

CM701/DT7000

Reed-Solomon Option Module (Intelsat Version)

Installation and Operation Guide

COMSTREAM
A Spar Company

6350 SEQUENCE DRIVE • SAN DIEGO, CALIFORNIA 92121-2724 • (619) 458-1800

© Copyright 1998 ComStream Corporation. All rights reserved.

CPN 01-0388-401
Rev. C 07/98

NOTICE

This publication and its contents are proprietary to ComStream Corporation (ComStream) and are intended solely for the contractual use of its customers for no other purpose than to install and operate the equipment described herein. This publication and its contents shall not be used or distributed for any other purpose and/or otherwise communicated, disclosed, or reproduced, in any way whatsoever, without the prior written consent of ComStream.

For the proper installation and operation of this equipment and/or all parts thereof, the instructions in this manual must be strictly and explicitly followed by experienced personnel. All of the contents of this manual must be fully read and understood prior to installing or operating any of the equipment, or parts thereof. **FAILURE TO COMPLETELY READ AND FULLY UNDERSTAND AND FOLLOW ALL OF THE CONTENTS OF THIS MANUAL PRIOR TO INSTALLING AND/OR OPERATING THIS EQUIPMENT, OR PARTS THEREOF, MAY RESULT IN DAMAGE TO THE EQUIPMENT, OR PARTS THEREOF, AND TO ANY PERSONS INSTALLING AND/OR OPERATING THE SAME.**

ComStream does not assume any liability arising out of the application or use of any products, component parts, circuits, software, or firmware described herein. ComStream further does not convey any license under its patent, trademark, copyright, or common-law rights nor the similar rights of others. ComStream further reserves the right to make any changes in any products, or parts thereof, described herein without notice.

© Copyright 1998 ComStream Corporation

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and radiates radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

WARNING

Shock Hazard!

Do Not Open The Equipment!

Service Only By ComStream!

The Reed-Solomon Option Module contains no user-serviceable parts. Do not attempt to service this product yourself. Any attempt to do so will negate any and all warranties.

Table of Contents

Preface

Using this Guide	v
Warranty Statement	vi
Return Procedure	vii
Revision History	viii
Customer Support	viii

Reed-Solomon (Intelsat Version) Option

Overview	1
Functional Description.....	1
Installation	2
Front Panel Operation.....	4
Configuration Commands	5
Monitor Commands.....	8
Fault Commands.....	8
Fault Reporting.....	9
Remote Control Operation.....	10
Remote Fault Monitoring and Fault Reporting	15
Testing	19
Specifications.....	22
Mechanical/Environmental	22

List of Figures

Figure 1. Reed-Solomon Option Module Block Diagram	1
Figure 2. CM701 Rear View with Reed-Solomon Option Module Installed	2
Figure 3. Reed-Solomon Performance Gain	21

List of Tables

Table i. Revision History	viii
Table 1. Reed-Solomon Option Configuration Commands	5
Table 2. Reed-Solomon Status Register Summary	13
Table 3. Fault Log Register Summary.....	16
Table 4. Reed-Solomon Coding Specifications.....	22

■ Preface

Using this Guide

Welcome to the ComStream world of satellite-based communication systems and networks. This guide is your sourcebook for using ComStream's Intelsat Reed-Solomon Option Module. It describes the installation, operation, and performance specifications of this product.

The sections in this guide provide step-by-step instructions for a variety of tasks and activities, including installing and operating the Reed-Solomon Option Module. The sections also provide an overview of system operations, as well as technical specifications and troubleshooting procedures.

Conventions Used in this Guide

This guide is designed to help you find and use information quickly and easily. To take full advantage of this design, please take a moment to review the specific formats.

Locating Information

The table of contents, located at the beginning, provides you with an outline of the major topics contained in this guide.

Special Paragraphs

Throughout this guide you will find special paragraphs designed to help you identify important information. These paragraphs are:

NOTE: This identifies information for the proper operation of your equipment, including helpful hints, shortcuts, or important reminders.

CAUTION: This identifies information that requires careful attention in order to prevent equipment damage and/or injury to the operator.

Warranty Statement

ComStream warrants that its products are free from defects in material and workmanship at the time of shipment and that they conform to applicable specifications. In no event will ComStream be liable for consequential misuse or damages.

The ComStream Intelsat Reed-Solomon Option Module is warranted against any above-mentioned defects that appear within one year of shipping date.

