



Appendix B

M7 IF and L-Band Remote Control Command Protocol

This Appendix applies to Datum Systems' M7 Class Modem series including all units that contain the main M709001A Controller card. This card runs the Operating System and communications processes that provide remote control. The remainder of this document refers only to these modems as the M7 or the modem.

Revision History

Rev. 0.02, September 3, 2013 – Initial Issue.

Rev. 0.03, September 8, 2013 – Added network diagram and corrected errors.

Differences From Previous Datum Systems' Command Protocols

The command protocol described here and used in the M7 Class Modems shares no commonality with previous M5 or M500 series modems. They do all use basic binary packets structures that are similar to those used for HDLC or IP packets/frames with headers, control bytes and data payloads but that is as far as the commonality extends.

Those previous M5 or M500 protocols contained a limited number of fixed packets for each functional modem area. Thus there was a modulator IF packet with all of the IF parameters, and a data packet with all of the data related parameters, and so on. The M7 contains a fully flexible packet structure that contains one to many sub-packets each with a single modem parameter being read or set and an upper level framing structure containing addressing, control and CRC bytes. The M7 structure is very efficient and flexible containing only that information needed for the current task.

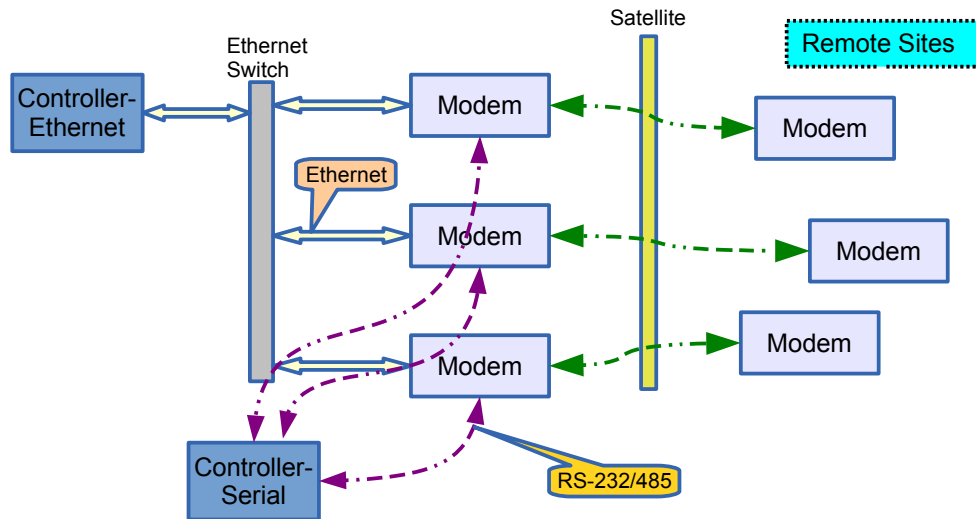
M7 Modem Control Overview

The M7 modem can be controlled by the front panel or from an external device. External control is provided via the controller's Ethernet port by either a high level web based interface, HTTP, or by the Simple Network Management Protocol, SNMP or by specialized UDP packets containing the protocol packets described herein as the datagram payload. The same binary packet protocol can also be used via either the RS-232 or RS-485 control connection.

In contrast to the higher level control methods the binary packet protocol provides built-in methods for control of modems on the far end of point to point satellite links plus control of multiple components at a hub station as part of point to multi-point networks.

The diagram below shows some possible binary control connection methods. One is by using any computer with an Ethernet connection as the controller. The other is using a computer with an RS-232 or RS-485 connection as a controller. RS-232 would require multiple serial ports, but by using for example a USB to RS-485 converter then all of the local modems could be tied on the same bus.

Note that the binary protocol allows directing a message to a remote modem. So the Ethernet controller can monitor and control the far end modems in this diagram. More complex network control is also possible since controllers using the binary protocol can address any local or remote modem with a communications path. When the modem interface is either the E7 or I7 there is a built in method for the modem's to insert Modem Control Channel (MCC) frames into the data stream. For all other interfaces the multiplexer must be turned on to provide an MCC channel for binary packet communications.



This Appendix only describes the binary packet protocol for control of the modem by an external computer or controller connecting to either the rear panel DB9 Control Port or the rear panel Ethernet port. The higher level SNMP and HTTP control is covered in another document.

The controlling computer may take many forms ranging from an handheld/portable device or dedicated stand-alone processor to a personal computer or a larger mini or main-frame computer, and is referred to here simply as a controller. The M7 contains full software allowing it to be externally controlled. Note however that no software is currently provided for the external controller, which is the responsibility of the user. Datum Systems does provide at request several demonstration programs based on internal software that can perform the external processing function for command line interface. These include the Python `mec.py` program which can run on any PC with Python installed and provides an easy ASCII interface to use of this binary protocol.

The protocol described here may contain “place holders” within the data structure in two types, “Reserved” and “Future Expansion”. The reserved data structure elements are used by the factory for specialized testing and calibration. The future expansion elements are spares and data needed for yet to be implemented features.

Setup For Remote Control

Before the M7 can be externally controlled it must be set to operate in the proper remote control mode via the front panel. Several parameters must be set as dictated by the control system to be used:

For RS-232 Connection:

1. RS-232 Control Address
2. RS-232 Format (0 - N81), Mode (2 – Full Access) and Protocol (0 - Binary)
3. RS-232 Bit Rate, – default and standard are 7 - 38400, N,8,1.

For RS-485 Connection:

1. RS-485 Control Address
2. RS-485 Format (0 - N81), Mode (2 – Full Access) and Protocol (0 - Binary)
3. RS-485 Bit Rate, – default and standard are 7 - 38400, N,8,1.

For Ethernet UDP Connection:

1. IP Control Address, Network Mask and Port (default 9101)

2. IP Control M&C Server Mode (2 – Full Access)

Front Panel setting of these parameters is available in the <Unit: Control> columns.

These parameters may also be set via the remote control port itself, but this is dangerous, as it will probably result in loss of communications.

The RS-232 interface is only useful in a point to point control with one controller and one modem because of the nature of RS-232. The 485 type interface allows multiple modems and controllers to be tied to the same serial bus. The modem address insures that the modem only responds to messages intended for it.

The RS-485 interface on the modem is configured as a “4 wire” interface. That means that the transmit and receive wire pairs are separate. This allows a controller to both talk and listen at the same time. If a “2 wire” configuration is desired, the transmit and receive pairs may be simply tied together external to the modem. Care should be taken here to insure that the “A” or “-“ side of the transmit is tied to the “A” or “-“ of the receive, and the same for the “B” or “+” side.

Packet Protocol Basics

All remote control communications are formatted as “packets” of information. The M7 binary packets actually contain at least two layers of control packet frames, each with a “header” and a data or “payload” section.

The lower level are individual parameter commands to “get” or “set” the value of a single parameter on a single card. The upper level is a frame/wrapper that contains one or more parameter command packets and addresses it to a specific modem unit plus adds control information and a CRC for integrity.

The lower level command packets are always the same no matter what the physical communication medium. The upper level header however changes depending on the medium as follows:

- RS-232/485 headers contain single byte destination modem and source controller addresses.
- Ethernet UDP headers contain neither the source or destination addresses because those are contained in the UDP packet header.

The upper level header and each command packet contain byte counts. In the command packets the byte count is set to zero to indicate that it is a “get” request. The upper level byte count can be used to aid in packet reception. The maximum binary byte count is 12 bits meaning that the maximum data payload is 4000 bytes.

The modem never initiates transmission of a packet on its own, it only responds to a request or command packet from the controller. The sequence of events in this protocol is for the controller to send a command packet to a particular addressed modem. The addressed modem reads the command packet and if valid executes the command and sends back a response packet. A response is always returned unless:

- a) The unit is improperly addressed, which causes the modem to never see the packet, or
- b) The message is globally addressed to all modems, or
- c) The message flags or CRC are incorrect causing the modem to reject the message.

If the message packet address is accepted by the modem but the packet format is incorrect then an invalid message response is returned. The response may take one of several formats depending on the command type, but the response format for any particular command is fixed.

To repeat, the destination modem address can take two forms depending on the physical connection.

- RS-232/485 connections contain the modem address within the packet as the Control RS-232 Address or Control RS-485 Address as appropriate.
- Ethernet UDP connections contain the modem address as the Unit IP Control Address plus the IP Control M&C Port number (defaults to 9101), as set in the modem. Ethernet UDP packets do not use or contain the RS-232/485 field within the binary packet header.

Example of Binary Packet Control System

An example Binary control system might consist of a single PC type computer communicating with one to 10 or more modems using a standard Ethernet connection in the PC and all units connected to a common Ethernet switch. This setup might be used to monitor and control a small station. The PC could in turn be communicating with a central computer system via the Internet, or even via a telephone line and modem. A program written in “C” or “Python” could periodically request status of each modem to insure that nothing has changed, and upon command from the central computer would change the parameters of any individual modem. For an example of the message format similar to this, see the Binary Packet Command and Response Message sections below.

Binary Packet Structure

The Binary Packet from the controller to the M7 Modem adheres to the following message format.

Upper Level Header				Payload	CRC
Opening Flag A5 hex	Destination Address 8 bits	Source Address 8 bits	Remote Address 8 bits	Command Packet 1 ~ n	16 bit CRC
			Control and Payload Byte Count 3 Bytes		

UDP packets place this entire structure without the Source and Destination Address bytes as the payload of a UDP packet addressed to the IP Control Address of the modem.

More About Address Fields

The Destination and Source Unit Addresses are only present in RS-232 or RS-485 packets. UDP packets place this entire structure without those two address bytes as the payload of a UDP packet addressed to the IP Control Address of the modem. The Source Address is an arbitrary but unique address used to differentiate controllers.

The modem is assigned an address via the front panel control or via the remote control line itself. Modems are normally shipped with the addresses preset to “1”. When multiple modems are connected to the same RS-485 control line each must have a unique address to avoid conflicts. A modem may have the same address as any controller device on a shared bus (not recommended), but no two controller devices may have the same address. Modems respond only to incoming messages containing their unique address in the destination address position of the control message. A destination address of 255 (0xFF) is a global address received by all modems.

The Source address may be any value from 0 to 254 that is not assigned to a modem and becomes the destination address of the response message. This allows for multiple controllers in one system. The convention of using 255 as the global address is assumed here also for controllers. The modem makes no use of the source address other than to place it in the response packet directing the response to the originating command source.

More About Address Fields

The Destination and Source Unit Addresses are only present in RS-232 or RS-485 packets. UDP packets We tend to use controller addresses in the range 0xC0 to 0xCF, simply as an easy to remember mnemonic for “Controller” 0 to 15.

When using the Ethernet control port there are no addresses used or recognized in the packets in either direction. This is because the Ethernet protocols insure delivery to and from the proper destination.

The CRC16-CCITT

The particular form of CRC-16 used in this protocol is called CRC16-CCITT. There are several other commonly used 16 bit CRC algorithms in use, and none of them including the CEC-ITU version will work correctly. See the notes on creating a controller at the end of this document for more specifics.

Control and Payload Byte Count Field

The Control field contains information to the modem about how to handle the payload. The fact that these controls are in the overall packet header mean that anything set here applies to the entire payload.

Byte 1								Byte 2								Byte 3							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	Profile Number 0 = current							Payload Byte Count BC LSbits								To	To	Lim	Wr	BC MSbits			
1	Data Block Number															Rmt	Ext		En				

Normally Byte 1 contains zero meaning that the payload is intended for the current modem configuration. Other values here permit reading or writing to one of 99 stored configuration “profiles”. Setting bit 7 to 1 means that this is a bulk command packet, not described here yet.

The Payload Byte count helps determine the integrity of the frame. Notice that it is 12 bits total split into two parts. This means that the maximum payload size is 4000 bytes.

If the “To Rmt” bit is set the payload contents are taken by the modem and sent over the MCC channel to a modem on the far end of the satellite link. Since this control flag pertains to the entire current packet then all individual commands are sent to the specified remote.

If the “To Ext” bit is set the payload contents are taken by the modem and sent over the control Ethernet port to a modem on the local LAN.

The Master Write Enable bit must be set for “set” commands to be valid.

Command Packet Payload

The general structure of the lower level individual command packets is shown below.

Extended Mode 4 bits	Slot Number 4 bits	Command Number 8 bits	Payload Byte Count 1 Byte	Data Bytes 0 ~ n
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The lower level individual command packets consist of 3 bytes for a get information request with the Payload Byte count set to 0. For set commands the data bytes are filled with the value to set the specified parameter to.

The command is fully specified by the Slot Number and the Command Number. The slot refers to the slot in the M7 modem that contains the desired card while the command number refers to one of that cards defined commands. The commands are shown in the table in Section 3 of this document, but may change with new software revisions.

The extended mode is normally set to 0.

