



# **M7 Series Modular Satellite Modem**

## **M7/M7L/M7LT/M7D/M7DL Series**

### **Installation and Operation Manual**



Revision 0.12

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NOTE: All appendices may not be present in manual. Some Appendixes may be shipped with the option.

## **Preface**

### **Standard Designations**

The M7 designation is used throughout this manual where references apply to either the M7, M7L or M7LT modems. Where a subject is specific to one modem the “L” or “LT” suffix is used or the specific differences in operation between the three modem versions are detailed.

Recommended Standard (RS) designations (i.e. RS-232) have been superseded by the new designation of the Electronic Industries Association (EIA) designations (i.e. EIA-232). The RS and EIA designation may be used interchangeably within the manual and protocol documentation and have the same electrical and mechanical meaning.

### **Electrical Safety and Compliance Notice**

The M7 Series has been safety tested and shown to comply with standard EN 60950 Safety of Information Technology Equipment (Including Electrical Business Machines).

The M7 Series is shipped with an external IEC filtered AC to DC power converter module designed to accept a 3-wire mains connection consisting of an earth ground, neutral and line conductors. The mating power cord should have a line cord and plug suitable for the country of operation. Installation and connection to the AC power line must be made in compliance to local or national wiring codes and regulations.

The external IEC filtered AC to DC power converter module is rated for a nominal operating range of 90 to 264 VAC. The unit has a maximum power consumption of 25 watts.

Never operate the equipment with the cover removed. Never remove the cover with power applied. As a safety measure the power cord should be disconnected from the unit when preparing to remove the cover.

### **Battery**

The M7 contains a Lithium Battery. Danger of explosion exists if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries in accordance with local and national regulations.

### **EMC (Electromagnetic Compatibility) and Safety Compliance**



This equipment has been tested in accordance with FCC and ESTI standards.

- FCC: Part 15, Subpart B, Class A
- ETSI EN 301 489-1 V1.9.2 (2011-09) (Emissions and Immunity)
- EN 55022 (2010) (Emissions)
- EN 55024 (2010) (Immunity)
- EN 60950-1:2006 (2nd Edition) and IEC 60950-1:2005 (Safety)

To maintain compliance with these standards the following the precautions must be observed.

- The equipment must be operated with the cover and all cover screws in place.
- Do not remove the rear panel option plate without replacing it with one designed for a specific option assembly.
- All rear connections are designed to have integral shielding on the cable and connector assembly. “D” type signal connectors must have grounding fingers on the connector shell.



**Telecommunications Terminal Equipment Directive (TTED)**

In accordance with the TTED 91/263/EEC, the M7 Series should not be connected directly to the Public Telecommunications Network.

**RoHS Compliance**

The M7 Series satisfies the requirements specified in the European Union Directive on the Restriction of Hazardous Substances, Directive 2002/95/EC (EU RoHS).

**Environmental**

The M7 Series is designed to operate in an indoor environment. Operation while exposed to precipitation, condensation, relative humidity above 95%, excessive dust, or temperature outside the operating range of 0 to +50°C may cause damage to the unit and will void the warranty.

Maximum storage temperature is -20° to +70°C.

Do not operate the modem in an unsafe environment near explosive or flammable gases or liquids

If the M7 Series is to operation in a mobile environment, the user must take precautions to provide a stable environment consistent with the equipment specifications.

**Grounding**

Insure good grounding practices. Where a ground lug is provided, the modem should be connected to a good earth ground with low impedance cable in rack installations.

## About This Manual

This manual is intended for use by personnel with reasonable knowledge of satellite communications and earth station terminology. This manual provides Installation, Operating, and Maintenance procedures for the M7 Satellite Modem and available options.

This manual is composed of several separable documents. The main body of the manual is separated into several “Chapters” and “Sections”. The Chapters within the main manual are the Modem Description, Installation, Operation, and Maintenance. The Appendices include the Specifications, Remote Control Protocol and information on Options, Cabling and information related to placing the Modem in service.

A Section is considered a sub-section of a Chapter. For example Section 4.1.2 is a numbered section within Chapter 4. Page numbers include the Chapter (i.e. Page 3-14) and all Tables and Figures will show the Chapter in the caption (i.e. Table 1-2).

This manual is available in a printed form and as an electronic “Portable Document Format” or .PDF file. The electronic format is produced as a universal Adobe Acrobat readable file, and can be requested directly from Datum Systems, Inc., or via download from the web at [www.datumsystems.com](http://www.datumsystems.com). The electronic format on the web is always the latest revision.

## Revision History

Release Number	Release Date	Comments
Revision 0.02	02/27/2013	Initial Public Release.
Revision 0.03	06/01/2013	Interface additions and cleanup
Revision 0.04	9/16/2013	M7LT, E7, PtMP AUPC, and cleanup
Revision 0.05	05/29/2014	Add Events, Feature update, Firmware update, and cleanup
Revision 0.06	01/15/2015	Add Smart Carrier Cancellation Appendix E and references
Revision 0.07	2/22/2016	Update Web Browser, added SNMP Appendix F, and added reference to new MSnIP interface option quick start guide.
Revision 0.08	12/14/2016	Updated Redundancy sections, added Trial Mode, and DVB-S2X Appendix G
Revision 0.09	4/16/2018	Updated Redundancy sections, updated Appendix E
Revision 0.10	10/24/2018	Updated for Dual IF and miscellaneous corrections
Revision 0.11	11/07/2018	Update 1:1 and Dual IF
Revision 0.12	1/19/2019	Minor Updates

## Pen and Ink Changes Made to this Manual

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## 1 Introduction

### 1.1 M7 Modem Description

The Datum Systems M7 series modular satellite modems (Figure 1 -1) represent a major extension to our seventh generation of innovative design concepts, proven and refined over fifteen years of production. The M7 series modems are capable of independent transmit and receive of BPSK, QPSK, OQPSK, 8PSK, 8QAM and 16QAM modulated carriers. The M7 series uses the latest Digital Signal Processing (DSP) technology and proprietary techniques to provide unsurpassed performance at a low cost. The M7 series is a highly modular design made possible by higher integration and smaller size. Impressive features are highlighted by this design methodology:

- The Standard chassis is a half-rack 1U (1.75" H x 9.75" W x 12" D)
- Individual cards within the chassis are replaceable to create multifaceted functionality
- Half-rack chassis can be combined to create multiple modems within a single rack unit



Figure 1-1– M7 Series Modems

The M7 series is available in standard 50-180MHz IF or 950-2150MHz L-Band versions with upgradeable “feature sets” within each version.

All M7 series modems encompass significant performance improvement over previous modems at reduced cost. All options in the M7, M7L and M7LT modems are fully interchangeable with the exception of the IF input and output frequency range which is selected and factory installed at the time of order.

The M7 is designed for service in a variety of satellite systems and network types. Carrier operating modes may be dedicated or shared. In a dedicated system two modems are set for continuous operation with each other, but in shared systems the modem carriers are typically controlled by a Network Management System (NMS) and operating in a controlled acquisition mode.

The M7 is designed to be easily integrated into either a master hub station or remote terminal via rack mounting or placement on a stable flat surface. The highly integrated design allows two (2) M7s to be built into a one 19" rack unit (1 RU) (1.75"H x 19"W x 12"D) mounting case. The M7 is an integral part of a satellite earth station's equipment operating between the Data Terminal Equipment and the station RF equipment.

## 1.2 Network Types

The M7 is extremely flexible in regard to the network types that can be configured. Depending on the network type, different baseband interface options are available that will maximize the capability for the network. The three main network types are:

- Point-to-Point (PtP)
- Point-to-Multipoint (PtMP)
- Mesh

In a Point-to-Point network, the M7 provides the industry leading Eb/No performance and flexible baseband interface options. This performance improvement and flexible interface support allows the operator to update legacy networks without changing the teleport infrastructure. The additions of the Ethernet/IP interfaces to the M7 provide the network operator with the latest technology needed to extend cellular backhaul connectivity and Internet access to remote locations. When optioned with the Ethernet/IP interfaces, Ethernet bridging and IP routing capabilities are internal to the M7 which reduces the number of devices that need to be managed and maintained. A typical PtP network is shown in Figure 1 -2.

### Point-to-Point Network Example

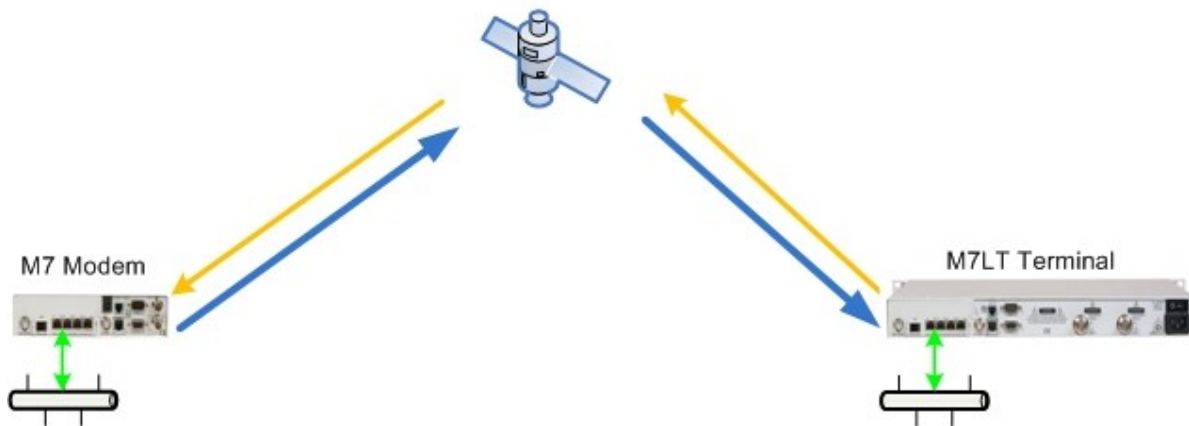


Figure 1-2 – Point-to-Point Network

Point-to-Multipoint networks are used to connect a central location to multiple remote locations. The central location, the Hub, will output a continuous carrier that is received by all of the remote sites and receive the individual carriers from each of the remote sites on individual demodulators. Within the shared outbound carrier will be all of the information destined for each of the remote sites. At each of the remote sites, the M7 with an Ethernet/IP interface will filter, or route, only the information that is to be received by that site. There is considerable statistical bandwidth savings by using the shared outbound carrier in an IP based network because of the typical traffic patterns consistent with IP networks. A typical PtMP network is shown in Figure 1 -3



Figure 1-3 – Four (4) Site Point-to-Multipoint Network

A Mesh network is used when all sites in a network need to be connected to all other sites within that same network with a single satellite link. This could be done by installing multiple PtP networks between each network site, but as the number of network nodes increases, there is a dramatic increase in the number of carriers that would be added and also an increase in the number of modems required at each site. At some point, this becomes unmanageable and the alternative is to use a Mesh network topology instead of multiple PtP networks. At each site in a Mesh network there is a single carrier that contains all the information destined for all the nodes within the network. In an IP based network there is considerable statistical satellite bandwidth savings by using the shared outbound carrier from each site because of the typical traffic patterns consistent with IP networks. A typical PtMP network is shown in Figure 1-4

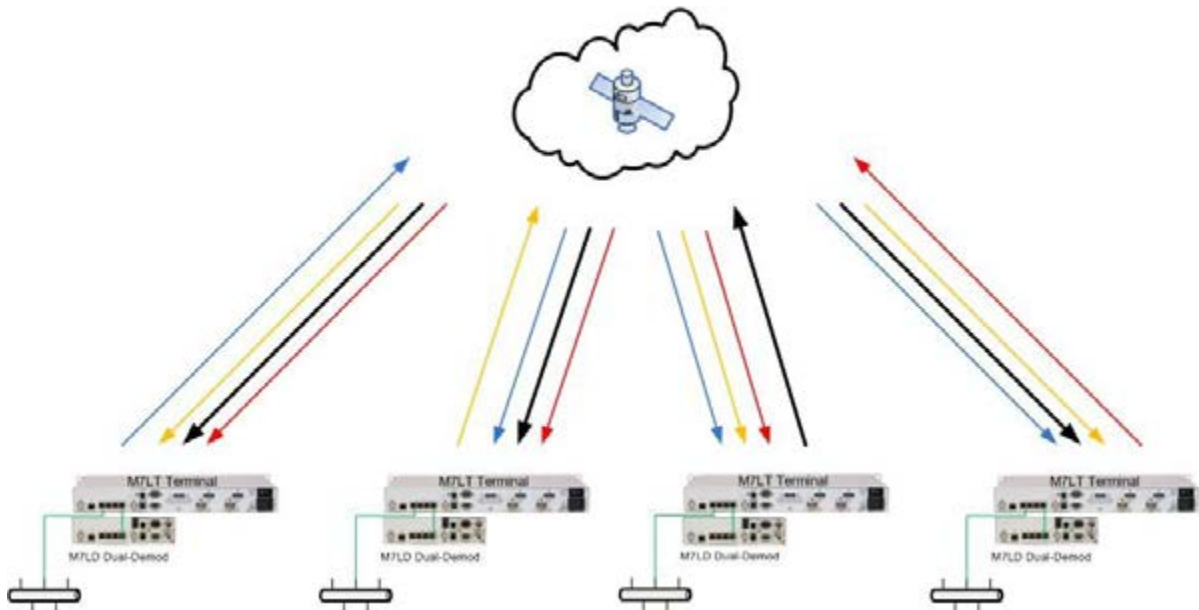


Figure 1-4 – Four (4) Site Mesh Network

### 1.3 What's New – This Modem and This Manual

The M7 is similar in operation to the previous Datum Systems modems, especially the PSM-4900 or PSM-500 series. However, there are a number of significant changes in this modem series when compared to the previous releases. The list below shows some of the differences between the M7 series and the previous Datum Systems modem products.

#### 1.3.1 New to the M7:

- The base M7 series is only a single half-rack width (Figure 1 -1). Consequently everything is slightly smaller except the new LCD display which provides more information including soft keys.
- A standard 1 RU 19" rack mounted front panel plate allows mounting of one or two M7 modems side-by-side (Figure 1 -5).



Figure 1-5 – M7 Modem (shown in 1RU shelf configuration)

- The 10/100 BaseT Ethernet interface on the rear panel now includes firmware updates, SNMP remote control and a Web Browser based user interface. In the M7 this interface is separate from any IP data interface option.
- An RS-232 remote control interface is also provided similar to previous modems for binary packet control.
- The M7 modems contain two slots for IF boards. These can include any combination of modulator and demodulator. This means the M7 is capable of being a modem, a TX only modulator, RX only demodulator, a dual modulator, or dual demodulator.
- There are two interface option slots in the chassis. There are currently two interface options covering 3 interface types: standard Synchronous Serial, Vyatta PC based IP interface/router, HSSI and a G.703/E1 Full and Fractional (Drop and Insert) interface either with or without the IP interface. Multiple interface configurations are possible within the two interface slots. Please consult factory.
- There is an option connector on the demodulator PCB used to add TPC FEC options. The modulator is capable of all FEC options without additional hardware
- The M7 is powered by 8 to 36 VDC input. In a standard shipment, Datum supplies an external power adapter module that converts 100 to 240 VAC to IPB at 24VDC.
- The M7 series is available in an L-Band terminal configuration in a 1RU configuration. This configuration is the M7LT model (Figure 1 -6) which provides 10MHz reference and DC power through the interfacility cable to the Block Up Converter (BUC) and Low Noise Down Converter (LNB).
- The M7 series is available with Sharp Carrier Technology that provides eight (8) filter roll-off options from 0.40 Alpha to 0.05 Alpha. Refer to Section 1.5.2 for more information on this feature.

- The M7 series is available with Smart Carrier Cancellation functionality that is an advanced second generation carrier canceller which allows two (2) similar carriers to occupy the same transponder spectrum. Refer to Appendix E for more information on this feature.
- Remote SNMP and Remote Web Browser capabilities (PtP and PtMP), Refer to Appendix F for more information on this feature.
- Addition of a new MSnIP interface option. Refer to the M7 MSnIP quick start guide for more information on this new interface.



Figure 1-6 – M7LT Terminal (showing front and rear views)

## 1.4 M7 Modem Assemblies

The M7 consists of four (4) main functional elements arranged on electronic printed circuit assemblies, as shown in Figure 1-7. A simplified block diagram of the M7 is shown in Figure 1-8.



Figure 1-7 – M7 Modem Assemblies (shown with standard serial interface)

The modem assembly consists of the following major assemblies:

- The M7 digital PSK/QAM modulator with carrier generation in the 50 to 180 MHz range for standard modem, or 950 to 2150 MHz in the L-Band versions.
- The M7 digital PSK/QAM demodulator accepting signals in the 50 to 180 MHz range for the standard modem or 950 to 2150 MHz in the L-Band versions. The Digital Signal Processor Acquisition subsystem is part of the demodulator assembly.
- The M7 microprocessor monitor/control subsystem.
- The optional M7 Data Interfaces. The standard serial data interface assembly contains selectable serial electrical interface types – EIA-422, EIA-232 Synchronous, EIA-232 Asynchronous, and V.35 on an EIA-530A 25 pin “D” connector. The modem can also accept special interfaces via an alternate or additional interface cards such as G.703, HSSI, and multiple Ethernet options.



The other two printed circuit assemblies are the Front Panel Control Assembly, and the common backplane assembly.

In addition the main demodulator PWB can accept a plug-in sub-assembly for optional TPC Forward Error Correction (FEC). All other FEC functions such as standard Viterbi, TCM and Reed-Solomon are contained in FPGA on the modulator and demodulator assemblies. LDPC is an optional FEC set which is loaded into the existing FPGAs.

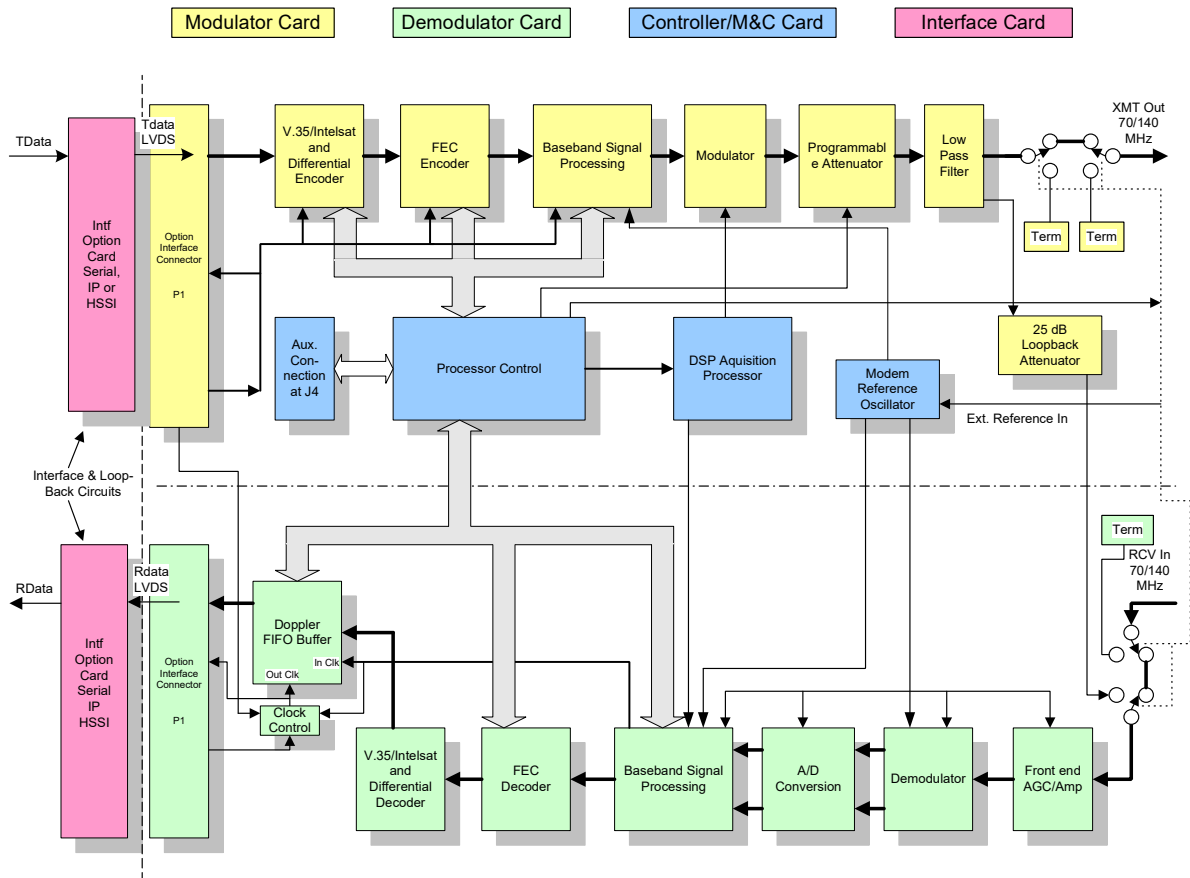


Figure 1-8 – Modem Block Diagram

## 1.5 M7 Capabilities

### 1.5.1 Inter-Facility Interface (IF)

The M7 series is offered with three (3) IF variations designed to meet the needs of various earth stations.

- IF = 50-180MHz (TX/RX)
- L-Band = 950-2150MHz (Tx/RX)
- Dual IF = 50-180MHz (TX/RX) and 950-2150MHz (Tx/Rx)

The standard M7 modem is equipped with a 50 to 180 MHz transmit and receive IF. This version is typical for use in traditional earth stations with IF to RF up and down converters between the modems and the High Power Amplifiers (HPA).

The M7L equipped with L-Band transmit and receive IF that provides optional 10MHz Frequency References for the BUC and LNB. This modem is ideal for earth stations that are designed with a block Up and Down conversion making it ideal for low cost earth stations.

The M7LT is an extension of the M7L that provides the LNB and BUC power supplies to power the low power outdoor RF equipment. This creates the ability to build extremely simple and low cost high performance remote terminals.

### 1.5.2 Sharp Carrier Technology

The M7 provides multiple setting for the modulation carrier roll-off that will allow interoperability with industry standards and optionally to increase the number of carriers that can be placed in a satellite transponder. This capability is referred to as “Sharp Carrier Technology”.

There are eight (8) filter roll-off options available to set in the modulator menu **<Mod: IF - Filter Roll-Off>** and demodulator menu **<Demod: IF - Filter Roll-Off>**. These optional filter “Alpha” values “0.40”, “0.35”, “0.30”, “0.25”, “0.20”, “0.15”, “0.10”, “0.08” and “0.05”. Figure 1-9 shows a comparison of two (2) spectrum plots one which is 0.35 Alpha (red) and the other 0.08 Alpha (green).

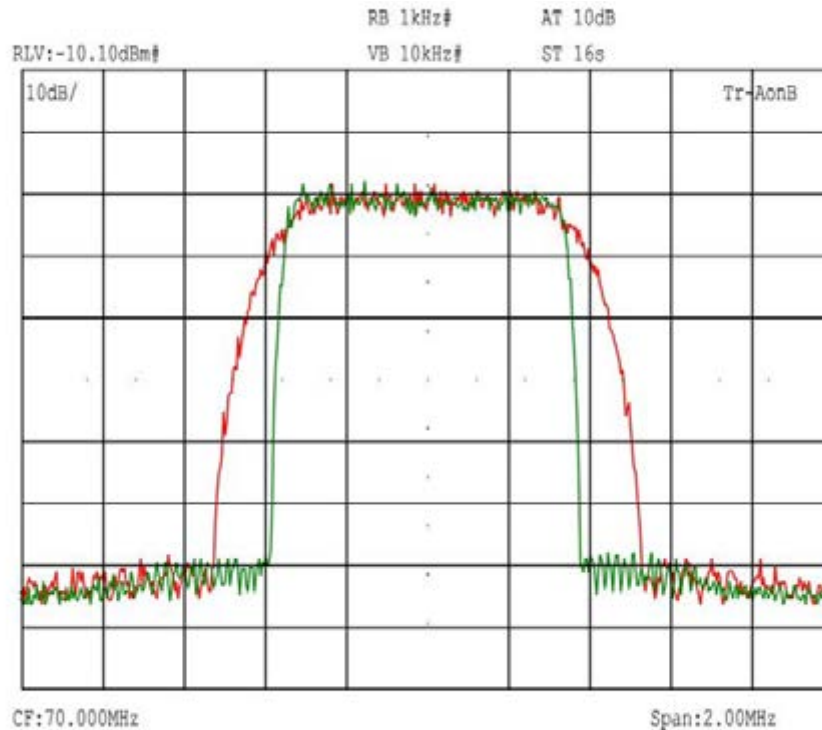


Figure 1-9 – Spectrum Analyzer Plot of 0.35 versus 0.08 Roll-off factors

A significant benefit of this technology is the reduction in carrier spacing required on the satellite. With a filter roll-off of 0.4, the carrier spacing would be 1.4 times the carrier symbol rate. When the carriers are changed to a 0.08 roll-off, this carrier spacing can be reduced by more than 20% to 1.1 times the carrier symbol rate. A spectrum analyzer plot that demonstrates this capability is shown in Figure 1 - 10.



Figure 1-10 – Carrier Alpha = 0.08, 1Msps x1.10 Carrier Spacing

For example, in a typical 36MHz transponder configured with 1Msps carriers with a 0.4 roll-off there could be twenty-five (25) carriers. If the 1Msps carrier roll-off was changed to 0.08, there could now be 32 carriers – a 28% increase in transponder throughput. Table 1 -1 shows the relative improvement that can be gained in a bandwidth limited 36MHz transponder by changing the carrier Alpha settings from 0.4.

Table 1-1 – Bandwidth Savings Related to Carrier Alpha

Carrier Alpha	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.08	0.05
# of 1Msps carriers	25	26	27	28	30	31	32	33	34
% improvement from 0.4 Alpha	0%	4%	8%	12%	20%	24%	28%	32%	36%

### 1.5.3 Data Interfaces

The modem is capable of accepting interface cards that provide connectivity to a number of different baseband interface types. These interfaces can be installed as a single interface or may be installed in a dual interface configuration. As required, additional interfaces will be added to the M7 options list to accommodate new capabilities. The currently available interfaces include:

- Multi-protocol Synchronous Serial Data interface (S7)
- Advanced IP interface with internal bridge/router (I7 and I7+)
- Express Ethernet interface (E7)
- Dual G.703/E1 with Drop and Insert interface (G7)
- High Speed Serial Interface (HSSI) (H7)
- **M7 Satellite network Interface Processor (MSnIP) internal bridge/router (PSM500 compatible).**

Installed option interfaces are automatically recognized by the modem, making them a selectable option on the front panel or remote control protocols. Refer to the optional interface appendix for detailed information on each of the interface options.

#### 1.5.3.1 Multi-protocol Synchronous Serial Data interface (S7)

The Synchronous Serial Data Interface is considered the standard baseband interface for the M7 (Figure 1 -11 and contains the drivers and receivers for one of seven possible data interface standards. All interface standards are selected under program control via the front panel or remote control. These standards are common interfaces used in the communications industry:

- RS-232
- RS-449
- RS-449/Unterm
- V.35
- X.21
- EIA-530
- EIA-530A

A single 25 pin “D” type female connector is available on the rear panel at J11 providing the terrestrial data interface. The interface standard is electronically selectable via front panel or remote control.

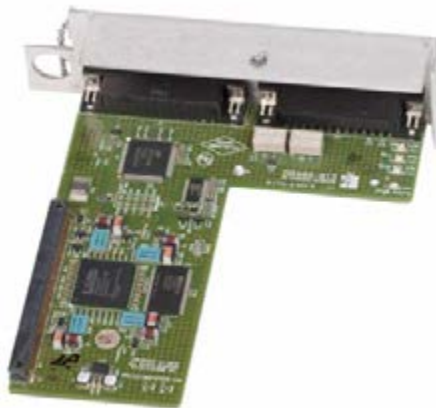


Figure 1-11 – Synchronous Serial Interface

The M7 includes two changes to previous modems to insure proper operation.

1. The modem detects if no data is present on the Send Data input by a lack of transitions for approximately 5 seconds and will produce a programmable alarm after that time.
2. Due to the higher data rates the M7 input circuitry automatically fine tunes the clocks to attempt to place the data period at the optimal point with respect to the clocks. This also helps tremendously when using the TT clock to create the transmit timing.

### 1.5.3.2 Advanced IP Interface (I7 and I7+)

There are two (2) versions of the I7 IP Interface.

- The standard I7
- The I7+ (plus)

The difference between the I7 and the I7+ interface is the type of Q7 processor that is installed. The I7 uses a Dual-Core processor and the I7+ uses a Quad-Core processor. The I7 and I7+ Advanced IP interface card provides the connection between IP Ethernet networks and the M7 satellite modem as part of point-to-point or point-to-multipoint data transfer. The I7 and I7+ interface (Figure 1 -12) contains a complete Linux X86 computer running the open source Vyatta router. This processor/router combination combines high performance with standard control mechanisms similar to Cisco or Juniper routers. The I7 and I7+ is a full function sophisticated router and therefore requires configuration in order for a network to operate properly.



Figure 1-12 – Ethernet Interface (I7 and I7+)

The I7 and I7+ provides the following features:

- Powerful x86 Atom processor based. Up to 1.6 GHz and dual virtual processors.
- Robust Vyatta Linux Operating System
- Industry Standard Vyatta Router overlay on Linux for control similar to IOS/JunOS. One major advantage of Vyatta is that it provides a clean single point configuration interface and saved configuration file.
- Modem command line and web control.

Refer to Table 3 -33 front panel configuration and Section 3.8.1 for technical information on this interface option.

### 1.5.3.3 Express Ethernet Interface (E7)

The Express Ethernet interface (E7) card is a layer 2 Gigabit Ethernet bridged interface. The E7 supports connections between GbE networks and the M7 satellite modem as part of point-to-point or point-to-multipoint Ethernet data transfer. The E7 interface (Figure 1 -13) includes 4 10/100/1000Base-T interface ports (RJ-45) and a single SFP port that can be used to support an additional Ethernet port or an optic fiber connection.



Figure 1-13 – Express Ethernet Interface (E7)

Refer to Table 3 -34 for front panel configuration and Section 3.8.2 for technical information on this interface option.

### 1.5.3.4 Dual G.703/E1 Interface (G7)

Dual G.703/E1 Interface (Figure 1 -14) is a legacy interface standard that is used in Telephony and Cellular Backhaul applications. The installation of the G7 (Dual G.703/E1) interface provides the M7 modem with an economical access solution for E1 network services over satellite.

The two (2) E1 ports are independent of each other except that they both must be selected for Balanced or Unbalanced operation. Each E1 port also operates independently on transmit and receive sides of each port.

Typical use of the G7 interface is in a duplex point to point link with a similarly configured modem at the other end of the link. The setup of the satellite link is very simple because the modems at both ends of the link are connected to DTE equipment with this same G.703/E1 interface type. Each port of the G7 interface can be configured independently for either Full E1.

The G7 fully meet all of the E1 rate 2048 kbit/s specifications including the ITU recommendations:

- G.703 - Physical/electrical characteristics of hierarchical digital interfaces.
- G.704 - Synchronous frame structures used at 2048, kbit/s hierarchical levels.
- G.732- Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s.
- G.823 - The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy.

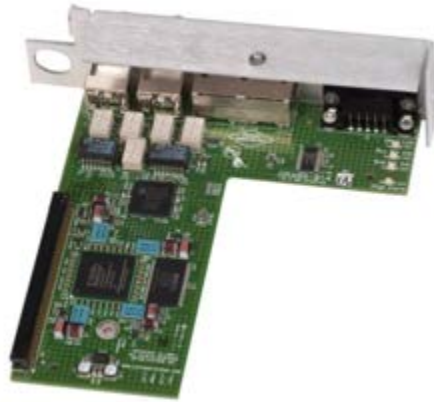


Figure 1-14 – Dual G.703/E1 Interface (G7)

The Full E1 mode allows for transmission of a 2.048Mbps input data stream without synchronizing to the imbedded framing of the E1 signal. In this case the port data rate through the satellite link is the full 2.048Mbps of the E1 transport stream.

NOTE: In Unframed E1 there is no requirement for G.704 framing.

The G7 interface provides these key features:

- Single or Dual port G.703/E1
- Unframed & Fractional E1 operation
- Balanced or Unbalanced operation
- Data rate: 2.048Mbps
- Fully transparent signal conversion under unframed mode
- Clock Regeneration from incoming HDB3 or AMI formatted data
- Diagnostic Loopbacks for both Terrestrial and Satellite side

The G7 interface provides E1 alarm monitoring for all common E1 transport stream alarms:

- LOS      Loss Of Signal. (All Modes)
- AIS      All 1's at input port. (All Modes).

Refer to Table 3 -35 for front panel configuration and Section 3.8.3 for technical information on this interface option.

### 1.5.3.5 High Speed Serial Interface (HSSI) (H7)

The installation of the optional High Speed Serial Interface or HSSI Card (Figure 1-15) provides the M7 modems with a high speed synchronous serial interface designed for higher data rates than are possible with standard serial interface protocols like V.35, RS-449 and EIA530. This optional Interface card is designed to be installed inside the main modem assembly in the option interface position. It can be installed alone or as a second interface option within the modem.

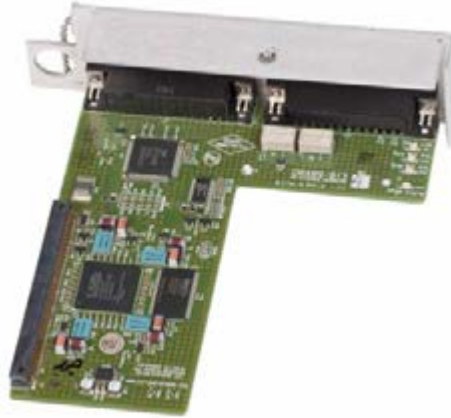


Figure 1-15 – HSSI Interface

HSSI is an industry standard interface type that is usually associated with connection to routers, such as the Cisco 3600 series, for higher data rates on WAN links. The standard itself describes communications at up to 52 Mbps over cable lengths up to 50 feet. Since the M7 series of modems is capable of up rates >52 Mbps, this optional interface allows full utilization of the M7 capabilities.

### 1.5.3.6 MSnIP interface

The MSnIP interface card provides the connection between IP Ethernet networks and the M7 satellite modem as part of point-to-point or point-to-multipoint data transfer. The purpose of the MSnIP interface is for legacy compatibility within networks that contain PSM500 modems with the SnIP interface card.



Figure 1-16 – MSnIP Interface



Because this is a legacy support interface, this manual will not provide a complete operational description. Instead, please refer to the MSnIP Quick Start Guide for operation and technical information on this interface option.

**1.5.3.7 Dual Interface Configuration**

The M7 allows for up to two (2) interface modules to be installed in the modem. The M7 controller will recognize the installed interfaces and provide the appropriate functions on the control and monitor interfaces. Below are some examples showing the rear panel view of dual interface configurations. The combination of the Advanced IP Interface (I7 and I7+) and the Multi-protocol Synchronous Serial Data interface (S7) is shown in Figure 1 -17. The combination of the Advanced IP Interface (I7 and I7+) and the Dual G.703/E1 Interface (G7) is shown in Figure 1 -18. The combination of the Express Ethernet Interface (E7) and the Dual G.703/E1 Interface (G7) is shown in Figure 1 -19. Additional dual interface combinations are possible. Contact Datum Systems details related to additional dual interface options.



Figure 1-17 – Dual Interface Configuration I7 and S7



Figure 1-18 – Dual Interface Configuration I7 and G7



Figure 1-19 – Dual Interface Configuration E7 and G7

### 1.5.4 Bit Rate Timing Options

The Modulator and the Demodulator each have four (4) possible sources for their bit rate timing. These clock sources may be used in various ways in a system implementation to provide correct timing at a destination. Each of the clock sources can be set either from the front panel or from an external monitor and control system. Refer to Section 3.9 for details about these options and how to configure the modem for each of these timing options.

### 1.5.5 Data Interface Loop-Back Function

The standard and most optional interfaces also provide the data loop-back function. The data loop-back can be controlled from the front panel or via remote control command. The data towards both the terrestrial and satellite sides can be looped back individually by enabling this function via the front panel or remote control

The data loop-back allows testing of the signal path connection up to the loop-back and back to the source. Since both terrestrial and satellite sides of the signal path can be looped, the connection from a local DTE can be checked on the terrestrial side while the connection from the far end DTE over the satellite and through the modem can be checked on the satellite side. More information on use of the loop-back modes is given in Section 4.3.

NOTE: Ethernet interfaces do not have this function.

⇒ CAUTION: Enabling the “Data Loop-Back” functions will result in loss of traffic. It should not be used in operating links without prior arrangements.

### 1.5.6 Data Interface BERT Function

The standard interfaces also include a programmable Bit Error Rate Test (BERT) function. The BERT is located between the M7’s satellite and terrestrial data loop-back functions. A new in the M7 is the ability to configure the BERT to test the “Line” side external cabling, acting as a DCE device. The BERT can be controlled from the front panel or via remote control command and provides extensive test result data. More on use of the BERT functions and modes is given in Section 4.3.2 -Using the Built-in BERT.

NOTE: Ethernet interfaces do not have this function.

⇒ CAUTION: Enabling the “BERT” functions will result in loss of traffic. It should not be used in operating links without prior arrangements.

### 1.5.7 Auxiliary Overhead Channel Multiplexer/Demultiplexer

The multiplexer is capable of combining a relatively low speed overhead channel onto the terrestrial data stream resulting in a slightly higher combined or “aggregate” data rate through the modem. The overhead channel is recovered at the far end. This added channel is termed variously an overhead channel, Engineering Service channel (ESC), service channel, “async” channel or, in IESS terminology, an ES to ES data channel.

The basic frame structure used by the multiplexer is that specified in the IESS-309 standard, Page 60, Figure 10, resulting in a 16/15 aggregate to through data ratio. This means that when the multiplexer is enabled the modem aggregate operating data rate is computed as the terrestrial connection (through) data rate multiplied by 16/15. The user sets only the desired through data rate while the modem computes the aggregate rate required. The multiplexer is also capable of expanded operating modes which include custom setting of the ratio of data to framing bytes.

The Multiplexer modes of operation are shown in Table 1 -2.

Table 1-2 – Internal Framing Options

Mode	Standard/ Compatibility	Overhead Ratio	Notes
Disabled	N/A	1/1	
Standard	IESS-309	16/15	Fixed synchronous ESC, No AUPC, No MCC
Custom	Modified IESS-309	Variable	Full ESC and MCC including AUPC, Remote Modem Control, 2 one-bit control channels (i.e. backward alarm). Also variable data load per frame.
Advanced	Datum Standard	Variable	Full ESC and MCC including AUPC, Remote Modem Control, 2 one-bit control channels (i.e. backward alarm). Also variable data load per frame. (only available with TPC or LDPC FEC options enabled)

The ESC Data Channel can be set under software-control to either RS-232 or RS-485 mode. The pin assignments for both modes are shown in the appropriate interface option subsection under Section . Not all interfaces provide an overhead channel but when this overhead is available, the signals appear on the interface rear panel “overhead connector only when the multiplexer/demultiplexer function is enabled.

The RS-485 Transmit Data Drivers can set to one of two modes:

- RS-485 2-wire
- RS-485 4-Wire

The “4-Wire” setting forces the driver continuously on while the “2-Wire” setting controls the output into tri-state when the modem is not transmitting data, allowing multiple modem outputs to be connected together. In the standard IBS mode only the “4-Wire” mode is available.

In Custom or Advanced mode a 2 wire receive operating mode can be selected for the receive data into the ESC channel. In this mode the receive input is muted while the transmit data output is active. In 4 wire mode the receive input is always enabled. In the standard IBS mode only the 4 wire mode is available.

NOTE: Transmit and receive pairs are physically separate wires and must be connected together if true RS-485 2 wire connectivity is desired.

The ESC Async Mode can be selected to Auto or Manual modes. In the Auto mode, the <Intf: Send – Mux Overhead Ratio> is calculated based on the <Intf: ESC – Async Rate>. When the <Intf: ESC – Async Mode> = Manual Overhead Rate, the <Intf: Send – Mux Overhead Ratio> is calculated based on the <Intf: ESC – Async Rate> and the <Intf: Send – Mux ESC Rate>. The recommendation is to use the Auto mode unless the operator is an expert user.

The user does not have to compute data framing variables to use the Custom or Advanced Multiplexer Mode. When placed in this mode the entry parameters are the ESC and MCC channel rates selected from standard asynchronous data rates (300bps to 3.5Mbps). The modem then computes the proper relationship between the framing and terrestrial data rates to achieve the proper operation. The modem also displays the terrestrial data to aggregate ratio.

NOTE: The Auxiliary Overhead Channel Multiplexer/Demultiplexer function is available in all of the synchronous baseband interface option. This would include the Multi-Sync, Dual G.703, and HSSI interfaces.

NOTE: The Advanced mode is only available when the FEC is set to TPC or LDPC.

### 1.5.8 Modem Control Channel (MCC)

In the synchronous baseband interface options, the MCC is available in both the Custom and Advanced Multiplexer modes. In these modes the MCC provides for the AUPC plus the Remote Modem Control (RMC) Channel and the Auxiliary control bits (RFC).

In the Ethernet and IP baseband interface options, the MCC channel is provided without the need to setting a separate multiplexer or demultiplexer function.

### 1.5.9 AUPC Control Channel (AUPC)

When the modem is placed into either the Custom or Advanced modes, the AUPC control channel becomes available. The AUPC operation itself is under control of the modem while the AUPC facility in the MCC provides the channel for the information. This channel provides a minimum 300 baud control channel in each direction to allow the modems at two ends of a link to interactively maintain the receive  $E_b/N_0$  by controlling the power output at the transmit site.

Refer also to the AUPC operation description of the main manual in Section 3.10.

### 1.5.10 Auxiliary Bit Control Channels (RFC)

When the multiplexer is placed into the Custom or Advanced mode the auxiliary bit control RFC channels becomes available. In the IESS standards, these are commonly referred to as “Backward Alarms”. These consist of two single line or “one-bit” control channels that can be used to send control information independently in both directions over the link. The input signals on these channels can be either a contact closure or a logic type signals while the output is a form C relay contract set whose state depends on the state of the input signal. The low input logic level is 0 to 0.4 VDC, while the logic high level can be from 2.4 to approximately 20 VDC. The input is current limited to accept this wide voltage range without damage. Higher voltages may damage the inputs however and caution should be exercised. Pin connections for these one bit channels are shown in the connector pinout of each interface in Section .

### 1.5.11 Smart Carrier Cancelling Overview

Smart Carrier is a patent pending advanced second generation carrier canceller which allows 2 similar carriers to occupy the same transponder spectrum, but is different from other cancellers in that it is a baseband canceller instead of an IF canceller. It allows excellent performance with easy setup and no additional cabling. Smart Carrier is compatible with all Datum modulation types and FECs, and is well suited to be used with Sharp Roll-Off factors all the way down to 5%. Datum’s technique provides improvement in the Shannon Capacity of ~ 2 dB, which is ~50 % increase in the fundamental channel capacity.

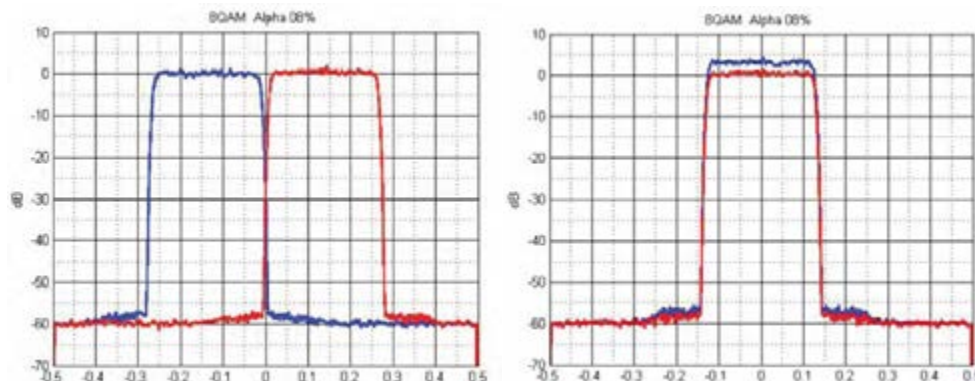


Figure 1-20 – Smart Carrier Bandwidth Savings of 50%

### 1.6 Forward Error Correction (FEC) Options

The hardware for Viterbi, TCM, Reed-Solomon Codec, and FlexLDPC FEC types are included in the modulator and demodulator cards, providing the M7 with basic functional capability for all standard operating parameters including 8PSK TCM and 16QAM. The following sections provide a general description of the characteristics of each of these functions.

All of the M7 series demodulators have a single plug-on option FEC card for an optional TPC function or future FEC options.

The Table 1 -3 shows the currently available FEC modes and the relation to the modulation types.

Table 1-3 – Modulation, FEC, and Code Rates.

FEC Type	Sel # (T)	FEC Type Option	Sel # (O)	Code Rates Available	Sel # (C)	R-S Option	Modulation Modes (see notes)								
							BPSK	QPSK	OQPSK	8PSK	8QAM	16APSK	16QAM		
							0	1	2	3	4	5	6		
None	0	N/A	0	N/A	0		●	●	●						
Viterbi	1	Normal	0	1/2	0	●	●	●	●					●	
			1	3/4	1	●	●	●	●				●		
			2	5/6	2	●	●	●	●				●		
			3	7/8	3	●	●	●	●				●		
		Swap C0/C1	1	0	1/2	0	●	●	●	●					●
				1	3/4	1	●	●	●	●				●	
				2	5/6	2	●	●	●	●				●	
				3	7/8	3	●	●	●	●				●	
		CT	2	3/4	1	◆◆								●	
				7/8	2	◆◆								●	
TCM	2		0	2/3	0	●				●					
TPC	4	Advanced	0	0.453-16k	0	●	●	●	●	●	●	●	●		
			1	1/2-16k	1	●	●	●	●	●	●	●	●		
			2	1/2-4k	2	●	●	●	●	●	●	●	●		
			3	3/4-16k	3	●	●	●	●	●	●	●	●		
			4	3/4-4k	4	●	●	●	●	●	●	●	●		
			5	7/8-16k	5	●	●	●	●	●	●	●	●		
			6	7/8-4k	6	●	●	●	●	●	●	●	●		
			7	0.922-16k	7	●	●	●	●	●	●	●	●		
			8	0.950-4k	8	●	●	●	●	●	●	●	●		
		CT	4	5/16	0	●									
				21/44	1	●	●	●							
				3/4	2	●	●	●	●	●	●	●	●		
				7/8	3	●	●	●	●	●	●	●	●		
		0.95	4	●	●	●	●	●	●	●	●				
LDPC	5	Any Block Size 256-16k Option 0-7	0	1/2	0	●	●	●	●	●	●	●			
			1	2/3	1	●	●	●	●	●	●	●			
			2	3/4	2	●	●	●	●	●	●	●			
			3	14/17	3	●	●	●	●	●	●	●			
			4	7/8	4	●	●	●	●	●	●	●			
			5	10/11	5	●	●	●	●	●	●	●			
			6	16/17	6	●	●	●	●	●	●	●			

NOTE: The front panel selection number for each of the options is listed as the "Sel #". For example, the Modulation modes show the selection numbers 0 through 6, and the FEC Type, Option and Code Rate selection numbers are listed in the column to the right of each item. These numbers can be referred for front panel operation but are even more applicable to the SnIP Telnet command line program named "M7ctl". This program has specific commands that

allow entering either just the 3 digit FEC options or the full **M**odulation, **F**EC **T**ype, **O**ption, **C**ode rate and **R**eed-Solomon mode (MTOCR) in a single entry.

Additional table notes:

- TPC 4k and 16k restrictions apply to that line and Code Rate only
- TPC16k operates up to up to 51.66Mbps depending on the Feature Set and modulation
- The Viterbi CT modes, Rate 3/4 & 7/8, 16QAM are only for Comtech modem compatibility as they only operate in this mode with R-S at 220, 200, depth of 4. R-S is auto-enabled
- TPC Advanced modes are Datum Systems proprietary implementations that require the TPC16k option only for the highlighted lines. They offer superior performance to CT modes

### 1.6.1 Viterbi, Trellis Code Modulation Codec

Viterbi has been the standard high performance FEC used in satellite communications for many years. It has only been in the past few years that new technologies have emerged which provide more coding gain with reasonable implementations. Viterbi still maintains the advantage of fairly high coding gain with very low latency.

Trellis Code Modulation or "TCM" is a standard part of the modem used with 8PSK at rate 2/3.

The Viterbi CT option mode allows interoperability with competitive modems for 16QAM operation at rates 3/4 and 7/8. The CT mode at this setting defaults to selecting Reed-Solomon CT mode at n, k and depth values of 220, 200, depth of 4 and inverts the data. This is a closed circuit mode that does not meet normal IESS standards, but is necessary in order to link to those modems.

### 1.6.2 FlexLDPC FEC

The addition of the *FlexLDPC* FEC allows replacement of the standard Viterbi FEC selectively for transmit and receive paths. The performance improvement achieved by *FlexLDPC* is the highest and most flexible of any specialized FEC technology to date, outperforming TPC across all modes. For example, the *FlexLDPC* at rate 1/2 is capable of operating at a sustained Eb/No of only 1.5 dB with an error rate less than  $10^{-9}$

### 1.6.3 Reed-Solomon Codec (RS)

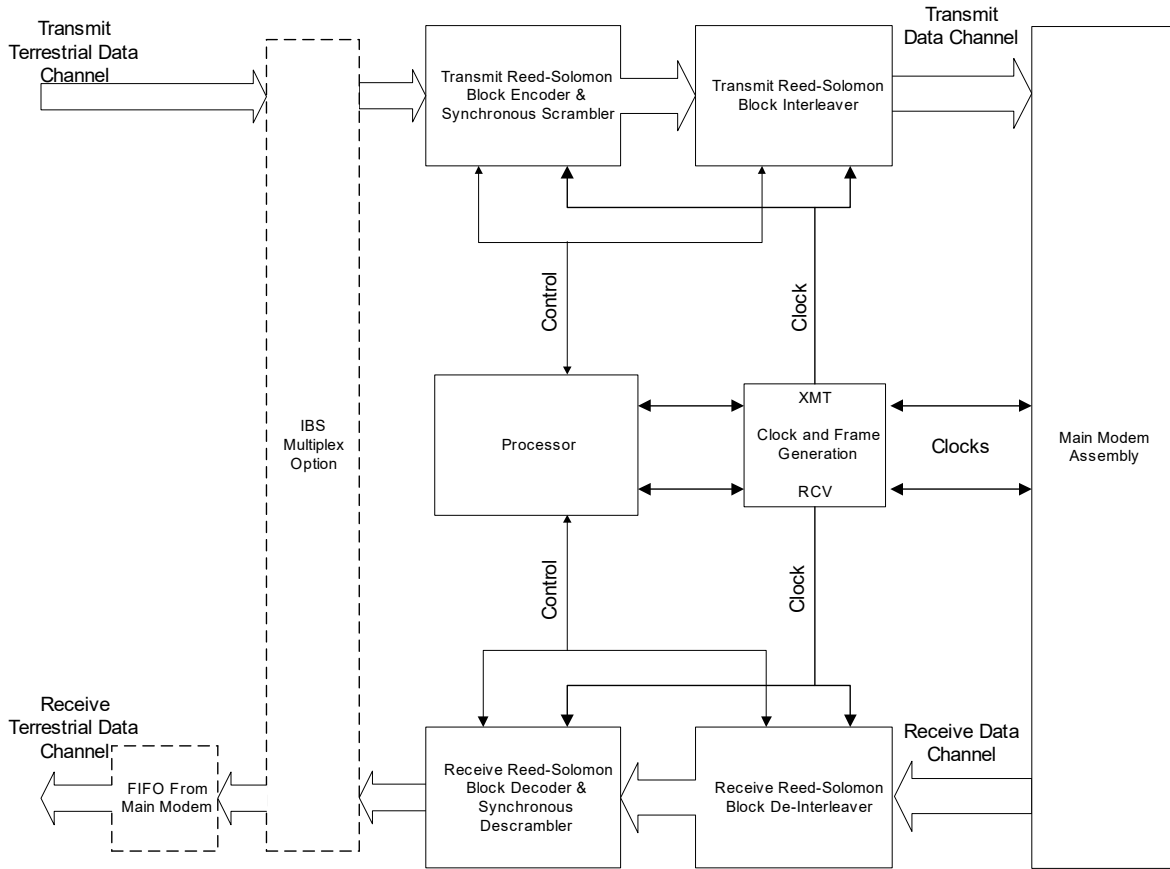
Reed-Solomon Codec places a second Forward Error Correction (FEC) process outside of and in series with the existing Viterbi FEC. The two FECs are thus considered "Concatenated". In addition, the data between the two FECs is "interleaved" which effectively reduces the possibility of multiple consecutive errored block symbols, thus improving the Reed-Solomon Codec performance.

The performance improvement achieved by this combination is significant. For example, the BER vs. Eb/No performance of concatenated Viterbi rate 3/4 coding with R-S is better than Viterbi rate 1/2 alone and it uses less bandwidth than the Viterbi rate 1/2 alone.

Reed-Solomon is a block oriented code, meaning that data is framed into fixed size blocks and processed in a specific way. A full block must be received before processing can begin, thus adding to the latency.

Reed-Solomon uses framing which allows the use of a synchronous scrambler resulting in slightly improved performance relative to the self-Synchronized scrambler normally used.

A simplified block diagram of the Reed-Solomon Codec is shown in the Figure 1-21.



Reed-Solomon Codec Simplified Block Diagram

Figure 1-21 – Reed-Solomon Block Diagram

The available Reed-Solomon modes shown in Table 1-4 can be selected from the front panel or remote control. The CT220,200 mode is a special compatibility mode and is automatically set by certain CT FEC modes, for example when Viterbi, Rate 3/4 is selected when in 16QAM mode. It can be over-riden from the Custom Reed-Solomon parameter settings.

Table 1-4 – Reed-Solomon Modes

Mode	Compatibility	Terrestrial Data Rate	Overhead Ratio	n, k and depth Values
Disabled	N/A		1/1	
IESS-308	IESS-308	1.2 kbps to <1.544 Mbps	9/8	126, 112, 4 (M4 modem compatible)
	IESS-308	1.544 Mbps to <2.048 Mbps	45/41	225, 205, 4
	IESS-308	>2.048 Mbps	73/67	219, 201, 4
IESS-309	IESS-309	All	73/67	219, 201, 4
CT220,200	Comtech	All	11/10	220, 200, 4
Custom	Modified IESS-309	All	Variable	Allows setting the “n”, “k” and “depth” values for special requirements. Can also be set for M4 compatibility to

				max M4 data rate.
--	--	--	--	-------------------

The IESS 308 mode automatically adjusts the  $n$  and  $k$  factors dependent on the data rate. The “Overhead” ratio is the ratio of the data rate at the RS encoder output to the data rate at the input. It is defined as  $n/k$ . The modem automatically adjusts to accommodate the new rate.

The Reed-Solomon Codec function can be turned on and off under software control, and is independent of the IBS ESC Data Channel enabling.

#### 1.6.4 Turbo Product Codes FEC

The addition of the Turbo Product Codes (TPC) option card (Figure 1 -22) allows replacement of the standard Viterbi FEC independently for transmit and receive paths. The performance improvement achieved by the TPC is significant. For example, the BER vs.  $E_b/N_0$  performance of TPC Rate 3/4 is approximately equal to Rate 1/2 Viterbi and uses over 40% less bandwidth. TPC also provides better bandwidth/power utilization than either Reed-Solomon concatenated on Viterbi or 8PSK/TCM with Reed-Solomon.

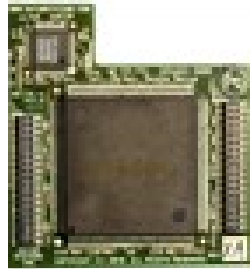


Figure 1-22 – TCP Option Card

The modem offers extensive TPC capabilities including first generation 4k block TPC, with both legacy Datum modem compatibility (PSM500) and Competitive Technology (CT) operating modes, plus a newer second generation 16k block TPC. This second generation TPC offers superior performance at the expense of more delay due to larger processing blocks.

The Datum Systems’ proprietary TPC “Advanced” mode has been optimized to provide the highest performance available in any TPC on the market. These modes not only outperform other manufacturer’s TPC, but also LDPC in many cases.

#### 1.6.5 Special Codec CT Modes

The wide range of FECs available today and the possibility of many different operating modes, and parameters for each, can make compatibility with other brands of modems extremely difficult. To aid in FEC compatibility with other brands of modems, the modem offers special “CT” modes, standing for “Competing Technology”. These modes use the same parameter settings as popular modems by other manufacturers.



## 1.7 1:1 Redundancy Function

The modem is capable of operating in a 1:1 redundancy protection mode without the use of a separate redundancy switch controller. Three (3) components are required to be external to the two (2) modems configured for 1:1 operation.

- a combiner at the transmit IF
- a splitter at the receive IF
- a connection for the terrestrial data interface

NOTE: The connection for the terrestrial data interface is dependent on the type of data interface used in the system. For serial data connections, a special “Y” cable is used but for Ethernet data connections, standard Ethernet cables connecting the “peer” modems to an Ethernet switch or a multiple port router are used.

With this connection scheme the switching is only performed on the outputs from the modem. The modem IF and data inputs are always available at the modem allowing internal circuitry to determine if one modem is correctly accepting and “locking” to the input signals while the other is unable to if in a failed state.

1:1 redundancy is accomplished by establishing two (2) M7 modems in a “peer” configuration. In this configuration, the two modems communicate with each other to determine the configuration, alarm status of each other, and force the “off-line” unit’s data interface into an un-terminated condition. This allows both interfaces to receive incoming data and clock signals, which are necessary to ascertain correct functioning. At the same time, transmit and receive IF ports are also connected together through transmit and receive IF combiner/splitter assemblies, and the “off-line” unit’s transmit signal is turned off.

The major advantage to the built-in redundancy capability is its extreme low cost but there are additional advantages.

- The second (backup) unit must be manually configured to match the on-line (prime) unit eliminating any configuration errors
- Fully programmable alarm content that determines the switching criteria
- The single point failure of an external switch in a classic 1:1 redundancy scheme is eliminated

The alarms that are used to determine switching criteria are programmable, and the first modem set up for this mode automatically loads its configuration information to the second or “backup” unit. These features create a very low cost redundancy system that is both flexible and easily set up.

NOTE: The two modems should be at the same firmware revision for proper redundant operation.

More information on the set-up and use of the 1:1 redundancy functions and modes is given in Section 3.15 - Built-in 1:1 Redundancy Mode Operation.

## 2 Installation

### 2.1 Installation Requirements

The M7 Modem is designed for installation in any standard 19-inch equipment cabinet or rack, and requires 1 RU mounting space (1.75 inches) vertically and 12 inches of depth (not including cabling space) but only one half of the rack space in width. The M7 is shipped with an external IEC filtered AC to DC power converter module designed to accept a 3-wire AC line cord and plug suitable for the country of operation. Installation and connection to the AC power line must be made in compliance to local or national wiring codes and regulations. The M7 may be placed on a table or suitable stable flat surface as required.

⇒ **CAUTION!**: There are no user-serviceable parts or configuration settings located inside the M7 modem chassis. When option card installation is to be done, **DO NOT** open the modem case unless prime power is removed.

⇒ **CAUTION!**: Before initially applying power to the modem, it is a good idea to disconnect the transmit output from the operating satellite ground station equipment. This is especially true if the current modem configuration settings are unknown, where incorrect setting could disrupt existing communications traffic.

### 2.2 Unpacking

The M7 Modem was carefully packed to avoid damage and should arrive complete with the following items for proper installation:

- M7 Modem Unit, L-Band Units may include an external BUC power supply.
- IEC filtered AC to DC power converter module with a six foot power cord
- Installation and Operation Manual plus other information on CD.

#### 2.2.1 Removal and Assembly

If using a knife or cutting blade to open the carton, exercise caution to ensure that the blade does not extend into the carton, but only cuts the tape holding the carton closed. Carefully unpack the unit and ensure that all of the above items are in the carton. If the Prime AC power available at the installation site requires a different power cord/AC connector, then arrangements to receive the proper device will be necessary before proceeding with the installation.

The M7 Modem unit is shipped fully assembled and does not require removal of the covers for any purpose in normal installation. All normal hardware configuration, including setting the data interface type and IF impedance is under software control. The type of Feature Sets, FEC Options and Interface Options installed can be read from the LCD display on the front panel under **<Unit: Status>** column by scrolling down after initial application of power.

Should the power cable AC connector be of the wrong type for the installation, either the cable or the power connector end should be replaced. The power supply itself is designed for world-wide application using from 90 to 264 VAC (100 to 240 VAC +/- 10%).

### 2.3 Mounting Considerations

When mounted in an equipment rack, adequate ventilation must be provided. The ambient temperature in the rack must be between 0° and 50° C, and held constant for best equipment operation. The air available to the rack should be clean and relatively dry. The modem units may be stacked one on top of the other to a maximum of 10 consecutive units before providing a 1 RU space for airflow. Modem units should not be placed immediately above a high heat or EMF generator to ensure the output signal integrity and proper receive operation.

Do not mount the modem in an unprotected outdoor location where there is direct contact with rain, snow, wind or sun. The modem is designed for indoor applications only.

The only tools and accessories required for rack mounting the modem is a set of four rack mounting screws and an appropriate screwdriver. Rack mount brackets are an integral part of the front panel plate of the unit and are not removable.

The following interface connections should be available at the mounting location as a minimum:

- Prime AC power.
- A 75Ω Transmit IF cable with BNC male connector. (50Ω optional) or a 50Ω Transmit IF cable with SMA male connector for the L-Band version.
- A 75Ω Receive IF cable with BNC male connector. (50Ω optional) or a 75Ω Receive IF cable with SMA connector for the L-Band versions.
- A Terrestrial data interface cable to mate with the modem or installed interface option; either a 25-pin male “D” sub connector for all standard or appropriate connector for an optional interface (such as G.703 or Ethernet).

## 2.4 Modem Connections

All connections to the modem are located on the rear of the unit: The connector definitions in the following sections describe the connectors on the modem. Any connection interfacing to the modem must be with an appropriate mating connector. Refer to Figure 2 -23 for the location of the rear panel connections on the M7 and Figure 2 -24 and Figure 2 -25 for the prime power input location on the M7LT



Figure 2-23– M7 Rear Panel with Synchronous Serial Interface Option

### 2.4.1 Prime DC power (J2)

For the standard M7 primary power is applied via an 8 to 36VDC input connector - J2. An external power convert is used to convert from 100-240 VAC or -48 VDC power sources.

There are two (2) prime power options for the M7LT that are applied directly to the rear panel of the chassis. These options are 100-240 VAC (Figure 2 -24) and -48 VDC (Figure 2 -25).



Figure 2-24 – M7LT Rear Panel with AC Prime Power Input



Figure 2-25 – M7LT Rear Panel with DC Prime Power Input

### 2.4.2 IP Control RJ45 (J4)

The RJ45 IP Control connection provides remote control of the modem via a Web Browser page or SNMP. Refer to Table 2 -5 for the pinout of the Auxiliary connector.

Table 2-5 – Remote IP Control Connector Pinout (J4)

Pin #	Signal Name	Use	Direction
1	TX D1+	Transmit Data +	Output
2	TX D1-	Transmit Data -	Output
3	RX D2+	Receive Data+	Input
4		Not Used	
5		Not Used	
6	RX D2-	Receive Data-	Input
7		Not Used	
8		Not Used	

### 2.4.3 Auxiliary RJ11 (J3) (Future Option)

The RJ11 auxiliary connector J3 is used for redundancy operation and contains all control signals required for 1:1 redundancy operation.

### 2.4.4 EIA-485/232 Control Port - 9-pin female “D” sub connector (J5)

The modem has a command interface serial control port which can be configured for either of two electrical interface modes of operation. Both are located on the rear panel 9-pin female “D” sub connector J6. Connection to either the RS-232 or RS-485 is selected by connecting to the proper set of pins as shown in Table 2 -6, and setting the remote mode as applicable via the front panel control. If a 2 wire RS-485 bus is desired, then transmit and receive RS-485 lines must be externally connected together (1 to 8 and 6 to 9).

NOTE: RS-485 supports both 2 wire and 4 wire interfaces.

Table 2-6 – Remote Control Connector Pinout (J5)

P2 Pin #	Signal Name	Use	Direction
1	Transmit B	RS-485 Transmit Data (B) +	Output
2	Transmit	RS-232 Transmit Signal	Output
3	Receive	RS-232 Receive Signal	Input
4		Not Used	
5	Common	RS-232 Signal Common	I/O
6	Transmit A	RS-485 Transmit Data (A) -	Output
7		Not Used	
8	Receive B	RS-485 Receive Data (B) +	Input
9	Receive A	RS-485 Receive Data (A) -	Input

Contact Datum Systems for information on making a remote control cable.

#### 2.4.5 Alarm Connector - 9-pin male “D” connector (J6)

The modem has two form-C dry contact alarm relays on board and an alarm connector located on the rear panel, the 9-pin male “D” sub connector J6.

The two relays are designated “A” and “B” and the particular alarms that are summarized on each relay are programmable from the front panel of the unit or via remote control. Connection to the A and B relays is via the proper set of pins as shown in Table 2-7 below and programming the applicable alarm entries via the front panel control or remote control. Non-Alarm is defined as the powered state of the relay resulting in an alarm when power is lost.

The analog monitor output is programmable from the front panel to select Receive Eb/No, Receive AGC voltage, or Transmit output power.

Table 2-7 – Alarm Connector Pinout (J6)

J5 Pin #	Connection
1	Relay A - NO on Alarm
2	Relay A - Common
3	Relay A - NC on Alarm
4	Analog Monitor Input
5	Analog Monitor Output (1kOhm)
6	GND for analog monitor
7	Relay B - NO on Alarm
8	Relay B - Common
9	Relay B - NC on Alarm

NOTE: By convention “NO” means Normally Open, and “NC” means Normally Closed. Both conditions are the non-powered, Alarm State.

## 2.4.6 The IF Input / Output (J7 - J10)

### 2.4.6.1 M7 – 50 to 180MHz IF Output - BNC (f) (J8 - M7, J9 – Dual IF)

The 50 – 180 MHz IF Output on an M7 IF unit is located on a female BNC J8. On a Dual IF unit, the IF Output is located on a female BNC J9. The frequency, power level, and impedance of this interface are programmable from any control interface. Please refer to the specifications in Appendix A

### 2.4.6.2 M7 – 50 to 180MHz IF Input - BNC (f) (J7 – M7, J8 – Dual IF)

The 50 – 180 MHz IF Input on a M7 unit is located on a female BNC J7. On a Dual IF unit, the IF Input is located on a female BNC J8. The frequency, power level, and impedance of this interface are programmable from any control interface. Please refer to the specifications in Appendix A

### 2.4.6.3 M7L – L-Band Modulator (M7L) L-Band IF Output - SMA (f) (J8 – M7L, J10 – Dual IF)

The modem L-Band IF Output on a M7L unit is located on a female SMA J8. On a Dual IF unit, the L-Band Output is located on a female SMA J10. The frequency and power level of this interface is programmable from any control interface. Please refer to the specifications in Appendix A

### 2.4.6.4 M7L – L-Band Demodulator (M7L) L-Band IF Input - SMA (f) (J7 – M7L and Dual IF)

The modem L-Band IF Input for the M7L and Dual IF unit is located on a female SMA J7. The frequency and power level of this interface is programmable from any control interface. Please refer to the specifications in Appendix A

### 2.4.6.5 M7LT – L-Band Modulator (M7LT) L-Band IF Output – N (f) or F (f) J8

The modem L-Band IF Output is located on J8, either a female N Type or F Type connector. The frequency and power level of this interface is programmable from any control interface. Please refer to the specifications in Appendix A and Figure 2 -26.

### 2.4.6.6 M7LT – L-Band Modulator (M7LT) L-Band IF Output – N (f) or F (f) J8

The modem L-Band IF Input is located on J7 either a female N Type or F Type connector. The frequency and power level of this interface is programmable from any control interface. Please refer to the specifications in Appendix A and Figure 2 -26.



Figure 2-26 – M7LT Rear Panel Connector Options (N Type, F Type, or Dual IF)

**2.4.6.7 L-Band BUC and LNB Power (M7LT Only)**

The M7LT modem has internal power supplies that have the capability to provide DC Voltage via the L-Band Xmt and Rcv IF cable to a low power BUC and/or the LNB. The internal relays under processor control and can be enabled or disabled using the front panel or remote control. The processor also reads the voltage and current applied to the BUC and LNB and can create alarms in addition to reading voltage and current at the front panel.

The rear panel LED next to the L-Band IF connector show status of the BUC and LNB voltage as shown in Table 2 -8 and Figure 2 -27. Figure 2 -26 shows the Prime Power and IF connector section of the M7LT rear panel.



Figure 2-27 – M7LT Rear Panel indicators

Table 2-8 – Rear Panel BUC and LNB Status Indicator

Indicator Color	Meaning
Off	Power sensed but disabled (disconnected) from transmit cable.
Green	Power sensed and enabled (connected) to transmit cable
Red	Power sensed and enabled but a fault condition exists.

**NOTE:** The internal AC or DC BUC power supplies in the M7LT can be changed in the field by a qualified operator. Figure 2-28 shows the location of the BUC power supply in the AC input power unit and Figure 2-29 shows the location of the BUC power supply in the DC input unit. Instructions on how to acquire and install a different BUC power supply can be found in an Application Note.