Should it be necessary to make a claim against this warranty, the buyer shall first notify ComStream's Customer Service Department to define the nature of the problem. When returning products, please be aware of the following:

1. Products returned to ComStream, whether for upgrade, warranted or out-of-warranty repair work, or maintenance, must comply with the ComStream Return Procedure (located on the next page).
2. Products shall be forwarded to ComStream, transportation prepaid.
3. Products returned to ComStream freight collect or without a return material authorization (RMA) number will NOT be accepted.
4. ComStream shall not accept any responsibility for returned products that are improperly packaged and/or damaged in shipment. If possible, please use original shipping and packing materials.
5. Original product identification markings and labels must not be removed, defaced, or altered. Further, to preserve the warranty, the product should not be subjected to abuse, improper installation or application, alteration, accident, or negligence in use, storage, transportation, or handling.
6. Any returned product shall be completely evaluated in an attempt to duplicate the problem so that appropriate corrective action and repair may be completed. Following repair, the product shall be thoroughly tested for compliance with appropriate specifications. This process will be handled in an expedient and prompt manner but may be subject to available labor and material resources.

The ComStream warranty, as stated herein, is in lieu of all other warranties, expressed, implied, or statutory.

For further information, please contact
ComStream Customer Service at
619-657-5454 or toll free 888-559-0831.

Return Procedure

If it is necessary to return a product for out-of-warranty repair, upgrade, or any modification, the following procedures must be followed:

1. Contact ComStream Customer Service, located in the United States, via phone or fax:
 - Phone 619-657-5454, or toll free at 888-559-0831
 - Fax 619-657-5455
2. Speak to a ComStream customer service representative about any questions, issues, or problems. Quite often equipment problems can be corrected over the phone, which keeps your equipment in service and avoids unnecessary and costly downtime.
3. Should it be necessary to return a product to ComStream for any reason, the ComStream customer service representative will issue you a return material authorization (RMA) number. To issue an RMA number, the ComStream representative will need the product's serial number, model number, and a description of the problem.
4. You may be returning a product for either repair, upgrade, or modification. If you are returning the product for:
 - Repair, please include a complete description of the problem, the operating conditions which caused the problem, and any circumstances that may have led to the problem. This information is essential for ComStream repair technicians to reproduce, diagnose, and correct the problem.
 - Upgrade or modification, please include a complete description of the current configuration and the desired change(s). This information will allow a ComStream customer service representative to provide a formal quote for the upgrade.
5. Include a purchase order for any upgrade or out-of-warranty repair work being performed. ComStream will begin repair work after a PO is received.
6. Reference the RMA number on all paperwork that accompanies the equipment, and write the RMA number clearly on the outside of the shipping container.
7. Ship your module in the original shipping carton and packing (or its equivalent), prepaid, to the following address.

ComStream Corporation
6350 Sequence Drive
San Diego, CA 92121-2724 USA
RMA Unit number

Do not include product accessories such as Installation and Operation guides or rack-mount brackets.

CAUTION: When handling or shipping static-sensitive equipment, observe antistatic procedures and always use antistatic bags for shipment. Upon request, ComStream will provide you with ESD bags for your use.

All equipment upgrade and repair requests will be completely evaluated and the required work performed in an expedient and prompt manner. The equipment will then be thoroughly tested for compliance with appropriate specifications.

Revision History

This guide is periodically updated and revised. The following table lists the revision number and date and provides a description of the type of revision made to the guide.

For documentation updates, call ComStream Customer Service (located in the United States) at 619-657-5454, toll free 888-559-0831, or fax your request to 619-657-5455.

NOTE: Revision A is always the first official release to ComStream customers.

Table i. Revision History

Revision	Date	Pages
Rev. A	04/94	Initial release
Rev. B	05/95	All
Rev. C	07/98	All

Customer Support

We hope this guide provides all of the information and instructions you need to operate the Reed-Solomon Option Module.

However, in the event that you need further assistance, or if problems are encountered, ComStream has set up a Customer Support Line for your use. Please feel free to contact ComStream Customer Support, located in the United States, by phone or fax at the following numbers:

- Phone 619-657-5454, toll free 888-559-0831
Monday through Friday 8:00 a.m. to 5:00 p.m. Pacific time
- Fax 619-657-5455

Reed-Solomon (Intelsat Version) Option

Overview

This option manual describes the installation, operation, and specifications of the CM701 Reed-Solomon (Intelsat version) option module. The Reed-Solomon option module is a Field Replaceable Unit (FRU) that can be easily added and configured without sending the modem back to the factory. Insert this option manual into the CM701 modem manual.

If the Reed-Solomon option module is to be used in the DT7000 modem, the references to the CM701 modem manual apply to the DT7000 modem manual.