Slot Number Field

The standard M7 modem chassis contains 5 card “slots” connected to a common backplane. Slot 0 always contains the controller itself and is typically referred to as the “Unit” card. Slots 1 and 2 are allocated to any combination of two RF cards from :

- IF Modulator,
- IF Demodulator,
- L-Band Modulator and
- L-Band Demodulator.

Slots 3 and 4 are allocated for any combination of the available Interface cards. These currently include:

- Sync Serial Interface

- HSSI High Speed Sync Serial Interface
- Dual G.703 Interface
- Quad G.703 Interface
- E7 – Extended IP Interface
- I7 – Processor based IP Interface

The cards placed in each slot can be determined from the front panel or via the parameters in the Unit card which is known to always be in slot 0. The identities are at Slot 0, parameters 9 through 13 in text format.

More on The Data Byte Count Field

The Data Byte Count field includes the total number of Data Bytes only, and should be zero (00) for read mode. Note that this determines if the command is a read (request for information) or write (command to change parameters). The data byte count can only be one of two values, either “0” as is common for a read request, or the actual fixed number of data bytes in that particular packet type. If the structure used in a program to store the contents of a packet’s parameters is “packed” so that each element occupies the same number of bytes as the protocol definition, then the data byte count is equal to the “sizeof(structure)” for example in C.

Data Byte Field

Multiple data formats are used within the data field: 1 byte entries are a single character or unsigned byte type or containers for bit flags; 2 byte numbers and 4 byte numbers in both signed and un-signed format. Strings consist of multiple consecutive bytes or characters not terminated by a “0” value byte as C strings often use, but are of the length specified in the byte count value. MAC addresses are 6 bytes while an 8 byte long integer is used for L-Band and RF Frequencies.

No floating point numbers are used, although the incremental value of an entry may allow a decimal point value. For instance the transmit power level is entered as an integer in increments of 0.01 dB, so an entry of -1760 represents -17.6 dB. The incremental value (represented by 1 least significant bit change) is determined from the Write Bytes section of the Command Tables by ignoring any decimal point and using the number of displayed digits. Thus frequencies are entered in 1 Hz increments, data rates in 1 bps increments, and times in increments as shown in the tables. No offsets are used in any of the number entries.

Binary Packet Response Message Format

The Binary Response Packet from the M7 Modem to the controller adheres to the following message format. The response from a modem will normally occur within approximately ½ second. Note that a modem set to 485 control port mode mutes its receive while sending the response message, so if the 485 bus is configured as 4 wire or 2 wire a modem will not receive a message while responding to a previous message.

Upper Level Header				Payload	CRC
Opening Flag 5A hex	Destination Address 8 bits	Source Address 8 bits	Remote Address 8 bits	Control and Payload Byte Count 3 Bytes	Command Packet 1 ~ n 16 bit CRC

The Destination address is taken from the Source address of the incoming packet to which this is a response. The Status and Error Bytes are defined later in this Appendix. The Data Byte Count field includes the total number of Data Bytes only, and should never be zero for a response message.

This response format is the same as the request format with the exception that the Opening flag is now 5A hex and the responses destination and source addresses, if applicable, are reversed from the request. Also two bits in the Control field are changed.

- The Limit to Available bit 5 in Byte 3 now has a meaning of Summary Change if set.
- The Master Write Enable bit 4 of Byte 3 now has a meaning of Summary Error notes if set.

The payload command packets however do contain a new byte with new information as shown below.

Response Command Packet Payload

The general structure of the lower level individual command packets for the response message is shown below.

Extended Mode 4 bits	Slot Number 4 bits	Command Number 8 bits	Error Byte 8 bits	Payload Byte Count 1 Byte	Data Bytes 0 ~ n
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The response packet from the modem includes two modifications to the original request sent.

1. The data bytes are always filled out with the current value of the parameter.
2. An error byte is included which indicates response status by bit flags as follows:
 - Bit 7 set if response contains a signed number value.
 - Bit 6 is set if the value is changed from that sent, and also means first time read from this port.
 - Bit 5 is set if there is an error in the original sent request.
 - Bits 4 to 0 indicate the type of error or warning detected.

The value in bits 4 to 0 contain any applicable warning message if bit 5 is not set, or contains applicable error messages if bit 5 is set.

Warning values and meanings are:

0. No warning
1. Parameter not active
2. Exceeded Limit, Set to available
3. Exceeded Limit, Set to default

Error values and meanings are:

0. No Error
1. Read only
2. Exceeded Limit, Set to available
3. Exceeded Limit, Set to default
4. Set to default
5. Configuration locked
6. Option not available
7. No options to set
8. Invalid extended mode
9. Write request without Write Enable Set
10. Incorrect write size/response packet larger than 4000 bytes
11. Invalid request
12. Invalid slot number, not installed
13. Configuration store failed
14. Configuration recall number not found
15. Configuration recall in slot A failed
16. Configuration recall in slot B failed
17. Configuration recall in slot C failed
18. Configuration recall in slot D failed

Data Payload Format

There may be 0 data bytes in a simple controller request for information, but all other request packets and all response packets have a non-zero data byte count and the corresponding number of bytes of information representing the data sent or received.

The data value field contains either string, signed numbers or unsigned numbers. Numbers may be 1, 2, 4 or 8 bytes corresponding to Bytes, Short, Integer and Long Integer for most computer languages. The numeric variable type can also include sequences of numbers such as 4 bytes representing an IP Address or 6 bytes representing a MAC Address. Strings are standard 8 bit ASCII characters.

Example Binary Packet Command and Response Messages

As an example of using the remote control assume that the controller should check the receive frequency, of an IF Demodulator is slot 2 and if not set correctly change it to 174.652 MHz. In this case we are using the IP control port and UDP packets to communicate with the modem's controller, so there are no source and destination addresses used. Here are the contents of the query and response packets.

```
Query Packet contents to modem in hex
  |--- header ---|--- command(s) payload -->
000: A5 00 00 03 00 02 11 00 C2 B2
```

```
Response Packet contents from modem in hex
  |--- header ---|--- command(s) payload -->
000: 5A 00 00 08 20 02 11 40 04 60 3F 9C 0A 2F F5
```

In the request query header that the "03" hex indicates that there are 3 bytes in the payload. The last two bytes are the 16 bit CRC and the payload consists of a single command to slot 2, command number 0x11. The following 00 indicates that it is a request for the current value.

The response packet shows a total byte count of 8 and the individual command response again shows slot 2 command 0x11. The error byte is 0x40 which means that it is the first time read from this port. The response value is 4 bytes of 0x0A9C3F60 (note that the packet uses Intel/ARM Little Endian format so the 4 byte integer is least significant byte first in the packet order). Converting that number to decimal gives 178012000 Hz or 178,012 MHz.

Now let us set the demodulator to our desired frequency of 174.652 MHz. The command and response is as follows:

```
Query Packet contents to modem in hex
  |--- header ---|--- command(s) payload -->
000: A5 00 00 07 10 02 11 04 60 FA 68 0A BD 16
```

```
Response Packet contents from modem in hex
  |--- header ---|--- command(s) payload -->
000: 5A 00 00 08 20 02 11 40 04 60 FA 68 0A 60 DD
```

This time we had a total payload count of 7 bytes and the command sub-packet had the same slot and command number but a data byte count of 4 bytes, representing 174652000 Hz

The response came back with a value change bit set to 1 indicating a new value and the value matches what we sent out indicating success, along with the lack of error messages.

Far End Modem Control via the MCC

The M7 series protocols contain the ability to relay control packets and responses via the Modem Control Channel, or MCC, from a local to a single or multiple far end modem. The packet "Send to Remote" bit and the Remote Address byte are used to address the far end modem.

A far end designated packet is not evaluated or processed by the local modem except that its source and destination addresses are removed. When the response is returned by the far end modem, the addresses are inserted into the response before returning it to the original calling controller.

The MCC channel originates in the interface card and can take two different formats depending on what card is installed. An I7 or E7 Ethernet card contains no multiplexer circuitry and the MCC channel is built by inserting packets into the HDLC frame stream when possible. All other interfaces must have the

transmit and receive multiplexers enabled and the MCC channel set to a reasonable speed value, typically at least 1 kbps, for successful remote communication success.

MCC Channel Timing

A packet sent to the far end via the MCC channel may take quite a while before a response is returned to the original caller. The timing also varies depending on the overhead rate assigned to the MCC channel. For example, a 9 byte request with a 50 byte response and a 9600 baud MCC channel overhead would take approximately 9 mS for local receipt, plus 9 mS to send via the MCC, plus 250 mS satellite time, then for the response, approximately 6 mS processing time, 50 mS to send, plus 250 mS satellite return time, plus 50 mS to retransmit to the originator. That is a total of approximately 624 mS. If the MCC overhead rate was lowered to 1200 baud then the time would increase to approximately 1237 mS! The originating controller must be set up to accept this order of delay.

Far End Modem Control via the ESC

The M7, and the M5 series modems equipped with the multiplexer, also have an overhead channel or Engineering Service Channel (ESC), which can be used to relay multiple types of control messages from one station to another. Although it requires more connecting cables, this method has several additional configurations not possible using the MCC.

The ESC is an asynchronous overhead channel capable of being formatted as either RS-232 or RS-485 physically. To use the ESC for control of one or more modems at a far end, the ESC locally is connected to a controlling computer. The ESC at the far end of the link is looped back into the modem's normal control port at J6. To control a single far end modem the physical connection could be either RS-232 or RS-485, but if RS-485 is chosen then multiple modems at a remote location can be controlled by simply daisy chaining the RS-485 to each modem. The ESC at the two ends of the link do not have to be the same physical protocol or even the same data rate since the ESC channel contains buffering at both ends.

Since the ESC channel is simply a link, and knows nothing about the information being carried, it can also be used to control a single far end modem using the VT100 control mode. This mode is limited to a single modem however since that method does not use addresses to point to a particular modem. The VT100 mode has the advantage that all of the programming required is contained within the modem. The controller simply needs to be a dumb terminal or a PC running a terminal emulation program like Hyperterminal in a Windows OS PC.

For information on building the cables needed to connect a computer or a modem's control port to the ESC port connections on the modem's Aux Port (J4), see Appendix C, Cabling, Section 3.

More Information on Modem Monitor and Control

Please see the separate Datum Systems Application Note 18 entitled "*Remote Control of Satellite Modems*". This App Note is available on our web site. It describes several scenarios for control of local and remote modems within a system.

Current Card Types and Command Sets

Each of the following currently available cards for the M7 modem have their own command set. Following is the command set for each starting with the Unit Controller card.

Unit Controller Card - Model M709001A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
0	'mst'	'StatusModem'	1 - RO Status	Integer	Option #	"
1	'yst'	'StatusRedundancy'	3 - RW Option	Integer	Option #	"
2	'rst'	'StatusReference'	1 - RO Status	Integer	Option #	"
3	'ist'	'StatusIPControlPort'	3 - RW Option	Integer	Option #	"

Unit Controller Card - Model M709001A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
4	'sid'	'StatusStationID'	2 - RW Number	String	Option #	"
5	'tim'	'StatusTime'	7	4B	1	"
6	'dat'	'StatusDate'	8	4B	1	"
8	'mdl'	'StatusModel'	1 - RO Status	String	Option #	"
9	'id0'	'StatusControllerID'	0 - RO Fixed Info	String	Option #	"
10	'id1'	'StatusRF1ID'	0 - RO Fixed Info	String	Option #	"
11	'id2'	'StatusRF2ID'	0 - RO Fixed Info	String	Option #	"
12	'id3'	'StatusInterface1ID'	0 - RO Fixed Info	String	Option #	"
13	'id4'	'StatusInterface2ID'	0 - RO Fixed Info	String	Option #	"
14	'swv'	'StatusSoftwareVersion'	0 - RO Fixed Info	String	Option #	"
15	'hsn'	'StatusHardwareSN'	0 - RO Fixed Info	Unsigned32	1	"
16	'lmd'	'EventLogMode'	1 - RO Status	Integer	Option #	"
17	'les'	'EventLogSummary'	1 - RO Status	Unsigned32	1	"
18	'lel'	'EventLogSummaryLast'	1 - RO Status	Unsigned32	1	"
19	'lev'	'EventLogEvents'	1 - RO Status	Integer	Option #	"
20	'led'	'EventLogRepeatDelay'	2 - RW Number	Unsigned32	1	's'
32	'rmd'	'RedundancyMode'	1 - RO Status	Integer	Option #	"
33	'rsr'	'RedundancySwRqst'	3 - RW Option	Integer	Option #	"
34	'rsh'	'RedundancySwHold'	2 - RW Number	Unsigned32	0.1	's'
35	'rcg'	'RedundancyConfig'	3 - RW Option	Integer	Option #	"
48	'crc'	'ConfigRecall'	2	Unsigned32	1	"
49	'cst'	'ConfigStore'	2 - RW Number	Unsigned32	1	"
50	'car'	'ConfigAutoRestore'	3 - RW Option	Integer	Option #	"
51	'cra'	'ConfigRestoreAfter'	2 - RW Number	Unsigned32	1	's'
52	'crn'	'ConfigRestore#'	2 - RW Number	Unsigned32	1	"
53	'cpu'	'ConfigPower-Up'	2 - RW Number	Unsigned32	1	"
64	'kmd'	'KeyboardMode'	3 - RW Option	Integer	Option #	"
65	'ken'	'KeyboardEntry'	3 - RW Option	Integer	Option #	"
66	'kla'	'KeyboardLCDActive'	3 - RW Option	Integer	Option #	"
67	'kli'	'KeyboardLCDIdle'	3 - RW Option	Integer	Option #	"
68	'kac'	'KeyboardActivity'	3 - RW Option	Integer	Option #	"
80	'hsm'	'HTTPServerMode'	3 - RW Option	Integer	Option #	"
81	'hst'	'HTTPServerType'	3 - RW Option	Integer	Option #	"
82	'hra'	'HTTPReadAccess'	3 - RW Option	Integer	Option #	"
83	'hrn'	'HTTPReadUserName'	2	String	Option #	"
84	'hrp'	'HTTPReadPassword'	2	String	Option #	"
85	'hfa'	'HTTPFullAccess'	3 - RW Option	Integer	Option #	"
86	'hfn'	'HTTPFullUserName'	2	String	Option #	"
87	'hfp'	'HTTPFullPassword'	2	String	Option #	"
88	'hac'	'HTTPActivity'	3 - RW Option	Integer	Option #	"
89	'hvw'	'HTTPWebVersion'	0 - RO Fixed Info	String	Option #	"
96	'ssm'	'SNMPServerMode'	1 - RO Status	Integer	Option #	"
97	'sst'	'SNMPServerType'	3 - RW Option	Integer	Option #	"

