564L. The CDD-564L supports Header Compression for the following Ethernet and Layer 3 & 4 Headers:

Supported Ethernet Headers
Ethernet 2.0
Ethernet 2.0 + VLAN-tag
Ethernet 2.0 + MPLS
802.3-raw
802.3-raw + VLAN-tag
802.3 + 802.2
802.3 + 802.2 + VLAN-tag
802.3 + 802.2 + SNAP
802.3 + 802.2 + SNAP + VLAN-tag
802.3 + 802.2 + SNAP + MPLS
Supported Layer 3&4 Headers
IP
TCP
UDP
RTP (Codec Independent)

Header Compression reduces the required VoIP bandwidth by 60 percent. Example: A G.729a voice codec, operating at 8 kbps, will occupy 32 kbps once encapsulated into IP framing on a LAN. Using IP/UDP/RTP Header Compression, the same traffic only needs 10.8 kbps total WAN satellite bandwidth to cross the link. A total maximum of 64 simultaneous VoIP calls can be compressed. Normal Web/HTTP traffic can be reduced an additional 10% via IP/TCP header compression.

Header Compression Configuration – Header Compression is completely independent from QoS, and there is no configuration required except enabling the Header Compression feature on both the sending and receiving Comtech EF Data IP modem. Packets with a Header Compression supported header will automatically be identified for compression. The only configuration consideration is the Header Compression Refresh Rate. This is how many compressed header packets will be sent before a single full header packet is sent. Some compressed header traffic could be lost during deteriorated satellite link conditions. Sending a full header packet will allow the return of the traffic stream. The Refresh Rate can be increased for poor satellite link conditions or decreased to further reduce overhead.

Header Compression Statistics - These statistics will display the total bytes of the pre-compressed and post-compressed traffic and effective compression ratio.

8.3.3 Payload Compression

Traffic optimization through Payload Compression is another optional feature of the CDD-564L.

- FAST feature to upgrade
- Uses AHA chip
- Compression algorithm applied to all data (HDLC header excluded).
- Compression statistics are fed back to QoS in order to maximize WAN utilization while maintaining priority, jitter and latency.
- 1024 simultaneous compression sessions to maximize compression across multiple distinct traffic flows.
- Compression algorithm not applied to RTP streams because this traffic is already compressed and would only INCREASE the satellite bandwidth if compressed again.
- Additional statistics have been added to the compression statistics menu in order to provide feedback on the compression efficiency that has been achieved.
- Payload Compression is selectable on a per route basis.

8.3.3.1 ADLC vs LZS Compression Comparison

These numbers have been generated using an internally created test program. This program takes the target benchmark files and splits the files into payload size chunks and compresses each chunk in a separate invocation of the compression algorithm. This is important to note because most compression algorithms are applied to the entire file data set as a single invocation of the compression algorithm, which is easier for other types of compression algorithms (LZS, GZIP in specific). This, of course, does not apply to streamed packet data across an IP network (FTP transfer, for example).

Algorithm	Payload size	File Set	Ratio
ADLC	1472	Calgary	1.76
ADLC	1000	Calgary	1.76
ADLC	500	Calgary	1.77
ADLC	100	Calgary	2.09
ADLC	1472	Canterbury	1.71
ADLC	1000	Canterbury	1.72
ADLC	500	Canterbury	1.74
ADLC	100	Canterbury	2.04
LZS	1472	Calgary	1.66
LZS	1000	Calgary	1.66
LZS	500	Calgary	1.68
LZS	100	Calgary	1.97
LZS	1472	Canterbury	1.61
LZS	1000	Canterbury	1.62
LZS	500	Canterbury	1.63
LZS	100	Canterbury	1.91

8.4 IP Module Specifications

Table 8-1. RFCs and Protocols

Supported RFC's and PROTOCOLS	
RFC 768 User Datagram Protocol	RFC 791 Internet Protocol
RFC 792 Internet Control Message Protocol	RFC 793 Transmission Control Protocol
RFC 826 An Ethernet Address Resolution Protocol	RFC 856 Telnet Binary Transmission
RFC 862 Echo Protocol	RFC 894 A Standard for the Transmission of IP Datagrams over Ethernet Networks
RFC 959 File Transfer Protocol	RFC 1112 Host Extensions for IP Multicasting
RFC 1213 Management Information Base for Network Management of TCP/IP-based internet: MIB-II	RFC 1812 Requirements for IP Version 4 Routers
RFC 2045 Multipurpose Internet Mail Extensions (MIME)	RFC 2236 Internet Group Management Protocol, Version 2
RFC 2474 Definition of the Differentiated Services Field (DS Field) in the Ipv4 and Ipv6 Headers	RFC 2475 An Architecture for Differentiated Services
RFC 2578 Structure of Management Information Version 2 (SMIv2)	RFC 2597 Assured Forwarding PHB Group
RFC 2598 An Expedited Forwarding PHB	RFC 2616 Hypertext Transfer Protocol – HTTP/1.1
RFC 2821 Simple Mail Transfer Protocol	RFC 3412 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
RFC 3416 Version 2 of the Protocol Operations for the Simple Network Management Protocol (SNMP)	RFC 3418 Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)

Notes:

Chapter 9. Typical IP Module Operational Setups

9.1 Overview

The CDD-564L with the integral IP Module has several modes of operation. This chapter shows examples of typical setups for the CDD-564L / IP Module to determine the best mode of operation for the appropriate network topology and Ethernet traffic environment.

9.2 Modem Compatibility

The CDD-564L is compatible with other Comtech EF Data IP modems (referred to hereafter as CDM-IP) provided the modems have similar operating modes and IP options. The following is a list of compatible CDM-IP modems:

CDD-564L IP SW Version	Comtech EF Data IP Modem IP SW Version	Additional Notes
Version 1.1.0 or later	CDM-IP 550 Version 1.3.0 or later	Must have Framer II Module (PL/9956-1) to support Data Compression IP option
Version 1.1.0 or later	CDM-IP 300L Version 1.3.0 or later	Must have Framer II Module (PL/9956-1) to support Data Compression IP option
Version 1.1.0 or later	CDM-570/570L Version 1.4.0 or later	

9.3 IP Module Working Modes

Typical CDM-IP modems support two Working Modes: easyConnect™ and Router Mode. **The CDD-564L only supports Router Mode, so the CDM-IP modem that is transmitting to CDD-564L must be in Router Mode.** Non-IP traffic is not supported in Router Mode.

Router Mode supports three HDLC Addressing Modes: Point-to-Point, Small Network, and Large Network. Separate HDLC Modes allows the user to minimize the HDLC overhead transmitted over the satellite based upon the size of their network. In Router/Point-to-Point Mode, no HDLC address is transmitted; Router/Small Network transmits 1 byte and Router/Large Network transmits 2 bytes as part of HDLC header for each packet.

This section describes the functionality of these modes in order to optimize the Comtech EF Data IP modems in the network, based upon Network Topology and Ethernet Traffic requirements.

IMPORTANT

The CDD-564L only supports Router Mode, so the CDM-IP modem that is transmitting to CDD-564L must be in Router Mode

The HDLC Address Mode of the Comtech EF Data IP modems must be identical to pass traffic between the TX modems and the CDD-564L.

Changing the HDLC Address Mode of the CDD-564L requires the IP Module to be rebooted. Before the user can select a different mode, the CDD-564L will notify the user that changing the mode will require a reboot.

Working Mode **HDLC Address Mode**	**Network Topology**	**Ethernet Traffic**
Router Mode **Point-to-Point**	Point-to-Point only Both sites on different LAN subnet	IP v4 only
Router Mode **Small Network**	Point-to-Point or Point-to-Multipoint (up to 254 sites) All sites on different LAN subnet	IP v4 only
Router Mode **Large Network**	Point-to-Point or Point-to-Multipoint (up to 32766 sites) All sites on different LAN subnet	IP v4 only

Feature Support - The CDD-564L also has several standard and optional features to further optimize security, performance and efficiency. The following table defines how these features are supported:

Standard Features	Additional Notes
HDLC Address Mode	Point-to-Point, Small Network, or Large Network
Access Lists	4 Clients by IP or IP Subnet
Multicast	RX all or specific Multicast streams
IGMP	IGMPv1, IGMPv2
Upgrade by FTP	By local LAN or remotely through satellite (requires a two way connection to CDD-564L)
*** Quality of Service**	Min/Max, Max/Priority, or DiffServ
Optional Features	**Additional Notes**
Header Compression	Must be enabled if any TX modem stream has Header Compression enabled.
Payload Compression	Must be enabled if any TX modem stream has Payload Compression enabled.
3xDES Encryption	Must be enabled if any TX modem stream has 3xDES Encryption enabled. Up to 8 Decrypt Keys or random

* Quality of Service (QoS) processing is performed by the transmit end of the link and passed through the IP Module in the CDD-564L. Support for QoS is a standard feature in CDD-564L.

9.3.1 Router – Point-to-Point Mode

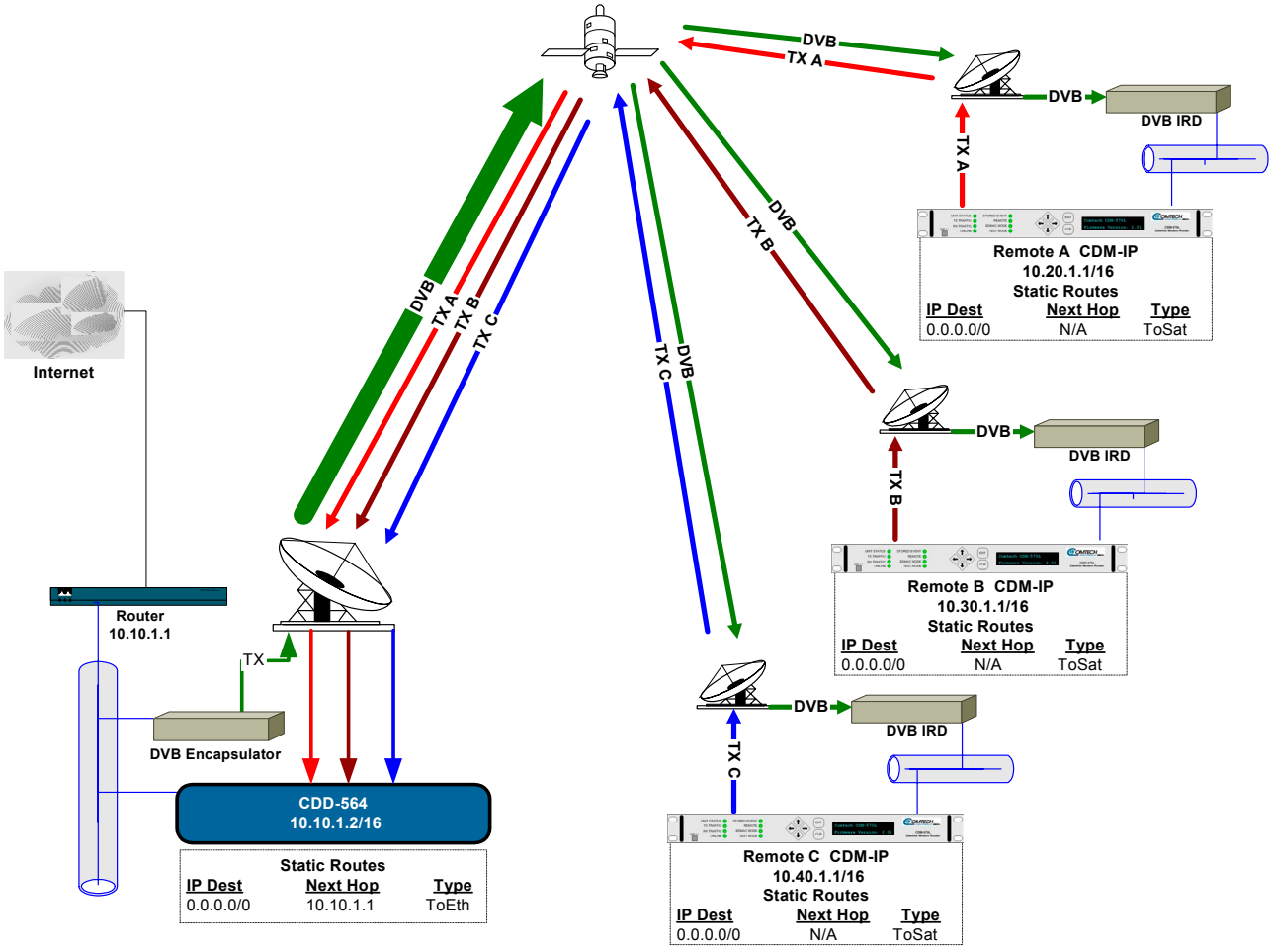


Figure 9-1. Router Mode, Point-to-Point Diagram

This diagram shows an example setup using the CDD-564L at a Hub site to receive three separate DVB return channels. The CDD-564L and all CDM-IP modems are in Point-to-Point Mode. Each remote site has a CDM-IP modem with a default static route. The CDD-564L has a default static route directing traffic to the hub router. The hub router would have routes defined for each remote network that would be directed to the DVB Encapsulator.

9.3.2 Router Working Mode – Point-to-MultiPoint

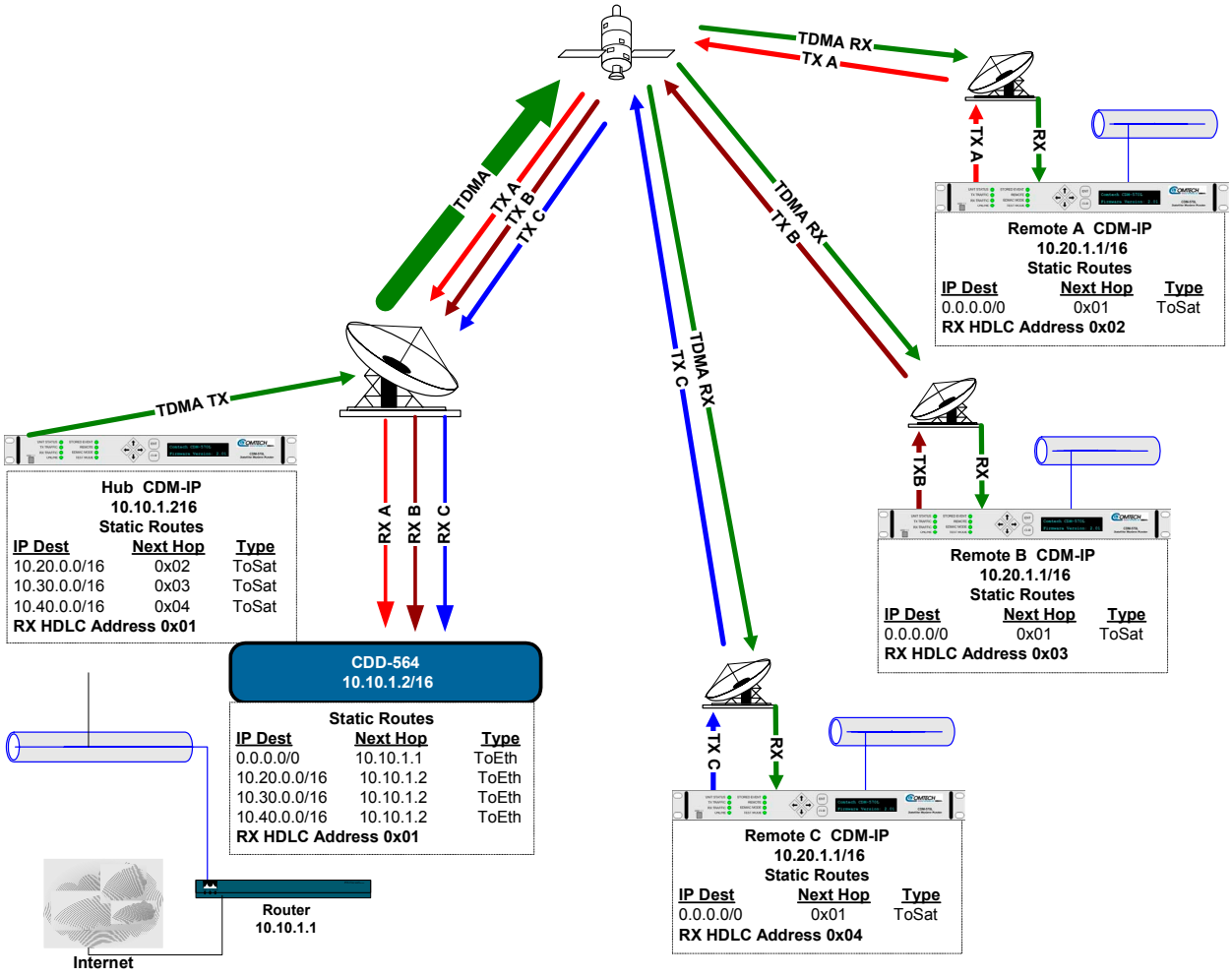


Figure 9-2. Router Mode, Point-to-Multipoint Diagram

"Star Network" Point-to-MultiPoint Configuration - Here, the Hub CDM-IP modem is transmitting a common STDMA carrier to three remote sites with CDM-IP modems. In turn, Remote CDM-IP is transmitting a link back to Hub that is received by the CDD-564L.

Since this is a Point-to-MultiPoint configuration, HDLC addressing is used so that the traffic not intended for a particular destination can be filtered (Small or Large HDLC Mode). For unicast traffic, it is best to associate a unique HDLC address for each site in the network. For this case, the Hub Site is HDLC 0x01, Remote A is HDLC 0x02, Remote B is 0x03, and Remote C is 0x04. Each CDM-IP modem would select the HDLC address associated with its site as a RX HDLC Address, so both CDM-IP modem and the CDD-564L at the Hub would have 0x01 as the first RX HDLC Address. Remote A CDM-IP would have 0x02, B would have 0x03, and C would have 0x04.

The remote CDM-IP modems only need a single default route to is directed to the Hub HDLC, 0x01. All of the traffic is managed by the static route entries in the hub CDM-IP and CDD-564L. The CDD-564L has a default route to the router for Internet access. It also has specific routes for the remote networks which are directed to the Hub CDM-IP. The Hub CDM-IP also has specific routes for the remote networks with the HDLC address associated with each site.

Chapter 10. IP Module - CLI and Telnet Operation

10.1 Overview

This section defines the user menu system provided by the console interface via a Terminal Emulator or via the Ethernet interface using Telnet. In the process of configuring each parameter, an overview of the parameter and its impact on the configuration of the CDD-564L is provided.

When connecting via a Terminal Emulator, the user should be physically attached to the Console Port of the IP Module. The terminal emulator should be configured to match the console port setting. The default console port setting is 38,400 bps, 8 data bits, no parity, 1 stop bit and no flow control.

When connecting via telnet, the user must have network connectivity to the Traffic Ethernet Port of the CDD-564L. This connectivity can be via a local LAN, a remote LAN, or via a satellite link from another IP modem. The Ethernet Speed Mode is a configurable parameter of the CDD-564L and thus its exact setting can vary between specific installations.

The CDD-564L does not allow concurrent access to the menu via telnet and the console port. If a user connects via telnet, CDD-564L automatically disables the console port for the duration of the Telnet session. All menu pages allow a Telnet logout to end a Telnet session. Also, the CDD-564L will automatically end a Telnet session after a period of inactivity (configurable from 1 to 60 minutes).

Any changes made to the CDD-564L IP parameters will be lost if the CDD-564L is reset or loses power unless the changes are saved to permanent storage. This applies to all of the IP parameters. The IP parameters can be saved by selecting "**S**", available on any CLI/Telnet Menu page.

All demodulator parameters configured via the CLI or Ethernet interface will be automatically stored in the CDD-564L unit non-volatile RAM and will be retained if there is a power loss.

The CLI and Telnet Access Levels are defined as follows:

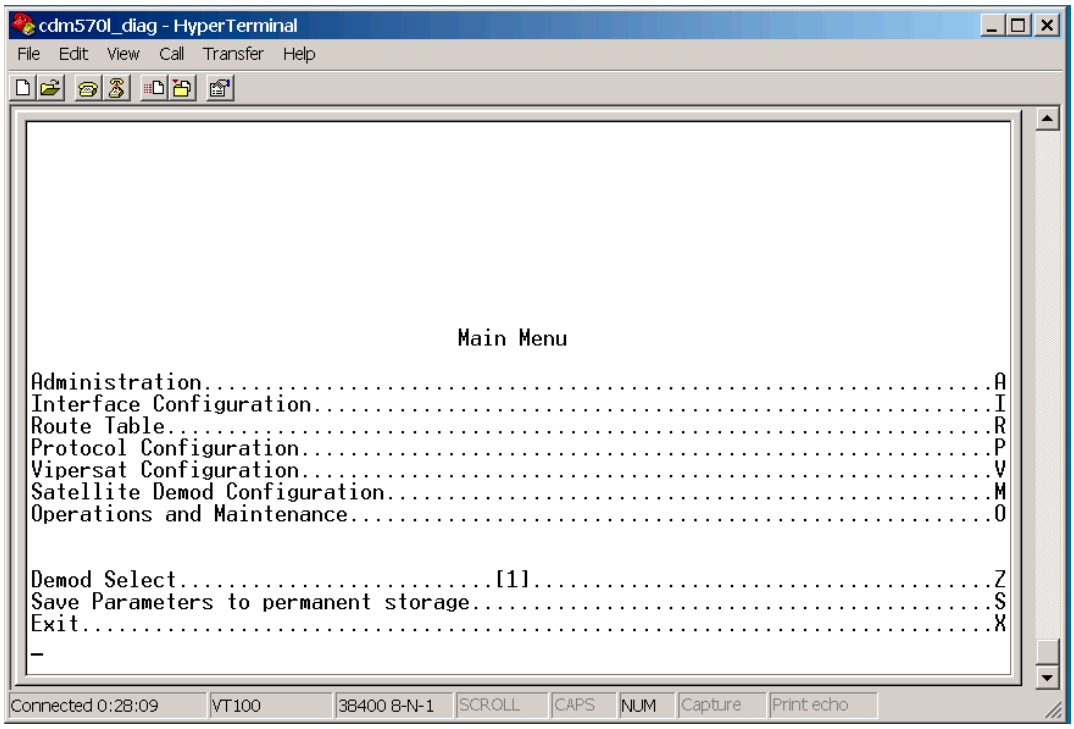
User Interface	**User Login Access Level**		
	Admin User	**Read/Write User**	**Read Only User**
CLI (direct to console port)	Full Access – no Login		
Telnet	Full Access all Menus	No Access to Admin Menu Full Access all other Menus	No Access

Default Name/Passwords are:

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

10.2 Main Menu Page

Menu pages are followed by a table listing the Menu Options/Fields, required Entry, and Descriptions.



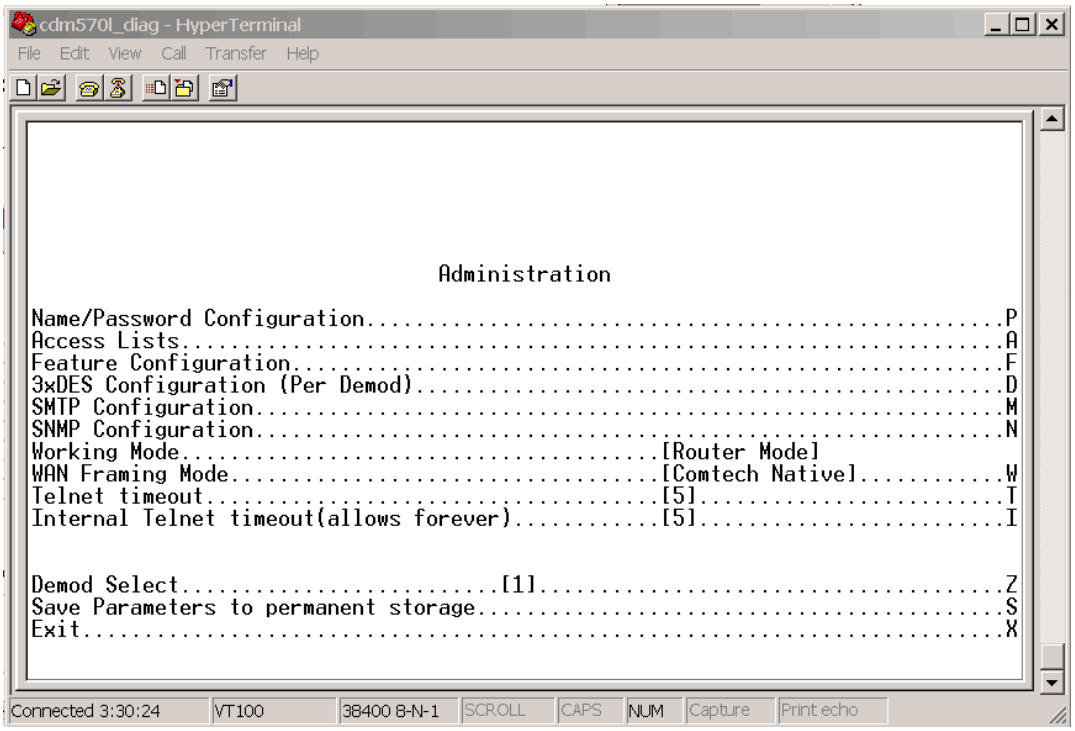
The *Main Menu* page has the following options/fields:

Menu Options/Fields	Entry	Description
Administration	**A**	The Administration menu provides a basic set of standard admin functions to the CDD-564L. When connected via telnet, navigation to this menu will be restricted to the admin user.
Interface Configuration	**I**	Allows the user to configure the Ethernet and Satellite interfaces.
Route Table	**R**	Allows a user to define how the CDD-564L will route packets that it receives on its Ethernet and Satellite interfaces.
Protocol Configuration	**P**	The Protocol Settings option allows the user to configure various protocols used by the CDD-564L. These protocols currently include ARP and IGMP.
Vipersat Configuration	**V**	Only used when the CDD-564L is used in a Vipersat system.

Menu Options/Fields	Entry	Description
Satellite Demod Configuration	**M**	The Modem Parameters option displays a set of menus that allows a user to configure and monitor the satellite base unit.
Operations and Maintenance	**O**	The Operations & Maintenance Menu allows a user to configure various options used to control and maintain the system. Also has diagnostic tools for troubleshooting and Statistics.
Save Parameters	**S**	This option allows a user to save the current configuration of the IP Module to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.1 Administration Page

The *Administration* page is activated from the *Main Menu* page.



IMPORTANT

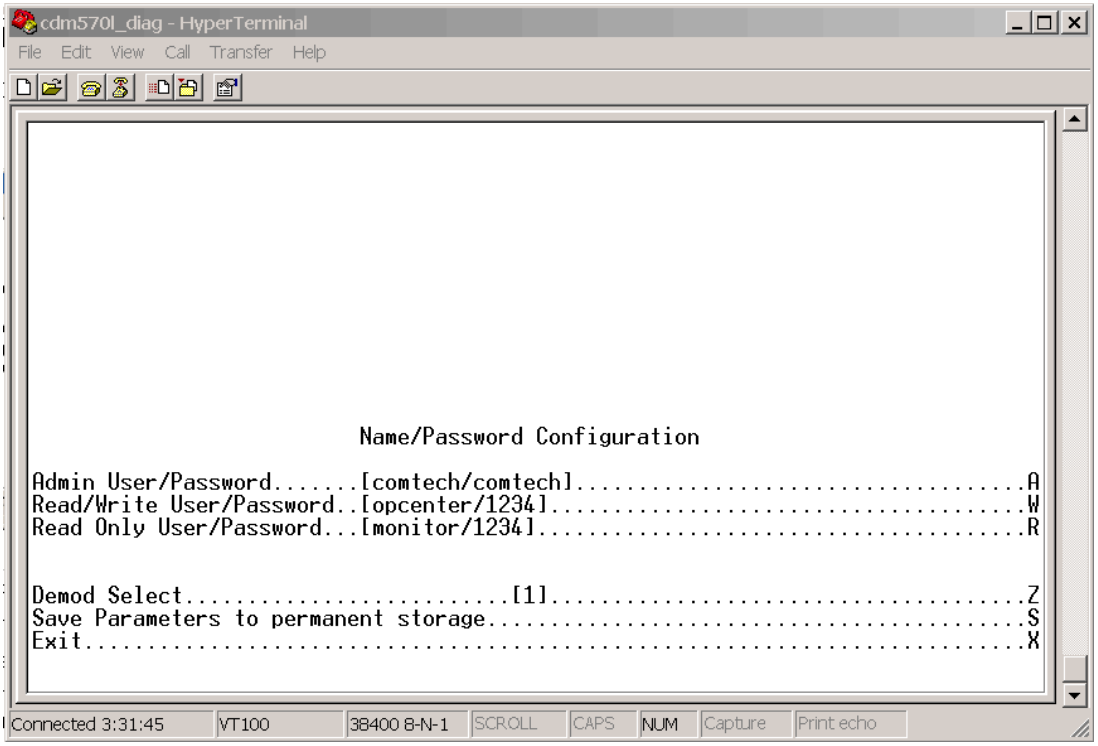
Access to the Administration page is restricted to the Admin user when connecting via the Telnet, SNMP, or HTTP interface. The Administration page is available when connected via the Terminal Emulator (serial) connection because there is no log in.