Functional Description

The Reed-Solomon option module supplements the CM701 modem's standard forward error correction (FEC) to improve the bit error rate performance by approximately 3 dB.

The Intelsat Reed-Solomon option module implements a Reed-Solomon encoder and byte interleaver on the transmit path, and a synchronizing circuit, deinterleaver, and Reed-Solomon decoder on the receive path. As shown in Figure 1, the encoder and decoder functions are completely independent.

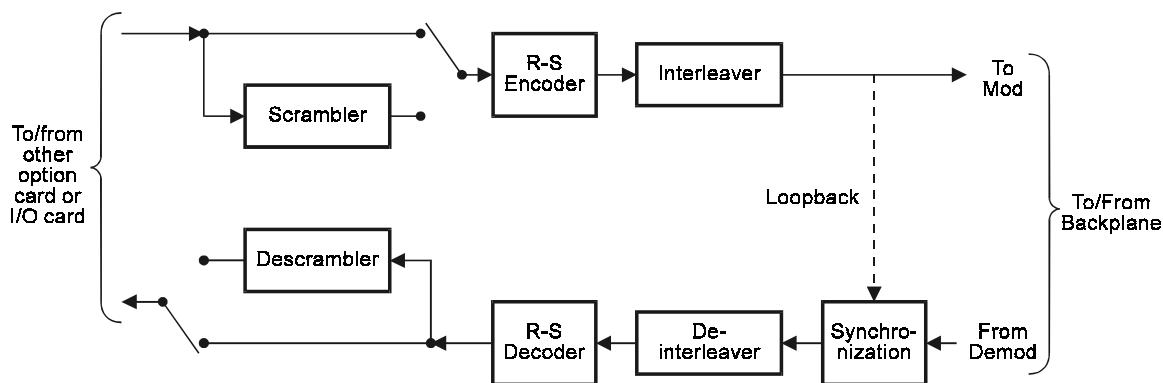


Figure 1. Reed-Solomon Option Module Block Diagram

The Reed-Solomon module accepts user-selectable input data rates from 4800 bps to 8544 kbps in 1-bps increments. In auto mode, the module automatically selects the Reed-Solomon coding/interleaving/scrambling algorithms to comply with Intelsat specification IESS-308, Revision 6B, Appendix F. Another mode lets the user choose which Reed-Solomon code size to use.

Installation

The Reed-Solomon option card can be installed in any general-purpose, vertical option card slot. Refer to the Troubleshooting, Self-test, and Maintenance chapter of the CM701 manual for a detailed explanation of installation and handling. Figure 2 shows an example of option installation.

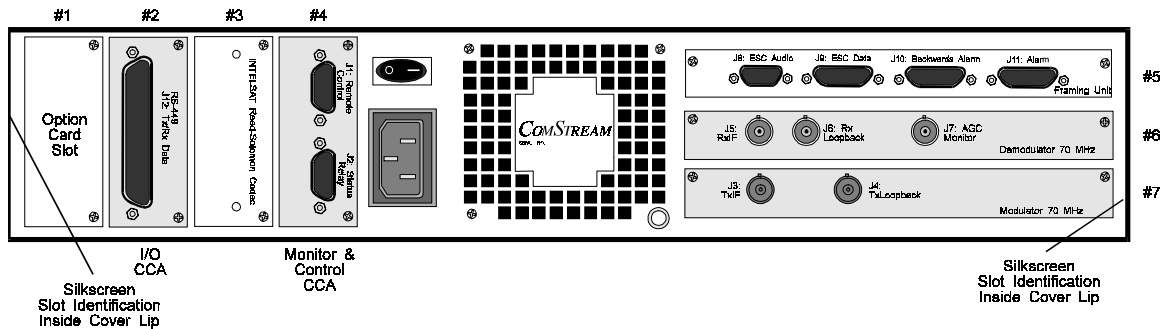


Figure 2. CM701 Rear View with Reed-Solomon Option Module Installed

After the Reed-Solomon option card is installed, the CM701 will automatically insert it (electrically) into the data path on power-up if the ACP command is set to 1 (default).

NOTE: CM701 modems with M&C software version 2.3 or older require manual backplane configuration. If you have M&C or modulator/demodulator software before version 4.1, contact ComStream Customer Service; older software will not support full functionality of this option.

Perform the following steps to configure the module for operation.