Unit Controller Card - Model M709001A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
98	'sra'	'SNMPReadAccess'	3 - RW Option	Integer	Option #	"
99	'srn'	'SNMPReadUserName'	2	String	Option #	"
100	'srp'	'SNMPReadPassword'	2	String	Option #	"
101	'sfa'	'SNMPFullAccess'	3 - RW Option	Integer	Option #	"
102	'sfn'	'SNMPFullUserName'	2	String	Option #	"
103	'sfp'	'SNMPFullPassword'	2	String	Option #	"
104	'sac'	'SNMPActivity'	3 - RW Option	Integer	Option #	"
112	'idh'	'IPControlDHCP'	3 - RW Option	Integer	Option #	"
113	'iad'	'IPControlAddress'	10 - RW IP Addr	IpAddress	1	"
114	'inm'	'IPControlNetworkMask'	10 - RW IP Addr	IpAddress	1	"
115	'igw'	'IPControlGateway'	10 - RW IP Addr	IpAddress	1	"
116	'is1'	'IPControlDNS1'	10 - RW IP Addr	IpAddress	1	"
117	'is2'	'IPControlDNS2'	10 - RW IP Addr	IpAddress	1	"
118	'ism'	'IPControlMCServerMode'	3 - RW Option	Integer	Option #	"
119	'ipn'	'IPControlMCPortNumber'	2 - RW Number	Unsigned32	1	"
120	'irp'	'IPControlMCRemotePath'	10 - RW IP Addr	IpAddress	1	"
121	'ixd'	'IPControlMCExtDevice'	10 - RW IP Addr	IpAddress	1	"
122	'iac'	'IPControlMCActivity'	3 - RW Option	Integer	Option #	"
123	'ima'	'IPControlMACAddress'	11 - RO MAC Addr	PhysAddress	1	"
128	'2md'	'ControlRS-232Mode'	3 - RW Option	Integer	Option #	"
129	'2pr'	'ControlRS-232Protocol'	3 - RW Option	Integer	Option #	"
130	'2ad'	'ControlRS-232Address'	2 - RW Number	Unsigned32	1	"
131	'2ra'	'ControlRS-232Rate'	3 - RW Option	Integer	Option #	"
132	'2fo'	'ControlRS-232Format'	3 - RW Option	Integer	Option #	"
133	'2ac'	'ControlRS-232Activity'	3 - RW Option	Integer	Option #	"
134	'4md'	'ControlRS-485Mode'	3 - RW Option	Integer	Option #	"
135	'4pr'	'ControlRS-485Protocol'	3 - RW Option	Integer	Option #	"
136	'4ad'	'ControlRS-485Address'	2 - RW Number	Unsigned32	1	"
137	'4ra'	'ControlRS-485Rate'	3 - RW Option	Integer	Option #	"
138	'4fo'	'ControlRS-485Format'	3 - RW Option	Integer	Option #	"
139	'4ac'	'ControlRS-485Activity'	3 - RW Option	Integer	Option #	"
144	'rso'	'ReferenceSource'	3 - RW Option	Integer	Option #	"
145	'rfr'	'ReferenceFrequency'	3 - RW Option	Integer	Option #	"
146	'rft'	'ReferenceFineTune'	2 - RW Number	Integer	1	"
160	'mmd'	'MonitorOutputMode'	3 - RW Option	Integer	Option #	"
161	'mfs'	'MonitorOutputFullScale'	2 - RW Number	Unsigned32	0.1	'V'
162	'msl'	'MonitorOutputSlope'	3 - RW Option	Integer	Option #	"
163	'mit'	'MonitorInputThreshold'	2 - RW Number	Unsigned32	0.1	'V'
164	'mis'	'MonitorInputSense'	3 - RW Option	Integer	Option #	"
208	'adm'	'AlarmRedundancyMask'	3 - RW Option	Integer	Option #	"
209	'arm'	'AlarmReferenceMask'	3 - RW Option	Integer	Option #	"

Unit Controller Card - Model M709001A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
210	'aim'	'AlarmIPControlPortMask'	3 - RW Option	Integer	Option #	"
211	'aom'	'AlarmOCXOOvenMask'	3 - RW Option	Integer	Option #	"
212	'amm'	'AlarmMonitorInputMask'	3 - RW Option	Integer	Option #	"
213	'apm'	'AlarmPowerSupplyMask'	3 - RW Option	Integer	Option #	"
214	'apn'	'AlarmPowerSupplyMin'	2 - RW Number	Unsigned32	0.1	'V'
215	'atm'	'AlarmTestActiveMask'	3 - RW Option	Integer	Option #	"
216	'ahm'	'AlarmHardwareMask'	3 - RW Option	Integer	Option #	"
217	'abm'	'AlarmBeepMask'	3 - RW Option	Integer	Option #	"
224	'tmo'	'TestModem'	3 - RW Option	Integer	Option #	"
225	'tcr'	'TestReferenceCal'	3 - RW Option	Integer	Option #	"
226	'tfc'	'TestFirmwareControl'	3 - RW Option	Integer	Option #	"
227	'tbc'	'TestBootControl'	3 - RW Option	Integer	Option #	"
228	'tpo'	'TestPowerSupply'	1 - RO Status	Unsigned32	0.1	'V'
229	'tmi'	'TestMonitorInput'	1 - RO Status	Unsigned32	0.1	'V'
230	'tra'	'TestReferenceAFC'	2	Unsigned32	0.01	'V'
232	'tot'	'TestOCXOTemperature'	1 - RO Status	Unsigned32	0.1	'C'
239	'tad'	'TestAdmin'	3 - RW Option	Integer	Option #	"
240	'fun'	'FeatureUnit'	20	Integer	Option #	"
254	'fac'	'FeatureActivation'	20	Unsigned64	1	"

IF Modulator Card - Model M709002A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
0	'cst'	'StatusCarrier'	1 - RO Status	Integer	Option #	"
1	'bst'	'StatusBUC'	1 - RO Status	Integer	Option #	"
2	'ist'	'StatusInterface'	1 - RO Status	Integer	Option #	"
3	'tst'	'StatusTest'	1 - RO Status	Integer	Option #	"
4	'bpo'	'StatusBUCPowerOption'	0 - RO Fixed Info	String	Option #	"
13	'typ'	'StatusHardwareType'	0 - RO Fixed Info	String	Option #	"
14	'hid'	'StatusHardwareID'	0 - RO Fixed Info	String	Option #	"
15	'hsn'	'StatusHardwareSN'	0 - RO Fixed Info	Unsigned32	1	"
16	'xfr'	'IFBUCXmtFrequency'	2 - RW Number	Unsigned64	1	'Hz'
17	'frq'	'IFFrequency'	2 - RW Number	Unsigned32	1	'Hz'
18	'xlv'	'IFBUCXmtLevel'	2 - RW Number	Integer	0.01	'dBW'
19	'lvl'	'IFLevel'	2 - RW Number	Integer	0.01	'dBm'
20	'out'	'IFOutput'	3 - RW Option	Integer	Option #	"
21	'mod'	'IFModulation'	3 - RW Option	Integer	Option #	"
22	'spc'	'IFSpectrum'	3 - RW Option	Integer	Option #	"
23	'fro'	'IFFilterRoll-Off'	3 - RW Option	Integer	Option #	"
24	'amd'	'IFAUPCMode'	3 - RW Option	Integer	Option #	"
25	'aeb'	'IFAUPCEbNo'	2 - RW Number	Unsigned32	0.01	'dB'
26	'amx'	'IFAUPCMaxLevel'	2 - RW Number	Integer	0.01	'dBm'
27	'amn'	'IFAUPCMinLevel'	2 - RW Number	Integer	0.01	'dBm'
28	'mut'	'IFMute'	3 - RW Option	Integer	Option #	"
29	'imp'	'IFImpedance'	3 - RW Option	Integer	Option #	"

IF Modulator Card - Model M709002A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
32	'bit'	'DataBitRate'	2 - RW Number	Unsigned32	1	'bps'
33	'sym'	'DataSymbolRate'	2 - RW Number	Unsigned32	1	'sps'
34	'rmd'	'DataRateEntryMode'	3 - RW Option	Integer	Option #	"
35	'int'	'DataSendInterface'	3 - RW Option	Integer	Option #	"
36	'fmd'	'DataFECMode'	3 - RW Option	Integer	Option #	"
37	'fop'	'DataFECOption'	3 - RW Option	Integer	Option #	"
38	'fra'	'DataFECCodeRate'	3 - RW Option	Integer	Option #	"
39	'rsm'	'DataRSMode'	3 - RW Option	Integer	Option #	"
40	'rsn'	'DataRSn'	2 - RW Number	Unsigned32	1	"
41	'rsk'	'DataRSk'	2 - RW Number	Unsigned32	1	"
42	'rsd'	'DataRSDepth'	3 - RW Option	Integer	Option #	"
43	'den'	'DataDifEncoder'	3 - RW Option	Integer	Option #	"
44	'scr'	'DataScrambler'	3 - RW Option	Integer	Option #	"
192	'bpe'	'BUCPower'	3 - RW Option	Integer	Option #	"
193	'bvm'	'BUCVoltageMonitor'	1 - RO Status	Unsigned32	0.1	'V'
194	'bim'	'BUCCurrentMonitor'	1 - RO Status	Unsigned32	0.01	'A'
195	'brf'	'BUC10MHzRef'	3 - RW Option	Integer	Option #	"
196	'blo'	'BUCLOFrequency'	2 - RW Number	Unsigned64	1	'Hz'
197	'bxs'	'BUCXmtSpectrum'	3 - RW Option	Integer	Option #	"
198	'bxg'	'BUCXmtGain'	2 - RW Number	Unsigned32	0.01	'dB'
199	'bxl'	'BUCXmtLevelMax'	2 - RW Number	Integer	0.01	'dBW'
200	'brm'	'BUCFSKRemoteMC'	3 - RW Option	Integer	Option #	"
201	'bp1'	'BUCParameter1'	3 - RW Option	Integer	Option #	"
202	'bp2'	'BUCParameter2'	3 - RW Option	Integer	Option #	"
203	'bp3'	'BUCParameter3'	3 - RW Option	Integer	Option #	"
208	'acm'	'AlarmCarrierMask'	3 - RW Option	Integer	Option #	"
209	'aam'	'AlarmAUPCMask'	3 - RW Option	Integer	Option #	"
210	'atm'	'AlarmTestActiveMask'	3 - RW Option	Integer	Option #	"
211	'ahm'	'AlarmHardwareMask'	3 - RW Option	Integer	Option #	"
212	'abm'	'AlarmBUCPowerMask'	3 - RW Option	Integer	Option #	"
213	'bcm'	'AlarmBUCCurrentMax'	2 - RW Number	Unsigned32	0.01	'A'
214	'bcn'	'AlarmBUCCurrentMin'	2 - RW Number	Unsigned32	0.01	'A'
215	'arm'	'AlarmBUCFSKMask'	3 - RW Option	Integer	Option #	"
224	'tmo'	'TestModulation'	3 - RW Option	Integer	Option #	"
225	'tob'	'TestTotalOccupiedBW'	1 - RO Status	Unsigned32	1	'Hz'
240	'fbr'	'FeatureBitRateLimit'	20	Integer	Option #	"
241	'fmo'	'FeatureModulation'	20	Integer	Option #	"
242	'fec'	'FeatureFEC'	20	Integer	Option #	"
254	'fac'	'FeatureActivation'	20	Unsigned64	1	"