The *Administration* page contains the following options/fields.

Menu Options/Fields	Entry	Description
Name/Password Configuration	**P**	Activates *Name/Password Configuration* page. Allows the user to define the user name and passwords that are required in order to access the management interfaces.
Access Lists	**A**	Activates *Access Lists* page. Allows the user to restrict access to the management interfaces based upon the requester's IP address.
Feature Configuration	**F**	Activates *Feature Configuration* page.
3xDES Configuration	**D**	The 3xDES Configuration page allows the user to determine if 3xDES encryption is enabled on a device and if so, the 3xDES keys that are used to decrypt traffic. The keys specified for the transmit function are completely independent for the 3xDES keys specified for the receiver function.
SMTP Configuration	**M**	The SMTP configuration page allows the user to specify appropriate settings for SMTP email server.
SNMP Configuration	**N**	The SNMP configuration page allows the user to specify management parameters for SNMP.
Working Mode		Read-Only
WAN Framing Mode	**W**	Comtech Native – CEFD Proprietary Framing
Telnet Timeout	**T**	The Telnet timeout determines how many minutes (1-60) of Telnet inactivity before the Telnet session is automatically terminated.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.1.1 Name/Password Configuration Page

The *Name/Password Configuration* page is activated from the *Administration* page. This option allows a user to define the passwords required to access via HTTP, FTP, SNMP, and TELNET.



IMPORTANT

All Usernames and Passwords are case sensitive.

There is a minimum of 1 and maximum of 11 characters.

Any or all of the Usernames and Passwords can be removed by entering “NONE NONE” from the CLI or Telnet.

Removing all Usernames and Passwords would only allow access to the IP functions when connected via the Terminal Emulator (serial) connection (because there is no log in).

FTP access is restricted to Admin Username/Password only. FTP is only used to upgrade the IP SOFTWARE or to load or retrieve the IP Parameter file.

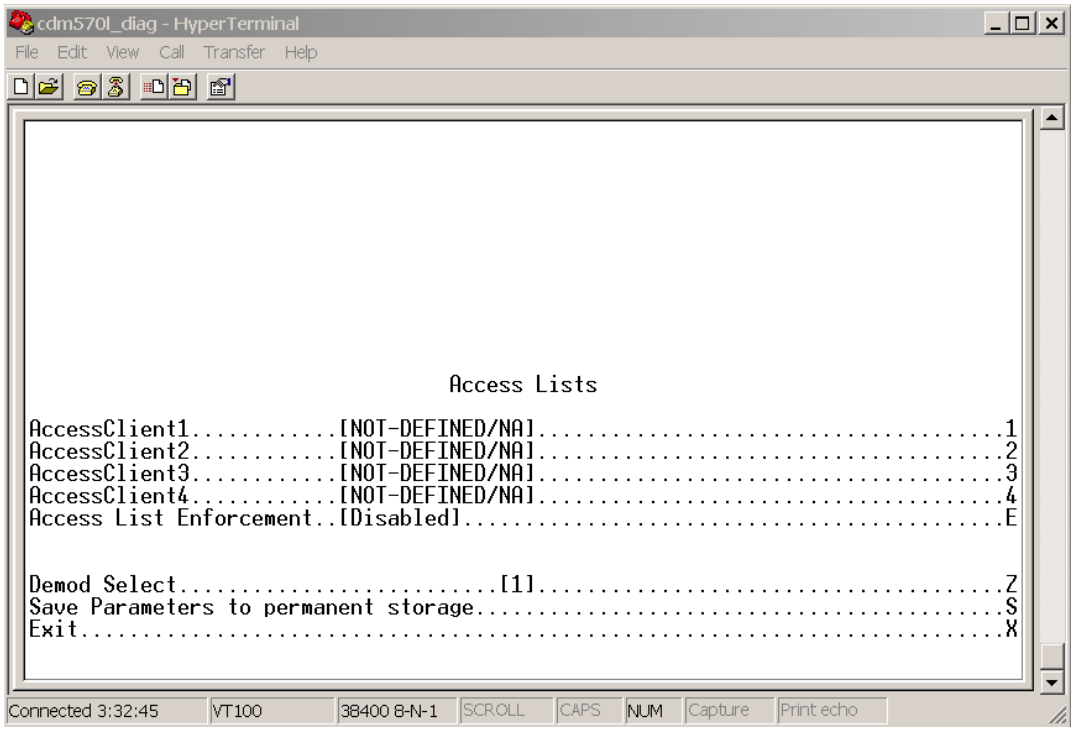
The *Name/Password Configuration* page contains the following options/fields:

Menu Options/Fields	Entry	Description
Admin User/Password	**A**	Enter the user name and password with a space delimiter. Ex: <user> <passwd> Enter NONE NONE to erase

Menu Options/Fields	Entry	Description
Read/Write User/Password	**W**	Enter the user name and password with a space delimiter. Ex: <user> <passwd> Enter NONE NONE to erase
Read Only User/Password	**R**	Enter the user name and password with a space delimiter. Ex: <user> <passwd> Enter NONE NONE to erase
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.1.2 Access Lists Page

The *Access Lists* page is activated from the *Administration* page. This page allows the user to limit monitor and control access to the unit from a specified list of authorized clients.



IMPORTANT

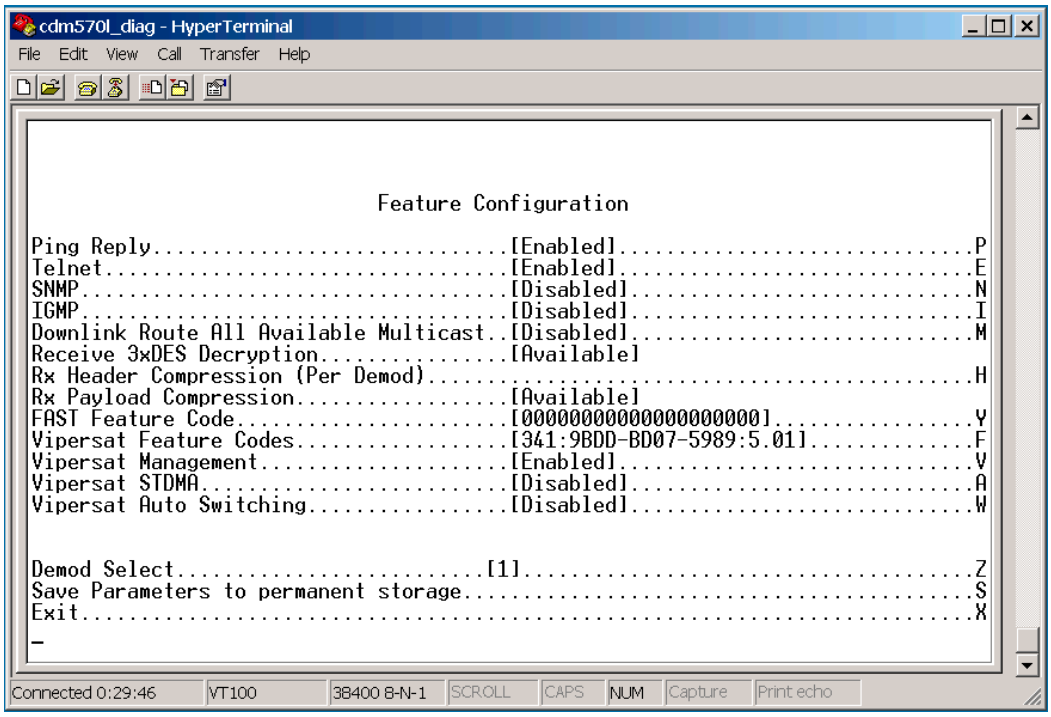
If connecting to the IP modem (or demodulator) remotely, the IP address of the machine used to manage the IP modem should be included in the Access List.

The *Access Lists* page contains the following options/fields:

Menu Options/Fields	Entry	Description
AccessClient1 - 4	**1 - 4**	The Access Client list allows a user to define which remote clients can connect when the Access List Enforcement is enabled. Each entry allows a user to specify an IP Address or a subnet mask to define a unique class of machines that are allowed access. For example, if a user wanted to grant access to a PC with an IP Address of 10.10.10.1 and any PC on a subnet of 192.168.10.xxx, then the Access List would be defined as: AccessClient1 …[10.10.10.1/32] AccessClient2…. [192.168.10.0/24]
Access List Enforcement	**E**	The Access List Enforcement allows a user to grant access via ping, telnet, HTTP, FTP, and SNMP to a well-defined list of client machines. Access List Enforcement toggles between [Enabled] and [Disabled]. If disabled, then any client machine will be able to connect via ping, telnet, HTTP, FTP, and SNMP. If enabled, then only those machines specified in the Access Client List will be allowed to connect via ping, telnet, HTTP, and SNMP.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.1.3 Feature Configuration Page

The *Feature Configuration* page is activated from the *Administration* page.



The Feature Configuration menu communicates to the user the current availability for each of the features. If a feature is marked “Unavailable” then the feature is a FAST feature. FAST features must be purchased from Comtech EF Data.

The Feature Configuration menu contains the following options/fields:

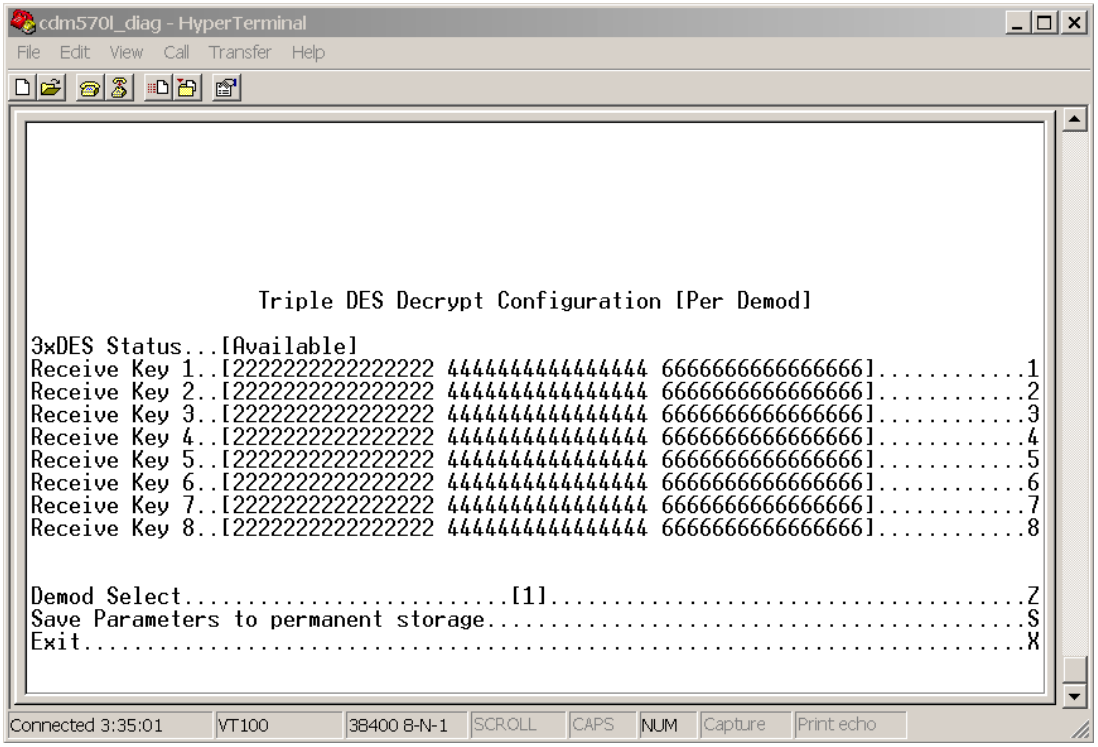
Menu Options/Fields	Entry	Description
Ping Reply	**P**	Toggles [Enabled] and [Disabled] Enabled tells the CDD-564L to respond to ping requests directed to the CDD-564L Ethernet Interface. Disabled tells the CDD-564L not to respond to ping requests. This is used as a security feature to prevent unauthorized parities from determining if a device exists via the ping utility.
Telnet	**E**	Toggles [Enabled] and [Disabled] Enabled allows access via Telnet. Disabled denies access via Telnet.

Menu Options/Fields	Entry	Description
SNMP	**N**	Toggles [Enabled] and [Disabled] Enabled tells the CDD-564L to respond to SNMP requests against the private and public MIB. Disabled tells the CDD-564L not to respond to SNMP requests against the private and public MIB.
IGMP	**I**	Toggles [Enabled] and [Disabled] The receive portion of a CDD-564L will utilize the CDD-564L as an IGMP server. The transmit portion of a CDD-564L will utilize the CDD-564L as an IGMP client. The *IGMP Information* page configures the CDD-564L to report an interest to join a Multicast group on an IGMP server. The IGMP protocol is used to regulate Multicast traffic on a LAN segment to prevent information of no interest from consuming bandwidth on the LAN.
Downlink Route All Available Multicast	**M**	Toggles [Enabled] and [Disabled] Enabled tells the CDD-564L to route all Multicast packets coming from the Satellite interface to the Ethernet LAN regardless of the Route Table entries. Disabled tells the CDD-564L not to automatically forward all Multicast packets. This CDD-564L will only forward multicast traffic received from the satellite to the Ethernet port if the multicast route exists in the Route Table.
Receive 3XDES Decryption	**Read Only**	This feature must be purchased. Available allows the CDD-564L to decrypt packets being received from the Satellite Interface. When Unavailable the CDD-564L cannot decrypt packets received from the Satellite Interface. This option is auto-sensed by a bit carried in packet headers. This option is always available if the option is purchased.
Rx Header Compression	**K**	This option tells the system to expect received streams to be Header compressed. Note a CDM-IP modem (or demodulator) must receive all streams compressed or not compressed. The modem has no way to distinguish between compressed or not compressed.
Rx Payload Compression	**Read Only**	Receive payload compression option allows a unit receiving a stream of data that has been payload compressed to be correctly uncompressed. This option is auto-sensed by a bit carried in packet headers. This option is always available if the option is purchased.
Vipersat Feature Codes	**F**	This option allows a user to enter a Vipersat features enable code that has been provided by Comtech Vipersat for modem (or demodulator) configured to operate under VMS control.

Menu Options/Fields	Entry	Description
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.1.4 3xDES Encrypt Configuration Page

The *3xDES Encrypt/Decrypt Configuration* page is activated from the *Administration* page.



Note: This menu will only be accessible if the 3xDES FAST feature has been purchased and the license key has been entered.

The *3xDES Encrypt Configuration* contains the following options/fields:

Menu Options/Fields	Entry	Description
3xDES Status	**Read Only**	Displays status, [Available] or [Unavailable]. Available is displayed when the 3xDES feature has been installed. Unavailable is displayed when the 3xDES feature has not been installed.

Receive Decrypt Enabled	**Read Only**	Displays feature status. This field updates via the *Features Configuration* menu.
Receive Key 1 - 8	**A through H**	These 3xDES keys are used to decrypt traffic being received from the Satellite Interface. The key is entered in HEX (48 digits max)
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

IMPORTANT

A 24 Byte [192-bit] 3xDES key is actually a combination of 3 single DES keys of 8 Bytes [64-bits]. The CLI will display the Key with a space separating the Key into 3 sections. In the screen capture above, Transmit Key 1 is displayed as:

2222222222222222 4444444444444444 6666666666666666

Consider the first section as Key1A, the second as Key1B, and the third as Key1C.

Data is first encrypted with Key1A and then decrypted with Key1B and again encrypted with Key1C. So if a user specifies all the three Keys the same, (like 48 '1's OR all the characters in DES key the same) the cumulative effect of 3xDES is just a single DES. When data is first encrypted with Key1A and decrypted with Key1B we get back the original data and then when encrypted with Key1C results in a total effect of single DES key.

Because of this, the user is required to enter unique 64-bit keys. If any 2 sections of the Key match, the CDD-564L will respond `Invalid Key - Please Re-enter`

Also, The Least Significant bit of each byte in a 24 Byte [192-bit] 3xDES key is reserved for the DES Algorithm for parity. Entries of 1, 3, 5, 7, 9, B, D, or F will have all the corresponding bit positions masked. So a Key entry of:

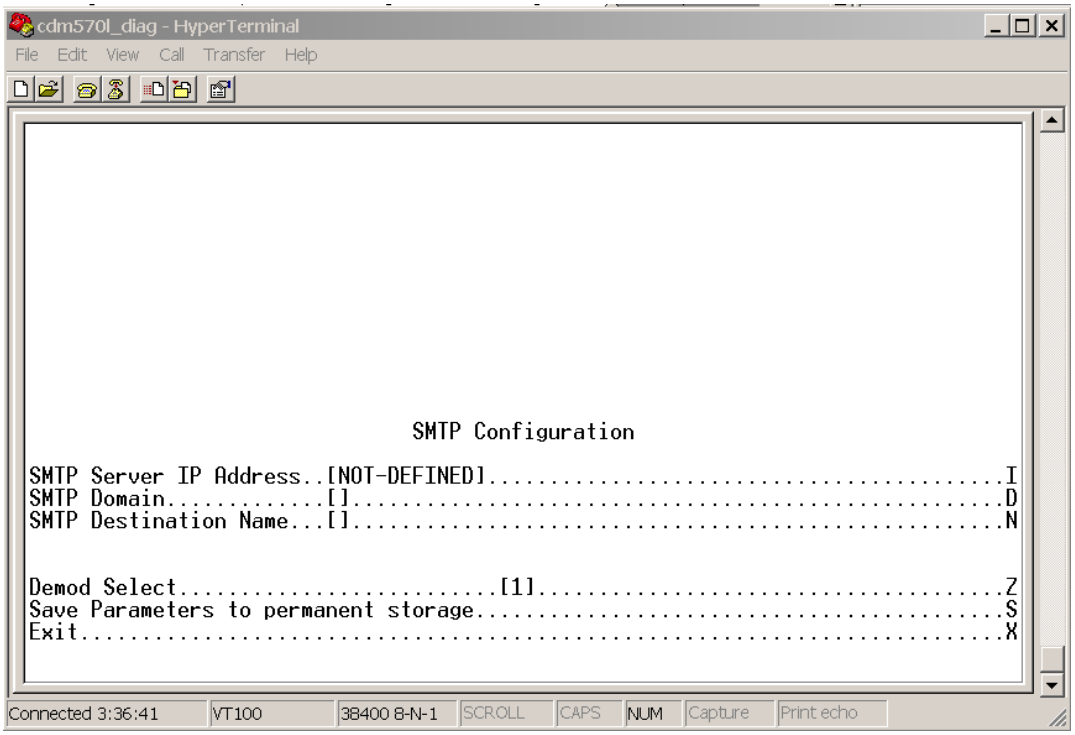
1111111133333333 5555555577777777 99999999BBBBBBBB

becomes

1010101032323232 5454545476767676 98989898BABABABA

10.2.1.5 SMTP Configuration Page

The *SMTP Configuration* page is activated from the *Administration* page.



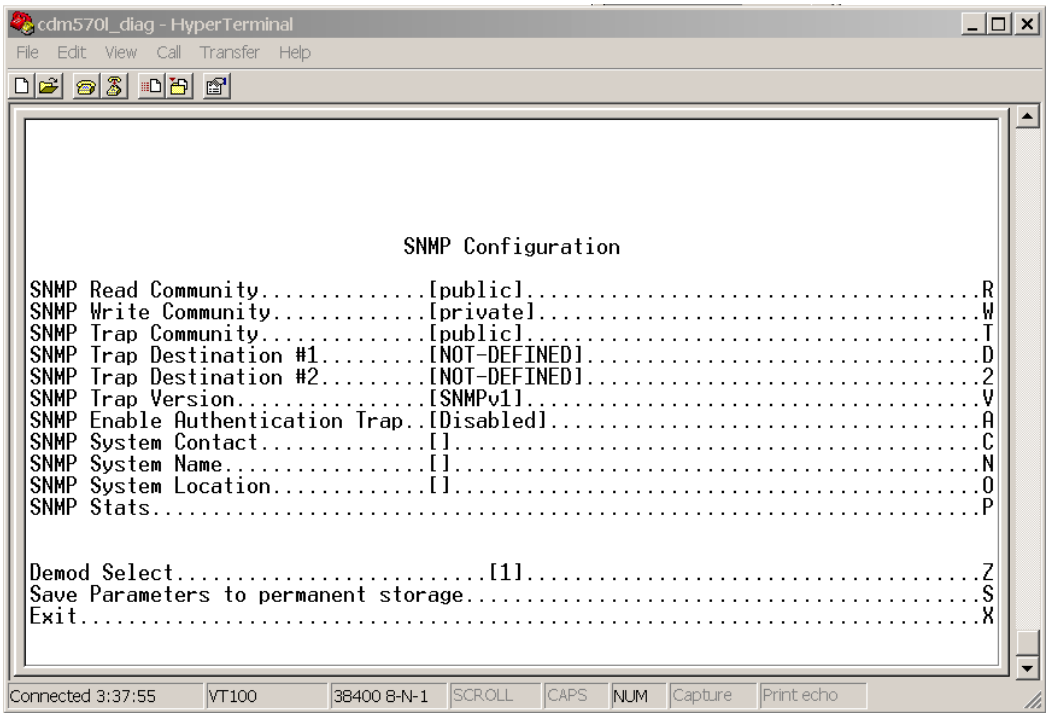
The SMTP Configuration contains the following options/fields:

Menu Options/Fields	Entry	Description
SMTP Server IP Address	**I**	The mail server address from where you want to send the email.
SMTP Domain	**D**	Set to the domain of the email server (usually found to the right of the @ symbol in an email address).
SMTP Destination Name	**N**	Set the email recipient names (usually found to the left of the @ symbol in an email address).
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

Note: SMTP can be used to send an email to Comtech EF Data IP Modem Support cdmipsupport@comtechefdata.com using the Support Web page by connecting to the CDD-564L with a Web Browser. The Support Web page allows you to compose an email message for questions or problems with the CDD-564L. The user can also select to automatically attach the CDD-564L parameter file in order to facilitate troubleshooting or to resolve configuration issues.

10.2.1.6 SNMP Configuration Page

The *SNMP Configuration* page is activated from the *Administration* page.



The SNMP Configuration contains the following options/fields:

Menu Options/Fields	Entry	Description
SNMP Read Community	**R**	GET community - allows GET operations to all portions of the CDD-564L Controller and CDD-564L Quad Demodulator MIBs.
SNMP Write Community	**W**	SET community string - allows SET operations to all portions of the CDD-564L Controller and CDD-564L Quad Demodulator MIBs.
SNMP Trap Community	**T**	Community String that will be set in the Community field of all outgoing traps. This field on the trap PDU may be checked by the network manager application to determine if the trap came from a “trusted” agent.

Menu Options/Fields	Entry	Description
SNMP Trap Destination	**D**	IP address where all traps/notifications will be sent. If a network management application is running in the network, it should be configured to receive traps and its IP address should be entered here.
SNMP Trap Version	**V**	Determines whether an SNMPv1 trap or SNMPv2 notification is sent.
SNMP Enable Authentication Trap	**A**	Determines whether a MIB2 authentication trap will be sent when a PDU with an invalid community string is encountered. A community string is invalid when it does not match the Admin, the Read Write, or the Read Only community strings.
SNMP System Contact	**C**	User defined SNMP Contact information.
SNMP System Name	**N**	User defined SNMP Name information.
SNMP System Location	**O**	User defined SNMP Location information.
SNMP Stats	**N**	Displays statistics concerning the operation of the SNMP agent (number of IN SNMP packets, number of OUT SNMP packets, number of OUT Traps, etc.)
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.1.7 Working Mode

The *Working Mode* page is activated from the *Administration* page.

The CDD-564L only supports Router.

10.2.1.8 WAN Framing Mode

The *WAN Framing Mode* page is activated from the *Administration* page.

The WAN Framing Mode contains the following option/field:

Menu Options/Fields	Entry	Description
WAN Framing Mode	**C**	Select 1 [Comtech Native] or 2 [SMR5000 Compatibility]. Comtech Native – default operating mode. In this mode the CDD-564L will communicate with another CDD-564L , or a compatible CDM-IP 550 or CDM-IP 300L.

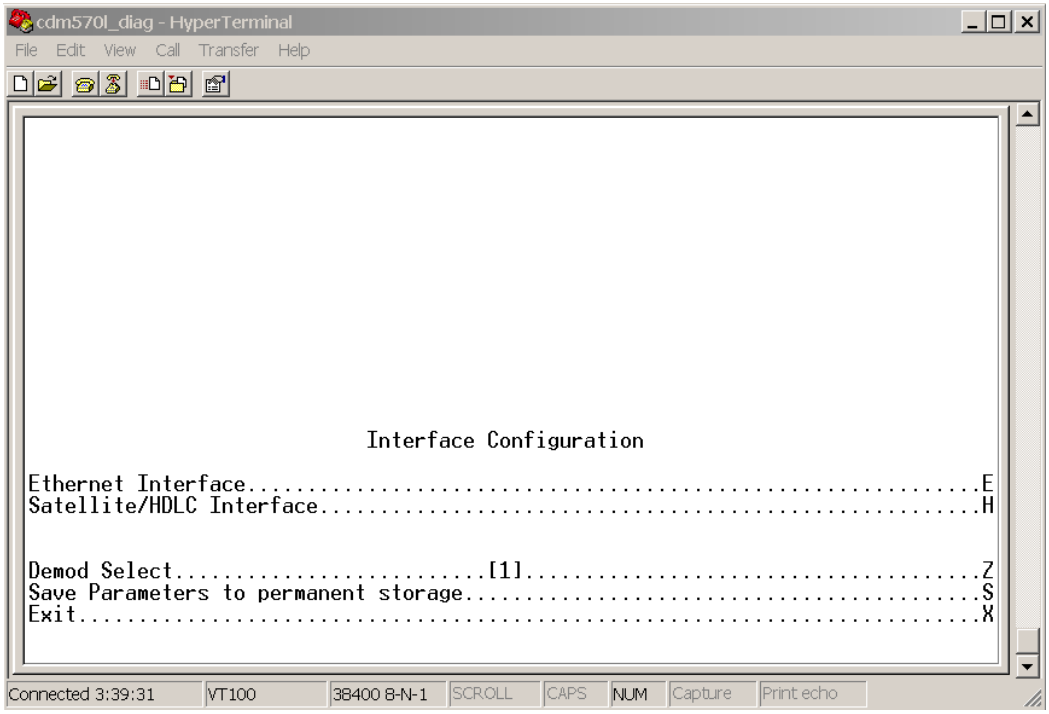
10.2.1.9 Telnet Timeout

The Telnet timeout determines how many minutes (1-60) of Telnet inactivity before the Telnet session is automatically terminated by the CDD-564L.

The CDD-564L does not allow concurrent access to the menu via telnet and the console port. If a user connects via telnet, CDD-564L automatically disables the console port for the duration of the Telnet session. All menu pages allow a Telnet logout to end a Telnet session. Also, the CDD-564L will automatically end a Telnet session after a period of inactivity (configurable from 1 to 60 minutes).

10.2.2 Interface Configuration Page

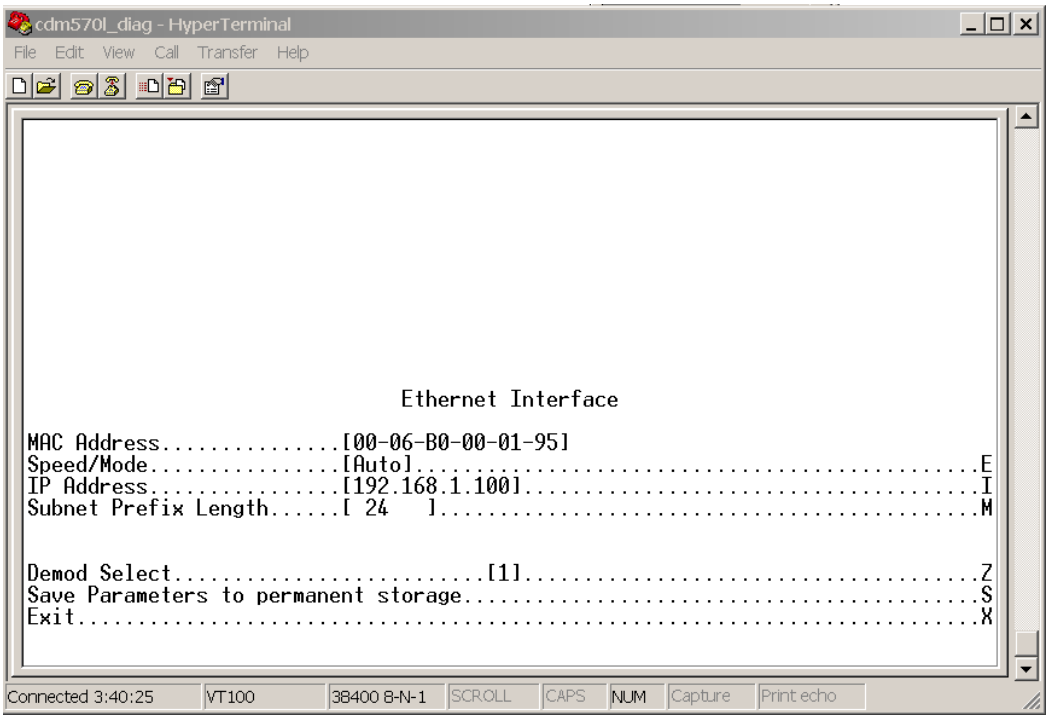
The *Interface Configuration* page is activated from the *Main Menu* page.