NOTE: If a specific Reed-Solomon scrambling mode was selected and you physically remove the Reed-Solomon module from the CM701 and turn the CM701 power on with the module out, the scrambling/descrambling options will get changed to no scrambling/descrambling, SM 0/SD 0. Any other scrambling options will have to be set as described in the CM701 manual. If the Reed-Solomon module is later reinstalled, you will have to reconfigure the scrambling/descrambling options as for initial installation.

1. Select the transmit scrambler's operating mode. This can be done with the front panel command Tx Scrambling, located under the Mod menu, or with the remote command SM. **I-RSAuto (SM 6)** automatically turns scrambling on or off based on the data rates in compliance with Intelsat specifications. Scrambling on the Intelsat Reed-Solomon option module will be active only for user data rates 1544 kbps and greater.

I-RSMan (SM 7) enables the synchronous scrambler on the Reed-Solomon option card at all rates. This is recommended when the system has no Framing Unit option card.

2. Select the receive descrambler's operating mode. This can be done with the front panel Rx Descrambling command, located under the Demod menu, or with the SD remote command. **I-RSAuto (SD 6)** lets the module automatically enable or disable descrambling based on the data rate, in compliance with Intelsat specifications. Descrambling on the Intelsat Reed-Solomon option module is active only at user data rates of 1544 kbps and greater.

I-RSMan (SD 7) enables the synchronous descrambler on the Reed-Solomon option card at all rates. This applies when the system has no Framing Unit option card installed. For more information on scrambling/descrambling options, refer to the Remote Control chapter of the CM701 Manual.

3. Select the module's bypass mode with the R-S Bypass front panel command or with the CBM remote command. The default is Tx/Rx bypass. No faults for the bypassed part of the module will be reported. The options are:
 - 0 – No bypass
 - 1 – Tx/Rx bypass
 - 2 – Tx bypass
 - 3 – Rx bypass

NOTE: If bypass is selected (option 1, 2, or 3 above) and the information rate into the Reed-Solomon module is 1640 kbps or higher, the IDR scrambler and/or descrambler on the CM701 modulator and/or demodulator will be activated, depending on the bypass and scrambling options. You can use the remote commands **CTD ?** on the encoder side and **CRD ?** on the decoder side to query the data rates. You can also use the front panel commands Reed-Solomon Transmit Clock In and Reed-Solomon Receive Clock Out to query the data rates.

4. If a Demodulator is installed, it will provide an E_b/N_0 alarm feature. You can set this feature via the remote command EBT. (You can enter the EBT command via the front panel remote simulator.) **EBT 67** will cause the modem to log a fault when the E_b/N_0 falls below 6.7 dB.

5. Assuming that the Reed-Solomon module is in the primary transmit path along with a Framing Unit option module, enter the primary transmit data rate. This can be done via the UserTxData front panel command, located under the system menu, or the PTD remote terminal command. Acceptable Framing Unit information rates are 64, 128, 192, 256, 384, 512, 768, 1024, 1544, 2048, 6312, and 8448 kbps.
6. Assuming that the Reed-Solomon module is in the primary receive path along with a Framing Unit option module, enter the primary receive data rate. This can be done via the UserRxData front panel command, located under the system menu, or the remote command PRD. The acceptable Framing Unit information rates are 64, 128, 192, 256, 384, 512, 768, 1024, 1544, 2048, 6312, and 8448 kbps.

The preceding rates are Framing Unit data rates. The Reed-Solomon option module is not limited to these.

Front Panel Operation

The CM701 front panel allows the user to monitor and control the Reed-Solomon option card without a remote terminal. This section describes the front panel parameters relating to the Reed-Solomon option card. The front panel command tree has three main branches: **Configuration**, **Monitor**, and **Fault**.

All configuration commands are stored in either nonvolatile (NV) memory or volatile (V) memory. (For more information on the use of the front panel, refer to the Front Panel Operation chapter of the CM701 Operation Manual.)

Configuration Commands

Configuration commands are accessed by selecting the “Config” path and by selecting the Reed-Solomon module, labeled “I R-S.” Table 1 summarizes the commands.

Table 1. Reed-Solomon Option Configuration Commands

Complete Name	LCD Label	LCD Parameter
Reed-Solomon Transmit Clock In (bps)	Tx In	4800 to 8544000
Reed-Solomon Transmit Clock Out (bps)	Tx Out	5268 to 9312000
Reed-Solomon Receive Clock Out (bps)	Rx Out	4800 to 8544000
Reed-Solomon Receive Clock In (bps)	Rx In	5268 to 9312000
Reed-Solomon Near End Loopback	R-S Loopback	Disabled/Enabled
Reed-Solomon Bypass Mode	R-S Bypass	OFF Tx/Rx Tx Rx
Reed-Solomon Encoder Code Size	Enc Code Size	Auto 225,205 219,201 194,178 126,112
Reed-Solomon Decoder Code Size	Dec Code Size	Auto 225,205 219,201 194,178 126,112
Receive Descrambling ¹	Rx Descrambling	I-RSAuto
Transmit Scrambling ²	Tx Scrambling	I-RSAuto
¹ Command is located in Demod menu. ² Command is located in Mod menu.		