L-Band Modulator Card - Model M709003A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
0	'cst'	'StatusCarrier'	1 - RO Status	Integer	Option #	"
1	'bst'	'StatusBUC'	1 - RO Status	Integer	Option #	"
2	'ist'	'StatusInterface'	1 - RO Status	Integer	Option #	"
3	'tst'	'StatusTest'	1 - RO Status	Integer	Option #	"
4	'bpo'	'StatusBUCPowerOption'	0 - RO Fixed Info	String	Option #	"

L-Band Modulator Card - Model M709003A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
13	'typ'	'StatusHardwareType'	0 - RO Fixed Info	String	Option #	"
14	'hid'	'StatusHardwareID'	0 - RO Fixed Info	String	Option #	"
15	'hsn'	'StatusHardwareSN'	0 - RO Fixed Info	Unsigned32	1	"
16	'xfr'	'IFBUCXmtFrequency'	2 - RW Number	Unsigned64	1	'Hz'
17	'frq'	'IFFrequency'	2 - RW Number	Unsigned32	1	'Hz'
18	'xlv'	'IFBUCXmtLevel'	2 - RW Number	Integer	0.01	'dBW'
19	'lvl'	'IFLevel'	2 - RW Number	Integer	0.01	'dBm'
20	'out'	'IFOutput'	3 - RW Option	Integer	Option #	"
21	'mod'	'IFModulation'	3 - RW Option	Integer	Option #	"
22	'spc'	'IFSpectrum'	3 - RW Option	Integer	Option #	"
23	'fro'	'IFFilterRoll-Off'	3 - RW Option	Integer	Option #	"
24	'amd'	'IFAUPCMode'	3 - RW Option	Integer	Option #	"
25	'aeb'	'IFAUPCEbNo'	2 - RW Number	Unsigned32	0.01	'dB'
26	'amx'	'IFAUPCMaxLevel'	2 - RW Number	Integer	0.01	'dBm'
27	'amn'	'IFAUPCMinLevel'	2 - RW Number	Integer	0.01	'dBm'
28	'mut'	'IFMute'	3 - RW Option	Integer	Option #	"
29	'imp'	'IFImpedance'	1 - RO Status	Integer	Option #	"
32	'bit'	'DataBitRate'	2 - RW Number	Unsigned32	1	'bps'
33	'sym'	'DataSymbolRate'	2 - RW Number	Unsigned32	1	'sps'
34	'rmd'	'DataRateEntryMode'	3 - RW Option	Integer	Option #	"
35	'int'	'DataSendInterface'	3 - RW Option	Integer	Option #	"
36	'fmd'	'DataFECMode'	3 - RW Option	Integer	Option #	"
37	'fop'	'DataFECOption'	3 - RW Option	Integer	Option #	"
38	'fra'	'DataFECCodeRate'	3 - RW Option	Integer	Option #	"
39	'rsm'	'DataRSMMode'	3 - RW Option	Integer	Option #	"
40	'rsn'	'DataRSn'	2 - RW Number	Unsigned32	1	"
41	'rsk'	'DataRSk'	2 - RW Number	Unsigned32	1	"
42	'rsd'	'DataRSDepth'	3 - RW Option	Integer	Option #	"
43	'den'	'DataDifEncoder'	3 - RW Option	Integer	Option #	"
44	'scr'	'DataScrambler'	3 - RW Option	Integer	Option #	"
192	'bpe'	'BUCPower'	3 - RW Option	Integer	Option #	"
193	'bvm'	'BUCVoltageMonitor'	1 - RO Status	Unsigned32	0.1	'V'
194	'bim'	'BUCCurrentMonitor'	1 - RO Status	Unsigned32	0.01	'A'
195	'brf'	'BUC10MHzRef'	3 - RW Option	Integer	Option #	"
196	'blo'	'BUCLOFrequency'	2 - RW Number	Unsigned64	1	'Hz'
197	'bxs'	'BUCXmtSpectrum'	3 - RW Option	Integer	Option #	"
198	'bxg'	'BUCXmtGain'	2 - RW Number	Unsigned32	0.01	'dB'
199	'bxl'	'BUCXmtLevelMax'	2 - RW Number	Integer	0.01	'dBW'
200	'brm'	'BUCFSKRemoteMC'	3 - RW Option	Integer	Option #	"
201	'bp1'	'BUCParameter1'	3 - RW Option	Integer	Option #	"
202	'bp2'	'BUCParameter2'	3 - RW Option	Integer	Option #	"
203	'bp3'	'BUCParameter3'	3 - RW Option	Integer	Option #	"
208	'acm'	'AlarmCarrierMask'	3 - RW Option	Integer	Option #	"
209	'aam'	'AlarmAUPCMask'	3 - RW Option	Integer	Option #	"
210	'atm'	'AlarmTestActiveMask'	3 - RW Option	Integer	Option #	"
211	'ahm'	'AlarmHardwareMask'	3 - RW Option	Integer	Option #	"
212	'abm'	'AlarmBUCPowerMask'	3 - RW Option	Integer	Option #	"
213	'bcm'	'AlarmBUCCurrentMax'	2 - RW Number	Unsigned32	1	"
214	'bcn'	'AlarmBUCCurrentMin'	2 - RW Number	Unsigned32	1	"

L-Band Modulator Card - Model M709003A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
215	'arm'	'AlarmBUCFSKMask'	3 - RW Option	Integer	Option #	"
224	'tmo'	'TestModulation'	3 - RW Option	Integer	Option #	"
225	'tob'	'TestTotalOccupiedBW'	1 - RO Status	Unsigned32	1	'Hz'
226	'tlc'	'TestCXRL LeakageCal'	3 - RW Option	Integer	Option #	"
227	'tlv'	'TestCXRL LevelBalCal'	3 - RW Option	Integer	Option #	"
228	'tph'	'TestCXRL PhaseBalCal'	3 - RW Option	Integer	Option #	"
240	'fbr'	'FeatureBitRateLimit'	20	Integer	Option #	"
241	'fmo'	'FeatureModulation'	20	Integer	Option #	"
242	'fec'	'FeatureFEC'	20	Integer	Option #	"
254	'fac'	'FeatureActivation'	20	Unsigned64	1	"

IF Demodulator Card - Model M709004A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
0	'cst'	'StatusCarrier'	3 - RW Option	Integer	Option #	"
1	'est'	'StatusEbNo'	1 - RO Status	Integer	0.01	'dB'
2	'ost'	'StatusOffset'	1 - RO Status	Integer	1	'Hz'
3	'lst'	'StatusLevel'	1 - RO Status	Integer	0.01	'dBm'
4	'bst'	'StatusEstBER'	1 - RO Status	Unsigned32	0.1	"
5	'sst'	'StatusSBER'	1 - RO Status	Unsigned32	0.01	"
6	'lns'	'StatusLNB'	1 - RO Status	Integer	Option #	"
7	'ist'	'StatusInterface'	1 - RO Status	Integer	Option #	"
8	'tst'	'StatusTest'	1 - RO Status	Integer	Option #	"
9	'fho'	'StatusFECHardwareOpt'	1 - RO Status	Integer	Option #	"
10	'lpo'	'StatusLNBPowerOption'	0 - RO Fixed Info	String	Option #	"
13	'typ'	'StatusHardwareType'	0 - RO Fixed Info	String	Option #	"
14	'hid'	'StatusHardwareID'	0 - RO Fixed Info	String	Option #	"
15	'hsn'	'StatusHardwareSN'	0 - RO Fixed Info	Unsigned32	1	"
16	'rfr'	'IFLNBRCvFrequency'	2 - RW Number	Unsigned64	1	'Hz'
17	'frq'	'IFFrequency'	2 - RW Number	Unsigned32	1	'Hz'
18	'swp'	'IFSweepRange'	2 - RW Number	Unsigned32	1	'Hz'
19	'swm'	'IFSweepMode'	3 - RW Option	Integer	Option #	"
20	'swp'	'IFSweepTime'	2 - RW Number	Integer	0.1	's'
21	'mod'	'IFModulation'	3 - RW Option	Integer	Option #	"
22	'spe'	'IFSpectrum'	3 - RW Option	Integer	Option #	"
23	'fro'	'IFFilterRoll-Off'	3 - RW Option	Integer	Option #	"
24	'arp'	'IFAUPCRemotePath'	3 - RW Option	Integer	Option #	"
25	'ara'	'IFAUPCRemoteMCCAddress'	2 - RW Number	Unsigned32	1	"
26	'imp'	'IFImpedance'	3 - RW Option	Integer	Option #	"
32	'bit'	'DataBitRate'	2 - RW Number	Unsigned32	1	'bps'
33	'sym'	'DataSymbolRate'	2 - RW Number	Unsigned32	1	'sps'
34	'rmd'	'DataRateEntryMode'	3 - RW Option	Integer	Option #	"
35	'int'	'DataRevInterface'	3 - RW Option	Integer	Option #	"
36	'fmd'	'DataFECMode'	3 - RW Option	Integer	Option #	"
37	'fop'	'DataFECOption'	3 - RW Option	Integer	Option #	"

IF Demodulator Card - Model M709004A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
38	'fra'	'DataFECCodeRate'	3 - RW Option	Integer	Option #	"
39	'rsm'	'DataRSMode'	3 - RW Option	Integer	Option #	"
40	'rsn'	'DataRSn'	2 - RW Number	Unsigned32	1	"
41	'rsk'	'DataRSk'	2 - RW Number	Unsigned32	1	"
42	'rsd'	'DataRSDepth'	3 - RW Option	Integer	Option #	"
43	'dec'	'DataDifDecoder'	3 - RW Option	Integer	Option #	"
44	'dsc'	'DataDescrambler'	3 - RW Option	Integer	Option #	"
45	'fhd'	'DataFECHold'	2 - RW Number	Unsigned32	1	"
192	'lpe'	'LNBPowr'	3 - RW Option	Integer	Option #	"
193	'lvm'	'LNBVoltageMonitor'	1 - RO Status	Unsigned32	0.1	'V'
194	'lim'	'LNBCurrentMonitor'	1 - RO Status	Unsigned32	0.01	'A'
195	'lrf'	'LNB10MHzRef'	3 - RW Option	Integer	Option #	"
196	'llo'	'LNBLOFrequency'	2 - RW Number	Unsigned64	1	'Hz'
197	'lsp'	'LNBRCvSpectrum'	3 - RW Option	Integer	Option #	"
208	'acm'	'AlarmCarrierLockMask'	3 - RW Option	Integer	Option #	"
209	'aem'	'AlarmLowEbNoMask'	3 - RW Option	Integer	Option #	"
210	'ael'	'AlarmLowEbNoLimit'	2 - RW Number	Unsigned32	0.01	'dB'
211	'alm'	'AlarmLowLevelMask'	3 - RW Option	Integer	Option #	"
212	'all'	'AlarmLowLevelLimit'	2 - RW Number	Integer	0.01	'dBm'
213	'atm'	'AlarmTestActiveMask'	3 - RW Option	Integer	Option #	"
214	'ahm'	'AlarmHardwareMask'	3 - RW Option	Integer	Option #	"
215	'lpm'	'AlarmLNBPowrMask'	3 - RW Option	Integer	Option #	"
216	'lcm'	'AlarmLNBCurrentMax'	2 - RW Number	Unsigned32	0.01	'A'
217	'lcn'	'AlarmLNBCurrentMin'	2 - RW Number	Unsigned32	0.01	'A'
224	'tlb'	'TestIFLoopback'	3 - RW Option	Integer	Option #	"
225	'tmm'	'TestMonitorMode'	3 - RW Option	Integer	Option #	"
226	'tsc'	'TestSpectAnalyzerCenter'	2 - RW Number	Unsigned32	1	'Hz'
227	'tss'	'TestSpectAnalyzerSpan'	2 - RW Number	Unsigned32	1	'Hz'
228	'tob'	'TestTotalOccupiedBW'	1 - RO Status	Unsigned32	1	'Hz'
229	'tlc'	'TestIFLoopbackCal'	3 - RW Option	Integer	Option #	"
230	'tbc'	'TestCXRBalanceCal'	3 - RW Option	Integer	Option #	"
240	'fbr'	'FeatureBitRateLimit'	20	Integer	Option #	"
241	'fmo'	'FeatureModulation'	20	Integer	Option #	"
242	'fec'	'FeatureFEC'	20	Integer	Option #	"
254	'fac'	'FeatureActivation'	20	Unsigned64	1	"