The Interface Configuration page contains the following options/fields:

Menu Options/Fields	Entry	Description
Ethernet Interface (fei0)	**E**	Activates *Fast Ethernet* page.
Satellite/HDLC Interface (hdl0)	**H**	Activates *Satellite/HDLC Interface* page.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.2.1 Fast Ethernet Interface (fei0) Page



The *Fast Ethernet Interface* page is activated from the *Interface Configuration* page.

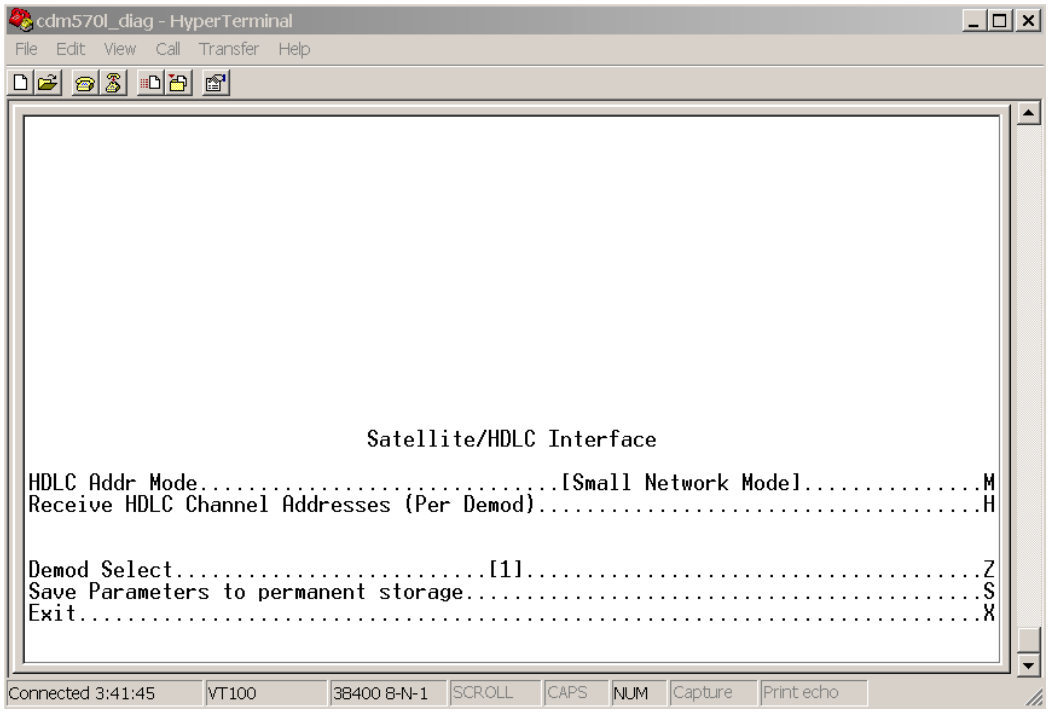
The *Fast Ethernet Interface* page contains the following options/fields:

Menu Options/Fields	Entry	Description
MAC Address	**Read Only**	The MAC Address defines the hardware destination MAC Address that is used when an Ethernet packet is destined for the CDD-564L Traffic Ethernet Interface. This address is unique and has been assigned permanently at the factory.
Speed/Mode	**E**	The Ethernet Speed Mode is a configurable parameter and thus its exact setting can vary between specific installations. The default setting allows the Ethernet port to auto negotiate its link speed on power-up. Selections are: 1 -- Auto 2 -- 10 MB/sec Half Duplex 3 -- 100 MB/sec Half Duplex 4 -- 10 MB/sec Full Duplex 5 -- 100 MB/sec Full Duplex
IP Address	**I**	This is the IP Address assigned the Ethernet Traffic Interface. Enter the IP address in aaa.bbb.ccc.ddd format
Subnet Prefix	**M**	Specifies the Subnet Mask assigned to the Ethernet Traffic

Menu Options/Fields	Entry	Description
Length		Interface. Enter the subnet mask prefix length (8...30)
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.2.2 Satellite/HDLC Interface (HDL0) Page

The *Satellite/HDLC Interface (HDL0)* page is activated from the *Interface Configuration* page.



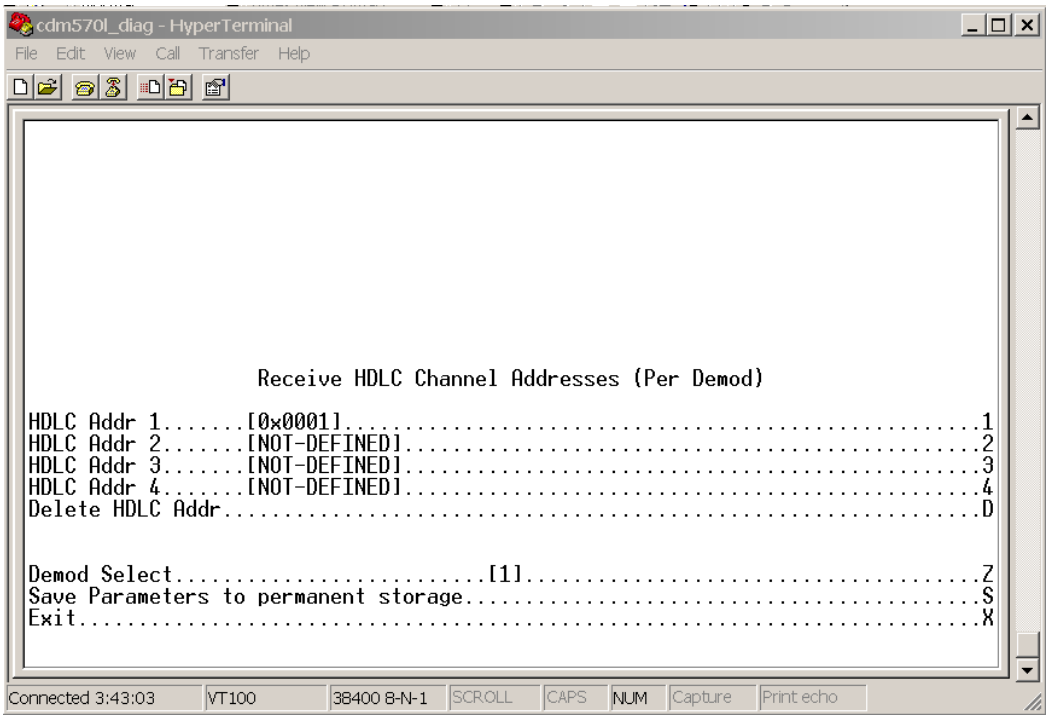
The Satellite/HDLC Interface page contains the following options/fields:

Menu Options/Fields	Entry	Description
HDLC Addr Mode	**M**	Toggles [Point-To-Point Mode], [Small Network Mode], and [Large Network Mode] Point-To-Point Mode – In this mode of operation, no HDLC address is transmitted over the satellite link. The restrictions on using this mode are that it can only be used for pure Point-to-Point configurations. Small Network Mode (up to 254 addresses) - In this mode of operation a single byte HDLC address will be transmitted over the satellite link (0x1 – 0xFE). Large Network Mode (up to to 32766 addresses) - In this mode of operation a two byte HDLC address will be transmitted over the satellite link (0x1 – 0xFFFE).
Receive HDLC Channel Addresses	**H**	Activates *Receiver HDLC Addresses* page.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.2.3 Receiver HDLC Addresses Page

The *Receiver HDLC Addresses* page is activated from the *Satellite/HDLC Interface* page.

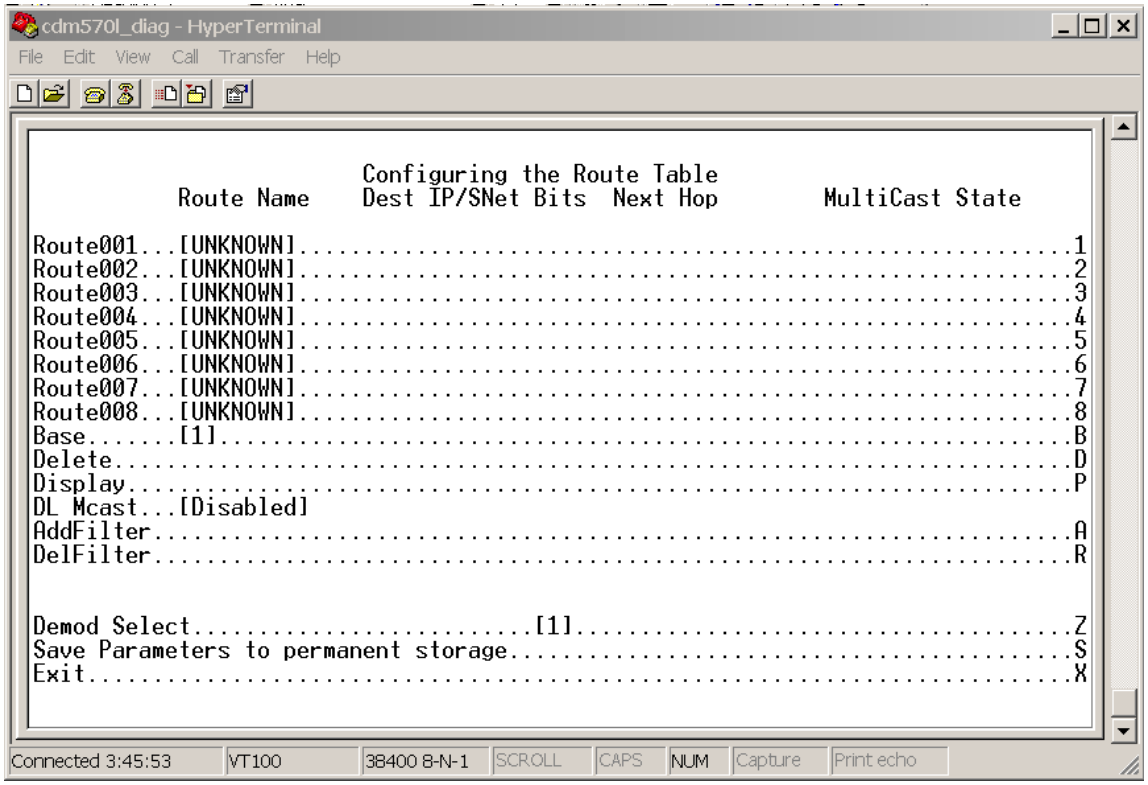
This page allows the user to define up to four HDLC addresses that can carry user information on the Satellite Interface.



The *Satellite/HDLC Interface* page contains the following options/fields:

Menu Options/Fields	Entry	Description
HDLC Addr 1 - 4	**1 - 4**	HDLC address in hex <1 - 7FFE, enter = 0001> **Note:** HDLC addresses are not used in Point-To-Point Mode. Small Network Mode (up to 254 addresses) - The user is limited to valid addresses between the values of 0x01 and 0xFE. Large Network Mode (up to 32766 addresses) - The user is limited to valid addresses between the values of 0x0001 and 0x7FFE.
Delete HDLC Addr	**D**	Enter the HDLC entry to delete <1...4>
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.3 Route Table Configuration Page



The *Route Table Configuration* page is activated from the *Main Menu* page.

IMPORTANT

Do not operate a CDM-IP modem satellite link where both IP modems have a Default Route to the satellite. For example, if both IP modems had this Route Table entry:

IP Dest	Next Hop	Type
0.0.0.0/0	Point-to-Point	ToSat

In this setup, any traffic forwarded by an IP modem that did not have a valid IP host at the remote LAN would then be resent by the remote IP modem. This traffic would continue to be forwarded until the TTL expired. This “routing loop” will limit the performance of the IP modem by wasting satellite bandwidth.

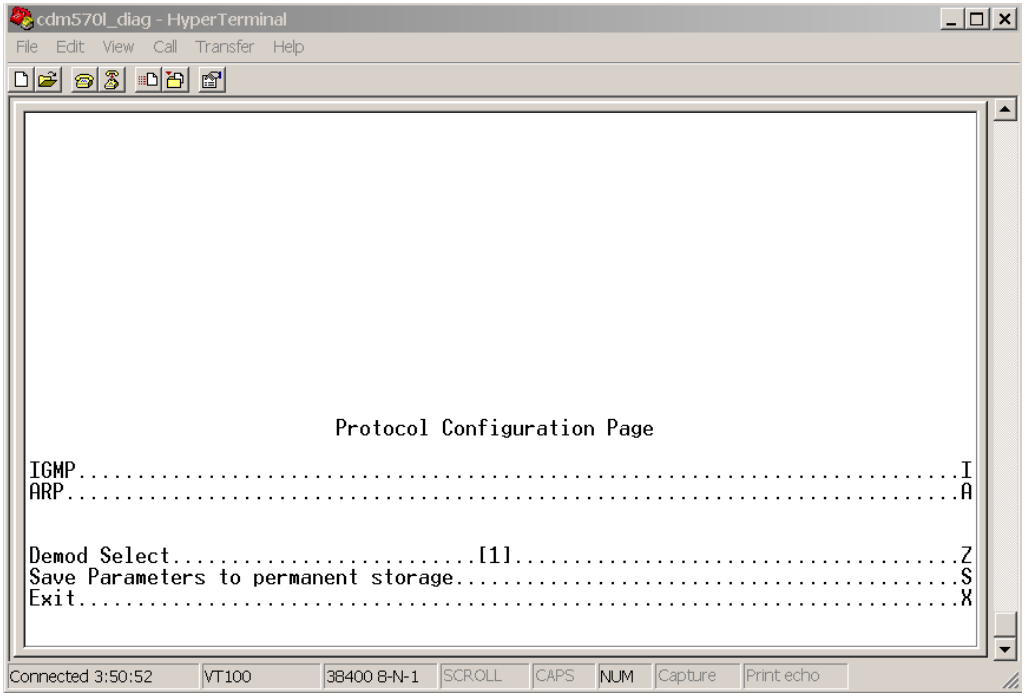
The *Route Table Configuration* page contains the following options/fields:

Menu Options/Fields	Entry	Description
Route001-Route008 (256) (The 8 currently displayed routes, up to 256 can be defined)	**1-8**	Route Table allows user to define how packets the IP Module receives are routed. Defining an entry in this table is similar to using 'route add' command of machines that support that command. For each route, the user must define: 1. A name assigned by the user to reference the route. The assigned name cannot contain any whitespace and must be unique. 2. The destination address of an IP packet of interest. The number of network addresses that are governed by the selected destination entry, i.e., subnet mask. The Next Hop IP address. This is the IP where the packet will be routed for further processing. The Next Hop IP Address for traffic to be sent over the satellite will be the desired HDLC address. Point-to-Point – no HDLC address Small Network - 0x1 – 0xFE Large Network – 0x1 – 0x7FFE Also, a route can be defined to have IP Module send traffic to another IP address on the same subnet as the Ethernet interface. **Optionally**: If the user enters a multicast address (224.0.0.0-239.255.255.255) as the destination IP address, then the following parameters will be requested: Route MultiCast packets from Ethernet to Satellite? [y/n] The option allows the user to specify if multicast packets that match the provided IP address will be routed from the Ethernet to Satellite. “No” means that the packets will be discarded. Route MultiCast packets from Satellite to Ethernet? [y/n] The option allows the user to specify if multicast packets that match the provided IP address will be routed from the Satellite to Ethernet. “No” means that the packets will be discarded. Multicast Routes always have a subnet length of 32 and the next hop is 0.0.0.0 because it is not applicable. **Note:** The IP Module does allow the specification of one and only one default route. Destination IP = 0.0.0.0 Subnet Length = 0. The default route can be defined to send traffic to either the Satellite or Ethernet interface. This will cause all packets that do not match any other route to be sent to the destination you have defined for further processing.

Menu Options/Fields	Entry	Description
Base	**B**	The Route Table menu allows the user to view up to 8 different routes per screen. To allow editing on any of the 256 entries that can be defined, the user can select a base address to control which 8 routes are displayed. For example, if the user wants to edit Routes 32-40, then a Base value of 32 should be defined.
Delete Route	**D**	Route Name to delete.
Display	**P**	Displays all of the routes that are currently defined in the system. This will include automatically generated routes that are provided to simplify provisioning of the system. The information displayed is: Route Name, DestIP/SnetBits, Next Hop, HDLC, and Flags.
Downlink Mcast	**Read Only**	Read only status of Downlink Multicast (Enabled or Disabled). This feature is enabled or disabled on the Administrator Feature page.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.4 Protocol Configuration Page

The *Protocol Configuration* page is activated from the *Main Menu* page.



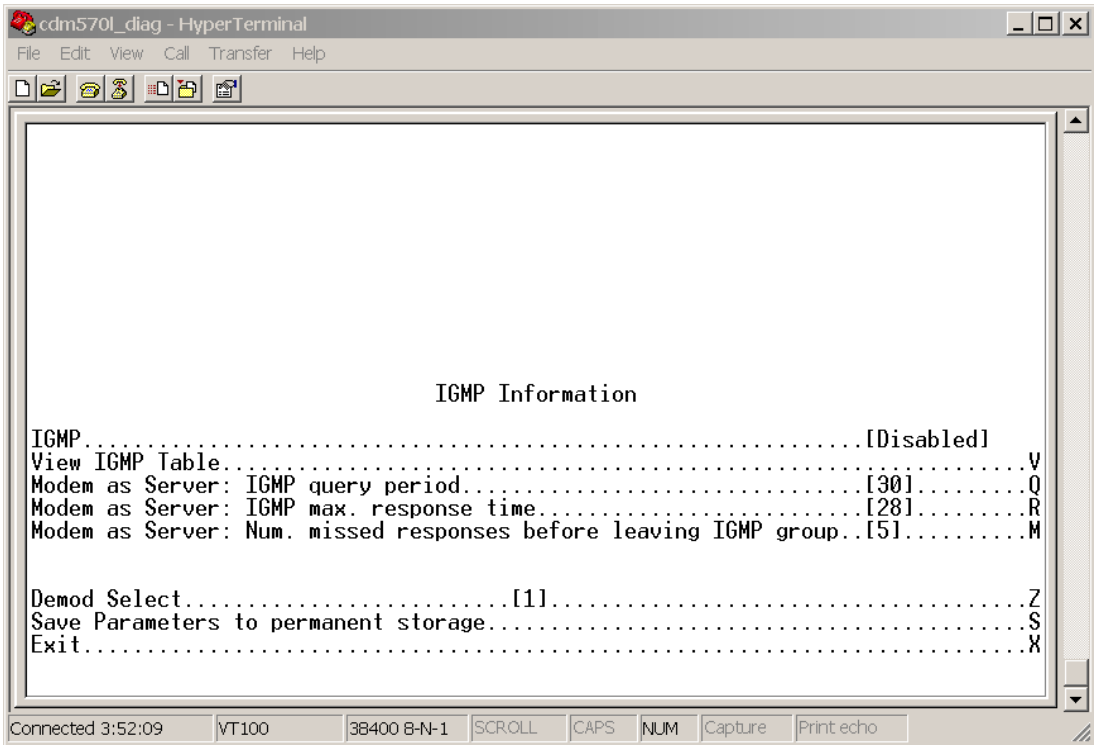
The Protocol Configuration page contains the following options/fields:

Menu Options/Fields	Entry	Description
IGMP	**I**	Activates *IGMP* page.
ARP	**A**	Activates *ARP Table Utilities* page.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.4.1 IGMP Information Page

The *IGMP information* page is activated from the *Protocol Configuration* page.

The IGMP Information page allows a user to view the IGMP clients that are actively listening to content being provided by the CDD-564L. It also allows the user to determine how the Ethernet Interface is configured either to receive requests to join IGMP groups or announce groups for others to join.



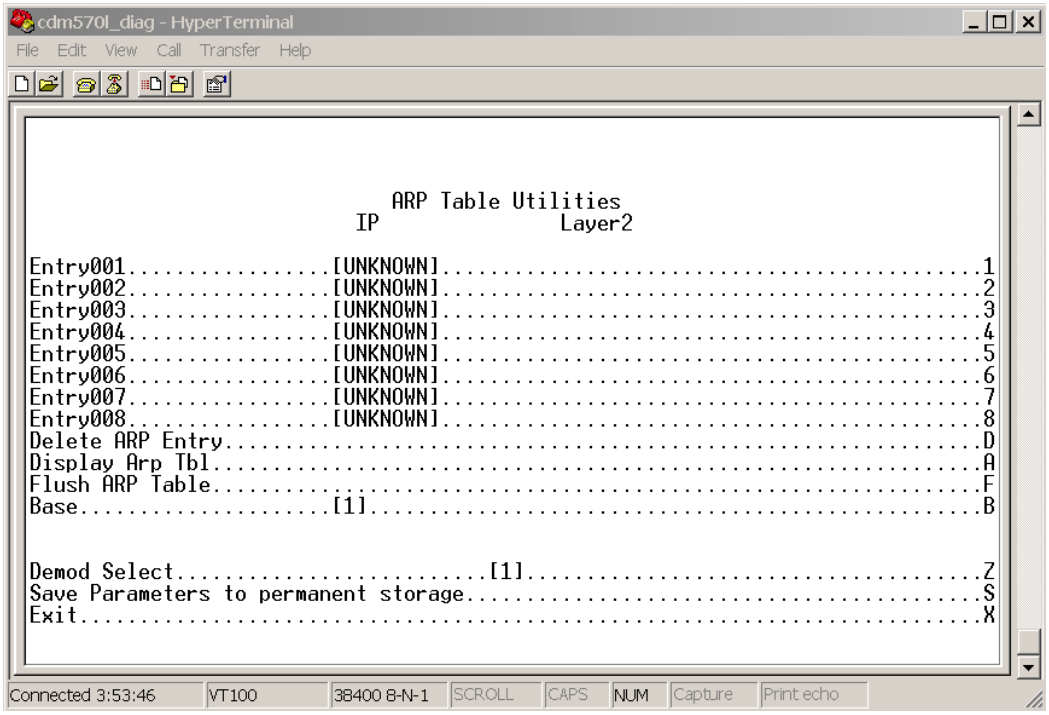
The *IGMP Information* page contains the following options/fields:

Menu Options/Fields	Entry	Description
IGMP	**Read Only**	Read only showing IGMP status (Enabled or Disabled).
View IGMP Table	**V**	This table reports the content that clients have subscribed to the CDD-564L using the IGMP protocol. This allows a user to determine which services are being used and the minimum time before a service will be terminated.
CDM-IP as Server: IGMP query period	**Q**	The IGMP protocol requests that a server periodically publish to users on the LAN the Multicast IP Addresses that it can service. The IGMP query period defines the time interval (in seconds) between each of these queries for membership.

Menu Options/Fields	Entry	Description
CDM-IP as Server: IGMP max. response time	**R**	The IGMP max response time defines the time interval (in seconds) that the CDD-564L should wait before it assumes that no parties are interested in the content published via an IGMP query. This option is expressed in seconds, and the max response time that is accepted by the CDD-564L is 25 seconds.
CDM-IP as Server: Number of missed responses before leaving IGMP group	**M**	Defines the number of membership queries that go unanswered from LAN clients before the Ethernet Interface will no longer forward data for that IGMP group. Consider a CDD-564L that has the IGMP query period set to 60 seconds and the number of missed responses set to 3. If a client joins an IGMP group, then the service to that group will not be discontinued until no clients respond to a query from the CDD-564L for a period of 60*3 = 180 seconds.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.4.2 ARP Table Utilities Page

The *ARP Table Utilities* page is activated from the *Protocol* page.



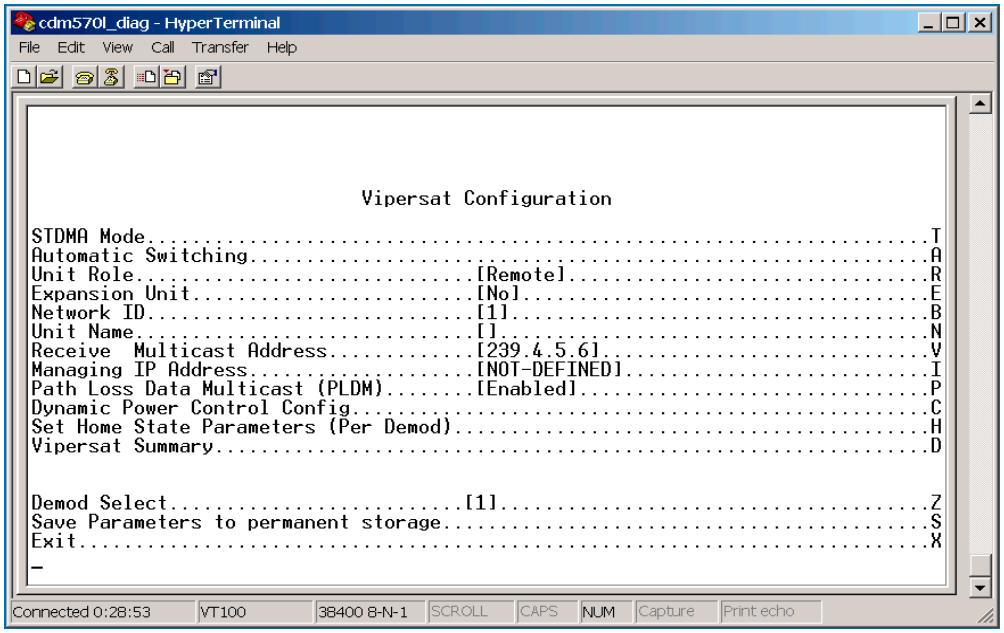
The *ARP Table Utilities* page allows the user to view and edit the ARP table defined by the CDD-564L. It allows up to 256 static IP->MAC ARP entries.

The *ARP Table Utilities* page contains the following options/fields:

Menu Options/Fields	Entry	Description
Entry001 - 008	**1 - 8**	The user can define up to 256 static ARP definitions on the CDD-564L. This table allows the user to operate/view up to 8 of these definitions. An ARP definition is defined as: 1. Unicast IP Address This IP Address is used as a lookup into the ARP table when the CDD-564L needs to resolve a MAC or HDLC Address. **Restrictions**: IP Address must be on the same subnet as the Ethernet Interface. IP Address must be a valid Unicast address (Not Multicast, broadcast, etc.) 2. MAC Address The MAC Address defines the hardware destination MAC Address that is used when an Ethernet packet is destined for an IP machine from the CDD-564L.
Delete ARP Entry	**D**	Allows the user to delete a Static ARP entry. Queries the user for the IP address of the ARP entry to delete.
Display ARP Tbl	**A**	Displays the entire IP to MAC ARP table. Includes the Static as well as dynamic ARP entries. Displays blocks of 10 ARP entries. Hit 'Enter' key to display next 10 entries or 'Escape' to return to ARP Table Utilities page.
Flush ARP Table	**F**	This option allows the entire ARP table to be removed. This is equivalent to performing the standard UNIX command "arp –d" on each address reported in an "arp –a" command. The command only flushes the dynamic ARP entries. The static ARP entries will not be removed.
Base	**B**	The ARP Table menu allows the user to view up to 8 different ARP definitions per screen. To allow editing on any of the 256 entries that can be defined, the user can select a base address to control which 8 ARP entries are displayed. For example, if the user wants to edit static ARP Entries 32-40, then a Base value of 32 should be defined.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.5 Vipersat Configuration Page

The *Vipersat Configuration* page is activated from the *Main Menu* page.