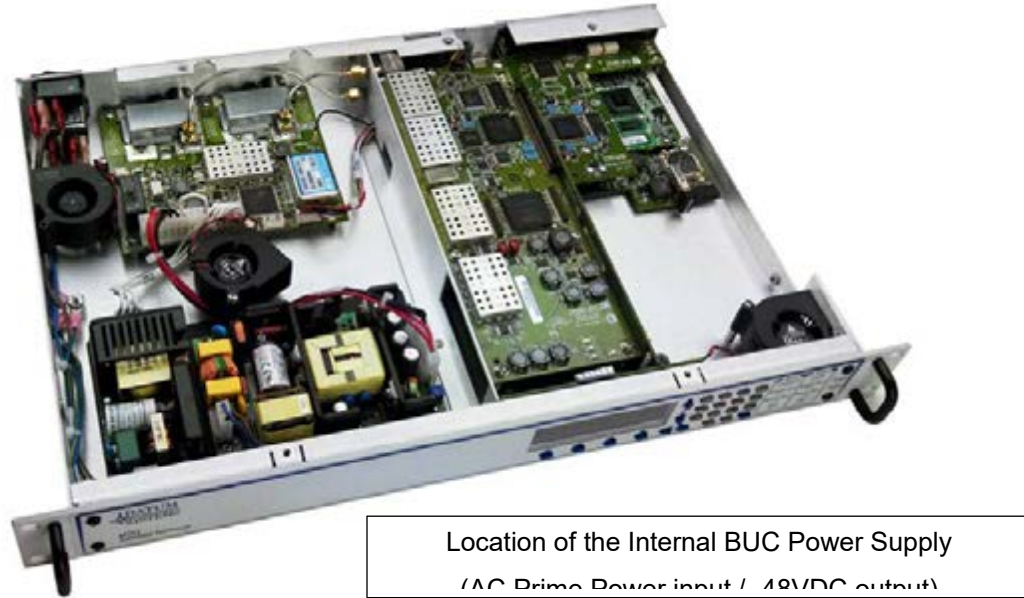


Figure 2-28 – M7LT Internal BUC Power Supply (AC version shown)

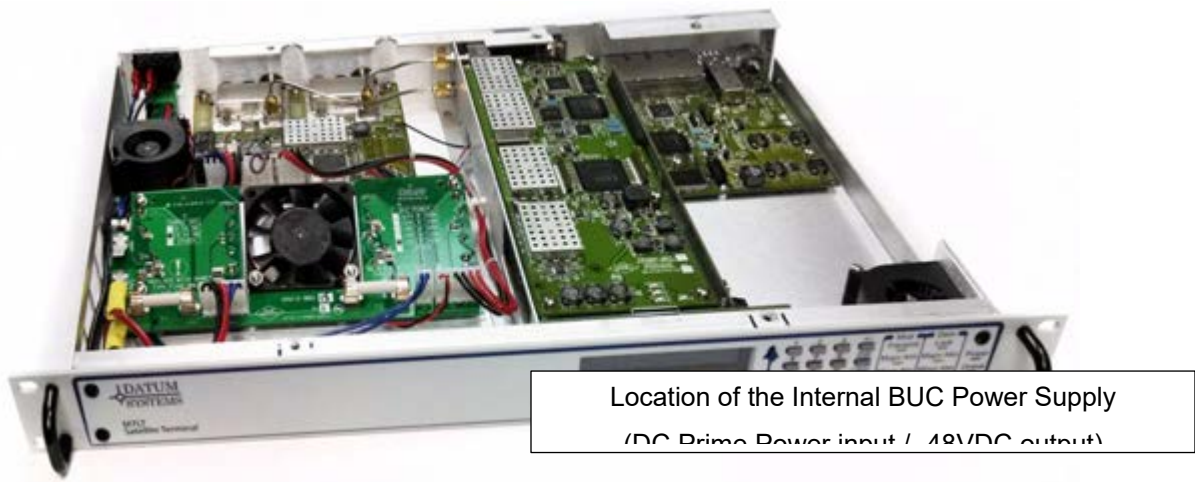


Figure 2-29 – M7LT Internal BUC Power Supply (DC Version)



Table 2-9 – BUC power supply options

BUC Power Supply Input Voltage	BUC Power Supply Output Voltage	BUC power Supply Power Rating	BUC power Supply Max Current
90-264 VAC	24 VDC	100 Watt	4.2 Amps
90-264 VAC	24 VDC	120 Watt	5.0 Amps
90-264 VAC	48 VDC	100 Watt	2.1 Amps
90-264 VAC	48 VDC	150 Watt	3.2 Amps
90-264 VAC	48 VDC	240 Watt	5.0 Amps
20-60 VDC	24 VDC	100 Watt	4.2 Amps
20-60 VDC	24 VDC	120 Watt	5.0 Amps
20-60 VDC	48 VDC	100 Watt	2.1 Amps
20-60 VDC	48 VDC	150 Watt	3.2 Amps
20-60 VDC	48 VDC	200 Watt	4.2 Amps

**NOTE:** DC Power Input is isolated so it can be either positive or negative ground;

**NOTE:** All M7LT DC units are shipped from the factory with a five foot 3-conductor cable with mating connector on one end that will allow connection to the main DC supply at the installation site.

⇒ **CAUTION!:** VERY important that the polarity needs to be wired correctly

#### 2.4.7 The Modem External Reference Input at female BNC (J1)

The modem External Ref Input is located on a 50Ω female BNC J1. The 1, 5, 9 or 10 MHz input frequency of this interface is programmable from any control interface. A sine wave input level of +10 to -15 dBm is required for normal operation. Please refer to the specifications in Appendix A

## 2.4.8 Data Interface Options

The modem is supplied with an electronically programmable data interface assembly

### 2.4.8.1 Synchronous Serial Data Interface

#### 2.4.8.1.1 Synchronous Serial Data Interface Connection (J11):

The connection to the primary data signals on the Synchronous Serial Data Interface is on a 25-pin female "D" sub connector. The physical connector and pinout is per the RS-530 interface standard. The electrical interface however can be changed under front panel or remote program control to include the types of interfaces shown above.

NOTE: Connecting the Data Interface to other types of equipment involves building cables between the M7 and that other equipment's physical interface. Contact Datum Systems for information about the specification of these cables

Table 2 -10 shows the pin assignments for the selectable standard electrical interfaces.

Table 2-10 – Synchronous Serial Data Interface Connector Pinout (J11)

J11 Pin #	EIA-449 Signal Name	V.35 Signal Name	EIA-232 Signal Name *(3)	EIA-530 Signal Name	Direction
1	Shield (GND)	Shield (GND)	Shield (GND)	SHD (GND)	GND
2	Transmit Data (A) –	SD A (SD-)	SD	TD A	Input
14	Transmit Data (B) +	SD B (SD+)		TD B	Input
15	Transmit Clock (A) –	SCT A (ST-)	ST	TTSETC A	Output
12	Transmit Clock (B) +	SCT B (ST+)		TSETC B	Output
3	Receive Data (A) –	RD A (RD-)	RD	RD A	Output
16	Receive Data (B) +	RD B (RD+)		RD B	Output
17	Receive Clock (A) –	SCR A (RT-)	RT	RSETC A	Output
9	Receive Clock (B) +	SCR B (RT+)		RSETC B	Output
4	RTS (A) –	RTS	RTS	RTS A	Input
19	RTS (B) +			RTS B	Input
5	CTS (A) –	CTS	CTS	CTS A	Output
13	CTS (B) +			CTS B	Output
6	Data Mode (A) –	DSR	DCR	DCR A	Output
22	Data Mode (B) +			DCR B	Output
20	TR (A) –	DTR	DTR	DTR A	Input
23	TR (B) +			DTR B	Input
8	Receive Ready	RLSD	RLSD	RLSD A	Output

	(A) –				
10	Receive Ready (B) +			RLSD B	Output
24	Terminal Timing (A) –	SCTE A (TT-)	TSETT	TSETT A	Input
11	Terminal Timing (B) +	SCTE B (TT+)		TSETT B	Input
18	Mod Fault Alarm	OC TTL output	25		Output
21	Demod Fault Alarm	OC TTL output	23		Output
7	Signal GND	SIG GND	GND	SGND	GND
25	Aux RS-232 Transmit/Receive	Aux RS-232 Transmit/Receive	Aux RS-232 Transmit/Receive	Aux RS-232 Transmit/Receive	Input / Output

NOTE: Data Interface Connections:

1. The modulator and demodulator fault alarms are Open Collector TTL outputs used to interface to redundancy control equipment.
3. The Shield is normally connected to the cables shield at one end of the cable only. Connecting at the DCE end only prevents ground loop currents being carried on the shield.
4. The synchronous RS-232 connection is limited to 128 kbps.

#### 2.4.8.1.2 Serial Interface Overhead Channel Connection (J10)

On the Synchronous Serial Data Interface, the connection to the overhead data is on an auxiliary connector located on the rear panel, the 25-pin male “D” sub connector J10. The pin-out of this connector is determined by the selected multiplexer mode. The pin definitions are defined in Table 2 -11 through Table 2 -14.

NOTE: The FIFO External Clock pins are an input to the modem. An input at the receive data rate can be used to clock data out of the demodulator FIFO buffer. An input at the transmit data rate can be used to provide a transmit send timing clock which the modem will phase locked to (if within acceptable range). The send timing signal is still an output from the modem, but in this case will be at the input signal rate. Both functions can be used simultaneously if the transmit and receive data rates are the same.

Table 2-11 – Serial Interface Overhead Channel - IBS Standard Mux - RS-232 (J10)

J10 Pin #	Signal Name	Use	Direction
1	Ground	All	Ground
2	ESC Send Data	RS-232 Standard Mode Connection (synchronous)	Input
3	ESC Rcv Data	RS-232 Standard Mode Connection (synchronous)	Output
5	ESC Send Clock	RS-232 Standard Mode Connection (synchronous)	Output
7	Ground	Ground	Ground

8	ESC Rcv Clock	RS-232 Standard Mode Connection (synchronous)	Output
9	Primary Interface External Clock+ (B)	FIFO External Clock input '+' or 'B' line. RS422 level	Input
15	Ground	Ground	Ground
17	Ground	Ground	Ground
21	Primary Interface External Clock- (A)	FIFO External Clock input '-' or 'A' line. RS422 level	Input

Table 2-12 – Serial Interface Overhead Channel - IBS Standard Mux - RS-485 (J10)

J10 Pin #	Signal Name	Use	Direction
1	Ground	All	Ground
2	ESC Send Data+ (B)	RS-485 Standard Mode Connection (synchronous)	Input
3	ESC Rcv Data+ (B)	RS-485 Standard Mode Connection (synchronous)	Output
4	ESC Send Data- (A)	RS-485 Standard Mode Connection (synchronous)	Input
5	ESC Rcv Data- (A)	RS-485 Standard Mode Connection (synchronous)	Output
6	ESC Rcv Clock- (A)	RS-485 Standard Mode Connection (synchronous)	Output
7	Ground	Ground	Ground
8	ESC Rcv Clock+ (B)	RS-485 Standard Mode Connection (synchronous)	Output
9	Primary Interface External Clock+ (B)	FIFO External Clock input '+' or 'B' line. RS422 level	Input
15	Ground	Ground	Ground
21	Primary Interface External Clock- (A)	FIFO External Clock input '-' or 'A' line. RS422 level	Input

Table 2-13 – Serial Interface Overhead Channel - Advanced/IBS Custom Mux - RS-232 (J10)

J10 Pin #	Signal Name	Use	Direction
1	Ground	All	Ground
2	ESC Send Data	RS-232 Advanced/Custom Mode Connection (sync)	Input
3	ESC Rcv Data	RS-232 Advanced/Custom Mode Connection (sync)	Output
4	ESC RTS	RS-232 Advanced/Custom Mode Connection (sync)	Input

5	ESC CTS	RS-232 Advanced/Custom Mode Connection (sync)	Output
6	ESC DSR	RS-232 Advanced/Custom Mode Connection (sync)	Output
7	Ground	Ground	Ground
8	ESC DCD	RS-232 Advanced/Custom Mode Connection (sync)	Output
9	Primary Interface External Clock+ (B)	FIFO External Clock input '+' or 'B' line. RS422 level	Input
11	ESC Alarm Out A Relay Common	Backward Alarm A, Form C Common	Output
12	ESC Alarm Out B Relay N.O.	Backward Alarm B, Form C Normally Open	Output
13	ESC Alarm Out B Relay N.C.	Backward Alarm B, Form C Normally Closed	Output
14	ESC Alarm In A	Alarm A Relay, Low Activates Remote ESC	Input, TTL, Internal 1mA Pull-Up
15	Ground (Return for ESC Alarm In A)	Alarm A Relay, Ground	Ground
16	ESC Alarm In B	Alarm B Relay, Low Activates Remote ESC	Input, TTL, Internal 1mA Pull-Up
17	Ground (Return for ESC Alarm In B)	Alarm B Relay, Ground	Ground
18	RS-232 Input	Not Currently Used	Input
20	ESC DTR	RS-232 Advanced/Custom Mode Connection (sync)	Input
21	Primary Interface External Clock- (A)	FIFO External Clock input '-' or 'A' line. RS422 level	Input
23	ESC Alarm Out A Relay N.O.	Backward Alarm A, Form C Normally Open	Output
24	ESC Alarm Out A Relay N.C.	Backward Alarm A, Form C Normally Closed	Output
25	ESC Alarm Out B Relay Common	Backward Alarm, Form C Normally Common	Output

Table 2-14 – Serial Interface Overhead Channel - Advanced/IBS Custom Mux - RS-485 (J10)

J10 Pin #	Signal Name	Use	Direction
1	Ground	All	Ground
2	ESC Send Data+ (B)	RS-485 Advanced/Custom Mode Connection (sync)	Input
3	ESC Rcv Data+ (B)	RS-485 Advanced/Custom Mode Connection (sync)	Output

4	ESC Send Data- (A)	RS-485 Advanced/Custom Mode Connection (sync)	Input
5	ESC Rcv Data- (A)	RS-485 Advanced/Custom Mode Connection (sync)	Output
6	ESC DCD- (A)	RS-485 Advanced/Custom Mode Connection (sync)	Output
7	Ground	Ground	Ground
8	ESC DCD+ (B)	RS-485 Advanced/Custom Mode Connection (sync)	Output
9	Primary Interface External Clock+ (B)	FIFO External Clock input '+' or 'B' line. RS422 level	Input
11	ESC Alarm Out A Relay Common	Backward Alarm A, Form C Common	Output
12	ESC Alarm Out B Relay N.O.	Backward Alarm B, Form C Normally Open	Output
13	ESC Alarm Out B Relay N.C.	Backward Alarm B, Form C Normally Closed	Output
14	ESC Alarm In A	Alarm A Relay, Low Activates Remote ESC	Input, TTL, Internal 1mA Pull-Up
15	Ground (Return for ESC Alarm In A)	Alarm A Relay, Ground	Ground
16	ESC Alarm In B	Alarm B Relay, Low Activates Remote ESC	Input, TTL, Internal 1mA Pull-Up
17	Ground (Return for ESC Alarm In B)	Alarm B Relay, Ground	Ground
18	RS-485 Input+ (B)	Not Currently Used	Input
20	RS-485 Input- (A)	Not Currently Used	Input
21	Primary Interface External Clock- (A)	FIFO External Clock input '-' or 'A' line. RS422 level	Input
23	ESC Alarm Out A Relay N.O.	Backward Alarm A, Form C Normally Open	Output
24	ESC Alarm Out A Relay N.C.	Backward Alarm A, Form C Normally Closed	Output
25	ESC Alarm Out B Relay Common	Backward Alarm, Form C Normally Common	Output

NOTE: ESC Alarm In/Out Not Available with IBS Standard Mux

NOTE: ESC Send Clock Not Available with RS-485

**2.4.8.2 Advanced IP Interface (I7 and I7+)**

The I7 and I7+ IP Interface connector is on the rear panel (Figure 2 -30) of the optional interface card.



Figure 2-30 – I7 - IP Interface Rear Panel

The IP connections for the primary transmit and receive data are on the RJ45 connector J12

Table 2-15 – I7 IP Interface Connector Pinout (J12)

Pin	Name	Description
1	TX D1+	Transmit Data+
2	TX D1-	Transmit Data-
3	RX D2+	Receive Data+
4	BI D3+	Bi-directional pair C +
5	BI D3-	Bi-directional pair C -
6	RX D2-	Receive Data-
7	BI D4+	Bi-directional pair D +
8	BI D4-	Bi-directional pair D -

The Console connector, J13, is a nine pin female “D” connector provides the user access to for configuration of the internal Vyatta router.

Table 2-16 – I7 Console Connector Pinout (J13)

Pin	Name	Description	Direction
1		Not Used	
2	Transmit	RS-232 Transmit Signal	Output
3	Receive	RS-232 Receive Signal	Input
4		Not Used	
5	Common	RS-232 Signal Common	I/O
6		Not Used	
7		Not Used	
8		Not Used	

9		Not Used	
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**2.4.8.3 Express Ethernet Interface (E7)**

The E7 Express Ethernet Interface connectors are on the rear panel (Figure 2 -31) of the optional interface card.



Figure 2-31 – Express Ethernet Interface (E7)



Figure 2-32 – Typical SFP Interface Adapters (Optical and GbE shown)

**2.4.8.3.1 GbE Ports 1 thru 4 (J29 - J32)**

With the E7 Interface installed, the M7 is able to interface with four (4) Gigabit Ethernet ports via J29 through J32. The connector pinout for each connector is shown in Table 2 -17.

Table 2-17 – E7 Gigabit Ethernet Interface Ports 1-4 Connector Pinout (J29-J32)

Pin	Name	Description
1	TX D1+	Transmit Data+
2	TX D1-	Transmit Data-
3	RX D2+	Receive Data+
4	BI D3+	Bi-directional pair C +
5	BI D3-	Bi-directional pair C -
6	RX D2-	Receive Data-
7	BI D4+	Bi-directional pair D +
8	BI D4-	Bi-directional pair D -

**2.4.8.3.2 SFP Interface (J28)**

The optional SFP port provides an additional interface port that can be configured with an interface available with a SFP Ethernet adapter. The SFP port supports both optical and electrical Ethernet. The connector is compatible with the SFP standard.

NOTE: Contact Datum Systems for recommended vendors on SFP products.

### 2.4.8.3.3 Reference I/O (J27)

The Reference I/O connector is located on a 75Ω female BNC J27. This connector is used to provide distributed bit timing reference over a satellite link. Typical use is for distribution of the master G703 timing within a cellular network.

### 2.4.8.4 Dual G.703/E1 Interface (G7)

The G7 interface has five (5) user interface connectors on the rear panel (Figure 2 -33) of the optional card. Refer to Table 2 -18 for the connector type, signal names, and connector pinout.



Figure 2-33 – G7 – Dual G.703/E1 Interface Rear Panel

#### 2.4.8.4.1 Dual G.703/E1 120 ohm Balanced Interface

The G7 interface offers dual G.703/E1 balanced interfaces presented on two (2) RJ48c connectors – (Port 1) and (Port 2). The pinout for the two connectors are shown in Table 2 -18

Table 2-18 – Port 1 (J22) & Port 2 (J21) Connector – 120 ohm Balanced Pinout (RJ48c)

Signal Name	Description	Direction	Pins
SD-T	Send Data Tip	To Modem	1
SD-R	Send Data Ring	To Modem	2
RD-T	Receive Data Tip	From Modem	4
RD-R	Receive Data Ring	From Modem	5
GND	Ground	n/a	3,6

#### 2.4.8.4.2 Dual G.703/E1 75 ohm Unbalanced

The G7 interface offers dual G.703/E1 unbalanced interfaces presented in two ways. For Port 1, two (2) BNC connectors (J23 and J24) provide direct for the data interface. For Port 2, a connector adapter must be used to convert the unbalanced interface signals on the RJ45 (J22) to unbalanced (75ohm, BNC). This adapter is available from Datum Systems and shown in Figure 2 -34.



Figure 2-34 – RJ45 to BNC adapter



#### 2.4.8.4.3 Dual G.703/E1 Overhead Channel Connection (J20)

The G7 interface offers access to the ESC overhead data is on an auxiliary connector located on the rear panel, a 9-pin female “D” sub connector J20. The pin-out of this connector is determined by the selected multiplexer mode. The pinout for the overhead connector when configured for RS-232 is shown in Table 2 -19 and when configured for RS-485 is shown in Table 2 -20.

Table 2-19 – Overhead Interface - RS-232 (J20)

J20 Pin #	Signal Name	Use	Direction
1	ESC DCD	RS-232 Advanced/Custom Mode Connection (sync)	Output
2	ESC Rcv Data	RS-232 Advanced/Custom Mode Connection (sync)	Output
3	ESC Send Data	RS-232 Advanced/Custom Mode Connection (sync)	Input
4	ESC DTR	RS-232 Advanced/Custom Mode Connection (sync)	Input
5	Ground	Ground	Ground
6	ESC DSR	RS-232 Advanced/Custom Mode Connection (sync)	Output
7	ESC RTS	RS-232 Advanced/Custom Mode Connection (sync)	Input
8	ESC CTS	RS-232 Advanced/Custom Mode Connection (sync)	Output
9	RS-232 Input	Not Currently Used	Input

Table 2-20 – Overhead Interface - RS-485 (J20)

J20 Pin #	Signal Name	Use	Direction
1	ESC DCD+ (B)	RS-485 Advanced/Custom Mode Connection (sync)	Output
2	ESC Rcv Data+ (B)	RS-485 Advanced/Custom Mode Connection (sync)	Output
3	ESC Send Data+ (B)	RS-485 Advanced/Custom Mode Connection (sync)	Input
4	RS-485 Input- (A)	Not Currently Used	Input
5	Ground	Ground	Ground
6	ESC DCD- (A)	RS-485 Advanced/Custom Mode Connection (sync)	Output
7	ESC Send Data- (A)	RS-485 Advanced/Custom Mode Connection (sync)	Input
8	ESC Rcv Data- (A)	RS-485 Advanced/Custom Mode Connection (sync)	Output

9	RS-485 Input+ (B)	Not Currently Used	Input
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## 2.4.8.5 High Speed Serial Interface (HSSI)

### 2.4.8.5.1 HSSI Data Interface Connector (J26)

The High-Speed Serial Interface connector is a 50 pin SCSI-2 on the rear panel (Figure 2 -35) of the optional interface card.



Figure 2-35 – HSSI Interface Rear Panel

Connection between the Router and the modem's HSSI interface connector is via a Cisco CAB-1HSSI cable or equivalent. This cable has the same 50 pin SCSI-2 type connector on both ends. Connect the cable and insure that the retaining clips are engaged on both ends. The standard HSSI SCSI-2 type cable designed to connect between a DTE Device, like a router, and a DCE such as the M7 modem is a 25 pair cable with shield. This cable is connected as a 1 to 1 pin connection between the two male cable connectors. That means that pin 1 on one end goes to pin 1 on the other, pin 2 to 2, etc, through pin 50 to pin 50.

### 2.4.8.5.2 HSSI Overhead Channel Connection (J25)

On the HSSI interface, the connection to the overhead data is on an auxiliary connector located on the rear panel, the 25-pin male "D" sub connector J25. The pin-out of this connector is determined by interface board(s) installed in the modem and the selected multiplexer mode. The pin definitions are defined in Table 2 -21 through Table 2 -24.

NOTE: The FIFO External Clock pins are an input to the modem. An input at the receive data rate can be used to clock data out of the demodulator FIFO buffer. An input at the transmit data rate can be used to provide a transmit send timing clock which the modem will phase locked to (if within acceptable range). The send timing signal is still an output from the modem, but in this case will be at the input signal rate. Both functions can be used simultaneously if the transmit and receive data rates are the same.

Table 2-21 – M7 Overhead Channel - IBS Standard Mux - RS-232 (J25)

J25 Pin #	Signal Name	Use	Direction
1	Ground	All	Ground
2	ESC Send Data	RS-232 Standard Mode Connection (synchronous)	Input
3	ESC Rcv Data	RS-232 Standard Mode Connection (synchronous)	Output
5	ESC Send Clock	RS-232 Standard Mode Connection (synchronous)	Output
7	Ground	Ground	Ground
8	ESC Rcv Clock	RS-232 Standard Mode Connection (synchronous)	Output
9	Primary Interface External Clock+ (B)	FIFO External Clock input '+' or 'B' line. RS422 level	Input
15	Ground	Ground	Ground
17	Ground	Ground	Ground
21	Primary Interface External Clock- (A)	FIFO External Clock input '-' or 'A' line. RS422 level	Input

Table 2-22 – M7 Overhead Channel - IBS Standard Mux - RS-485 (J25)

J25 Pin #	Signal Name	Use	Direction
1	Ground	All	Ground
2	ESC Send Data+ (B)	RS-485 Standard Mode Connection (synchronous)	Input
3	ESC Rcv Data+ (B)	RS-485 Standard Mode Connection (synchronous)	Output
4	ESC Send Data- (A)	RS-485 Standard Mode Connection (synchronous)	Input
5	ESC Rcv Data- (A)	RS-485 Standard Mode Connection (synchronous)	Output
6	ESC Rcv Clock- (A)	RS-485 Standard Mode Connection (synchronous)	Output
7	Ground	Ground	Ground
8	ESC Rcv Clock+ (B)	RS-485 Standard Mode	Output

		Connection (synchronous)	
9	Primary Interface External Clock+ (B)	FIFO External Clock input '+' or 'B' line. RS422 level	Input
15	Ground	Ground	Ground
21	Primary Interface External Clock- (A)	FIFO External Clock input '-' or 'A' line. RS422 level	Input

Table 2-23 – M7 Overhead Channel - Advanced/IBS Custom Mux - RS-232 (J25)

J25 Pin #	Signal Name	Use	Direction
1	Ground	All	Ground
2	ESC Send Data	RS-232 Advanced/Custom Mode Connection (sync)	Input
3	ESC Rcv Data	RS-232 Advanced/Custom Mode Connection (sync)	Output
4	ESC RTS	RS-232 Advanced/Custom Mode Connection (sync)	Input
5	ESC CTS	RS-232 Advanced/Custom Mode Connection (sync)	Output
6	ESC DSR	RS-232 Advanced/Custom Mode Connection (sync)	Output
7	Ground	Ground	Ground
8	ESC DCD	RS-232 Advanced/Custom Mode Connection (sync)	Output
9	Primary Interface External Clock+ (B)	FIFO External Clock input '+' or 'B' line. RS422 level	Input
11	ESC Alarm Out A Relay Common	Backward Alarm A, Form C Common	Output
12	ESC Alarm Out B Relay N.O.	Backward Alarm B, Form C Normally Open	Output
13	ESC Alarm Out B Relay N.C.	Backward Alarm B, Form C Normally Closed	Output
14	ESC Alarm In A	Alarm A Relay, Low Activates Remote ESC	Input, TTL, Internal 1mA Pull-Up
15	Ground (Return for ESC Alarm In A)	Alarm A Relay, Ground	Ground
16	ESC Alarm In B	Alarm B Relay, Low Activates Remote ESC	Input, TTL, Internal 1mA Pull-Up
17	Ground (Return for ESC Alarm In B)	Alarm B Relay, Ground	Ground
18	RS-232 Input	Not Currently Used	Input
20	ESC DTR	RS-232 Advanced/Custom	Input



		Mode Connection (sync)	
21	Primary Interface External Clock- (A)	FIFO External Clock input '-' or 'A' line. RS422 level	Input
23	ESC Alarm Out A Relay N.O.	Backward Alarm A, Form C Normally Open	Output
24	ESC Alarm Out A Relay N.C.	Backward Alarm A, Form C Normally Closed	Output
25	ESC Alarm Out B Relay Common	Backward Alarm, Form C Normally Common	Output

Table 2-24 – M7 Overhead Channel - Advanced/IBS Custom Mux - RS-485 (J25)

J25 Pin #	Signal Name	Use	Direction
1	Ground	All	Ground
2	ESC Send Data+ (B)	RS-485 Advanced/Custom Mode Connection (sync)	Input
3	ESC Rcv Data+ (B)	RS-485 Advanced/Custom Mode Connection (sync)	Output
4	ESC Send Data- (A)	RS-485 Advanced/Custom Mode Connection (sync)	Input
5	ESC Rcv Data- (A)	RS-485 Advanced/Custom Mode Connection (sync)	Output
6	ESC DCD- (A)	RS-485 Advanced/Custom Mode Connection (sync)	Output
7	Ground	Ground	Ground
8	ESC DCD+ (B)	RS-485 Advanced/Custom Mode Connection (sync)	Output
9	Primary Interface External Clock+ (B)	FIFO External Clock input '+' or 'B' line. RS422 level	Input
11	ESC Alarm Out A Relay Common	Backward Alarm A, Form C Common	Output
12	ESC Alarm Out B Relay N.O.	Backward Alarm B, Form C Normally Open	Output
13	ESC Alarm Out B Relay N.C.	Backward Alarm B, Form C Normally Closed	Output
14	ESC Alarm In A	Alarm A Relay, Low Activates Remote ESC	Input, TTL, Internal 1mA Pull-Up
15	Ground (Return for ESC Alarm In A)	Alarm A Relay, Ground	Ground
16	ESC Alarm In B	Alarm B Relay, Low Activates Remote ESC	Input, TTL, Internal 1mA Pull-Up
17	Ground (Return for ESC Alarm In B)	Alarm B Relay, Ground	Ground
18	RS-485 Input+ (B)	Not Currently Used	Input
20	RS-485 Input- (A)	Not Currently Used	Input
21	Primary Interface External Clock- (A)	FIFO External Clock input '-' or 'A' line. RS422 level	Input
23	ESC Alarm Out A Relay N.O.	Backward Alarm A, Form C Normally Open	Output
24	ESC Alarm Out A Relay N.C.	Backward Alarm A, Form C Normally Closed	Output

25	ESC Alarm Out B Relay Common	Backward Alarm, Form C Normally Common	Output
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NOTE: ESC Alarm In/Out Not Available with IBS Standard Mux

NOTE: ESC Send Clock Not Available with RS-485

## 2.5 Adding or Changing the Interface Type

Up to two interface cards may be installed in a modem unit by removing the modem's top cover (Figure 2-36). First the interface option card rear panel plate is released from the chassis by removing the Ext Ref In (J1) coaxial connector nut and washer. Second, remove any screws that hold the interface card to the chassis. Remove the interface card by releasing the card from the connectors on the interconnect board. If there are two (2) installed interfaces, the top card must be removed first and installed last in the process.

Installation of the new interface(s) is done in the reverse order.



Figure 2-36 – Typical single interface card layout (Synchronous Serial Interface shown)

Once the new interface card is installed and the modem is powered-up, the main modem processor will automatically query the new interface card and determine the type and options installed.

Most option interface cards completely co-exist with other interface types, allowing the optional interface to represent one or more added interface types available. However, only one interface type is allowed to be enabled at one time.

Installed interface card(s) are automatically recognized by the modem and an entry is added to the Interface Option selection menu. Selection of the option interface then becomes identical to selection of any of the standard interfaces.

## 2.6 Option Turbo Product Codes FEC Option Installation

The M7 demodulator contains on-board circuitry and connectors for adding a Turbo Product Codes FEC Option Card. This card can co-exist with the IBS Multiplexer (and the Reed-Solomon function also, but both cannot be used simultaneously).

Installation of these cards is not difficult, but requires removal of the modem from service and removal of the unit's cover, and should be accomplished only by a qualified technician. The modem automatically recognizes the presence of the optional FEC card and provides additional front panel and remote control parameter settings allowing control of the selected option.

**NOTE:** In some cases, when options are first introduced, a software update to the modems internal program is necessary to allow use of the option. Refer to Section - Updating Modem Software. The Datum Systems M7 Update program will also recognize and install software for FEC cards present in the modem.

Turbo Product Codes or TPC is available in three versions depending on the link requirements. The three versions are:

- TPC4K which uses the same TPC chip as in legacy Datum modems
- TPC16K which uses a newer 16K block size to improve performance
- TPC20K board with both the TPC4k and TPC16k chips installed

Because of the larger processed block size, the TPC16K device has much higher delay or latency than the 4K block device. The M7 can be ordered with any of these TPC options from the factory or installed in the field by a qualified technician. Once installed, the TPC option card will provide added functionality to the standard FEC functions already contained within the modem (Viterbi, TCM, Reed-Solomon, and FlexLDPC).

The Turbo Product Codes option, when enabled, replaces any other FEC function. The Modulator (Transmit) and Demodulator (Receive) functions of each option are also independent and can be enabled and disabled as required.

The physical arrangement of the FEC slot is shown in Figure 2 -37. The same size PWB is used for the TPC4K, TPC16K, and TCP20K optional card.

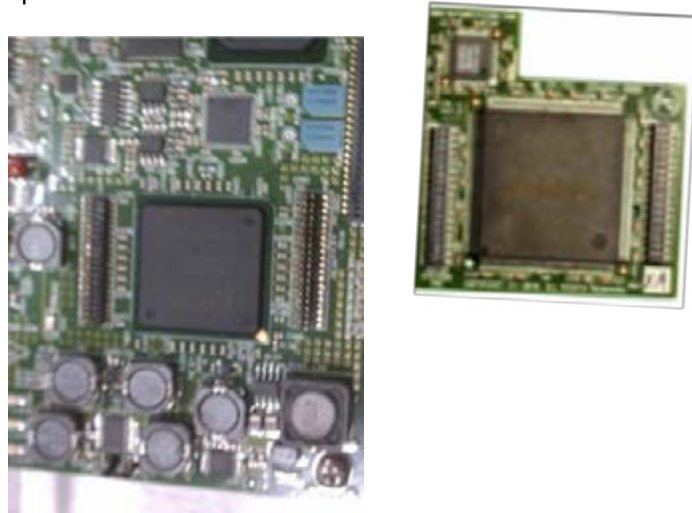


Figure 2-37 – FEC Option Card Installation

## 2.7 Redundancy Connection

1:1 redundancy is accomplished by establishing two (2) M7 modems in a redundancy partner configuration. In this configuration, the two modems communicate with each other to determine the configuration, alarm status of each other, and force the “off-line” unit’s data interface into an un-terminated condition. This allows both interfaces to receive incoming data and clock signals, which are necessary to ascertain correct functioning. At the same time, transmit and receive IF ports are also connected together through transmit and receive IF combiner/splitter assemblies, and the “off-line” unit’s transmit signal is turned off.

The major advantage to the built-in redundancy capability is its extreme low cost but there are additional advantages.

- The second (or partner) unit is configured by the on-line unit eliminating any configuration errors
- Fully programmable alarm content that determines the switching criteria
- The single point failure of an external switch in a classic 1:1 redundancy scheme is eliminated

Operation of the 1:1 redundancy mode is described in Section 3.15.

NOTE: The two modems should be at the same firmware revision for proper redundant operation.

### 3 Operation

#### 3.1 **Operating Procedures**

Operation of the M7 Modem consists of controlling the unit's operating parameters and monitoring status and responses via one of the control interfaces. There are three possible control methods for the modem:

1. Front Panel Keypad Control. (Section 3.2)
5. Command Interface Binary Control via rear panel 232/485 is discussed in Section .

Any of these methods may be used separately or together to monitor and control the modem unit. Each of these three interfaces and their respective methods are discussed separately below in the sections noted above.

Additional operating procedures are also presented later in this section on using some of the unique features of the M7 that would not normally be set-up during installation. These include such items as the FIFO buffer, built-in BERT, storing and recalling configuration information, AUPC, the analog monitor output, redundancy and automatic recovery.

#### 3.2 **Front Panel**

The M7 front panel is divided into three functional areas: the LED Indicators, the Keypad, and the LCD display. The front panel of the M7 allows complete control and monitor of all modem parameters and functions. The front panel layout showing the location and labels is shown in Figure 3-1



Figure 3-38 – M7L Front Panel Controls and Indicators

##### 3.2.1 **Front Panel LED Indicators**

There are 10 LEDs on the modem front panel to indicate current status of the modem's operation. They are separated into two columns representing the Modulator status, shown in Table 3-26, and the Demodulator status, shown in Table 3-27. Modem (Unit) status is shown in Table 3-25. The LED colors maintain a consistent meaning. Green signifies that the indication is appropriate for normal operation, Yellow means that there is a condition not proper for normal operation. Red indicates a fault condition which will result in lost communications

When one of the Alarm lamps below is illuminated, the highest priority alarm condition is displayed in the LCD window.

Table 3-25 – Modem LED Indicators

Indicator Name	Indicator Color	Description
Power:	Green	Indicates the modem unit is currently under power.
Online	Green/Off	Indicated that the modem is online. In 1:1 redundancy configuration, (future option) this indicator will be lit green on the on-line modem and the off on the modem that is off line.

Table 3-26 – Modulator LED Indicators

Indicator Name	Indicator Color	Description
Transmit:	Green	Indicates that the transmit output is currently active
	Green Flashing	Indicates an IF Loopback test is active and the carrier is configured to the “disabled” state.
Major Alarm:	Red	Indicates that the transmit direction has failed, losing traffic
Minor Alarm:	Yellow	Indicates a transmit warning condition exists.
Test:	Yellow Flashing	Indicates the modulator is involved in a current test mode activity

Table 3-27 – Demodulator LED Indicators

Indicator Name	Indicator Color	Description
Lock:	Green	Indicates receiver lock to an incoming CXR and data including FEC sync
Major Alarm:	Red	Indicates that the receive direction has failed, losing traffic.
Minor Alarm:	Yellow	Indicates a receive warning condition exists, either an incoming carrier with a low input level or a low $E_b/N_o$ (programmable threshold), or a backward alarm received from the far end
Test:	Yellow Flashing	Indicates the receiver is involved in a current test mode activity

### 3.2.2 Front Panel Keypad

The front panel keypad consists of three areas: First, is a 10-key numeric entry with 5 additional keys. Two keys provide for a “+/-” (change sign) and “.” (decimal point) function, three provide “Edit”, “Clear” and “Enter”, and four. The “Enter” key on the lower right is normally blue while the rest of the numeric keypad keys are gray.

The second area is a set of “Arrow” or “Cursor” keys used to navigate the parameter currently being monitored or controlled. During entry, the cursor keys allow moving a cursor to individual digits of a numerical entry or scrolling through the available options of a selection entry. The arrow keys are also in blue.

The third area is the four selection keys located below the LCD display. These buttons select which functional area or “sheet” of the display matrix is currently in use and are discussed within the LCD display section below.



### 3.2.3 Front Panel LCD Display

The LCD display is a single entry window into the large matrix of parameters which can be monitored and set from the front panel. The front panel display is graphical 240 x 64 pixel LCD display. The display is backlit and the brightness can be set for two states: Active and Idle. The active state is entered whenever a key on the front panel is pressed and the display will automatically go to the idle state after approximately 60 seconds of inactivity. Each state may be set to different levels of brightness based on the preference of the operator. The default setting is 'Backlight Full' in the active state and 'Backlight 2' in the idle state. To change the settings for either state go to the **<Unit: Keyboard – LCD Active>** or **<Unit: Keyboard – LCD Idle>** brightness parameter and adjust to the desired values.

The display, shown in Figure 3 -39, has four distinct areas showing current status information. The upper left of the LCD shows the current area of use, such as "Status", "IF", "Data", "Alarm" or "Test" (for the Mod and Demod). The upper right shows the current parameter being monitored, such as "Frequency", "Offset" or "Bit Rate". The middle lines show the current value of that parameter and the bottom line will show the four legends that indicate the Modem's functional areas. The type of the active interface will show in the "Interface" location, for example "Sync" will be displayed when the synchronous interface is active. At times this line may be replaced with status messages that are longer than two lines.

NOTE: The front panel matrix functions like a three-dimensional multi-sheet spreadsheet. The different "sheets" are selected by the buttons for Unit, Mod, Demod and Interface, while navigation on a given sheet is accomplished using the up, down, left and right arrow keys.

### 3.3 Front Panel Control and Monitor Matrix

The front panel (Figure 3 -39) can be used to completely control the modem setup and operating parameters.

The modem parameters are arranged in four matrices:

- "Unit" - Unit
- "Mod" - Modulator
- "Demod" - Demodulator
- "Intf" - Interface

Each matrix represents a major functional area of modem operation (i.e. Unit, Modulator, Demodulator, and Interface) while the columns represent groupings within those functional areas (i.e. Status, IF, Data, Alarm and Test) and the rows represent individual parameter associated with that function. Each matrix is 4 to 14 columns wide and up to 32 rows long as shown in the parameter matrices example Table 3 -28.



Figure 3-39 – Front Panel Matrix Navigation

Within this manual, the format used to identify a specific parameter is shown as **<Function: Column – Row>**. For example, to get to the Modulator IF Level the method is to press the "Mod" key then use the left and right arrow keys to access the "IF" column and the up and down arrow keys to arrive at the "Level" parameter. This is shown by convention in this manual as **<Mod: IF – Level>**. Selection of a specific value for the parameter will use the notation **<Function: Column**

– **Row> = value(#)**. The value is descriptive and the # in parenthesis is the selection number key to press for optional parameters, if applicable, in the direct entry mode explained below.

### 3.3.1 Front Panel Matrix Navigation

A functional matrix is selected by pressing one of the four buttons below the LCD display. In response the modem will highlight the particular button text selected.

Each individual item that may be controlled or monitored is referred to as a “parameter”. Parameters are arranged within each matrix as rows and columns. The LCD display shows a single parameter at one time. The four arrow keys (↑), (↓), (→), (←), allow scrolling through the rows and columns of the parameter matrix or sheet. The left and right arrow keys scroll through the columns and the up and down arrow keys scroll through the available parameters in each column. Both the columns and rows “wrap around” such that scrolling past the last item in a row starts with the first item in the same row again, and the same for columns.

### 3.3.2 Monitoring Modem Parameters

Any available modem parameter is monitored by simply using the function and arrow keys to display the desired parameter in the LCD display. The item displayed will remain until changed or power is removed from the modem unit. The display operates in real time, therefore when a currently displayed parameter changes the display will change without operator intervention.

When multiple parameters could be displayed (such as when multiple test modes are currently running or multiple alarms are present) only the highest priority item is displayed. When that item is no longer valid the next highest priority is displayed. The priority of items is fixed within the modem software.

### 3.3.3 Changing Modem Parameters

The process to change any parameter is as follows:

1. Select the functional matrix by choosing one of the four function keys; Unit, Mod, Dem and Intf
6. Select the parameter to be changed using the four arrow keys to the right of the LCD display. The Left and right arrow keys control the column of the matrix and is shown in the upper left position of the LCD display. The up and down arrow keys control the row of the matrix and is shown in the upper right of the LCD display
7. Press the “Edit” key to indicate that a new entry is desired (If the “Quick” keyboard entry is enabled this step may be skipped)
8. Set the parameter via the numeric keypad or arrow keys
9. Finalize the data entry using the “Enter” key

Parameters take one of two forms:

1. Numeric entry such as frequency or bit rate;
10. Selection from a list such as selecting FEC rates 1/2, 3/4 or 7/8.

#### 3.3.3.1 Numeric entries may be entered by performing one of the following:

- When a numeric parameter is displayed, it can be changed by pressing the “Edit” key, then using the left and right arrow keys to select the first digit to be changed and entering a new digit. Successive digit entries go to successive characters on the display, skipping over the decimal point which is in a fixed location. Leading zeros must be used to enter smaller numbers than are currently displayed, and trailing zeroes are used to eliminate trailing digits not required. The entry is finalized by pressing the “Enter” key.
- An alternate edit mode is accomplished by first pressing the “Edit” key, then using the left and right arrow keys to select the first digit to be changed. The digit is “scrolled” using the up and down arrow key. Additional digits are pointed to using the left and right arrows and also scrolled. Finish the edit by pressing the enter key. Overflow when scrolling up through 9 will increment the next higher digit while underflow will decrement the next higher digit.
- Direct entry can be accomplished if the **<Unit: Keyboard – Entry Mode>** is set to “Quick”. In this mode the current parameter can be changed by simply entering new information, which completely overwrites the existing parameter. For example when viewing the Modulator Data

Bit Rate of 256.000kbps entering the digits 64.000 (including the decimal point) and pressing "Enter" will change to that new 64kbps data rate. Note that a leading "0" did not have to be entered to overwrite the "2" of the existing parameter.

The current input can be canceled by pressing the "Clear" key at any time before pressing "Enter". Failure to press a key for approximately 60 seconds results in automatic canceling of the current entry and return of the display to the current setting.

#### **3.3.3.2 Selection entries may be accomplished by one of the following:**

- When a selection entry parameter is displayed, simply press the "Edit" key followed by a digit key 0, 1, 2, 3 or 4. In this scheme "0" represents disabled, OFF, NO or the first possible choice. "1" represents enabled, ON, YES or the second possible choice. "2", "3" and "4" represents the third, fourth and fifth possible choices. Then press the "Enter" key to finalize the entry.
- Alternately, when a selection parameter is displayed it can be changed by pressing the "Edit" key, then using the up and down arrow keys to scroll through the possible choices. When the desired option is displayed, pressing the "Enter" key selects the displayed choice and finalizes the entry. When scrolling through the available options, an arrow in the left column position denotes the current setting.
- Direct entry can be accomplished if the **<Unit: Keyboard – Entry Mode>** is set to "Quick". In this mode the current parameter can be changed by simply entering digit key 0, 1, 2, 3 or 4 ... and pressing "Enter" to finalize the entry. Optional selections can be viewed by successively pressing several keys to determine their value, then pressing "Enter".

Following a valid input, the modem will store the new parameter into nonvolatile memory.

#### **3.3.4 Automatic Modem Parameter Sequences**

Certain parameters are dependent on other parameter settings. The M7 will automatically present those parameters that must be set to properly achieve the first setting entered. An example of this is when entering an "IF Modulation" mode change, the modem will accept that but next request entry of the "Data FEC Mode", then the "Data FEC Code Rate" finally returning to the original IF Modulation screen. If only the Data FEC Mode were initially changed then only the following item in the sequence would be requested. This insures that all of the necessary parameters are entered to enable any mode dependent on other settings. Normal settings are typically displayed during this sequence and it may be possible to simply press the "Enter" key at each succeeding request.

#### **3.3.5 Finding Modem Parameter Limits**

During parameter entry, the maximum or minimum value may not be known. The modem can help in some cases by taking the parameter to its maximum or minimum value when you enter a value greater or less than what is possible. For example, when all other parameters have been set, to configure the maximum transmit data rate possible in the modem, simply enter a value like 10000 (for 10,000 kbps). The modem should beep, display "Set at max" and enter a value of 5000 (for 5 Mbps).

### 3.4 Web Browser Operation

Activate the M7 Web Browser by opening the Internet Browser on the computer and type in the IP address of the target M7 in the address bar of the browser. The default IP address for the M7 modem is 192.168.2.100. However, this is only the address configuration when the M7 is shipped from the factory. Identification of the M7's current IP address is found in if the **<Unit: IP Control – Address>** menu on the front panel.

NOTE: Login security may be activated by setting up the <Unit: HTTP Server Mode>, <Unit: HTTP Full User Name>, <Unit: HTTP Full Password>, <Unit: HTTP Read User Name>, and <Unit: HTTP Read Password> menus on the front panel. Once this parameter is active, the operator will be prompted to enter the username and password (Figure 3 -40) prior to connection to the M7 Web Browser. The default user name is *Admin* and default password is *Datum*.

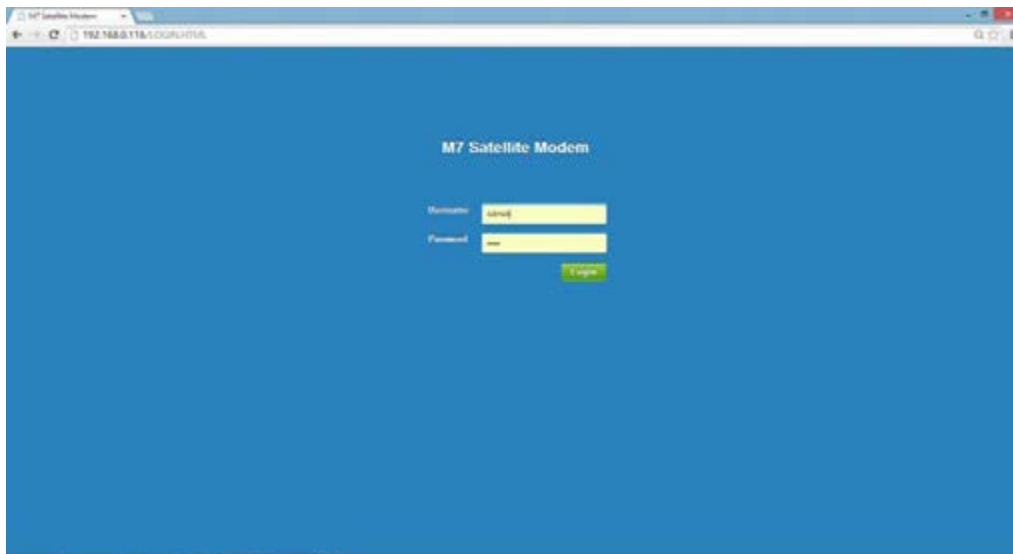


Figure 3-40 – Login Page

### 3.4.1 Page Sections

There are 3 main sections on all M7 web pages (refer to Figure 3 -41).

- Status Windows
- Page Menu
- Parameter Window

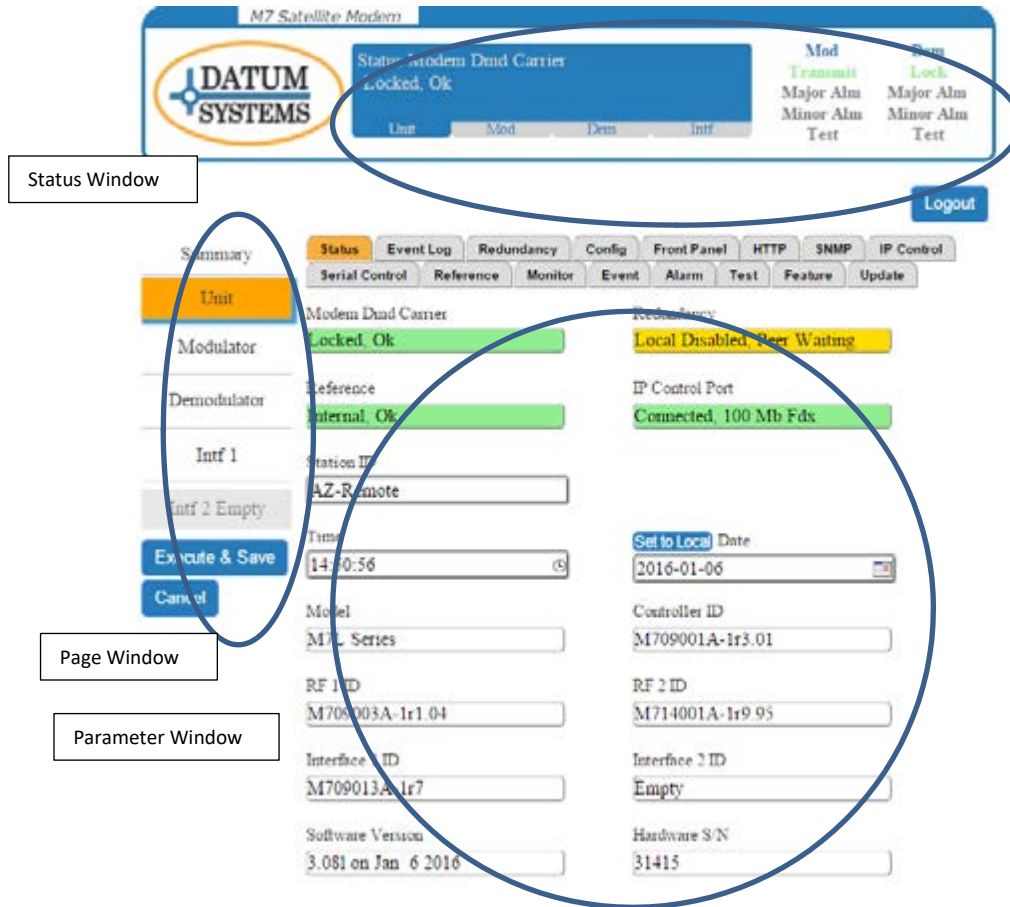


Figure 3-41 – M7 Web Browser Page Sections

The Status Window provides the user a summary status of the M7 that reflects what would normally show on the front panel. Active Mod and Demod status is shown but color coded text (Green, Yellow, Red). The center status screen will display the current summary status of the selected page (Unit, Mod, Dem, or Intf).

There are two versions of the status window.

- Local M7
- Remote M7

The upper left window in the Status window will indicate whether the displayed modem is “local” (M7 Satellite Modem) or “remote” (Remote M7 Modem). The local modem will show a white background (Figure 3 -42) and the remote modem (Figure 3 -43) will show a yellow background.

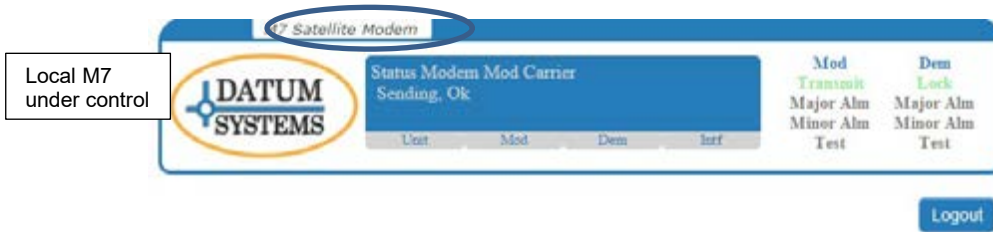


Figure 3-42 – Local M7 Web Browser Status Window



Figure 3-43 – Remote M7 Web Browser Status Window

The Page Menu (Figure 3-44) allows the operator to navigate between the modem card set functions - Unit, Mod, Dem, and Intf.

On any page where the user has initiated a parameter change, the “Execute & Save” and “Cancel” buttons will appear on the bottom of the Page Menu. The M7 Web Browser allows the user to make all of the desired changes to the modem under control, and execute them at one time. Unexecuted changes to a modem card function will be shown with a blue shadow on the function that has unexecuted changes. When all changes to the parameters are done, the operator must click the “Execute & Save” button for any change to be accepted. Closing the browser will cancel any pending changes. The Page Menu functions the same regardless of whether the modem is under local control or remote control.

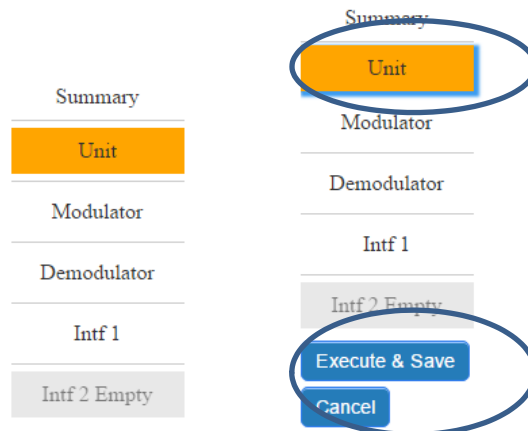


Figure 3-44 – M7 Web Browser Page Menus

The Parameter Window (Figure 3 -45) is the section of the M7 Web Browser that allows detailed status and modification of every parameter of the M7. The Parameter Window is further divided into sub-pages by selecting the “Tab” for the desired function. Change of any modified parameter, in these windows, must be accomplished by clicking the “Execute & Save” button in the Page Menu section. The Parameter Window functions the same regardless of whether the modem is under local control or remote control.

Status	IF	Data	BUC	Event	Alarm	Test	Feature
Frequency (MHz)	1250.000000		BUC Xmt Frequency (MHz)	1250.000000			
Spectrum	Invert		Filter Roll-Off	0.05			
Level (dBm)	-35.00		BUC Xmt Level (dBW)	-65.00			
Output	Enabled		Mute	Automatic			
Modulation	8QAM						
AUPC Mode	Disabled		AUPC Eb/No (db)	10.00			
AUPC Max Level (dBm)	5.00		AUPC Min Level (dBm)	-35.00			
Impedance (ohm)	50						

Figure 3-45 – M7 Web Browser Parameter Window (example)



### 3.4.2 M7 Web Browser Page Screen Shots

#### 3.4.2.1 Summary Page

The Summary Status (Figure 3-46) will be the first page that is displayed when the computer connects to the M7 Web Browser. The summary page provides the user a snapshot of the current M7 status and indicates the available interfaces. The status window cycles through the status of the Mod Carrier, Dem Carrier, RX Eb/No, and RX Level.



Figure 3-46 – Summary Status Page

From the Summary Status page, the user may navigate to the other modem card set pages by selecting the desired parameter page on the “Page Menu”. The available pages are “Unit”, “Modulator”, “Demodulator”, and “Interface”. Within each page are tabs that relate to specific parameter matrixes shown in Section 3.4.2.5.4.

### 3.4.2.2 Unit Page

The unit page is used to configure the common parameters of the M7. The remote control interface parameters, the unit frequency reference, and other unit parameters are controlled in the “Unit” pages. Figure 3 -47 through Figure 3 -53 represent seven (7) of the sixteen (16) Unit pages available to the user.

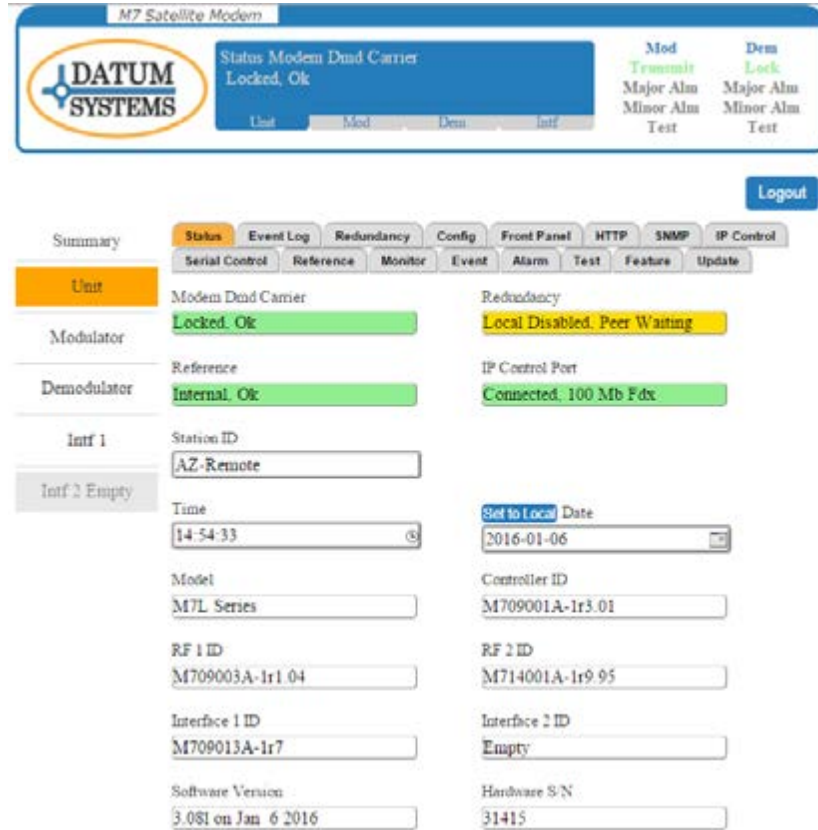


Figure 3-47 – Unit Status Page

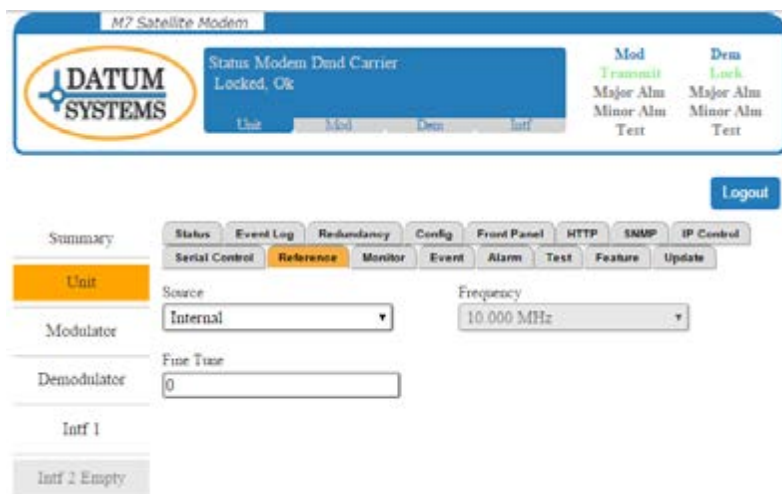


Figure 3-48 – Unit Reference Page

M7 Satellite Modem

Status Modem Dmd Carrier  
Locked, Ok

Mod Transmit  
Major Alm  
Minor Alm  
Test

Dem Lock  
Major Alm  
Minor Alm  
Test

Unit Mod Dem Intf

Logout

Summary

Status Event Log Redundancy Config Front Panel HTTP SNMP IP Control

Serial Control Reference Monitor Event Alarm Test Feature Update

Unit

Send Alert To Disabled Activity None

Modulator

Demodulator Clear Total Events 2048 Debounce Time (sec) 5.0

Intf 1 Last Event Dmd Eb/No Ok @ 2016-01-06 14:44:44.14

Intf 2 Empty View Complete Log Save Log File

```
#1 Intf Send Data Ok @ 2015-12-18 13:21:30.51, 3 Events, Last Eve
#2 Intf SEND DATA ALARM @ 2015-12-18 13:21:30.73, 3 Events, Last
#3 Intf Send Data Ok @ 2015-12-18 13:21:40.05, 3 Events, Last Eve
#4 Intf SEND DATA ALARM @ 2015-12-18 13:21:40.27, 3 Events, Last
#5 Intf Send Data Ok @ 2015-12-18 13:21:57.22
#6 Intf SEND DATA ALARM @ 2015-12-18 13:21:57.44
#7 Intf Send Data Ok @ 2015-12-18 13:22:02.47
#8 Intf SEND DATA ALARM @ 2015-12-18 13:22:02.69
#9 Intf Send Data Ok @ 2015-12-18 13:22:07.72, 2 Events, Last Eve
#10 Intf SEND DATA ALARM @ 2015-12-18 13:22:07.94, 2 Events, Last
#11 Intf Send Data Ok @ 2015-12-18 13:22:12.98
#12 Intf SEND DATA ALARM @ 2015-12-18 13:22:13.19
#13 Intf Send Data Ok @ 2015-12-18 13:22:18.23
#14 Intf SEND DATA ALARM @ 2015-12-18 13:22:18.45
#15 Intf Send Data Ok @ 2015-12-18 13:22:30.66
#16 Intf SEND DATA ALARM @ 2015-12-18 13:22:30.88
#17 Intf Send Data Ok @ 2015-12-18 13:22:43.57, 3 Events, Last Eve
#18 Intf SEND DATA ALARM @ 2015-12-18 13:22:43.79, 3 Events, Last
#19 Intf Send Data Ok @ 2015-12-18 13:22:53.12, 2 Events, Last Eve
#20 Intf SEND DATA ALARM @ 2015-12-18 13:22:53.34, 2 Events, Last
#21 Intf Send Data Ok @ 2015-12-18 13:23:02.65
#22 Intf SEND DATA ALARM @ 2015-12-18 13:23:02.90
#23 Intf Send Data Ok @ 2015-12-18 13:23:08.42
#24 Intf SEND DATA ALARM @ 2015-12-18 13:23:08.64
```

Figure 3-49 – Unit Events Log Page

**M7 Satellite Modem**

**DATUM SYSTEMS**

Status Modem Mod Carrier  
Sending, Ok

Unit Mod Dem Intf

Mod Transmit  
Major Alm  
Minor Alm  
Test

Dem Lock  
Major Alm  
Minor Alm  
Test

Logout

Summary

Status Event Log Redundancy Config Front Panel HTTP SNMP **IP Control**

Serial Control Reference Monitor Event Alarm Test Feature Update

**Unit**

Modulator DHCP: Disable | IP Address: 192.168.0.201

Demodulator Network Mask: 255.255.255.0 | Gateway: 192.168.0.1

Intf 1 DNS1: 8.8.8.8 | DNS2: 8.8.4.4

Intf 2 Empty

M&C Server Mode: Full Access | M&C Port Number: 9101

M&C Remote Path: 0.0.0.0 | M&C External Unit: 0.0.0.0

M&C Activity: Beep | MAC Address: 00:19:78:00:12:ED

Figure 3-50 – Unit IP Control Pages

**M7 Satellite Modem**

**DATUM SYSTEMS**

Status Modem Dmod Carrier  
UNLOCKED, AGC ALARM

Unit Mod Dem Intf

Mod Transmit  
Major Alm  
Minor Alm  
Test

Dem Lock  
Major Alm  
Minor Alm  
Test

Logout

Summary

Status Event Log Redundancy Config Front Panel HTTP **SNMP** IP Control

Serial Control Reference Monitor Event Alarm Test Feature Update

**Unit**

Modulator Server Mode: Full Access | Server Type: V2c

Demodulator Server Port Number: 161

Intf 1 Read Only Community: public | Read/Write Community: private

Intf 2 Empty

Trap Community: datum | Trap Path: Out IP Control Port

Trap Address: 192.168.2.101 | Trap Port Number: 162

Trap Remote MCC Address: 2 | Trap Forwarding Port: 162

Activity: None | MIB Version: 201606100033Z

Figure 3-51 – Unit SNMP Page

**M7 Satellite Modem**

Status: Modem Mod Carrier  
Sending: Ok

Unit | Mod | Dem | Intf

Mod Transmit Major Alm Minor Alm Test  
Dem Lock Major Alm Minor Alm Test

Logout

Summary: Status | Event Log | Redundancy | Config | Front Panel | **HTTP** | SNMP | IP Control  
Serial Control | Reference | Monitor | Event | Alarm | Test | Feature | Update

**Unit**

Server Mode: Full Access

Modulator: Read User Name: Admin, Read Password: Guest

Demodulator: Full User Name: Admin, Full Password: Datum

Intf 1: Activity: None

Intf 2 Empty

Figure 3-52 – Unit HTTP Page

**M7 Satellite Modem**

Status: Modem Mod Carrier  
Sending: Ok

Unit | Mod | Dem | Intf

Mod Transmit Major Alm Minor Alm Test  
Dem Lock Major Alm Minor Alm Test

Logout

Summary: Status | Event Log | Redundancy | Config | Front Panel | HTTP | **SNMP** | IP Control  
Serial Control | Reference | Monitor | **Event** | Alarm | Test | Feature | Update

**Unit**

Reference Alarm: Log, IP Control Alarm: Log

Modulator: Monitor Input Alarm: Log

Demodulator: Power Supply Alarm: Log

Intf 1: System: Do Not Log, Redundancy Alarm: Log

Intf 2 Empty: HTTP Access: Log, SNMP Access: Log

Cold/Warm Start: Log

Minor Alarm: Do Not Log, Major Alarm: Do Not Log

Test Active: Log, Hardware Alarm: Log

Figure 3-53 – Unit Event Page

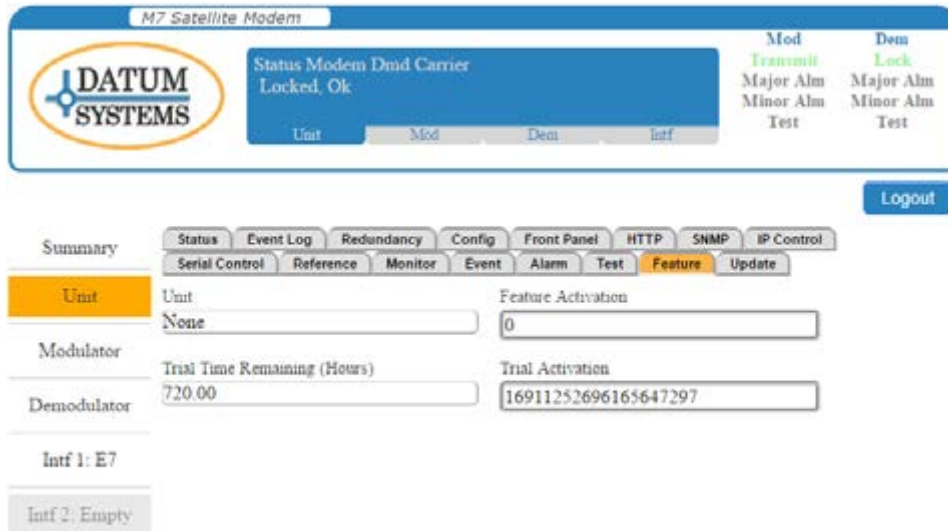


Figure 3-54 – Unit Feature Page

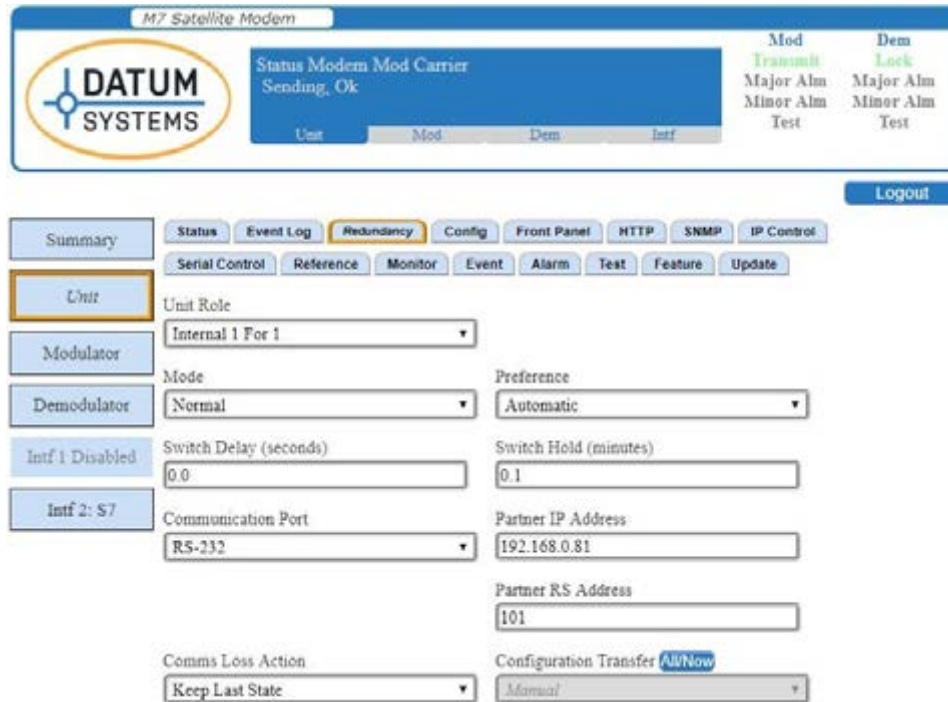


Figure 3-55 – Unit Redundancy Page

**3.4.2.3 Modulator Pages**

The Modulator pages are used to configure the transmit section parameters of the M7. The IF, Data interface, and other transmit parameters are controlled in the “Modulator” pages. Figure 3 - 56 through Figure 3 -59 represent four (4) of the eight (8) Modulator pages available to the user.