L-Band Demodulator Card - Model M709007A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
0	'cst'	'StatusCarrier'	3 - RW Option	Integer	Option #	"
1	'est'	'StatusEbNo'	1 - RO Status	Integer	0.01	'dB'

L-Band Demodulator Card - Model M709007A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
2	'ost'	'StatusOffset'	1 - RO Status	Integer	1	'Hz'
3	'lst'	'StatusLevel'	1 - RO Status	Integer	0.01	'dBm'
4	'bst'	'StatusEstBER'	1 - RO Status	Unsigned32	0.1	"
5	'sst'	'StatusSBER'	1 - RO Status	Unsigned32	0.01	"
6	'lns'	'StatusLNB'	1 - RO Status	Integer	Option #	"
7	'ist'	'StatusInterface'	1 - RO Status	Integer	Option #	"
8	'tst'	'StatusTest'	1 - RO Status	Integer	Option #	"
9	'fho'	'StatusFECHardwareOpt'	1 - RO Status	Integer	Option #	"
10	'lpo'	'StatusLNBPowerOption'	0 - RO Fixed Info	String	Option #	"
13	'typ'	'StatusHardwareType'	0 - RO Fixed Info	String	Option #	"
14	'hid'	'StatusHardwareID'	0 - RO Fixed Info	String	Option #	"
15	'hsn'	'StatusHardwareSN'	0 - RO Fixed Info	Unsigned32	1	"
16	'rfr'	'IFLNBRCvFrequency'	2 - RW Number	Unsigned64	1	'Hz'
17	'frq'	'IFFrequency'	2 - RW Number	Unsigned32	1	'Hz'
18	'swp'	'IFSweepRange'	2 - RW Number	Unsigned32	1	'Hz'
19	'swm'	'IFSweepMode'	3 - RW Option	Integer	Option #	"
20	'swt'	'IFSweepTime'	2 - RW Number	Integer	0.1	's'
21	'mod'	'IFModulation'	3 - RW Option	Integer	Option #	"
22	'spc'	'IFSpectrum'	3 - RW Option	Integer	Option #	"
23	'fro'	'IFFilterRoll-Off'	3 - RW Option	Integer	Option #	"
24	'arp'	'IFAUPCRemotePath'	3 - RW Option	Integer	Option #	"
25	'ara'	'IFAUPCRemoteMCCAd dress'	2 - RW Number	Unsigned32	1	"
26	'imp'	'IFImpedance'	1 - RO Status	Integer	Option #	"
32	'bit'	'DataBitRate'	2 - RW Number	Unsigned32	1	'bps'
33	'sym'	'DataSymbolRate'	2 - RW Number	Unsigned32	1	'sps'
34	'rmd'	'DataRateEntryMode'	3 - RW Option	Integer	Option #	"
35	'int'	'DataRcvInterface'	3 - RW Option	Integer	Option #	"
36	'fmd'	'DataFECMode'	3 - RW Option	Integer	Option #	"
37	'fop'	'DataFECOption'	3 - RW Option	Integer	Option #	"
38	'fra'	'DataFECCodeRate'	3 - RW Option	Integer	Option #	"
39	'rsm'	'DataRSMmode'	3 - RW Option	Integer	Option #	"
40	'rsn'	'DataRSn'	2 - RW Number	Unsigned32	1	"
41	'rsk'	'DataRSk'	2 - RW Number	Unsigned32	1	"
42	'rsd'	'DataRSDepth'	3 - RW Option	Integer	Option #	"
43	'dec'	'DataDifDecoder'	3 - RW Option	Integer	Option #	"
44	'dsc'	'DataDescrambler'	3 - RW Option	Integer	Option #	"
45	'fhd'	'DataFECHold'	2 - RW Number	Unsigned32	1	"
192	'lpe'	'LNBPower'	3 - RW Option	Integer	Option #	"
193	'lvm'	'LNBVoltageMonitor'	1 - RO Status	Unsigned32	0.1	'V'
194	'lim'	'LNBCurrentMonitor'	1 - RO Status	Unsigned32	0.01	'A'
195	'lrf'	'LNB10MHzRef'	3 - RW Option	Integer	Option #	"
196	'llo'	'LNBLOFrequency'	2 - RW Number	Unsigned64	1	'Hz'

L-Band Demodulator Card - Model M709007A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
197	'lsp'	'LNBRCvSpectrum'	3 - RW Option	Integer	Option #	"
208	'acm'	'AlarmCarrierLockMask'	3 - RW Option	Integer	Option #	"
209	'aem'	'AlarmLowEbNoMask'	3 - RW Option	Integer	Option #	"
210	'ael'	'AlarmLowEbNoLimit'	2 - RW Number	Unsigned32	0.01	'dB'
211	'alm'	'AlarmLowLevelMask'	3 - RW Option	Integer	Option #	"
212	'all'	'AlarmLowLevelLimit'	2 - RW Number	Integer	0.01	'dBm'
213	'atm'	'AlarmTestActiveMask'	3 - RW Option	Integer	Option #	"
214	'ahm'	'AlarmHardwareMask'	3 - RW Option	Integer	Option #	"
215	'lpm'	'AlarmLNBPowMask'	3 - RW Option	Integer	Option #	"
216	'lcm'	'AlarmLNBCurrentMax'	2 - RW Number	Unsigned32	0.01	'A'
217	'lcn'	'AlarmLNBCurrentMin'	2 - RW Number	Unsigned32	0.01	'A'
224	'tlb'	'TestIFLoopback'	3 - RW Option	Integer	Option #	"
225	'tmm'	'TestMonitorMode'	3 - RW Option	Integer	Option #	"
226	'tsc'	'TestSpectAnalyzerCenter'	2 - RW Number	Unsigned32	1	'Hz'
227	'tss'	'TestSpectAnalyzerSpan'	2 - RW Number	Unsigned32	1	'Hz'
228	'tob'	'TestTotalOccupiedBW'	1 - RO Status	Unsigned32	1	'Hz'
229	'tlc'	'TestIFLoopbackCal'	3 - RW Option	Integer	Option #	"
230	'tbc'	'TestCXRBalaceCal'	3 - RW Option	Integer	Option #	"
240	'fbr'	'FeatureBitRateLimit'	20	Integer	Option #	"
241	'fmo'	'FeatureModulation'	20	Integer	Option #	"
242	'fec'	'FeatureFEC'	20	Integer	Option #	"
254	'fac'	'FeatureActivation'	20	Unsigned64	1	"

Sync Serial Interface Card - Model M709013A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
0	'ios'	'StatusIO'	1 - RO Status	Integer	Option #	"
1	'scs'	'StatusSendClock'	1 - RO Status	Integer	Option #	"
2	'sds'	'StatusSendData'	1 - RO Status	Integer	Option #	"
3	'rbs'	'StatusRcvBuffer'	1 - RO Status	Unsigned32	1	'%'
4	'rds'	'StatusRcvData'	1 - RO Status	Integer	Option #	"
5	'isi'	'StatusIOSignaling'	1 - RO Status	Integer	Option #	"
6	'esi'	'StatusESCSignaling'	1 - RO Status	Integer	Option #	"
7	'tst'	'StatusTest'	1 - RO Status	Integer	Option #	"
13	'typ'	'StatusHardwareType'	0 - RO Fixed Info	String	Option #	"
14	'hid'	'StatusHardwareID'	0 - RO Fixed Info	String	Option #	"
15	'hsn'	'StatusHardwareSN'	0 - RO Fixed Info	Unsigned32	1	"
16	'imd'	'IOMode'	3 - RW Option	Integer	Option #	"
17	'iss'	'IOSendClockSource'	3 - RW Option	Integer	Option #	"
18	'isd'	'IOSendData'	3 - RW Option	Integer	Option #	"
19	'irs'	'IORcvClockSource'	3 - RW Option	Integer	Option #	"

Sync Serial Interface Card - Model M709013A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
20	'ibd'	'IORcvBufferDelay'	2 - RW Number	Unsigned32	0.0001	'ms'
21	'ibs'	'IORcvBufferSize'	1 - RO Status	Unsigned32	1	"
22	'irc'	'IORcvClock'	3 - RW Option	Integer	Option #	"
23	'ird'	'IORcvData'	3 - RW Option	Integer	Option #	"
24	'irt'	'IORTS'	3 - RW Option	Integer	Option #	"
25	'ict'	'IOCTS'	3 - RW Option	Integer	Option #	"
26	'ide'	'IODCD'	3 - RW Option	Integer	Option #	"
27	'idt'	'IODTR'	3 - RW Option	Integer	Option #	"
28	'ids'	'IODSR'	3 - RW Option	Integer	Option #	"
29	'irm'	'IORTSMonitor'	3 - RW Option	Integer	Option #	"
32	'smm'	'SendMuxMode'	3 - RW Option	Integer	Option #	"
33	'ser'	'SendMuxESCRate'	2 - RW Number	Unsigned32	1	'bps'
34	'smr'	'SendMuxMCCRate'	2 - RW Number	Unsigned32	1	'bps'
35	'sac'	'SendMuxAlarmsChannel'	3 - RW Option	Integer	Option #	"
36	'sor'	'SendMuxOverheadRatio'	9 - RW Ratio	UShort	1	"
48	'rmm'	'RcvMuxMode'	3 - RW Option	Integer	Option #	"
49	'rer'	'RcvMuxESCRate'	2 - RW Number	Unsigned32	1	'bps'
50	'rmr'	'RcvMuxMCCRate'	2 - RW Number	Unsigned32	1	'bps'
51	'rac'	'RcvMuxAlarmsChannel'	3 - RW Option	Integer	Option #	"
52	'ror'	'RcvMuxOverheadRatio'	9 - RW Ratio	UShort	1	"
64	'emd'	'ESCAsyncMode'	3 - RW Option	Integer	Option #	"
65	'epo'	'ESCAsyncPort'	3 - RW Option	Integer	Option #	"
66	'era'	'ESCAsyncRate'	2 - RW Number	Unsigned32	1	'bps'
67	'efo'	'ESCAsyncFormat'	3 - RW Option	Integer	Option #	"
68	'ect'	'ESCAsyncCTS'	3 - RW Option	Integer	Option #	"
69	'edc'	'ESCAsyncDCD'	3 - RW Option	Integer	Option #	"
70	'edt'	'ESCAsyncDTR'	3 - RW Option	Integer	Option #	"
71	'eds'	'ESCAsyncDSR'	3 - RW Option	Integer	Option #	"
80	'mmd'	'MCCMode'	3 - RW Option	Integer	Option #	"
81	'mpl'	'MCCProtocol'	3 - RW Option	Integer	Option #	"
82	'msa'	'MCCSendAddress'	2 - RW Number	Unsigned32	1	"
83	'mra'	'MCCRcvAddress'	2 - RW Number	Unsigned32	1	"
84	'mac'	'MCCActivity'	3 - RW Option	Integer	Option #	"
208	'scm'	'AlarmSendClockMask'	3 - RW Option	Integer	Option #	"
209	'sdm'	'AlarmSendDataMask'	3 - RW Option	Integer	Option #	"
210	'sdi'	'AlarmSendDataIdle'	2 - RW Number	Unsigned32	1	's'
211	'rdm'	'AlarmRcvDataMask'	3 - RW Option	Integer	Option #	"
212	'rdi'	'AlarmRcvDataIdle'	2 - RW Number	Unsigned32	1	's'
213	'abm'	'AlarmBackwardMask'	3 - RW Option	Integer	Option #	"
214	'alm'	'AlarmBERLossMask'	3 - RW Option	Integer	Option #	"
215	'atm'	'AlarmTestActiveMask'	3 - RW Option	Integer	Option #	"
216	'ahm'	'AlarmHardwareMask'	3 - RW Option	Integer	Option #	"

Sync Serial Interface Card - Model M709013A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
224	'tlb'	'TestTerLoopback'	3 - RW Option	Integer	Option #	"
225	'slb'	'TestSatLoopback'	3 - RW Option	Integer	Option #	"
226	'bio'	'TestBERIO'	3 - RW Option	Integer	Option #	"
227	'tsb'	'TestSendBER'	3 - RW Option	Integer	Option #	"
228	'trb'	'TestRcvBER'	3 - RW Option	Integer	Option #	"
229	'ber'	'TestBER'	1 - RO Status	Unsigned32	0.001	"
230	'bsl'	'TestBERSyncLoss'	1 - RO Status	Unsigned32	1	"
231	'brs'	'TestBERErrors'	1 - RO Status	Unsigned64	1	"
232	'bbi'	'TestBERBits'	1 - RO Status	Unsigned64	1	"
233	'bfs'	'TestBEREFS'	1 - RO Status	Unsigned32	0.01	'%'
234	'bes'	'TestBERErredSec'	1 - RO Status	Unsigned32	1	's'
235	'bts'	'TestBERTotalSec'	1 - RO Status	Unsigned32	1	's'
236	'tso'	'TestSendBitOffset'	1 - RO Status	Integer	1	'ppm'
237	'tro'	'TestRcvBitOffset'	1 - RO Status	Integer	1	'ppm'
240	'fop'	'FeatureOptions'	20	Integer	Option #	"
254	'fac'	'FeatureActivation'	20	Unsigned64	1	"