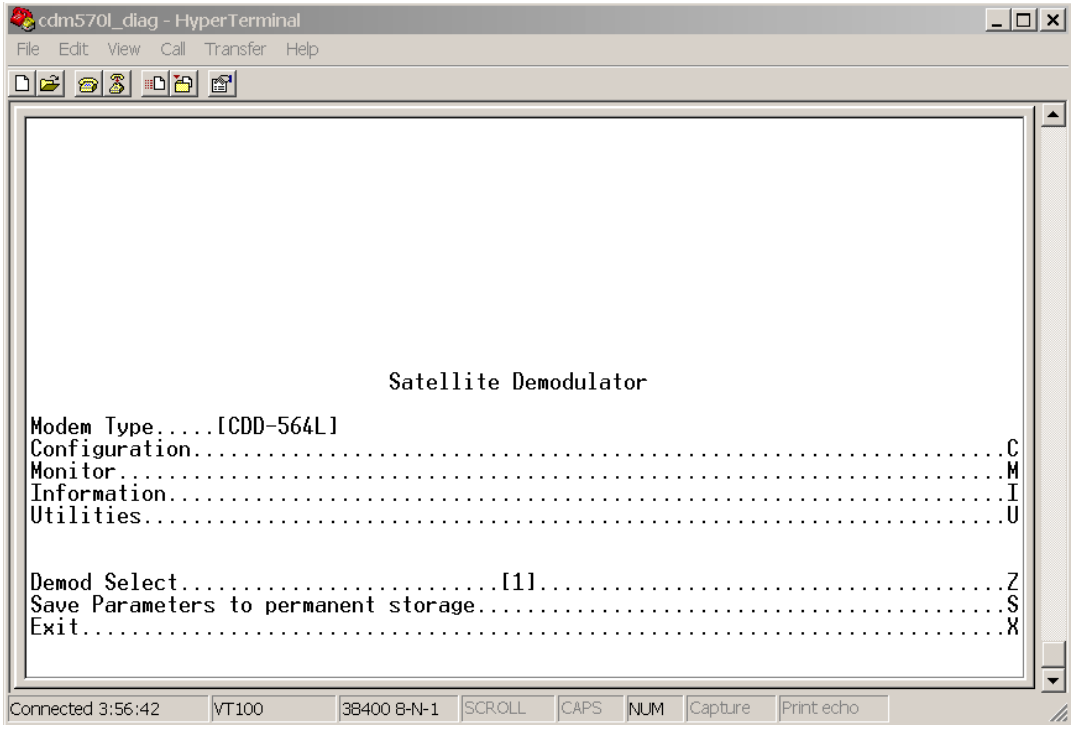


The Vipersat Configuration page contains the following options/fields:

Menu Options/Fields	Entry	Description
STDMA Mode	**T**	Only used when CDD-564L is used in a Vipersat system. Refer to Vipersat Operators Manual for more information.
Automatic Switching	**A**	
Unit Role	**R**	
Expansion Unit	**E**	
Bandwidth Group ID	**B**	
Unit Name	**N**	
Multicast Management IP Address	**M**	
Multicast VMS Management IP Address	**V**	
Managing IP Address	**I**	
Path Loss Data Multicast (PLDM)	**P**	
Dynamic Power Config	**C**	
Set Home State Parameters	**H**	
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.6 Satellite Demodulator Parameters Page

The *Satellite DemodulatorParameters* page is activated by selecting *Satellite Demodulator Configuration* from the *Main Menu* page.

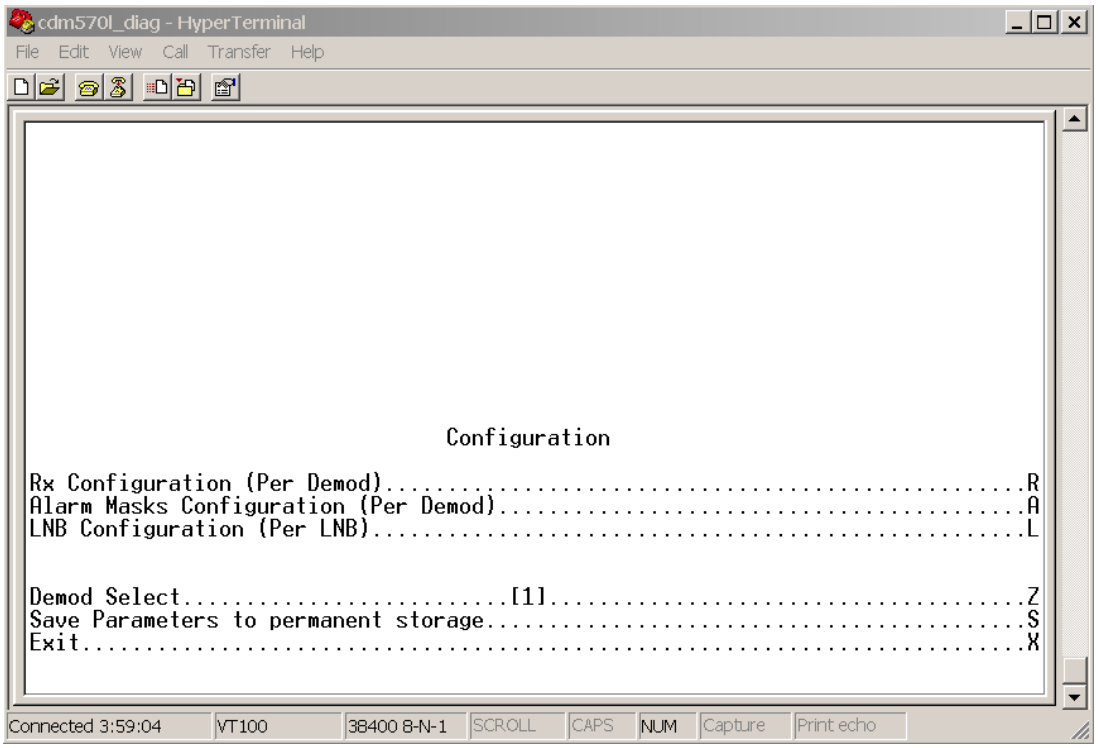


The Modem Parameters page contains the following options/fields:

Menu Options/Fields	Entry	Description
Modem Type	**Read Only**	Modem type – CDD-564L .
Configuration	**C**	Activates *Receive Modem Configuration* page.
Monitor	**M**	Activates *Monitor* page.
Information	**I**	Activates *Information* page.
Utilities	**U**	Activates *Utilities* page.
Demod Select	**Z**	Used to select Demodulator.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.6.1 Configuration Page

The *Configuration* page is activated from the *Satellite Demod* page.

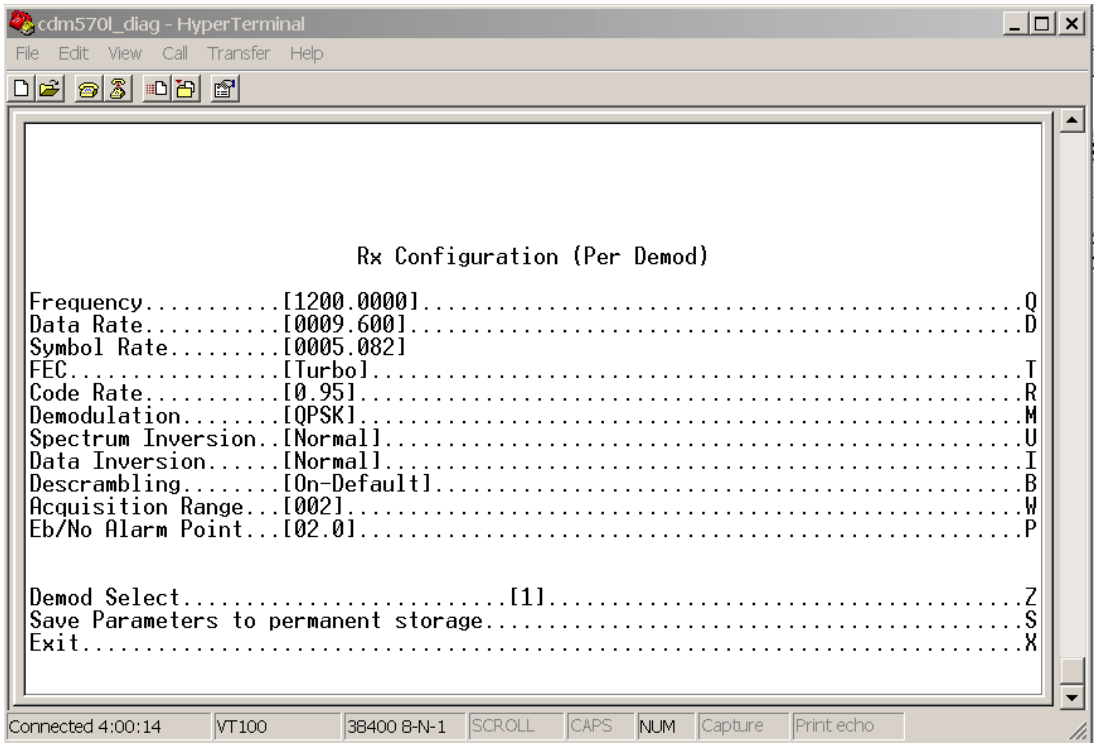


The Configuration page contains the following options/fields:

Menu Options/Fields	Entry	Description
Rx Configuration	**R**	Activates *Receive Modem Configuration* page.
Alarm Masks Configuration	**A**	Activates *Alarm Mask* page.
LNB Configuration	**L**	Activates *LNB Configuration* page.
Demod Select	**Z**	Used to select Demodulator.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.6.1.1 Rx Configuration Page

The *RxConfiguration* page is activated from the *Configuration* page.



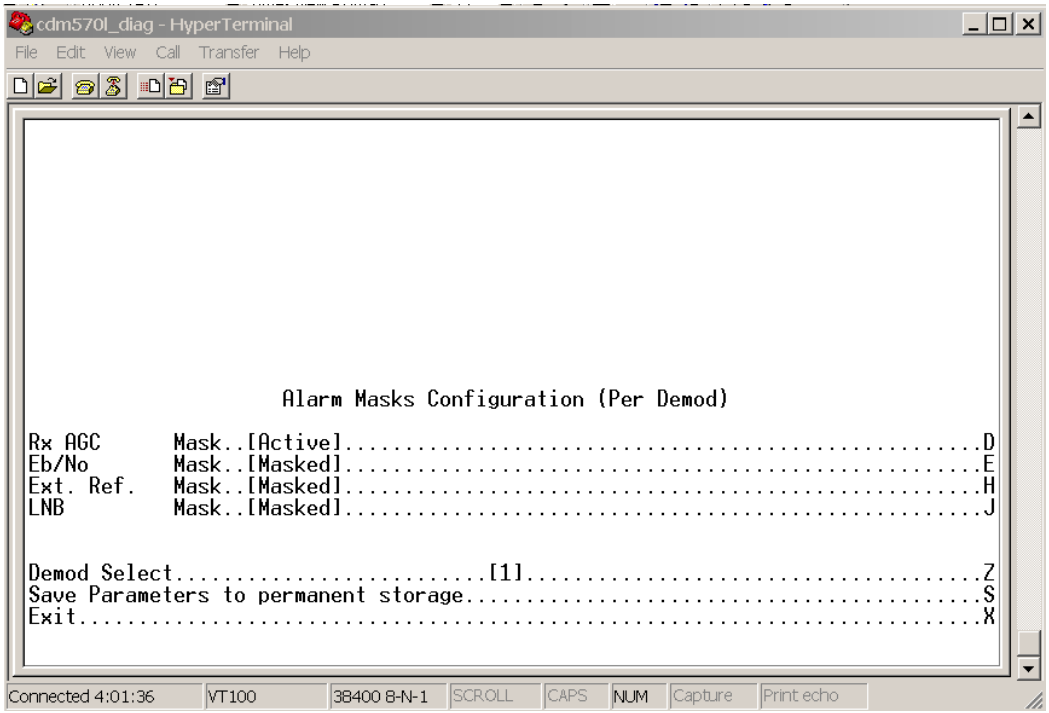
The Rx Configuration page contains the following options/fields:

Menu Options/Fields	Entry	Description
Receive Frequency	**Q**	Valid ranges are from 950 to 1950 MHz.
Receive Data Rate	**D**	Valid ranges are from 2.4 to 5000 kbps.
Decoder Type (Only Type 2 is available with CDD-564L)	**T**	2 - TURBO
Decoder Rate (Only R = 1 and R = 2 available with CDD-564L)	**R**	1 – 3/4 2 – 0.95
Modulation Type (Only M = 1 available with CDD-564L)	**M**	Sets receive demodulation type 1 -- QPSK
Spectrum	**U**	1 - NRM 2 - INV

Menu Options/Fields	Entry	Description
De-scrambler	**B**	1 - OFF 2 - ON – Default 3 - ON – IESS-315
Acquisition Range	**W**	Valid ranges are from 0 to 200 kHz (1 to 32HKz if symbol rate < 625Ksymbol)
Eb/No Alarm Point	**P**	Valid ranges are from 0.1 to 16.0
Demod Select	**Z**	Used to select Demodulator.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

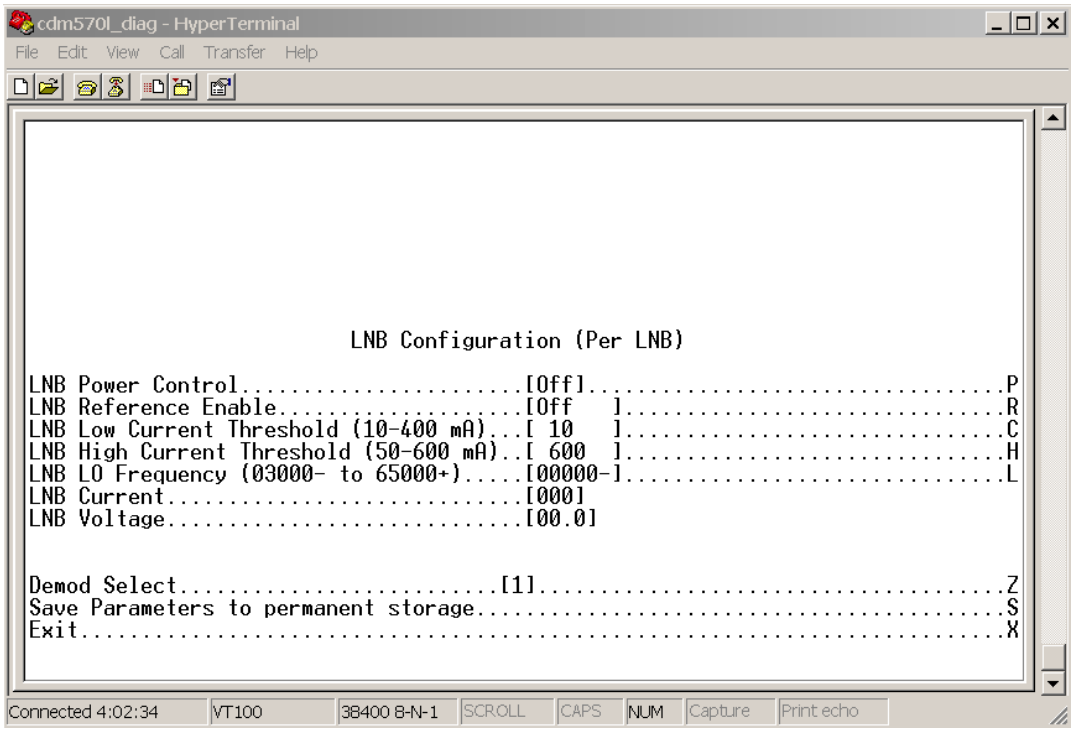
10.2.6.1.2 Alarm Mask Page

The *Alarm Mask configuration* page is activated from the *Configuration* page.



10.2.6.1.3 LNB Configuration Page

The *LNB Configuration* page is activated from the *Configuration* page.

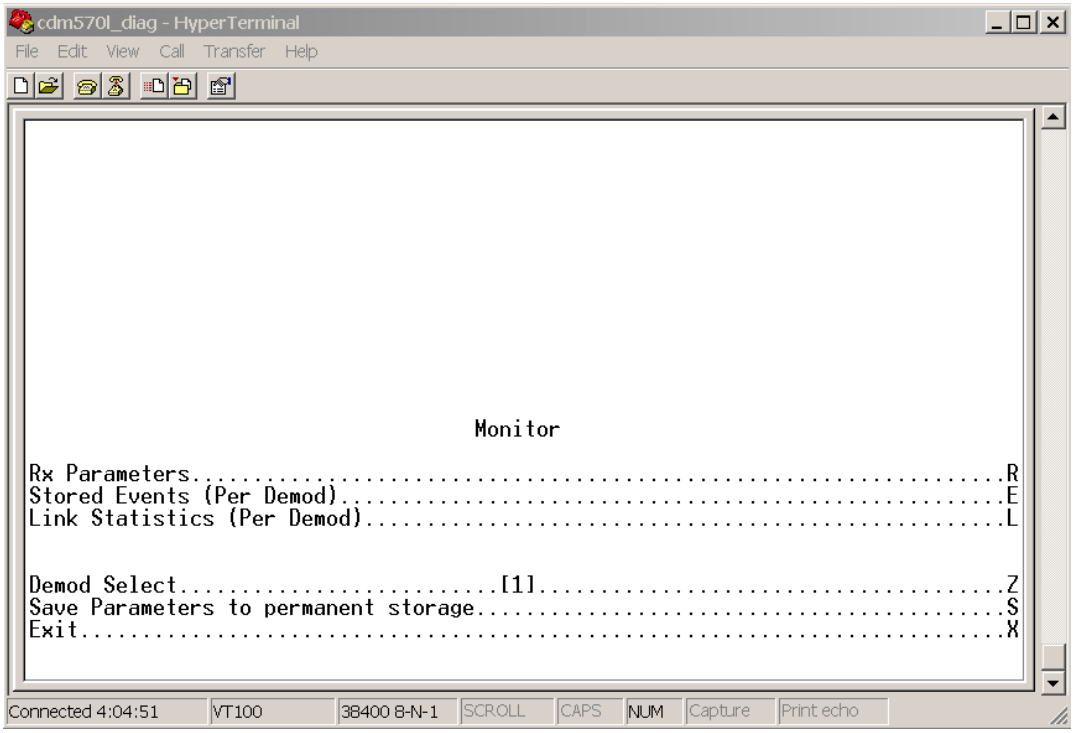


The LNB Configuration page contains the following options/fields:

Menu Options/Fields	Entry	Description
LNB Power Control	**P**	Select ON or OFF.
LNB Reference Enable	**R**	Select ON or OFF.
LNB Low Current Threshold	**C**	Valid ranges are from 10 to 400 mA.
LNB High Current Threshold	**H**	Valid ranges are from 50 to 600 mA.
LNB LO Frequency	**L**	Valid ranges are from 3000 to 65000.
LNB Current	**-**	Read Only
LNB Voltage	**-**	Read Only
Demod Select	**Z**	Used to select Demodulator.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.6.2 Monitor

The *Monitor* page is activated from the *Satellite Demod* page.

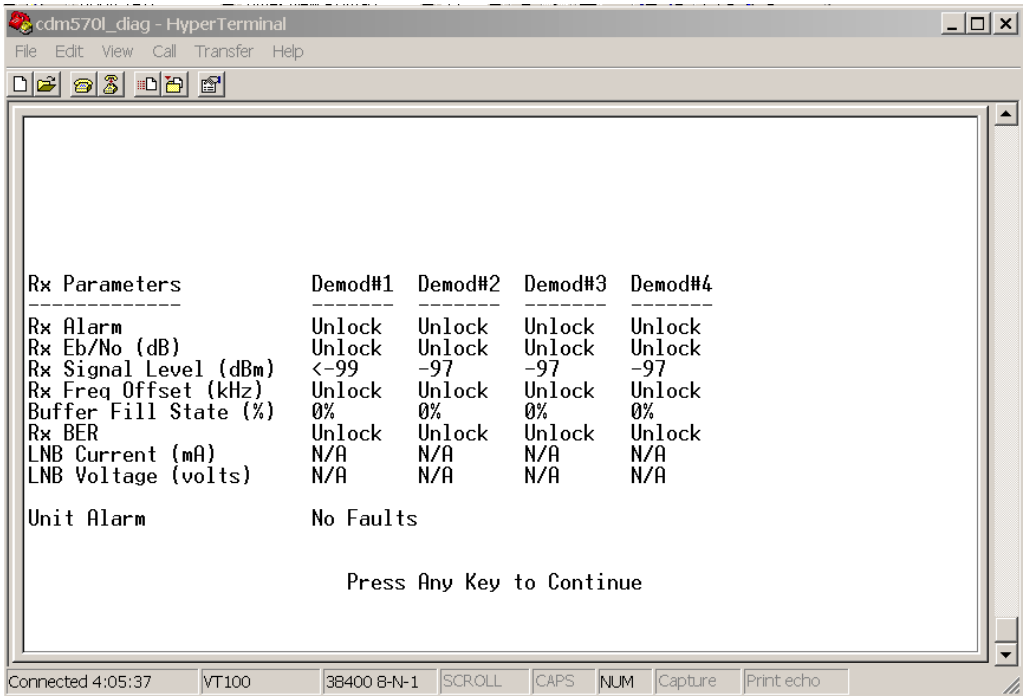


The Monitor page contains the following options/fields:

Menu Options/Fields	Entry	Description
Rx Parameters	**R**	Activates *Receive Parameters* page.
Stored Events	**E**	Activates *Stored Events* page.
Link Statistics	**L**	Activates *Link Statistics* page.
Demod Select	**Z**	Used to select Demodulator.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

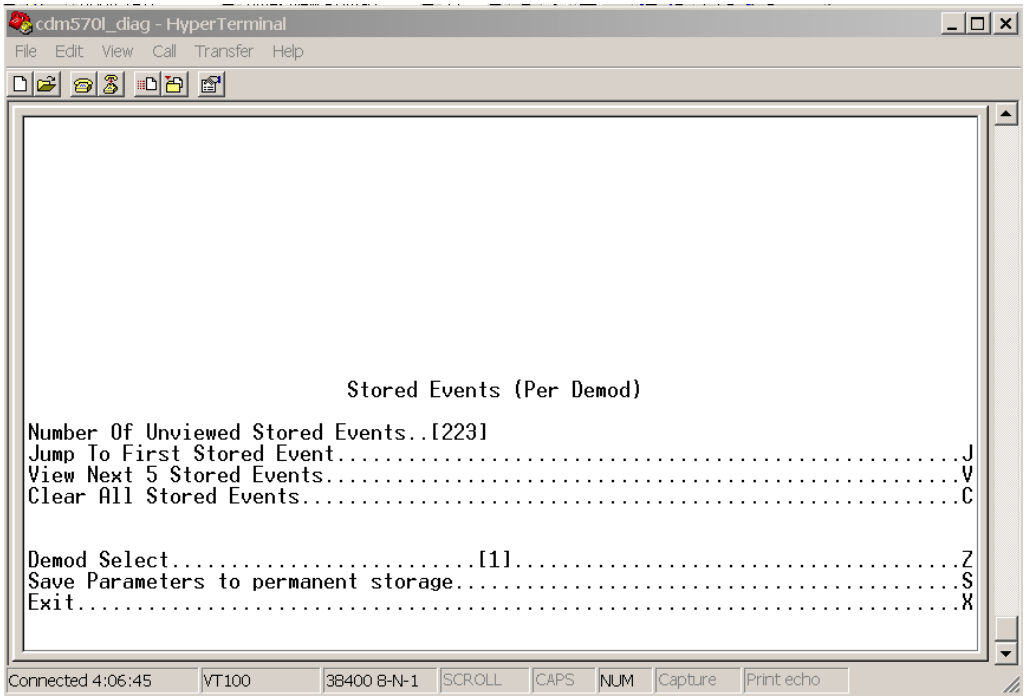
10.2.6.2.1 Rx Parameters Page

The *RxParameters* page is activated from the *Monitor* page.



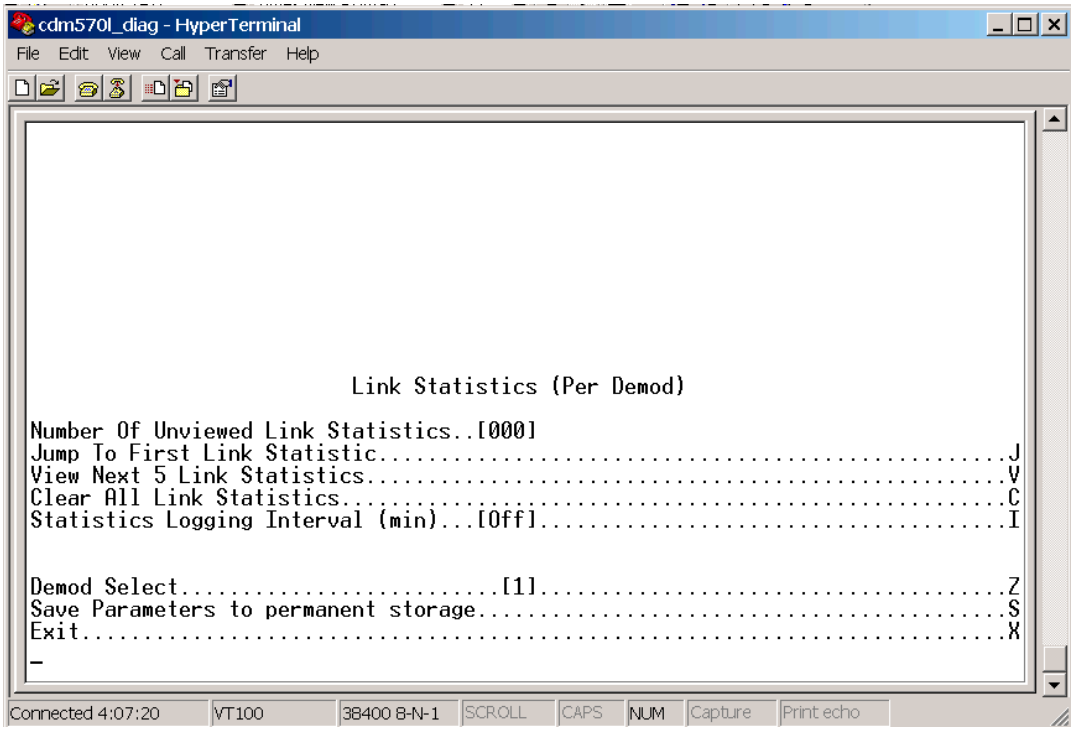
10.2.6.2.2 Stored Events Page

The *Stored Events* page is activated from the *Monitor* page.



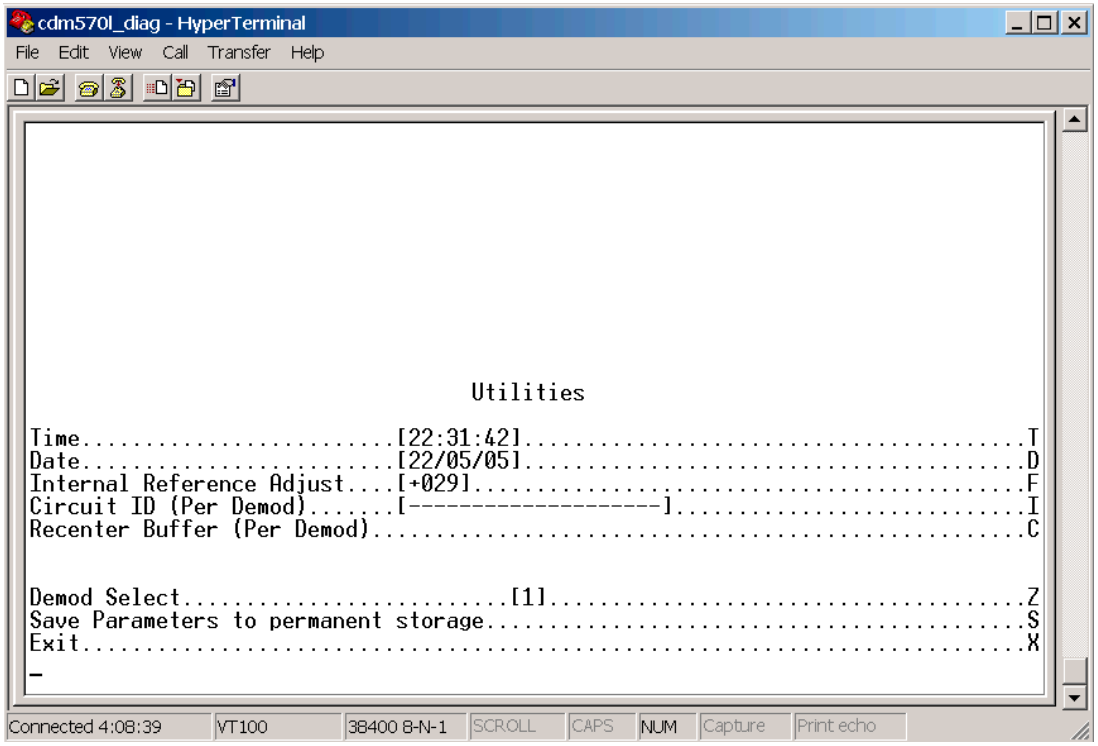
10.2.6.2.3 Link Statistics Page

The *Link Statistics* page is activated from the *Monitor* page.