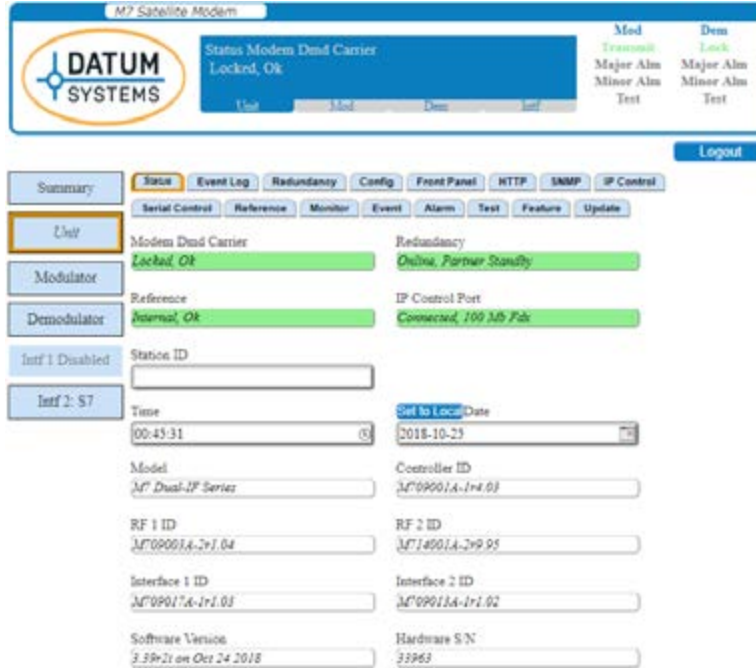


Figure 3-56 – Modulator Status Page

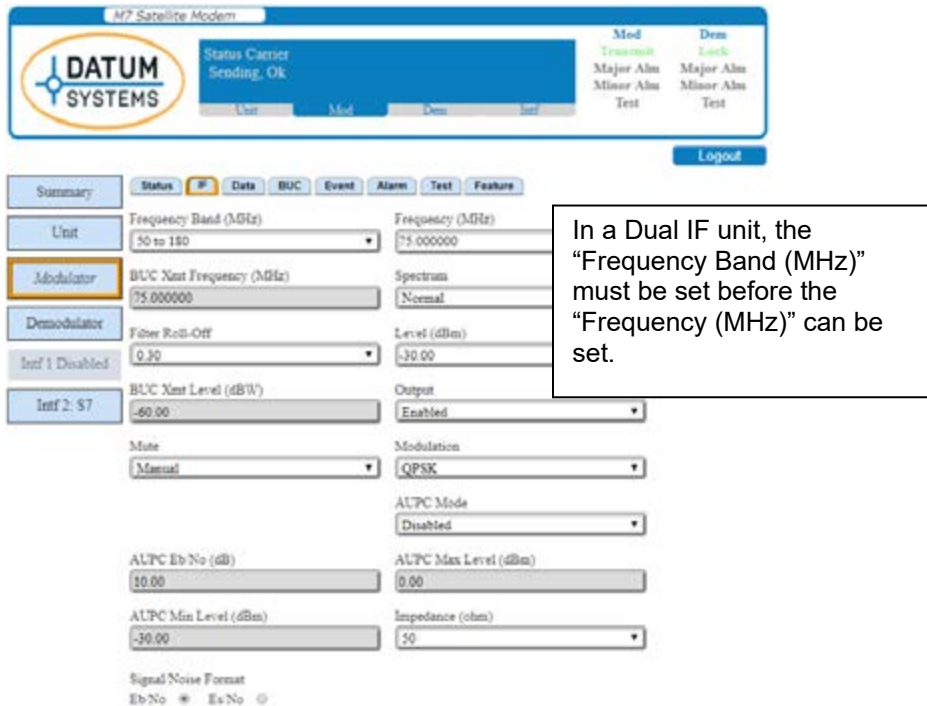


Figure 3-57 – Modulator IF Page

**M7 Satellite Modem**

Status Carrier Sending: Ok

Mod Transmit Major Alm Minor Alm Test

Dem Lock Major Alm Minor Alm Test

Logout

Summary: Status IF **Data** BUC Event Alarm Test Feature

Unit: Bit Rate (kbps) 1000.001 Symbol Rate (kops) 666.667

**Modulator**: Rate Entry Mode Bit Rate Send Interface S7 Synchronous Interface

Demodulator: FEC Mode Viterbi FEC Option Normal

Intf 1 Disabled

Intf 2: S7: FEC Code Rate 3/4

RS Mode Disable RS-N 219

RS-K 201 RS Depth 4

Dif Encoder Enable Scrambler Auto

Figure 3-58 – Modulator Data Interface Page

**M7 Satellite Modem**

Status Carrier Sending: Ok

Mod Transmit Major Alm Minor Alm Test

Dem Lock Major Alm Minor Alm Test

Logout

Summary: Status IF Data BUC **Event** Alarm Test Feature

Unit: Carrier Alarm Log AUPC Alarm Log

**Modulator**: Minor Alarm Do Not Log Major Alarm Do Not Log

Demodulator: Test Active Log Hardware Alarm Log

Intf 1 Disabled

Intf 2: S7

Figure 3-59 – Modulator Event Page



3.4.2.4 Demodulator Pages

The Demodulator pages are used to configure the receive section parameters of the M7. The IF, Data interface, and other receive parameters are controlled in the “Demodulator” pages. Figure 3 -60 through Figure 3 -65 represent six (6) of the eight (8) pages available to the user. Refer to Appendix E for the Smart Carrier Demodulator pages.



Figure 3-60 – Demodulator Status Page

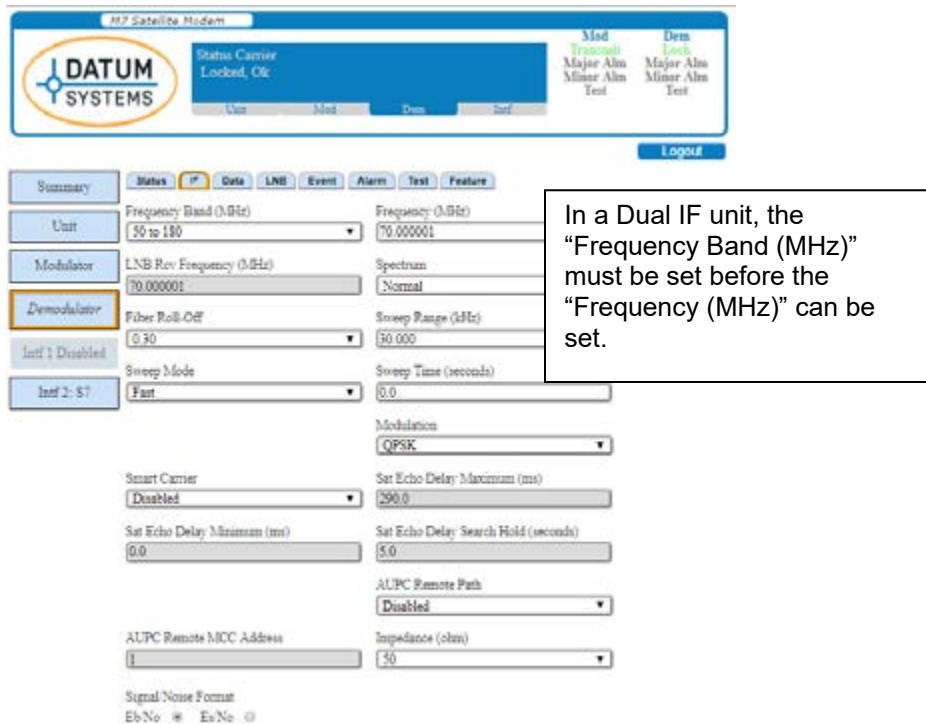


Figure 3-61 – Demodulator IF Page

**M7 Satellite Modem**

**DATUM SYSTEMS**

Status Carrier: Locked, Ok

Mod Transmit: Major Alm, Minor Alm, Test

Dem Lock: Major Alm, Minor Alm, Test

Unit Mod Dem Intf

Logout

Summary | Status | IF | **Data** | LNB | Event | Alarm | Test | Feature

Unit: Bit Rate (kbps) 1000.000, Symbol Rate (ksps) 666.667

Modulator: Rate Entry Mode Bit Rate, Rcv Interface S7 Synchronous Interface

**Demodulator**

Intf 1 Disabled

Intf 2: S7

FEC Mode: Viterbi, FEC Option: Normal

FEC Code Rate: 3/4

RS Mode: Disable, RS-N: 219

RS-K: 201, RS Depth: 4

Dif Decoder: Enable, Descrambler: Auto

FEC Hold: 1, Rcv Minimum BER: 1.0E-8 @ 7.38 dB Eb/No

Figure 3-62 – Demodulator Data Interface Page

**M7 Satellite Modem**

**DATUM SYSTEMS**

Status Carrier: Locked, Ok

Mod Transmit: Major Alm, Minor Alm, Test

Dem Lock: Major Alm, Minor Alm, Test

Unit Mod Dem Intf

Logout

Summary | Status | IF | Data | LNB | **Event** | Alarm | Test | Feature

Unit: Carrier Alarm Log, Eb/No Alarm Log

Modulator: Sat Echo Lock Alarm Log

**Demodulator**

Intf 1 Disabled

Intf 2: S7

Imbalance Offset Alarm Log, Imbalance Level Alarm Log

Level Alarm Log

Minor Alarm Do Not Log, Major Alarm Do Not Log

Test Active Log, Hardware Alarm Log

Figure 3-63 – Demodulator Event Page

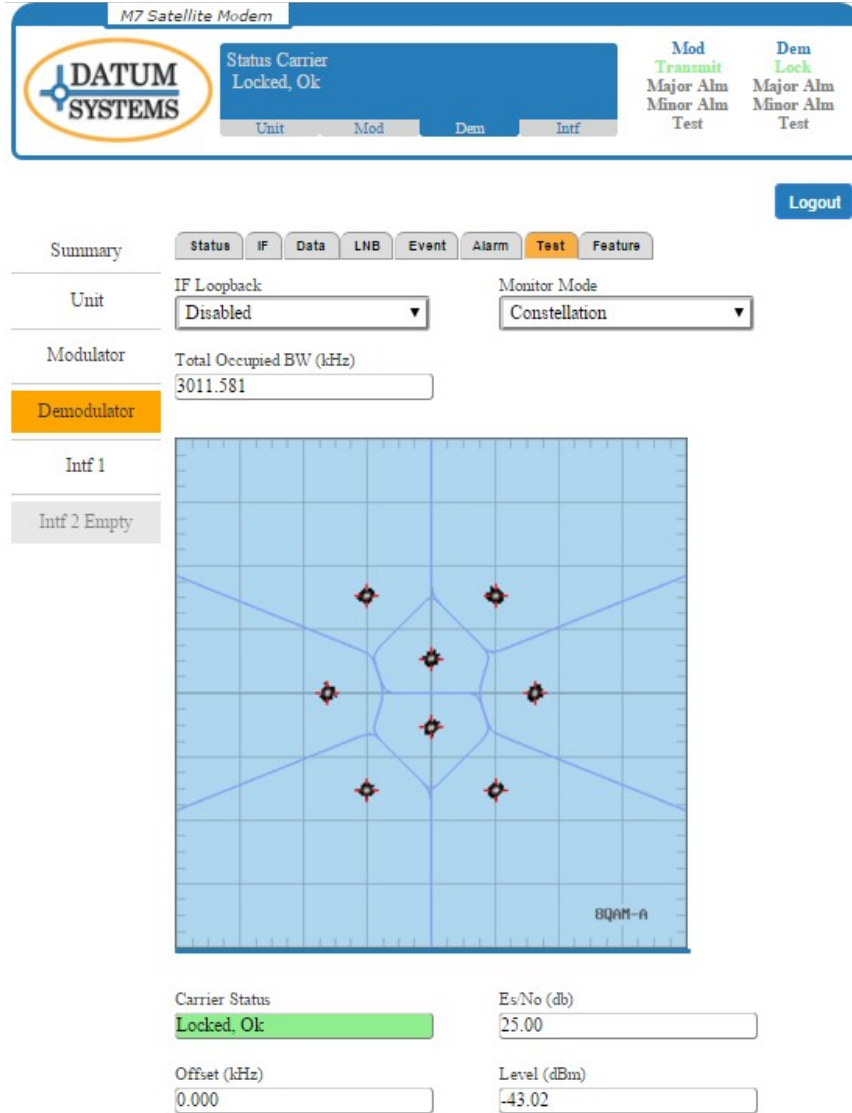


Figure 3-64 – Demodulator Monitor Constellation Page

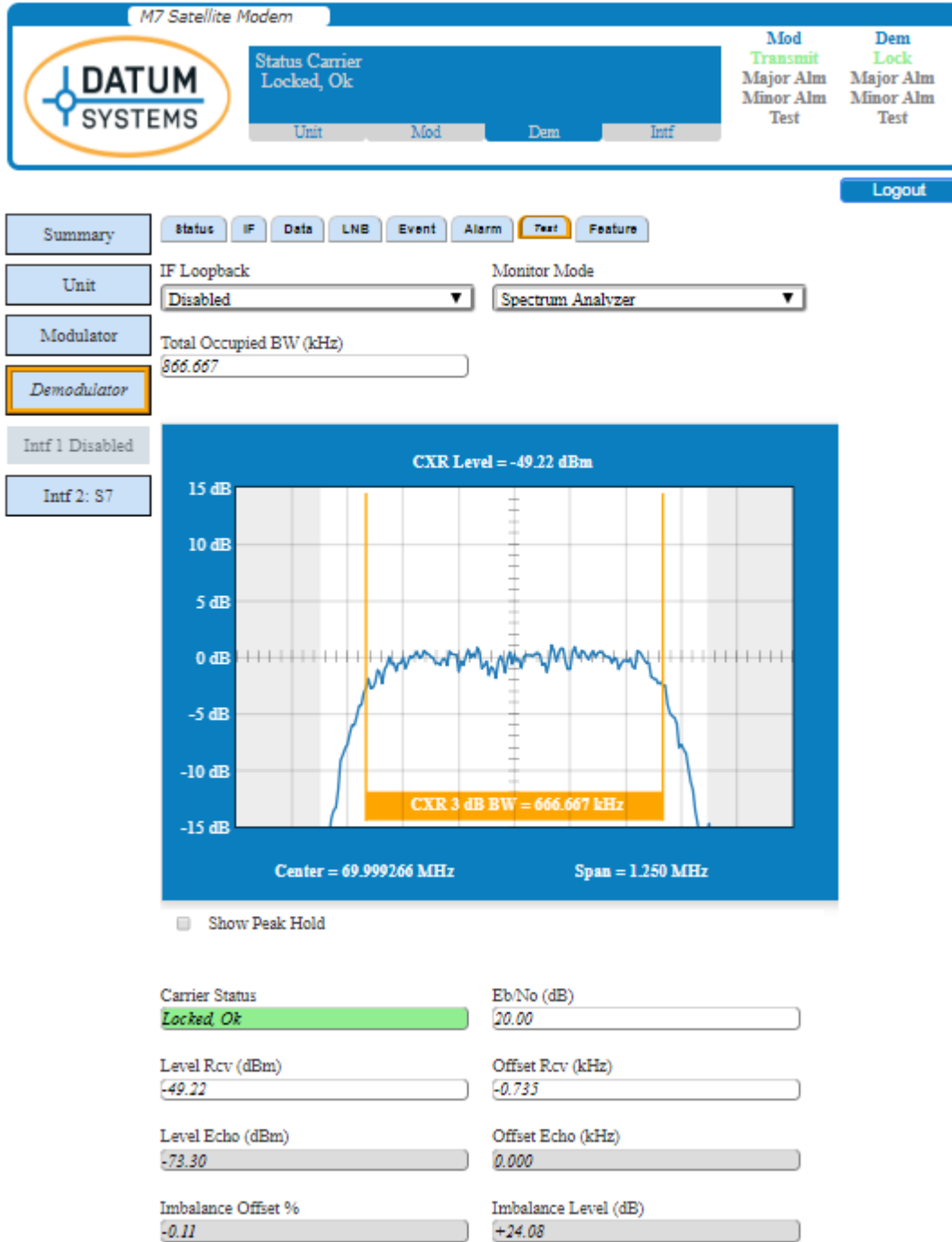


Figure 3-65 – Demodulator Monitor Spectrum Analyzer Page

**3.4.2.5 Interface Pages**

The active interface parameters will be shown in the Interface pages and are used to configure the baseband interface parameters of the M7. The Electrical Interface I/O, Overhead multiplex/demultiplex, Engineering Service Channel parameters, and other interface parameters are controlled in the “Interface” pages.

Each interface type will have a different set of pages. Details of the parameters can be found in Section 3.4.2.5.4.

NOTE: The active interface is selected in the “Modulator” and “Demodulator” Data Interface pages.

**3.4.2.5.1 Serial Synchronous Interface Pages**

Figure 3 -66 through Figure 3 -71 represent six (6) of the eight (8) pages Serial Synchronous Interface pages available to the user.

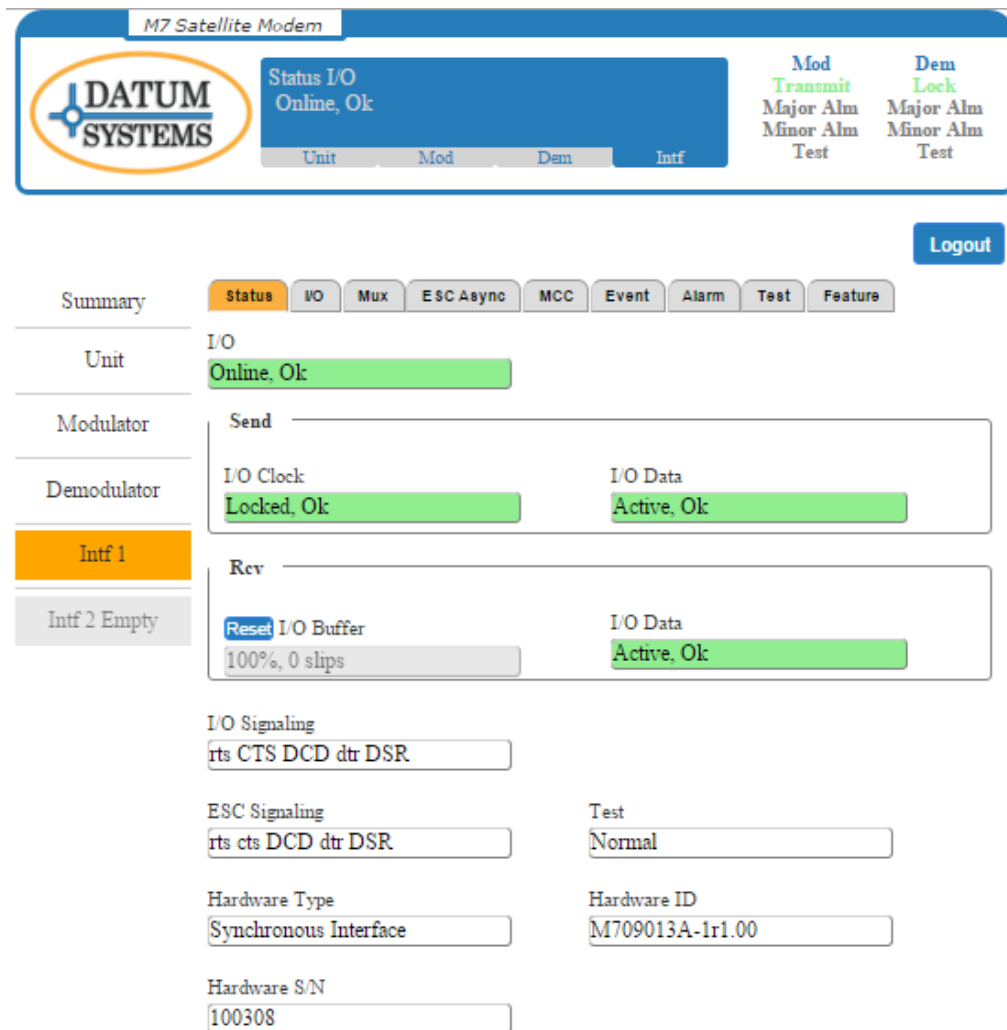



Figure 3-66 – Serial Synchronous Interface Status Page



Figure 3-68 – Serial Synchronous Interface Overhead Mux/Demux Page

Figure 3-69 – Serial Synchronous Interface ESC Interface Page



**Status I/O**  
Online, Ok

**Mod**  
Transmit  
Major Alm  
Minor Alm  
Test

**Dem**  
Lock  
Major Alm  
Minor Alm  
Test

Unit
Mod
Dem
Intf

Logout

Summary

Status
IO
Mux
ESC Async
MCC
Event
Alarm
Test
Feature

Unit	Ter Loopback <input style="width: 100%;" type="text" value="Disable"/>	Sat Loopback <input style="width: 100%;" type="text" value="Disable"/>										
Modulator	BER I/O <input style="width: 100%;" type="text" value="Satellite"/>											
Demodulator	Send											
Intf 1	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;">BER <input style="width: 100%;" type="text" value="Disable"/></td> <td style="width: 50%; padding: 5px;">Bit Offset (PPM) <input style="width: 100%;" type="text" value="0"/></td> </tr> </table>		BER <input style="width: 100%;" type="text" value="Disable"/>	Bit Offset (PPM) <input style="width: 100%;" type="text" value="0"/>								
BER <input style="width: 100%;" type="text" value="Disable"/>	Bit Offset (PPM) <input style="width: 100%;" type="text" value="0"/>											
Intf 2 Empty	Rcv											
	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> <span style="background-color: #0056b3; color: white; padding: 2px;">Restart Test</span> BER  <input style="width: 100%;" type="text" value="Disable"/> </td> <td style="width: 50%; padding: 5px;">Bit Offset (PPM) <input style="width: 100%;" type="text" value="0"/></td> </tr> <tr> <td style="padding: 5px;">BER Errors <input style="width: 100%;" type="text" value="0"/></td> <td style="padding: 5px;">BER Sync Loss <input style="width: 100%;" type="text" value="0"/></td> </tr> <tr> <td style="padding: 5px;">BER <input style="width: 100%;" type="text" value="0.0e-0"/></td> <td style="padding: 5px;">BER Bits <input style="width: 100%;" type="text" value="0"/></td> </tr> <tr> <td style="padding: 5px;">BER EFS % <input style="width: 100%;" type="text" value="0.00"/></td> <td style="padding: 5px;">Test <input style="width: 100%;" type="text" value="Normal"/></td> </tr> <tr> <td style="padding: 5px;">BER Errored Sec <input style="width: 100%;" type="text" value="0"/></td> <td style="padding: 5px;">BER Total Sec <input style="width: 100%;" type="text" value="0"/></td> </tr> </table>		<span style="background-color: #0056b3; color: white; padding: 2px;">Restart Test</span> BER <input style="width: 100%;" type="text" value="Disable"/>	Bit Offset (PPM) <input style="width: 100%;" type="text" value="0"/>	BER Errors <input style="width: 100%;" type="text" value="0"/>	BER Sync Loss <input style="width: 100%;" type="text" value="0"/>	BER <input style="width: 100%;" type="text" value="0.0e-0"/>	BER Bits <input style="width: 100%;" type="text" value="0"/>	BER EFS % <input style="width: 100%;" type="text" value="0.00"/>	Test <input style="width: 100%;" type="text" value="Normal"/>	BER Errored Sec <input style="width: 100%;" type="text" value="0"/>	BER Total Sec <input style="width: 100%;" type="text" value="0"/>
<span style="background-color: #0056b3; color: white; padding: 2px;">Restart Test</span> BER <input style="width: 100%;" type="text" value="Disable"/>	Bit Offset (PPM) <input style="width: 100%;" type="text" value="0"/>											
BER Errors <input style="width: 100%;" type="text" value="0"/>	BER Sync Loss <input style="width: 100%;" type="text" value="0"/>											
BER <input style="width: 100%;" type="text" value="0.0e-0"/>	BER Bits <input style="width: 100%;" type="text" value="0"/>											
BER EFS % <input style="width: 100%;" type="text" value="0.00"/>	Test <input style="width: 100%;" type="text" value="Normal"/>											
BER Errored Sec <input style="width: 100%;" type="text" value="0"/>	BER Total Sec <input style="width: 100%;" type="text" value="0"/>											

Figure 3-70 – Serial Synchronous Interface Test Configuration Page



M7 Satellite Modem

Status I/O  
Online, Ok

Unit Mod Dem Intf

Mod Transmit Major Alm Minor Alm Test  
Dem Lock Major Alm Minor Alm Test

Logout

Summary

Status I/O Mux ESC Async MCC Event Alarm Test Feature

Send

Unit

Modulator

Demodulator

Intf 1

Intf 2 Empty

Data Alarm Log

Clock Alarm Log

Rev

Data Alarm Log

Backward Alarm Log

Buffer Slip Log

BER Loss Alarm Log

Minor Alarm Do Not Log

Major Alarm Do Not Log

Test Active Log

Hardware Alarm Log

Figure 3-71 – Serial Synchronous Interface Event Page

**3.4.2.5.2 I7 and I7+ Interface Screens**

Figure 3 -72 through Figure 3 -76 represent five (5) of the eight (8) I7 Interface pages available to the user.

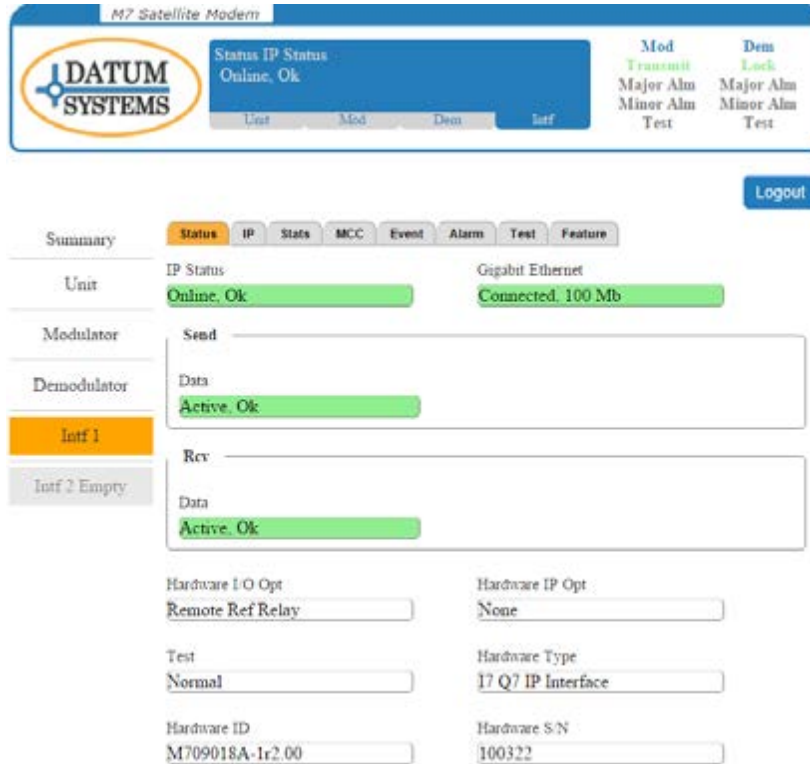


Figure 3-72 – I7 Interface Status Page

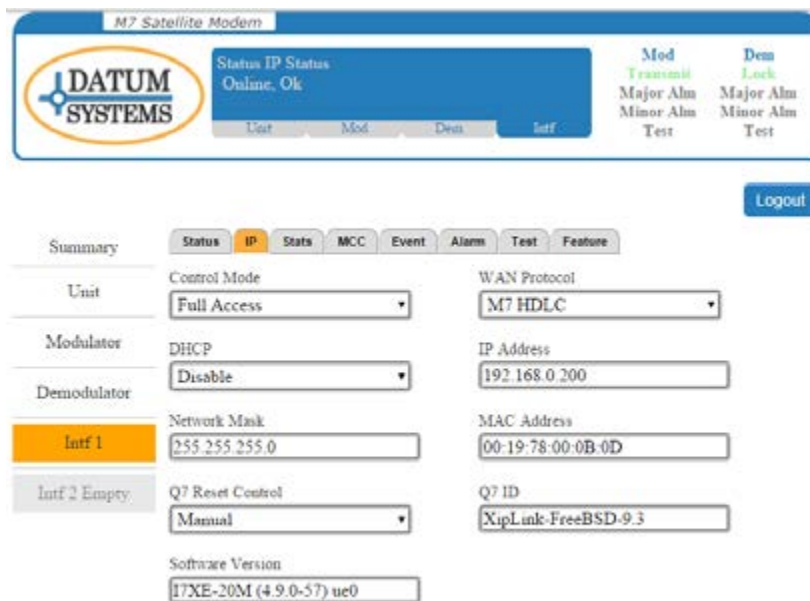


Figure 3-73 – I7 Interface IP Configuration Page

M7 Satellite Modem

Status IP Status  
Online, Ok

Mod **Transmit** Dem **Lock**  
Major Alm Major Alm  
Minor Alm Minor Alm  
Test Test

Unit Mod Dem Intf

Logout

Summary Status IP Stats **MCC** Event Alarm Test Feature

Unit Mode: Full Access Protocol: M7 Binary Packet

Modulator Send Rate Limit (kbps): 1.0 Send Address: 1

Demodulator Rcv Address: 1 Activity: None

Intf 1  
Intf 2 Empty

Figure 3-74 – I7 Interface MCC Configuration Page

M7 Satellite Modem

Status IP Status  
Online, Ok

Mod **Transmit** Dem **Lock**  
Major Alm Major Alm  
Minor Alm Minor Alm  
Test Test

Unit Mod Dem Intf

Logout

Summary Status IP Stats MCC **Event** Alarm Test Feature

Unit IP Alarm: Log Ref Relay Alarm: Log

Modulator

Demodulator

Intf 1

Intf 2 Empty

Send Data Alarm: Log

Rev Data Alarm: Log

Minor Alarm: Do Not Log Major Alarm: Do Not Log

Test Active: Log Hardware Alarm: Log

Figure 3-75 – I7 Interface Event Page

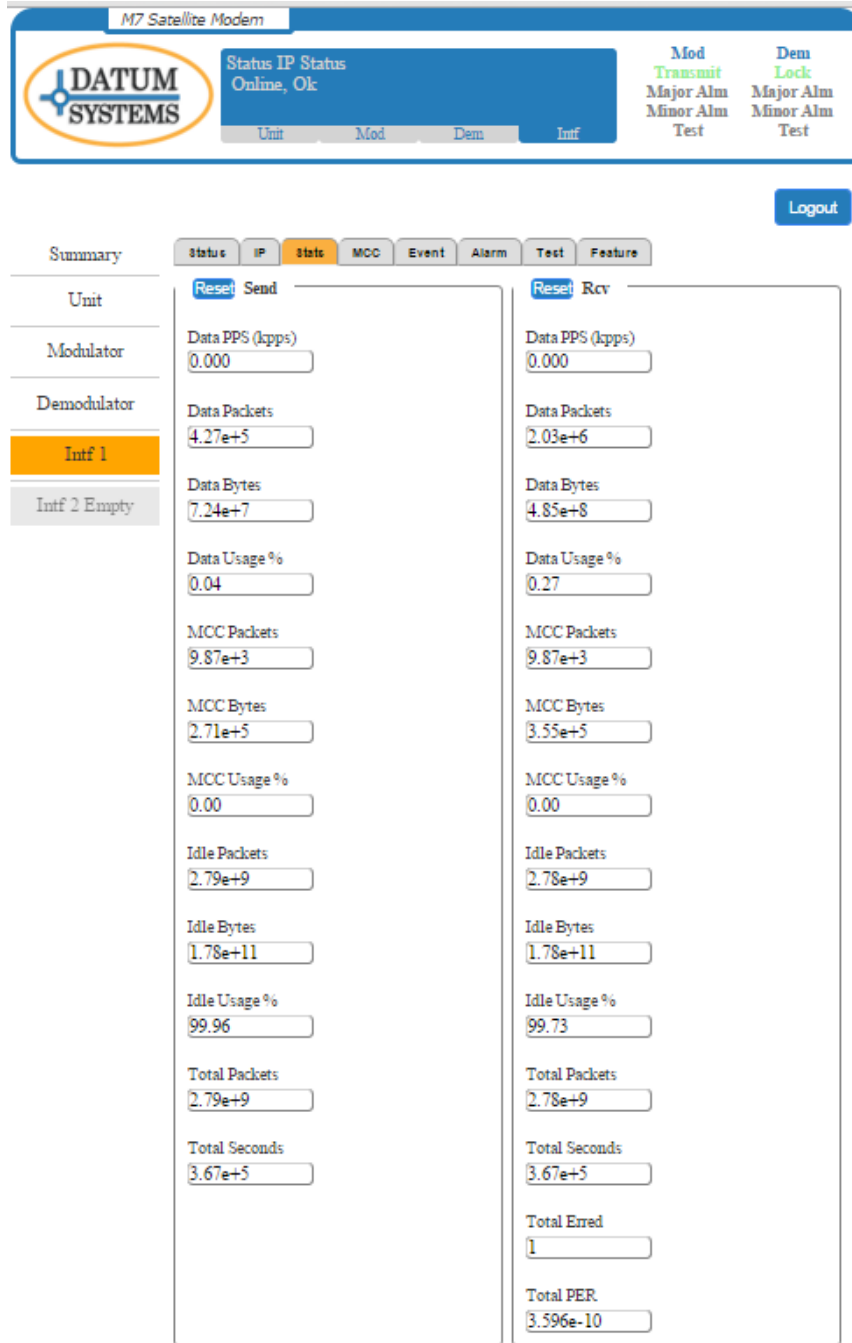


Figure 3-76 – I7 Interface Statistics Page

**3.4.2.5.3 E7 Interface Screens**

Figure 3 -77 through Figure 3 -81 represent five (5) of the eleven (11) E7 Interface pages available to the user.

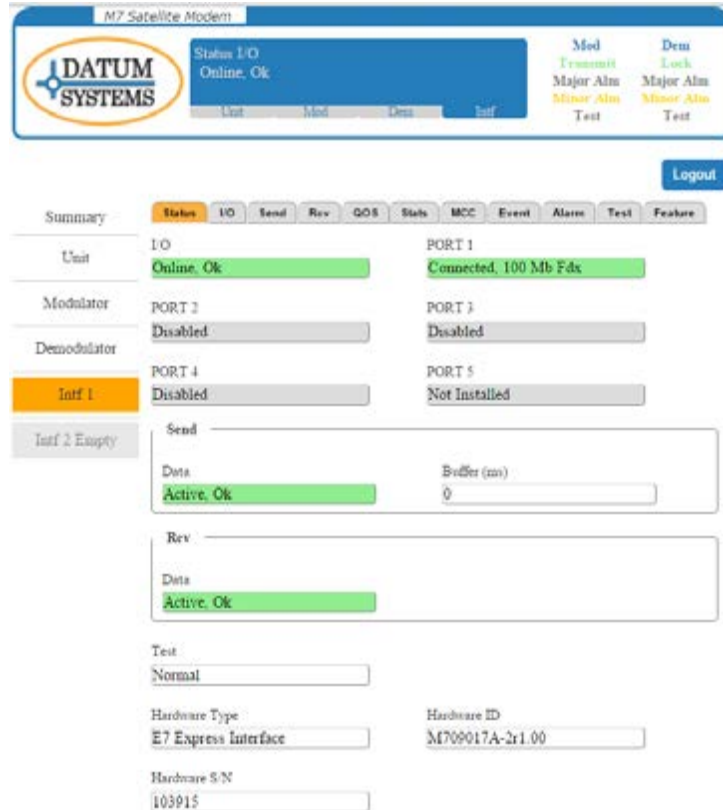


Figure 3-77 – E7 Interface Status Page

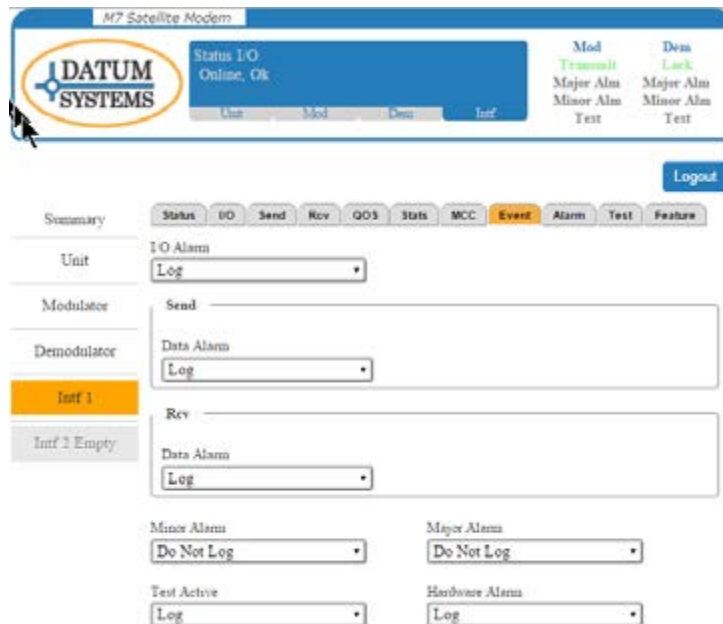


Figure 3-78 – E7 Interface Events Page

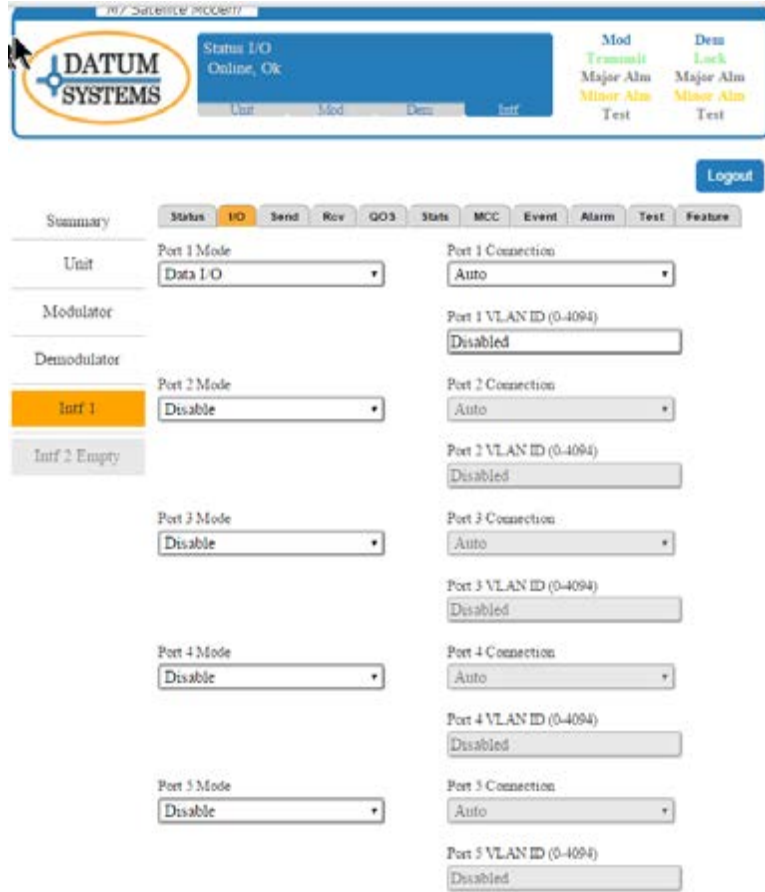


Figure 3-79 – E7 Interface I/O Port Configuration Page



Figure 3-80 – E7 Interface QoS Configuration Page

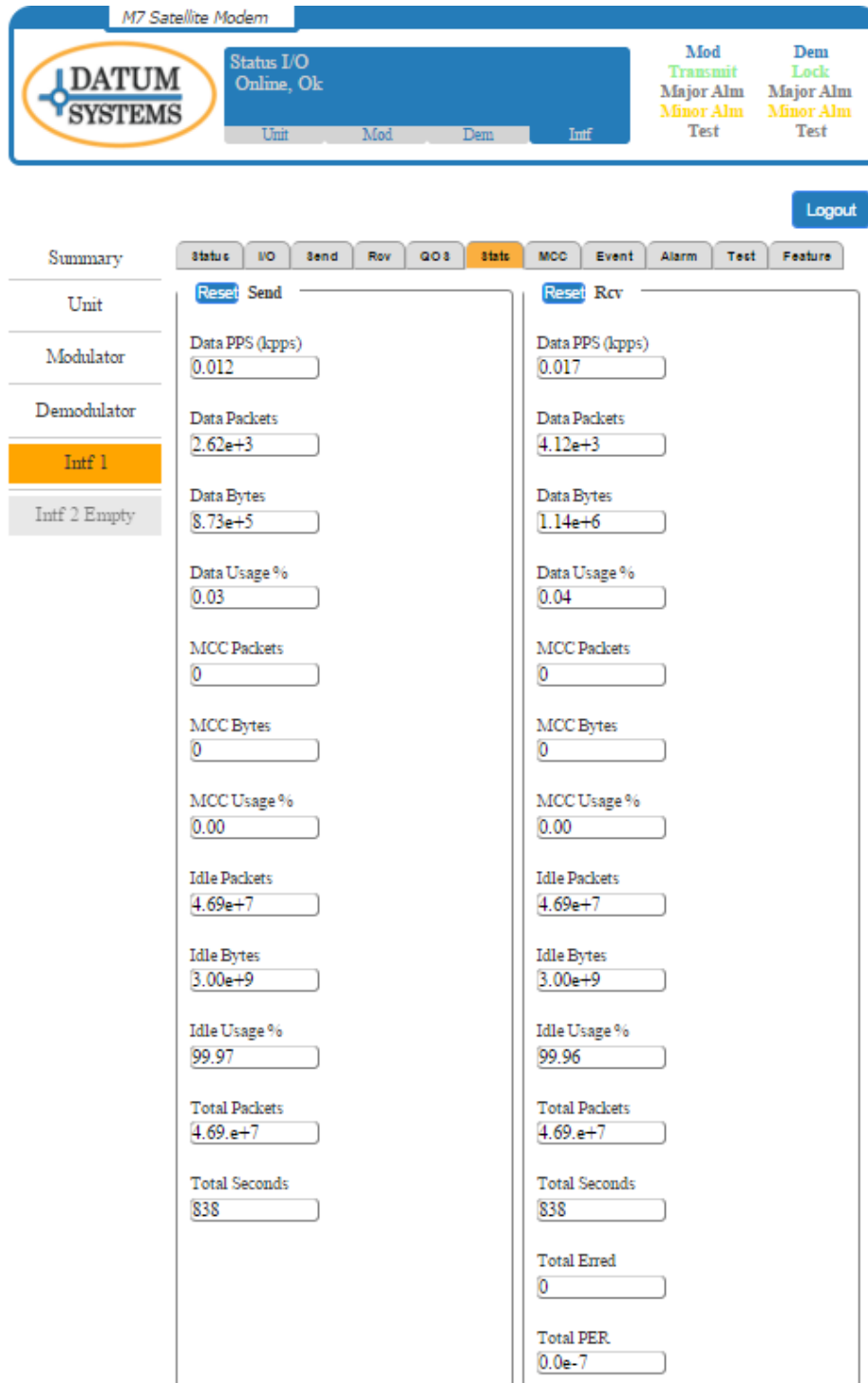


Figure 3-81 – E7 Interface Statistics Page


3.4.2.5.4 Dual G.703 Interface Screens

Figure 3 -82 through Figure 3 -85 represent four (4) of the ten (10) Dual G.703 Interface pages available to the user.

The screenshot displays the 'M7 Satellite Modem' web interface. At the top, there is a header with the 'DATUM SYSTEMS' logo and a 'Status I/O' section showing 'Online, Ok'. To the right, there are indicators for 'Mod Transmit' and 'Dem Lock', along with 'Major Alm' and 'Minor Alm' for both. A navigation bar contains buttons for 'Unit', 'Mod', 'Dem', and 'Intf'. A 'Logout' button is located in the top right. Below the navigation bar, a 'Summary' section has tabs for 'Status', 'I/O Port 1', 'I/O Port 2', 'Mux', 'ESC Async', 'MCC', 'Event', 'Alarm', and 'Test'. The 'Status' tab is active. The 'Unit' section shows 'I/O' with a green 'Online, Ok' indicator. The 'Modulator' section shows 'I/O Port 1' as 'Normal' and 'I/O Port 2' as 'Disabled'. The 'Demodulator' section shows 'I/O Port 1' as 'Normal' and 'I/O Port 2' as 'Disabled'. The 'Intf 1' section is highlighted in orange. It contains a 'Send' section with 'I/O Port1 Input Level' set to '> -2.5 dB', 'I/O Port2 Input Level' set to '-10 to -12.5 dB', and error counters for BPV and CRC for both ports, each with a 'Clear' button and a value of '0'. Below this is a 'Rev' section with 'I/O Port 1 Buffer' and 'I/O Port 2 Buffer' both showing '100%, 0 slips'. At the bottom, there are fields for 'ESC Signaling' (rts cts dcd dtr DSR), 'Test' (Normal), 'Hardware Type' (Dual G.703 Interface), 'Hardware ID' (M709014A-1r1.99), and 'Hardware S/N' (1).

Figure 3-82 – Dual G.703 Interface Status Page





**M7 Satellite Modem**

Status I/O  
Online, Ok

Mod  
Transmit  
Major Alm  
Minor Alm  
Test

Dem  
Lock  
Major Alm  
Minor Alm  
Test

Unit Mod Dem Intf

Logout

Summary
Status
I/O Port 1
I/O Port 2
Mux
ESC Async
MCC
Event
Alarm
Test

Feature

Unit

Modulator

Demodulator

Intf 1

Intf 2 Empty

**Send**

Mode

ESC Rate (kbps)

MCC Rate (kbps)

Alarms Channel

Overhead Ratio

**Rev**

Mode


ESC Rate (kbps)

MCC Rate (kbps)

Alarms Channel

Overhead Ratio

Figure 3-83 – Dual G.703 Interface Mux Page



Status I/O  
Online, Ok

Mod Transmit    Dem Lock  
 Major Alm    Major Alm  
 Minor Alm    Minor Alm  
 Test    Test

Unit Mod Dem Intf

Logout

Summary

Status
I/O Port 1
I/O Port 2
Mux
ESC Async
MCC
Event
Alarm
Test

Unit
Mode

Modulator

Demodulator

Intf 1

Intf 2 Empty

Send

Coding: HDB3    Framing: PCM31-CCS

Nx64 Rate (kbps): 1536.000    CRC: Disable

Drop Map: 1,536.000 kbps

CH01	CH02	CH03	CH04	CH05	CH06	CH07	CH08	CH09	CH10	CH11	CH12
TS04	TS03	TS02	TS01	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12
CH13	CH14	CH15	CH16	CH17	CH18	CH19	CH20	CH21	CH22	CH23	CH24
TS13	TS14	TS15	TS16	TS17	TS18	TS19	TS20	TS21	TS22	TS23	TS24

Show Revert Time Slots

Rev

Coding: HDB3    Framing: PCM31-CCS

Nx64 Rate (kbps): 1536.000    CRC: Disable

Clock Source: Dmd Rcv Clock

Buffer Delay (ms): 4,000    Buffer Size (frames): 32

Insert Map: 1,536.000 kbps

CH01	CH02	CH03	CH04	CH05	CH06	CH07	CH08	CH09	CH10	CH11	CH12
TS04	TS03	TS02	TS01	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12
CH13	CH14	CH15	CH16	CH17	CH18	CH19	CH20	CH21	CH22	CH23	CH24
TS13	TS14	TS15	TS16	TS17	TS18	TS19	TS20	TS21	TS22	TS23	TS24

Show Revert Time Slots

Figure 3-84 – Dual G.703 I/O Port 1 Page (showing D&I selections)

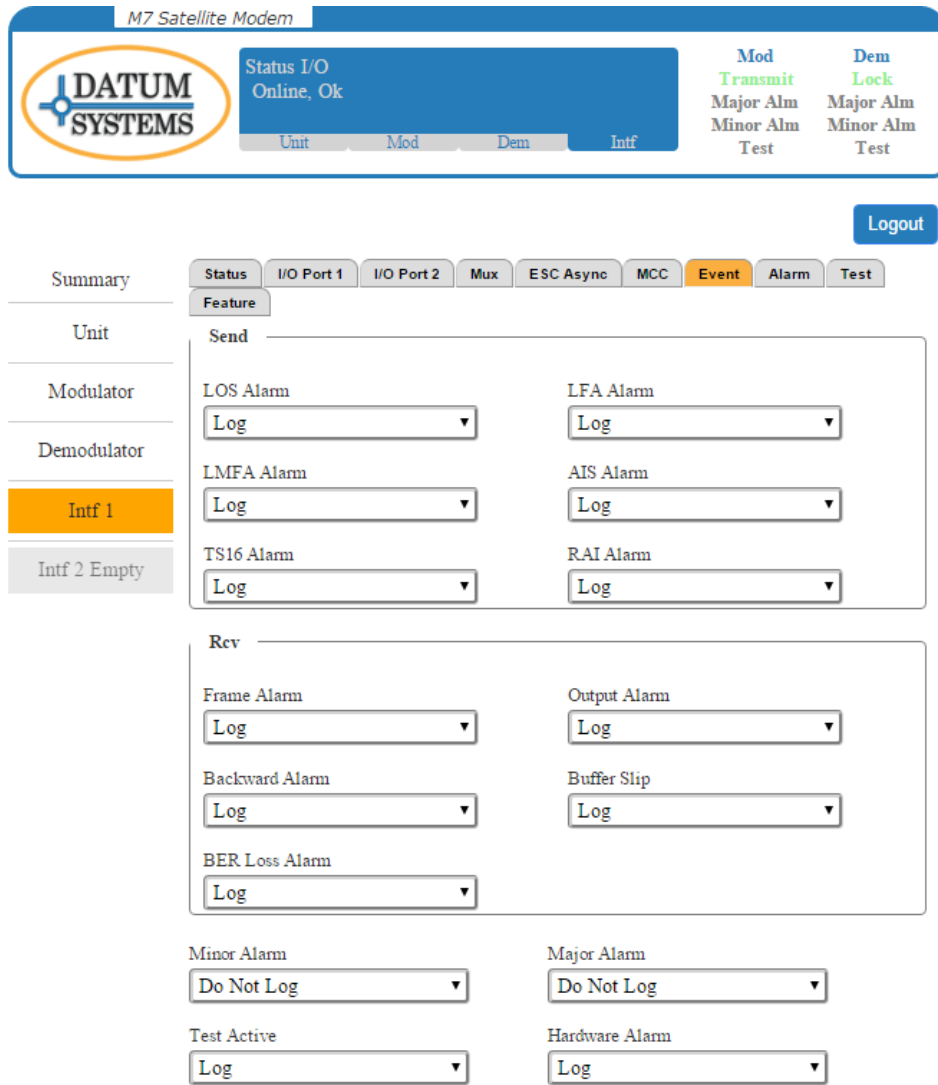


Figure 3-85 – Dual G.703 Interface Event Page

**3.4.2.5.5 MSnIP Interface Screens**

The MSnIP interface screens are shown in the MSnIP Quick Reference Guide.

### 3.5 Front Panel Monitor and Control Parameters

Parameter matrices are available from the front panel. Within the tables following, parameters that appear shaded are only accessible when the modem is configured to use those parameters. For example, those parameters pertaining to the AUPC are only available when the AUPC is enabled, and those pertaining to the Reed-Solomon Codec will appear only if the Reed-Solomon Codec is installed and enabled. There may also be some parameters or parameter sections that will be a future option and will be identified as such within each detailed parameter matrix table.

In the example of the M7 Modulator Parameter Matrix (Table 3 -28) the top gray row represents column headers, which are shown on the LCD display in the upper left. Items below the header are row parameter names shown in the upper right of the LCD. Columns are navigated using the left and right arrow keys while rows are navigated using the up and down arrow keys. All other parameter matrices navigate in the same manner.

Table 3-28 – M7 Front Panel Parameter Matrix – Modulator Sheet

Status	IF	Data	BUC	Event	Alarm	Test	Feature
Carrier	BUC Xmt Freq	Bit Rate	Power	Event	Carrier	Modulation	BR Limit
BUC	Frequency	Symbol Rate	Voltage	AUPC	AUPC	Total BW	Modulation
Interface	BUC Xmt Level	Rate Entry Mode	Current	BUC	BUC Power		FEC
Test	Level	Send Interface	10 MHz Ref	BUC FSK	BUC Cr Max		Activation
BUC Pwr Opt	Output	FEC Mode	LO Freq	Minor	BUC Cr Min		
HW Type	Modulation	FEC Option	Xmt Frequency	Major	BUC FSK		
HW ID	Spectrum	FEC Code Rate	Xmt Spectrum	Test Active	Test Active		
HW S/N	Filter Mode	RS Mode	Xmt Gain	Hardware	Hardware		
	Filter Alpha	RS (n)	Xmt Level Max				
	AUPC Mode	RS (k)	FSK Rmt M&C				
	AUPC Eb/No	RS Depth	Rmt Parameter 1				
	AUPC Max Lvl	Dif Encoder	Rmt Parameter 2				
	AUPC Min Lvl	Scrambler	Rmt Parameter 3				
	Mute						
	Impedance						
	Signal To Noise						

The tables below are organized with general “Rules of Thumb” which aid navigation.

1. The “Status” columns are generally read only, providing status on specific areas of modem operation.
11. The Modulator and Demodulator matrixes use common column designations. A current parameter in one area can be immediately accessed in the other by pressing the appropriate “Mod” or “Dem” button. For example when viewing the Mod Bit Rate, the Demod Bit Rate is accessed by simply pressing the “Dem” button.
12. The “Alarm” columns existing in all four matrixes and represents the disposition of alarm information from that source. Therefore the **<Demod: Alarm – CXR Lock>** sets the disposition of the Demodulator Carrier Lock Alarm as either None, to Alarm Relay A, to Alarm Relay B, or to Alarm Relay A & B.
13. The “Test” columns existing in all four matrixes and represents the control and display of test information for that area. The top entries in the Test column contain tests which can be enabled or disabled if available. The lower rows represent measurements of parameters and are read only. Active tests enabled in these columns generate flashing “Test” LED lamps in appropriate areas.

NOTE: Word spelling is purposely truncated to fit in available LCD display window. Other columns may be added by options added to the modem or software. Redundancy parameters are only shown when connected to another unit in redundancy mode.

Within Table 3 -29 through Table 3 -36 are descriptions of the parameters available from the front panel and entry in detail. The grayed separators delineate column divisions in the area matrix. A gray highlighted parameter indicates that this parameter is not available unless a preceding parameter is enabled or set to require those parameters, or optional hardware is installed that uses that particular parameter. Parameters will also be added as new options are installed. A blue highlighted section indicates that that parameter is a future option and is not available at the current manual release.

Table 3-29 – Modem (Unit) Parameter Detail

Unit Parameters			
Representation	Type	Entry	Description
Status Modem Locked & Sending, Ok	Read Only	Read Only	Mod & Demod Status
Status Redundancy Stand Alone	Read Only	Read Only	Status of the Redundancy control
Status Reference Internal, Ok	Read Only	Not changeable	Reference source and status
Status IP Control Port Connected, 100 Mb Fdx	Read Only	Not changeable	IP Control Port Status
Status Station ID San Jose #56	Alpha – Numeric	Entered as ASCII for up to 16 characters	Station Name for user
Status Time 17:24:59	Time	Entered as 24 hour time format	Current Time
Status Date 09/10/12	Date	Entered current date in mm/dd/yy format	Current Date
Status Model M7 Series	Read Only	Read from Installed Option	Modem Model Number
Status Controller ID M7009001A-1r1.00	Read Only	Read from Installed Option	ID of Installed Controller in Slot 0
Status RF 1 ID M709002A-1r1.00	Read Only	Read from Installed Option	Installed Modulator or Demodulator in RF Slot 1
Status RF 2 ID M709004A-1r1.00	Read Only	Read from Installed Option	Installed Modulator or Demodulator in RF Slot 2
Status Interface 1 ID M709018A-1r1.05	Read Only	Read from Installed Option	Installed Interface Option in Interface Slot 1
Status Interface 2 ID M709013A-1r1.00	Read Only	Read from Installed Option	Installed Interface Option in Interface Slot 2
Status Software Version 3.08k Created Dec 15 2015	Read Only	Read from Installed Option	Modem Software Version
Status Hardware S/N 1021004	Read Only	Read from Installed Option	Modem Serial Number
Event Log Last Event Intf Hardware OK @ 2014-05-15 03:21:00.85	Read Only	Press "Edit" then use the up/dn arrows to scroll through the logged events	Log of events based on the configuration of the Event menu in each functional area.
Event Log Total Events 18	Read Only	Press "Edit" then "Enter" to clear the logged events	# of Events logged based on the configuration of the Event menu in each functional area.

Unit Parameters			
Representation	Type	Entry	Description
Event Log Debounce Time 5.0 Sec	Numeric	0.5 to 600 seconds	Configuration of a filter in the Event log to set the time for logging and display of consecutive instances of the same event.
Event Log Send Alert To Disabled	Selection	0 = Disable 1 = SNMP trap	Setting to determine the alert action to take when there is an event logged based on the configuration of the Event menu in each functional area
Event Log Activity None	Selection	0 = None 1 = Beep 2 = Blink Online Lamp 3 = Beep & Blink Online	Setting to determine the front panel alert action to take when there is an event logged based on the configuration of the Event menu in each functional area
Redundancy Unit Role Stand Alone	Selection	0 = Stand Alone 1 = Internal 1 For 1	Setting to determine the redundancy control. Stand Alone = No redundancy Internal 1For1 = Redundancy
Redundancy Mode Tx Allowed	Selection	0 = Maintenance (Force Offline) 1 = Normal 2: Maintenance (Force Online)	Setting to allow the modulator to transmit if there are no faults in the modulator and it has been placed in the online position or to disable the transmit output regardless of online or offline position.
Redundancy Preference Primary	Selection	0 = Automatic 1 = Primary 2 = Backup	Setting that dictates the timing and exchange of configuration information
Redundancy Switch Delay 0.5 Sec.	Numeric	0.0 to 9999.9	Sets the amount of time required for the online unit to have an alarm condition before releasing its online status
Redundancy Switch Hold 0.1 Minutes	Numeric	0.1 to 99999.9	Sets the amount of time that a backup unit will remain online after the primary unit has recovered from its alarm condition
Redundancy Communications Port IP Control	Selection	0 = IP Control 1 = RS-232 2 = RS-485	Setting to configure the control interface between the prime and backup units
Redundancy Partner IP Addr 192.168.0.100	Numeric	IPv4 address	Enter IPv4 address of the partner modem
Redundancy Partner RS Addr 100	Numeric	0 to 254 0 = address disabled 255 = global	Enter the RS-232 or RS-485 address of the partner modem

Unit Parameters			
Representation	Type	Entry	Description
Redundancy Comms Loss Action Go Online	Selection	0 = Go Online 1 = Go Offline 2 = Keep Last State	Set the action taken by the offline unit if communications is lost between the prime and backup unit
Redundancy Config Transfer Automatic	Selection	0 = n/a 1 = Manual	Set how the prime configuration is transferred to the backup unit
Config Recall Factory, 1 to 99	Selection/ Numeric	1 to 99	Location number of a stored modem configuration to recall.
Config Store Factory, 1 to 99	Selection/ Numeric	1 to 99	Location number to store the current configuration to recall at a later time.
Config Auto Restore Disabled	Selection	0 = Disable, 1 = Enable	Set a modem configuration defined in the "Config Restore #" menu, based on loss of rcv carrier for the time set in the "Config Restore After" menu. This can be referred to as a 'user default configuration'
Config Restore After 30 Sec	Numeric	1 to 14,400 seconds	Time after loss of rcv carrier to restore this configuration.
Config Restore # Disabled	Numeric	0 = Disabled, 0 to 99	Setting the configuration to use for the "Auto Restore"
Config Power-Up Last	Selection/ Numeric	0 = Last, 0 to 99	Behavior on power-up. Either the last settings or try to lock using one of the stored configurations.
Front Panel Mode Full Access	Selection	0 = Disable, 1 = Read Only, 2 = Full Access	Front Panel Keyboard access control.
Front Panel Entry Quick	Selection	0 = Quick, 1 = Edit Only 2 = Confirm	Front Panel Keyboard Entry method. Quick is the normal default mode. Refer to Section 3.3.3
Front Panel LCD Active Backlight Full	Selection	0 = 13%, 1 = 25%, 2 = 38%, 3 = 50%, 4 = 63%, 5 = 75%, 6 = 88%, 7 = Full	Active level of LCD backlight
Front Panel LCD Idle 25%	Selection	0 = off, 1 = 13%, 2 = 25%, 3 = 38%, 4 = 50%	Idle level of LCD backlight
Front Panel Activity Beep	Selection	0 = None, 1 = Beep, 2 = Blink Online Lamp, 3 = Beep & Blink Online	Audible "beep" and/or "Online" LED Blink on front panel key press.
HTTP Server Mode Full Access	Selection	0 = Disable, 1 = Read Only, 2 = Full Access.	Control access and mode to the Web Browser.

Unit Parameters			
Representation	Type	Entry	Description
HTTP Read User Name Admin	Alpha – Numeric	Enter up to 24 characters	HTTP read only access user name
HTTP Read Password Guest	Alpha – Numeric	Enter up to 24 characters	HTTP read only access password
HTTP Full User Name Admin	Alpha – Numeric	Enter up to 24 characters	HTTP full access user name
HTTP Full Password Datum	Alpha – Numeric	Enter up to 24 characters	HTTP full access password
HTTP Activity Blink Online Lamp	Selection	0 = None, 1 = Beep, 2 = Blink Online Lamp, 3 = Beep & Blink Online	Audible “beep” and/or “Online” LED Blink on HTTP port activity.
SNMP Server Mode Full Access	Selection	0 = Disable, 1 = Read Only, 2 = Full Access.	Control access and mode to the SNMP Server
SNMP Server Type V2c	Selection	0 = V1 1 = V2c 2 = V3	Set the SNMP Server type
SNMP Server Port Number 161	Numeric	1 to 65535 161 = IANA	Set the Internet socket port number for the SNMP server
SNMP Read Only Community public	Alpha – Numeric	Up to 24 characters and can contain any combination of alphanumeric characters, hyphens (-), and underscore characters (_).	Set the Read-Only community name for authentication for SNMP traffic.
SNMP Read/Write Community private	Alpha – Numeric	Up to 24 characters and can contain any combination of alphanumeric characters, hyphens (-), and underscore characters (_).	Set the Read-Write community name for authentication for SNMP traffic.
SNMP Trap Community datum	Alpha – Numeric	Up to 24 characters and can contain any combination of alphanumeric characters, hyphens (-), and underscore characters (_).	Set the Trap community name for authentication for SNMP traffic.
SNMP Trap Path Out IP Control Port	Selection	0 = Out IP Control Port 1 = Out MCC Port	Set the signal path for the SNMP Trap
SNMP Trap Address 192.168.2.101	Numeric	Enter IPv4 address	Set the IP Address for the SNMP Trap
SNMP Trap Port Number 162	Numeric	1 to 65535 162 = IANA	Set the Internet socket port number for the SNMP trap
SNMP Trap Rmt MCC Add 1	Numeric	1 to 254. 255 = Global	Set the MCC address signal path for the SNMP Trap from the remote modem



Unit Parameters			
Representation	Type	Entry	Description
SNMP Trap forwarding Port 162	Numeric	1 to 65535 162 = IANA	Set the Internet Socket forwarding Port for the SNMP Trap
SNMP Server Activity None	Selection	0 = None, 1 = Beep, 2 = Blink Online Lamp, 3 = Beep & Blink Online	Audible “beep” and/or “Online” LED Blink on SNMP port activity.
SNMP MIB Version 1.0.3h	Read Only	N/A	Read only indication of the MIB version
IP Control DHCP Enable	Selection	0 = Disable, 1 = Enable	IP Address of the IP Control Port is selected via DHCP or manually
IP Control Address 192.168.002.122	Numeric	Enter IPv4 address	If DHCP is Disabled, manually enter the IP Control Port IPv4 Address
IP Control Network Mask 255.255.255.000	Numeric	Enter IPv4 Network Subnet Mask	If DHCP is Disabled, manually enter the IP Control Port IPv4 Subnet Mask
IP Control Gateway ____.____.____.____	Numeric	Enter IPv4 Default Gateway Address (can remain blank)	If DHCP is Disabled, manually enter the IP Control Port IPv4 Default Gateway
IP Control DNS 1 208.067.222.222	Numeric	Enter IPv4 Domain Name Server Address (can remain blank)	If DHCP is Disabled, manually enter the IP Control Port IPv4 DNS1 Server Address
IP Control DNS 2 208.067.220.220	Numeric	Enter IPv4 Domain Name Server Address (can remain blank)	If DHCP is Disabled, manually enter the IP Control Port IPv4 DNS 2 Server Address
IP Control M&C Server Mode Full Access	Selection	0 = Disable, 1 = Read Only, 2 = Full Access.	Control access and mode of the UDP packet protocol.
IP Control M&C Port Number 9101	Numeric	200 to 65535	UDP Port number that is used for modem control
IP Control M&C Remote Path 192.168.002.201	Numeric	Enter IPv4 address	This address is used with the Demod IF AUPC Remote Path setting of “Out IP Control Port” to set the proper destination address for the MCC data that is received by the demodulator.
IP Control M&C Ext Device ____.____.____.____	Numeric	Enter IPv4 address (can remain blank)	This address is set to identify an external device that is to receive UDP packets.
IP Control M&C Activity None	Selection	0 = None, 1 = Beep, 2 = Blink Online Lamp, 3 = Beep & Blink Online	Audible “beep” and/or “Online” LED Blink on IP Control M&C port activity.

Unit Parameters			
Representation	Type	Entry	Description
Remote IP MAC Address 00:19:78:00:0a:9e	Read Only	Not changeable	Displays the MAC address of the modem controller
Control RS-232 Mode Full Access	Selection	0 = Disable, 1 = Read Only, 2 = Full Access.	Remote control access mode allowed
Control RS-232 Protocol M7 Binary Packet	Selection	0 = VT100, 1 = Quiet VT100, 2 = M7 Binary Packet,	Remote control mode type
Control RS-232 Address 1	Numeric	0 to 254 0 = address disabled 255 = global	Address used to access this unit via remote control and USB packets.
Control RS-232 Rate 9600 bps	Selection	0 to 8 selects 300 to 57,600 bits per second.	Remote port bit rate
Control RS-232 Format N,8,1	Selection	0 = N,8,1 1 = E,8,1 2 = O,8,1 3 = M,8,1 4 = S,8,1	Remote control data/stop bits and parity. Always 8 data bits and 1 stop bit. N= No Parity, E = Even, M = Mark, S = Space.
Control RS-232 Activity Blink Online Lamp	Selection	0 = None, 1 = Beep, 2 = Blink Online Lamp, 3 = Beep & Blink Online	Audible "beep" and/or "Online" LED Blink on Remote port activity.
Control RS-485 Mode Full Access	Selection	0 = Disable, 1 = Read Only, 2 = Full Access.	Remote control access mode allowed
Control RS-485 Protocol M7 Binary Packet	Selection	0 = VT100, 1 = Quiet VT100, 2 = Binary Packet,	Remote control mode type
Control RS-485 Address 101	Numeric	0 to 255 0 = address disabled 255 = global	Address used to access this unit via remote control and USB packets.
Control RS-485 Rate 9600 bps	Selection	0 to 8 selects 300 to 57,600 bits per second.	Remote port bit rate
Control RS-485 Format N,8,1	Selection	0 = N,8,1 1 = E,8,1 2 = O,8,1 3 = M,8,1 4 = S,8,1	Remote control data/stop bits and parity. Always 8 data bits and 1 stop bit. N= No Parity, E = Even, M = Mark, S = Space.
Control RS-485 Activity Blink Online Lamp	Selection	0 = None, 1 = Beep, 2 = Blink Online Lamp, 3 = Beep & Blink Online	Audible "beep" and/or "Online" LED Blink on Remote port activity.
Reference Source External	Selection	0 = Internal, 1 = External	Rear panel external reference.

Unit Parameters			
Representation	Type	Entry	Description
Reference Frequency 10.000MHz	Selection	0 =1.0, 1 =2.0, 2 =5.0, 3 =10.0 MHz	Reference input frequency at rear panel. Only available if set to external reference.
Reference Fine Tune -11	Numeric	+127 to -127	Internal reference fine adjustment. Only available is set to internal reference
Monitor Mode Dem CXR Level	Selection	0 =Dmd CXR Level, 1 =Dmd Eb/No, 2 =Mod CXR Level	Selects source of analog output on rear panel alarm connector pins 5 and 6 on connector J6 on the rear panel.
Monitor Output Full Scale +5.000V	Numeric	+1.0V to +10.0 V	Full scale setting for maximum output voltage
Monitor Output Slope Positive	Numeric	0 = Positive, 1 = Negative	Setting the slope of the Monitor output to be +X and +Y or +X and -Y.
Monitor Input Threshold +1.2 V	Numeric	0.5V to 49.5V in 0.1V steps	Sets the trigger threshold for the analog input signal on pins 4 and 6 of the connector J6 on the rear panel
Monitor Input Sense Active High	Selection	0 = Active Low, 1 = Active High	Sets the sense for the analog input monitor trigger.
Event Redundancy Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the redundancy status
Event Reference Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the reference oscillator alarm
Event IP Control Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the IP Control Port status alarm
Event OCXO Oven Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the OCXO Oven Mask alarm (M7LT only)
Event Monitor Input Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the analog input alarm.
Event Power Supply Alarm Log	Selection	1 = Log 2 = Log & Send Alert	Selects whether to set and alert for the Power Supply Mask alarm

Unit Parameters			
Representation	Type	Entry	Description
Event System Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of "System" events. System events include: Recalled or Stored configuration, Firmware flash updates, Buffer slips, DHCP address acquired, etc.
Event HTTP Access Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log activity of the HTTP port
Event SNMP Access Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log activity status of the SNMP port
Event Cold/Warm Start Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log a Cold or Warm Start (power cycle or system reset).
Event Minor Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Minor alarms
Event Major Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Major alarms
Event Test Active Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the Test Active alarm
Event Hardware Alarm Log	Selection	1 = Log 2 = Log & Send Alert	Selects whether to set an alert for the status of the Hardware alarm
Alarm Event Pending Mask to Alarm A & B	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B, 4 = Flash Online Only 5 = Flash Minor Alm Only	Selects destination and action taken when an event of any kind has been logged.
Alarm Redundancy Mask to Alarm A & B	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination and action taken for redundancy status alarm types.
Alarm Reference Mask to Alarm A & B	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination and action taken for reference oscillator alarm types.