Dual G.703 Interface Card - Model M709014A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
0	'ios'	'StatusIO'	1 - RO Status	Integer	Option #	"
1	's1p'	'StatusIOPort1'	1 - RO Status	Integer	Option #	"
2	's2p'	'StatusIOPort2'	1 - RO Status	Integer	Option #	"
3	's1b'	'StatusIOPort1RcvBuffer'	1 - RO Status	Unsigned32	1	'%'
4	's2b'	'StatusIOPort2RcvBuffer'	1 - RO Status	Unsigned32	1	'%'
5	'esi'	'StatusESCSignaling'	1 - RO Status	Integer	Option #	"
6	'tst'	'StatusTest'	1 - RO Status	Integer	Option #	"
13	'typ'	'StatusHardwareType'	0 - RO Fixed Info	String	Option #	"
14	'hid'	'StatusHardwareID'	0 - RO Fixed Info	String	Option #	"
15	'hsn'	'StatusHardwareSN'	0 - RO Fixed Info	Unsigned32	1	"
16	'1md'	'IOPort1Mode'	3 - RW Option	Integer	Option #	"
17	'1sc'	'IOPort1SendCoding'	3 - RW Option	Integer	Option #	"
18	'1sf'	'IOPort1SendFraming'	3 - RW Option	Integer	Option #	"
19	'1sr'	'IOPort1SendCRC'	3 - RW Option	Integer	Option #	"
20	'1dm'	'IOPort1SendDropMap'	2 - RW Number	Unsigned32	1	"
21	'1sx'	'IOPort1SendNx64'	1 - RO Status	Unsigned32	1	"
22	'1rc'	'IOPort1RcvCoding'	3 - RW Option	Integer	Option #	"
23	'1rf'	'IOPort1RcvFraming'	3 - RW Option	Integer	Option #	"
24	'1rr'	'IOPort1RcvCRC'	3 - RW Option	Integer	Option #	"
25	'1im'	'IOPort1RcvInsertMap'	2 - RW Number	Unsigned32	1	"
26	'1rx'	'IOPort1RcvNx64'	1 - RO Status	Unsigned32	1	"
27	'1cs'	'IOPort1RcvClockSource'	3 - RW Option	Integer	Option #	"

Dual G.703 Interface Card - Model M709014A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
28	'1bd'	'IOPort1RcvBufferDelay'	2 - RW Number	Unsigned32	0.001	'ms'
29	'1bs'	'IOPort1RcvBufferSize'	1 - RO Status	Unsigned32	1	"
32	'2md'	'IOPort2Mode'	3 - RW Option	Integer	Option #	"
33	'2sc'	'IOPort2SendCoding'	3 - RW Option	Integer	Option #	"
34	'2sf'	'IOPort2SendFraming'	3 - RW Option	Integer	Option #	"
35	'2sr'	'IOPort2SendCRC'	3 - RW Option	Integer	Option #	"
36	'2dm'	'IOPort2SendDropMap'	2 - RW Number	Unsigned32	1	"
37	'2sx'	'IOPort2SendNx64'	1 - RO Status	Unsigned32	1	"
38	'2rc'	'IOPort2RcvCoding'	3 - RW Option	Integer	Option #	"
39	'2rf'	'IOPort2RcvFraming'	3 - RW Option	Integer	Option #	"
40	'2rr'	'IOPort2RcvCRC'	3 - RW Option	Integer	Option #	"
41	'2im'	'IOPort2RcvInsertMap'	2 - RW Number	Unsigned32	1	"
42	'2rx'	'IOPort2RcvNx64'	1 - RO Status	Unsigned32	1	"
43	'2cs'	'IOPort2RcvClockSource'	3 - RW Option	Integer	Option #	"
44	'2bd'	'IOPort2RcvBufferDelay'	2 - RW Number	Unsigned32	0.001	'ms'
45	'2bs'	'IOPort2RcvBufferSize'	1 - RO Status	Unsigned32	1	"
48	'smm'	'SendMuxMode'	3 - RW Option	Integer	Option #	"
49	'ser'	'SendMuxESCRate'	2 - RW Number	Unsigned32	1	'bps'
50	'smr'	'SendMuxMCCRate'	2 - RW Number	Unsigned32	1	'bps'
51	'sac'	'SendMuxAlarmsChannel'	3 - RW Option	Integer	Option #	"
52	'sor'	'SendMuxOverheadRatio'	9 - RW Ratio	UShort	1	"
64	'rmm'	'RcvMuxMode'	3 - RW Option	Integer	Option #	"
65	'rer'	'RcvMuxESCRate'	2 - RW Number	Unsigned32	1	'bps'
66	'rmr'	'RcvMuxMCCRate'	2 - RW Number	Unsigned32	1	'bps'
67	'rac'	'RcvMuxAlarmsChannel'	3 - RW Option	Integer	Option #	"
68	'ror'	'RcvMuxOverheadRatio'	9 - RW Ratio	UShort	1	"
80	'emd'	'ESCAsyncMode'	3 - RW Option	Integer	Option #	"
81	'epo'	'ESCAsyncPort'	3 - RW Option	Integer	Option #	"
82	'era'	'ESCAsyncRate'	2 - RW Number	Unsigned32	1	'bps'
83	'efo'	'ESCAsyncFormat'	3 - RW Option	Integer	Option #	"
84	'ect'	'ESCAsyncCTS'	3 - RW Option	Integer	Option #	"
85	'edc'	'ESCAsyncDCD'	3 - RW Option	Integer	Option #	"
86	'edt'	'ESCAsyncDTR'	3 - RW Option	Integer	Option #	"
87	'eds'	'ESCAsyncDSR'	3 - RW Option	Integer	Option #	"
96	'mmd'	'MCCMode'	3 - RW Option	Integer	Option #	"
97	'mpl'	'MCCProtocol'	3 - RW Option	Integer	Option #	"
98	'msa'	'MCCSendAddress'	2 - RW Number	Unsigned32	1	"
99	'mra'	'MCCRcvAddress'	2 - RW Number	Unsigned32	1	"
100	'mac'	'MCCActivity'	3 - RW Option	Integer	Option #	"
208	'a1m'	'AlarmIOPort1Mask'	3 - RW Option	Integer	Option #	"
209	'a2m'	'AlarmIOPort2Mask'	3 - RW Option	Integer	Option #	"
210	'abm'	'AlarmBackwardMask'	3 - RW Option	Integer	Option #	"

Dual G.703 Interface Card - Model M709014A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
211	'alm'	'AlarmBERLossMask'	3 - RW Option	Integer	Option #	"
212	'atm'	'AlarmTestActiveMask'	3 - RW Option	Integer	Option #	"
213	'ahm'	'AlarmHardwareMask'	3 - RW Option	Integer	Option #	"
224	'tlb'	'TestTerLoopback'	3 - RW Option	Integer	Option #	"
225	'slb'	'TestSatLoopback'	3 - RW Option	Integer	Option #	"
226	'bio'	'TestBERIO'	3 - RW Option	Integer	Option #	"
227	'tsb'	'TestSendBER'	3 - RW Option	Integer	Option #	"
228	'trb'	'TestRcvBER'	3 - RW Option	Integer	Option #	"
229	'ber'	'TestBER'	1 - RO Status	Unsigned32	0.001	"
230	'bsl'	'TestBERSyncLoss'	1 - RO Status	Unsigned32	1	"
231	'brs'	'TestBERErrors'	1 - RO Status	Unsigned64	1	"
232	'bbi'	'TestBERBits'	1 - RO Status	Unsigned64	1	"
233	'bfs'	'TestBEREFS'	1 - RO Status	Unsigned32	0.01	'%'
234	'bes'	'TestBERErredSec'	1 - RO Status	Unsigned32	1	's'
235	'bts'	'TestBERTotalSec'	1 - RO Status	Unsigned32	1	's'
236	'tso'	'TestSendBitOffset'	1 - RO Status	Integer	1	'ppm'
237	'tro'	'TestRcvBitOffset'	1 - RO Status	Integer	1	'ppm'
240	'fop'	'FeatureOptions'	20	Integer	Option #	"
254	'fac'	'FeatureActivation'	20	Unsigned64	1	"

High Speed Serial Interface Card - Model M709016A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
0	'ios'	'StatusIO'	1 - RO Status	Integer	Option #	"
1	'scs'	'StatusSendClock'	1 - RO Status	Integer	Option #	"
2	'sds'	'StatusSendData'	1 - RO Status	Integer	Option #	"
3	'rbs'	'StatusRcvBuffer'	1 - RO Status	Unsigned32	1	'%'
4	'rds'	'StatusRcvData'	1 - RO Status	Integer	Option #	"
5	'isi'	'StatusIOSignaling'	1 - RO Status	Integer	Option #	"
6	'esi'	'StatusESCSignaling'	1 - RO Status	Integer	Option #	"
7	'tst'	'StatusTest'	1 - RO Status	Integer	Option #	"
13	'typ'	'StatusHardwareType'	0 - RO Fixed Info	String	Option #	"
14	'hid'	'StatusHardwareID'	0 - RO Fixed Info	String	Option #	"
15	'hsn'	'StatusHardwareSN'	0 - RO Fixed Info	Unsigned32	1	"
16	'imd'	'IOMode'	3 - RW Option	Integer	Option #	"
17	'iss'	'IOSendClockSource'	3 - RW Option	Integer	Option #	"
18	'isd'	'IOSendData'	3 - RW Option	Integer	Option #	"
19	'irs'	'IORcvClockSource'	3 - RW Option	Integer	Option #	"
20	'ibd'	'IORcvBufferDelay'	2 - RW Number	Unsigned32	0.0001	'ms'
21	'ibs'	'IORcvBufferSize'	1 - RO Status	Unsigned32	1	"
22	'irc'	'IORcvClock'	3 - RW Option	Integer	Option #	"
23	'ird'	'IORcvData'	3 - RW Option	Integer	Option #	"

High Speed Serial Interface Card - Model M709016A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
24	'ita'	'IOTA'	3 - RW Option	Integer	Option #	"
25	'ica'	'IOCA'	3 - RW Option	Integer	Option #	"
32	'smm'	'SendMuxMode'	3 - RW Option	Integer	Option #	"
33	'ser'	'SendMuxESCRate'	2 - RW Number	Unsigned32	1	'bps'
34	'smr'	'SendMuxMCCRate'	2 - RW Number	Unsigned32	1	'bps'
35	'sac'	'SendMuxAlarmsChannel'	3 - RW Option	Integer	Option #	"
36	'sor'	'SendMuxOverheadRatio'	9 - RW Ratio	UShort	1	"
48	'rmm'	'RcvMuxMode'	3 - RW Option	Integer	Option #	"
49	'rer'	'RcvMuxESCRate'	2 - RW Number	Unsigned32	1	'bps'
50	'rmr'	'RcvMuxMCCRate'	2 - RW Number	Unsigned32	1	'bps'
51	'rac'	'RcvMuxAlarmsChannel'	3 - RW Option	Integer	Option #	"
52	'ror'	'RcvMuxOverheadRatio'	9 - RW Ratio	UShort	1	"
64	'emd'	'ESCAsyncMode'	3 - RW Option	Integer	Option #	"
65	'epo'	'ESCAsyncPort'	3 - RW Option	Integer	Option #	"
66	'era'	'ESCAsyncRate'	2 - RW Number	Unsigned32	1	'bps'
67	'efo'	'ESCAsyncFormat'	3 - RW Option	Integer	Option #	"
68	'ect'	'ESCAsyncCTS'	3 - RW Option	Integer	Option #	"
69	'edc'	'ESCAsyncDCD'	3 - RW Option	Integer	Option #	"
70	'edt'	'ESCAsyncDTR'	3 - RW Option	Integer	Option #	"
71	'eds'	'ESCAsyncDSR'	3 - RW Option	Integer	Option #	"
80	'mmd'	'MCCMode'	3 - RW Option	Integer	Option #	"
81	'mpl'	'MCCProtocol'	3 - RW Option	Integer	Option #	"
82	'msa'	'MCCSendAddress'	2 - RW Number	Unsigned32	1	"
83	'mra'	'MCCRcvAddress'	2 - RW Number	Unsigned32	1	"
84	'mac'	'MCCActivity'	3 - RW Option	Integer	Option #	"
208	'scm'	'AlarmSendClockMask'	3 - RW Option	Integer	Option #	"
209	'sdm'	'AlarmSendDataMask'	3 - RW Option	Integer	Option #	"
210	'sdi'	'AlarmSendDataIdle'	2 - RW Number	Unsigned32	1	's'
211	'rdm'	'AlarmRcvDataMask'	3 - RW Option	Integer	Option #	"
212	'rdi'	'AlarmRcvDataIdle'	2 - RW Number	Unsigned32	1	's'
213	'abm'	'AlarmBackwardMask'	3 - RW Option	Integer	Option #	"
214	'alm'	'AlarmBERLossMask'	3 - RW Option	Integer	Option #	"
215	'atm'	'AlarmTestActiveMask'	3 - RW Option	Integer	Option #	"
216	'ahm'	'AlarmHardwareMask'	3 - RW Option	Integer	Option #	"
224	'tlb'	'TestTerLoopback'	3 - RW Option	Integer	Option #	"
225	'slb'	'TestSatLoopback'	3 - RW Option	Integer	Option #	"
226	'bio'	'TestBERIO'	3 - RW Option	Integer	Option #	"
227	'tsb'	'TestSendBER'	3 - RW Option	Integer	Option #	"
228	'trb'	'TestRcvBER'	3 - RW Option	Integer	Option #	"
229	'ber'	'TestBER'	1 - RO Status	Unsigned32	0.001	"
230	'bsl'	'TestBERSyncLoss'	1 - RO Status	Unsigned32	1	"
231	'brs'	'TestBERErrors'	1 - RO Status	Unsigned64	1	"