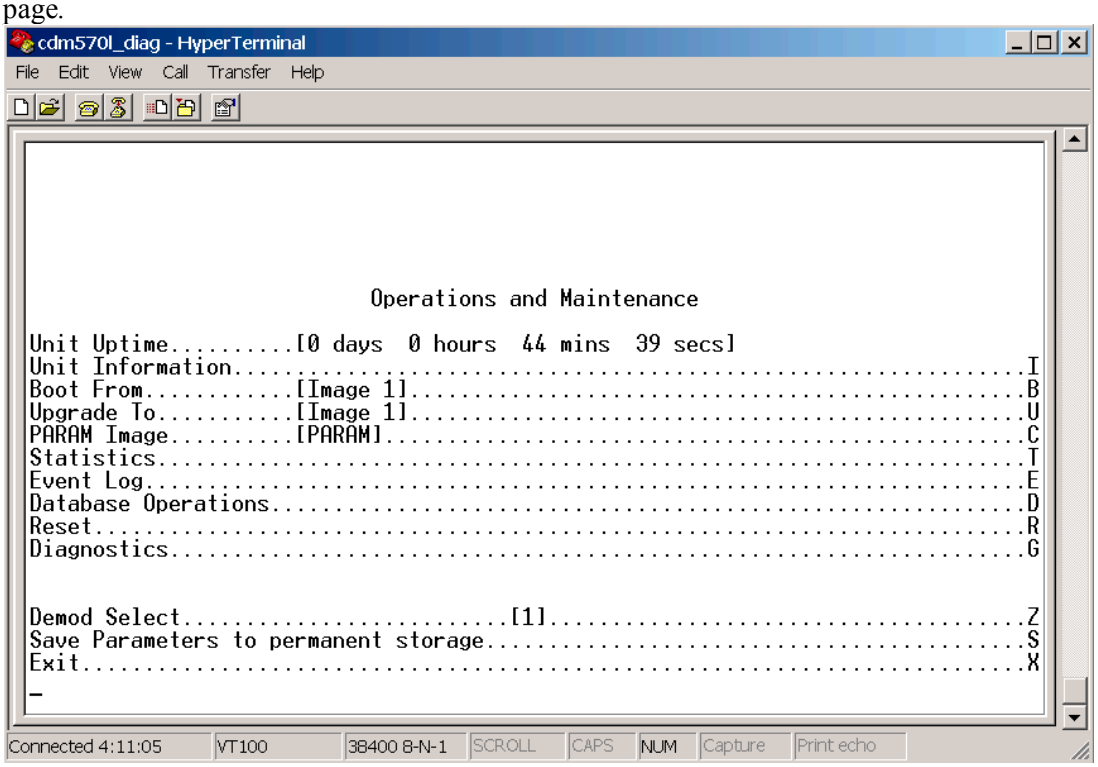
10.2.6.3 Utility

The *Utility* page is activated from the *Satellite Demod* page.



10.2.7 Operations and Maintenance Page

The *Operations and Maintenance* page is activated from the *Main Menu* page.



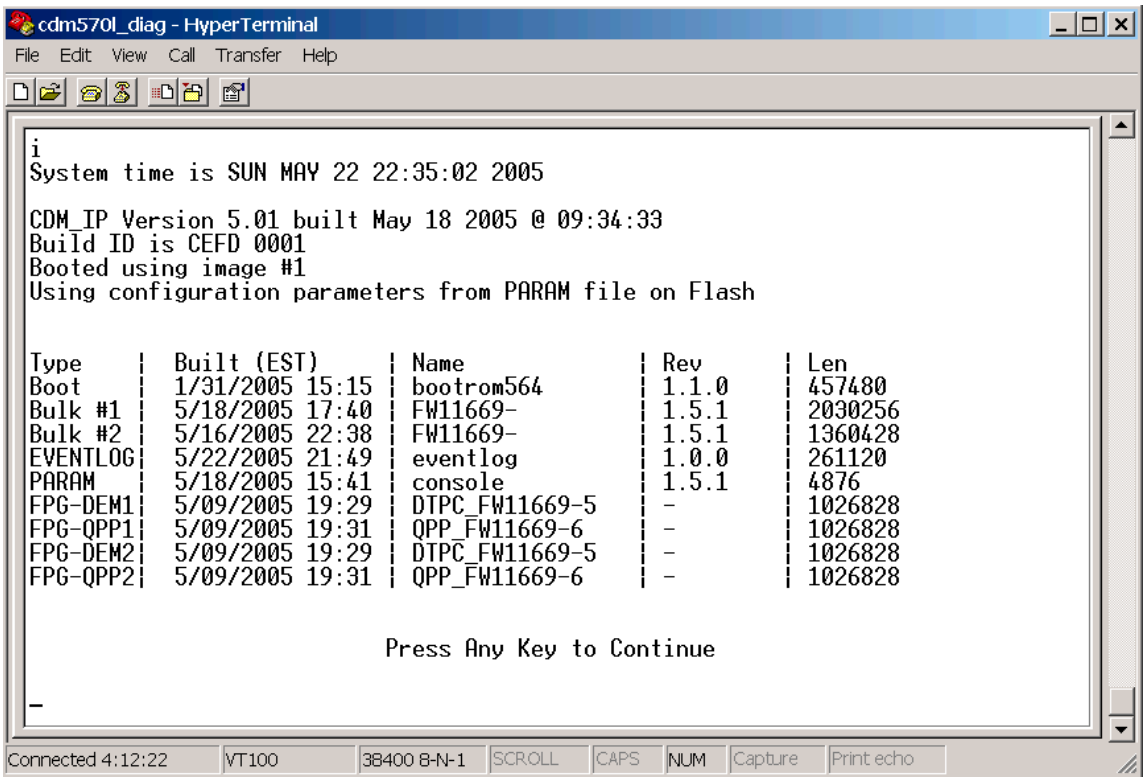
The *Operations and Maintenance* page contains the following options/fields:

Menu Options/Fields	Entry	Description
Unit Information	**I**	Displays unit current operational Software information.
Boot From	**B**	Determines which version of the IP Module software package (includes Application, FPGA, and FFPGA) will be loaded upon boot-up. The possible options are: 0. Latest - boot the newest software package based upon date. 1. Image1 - boot the software package loaded into the first slot in permanent storage. 2. Image2 - boot the software package loaded into the second slot in permanent storage.
Upgrade To	**U**	Determines which installed software package (includes Application, FPGA, and FFPGA) that the IP Module will overwrite when upgrading with a new software package. The possible options are: 0. Oldest – overwrite the oldest software package based upon date.

Menu Options/Fields	Entry	Description
		1. Image1 – overwrite the software package loaded into the first slot in permanent storage. 2. Image2 – overwrite the software package loaded into the second slot in permanent storage.
PARAM Image	**C**	Identifies the PARAM file that will be loaded on bootup. The options are: 1. Last saved Parameter file 2. Factory – uses the internal, hard-coded factory default parameters.
Statistics	**T**	Activates *Statistics Menu* page.
Event Log	**E**	Activates *Event Log* page.
Database Operations	**D**	Activates *Administrative Database Operations* page.
Reset	**R**	Allows user to reboot the modem. It has the same logical effect of power-cycling the unit.
Diagnostics	**G**	Activates *Diagnostics* page.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.7.1 Unit Information Page

The *Unit Information* page is activated by entering "**I**" from the *Operations and Maintenance* page.



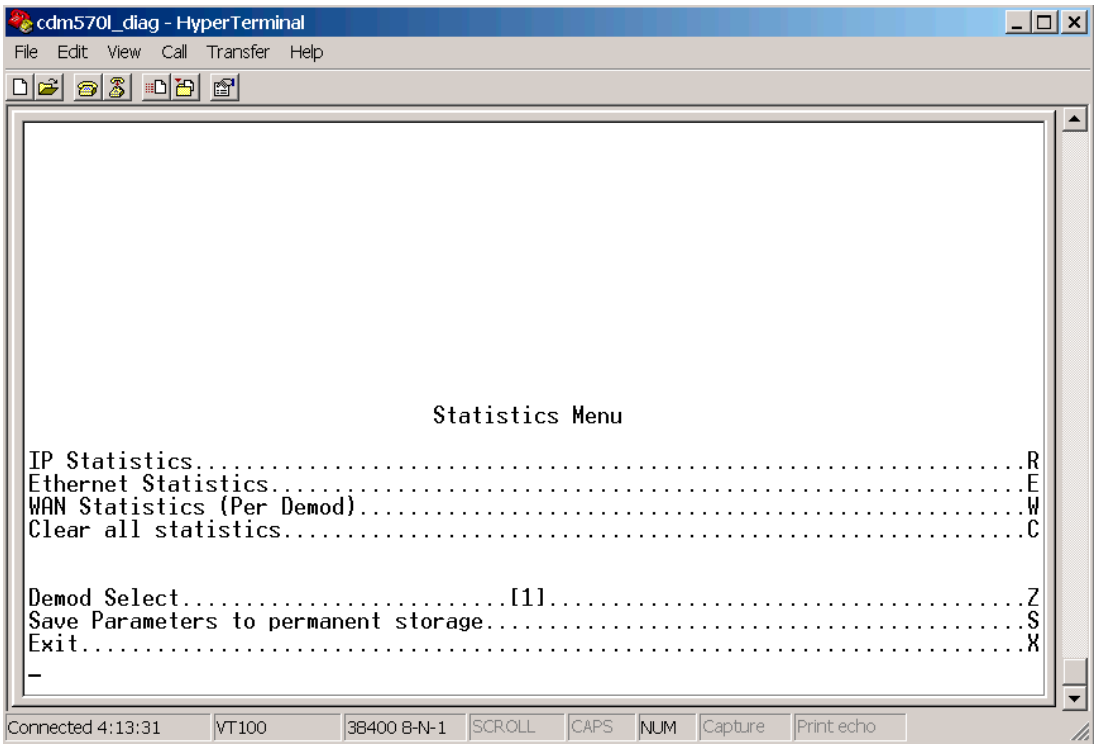
The *Unit Information* page contains the following informatiom:

Current System time	DAY MONTH DATE hh:mm:ss YEAR
Image # that the CDD-564L is currently booted from	By default will be the Latest, unless "Boot From" is set to Image #1 or Image #2
PARAM file that the CDD-564L is currently configured from	Will be PARAM file from Flash or Factory Default If no parameter file is found in flash memory.

Currently Loaded CDD-564L SW	Will display Build Date, CEFD FW#, Revision #, and size of each CDD-564L SW file.
Boot	There will be a single Boot SW file.
Bulk #1	The Bulk file contains all of the SW files for the CDD-564L and there are two slots available.
Bulk #2	The FPGA RX files are subsets of the Bulk SW.
FPG-DEM1	
FPG-QPP1	
FPG-DEM2	
FPG-QPP2	
EVENTLOG	Will display the date/time that the EVENTLOG file was last updated.
PARAM	Will display the date/time that the PARAM1 file was last updated. It will also show what user interface was used to last update the PARAM file. From CLI will display ‘console’ From Web will display ‘http’ From Telnet will display the Telnet user login name From SNMP will display ‘snmp

10.2.7.2 Statistics Page

The *Statistics Menu* page is activated from the *Operations and Maintenance* page.



The *Statistics Menu* page contains the following options/fields:

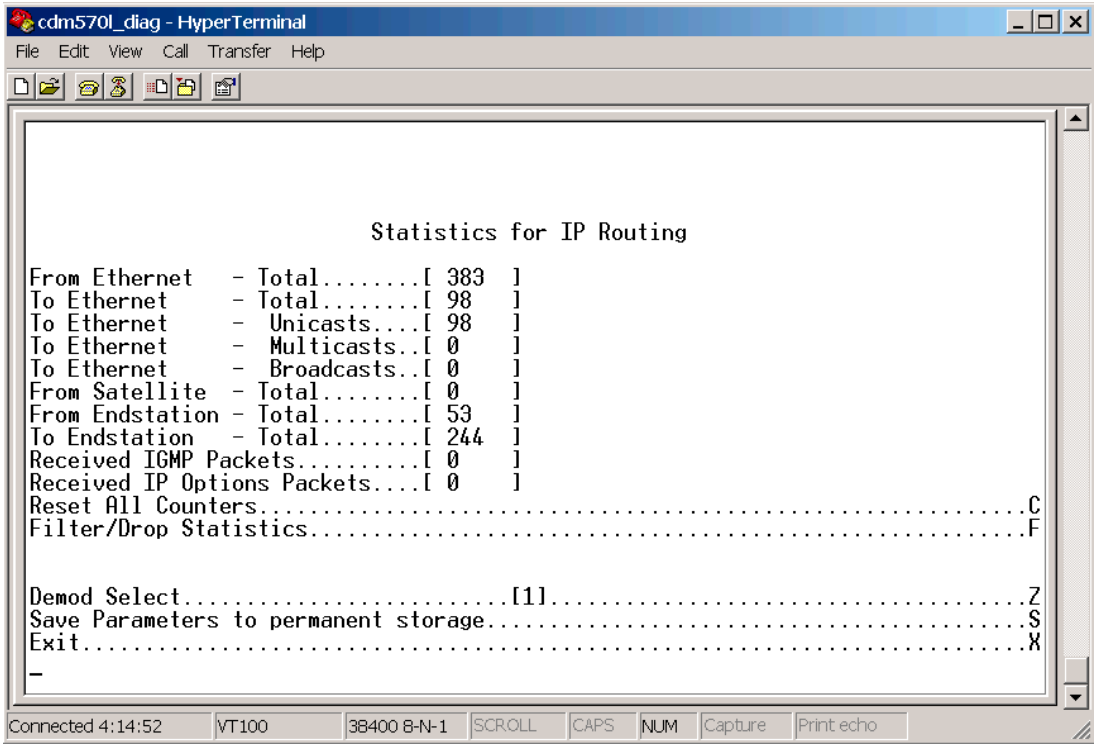
Menu Options/Fields	Entry	Description
IP Statistics	**R**	Displays Statistics for IP Routing and allows counters to be reset.
Ethernet Statistics	**E**	Displays Statistics for the Ethernet Port and allows counters to be reset.
WAN Statistics	**W**	Displays Statistics for the WAN (HDLC) Port and allows counters to be reset.
Clear all stats	**C**	Globally resets all statistics counters.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

IMPORTANT

All updates for Statistics information will occur once every 6 seconds.

10.2.7.2.1 IP Statistics Page

The *IP Statistics* page is activated from the *Statistics Menu* page. The *IP Statistics* page displays counts of the number of packets routed or dropped in the IP Module.



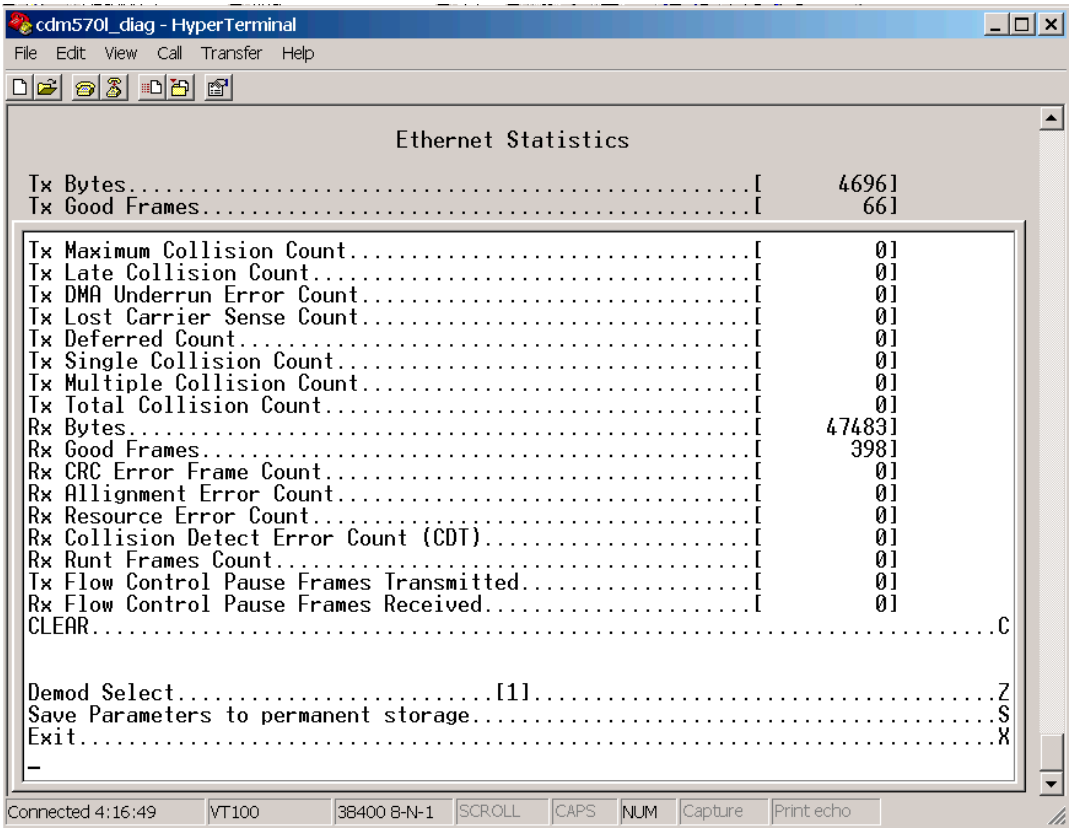
The *IP Statistics* page contains the following options/fields:

Menu Options/Fields	Entry	Description
From Ethernet - Total		Ethernet Statistics page, Rx Good Frames
To Ethernet - Total		Ethernet Statistics page, Tx Good Frames
To Ethernet - Unicast		Unicast packets to LAN
To Ethernet - Multicast		Multicast packets to LAN
To Ethernet - Broadcast		Broadcast packets to LAN
From Satellite - Total		WAN Statistics page, Rx HDLC Packet Count
From Endstation - Total		Packets sent from CDD-564L
To Endstation - Total		Packets directed to CDD-564L
Received IGMP Packets		Internet Group Management Packets received (used for management of multicast traffic).
Received IP Options Packets		Number of IP Options packets received.
Reset Packet Counters	**C**	Executing this menu option resets all WAN, Ethernet

Menu Options/Fields	Entry	Description
(Clears WAN, Ether, IP stats)		and IP Routing statistics gathered to zero.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.7.2.2 Ethernet Statistics Page

The *Ethernet Statistics* page is activated from the *Statistics Menu* page The *Ethernet Statistics* page displays the statistics for the number of IP packets received from and sent to the Ethernet interface.

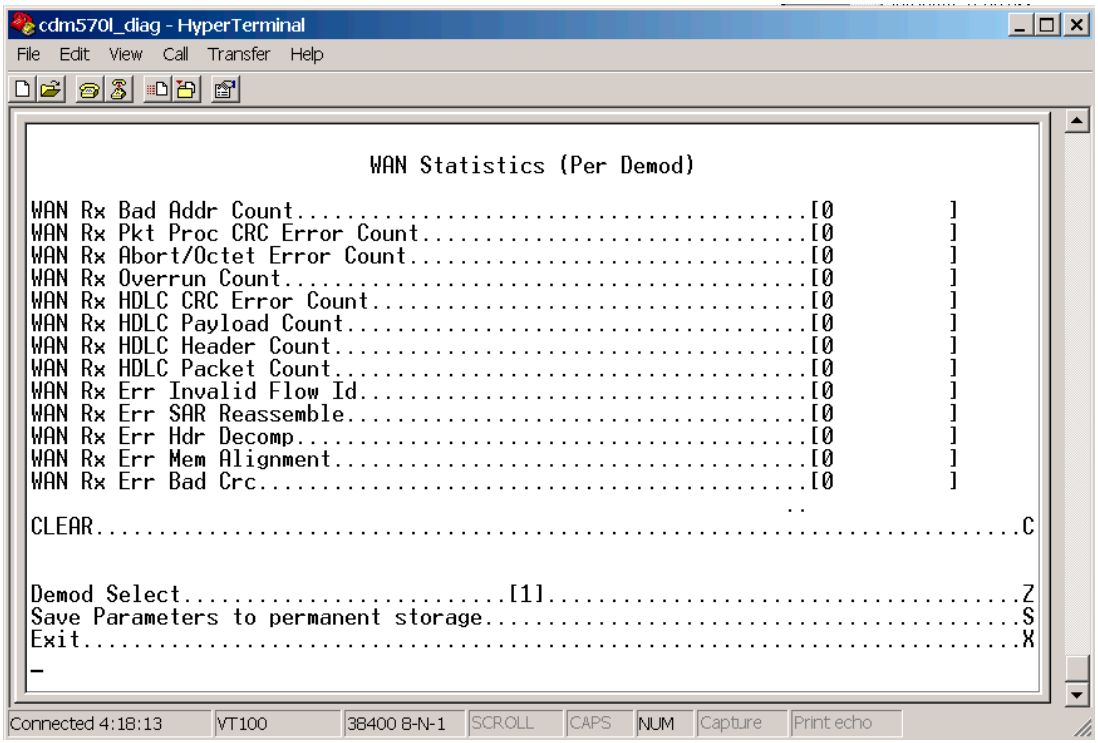


The *Ethernet Statistics* page contains the following options/fields . The Ethernet Statistics presents the total packets transmitted and received for the Ethernet Port of the IP Module.

Menu Options/Fields	Entry	Description
Tx Bytes	**Read Only**	Number of bytes transmitted by this Ethernet interface.
Tx Good Frames		Number of good frames transmitted by this Ethernet interface.
Tx Maximum Collision Count		Number of frames that are not transmitted because they encountered configured max collisions.
Tx DMA Underrun Error Count		Number of frames not transmitted or re-transmitted due to transmit DMA underrun.
Tx Lost Carrier Sense Count		Number of frames transmitted by device despite the fact that it detected a deassertion of carrier sense.
Tx Deferred Count		Number of frames deferred before transmission due to activity on link.
Tx Single Collision Count		Number of transmitted frames that encountered only one collision.
Tx Multiple Collision Count		Number of transmitted frames that encountered more than one collision.
Tx Total Collision Count		Total number of collisions encountered while attempting to transmit.
Rx Bytes		Number of bytes received by this Ethernet interface.
Rx Good Frames		Count of good frames received by the Ethernet device.
Rx CRC Error Frame Count		Number of aligned frames discarded due to a CRC error.
Rx Alignment Error Count		Number of frames that are both misaligned and contain a CRC error.
Rx Resource Error Count		Count of good frames discarded due to unavailable resources.
Rx FIFO Overrun Error Count		Number of good frames discarded due to overflow of internal receive FIFO.
Rx Collision Detect Error Count (CDT)		Number of frames encountered collisions during frame reception.
Rx Runt Frames Count		Count of undersize frames received by the Ethernet device.
Tx Flow Control Pause Frames Transmitted		Number of Flow Control frames transmitted by the device.
Rx Flow Control Pause Frames Received		Number of Flow Control frames received by the device.
Clear	**C**	Resets all Ethernet Statistics
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.7.2.3 WAN Statistics

The *WAN Statistics* page is activated from the *Statistics Menu* page. The *WAN Statistics* page displays counts of the number of packets routed or dropped in the IP Module Satellite interface.



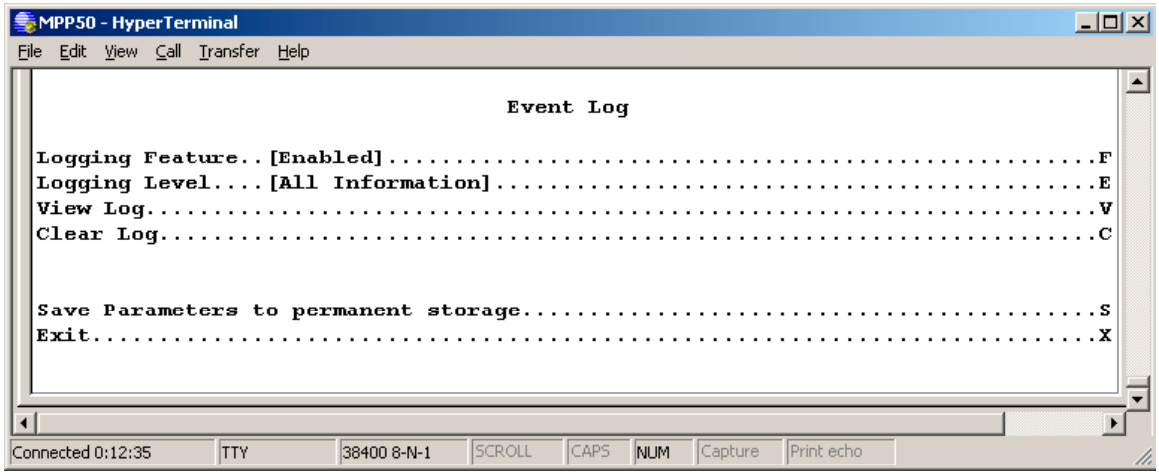
The *WAN Statistics* page contains the following options/fields:

Menu Options/Fields	Entry	Description
WAN Rx Bad Addr Count	**Read Only**	The count of received frames that did not match any of the 4 HDLC addresses or the broadcast address.
WAN Rx Pkt Proc CRC Error Count		Count of received frames that failed packet processor CRC check.
WAN Rx Abort/Octet Error Count		Count of aborted frames and octet error frames.
WAN Rx Overrun Count		Count of received frames that exceeded max frame length of 2K bytes in length (Or) overflowed the HDLC buffer.
WAN HDLC CRC Error Count		Number of received frames that failed HDLC CRC check.
WAN Rx HDLC Payload Count		The count of payload bytes that were received over satellite link excluding any frame overhead.

Menu Options/Fields	Entry	Description
WAN Rx HDLC Header Count		The count of HDLC header bytes received over satellite link including control, HDLC address, Flow ID, and CRC.
WAN Rx HDLC Packet Count		Number of packets received over satellite link.
WAN Rx Err Invalid Flow Id		Number of packets which the flow identifier has been corrupted, does not fall into the range of acceptable values.
WAN Rx Err SAR Reassemble		Number of packets unable to correctly reassemble a segmented packet.
WAN Rx Err Hdr Decomp		Number of packets unable to correctly decompress the header information.
WAN Rx Err Mem Alignment		Number of packets discarded (caused by memory corruption).
WAN Rx Err bad CRC		Number of corrupted packets indicated by CRC check.
Clear	**C**	Resets all WAN statistics.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.7.3 Event Log Page

The *Event Log* page is activated from the *Operations and Maintenance* page.