Unit Parameters			
Representation	Type	Entry	Description
Alarm IP Control Port Mask to Alarm A & B	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination and action taken for the IP Control Port status
Alarm OCXO Oven Mask Mute & Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination of alarm. M7LT only
Alarm Monitor Input Mask None	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination and action taken for the analog input alarm.
Alarm Power Supply Mask to Alarm A & B	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination and action taken for the input power DC voltage threshold alarm.
Alarm Power Supply Min +8.0 V	Numeric	+7.6V to +34.0V in 0.1V steps	Threshold setting for the input power DC voltage alarm.
Alarm Trial <7 Days Mask to Alarm A & B	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination and action taken when the trial period is less than 7 days from completion.
Alarm Trial <24 Hours Mask to Alarm A & B	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination and action taken when the trial period is less than 24 hours from completion.
Alarm Beep Mask On Alarm A & B	Selection	0=None, 1=On Alarm A, 2=On Alarm B, 3=On Alarm A & B	Selects if alarm causes a unit audible "beep".
Alarm Test Active Mask to Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	Selects destination of alarm
Alarm Hardware Mask to Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	Selects destination of alarm

Unit Parameters			
Representation	Type	Entry	Description
Test Modem Disabled	Selection	0 = Disabled, 1 = Lamp Test, 2 = Self Test, 3 = Lamp & Self Test.	Carrier output mode for test purposes.
Test Firmware Flash 1 2.30i1 - Running	Read Only	N/A	Read only indication of the current operating Firmware. In Admin mode this becomes a selection of Flash 1 or 2.
Test Firmware Flash 2 2.30i1	Read Only	N/A	Read only indication of the pending or recently updated firmware. In Admin mode this becomes a selection of Flash 1 or 2.
Test Installer Idle	Read Only	Idle, Downloading, Verifying, Installing,	Read only indication of the current state of the firmware installer
Test Boot Control Normal	Selection	0 = Normal, 1 = Reboot Now, 2 = Reboot After 1 Sec, 3 = Reboot After 2 Sec 4 = Reboot After 5 Sec 5 = Reboot After 10 Sec 6 = Reboot After 20 Sec 7 = Reboot After 50 Sec	Admin mode only. Set a time delay to start the reboot process.
Test Reference Cal Calibrated	Read Only	UNCALIBRATED, Calibrated , Calibrating..., CALIBRATION FAILED. Press enter to Calibrate.	Admin Mode only. Reserved Depot or Factory calibration procedure.
Test Reference AFC +1.67 V	Read Only	N/A	Admin Mode only. Indication of control voltage to the internal reference oscillator.
Test Power Supply +24.2 V	Read Only	N/A	Real time input power DC voltage monitor
Test Monitor Input +24.2 V	Read Only	N/A	Real time analog input voltage monitor on pin 4 of J6
Test OCXO Temperature +90.0°C	Read Only	N/A	Real time OCXO temperature monitor. M7LT only
Test Admin Normal	Selection	0 = Normal, 1 = Enable	Normal function is meant for the typical earth station operator. Enabling the Test Admin function is reserved for depot maintenance.
Feature Unit None	Read Only	N/A	Shows the option capability of the modem
Feature Trial Activation 00000000000000000000	Numeric	20 characters	Allows entry of a Feature code to activate new features for a trial time period.

Unit Parameters			
Representation	Type	Entry	Description
Feature Trial Time Remaining 15 hours	Numeric	Time in hours	Indicates the time remaining on the trial feature.
Feature Activation 00000000000000000000	Numeric	20 characters	Allows entry of a Feature code to activate new features.

Table 3-30 – Modulator Parameter Detail

Modulator Parameters			
Representation	Type	Entry	Description
Status Carrier Sending, OK	Read Only	Read Only	Modulator Carrier Status
Status BUC Normal	Read Only	Read Only	External BUC Status. M7LT only
Status Interface Normal	Read Only	Read Only	Transmit Interface Status
Status Test Normal	Read Only	Read Only	Modulator Test Status
Status BUC Power Option +48v @ 3.13A	Read Only	Read Only	Installed Internal BUC Power Supply (M7LT only)
Status HW Type Std IF Modulator	Read Only	Read Only	Identification of installed Modulator hardware
Status HW ID M709002A-1r1.00	Read Only	Read Only	Part number of installed Modulator hardware
Status HW S/N 100032	Read Only	Read Only	Serial number of installed Modulator hardware
IF BUC Xmt Frequency 14132.000MHz	Numeric	Can change depending on the setting of the BUC LO	RF carrier center frequency based on the BUC LO Frequency parameter setting
IF Frequency 70.000000MHz	Numeric	50.000000 to 180.000000 MHz 950.000000 to 2150.000000 MHz for L-Band unit	Transmit carrier center frequency For Dual IF units the IF Band must be configured for IF or L-band prior to setting the IF Frequency.
IF BUC Xmt Level +10dBW	Numeric	Can change depending on the setting of the BUC Xmt Gain	Transmit output power level display based on the BUC Xmt Gain parameter setting
IF Level -3.82dBm	Numeric	+5.0 to -35.0 dBm +3.0 max at 50Ω	Transmit output power level
IF Output Enabled	Selection	0 = Disable, 1 = Enable	Transmit carrier output enable
IF Modulation QPSK	Selection	0 = BPSK, 1 = QPSK, 2 = OQPSK, 3 = 8PSK, 4 = 8QAM, 6 = 16QAM	Modulation Mode. Some values left available for new options.
IF Spectrum Normal	Selection	0 = Normal, 1 = Inverted	Modulation Spectrum control

Modulator Parameters			
Representation	Type	Entry	Description
IF Filter Roll-Off 0.35	Selection	0=0.40, 1=0.35, 2=0.30, 3=0.25, 4=0.20, 5=0.15, 6=0.10, 7=0.08, 8=0.05	Sets the Alpha roll-off factor for the modulator filters
IF AUPC Mode Disabled	Selection	0 = Disable, 1 = Enable,	Automatic Uplink Power Control.
»IF AUPC Eb/No 8.0dB	Numeric	3.0 to 20.0 dB	AUPC remote receive Eb/No level set point.
»IF AUPC Max Level -5.0 dB	Numeric	+5.0 dBm to Minimum level	Max. Transmit level under AUPC control
»IF AUPC Min Level -14.0 dB	Numeric	Maximum level to -35 dBm	Min. Transmit Level under AUPC control
IF Mute Automatic	Selection	0 = Automatic, 1 = Confirm, 2 = Manual 3 = Manual & Power Loss	Manual requires manual Carrier enable after Mod output change. Option 3 forces Cxr off after power fail.
IF Impedance 75 Ohm	Selection	0 = 50Ω, 1 = 75Ω	Transmit IF impedance.
IF Signal to Noise Format Eb/No	Selection	0 = Eb/No, 1 = Es/No	Sets the format for signal to noise measurements
Data Bit Rate 4.096000Mbps	Numeric	1.2 kbps to 59.04 Mbps in 1 bps resolution. Entered in kbps but display will change to Mbps if the rate is 1000.000 kbps or higher.	Modulator Bit Rate – The max and min are determined by settings and options.
Data Symbol Rate 2.730667Msps	Numeric	2.4 ksps to 14.76Msps in 1sps resolution. Entered in ksps but display will change to Msps if the rate is 1000.000 ksps or higher.	Modulator Symbol Rate – The max and min are determined by settings and options.
Data Rate Entry Mode Bit Rate	Selection	0 = Bit Rate, 1 = Symbol Rate, 2 = Interface.	Determines which parameter is used to enter the modulator rate
Data Send Interface Disabled	Selection	0 = Disabled, 1 = Installed Interface Option in Slot 3 2 = Installed Interface Option in Slot 4	Sets the active interface for the data input to the modulator.
Data FEC Mode Viterbi	Selection	0 = None 1 = Viterbi, 2 = TCM, 3 = Reserved 4 = TPC 5 = LDPC	Reed-Solomon is enabled below. Please note that available FEC options are determined by other modem settings.
Data FEC Option Swap C0/C1	Selection	0 = Normal, 1 = Swap C0/C1, 0 = Normal for TCM	(Vit) Sets the bit compatibility of the Viterbi FEC encoder.



Modulator Parameters			
Representation	Type	Entry	Description
Data FEC Code Rate 3/4	Selection	0 = 1/1 for FEC=None 0 = 1/2, 1 = 3/4, 2 = 5/6 3 = 7/8. 0 = 2/3 in 8PSK TCM	(Vit) Sets the code rate of the Viterbi FEC encoder.
Data RS Mode IESS-309	Selection	0 = Disabled, 1 = IESS-308 2 = IESS-309 3 = IESS310 4 = CT 200-220 5 = Custom	(Vit + R-S) Reed-Solomon column and options only available if enabled. Entry is not shown when TPC enabled.
»Data RS (n) 219	Numeric	In Custom Mode only: Available n values Read only in other modes	(Vit + R-S) Block size n = 22 to 255
»Data RS (k) 201	Numeric	In Custom Mode only: Available k values Read only in other modes	(Vit + R-S) k = 20 to 253, k must be 2 to 20 less than n
»Data RS Depth 4	Selection	In Custom Mode only: 0 = 4, 1 = 8, 2 = 16 Read only in other modes	(Vit + R-S) Interleave depth factor
Data Dif Encoder Enabled	Selection	0 = Disable, 1 = Enable	(Vit + R-S) Differential Encoder Not shown or settable except in special modes.
Data Scrambler Auto	Selection	0 = Disable, 1 = Auto 2 = V.35, 3 = Intelsat, 4 = EFD, 5 = Alt V.35 6 = Alt Intelsat 7 = Alt RS EFD** 8 = FEC Sync 9 = RS Sync** 10 = Mux Sync	(Vit + R-S) Scrambler types. Types are added if optional hardware is installed. The Auto mode uses IESS standards to automatically switch to use synchronous scramblers part of R-S and TPC. ** only when R-S = Enabled
Data FEC Option Advanced	Selection	0 = Advanced, 1 = CT,	(TPC) Sets the compatibility mode for the TPC FEC encoder
Data FEC Code Rate 3/4-4k	Selection	0 = 0.453-16k, 1 = 1/2-16k, 2 = 1/2-4k 3 = 3/4-16k, 4 = 3/4-4k 5 = 7/8-16k, 6 = 7/8-4k 7 = 0.922-16k, 8 = 0.950-4k	(TPC) Sets the code rate of the TPC FEC encoder.

Modulator Parameters			
Representation	Type	Entry	Description
Data Scrambler Auto	Selection	0 = Disable, 1 = Auto 2 = V.35, 3 = Intelsat, 4 = EFD, 5 = Alt V.35 6 = Alt Intelsat 7 = n/a in TPC mode 8 = FEC Sync 9 = n/a in TPC mode 10 = Mux Sync	(TPC) Scrambler types. Types are added or removed depending on the selected FEC mode. The Auto mode uses IESS standards to automatically switch to use synchronous scramblers part of R-S and TPC.
Data FEC Option 4k Block	Selection	0 = 256 Block, 1 = 512 Block, 2 = 1k Block, 3 = 2k Block, 4 = 4k Block, 5 = 8k Block, 6 = 16k Block,	(LDPC) Sets the LDPC FEC encoder block size
Data FEC Code Rate 3/4	Selection	0 = 1/2, 1 = 2/3, 2 = 3/4, 3 = 14/17, 4 = 7/8, 5 = 10/11, 6 = 16/17	(LDPC) Sets the code rate of the LDPC FEC encoder.
Data Scrambler Auto	Selection	0 = Disable, 1 = Auto 2 = V.35, 3 = Intelsat, 4 = EFD, 5 = Alt V.35 6 = Alt Intelsat 7 = n/a in LDPC mode 8 = FEC Sync 9 = n/a in LDPC mode 10 = Mux Sync	(LDPC) Scrambler types. Types are added or removed depending on the selected FEC mode. The Auto mode uses IESS standards to automatically switch to use synchronous scramblers part of R-S and TPC.
IF Band 50 – 180 MHz	Selection	50 - 180 MHz for IF-band or 950 - 2250 MHz for L-Band	Transmit carrier frequency band This menu item will only show for Dual IF units
BUC Power Enabled	Selection	0 = Disabled 1 = xxV Enabled 2 = yyV Enabled 3 = zzV Enabled	Selects Power and Voltage to a BUC in the M7LT. Available voltages will populate the 'xx', 'yy', 'zz' fields.
BUC Voltage Out +23.2 V	Numeric	Read Only	Displays Voltage Output on Transmit Cable in the M7LT
BUC Current +3.42 A	Numeric	Read Only	Displays Current draw of BUC in the M7LT
BUC 10 MHz Ref Enabled	Selection	0 = Disabled 1 = Enable	Selects if modem's current 10 MHz reference to be supplied to a BUC in M7L/LT

Modulator Parameters			
Representation	Type	Entry	Description
BUC LO Frequency 13050.000000MHz	Numeric	0 to 49999.999996 MHz	Selects BUC LO frequency in M7L/LT. If set non-zero then IF frequency setting is at RF frequency.
BUC Xmt Spectrum Non-Inverted	Selection	0 = Non-Inverted 1 = Inverted	Sets the compatibility of the spectrum dependent on inverting or non-inverting BUCs in M7L/LT. Low side LO provides a non-inverted spectrum.
BUC Xmt Gain Disabled	Numeric	0.00 to 99.99 dB	Sets the gain of the BUC in the M7L/LT
BUC Xmt Level Max +30 dBW	Numeric	0.00 to +30dBW	Sets the ?? in the M7LT
BUC FSK Remote M&C Enabled	Selection	0 = Disabled 1 = Enable	Future Option
BUC Remote Parameter 1 Undefined 1	Selection	0 = Undefined 1 1 = Undefined 2	Future Option
BUC Remote Parameter 2 Undefined 1	Selection	0 = Undefined 1 1 = Undefined 2	Future Option
BUC Remote Parameter 3 Undefined 1	Selection	0 = Undefined 1 1 = Undefined 2	Future Option
Event Carrier Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Carrier alarm.
Event AUPC Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the AUPC alarm.
Event BUC Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the BUC alarm.
Event BUC FSK Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the BUC FSK alarm.
Event Minor Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Minor alarms
Event Major Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Major alarms
Event Test Active Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the Test Active alarm
Event Hardware Alarm Log	Selection	1 = Log 2 = Log & Send Alert	Selects whether to set an alert for the status of the Hardware alarm

Modulator Parameters			
Representation	Type	Entry	Description
Alarm Carrier Mask Mute & Alarm A	Selection	0-4= Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination of alarm
Alarm AUPC Mask To Alarm B	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm BUC Power Mask to Alarm A	Selection	0=None, 1=A, 2=B, 3=A&B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination of alarm in the M7LT.
Alarm BUC Current Max +5.00 A	Numeric		
Alarm BUC Current Min +2.50 A	Numeric		
Alarm BUC FSK Mask To Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	(Future Option) Selects destination of alarm in the M7LT.
Alarm Test Active Mask To Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	Selects destination of alarm
Alarm Hardware Mask Mute & Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B 4= Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination of alarm
Test Modulation Normal	Selection	0 = Normal, 1 = Pure CXR, 2 = Alt 1/0 3 = Lower Sideband, 4 = Upper Sideband	Carrier output mode for test purposes.
Test Total Occupied BW 3.413333 MHz	Read Only	N/A	Displays modulated carrier Occupied BW. This value will be determined by the IF Filter Roll-Off parameter setting.
Feature Bit Rate Limit 5.00 Mbps	Read Only	N/A	Shows the Bit Rate capability of the modem
Feature Modulation B/Q/OQ/8/PSK 8/16QAM	Read Only	N/A	Shows the modulation capability of the modem

Modulator Parameters			
Representation	Type	Entry	Description
Feature FEC Vit TCM RS L16k T16k	Read Only	N/A	Shows the FEC capability of the modem
Feature Activation 00000000000000000000	Numeric	20 characters	Allows entry of a Feature code to activate new features.

Table 3-31 – Demodulator Parameter Detail

Demodulator Parameters			
Representation	Type	Entry	Description
Status Carrier Locked, Ok	Read Only	N/A	Demodulator receive Carrier Status
Status Eb/No 7.32 dB	Read Only	N/A	Measured Eb/No
Status Imbalance Offset +0.01% Level +0.47 dB	Read Only	N/A	Offset – shows the frequency offset imbalance between the far end carrier and the echo carrier as a percentage of the receive symbol rate. Level – shows the level imbalance between the far end carrier and the carrier. Smart Carrier Demod ONLY
Status Offset Rcv -0.074 kHz Echo -0.003 kHz	Read Only	N/A	Displays both the far end carrier “Rcv” error offset frequency and the “Echo” offset frequency when they are each locked Second line is Smart Carrier Demod ONLY
Status Level Rcv -35.96 dBm Echo -36.35 dBm	Read Only	N/A	Displays both the far end carrier “Rcv” level and the “Echo” level in dBm. The echo level is only valid when the echo is locked Second line is Smart Carrier Demod ONLY
Status Sat Echo Delay 243.1 ms	Read Only	Press Edit or the 0 key to edit this option: Pressing Enter will then set the “IF Sat Echo Delay Maximum” to the currently received echo delay plus 4 ms and the “IF Sat Echo Delay Minimum” to the currently received echo delay minus 4 ms	This +/-4 ms delay range will allow for normal geostationary satellite movement while providing the fastest possible echo reacquisition time when reception is interrupted Smart Carrier Demod ONLY
Status Estimated BER 7.4E-8	Read Only	N/A	Estimated BER Status
Status Link Margin +0.52 dB	Read Only	N/A	Link Margin Status. Calculated from the Estimated BER and the Data Rcv Minimum BER setting

Demodulator Parameters			
Representation	Type	Entry	Description
Status LNB Normal	Read Only	N/A	LNB Status. M7LT
Status Interface Normal	Read Only	N/A	Demodulator Interface Status
Status Test Normal	Read Only	N/A	Demodulator Test Status
Status FEC Hardware Opt None	Read Only	N/A	Identification of installed FEC optional hardware.
Status LNB Power Option +13V, +18V @ 0.050A	Read Only	N/A	LNB Power Supply Status. M7L and M7LT
Status Hardware Type Std IF Demodulator	Read Only	N/A	Identification of installed Demodulator hardware
Status Hardware ID M709004A-1r1.00	Read Only	N/A	Part number of installed Demodulator hardware
Status Hardware S/N 101820	Read Only	N/A	Serial number of installed Demodulator hardware
IF LNB Rcv Frequency 10750.000MHz	Numeric	Can change depending on the setting of the LNB LO	RF carrier center frequency based on the LNB LO Frequency parameter setting
IF Frequency 70.000000MHz	Numeric	50.000000 to 180.000000 MHz for IF unit, 950.000000 to 2150.000000 MHz for L-Band unit	Receive carrier center frequency. L-Band frequency shown if LNB LO is set to 0, else is set to RF frequency. For Dual IF units the IF Band must be configured for IF or L-band prior to setting the IF Frequency.
IF Smart Carrier Enabled	Selection	0 = Disable, 1 = Enable	Selects the operation for Smart Carrier. Smart Carrier Demod ONLY
IF Sat Echo Delay Maximum 290.0 ms	Numeric	0.0 to 320.0 ms	Sets the maximum satellite echo search delay Smart Carrier Demod ONLY
IF Sat Echo Delay Minimum 230.0 ms	Numeric	0.0 to 318.0 ms	Sets the minimum satellite echo search delay Smart Carrier Demod ONLY
IF Sat Echo Delay Search Hold 300.0 Sec	Numeric	0.0 to 600.0 Sec	Sets the amount of time a narrow +/-1 ms delay search hold is active until returning to the full delay sweep range set by "IF Sat Echo Delay Maximum" and "IF Sat Echo Delay Minimum" after echo lock is lost. Smart Carrier Demod ONLY
IF Sweep Range 30.000kHz	Numeric	0.100 to 3500.000 kHz	Receive carrier acquisition range in kHz.

Demodulator Parameters			
Representation	Type	Entry	Description
IF Sweep Mode Fast	Selection	0 = Fast, 1 = Search	Fast acquisition mode is standard method. Search acquisition parameters are set in the Sweep Time menu
»IF Sweep Time 10.0 Sec	Numeric	0.0 to 99.9 Seconds. 0 Disables Narrow Sweep	Narrow Sweep time applicable to Search sweep mode only.
IF Modulation QPSK	Selection	0 = BPSK, 1 = QPSK, 2 = OQPSK, 3 = 8PSK, 4 = 8QAM, 6 = 16QAM	Modulation Mode. Some values left available for new options.
IF Spectrum Normal	Selection	0 = Normal, 1 = Inverted	Demodulation Spectrum control
IF Filter Roll-Off 0.35	Selection	0=0.40, 1=0.35, 2=0.30, 3=0.25, 4=0.20, 5=0.15, 6=0.10, 7=0.08	Sets the Alpha roll-off factor for the demodulator filters
IF AUPC Remote Path Disable	Selection	0 = Disable, 1 = Local, 2 = Out MCC Port, 3 = Out IP Control Port	Sets the output path for the AUPC data. "Out MCC Port" setting at both ends of a duplex PtP link is the standard for bi-directional AUPC on a duplex link. "Local" is the setting for AUPC of the transmit carrier in a broadcast network.
IF AUPC Remote MCC Address 1	Numeric	1 to 254. 255 = Global	Set the address of the target MCC port
IF Impedance 75 Ohm	Selection	0 = 50Ω, 1 = 75Ω	Receive IF impedance.
IF Signal to Noise Format Eb/No	Selection	0 = Eb/No, 1 = Es/No	Sets the format for signal to noise measurements
Data Bit Rate 4.096000 Mbps	Numeric	1.2 kbps to 59.04 Mbps in 1 bps resolution. Entered in kbps but display will change to Mbps if the rate is 1000.000 kbps or higher.	Demodulator Bit Rate – The max and min are determined by settings and options.
Data Symbol Rate 2.730677 Msps	Numeric	2.4 ksps to 14.76Msps in 1sps resolution. Entered in ksps but display will change to Msps if the rate is 1000.000 ksps or higher.	Demodulator Symbol Rate – The max and min are determined by settings and options.
Data Rate Entry Mode Bit Rate	Selection	0 = Bit Rate, 1 = Symbol Rate	Determines which parameter is used to enter the demodulator rate
Data Rcv Interface Disabled	Selection	0 = Disabled, 1 = Installed Interface Option in Slot 3 2 = Installed Interface Option in Slot 4	Sets the active interface for the data output from the demodulator.

Demodulator Parameters			
Representation	Type	Entry	Description
Data FEC Mode Viterbi	Selection	0 = None 1 = Viterbi, 2 = TCM, 3 = N/A 4 = TPC 5 = LDPC	Reed-Solomon is enabled below. Please note that available FEC options are determined by installed options and other modem settings
Data FEC Option Normal	Selection	0 = Normal, 1 = Swap C0/C1, 0 = Normal for TCM	(Vit) Sets the bit compatibility of the Viterbi FEC decoder.
Data FEC Code Rate 3/4	Selection	0 = 1/1 for FEC=None 0 = 1/2, 1 = 3/4, 2 = 5/6 3 = 7/8. 0 = 2/3 in 8PSK TCM	(Vit) Sets the code rate of the Viterbi FEC decoder.
Date RS Mode IESS-309	Selection	0 = Disabled, 1 = IESS-308 2 = IESS-309 3 = IESS-310 4 = CT 200-220 5 = Custom	(Vit + R-S) Reed-Solomon column and options only available if enabled. Entry is not shown when TPC enabled.
»Data RS (n) 219	Numeric	In Custom Mode only: Available n values Read only in other modes	(Vit + R-S) Block size n = 22 to 255. Entry is not shown when TPC enabled.
»Data RS (k) 201	Numeric	In Custom Mode only: Available k values Read only in other modes	(Vit + R-S) k = 20 to 253, k must be 2 to 20 less than n. Entry is not shown when TPC enabled.
»Data RS Depth 4	Selection	In Custom Mode only: 0 = 4, 1 = 8, 2 = 16 Read only in other modes	(Vit + R-S) Interleave depth factor. Entry is not shown when TPC enabled.
Data Dif Decoder Enabled	Not Shown	0 = Disable, 1 = Enable	(Vit + R-S) Differential Encoder Not shown or settable except in special modes.
Data Descrambler Auto	Selection	0 = Disable, 1 = Auto 2 = V.35, 3 = Intelsat, 4 = EFD, 5 = Alt V.35 6 = Alt Intelsat 7 = Alt RS EFD** 8 = FEC Sync 9 = RS Sync** 10 = Mux Sync	(Vit + R-S) Descrambler types. Types are added if optional hardware is installed. The Auto mode uses IESS standards to automatically switch to use synchronous scramblers part of R-S and TPC. ** only when R-S = Enabled
Data FEC Option Advanced	Selection	0 = Advanced, 1 = CT,	(TPC) Sets the compatibility mode for the TPC FEC decoder



Demodulator Parameters			
Representation	Type	Entry	Description
Data FEC Code Rate 3/4-4k	Selection	0 = 0.453-16k, 1 = 1/2-16k, 2 = 1/2-4k 3 = 3/4-16k, 4 = 3/4-4k 5 = 7/8-16k, 6 = 7/8-4k 7 = 0.922-16k, 8 = 0.950-4k	(TPC) Sets the code rate of the TPC FEC decoder.
Data Descrambler Auto	Selection	0 = Disable, 1 = Auto 2 = V.35, 3 = Intelsat, 4 = EFD, 5 = Alt V.35 6 = Alt Intelsat 7 = n/a in TPC mode 8 = FEC Sync 9 = n/a in TPC mode 10 = Mux Sync	(TPC) Descrambler types. Types are added or removed depending on the selected FEC mode. The Auto mode uses IESS standards to automatically switch to use synchronous descramblers part of R-S and TPC.
Data FEC Option 4k Block	Selection	0 = 256 Block, 1 = 512 Block, 2 = 1k Block, 3 = 2k Block, 4 = 4k Block, 5 = 8k Block, 6 = 16k Block,	(LDPC) Sets the LDPC FEC decoder block size
Data FEC Code Rate 3/4	Selection	0 = 1/2, 1 = 2/3, 2 = 3/4, 3 = 14/17, 4 = 7/8, 5 = 10/11, 6 = 16/17	(LDPC) Sets the code rate of the LDPC FEC decoder.
Data Descrambler Auto	Selection	0 = Disable, 1 = Auto 2 = V.35, 3 = Intelsat, 4 = EFD, 5 = Alt V.35 6 = Alt Intelsat 7 = n/a in LDPC mode 8 = FEC Sync 9 = n/a in LDPC mode 10 = Mux Sync	(LDPC) Scrambler types. Types are added or removed depending on the selected FEC mode. The Auto mode uses IESS standards to automatically switch to use synchronous scramblers part of R-S and TPC.
Data FEC Hold 1	Numeric	0 to 255 Normally set to 1	Number of FEC lock “cycles” the FEC will accomplish before declaring loss of lock.
Data Rcv Minimum BER 1.0E-08 @ Eb/No = 6.83 dB	Selection	1.0E-5 to 1.0E-10	Available selection criteria determined by the selected FEC option.
IF Band 50 – 180 MHz	Selection	50 - 180 MHz for IF-band or 950 - 2250 MHz for L-Band	Receive carrier frequency band This menu item will only show for Dual IF units

Demodulator Parameters			
Representation	Type	Entry	Description
LNB Power +18 V	Selection	0 = Disabled 1 = +13VDC 2 = +18VDC 3 = xxVDC	Selects Power and Voltage to an LNB in the M7LT. . Available voltages will populate the voltage fields.
LNB Voltage Monitor +17.4 V	Read Only	N/A	Monitors the Voltage to the LNB in the M7LT
LNB Current Out 221 mA	Numeric	Read Only	Displays Current draw of LNB when LNB Power is active in the M7LT
LNB 10 MHz Ref Enabled	Selection	0 = Disabled 1 = Enable	Selects if modem's current 10 MHz reference to be supplied to an LNB in the M7LT
LNB LO Frequency 5150.000000 MHz	Numeric	0 to 49999.999996 MHz	Selects LNB LO frequency in the M7L/LT. If set non-zero then IF frequency setting is at RF frequency.
LNB Rcv Spectrum Inverted	Selection	0 = Non-Inverted 1 = Inverted	Sets the compatibility of the spectrum dependent on inverting or non-inverting LNBs in the M7LT. Low side LO provides a non-inverted spectrum
<hr/>			
Event Sat Echo Lock Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Echo Carrier lock alarm. Smart Carrier Demod ONLY
Event Carrier Lock Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Carrier Lock alarm.
Event Eb/No Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Eb/No alarm.
Event Offset Imbalance Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Offset Imbalance alarm. Smart Carrier Demod ONLY
Event Level Imbalance Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Level Imbalance alarm. Smart Carrier Demod ONLY
Event Level Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Level alarm.
Event LNB Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of any LNB alarm in the M7LT.
Event Minor Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Minor alarms

Demodulator Parameters			
Representation	Type	Entry	Description
Event Major Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Major alarms
Event Test Active Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the Test Active alarm
Event Hardware Alarm Do Not Log	Selection	1 = Log 2 = Log & Send Alert	Selects whether to set an alert for the status of the Hardware alarm
Alarm Sat Echo Lock Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination of alarm Smart Carrier Demod ONLY
Alarm Carrier Lock Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination of alarm
Alarm Low Eb/No Mask to Alarm B	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B 4 = Mute Data 5 = Mute Data & Alarm A, 6 = Mute Data & Alarm B, 7 = Mute Data & Alarm A & B	Selects destination of alarm
Alarm Low Eb/No Limit 5.00 dB	Numeric	0.50 to 19.99 dB	Sets the Eb/No threshold that will raise an alarm.
Alarm Offset Imbalance Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm Smart Carrier Demod ONLY
Alarm Offset Imbalance Limit 3.00 %	Numeric	0.5 % to 20 %	Sets the Offset Imbalance limit threshold that will raise an alarm.  Smart Carrier Demod ONLY
Alarm Level Imbalance Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm Smart Carrier Demod ONLY
Alarm Level Imbalance Limit 10.00 dB	Numeric	1 dB to 12 dB	Sets the Level Imbalance limit threshold that will raise an alarm.  Smart Carrier Demod ONLY

Demodulator Parameters			
Representation	Type	Entry	Description
Alarm Low Level Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Low Level Limit -55.00 dBm	Numeric	-91.19 to -8.30 dBm	Sets the Rcv Level threshold that will raise an alarm. Range is variable based on the symbol rate of the Rcv carrier.
»Alarm LNB Power Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm – Only shown in M7LT
»Alarm LNB Current Max 300 mA	Numeric	0.01 to 0.5 A	Selects destination of alarm – Only shown in M7LT
»Alarm LNB Current Min 150 mA	Numeric	0.01 to 0.5 A	Selects destination of alarm – Only shown in M7LT
Alarm Test Active Mask To Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Hardware Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Test IF Loopback Disabled	Selection	0 = Disable, 1 = Enable	IF Loop-back control.
Test Monitor Mode Disabled	Selection	0 = Disabled, 1 = Constellation, 2 = Spectrum Analyzer, 3 = Fixed CXR, 4 = Fixed CXR Hold	IF Monitor mode control.
Test Spect. Analyzer Center 2011.198122 MHz	Numeric	50.000000 to 180.000000 MHz for IF unit; 950.000000 to 2150.000000 MHz for L-Band unit	IF Spectrum Analyzer center frequency.
Test Spect. Analyzer Span 10.000000 MHz	Numeric	Auto set to scale with the symbol rate of the received carrier. Max span 27.675 MHz.	IF Spectrum Analyzer span. NOTE: A special test mode is available by contacting Datum Systems.
Test Total Occupied BW 3.413333 MHz	Read Only	N/A	Displays modulated carrier Occupied BW. This value will be determined by the IF Filter Roll-Off parameter setting.
Feature Smart Carrier Limit 500 kbps	Read Only		Shows the max capability of the smart carrier operation. Smart Carrier Demod ONLY
Feature Bit Rate Limit 5.00 Mbps	Read Only		Shows the Bit Rate capability of the modem

Demodulator Parameters			
Representation	Type	Entry	Description
Feature Modulation B/Q/OQ/8/PSK 8/16QAM	Read Only		Shows the modulation capability of the modem
Feature FEC Vit TCM RS L16k T16k	Read Only		Shows the FEC capability of the modem
Feature Activation 00000000000000000000	Numeric	20 characters	Allows entry of a Feature code to activate new features.

Table 3-32 – Synchronous Interface Parameter Detail

Synchronous Interface Parameters			
Representation	Type	Entry	Description
Status I/O Online	Read Only	N/A	Interface Status
Status I/O Send Clock Locked, Ok	Read Only	N/A	
Status I/O Send Data Active, Ok	Read Only	N/A	
Status I/O Rcv Buffer 100%, 0 Slips	Read Only	Press "1" then "Enter" to re-center the buffer. Press "0" then "Enter" to clear the "Slip Status".	Only shows if the Rcv Buffer is active. 100% is buffer center.
Status I/O Rcv Data Active, Ok	Read Only	N/A	
Status I/O Signaling rts CTS DCD dtr DSR	Read Only	N/A	Synchronous Interface signaling status. Lower case indicates not-active status, upper case indicates active status
Status ESC Signaling rts CTS DCD dtr DSR	Read Only	N/A	Engineering service channel interface signaling status. Lower case indicates not-active status, upper case indicates active status. Only shown when the ESC channel is active.
Status Test BER Active	Read Only	N/A	Interface Test status
Status Hardware Type Multi-Sync Interface	Read Only	N/A	Indicates the type of the active interface
Status Hardware ID M709013A-1r1.00	Read Only	N/A	Indicates the part number of the active interface
Status Hardware S/N 101678	Read Only	N/A	Indicates the serial number of the active interface

Synchronous Interface Parameters			
Representation	Type	Entry	Description
I/O Mode RS-449	Selection	0 = Disable 1 = RS-232 2 = RS-449 3 = RS-449/Unterm 4 = V.35 5 = X.21 6 = EIA-530 7 = EIA-530A	Interface electrical mode.
I/O Send Clock Source TT Clock	Selection	0 = Internal, 1 = TT Clock 2 = Rcv Clock, 3 = External	Transmit Clock Source.
I/O Send Data Normal	Selection	0 = Normal, 1 = Inverted	Transmit Data Inversion
I/O Rcv Clock Source Dmd Rcv Clock	Selection	0 = Dmd Rcv Clock, 1 = Internal, 2 = Mod Clock, 3 = TT Clock, 4 = External	Receive Clock Source. 'Dmd Rcv Clock' selection disables the buffer.
I/O Rcv Buffer Delay 2.0000 ms	Numeric	0.0001 to 999.9999 ms	Sets the size of the Rcv Buffer in mSec. Range is dependent on the data rate of the Rcv carrier.
I/O Rcv Buffer Size 8192 bits	Read Only	N/A	Indicates the size of the Rcv Buffer in bits.
I/O Rcv Clock Normal	Selection	0 = Normal, 1 = Inverted	Receive Clock Inversion
I/O Rcv Data Normal	Selection	0 = Normal, 1 = Inverted	Receive Data Inversion
I/O RTS Normal	Selection	0 = Normal 1 = Control CXR	Interface RTS line control
I/O CTS Normal	Selection	0 = Normal, 1 = Force Active	Interface CTS line control
I/O DCD Normal	Selection	0 = Normal, 1 = Force Active	Interface DCD line control
I/O DTR Ignore	Selection	0 = Normal, 1 = Ignore	Interface DTR line control
I/O DSR Force Active	Selection	0 = Normal, 1 = Force Active	Interface DSR line control
I/O RTS Monitor to Alarm A	Selection	0 = Disabled, 1 = to Alarm A, 2 = to Alarm B	Allows using Alarm relay contacts to show RTS Status, overriding other alarms.
Send Mux Mode Advanced	Selection	0 = Disabled, 1 = Advanced, 2 = IBS Custom 3 = IBS Standard	Enables Multiplexer to specified mode. Enable makes other menu selection below visible.

Synchronous Interface Parameters			
Representation	Type	Entry	Description
Send Mux ESC Rate 2.400 kbps	Selection	0 = Disable 1 to 7 selects standard rates 0.300 kbps – 38.4 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to ESC Communications
Send Mux MCC Rate 0.300 kbps	Selection	0 = Disable 1 to 7 selects standard rates 0.300 kbps – 38.4 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to MCC Communications.
Send Mux Alarm Channel 0.100 kbps	Selection	0 = Disabled, 1 = Enabled	Enable the backward alarms
Send Mux Overhead Ratio 3871:4096	Read Only	N/A	Shows current data to aggregate ratio for mux.
Rcv Mux Mode Advanced	Selection	0 = Disabled, 1 = Advanced 2 = IBS Custom 3 = IBS Standard	Enables Demultiplexer to specified mode. Enable makes other menu selection below visible.
Rcv Mux ESC Rate 2.400 kbps	Selection	0 = Disable 1 to 7 selects standard rates 0.300 kbps – 38.4 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to ESC Communications.
Rcv Mux MCC Rate 0.300 kbps	Selection	0 = Disable 1 to 7 selects standard rates 0.300 kbps – 38.4 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to MCC Communications
Rcv Mux Alarm Overhead Enabled	Selection	0 = Disabled, 1 = Enabled	Enable the backward alarms
Rcv Mux Overhead Ratio 3871:4096	Read Only	N/A	Shows current data to aggregate ratio for mux.
ESC Async Mode Auto Overhead Rate	Selection	0 = Disabled 1 = Auto Overhead Rate 2 = Manual Ovhd Rate	Selects method for determining the ESC overhead rate.
ESC Async Port RS-232	Selection	0 = RS-232, 1 = RS-485 2 wire, 2 = RS-485 4 wire, 3 = RS-485 Drvr On	Physical ESC port type.
ESC Async Rate 9.600 kbps	Selection	0 to 7 selects standard rates 0.300 kbps – 38.4 kbps	Physical ESC port rate at rear panel.
ESC Async Format N,8,1	Selection	0 = N,7,1 1 = P,7,1 2 = N,8,1 3 = P,8,1	Physical ESC port format at rear panel.
ESC Async CTS Normal	Selection	0 = Normal, 1 = Force Active	ESC CTS line control
ESC Async DCD Normal	Selection	0 = Normal, 1 = Force Active	ESC DCD line control

Synchronous Interface Parameters			
Representation	Type	Entry	Description
ESC Async DTR Ignore	Selection	0 = Normal, 1 = Ignore	ESC DTR line control
ESC Async DSR Force Active	Selection	0 = Normal, 1 = Force Active	ESC DRS line control
MCC Mode Full Access	Selection	0 = Disable 1 = Read Only 2 = Full Access	Sets the rights of the MCC channel.
MCC Protocol M7 Binary Packet	Selection	0 = M7 Binary Packet 1 = M500 AUPC Packet	Sets the interoperability protocol of the MCC.
MCC Send Address 1	Numeric	1 to 254, 255 is a broadcast address	Sets the address of the Send MCC port
MCC Rcv Address 1	Numeric	1 to 254, 255 is a broadcast address	Sets the address of the Rcv MCC port
MCC Activity 1	Selection	0 = None 1 = Beep 2 = Blink Online Lamp 3 = Beep & Blink Online	Sets the notification when there is MCC traffic detected.
Event Send Clock Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Send Clock activity alarm
Event Send Data Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Send Data activity alarm
Event Rcv Data Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Rcv Data activity alarm
Event Backward Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Backward alarm
Event BER Loss Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the BER Loss alarm
Event Buffer Slip Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Buffer Slip alarm
Event Minor Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Minor alarms
Event Major Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Major alarms
Event Test Active Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the Test Active alarm



Synchronous Interface Parameters			
Representation	Type	Entry	Description
Event Hardware Alarm Do Not Log	Selection	1 = Log 2 = Log & Send Alert	Selects whether to set an alert for the status of the Hardware alarm
Alarm Send Clock Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Send Data Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Send Data Idle 30 sec.	Numeric	0000 to 9999 Sec	Sets the time before an alarm is raised after there is no data detected at the Tx interface. (0 = Disable)
Alarm Rcv Data Mask to Alarm B	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Rcv Data Idle 30 sec.	Numeric	0000 to 9999 Sec	Sets the time before an alarm is raised after there is no data detected at the Rcv interface. (0 = Disable)
Alarm Backward Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm BER Loss Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Test Active Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Hardware Mask to Alarm A & B	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Test Ter Loopback Disabled	Selection	0 = Disable, 1 = Enable	Interface terrestrial loop-back send input to receive output.
Test Sat Loopback Disabled	Selection	0 = Disable, 1 = Enable	Interface satellite loop-back receive output to send input.
Test BER I/O Satellite	Selection	0 = Satellite, 1 = Interface	BERT Transmit output and Receive input direction..
Test Send BER Disabled	Selection	0 = Disable, 1 = 2047, 2 = 2 <sup>23</sup> -1 (ANSI) 3 = Insert 1 Error (if enabled)	BERT enable to modem transmit input.
Test Rcv BER 2 <sup>23</sup> -1	Selection	0 = Disable, 1 = 2047, 2 = 2 <sup>23</sup> -1 (ANSI)	BERT enable from modem receive output.
Test BER 5.253E-8	Read Only	Enter to restart test	BERT measurement of the active test if "Test Rcv BER" is active

Synchronous Interface Parameters			
Representation	Type	Entry	Description
Test BER Sync Loss 0	Read Only	Enter to restart test	Measurement of the number of sync losses in the active test if "Test Rcv BER" is active
Test BER Errors 15	Read Only	Enter to restart test	Measurement of the number of bit errors in the active test if "Test Rcv BER" is active
Test BER Bits 2.853E9	Read Only	Enter to restart test	Total Bits in active test measurement if "Test Rcv BER" is active
Test BER EFS 94.35%	Read Only	Enter to restart test	Error free seconds in the active test measurement if "Test Rcv BER" is active
Test BER Erred Sec 15	Read Only	Enter to restart test	Errored seconds in the active test measurement if "Test Rcv BER" is active
Test BER Total Sec 8485	Read Only	Enter to restart test	Total seconds in the active test measurement if "Test Rcv BER" is active
Test Send Bit Offset 0 PPM	Read Only	N/A	Monitor of the frequency offset of the incoming bit clock reference to the internal modem reference standard.
Test Rcv Bit Offset 0 PPM	Read Only	N/A	Monitor of the frequency offset of the bit clock recovered from the satellite, reference to the internal modem reference standard.
Feature Options None Available	Read Only	N/A	
Feature Activation 00000000000000000000	Numeric	20 characters	Allows entry of a Feature code to activate new features.

Table 3-33 – I7 – IP Interface Parameter Detail

I7 Interface Parameters			
Representation	Type	Entry	Description
Status IP Online, OK	Read Only	N/A	Interface Status
Status GbE Connected, 1 Gb	Read Only	N/A	Interface Mode Status
Status Ref Relay Locked, OK	Read Only	N/A	Future Option
Status Send Data Active, Ok	Read Only	N/A	Send Data Activity Status
Status Rcv Data Active, Ok	Read Only	N/A	Rcv Data Activity Status
Status Test Normal	Read Only	N/A	Interface Test status

I7 Interface Parameters			
Representation	Type	Entry	Description
Status Hardware I/O Opt Remote Ref Relay	Read Only	N/A	
Status Hardware IP Opt IP Accelerator	Read Only	N/A	
Status Hardware Type I7 IP Interface	Read Only	N/A	Indicates the type of the active interface
Status Hardware ID M709018A-1r0	Read Only	N/A	Indicates the part number of the active interface
Status Hardware S/N 1016001	Read Only	N/A	Indicates the serial number of the active interface
IP Control Mode Full Access	Selection	0 = Disable, 1 = Read Only, 2 = Full Access	
Send WAN Protocol M7 HDLC	Selection	0 = M7 HDLC 1 = M500 HDLC	
IP DHCP Enabled	Selection	0 = Disable, 1 = Enable	
IP Address 192.168.100.001	Numeric	IP v4 IP Address format	
IP Network Mask 255.255.255.0	Numeric	IP v4 IP network mask format	
IP MAC Address 00:80:A8:00:25:6C	Read Only	N/A	
IP Q7 Reset Control Watchdog	Selection	0 = Watchdog, 1 = Manual, 2 = Force Reboot Now	Selects the reset control of the I7 Controller.
IP Q7 ID PQ7-M101G-R10-2	Read Only	N/A	I7 Controller Model Number
IP Q7 Software Ver Vyatta-3.03	Read Only	N/A	I7 Controller software type and version
Stats Send Data PPS 0.015 kpps	Read Only		
Stats Send Data Packets 3.125E3	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Send Data Bytes 2.000E5	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Send Data Usage 12.66%	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Send MCC Packets 0	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Send MCC Bytes 0	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Send MCC Usage 0.00%	Read Only	Press "Edit" then "Enter" to reset the counter	

I7 Interface Parameters			
Representation	Type	Entry	Description
Stats Send Idle Packets 2.156E4	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Send Idle Bytes 1.380E6	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Send Idle Usage 87.33%	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Send Total Packets 2.468E4	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Send Total Sec. 208	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv Data PPS 0.015 kpps	Read Only		
Stats Rcv Data Packets 3.125E3	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv Data Bytes 2.000E5	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv Data Usage 12.66%	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv MCC Packets 0	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv MCC Bytes 0	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv MCC Usage 0.00%	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv Idle Packets 2.156E4	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv Idle Bytes 1.380E6	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv Idle Usage 87.33%	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv Total Packets 2.468E4	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv Total Erred 10	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv Total PER 4.051E-7	Read Only	Press "Edit" then "Enter" to reset the counter	
Stats Rcv Total Sec. 208	Read Only	Press "Edit" then "Enter" to reset the counter	
MCC Mode Full Access	Selection	0 = Disable 1 = Read Only 2 = Full Access	Sets the rights of the MCC channel.
MCC Protocol M7 Binary Packet	Selection	0 = M7 Binary Packet	Sets the MCC protocol.

I7 Interface Parameters			
Representation	Type	Entry	Description
MCC Send Rate Limit 10.0 kbps	Numeric	Entered in kbps up to the maximum rate of the satellite data rate.	Sets the maximum rate of the MCC channel
MCC Send Address 1	Numeric	1 to 254, 255 is a broadcast address	Sets the address of the Send MCC port
MCC Rcv Address 1	Numeric	1 to 254, 255 is a broadcast address	Sets the address of the Rcv MCC port
MCC Activity 1	Selection	0 = None 1 = Beep 2 = Blink Online Lamp 3 = Beep & Blink Online	Sets the notification when there is MCC traffic detected.
Ref Relay Mode Output	Selection		Future Option
Ref Relay Frequency 2.048 MHz	Numeric		Future Option
Event IP Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the IP alarm
Event Send Data Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Send Data alarm
Event Rcv Data Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Rcv Data alarm
Event Ref Relay Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	(Future Option) Selects whether to log the change in status of the Ref Relay alarm
Event Minor Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Minor alarms
Event Major Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Major alarms
Event Test Active Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the Test Active alarm
Event Hardware Alarm Do Not Log	Selection	1 = Log 2 = Log & Send Alert	Selects whether to set an alert for the status of the Hardware alarm
Alarm IP Mask Mute & Alarm A & B	Selection	0=None, 1=A, 2=B, 3=A&B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination of alarm and selects whether to mute the carrier.

I7 Interface Parameters			
Representation	Type	Entry	Description
Alarm Send Data Mask to Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	Selects destination of alarm
Alarm Send Data Idle 30 Sec.	Numeric	0000 to 9999 Sec	Sets the time before an alarm is raised after there is no data detected at the Tx interface. (0 = Disable)
Alarm Rcv Data Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Rcv Data Idle 30 Sec.	Numeric	0000 to 9999 Sec	Sets the time before an alarm is raised after there is no data detected at the Rcv interface. (0 = Disable)
Alarm Ref Relay Mask to Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	(Future Option) Selects destination of alarm
Alarm Test Active Mask to Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	Selects destination of alarm
Alarm Hardware Mask to Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	Selects destination of alarm
Test Sat WAN Loopback Disabled	Selection	0 = Disabled, 1 = Enabled	Interface satellite loop-back receive output to send input
Test Ter WAN Loopback Disabled	Selection	0 = Disabled, 1 = Enabled	Interface terrestrial loop-back send input to receive output.
Test Ter HDLC Loopback Disabled	Selection	0 = Disabled, 1 = Enabled	Interface terrestrial loop-back send input to receive output.
Feature Options None			Shows the optional active features capability of the I7
Feature Activation 00000000000000000000	Numeric	20 characters	Allows entry of a Feature code to activate new features.

Table 3-34 – E7 – Express Ethernet Interface Parameter Detail

E7 Interface Parameters			
Representation	Type	Entry	Description
Status I/O Online, OK	Read Only	N/A	Interface Status
Status Port 1 Connected, 1 Gb	Read Only	N/A	Port 1 Status
Status Port 2 Connected, 100 Mb Fdx	Read Only	N/A	Port 2 Status
Status Port 3 UNCONNECTED	Read Only	N/A	Port 3 Status

E7 Interface Parameters			
Representation	Type	Entry	Description
Status Port 4 Disabled	Read Only	N/A	Port 4 Status
Status Port 5 Not Installed	Read Only	N/A	SFP Port 5 Status
Status Send Buffer 0 ms Data Backlog	Read Only	N/A	Input Ethernet Buffer Status
Status Send Data Active, Ok	Read Only	N/A	Send Data Activity Status
Status Rcv Data Active, Ok	Read Only	N/A	Rcv Data Activity Status
Status Ref Relay Locked OK	Read Only	N/A	Future Option
Status Test Normal	Read Only	N/A	Interface Test status
Status Hardware Type E7 Express Interface	Read Only	N/A	Indicates the type of the active interface
Status Hardware ID M709017A-1r9.91	Read Only	N/A	Indicates the part number of the active interface
Status Hardware S/N 100360	Read Only	N/A	Indicates the serial number of the active interface
I/O Port 1 Mode Data I/O	Selection	0 = Disable, 1 = Data I/O 2 = Dmd Output I/O 3 = Dmd Input I/O 4 = Switch M&C I/O	Sets the mode of the Ethernet Port
I/O Port 1 Connection Auto	Selection	0 = Auto, 1 = 1000BASE-T 2 = 100BASE-T Full Duplex 3 = 100BASE-T Half Duplex 4 = 10BASE-T Full Duplex 5 = 10BASE-T Half Duplex	Sets the connection type of the Ethernet Port
I/O Port 1 VLAN ID 1	Numeric	Valid ID: 1 to 4094, 0 = Disabled, 4095 reserved	VLAN ID for Port 1
I/O Port 2 Mode Data I/O	Selection	0 = Disable, 1 = Data I/O 2 = Dmd Output I/O 3 = Dmd Input I/O 4 = Switch M&C I/O	Sets the mode of the Ethernet Port

E7 Interface Parameters			
Representation	Type	Entry	Description
I/O Port 2 Connection Auto	Selection	0 = Auto, 1 = 1000BASE-T 2 = 100BASE-T Full Duplex 3 = 100BASE-T Half Duplex 4 = 10BASE-T Full Duplex 5 = 10BASE-T Half Duplex	Sets the connection type of the Ethernet Port
I/O Port 2 VLAN ID 4094	Numeric	Valid ID: 1 to 4094, 0 = Disabled, 4095 reserved	VLAN ID for Port 2
I/O Port 3 Mode Data I/O	Selection	0 = Disable, 1 = Data I/O 2 = Dmd Output I/O 3 = Dmd Input I/O 4 = Switch M&C I/O	Sets the mode of the Ethernet Port
I/O Port 3 Connection Auto	Selection	0 = Auto, 1 = 1000BASE-T 2 = 100BASE-T Full Duplex 3 = 100BASE-T Half Duplex 4 = 10BASE-T Full Duplex 5 = 10BASE-T Half Duplex	Sets the connection type of the Ethernet Port
I/O Port 3 VLAN ID Disabled	Numeric	Valid ID: 1 to 4094, 0 = Disabled, 4095 reserved	VLAN ID for Port 3
I/O Port 4 Mode Data I/O	Selection	0 = Disable, 1 = Data I/O 2 = Dmd Output I/O 3 = Dmd Input I/O 4 = Switch M&C I/O	Sets the mode of the Ethernet Port
I/O Port 4 Connection Auto	Selection	0 = Auto, 1 = 1000BASE-T 2 = 100BASE-T Full Duplex 3 = 100BASE-T Half Duplex 4 = 10BASE-T Full Duplex 5 = 10BASE-T Half Duplex	Sets the connection type of the Ethernet Port
I/O Port 4 VLAN ID Disabled	Numeric	Valid ID: 1 to 4094, 0 = Disabled, 4095 reserved	VLAN ID for Port 4
I/O Port 5 Mode Data I/O	Selection	0 = Disable, 1 = Data I/O 2 = Dmd Output I/O 3 = Dmd Input I/O	Sets the mode of the Ethernet Port



<b>E7 Interface Parameters</b>			
<b>Representation</b>	<b>Type</b>	<b>Entry</b>	<b>Description</b>
I/O Port 5 Connection Auto	Read Only	0 = Auto	Sets the connection type of the Ethernet Port
I/O Port 5 VLAN ID Disabled	Numeric	Valid ID: 1 to 4094, 0 = Disabled, 4095 reserved	VLAN ID for Port 5
Send WAN Mode Bridge PTP	Selection	0 = Bridge PTP 1 = Hub Bridge PTMP 2 = Remote Bridge PTMP 3 = Mesh Bridge	Sets the WAN network type
Send WAN Protocol M7 HDLC	Selection	0 = M7 HDLC 1 = M500 HDLC	Sets the protocol of the HDLC for legacy support
Rcv WAN Mode Bridge PTP	Selection	0 = Bridge PTP 1 = Hub Bridge PTMP 2 = Remote Bridge PTMP 3 = Mesh Bridge	Sets the WAN network type
Rcv WAN Protocol M7 HDLC	Selection	0 = M7 HDLC 1 = M500 HDLC	Sets the protocol of the HDLC for legacy support
QOS Mode WRED	Selection	0 = WRED 1 = Strict Priority	Sets the flow control mode
QOS WAN Drop None < 50 ms	Numeric	Set value in mSec	Sets the time before an the WAN buffer will initiate flow control
QOS WAN Drop All > 2938 ms	Numeric	Set value in mSec	Sets the time before a the WAN buffer will drop all packets that overfills the buffer.
Stats Send Data PPS 38.871 kpps	Read Only		Indicates the Send rate of the Ethernet Data traffic
Stats Send Data Packets 7.812E7	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of Ethernet packets sent
Stats Send Data Bytes 9.374E9	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of Ethernet Bytes sent
Stats Send Data Usage 80.42%	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the percentage of the WAN link that is used by the Ethernet port
Stats Send MCC Packets 3.413E3	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of MCC packets sent
Stats Send MCC Bytes 9.374E4	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of MCC Bytes sent
Stats Send MCC Usage 18.56%	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the percentage of the WAN link that is used by the MCC port
Stats Send Idle Packets 3.413E3	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of Idle packets sent

E7 Interface Parameters			
Representation	Type	Entry	Description
Stats Send Idle Bytes 9.374E3	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of Idle Bytes sent
Stats Send Idle Usage 1.71%	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the percentage of the WAN link that is used by the Idle packets
Stats Send Total Packets 7.812E7	Read Only	Press "Edit" then "Enter" to reset the counter	Indicated the total number of packets send for all data types
Stats Send Total Dropped 1.282E3	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the total number of packets dropped for all data types
Stats Send Total PDR 1.641E-5	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the total packet dropped rate for all data types.
Stats Send Total Sec. 9.934E3	Read Only	Press "Edit" then "Enter" to reset the counter	Indicated the number of seconds since the status counter was reset.
Stats Rcv Data PPS 38.871 kpps	Read Only		Indicates the Rcv rate of the Ethernet Data traffic
Stats Rcv Data Packets 7.812E7	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of Ethernet packets received
Stats Rcv Data Bytes 9.374E9	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of Ethernet Bytes received
Stats Rcv Data Usage 80.42%	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the percentage of the WAN link that is used by the Ethernet port
Stats Rcv MCC Packets 3.413E3	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of MCC packets received
Stats Rcv MCC Bytes 9.374E4	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of MCC Bytes received
Stats Rcv MCC Usage 18.56%	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the percentage of the WAN link that is used by the MCC port
Stats Rcv Idle Packets 3.413E3	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of Idle packets received
Stats Rcv Idle Bytes 9.374E3	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of Idle Bytes received
Stats Rcv Idle Usage 1.71%	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the percentage of the WAN link that is used by the Idle packets
Stats Rcv Total Packets 7.812E7	Read Only	Press "Edit" then "Enter" to reset the counter	Indicated the total number of packets received for all data types
Stats Rcv Total Erred 1.282E3	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the number of errored packets
Stats Rcv Total PER 1.641E-5	Read Only	Press "Edit" then "Enter" to reset the counter	Indicates the packet error rate

<b>E7 Interface Parameters</b>			
<b>Representation</b>	<b>Type</b>	<b>Entry</b>	<b>Description</b>
Stats Rcv Total Sec. 4.551E4	Read Only	Press "Edit" then "Enter" to reset the counter	Indicated the number of seconds since the status counter was reset
MCC Mode Full Access	Selection	0 = Disable 1 = Read Only 2 = Full Access	Sets the rights of the MCC channel.
MCC Protocol M7 Binary Packet	Selection	0 = M7 Binary Packet	Sets the protocol of the MCC
MCC Send Rate Limit 10.0 kbps	Numeric	Entered in kbps up to the maximum rate of the satellite data rate.	Sets the maximum rate of the MCC channel
MCC Send Address 1	Numeric	1 to 254, 255 is a broadcast address	Sets the address of the Send MCC port
MCC Rcv Address 1	Numeric	1 to 254, 255 is a broadcast address	Sets the address of the Rcv MCC port
MCC Activity 1	Selection	0 = None 1 = Beep 2 = Blink Online Lamp 3 = Beep & Blink Online	Sets the notification when there is MCC traffic detected.
Ref Relay Mode Output	Selection	0 = Disable, 1 =	Future Option
Ref Relay Frequency 2.048 MHz	Numeric		Future Option
Event I/O Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the IO alarm
Event Send Data Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Send Data alarm
Event Rcv Data Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Rcv Data alarm
Event Ref Relay Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	(Future Option) Selects whether to log the change in status of the Ref Relay alarm
Event Minor Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Minor alarms
Event Major Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Major alarms
Event Test Active Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the Test Active alarm

E7 Interface Parameters			
Representation	Type	Entry	Description
Event Hardware Alarm Do Not Log	Selection	1 = Log 2 = Log & Send Alert	Selects whether to set an alert for the status of the Hardware alarm
Alarm IO Mask Mute & Alarm A & B	Selection	0=None, 1=A, 2=B, 3=A&B, 4 = Mute CXR, 5 = Mute CXR & Alarm A, 6 = Mute CXR & Alarm B, 7 = Mute CXR & Alarm A & B	Selects destination of alarm and selects whether to mute the carrier.
Alarm Send Data Mask to Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	Selects destination of alarm
Alarm Send Data Idle 30 Sec.	Numeric	0000 to 9999 Sec	Sets the time before an alarm is raised after there is no data detected at the Tx interface. (0 = Disable)
Alarm Rcv Data Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Rcv Data Idle 30 Sec.	Numeric	0000 to 9999 Sec	Sets the time before an alarm is raised after there is no data detected at the Rcv interface. (0 = Disable)
Alarm Ref Relay Mask to Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	(Future Option) Selects destination of alarm
Alarm Test Active Mask to Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	Selects destination of alarm
Alarm Hardware Mask to Alarm A	Selection	0=None, 1=to Alarm A, 2=to Alarm B, 3=to Alarm A & B	Selects destination of alarm
Test Sat WAN Loopback Disabled	Selection	0 = Disabled, 1 = Enabled	Interface satellite loop-back receive output to send input
Test Ter WAN Loopback Disabled	Selection	0 = Disabled, 1 = Enabled	Interface terrestrial loop-back send input to receive output.
Feature Options None	Read Only	N/A	
Feature Activation 00000000000000000000	Numeric	20 characters	Allows entry of a Feature code to activate new features.

Table 3-35 – G7 – Dual G.703/E1 Interface Parameter Detail

G7 Interface Parameters			
Representation	Type	Entry	Description
Status I/O Online, OK	Read Only	N/A	Interface Status
Status I/O Port 1 Normal	Read Only	N/A	Port 1 Interface Status
Status I/O Port 2 Normal	Read Only	N/A	Port 2 Interface Status
Status I/O Port 1 Rcv Buffer 100%, 0 Slips	Read Only and Reset	Press "Edit" then "Enter" to re-center the buffer.	Only shows if the Rcv Buffer is active. 100% is buffer center.
Status I/O Port 2 Rcv Buffer 100%, 0 Slips	Read Only and Reset	Press "Edit" then "Enter" to re-center the buffer.	Only shows if the Rcv Buffer is active. 100% is buffer center.
Status I/O Port 1 Input Level	Read Only	N/A	Port 1 Interface Level Status
Status I/O Port 2 Input Level	Read Only	N/A	Port 2 Interface Level Status
Status I/O Port 1 BPV Errors	Read Only and Reset	Press "Edit" then "Enter" to reset	Port 1 bipolar violation errors
Status I/O Port 2 BPV Errors	Read Only and Reset	Press "Edit" then "Enter" to reset	Port 2 bipolar violation errors
Status I/O Port 1 CRC Errors	Read Only and Reset	Press "Edit" then "Enter" to reset	Port 1 cyclic redundancy check errors
Status I/O Port 2 CRC Errors	Read Only and Reset	Press "Edit" then "Enter" to reset	Port 2 cyclic redundancy check errors
Status ESC Signaling RTS CTS DCD DTR DSR	Read Only	N/A	Interface ESC signaling status. Lower case indicates not-active status, upper case indicates active status. Only shown when the ESC channel is active.
Status Test BER Active	Read Only	N/A	Interface Test status
Status Hardware Type Dual G703 Interface	Read Only	N/A	Indicates the type of the active interface
Status Hardware ID M709014A-100r1.00	Read Only	N/A	Indicates the part number of the active interface
Status Hardware S/N 100048	Read Only	N/A	Indicates the serial number of the active interface
I/O Port 1 Mode E1 Balanced 120 Ohm	Selection	0 = Disable 1 = E1 Balanced 120 Ohm 2 = E1 Unbalanced 75 Ohm	Interface Port 1 electrical mode.
I/O Port 1 Send Coding HDB3	Selection	0 = AMI, 1 = HDB3	Sets the line coding of the Port 1 E1 Send Data

G7 Interface Parameters			
Representation	Type	Entry	Description
I/O Port 1 Send Framing Full E1	Selection	0 = Full E1 1 = PCM30-CAS 2 = PCM31-CCS 3 = PCM30-CAS w/TS 0 4 = PCM31-CCS w/TS 0	Sets the Framing of the Port 1 E1 Send Data
I/O Port 1 Send Drop Map Chan 1 of 5 <= TS 2	Selection	Press Edit to start the Drop Map setup. Press Up/Down key to select the Satellite Channel, Press Left/Right keys to change G703 Timeslot to 'drop' into the displayed Satellite Channel. Press Enter to program all Drop Channels and Timeslots. Chan xx of yy <= TS zz xx = 01 to 31 (Sat Channel) yy = Total number of available Sat Channels zz = 01 to 31 (G703 Time Slots)	Sets the map between the terrestrial G.703 time slots and the satellite channels. The number of available satellite channels is determined by the number of enabled G703 time slots. NOTE: Setting up the Drop map via the Web Interface gives a more visual representation.
I/O Port 1 Send Nx64 2048.000 kbps	Numeric	64.000 to 2048.000 kbps in 64 kbps steps. If Send Framing is set to Full E1, 2048.000 is the only setting	Sets the Interface Port 1 Send data rate
I/O Port 1 Send CRC Disabled	Selection	0 = Disabled, 1 = Enabled	Enables Port 1 Send CRC.
I/O Port 1 Rcv Coding HDB3	Selection	0 = AMI, 1 = HDB3	Sets the line coding of the Port 1 E1 Rcv Data
I/O Port 1 Rcv Framing Full E1	Selection	0 = Full E1 1 = PCM30-CAS 2 = PCM31-CCS 3 = PCM30-CAS w/TS 0 4 = PCM31-CCS w/TS 0	Sets the Framing of the Port 1 E1 Rcv Data

G7 Interface Parameters			
Representation	Type	Entry	Description
I/O Port 1 Rcv Insert Map Chan 2 of 5 => TS32	Selection	Press Edit to start the Insert Map setup. Press Up/Down key to select the Satellite Channel, Press Left/Right keys to change G703 Timeslot that will receive (insert) the displayed Satellite Channel. Press Enter to program all Insert Channels and Timeslots. Chan xx of yy => TS zz xx = 01 to 31 (Sat Channel) yy = Total number of available Sat Channels zz = 01 to 31 (G703 Time Slots)	Sets the map between the satellite frame time slots and the terrestrial G.703 time slots. The number of available satellite time slots is determined by the number of enabled G703 time slots. NOTE: Setting up the Insert map via the Web Interface gives a more visual representation.
I/O Port 1 Rcv Nx64 2048.000 kbps	Numeric	64.000 to 2048.000 kbps in 64 kbps steps. If Rcv Framing is set to Full E1, 2048.000 is the only setting	Sets the Interface Port 1 Rcv data rate
I/O Port 1 Rcv CRC Disabled	Selection	0 = Disabled, 1 = Enabled	Enables Port 1 Rcv CRC.
I/O Port 1 Rcv Clock Source Send Port 1 Clock	Selection	0 = Dmd Rcv Clock 1 = Internal 2 = Send Port 1 Clock 3 = Send Port 1 Clock & Data 4 = Send Port 2 Clock 5 = Send Port 2 Clock & Data	Sets the output clock for the Port 1 Rcv Buffer Any selection other than Dmd Rcv Clock makes other menu selection below visible.
I/O Port 1 Rcv Buffer Delay 2.0000 ms	Numeric	0.0001 to 999.9999 ms	Sets the size of the Port 1 Rcv Buffer in mSec. Range is dependent on the data rate of the Rcv carrier.
I/O Port 1 Rcv Buffer Size 8192 bits	Read Only	N/A	Indicates the size of the Port 1 Rcv Buffer in bits.
I/O Port 2 Mode E1 Balanced 120 Ohm	Selection	0 = Disable 1 = E1 Balanced 120 Ohm 2 = E1 Unbalanced 75 Ohm	Interface Port 2 electrical mode.
I/O Port 2 Send Coding HDB3	Selection	0 = AMI, 1 = HDB3	Sets the line coding of the Port 2 E1 Send Data

G7 Interface Parameters			
Representation	Type	Entry	Description
I/O Port 2 Send Framing Full E1	Selection	0 = Full E1 1 = PCM30-CAS 2 = PCM31-CCS 3 = PCM30-CAS w/TS 0 4 = PCM31-CCS w/TS 0	Sets the Framing of the Port 2 E1 Send Data
I/O Port 2 Send Drop Map Chan 1 of 5 <= TS 2	Selection	Press Edit to start the Drop Map setup. Press Up/Down key to select the Satellite Channel, Press Left/Right keys to change G703 Timeslot to 'drop' into the displayed Satellite Channel. Press Enter to program all Drop Channels and Timeslots. Chan xx of yy <= TS zz xx = 01 to 31 (Sat Channel) yy = Total number of available Sat Channels zz = 01 to 31 (G703 Time Slots)	Sets the map between the terrestrial G.703 time slots and the satellite channel. The number of available satellite channels is determined by the by the number of enabled G703 time slots. NOTE: Setting up the Drop map via the Web Interface gives a more visual representation.
I/O Port 2 Send Nx64 2048.000 kbps	Numeric	64.000 to 2048.000 kbps in 64 kbps steps. If Send Framing is set to Full E1, 2048.000 is the only setting	Sets the Interface Port 2 Send data rate
I/O Port 2 Send CRC Disabled	Selection	0 = Disabled, 1 = Enabled	Enables Port 2 Send CRC.
I/O Port 2 Rcv Coding HDB3	Selection	0 = AMI, 1 = HDB3	Sets the line coding of the Port 2 E1 Rcv Data
I/O Port 2 Rcv Framing Full E1	Selection	0 = Full E1 1 = PCM30-CAS 2 = PCM31-CCS 3 = PCM30-CAS w/TS 0 4 = PCM31-CCS w/TS 0	Sets the Framing of the Port 2 E1 Rcv Data



G7 Interface Parameters			
Representation	Type	Entry	Description
I/O Port 2 Rcv Insert Map Chan 2 of 5 => TS32	Selection	Press Edit to start the Insert Map setup. Press Up/Down key to select the Satellite Channel, Press Left/Right keys to change G703 Timeslot that will receive (insert) the displayed Satellite Channel. Press Enter to program all Insert Channels and Timeslots. Chan xx of yy => TS zz xx = 01 to 31 (Sat Channel) yy = Total number of available Sat Channels zz = 01 to 31 (G703 Time Slots)	Sets the map between the satellite frame time slots and the terrestrial G.703 time slots. The number of available satellite time slots is determined by the number of enabled G703 time slots. NOTE: Setting up the Insert map via the Web Interface gives a more visual representation.
I/O Port 2 Rcv Nx64 2048.000 kbps	Numeric	64.000 to 2048.000 kbps in 64 kbps steps. If Rcv Framing is set to Full E1, 2048.000 is the only setting	Sets the Interface Port 2 Rcv data rate
I/O Port 2 Rcv CRC Disabled	Selection	0 = Disabled, 1 = Enabled	Enables Port 2 Rcv CRC.
I/O Port 2 Rcv Clock Source Send Port 1 Clock	Selection	0 = Dmd Rcv Clock 1 = Internal 2 = Send Port 1 Clock 3 = Send Port 2 Clock	Sets the output clock for the Port 2 Rcv Buffer Any selection other than Dmd Rcv Clock makes other menu selection below visible
I/O Port 2 Rcv Buffer Delay 2.0000 ms	Numeric	0.0001 to 999.9999 ms	Sets the size of the Port 2 Rcv Buffer in mSec. Range is dependent on the data rate of the Rcv carrier
I/O Port 2 Rcv Buffer Size 8192 bits	Read Only	N/A	Indicates the size of the Port 2 Rcv Buffer in bits
Send Mux Mode Advanced	Selection	0 = Disabled 1 = Advanced 2 = IBS Custom	Enables Multiplexer to specified mode. Enable makes other menu selection below visible
Send Mux ESC Rate 1.200 kbps	Numeric	0.000 = Disable 0.300 to 29428.110 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to the ESC channel
Send Mux MCC Rate 0.300 kbps	Numeric	0.000 = Disable 0.300 to 29428.110 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to (MCC) Modem Control Communications

G7 Interface Parameters			
Representation	Type	Entry	Description
Send Mux Alarm Channel Disabled	Selection	0 = Disabled, 1 = Enabled	Enable the backward alarms
Send Mux Overhead Ratio 16379:16384	Read Only	N/A	Shows current data-to-aggregate ratio for mux
Rcv Mux Mode Advanced	Selection	0 = Disabled 1 = Advanced 2 = IBS Custom	Enables Demultiplexer to specified mode. Any selection other than Disabled makes other menu selection below visible
Rcv Mux ESC Rate 1.200 kbps	Numeric	0.000 = Disable 0.300 to 29428.110 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to the ESC channel
Rcv Mux MCC Rate 0.300 kbps	Numeric	0.000 = Disable 0.300 to 29428.110 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to (MCC) Modem Control Communications.
Rcv Mux Alarm Channel Enabled	Selection	0 = Disabled 1 = Enabled	Enable the backward alarms
Rcv Mux Overhead Ratio 16384:16379	Read Only	N/A	Shows current data-to-aggregate ratio for mux
ESC Async Mode Auto Overhead Rate	Selection	0 = Disable 1 = Auto Overhead Rate 2 = Manual Overhead Rate	Activates the ESC Port on the rear panel for Auto or Manual baud rate Any selection other than Disabled makes other menu selection below visible
ESC Async Port RS-232	Selection	0 = RS-232, 1 = RS-485 2 wire, 2 = RS-485 4 wire, 3 = RS-485 Drvr On	Interface type of the ESC port on the rear panel.
ESC Async Rate 9.600 kbps	Numeric	0.300 – 1000.000 kbps	Baud rate at the ESC port on the rear panel.
ESC Async Format N,8,1	Selection	0 = N,7,1, 1 = P,7,1 2 = N,8,1 3 = P,8,1	Format of the ESC port on the rear panel
ESC Async CTS Normal	Selection	0 = Normal 1 = Force Active	ESC CTS line control
ESC Async DCD Normal	Selection	0 = Normal, 1 = Force Active	ESC DCD line control
ESC Async DTR Ignore	Selection	0 = Normal, 1 = Ignore	ESC DTR line control
ESC Async DSR Force Active	Selection	0 = Normal, 1 = Force Active	ESC DRS line control

G7 Interface Parameters			
Representation	Type	Entry	Description
MCC Mode Full Access	Selection	0 = Disable 1 = Read Only 2 = Full Access	Activates the Modem Control Channel (MCC) Any selection other than Disabled makes other menu selection below visible
MCC Protocol M7 Binary Packet	Selection	0 = M7 Binary Packet 1 = M500 AUPC Packet	Sets the Protocol of the MCC
MCC Send Address 1	Numeric	0 to 255, 255 = Global	Sets the Send Address of the MCC
MCC Rcv Address 1	Numeric	0 to 254	Sets the Rcv Address of the MCC
MCC Activity None	Selection	0 = None 1 = Beep 2 = Blink Online Lamp 3 = Beep & Blink Online Lamp	Sets the front panel indication on MCC activity.
Event Send LOS Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Loss Of Signal Alarm.
Event Send LFA Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Loss of Frame Alignment Alarm.
Event Send LMFA Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Loss of Multi-Frame Alignment Alarm
Event Send AIS Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Alarm Indication Signal Alarm
Event Send TS16 AIS Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Alarm Indication Signal Alarm for Time Slot 16
Event Send RAI Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Remote Alarm Indication Alarm.
Event Rcv Frame Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Rcv Frame Alignment Alarm.
Event Rcv Output Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in activity status of the Rcv data output.
Event Rcv Buffer Slip Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of slip in the Rcv Buffer.
Event Backward Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Backward alarm

G7 Interface Parameters			
Representation	Type	Entry	Description
Event BER Loss Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the BER Alarm.
Event Minor Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Minor alarms
Event Major Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Major alarms
Event Test Active Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the Test Active alarm
Event Hardware Alarm Do Not Log	Selection	1 = Log 2 = Log & Send Alert	Selects whether to set an alert for the status of the Hardware alarm
Alarm Send LOS Alarm Do Not Log	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Send LFA Alarm Do Not Log	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Send LMFA Alarm Do Not Log	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Send AIS Alarm Do Not Log	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Send TS16 AIS Alarm Do Not Log	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Send RAI Alarm Do Not Log	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Rcv Frame Alarm Do Not Log	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Rcv Output Alarm Do Not Log	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Backward Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm BER Loss Mask Do Not Log	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm

<b>G7 Interface Parameters</b>			
<b>Representation</b>	<b>Type</b>	<b>Entry</b>	<b>Description</b>
Alarm Test Active Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Hardware Mask to Alarm A & B	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Test Ter Loopback Disabled	Selection	0 = Disabled, 1 = Port 1, 2 = Port 2, 3 = Port 1 & 2	Set Test Terrestrial Loopback option.
Test Sat Loopback Disabled	Selection	0 = Disabled, 1 = Port 1, 2 = Port 2, 3 = Port 1 & 2	Set Test Satellite Loopback option.
Test BER I/O Port 1 Satellite	Selection	0 = Port 1 Satellite, 1 = Port 1 Terrestrial, 2 = Port 2 Satellite, 3 = Port 2 Terrestrial	Set Port for BER Testing.
Test Send BER Disabled	Selection	0 = Disabled, 1 = 2047, 2 = 2 <sup>23</sup> -1 (ANSI), 3 = 2 <sup>23</sup> -1 (EURO), 4 = Insert Error	Set Test BER pattern and manually insert an error.
Test Send BER Map BER => TS 5	Selection	Column: BER => TS xx xx = 01 to 31. Row: 0 = Disable, 1 = Enable Press Up/Down key to toggle between Off and On. Press Left/Right keys to change Timeslot channel number. Press enter to program the timeslots.	Sets the time slot(s) to insert the BER test data.
Test Send BER Nx64 Rate 128 kbps	Numeric	64.000 to 2048.000 kbps in 64 kbps steps. If Rcv Framing is set to Full E1, 2048.000 is the only setting	Sets the Send BER Test data rate
Test Rcv BER Disabled	Selection	0 = Disabled, 1 = 2047, 2 = 2 <sup>23</sup> -1 (ANSI), 3 = 2 <sup>23</sup> -1 (EURO)	Set Rcv Test BER pattern.