NOTE: The data rates do not need to be set during Reed-Solomon module configuration if the remote control commands PRD and PTD (or their front panel equivalents) have been used to set data rates. If data rates are set using the Reed-Solomon configuration commands, then each card in the path will have to have its data rate set individually.

Reed-Solomon Transmit Clock In (NV) sets the rate of the transmit data entering the Reed-Solomon encoder. The range is 4800 to 8544000 bps in 1 bps increments.

Reed-Solomon Transmit Clock Out (Query only) reports the rate of the data leaving the Reed-Solomon encoder, given the correct transmit clock in. In most applications this parameter must match the data rate of the modulator. This parameter is computed using the following formula:

$$CTO = CTD \times (\#Message_Bytes + \#Parity\ Bytes) \div \#Message_Bytes$$

Reed-Solomon Receive Clock In (Query only) reports the expected rate of the data entering the Reed-Solomon decoder. In most applications this parameter must match the data rate of the demodulator. This parameter is computed using the following formula:

$$CRI = CRD \times (\#Message_Bytes + \#Parity_Bytes) \div \#Message_Bytes$$

NOTE: You can ascertain which Reed-Solomon code is being used from the information rate (remote control commands CRD and CTD) and Table 4 in the “Specifications” section.

Reed-Solomon Receive Clock Out (NV) sets the rate of the receive data leaving the Reed-Solomon decoder. The range is 4800 to 8544000 bps.

Reed-Solomon Loopback (V) enables the output of the encoder section to be routed directly to the input of the decoder section for testing purposes.

Reed-Solomon Bypass Mode (NV) allows the user to bypass either part or all of the Reed-Solomon card. The options are:

- No bypass
- Tx/Rx bypass
- Tx bypass
- Rx bypass

NOTE: If bypass is selected (option 1, 2, or 3 above) and the information rate into the Reed-Solomon module is 1640 kbps or higher, the IDR scrambler and/or descrambler on the CM701 modulator and/or demodulator will be activated, depending on the bypass and scrambling options. You can use **CTD ?** on the encoder side or **CRD ?** on the decoder side to query the data rates.

Reed-Solomon Encoder Code Size (NV) allows the user to either let the card select the transmit Reed-Solomon code size according to Intelsat specifications, or manually select which code to use. The options are:

- Auto
- 225, 205
- 219, 201
- 194, 178
- 126, 112

Reed-Solomon Decoder Code Size (NV) allows the user to either let the card select the receive Reed-Solomon code size according to Intelsat specifications, or manually select which code to use. The options are:

- Auto
- 225, 205
- 219, 201
- 194, 178
- 126, 112

Receive Descrambling (NV) specifies the descrambling algorithm applied to the receive data stream. In addition to the options listed in the CM701 modem manual, the Reed-Solomon module adds **I-RSAuto** and **I-RSMan**. **I-RSAuto** lets the module automatically enable or disable descrambling, depending on the data rate, in compliance with Intelsat specifications. (See Table 4.) Descrambling on the Reed-Solomon module will be active only at Framing Unit data rates of 1544 kbps or more, or Reed-Solomon information rates of 1640 kbps and up. **I-RSMan** enables the synchronous descrambler on the Reed-Solomon module at all data rates. This is recommended when the system has no Framing Unit option module. This command is in the Demod menu.

Transmit Scrambling (NV) specifies the scrambling algorithm applied to the transmit data stream. In addition to the options listed in the CM701 manual, the Reed-Solomon module adds **I-RSAuto** and **I-RSMan**. **I-RSAuto** lets the module automatically enable or disable scrambling depending on the data rate, in compliance with Intelsat specifications. (See Table 4.) Scrambling on the Reed-Solomon module will be active only at Framing Unit data rates of 1544 kbps or more, or Reed-Solomon information rates of 1640 kbps and up. **I-RSMan** enables the synchronous scrambler on the Reed-Solomon module at all data rates. This is recommended when the system has no Framing Unit option modules.

Monitor Commands

Monitor commands are accessed via the front panel Monitor menu. In addition to other monitor commands, the Reed-Solomon will display the following commands.