The *Event Log* page allows the user to capture all IP Module events to a log. The *Event Log* page contains the following options/fields:

Menu Options/Fields	Entry	Description
Logging Feature	**F**	Select to Enable/Disable Logging
Logging Level	**E**	Select 1 – Errors Only 2 – Errors and Warnings 3 – All Information
View log	**V**	Select to view log. Will display most recent events. Press any key to scroll through events or Escape to exit. All events will display Type – Error, Warning, or Information Date/Time – NOTE: During Bootup, multiple Boot Events will be created, but a Date/Time will only be seen when the Bootup has completed. Category – Boot, Database, FTP logins, upgrade file transfers, Ethernet Link status change. Description – Event details
Clear log	**C**	Select to clear log contents.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

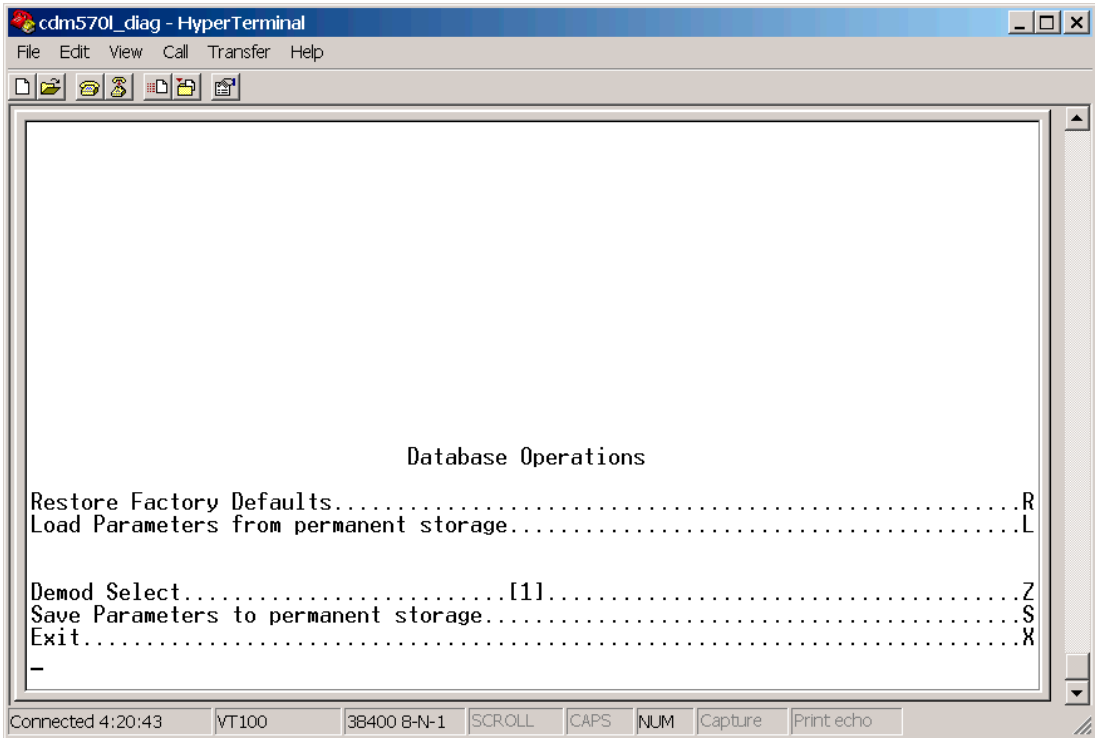
NOTE: The full Event log file can be retrieved by FTP. Use Admin login and type command ‘get eventlog’. The entire Event log can then be viewed with a text viewer.

```
54        Information    05/21/2004 10:12:04 C:/Comtech/ftp/ftpCallbacks.c
1041      FTP                 FTP Connected - 'User: comtech' logged in


53        Information    05/21/2004 09:07:40 C:/Comtech/cimmib/cimMib.c
520       Database            Set system clock to FRI MAY 21 09:07:40 2004


52        Information    Unknown    Unknown  C:/Comtech/startup/usrAppInit.c
534       Boot                Configuring router using PARAM file


51        Information    Unknown    Unknown  C:/Comtech/startup/usrAppInit.c
364       Boot                Detected Framer Module II.


50        Information    05/21/2004 08:57:42 C:/Comtech/cimmib/cimMib.c
520       Database            Set system clock to FRI MAY 21 08:57:42 2004


49        Information    Unknown    Unknown  C:/Comtech/startup/usrAppInit.c
534       Boot                Configuring router using PARAM file


48        Information    Unknown    Unknown  C:/Comtech/startup/usrAppInit.c
364       Boot                Detected Framer Module II.


47        Information    05/21/2004 08:13:02 C:/Comtech/ftp/ftpCallbacks.c
180       FTP                 Disconnected FTP


46        Information    05/21/2004 07:58:06 C:/Comtech/ftp/ftpCallbacks.c
540       FTP                 FTP Transfer complete


45        Information    05/21/2004 07:58:04 C:/Comtech/ftp/ftpCallbacks.c
863       FTP                 Image has been saved to FLASH


44        Information    05/21/2004 07:57:40 C:/Comtech/ftp/ftpCallbacks.c
1041      FTP                 FTP Connected - 'User: comtech' logged in


43        Information    05/21/2004 06:55:14 C:/Comtech/telnetd/telnetd.c
421       Telnet              Telnet disconnected


42        Information    05/21/2004 06:54:26 C:/Comtech/telnetd/telnetd.c
385       Telnet              Connected host 10.6.6.94


41        Information    05/21/2004 06:38:02 C:/Comtech/ftp/ftpCallbacks.c
180       FTP                 Disconnected FTP


40        Information    05/21/2004 06:23:07 C:/Comtech/ftp/ftpCallbacks.c
540       FTP                 FTP Transfer complete
```

```
39        Information    05/21/2004 06:23:06 C:/Comtech/ftp/ftpCallbacks.c
863       FTP                 Image has been saved to FLASH


38        Information    05/21/2004 06:22:43 C:/Comtech/ftp/ftpCallbacks.c
1041      FTP                 FTP Connected - 'User: comtech' logged in
```

10.2.7.4 Administrative Database Operations Page

Administrative Database Operations is opened from *Operations and Maintenance.*



The Database Operations option allows the user to view, save, or erase an existing user configuration of the CDD-564L. An CDD-564L uses these types of configuration files to initialize itself on power-up.

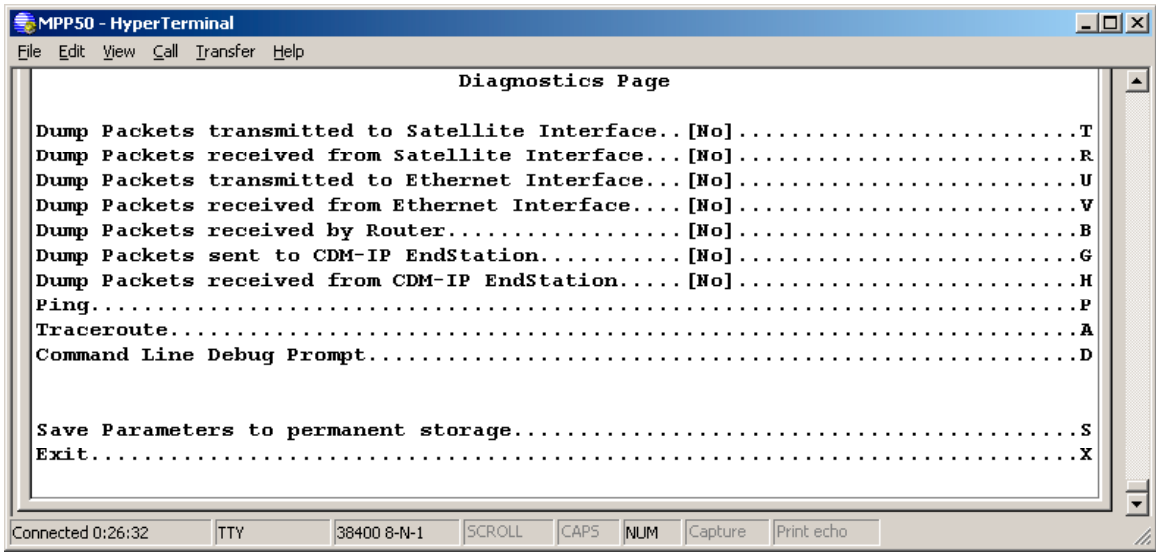
The User Configuration File allows a user to overwrite the values defined in the Factory Configuration File. This allows full customization of a CDD-564L without erasing a set of parameters defined from the factory. The User Configuration File can also be retrieved or overwritten via FTP by specifying the filename ‘param1’.

The Administrative Database Operations page contains the following options/fields:

Menu Options/Fields	Entry	Description
Restore Factory Default	**R**	Restores the CDD-564L settings to “safe” values as defined by the factory.
Load Parameters from permanent storage	**L**	This option overwrites the current configuration of the CDD-564L with the configuration last saved to permanent storage. It allows the user to perform an “Undo” type operation if the CDD-564L is put into an undesirable state by the user.
Save Parameters	**S**	This option allows a user to save the current configuration of the CDD-564L to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.7.5 Diagnostics Page

The *Diagnostics* page is activated from the *Operations and Maintenance* page.



IMPORTANT

Using Dump Packets Diagnostics Utilities

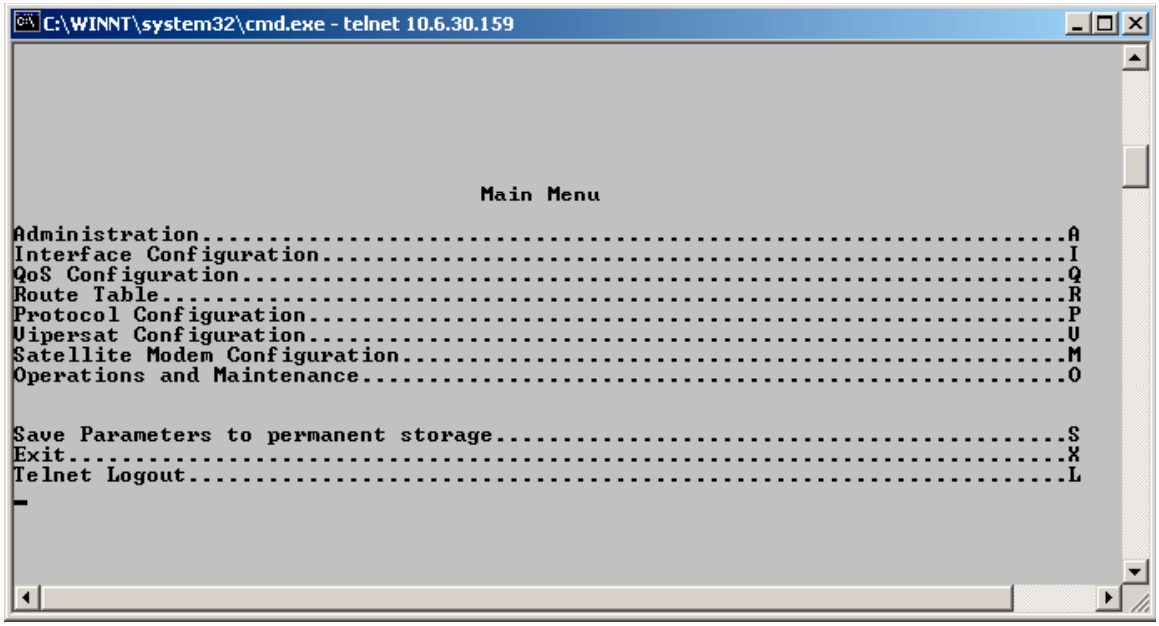
1. The Dump Packet Utilities will display a hexadecimal representation of each packet and should not be used when the the CDD-564L is is on a “live” network.
2. Selecting the menu option a second time terminates the dump operation. Each selection toggles the value of the dump engine.

The *Diagnostics* page contains the following options/fields:

Menu Options/Fields	Entry	Description
Dump Packets received from Satellite Interface	**R**	Toggles [Yes] and [No] Executing this menu option forces the IP Module to dump a hexadecimal representation of each packet that it receives from the Satellite Interface.
Dump Packets transmitted to Ethernet Interface	**U**	Toggles [Yes] and [No] Executing this menu option forces the IP Module to dump a hexadecimal representation of each packet that is transmitted to the Ethernet Interface.
Dump Packets received from Ethernet Interface	**V**	Toggles [Yes] and [No] Executing this menu option forces the IP Module to dump a hexadecimal representation of each packet that it receives from the Ethernet Interface.

Menu Options/Fields	Entry	Description
Dump Packets received by Router	**B**	Toggle [Yes] and [No] Executing this menu option forces the IP Module to dump a hexadecimal representation of each packet that is received by the routing engine. (Note: Does not apply when in easyConnect™ mode.)
Dump Packets received from EndStation	**H**	Toggle [Yes] and [No] Executing this menu option forces the IP Module to dump a hexadecimal representation of each packet that is sourced from this modem and destined for some other device. This allows a user to see what type of packets this modem is generating internally.
Ping	**P**	Enter the ip address in aaa.bbb.ccc.ddd format
Traceroute	**A**	Enter the ip address in aaa.bbb.ccc.ddd format
Command Line Debug Prompt	**D**	Enter the password to access the debug command line. Note: This is reserved for Customer Service and engineering use.
Save Parameters	**S**	This option allows a user to save the current configuration to permanent storage. This configuration will be restored on each successive power cycle.
Exit	**X**	This option allows a user to exit the current menu and return to its parent menu.

10.2.8 Telnet - Logout Option



When connecting to the CDD-564L through a Telnet session, the menus present another option to logout of the Telnet session. This logout option is in all the menus and when selected, logs the user out of the Telnet session, returning control of the CLI to the serial interface.

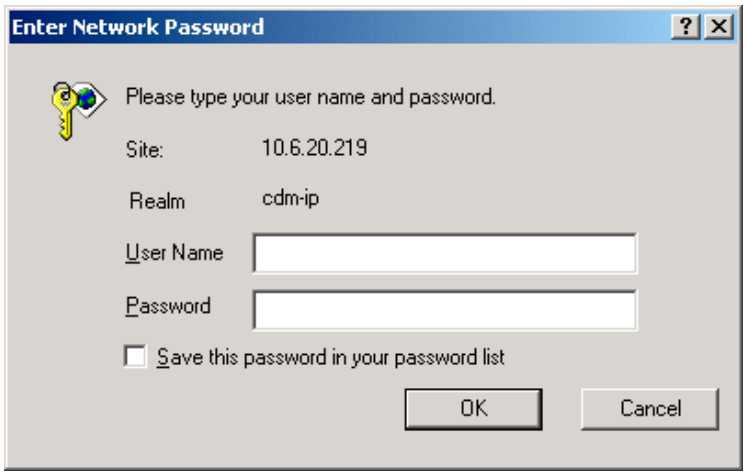
IMPORTANT

The CDD-564L does not allow concurrent access to the menu via telnet and the console port. If a user connects via telnet, CDD-564L automatically disables the console port for the duration of the Telnet session. All menu pages allow a Telnet logout to end a Telnet session. Also, the CDD-564L will automatically end a Telnet session after a period of inactivity (configurable from 1 to 60 minutes).

Chapter 11. Web Server Pages

11.1 Web Server Usage

The easy-to-use Web Server Interface provides the user the ability to configure and monitor all aspects of the CDD-564L. These web pages have been designed for optimal performance when using Microsoft's Internet Explorer 5.5 or higher. By typing http://xxx.xxx.xxx.xxx" (where xxx.xxx.xxx.xxx =CDD-564L IP address) on your browser, the Login prompt will appear.



HTTP Login Access Levels are defined as follows:

User Interface	User Login Access Level		
	Admin User	Read/Write User	Read Only User
Web	11.1.1.1 FULL ACCESS TO ALL WEB PAGES	11.1.1.2 NO ACCESS TO ADMIN OR ENCRYPTION WEB PAGES	11.1.1.3 NO ACCESS TO ADMIN OR ENCRYPTION WEB PAGES
		11.1.1.4 FULL ACCESS FOR ALL OTHER WEB PAGES	11.1.1.5 VIEW ONLY ACCESS FOR ALL OTHER WEB PAGES, ABLE TO RESET STATISTICS

CDD-564L Default Name/Passwords are:

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

IMPORTANT

Any changes made to the CDD-564L will be lost upon reset or power loss unless the changes are saved to permanent storage. This applies to all of the CDD-564L IP parameters. The CDD-564L parameters are saved by selecting “Save Parameters to Flash” on the Maintenance/IP Dbase web page.

All CDD-564L demodulator parameters configured via the CDD-564L (i.e., Frequency, data rate, etc.) will be automatically stored in the CDD-564L base unit non-volitile RAM and will be retained if there is a power loss.

IMPORTANT

See Chapter 10 CDD-564L CLI and Telnet Interface section for a more detailed explanation of CDD-564L functions.

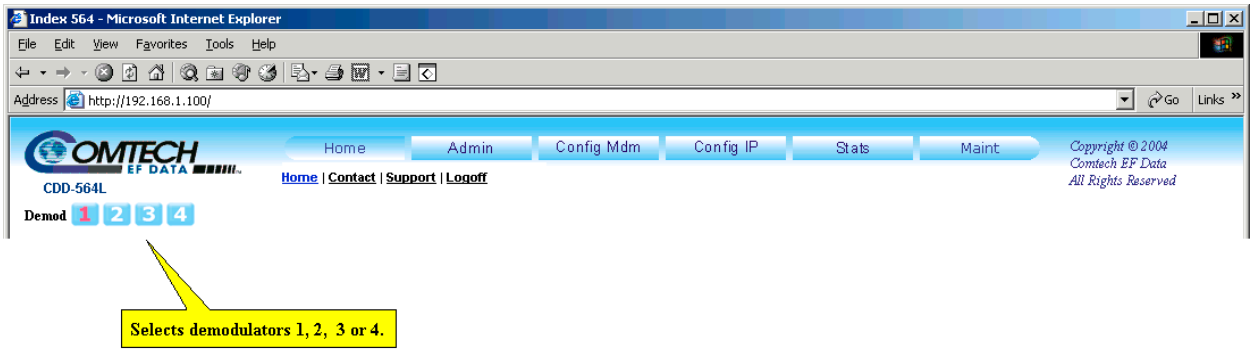
11.1.2 Web Server Menu Tree

Table 11-1. CDD-564L Web Server Menu Tree

Level 1	Level 2	Per Demod
Home	Home	No
	Contact	No
	Support	No
	Logoff	No
ADMIN	Access	No
	Features	No
	Remote	No
CONFIG MDM	Summary	No
	Wan Interface	**Yes**
	Lan Interface	No
	Modem (parameters)	**Yes**
	Modem Utilities	**Yes**
	LNB	**Yes**
CONFIG IP	Routes	No
	Multicast Routes	No
	ARP	No
	IGMP	No
	Encrypt	**Yes**
STATS	Ethernet	No
	IP	No
	WAN	**Yes**
	Modem Status	**Yes**
	Modem Events	**Yes**
	Modem Statistics	**Yes**
MAINTENANCE	Reset Unit	No
	Unit Info	No
	Database	No
	Save Flash	No

11.2 Selecting Demodulators

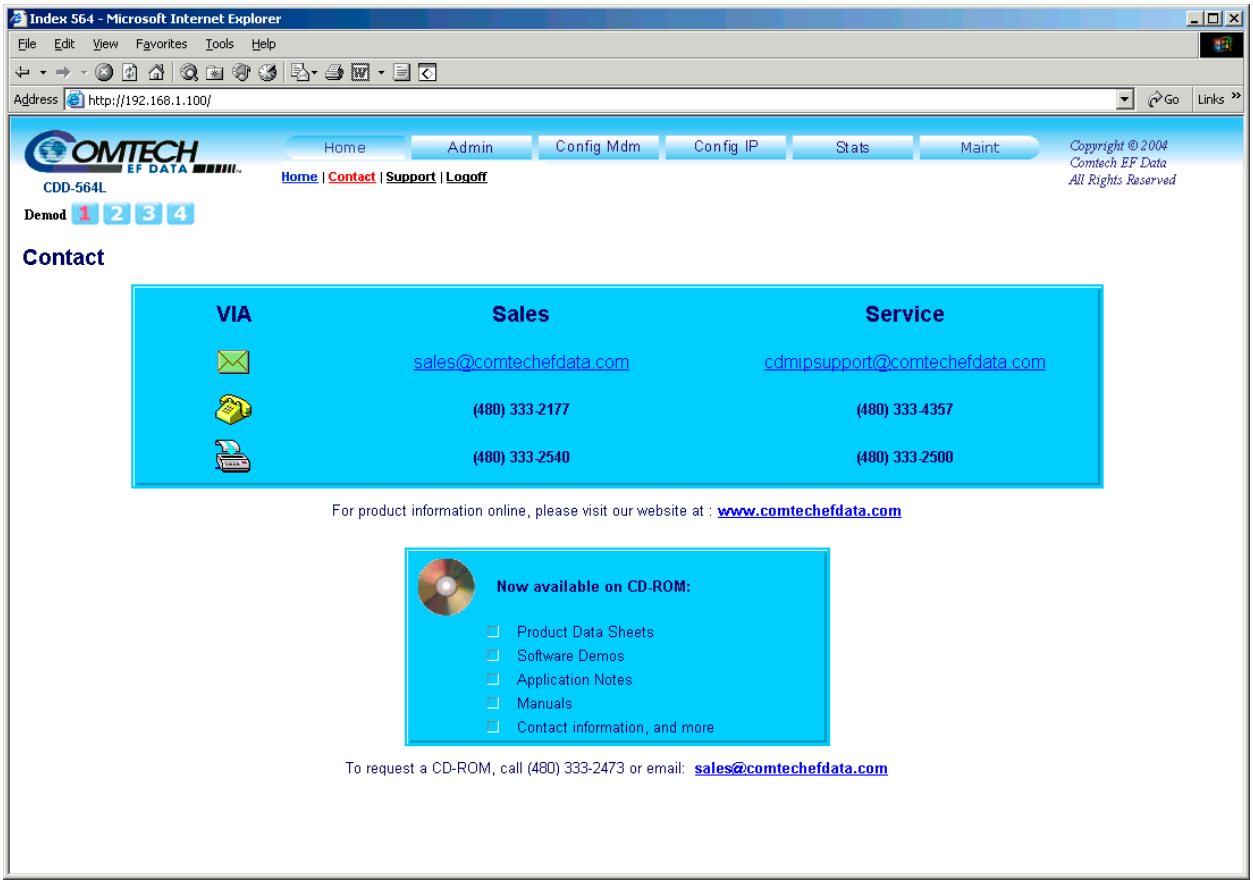
The CDD-564L unit supports 4 independent demodulators. Select the individual demodulator number, located in the upper left hand corner of every web page, to address that demodulator. Web pages that do not include demodulator parameters (routes, administrative pages, etc.) are not affected by changes in the addressed demodulator.



11.3 Home Page

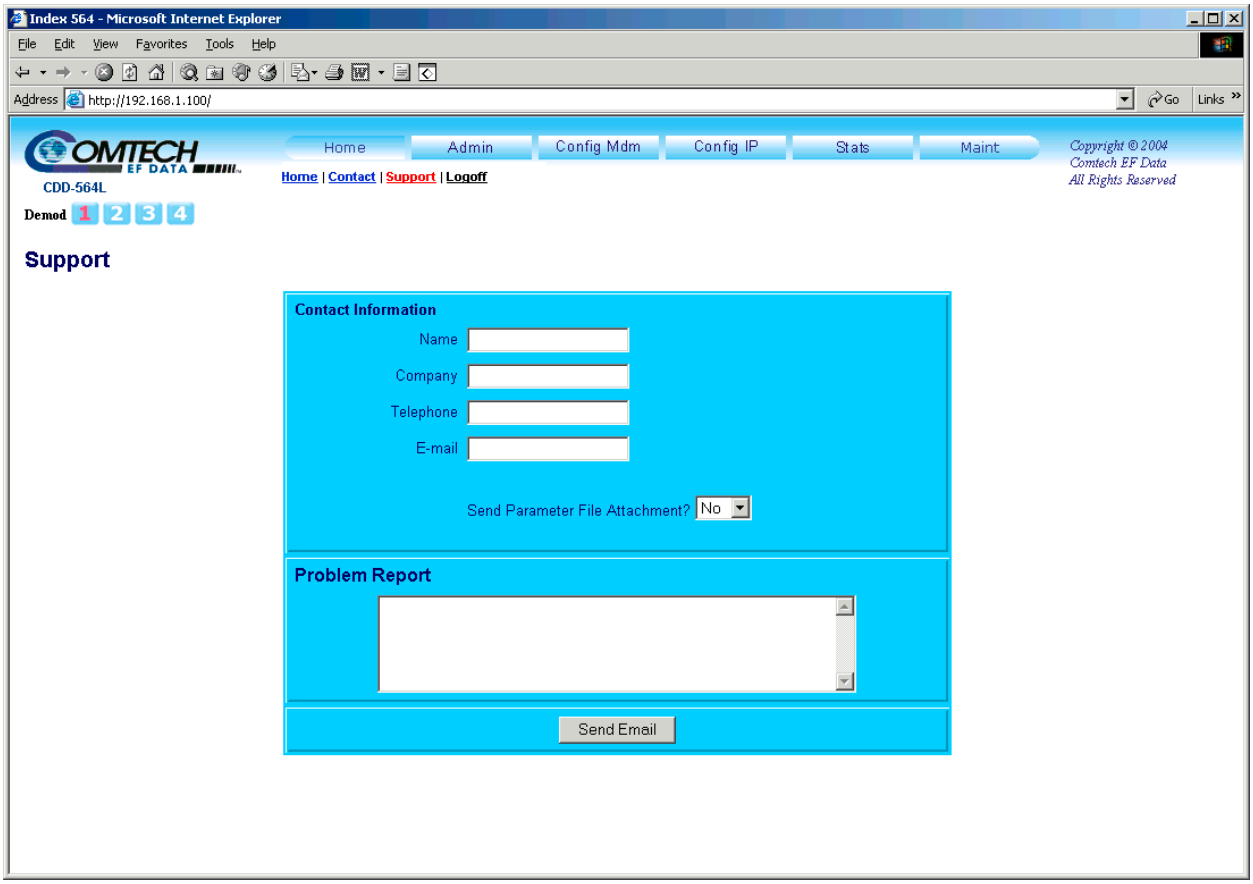
Welcome to the CDD-564L Web Interface. The following sections will describe the functionality that is unique to the Web Interface.

11.3.1 Contact Information



This page provides basic contact information to reach Comtech EF Data Sales and Customer Support via phone or automated e-mail links.

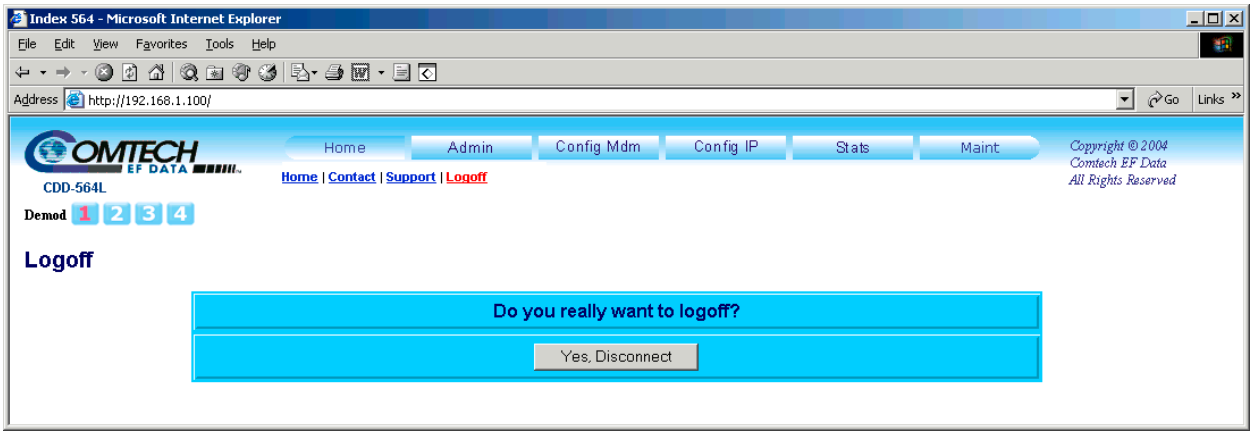
11.3.2 Support



Notes on SMTP – SMTP can be used to send an email to Comtech EF Data IP Modem Support cdmipsupport@comtechefdata.com from the Support Web Page. The Support Web Page allows you to compose an email message for questions or problems with the modem. The user can also select to automatically attach the modem's parameter file (which will contain the unit's serial number and configuration information) in order to facilitate troubleshooting or to resolve configuration issues. The problem report area of the display allows up to 2,000 characters maximum.

The CDD-564L uses SMTP (Simple Mail Transport Protocol) to send email and will require the unit's administrator to specify the SMTP server, domain name and destination name on the Administration Screen for SMTP to operate correctly (see Chapter 12 for details on Administration SMTP Configuration).

11.3.3 Logoff

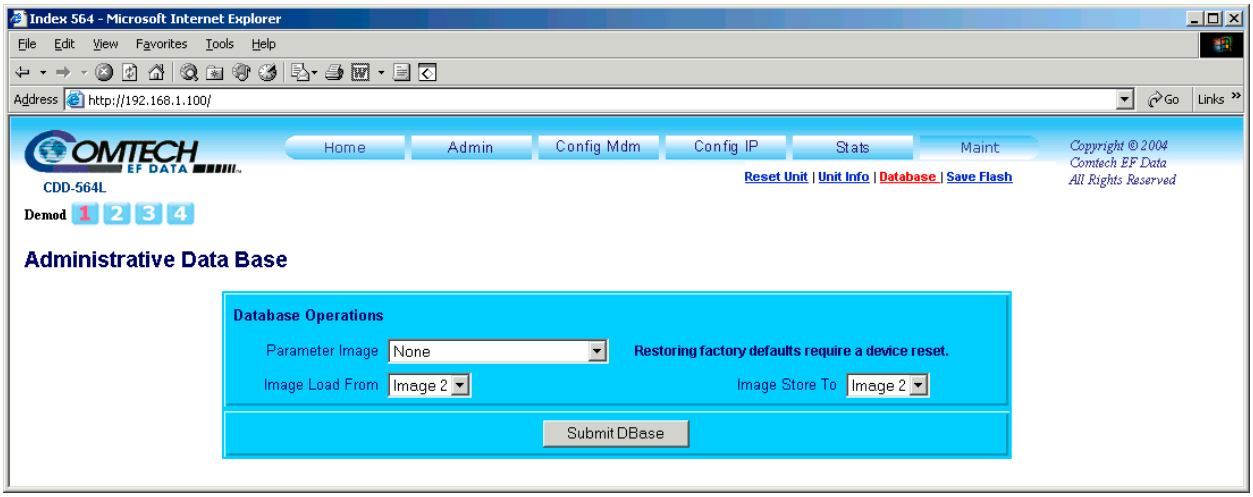


Currently the CDD-564L only allows one connection to the CLI or the Web Interface. Use this option to formally disconnect from the Web Interface.