G7 Interface Parameters			
Representation	Type	Entry	Description
Test Rcv BER Map BER <= TS 5	Selection	Column: BER <= TS xx xx = 01 to 31. Row: 0 = Disable, 1 = Enable Press Up/Down key to toggle between Off and On. Press Left/Right keys to change Timeslot channel number. Press enter to program the timeslots.	Sets the time slot(s) to receive the BER test data.
Test Rcv BER Nx64 Rate 128 kbps	Numeric	64.000 to 2048.000 kbps in 64 kbps steps. If Rcv Framing is set to Full E1, 2048.000 is the only setting	Sets the receive BER Test data rate
Test BER 5.253E-8	Read Only	Press "Edit" then "Enter" to restart	BER measurement of the active test if "Test Rcv BER" is active
Test BER Sync Loss 0	Read Only	Press "Edit" then "Enter" to restart	Measurement of the number of sync losses in the active test if "Test Rcv BER" is active
Test BER Errors 15	Read Only	Press "Edit" then "Enter" to restart	Measurement of the number of bit errors in the active test if "Test Rcv BER" is active
Test BER Bits 2.853E9	Read Only	Press "Edit" then "Enter" to restart	Total Bits in active test measurement if "Test Rcv BER" is active
Test BER EFS 94.35%	Read Only	Press "Edit" then "Enter" to restart	Error free seconds in the active test measurement if "Test Rcv BER" is active
Test BER Erred Sec 15	Read Only	Press "Edit" then "Enter" to restart	Errored seconds in the active test measurement if "Test Rcv BER" is active
Test BER Total Sec 8485	Read Only	Press "Edit" then "Enter" to restart	Total seconds in the active test measurement if "Test Rcv BER" is active
Feature Options None Available	Read Only	N/A	
Feature Activation 00000000000000000000	Numeric	20 characters	Allows entry of a Feature code to activate new features.

Table 3-36 – High Speed Serial Interface (HSSI) Parameter Detail

High Speed Serial Interface Parameters			
Representation	Type	Entry	Description
Status I/O Online	Read Only	N/A	Interface Status

High Speed Serial Interface Parameters			
Representation	Type	Entry	Description
Status Send Clock Locked, Ok	Read Only	N/A	
Status Send Data Active, Ok	Read Only	N/A	
Status Rcv Buffer 100%, 0 Slips	Read Only and Reset	Press "1" then "Enter" to re-center the buffer. Press "0" then "Enter" to clear the "Slip Status".	Only shows if the Rcv Buffer is active. 100% is buffer center.
Status Rcv Data Active, Ok	Read Only	N/A	
Status I/O Signaling ta CA	Read Only	N/A	HSSI signaling status. Lower case indicates not-active status, upper case indicates active status
Status ESC Signaling rts CTS DCD dtr DSR	Read Only	N/A	Engineering service channel interface signaling status. Lower case indicates not-active status, upper case indicates active status. Only shown when the ESC channel is active.
Status Test BER Active	Read Only	N/A	Interface Test status
Status Hardware Type HSSI Interface	Read Only	N/A	Indicates the type of the active interface
Status Hardware ID M709016A-1r1.02	Read Only	N/A	Indicates the part number of the active interface
Status Hardware S/N 1016788	Read Only	N/A	Indicates the serial number of the active interface
I/O Mode HSSI	Selection	0 = Disable 1 = HSSI	Interface electrical mode.
I/O Send Clock Source TT Clock	Selection	0 = Internal, 1 = TT Clock 2 = Rcv Clock.	Transmit Clock Source.
I/O Send Data Normal	Selection	0 = Normal, 1 = Inverted	Transmit Data Inversion
I/O Rcv Clock Source Dmd Rcv Clock	Selection	0 = Dmd Rcv Clock, 1 = Internal, 2 = Mod Clock, 3 = TT Clock.	Receive Clock Source. 'Dmd Rcv Clock' selection disables the buffer.
I/O Rcv Buffer Delay 2.0000 ms	Numeric	0.0001 to 999.9999 ms	Sets the size of the Rcv Buffer in mSec. Range is dependent on the data rate of the Rcv carrier.
I/O Rcv Buffer Size 8192 bits	Read Only	N/A	Indicates the size of the Rcv Buffer in bits.
I/O Rcv Clock Normal	Selection	0 = Normal, 1 = Inverted	Receive Clock Inversion
I/O Rcv Data Normal	Selection	0 = Normal, 1 = Inverted	Receive Data Inversion

High Speed Serial Interface Parameters			
Representation	Type	Entry	Description
I/O TA Control CXR	Selection	0 = Normal 1 = Control CXR	Interface TA line control
I/O CA Normal	Selection	0 = Normal, 1 = Force Active	Interface CA line control
Send Mux Mode Advanced	Selection	0 = Disabled, 1 = Advanced 2 = IBS Custom 3 = IBS Standard,	Enables Multiplexer to specified mode. Enable makes other menu selection below visible.
Send Mux ESC Rate 2.400 kbps	Selection	0 = Disable 1 to 7 selects standard rates 0.300 kbps – 38.4 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to ESC Communications
Send Mux MCC Rate 0.300 kbps	Selection	0 = Disable 1 to 7 selects standard rates 0.300 kbps – 38.4 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to MCC Communications.
Send Mux Alarm Channel Enabled	Selection	0 = Disabled, 1 = Enabled	Enable the backward alarms
Send Mux Overhead Ratio 3871:4096	Read Only	N/A	Shows current data to aggregate ratio for mux.
Rcv Mux Mode Advanced	Selection	0 = Disabled, 1 = Advanced 2 = IBS Custom 3 = IBS Standard.	Enables Multiplexer to specified mode. Enable makes other menu selection below visible.
Rcv Mux ESC Rate 2.400 kbps	Selection	0 = Disable 1 to 7 selects standard rates 0.300 kbps – 38.4 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to ESC Communications.
Rcv Mux MCC Rate 0.300 kbps	Selection	0 = Disable 1 to 7 selects standard rates 0.300 kbps – 38.4 kbps	Only in Custom or Advanced Mode. Selects framing resources committed to MCC Communications
Rcv Mux Alarm Channel Enabled	Selection	0 = Disabled, 1 = Enabled	Enable the backward alarms
Rcv Mux Overhead Ratio 3871:4096	Read Only	N/A	Shows current data to aggregate ratio for mux.
ESC Async Mode Auto Overhead Rate	Selection	0 =	ESC port ???
ESC Async Port RS-232	Selection	0 = RS-232, 1 = RS-485 2 wire, 2 = RS-485 4 wire, 3 = RS-485 Drvr On	Physical ESC port type.
ESC Async Rate 9.600 kbps	Selection	0 to 7 selects standard rates 0.300 kbps – 38.4 kbps	Physical ESC port rate at rear panel.



High Speed Serial Interface Parameters			
Representation	Type	Entry	Description
ESC Async Format N,8,1	Selection	0 = N,7,1, 1 = P,7,1 2 = N,8,1 3 = P,8,1	Physical ESC port format at rear panel.
ESC Async CTS Normal	Selection	0 = Normal, 1 = Force Active	ESC CTS line control
ESC Async DCD Normal	Selection	0 = Normal, 1 = Force Active	ESC DCD line control
ESC Async DTR Ignore	Selection	0 = Normal, 1 = Ignore	ESC DTR line control
ESC Async DSR Force Active	Selection	0 = Normal, 1 = Force Active	ESC DRS line control
MCC Mode Full Access	Selection	0 = Disable 1 = Read Only 2 = Full Access	Activates the Modem Control Channel (MCC) Any selection other than Disabled makes other menu selection below visible
MCC Protocol M7 Binary Packet	Selection	0 = M7 Binary Packet 1 = M500 AUPC Packet	Sets the Protocol of the MCC
MCC Send Address 1	Numeric	0 to 255, 255 = Global	Sets the Send Address of the MCC
MCC Rcv Address 1	Numeric	0 to 254	Sets the Rcv Address of the MCC
MCC Activity None	Selection	0 = None 1 = Beep 2 = Blink Online Lamp 3 = Beep & Blink Online Lamp	Sets the front panel indication on MCC activity.
Event Send Clock Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Send Clock activity alarm
Event Send Data Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Send Data activity alarm
Event Rcv Data Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Rcv Data activity alarm
Event Backward Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Backward alarm
Event BER Loss Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the BER Loss alarm
Event Buffer Slip Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the change in status of the Buffer Slip alarm

High Speed Serial Interface Parameters			
Representation	Type	Entry	Description
Event Minor Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Minor alarms
Event Major Alarm Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the activity of any Major alarms
Event Test Active Do Not Log	Selection	0 = Do Not Log 1 = Log 2 = Log & Send Alert	Selects whether to log the status of the Test Active alarm
Event Hardware Alarm Do Not Log	Selection	1 = Log 2 = Log & Send Alert	Selects whether to set an alert for the status of the Hardware alarm
Alarm Send Clock Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Send Data Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Send Data Idle 30 sec.	Numeric	0000 to 9999 Sec	Sets the time before an alarm is raised after there is no data detected at the Tx interface. (0 = Disable)
Alarm Rcv Data Mask to Alarm B	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Rcv Data Idle 30 sec.	Numeric	0000 to 9999 Sec	Sets the time before an alarm is raised after there is no data detected at the Rcv interface. (0 = Disable)
Alarm Backward Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm BER Loss Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Test Active Mask to Alarm A	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Alarm Hardware Mask to Alarm A & B	Selection	0 = None, 1 = to Alarm A, 2 = to Alarm B, 3 = to Alarm A & B	Selects destination of alarm
Test Ter Loopback Disabled	Selection	0 = Disable, 1 = Enable	Interface terrestrial loop-back send input to receive output.
Test Sat Loopback Disabled	Selection	0 = Disable, 1 = Enable	Interface satellite loop-back receive output to send input.
Test BER I/O Satellite	Selection	0 = Satellite, 1 = Terrestrial	BERT Transmit output and Receive input direction..

High Speed Serial Interface Parameters			
Representation	Type	Entry	Description
Test Send BER Disabled	Selection	0 = Disable, 1 = 2047, 2 = 2 <sup>23</sup> -1 (ANSI) 3 = Insert 1 Error (if enabled)	BERT enable to modem transmit input.
Test Rcv BER 2 <sup>23</sup> -1	Selection	0 = Disable, 1 = 2047, 2 = 2 <sup>23</sup> -1 (ANSI)	BERT enable from modem receive output.
Test BER 5.253E-8	Read Only	Enter to restart test	BER measurement of the active test if "Test Rcv BER" is active
Test BER Sync Loss 0	Read Only	Enter to restart test	Measurement of the number of sync losses in the active test if "Test Rcv BER" is active
Test BER Errors 15	Read Only	Enter to restart test	Measurement of the number of bit errors in the active test if "Test Rcv BER" is active
Test BER Bits 2.853E9	Read Only	Enter to restart test	Total Bits in active test measurement if "Test Rcv BER" is active
Test BER EFS 94.35%	Read Only	Enter to restart test	Error free seconds in the active test measurement if "Test Rcv BER" is active
Test BER Erred Sec 15	Read Only	Enter to restart test	Errored seconds in the active test measurement if "Test Rcv BER" is active
Test BER Total Sec 8485	Read Only	Enter to restart test	Total seconds in the active test measurement if "Test Rcv BER" is active
Test Send Bit Offset 0 PPM	Read Only	N/A	Monitor of the frequency offset of the incoming bit clock reference to the internal modem reference standard.
Test Rcv Bit Offset 0 PPM	Read Only	N/A	Monitor of the frequency offset of the bit clock recovered from the satellite, reference to the internal modem reference standard.
Feature Options None Available	Read Only	N/A	
Feature Activation 00000000000000000000	Numeric	20 characters	Allows entry of a Feature code to activate new features.

### 3.6 Remote Command Interface Control

The modem command mode allows the use of an external controller or computer to monitor and control the modem via a packet-based message protocol. This mode normally uses the RS-485 connection which allows multiple modems (and other devices) to share the command link under control of a single or multiple entities. An RS-232 connection is also allowed but is for only a single controller and single modem and cannot share the command link with other devices.

The packets use a unique address for each controlled device, which is set using the modem's front panel. The message packets themselves use a binary format for efficiency. Contact Datum Systems for the complete control protocol.

The protocol consists of messages from the controller to the modem and response messages from the modem back to the controller. The modem never initiates communications without having first received a correctly addressed and formed message requiring a response.

Message packets to the modem can take two forms;

1. Messages requesting information in a response message or "Read";
14. Messages commanding a change in operating parameters or "Write".

Any write information is automatically saved to non-volatile memory

The packets of both incoming and outgoing messages take the same generic form. First are pad and opening flag, then the destination and source addresses, followed by the command code (and read or write mode), then necessary data. The message packet is closed with a closing flag and check word to verify the packet integrity. The use of a source address allows multiple controllers on a single control link.

NOTE: Special considerations are required when legacy modems are to be connected on the same command line with the latest modes. Contact Datum Systems for more information.

### 3.7 Modem Configuration

Configuring the modem operating parameters is essential before placing the unit into service. The modem operating parameters may be set up using the front panel, the USB or the terminal command mode. The binary remote control input may also be used if the remote interface parameters are already known and set.

#### 3.7.1 Configuring the Modem for Operation

The following description assumes that the modem setup is to be done manually at a depot location or in the field via the front panel. Alternately, the modem could be automatically set up using a controller and the command interface. No software is provided for such an external control application and therefore this task is the responsibility of the using organization.

#### 3.7.2 Setting Essential Parameters

The setting of several basic parameters is essential to achieve proper operation and carrier lock with the modem. Improper setting of any of these parameters will result in failure to communicate with the far end of the link. These basic parameters are listed here to serve as a minimum checklist for installation. There are many other parameters, which must be set on the modem to configure operation within a system. These include setting parameters for interface compatibility; automatic correction for link properties; and alarm relay and display configuration. The discussion in the following sections is to be used as a starting point and is not expected to explain every possible configuration available in the modem.

### 3.7.2.1 Modulator and Demodulator

1. Carrier Frequency (Note special procedures below available for L-Band interfaces.)
15. Modulation Mode (BPSK, QPSK, 8PSK, etc.)
16. Bit Rate
17. FEC Code Rate
18. Scrambler (Normally Enabled in IESS 308/309 mode – See “Using The Proper Scramble” below)
19. Clock sources set per system requirements.
20. Reed-Solomon Codec settings if enabled
21. IBS Multiplexer settings if enabled
22. External reference set properly

### 3.7.2.2 Modulator

1. Output Level
23. Carrier Enable
24. The L-Band modem can also supply power and reference to a BUC.

### 3.7.2.3 Demodulator

1. Carrier Acquisition Mode and Acquisition Range
25. The L-Band modems with L-Band Receive can be set to supply power at either 13 or 18 VDC and/or a 10 MHz reference signal on the receive input connector for coupling to the LNB via the receive cable.

## 3.7.3 Using the Proper Scrambler

The modem has an “Auto” mode used to automatically select the preferred scrambler setting in any FEC or other dependent mode. This replaces the previous “IESS 308” or “IESS-309” or “auto modes” used in legacy Datum modems. There is no IESS Standard covering the Turbo Product Codes FEC. The Auto mode is highly recommended. Following are the settings chosen by the modem when in Auto Scrambler mode:

- When TPC is either not installed or not enabled the preferred scrambler and descrambler is automatically selected to “IESS 308” or “IESS 309”. See below for the difference.
- When TPC is enabled but the IBS multiplexer option is not installed or not enabled “Auto” uses the new Scrambler and Descrambler option #7 “TPC Sync” this uses a synchronous scrambler specific to the TPC Codec.
- When both TPC and IBS multiplexer are installed and enabled Auto uses the “IESS 308” option.

Remember that the scrambler and descrambler may be set independently in each link direction.

### 3.7.3.1 IESS-308 Scrambler Mode Operation

- With no mux or RS, the self-synchronizing Intelsat scrambler is used
- With just the IBS mux enabled, the IBS synchronous scrambler is used
- With just the RS enabled, the RS synchronous scrambler is used
- With both IBS Mux and RS enabled, the IBS synchronous scrambler is used.

### 3.7.3.2 IESS-309 Scrambler Mode Operation

The operation is the same as the IESS-308 option with the exception that with just RS enabled, the self-synchronizing Intelsat scrambler is used.

### 3.7.3.3 Fixed Scrambler Mode Operation

The V.35 and Intelsat scrambler modes use the V.35 and Intelsat self-synchronizing scramblers respectively in all modes.

### 3.7.3.4 Alternate Scrambler Mode Operation

The alternate V.35 and alternate Intelsat scrambler mode performs a data inversion required by some legacy “Comstream” modems.

### 3.7.4 Using the Internal or an External Reference

The modem contains an internal Temperature Compensated Crystal Oscillator (TCXO) reference which determines the basic accuracy of all modem frequency and rate settings. This internal reference is nominally 2.0 ppm stability over normal operating temperature, and exhibits aging less than 1 ppm per year. If this accuracy is not sufficient, or the network operating mode dictates, an external reference can be used.

The M7L/LT, uses an Oven Controlled Crystal Oscillator (OCXO) and the standard unit has a  $1 \times 10^{-7}$  stability and  $2$  to  $3 \times 10^{-7}$  aging rate per year. The increased stability is necessary because the oscillator can be used as the reference for a BUC.

The external reference frequency is applied at the rear panel BNC connector, J1, at a frequency of 1, 5, 9 or 10 MHz. Selection of the external reference and the reference frequency are selected at the front panel from the **<Unit: Reference - Source =External>**, setting to external which then enables the entry for **<Unit: Reference - Frequency>**.

The external reference input does not perform any clean-up of an input other than band-pass filtering with a pass-band from approximately 1 to 12 MHz. The reference input should therefore be a low phase noise source.

### 3.7.5 Using the M7L/LT BUC Reference Control

The M7L/LT modem contains a high stability 10 MHz OCXO reference oscillator designed to provide a suitable reference signal to the Block Up Converter (BUC). The application of the reference to the transmit cable is under front panel or remote control, as required by the BUC. Some BUCs use the 10 MHz signal to control application of power to the final PA, removing it and going to a low power state when the 10 MHz is absent. This reference is activated in the **<Mod: BUC – 10 MHz Ref>** parameter.

NOTE: See the specifications in Appendix A for the exact reference stability, aging, phase noise and level specifications.

### 3.7.6 Using the M7L/LT LNB Reference Control

The M7L/LT modem contains a high stability 10 MHz OCXO reference oscillator designed to provide a suitable reference signal to the Low Noise Block Down Converter (LNB). The application of the reference to the receive cable is under front panel or remote control, as required by the LNB. This reference is activated in the **<Demod: LNB – 10 MHz Ref>** parameter.

NOTE: See the specifications in Appendix A for the exact reference stability, aging, phase noise and level specifications.

### 3.7.7 Using the M7L/LT Transmit RF Frequency Feature

The M7L/LT modem output can be tuned to any frequency between 950 to 2150 MHz in 1 Hz increments. The modem can display the actual satellite RF frequency being transmitted at the BUC output. To enable this feature simply supply the **<Mod: BUC – LO Frequency>** parameter with a value other than “0”. When the value set here is equal to the BUC’s LO frequency then the modem can automatically compute the RF frequency at the BUC output.

The M7L/LT modem will also set the proper spectrum for high side or low side LO. If the BUC has a Low side LO, the spectrum is not inverted and the **<Mod: BUC – Xmt Spectrum >** setting would typically be set for “Non-Inverted”.

NOTE: In a M7 Dual IF unit, the L-band frequency band must be selected prior to setting the L-band center frequency.

NOTE: After entering a new **<Mod: BUC – LO Frequency>** parameter, the modem requires a new Transmit IF frequency input to recalculate the proper output frequency setting.

To return to using the L-Band IF frequency setting, simply enter a value of “0” into the **<Mod: BUC – LO Frequency>** parameter.

Common BUC LO frequency for the 5.925 to 6.425 GHz C-Band range is 4900 MHz (low side LO), while a low side LO for the 14.0 to 14.5 GHz Ku Band range is 13050 MHz.

### 3.7.8 Using the M7L/LT Receive RF Frequency Feature

The M7L (and M7LT) can be tuned to any frequency between 950 to 2150 MHz in 1 Hz increments. The modem can display the actual satellite RF frequency being received at the LNB input. To enable this feature simply supply the **<Demod: LNB – LO Frequency>** parameter with a value other than “0”. When the value set here is equal to the LNB’s LO frequency then the modem can automatically compute the RF frequency at the LNB input.

The M7L/LT modems will also set the proper spectrum for high side or low side LO. If the LNB has a Low side LO, the spectrum is not inverted and the **<Demod: LNB – Rcv Spectrum>** setting would typically be set for “Non-Inverted”.

NOTE: After entering a new **<Demod: LNB – LO Frequency>** parameter the modem requires a new Receive IF frequency input to recalculate the proper input frequency setting.

To return to using the L-Band IF frequency setting, simply enter a value of “0” into the **<Demod: LNB – LO Frequency>** parameter.

Common LO frequency for the 3.7 to 4.2 GHz C-Band range is 5150 MHz (high side LO), while a common LO for the 11.7 to 12.2 GHz Ku Band range is 10750 MHz (low side LO).

### 3.7.9 Using the M7LT BUC Control

The M7LT offers features related to the control and use of an outdoor Block Up Converter (BUC)

- **BUC Power Control** – The M7LT contain an internal BUC power supply and internal power relay to control application of power to the L-Band transmit cable under front panel or remote control. The modem can also read the voltage and current being applied to the transmit cable.
- **Transmit Frequency Control** – When the BUC Local Oscillator or LO frequency is entered into the **<Mod: BUC – LO Frequency>** parameter, the **<Mod: IF – Frequency>** parameter requires entry of transmit frequency at the actual satellite uplink RF frequency. To return to using L-Band IF frequencies set the **<Mod: BUC – LO Frequency>** parameter to “0”.
- **BUC Transmit Gain** – The **<Mod: BUC – Xmt Gain>** parameter is used to set the desired gain of the BUC.
- **BUC Transmit Level Max** – When the **<Mod: BUC – Xmt Level Max>** parameter is set, the M7LT will provide an alarm if the output level exceeds the setting.
- **BUC FSK Remote M&C** – When the **<Mod: BUC – FSK Remote M&C>** parameter is “Enabled”, the M7LT provides the ability to control a ‘smart BUC’ from the front panel or remotely via the control interface.

### 3.7.10 Using the M7LT LNB Control

The M7LT offers features related to the control and use of an outdoor Low Noise Block Down Converter (LNB).

- **Receive Frequency Control** – When the LNB Local Oscillator or LO frequency is entered into the **<Demod: LNB – LO Frequency>** parameter the **<Demod: IF – Frequency>** parameter requires entry of receive frequency at the actual satellite downlink RF frequency. To return to using L-Band IF frequencies set the **<Demod: LNB – LO Frequency>** parameter to “0”.
- **LNB Power Control** – The M7LT contain an internal LNB power supply and internal power relay to control application of power to the LNB’s receive output cable under front panel or

remote control. The voltage applied can be chosen for either 18VDC or 13 VDC. The modem can also read the voltage and current being applied to the receive cable.

### 3.7.11 Carrier Acquisition Parameters

The modem has two main modes and several programmable receive carrier acquisition parameters available. These parameters control the initial acquisition of a carrier and reacquisition of a carrier that has been removed and reapplied.

There are two acquisition methods used by the modem. The normal mode for fastest possible acquisition (especially at low data rates) is the “Fast” mode which utilizes an onboard digital signal processor (DSP) to mathematically determine the location of the carrier and lock as fast as possible. This mode initially goes for the largest carrier power within the acquisition range. A new acquisition attempt will always repeat the same process and go to the same carrier. The “fast” acquisition mode is optimized for the fastest possible acquisition speed, and is set as the default acquisition mode for the modem.

A second mode called “Search” also uses the DSP but performs a piece-wise sweep of the programmable acquisition range to locate the carrier and lock to it. If the modem cannot lock to the first carrier it detects it will attempt to find another carrier in the next step of frequency. The sweep always starts at the low end of the acquisition range and moves upward, wrapping around to the low end when the top is reached.

NOTE: The Search mode is optimized for crowded spectrum applications where nearby high power carriers may interfere with the standard “Fast” acquisition mode.

The acquisition mode is set by setting the **<Demod: IF - Sweep Mode>** option parameter to either “Fast” (0), or “Search” (1). The “Fast” mode is the standard setting.

#### 3.7.11.1 Initial Acquisition

For initial acquisition, a single setting allows programming the acquisition sweep range that the modem will search to find an available carrier. This parameter can be set from  $\pm 100 \text{ Hz} \pm 1.25 \text{ MHz}$ , where  $\pm 30 \text{ kHz}$  is common for standard demodulators. If all of the system offsets are known and stable for a given installation, the initial acquisition range can be set to a low value which will slightly reduce acquisition time, especially at low data rates. Conversely if system frequency offsets are not known, or change over time, the initial acquisition range should be set very wide to allow locking to a carrier well outside the typical range.

⇒ CAUTION!: If the acquisition range is set too small and the system offsets drift, then a carrier may be locked out of acquisition or lost during operation. If the acquisition range is set too wide and other compatible carriers are within the acquisition range, then the wrong carrier may be acquired.

#### 3.7.11.2 Carrier Re-acquisition

For **<Demod: IF - Sweep Mode=Search>**, the modem attempts to find a carrier in a reduced search range for a specified period of time before reverting to the standard search range. The reduced sweep range is equal to the symbol rate in Hertz. Once **< Demodulator: IF - Sweep Mode=Search>** acquisition mode is set, the **< Demodulator: IF - Sweep Time>** parameter setting controls the acquisition search time in the reduced range.

NOTE: The reduced sweep range is referenced the last demodulator lock offset.

### 3.7.12 Interface Type Configuration

The modem has the capability to implement several different interface types. The modem processor automatically determines the presence and type of the installed interface(s) and options by querying the interface card slots. The installed interface part number will be displayed in the **< Unit: Status - Slot 3 ID>** front panel display. If there is more than one interface type installed in the modem, the **< Unit: Status - Slot 4 ID>** will display the part number of the second



installed interface. Selection of the active interface is done in the **< Modulator: Data - Send Interface>** and **< Demodulator: Data - Rcv Interface>** parameter settings.

The following interface types are currently available as options within the M7 modem.

- Multi-protocol Synchronous Serial Data interface (S7)
- Advanced IP interface with internal bridge/router (I7 and I7+)
- Express Ethernet interface (E7)
- Dual G.703/E1 with Drop and Insert interface (G7)
- High Speed Serial Interface (HSSI) (H7)

NOTE: Adding an optional interface card or changing an already installed interface should only be attempted by experienced personnel familiar with electronic communications equipment. Refer to Section for details on how to add or change an interface option.

### 3.7.13 Alarm configuration

The modem alarm system represents a sophisticated method of controlling visual, relay and logical alarm outputs which can be used for multiple purposes including redundancy. The modem alarm outputs are:

- two alarm relays (A & B) on J6 (Alarm Connector - 9-pin male "D" connector)
- four front panel LEDs (Modulator- Major/Minor and Demodulator – Major/Minor)
- two open collector alarms on the serial interface card (Modulator & Demodulator)
- one redundancy switch request

A basic representation of the alarm system functioning is shown in the Figure 3 -86.

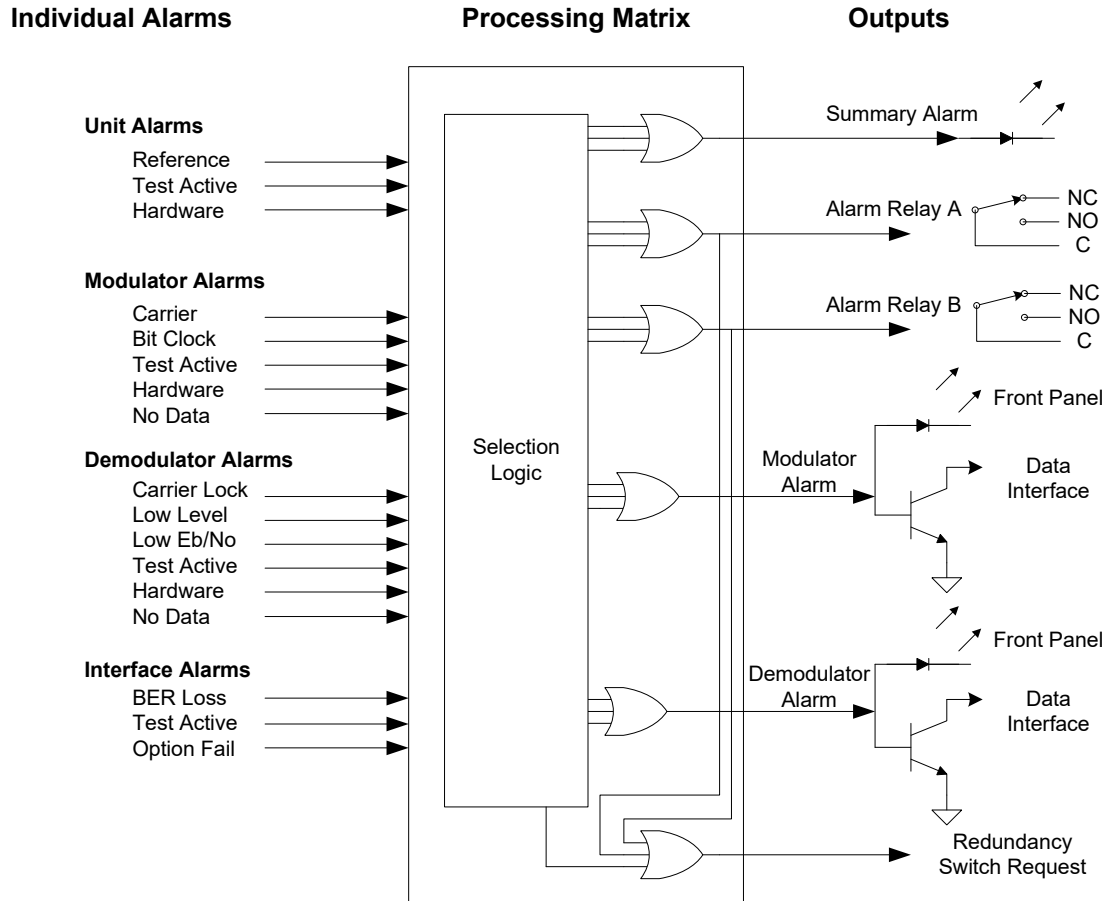


Figure 3-86 – Alarm Processing

There are many possible alarm inputs depending on the modem options and configuration. Each of the individual alarm inputs has a configuration selection parameter under the “Alarm” column of its operation matrix. Alarm inputs can be set to be ignored (None), set the Alarm Relay ‘A’, set the Alarm Relay ‘B’ or set both the ‘A’ and ‘B’ Alarm Relays. The default setting for the alarm matrix is for all modulator related alarms assigned to Alarm Relay ‘A’ and all demodulator related alarms assigned to Alarm Relay ‘B’.

The modem’s built-in redundancy switch logic uses Alarm Relay ‘A’ or ‘B’ to activate a switch request via the inter-modem communication channel. The open collector outputs for the modulator and demodulator alarms are available on the serial data interface connector and may be used by third party redundancy switches for determining alarm status.

The summary Alarm LED is the “OR” function of either alarm relay. The modem allows the user to select such items as a low input level or  $E_b/N_o$  to activate an alarm. By providing two relays and the configuration options, several alternative alarm indication scenarios can be arranged.

Descriptions of alarm conditions that can be mapped to alarm outputs are shown in the matrix tables in Section 3.5.

### 3.7.14 Setting the Modem Station ID Name

Each modem contains two unique identification entries available at the front panel or remotely. They are the unit serial number and the Unit Name or “Station ID”. The serial number is set at the factory and cannot be changed, but the Station ID can be set and changed whenever necessary. This field allows identification of the modem with up to 16 characters.

The Station ID can be set in the front panel **<Unit: Status – Station ID>** parameter and pressing “Edit” to begin entry. Each character position is selected using the right and left arrow keys, and the character at that position is set using the up and down arrow keys. When the proper entry is achieved press the “Enter” key to finalize the input. The first character is the “Space” followed by the characters below.

Table 3-37 – ASCII Characters Available for Unit Station ID

**ASCII Characters Available for Unit Station ID**

Char	Char	Char	Char	Char	Char	Char
!	/	.	M	]	l	{
“	0	?	N	^	m	
#	1	@	O	_	n	}
\$	2	A	P	‘	o	→
%	3	B	Q	a	p	÷
&	4	C	R	b	q	&
‘	5	D	S	c	r	
(	6	E	T	d	s	
)	7	F	U	e	t	
*	8	G	V	f	u	
+	9	H	W	g	v	
,	:	I	X	h	w	
-	;	J	Y	l	x	
.	<	K	Z	j	y	
	=	L	[	k	z	

When entering this parameter via a terminal connected to the remote port, the Station ID name is entered directly as text from the terminal keyboard. After any entry mode the processor will center the input characters on the lower line of the LCD display

### 3.7.15 Setting the Modem Address for Command Mode Operation

If Command Mode Binary Packet Operation is desired the modem packet “address” must be set via the front panel before the modem will recognize packets. To activate Binary Packet RS-485 remote control and set the address, navigate to the **<Unit: Remote – RS-485 Mode>** parameter and set to ‘Full Access’. Then navigate to the **<Unit: Remote – RS-485 Protocol>** and set to ‘Binary Packet’. Then navigate to the **<Unit: Remote – RS-485 Address>** and use the numeric keypad to enter the address from 0 to 255. Then press the “Enter” key to enable the change.

The address 255 is “global” and all units will respond to a message packet with this address regardless of its setting, but no unit will return a response message. It is suggested that you do not use addresses 1 or 255 (1 is the factory setting, and any new unit added to a system will have address 1).

The address “0” is also unique. This address causes the modem to accept commands and send responses without the address fields normally required in the command packets.

## 3.8 Data Interface Options - Technical Details

### 3.8.1 I7 and I7+ – Advanced IP Interface

There are two (2) versions of the I7 IP Interface.

- The standard I7
- The I7+ (plus)

Both I7 IP interface use sophisticated processors consisting of an x86 based embedded computer on a module which is plugged into the interface card. The module is referred to here as a “Q7” because it follows a computer interface standard known as Q-seven. The Q7 is a complete x86 based embedded Linux computer including multiple interfaces. The interface board with Q7 module is housed entirely within the M7 series of Datum Systems satellite modems. The difference between the I7 and the I7+ interface is the type of Q7 processor that is installed. The I7 uses a Dual-Core processor and the I7+ uses a Quad-Core processor.

The purpose of the I7 and I7+ is to act as an interface between IP Ethernet networks and satellite modems as part of point-to-point or point-to-multipoint data transfer. The I7 is not a fixed dumb interface, it is a full sophisticated router class device and therefore requires configuration. In addition, the I7+ increased the capability of the interface card to provide WAN optimization on both IP networks and cellular backhaul networks.

The purpose of this section is to introduce the IP interface cards that use the Q7 processor based platform for routing and bridging. Detailing the full capabilities of these IP cards is beyond the scope of this section. Our goal here instead is to:

1. Introduce you to this card,
26. Show initial set up the or I7 and I7+ IP addresses allowing access for full configuration,
27. Show a few initial Vyatta configuration methods.
28. Show command line methods of modem control from these cards.

#### 3.8.1.1 More about the Q7 Processor Cards

The Q7 Linux software starts life as a standard Vyatta Router which normally contains virtually all of a standard Debian OS overlaid with the Vyatta Router system. We modify both Debian and Vyatta for this application and also add modifications to support the M7 series of modems. The Vyatta Router provides an industry standard open source and very consistent router facility. The modem modifications consist of changes to the Linux/Debian drivers to support our custom embedded board and modem interface plus some changes to the Vyatta system and finally added programs specifically intended for monitor and control of the specific host modem. Everything added except some tweaks to the underlying kernel to aid in reboot is accomplished by standard Debian packages and the installed “apt” package management system. Users of

Linux and Vyatta should feel comfortable in this environment while users standard routers should also adapt very quickly.

The Q7-IP provides the following features:

- Powerful x86 Atom processor based. Up to 1.6 GHz virtual processors.
- Robust Debian Linux Operating System – currently modified Debian “Squeeze”.
- Industry Standard Vyatta Router overlay on Linux for IOS/JunOS like control. One major advantage of Vyatta is that it provides a clean single point configuration interface and saved configuration file.
- Datum System’s modifications and additions to both Linux and Vyatta providing modem command line and web control.
- Custom applications become relatively easy with multiple built-in user available programming languages including Bash, Perl, Python, C and C++ compilers.

Although the I7 and I7+ are more complex and expensive than the previous generation SnIP, this system offers significant advantages. Not only does it use an industry standard router subsystem, but the full power of Debian Linux is available including many languages (like Python), standard compilers and the Debian packaging system which allow a user to install almost any program made for Linux. An installed system is even capable of compiling its own programs.

This Tech Note describes the basic resources and procedures necessary to initially install, configure, modify, and update the Q7 Vyatta system and Linux Kernel as necessary.

### 3.8.1.2 Naming Conventions Terms and Definitions

For the purposes of the remainder of this document the conventions for naming the different portions of the Linux operating system and technical terms are given below in short form. Almost everything here is standard terminology and more information is available on the web:

1. **“Kernel and Kernel Space”**. These refer to the Linux kernel itself and the modules that are compiled with the kernel to be loaded as part of the kernel. The current kernel is Version 2.6.35 minimum and some 3.x systems are in testing.
2. **“User and User Space”** Multiple types of programs can exist in the user space. The user space is where all the files that a user can directly interact with reside. This includes the control programs and configuration files for the routing and bridging functions as created by Vyatta.
3. **“Root Filesystem”** The Root Filesystem consists of the kernel modules not built into the kernel, common and user libraries and all of the user space programs and configuration. The Datum Systems’ implementation is based on the Debian “Squeeze” distribution of Linux with Vyatta router overlay and Datum Systems additions specific to satellite modem use.
4. **“Packages”** are the Linux term for software programs and drivers. The entire Linux system consists of a small set of kernel and base programs with many packages added to provide the particular capabilities needed for its intended use. Most of the drivers and virtually all of the user space programs are packages. Packages can be installed removed and upgraded via the package manager. In the Q7 X86 card the package manager is named “APT” and common package functions are performed using the apt-get command line directives.
5. **“Package Repository”** is a web location containing groups of packages which can be installed in the Linux system via the package manager. Two are necessary, the Vyatta repository and the Datum Systems repository although there are many more available including the standard Debian repository.
6. **“I7”** These are the base IP interface cards for the M7 modems. The Q7 processor is plugged into these base “carrier” cards as the processing element.
7. **“LAN and WAN”** are terms for the Local Area Network and Wide Area Network interfaces standard on the I7 and I7+. The LAN is always the standard Ethernet TCP/IP Gigabit Ethernet port (GbE) on the rear panel of the interface card. It’s interface name is **“eth0”**. The WAN is the internal custom interface port which

connects to the modem. Because it appears to Linux and Vyatta as a standard Ethernet port its default name is “eth1”, although that can be changed.

8. **“Static and DHCP”** Are two possible ways of configuring the LAN side IP addresses and masks. By default the eth0 LAN is configured with a static IP address.
9. **“Console and Terminal Sessions”** These refer to a command line connection to the I7 and I7+. The console is a standard serial RS-232 connection on the rear of the interface card which can be connected to a computer running a standard terminal emulation program such as Hyperterminal or Putty or Linux minicom and other programs. A terminal session is a more generic term and can refer to virtual terminal sessions connected via TCP/IP in either Telnet or SSH mode. Both present the standard Linux/Vyatta command line interface.
10. **“Bridge”** is the standard network term for an OSI model Layer 2 process that is intended to connect two segments of the same LAN together having common IP addresses within the same LAN mask. The bridge function only looks at MAC addresses. A bridge can be compared to a smart switch.
11. **“Router”** is the standard network term for Layer 3 processes intended to direct and control traffic in a transmission system between two or more networks with different addresses. It operates on the OSI Model Layer 3, working with IP Addresses. Commonly routing also includes the concepts of multiple processes including NAT, traffic shaping, QOS, etc.
12. **“daemon”** is a term for a program that runs separately in the background and produces little or no output to any of the terminal sessions running, instead sending output to log files. There are a significant number of daemons always running in Linux, but in a sleep state waiting for some input that requires their attention.

**3.8.1.3 About LAN IP Addresses and Network Masks**

The modem only displays a single IP address and mask for the LAN interface. Vyatta however is capable of having multiple IP addresses for each interface. Vyatta also enters and displays network masks in the CIDR mask-prefix format – that is the class C mask of 255.255.255.0 is shown and entered as “/24”. This mask-prefix refers to the number of leading 1’s in the mask.

The standard operation of the modem front panel entries is to replace the first address in the Vyatta configuration. If there is no address currently then the front panel entry will add that as the first address. The polling software does this by detecting the front panel change and first deleting the existing first address and then adding the new one entered. That is also the normal Vyatta method for replacing an IP address - delete the current and set (add) the new one.

In Vyatta if an interface is to get its IP address and mask via DHCP then its address is actually set to “dhcp”. On the modem when the front panel “dhcp” parameter is set to “1” or enabled then Vyatta sets its IP address to “dhcp” and forwards the obtained leased address to the modem’s IP address parameter. If DHCP is then disabled it will retain the leased address. To set a new static IP address you enter the new desired address either on the front panel or in Vyatta’s configure mode.

The comparable IP entries on the modem front panel verses the Vyatta configuration, are shown in the table below. In Vyatta a single configuration entry encompasses the three (3) controls on the modem front panel.

Vyatta Configuration	M7 Modem FP Display
Address: 192.168.2.131/24 [Optional additional addresses]	DHCP: Disabled IP Address: 192.168.2.131 Mask: 255.255.255.0
Address: dhcp Note: DHCP lease address sent to modem.	DHCP: Enabled IP Address: 192.168.4.109

	Mask 255.255.255.0
--	--------------------

### 3.8.1.4 Initial Installation and Configuration

It is highly advised that you also read the documentation at [www.vyatta.org](http://www.vyatta.org) to get a feel for configuring and controlling the Vyatta router. Vyatta is a modern up to date router overlay on Linux comparable to Cisco or Juniper IOS and using similar language and procedures.

The following is a short list of initial configuration items:

1. Connect the two modems into your network as normal and turn on the modems. Modem parameters are configured as normal either via the front panel or remote methods. Make sure that you connect an Ethernet cable to the I7 and I7+, preferably with access to the Internet if you intend to download packages.
2. Wait approximately 1 to 2 minutes for the Q7 to boot completely. In the meantime determine and set your modem parameters on both ends.
3. Setting the IP Address - The I7 and I7+ interface card is factory configured with a default static IP address, for example 192.168.2.130 or similar, which can be read on the modem front panel display in the interface section. If this is not within your network either set a new IP address on the modem front panel or log into the console port of the Interface board at: 9600,N,8,1 and use Vyatta to set an IP address.

NOTE: On the modem front panel you must select either the "Mod" or "Dem" tab below the LCD display first, then make sure the transmit and receive interface is selected as "I7". At this point, the "Intf" tab will show on the front panel. Selecting the "Intf" tab will allow configuration of the I7 and I7+ parameters.

Setting the LAN IP address on the modem front panel is the easiest method to get started with a new modem.- Simply navigate to the interface and scroll right to the IP column and then down until you see the listed IP address. Enter or edit to input the new desired IP address and press enter.

For later setting or resetting of IP addresses and the complete Vyatta configuration, it is most easily done via the console or an SSH or telnet session To log in the default user is Vyatta and the default password is Vyatta. You can change these and add other users easily.

The M7 modem will replace the current Vyatta configured first IP address and save the configuration.



### 3.8.2 Express Ethernet Interface (E7)

The E7 Express Ethernet interface is a layer 2 Ethernet bridge that provides high speed switched Ethernet capability to the M7. The E7 interface does not provide any IP routing functionality.

The purpose of the E7 is to act as an interface for up to four (4) Ethernet LAN ports within a single satellite modems as part of point-to-point or point-to-multipoint satellite network. The E7 also offers a fifth interface port that complies with the Small Form-factor Pluggable (SFP) standard. The SFP port will allow interfacing to optical interfaces or will add an additional GbE port to the M7.

Detailing the internal design criteria and future capabilities of these cards is beyond the scope of this section. Instead this section will provide an overview of the card functionality and provide typical network configurations where this card is used within a satellite network. A simplified block diagram is shown in Figure 3-87.

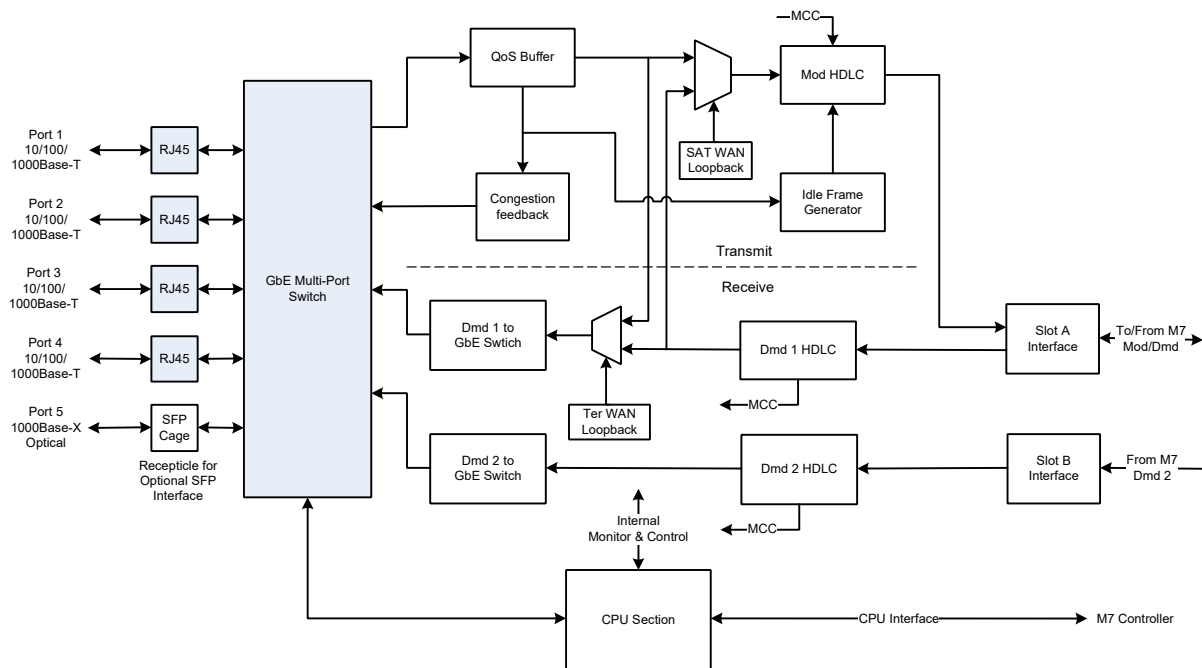


Figure 3-87 – Express Ethernet Interface Block Diagram

#### 3.8.2.1 Gigabit Ethernet Ports 1 Through 4

The physical interface connectors for Ports 1 - 4 are conventional RJ-45 10/100/1000 copper interfaces. The connectors interface to four (4) ports of the multi-port internal Ethernet switch.

Each port can be activated by the menu **<Intf: I/O Port x Mode = Data I/O>** (x=1 to 4). If a port is not being used, the port can be disabled by the menu **<Intf: I/O Port x Mode = Disabled>** (x=1 to 4). If the E7 interface is installed in a multi-demod M7, the configuration of the ports will need to reflect the data flow from the multi-demod(s) to the central router. This will be typical of a point to multipoint network where the Hub site has a single modulator and multiple demodulators. In this case, the hub router would need to interface to a single transmit port and multiple demod ports. Using the menu **<Intf: I/O Port x Mode = Dmd Output I/O>** (x=1 to 4) and menu **<Intf: I/O Port x Mode = Dmd Input I/O>** (x=1 to 4), the multiple demodulator output data ports can be connected to the single router port by using the internal Ethernet switch within the E7 interface. This configuration will be explained in more detail in the network configuration discussion in Section 3.8.2.4.2.

The type of connection for each port can be configured independently in the menu **<Intf: I/O Port x Connection = Auto>** (x=1 to 4). . The most common setting for a port once it is activated will

be “Auto” but each port can be configured to “1000BASE-T”, “100BASE-T Full Duplex”, “100BASE-T Half Duplex”, “10BASE-T Full Duplex”, or “10BASE-T Half Duplex”.

### 3.8.2.2 SFP Interface - Port 5

This port allows the E7 to offer a wide variety of optical interfaces (1000Base-T, 1000Base-SX multimode, and 1000Base-LX and BX single mode) from qualified vendors. In addition, the SFP interface can offer an additional GbE interface port to the internal Ethernet switch. The M7 will recognize if there is a SFP module installed and will provide the appropriate menus for control.

NOTE: **<Intf: I/O Port 5 Mode = Data I/O>** Port 5 will only show in the menu when there is an SFP module installed in the SFP slot.

### 3.8.2.3 Flow Control

The M7 transmission is classified as FDMA and as such has a constant bit rate for transmission over the satellite, which is the WAN side of the E7 interface. Conversely, an Ethernet interface can have significant variability in the instantaneous bit rate and through flow control will settle in to a long term average of the constant bit rate of the FDMA link. QoS buffering is provided at the output of the internal Ethernet switch to store data until it is needed for transmit to the WAN. The QoS mode can be configured in the menu **<Intf: QOS Mode>** to either “WRED” (Weighted Random Early Detection) or “Strict Priority”. These settings will determine the procedure for dropping packets at the point where the QoS buffer has reached the point of congestion. The default setting is WRED.

Additionally, the E7 allows the user to set flow control for the QoS buffer for a non-congested state and full congestion of the WAN traffic. This is set in the menu item **<Intf: QOS WAN Drop None>** for the non-congested state and **<Intf: QOS WAN Drop All>** for the congestion point where all incoming packets will be dropped until the QoS buffer drops below this setting. Between the QoS buffer settings of “Drop None” and “Drop All”, there is an expectation that some packets will be dropped in line with the “QoS Mode”.

The proper setting of “Drop None” and “Drop All” is dependent on the type of traffic, i.e. VoIP, Web, Streaming Video, FTP, etc., that is transiting the network and the constant data rate of the WAN satellite link. These settings correspond to the fill status of the QoS buffer. The “Drop None” setting is the point below which there is no flow control activated.

The “Drop None” minimum setting should represent the time, in mSec, that is equivalent to at least 2 Ethernet packets. For example if the M7 modulator is set to transmit at 1Mbps toward the WAN, set the menu item **<Intf: QOS WAN Drop None = 24 ms>**. This would be the minimum setting for this configuration. The recommended maximum setting would be set to half of the “Drop All” setting.

The “Drop All” setting will determine the maximum delay that the QoS buffer will add to the network. Certain traffic types that are sensitive to delay will require that the “Drop All” value be set to a minimum value but if this is set too low, the E7 will drop packets when large packet Web content is transmitted toward the WAN. The recommended minimum setting for the “Drop All” would represent the time, in mSec, that is equivalent to at least 20 Ethernet packets. For example if the M7 modulator is set to transmit at 1Mbps toward the WAN, set the menu item **<Intf: QOS WAN Drop All = 240 ms>**. The setting of the “Drop All” can be arbitrary and may need to be adjusted to optimize the network performance once the traffic types are known.

### 3.8.2.4 WAN Mode

The E7 allows for Ethernet bridge functionality in either a point-to-point (PtP) or a point-to-multipoint (PtMP) satellite network. This functionality is configured in the menu item **<Intf: Send WAN Mode>** for the transmit modem section and **<Intf: Rcv WAN Mode>** for the receive modem section.

NOTE: The E7 allows for over the satellite interoperability with some legacy Datum modems by setting the menu item **<Intf: Send WAN Protocol = M500 HDLC>** and **<Intf: Rcv WAN Protocol = M500 HDLC>**. The default mode is **<Intf: Send WAN Protocol = M7 HDLC>** and **<Intf: Rcv WAN Protocol = M7 HDLC>** for operation in a network that has all M7 modems installed.

Configuration of the proper “WAN Mode” and “WAN Protocol” will automatically set the proper MAC learning and packet forwarding to prevent duplicate MAC addresses and enable proper network operation.

#### 3.8.2.4.1 Point-to-Point (PtP) Satellite Network

Figure 3 -88 shows a typical PtP satellite network that could be used for extending a local LAN and Internet access to a single remote location.

## Point-to-Point Network Example

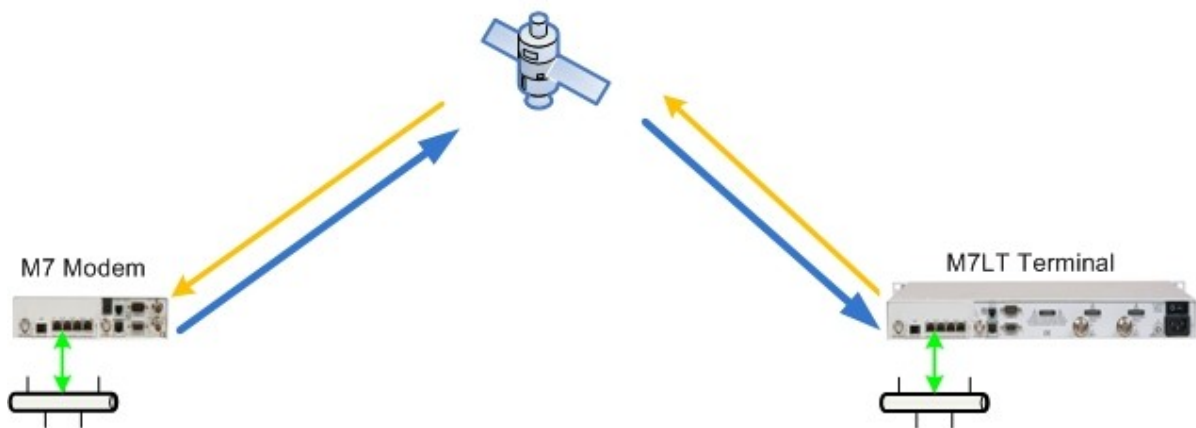


Figure 3-88 – Point-to-Point Satellite Network

In the PtP example shown in Figure 3 -88, the E7 configuration is very simple for the user. The menu setting would be the same on the modems at both ends of the satellite link.

- **<Intf: Send WAN Mode = Bridge PTP>**
- **<Intf: Rcv WAN Mode = Bridge PTP>**

**3.8.2.4.2 Point-to-Multipoint (PtMP) Satellite Network**

Figure 3 -89 shows a typical PtMP satellite network that could be used for extending a local LAN and Internet access to multiple remote locations.

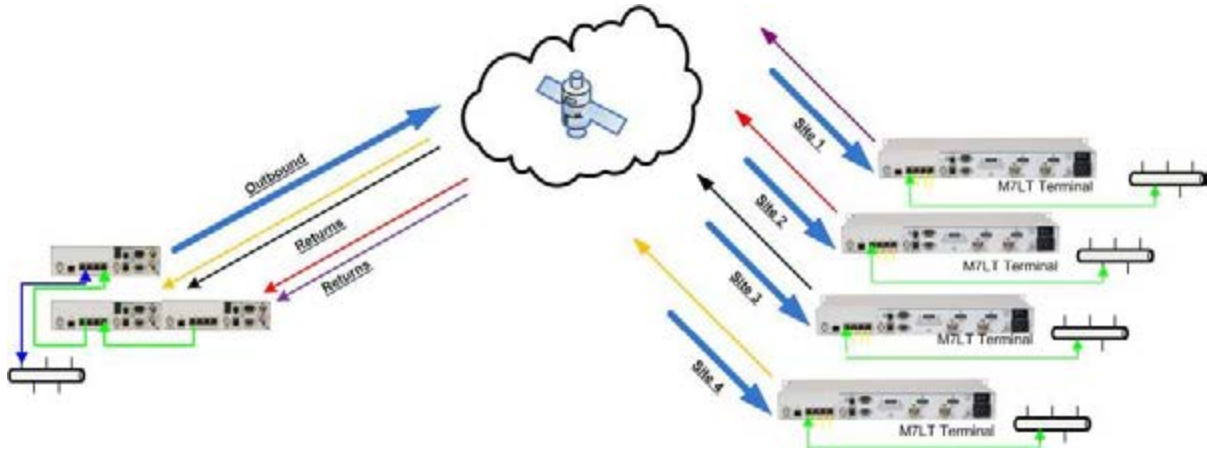


Figure 3-89 – Point-to-Multipoint Satellite Network

Configuration of the E7 interface in the hub M7s is critical to proper network operation. The physical cable connections for a PtMP Hub and single remote example are shown in Figure 3 -90.

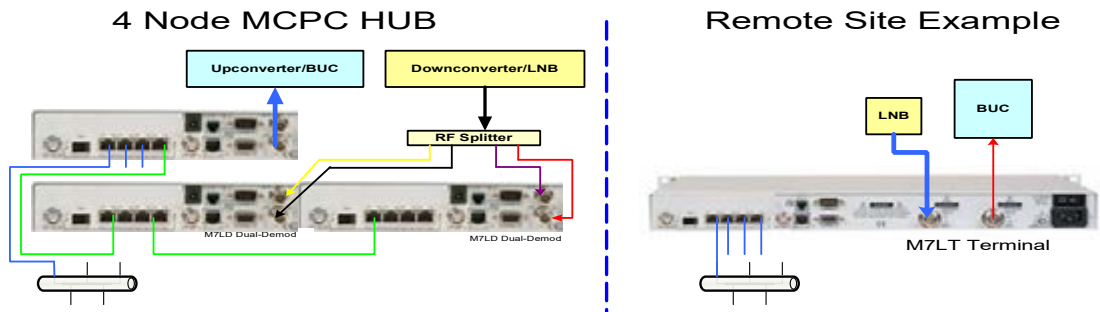


Figure 3-90 – Four site PtMP Hub and one Remote site example

The E7 interface configuration in the Hub M7s must be configured based on the size of the network and the physical position within the Hub cabling configuration.

The menu setting for the E7 interface in the hub M7 modulator would be:

- <Intf: Send WAN Mode = Hub Bridge PTMP>
- <Intf: I/O Port 1 Mode = Data I/O>
- <Intf: I/O Port 4 Mode = Dmd Input I/O>

The menu setting for the E7 interface in the hub M7 multi-demod #1 would be:

- <Intf: Rcv WAN Mode = Hub Bridge PTMP>
- <Intf: I/O Port 1 Mode = Dmd Output I/O>

The menu setting for the E7 interface in the hub M7 multi-demod #2 and #3 would be:

- <Intf: Rcv WAN Mode = Hub Bridge PTMP>
- <Intf: I/O Port 1 Mode = Dmd Output I/O>
- <Intf: I/O Port 4 Mode = Dmd Input I/O>

The menu setting for the E7 interface in the M7s at the distant end of the links would be:

- <Intf: Send WAN Mode = Remote Bridge PTMP>
- <Intf: Rcv WAN Mode = Remote Bridge PTMP>

The physical connections shown in Figure 3 -90 are specific to this example and are dependent on the number of sites in the network. This example is a very simple PtMP example and a more complex network with more user ports and modems would require careful attention to the E7 interface configuration within the hub M7s.

### 3.8.2.4.3 Mesh Satellite Network

Figure 3 -91 shows a typical four (4) site MESH satellite network that could be used for connecting multiple remote locations with a single satellite hop. In a PtMP network, multiple remote sites can be connected but all of the traffic would need to transit the Hub location which would cause two (2) satellite hops. Real time applications operate better with less delay and the difference between a PtMP network double hop connection and a Mesh single hop connection can make the difference for acceptable user experience.

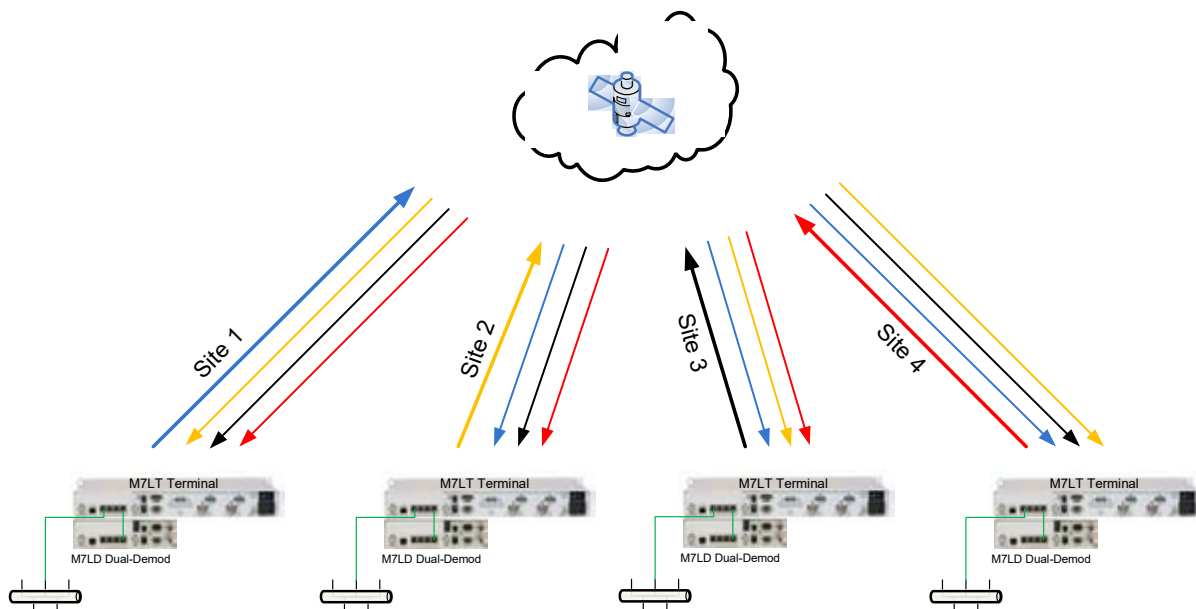


Figure 3-91 – Four site Mesh network example

Configuration of the hub M7s with E7 interface is critical to proper network operation. The physical cable connections for a mesh network example are shown in Figure 3 -92.

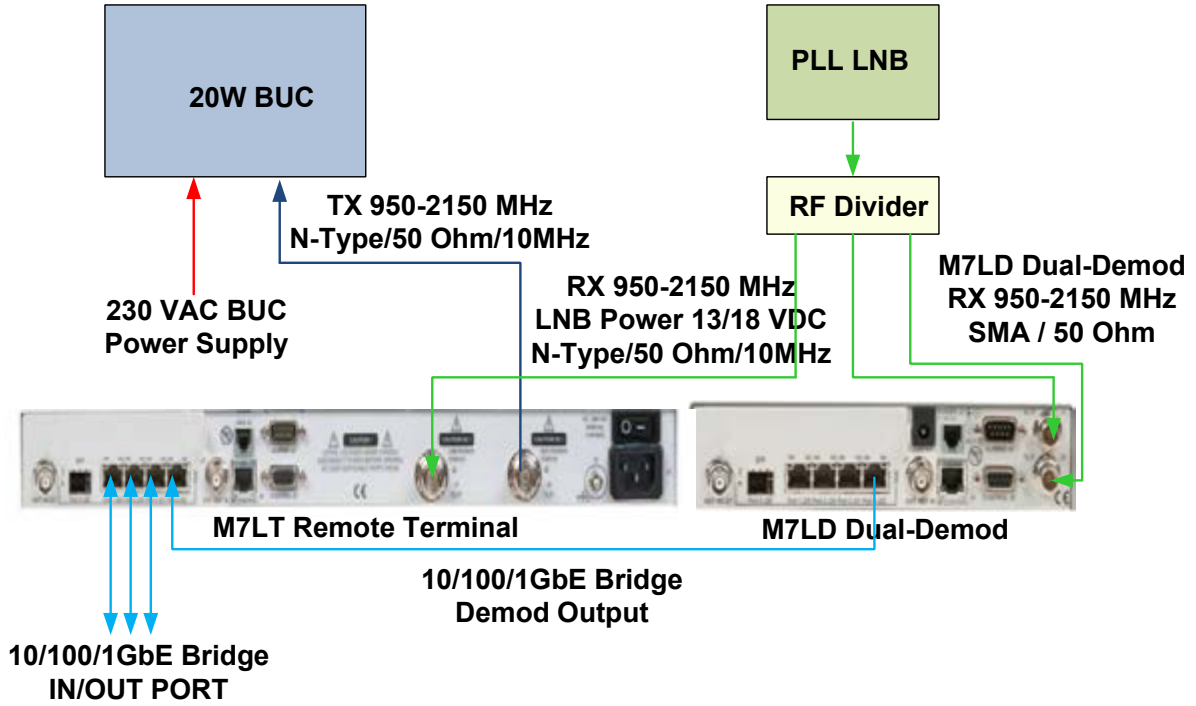


Figure 3-92 – Configuration of a Mesh network site with a spare demodulator

The E7 interface configuration of the M7s at each remote site must be configured properly for the network type and the size of the network.

The menu setting for the E7 interface in the M7 modulator and demodulator #1 would be:

- <Intf: Send WAN Mode = Mesh Bridge>
- <Intf: I/O Port 1 Mode = Data I/O>
- <Intf: I/O Port 4 Mode = Dmd Input I/O>
- <Intf: Rcv WAN Mode = Mesh Bridge>

The menu setting for the E7 interface in the M7 multi-demod #2 and #3 would be:

- <Intf: Rcv WAN Mode = Mesh Bridge>
- <Intf: I/O Port 4 Mode = Dmd Output I/O>

The physical connections shown in Figure 3 34 are specific to this example and are dependent on the number of sites in the network. This example is a very simple Mesh network example and a more complex network with more remote sites would require additional M7 hardware at each site and careful attention to the E7 interface configuration on each M7.

### 3.8.2.5 Modem Control Channel (MCC)

The E7 interface provides an in-band management channel that allows communications over the satellite link to the modem(s) at the distant end. Activation for read/write capability over the MCC is set in menu item **<Intf: MCC Mode = Full Access>**. The default setting for the MCC mode is “Disable” and limited access is set by “Read Only” configuration. The MCC addresses and bit rate limits are set in menu items **<Intf: MCC Send Address>**, **<Intf: MCC Rcv Address>**, and **<Intf: MCC Send Rate Limit>**.