R-S Byte Error Rate 1×10^{-5}

This displays the channel byte error rate as perceived by the Reed-Solomon decoder. For this example the byte error rate is one byte error every 100,000 (10^5) bytes. The displayed range is 1×10^{-2} to 0×10^{-9} .

R-S Bit Error Rate 1×10^{-6}

This displays the output bit error rate as estimated by the Reed-Solomon decoder. For this example, the bit error rate is one bit error every 1,000,000 (10^6) bits. The displayed range is 1×10^{-4} to 0×10^{-9} .

A display of 0×10^{-9} indicates zero detected errors.

The above are averages calculated over the past $9600 * n$ bytes where n is the Reed Solomon code length.

Fault Commands

Front panel fault commands are accessible via the “Fault” path. The following menu headings are displayed.

NOTE: All of the fault conditions are set upon power-up. After power-up, faults must be cleared before the fault register is valid.

Fault Log displays all faults that have occurred since a fault clear command was issued. **Fault Log** is associated with the yellow **FAULT** indicator on the front panel. This fault indicator can be masked with the FLO command described in the “Remote Fault Monitoring and Fault Reporting” section of this manual.

Current displays all currently active faults, associated with the red **FAULT** indicator. If the condition that caused the fault has disappeared, then there will be no current fault message or red fault indicator. This fault indicator can be masked with an STO command, described in the “Remote Fault Monitoring and Fault Reporting” section of this manual.

Clear resets the fault log register and the current fault register. The current fault register remains cleared only until the existing faults can be relogged.

Fault Reporting

The following faults generated by the Reed-Solomon option card are reported via the front panel.

R-S Dec Sync Loss will occur if the Reed-Solomon decoder cannot locate the synchronization pattern in the data.

R-S Tx Clk Tracking Err will occur if the encoder data rate setting does not correspond with the associated DTE or the modulator.

R-S Tx Clk Range Err will occur if the transmit clock coming into the board from the DTE or the Framing Unit card is more than ± 150 ppm from where it should be.

R-S Rx Clk Range Err will occur if the receive clock from the demodulator is more than ± 300 ppm from where it should be.

R-S Rx Clk Tracking Err will occur if the decoder data rate setting does not correspond with the associated DTE or the demodulator, or when there is an R-S Dec Sync Loss.

R-S Enc I/O In Err will appear if there is a hardware problem or while new data rates are taking effect.

R-S Dec I/O In Err will appear if there is a hardware problem or while new data rates are taking effect.

R-S Enc I/O Out Err will appear if there is a hardware problem or while new data rates are taking effect.

R-S Dec I/O Out Err will appear if there is a hardware problem or while new data rates are taking effect.

NVRAM Failure will appear if a parameter stored in a nonvolatile memory location is corrupted.

Self-Test Failure indicates a hardware problem discovered during the built-in test.

Remote Control Operation

The following remote commands are related to the Reed-Solomon option module. For more information on remote control operation and setup, refer to the Remote Control chapter of the CM701 Manual.

NOTE: All of the fault conditions are set upon power-up. After power-up, faults must be cleared before the fault register is valid.

CBE Reed-Solomon Estimated Bit Error Rate (Monitor)

The CBE command displays the bit error rate as estimated by the Reed-Solomon decoder.

CBE ?

The value is returned in a two-digit coded exponential format where the first digit represents the mantissa and the second the exponent (e.g., 26 = 2×10^{-6}). The range of values is 14 to 09 (1×10^{-4} to 0×10^{-9}).

This is an average calculated over the past $9600 * n$ bytes where n is the Reed Solomon code length.

CBM Reed-Solomon Bypass Mode (Configuration) (NV)

The CBM command allows the user to bypass either part or all of the Reed-Solomon card. The options are:

- 0 – No bypass
- 1 – Tx/Rx bypass
- 2 – Tx bypass
- 3 – Rx bypass

CBM 0

NOTE: If bypass is selected (option 1, 2, or 3 above) and the information rate into the Reed-Solomon module is 1640 kbps or higher, the IDR scrambler and/or descrambler on the CM701 modulator and/or demodulator will be activated, depending on the bypass and scrambling options. You can use **CTD ?** on the encoder side or **CRD ?** on the decoder side to query the data rates.

CCE Reed-Solomon Channel Byte Error Rate (Monitor)

The CCE command displays the channel byte error rate as perceived by the Reed-Solomon decoder.

CCE ?

The value is returned in a two-digit coded exponential format where the first digit represents the mantissa and the second the exponent (e.g., 15 = 1×10^{-5}). The range of values is 12 to 09 (1×10^{-2} to 0×10^{-9}).