IMPORTANT

Upon disconnection, you will be required to close the Web Browser so as to delete the security cookie to the modem.

11.3.4 Administrative Database



IMPORTANT

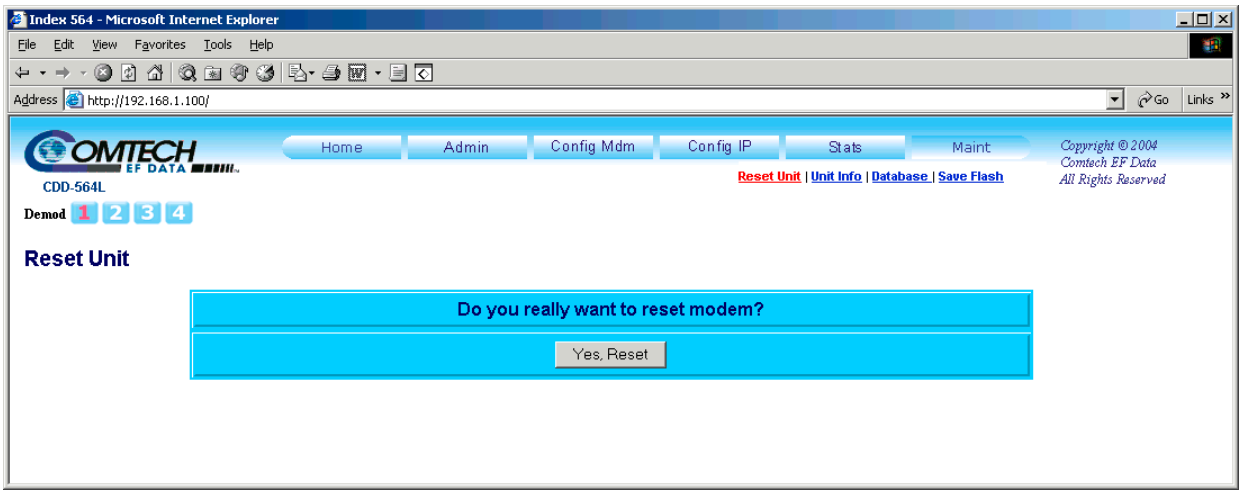
Any changes made to the CDD-564L will be lost if it is reset or loses power, unless the changes are saved to permanent storage. This applies to all of the CDD-564L parameters. The CDD-564L parameters are saved by selecting "Save Parameters to Flash" on the Maintenance/IP Dbase web page.

The following individual demodulator parameters are saved each time they are changed and do not require a "Save Parameters to Flash" operation: Frequency, Data Rate, Rx Acquisition Range, Internal Reference Adjust, Decoder, Data Invert, Eb/No Alarm Point, De-scrambler, Spectrum, Alarm Mask, and Statistics Log Interval.

Table 11-2. Administrative Database Fields

Field	Description
Parameter Image	Select from: • Save Parameters to Flash - When changes are made to the CDD-564L protocol system, the Flash Save option must be selected in order for these settings to be valid through a power cycle. Without using this option, settings will revert back to their previous state as indicated by the last time the flash was saved. • Restore Factory Defaults – uses the internal, hard-coded factory default parameters.
Image Load From	Determines which version of the CDD-564L Software Package (includes Application, FPGA, and FFPGA) will be loaded upon boot-up. The options are: • Latest - boot the newest Software Package based upon date. • Image1 - boot the Software Package loaded into the first slot in permanent storage. • Image2 - boot the Software Package loaded into the second slot in permanent storage.
Image Save To	Determines which installed Software Package (includes Application, FPGA, and FFPGA) that the CDD-564L will overwrite when upgrading with a new Software Package. The options are: • Oldest - overwrite the oldest Software Package based upon date. • Image1 - overwrite the Software Package loaded into the first slot in permanent storage. • Image2 - overwrite the Software Package loaded into the second slot in permanent storage.

11.3.5 Reset Unit



The last item on the left-hand menu is "Reset." This option will force the CDD-564L to reboot.

Notes: 1. Rebooting does not remove the name/password cookie. Therefore, it is recommended that after rebooting is selected, the user close the web browser.

Chapter 12. SNMP Interface

12.1 SNMP Interface

The *Simple Network Management Protocol* (SNMP) is an application-layer protocol designed to facilitate the exchange of management information between network devices. The CDD-564L SNMP agent supports both SNMPv1 and v2c.

For proper SNMP operation, the CDD-564L MIB files must be used with the associated version of the CDD-564L software. Please refer to the CDD-564L SW Release Notes for information on the required FW/SW compatibility.

12.2 CDD-564L Management Information Base (MIB) Files

MIB files are used for SNMP remote management and consist of Object Identifiers (OID's). Each OID is a node that provides remote management of a particular function. A MIB file is a tree of nodes that is unique to a particular device. There are three MIB files associated with the CDD-564L:

MIB File/Name	Description
FW11669-2-.mib ComtechEFData MIB file	ComtechEFData MIB file gives the root tree for ALL Comtech EF Data products and consists of only the following OID: Name: comtechEFData OID: 1.3.6.1.4.1.6247 Path: iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).comtechEFData(6247)
FW11669-3-.mib CDD-564L MIB file	CDD-564L MIB file consists of all of the OID's for management of the CDD-564L modem functions.
FW11669-4-.mib CDD-564L Traps MIB file	CDD-564L Trap MIB file is provided for SNMPv1 traps.

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

Note: The **CDD-564L** SNMP agent supports both SNMPv1 and v2c. The CDD-564L Traps file only needs to be compiled if SNMPv1 traps are to be used.

Any changes made to the IP Parameters will be lost if the CDD-564L is reset or loses power unless the changes are saved to permanent storage. The IP Parameters can be saved by a SET of the cdd564SaveParamToFlash OID within the CDD-564L MIB.

12.3 SNMP Community Strings

The CDD-564L uses community strings as a password scheme that provides authentication before gaining access to the CDD-564L agent's MIBs.

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

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

The user defines three Community Strings for SNMP access:

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

12.4 SNMP Traps

The CDD-564L has the ability to send out SNMP traps when certain events occur in the modem. For example, when the CDD-564L boots, it sends out a coldstart trap and five linkup traps, one for each interface that is brought up. The CDD-564L also sends out traps when an alarm or a fault occurs in the modem. These include Unit faults, Rx faults, and LNB faults. A trap is sent both when a fault occurs and is cleared.

The CDD-564L supports both SNMPv1 traps and SNMPv2 notifications. Which style of traps the CDD-564L sends can be configured by the user using the cdd564SNMPTrapVersion OID.

The following are the MIB2 v1traps/v2 notifications that the CDD-564L supports.

CDD-564L IP Controller MIB2 SNMPv1 traps:

Cold Start	1
Link Up	4
Authentication Failure	5

CDD-564L MIB2 SNMPv2 notifications:

Cold Start	1.3.6.1.6.3.1.1.5.1
Link Up	1.3.6.1.6.3.1.1.5.4
Authentication Failure	1.3.6.1.6.3.1.1.5.5

The following tables are the Alarms and Faults v1 traps / v2 notifications that the CDD-564L supports.

CDD-564L Alarms and Faults SNMPv1 traps:

cdd564UnitAlarmTrap	6247251
cdd564RxAlarmTrap	6247252
cdd564LNBAlarmTrap	6247253

CDD-564L Alarms and Faults SNMPv2 notifications:

cdd564UnitAlarmNotification	1.3.6.1.4.1.6247.25.2.0.1
cdd564RxAlarmNotification	1.3.6.1.4.1.6247.25.2.0.2
cdd564LNBAlarmNotification	1.3.6.1.4.1.6247.25.2.0.3

12.5 MIB-II

The CDD-564L agent implements RFC 1213, Management Information Base for Network Management of TCP/IP-based Internets. This is known as "MIB-II" or "Public MIB support." For detailed OID information please refer to the actual MIB file. The agent implements the following Groups:

Table 12-1. MIB-II Support

Group	Comments
System Group	Mandatory for RFC1213
Interface	Mandatory for RFC1213
IP	Mandatory for RFC1213
ICMP	Mandatory for RFC1213
TCP	Mandatory for RFC1213
UDP	Mandatory for RFC1213
SNMP	Mandatory for RFC1213
Address Translation Group	Implemented but deprecated in MIB-II
EGP	Not applicable

12.5.1 System Group

This System Group provides information about the following items:

Table 12-2. System Group

OID	Defaults Value
SysDescr	CDD-564L L-Band Satellite Quad Demod
SysObjectID	1.3.6.1.4.1.6247.25
SysUpTime	The time (in hundredths of a second) since the network management portion of the system was last re-initialized.
SysContact	User Configurable
SysName	User Configurable
SysLocation	User Configurable
SysServices	79

The system services provided by the CDD-564L in the OSI network model are:

$\sum 2^{L-1}$ where L is the network layer support by the CDD-564L.

In the CDD-564L, this is calculated by 2^{1-1} (layer 1) + 2^{2-1} (layer 2) + 2^{3-1} (layer 3) + 2^{4-1} (layer 4) + 2^{7-1} (layer 7) = 1 + 2 + 4 + 8 + 64 = 79.

12.5.2 Interface Group

This group provides the number of interfaces on a managed device and a table describing all interfaces.

The **ifNumber** OID is the number of network interfaces present on this system. On a CDD-564L the ifNumber should be 3 corresponding to the Ethernet, and Satellite interfaces.

Table 12-3. Interfaces Table OIDs

OID	Description
IfIndex	Unique value for each interface. The CDD-564L gives the satellite Rx interfaces (1-4) and the Ethernet interface (5).
IfDescr	Textual string containing information about the interface. The Ethernet interface is “ethernet”. The satellite interface is “satelliteRx”.
IfType	Link protocol for the interface. The Ethernet interface is set to ethernetCsmacd(6). The satellite Interface is hdlc(118).
IfMtu	For the Ethernet and satellite Interfaces, the MTU is 1500 octets.
IfSpeed	Estimate of the interface's current bandwidth in bits per second. The Ethernet Interface can be set to either 100000000 (100 Mbps) or 10000000 (10 Mbps). If the Ethernet driver is set to “Auto” then 100000000 will be returned. The satellite Interface’s ifSpeed corresponds to the data rate of the demodulator. The demodulator’s ifSpeed can range from 4800 (4.8 Kbps) to 5000000 (5.0 Mbps).
ifPhyAddress	Interface's address at the datalink layer. For the Ethernet Interface this corresponds to the MAC address (6 bytes). For the satellite Interface this value is undefined.
ifAdminState	Desired state of the interface. For the CDD-564L, the interfaces cannot be changed from an up (1) status.
ifOperState	Current operational state of the interface. For the CDD-564L, the interfaces will remain in an up (1) status.
ifLastChange	Per RFC1213
IfInOctets	Per RFC1213
ifInUcastPkts	Per RFC1213
ifInNUcastPkts	Per RFC1213
ifInDiscards	Per RFC1213
IfInErrors	Per RFC1213
ifInUnknownProtos	Per RFC1213
ifOutOctets	Per RFC1213
ifOutUcastPkts	Per RFC1213
ifOutNUcastPkts	Per RFC1213
IfOutDiscards	Per RFC1213
IfOutErrors	Per RFC1213
IfOutQLen	Per RFC1213
IfSpecific	This OID is not used.

12.5.2.1 AT Group

This group contains a table that permits mappings from network addresses (i.e., IP addresses) to physical addresses (i.e., MAC addresses). This group is depreciated.

12.5.2.2 Address Translation Table

This table is implemented per RFC1213.

12.5.2.3 IP Group

This group is implemented per RFC1213.

12.5.2.4 IP Address Table

This table is implemented per RFC1213.

12.5.2.5 Route Table

This table is implemented per RFC1213

12.5.2.6 Net to Media Translation Table

This table is implemented per RFC1213.

12.5.2.7 Additional IP Objects

The **ipRoutingDiscards** OID is the number of routing entries chosen to be discarded even though they are valid.

12.5.3 ICMP Group

This group contains the Internet Control Message Protocol (ICMP) input and output statistics. ICMP messages are used for out-of-band messages related to network operation. This group is implemented per RFC1213.

12.5.4 TCP Group

This group contains statistics and control parameters for the TCP protocol. This group contains a table describing the current TCP connections.

Note: The instances of object types that represent information about a particular TCP connection are transient; they persist only as long as the connection in question.

Table 12-4. TCP Group OIDs

OID	Description
TcpRtoAlgorithm	Algorithm used to determine the timeout value used for retransmitting unacknowledged octets. The CDD-564L uses Van Jacobson's algorithm.
TcpRtoMin	Minimum value permitted by a TCP implementation for the retransmission timeout. The CDD-564L uses a minimum timeout of 1000 milliseconds.
TcpRtoMax	Maximum value permitted by a TCP implementation for the retransmission timeout. The CDD-564L uses a maximum timeout of 64000 milliseconds.
TcpMaxConn	Limit on the total number of TCP connections the entity can support. In the CDD-564L, the maximum number of connections is dynamic so a value of –1 is returned.
TcpActiveOpens	Per RFC1213
TcpPassiveOpens	Per RFC1213
TcpAttemptFails	Per RFC1213
TcpEstabResets	Per RFC1213
TcpCurrEstab	Per RFC1213
TcpInSegs	Per RFC1213
TcpOutSegs	Per RFC1213
TcpRetransSegs	Per RFC1213

12.5.4.1 TCP Connection Table

The tcpConnTable is a table containing TCP connection-specific information. Each row contains information about a particular current TCP connection. A row is transient, in that it ceases to exist when the connection makes the transition to the CLOSED state. This table is implemented per RFC1213.

12.5.5 UDP Group

This group contains control parameters and statistics for the UDP protocol. This group contains a UDP table describing the UDP ports in use. This group is implemented per RFC1213.

12.5.5.1 UDP Listener Table

The UDP listener table contains information about this entity's UDP end-points on which a local application is currently accepting datagrams. A row contains information about a particular current UDP listener. This group is implemented per RFC1213.

12.5.6 EGP Group

This group is not implemented in the agent.

12.5.7 Transmission Group

This group is not implemented in the agent.

12.5.8 SNMP Group

This group provides statistical information regarding the SNMP Protocol. This group is implemented per RFC1213.

12.6 CDD-564L Private MIB

The CDD-564L MIB holds all the security, feature selection, IP related parameters and all the modem specific parameters. For detailed OID information please refer to the actual MIB file.

12.6.1 Administration Group

This group contains system security, administration, and feature configuration parameters.

12.6.1.1 CDM-IP Access Lists Subgroup

The Access Client List allows a user to define which remote clients can connect to a CDD-564L when the Access List Enforcement is enabled. Each entry allows a user to specify an IP address and a subnet mask to define a unique class of clients that are allowed access to the CDD-564L.

12.6.1.2 Features Subgroup

This subgroup allows a user to enable/disable a Standard or FAST feature.

Standard features (Telnet, ping response, multicast routing, and IGMP) can be enabled or disabled by sending a 1 (enable) or 0 (disable). Header decompression can be enabled or disabled on a per demodulator basis via the FeaturesTable.

12.6.1.3 Decryption Subgroup

This subgroup controls the parameters for the Triple DES (3xDES) feature. Each Receive key is of 192-bit length. The Rx DES keys can be entered through the DESRxKeyTable.

12.6.1.4 SMTP

The cdd564SMTP subsection sets up the CDD-564L to use a SMTP mail server to send a problem report back to Comtech EF Data Modem Support. Along with the problem report, the CDD-564L sends the equipment serial number and configuration, which is attached to the email message. By default, the problem report is sent to cdmipsupport@comtechefdata.com. In order for this to work, the user is required to enter the IP address of their outgoing SMTP mail server and the domain name for that server.

12.6.1.5 SNMP Traps

This cdd564SNMP subsection controls where SNMP traps are sent and the community string used in sending traps. Either V1 or V2 traps can be sent.

12.6.2 Interface Group

This group controls the parameters of the modem's Ethernet and demodulator interfaces.

12.6.2.1 Ethernet Interface Subgroup

This subgroup defines the modem's Ethernet interface. These include parameters for setting the Ethernet speed, IP address, and IP address subnet prefix length.

12.6.2.2 Demodulator Interface Subgroup

This subgroup defines the Demodulator's interfaces including Address Mode and each demodulator's HDLC addresses.

Changing the HDLC Address mode between Point-to-Point Mode, Small Network Mode, and Large Network Mode forces the system to reboot. System configuration will be saved before re-booting. Please make sure you are setting the correct value.

12.6.3 Route Table Group

The **cdd564RouteTable** allows a user to define how the packets that the CDD-564L receives are routed.

12.6.4 Protocols Group

The protocols groups allows user to control networking protocols such as IGMP.

12.6.4.1 IGMP Subgroup

This subgroup controls the IGMP, Internet Group Management Protocol, which is the standard for IP multicasting in the Internet.

12.6.5 Maintenance Group

This group contains several miscellaneous operations for CDD-564L, including the unit information, bulk database configuration (allows the user to define which image to boot from and into which image to save a new bulk file), and IP PARAM file configuration. Rebooting the CDD-564L is also possible from this group.

12.6.6 Statistics Group

This group collects various statistics on Ethernet interface, satellite interfaces, and IP routing.

12.6.6.1 Ethernet Statistics

The cdd564EthernetStatistics section collects statistics reported on the Ethernet network card.

12.6.6.2 IP Routing Statistics

The cdd564IPRoutingStatistics reports statistics collected by the IP router mechanism.

12.6.6.3 Satellite Statistics

The cdd564SatelliteStatistics section collects statistics reported on the WAN (satellite interface) FPGA.

12.7 Demodulator Configuration

IMPORTANT Whenever modifying the Demodulator parameters by SNMP, the user must be aware that the following variables must be executed in this order:

1. FEC (Forward Error Correction)
2. Demodulation
3. Code Rate
4. Data Rate

For detailed OID information please refer to the actual MIB file.

This group allows the user to configure the demodulator parameters, alarm masks, and internal reference adjustment. LNB units attached to the modem can also be configured.

12.7.1.1 Rx Parameters

The cdd564Rx section allows the user to configure the demodulators' parameters.

12.7.1.2 Alarm Mask Parameters

This section allows the user to mask alarms that the user does not want to see.

12.7.1.3 LNB Parameters

The section allows a user to configure LNB parameters when a LNB is attached to the modem.

12.7.2 Monitor Group

This groups reports the modem's status, including alarms, demodulator parameters, event log entries, statistics entries, and LNB parameters.

12.7.2.1 Unit Monitor

The section reports serial number, software revision, model number, and temperature. Any alarms that have been raised for the unit are also available.

12.7.2.2 Rx Monitor

The cdd564RxMonitor section reports the demodulator's bit error rate (BER), buffer fill state, frequency offset, receive signal level, and Eb/No value. Alarms that have been raised on a specific demodulator are also reported.

12.7.2.3 LNB Monitor

This section reports LNB unit status, including LNB current, LNB voltage, and any alarms.

12.7.2.4 Stored Events Log

The event log is a table that informs the user of any faults that have occurred in the demodulators. Event entries may also include informational items, such as power on/off.

12.7.2.5 Stored Statistics

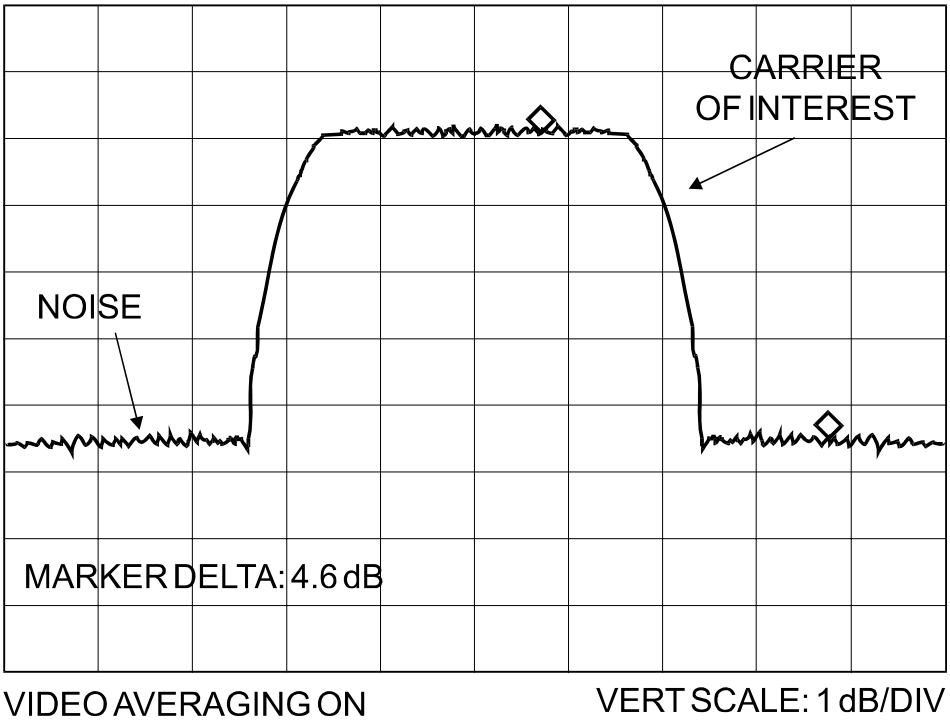
The statistics log is a table that gathers data concerning receive Eb/No. The user can decide to collect these statistics on intervals ranging from 10 minutes to 90 minutes.

12.7.3 Util Group

The cdd564Util group allows the user set the unit's time and date, and set the circuit ID string.

Appendix A. Eb/No Measurement

Although the CDD-564L calculates the value of receive Eb/No and makes it available through the remote port of the unit. It is sometimes useful to measure the value using a spectrum analyzer, if one is available.



The idea is to accurately measure the value of (Co+No)/No, (Carrier density + Noise density/Noise density). This is accomplished by tuning the center frequency of the Spectrum analyzer to the signal of interest, and measuring the difference between the peak spectral density of the signal (the flat part of the spectrum shown) and the noise density. To make this measurement:

- Use a vertical scale of 1 or 2 dB/division.
- Set the Resolution Bandwidth of the Spectrum Analyzer to < 20 % of the symbol rate.
- Use video filtering and/or video averaging to reduce the variance in the displayed trace to a low enough level that the difference can be measured to within 0.2dB.
- Place a marker on the flat part of the signal of interest, then use the MARKER DELTA function to put a second marker on the noise to the side of the carrier. This value is (Co+No)/No, in dB.
- Use this value of (Co+No)/No in the table on the following page to determine the Eb/No. You will need to know the operating mode to read from the appropriate column.
- If the (Co+No)/No value measured does not correspond to an exact table entry, interpolate using the two nearest values.

Note: The accuracy of this method degrades significantly at low values of (Co+No)/No (approximately less than 6 dB).

Example:
In the diagram above, the (Co+No)/No measured is 4.6 dB. If Rate 1/2 QPSK is being used, this would correspond to an Eb/No of approximately 2.6 dB.

The exact relationship used to derive the table values is as follows:

$$\text{Eb/No} = 10\log_{10}(10^{(\text{Co+No/No})/10} - 1) - 10\log_{10}(\text{FEC Code Rate}) - 10\log_{10}(\text{bits/symbol})$$

where:

- Eb/No and (Co+No)/No are expressed in dB
- Bits/symbol = 1 for BPSK
- Bits/symbol = 2 for QPSK
- Bits/symbol = 3 for 8-PSK/8-QAM
- Bits/symbol = 4 for 16-QAM
- Code Rate for ‘uncoded’ = 1
- Pay close attention to the sign of the middle term

The table contains information for the available modulation and code rates and others.

(Co+No) /No	Eb/No Uncoded BPSK	Eb/No Rate 1/2 BPSK	Eb/No Rate 21/44 BPSK	Eb/No Rate 5/16 BPSK	Eb/No Uncoded QPSK	Eb/No Rate 1/2 QPSK	Eb/No Rate 3/4 QPSK	Eb/No Rate 7/8 QPSK	Eb/No Rate 0.95 QPSK	Eb/No Rate 2/3 8-PSK	Eb/No Rate 3/4 8-PSK	Eb/No Rate 7/8 8-PSK	Eb/No Rate 0.95 8-PSK	Eb/No Rate 3/4 16-QAM	Eb/No Rate 7/8 16-QAM
1.4	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-
1.6	-	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-
1.8	-	-	-	2.1	-	-	-	-	-	-	-	-	-	-	-
2.0	-	0.7	0.9	2.7	-	-	-	-	-	-	-	-	-	-	-
2.2	-	1.2	1.4	3.2		-	-	-	-	-	-	-	-	-	-
2.4	-	1.7	1.9	3.7	-	-	-	-	-	-	-	-	-	-	-
2.6	-	2.1	2.3	4.2	-	-	-	-	-	-	-	-	-	-	-
2.8	-	2.6	2.8	4.6	-	-	-	-	-	-	-	-	-	-	-
3.0	0.0	3.0	3.2	5.0	-	-	-	-	-	-	-	-	-	-	-
3.5	0.9	3.9	4.1	5.9	-	0.9	-	-	-	-	-	-	-	-	-
4.0	1.8	4.8	5.0	6.8	-	1.8	-	-	-	-	-	-	-	-	-
4.5	2.6	5.6	5.8	7.6	-	2.6	0.8	-	-	-	-	-	-	-	-
5.0	3.3	6.3	6.5	8.4	-	3.3	1.5	0.9	-	-	-	-	-	-	-
5.5	4.1	7.1	7.3	9.1	1.1	4.1	2.3	1.7	1.3	-	-	-	-	-	-
6.0	4.7	7.7	7.9	9.8	1.7	4.7	2.9	2.3	1.9	-	-	-	-	-	-
6.5	5.4	8.4	8.6	10.4	2.4	5.4	3.6	3.0	2.6	-	-	-	-	-	-
7.0	6.0	9.0	9.2	11.1	3.0	6.0	4.2	3.6	3.2	-	-	-	-	-	-
7.5	6.6	9.6	9.8	11.7	3.6	6.6	4.8	4.2	3.8	-	-	-	-	-	-
8.0	7.3	10.3	10.5	12.3	4.3	7.3	5.5	4.9	4.5	-	-	-	-	-	-
8.5	7.8	10.8	11.0	12.9	4.8	7.8	6.0	5.4	5.0	4.8	-	-	-	-	-
9.0	8.4	11.4	11.6	13.4	5.4	8.4	6.6	6.0	5.6	5.4	4.9	-	-	-	-
9.5	9.0	12.0	12.2	14.0	6.0	9.0	7.2	6.6	6.2	6.0	5.5	4.8	4.5	-	-
10.0	9.5	12.5	12.7	14.6	6.5	9.5	7.7	7.1	6.7	6.5	6.0	5.3	5.0	-	-
10.5	10.1	13.1	13.3	15.1	7.1	10.1	8.3	7.7	7.3	7.1	6.6	5.9	5.6	5.3	-
11.0	10.6	13.6	13.8	15.7	7.6	10.6	8.8	8.2	7.8	7.6	7.1	6.4	6.1	5.8	5.2
11.5	11.2	14.2	14.4	16.2	8.2	11.2	9.4	8.8	8.4	8.2	7.7	7.0	6.7	6.4	5.8
12.0	11.7	14.7	14.9	16.7	8.7	11.7	9.9	9.3	8.9	8.7	8.2	7.5	7.2	6.9	6.3
12.5	12.2	15.2	15.4	17.3	9.2	12.2	10.4	9.8	9.4	9.2	8.7	8.0	7.7	7.4	6.8
13.0	12.8	15.8	16.0	17.8	9.8	12.8	11.0	10.4	10.0	9.8	9.3	8.6	8.3	8.0	7.4
13.5	13.3	16.3	16.5	18.3	10.3	13.3	11.5	10.9	10.5	10.3	9.8	9.1	8.8	8.5	7.9
14.0	13.8	16.8	17.0	18.8	10.8	13.8	12.0	11.4	11.0	10.8	10.3	9.6	9.3	9.0	8.4
14.5	14.3	17.3	17.5	19.4	11.3	14.3	12.5	11.9	11.5	11.3	10.8	10.1	9.8	9.5	8.9
15.0	14.9	17.9	18.1	19.9	11.9	14.9	13.1	12.5	12.1	11.9	11.4	10.7	10.4	10.1	9.5
15.5	15.4	18.4	18.6	20.4	12.4	15.4	13.6	13.0	12.6	12.4	11.9	11.2	10.9	10.6	10.0
16.0	15.9	18.9	19.1	20.9	12.9	15.9	14.1	13.5	13.1	12.9	12.4	11.7	11.4	11.1	10.5
16.5	16.4	19.4	19.6	21.4	13.4	16.4	14.6	14.0	13.6	13.4	12.9	12.2	11.9	11.6	11.0
17.0	16.9	19.9	20.1	21.9	13.9	16.9	15.1	14.5	14.1	13.9	13.4	12.7	12.4	12.1	11.5
17.5	17.4	20.4	20.6	22.4	14.4	17.4	15.6	15.0	14.6	14.4	13.9	13.2	12.9	12.6	12.0
18.0	17.9	20.9	21.1	23.0	14.9	17.9	16.1	15.5	15.1	14.9	14.4	13.7	13.4	13.1	12.5
18.5	18.4	21.4	21.6	23.5	15.4	18.4	16.6	16.0	15.6	15.4	14.9	14.2	13.9	13.6	13.0
19.0	18.9	21.9	22.1	24.0	15.9	18.9	17.1	16.5	16.1	15.9	15.4	14.7	14.4	14.1	13.5
19.5	19.5	22.5	22.7	24.5	16.5	19.5	17.7	17.1	16.7	16.5	16.0	15.3	15.0	14.7	14.1
20.0	20.0	23.0	23.2	25.0	17.0	20.0	18.2	17.6	17.2	17.0	16.5	15.8	15.5	15.2	14.6

Notes: IBS Framing: add 0.2 dB EDMAC Framing: rates below 2048 kbps add 0.2 dB, otherwise 0 Reed-Solomon: add an *additional* 0.4 dB to the values shown

Notes:

Appendix B. FAST Activation Procedure

B.1 Introduction

FAST is an enhancement feature available in Comtech EF Data products, enabling on-location upgrade of the operating feature set—in the rack—without removing a modem from the setup. This accelerated upgrade can be accomplished only because of FAST's extensive use of programmable devices incorporating Comtech EF Data-proprietary signal processing techniques. These techniques allow the use of a unique access code to enable configuration of the available hardware. The access code can be purchased at any time from Comtech EF Data. Once obtained, the access code is loaded into the unit through console (RJ-11) port.