### 3.8.2.6 Test Modes and Statistics

The E7 offers loopback modes for link verification prior to running live traffic or for troubleshooting. Loop back of Ethernet traffic can cause considerable problems within a network but the E7 design resolves all of these issues and allows proper loopback testing. Loopback functions are set in menu item **<Intf: Test Sat WAN Loopback >** for over the satellite testing and menu item **<Intf: Test Ter WAN Loopback >** for local interface checkout.

The E7 provides extensive live statistics of the link performance. Statistics on Packets per Second (PPS) sent and received, number of data, MCC, and idle packets and Bytes sent and received, the percentage of the link that contains data, MCC, or idle packets, and total packets sent and received. There is also a count of the total errored packets and the packet error rate. These statistics are displayed in the **<Intf: Stats Send Data>** and **<Intf: Stats Rcv Data>** menu items. The send and receive statistic counters can be independently reset in any of the menu items by pressing the “Edit” and then the “Enter” keys on the front panel.

NOTE: When the **<Intf: Send WAN Protocol = M7 HDLC>** Idle Packets are inserted into the send bit stream, up to the WAN throughput data rate, when there are no valid packets of either Data or MCC. No Idle packets will be inserted when the **<Intf: Send WAN Protocol = M500 HDLC>**.

### 3.8.3 G7 – Dual G.703/E1 Interface

#### 3.8.3.1 E1 Signal Structure

Each port of the Dual G.703/E1 interface operates at a nominal rate of 2.048Mbps and adds 3975 bits of overhead (<0.2%) to the data rate transmitted via the modulator. This overhead is needed to allow for independent operation of the two (2) G.703/E1 ports. This overhead is independent of any additional overhead that is added as a result of the MCC or ESC channels baud rate.

When the G7 is the active interface, selection of the Data Rate Entry Mode in the Modulator and the Demodulator is automatically set to Interface; **<Mod: Data - Rate Entry Mode> = Interface, <Dmd: Data - Rate Entry Mode> = Interface**

#### 3.8.3.2 E1 Line Coding

The basic E1 signal is coded using the Alternate Mark Inversion (AMI) or High-Density Bipolar 3 (HDB3). In AMI coding, “ones” are alternately transmitted as positive and negative pulses, whereas “zeros” are transmitted as a zero voltage level. AMI is not used in most E1 transmissions because synchronization loss will occur during long strings of data zeros. In HDB3 coding, a string of four consecutive zeros is replaced with a substitute string of pulses containing an intentional bipolar violation. The HDB3 code substitutions provide high pulse density so that the receiving equipment is able to maintain synchronization with the received signal.

The G7 supports two E1 link line codes:

- AMI coding
- HDB3 coding.

#### 3.8.3.3 Other Interface Specifications

- Balanced: 120 ohm impedance on a RJ48c (Port 1 and Port 2)
- Unbalanced: 75 ohm impedance using J23 and J24 for Port 1 and a connector adapter for Port 2.
- Jitter performance is in according to ITU G.823

#### 3.8.3.4 Alarm Indication Signal (AIS)

The AIS signal is an unframed “all-ones” signal, and is used to maintain line signal synchronization in case of loss of input signal. The G7 interface will provide an AIS on the receive data line if there is a fault condition in the demodulator. There will also be an indication on the G7 interface if there is an AIS condition received on the transmit data line.

### 3.9 Data Interface Clock Options

The active interface type will determine availability of the bit timing sources. When the Synchronous Interface is selected as the active interface, the Modulator and the Demodulator each have four (4) possible sources for bit rate timing. These clock sources may be used in various ways in a system implementation to provide correct timing at a destination. The network configuration will determine the requirements for bit rate timing in the modem.

The options for modulator bit timing (Section ) and demodulator bit timing (section ) are shown below. Descriptions of two (2) typical network timing configurations are explained in Section 3.9.3 and Section 3.9.4.



### 3.9.1 Modulator Bit Timing

When the modem is configured with any serial interface option, the modulator always outputs the Send Timing signal on the baseband interface connector. In a typical network, this timing signal is used to generate the bit timing for the transmission toward the satellite. This timing signal may be selected from 1 of 4 sources:

1. Internal – locked to a 2.0 ppm Internal Reference. If bit rate timing requirements require a better reference, the internal oscillator may be phase locked to an External Reference applied at the rear panel (J1). Refer to Section 3.7.4 for details on how to activate the External Reference.
29. RCV Clock – locked to the demodulator Receive Timing (i.e. Loop Timing)
30. External – locked to an external timing input at the bit rate on pins 9 and 21 of the overhead channel interface connector J10. This option allows a station-derived standard clock rate to be used to clock data out of the FIFO
31. Terminal Timing – locked to the Terminal Timing input (pins 24/11)

NOTE: Bit timing options for optional interfaces are discussed in the applicable interface appendix.

A simplified block diagram of the Modulator clock sources for a Synchronous Interface is shown in Figure 3-93.

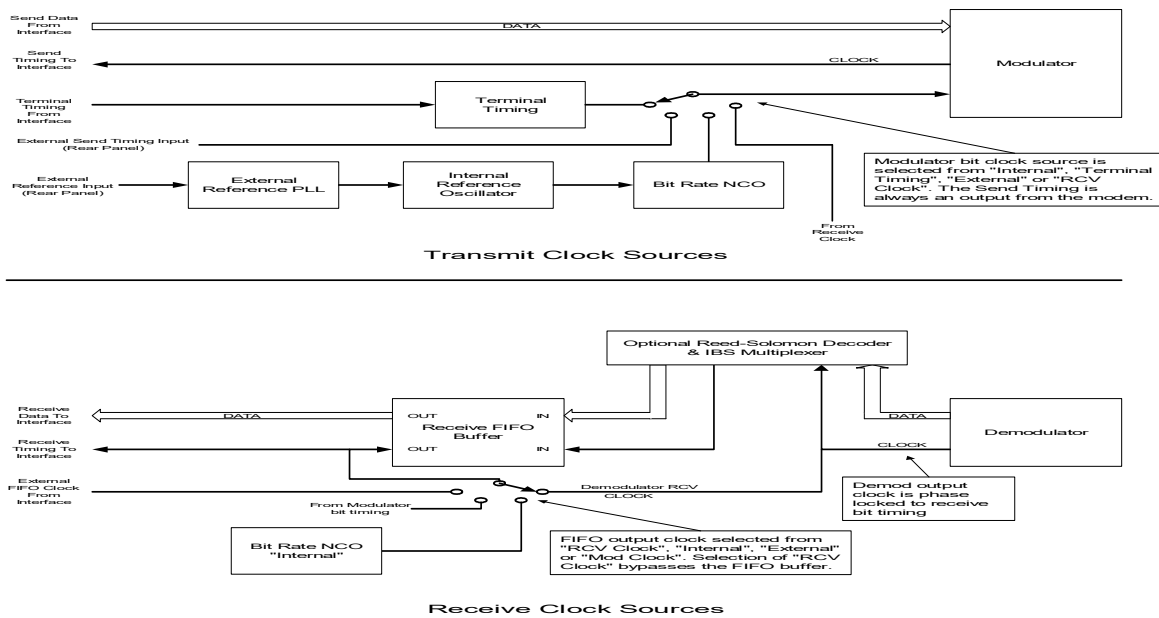


Figure 3-93 – Modulator Clock Source Options

### 3.9.2 Demodulator Timing

When the modem is configured with any serial interface option, the modem will always output receive timing synchronous with the receive data and is a source of the timing for the local network. If the system requires a different timing standard then provisions are made to buffer the data in a programmable FIFO buffer. The receive timing signal that is derived from the satellite is always used to clock the data into the FIFO buffer. The FIFO buffer output clock must be the same average rate as the demodulator receive timing otherwise a buffer over/under flow will occur. The FIFO buffer clock output may be selected to 1 of 4 sources

1. RCV Clock – the demodulator receive timing (buffer bypass mode) Meaning that the input and output clocks are the same, disabling the FIFO
32. Mod Clock – uses the selected modulator data rate clock as the output clock and requires that the modulator and demodulator data rate be identical
33. Internal – an internally generated bit rate NCO locked to the 2.0 ppm Internal Reference. If bit rate timing requirements require a better reference, the internal oscillator may be phase locked to an External Reference applied at the rear panel (J1). Refer to Section 3.7.4 for details on how to activate the External Reference.
34. External – an external clock at the bit rate applied on pins 9 and 21 of the overhead channel interface connector J10. This option allows a station-derived standard clock rate to be used to clock data out of the FIFO

A simplified block diagram representation of the demodulator clock sources are shown in Figure 3 -94.

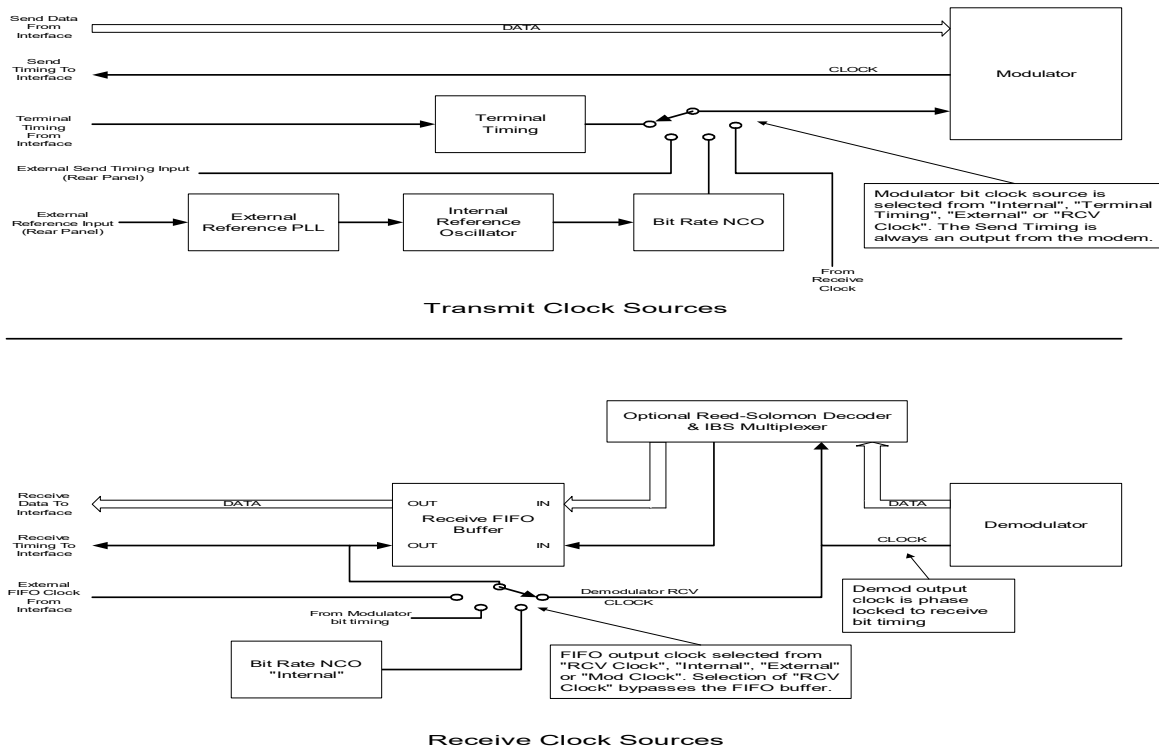


Figure 3-94 – Demodulator Clock Source Options

### 3.9.2.1 Demodulator Receive Data FIFO Operation

The modem has a built-in First-In First-Out (FIFO) buffer on the receive data channel that may be enabled to compensate for cyclical variations in the receive data rate. Cyclical variations are most often caused by the daily movement of the satellite in its position resulting in a varying distance from earth station locations. This movement would cause the receive data rate to increase during a portion of the day and decrease during other periods. This type of cyclic change is termed Doppler variation and the buffer to absorb the variation is a Doppler Buffer. The setting of the FIFO buffer size will need to accommodate these variations to prevent any data loss.

In certain network configuration typical in international Telco connections, there will be separate very high stability clock standards that are not locked to each other. The FIFO at each end of the link will be provided a local clock for the purpose of clocking the data out of the modem. A receive buffer used to absorb this type of clock offset is referred to as a Plesiochronous buffer. This type of clock difference is uni-directional and cumulative to the point that eventually there will be a FIFO buffer slip. The severity of the disruption can be minimized by setting the buffer size in bits to multiples of the frame size. For example if the total frame size is 512 bits and the buffer is set to a size of 1024 bits an under or over-run would result in the frame flags remaining in the same location in the data stream. Note that frames will still be errored by the under or over-run, but synchronization may not be lost. If a superframe structure is used it is likely that synchronization will still be lost.

Other data rate variations between the transmitting and receiving stations which are not periodic, i.e. do not average to zero, can be buffered by the FIFO, but will eventually result in lost data.

Refer to the discussion in Section above for the selections available for clocking the data in and out of the FIFO buffer.

The Receive FIFO operation can be set from the front panel or remote control, and consists of selecting the **<Intf: I/O - Rcv Clock Source>** parameter to something other than "Dmd Rcv Clock" and the **<Intf: I/O - Rcv Buffer Delay>** parameter to the desired delay in milliseconds. The processor computes the **<Intf: I/O - Rcv Buffer Size>** parameter to the size of the FIFO in bits based on the current data rate.

The modem processor also can display the current FIFO fill percentage status. The FIFO sets the delay or number of bits selected upon activation and this center value represents 100% FIFO fill. At any time the FIFO may contain from 0% to 200% of the set value. The percentage fill can also represent the percentage of delay with respect to the setting. For example if the buffer was set to 2 mS of delay and the fill is 150% this represents 3 mS of delay.

When the data rate is changed the modem maintains delay time constant, automatically changing the number of bits stored in the buffer to compensate.

NOTE: When the number of bits of delay are very small, one bit may represent a large percentage change (e.g. if the delay is only 4 bits, each bit represents 25%). The delay may be set from 4 bits to 131,070 bits at any data rate, resulting in a delay ranging from 0.00081mS (4 bits at 4.92 Mbps) to over 42,000 mS (131,070 bits at 2400 bps).

An overrun occurs when a bit is clocked into the FIFO causing the fill to reach a full 200% of the selected value. This causes flushing the upper half of the FIFO, restoring the fill to 100%, re-centering the FIFO. The data flushed is lost and cannot be recovered.

An under-run occurs when the last bit is clocked out of the FIFO, emptying it. This also causes re-centering of the FIFO by resetting the buffer pointers to the mid or 100% level, resending all the data in the buffer. Both conditions result in a potential serious disruption of traffic.

When an under or over-run occurs an internal modem flag is set indicating that a re-center has occurred. The front panel display shows "Slip" and FIFO fill data percentages read from the remote port are negative numbers. This latched flag may be reset at the front panel or by writing to the remote port FIFO parameter.

The FIFO may also be re-centered at any time on command from either the front panel or via the remote control. At the front panel the command is **<Intf: Status - Rcv Buffer>** and pressing the "1" key, then "Enter" to confirm. Pressing the "0" key on this parameter will clear the "Slip Status".

### 3.9.3 Master/Slave Network

In this network configuration, one station is considered the master (hub) and the other station(s) is considered the slave (remote).

The master transmit timing is either an input to (External or Terminal timing) or output from (Internal) the master station modulator. The slave station receive data clock maintains this synchronization (RCV Clock). The receive data clock is used by the local network to generate the contra-directional transmit timing (loop timing). If the slave local network requires timing from the modulator, RCV Clock is selected for the modulator timing option. Alternatively, if the local network will derive timing from the receive timing signal and return a timing clock synchronous with the transmit data, then Terminal Timing would be selected for the modulator timing option.

### 3.9.4 Master/Master

In this network configuration, both stations are considered a master. This would be required for any connection between local networks that operate on their own network timing standard. This is typical within Telco networks running G.703 as an interface at the modem.

At both ends of the satellite link, the transmit timing is typically derived from the incoming network timing standard. In the case of G.703, this will be derived from the data signal but in the case of a serial interface, this can either be an input to (External or Terminal timing) or output from (Internal) the modulator.

At both ends of the satellite link, the recovered receive timing signal is used to input the data into the FIFO Buffer. The FIFO buffer output clock is selected from a source that contains the local network timing signal. This is typically the set to Mod Clock which has derived the network timing from the local network.

NOTE: In a Master/Master network, there is expected to be a FIFO buffer slip at some point in time. The time between FIFO buffer slips is determined by the time base offset between the two (2) master clocks and the size of the FIFO buffer. When this slip occurs, there will be a loss of data equivalent to approximately one half the size of the FIFO buffer.

### 3.10 Automatic Uplink Power Control (AUPC) Operation

The modem has built-in logic for Automatic Uplink Power Control (AUPC). There are three (3) operating modes available: Point-to-Point, Local, and Point-to-Multipoint.

NOTE: The examples following will assume the modems at all ends of the satellite links are configured with the M7 Express Ethernet Interface (E7).

- The Point-to-Point mode is used to maintain constant Eb/No performance in a duplex Point-to-Point (PtP) link by adjusting the transmit power at both ends of the links during changes in link performance. This is especially useful when operating over a satellite at Ku-Band or Ka-Band frequencies in locations with high rainfall periods.
- The Local mode is used in a broadcast or Point-to-Multipoint (PtMP) network where feedback from remote ends of the link is not possible. In this mode, the transmit power of the broadcast carrier is adjusted based on the Eb/No performance of the local receiver that is monitoring the broadcast carrier.
- A third mode is used in Point-to-Multipoint (PtMP) when information from the hub demod is routed through the outbound hub carrier to each of the remote sites in order to maintain a defined Eb/No performance on each of the return links independently.

There must be safeguards built into any AUPC system to limit the automatic maximum and minimum power output level changes. Other safeguard controls are built into the operating control software to limit response times and detect adverse operating conditions.

The AUPC selection parameters and their descriptions are shown in Table 3-38.

Table 3-38 – AUPC Functions

Function	Selection Criteria	Description
Mod: IF AUPC Mode	0 = Disable, 1 = Enable,	Automatic Uplink Power Control.
Mod: IF AUPC Eb/No	3.0 to 20.0 dB	AUPC remote receive Eb/No level set point.
Mod: IF AUPC Max Level	+5.0 dBm to Minimum level	Max. Transmit level under AUPC control
Mod: IF AUPC Min Level	Maximum level to –35 dBm	Min. Transmit Level under AUPC control
Demod: IF AUPC Send Path	0 = Disable, 1 = Local, 2 = Out MCC Port, 3 = Out IP Control Port	Sets the output path for the AUPC data “Out MCC Port” setting at both ends of a duplex PtP link is the standard for bi-directional AUPC on a duplex link. “Local” is the setting for AUPC of the transmit carrier in a broadcast network.
Demod: IF AUPC Remote MCC Address	1 to 254. 255 = Global	Set the address of the target MCC port
Intf: MCC Mode	0 = Disable 1 = Read Only 2 = Full Access	Sets the rights of the MCC channel.

Function	Selection Criteria	Description
Intf: MCC Send Rate Limit	Entered in kbps up to the maximum rate of the satellite data rate.	Sets the maximum rate the MCC channel will use from the satellite channel. AUPC will require at least 0.5 kbps
Intf: MCC Send Address	1 to 254. 255 = Global	Sets the address of the Send MCC port
Intf: MCC Rcv Address	1 to 254. 255 = Global	Sets the address of the Rcv MCC port

### 3.10.1 AUPC Remote Mode

The AUPC Remote function requires at least a 500 baud data channel between the sites in order to operate. This data channel can either be external to the modem, provided by an external multiplexer, a telephone line modem, or provided by the internal modem control channel (MCC) when enabled. The normal method for setting up AUPC Remote over a PtP link is to use the built in MCC to provide the necessary communications link.

NOTE: When using an interface other than an IP interface, the “Custom” or “Advanced” Multiplexer mode MUST be selected to provide a channel for AUPC Remote operation from the IBS multiplexer option.

Figure 3 -95 shows a PtP link between Site 1 and Site 2 with both modems set to monitor the distant end Eb/No performance and adjust the local transmit power to maintain a set Eb/No level.

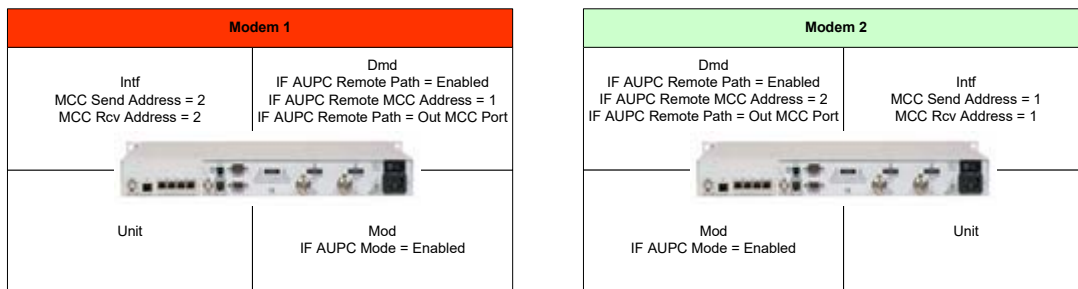


Figure 3-95 – AUPC Remote Enabled Network

#### 3.10.1.1 AUPC Remote Mode Setup Guide

Assume a working link between Site 1 and Site 2 without any active modem control channels or AUPC enabled and a desired link performance of 7.0 dB Eb/No.

NOTE: AUPC Remote can be enabled in a single direction or in both directions as required. When operating AUPC Remote in a single direction, the MCC must be enabled in only the direction necessary to return Eb/No information to the controlled transmit modem.

##### 3.10.1.1.1 Site 2 AUPC Setup

1. Set the **<Intf: MCC Mode>** parameter to “Full Access”.
2. Set the **<Intf: MCC Send Rate Limit>** parameter to “0.500 kbps” or higher.
3. Set the **<Intf: MCC Send Address>** and **<Intf: MCC Rcv Address>** parameters to “1” for this example. The setting of this address can be any address between 1 and 254 but must match the **<Demod: IF AUPC Remote MCC Address>** setting of the modem at Site A.
4. Set the **<Demod: IF AUPC Remote Path>** to “Out MCC Port”.
5. Set the **<Demod: IF AUPC Remote MCC Address>** to “2” for this example. The setting of this address can be any address between 1 and 254 but must match the

<Intf: MCC Send Address> and <Intf: MCC Rcv Address> parameter settings of the modem at Site A.

6. Set the <Mod: IF AUPC Mode> to “Enabled”.
7. Set the < Mod: IF - AUPC Eb/No> to the desired value, e.g. 7.0 dB.
8. Set the < Mod: IF - AUPC Max Level> parameter to the desired level. Determine the value for this parameter by calculating the maximum power that is allowed to prevent the link from saturation but should be several dB above the nominal operating point for margin, e.g. -10.0 dBm.
9. Set the < Mod: IF - AUPC Min Level> parameter to the desired level. Determine the value for this parameter by calculating the minimum power that is allowed to prevent the link from dropping below the operating threshold but should be several dB below the nominal operating point for margin, e.g. -15.0 dBm.

#### 3.10.1.1.2 Site 1 AUPC Setup

1. Set the <Intf: MCC Mode> parameter to “Full Access”. Please note that this will interrupt the link from A to B until the B modem is set to the same settings.
2. Set the <Intf: MCC Send Rate Limit> parameter to “0.500 kbps” or higher.
3. Set the <Intf: MCC Send Address> and <Intf: MCC Rcv Address> parameters to “2” for this example. The setting of this address can be any address between 1 and 254 but must match the <Demod: IF AUPC Remote MCC Address> setting of the modem at Site A.
4. Set the <Demod: IF AUPC Remote Path> to “Out MCC Port”.
5. Set the <Demod: IF AUPC Remote MCC Address> to “1” for this example. The setting of this address can be any address between 1 and 254 but must match the <Intf: MCC Send Address> and <Intf: MCC Rcv Address> parameter settings of the modem at Site B.
6. Set the <Mod: IF AUPC Mode> to “Enabled”.
7. Set the < Mod: IF - AUPC Eb/No> to the desired value, e.g. 7.0 dB.
8. Set the < Mod: IF - AUPC Max Level> parameter to the desired level. Determine the value for this parameter by calculating the maximum power that is allowed to prevent the link from saturation but should be several dB above the nominal operating point for margin, e.g. -10.0 dBm.
9. Set the < Mod: IF - AUPC Min Level> parameter to the desired level. Determine the value for this parameter by calculating the minimum power that is allowed to prevent the link from dropping below the operating threshold but should be several dB below the nominal operating point for margin, e.g. -15.0 dBm.

The PtP link should now be operating and using bidirectional AUPC that will adjust both transmit output power levels in order to keep the distant end receive Eb/No constant. Alarms will be generated if the transmit level reaches either the max or min level attempting to maintain proper receive Eb/No.

The exact settings required can be further adjusted to account for the type of fading expected. For example if in a tropical environment with sudden heavy showers you may want to allow more power margin.

#### 3.10.2 AUPC Local Mode

In AUPC Local operation no external or mux overhead Eb/No return channel is required. However, the modem at the broadcast transmit site must be a full duplex modem and the demodulator must be set up to receive the broadcast carrier from the satellite.

Local AUPC must consider some potential sources for error in the operation of a local only AUPC function:

1. The demodulator providing the Eb/No reference is at the same location of the modulator, which will cause a ‘double’ fade when there is a fading event on the broadcast site.

35. The fade on the transmit carrier will be slightly different than the fade on the received carrier at the same site due to the different satellite frequencies.
36. The antenna sizes in a broadcast network will typically have significant differences between the transmit site and any of the receive sites. This antenna size difference will cause a difference in the absolute Eb/No readings from the demodulators. The accuracy of the Eb/No reading may be different at the higher Eb/No readings, i.e. >10dB, when compared to the lower Eb/No readings, i.e. <7dB.

### 3.10.2.1 AUPC Local Mode Setup Guide

Assume a working link between A and any number of sites (N) without any multiplexers or AUPC enabled and a minimum operating link performance at the remotes of 7.0 dB Eb/No. The AUPC Local setup simply requires setting up the AUPC parameters in the Site A transmitting modem (the Hub). No changes are required at any of the remote sites

Figure 3 -96 shows a PtMP hub modulator with the optional AUPC demodulator installed that will monitor the local transmit carrier Eb/No performance and adjust the local transmit power to maintain a set Eb/No level.

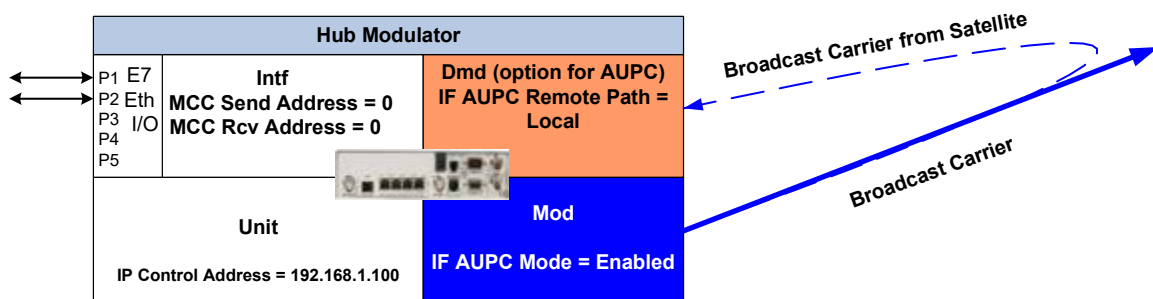


Figure 3-96 – Hub Modulator with optional AUPC Demodulator

#### 3.10.2.1.1 Site A AUPC Local Setup

1. Determine the current receive Eb/No at a sampling of the remote sites during clear sky condition.
37. Read Site A Eb/No.
38. Set the < **Mod: IF - AUPC Mode**> parameter to “Enabled”.
39. Set the < **Mod: IF - AUPC Eb/No**> parameter to that desired value, e.g. 9.0 dB.
40. Set the < **Mod: IF - AUPC Max Level**> parameter to the desired level. Determine the value for this parameter by calculating the maximum power that is allowed to prevent the link from saturation but should be several dB above the nominal operating point for margin.
41. Set the < **Mod: IF - AUPC Min Level**> parameter to the desired level. Determine the value for this parameter by calculating the minimum power that is allowed to prevent the link from dropping below the operating threshold but should be several dB below the nominal operating point for margin.
42. Set the < **Demod: IF - AUPC Send Path**> parameter to “Local”.

The link should now be operating and using AUPC to set the A hub transmit level keeping its own receive Eb/No constant and therefore the (N) remote sites receive Eb/No almost constant. Alarms will be generated if the transmit level reaches either the max or min level attempting to maintain the receive E/b/No.



### 3.10.3 AUPC Point-to-Multipoint Mode

The AUPC PtMP function requires at least a 500 baud data channel between the hub site and each remote site in order to operate. This data channel will be an in-band channel in the outbound carrier and in each of the inbound carriers from the remote sites. The normal method for setting up AUPC PtMP link is to use the built in MCC to provide the necessary communications link.

NOTE: AUPC PtMP requires the use of the E7 interface in the M7 modems within the PtMP network.

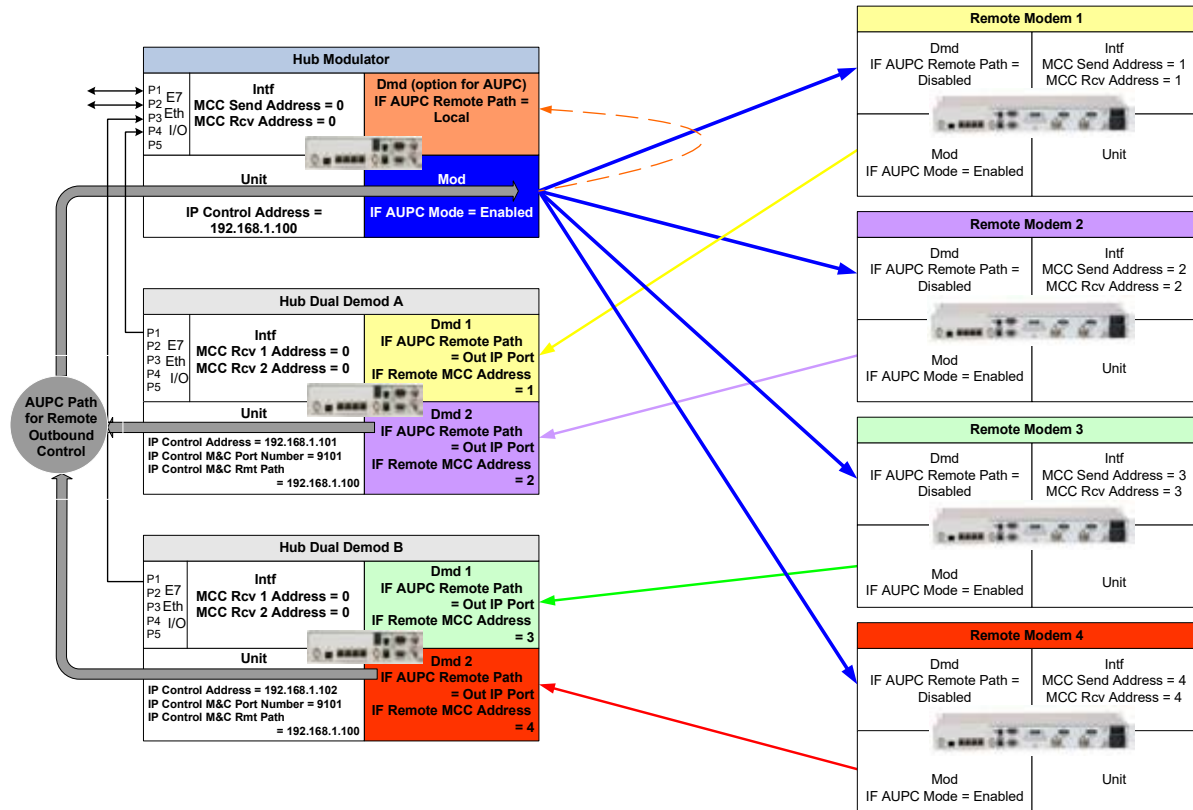


Figure 3-97 – Point-to-Multipoint AUPC configuration for a four (4) site network

#### 3.10.3.1 AUPC PtMP Mode Setup Guide

Assume a working link between A and any number of sites (N) without any multiplexers or AUPC enabled and an minimum operating link performance from the remotes of 7.0 dB Eb/No. The AUPC PtMP setup requires setting up the AUPC parameters in the Hub (Site A) modulator and each demodulator and setting of the appropriate configuration of each remote site that AUPC is desired.

Figure 3 -97 shows a PtMP link between a Hub (Sites A) and four (4) sites numbered Remote 1 – 4. At the Hub, there is a single outbound carrier that is received by all of the remote sites and a designated demodulator set to receive the inbound carrier from each remote site. When AUPC PtMP mode is configured, the specific demodulator at the hub will monitor the Eb/No performance and send the information to the local Hub modulator. The Hub modulator will transmit this information to the specific remote site for transmit power adjustment to maintain the set Eb/No level for the link.

NOTE: The configuration settings in this section are specific to the configuration shown in Figure 3 -97. The actual network configuration may be different and will require different settings of the MCC Send and Rcv addresses at the remote sites and Remote MCC addresses at the Hub site.

### 3.10.3.1.1 HUB (Site A) Modulator AUPC PtMP Setup

1. Take note of the **<Unit: IP Control Address>** parameter as it will be required later in the setup of the hub dual demodulators.
2. Set the **<Unit: IP Control M&C Port Number>** parameter to 9101.
3. Set the **<Mod: IF AUPC Mode>** to “Enabled”.
4. Set the **<Intf: MCC Mode>** parameter to “Full Access”.
5. Set the **<Intf: MCC Send Rate Limit>** parameter to “0.500 kbps” or higher. This rate is determined by the number of remote sites in the network and the recommended rate is to have 0.500 kbps per remote site.
6. Set the **<Intf: MCC Send Address>** and **<Intf: MCC Rcv Address>** parameters to “10” for this example. This address is set per network requirements and all units at the hub must have a different MCC address.

NOTE: Steps 7 – 10 are settings for enabling and using the optional AUPC Local mode that can operate independently at the Hub location.

7. Set the **<Demod: IF AUPC Remote Path>** to “Local”.
8. Set the **< Mod: IF - AUPC Eb/No>** to the desired value, e.g. 9.0 dB.
9. Set the **< Mod: IF - AUPC Max Level>** parameter to the desired level. Determine the value for this parameter by calculating the maximum power that is allowed to prevent the link from saturation but should be several dB above the nominal operating point for margin, e.g. -10.0 dBm.
10. Set the **< Mod: IF - AUPC Min Level>** parameter to the desired level. Determine the value for this parameter by calculating the minimum power that is allowed to prevent the link from dropping below the operating threshold but should be several dB below the nominal operating point for margin, e.g. -15.0 dBm.

### 3.10.3.1.2 HUB (Site A) Dual Demodulator A AUPC PtMP Setup

1. Set the **<Unit: IP Control Address>** parameter to be in the same subnet at the Hub modulator but not the same address as any other unit connected to the LAN.
11. Set the **<Unit: IP Control M&C Port Number>** parameter to 9101. Port 9101 is the default port and this can be set per network requirements BUT all units in the AUPC PtMP configuration MUST be set to the same port number.
12. Set the **<Unit: IP Control M&C Rmt Path>** address parameter to match the Hub Modulator **<Unit: IP Control Address>** parameter.
13. Set the **<Intf: MCC Mode>** parameter to “Full Access”.
14. Set the **<Intf: MCC Rcv 1 Address>** parameters to “11” and **<Intf: MCC Rcv 2 Address>** parameters to “12” for this example. This address is set per network requirements and all units at the hub must have a different MCC address.

#### 3.10.3.1.2.1 HUB (Site A) Dual Demodulator A; Demod 1 AUPC PtMP Setup

15. Set the **<Demod: IF AUPC Remote Path>** to “Out IP Port”.
16. Set the **<Demod: IF AUPC Remote MCC Address>** to “1” for this example. The setting of this address can be any address between 1 and 254 but must match the **<Intf: MCC Send Address>** and **<Intf: MCC Rcv Address>** parameter settings of the modem at the specific remote site transmitter that is being received by Dual Demodulator A; Demod 1.

#### 3.10.3.1.2.2 HUB (Site A) Dual Demodulator A; Demod 2 AUPC PtMP Setup

17. Set the **<Demod: IF AUPC Remote Path>** to “Out IP Port”.
18. Set the **<Demod: IF AUPC Remote MCC Address>** to “2” for this example. The setting of this address can be any address between 1 and 254 but must match the **<Intf: MCC Send Address>** and **<Intf: MCC Rcv Address>** parameter settings of the modem at the specific remote site transmitter that is being received by Dual Demodulator A; Demod 2.

### 3.10.3.1.3 HUB (Site A) Dual Demodulator B AUPC PtMP Setup

1. Set the <Unit: IP Control Address> parameter to be in the same subnet at the Hub modulator but not the same address as any other unit connected to the LAN.
19. Set the <Unit: IP Control M&C Port Number> parameter to 9101. Port 9101 is the default port and this can be set per network requirements BUT all units in the AUPC PtMP configuration MUST be set to the same port number.
20. Set the <Unit: IP Control M&C Rmt Path> parameter to match the Hub Modulator <Unit: IP Control Address> parameter.
21. Set the <Intf: MCC Mode> parameter to "Full Access".
22. Set the <Intf: MCC Rcv 1 Address> parameters to "13" and <Intf: MCC Rcv 2 Address> parameters to "14" for this example. This address is set per network requirements and all units at the hub must have a different MCC address.

#### 3.10.3.1.3.1 HUB (Site A) Dual Demodulator B; Demod 1 AUPC PtMP Setup

23. Set the <Demod: IF AUPC Remote Path> to "Out IP Port".
24. Set the <Demod: IF AUPC Remote MCC Address> to "3" for this example. The setting of this address can be any address between 1 and 254 but must match the <Intf: MCC Send Address> and <Intf: MCC Rcv Address> parameter settings of the modem at the specific remote site transmitter that is being received by Dual Demodulator A; Demod 3.

#### 3.10.3.1.3.2 HUB (Site A) Dual Demodulator B; Demod 2 AUPC PtMP Setup

25. Set the <Demod: IF AUPC Remote Path> to "Out IP Port".
26. Set the <Demod: IF AUPC Remote MCC Address> to "4" for this example. The setting of this address can be any address between 1 and 254 but must match the <Intf: MCC Send Address> and <Intf: MCC Rcv Address> parameter settings of the modem at the specific remote site transmitter that is being received by Dual Demodulator A; Demod 4.

### 3.10.3.1.4 Remote Site 1 AUPC PtMP Setup

1. Set the <Mod: IF AUPC Mode> to "Enabled".
27. Set the <Demod: IF AUPC Remote Path> to "Disable".
28. Set the <Intf: MCC Mode> parameter to "Full Access".
29. Set the <Intf: MCC Send Rate Limit> parameter to "0.500 kbps" or higher.
30. Set the <Intf: MCC Send Address> and <Intf: MCC Rcv Address> parameters to "1" for this example. The setting of this address can be any address between 1 and 254 but match the <Demod: IF AUPC Remote MCC Address> parameter settings of the Dual Demodulator A; Demod 1.
31. Set the < Mod: IF - AUPC Eb/No> to the desired value, e.g. 7.0 dB.
32. Set the < Mod: IF - AUPC Max Level> parameter to the desired level. Determine the value for this parameter by calculating the maximum power that is allowed to prevent the link from saturation but should be several dB above the nominal operating point for margin, e.g. -10.0 dBm.
33. Set the < Mod: IF - AUPC Min Level> parameter to the desired level. Determine the value for this parameter by calculating the minimum power that is allowed to prevent the link from dropping below the operating threshold but should be several dB below the nominal operating point for margin, e.g. -15.0 dBm.

### 3.10.3.1.5 Remote Site 2 AUPC PtMP Setup

1. Set the <Mod: IF AUPC Mode> to "Enabled".
34. Set the <Demod: IF AUPC Remote Path> to "Disable".
35. Set the <Intf: MCC Mode> parameter to "Full Access".
36. Set the <Intf: MCC Send Rate Limit> parameter to "0.500 kbps" or higher.

37. Set the **<Intf: MCC Send Address>** and **<Intf: MCC Rcv Address>** parameters to “2” for this example. The setting of this address can be any address between 1 and 254 but match the **<Demod: IF AUPC Remote MCC Address>** parameter settings of the Dual Demodulator A; Demod 2.
38. Set the **< Mod: IF - AUPC Eb/No>** to the desired value, e.g. 7.0 dB.
39. Set the **< Mod: IF - AUPC Max Level>** parameter to the desired level. Determine the value for this parameter by calculating the maximum power that is allowed to prevent the link from saturation but should be several dB above the nominal operating point for margin, e.g. -10.0 dBm.
40. Set the **< Mod: IF - AUPC Min Level>** parameter to the desired level. Determine the value for this parameter by calculating the minimum power that is allowed to prevent the link from dropping below the operating threshold but should be several dB below the nominal operating point for margin, e.g. -15.0 dBm.

#### 3.10.3.1.6 Remote Site 3 AUPC PtMP Setup

1. Set the **<Mod: IF AUPC Mode>** to “Enabled”.
41. Set the **<Demod: IF AUPC Remote Path>** to “Disable”.
42. Set the **<Intf: MCC Mode>** parameter to “Full Access”.
43. Set the **<Intf: MCC Send Rate Limit>** parameter to “0.500 kbps” or higher.
44. Set the **<Intf: MCC Send Address>** and **<Intf: MCC Rcv Address>** parameters to “3” for this example. The setting of this address can be any address between 1 and 254 but match the **<Demod: IF AUPC Remote MCC Address>** parameter settings of the Dual Demodulator B; Demod 1.
45. Set the **< Mod: IF - AUPC Eb/No>** to the desired value, e.g. 7.0 dB.
46. Set the **< Mod: IF - AUPC Max Level>** parameter to the desired level. Determine the value for this parameter by calculating the maximum power that is allowed to prevent the link from saturation but should be several dB above the nominal operating point for margin, e.g. -10.0 dBm.
47. Set the **< Mod: IF - AUPC Min Level>** parameter to the desired level. Determine the value for this parameter by calculating the minimum power that is allowed to prevent the link from dropping below the operating threshold but should be several dB below the nominal operating point for margin, e.g. -15.0 dBm.

#### 3.10.3.1.7 Remote Site 4 AUPC PtMP Setup

1. Set the **<Mod: IF AUPC Mode>** to “Enabled”.
48. Set the **<Demod: IF AUPC Remote Path>** to “Disable”.
49. Set the **<Intf: MCC Mode>** parameter to “Full Access”.
50. Set the **<Intf: MCC Send Rate Limit>** parameter to “0.500 kbps” or higher.
51. Set the **<Intf: MCC Send Address>** and **<Intf: MCC Rcv Address>** parameters to “4” for this example. The setting of this address can be any address between 1 and 254 but match the **<Demod: IF AUPC Remote MCC Address>** parameter settings of the Dual Demodulator B; Demod 2.
52. Set the **< Mod: IF - AUPC Eb/No>** to the desired value, e.g. 7.0 dB.
53. Set the **< Mod: IF - AUPC Max Level>** parameter to the desired level. Determine the value for this parameter by calculating the maximum power that is allowed to prevent the link from saturation but should be several dB above the nominal operating point for margin, e.g. -10.0 dBm.
54. Set the **< Mod: IF - AUPC Min Level>** parameter to the desired level. Determine the value for this parameter by calculating the minimum power that is allowed to prevent the link from dropping below the operating threshold but should be several dB below the nominal operating point for margin, e.g. -15.0 dBm.

### 3.11 Special Control Mechanisms

The modem includes several special controls that were built in for specific customer systems, but are available in the standard modem. These are not considered normal operation so care must be taken if they are used.

- Power-Up Behavior
- Analog Monitor Output
- RTS Monitor

#### 3.11.1 Power-Up Behavior

The modem can be set to always revert to the transmit carrier disabled on power-up. This might be useful for example in mobile environments where the antenna may not be deployed or aligned on each power-up cycle. Setting this option in the **<Mod: IF - Mute>** parameter to “Manual & Power Loss” allows such operation.

In other cases the user may require that the modem always revert to a specific configuration on power-up. The normal behavior is for the modem to power-up with the last settings still in effect. One of the options in the Unit Configuration column is **<Unit: Config – Power-Up>**. The default setting is “Last” which performs as the normal described above. A user can select any of the stored configurations to be recalled on each power-up cycle. This could be useful in a mobile environment or a DAMA system where a control channel is desired on each power-up. In a large system, units can be pre-set to a specific configuration during initial commissioning, but then easily changed to another configuration for normal operation.

#### 3.11.2 Analog Monitor Output Operation

The modem has a built-in function to output an analog voltage representing the current value of one of three internal parameters by setting the **<Unit: Monitor - Mode>** parameter. The available parameters that can be selected for this output are:

- Receive carrier level (Dmd CXR Level)
- Receive Eb/No (Dmd Eb/No)
- Transmit output power level (Mod CXR Level)

The analog output can be tailored to the user requirements through any of the control interfaces. The output the processor allows control of the full scale voltage by setting the **<Unit: Monitor – Full>** parameter to a range of +1.0 Volts to +10.0 Volts and the slope by setting the **<Unit: Monitor – Output Slope>** parameter to positive or negative. These two settings control the output slope (gain and direction) of this analog output voltage.

To illustrate consider the example of using the Receive carrier level for the monitor output to automatic antenna positioning equipment. For this example, the modem has a carrier input range of –20 to –60 dBm.

If the antenna auto-track controller requires a positive slope between 0 and +10 Volts, where +10 Volts represents the maximum received signal level, set the **<Unit: Monitor – Full>** parameter to “+10.0” and the **<Unit: Monitor – Output Slope>** parameter to “Negative”. These settings have the effect of inverting the slope of the AGC signal and setting the gain of the voltage to match the input to the antenna controller.

NOTE: The output voltage is always a positive voltage.

The analog output presented at pins 5 (+voltage) and 6 (gnd) on the rear panel Alarms connector (J6). The voltage pin has a 1k $\Omega$  output impedance, protecting the driver circuitry from shorts.

#### 3.11.3 Analog Monitor Input Operation

The modem allows for an analog voltage input at pins 4 (voltage) and 6 (gnd) on connector the rear panel Alarms connector (J6) to control alarms indications and/or the transmit carrier. The analog input signal can be set to control the following functions:

- Do nothing
- Set Alarm A
- Set Alarm B
- Set Alarm A & B
- Mute transmit carrier
- Mute transmit carrier & Set Alarm A
- Mute transmit carrier & Set Alarm B
- Mute transmit carrier & Set Alarm A & B

The **<Unit: Monitor – Input Threshold>** parameter sets the threshold trigger for the analog input signal and the **<Unit: Monitor – Input Sense>** parameter sets whether the analog input is active high or active low. The **<Unit: Test – Monitor Input>** parameter is a real time monitor of the voltage at the analog input. Use the **<Unit: Alarm - Monitor Input Mask>** parameter to set the action to be taken by the analog input signal.

#### 3.11.4 RTS Monitor and Output

The modem allows configuration of the Data Interface RTS status onto either the A or B Alarm relay output on the rear panel Alarms connector J6. Since these relays are Form C, either logic direction can be chosen for the output to use in controlling other equipment. Control of this feature is **<Intf: I/O – RTS Monitor>**. This feature is independent of the **<Intf: I/O – RTS>** parameter which can be used to control the Carrier enable via the RTS status.

⇒ CAUTION!: Setting this to either Alarm A or B relay will override any other settings going to that alarm relay.

NOTE: It is the responsibility of the user to set alarms properly when using this unique feature. This relay control is not de-bounced with a time delay, therefore a fast changing or chattering RTS signal will cause the relay to chatter.

### 3.12 Storing and Recalling Configuration

The modem has a built-in function allowing the operator to store the current complete configuration in one of 99 numbered locations by setting the **<Unit: Config - Store>** parameter to “1” to “99”

Any stored configuration can then be recalled, including one permanent configuration called “Factory” which is a set of default configurations by setting the **<Unit: Config - Recall>** parameter to “Factory” or “1” to “99”

#### 3.12.1 Automatic Configuration Recovery (ACR)

The modem allows any of the 99 configurations can be set to be automatically recalled in the event of receive carrier loss after a specified number of seconds. To activate this feature, set the **<Unit: Config – Auto Restore>** parameter to “Enable”. Set the time delay before restoring the configuration in the **<Unit: Config – Restore After>** parameter and the configuration that is to be restored in the **<Unit: Config – Restore #>** parameter.

NOTE: ACR is also commonly used to disable the transmit off after loss of receive carrier.

NOTE: The ACR is not available when the modem is operating in a redundancy mode.

### 3.13 Burst Mode Operation

NOTE: Burst mode is a special factory request option and not installed in standard modems.

The modulator burst mode is controlled by the interface RTS/CTS and data flag signals. The sequence of events for the burst mode is as follows:

1. The RTS from the DTE device is normally active. The idle character from the DTE is a continuous Mark condition. The modulator output carrier is off in this idle state.
43. The modulator responds to the DTE device when ready to transmit by activating the CTS signal.
44. Any time after the CTS is received by the DTE, the DTE starts transmitting flags and/or data. The first non-SDLC/HDLC flag character received by the modulator is the start of transmission signal, causing the modem to generate a preamble and initiate the "Carrier ON" command. Transmission continues with data bytes placed after the preamble.
45. The next SDLC/HDLC flag received by the modulator is the end of transmission signal.
46. When the closing flag is detected by the modulator, it drops the CTS indicating that a new data message cannot be started. When the last data bit is sent, the modulator will reassert the CTS signal, and turn the carrier OFF.

### 3.14 Trial / Backup Activation Mode

#### 3.14.1 Introduction

The Datum Series M7 series modem contains a unique feature capability called Trial Activation Mode. (TAM). When activating TAM the M7 series modem activates every software feature available that is supported by the installed hardware the M7 modem.

NOTE: The exceptions to this is the Xiplink IP acceleration and optimization features and the Sevis cellular backhaul optimization software capabilities. These features must be previously loaded into the modem.

TAM may be active for up to 1000 hours (30+ days) before having to be reset by a factory provided code. The TAM countdown timer is active when the modem has the transmitter ON and the demodulator has carrier lock.

TAM is also used in a redundancy system to enable a modem with minimal features to be installed as a backup modem. Once the TAM code installed in the backup modem, any feature in the on-line modem will have redundancy in the backup modem. If the backup modem is never placed on-line, the TAM timer will never start counting down.

#### 3.14.2 Operation

To activate TAM enter the 20 digit code via front panel key pad (Table 3 -29) or via web interface (Figure 3 -54).

The 20-digit TAM code is provided by the factory and includes the serial number of the unit to be utilized. Please have this information available when requesting a TAM activation code.

### 3.15 Built-in 1:1 Redundancy Mode Operation

The modem has a built-in 1:1 redundancy mode that allows two modems to be connected together sharing connections, but with only one unit “on-line”. The built-in software provides automatic back-up protection should the on-line unit indicate a failure by switching to a functioning off-line unit.

NOTE: The two modems must be the same model number and type, and should be at the same firmware revision for proper redundant operation.

#### 3.15.1 Understanding Unit Roles, Modes, and Preferences

Before the discussion of how to operate the Datum System 1:1 Redundancy System, it will be important to understand three (3) critical terms that will be used in the setup of a 1:1 Redundancy Configuration. Datum Systems 1:1 redundancy has three selections which dictate the unit behavior:

- Unit Role
- Redundancy Mode
- Unit Preference

##### 3.15.1.1 Unit Role

Unit Role specifies the intended use of a modem, or unit, within the system. There are two (2) roles that determine the how the modem will consider other modems within the system:

- Stand Alone
- Internal 1 For 1

###### 3.15.1.1.1 Stand Alone Role

The ‘Stand Alone’ role means the unit is not to be used for redundancy. None of the redundancy menu selections are available or used by the unit. When a unit is in ‘Stand Alone’, it will assert its outputs immediately. The RF signal will be output as soon as the user enables the IF Output and no inhibiting alarms are present. The unit’s interface card will set the appropriate current and voltage levels on its I/O portals. The interface cards will assert their I/O based on the user configuration and will not gate their output because of any alarm.

**CAUTION:** A ‘Stand Alone’ unit should never be wired into a redundancy harness or cable set. A ‘Stand Alone’ unit will not cooperate with any other unit to insure only a single signal is output at a time. Two units simultaneously emitting their I/O can seriously damage the portal electronics of one or both units.

###### 3.15.1.1.2 Internal 1 For 1 Role

The ‘Internal 1 For 1’ role means that the unit will cooperate with its redundancy partner, to avoid placing contending signals at an output.

A ‘Stand Alone’ unit does not have to have a partner address and will not exchange status with a partner even if he has a partner address. So a second unit, configured as Internal 1 For 1 is expecting a partner, will assume that the lack of communication to the other unit in the redundancy pair is due to a failure by its partner and will go online to maintain the terrestrial and satellite links.

###### 3.15.1.2 Redundancy Mode

Redundancy Mode is a control used when initially configuring a redundancy modem pair, or when replacing a faulted modem.

1. “Normal” control will make the redundancy active. Online and offline modems will be managed to provide the redundancy. If the online modem fails, the offline modem will become online and will maintain the satellite and terrestrial links.



47. "Maintenance (Force Offline)" control allows for a replacement unit to be placed into a redundancy configuration. This control will keep the modem offline to prevent transmitter contention.
48. "Maintenance (Force Online)" control allows for an online unit to have a replacement unit installed as its paired unit.

If a redundancy pair has a failed unit, the failed unit will be offline and the working unit will be online. To replace the failed unit, follow the procedure in Section 3.15.7.2.

### 3.15.1.3 Unit Preference

'Unit Preference' is an important redundancy specifier for two (2) major reasons.

1. 'Unit Preference', dictates the timing and exchange of configuration information.
49. The units fail over and recovery behavior is controlled by the 'Unit Preference' setting.

There are three (3) unit preference that provide the user a way to configure the 1:1 redundancy system to determine which unit will be on-line.

- Primary
- Backup
- Automatic

#### 3.15.1.3.1 Primary / Backup Preference

When a Unit designated as 'Primary' fails over the 'Backup' unit will become the online unit. The 'Backup' unit will remain the online unit unless it encounters a fault more severe than its partner.

If a more severe alarm occurs on the 'Backup' unit; after its delay time, it will fail back over to the 'Primary'. On the other hand, if the 'Primary's' fault condition clears but the 'Backup' does not have a more severe alarm condition, or the alarm condition is equal, the 'Backup' unit will hold onto the online duties until it switch over hold time expires and then will return online responsibilities to the preferred 'Primary' unit. In other words, with all Fault conditions equal, the 'Primary' unit will assume online duties.

#### 3.15.1.3.2 Automatic Preference

When 'Automatic' preference is used a fail over is sticky. When a fault occurs on the online unit and online responsibilities are passed to the offline partner. The partner will go online and remain the online unit. A switchover will only occur if an online unit experiences a more severe fault than its offline partner. With all fault conditions equal the online unit will not interrupt the satellite or terrestrial signal path.

### 3.15.2 Redundancy Config Transfer.

The Redundancy Config Transfer configuration is used to transfer modem operating parameters from the online to offline unit. Configuration transfers are only allowed from the online to the offline unit. Configuration transfers are initiated by changing the Redundancy Config Transfer from "Manual" to "Transfer Now". After a successful configuration transfer, the Redundancy Config Transfer will revert to the "Manual" setting.

### 3.15.3 1:1 Redundancy Function

Datum Systems' modems are capable of operating in a 1:1 redundancy protection mode without the use of a separate redundancy switch controller. In addition to the two (2) modems, three (3) external components are required to configure the modems for 1:1 operation.

- a combiner at the transmit IF
- a splitter at the receive IF
- a connection for the terrestrial data interface

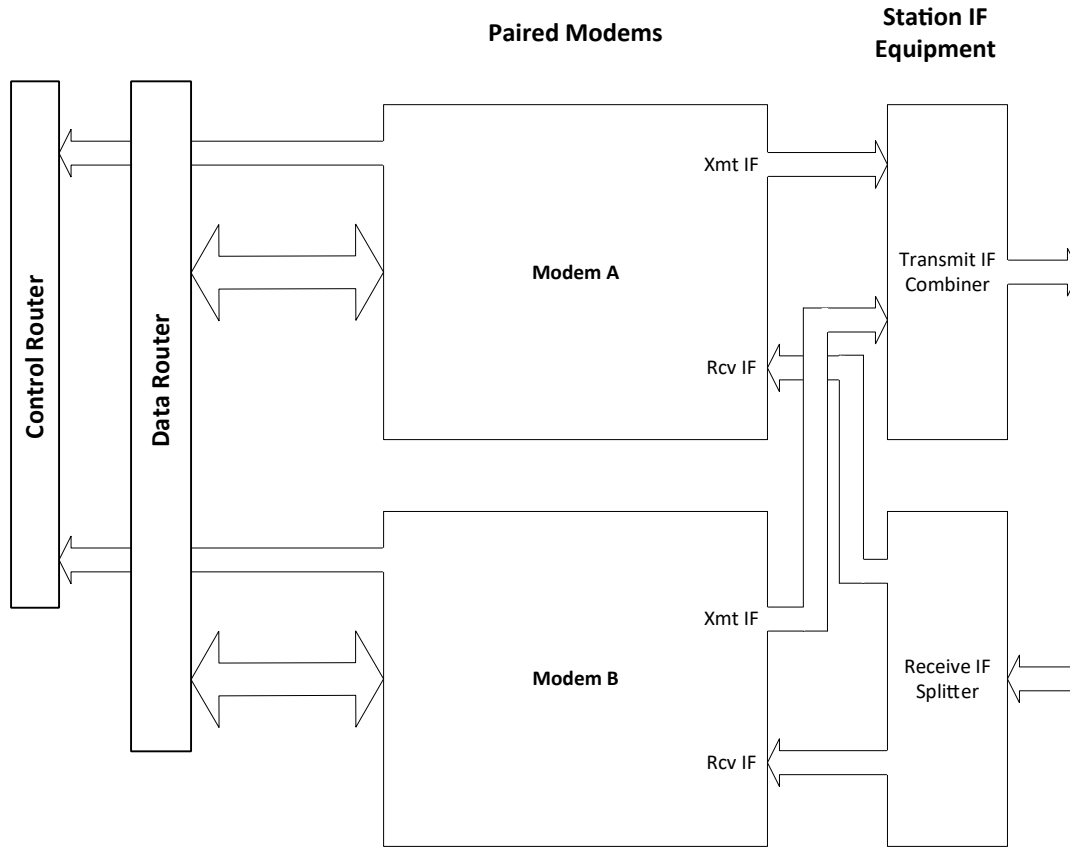


Figure 3-98 – M7 Connections for 1:1 Redundancy

NOTE: The connection for the terrestrial data interface is dependent on the type of data interface used in the system. For serial data connections, a special “Y” cable is used but for Ethernet data connections, standard Ethernet cables connecting the peer modems to an Ethernet switch or a multiple port router are used.

A diagram of the connections required for 1:1 redundancy is shown in the Figure 3 -98.

With this connection scheme the switching is only performed on the outputs from the modem. The modem IF and data inputs are always available at the modem allowing internal circuitry to determine if one modem is correctly accepting and “locking” to the input signals while the other is incapable of doing so.

NOTE: It is important in L-Band systems to use special splitters and combiners that have the ability to pass DC used to power the BUC and LNB with sufficient current capacity.

1:1 redundancy is accomplished by establishing two (2) modems in a peer configuration. In this configuration, the two modems communicate with each other to determine the configuration, alarm status of each other, and force the “off-line” unit’s data interface into an un-terminated condition. This allows both interfaces to receive incoming data and clock signals, which are necessary to ascertain correct functioning. At the same time, transmit and receive IF ports are also connected together through transmit and receive IF combiner/splitter assemblies, and the offline units transmit signal is turned off.

The major advantage to the built-in redundancy capability is its extreme low cost but there are additional advantages.

- The second (backup) unit is configured by the on-line (prime) unit eliminating any configuration errors
- Fully programmable alarm content that determines the switching criteria

- The single point failure of and external switch in a classic 1:1 redundancy scheme is eliminated

The alarms that are used to determine switching criteria are programmable, and the first modem set up for this mode automatically loads its configuration information to the second or “backup” unit. These features create a very low cost redundancy system that is both flexible and easily set up.

NOTE: The two modems should be at the same firmware revision for proper redundant operation.

### 3.15.4 Alarm configuration

The modem alarm system represents a sophisticated method of controlling visual, relay and logical alarm outputs which can be used for multiple purposes including redundancy. The modem alarm outputs are:

- two alarm relays (A & B) on J6 (Alarm Connector - 9-pin male “D” connector)
- four front panel LEDs (Modulator - Major/Minor and Demodulator - Major/Minor)
- two open collector alarms on the Serial Interface card (Modulator & Demodulator)

There are many possible alarm inputs depending on the modem options and configuration. Each of the individual alarm inputs has a configuration selection parameter under the “Alarm” column of its operation matrix. An alarm can be set to be ignored (none), set alarm relay ‘A’, set alarm relay ‘B’, or set both alarm relay ‘A’ and ‘B’. The default setting for the alarm matrix is for all modulator related alarms assigned to alarm relay ‘A’ and all demodulator related alarms assigned to alarm relay ‘B’.

NOTE: The modem’s built-in redundancy switch logic uses the setting of either alarm relay ‘A’ or ‘B’ to activate a redundancy switch request via the inter-modem communication channel.

The summary alarm LED is the “OR” function of either of the alarm relays. The modem allows the user to select such items as a low input level or  $E_b/N_o$  to activate an alarm. By providing two relays and the configuration options, several alternative alarm indication scenarios can be arranged.

For each modem function, the lists below provide a description of the alarms that can be configured to initiate a redundancy switchover or be ignored by the redundancy function.

## Unit Alarms:

- Event Pending
- Redundancy
- Reference
- IP Control Port
- OCXO Oven (LT only)
- Monitor Input
- Power Supply
- Trial <7 Days (Trial period < 7 days from completion)
- Trial <24 Hours (Trial period < 24 hours from completion)
- Test Active
- Hardware

## Modulator Alarms

- Carrier
- AUPC
- BUC Power (LT only)
- Test Active
- Hardware

## Demodulator Alarms

- Sat Echo Lock (Smart Carrier Demod ONLY)
- Carrier Lock
- Low Eb/No
- Offset Imbalance (Smart Carrier Demod ONLY)
- Level Imbalance (Smart Carrier Demod ONLY)
- Low Level
- LNB Power (LT only)
- Test Active
- Hardware

## Synchronous and HSSI Interface Alarms:

- Send Clock
- Send Data
- Rcv Data
- Backward
- BER Loss
- Test Active
- Hardware

## I7 Interface Alarms

- IP
- Send Data
- Rcv Data
- Test Active
- Hardware

## E7 Interface Alarms

- I/O
- Send Data
- Rcv Data
- Test Active
- Hardware

## Dual G.703 Interface Alarms

- Send LOS Alarm
- Send LFA Alarm
- Send LMFA Alarm
- Send AIS Alarm
- Send TS16 AIS Alarm
- Send RAI Alarm
- Rcv Frame Alarm
- Rcv Output Alarm
- Backward
- BER Loss
- Test Active
- Hardware

Complete descriptions of alarm conditions that can be mapped to alarm outputs are shown in the matrix tables in the Section 3.5.

### 3.15.5 Set-Up Procedure for 1:1 Redundancy

If redundancy mode is to be set up between a pair of M7 modems then the following procedure should be followed during installation and setup.

NOTES Physical installation of the two units is best accomplished with one unit directly beside or above the other in the rack. This allows the status of the

two modems to be seen together and avoids confusion.

The instructions in this section are defined for front panel control. Refer to the matrix tables in Section 3.5 for details on the available settings of each redundancy parameter. Setup and configuration of the 1:1 redundancy can also be done via the web browser control. Refer to Section 3.4.2.2 for details on the web browser control of the Redundancy parameters.

The connection for the terrestrial data interface is dependent on the type of data interface used in the system. Serial data connections use a special “Y” cable.

Ethernet data connections use standard Ethernet cables, simply connect the peer modems directly to one another, use an Ethernet switch or use a multiple port router.

NOTES: Redundancy control using IP control (J4) uses standard Ethernet cables and connect the partner modems directly to one another, use an Ethernet switch, or use a multiple port router.

Redundancy control using serial control (J5) requires the use of a ‘null modem’ connection between the partner modems serial control connector.

**CAUTION!** Care should be taken that both units are not turned on in a non-redundant synchronous data interface configuration with the “Y” data cable installed. This will result in the two unit’s data driver outputs possibly conflicting and possibly causing damage.

1. Physically install both units to be paired and connect only the Control port (J4 or J5) of the redundant partner modems to each other.
50. Power-up and configure the “Primary” modem completely for the intended operating parameters to operate within the network.

51. Connect the data I/O port of the “Primary” modem the terrestrial network via a serial “Y” cable or via Ethernet cables. **DO NOT** connect the second unit at this point.
52. Connect the IF ports of the “Primary” unit to the Tx combiner and Rx dividers. **DO NOT** connect the second unit at this point.
53. Within the “Primary” modem ‘Unit’ menu set the following:  
**<Unit: Redundancy – Unit Role>** to “Internal 1:1”  
**<Unit: Redundancy – Mode>** to “Maintenance (Force Online)”  
**<Unit: Redundancy – Unit Preference>** to “Primary”  
**<Unit: Redundancy – Switch Delay>** to “0.5”  
**<Unit: Redundancy – Switch Hold>** to “0.1”  
**<Unit: Redundancy – Communication Port>** to “IP Control” “RS-232” or “RS-485”  
**<Unit: Redundancy – Partner Address>** to “IP or serial address of ‘Partner’ unit”  
**<Unit: Redundancy –Comms Loss Action>** to “Keep Last State”

At this point, the initial “Primary” unit demodulator should be locked to the desired carrier and passing data to terrestrial network. The transmitter should also be online and the distant end demodulator should be locked and passing data to the terrestrial network.

54. Turn the power on the second M7 Modem and configure the following:  
**<Unit: Redundancy – Unit Role>** to “Internal 1:1”  
**<Unit: Redundancy – Mode>** to “Maintenance (Force Offline)”  
**<Unit: Redundancy – Unit Preference>** to “Backup”  
**<Unit: Redundancy – Switch Delay>** to “0.5”  
**<Unit: Redundancy – Switch Hold>** to “0.1”  
**<Unit: Redundancy – Communication Port>** to “IP Control”, “RS-232”, or “RS485”  
**<Unit: Redundancy – Partner Address>** to “IP or serial address of ‘Partner’ unit”  
**<Unit: Redundancy –Comms Loss Action>** to “Keep Last State”

55. Within the “Primary” modem ‘Unit’ menu set the following:  
**<Unit: Redundancy – Configuration Transfer>** click the “All/Now” button

The second M7 modem will now take on the same configuration as that of the M7 Modem that is designated as the Prime unit.

56. Connect the data I/O port of the “Backup” modem the terrestrial network via a “Y” cable or via Ethernet cables.
57. Connect the IF ports of the “Backup” unit to the Tx combiner and Rx dividers. Once the system is verified go to the “Primary” and “Backup” units and set the **<Unit: Redundancy – Unit Mode>** to “Normal”
58. Verify that the units are functioning correctly in redundancy mode. Go to the **<Unit: Status – Redundancy>** item in both units. The on-line unit will say “Online, Partner Standby” while the off-line unit will say “Standby, Partner Online”.
59. Once the system is verified, go to the “Primary” unit and set the **<Unit: Redundancy – Unit Preference>** to “Automatic”. In this mode, the modem that is performing the best will be on line and the other will be in a backup state. Also, in this mode the online unit will remain until there is a failure or a reduction in performance that is worse than the offline unit.

### 3.15.6 Teardown Procedure for 1:1 Redundancy

Teardown or un-pairing of two redundant units is accomplished by the following procedure

1. Removing the terrestrial cables (“Y” cable or Ethernet cables).
2. Remove the IF cables from the Transmit connection.
3. On the front panel menu of both M7 modems, go to the **<Unit: Redundancy – Unit Role>** and set them to “Stand Alone”.
4. Remove power from both M7 modems.

### 3.15.7 Operating 1:1 Redundancy Mode

Operation of a redundant pair of modems consists mainly of determining the status of units and forcing transfer of operation from one unit to the other.

A quick status to determine which modem is currently online and the failure state of the paired modems is done by viewing the LED indicators on the front panels. In a fully operating set-up there will be no alarms on either unit; but, one modem will have the green Transmit LED illuminated and the green Online LED while the other unit will have the Transmit LED and the Online LED extinguished. The other LED indicators still show the relevant condition of the Modulator and Demodulator.

The front panel menu on each modem **<Unit: Status – Redundancy>** will indicate the online and offline status of each unit.



#### 3.15.7.1 Forcing a Transition in 1:1 Redundancy Mode

If there is a desire to configure which unit is online, set the **<Unit: Redundancy – Unit Preference>** to “Primary” on the unit that is to be placed in the online position. Once the unit has switched to online, the **<Unit: Redundancy – Unit Preference>** can be set back to “Automatic”, if desired. The 1:1 transition process of forcing the two paired modems to swap their on-line/off-line status is a one step process.

If the units have failed-over, then a backup unit in a non-Automatic preference **<Unit: Redundancy – Unit Preference>**, will remain online until:

- Its alarm conditions are worse than the failed primary.
- The designated “Primary” has achieved the same alarm level as the “Backup” and the backup “Hold” time has expired.

NOTE: If a backup has a very long “Switch Hold” time, the operator may cancel the current fail-over hold by clicking the “Cancel” button next to the “Switch Hold” label.

### 3.15.7.2 Removal and Replacement of Units in Redundancy Mode

It may be necessary to remove a unit of a redundant pair and replace that unit with another. The following process performs that function with the minimum disruption to the traffic status.

1. Manually transfer the unit (if it is currently on-line) to the off-line position by setting the **<Unit: Redundancy – Unit Preference>** to “Backup”. This will force this unit into a role of “Backup” and will disable all of the outputs from the modem.
2. Remove power from the “Backup” unit.
3. Disconnection of cables from the “Backup” unit.
4. Physically remove the unit from the installed location.

To install the replacement unit, follow the following procedure steps:

1. Physically install the new “Backup” unit into the installed location but DO NOT connect the data or IF cables.
5. Connect the control cable of the redundancy partner modems to each other (J4 or J5)
6. Connect the power cable and apply power
7. Follow the similar steps outlined in step 6 of the installation procedure shown in Section 3.15.5  
**<Unit: Redundancy – Unit Role>** to “Internal 1 For 1”  
**<Unit: Redundancy – Unit Preference>** to “Backup”  
**<Unit: Redundancy – Communication Port>** to “IP Control” , “RS-232” , or “RS-485”

**<Unit: Redundancy – Partner Address>** to “IP or serial address of ‘Partner’ unit”  
**<Unit: Redundancy – Configuration Transfer>** click the “All/Now” button  
**<Unit: Redundancy – Mode>** to “Normal”

The new “Backup” modem will now take on the same configuration as that of the “Primary” online modem.