This is an average calculated over the past $9600 * n$ bytes where n is the Reed Solomon code length.

CDK Reed-Solomon Decoder Code Size (Configuration) (NV)

The CDK allows the user to either let the card select the receive Reed-Solomon code size according to Intelsat specifications, or manually select which code to use. The options are:

- 0 – Auto
- 1 – (225, 205, 10)
- 2 – (219, 201, 9)
- 3 – (194, 178, 8)
- 4 – (126, 112, 7)

CDK 1

CDS Reed-Solomon Sync Status (Monitor)

The CDS command returns a 1 if the Reed-Solomon decoder is locked to the sync pattern, or a 0 if it has lost track of the sync pattern.

CDS ?

CEK Reed-Solomon Encoder Code Size (Configuration) (NV)

The CEK allows the user to either let the card select the transmit Reed-Solomon code size according to Intelsat specifications, or manually select which code to use. The options are:

- 0 – Auto
- 1 – (225, 205, 10)
- 2 – (219, 201, 9)
- 3 – (194, 178, 8)
- 4 – (126, 112, 7)

CEK 1

CLB Reed-Solomon Loopback (Configuration) (V)

The CLB command sets near end loopback if the parameter is 1. If the parameter is 0, near end loopback is disabled. If near end loopback is enabled, the output of the encoder is routed to the input of the decoder.

CLB 1

CRD Reed-Solomon Receive Clock Out (Configuration) (NV)

The CRD command sets the rate of the receive data leaving the Reed-Solomon decoder. The range is 4800 to 8544000 bps in 1-bps increments.

CRD 64000

NOTE: The data rates do not need to be set during Reed-Solomon module configuration if the remote control commands PRD and PTD (or their front panel equivalents) have been used to set data rates. If data rates are set using the Reed-Solomon configuration commands, then each card in the path will have to have its data rate set individually.

CRI Reed-Solomon Receive Clock In (Query Only)

The CRI command reports the rate of the data entering the Reed-Solomon decoder. In most applications the parameter must match the data rate of the demodulator. This parameter is computed using the following formula:

$$\text{CRI} = \text{CRD} \times (\#\text{Message_Bytes} + \#\text{Parity_Bytes}) \div \#\text{Message_Bytes}$$

CRI ?

CST Reed-Solomon Status

The CST command queries the Reed-Solomon module for its current status. The module has a 32-bit status register that uses each bit to represent a status flag. The response to this command is a decimal number that represents the contents of the 32-bit status register. The status register bits are summarized in Table 2.

Table 2. Reed-Solomon Status Register Summary

Bit	Weight	Fault
0	1	NVRAM Failure
1	2	Self-Test Failure
2	4	Reserved
3	8	FPGA Program Error
4	16	R-S Dec I/O In Err
5	32	R-S Dec I/O Out Err
6	64	R-S Rx Clk Tracking Err
7	128	R-S Rx Clk Range Err
8	256	R-S Enc I/O In Err
9	512	R-S Enc I/O Out Err
10	1024	R-S Tx Clk Tracking Err
11	2048	R-S Tx Clk Range Err
12	4096	R-S Dec Sync Loss
13	8192	R-S Tx Summary Fault
14	16384	R-S Rx Summary Fault
15	32768	R-S Tx Hardware Fault
16	65536	R-S Rx Hardware Fault
17-31	—	Reserved

CTD Reed-Solomon Transmit Clock In (Configuration) (NV)

The CTD command sets the rate of the transmit data entering the Reed-Solomon encoder. The range is 4800 bps to 8544000 bps in 1 bps increments.

CTD 64000

NOTE: You can ascertain which Reed-Solomon code is being used from the information rate (remote control commands CRD and CTD) and Table 4 in the “Specifications” section.

CTO Reed-Solomon Transmit Clock Out (Query Only)

The CTO command reports the rate of the data leaving the Reed-Solomon encoder. In most applications the parameter must match the data rate of the modulator. The parameter is computed using the following formula:

$$\text{CTO} = \text{CTD} \times (\#\text{Message_Bytes} + \#\text{Parity_Bytes}) \div \#\text{Message_Bytes}$$

CTO ?