High Speed Serial Interface Card - Model M709016A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
232	'bbi'	'TestBERBits'	1 - RO Status	Unsigned64	1	"
233	'bfs'	'TestBEREFS'	1 - RO Status	Unsigned32	0.01	'%'
234	'bes'	'TestBERErredSec'	1 - RO Status	Unsigned32	1	's'
235	'bts'	'TestBERTotalSec'	1 - RO Status	Unsigned32	1	's'
236	'tso'	'TestSendBitOffset'	1 - RO Status	Integer	1	'ppm'
237	'tro'	'TestRcvBitOffset'	1 - RO Status	Integer	1	'ppm'
240	'fop'	'FeatureOptions'	20	Integer	Option #	"
254	'fac'	'FeatureActivation'	20	Unsigned64	1	"

Express Ethernet Interface Card - Model M709017A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
0	'ios'	'StatusIO'	1 - RO Status	Integer	Option #	"
1	'p1s'	'StatusPort1'	1 - RO Status	Integer	Option #	"
2	'p2s'	'StatusPort2'	1 - RO Status	Integer	Option #	"
3	'p3s'	'StatusPort3'	1 - RO Status	Integer	Option #	"
4	'p4s'	'StatusPort4'	1 - RO Status	Integer	Option #	"
5	'p5s'	'StatusPort5'	1 - RO Status	Integer	Option #	"
6	'w1s'	'StatusSendData'	1 - RO Status	Integer	Option #	"
7	'w2s'	'StatusRcvData'	1 - RO Status	Integer	Option #	"
8	'rrs'	'StatusRefRelay'	1 - RO Status	Integer	Option #	"
9	'tst'	'StatusTest'	1 - RO Status	Integer	Option #	"
13	'typ'	'StatusHardwareType'	0 - RO Fixed Info	String	Option #	"
14	'hid'	'StatusHardwareID'	0 - RO Fixed Info	String	Option #	"
15	'hsn'	'StatusHardwareSN'	0 - RO Fixed Info	Unsigned32	1	"
16	'p1m'	'IOPort1Mode'	3 - RW Option	Integer	Option #	"
17	'p1c'	'IOPort1Connection'	3 - RW Option	Integer	Option #	"
18	'p1v'	'IOPort1VLANID'	2 - RW Number	Unsigned32	1	"
19	'p2m'	'IOPort2Mode'	3 - RW Option	Integer	Option #	"
20	'p2c'	'IOPort2Connection'	3 - RW Option	Integer	Option #	"
21	'p2v'	'IOPort2VLANID'	2 - RW Number	Unsigned32	1	"
22	'p3m'	'IOPort3Mode'	3 - RW Option	Integer	Option #	"
23	'p3c'	'IOPort3Connection'	3 - RW Option	Integer	Option #	"
24	'p3v'	'IOPort3VLANID'	2 - RW Number	Unsigned32	1	"
25	'p4m'	'IOPort4Mode'	3 - RW Option	Integer	Option #	"
26	'p4c'	'IOPort4Connection'	3 - RW Option	Integer	Option #	"
27	'p4v'	'IOPort4VLANID'	2 - RW Number	Unsigned32	1	"
28	'p5m'	'IOPort5Mode'	3 - RW Option	Integer	Option #	"
29	'p5c'	'IOPort5Connection'	3 - RW Option	Integer	Option #	"
30	'p5v'	'IOPort5VLANID'	2 - RW Number	Unsigned32	1	"
32	'1wp'	'SendWANProtocol'	3 - RW Option	Integer	Option #	"
33	'1wv'	'SendWANVLANID'	2 - RW Number	Unsigned32	1	"

Express Ethernet Interface Card - Model M709017A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
34	'1ae'	'SendAESEncryption'	3 - RW Option	Integer	Option #	"
35	'1kl'	'SendAESKeyLength'	3 - RW Option	Integer	Option #	"
36	'1k0'	'SendAESKeyBits0-63'	2 - RW Number	Unsigned64	1	"
37	'1k1'	'SendAESKeyBits64-127'	2 - RW Number	Unsigned64	1	"
38	'1k2'	'SendAESKeyBits128-191'	2 - RW Number	Unsigned64	1	"
39	'1k3'	'SendAESKeyBits192-255'	2 - RW Number	Unsigned64	1	"
40	'1hc'	'SendHeaderCompression'	3 - RW Option	Integer	Option #	"
41	'1pc'	'SendPayloadCompression'	3 - RW Option	Integer	Option #	"
48	'2wp'	'RcvWANProtocol'	3 - RW Option	Integer	Option #	"
49	'2wv'	'RcvWANVLANID'	2 - RW Number	Unsigned32	1	"
50	'2ae'	'RcvAESEncryption'	3 - RW Option	Integer	Option #	"
51	'2kl'	'RcvAESKeyLength'	3 - RW Option	Integer	Option #	"
52	'2k0'	'RcvAESKeyBits0-63'	2 - RW Number	Unsigned64	1	"
53	'2k1'	'RcvAESKeyBits64-127'	2 - RW Number	Unsigned64	1	"
54	'2k2'	'RcvAESKeyBits128-191'	2 - RW Number	Unsigned64	1	"
55	'2k3'	'RcvAESKeyBits192-255'	2 - RW Number	Unsigned64	1	"
56	'2hc'	'RcvHeaderCompression'	3 - RW Option	Integer	Option #	"
57	'2pc'	'RcvPayloadCompression'	3 - RW Option	Integer	Option #	"
64	'qwm'	'QOSMode'	3 - RW Option	Integer	Option #	"
65	'qwn'	'QOSWANDropNone'	2 - RW Number	Unsigned32	1	'ms'
66	'qwa'	'QOSWANDropAll'	2 - RW Number	Unsigned32	1	'ms'
67	'q1n'	'QOSPort1DropNone'	2 - RW Number	Unsigned32	1	'ms'
68	'q1a'	'QOSPort1DropAll'	2 - RW Number	Unsigned32	1	'ms'
69	'q2n'	'QOSPort2DropNone'	2 - RW Number	Unsigned32	1	'ms'
70	'q2a'	'QOSPort2DropAll'	2 - RW Number	Unsigned32	1	'ms'
71	'q3n'	'QOSPort3DropNone'	2 - RW Number	Unsigned32	1	'ms'
72	'q3a'	'QOSPort3DropAll'	2 - RW Number	Unsigned32	1	'ms'
73	'q4n'	'QOSPort4DropNone'	2 - RW Number	Unsigned32	1	'ms'
74	'q4a'	'QOSPort4DropAll'	2 - RW Number	Unsigned32	1	'ms'
75	'q5n'	'QOSPort5DropNone'	2 - RW Number	Unsigned32	1	'ms'
76	'q5a'	'QOSPort5DropAll'	2 - RW Number	Unsigned32	1	'ms'
80	'mmd'	'MCCMode'	3 - RW Option	Integer	Option #	"
81	'mpl'	'MCCProtocol'	3 - RW Option	Integer	Option #	"
82	'm1a'	'MCCSendAddress'	2 - RW Number	Unsigned32	1	"
83	'm2a'	'MCCRcvAddress'	2 - RW Number	Unsigned32	1	"
84	'mrl'	'MCCDataRateLimit'	2 - RW Number	Unsigned32	100	'bps'
85	'mac'	'MCCActivity'	3 - RW Option	Integer	Option #	"
192	'rem'	'RefRelayMode'	3 - RW Option	Integer	Option #	"

Express Ethernet Interface Card - Model M709017A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
193	'ref'	'RefRelayFrequency'	3 - RW Option	Integer	Option #	"
208	'aim'	'AlarmIOMask'	3 - RW Option	Integer	Option #	"
209	'a1m'	'AlarmSendDataMask'	3 - RW Option	Integer	Option #	"
210	'a1i'	'AlarmSendDataIdle'	2 - RW Number	Unsigned32	1	's'
211	'a2m'	'AlarmRcvDataMask'	3 - RW Option	Integer	Option #	"
212	'a2i'	'AlarmRcvDataIdle'	2 - RW Number	Unsigned32	1	's'
214	'rrm'	'AlarmRefRelayMask'	3 - RW Option	Integer	Option #	"
215	'atm'	'AlarmTestActiveMask'	3 - RW Option	Integer	Option #	"
216	'ahm'	'AlarmHardwareMask'	3 - RW Option	Integer	Option #	"
224	'wlb'	'TestWANLoopback'	3 - RW Option	Integer	Option #	"
225	'slb'	'TestSatLoopback'	3 - RW Option	Integer	Option #	"
226	'tss'	'TestStatsSource'	3 - RW Number	Integer	Option #	"
227	'tdb'	'TestSendDataBytes'	1 - RO Status	Unsigned64	1	"
228	'tdp'	'TestSendDataPackets'	1 - RO Status	Unsigned64	1	"
229	'tde'	'TestSendDataPcktsDropped'	1 - RO Status	Unsigned64	1	"
230	'tdr'	'TestSendDataPDR'	1 - RO Status	Unsigned32	0.001	"
231	'tib'	'TestSendIdleBytes'	1 - RO Status	Unsigned64	1	"
232	'tip'	'TestSendIdlePackets'	1 - RO Status	Unsigned64	1	"
233	'tie'	'TestSendIdlePcktsDropped'	1 - RO Status	Unsigned64	1	"
234	'tir'	'TestSendIdlePDR'	1 - RO Status	Unsigned32	0.001	"
235	'tts'	'TestSendTotalSec'	1 - RO Status	Unsigned32	1	's'
240	'fop'	'FeatureOptions'	20	Integer	Option #	"
254	'fac'	'FeatureActivation'	20	Unsigned64	1	"