B.2 Activation Procedure

Refer to the chapter 10- CLI And Telnet Operation for information on using the command line interface (CLI) for this procedure.

B.2.1 Serial Number

Obtain the Modem serial number as follows:

From the main menu,

```
                              Main Menu

Administration.....................................................A
Interface Configuration............................................I
QoS Configuration..................................................Q
Route Table........................................................R
Protocol Configuration.............................................P
Satellite Modem Configuration......................................M
Redundancy Configuration...........................................E
Operations and Maintenance.........................................O


Save Parameters to permanent storage...............................S
Exit...............................................................X
```

Select "M" for Satellite Modem Configuration.

```
                           Satellite Modem

Modem Type.....[CDD-564L]
Configuration......................................................C
Monitor............................................................M
Information........................................................I
Utilities..........................................................U


Save Parameters to permanent storage...............................S
Exit...............................................................X
```

Select "I" for Information. The serial number is on this next page.

```
Modem Information
---------------------------------
Model Number                      CDD-564L
Data Rate Option                  Up to 5000 kbps
Higher-order Modulation           8-PSK/8-QAM and 16QAM (future)
Software Revision                 Boot:1.1.1 Bulk1:1.3.2o Bulk2:1.2.1g
Active Image                      Bulk1
Serial Number                     041682669
Circuit ID                        ------------------------


                      Press Any Key to Continue
```

B.2.2 View Currently Installed Features

The “Modem Information” screen above provides the currently installed features.

Contact a Comtech EF Data sales representative to order features. You will be asked to provide the Modem Serial Number. Comtech EF Data Customer Support personnel will verify the order and provide an invoice and instructions, including a 20-character configuration code.

B.2.3 Enter Access Codes

Enter the access codes as follows:

From the main menu:

```
                                Main Menu

Administration.....................................................A
Interface Configuration............................................I
Route Table........................................................R
Protocol Configuration.............................................P
Satellite Demod Configuration......................................M
Operations and Maintenance.........................................O


Save Parameters to permanent storage...............................S
Exit...............................................................X
```

Select "A" for the administration menu.

```
                             Administration

Name/Password Configuration........................................P
Access Lists.......................................................A
Feature Configuration..............................................F
3xDES Configuration................................................D
SMTP Configuration.................................................M
SNMP Configuration.................................................N
Working Mode.....................................[Router Mode]
WAN Framing Mode.................................[Comtech Native]....W
Telnet timeout...................................[5].....................T
Internal Telnet timeout(allows forever).....[5].....................I


Save Parameters to permanent storage...............................S
Exit...............................................................X
```

Select "F" for Feature Configuration.

```
                              Feature Configuration

Ping Reply.............................[Enabled].............................P
Telnet.................................[Enabled].............................E
SNMP...................................[Disabled]............................N
IGMP...................................[Disabled]............................I
Downlink Route All Available Multicast..[Disabled]..........................M
Receive 3xDES Decryption................[Available]
Rx Header Compression.....................................................H
Rx Payload Compression..................[Available]
FAST Feature Code.....................[00000000000000000000].................Y
Vipersat Feature Codes.................[341:89B0-66F0-C1B0:4.05]..............F
Vipersat Management....................[Disabled]............................V


Save Parameters to permanent storage.....................................S
Exit.....................................................................X
```

From this menu, select "Y" to enter the fast feature 20-byte code string.

```
Please enter a value for the FAST Feature Code
Press ESC to abort

                Enter the FAST Feature Code (Must be exactly 20 digits)
```

B.2.4 Enable / Disable Demo Mode

Not available

Appendix C. Quick-Start Guide

C.1 Introduction

This quick start guide will allow a user to configure a pair of CDM-570Ls (referred to as CDM-IP modems in this section) and a CDD-564L from the beginning (i.e., starting from factory default settings) and be able to pass traffic within minutes. It is assumed that the user is familiar with the configuration of the base satellite modem.

C.1.1 Equipment List

Following equipment is required:

Item	Equipment	Quantity	Comments
1	CDM-IP Modem	2	CDM-570/570L w/ IP Module, CDM-IP 550, CDM-IP 300L and CDD-564L **Note:** customer may need to provide equipment to convert 70 MHz IF to L-band for a duplex connection depending upon modems.
2	10/100 BaseT Ethernet Hub	2	Provided by customer **Note**: Only 10BaseT operation is supported in easyConnect™ mode. RJ-45 crossover Ethernet cables can be substituted to directly connect PC to CDM-IP modem without the use of a hub.
3	PC with NIC and a terminal emulation program	2	Provided by customer
4	Console cable (DB-9 to RJ-11)	1	Supplied by Comtech EF Data
5	Ethernet cables (CAT 5)	4	Provided by customer
6	IF cables	2	Provided by customer (To interconnect TX-RX between both CDM-IP modems.)

C.1.2 Equipment Setup

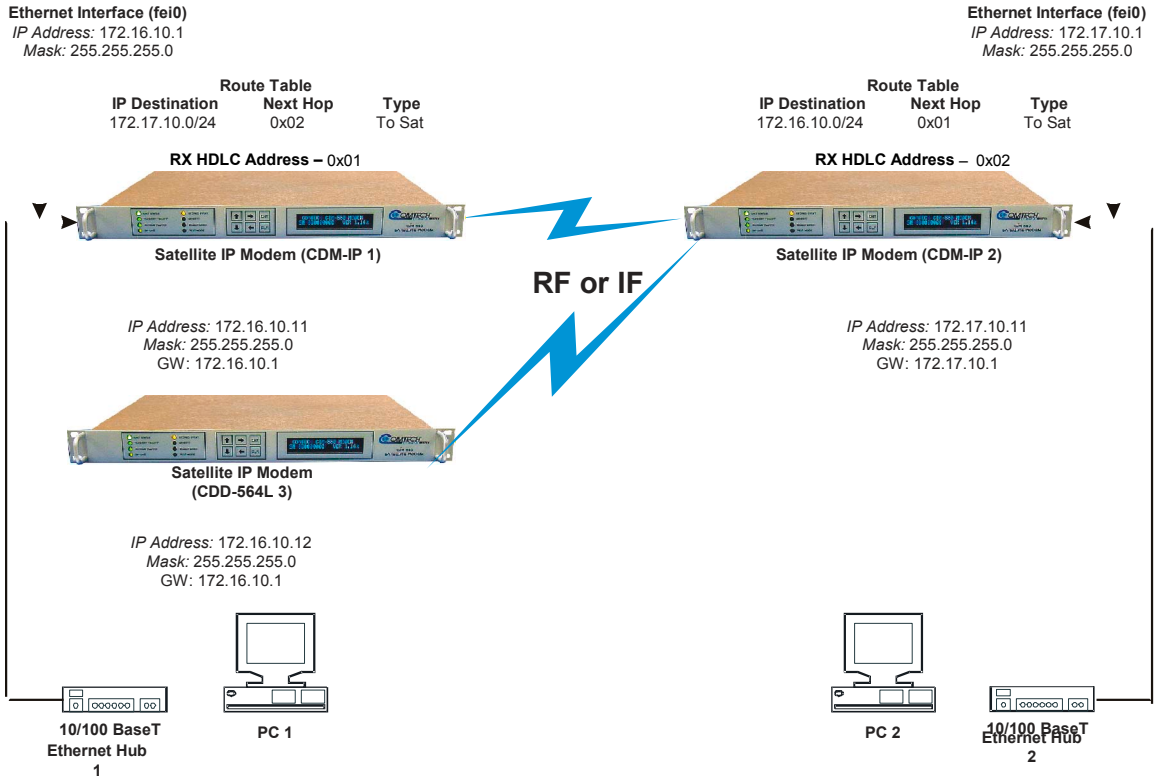


Figure C-1. Router Mode Point-to-Point System Configuration

Step	Description
1	Connect CDM-IP 1 and CDD-564 3 to PC1 via Hub 1 and CDM-IP 2 to PC2 via hub 2
2	Connect the TX IF on CDM-IP 1 to RX IF of CDM-IP 2 and Tx IF on CDM-IP on CDM-IP 2 to the RX IF of the CDD-564L.
3	Connect the DB-9 end of the console cable to the COM1 or COM2 port of the PC and the RJ-11 end to the console port at the back of CDM-IP 1.
4	Connect CDM-IP 1, CDM-IP 2 and CDD-564L to suitable power supply and turn them ON.

C.1.3 Transmit and Receive IF Configuration

Step	Description
1	Configure the transmit and receive IF parameters on CDM-IP 1, CDM-IP 2 and CDD-564L via the front panel.
	Note: The IF parameters can also be set via console menu, Telnet, web interface and SNMP, but for this exercise, it is recommended that the front panel be used.
2	Set the **TxPower** to minimum level.
3	Before proceeding to next step, make sure that each CDM-IP 1 is appropriately carrier-locked to the other CDM-IP 2 , and CDM-IP 2 to CDD-564L.

C.1.4 Serial Console Port Command Line Interface (CLI) Configuration

Step	Description
1	Launch the terminal emulation program - such as HyperTerminal on Microsoft Windows.
2	Select the appropriate COM port (to which the DB-9 end of the console cable is connected) and configure it for: ▸ 38,400 bps ▸ 8 data bits ▸ no parity ▸ 1 stop bit ▸ no hardware flow control
3	Press return and to bring up the Main menu.

C.1.5 Main Menu

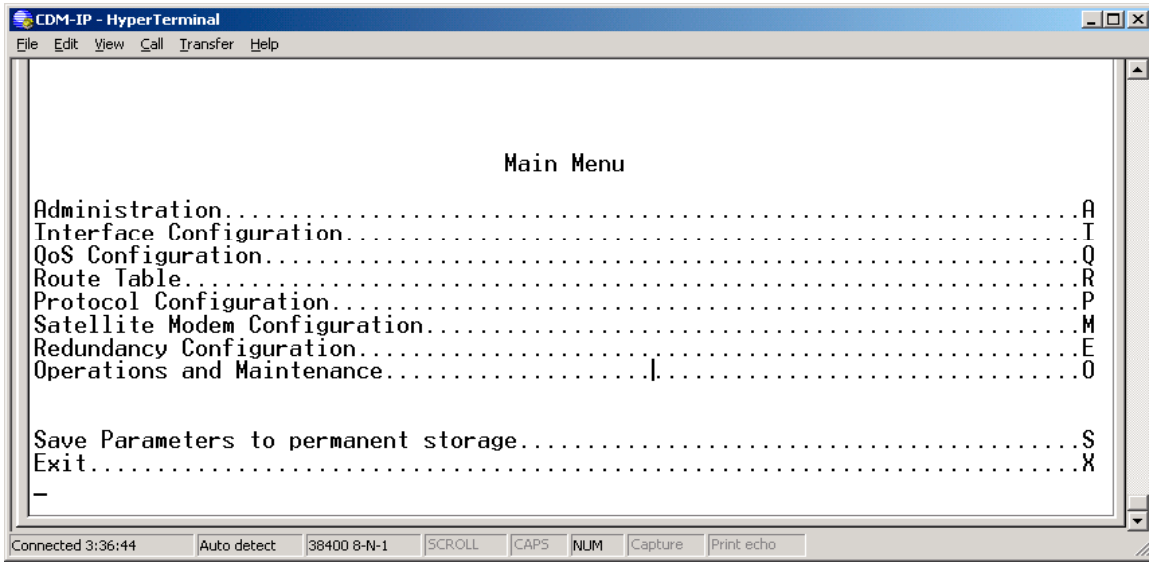
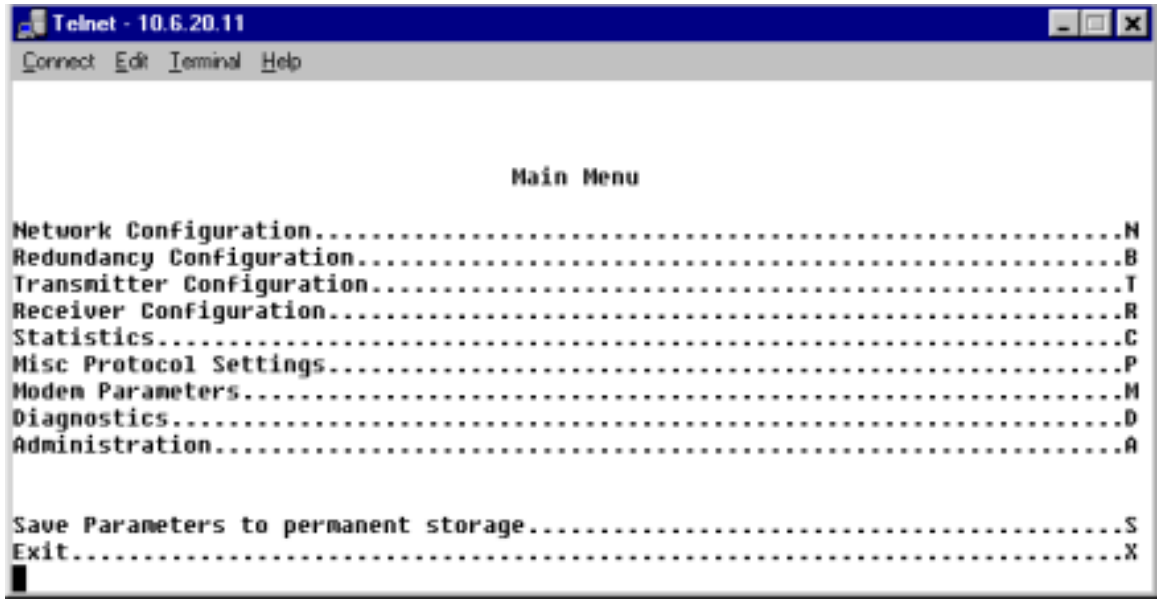


Figure C-1. Main Menu



To use the CLI, select the appropriate sub-menu or the entry by pressing the character indicated at the right. Enter ***x*** to return to the previous menu.

Note: Any CDM-IP configuration changes need to be saved to permanent storage by selecting [**S**] from any menu screen and then typing [**y**] to save.

C.1.6 Restoring Factory Default Configuration

The following sections in this guide assume that the CDM-IP is still in factory default configuration for IP. If that' is not the case, the factory default configuration can be restored from the menu:

Step	Description
1	From the **Main Menu,** select **Operations and Maintenance** sub-menu [**O**].
2	From the **Operations and Maintenance** menu, select **Database Operations** sub-menu [**D**].
3	From the **Database Operations** menu, select **Restore Factory Default** option [**R**].
4	Confirm when prompted by typing '**yes**' when the following prompt is displayed:

```
Are you sure you want to restore factory default settings?

WARNING: Choosing Yes will restore factory defaults and then
reboot..
```

This will erase any user configuration and restore the CDD-564 L to factory default configuration. Proceed to Section C.2 to perform the Router Mode configuration.

C.2 Router Mode Point-to-Point System Configuration

The steps in this guide will lead to the following configuration: use Figure C-1. Router Mode Point-to-Point System Configuration

C.2.1 PC Configuration

Step	Description
1	Set the IP address on **PC 1** to **172.16.10.11**, mask to **255.255.255.0**. Set PC Gateway to **172.16.10.1**
2	Set the IP address on **PC 2** to **172.17.10.11**, mask to **255.255.255.0.** Set PC Gateway to **172.17.10.1**

Reboot the PCs (if required).

C.2.2 Setting CDM-IP Modems to Router Mode Operation

Perform the following steps on **CDM-IP 1**

Step	Description
1	From the **Main Menu,** select **Administration** [**A**] sub-menu.
2	From the **Administration** menu, select **CDM-IP Working Mode** [**C**].

3	Confirm when prompted by typing **'y'** when the following prompt is displayed:
	`Changing Modem working mode requires system Reboot.`
	`Do you want to continue(Y/N)[Enter :No]`
	Select [**1**] for **Router Mode**.

4	Allow CDM-IP to reboot, then select **Interface Configuration** [**I**] from **Main Menu**.
5	From the **Interface Configuration** menu, select **Satellite/HDLC Interface (hdl0)** [**H**].
6	From the **Satellite/HDLC Interface (hdl0)** menu, select **HDLC Addr Mode** [**M**].
7	Confirm when prompted by typing **'y'** when the following prompt is displayed:; **`Changing HDLC address mode causes system Reboot.`** **`Do you want to continue(Y/N)[Enter :No]`** Select [**1**] for **Small Network Mode**.
8	Allow CDM-IP to reboot. After reboot, select **Interface Configuration** [**I**] from the **Main Menu**.
9	From the **Interface Configuration** menu, select **Receive HDLC Channel Addresses** [**H**].
10	From the **Receive HDLC Channel Addresses** menu, select [**1**] for **HDLC Addr 1**. The following prompt will be displayed: **`Please enter a value for the HDLC Addr 1`** **`Press ESC to abort`** **`HDLC address [SMALL NETWORK] in hex <0x1 - 0xFE, enter = 0001>:`** Enter [2] to set **HDLC Addr 1** to **0x01**. **Note:** **HDLC Addr 1** will display as **0x0001**, although only the last 2 digits are used in **Small Network Mode,** allowing up to 254 separate HDLC addresses.
11	Repeat **Steps 1 - 9** on **CDM-IP 2**. Also, repeat **Step 10**, but set **HDLC Addr 1** to **0x02**.

Both CDM-IP modems are now in Router/Small Network Mode, which means that the CDM-IP modems will be on independent IP subnets and will require adding static routes to pass traffic between them.

The HDLC MAC address is user configurable.

C.2.3 Setting IP Address(es)

Step	Description
1	From the **Main Menu** select **Network Interface Configuration** sub-menu [**I**].
2	From the **Interface Configuration Menu** select **Ethernet Interface (fei0)** sub-menu [**E**].
3	Set **Ethernet IP Address** [**I**]. **CDM-IP 1** to **172.16.10.1** **CDM-IP 2** to **172.17.10.1**
4	Set **Ethernet Subnet MaskSubnet Prefix Length** [**M**] to **24.**

C.2.4 Set IP Stack DES Select Key to ClearRoute Table

Perform the following steps on **CDM-IP 1**

Step	Description
1	From **Transmitter Configuration Main Menu** sub-menu select **Route Table [R]**sub-menu.
2	Enter **1** to configure the first route.
3	Enter a suitable name.
4	Set **IP Address** to **172.17.10.0**
5	Set **Number of Subnet Bits** to **24.**
6	For **Interface to which route is destined to <E-Ethernet S-Satellite Enter : S>** select **S.**
6	For **HDLC address [SMALL NETWORK] in hex <0x1 - 0xFE, enter = 0000>:** select **2.**
7	CDM-IP 1 Route Table should display the following:

```
•                    Route Name  Dest IP/SNet Bits  Next Hop
MultiCast   State
Route001..[test  172.17.10.0/24    0x2       N/A      toSat]
```

Perform the following steps on **CDM-IP 2**

Step	Description
8	From **Transmitter Configuration Main Menu** sub-menu select **Route Table [R]** sub-menu.
9	Enter **1** to configure the first route.
10	Enter a suitable name
11	Set **IP Address** to **172.16.10.0**
12	Set **Number of Subnet Bits** to **24**
13	For **Interface to which route is destined to <E-Ethernet S-Satellite Enter : S>** select **S**
14	For **HDLC address [SMALL NETWORK] in hex <0x1 - 0xFE, enter = 0000>:** select **1**
15	CDM-IP 2 Route Table should display the following:

```
•                    Route Name  Dest IP/SNet Bits  Next Hop
MultiCast   State
•                    Route001..[test  172.16.10.0/24    0x1
N/A      toSat]
```

- Set ***Remote HDLC IP Address*** to **192.168.1.2**

At this point the basic configuration is over and you should be able to:

- Ping PC 1 from PC 2 and vice versa
- Ping **CDM-IP** 2 from PC 1 and vice versa
- Pass any other data between the 2 PCs

1 From **PC1**

Ping 172.16.10.1 (**CDM-IP 1**)

Ping 172.17.10.2 (**CDM-IP 2**)

Ping 172.17.10.11 (**PC 2**)

2 From **PC2**

Ping 172.17.10.1 (**CDM-IP 2**)

Ping 172.16.10.1 (**CDM-IP 1**)

Ping 172.16.10.11 (**PC 1**)

C.3 Troubleshooting the IP Module

The CDM-IP comes with a variety of diagnostic tools to aid in identifying the traffic path going into and out of the CDM-IP modem. This troubleshooting section shows how to use some of these tools and also identifies several common problems encountered when first setting up two CDM-IP modems. If following these troubleshooting steps fails to resolve the problem, contact a Customer Support representative at:

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

(480) 333-2200 (Main Comtech EF Data Number)

(480) 333-4357 (Customer Support Desk)

(480) 333-2161 FAX

or, E-Mail can be sent to the Customer Support Department at:

cdmipsupport@comtechefdata.com

C.3.1 Router Mode Troubleshooting

Use the following troubleshooting steps if unable to successfully send traffic in Router Mode.

Router Mode Troubleshooting

Step	Problem	Action

1	No Ping response from the locally connected PC to the CDM-IP/CDD-564L Ethernet port. ICMP response is 'Request timed out'.	a) Verify correct IP address/subnet on PC and CDM-IP/CDM-564L.
		b) Verify Ethernet connection – cables, hub, etc. PC, hub, and CDM-IP/CDD-564L should have Ethernet activity LED lit.
		Note: A PC must be connected to the CDM-IP using a hub, switch or a RJ45 crossover cable. When the CDM-IP/CDD-564L Ethernet port senses an Ethernet connection, the CLI will display:
		`phymon_callback(): enet link change! link=1`
		If the connection is broken, the CLI will display:
		`phymon_callback(): enet link change! link=0`

23	No Ping response from PC 1 to PC 2 or vice versa. ICMP response is ' Reply from 172.XXX.10.1 - Destination net unreachable'	a) Verify CDM-IP, CDD-564L Route Tables are correct. b) Verify the hdrcomp and decomp both are either enabled or disabled. **Note:** Go to the route table and then options page is hdrcomp is enabled or disabled. And on the remote modem go the main menu, press "a" administration, and F for feature, hdrdecomp sould be same as hdrcomp (both sould be enabled or diabled).

Appendix D. Flash Upgrading

The CDD-564L eliminates the need for updating firmware by physically replacing EPROMs. Instead, the CDD-564L Quad Demodulator uses 'flash memory' technology internally, and new firmware can be uploaded to the unit from an external PC, as follows:

Go to: www.comtechefdata.com
Click on: downloads
Click on: flash upgrades

This makes software upgrading very simple, and updates can now be sent via the Internet, E-mail, or on disk. The upgrade can be performed without opening the unit, by simply connecting the unit to the Ethernet port of a computer.

D.1 Ethernet FTP Upload Procedure

1. Identify the reflashable product, firmware number, and version to be downloaded.

   From Telnet via the 10/100 Ethernet Traffic port, view the IP Module information by selecting Operations and Maintenance/ Unit Information.

   From HTTP via the 10/100 Ethernet Traffic port, view the IP Module information by selecting Operations and Maintenance/Unit Information.

2. Create a temporary directory (folder) on your PC.

   Windows: Select File > New > Folder > and rename the New Folder to "temp" or another convenient and unused name. Assuming "temp" works, you should now have a "c:\temp" folder created.
   Note: The c: is the drive letter used in this example. Any valid writable drive letter can be used.

   CMD Prompt: At the command prompt (c:\>) type "MD temp" without quotes (MD stands for make directory). This is the same as creating a new folder from within Windows. Assuming this works, you should now have a "c:\temp" subdirectory created where c: is the drive letter used in the example.

3. Download the correct firmware file to this temporary folder.

Access the download server with the flash firmware data files link, http://206.223.8.10/linksite/flashupgrades/CDM570L/

About Firmware Numbers, File Versions, and Formats:

The flashable files on the download server are organized by product first, then by firmware number, (make sure you know the correct firmware number; see step 1) version, if applicable, and release date. The IP firmware for the CDD-564L will be FW11669*_*_* (where the asterisks show revision, version and date).

The current version firmware release is provided. If applicable, one version prior to the current release is also available. Be sure to identify and download the desired version.

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

For additional help with "zipped" file types, refer to "pkzip for windows", "winzip", or "zip central" help files. Pkzip for DOS is not supported due to our file naming conventions.

4. Unzip the files in the temporary folder on your PC.

At least 3 files should be extracted:

a. FWxxxxxx.bin, where "x" is the version (bulk image file).
b. FWxxxxxx.txt, where "x" is the version (history notes).
c. README.TXT installation notes.

5. Connect the client PC to the CDD-564L unit 10/100 Ethernet Traffic via a hub or a switch, or directly to a PC with a crossover cable.

To PING and FTP from DOS, press the “Start” button on the Windows toolbar, and select the “Run...” option. From Win95 or Win98, type “command”. From WinNT, Win2K or WinXP, type “cmd”. You can also use the “DOS Prompt” or “Command Prompt” icons in the Start Menu. Now change to the temporary directory you created earlier with “cd C:\temp”. A quick “dir” will show the downloaded files.

6. Initiate an FTP session with the unit. The example is with a DOS window.

a. From the PC, type "ftp xxx.xxx.xxx.xxx" where "xxx.xxx.xxx.xxx" is the IP address of the CDD-564L .

b. Enter admin user name and password to complete login.

c. Verify FTP transfer is binary by typing "bin".

d. Type "prompt" then type "hash" to facilitate the file transfers.

7. Transfer the files.

Type "put FW FW11669*.bin" to begin the file transfers. It will take several minutes to transfer and write the files to flash memory. View the IP Module information by selecting Operations and Maintenance/Unit Information and verify that the new Version is now loaded.

The unit will need to be reset to boot to the new Version. By default, the CDD-564L will boot to the version with the latest date (Boot to - Latest). Bott to can also be set to force the CDD-564L to boot to either Image #1 or #2.

8. Verify the file transfer.

a. The PC should report that the file transfer has occurred, and the status of the upgrade can be viewed by serial console or Telnet. The FTP log in will be displayed and the file transfer status. When the upgrade image has been received, the image will be written to flash memory. .

b. Terminate the FTP session by typing "bye" and closing the DOS window.

c. Verify that the new file loaded using the procedure in step 1.

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METRIC CONVERSIONS

Units of Length

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

Temperature Conversions

Unit	° Fahrenheit	° Centigrade
32° Fahrenheit	—	0 (water freezes)
212° Fahrenheit	—	100 (water boils)
-459.6° Fahrenheit	—	273.1 (absolute 0)

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

Units of Weight

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

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