8. Connect the data I/O port of the “Backup” modem the terrestrial network via a “Y” cable or via Ethernet cables.
9. Connect the IF ports of the “Backup” unit to the Tx combiner and Rx dividers.
10. Verify that the units are functioning correctly in redundancy mode. Go to the **<Unit: Status – Redundancy>** item in both units. The on-line unit will say “Online, Partner Standby” while the off-line unit will say “Standby, Partner Online”.
11. Once the system is verified, if desired, go to the “Primary” unit and set the **<Unit: Redundancy – Unit Preference>** to “Automatic”. In this mode, the modem that is performing the best will be on line and the other will be in a backup state. Also in this mode, the Online unit will remain until there is a failure or reduction in performance that is worse than the Offline unit.

## 4 Maintenance

### 4.1 Periodic Maintenance

The modem requires no mandatory periodic field maintenance procedures. The unit contains no required periodic adjustments and the digital calibration data is held in EEPROM. Should a unit be suspected of a defect in field operations after all interface signals are verified the proper procedure is to replace the unit with another known working modem. If this does not cure the problem, other equipment in the link, wiring or power should be suspect. There are no batteries or parts requiring periodic service contained within the case. The only moving part is the internal fan, which is designed for a service life in excess of 200,000 hours. There is no external fuse on the M7 Modem. The fuse is located on the power supply assembly inside the case, and replacement is not intended in the field.

#### 4.1.1 Internal Reference Calibration

During factory testing and calibration the modem unit is compared to a known in-house reference and calibrated. A default value is permanently stored representing this factory calibration. The unit may be offset from this factory value by using the manual tuning or automatic recalibration.

Manual tuning of the modem's reference is accomplished using the **<Unit: Ref – Fine Tune>** parameter and entering a value from –127 to +127

Automatic calibration of the modem's internal reference is accomplished by inserting a known high accuracy reference at the rear panel "External Reference" input and enabling the **<Unit: Test – Cal Ref>** item. The calibration should take several seconds and will indicate a successful completion. If the calibration fails then the external reference was out of range in either level or frequency.

⇒ **CAUTION!:** The Reference Calibration procedure may result in lost traffic during performance of the calibration! The calibration should not be performed in operating links without prior arrangements.

The factory calibration may be restored by setting the **<Unit: Ref – Fine Tune>** value to "0".

### 4.2 Modem Checkout

The following descriptions assume that the full system is in operation and that software is running properly on the central processor.

#### 4.2.1 Initial Power-Up

⇒ **CAUTION!:** Before initial power-up of the modem, it is recommended to disconnect the transmit output from the operating satellite ground station equipment. This is especially true if the current modem configuration settings are unknown, where incorrect setting could disrupt existing communications traffic. New modems from the factory are normally shipped in a default configuration which includes setting the transmit carrier off.

The modem does not have a power switch so turning the unit "ON" is done by connecting the DC power to the DC input connector J2. At every power-up, the modem processor tests itself and several of its components before beginning its main monitor/control program. These power-up diagnostics take approximately 1 second and show no results if successful. If a failure is detected, the indications vary by the type of fault detected. A serious failure will result in the front panel Alarm LEDs flashing at a rate of approximately 4 times a second, and the unit beeper sounding.

Most potential failures will result in the modem giving an description of the problem on the front panel LCD display. Status indications are shown highest priority first.

The initial field checkout of the modem can be accomplished from the front panel or in the Terminal Mode. The Terminal Mode has the advantage of providing full screen access to all of the modem's parameters, but requires a separate VT100 terminal or computer running a terminal program in VT100 or ANSI mode.

#### 4.2.2 Factory Default Parameters

New modems from the factory have default values placed into the non-volatile memory for operating parameters. If a Monitor/Control System does not configure the modem automatically via remote



control, the modem can be easily configured from the front panel or through the HTTP interface using a standard internet browser. To restore the factory default parameters the modem can be powered on while depressing the “Clear” key. A modem can be returned to the factory default settings by using the front panel command **<Unit: Config - Recall>**, then editing (or quick edit) and choosing the “Factory” or “0” selection option.

The most common factory default parameters placed into the non-volatile memory are shown in Table 4 -39.

Table 4-39 – Factory Default Parameters

**Modulator:**

Carrier Frequency = 70.00 MHz  
 Data Rate = 256 kbps  
 Modulation = QPSK  
 Code Rate = Rate 1/2  
 Differential Encoder = Enabled  
 Scrambler = Auto  
 Clock phase = Normal  
 Data = Normal  
 Clock Source = Internal  
 RTS = Ignore  
 Carrier = Off.  
 All Mod Alarms to Relay A

**Demodulator:**

Carrier Frequency = 70.00 MHz  
 Data Rate = 256 kbps  
 Modulation = QPSK  
 Code Rate = Rate 1/2  
 Differential Decoder = Enabled  
 Descrambler = Auto  
 Clock phase = Normal  
 Data = Normal  
 Clock Source = Receive  
 Sweep mode = Fast  
 Acquisition Range = +/- 30 kHz  
 All Demod Alarms to Relay B

**Modem Unit:**

Modem Reference: Internal, 10 MHz  
 Remote Port Address = 1  
 Remote Port = RS-232  
 Remote Mode = Binary Packet  
 Remote Rate = 9.6 kbps  
 Remote Data Format = 8 data bits, 1 stop,  
 no parity

**Synchronous Serial Interface (if installed):**

Mode = RS-449  
 All Tests Off  
 Data and Clocks in normal mode (not inverted). The XMT Clock now uses a default “Auto” mode that detects the proper phasing and applies it.

### 4.2.3 Lamp-Test Mode

The modem provides a built-in Lamp-test mode which momentarily lights the display and the LED indicators to verify they are functioning.

Access the “Lamp Test” Mode from the front panel parameter **<Unit: Test - Modem>**. Press “Edit” to select the “Lamp Test” and press “Enter” to start the modem self-test.

### 4.3 Internal Modem Test Functions

When a modem is first installed and placed in service it is common to run several tests to verify proper performance of each of the equipment items in the link. The modem is designed to aid in this process by providing built in test modes geared to verifying performance, and isolating potential problems. These aids consist of multiple Loop-Back modes and the built-in Bit Error Rate Tester (BERT). These facilities are also useful when troubleshooting system or link problems which involve the modem.

⇒ **CAUTION!:** All of the modem testing functions described below will result in loss of traffic. They should not be used in operating links without prior arrangements.

#### 4.3.1 Loopback Testing

The Loopback modes are typically used in a wired link with DTE equipment that can transmit and verify receipt or preferably a Bit Error Rate Test Set (BERT). The basic procedure used is to transmit a data signal at one end of the link and sequentially set each of the loop-back options. Proper reception of the loop-back data verifies all components between the source and the loop.

The simplified diagram below shown in Figure 4 -99 show the location of the modem's built in loopback functions. The advantage to having these functions built-in is that they are electronically programmable without having to disconnect existing cabling to connect equipment that must be available for testing.

Each of these loopback modes are individually programmable at the modem front panel or remote control interface. More detail on each of the typical loopback uses is given below.

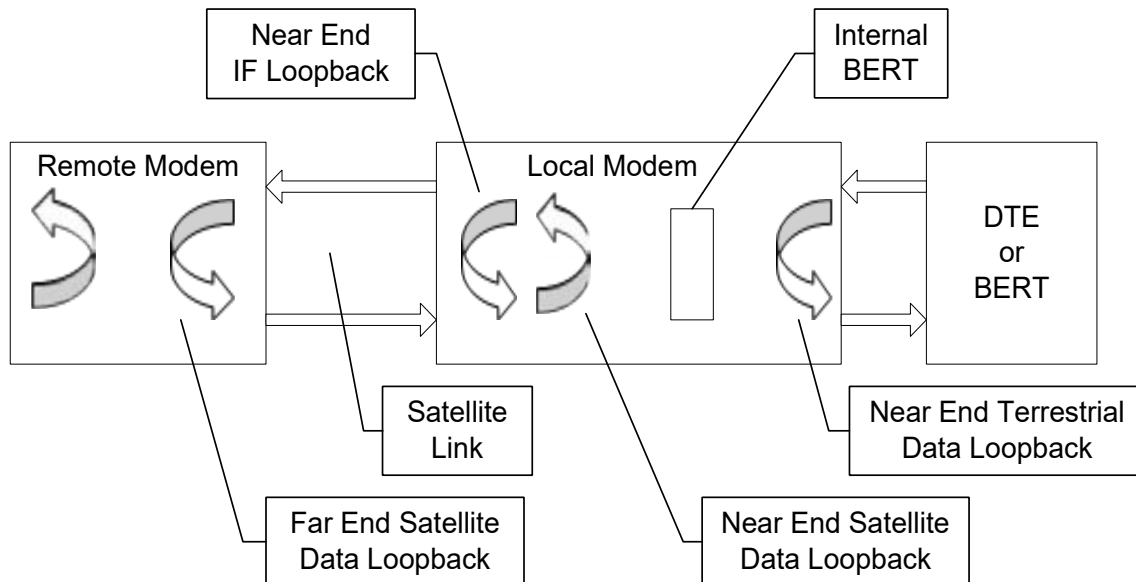


Figure 4-99 – Loopback Block Diagram

#### 4.3.1.1 Near End Terrestrial Data Loopback:

The near end terrestrial data loopback will be the closest loopback to the input data connection of the modem. If data is returned and received properly this loopback will indicate the DTE wiring and connection to the modem are correct. This loopback is set in **<Intf: Test - Ter Loopback>**.

NOTE: This test requires an external source of data.

#### 4.3.1.2 Near End Satellite Data Loop-Back

The near end satellite data loopback test is used to return the data that was received over a proper satellite link back over the satellite to be received at the other end of the link. This loopback tests the complete satellite link and the modems at both ends of the link. This loopback is set in **<Intf: Test - Sat Loopback>**.

NOTE: This is a uni-directional loopback and no data will be returned to the terrestrial side of the modem.

#### 4.3.1.3 Near End IF Loop-Back:

This loop-back test will verify the modem transmit data signal processing, modulation, demodulation, receive signal processing, and connection to the receive interface. This loopback is set in IF loop-back in **<Dem: Test - IF Loopback>**.

#### 4.3.1.4 Far End Satellite Data Loop-Back:

This loopback will test most of the satellite link as well as the functions checked in paragraph 4.3.1.3 above. The signal is sent over the satellite (or test setup) and is looped back at the satellite side of the data interface on the far end modem. This tests both modems, the satellite link and originating end wiring. The M7 sets the satellite side loop-back in **<Intf: Test - Sat Loopback>**.

NOTE: In this test, the near end satellite and IF loop-back functions should not be enabled whether using the internal or an external BERT. Setting this mode slaves the modulator timing to the demod timing and the FIFO buffer remains engaged if enabled.

In this type of testing an external BERT is typically set to provide a terminal timing output, while the connected modem is set to use the terminal timing signal as the transmit bit rate clock source. This modem can alternatively be set to use its internal clock for the transmit clock timing and provide that signal to the BERT for synchronization. More information on using the M7's internal BERT is given below.

### 4.3.2 Built-in BERT

The modem contains a complete transmit and receive Bit Error Rate Test (BERT) function. Each direction is independent and can be used for either loop-back testing or uni-directional testing with another modem on the other end of the link. Since the internal test patterns are based on industry standard test patterns it is possible to use the built in BERT with an external BERT or any brand of modem at the other link end as long as the interoperability of the test patterns has been verified. The IF Loop-back state and the BERT state are both stored in non-volatile memory, therefore if the unit is powered off during IF loop-back and/or BERT test it will return to this state when powered up again.

⇒ **CAUTION!:** Enabling the BER Test set will result in disruption of any traffic currently through the M7 in the direction that is enabled. BER Tests should not be performed on a live traffic unit.

The modem BERT can be “pointed” in two possible directions. The normal mode involves the BER transmitting in the direction of the satellite and receiving from the satellite direction. Added in the M7 is an alternate mode which allows the BERT to transmit and receive toward the terrestrial data interface side. The direction is controlled via the Interface **<Intf: Test – BER I/O>** parameter and can be selected for either “Satellite” or “Terrestrial”. The Satellite direction looks to the modem as if a DTE is sending and receiving data. The Terrestrial direction appears to the line as if a DCE device is sending and receiving data.

The Modulator (Transmit) BERT is enabled at **<Intf: Test – Send BER>**, and the Demodulator (Receive) BERT is enabled at **<Intf: Test – Rcv BER >**. With either transmit or receive being enabled by choosing either the 2047 or 2<sup>23</sup>-1 test pattern options. Both BERT setting should be the same to operate properly.

When the Demodulator receive BER Test is enabled, there are seven (7) test status items shown in the Interface Test column. These seven (7) items are:

1. BER – The ratio of errored bits to un-errored bits since the test began or was last reset. Expressed in bits per bit as x.yyy E-power where the mantissa (x.yyy) is always between 0 and 10 and power is the power of 10. For example 1.200 E-6 is 1.2 errored bits in 10<sup>6</sup> bits, or 1.2 errors per million bits. No errors are expressed as 0.000E-power. Since Errored bits do not accumulate during a sync loss, it is possible to lose sync for several seconds and not have the BER affected.
60. BER Sync Loss – The total number of sync losses that have occurred since the test began or was last reset.
61. BER Errors – The total number of bit errors that have occurred since the test began or was last reset. Errored bits do not accumulate during a sync loss.
62. BER Bits – The total number of bits that have been received since the test began or was last reset.
63. BER EFS – Error Free Seconds. The percentage of the total number of seconds with no errors occurring during that particular second. Compiled since the test began or was last reset. No errors are shown as “100.00%”. Errored seconds accumulate during a sync loss.
64. BER Erred Sec – The total number of seconds with errors occurring during that particular second, since the test began or was last reset. Errored seconds accumulate during a synch loss
65. BER Total Sec – The total number of seconds since the test began or was last reset.

The test is reset or started over by viewing any of the 7 status items listed above and pressing the “Edit” or “0” key, then responding to the prompt “Enter to Restart” by pressing “Enter”. A restart on any items resets all items and values.

A single error may be inserted when the BER test is active to verify proper operation by using the **<Intf: Test – Send BER>** parameter and pressing “3” and “Enter”. This could be useful since it is sometimes difficult to see errors with the Turbo Product Codes FEC.

In the loop-back diagram shown above, the BER test sets are physically between the satellite and terrestrial loop-back functions. Thus data traversing through either of these loop-backs does not

involve the BER test sets, even if enabled. If the built-in BERT is being used the local “satellite loop-back” function should not be enabled.

The transmit output from the built-in BERT always faces toward the modem’s transmit or satellite side, while the receive comes from the modem’s receive side. It is not designed to transmit and receive signals from the terrestrial side of the data connection.

All of these settings and test results are also available via the remote control interface, allowing for automated and periodic testing of units not in service.

## 4.4 Troubleshooting

The following is a list of possible problems that could be caused by failures of the modem or improper setup and configuration for the type of service. The list is arranged by possible symptoms exhibited by the modem. When simple solutions yield no results then test equipment may be necessary to help isolate the trouble. A spectrum analyzer and an external Bit Error Rate Test (BERT) function are invaluable. The modem has a built in BERT function that can be used as a substitute for the external BERT function.

In most cases the first attempt at isolating a problem suspected of being within the modem is to substitute the suspect modem with known good equipment assuring the configuration parameters are correct. If the configuration setting of the equipment is not the source of the problem, this method will quickly eliminate items from the potential source list. The two drawbacks to this method are the availability of extra equipment and the possibility of interaction between two or more equipment items.

### 4.4.1 Symptom: The Modem will not acquire the incoming carrier:

- **Possible Cause:** Improper receive input to modem.
- **Action:** Verify all receive cabling is correct.
  
- **Possible Cause:** Receive carrier level too low.
- **Action:** Verify all receive cabling is correct, that the down converter is properly set and that the LNA is turned on. If a spectrum analyzer is available, locate and measure the receive level, which should not be below  $-60$  dBm absolute. At lower data rates the input level may be as low as  $-84$  dBm.
  
- **Possible Cause:** Receive carrier frequency outside of acquisition range.
- **Action:** Check the receive acquisition range is adequate for the possible system offsets. Setting the value to 30 kHz is a standard value encompassing all normal offsets. After acquisition, the actual receive frequency can be read from the front panel.
  
- **Possible Cause:** Transmit carrier incompatible.
- **Action:** Check the receive parameter settings and ensure that they match those on the modulator.
  
- **Possible Cause:** Modem is in test mode.
- **Action:** Check the modem front panel for yellow warning LEDs indicating a test mode is enabled. Self-Test or IF Loop-back disconnects the Demodulator from the IF receive input connector.
  
- **Possible Cause:** Interference on the satellite.
- **Action:** The interference can take many forms. The most common are an adjacent large carrier, antenna feed polarization off resulting in carrier interference in opposite polarization, intermodulation products. Most of these cases can more easily be determined with a spectrum analyzer. If possible move to another operating frequency to see if that resolves the problem.

#### 4.4.2 Symptom: The Modem acquires a carrier but loses lock intermittently.

- **Possible Cause:** Receive acquisition range set too narrow. When the carrier drifts outside of the acquisition range the demodulator loses lock until the carrier returns inside the acquisition range.
- **Action:** Check the actual receive carrier frequency and the receive offset at the front panel and set the acquisition range appropriately.
  
- **Possible Cause:** Receive level varying out of AGC range.
- **Action:** Check the actual receive input level at the front panel. Change the carrier input level to within the correct range. In Ku-Band systems, please note that rain fade can cause significant receive level variance.
  
- **Possible Cause:** Transmit or Receive Converter equipment noisy.
- **Action:** The dependence up good phase noise in converter equipment is especially noticeable at low data rates and when using QPSK modulation. Very low frequency phase noise on the converter oscillators is very difficult to see or measure, but is detrimental to proper low data rate performance. Substitution of another modem will verify the correct modem functioning.

#### 4.4.3 Symptom: The Modem output data is corrupted.

- **Possible Cause:** Receive data or clock inverted.
- **Action:** Check the current state of the Demod Clock and Data Phase. Try inverting the phase.
  
- **Possible Cause:** Receive Carrier signal Eb/No is too low resulting in poor BER performance.
- **Action:** Ensure that the transmit end is properly set and that the receive subsystems are all operating correctly. In a small station ensure that the antenna is “peaked” on the satellite. In a Ku-Band station, intense rain can cause poor receive performance.
  
- **Possible Cause:** Transmit and Receive scrambler or differential encoder options do not match or not enabled. Note – The differential encoder in the M7 is under processor control only, but this cause could apply to a mixed system linked to another modem.
- **Action:** Check the current state of the Scrambler and differential encoder. In all operating systems the differential encoder/decoder and one of the available scramblers must be enabled.

#### 4.4.4 Symptom: The Modem receive FIFO buffer indicates “Slip”.

- **Possible Cause:** The FIFO automatically re-centers when an overrun or under-run condition occurs.
- **Action:** Check that the proper clocking options are used and the FIFO buffer is set large enough to handle the expected satellite Doppler shift over a 24 hour period. No amount of buffering will correct for different clocks on the input and output of the FIFO.

#### 4.4.5 Symptom: Receive DTE equipment indicates “clock slip” or “sync lost”.

- **Possible Cause:** The FIFO automatically re-centers when an overrun or under-run condition occurs.
- **Action:** Check that the proper clocking options are used and the FIFO buffer is set large enough to handle the expected satellite Doppler shift over a 24 hour period. No amount of buffering will correct for different clocks on the input and output of the FIFO.
  
- **Possible Cause:** Receive signal or clock inverted.
- **Action:** Check the current state of the Demod Clock Phase. Try inverting the phase.

### 4.5 Updating Modem Firmware

The M7 modem series system firmware is updated by reprogramming the SD card. If the unit requires a firmware update, contact Datum customer service to request the proper firmware for the specific unit that requires update. The proper firmware will be available on the Datum FTP site for download.

There are two (2) ways to upgrade the firmware in the M7.

- The first is to replace the internal SD card with a new card that has the updated firmware.
- The second is to update the M7 firmware via the Web Browser interface.

#### 4.5.1 Software Update using the Web Browser

The following information will provide a step by step process to update the M7 firmware using the Web browser interface. Instructions on how to set up and communicate to the M7 via a web browser are found in Section 3.4.

Before starting the update process access the Unit-Test tab and verify the installed firmware.



Clicking on the "Browse" button will open a dialog box to allow navigation to the folder location where the file that was saved after it was downloaded from the Datum FTP site.

Open

File name: m700v230i1.m7f

M7F File (.m7f)

Open

Click "Update" to begin the process to update the M7 firmware



M7 Satellite Modem

**DATUM SYSTEMS**

Status Modem Mod Carrier  
Locked, Ok

Mod Transmit Major Alm Minor Alm Test  
Dem Lock Major Alm Minor Alm Test

Summary Unit Modulator Demodulator Interface

Execute & Save

HTTP SNMP IP Control  
Test Feature Update

Browse... Update

100.0%

Upload Complete

Extracting

Execute & Save

Status of the update will be shown in four (4) screens. The first status will show the process of uploading the installation file into an internal memory location.

M7 Satellite Modem

**DATUM SYSTEMS**

Status Modem Dmd Carrier  
Locked, Ok

Mod Transmit Major Alm Minor Alm Test  
Dem Lock Major Alm Minor Alm Test

Summary Unit Modulator Demodulator Interface

Execute & Save

HTTP SNMP IP Control  
Test Feature Update

Browse... Update

100.0%

Upload Complete

81.0%

Verifying

Execute & Save

The second status will show the process of verification of the installation file that was uploaded into an internal memory location.

M7 Satellite Modem

**DATUM SYSTEMS**

Status Modem Dmd Carrier  
Send Up

Mod Transmit Major Alm Minor Alm Test  
Dem Lock Major Alm Minor Alm Test

Summary Unit Modulator Demodulator Interface

Execute & Save

Serial Control Reference Monitor Event Alarm Test Feature Update

Browse... Update

100.0%

Upload Complete

50.8%

Extracting

Execute & Save

The third status will show the process of extracting the contents of the installation into internal flash memory.

**M7 Satellite Modem**

**DATUM SYSTEMS**

At the end of the extraction process, the M7 will reboot. At this point, the current browser session will terminate and the "Login" page will display. Reenter the login credentials to verify the update process was completed properly.

Mod Transmit Major Alm Minor Alm Test  
Dem Lock Major Alm Minor Alm Test

Summary | Status | Serial

Unit

Modulator C:\fakepath\m700v230i1.m7f Browse... Update

Demodulator 100.0% Upload Complete

Interface 100.0% **Rebooting!**

Execute & Save

HTTP | SNMP | IP Control | Feature | Update

**M7 Satellite Modem**

**DATUM SYSTEMS**

Status Modem Dmd Carrier Locked, TEST ACTIVE

Unit | Mod | Dem | Intf

Mod Transmit Major Alm Minor Alm Test  
Dem Lock Major Alm Minor Alm Test

Summary | Status | Event Log | Redundancy | Config | Front Panel | HTTP | SNMP | IP Control | Serial Control | Reference | Monitor | Event | Alarm | **Test** | Feature | Update

Firmware Flash 1 2.30i1

Firmware Flash 2 2.30i1 - Running

Installer Idle

Power Supply 12.0 V

Test Monitor Input 0.0 V

In the "Unit-Test" tab, the current updated firmware will show in either "Firmware Flash 1 or 2" and display "Running" to indicate it is the operating firmware. The previous firmware will be maintained in the other flash location and can be called up if there is an issue with the new update.

## 4.6 Upgrading the Modem Features

Each of the modulator and demodulator cards in the M7 series are available with a different set of features that enable a cost effective approach for matching the modem capability to the system requirement. Upgrading from one set of features to another is a simple process that can be accomplished from the front panel or any of the control interfaces.

The first step is to contact your local reseller or Datum Systems directly requesting a feature upgrade. When requesting an upgrade, the information required is:

- Modulator Serial Number;
- Demodulator Serial Number;
- Features desired to be upgraded.

Upon confirmation of the upgrade purchase a specific 20 digit code which be sent to enable the upgraded features. The code is unique to the serial number of the card to be updated and will not work in any other card.

The two (2) most common ways to insert the feature code into the M7 are via the front panel menu or via the web browser.

### 4.6.1 Using the front panel menu

To insert the code go to the **<Mod: Feature – Activation>** and/or **<Demod: Feature –Activation>** parameter using the front panel keypad. Press “Edit” to enter the 20 digits of the given code directly using the digits on the keypad, then press the “Enter” key. If correctly entered the Mod and/or Demod will now display the new set of features and list the available features. For example when the modulator feature is updated to enable all of the ‘Modulation’ types the **<Mod: Feature - Modulation>** parameter will display “B/Q/OQ/8/PSK/8/16Q”.

### 4.6.2 Using the web browser

To insert the code go to the “Feature” tab in the Modulator (Figure 4 -101) and/or Demodulator (Figure 4 -102) page and enter the 20 digits of the given code directly in the “Feature Activation box”, then press the “Execute & Save” button. If correctly entered the modem will now display the new features in the various “Feature” tab parameter box. For example when the maximum data rate is enabled the “Bit Rate Limit” parameter box will display “Hardware Limits”.

The screenshot shows the M7 Satellite Modem web interface. At the top, there's a header with the Datum Systems logo and status information: "Status Modem Dmtd Carrier: Locked, Ok". Below this are navigation tabs for "Unit", "Mod", "Dem", and "Intf". The "Unit" tab is selected, showing a "Feature Activation" box with the value "0" and a "Trial Activation" box with the value "16911252696165647297". The "Unit" section also shows "None" for the unit name and "720.00" for the trial time remaining. The "Modulator" and "Demodulator" sections are visible below.

Figure 4-100 – Unit Feature Page

Feature sets can only be upgraded. There is no code to downgrade a feature set to a lower one.

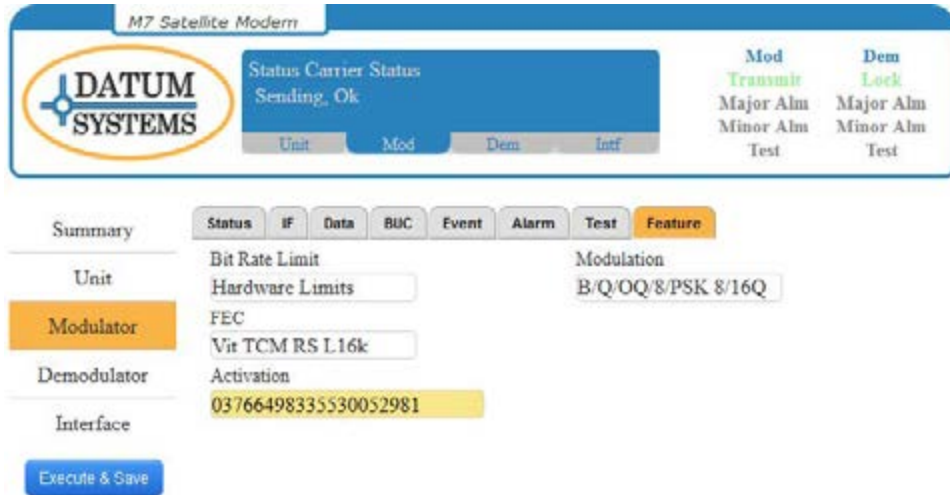


Figure 4-101 – Modulator Feature Page

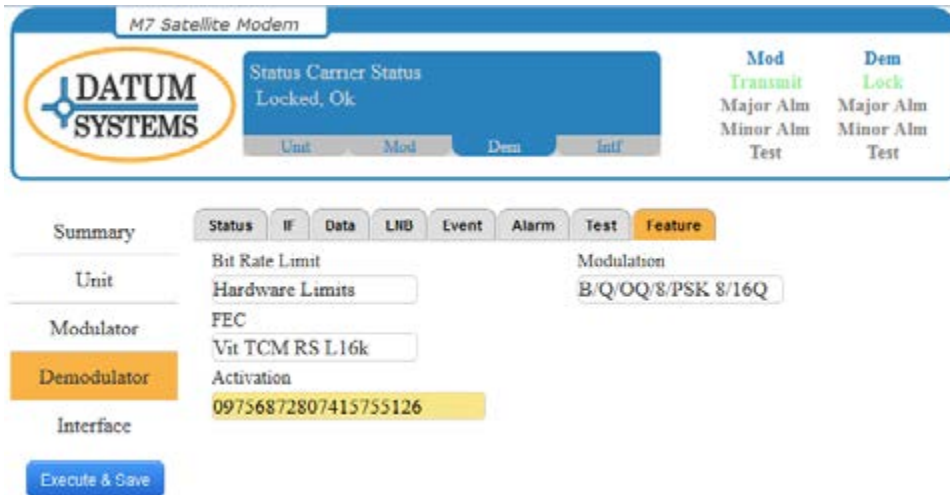


Figure 4-102 – Demodulator Feature Page

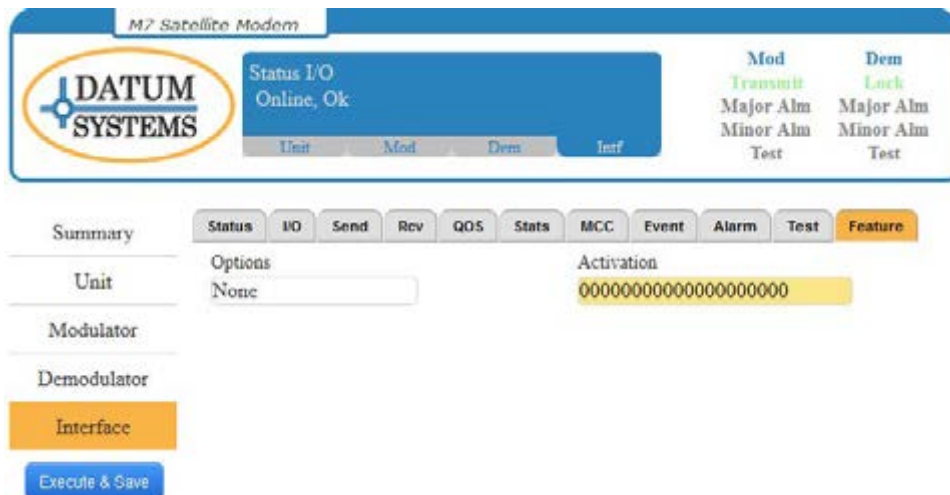


Figure 4-103 – E7 Interface Feature Page

## 4.7 Frequently Asked Questions - FAQ

### OR How Do I? Why Doesn't It? and Where Is?

This section is intended to form a smart index pointing to proper sections of the manual with information on performing common actions or answering common questions. The presentation here is divided into 5 common areas – Link Setup, Front Panel, Remote Control, Data Interface and Manual.

#### 4.7.1 Link Set Up and Installation.

##### 4.7.1.1 Compatibility with other Modems.

###### 4.7.1.1.1 How do I make the M7 talk to a “x” brand modem on the other end of a link?

The M7 has several new programmable features which should make this easier than ever. First, where possible if both modems adhere to Intelsat IESS standards then those defined parameters should be set the same. Still all modem manufacturers have their own conventions for setting parameters with no specified standard, so for example some modems may have a different modulation sense for data bits than others. This would make no difference between two modems of the same type, but would invert data between modems of different types on each end of a link. Most items of this type are programmable in the M7 modem.

The M7 also has a significant number of FEC compatibility modes for aid in achieving compatibility with some competitive modems, especially in Turbo FEC modes. These modes are denoted by the FEC Option type “CT” on the front panel selection.

###### 4.7.1.1.2 Is Datum Systems' Turbo Product Codes compatible with that made by other modem manufacturers?

The M7 also has a significant number of FEC compatibility modes for aid in achieving compatibility with some competitive modems, especially in Turbo FEC modes. These modes are denoted by the FEC Option “CT” on the front panel selection. These modes are typified by the modes used in the CDM5xx and CDM6xx series of competitive modems.

There are several modes that are probably **not** compatible for several reasons. First is that there is no standard for implementation of TPC. Second, Datum Systems spent a lot of time and development in implementing a full set of TPC parameters (i.e. Rates 1/2, 3/4 and 7/8), and insuring the absolute best performance with no compromises. We have seen no other TPC implementation that even comes close to ours. Third, because we have many customers that use our modems in systems requiring low latency we implemented an alternate "Short Block" mode that reduces the typical TPC delay by approximately 1/3. The techniques used in this TPC achieve the best performance of any modem currently produced. Our latest TPC “Advanced” modes are also proprietary to Datum Systems, simply because we know of no one else using the specific parameters.

###### 4.7.1.1.3 Is the M7 Remote Control Protocol Compatible with the PSM-4900?

The M7 has significant new capabilities and features that cannot fit into the structure of the PSM-4900 protocol. However, the M7 will respond to properly formatted PSM-4900 binary control packets within the capabilities of the PSM-4900. This allows mixed systems of 4900 and 500 series modems without initially changing control software. The compatibility does not currently extend to operation over the link on the MCC channel.

##### 4.7.1.2 Operating and Performance Questions.

###### 4.7.1.2.1 There are so many options and parameter settings! Where do I start?

The M7 is highly programmable. This can make the set-up daunting at first. If you are unfamiliar with the common terms and modes used in satellite communications you should first refer to Chapter 2 of this manual “*Installation and Setup*”. As a starting point the modem can also be taken to a default basic set of operating parameters by using the front panel **<Unit: Configuration - Recall>** parameter

and select option “0” or “Factory”. From that point you make necessary changes to set the desired configuration. Once all parameters are set as required the configuration can be saved using the **<Unit: Configuration - Store>** control. From there you can always go back to this configuration by recalling it.

#### **4.7.1.2.2 Why doesn't my M7 talk to another M7 over the satellite? I have set all the parameters the same.**

Any satellite modem has a significant number of parameters, which are settable in order to achieve the maximum performance at the least cost. Because there are so many parameters it is possible to have one unit with a slightly different parameter set than that at the other end of the link. If after insuring that all parameters are set the same and that the acquisition range is correct and that there are no interfering carriers; one other method is to take both modems back to the factory default condition and rebuild the configuration from “scratch”. Use the front panel **<Unit: Configuration - Recall>** and select option “0” or “Factory”. You may want to save your current configuration before resetting to the default.

#### **4.7.1.2.3 What is the delay from end to end using the M7?**

The satellite link itself represents a fixed and very slightly variable delay due to the distance of the satellite from the two stations linked. This delay is approximately 250 milli-seconds. In addition Appendix A lists the specified fixed and rate dependent delays incurred in the modem's transmit and receive processing, including those in the IBS Multiplexer and Reed-Solomon if equipped and enabled.

#### **4.7.1.2.4 Can I use the M7 to help align the station antenna? Is an AGC output provided to feed to automatic antenna positioning equipment?**

Yes - The M7 has a single analog output that is produced by the main processor and converted to analog by a D/A converter. The parameter selected for this output can be either the AGC, Eb/No or Mod CXR Level selected in the **<Unit: Monitor - Mode>**. The slope and polarity are selected using the “Zero” and “Full” parameters below this. The signal is available at the rear panel on the J5 Alarm Connector, pin 5 with the Ground return on pin 6. See Installation Section 2.3.3, “Alarm Connection”, and Operations Section 3.11 for more information on connection and use of the monitor function. The AGC has been the classic parameter used for this type of function, but the M7 provides an output that may be better in most situations. That is the Eb/No, which is a function without the slope changes and negative signal sense of the AGC signal.

#### **4.7.1.2.5 Where is the “Eye Pattern” test points for the I and Q channel receive signals?**

The M7 does not have an analog test point to view the eye pattern. All information at this point in the receive chain is digital and measured by the modem processor. The result of this measurement is presented as the Eb/No. If it is absolutely essential to view the eye pattern as analog test information, contact the factory for availability of a special test fixture for conversion.

#### **4.7.1.2.6 What happened to the Burst Modulator mode in the M7?**

The M7 has the basic circuitry necessary to implement burst modulation. The burst demodulation scheme compatible with the modulation used in the PSM-2100 is no longer manufactured, and there is no clear standard for implementing this capability. Modifying the M7 to work with a specific burst demodulator scheme is an option which requires contacting the factory for availability.

#### **4.7.1.2.7 How do I use the modulator and demodulator functions to invert the spectrum?**

These options were added into the M7 to aid in building specialized systems which may invert the spectrum sense of the received carrier. The main cause of this would be an up or down converter which performs a spectrum inversion.

#### **4.7.1.2.8 How do I use the modulator and demodulator functions to vary the FEC C0 and C1 values?**

These options were added into the M7 to help achieve compatibility with other brands of modems at the other end of a link. These parameter settings also allow changing the modulation of adjacent carriers on the satellite so that a demodulator will not lock to them. This has value if the carriers are

placed closer than the required receive acquisition range. Using this scheme requires the use of the demodulator search mode.

Intelsat in the latest IESS 308/309 has changed the definition of the C0 and C1 values. This option allows compatibility with any definition.

#### **4.7.1.2.9 How do I determine the transmitted "Symbol Rate" of the modem?**

This particular parameter used to be a lot simpler to define. With the introduction of Turbo Product Codes coupled with all the other modem modes and options like programmable IBS multiplexer data load it is now extremely hard to define. The modem knows though, and it is available at the front panel parameter showing the current transmit/receive symbol rate. It is in the **<Mod: Test – Symbol Rate>** and the **<Dem: Test – Symbol Rate>** parameters.

### **4.7.2 Why does It do that?**

#### **4.7.2.1 The modem is operating fine and then suddenly will not lock!**

You probably have the differential encoder/decoder turned off. It is only provided as a control for very special cases and should normally be set to "Enabled".

#### **4.7.2.2 The modem changed its operating parameters without me doing anything!**

The ACR or Automatic Configuration Recovery feature is possibly enabled by setting one of the **<Unit: Config – Recall X>** parameters set to a non-zero value. This will change the modem configuration if the receive carrier is lost longer than the number of seconds entered.

The **<Unit: Config – Power-Up>** parameter may be set to change to a specified configuration on power-up. The normal setting for this is "Last" (0).

### **4.7.3 Front Panel Control**

#### **4.7.3.1 What happened to the "Differential Encoder/Decoder parameter?"**

In normal operation there is no need to disable the Differential encoder or decoder. We only found that occasionally someone disabled it and then had problems locking up to carriers, so this capability was initially removed from front panel control. All of the latest firmware however now allows this control, so you may need to update your firmware.

#### **4.7.3.2 How do I enter a number with a minus sign?**

At any time during the "Edit" process the "+/-" key will change the sign of the current entry (if the change is possible). In the quick edit mode this can be the first key pressed, so for instance, if the current setting for modulator transmit output level is -10 dBm then pressing "+/-, 12" will enter a value of -12 dBm. You could also press "1+/-2" or "12+/-" with the same result.

#### **4.7.3.3 Why doesn't the M7 front panel act like the PSM-2100 or PSM-4900? [and] How do I make it act like the PSM-2100?**

The M7 has many more features and programmable options than the PSM-2100 modems. A close match is achieved by disabling the "quick" entry mode and remembering to press the "Edit" key first instead of the "Enter" key. Once you become accustomed to the "Quick" entry mode and using the change sign (+/-) and decimal point keys you will find it more convenient than any entry on the PSM-2100.

#### **4.7.3.4 Why does the transmit carrier turn off whenever I make a change?**

First the transmit carrier can be set to a mode which will turn the carrier off if any change is made that would result in a possible interference with other carriers on the satellite. This mode can be set to one of three states: Automatic, Confirm or Manual. Automatic will turn the carrier off during the parameter change and return the carrier on (if currently enabled) after the change is completed, Confirm will ask if the carrier should be left on (requiring a "yes" or "no" answer), while Manual will always turn the carrier off after a change. This option is set in **<Mod: IF – Mute>**. More directly the setting described is probably set to "Manual" mute mode.

#### 4.7.3.5 Why can't I find or see a certain option parameter that is shown in the tables?

Many parameters are only available when another option has been enabled which requires that parameter. For example, the **<Demod: IF – Sweep Time>** parameter is only visible if the **<Demod: IF – Sweep Mode>** is set to "Search". These options are shown in the tables as gray to indicate this status.

#### 4.7.3.6 Can I control the far end modem from the front panel of a local modem?

The M7 has the ability to control the far end modem (when linked and locked) from a local modem, but only using the remote control port. This ability requires enabling the Multiplexer option. Control from the front panel is prone to possible mistakes that would lead to accidentally setting the remote modem in a state that could not be recovered without going to the remote site.

#### 4.7.3.7 The far right "Remote" LED is blinking. What does it mean?

The Unit Remote Activity parameters allow setting this lamp to blink when activity is detected on the USB or serial remote control ports. The same is possible for the "Local" LED using the Unit Keyboard Activity control.

#### 4.7.3.8 I seem to have no modulator or demodulator functions available?

There are two reasons that could explain this. First, there are some units sold with only one function installed for special purposes. These units would have a model number indicating this such as PST for a Modulator transmit only or PSD indicating a Demodulator receive only.

The other reason could be that the Modulator or Demodulator is disabled. To check and enable if desired, go to the **<Unit: Config – Modem>**.parameter which shows what is enabled and allows changing.

#### 4.7.3.9 What do the abbreviations on the front panel and in the manual mean?

See the abbreviations in FAQ Section E below.

### 4.7.4 Remote Control

#### 4.7.4.1 Where is the ASCII Control packet structure in the M7?

The M7 and the PSM-4900 modems do not have an ASCII control packet protocol, only the binary packet protocol. The SnIP however does have a fairly complete command line driven control method via the "M7ctl" program. In addition the SnIP can potentially control multiple modems connected via its external RS-485 control port.

#### 4.7.4.2 Can I use the USB connector at J10 to remotely control the M7?

The USB connector is mainly intended for firmware updates requiring a faster speed than the RS-232/449 connection can supply. It is possible to control the modem in binary packet mode via the USB connection. However, this connection does not use or accept addresses in the packet structure, so it will likely require re-writing your packet routines.

You cannot currently use the USB connection for "Terminal Mode" control.

#### 4.7.4.3 Is there a "compatibility" mode for the remote control binary packet protocol that looks like that in the PSM-4900?

Yes. The new M7 design dictated a new structure to implement the significantly greater number of commands available in the M7. Many items such as the interface structure, data rates and available options are so different that creating a compatible command set was impossible. However the M7 actually contains both its own and a copy of the PSM-4900 protocol, allowing the M7 to accept and respond to PSM-4900 packets within the limitations of the PSM-4900 capabilities. This allows mixed systems of 4900 and 500 series modems without initially changing control software. The compatibility does not currently extend to operation over the link on the MCC channel.

#### 4.7.4.4 Is there a "compatibility" mode for the remote control binary packet protocol that looks like that in the PSM-2100?

No. The new commands dictated a new structure to implement the significantly greater number of commands available in the M7. Many items such as the interface structure, data rates and available



options are so different that creating a compatible command set was impossible. The packet structure itself is virtually identical though and in most cases the new command set can be accommodated by a “driver” tailored to the M7.

#### **4.7.5 Data Interface**

##### **4.7.5.1 How do I make a cable to connect to my V.35 (or EIA-530) device?**

See the “Installation” Chapter 2 and Contact Datum Systems for Cabling Specifications which will show how to make cables to interface between the modem’s DB37 connector and other types of common connectors used.

##### **4.7.5.2 Where do I get a “Y” cable to implement 1:1 redundancy?**

These may be purchased from Datum Systems or it is possible to build your own. The connections are discussed in Chapter 2 “Installation” or Contact Datum Systems for cable specifications.

##### **4.7.5.3 Why do I keep getting “sync losses” on my link? Or why does a BERT test show “sync losses”?**

This is usually a sign that some section of the link has a clock or data inversion. See Chapter 4 of the manual for “Loop” testing to try to determine where the problem is and correct either the wiring or change the modem data or clock sense.

##### **4.7.5.4 Why does the modem occasionally fail to operate with my DTE equipment, and to correct it I have to invert the data or clock?**

The only cause in an otherwise functioning modem for this symptom is that the differential encoder/decoder is turned off. Modems use the differential encoding to determine the proper relationship between the clock and data. If the encoder is turned off the modem has a possibility of locking to a signal with the wrong phase. For all normal operation of the modem the Modulator differential encoder and the Demodulator differential decoder must be “Enabled”. The Turbo Product Codes (TPC) option does not use the differential encoder, and when it is enabled the differential encoder and/or decoder is turned off and the option is removed from the parameter matrix. Other modes also automatically control the differential encoder and decoder in the M7, but a linked modem may have the ability to turn it on or off.

##### **4.7.5.5 How do I use the built-in Bit Error Rate Test (BERT) set?**

See Maintenance Section 4.1.2 for information on using the built-in BERT. The M7 BERT now has the ability to be switched to look at the data line side.

##### **4.7.5.6 Can I use the built-in Bit Error Rate Test (BERT) set to test the line or DTE side equipment?**

Yes with reservations. The BERT is designed to normally transmit and receive to the modem side. New in the M7 is the ability to electrically switch the direction that the BERT “looks” toward the line side. However, because of the hard wiring of the interface the pinout is fixed as a DCE device. See Maintenance Section 4.1.2 for information on using the built-in BERT.

##### **4.7.5.7 Why doesn’t my 1:1 redundant switch on certain alarms?**

The 1:1 redundancy logic is programmable on two levels. First is the **<Unit: Redundcy – SW Rqst>** parameter which selects whether a switch is requested on all alarms, alarm A and/or alarm B. If it is set to any options but “On All Alarms” then the particular alarms that are summed into the A and B alarms are themselves programmable, creating the second level. See the discussion in section for more information.

## 4.7.6 Manual

### 4.7.6.1 What do the abbreviations on the front panel and in the manual mean?

A good example is the display and manual representation "Redundcy SW Rqst". Unfortunately the display does not hold enough characters to display the full text of "Redundancy Switch Request". Following is a list of abbreviations used.

Abbreviation	Full Text
1:1, 1:N, M:N	One for One, One for N and M for N. All redundancy switch types.
ACR	Automatic Configuration Recovery
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
ALC	Automatic Level Control
Alm	Alarm
Alt	Alternate
AUPC	Automatic Uplink Power Control
AUFC	Automatic Uplink Frequency Control
BER, BERT	Bit Error Rate, Bit Error Rate Test
BUC	Block Up-Converter
Cal	Calibrate
Clk	Clock
Config	Configuration
Cntst	Contrast
CXR	Carrier
Dem	Demodulator
Dif	Differential
ESC	Engineering Service Channel
Erred	Errored
FEC	Forward Error Correction
Freq, Frq	Frequency
Frmt	Format
HSSI	High Speed Serial Interface (used with routers)
IDcOff, QDcOff	I and Q channel DC Offset
I/O	Input/Output
Intf	Interface
Keybrd	Keyboard
LCD	Liquid Crystal Display
LDPC & FLDP	(Flexible) Low Density Parity Check FEC
LNB	Low Noise Block downconverter
LO	Local Oscillator
Loopbck	Loop-back
Lvl	Level
Max	Maximum
MCC	Modem Control Channel

Min	Minimum
Mod	Modulator
Mux	Multiplexer
Opt	Option
OverHd	Overhead
RCV, Rcv	Receive, into the Demodulator
Redundcy	Redundancy
Ref	Reference
Rqst	Request
RS, R-S	Reed-Solomon – Type of FEC
Sat	Satellite
SCPC	Single Channel Per Carrier
SER	Symbol Error Rate
SnIP	Satellite network Interface Processor, our name for an Ethernet Interface running Linux.
SW, Sw	Switch
Sync	Synchronous or Synchronization
SysClk	System Clock
Ter, Terr	Terrestrial – Line side of modem
TPC	Turbo Product Codes – Type of FEC
Tst	Test
USB	Universal Serial Bus
VSAT	Very Small Aperture Terminal
XMT, Xmt	Transmit, from the Modulator

**Appendixes**

**Appendix A Specification**

Contact Datum Systems for a copy of the current M7 Specification

**Appendix B Remote Protocol**

Contact Datum Systems for a copy of the current M7 Remote Control Protocol document.

**Appendix C Cabling Specifications**

Contact Datum Systems for details of the M7 Cabling Specification requirements.

**Appendix D Interface Options**

Contact Datum Systems for information on the available M7 Interface Options.

## Appendix E Smart Carrier Cancellation

### E.1. Smart Carrier Cancellation Quick Start Guide

#### E.1.1. Smart Carrier Cancellation Overview

Smart Carrier is a patent pending advanced second generation carrier canceller which allows two (2) similar carriers to occupy the same transponder spectrum, but is different from other cancellers in that it is a baseband canceller instead of an IF canceller. It allows excellent performance with easy setup and no additional cabling. Smart Carrier is compatible with all Datum modulation types and FECs, including the newly released DVB-S2X. Smart Carrier is well suited to be used with Sharp Roll-Off factors all the way down to 5%. Datum's technique provides improvement in the Shannon Capacity of ~ 2 dB, which is ~50 % increase in the fundamental channel capacity. An example is shown in Figure E -1.

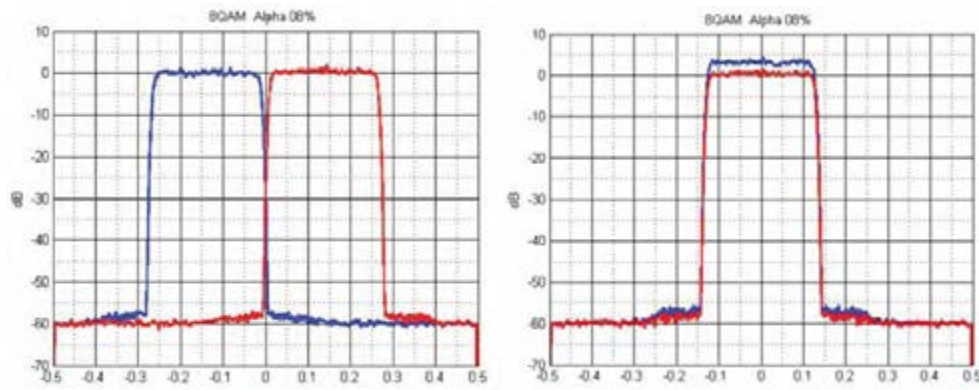


Figure E-1 – Smart Carrier Cancellation Example

#### E.1.2. The purpose of this appendix

1. Introduce the “Smart Carrier” Demodulator Card.
66. Show a typical Smart Carrier network configuration
67. Provide an understanding of the Smart Carrier Terminology
68. Show setup configuration and explain status information.

## E.2. About the “Smart Carrier Ready” Demod Card

To use the Smart Carrier cancelling option you must have a “Smart Carrier Ready Demod (SCR)” installed in your M7 Series modem. The part numbers for the multiple versions are listed below and can be confirmed in the menu or web browser interface of the modem under the Demod/Status section. There are five (5) versions of SCR Demods:

1. M7 Smart Carrier Ready IF Demod: M714002A-1  
(PCB # DRA14002-01)
69. M7L Smart Carrier Ready L-Band Demod: M714001A-1  
(PCB # DRA14001-01)
70. M7LT Smart Carrier Ready L-Band Demod: M714001A-2  
(PCB # DRA14002-02)
71. M7 Smart Carrier Ready L-band DVB-S2X Demod: M715002A-1  
(PCB# DRA15002-01)
72. M7 Smart Carrier Ready L-band DVB-S2X Demod: M715002A-2  
(PCB# DRA15002-02)

### E.2.1. Before you begin

To verify your M7 Series modem demod is Smart Carrier Ready, go to the Dmd/Status section of the front panel menu or web browser interface. Under “**Hardware Type**”, it should show “**Smart Carrier IF Demod**” or “**Smart Carrier L-Band Demod**”, as shown in Figure E -2 below. To locate the Smart Carrier Ready Demod version, scroll down to the Status/Hardware ID and verify you have Items 1 through 5 above.

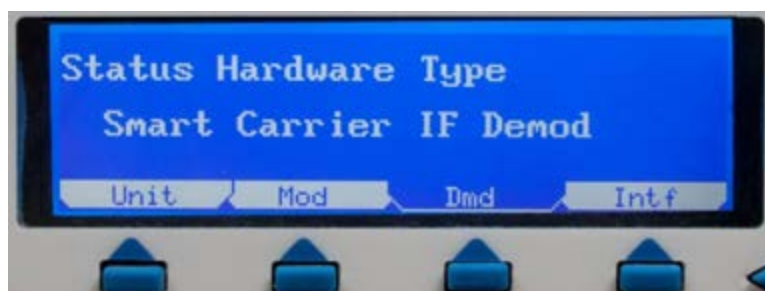


Figure E-2 – M7 Demod Hardware Status

## E.3. Terms and Definitions for Smart Carrier Demod Configuration and Status Menus

For the purposes of this Guide, the naming and definitions of the following operational and technical terms are given below in short form.

### E.3.1. Demod Configuration:

1. “**IF Smart Carrier**” This refers to Datum System’s patented point-to-point Carrier Canceling technology.
73. “**IF Sat Echo Delay Max**” This defines the maximum satellite echo delay that Smart Carrier will search to when looking for the undesired echo carrier. Echo delay is the time it takes the local uplink carrier to travel to the satellite and back to the same location it started from, returning as an echo. Typical geostationary satellites have an echo delay of about 240 ms.
74. “**IF Sat Echo Delay Min**” This defines the minimum satellite echo delay that Smart Carrier will search from when looking for the undesired echo carrier. Echo delay is the time it takes the local uplink carrier to travel to the satellite and back to the same location it started from, returning as an echo. Typical geostationary satellites have an echo delay of about 240 ms.

75. **“IF Sat Echo Delay Search Hold”** When echo lock is lost after being locked this determines how long Smart Carrier searches +/- 1 ms of the last known echo delay value before going to the full search range set by “IF Sat Echo Delay Max” and “IF Sat Echo Delay Min”. The wider the echo delay search range the longer on average it takes to acquire echo lock.
76. **“IF Sweep Range”** This defines the frequency sweep range and needs to be set so that it is greater than the far end carrier and echo carrier maximum frequency errors. The primary cause of frequency errors is the accuracy of the reference used for the up and down converters. The satellite itself also contributes to this error and should be accounted for. In most systems a +/-30 kHz sweep is sufficient.
77. **“IF Sweep Mode”** Normally this should be set to “Fast”. Search mode is for special applications requiring very low symbol rates where multiple carriers can be present in the above sweep range.

### E.3.2. Demod Status:

1. **“Status Carrier”** Is the summary status of the Smart Carrier demod. This will indicate if there’s an alarm, if the echo is unlocked, if a test mode is active and if the demod is locked to the far end carrier.
78. **“Status Eb/No”** Is the current Eb/No of the far end carrier being received.
79. **“Status Offset”** Displays both the far end carrier “Rcv” error offset frequency and the “Echo” offset frequency when they are each locked.
80. **“Status Level”** Displays both the far end carrier “Rcv” level and the “Echo” level in dBm. The echo level is only valid when the echo is locked.
81. **“Status Imbalance”** Displays the frequency offset imbalance between the far end carrier and the echo carrier as a percentage of the symbol rate and the level imbalance between the two carriers in dB. The default offset imbalance alarm threshold is 3.00% and the default level imbalance alarm is 10.00 dB. Generally best performance is achieved when the offset imbalance is less than 1% and the far end carrier and echo carrier level imbalance is less than 7 dB.
82. **“Status Sat Echo Delay”** Displays the current satellite echo delay in milliseconds when the echo is locked. Otherwise it shows the current delay being searched in an attempt to acquire echo lock.
83. **“Status Hardware Type”** Displays the type of card installed in the slot being viewed. See Section E.2.1.

## E.4. System Configuration Requirements

The following conditions are necessary in order to operate Smart Carrier cancellation.

1. A Smart Carrier enabled modem must be used at each end of the satellite link.
55. The link must be full duplex and each end of the link must be able to see an echo (copy) of its own signal in the return (downlink) path from the satellite. Each modem will cancel its own echo using the Smart Carrier technology.
56. Smart Carrier cancellation cannot operate in spot beams type transponders and only be used within a bent-pipe transponder.
57. Power Spectral Density Ratio between the RX carrier and the Echo must be within +/- 10 dB
58. Symbol Rate Ratio between the RX carrier and the Echo must be within +/- 1/8 of the symbol rate
59. Frequency Offset between the RX carrier and the Echo must be within +/- 1/8 of the Symbol Rate

Figure E -3 below shows a simple block diagram needed to operate Smart carrier. The two ends of the link are shown with their own echo carrier being received on the downlink.

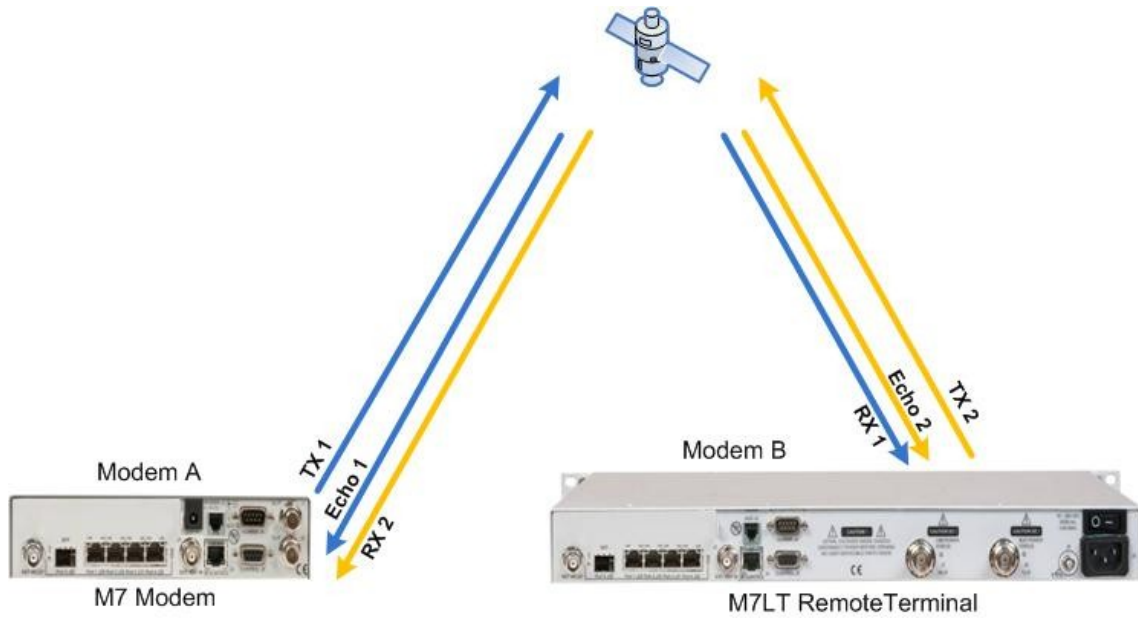


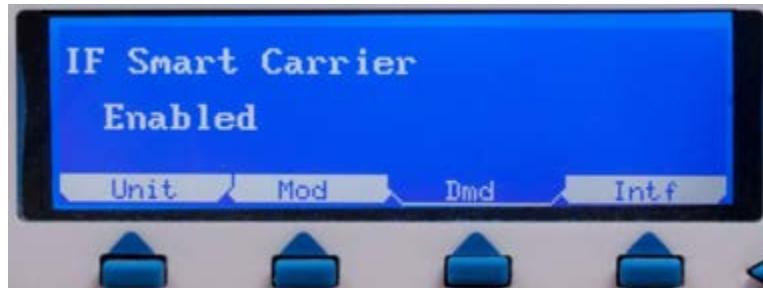
Figure E-3 – Smart Carrier Cancellation Block Diagram



## E.5. Modem and Smart Carrier Operating System and Status Menu's

### E.5.1. Demod Front Panel Configuration Menus

The following configuration menus are related to Smart Carrier cancellation operation. Smart Carrier was designed for easy set-up and trouble free operation. It is recommended to start with the factory default settings (shown below). The front panel menus for configuration are found in the Demod/IF menu Section 3.5 (Table 3 -31) and are provided below with helpful descriptions. Configuration may also be done via the Web Browser interface which is shown in Section E.5.3.



<Dmd: IF Smart Carrier –Enabled> enables Smart Carrier operation.



<Dmd: IF Sat Echo Delay Maximum – 2.0 to 320.0 ms > Sets the maximum satellite echo search delay. The recommended initial value is 290.0 ms.



<Dmd: IF Sat Echo Delay Minimum – 0.0 to 318.0 ms > Sets the minimum satellite echo search delay. The recommended initial value is 230.0 ms for geostationary satellite operation and 0.0 ms for test bench operation.



**<Dmd: IF Sat Echo Delay Search Hold – 0.0 to 600.0 Sec >** Sets the amount of time a narrow +/-1 ms delay search hold is active until returning to the full delay sweep range set by “IF Sat Echo Delay Maximum” and “IF Sat Echo Delay Minimum” after echo lock is lost. This speeds echo reacquisition when brief interruptions occur.



**<Dmd: IF Sweep Range – 0.100 kHz to 3.250 MHz>** Sets the +/- carrier frequency acquisition sweep range.



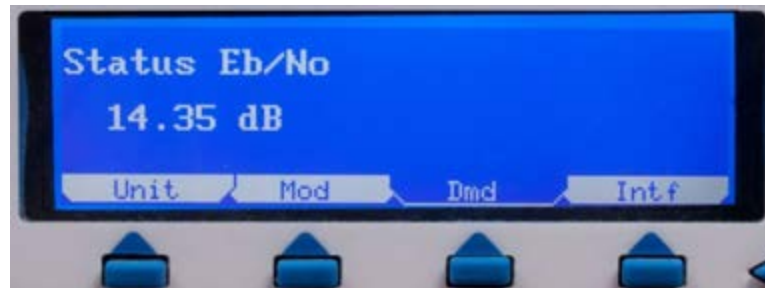
**<Dmd: IF Sweep Mode – Fast or Search>** “Fast” enables fast acquisition mode. Search mode is only used with very low symbol rates where multiple carriers can be within the IF Sweep Range. Should be set to “Fast” under normal conditions.

### E.5.2. Demod Front Panel Status Menus

Detailed Smart Carrier status menus are provided to assist in simple set-up and operation, as well as providing the tools for easy troubleshooting of the cancelled satellite link. Below are the related status menus and descriptions.



<Status: Carrier – Locked, OK> Shows far end Carrier Locked and Normal.



<Status: Eb/No – 30 to 0 dB> Shows real-time Eb/No level of the far end carrier being received when the demod is locked.



<Status: Offset – Rcv> Shows the far end carrier offset frequency being received.

<Status: Offset – Echo> Shows the echo offset frequency being received.



<Status: Level – Rcv> Shows the far end carrier level being received.

<Status: Level – Echo> Shows the echo carrier level being received.



**<Status: Imbalance – Offset>** Shows the frequency offset imbalance between the far end carrier and the echo carrier as a percentage of the receive symbol rate. For best performance the two carriers should be close together in frequency, typically the difference should be less than 1% of the symbol rate.

**<Status: Imbalance – Level>** Shows the level imbalance between the far end carrier and the echo carrier. Positive values indicate the far end carrier level is greater than the echo carrier level. Negative values indicate the echo level is greater than the far end carrier level.



**<Status: Sat Echo Delay – Edit >** When viewing the "Status Sat Echo Delay" and the echo is locked, pressing Edit or the 0 key will bring up this option. Pressing Enter will then set the "IF Sat Echo Delay Maximum" to the currently received echo delay plus 4 ms and the "IF Sat Echo Delay Minimum" to the currently received echo delay minus 4 ms. This +/-4 ms delay range will allow for normal geostationary satellite movement while providing the fastest possible echo reacquisition time when reception is interrupted.

### E.5.3. Demod Web Browser Configuration Menus

The following two (2) Demodulator Web Browser pages are related to Smart Carrier cancellation operation. The Web Browser pages provide the same information and control as is shown in the previous front panel section.

The screenshot shows the M7 Satellite Modem web browser interface. At the top, there is a header with the DATUM SYSTEMS logo and a status bar indicating 'Status Carrier Locked, Ok'. Below the header, there are navigation tabs for 'Unit', 'Mod', 'Dem', and 'Intf'. The 'Dem' tab is currently selected. On the right side, there are indicators for 'Mod Transmit', 'Major Alm', 'Minor Alm', and 'Test', along with 'Dem Lock', 'Major Alm', and 'Minor Alm'. A 'Logout' button is located in the top right corner.

The main content area is divided into several sections. The 'Demodulator' section is highlighted with a blue box and contains the following parameters:


Parameter	Value
Level Echo (dBm)	-28.06
Offset Echo (kHz)	0.000
Imbalance Offset %	-0.01
Imbalance Level (dB)	-6.20
Sat Echo Delay (ms)	0.0

Other sections include 'Unit' (Status: Locked, Ok), 'Modulator' (Level Rcv: -34.26, Offset Rcv: -0.397), 'Interface' (Normal), 'Test' (Normal), 'Estimated BER' (< 1.0e-10), 'Lmk Margin (dB)' (16.73), 'FEC Hardware Opt' (None), 'Hardware Type' (Smart Carrier L-Band Demod), and 'Hardware ID' (M714001A-1r9.95).

Two callout boxes on the left side of the image point to specific elements:

- Smart Carrier Status
- Dmd HW Type

Figure E-4 – Smart Carrier Demodulator Status Page



Status Carrier  
**UNLOCKED**

Mod  
Transmit  
Major Alm  
Minor Alm  
Test

Dem  
Lock  
Major Alm  
Minor Alm  
Test

Logout

Summary

	Status	IF	Data	LNB	Event	Alarm	Test	Feature
Unit	Frequency (MHz) 975.000000		LNB Rcv Frequency (MHz) 975.000000					
Modulator	Spectrum							
Demodulator	Normal							
Intf 1	Filter Roll-Off 0.35		Sweep Range (kHz) 30.000					
Intf 2 Empty	Sweep Mode Fast		Sweep Time (sec) 10.0					
	Modulation QPSK							
	Smart Carrier Enabled							
	Sat Echo Delay Maximum (ms) 10.0				Sat Echo Delay Minimum (ms) 0.0			
	Sat Echo Delay Search Hold (sec) 5.0				AUPC Remote Path Disabled			
	AUPC Remote MCC Address 1				Impedance (ohm) 50			
	Signal/Noise Format Eb/No <input checked="" type="radio"/> Es/No <input type="radio"/>							

Activate Smart Carrier

Figure E-5 – Smart Carrier Demodulator IF Page

## Appendix F M7 Modem SNMP

### F.1. M7 Modem SNMP Overview

SNMP stands for Simple Network Management Protocol. This appendix describes the resources and procedures necessary to use the SNMP facilities provided by the Datum System's M7 modem. It does not describe SNMP itself or methods and procedures for network management other than basic concepts.

The M7 modem utilizes a custom OS for modem operation and control including an SNMP agent (server) which responds to requests from valid SNMP browsers (clients).

The current M7 SNMP agent is capable of operating with v1 and v2c protocol versions.

The Datum Systems "PEN" for SNMP is 31968 which is used for the branch of the standard SNMP tree dealing with Datum System's Private Enterprise Network objects.

The M7 Modem SNMP implementation is unique in that it is capable of gathering information from modems on the far end of a satellite link not served directly by an Internet connection.

#### F.1.1. SNMP – Some Definitions

For the purposes of the remainder of this document the conventions for naming the different objects that are part of SNMP are:

- "**Manager**" or "**Client**" The controlling device or computer. This can be a Windows, Linux or other computer with a SNMP manager or browser programs installed.
- "**Agent**" The controlled device, in this case, typically an M7 modem. The agent performs server functionality; providing information in response to requests from a client or manager.
- "**Trap**" A background task runs as a daemon and determines if a parameter is outside normal bounds. Boundary exception conditions are identified and an autonomous message is sent to a specified client/manager.
- "**MCC**" or Modem Control Channel. An internal modem service which sends and receives binary messages for maintenance and control purposes.
- "**MIB**" The Management Information Base. This is the database of the individual elements (objects) that can be managed via SNMP. The MIB basically is an address book of object identifiers and the parameters they control. The MIB can be textual or compiled and may have extensions of either ".mib", ".txt", or no extension – all with the same content. It's worth noting that MIBs typically use the line endings from Linux which is slightly different from Windows.
- "**OID**" short for Object Identifier - The unique number that represents the position of a particular parameter in the SNMP tree structure. Standard Internet management OIDs begin with 1.3.6.1.2 followed by additional object identifiers. Datum Systems private OIDs begin with 1.3.6.1.4.1 followed by the "PEN" of the company developing the MIB (Datum Systems - 31968) and followed by additional numbers separated by decimal points. Each of these numbers represents a node in the MIB tree. All proprietary Datum System OIDs begin with 1.3.6.1.4.1.31968. There may be additional nodes representing discovery items.

### F.1.2. SNMP – Basic Model

SNMP consists of three main elements (Figure F -6): The “Manager”, the “Agent” and the device(s) that the agent controls. We are expressly differentiating between the agent and the device that it controls. The manager is distinct from the computer that it is installed on, just as the agent is distinct from the device that operates its control processes.

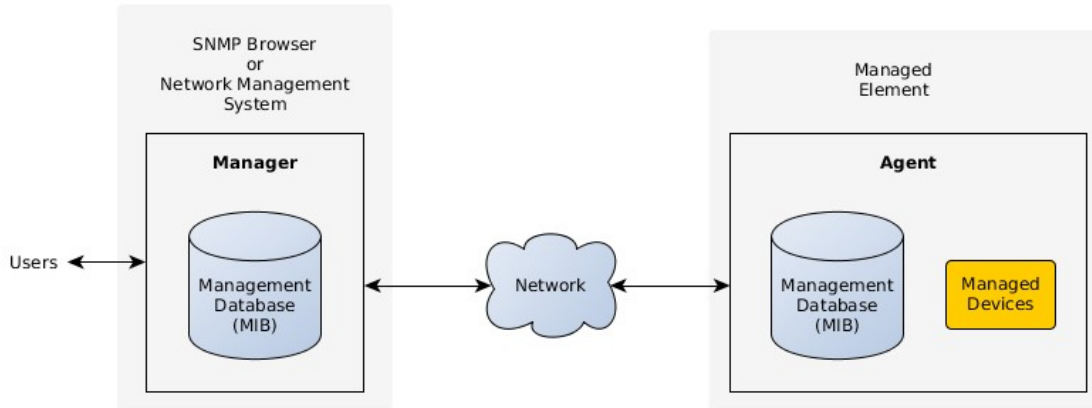


Figure F-6 – SNMP Components

The manager and agent use a Management Information Base or “MIB” to identify data. Both the manager and agent must have the same MIB versions -- although they may be in different formats. However, if they are different formats, the agent must be compiled with knowledge of the MIB, and the methods of retrieving the MIB reference values. The manager typically loads a text version of the MIB and can load many MIBs.

The manager and agent communicate using the SNMP Protocol over their network interconnection. This process functions as a client-server, where the agent is the server providing information in response to a client requests. This is also similar to a web server providing web pages in response to a browser client request. All communication between the user, or information requestor, and the Agent are through the Manager.