I7 Ethernet Interface Card - Model M709018A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
0	'ios'	'StatusIP'	1 - RO Status	Integer	Option #	"
1	'gbs'	'StatusGbE'	1 - RO Status	Integer	Option #	"
2	'rrs'	'StatusRefRelay'	1 - RO Status	Integer	Option #	"
3	'sds'	'StatusSendData'	1 - RO Status	Integer	Option #	"
4	'rds'	'StatusRcvData'	1 - RO Status	Integer	Option #	"
5	'tst'	'StatusTest'	1 - RO Status	Integer	Option #	"
6	'ho1'	'StatusHardwareIOOpt'	1 - RO Status	Integer	Option #	"
7	'ho2'	'StatusHardwareIPOpt'	1 - RO Status	Integer	Option #	"
13	'typ'	'StatusHardwareType'	0 - RO Fixed Info	String	Option #	"
14	'hid'	'StatusHardwareID'	0 - RO Fixed Info	String	Option #	"
15	'hsn'	'StatusHardwareSN'	0 - RO Fixed Info	Unsigned32	1	"
16	'imd'	'IPControlMode'	3 - RW Option	Integer	Option #	"
17	'iwp'	'IPWANProtocol'	3 - RW Option	Integer	Option #	"
18	'idh'	'IPDHCP'	3 - RW Option	Integer	Option #	"
19	'iad'	'IPIPAAddress'	10 - RW IP Addr	IpAddress	1	"
20	'inm'	'IPNetworkMask'	10 - RW IP Addr	IpAddress	1	"
21	'ima'	'IPMACAddress'	11 - RO MAC Addr	PhysAddress	1	"
22	'irs'	'IPQ7ResetControl'	3 - RW Option	Integer	Option #	"
23	'iid'	'IPQ7ID'	0 - RO Fixed Info	String	Option #	"
24	'isv'	'IPQ7SoftwareVer'	0 - RO Fixed Info	String	Option #	"
32	'sps'	'StatsSendDataPPS'	1 - RO Status	Unsigned32	1	'pps'
33	'sdp'	'StatsSendDataPackets'	1 - RO Status	Unsigned64	1	"
34	'sdb'	'StatsSendDataBytes'	1 - RO Status	Unsigned64	1	"
35	'sdu'	'StatsSendDataUsage'	1 - RO Status	Unsigned32	0.01	'%'
36	'smp'	'StatsSendMCCPackets'	1 - RO Status	Unsigned64	1	"
37	'smb'	'StatsSendMCCBytes'	1 - RO Status	Unsigned64	1	"
38	'smu'	'StatsSendMCCUsage'	1 - RO Status	Unsigned32	0.01	'%'
39	'sip'	'StatsSendIdlePackets'	1 - RO Status	Unsigned64	1	"
40	'sib'	'StatsSendIdleBytes'	1 - RO Status	Unsigned64	1	"
41	'siu'	'StatsSendIdleUsage'	1 - RO Status	Unsigned32	0.01	'%'
42	'spk'	'StatsSendTotalPackets'	1 - RO Status	Unsigned64	1	"
43	'spd'	'StatsSendTotalDropped'	1 - RO Status	Unsigned64	1	"
44	'spr'	'StatsSendTotalPDR'	1 - RO Status	Unsigned32	0.001	"
45	'sts'	'StatsSendTotalSec'	1 - RO Status	Unsigned32	1	's'
48	'rps'	'StatsRcvDataPPS'	1 - RO Status	Unsigned32	1	'pps'
49	'rdp'	'StatsRcvDataPackets'	1 - RO Status	Unsigned64	1	"
50	'rdb'	'StatsRcvDataBytes'	1 - RO Status	Unsigned64	1	"
51	'rdu'	'StatsRcvDataUsage'	1 - RO Status	Unsigned32	0.01	'%'
52	'rmp'	'StatsRcvMCCPackets'	1 - RO Status	Unsigned64	1	"
53	'rmb'	'StatsRcvMCCBytes'	1 - RO Status	Unsigned64	1	"
54	'rmu'	'StatsRcvMCCUsage'	1 - RO Status	Unsigned32	0.01	'%'
55	'rip'	'StatsRcvIdlePackets'	1 - RO Status	Unsigned64	1	"
56	'rib'	'StatsRcvIdleBytes'	1 - RO Status	Unsigned64	1	"
57	'riu'	'StatsRcvIdleUsage'	1 - RO Status	Unsigned32	0.01	'%'
58	'rpk'	'StatsRcvTotalPackets'	1 - RO Status	Unsigned64	1	"
59	'rpe'	'StatsRcvTotalErred'	1 - RO Status	Unsigned64	1	"
60	'rpr'	'StatsRcvTotalPER'	1 - RO Status	Unsigned32	0.001	"
61	'rts'	'StatsRcvTotalSec'	1 - RO Status	Unsigned32	1	's'

I7 Ethernet Interface Card - Model M709018A						
Cmd (Dec)	Mnemonic	Compressed Name	Type	Format	Increment/Option	Units
64	'mmd'	'MCCMode'	3 - RW Option	Integer	Option #	"
65	'mpl'	'MCCProtocol'	3 - RW Option	Integer	Option #	"
66	'mrl'	'MCCSendRateLimit'	2 - RW Number	Unsigned32	100	'bps'
67	'msa'	'MCCSendAddress'	2 - RW Number	Unsigned32	1	"
68	'mra'	'MCCRcvAddress'	2 - RW Number	Unsigned32	1	"
69	'mac'	'MCCActivity'	3 - RW Option	Integer	Option #	"
192	'rem'	'RefRelayMode'	3 - RW Option	Integer	Option #	"
193	'ref'	'RefRelayFrequency'	3 - RW Option	Integer	Option #	"
208	'aim'	'AlarmIPMask'	3 - RW Option	Integer	Option #	"
209	'sdm'	'AlarmSendDataMask'	3 - RW Option	Integer	Option #	"
210	'sdi'	'AlarmSendDataIdle'	2 - RW Number	Unsigned32	1	's'
211	'rdm'	'AlarmRcvDataMask'	3 - RW Option	Integer	Option #	"
212	'rdi'	'AlarmRcvDataIdle'	2 - RW Number	Unsigned32	1	's'
213	'rrm'	'AlarmRefRelayMask'	3 - RW Option	Integer	Option #	"
214	'atm'	'AlarmTestActiveMask'	3 - RW Option	Integer	Option #	"
215	'ahm'	'AlarmHardwareMask'	3 - RW Option	Integer	Option #	"
224	'swl'	'TestSatWANLoopback'	3 - RW Option	Integer	Option #	"
225	'twl'	'TestTerWANLoopback'	3 - RW Option	Integer	Option #	"
226	'thl'	'TestTerHDLCLoopback'	3 - RW Option	Integer	Option #	"
240	'fop'	'FeatureOptions'	20	Integer	Option #	"
254	'fac'	'FeatureActivation'	20	Unsigned64	1	"

Please see the separate Datum Systems Application Note 18 entitled “*Remote Control of Satellite Modems*”. This App Note is available on our web site. It describes several scenarios for control of local and remote modems within a system.

Common Notes

All numbers are least significant byte first. All strings terminate with a **[00h]** byte and are 16 characters maximum (not including the string terminator).

END OF PROTOCOL

Notes on Creating a Controller Mechanism

We get occasional questions on writing M&C or controllers to talk to and remotely control either the M5 class or M7 class modems. Here are a few suggestions on making a working controller.

1. The modem returns a response very quickly, usually only a few milli-seconds after the end of your response message. You have to be ready to accept the response immediately.
2. When operating in either RS-232 or RS-485 mode and using a PC running Windows, the COM port must be set to a binary mode and not do any manipulation of the incoming data. There are no carriage returns or line feeds that would be used to read a line at a time or an entire response packet.

Linux computers seem to be even more difficult to get into a pure binary character receive mode. Here is a short snippet showing one way to set the COM1 equivalent in Linux which is “ttyS0”. The variable “devicename” in this case is a string set to “/dev/ttyS0”. This snippet does not show any actual operations other than setting up the port.

```
fd = open(devicename, O_RDWR | O_NOCTTY | O_NONBLOCK);
if (fd < 0) {
    perror("Device could not be opened");
    exit(-1);
}
tcgetattr(fd, &oldtio); // save current port settings
// set new port settings for canonical input processing
newtio.c_cflag = B9600 | CS8 | /*STOPBITS | */CLOCAL | CREAD;
newtio.c_iflag = IGNPAR;
newtio.c_oflag = 0;
newtio.c_lflag = 0; //ICANON;
newtio.c_cc[VMIN]=1;
newtio.c_cc[VTIME]=0;
tcflush(fd, TCIFLUSH);
tcsetattr(fd, TCSANOW, &newtio);
close(fd);
```

3. The modem’s processor is an ARM 32 bit with instruction set v5, and it writes words in classic Intel or any X86 type “Little-Endian” style. If you are using a controller that is “Big-Endian” like the Motorola/Freescale processors then the byte order of a variable is reversed and will have to be re-ordered before evaluating or sending back to the modem.
4. Calculating the 16 bit CRC is not difficult as long as a computer is doing it. Here is a simple “C” routine to calculate the 16 bit CRC-CCITT taken directly from Linux. It includes a table and very small routine.

```
/*
 * This mysterious table is just the CRC of each possible byte. It can be
 * computed using the standard bit-at-a-time methods. The polynomial can
 * be seen in entry 128, 0x8408. This corresponds to x^0 + x^5 + x^12.
 * Add the implicit x^16, and you have the standard CRC-CCITT.
 */
u16 const crc_ccitt_table[256] = {
    0x0000, 0x1189, 0x2312, 0x329b, 0x4624, 0x57ad, 0x6536, 0x74bf,
    0x8c48, 0x9dc1, 0xaf5a, 0xbcd3, 0xca6c, 0xdbe5, 0xe97e, 0xf8f7,
    0x1081, 0x0108, 0x3393, 0x221a, 0x56a5, 0x472c, 0x75b7, 0x643e,
    0x9cc9, 0x8d40, 0xbfdb, 0xae52, 0xdaed, 0xcb64, 0xf9ff, 0xe876,
    0x2102, 0x308b, 0x0210, 0x1399, 0x6726, 0x76af, 0x4434, 0x55bd,
    0xad4a, 0xbcc3, 0x8e58, 0x9fd1, 0xeb6e, 0xfae7, 0xc87c, 0xd9f5,
    0x3183, 0x200a, 0x1291, 0x0318, 0x77a7, 0x662e, 0x54b5, 0x453c,
    0xbdcb, 0xac42, 0x9ed9, 0x8f50, 0xfbef, 0xea66, 0xd8fd, 0xc974,
    0x4204, 0x538d, 0x6116, 0x709f, 0x0420, 0x15a9, 0x2732, 0x36bb,
    0xce4c, 0xdfc5, 0xed5e, 0xfcd7, 0x8868, 0x99e1, 0xab7a, 0xbaf3,
    0x5285, 0x430c, 0x7197, 0x601e, 0x14a1, 0x0528, 0x37b3, 0x263a,
```

```

0xdecd, 0xcf44, 0xfddf, 0xec56, 0x98e9, 0x8960, 0xbbfb, 0xaa72,
0x6306, 0x728f, 0x4014, 0x519d, 0x2522, 0x34ab, 0x0630, 0x17b9,
0xef4e, 0xfec7, 0xcc5c, 0xdd5, 0xa96a, 0xb8e3, 0x8a78, 0x9bf1,
0x7387, 0x620e, 0x5095, 0x411c, 0x35a3, 0x242a, 0x16b1, 0x0738,
0xffcf, 0xee46, 0xdcdd, 0xcd54, 0xb9eb, 0xa862, 0x9af9, 0x8b70,
0x8408, 0x9581, 0xa71a, 0xb693, 0xc22c, 0xd3a5, 0xe13e, 0xf0b7,
0x0840, 0x19c9, 0x2b52, 0x3adb, 0x4e64, 0x5fed, 0x6d76, 0x7cff,
0x9489, 0x8500, 0xb79b, 0xa612, 0xd2ad, 0xc324, 0xf1bf, 0xe036,
0x18c1, 0x0948, 0x3bd3, 0x2a5a, 0x5ee5, 0x4f6c, 0x7df7, 0x6c7e,
0xa50a, 0xb483, 0x8618, 0x9791, 0xe32e, 0xf2a7, 0xc03c, 0xd1b5,
0x2942, 0x38cb, 0x0a50, 0x1bd9, 0x6f66, 0x7eef, 0x4c74, 0x5dfd,
0xb58b, 0xa402, 0x9699, 0x8710, 0xf3af, 0xe226, 0xd0bd, 0xc134,
0x39c3, 0x284a, 0x1ad1, 0x0b58, 0x7fe7, 0x6e6e, 0x5cf5, 0x4d7c,
0xc60c, 0xd785, 0xe51e, 0xf497, 0x8028, 0x91a1, 0xa33a, 0xb2b3,
0x4a44, 0x5bcd, 0x6956, 0x78df, 0x0c60, 0x1de9, 0x2f72, 0x3efb,
0xd68d, 0xc704, 0xf59f, 0xe416, 0x90a9, 0x8120, 0xb3bb, 0xa232,
0x5ac5, 0x4b4c, 0x79d7, 0x685e, 0x1ce1, 0x0d68, 0x3ff3, 0x2e7a,
0xe70e, 0xf687, 0xc41c, 0xd595, 0xa12a, 0xb0a3, 0x8238, 0x93b1,
0x6b46, 0x7acf, 0x4854, 0x59dd, 0x2d62, 0x3ceb, 0x0e70, 0x1ff9,
0xf78f, 0xe606, 0xd49d, 0xc514, 0xb1ab, 0xa022, 0x92b9, 0x8330,
0x7bc7, 0x6a4e, 0x58d5, 0x495c, 0x3de3, 0x2c6a, 0x1ef1, 0x0f78
};
EXPORT_SYMBOL(crc_ccitt_table);

/**
 *   crc_ccitt - recompute the CRC for the data buffer
 *   @crc: previous CRC value
 *   @buffer: data pointer
 *   @len: number of bytes in the buffer
 */
u16 crc_ccitt(u16 crc, u8 const *buffer, size_t len)
{
    while (len--)
        crc = crc_ccitt_byte(crc, *buffer++);
    return crc;
}

```

If you wanted to do the same thing in Python with the table renamed to “crc16tab” which now uses parenthesis (tuple) instead of braces and an input packet string named “s”

```

for ch in s:
    tmp=crcValue^(ord(ch))
    crcValue=(crcValue>> 8)^crc16tab[(tmp & 0xff)]
return crcValue

```

5. If you want to define Records or Structures in C to hold the variables of a particular message packet, those variables or the whole structure will normally have to be specified as “Packed”. This is because most languages will use, for example, a 4 byte integer as their least standard variable size. Packing should allow you to copy the message data directly into the instance of the structure.

In Python use the “Struct” module to handle the packing and unpacking of data in and out of the message packets.