Figure F -7 below shows a small portion of a satellite based communications system.



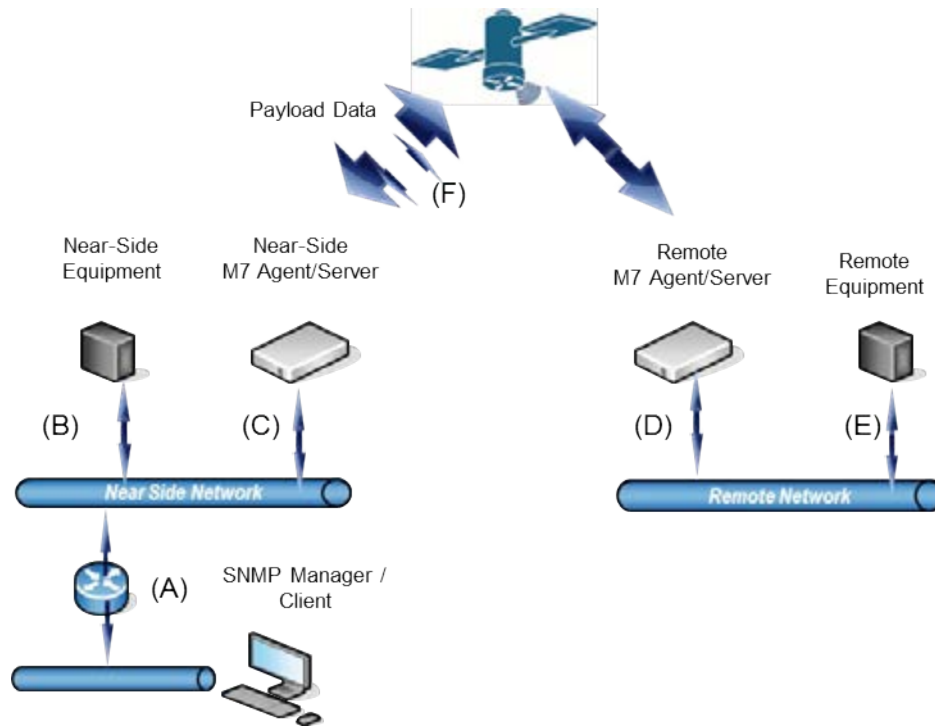


Figure F-7 – Satellite Link with SNMP

Throughout this document Figure F-7 will be used to describe requirements and potential pitfalls in using the SNMP locally and remotely.

For the SNMP to properly function, each lettered link (A-F) must be configured. Configuration includes setting the:

- IP addresses,
- IP ports,
- Modem Control Channel addresses,
- Channel bandwidth,
- SNMP community names for reading and writing,
- Enabling the SNMP agent and MCC agent.

The next section will provide an overview of the data paths for Monitor and Control messaging. Sections F.2 and F.3 describe the steps required to configure and test the SNMP exchanges.

### F.1.3. Case Examples

#### 1) Near side Agent

The simplest case is a local SNMP manager controlling or monitoring a local (Near-Side) M7 agent.

Communication must be established from:

**SNMP Manager → A → C → Near Side M7 Agent**

The reply path must be available from:

**Near Side M7 Agent → C → A → SNMP Manager**

#### 2) Far side Agent

For the same command to be successful to the Remote M7 Agent a communication path must be available for the Monitor and Control (M&C) traffic. In this case the satellite link must provide the data bridge for the messages and their responses.

If the Near-Side and the Far-Side agents both have Ethernet interfaces installed, then the M&C information can be placed onto the LANs along with the payload data. In this scenario, the payload and M&C modem ports would both be connected to their respective LANs and the M&C data travels undistinguished from the payload carried over the satellite link.

This can be advantageous in some cases but this is impossible when either modem does not have an Ethernet LAN connected to an interface. It should be noted that some customers will not want to have their payload information interspersed with M&C data.

The M7 provides a mechanism for exchanging the SNMP packets between the two modems by using an overhead Modem Control Channel (MCC). The overhead Modem Control Channel, (F in Figure F-7) can be set up explicitly in the modem configuration. For I7, I7+, and E7 IP interface cards an on-demand embedded channel can be configured.

The MCC bandwidth is manageable by the customer and keeps the payload separate from M&C data. See Section F.7 for information and examples on this capability.

The remote communication path is now

**SNMP Manager → A → C → Near Side M7 Agent → F → Remote M7 Agent**

The symmetric reply path is now:

**Remote M7 Agent → F → Near Side M7 Agent → C → A → SNMP Manager**

This in turn can be extended so that the remote agent can provide communications with remote equipment via (D → E). Far end devices are addressed via special formatting of the community names in the SNMP messages.

#### F.1.4. SNMP – Tree Structure

SNMP information is arranged in a tree like structure with branches and leaves. The first few digits of the tree are defined by the ISO organization and begin with 1.3.6.1.4.1 which stands for

iso	org	dod	internet	private	enterprises	manufacturer	device	model
1.	3.	6.	1.	4.	1.	31968		

The top level OID for the M7 modem as controlled by a M7 modem device is:

1.3.6.1.4.1.31968.3.1.3

All objects and events for the M7 series of modems will begin with this OID number. For example the full OID for the M7 modem modulator IF output level is:

1.3.6.1.4.1.31968.3.1.3.1.2.1.4.1.1.5.1

A quick note here if you are not familiar with SNMP. The individual parameters in the tree are sometimes called a “leaf”, and a scalar leaf uses “.0” after its OID to access that parameter. If the parameter is part of a table the individual parameters have designations of “.1”, “.2” and so forth representing the columns of the table.

A lengthy tree structure defined as a series of numbers would be very difficult to work with. One purpose of the MIB database is to provide a textual definition and translation between the numeric OID and human readable names for each of the parameters.

When the proper MIBs for a device such as the M7 modem are loaded into the manager/browser or into a command line version of the Net-SNMP manager/client programs, then much simpler names can be used. For example:

**DATUM-M7-MODEM::modlflLevel.1**

or more simply:

**modlflLevel.1**

Obviously each OID is unique and the named element referenced by it must be unique. MIB node names follow a naming convention called “camelback”, where the first character is always lower case letter, and upper case is used to clarify the word beginnings.

#### F.1.5. SNMP Additional Resources

If you are unfamiliar with SNMP and its operation there is a wealth of information available on the web. A good starting point might be to Google for “SNMP Tutorial” and “SNMP Tools”.

There are also free and commercial programs that allow one to browse the MIBs of controlled device agents. These programs run on Windows, Linux and Mac computers to provide either a textual or graphic displays of information. There are multiple open source tools available for Linux variants such as Fedora and Ubuntu among others.

The MIB provided by Datum Systems, Inc. has been tested and is believed to work without error using the free iReasoning version 10.0 MIB browser.

## F.2. SNMP Configuration

Proper SNMP function requires configuring and enabling the M7 modem agent and also configuring and running an SNMP manager or “browser”.

M7 modem SNMP configuration consists of setting the correct values for your system in the SNMP configuration parameters and enabling SNMP and or SNMP trap operations. This configuration can be done from the front panel menu **<Unit: SNMP Server Mode>** or via the web interface.

In most cases, since the manager/browser is talking to multiple modems in a system, the configuration will be the same for all local modems except for its unique IP address.

### F.2.1. SNMP Configuration Basics

When enabled, the SNMP agent processes wait and listen for messages on the Ethernet control interface port containing the SNMP protocol. If the messages are addressed to this unit's IP Address, and are properly formed, the agent will act upon the message and return a response. The modem also listens for messages on the MCC channel with its MCC receive address.

Link configuration for SNMP involves setting the SNMP parameters properly plus setting up the MCC channel if required.

Common settings for SNMP operation are identified in this document with the following color keys:

- Common modem settings are highlighted in **yellow**, while
- Modems with a LAN connection are highlighted in **blue**, and
- Modems for the remote site are in **green**.

Notice that a response port is not specified; all messages are returned to the incoming port.

Table F-1 – SNMP Settings

Name	Type	Options
Server Mode	Selection	0 = Disable, 1 = Read Only, <b>2 = Full Access</b>
Server Type	Selection	0 = V1, <b>1 = V2c</b>
Server Port Number	Entry	Default <b>161</b> , use keypad to change
Read Only Community	Entry	Default "public"
Read/Write Community	Entry	Default "private"
Trap Community	Entry	Default "datum"
Trap Path	Selection	<b>0 – Out IP Control Port</b> , <b>1 = Out MCC Port</b> ,
Trap Address	Entry	IP Address to send traps to.
Trap Port Number	Entry	Default <b>162</b> , use keypad to change
Activity	Selection	<b>0 = None</b> , 1 = Beep, 2 = Blink Online Lamp, 3 = Beep and Blink Lamp

Also, most operators will want to set unique community strings as a minimal protection.

This list does not include the control port IP Address which should already be set. The control port IP Address is currently common to three modem controllers: the remote binary control, web control and SNMP control.

As we've mentioned, if a remote unit is not accessible on an Ethernet LAN, it may still be controlled via SNMP using MCC accesses. However, you must configure the remote modem for SNMP operation as though it were connected to a LAN. The Control port IP Address must be set.

When the MCC is being used the remote modem must also have its MCC Rcv Address set and the MCC overhead channel operating. In fact, we recommend that a unique MCC Rcv address always be set in all modems in your network. Once the addressing is set, the channel can be enabled on an as needed basis. See the instructions in Section F.7 on setting up the MCC channel.

### F.2.2. Configuring SNMP via Web User Interface

Log into a M7 modem control web address and select the “Unit” page from the links on the left and then click the “SNMP” tab. The display should be similar to the Figure F -8 below and configuration is straight forward since all the table options available are shown in a single view.

The screenshot shows the M7 Satellite Modem web interface. At the top, there is a header with the DATUM SYSTEMS logo and a status bar indicating 'Status Modem Mod Carrier Sending, Ok'. To the right of the status bar, there are indicators for 'Mod Transmit' (green) and 'Dem Lock' (green), along with alarm levels: 'Major Alm', 'Minor Alm', and 'Test'. Below the header is a navigation menu with tabs for 'Unit', 'Mod', 'Dem', and 'Intf'. The 'Unit' tab is selected. On the left side, there is a vertical menu with buttons for 'Summary', 'Unit' (highlighted), 'Tropo-Mod', 'Tropo-Demod', 'Intf 1: E7', and 'Intf 2: Empty'. The main content area has a sub-menu with tabs for 'Status', 'Event Log', 'Redundancy', 'Config', 'Front Panel', 'HTTP', 'SNMP' (highlighted), and 'IP Control'. Below this, there are more tabs: 'Serial Control', 'Reference', 'Monitor', 'Event', 'Alarm', 'Test', 'Feature', and 'Update'. The configuration area is divided into sections: 'Server' with fields for Mode (Read Only), Type (V2c), Port (161), Read Only Community (public), and Read/Write Community (private); 'Trap Client' with fields for Trap Client (1), Community 1 (datum), Path 1 (Out IP Control Port), Dest Address 1 (192.168.2.101), and Dest Port 1 (162); 'Trap Forwarding' with fields for Remote MCC Address (0) and Local Listening Port (162); and 'Activity' (None) and 'MIB Version' (201807032056Z).

Figure F-8 – SNMP Web Control Page

### F.2.3. Configuring SNMP via Front Panel Controls

On the modem front panel first press the “Unit” button under the LCD display, then scroll right until you see the label “SNMP” in the upper left of the LCD display (Figure F -9). All of the SNMP configuration items are in this sub-menu by scrolling up and down.

Front panel menu operation is explained in Section 3.2 and the SNMP sub-menu is shown in Table 3 -29, and will not be repeated here. If there are any questions about the front panel menu operation refer to these sections.

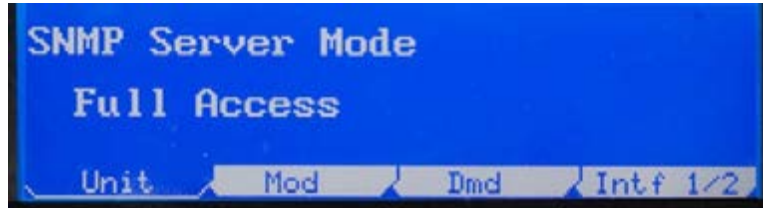


Figure F-9 – Front Panel LCD SNMP Control

### F.3. M7 Modem Agent – Built-in Parameter Organization

The parameter list in the M7 modem is too extensive to show fully here. One of the best ways to view the parameter list is to use a graphical browser and show the MIB in a “Tree” view (Figure F -10).

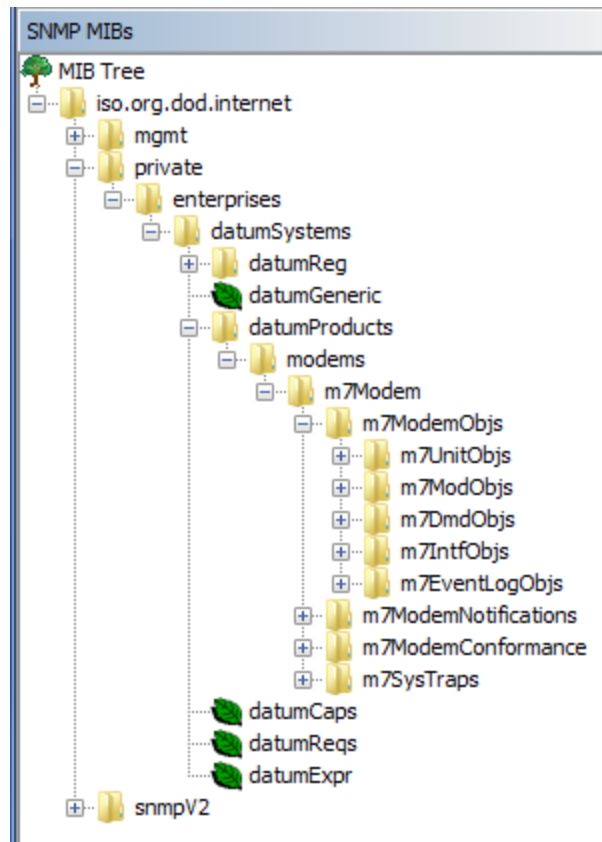


Figure F-10 – Example Tree View of the M7 Upper-Level MIB

The parameters are divided into sections based on the installed functional cards which are plugged into the internal “slots” of the modem. There is one controller slot, two RF card slots and two interface slots. The M7 MIB will identify the card number that is installed in each of these slots, which is used in the SNMP MIB node name

- The controller card is named “Unit” and this category, under the “m7UnitObjs”, contains all of the parameters that are related to the unit as a whole plus those related to the control functions. SNMP MIB node names in this category all begin with “m709001a”. If there is a new controller card, the first part of the node name will change to reflect the proper controller card.
- The RF slots contain modulator and/or demodulator cards of different types installed for specific applications. They usually contain one modulator and one demodulator, but could contain only one card or two demodulators. SNMP MIB node names are listed under the “m7ModObjs” and “m7DmdObjs” categories. The installed modulator or demodulator cards are identified by a part number that is used at the start of the SNMP MIB node name. For example, the modulator IF frequency would be identified by “m709002aIFFrequency”.
- The interface slots can contain a wide variety of cards including, but not limited to, Serial Sync, Dual G.703, IP Extended Bridging (E7), and programmable IP (I7 and I7+). The SNMP MIB node names are listed under the “m7IntfObjs” category. The installed interface cards are identified by a part number that is used at the start of the SNMP MIB node name. For example the SNMP MIB node names for the mode of port 1 on a dual G.703 interface would be “m709014aIOPort1Mode”.

Since there can be more than one RF card or interfaces these are arranged in an SNMP table format where the first of one particular card is followed by “.1” while the second instance is followed by “.2”. If the unit contains two (2) IF based demodulators, the first instance is “m709004a.....1 and the second is “m709004a.....2. However if the cards are different, each one is followed by “.1”.

NOTE: The exact list of available parameters may change. Refer to the Datum Systems web site for the latest information on available MIBs. The MIB may also be exported from the modem using the Web Browser in the “Unit – Update” tab.

#### F.4. SNMP Browser/Manager Configuration

The Browser or Manager program is what queries the M7 modem for information. For access to the M7 modem a standard set of MIBs are used to traverse the tree from the top “iso” level down to the Private Datum Systems Products. These standard MIBs are typically distributed with the browser being used.

The Browser (or Manager) program must have a copy of the MIBs for all equipment targeted for access, knowledge of the community string, and security arrangements of that equipment. The file names for the unique loaded MIBs for the M7 series modems are:

DATUM-REG-MIB – The base Datum Systems Global Registration MIB.

DATUM-M7-MODEM-MIB – The M7 series modem MIB.

Note that these files have no extension, but some browsers may require the addition of “.txt” or “.mib” to operate properly. If this is the case, rename the MIB(s) to add the extension as required. Note also that Net-SNMP does not load MIBs by their file name, but instead the MIBs must be located in specific folders and the MIB is loaded using its “Definition” name. For the two MIBs above those are:

DATUM-GLOBAL-REG

DATUM-M7-MODEM-MIB

##### F.4.1. Net-SNMP Specific Information

The Net-SNMP suite of Master processes is common to Linux and those will be briefly described in Section F.6 with examples to show their use.

NOTE: Our original MIB versions are created in Linux and use the Linux new line conventions which may not display correctly using a Windows program such as “Notepad”. We attempt to reformat the “.txt” versions of these programs with the standard Windows new line characters.

This section expects that Net-SNMP is installed on a Linux computer. The typical file location for the MIBs is in the “/usr/share/snmp/mibs” directory. For versions of Net-SNMP after 5.4.2.1, the file location may be in the “/usr/share/mibs/netsnmp” directory. The MIBs for the M7 modems may be downloaded from the Data Systems web site or from within the M7 modem files.

To load the M7 MIBs into the Linux computer, instruct Net-SNMP which MIBs to load beyond its standard set. To load the MIBs into a Linux computer you will need root access or use of “sudo” to access MIB file directory. SNMP commands such as walk, get, set, etc may scan the MIBs located in this file location for your given parameter name.

A typical sequence to load the M7 modem MIBs might be:

```
export MIBS=+DATUM-GLOBAL-REG
export MIBS=+DATUM-M7-MODEM-MIB
```

NOTE: The top level MIB definition inside the DATUM-REG-MIB file does **not** match the name of the file. Net-SNMP always looks into the files to determine the MIB definition names.

After loading the MIBs you can then issue commands using the short-hand names of parameters. For example to get the current Demodulator Rcv IF Frequency you could use “snmpget” as in:

```
$ snmpget -v 2c -c public 192.168.15.64 m709007aIFFrequency.0
```

SNMP is also possible without loading the MIB, but you will have to know the full “OID” address of the modem parameters. They start at 1.3.6.1.4.1.31968.3.1.3 as described in Section F.1 above.

## F.5. Ubuntu 10.10 or others using Net-SNMP 5.4.3 and above

If you have recently updated your Linux computer and the new version of Net-SNMP is 5.4.3 or above then file locations may have changed and Net-SNMP may not work correctly with the M7 modem.

Beginning with Ubuntu 10.10, Net-SNMP was upgraded from Version 5.4.2.1 to 5.4.3 and all of the standard MIBs were removed. The default file location for the MIBs was also moved to “*/usr/share/mibs/netsnmp*” or “*/usr/share/mibs/ietf*” or “*/usr/share/mibs/iana*”.

The following changes to your Linux computer may be needed to work with the M7 modem.

1. To get back the standard MIBs you need to install a new package

```
sudo apt-get install snmp-mibs-downloader
```

The package installation normally downloads the standard MIBs and puts them into three folders under “*/usr/share/mibs*”. There is also a resulting program named “download-mibs” but most likely this will not be required.

2. You need to modify the snmp.conf configuration file by removing the comment # on the last line which reads **#mibs** :

```
sudo gedit /etc/snmp/snmp.conf
```

After modification of the configuration file, the last line will now be:

```
mibs :
```

3. Then you need to move the Datum System's mibs from the */usr/share/snmp/mibs* folder to one of the new ones in */usr/share/mibs*, for example in the *netsnmp* folder. They may work equally well in another folder.

```
sudo cp /usr/share/snmp/mibs/DATUM-* /usr/share/mibs/netsnmp/
```

You could also get these MIB files from the M7 modem itself if you did not have them in the *snmp/mibs* folder.



## F.6. Basics for Using SNMP – Commands and Examples

The M7 modem is mainly intended as an agent, returning responses to SNMP commands. However, it can also act as a manager, getting information from other M7 modems or devices, but that application is not covered here except to note that the capability exists.

NOTE: The following commands and examples are representative of operations and responses from a Linux computer running standard Net-SNMP, which is the only base system we can describe for non-proprietary SNMP functions.

NOTE: For operating any commercial or proprietary browser or NMS you should consult their documentation.

Before these operations will succeed you must have checked the computer's package manager to determine if Net-SNMP is loaded and if not then install it.

Before being able to access SNMP information from the M7 modem you must know its "community" string that is defined for specific areas in the SNMP configuration file located in and named `"/etc/snmp/snmpd.conf"`. This file is located within the M7 modem itself and has been set up with a base configuration to verify functioning of SNMP on the M7 modem. Once verified, this should be configured properly by the user for system, security and control methods desired, which is beyond the scope of this document.

A typical command typed at the console of an SNMP controller might be something like the following.

```
$ snmpget -v1 192.168.15.68 -c public iso.3.6.1.2.1.1.0
```

Which would mean: Get the public community value of the numbered iso parameter shown from the M7 modem at the IP Address shown using version 1 protocol.

NOTE: The \$ is the prompt from the command line in Linux and is not entered as part of a command.

A response in this case might be:

```
iso.3.6.1.2.1.1.0 = STRING: "M7 Series Modem"
```

The M7 modem is set up by default with the "**community string**" value of "**public**" for read operations. This next example will walk through the full tree for the "SNMPv2-MIB" which is normally a predefined MIB loaded into Net-SNMP by default and is also part of the standard MIBs configured into the M7 modem's SNMP master agent.

```
$ snmpwalk -v 2c -c public 92.168.15.68 iso.3.6.1.2.1.1
```

This will produce about 7 lines of information containing the basic M7 modem identification information. Some of the information returned above can be set via the web interface on each modem to help identify it. This specific command does not return the modem parameters however since this branch of the MIB ends before connecting to the modem parameters themselves.

To see everything the modem has you can end the above command after the "iso" entry.

Assuming that the M7 Modem MIBs have been loaded as described above, commands can be issued to view parameters or blocks of parameters as shown in the following examples with the response from the command on the next line:

Get the Demodulator IF Data Bit Rate setting from the modem/M7 modem at IP address 192.168.15.64:

```
$ snmpget -v 2c -c public 192.168.15.64 dmdlIfDataBitRate.1
```

```
DATUM-M7-MODEM-MIB::dmdlIfDataBitRate.1 = Gauge32: 2000000 1 bps
```

Set the Modulator Data Bit Rate to 2.048 Mbps

```
$ snmpset -v 2c -c private 192.168.15.64 modIfDataBitRate.1 u 2048000
```

```
DATUM-M7-MODEM-MIB::modIfDataBitRate.1 = Gauge32: 2048000 1 bps
```

NOTE: In these examples the name of the parameter must be followed by a “.1” because there are 2 slots for RF cards and therefore the card parameters are part of a table.

The response from the “set” command for the “modIfDataBitRate” is shown below the command. Note that an Unsigned32 value is returned as a Gauge32 in this particular version of Net-SNMP, but the “u” type in the set command is required. Also note in the “Set” example that we had to use the read-write community value of “private” for the command to work.

Many SNMP agents attempt to “parse” the names given and searches through the available MIBs for matching entries. So for example a “Walk” command can find all items beginning with (and in some cases containing) a name. Names are not case sensitive either. So the following is an example of looking for all modulator alarms.

```
$ snmpwalk -v 2c -c public 192.168.15.68 modIfStatus
```

```
DATUM-M7-MODEM-MIB::modIfStatusCarrier.1 = INTEGER: sendingInterfaceAlarm(12)
DATUM-M7-MODEM-MIB::modIfStatusInterface.1 = INTEGER: summaryAlarm(2)
DATUM-M7-MODEM-MIB::modIfStatusTest.1 = INTEGER: normal(0)
DATUM-M7-MODEM-MIB::modIfTestTotalOccupiedBW.1 = Gauge32: 1733333 1 Hz
DATUM-M7-MODEM-MIB::modIfFeatureBitRateLimit.1 = INTEGER: hardwareLimits(9)
DATUM-M7-MODEM-MIB::modIfFeatureModulation.1 = INTEGER: bqoq8psk816q(2)
DATUM-M7-MODEM-MIB::modIfFeatureFEC.1 = INTEGER: vitTcmRsTpcL16k(5)
```

The same response would have resulted from using “**modIfSt**” or “**modIfst**”. This does not always work as it depends on the sophistication of the agent.

If you want to see all of the parameters available in the modem then you can use the walk command from some point in the tree at the top M7 level or higher. So the following will show it all.

```
$ snmpwalk -Os -v 2c -c public 192.168.15.68 iso
```

We added the -Os option in this case that removes all the preceding “DATUM-M7-MODEM-MIB:” from the output.

### F.6.1. Aggregating SNMP Commands for Interdependent Parameters

Several parameters in the modem are interdependent and may be very difficult to set as individual values. For example the FEC Type, Options and Code Rate are dependent on each other and on the modulation mode currently in force. The key to getting desirable results is to use the SNMP browser and agents' ability to send multiple elements in the same request and have the modem act upon them as a group. To read, or write, multiple parameters – names are placed in the same line with only a space between them.

For example the 3 FEC parameters could be get and set in a single request as:

```
$ snmpget -v 2c -c public 192.168.15.68 modIfDataFECMode.1 modIfDataFECOption.1 modIfDataFECCodeRate.1
```

```
DATUM-M7-MODEM-MIB::modIfDataFECMode.1 = INTEGER: viterbi(1)
```

```
DATUM-M7-MODEM-MIB::modIfDataFECOption.1 = Gauge32: 0
```

```
DATUM-M7-MODEM-MIB::modIfDataFECCodeRate.1 = Gauge32: 1
```

Now if we want to set it to TPC, Option 0 and Code Rate 4:

```
$ snmpset -v 2c -c private 192.168.15.68 modIfDataFECMode.1 i 4 modIfDataFECOption.1 u 0 modIfDataFECCodeRate.1 u 4
```

```
DATUM-M7-MODEM-MIB::modIfDataFECMode.1 = INTEGER: tpc(4)
```

```
DATUM-M7-MODEM-MIB::modIfDataFECOption.1 = Gauge32: 0
```

```
DATUM-M7-MODEM-MIB::modIfDataFECCodeRate.1 = Gauge32: 4
```

There are similar methods for creating these multi-parameter packets in graphical MIB browsers. We'll return to this example when we discuss error handling and best practices in Section F.9.

## F.7. Basics for Using SNMP – Remote Device Control

In managing a network of satellite modems a problem arises for SNMP if the remote system does not use IP traffic as its data transfer method. Remote modems, and possibly equipment at those remote locations, have no traditional access to allow SNMP control.

When a remote IP medium is not available, the M7 modem can provide an alternate method for achieving SNMP access to the far-side modem and equipment. The user can modify the community string to act as additional addressing. In the M7 modem the community string can take three forms depending on the item to be addressed:

1. Local M7 modem directly connected to the IP LAN –  
“communityString”
84. Remote M7 modem directly connected via the RF link –  
“communityString#xxx” where xxx is the 3 digit decimal address of the MCC Receive channel at the remote modem. The “#” symbol is used as a token to denote the address.
85. Remote device on the same LAN as the remote M7 modem in Form 2 above –  
“communityString#xxxabb.ccc.ddd.eee” where xxx is addressing the remote modem as above. The “a” literal character is used as a token to denote the address following and bbb.ccc.ddd.eee is the IP address of the device connected to the LAN at the remote location. The LAN must be attached to the modems control port and be within the mask of the other controlled devices.

In the methods above the community string with the added address components should not have any included spaces and must use 3 characters for each address element. The modified community string would be used in a Net-SNMP command after the “-c” argument flag. In a graphical browser you would need to define each device with its full community string, but using the same local IP address as the local modem that links to those devices.

To allow control communications with remote modems an overhead Modem Control Channel, MCC, must be provided. The MCC channel must be enabled in the modems on both ends of the link

NOTE: The E7 and I7 IP interfaces automatically allow for MCC overhead communications within the allowable data bandwidth. So, if both ends of the link are either the E7 or I7 IP interfaces; then, the MCC is already in place.

### F.7.1. Setting up the MCC channel

The more bandwidth that can be allocated to the MCC channel the faster the data can be retrieved from the far end. However, understand that there is a 500 mS round trip delay over the satellite plus the communications time for the given baud rate. For example a 9600 baud bi-directional MCC channel will require approximately an additional 1 mS for each character in each direction.

You cannot perform this setup in an operating link without an operator at the remote end. The local and remote end parameters must match.

**Important:** As noted earlier, you do not need to perform Steps 1 - 3 if you are using either an I7 or E7 as your operating data interface on both ends! For I7 or E7 Interfaces, skip to Step 4.

Use the following steps to set up the MCC channel. Set the:

1. Send and Rcv Mux Mode to Advanced
86. Send and Rcv Mux ESC Rate to 0 unless required for other purposes.
87. Send and Rcv Mux MCC Rate to no lower than 1200 bps and preferably 9600 bps or higher.
88. Set MCC Local Modem Send and Rcv address to a unique number, such as Send/Rcv 1.
89. Set MCC Remote modem Send and Rcv Address to a unique number, such as Send/Rcv 2.
90. The MCC protocol to M7 Binary Packet.
- 91.** MCC Mode to “Full Access”.

### F.7.2. SNMP Control of Remote Modems

In a network with the overhead Mux and MCC channels enabled you will be able to communicate over the satellite link. Information on the far end modem is now available as if it was on the local LAN. As an example if you are in Internet contact with a local modem at 192.168.15.68 and you want to get the parameters for the remote modem with MCC Rcv Address 2 you could use:

```
$ snmpwalk -Os -v 2c -c public#002 192.168.15.68 iso
```

The browser requests specific data from the local LAN connected M7 modem who in turn requests the information from the far end modem. That modem sends the data back over the MCC channel and the local modem prepares it as a response to the browser.

## F.8. Basics for Using SNMP – Best Practices and Cautions

SNMP is designed as a general purpose tool for networking and parameter monitoring and control. It is also intended more for machine to machine communications rather than human readability. Therefore, there are cases where SNMP does not match well with modem or satellite link capabilities

### F.8.1. Aggregate SNMP Commands

A satellite modem is a complex piece of equipment and SNMP has a rigid set of rules that cannot easily accommodate some types of settings easily. One example of this issue is the interdependent modulator, or demodulator, FEC settings required to configure a M7 modem.

There are three interdependent and interactive settings for the FEC Type, FEC Option and FEC Code Rate which will return an error if they are set in the wrong order. To avoid this problem, parameters should be sent as a single command as described in Section F.6.1.

The M7 modem will make a best effort and set the value to the maximum (or minimum) constraints; but, caution is required when specifying settings that are “out of range”.

As an example, the mod and demod data bit rate and the lower level alarm limits on the demodulator carrier level. The maximum or minimum for these values can vary considerably depending on modulation mode, interface types, installed options, FEC types, etc.

Therefore, if a modulator bit rate setting requests 12 Mbps but the maximum possible bit rate for the configured FEC type is 5 Mbps, then the modem would limit the setting to the value of 5 Mbps. Because, either disqualifying the request or setting the value to 5 Mbps would be reasonable actions, SNMP has no explicit response or error type to represent this case and will return a general error. It is good practice to read the value of a parameter again when an error is reported after attempting to set it.

### F.8.2. SNMP Bandwidth Caution

Basic SNMP “walk” commands can easily return a significant amount of information. SNMP is also very inefficient from a bandwidth standpoint. Considering that much SNMP monitor traffic will be over a satellite link with limited bandwidth and resources, care should be exercised to reduce the amount of SNMP traffic to a minimum. If a management system is polling every possible parameter every second; then, the system performance will suffer.

### F.8.3. Far End SNMP Modem Control Caution

Satellite links often connect to remote unmanned sites. It is extremely easy to change a setting on the far end of a link at a remote site and cause the link to lose connectivity and control. If this is done, someone will have to go to that site to restore operation.

**Caution:** Make sure that any command sent to the remote site will not disrupt the satellite link!

Advanced planning can eliminate the requirement of a site visit to restore communications should be part of a recovery strategy. The M7 series of modems are designed with the ability to automatically go to several predefined configurations if the receive carrier is lost for longer than a specified period of time. Refer to Section 3.12.1 in the main M7 modem manual for more information on the “ACR” or Automatic Configuration Recovery feature.

## F.9. Troubleshooting

If you are unable to get SNMP to work with the M7 modem then information in this section provides some basic checking and troubleshooting.

### F.9.1. Basic Requirements for SNMP to Work and Tests

SNMP can be difficult for newcomers. All of the following must be in place for SNMP to work:

1. The M7 modem must be at a valid IP Address and Mask for the connected network.
92. You must have a valid browser/manager computer to access the M7 modems' SNMP agent.
93. The management computer and the M7 modem must be mutually accessible. All intervening routers and firewalls must allow access to the ports and protocols to be used.
94. The SNMP agent software must be enabled on the M7 modem. Check the front panel Unit: SNMP Mode setting.
95. The manager computer must be running Net-SNMP or an SNMP Browser program.
96. The SNMP browser/manager must have the appropriate MIBs loaded.
97. Community names are case sensitive and must match exactly between communicating elements.

### F.9.2. Test Connectivity:

The first test to determine if 1, 2 and 3 conditions above are met is to “ping” the M7 modem from the management computer. If you do not get a response then several things might be at fault:

1. The most common issue is that the network addresses are incorrect.
98. ICMP messaging, which IP ping relies on, may be blocked by the router on the local network, (A) in Figure 2. Keep in mind that routers may allow ping replies originated from a ping request on a local node; but, may also disallow ping requests originating on the “hot” side of a firewall.
99. Similarly, the protocol may be allowed but may require a non-standard port.
100. Routes in the gateway, (A) in Figure 2, are usually not the main culprit; but, tracert may be helpful to determine that the messaging is using the path you expect. Modern computers typically have a wired and a wireless interface – insure you’re using the connection you want.

Check with your IT group and make sure you can at least ping the local modem before you try any advanced testing. Keep in mind the issues mentioned for the ICMP ping can also be true for the SNMP and HTTP protocols and ports. If non-standard ports are necessary make sure to make the adjustments to Modem protocol configuration.

### F.9.3. Test M7 Agent Running:

The agent is running if you get a response to a known good SNMP request. If not then check the modem configuration to insure that SNMP is enabled.

The web interface also contains a SNMP tab in the Unit page which allows both immediate and persistent SNMP agent control.

### F.9.4. Test Manager/Browser Functionality:

If you've made it this far and you cannot get information in the browser or Net-SNMP from the M7 modem then you should double check the browser configuration again. Make sure you are using the correct IP Addresses and community string in the configuration. For Net-SNMP this is on the command line for each command. For browsers this is typically a GUI configuration item. For example iReasoning's browser has a configuration setup at Tools>>Options and the Agents tab which is used to set up the version and read and write community strings for each IP Address.

### **F.9.5. Test Manager/Browser MIB Load:**

Insure that the MIBs are loaded in the browser or Net-SNMP. Read Section 2.2 and check that the proper MIBs and directories exist and are being used for loading. Graphical browsers normally show which MIBs are loaded as part of their window presentation. With Net-SNMP the standard MIBs loaded by default should allow operation with the M7 modem.

It is often beneficial to change the file name or directory name and make sure that the tool fails to load the file with the name altered. If the tool still loads the MIB in the same way, there's a duplication, or cache, which must be accounted for.

### **F.10. SNMP Traps**

Notifications and Traps serve the same purpose which is to asynchronously inform a client of an event. The names of the messages and the datagram formats differ between the two types of messages as they were introduced in different revisions of the SNMP protocol. Traps are the SNMP v1 form of messaging and this was usurped by Notifications in SNMP v2c.

However, most users refer to both with the same term – traps. The changes in the packet format are handled transparently by the MIB browser/query tool and the differences become superfluous to the end user. So we'll refer to both datagram types as traps – regardless of the protocol version.

SNMP Traps are generated by background processes that monitor specified parameters. If the parameter falls outside of proper range then a “trap” message is generated and the manager is notified.

#### **F.10.1. SNMP Notification Setup Procedure**

The setup to send Traps to a SNMP client/manager involves the following steps:

1. Setting the SNMP Trap Address
  101. Setting the SNMP Trap Port Number
  102. Setting the SNMP Trap Community
  103. Setting the SNMP Trap Path

These configuration values can be manipulated on the front panel or can be changed using the Web interface.

## Appendix G M7 Modem DVB-S2X Operation

### G.1. Introduction

#### G.1.1. Digital Video Broadcasting Project (DVB) Overview

The Digital Video Broadcasting Project (DVB) started in 1993 by a consortium of broadcasters, manufacturers, network operators, software developers, regulatory bodies, content owners and others committed to designing global standards for the delivery of digital television and data services. The standards developed by the DVB cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. However, the main focus of this introduction will be on the satellite transmission standards that have been and are in development.

The first DVB standard for satellite transmission (DVB-S) was developed and released in 1994 for the purpose of creating an interoperability standard for the digital broadcast industry. The second standard (DVB-DSNG) was released in 1997 and expanded the capability of DVB-S while maintaining interoperability with DVB-S.

NOTE: Within the DVB standards, not all new standard released are 100% backward compatible and interoperable with older standards. This is why it is very important to understand forward and reverse product compatibility with in the DVB industry.

The following sections provide a brief overview of the DVB standards that are applicable to the DVB-S2X feature in the M7 modem.

The DVB-S and DVB-DSNG were the early standards released by the DVB that have been widely set aside and replaced by the newer more efficient standards. The target markets for these standards were primarily video. The distant end equipment was typically an integrated receiver decoder (IRD) that provided the video output in either ASI/MPEG or component video/audio.

As long as the data within the MPEG transport stream was consistent with compressed digital video, the efficiency of the interface was well matched to the application. However, as the industry moved to Internet Protocol (IP) as a means to transport video and audio information, the efficiency of the MPEG transport stream and the reliance on DVB-S lead to increased link costs.

#### G.1.2. DVB-S2

The satellite industry's adoption of the DVB-S/DSNG standards expanded beyond video and audio. This led to a need for an interoperability standard that would properly interface to a variety of transport streams. In addition to the need for baseband efficiency, the satellite transponder efficiency continues to push transmission technology. Utilization of Ku-band services in more tropical regions, and the look toward the future of Ka-band satellites, required an adaptive variable coding functionality to be imbedded in the transmission equipment for interactive links. This led to the development and release of the "second generation" DVB standard (DVB-S2) in 2005.

The DVB-S2 standard defines a number of features and capability that, when implemented, provide an expanded market for the satellite transmission equipment but do not provide interoperability with older DVB standards. Some satellite transmission equipment may be capable of operation to both standards, but DVB-S2 is not an interoperability standard to DVB-S/DSNG. The expanded capability of the equipment operating to the DVB-S2 standard provide significant gains in both transponder and baseband efficiency that incentivize the operator to move to the new standard. A summary of the expanded capability that was added in DVB-S2:

- Changed the baseband interface to a flexible input stream adapter, suitable for operation with various formats (packetized or continuous);
- Changed the Forward Error Correction (FEC) to Low-Density Parity Check (LDPC) codes concatenated with Bose-Chaudhuri-Hocquenghem (BCH) codes, allowing operation to within a 1 dB of theoretical operation.
- Expanded range of code rates (from 1/4 up to 9/10);

- Expanded the available constellations to four (4) ranging in spectrum efficiency from 2 bit/s/Hz to 5 bit/s/Hz;
- Added optimization for operation over non-linear transponders;
- Expanded the available spectrum shapes to three (3) with roll-off factors 0.35, 0.25 and 0.20;
- Added Adaptive Coding and Modulation (ACM) functionality, which optimizes channel coding and modulation on a frame-by-frame basis when there are changes in the satellite link performance.

### G.1.3. DVB-S2X

The DVB-S2X specification reuses the DVB-S2 system architecture, while adding

- finer MODCOD steps;
- sharper roll-off filtering;
- extended data rates.

## G.2. DVB-S2X Option Overview

The DVB-S2X option in the M7 is contained in the M70 Modulator (Figure G -12) and D70 Demodulator cards (Figure G -11). The IF interface is L-band (950 MHz – 2150 MHz). The baseband interface for the DVB-S2X option is the Express Ethernet Interface (E7). The E7 interface (Figure G -13) is a layer 2 Gigabit Ethernet bridged interface with four (4) Ethernet ports and a single SFP port. Refer to Section 2.4.8.3.2 in the M7 manual for more information on the SFP port.



Figure G-11– D70 DVB-S2X L-band Demodulator Card



Figure G-12 – M70 DVB-S2X L-band Modulator Card



Figure G-13 – Express Ethernet Interface (E7)



### G.3. Capability of the M7 DVB-S2X Option

The M7 with the DVB-S2X option will interoperate with other modems that conform to the DVB-S2 and DVB-S2X standards. However, there may be some interoperability issues with Generic Stream Encapsulation (GSE) between modems from different manufacturers.

NOTE: Currently the M7 with DVB-S2X option is not interoperable with modems that only comply to the DVB-S and DVB-DSNG standards.

#### G.3.1. Data Rate Range

Within a 72 MHz wide transponder, the maximum data rate of a M7 operating with DVB-S2 would be 320.62 Mbit/s using 32APSK modulation with 9/10 coding. DVB-S2X extends the data rate capability to 355.44 Mbit/s using 64APSK modulation with 5/6 coding. The extension of the data rate capability is due to extending the Modulation and Coding combinations (ModCod) that are available within DVB-S2X.

Table G -2 shows the ModCod verses data rate capability of the M7 operating as a DVB-S2 modem at 72 Msym/s.

Table G -3 shows the ModCod verses data rate capability of the M7 operating as a DVB-S2X modem at 72 Msym/s.

Table G-2– DVB-S2 ModCod verses Data Rate

Normal Frame DVB-S2				Symbol Rate (Msym/s)
				72
Mode	QEF Es/No	Bits/Hz	Pilot	Data Rate (Mbit/s)
QPSK 1/2	1.2	0.97	Yes	69.50
QPSK 3/5	2.43	1.16	Yes	83.52
QPSK 2/3	3.3	1.29	Yes	92.94
QPSK 3/4	4.23	1.45	Yes	104.55
QPSK 4/5	4.88	1.55	Yes	111.56
QPSK 5/6	5.38	1.62	Yes	116.30
QPSK 8/9	6.4	1.72	Yes	124.16
QPSK 9/10	6.62	1.75	Yes	125.72
8PSK 3/5	5.75	1.74	Yes	125.25
8PSK 2/3	6.87	1.94	Yes	139.37
8PSK 3/4	8.16	2.18	Yes	156.78
8PSK 5/6	9.6	2.42	Yes	174.40
8PSK 8/9	10.94	2.59	Yes	186.19
8PSK 9/10	11.23	2.62	Yes	188.52
16APSK 2/3	9.27	2.57	Yes	185.37
16APSK 3/4	10.51	2.90	Yes	208.54
16APSK 4/5	11.33	3.09	Yes	222.52
16APSK 5/6	11.91	3.22	Yes	231.97
16APSK 8/9	13.19	3.44	Yes	247.65
16APSK 9/10	13.43	3.48	Yes	250.75
32APSK 3/4	13.08	3.62	Yes	260.88
32APSK 4/5	13.99	3.87	Yes	278.37
32APSK 5/6	14.63	4.03	Yes	290.20
32APSK 8/9	16.04	4.30	Yes	309.81
32APSK 9/10	16.4	4.36	Yes	313.70

Table G -2Notes:

QEF = Quasi Error Free performance is equal to Frame Error Rate (FER) of 1E-5;

Pilot = Operation with this ModCod requires the Pilot to be ON;

Highlighted cells indicate the preferred ModCods. All ModCods are available but not all ModCods are practical.

Table G-3 – DVB-S2X ModCod verses Data Rate

Normal Frame DVB-S2X				Symbol Rate (Msym/s)
				72
ModCod	QEF Es/No	Bits/Hz	Pilot	Data Rate (Mbit/s)
QPSK 13/45	-1.83	0.55	Yes	39.91
QPSK 9/20	0.42	0.87	Yes	62.49
QPSK 1/2	1.2	0.97	Yes	69.50
QPSK 11/20	1.65	1.06	Yes	76.51
QPSK 3/5	2.43	1.16	Yes	83.52
QPSK 2/3	3.3	1.29	Yes	92.94
QPSK 3/4	4.23	1.45	Yes	104.55
QPSK 4/5	4.88	1.55	Yes	111.56
QPSK 5/6	5.38	1.62	Yes	116.30
QPSK 8/9	6.4	1.72	Yes	124.16
QPSK 9/10	6.62	1.75	Yes	125.72
8APSK 5/9-L	4.98	1.61	Yes	115.91
8APSK 26/45-L	5.38	1.67	Yes	120.58
8PSK 3/5	5.75	1.74	Yes	125.25
8PSK 23/36	6.37	1.85	Yes	133.42
8PSK 2/3	6.87	1.94	Yes	139.37
8PSK 25/36	7.27	2.02	Yes	145.10
8PSK 13/18	7.74	2.10	Yes	150.94
8PSK 3/4	8.16	2.18	Yes	156.78
8PSK 5/6	9.6	2.42	Yes	174.40
8PSK 8/9	10.94	2.59	Yes	186.19
8PSK 9/10	11.23	2.62	Yes	188.52
16APSK 1/2-L	6.27	1.93	Yes	138.63
16APSK 8/15-L	6.85	2.05	Yes	147.95
16APSK 5/9-L	7.14	2.14	Yes	154.17
16APSK 26/45	7.81	2.23	Yes	160.38
16APSK 3/5	8.1	2.31	Yes	166.59
16APSK 3/5-L	7.71	2.31	Yes	166.59

Normal Frame DVB-S2X				Symbol Rate (Msym/s)
				72
Mode	QEF Es/No	Bits/Hz	Pilot	Data Rate (Mbit/s)
16APSK 28/45	8.4	2.40	Yes	172.81
16APSK 23/36	8.68	2.46	Yes	177.47
16APSK 2/3-L	8.73	2.57	Yes	185.23
16APSK 2/3	9.27	2.57	Yes	185.37
16APSK 25/36	9.57	2.68	Yes	193.00
16APSK 13/18	10.01	2.79	Yes	200.77
16APSK 3/4	10.51	2.90	Yes	208.54
16APSK 7/9	10.95	3.00	Yes	216.30
16APSK 4/5	11.33	3.09	Yes	222.52
16APSK 5/6	11.91	3.22	Yes	231.97
16APSK 77/90	12.29	3.31	Yes	238.05
16APSK 8/9	13.19	3.44	Yes	247.65
16APSK 9/10	13.43	3.48	Yes	250.75
32APSK 2/3-L	11.45	3.22	Yes	231.73
32APSK 32/45	12.1	3.43	Yes	247.28
32APSK 11/15	12.52	3.54	Yes	255.05

Table G -3 Notes:

QEF = Quasi Error Free performance is equal to Frame Error Rate (FER) of 1E-5;

Pilot = Operation with this ModCod requires the Pilot to be ON;

Highlighted cells indicate the preferred ModCods. All ModCods are available but not all ModCods are practical;

ModCods with a '-L' indication are ModCods intended for use in very low Es/No links.

### G.3.2. Bit Error Rate Performance

Performance of DVB-S2 and DVB-S2X approach the theoretical channel capacity limit defined by Claude Shannon in the early 1950s (Shannon's Limit). Figure G-14 shows the comparison between Shannon's limit (red line) and the preferred DVB-S2X ModCods within the M7 (blue line).

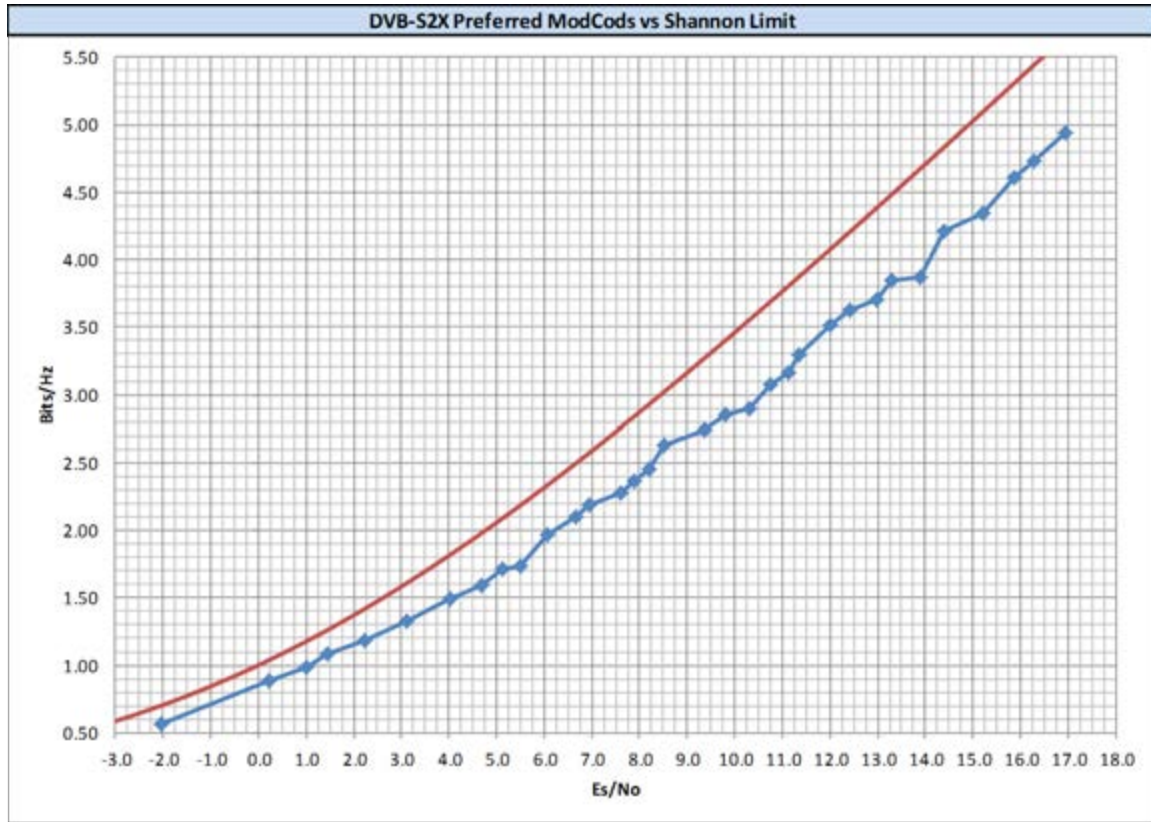


Figure G-14 – DVB-S2X versus Shannon's Limit

### G.4. Operation

The M7 with the DVB-S2X option installed is controlled and monitored in the same way as any other M7 modem. Refer to the referenced M7 sections of the M7 Series Installation and Maintenance Manual for detailed information on the control and monitoring of the M7 with the DVB-S2X option installed. This section will focus on the web browser pages and tabs that have changes from the standard M7.

Control and monitor of the M7 modem is possible through multiple interfaces:

- front panel menu system (Section 3.2, Section 3.3, and Section 3.5);
- web browser (Section 3.4);
- remote control interfaces (Section 3.6);
- SNMP (Appendix F);

### G.4.1. Summary Page

The Summary Status (Figure G -15) will be the first page that is displayed when the computer connects to the M7 Web Browser. The summary page provides the user a snapshot of the current M7 status, modem type, and indicates the available interfaces. The status window cycles through the status of the Mod Carrier, Dem Carrier, RX Eb/No, and RX Level.

The screenshot displays the 'M7 Satellite Modem' web interface. At the top, there is a header with the DATUM SYSTEMS logo and a status bar showing 'Status Modem Dmd Carrier Locked, Ok'. To the right, there are alarm indicators for 'Mod Transmit' (Major/Minor Alms) and 'Dem Lock' (Major/Minor Alms). A 'Logout' button is located in the top right corner.

On the left side, there is a navigation menu with buttons for 'Summary' (highlighted), 'Unit', 'Modulator', 'Demodulator', 'Intf 1', and 'Intf 2 Empty'.

The main content area is divided into several sections:

- Modulator:**
  - Rf Type: M70 DVB-S2X L-Band Modulator
  - Carrier: Sending, Ok
  - ModCod: 32APSK 4/5 with Pilot 123.72 Mbps, QEF @ 13.64 dB
  - Interface: Normal
- Tx Interface:**
  - Intf Type: E7 Express Interface
  - I/O: Online, Ok
  - Send Data: Active, Ok
  - Test: Normal
- Demodulator:**
  - Rf Type: D70 DVB-S2X L-Band Demodulator
  - Carrier: Locked, Ok
  - ModCod: 32APSK 3/4 with Pilot 108.70 Mbps, QEF @ 12.73 dB
  - Offset (kHz): +0.050
  - Level (dBm): -30.84
  - Es/No (dB): -17.20
  - Interface: Normal
  - Test: Normal
- Rx Interface:**
  - Intf Type: E7 Express Interface
  - I/O: Online, Ok
  - Data: Active, Ok
  - Test: Normal
- Unit:**
  - Model: M7L Series
  - Hardware Config: Modem
  - Hardware S/N: 21058
  - Software Version: 3.14k on Jul 12 2016
  - Installed Intf Opt:
    - Slot 1: E7 Express Interface
    - Slot 2: Not Installed

Figure G-15 - Summary Status Page

### G.4.2. Unit Pages

The unit page is used to configure the common parameters of the M7. The remote control interface parameters, the unit frequency reference, and other unit parameters are controlled in the “Unit” pages. The Unit Status page (Figure G -16) also shows the model numbers and firmware version number of all the installed cards.

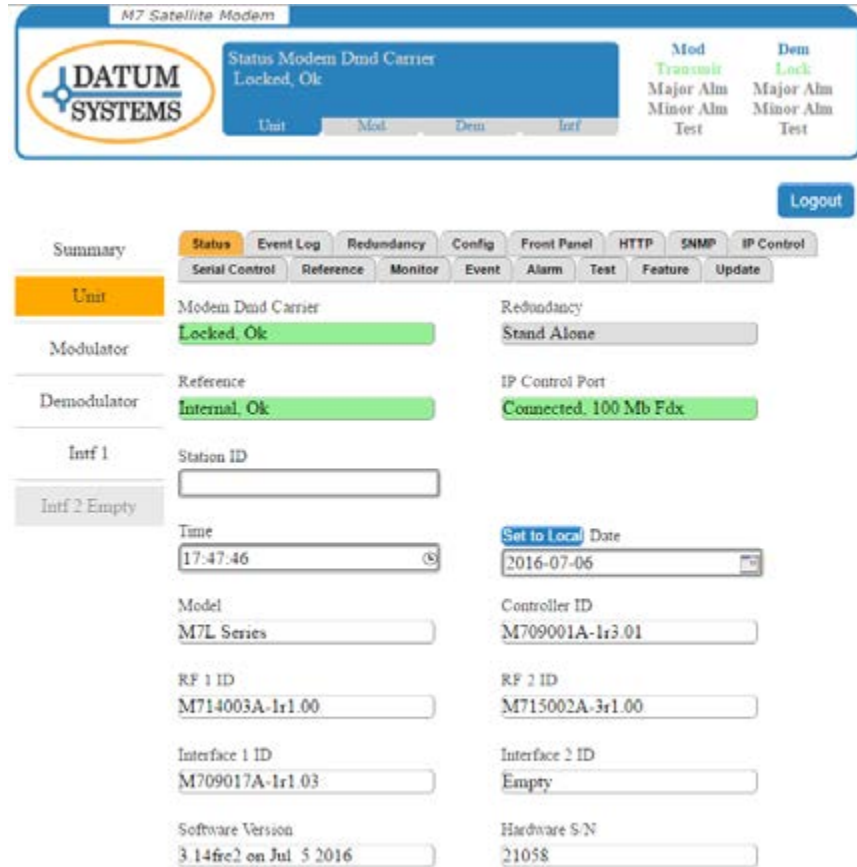


Figure G-16 – Unit Status Page

### G.4.3. Modulator Pages

The Modulator tabs are used to configure the transmit section parameters of the M7. The IF, Data interface, and other transmit parameters are controlled in the “Modulator” tabs. The Status and Data are the only tabs in the DVB-S2X option that have additional parameters to what is shown in the standard M7.

The Modulator Status tab (Figure G -17) displays the status of the transmit carrier and the status of the test functions. The hardware type, ID, and serial number of the modulator card are also displayed on this tab.



Figure G-17 – Modulator Status Tab

The Modulator Data tab (Figure G -18) provided monitor and control of the modulation parameters of the transmit carrier.

- Symbol Rate: Configuration of the transmit carrier symbol rate;
- Send Interface: Selection of the installed interface. Note: for DVB-S2X this will be the E7 Express Interface;
- Service Type: Selection of the service type of DVB-S2, DVB-S2 ACM, DVB-S2X, or DVB-S2X ACM;
- Pilot: Selection of Pilot ON/OFF. Pilots are used to aide in acquisition of carriers with low Es/No;
- Frame: Selection of the normal (64kb) DVB-S2 frame length or a short frame (16kb);
- ModCod: Set the modulation and coding combination (ModCod) for the transmit carrier;
- ACM Min ModCod: When service type is ACM, set the minimum ModCod;
- ACM Max ModCod: When service type is ACM, set the maximum ModCod;
- ACM Lost Signal: When service type is ACM, set action to be taken at loss of ACM control from remote demodulator;
- ACM Fade Margin (dB): When service type is ACM, set desired minimum link margin for ACM control;
- Link Degradation (dB): When service type is ACM, set allowed link degradation for each modulation and coding ModCod within the configured min/max ModCod range;
- PLS Scrambler Sequence: Set a Physical Layer Scrambler sequence in the transmit carrier that will only be able to be received by a demodulator with the same PLS sequence setting.

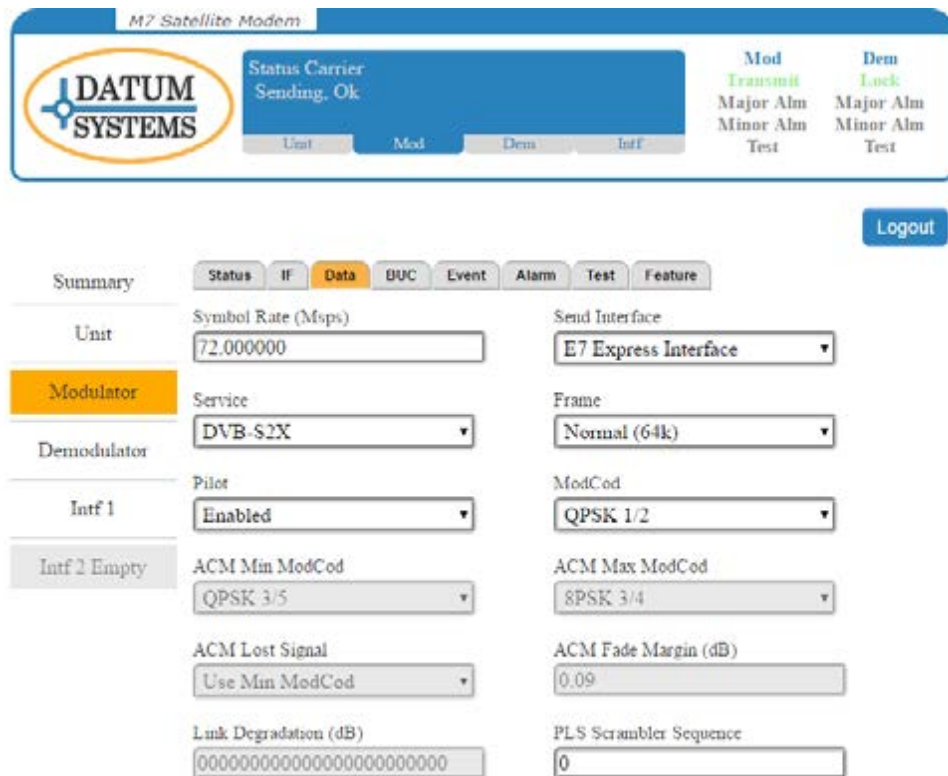


Figure G-18 – Modulator Data Tab

### G.4.4. Demodulator Pages

The Demodulator tabs are used to configure the receive section parameters of the M7. The IF, Data interface, and other receive parameters are controlled in the “Demodulator” tabs. The Status and Data are the only tabs in the DVB-S2X option that have additional parameters to what is shown in the standard M7.

The Demodulator Status tab (Figure G -19) displays the status of the receive carrier and the status of the test functions. The hardware type, ID, and serial number of the demodulator card are also displayed on this tab.

The screenshot shows the M7 Satellite Modem web interface. At the top, there is a navigation bar with tabs for Status, IF, Data, LNB, Event, Alarm, Test, and Feature. The 'Status' tab is currently selected. Below the navigation bar, there is a 'Demodulator' section with a sub-tab for 'Status'. The 'Status' sub-tab is active, showing the following information:

- Unit:** Carrier Locked, Ok
- ModCod:** 16APSK 26/45 with Pilot 160.38
- Modulator:** Es/No (dB) +8.10, QEF Margin (dB) +0.59
- Demodulator:** Level Rcv (dBm) -34.76, Level Echo (dBm) -58.84
- Intf 1:** Offset Rcv (kHz) -1.611, Offset Echo (kHz) 0.000
- Intf 2 Empty:** Imbalance Offset % 0.00, Imbalance Level (dB) +24.08
- Sat Echo Delay (ms):** 0.0, **Restart FER:** 227.2e-2
- Frames Erred:** 2308902, **Frames Total:** 101676027
- Interface:** Normal, **Test:** Normal
- Hardware Type:** D70 L-Band DVB-S2X Demod, **Hardware ID:** M715002A-3r1.00
- Hardware S/N:** 83

Figure G-19 – Demodulator Status Tab



The Demodulator Data tab (Figure G -20) provided monitor and control of the demodulation parameters of the receive carrier.

- Symbol Rate: Configuration of the receive carrier symbol rate;
- Rcv Interface: Selection of the installed interface. Note: For DVB-S2X this will be the E7 Express Interface;
- Service Type: Selection of the service type of DVB-S2, DVB-S2 ACM, DVB-S2X, or DVB-S2X ACM;
- Frame: Selection of the normal (64kb) DVB-S2 frame length or a short frame (16kb);
- Pilot: Selection of Pilot ON/OFF. Pilots are used to aide in acquisition and tracking of carriers with low Es/No;
- ModCod: Select the receive carrier modulation and coding combination;
- PLS Scrambler Sequence: Set a Physical Layer Scrambler sequence for the receive carrier that will only allow the demodulator to lock to a carrier transmitted by a modulator with the same PLS sequence setting.

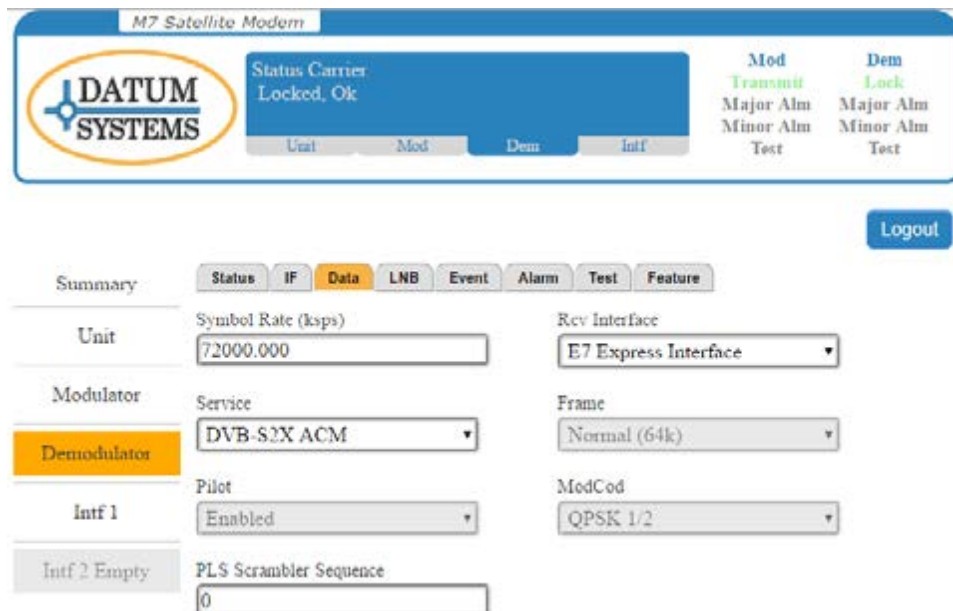


Figure G-20 – Demodulator Data Tab

### G.4.5. E7 – Express Ethernet Interface Pages

The M7 modem may have up to two (2) different interface hardware types installed at the same time but only one can be the active interface. The active interface is selected in the “Modulator” and “Demodulator” Data Interface tabs.

Each interface type will have a different set of tabs that provide complete control and monitor of the active interface parameters in the baseband interface. The Electrical Interface I/O, Overhead multiplex/demultiplex, Engineering Service Channel parameters, and other interface parameters are controlled in the “Interface” tabs. The Status, Send, and Rcv are the only tabs in the DVB-S2X option that have additional parameters to what is shown in the standard M7.

Figure G -21 shows the Status tab for the E7 – Express Ethernet Interface. The hardware type, ID, and serial number of the Interface card are also displayed on this tab.

Figure G-21 – E7 Interface Status Tab

The E7 Send tab is shown in Figure G -22. The Send Tab allows selection of the following:

- WAN Mode:
  - Bridge PTP: Select a Layer 2 Ethernet connection in a point to point configuration;
  - Hub Bridge PTMP: Select a Layer 2 Ethernet connection at the hub modem in a point to multipoint configuration which will prevent a MAC storm;
  - Remote Bridge PTMP: Select a Layer 2 Ethernet connection at the remote modem in a point to multipoint configuration which will prevent a MAC storm;
  - Mesh Bridge: Select a Layer 2 Ethernet connection at the each modem in a mesh network configuration which will prevent a MAC storm;
- WAN Protocol:
  - GSE: Select Generic Stream Encapsulation;
  - GSE CT: Select a modified Generic Stream Encapsulation.

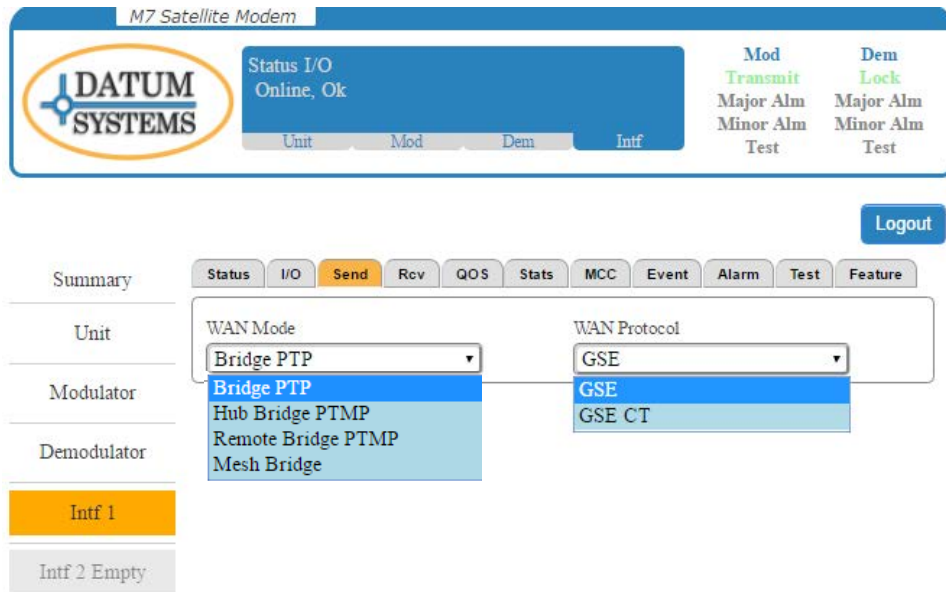


Figure G-22 – E7 – Express Ethernet Interface – Send Tab

The E7 Receive tab is shown in Figure G -23. The Receive Tab allows selection of the following:

- WAN Mode:
  - Bridge PTP: Select a Layer 2 Ethernet connection in a point to point configuration;
  - Hub Bridge PTMP: Select a Layer 2 Ethernet connection at the hub modem in a point to multipoint network configuration which will prevent a MAC storm;
  - Remote Bridge PTMP: Select a Layer 2 Ethernet connection at the remote modem in a point to multipoint network configuration which will prevent a MAC storm;
  - Mesh Bridge: Select a Layer 2 Ethernet connection at the each modem in a mesh network configuration which will prevent a MAC storm;
- WAN Protocol:
  - GSE: Select Generic Stream Encapsulation;
  - GSE CT: Select a modified Generic Stream Encapsulation.

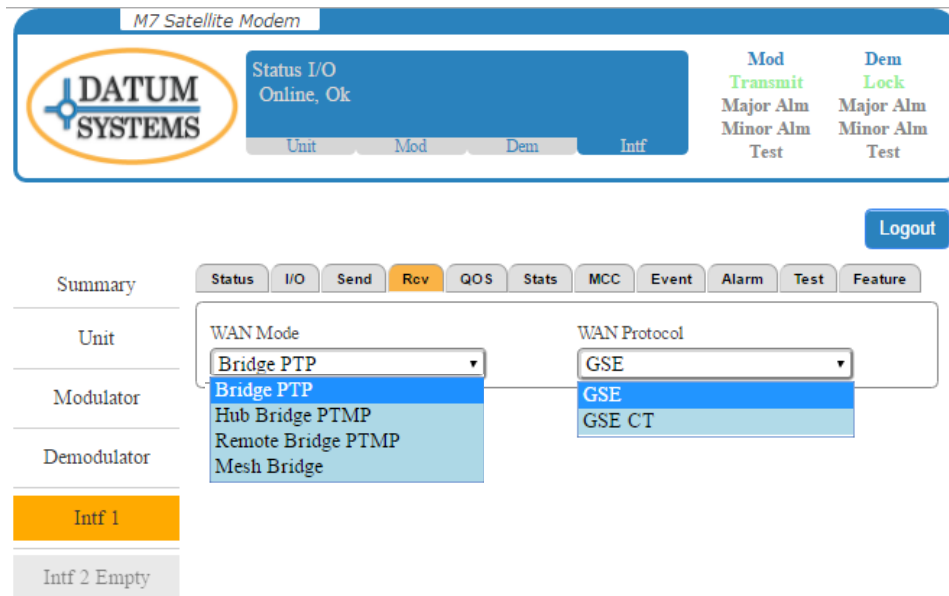


Figure G-23 – E7 – Express Ethernet Interface – Rcv Tab