SD Receive Path Descrambling (Configuration) (NV)

The SD command specifies the descrambling algorithm applied to the data stream. In addition to the parameters listed in the CM701 manual, the Reed-Solomon option module adds **6** and **7**. Parameter **6** is equivalent to **I-RSAuto** and lets the module automatically enable or disable descrambling depending on the information rate into the Reed-Solomon module, in compliance with Intelsat specifications. Descrambling on the Intelsat Reed-Solomon option module will be active only at Framing Unit data rates of 1544 kbps or more, or Reed-Solomon information rates of 1640 kbps or more. Parameter **7** is equivalent to **I-RSMan** and enables the synchronous descrambler on the Reed-Solomon module at all data rates. This is recommended when the system has no Framing Unit option module.

SD 6

SM Receive Path Descrambling (Configuration) (NV)

The SM command specifies the scrambling algorithm applied to the data stream. In addition to the parameters listed in the CM701 manual, the Reed-Solomon option module adds **6** and **7**. Parameter 6 is equivalent to **I-RSAuto** and lets the module automatically enable or disable scrambling depending on the information rate into the Reed-Solomon module, in compliance with Intelsat specifications. Descrambling on the Intelsat Reed-Solomon option module will be active only at Framing Unit data rates of 1544 kbps or more, or Reed-Solomon information rates of 1640 kbps or more. Parameter 7 is equivalent to **I-RSMan** and enables the synchronous scrambler on the Reed-Solomon module at all data rates. This is recommended when the system has no Framing Unit option module.

SM 6

NOTE: If bypass is selected (option 1, 2, or 3 above) and the information rate into the Reed-Solomon module is 1640 kbps or higher, the IDR scrambler and/or descrambler on the CM701 modulator and/or demodulator will be activated, depending on the bypass and scrambling options. You can use **CTD ?** on the encoder side or **CRD ?** on the decoder side to query the data rates.

Remote Fault Monitoring and Fault Reporting

The CM701 continually monitors for internal hardware faults and has two ways to display them: current fault monitoring and fault log reporting. Current fault monitoring is the real-time reporting of any fault condition, and fault log reporting is a report of all faults since the fault log register was last cleared. The following are partial descriptions of the commands and reports as they apply to the Reed-Solomon module. For a more detailed explanation of fault monitoring and fault log reporting, refer to the Remote Control chapter of the CM701 Manual.

CST Reed-Solomon Status

The CST command queries the Reed-Solomon module for its current status. The module has a 32-bit status register that uses each bit to represent a status flag. The response to this command is a decimal number that represents the contents of the 32-bit status register. For more information, refer to the command description in the previous section.

FLO Fault Log Overlay Mask (Configuration)(NV)

The FLO command designates the fault condition history that will illuminate the yellow FAULT message on the front panel. The CM701 has a 32-bit fault log register that has each bit assigned to represent a single fault.

To monitor only the faults that are possibly related to the Reed-Solomon option card, enter the following:

FLO 503316480

FO Status Relay Overlay Mask (Configuration)(NV)

The FO command designates the faults that will affect the Status Relay on the rear panel of the CM701. A 32-bit current fault register has each bit assigned to a single fault. To monitor only the faults that are possibly related to the Reed-Solomon option card, on the Status Relay, enter the following:

FO 503316480

VF View faults

The VF command queries the CM701 for its stored fault history. No parameter is required for the VF command.

VF

VFT View Faults with Time Stamp

The VFT command queries the CM701 for the last 10 faults since the faults were cleared. These faults also have a time and date stamp on each one.

No parameter is required for the VFT command.

VFT

(For more information on VF and VFT commands, refer to the Remote Control chapter of the CM701 Manual.)

ST Current Fault Status (Faults)

The ST command queries the CM701 for its real-time fault conditions. A 32-bit current fault register has each bit assigned to represent a single fault. The response to this command is a decimal number that represents the contents of the 32-bit register. The current fault register bits that are possibly related to the Reed-Solomon option card are summarized in Table 3.

The only acceptable parameter is ?.

ST ?

STO Current Fault Status Overlay Mask (Configuration)(NV)

The STO command designates which fault condition will illuminate the red FAULT message on the front panel. The 32-bit current fault register has each bit assigned to a single fault. To monitor only the faults that are possibly related to the Reed-Solomon option card, the following command would be entered:

STO 503316480

VS View Current Fault Status

The VS command queries the CM701 for its real-time fault conditions with a verbose description for each module. No parameter is required for the VS command.

VS

AL Alarm Reporting

The AL command controls the unsolicited fault reporting by the CM701 to a remote control terminal.

An AL parameter of 0 disables fault reporting; an AL parameter of 1 enables it.

AL 1

CF Clear Faults

The CF command clears all displayed faults and permits monitoring for recurrence of faults. No parameter is required for the CF command.

CF

(For more information on the VS, AL, and CF commands, refer to the Remote Control chapter of the CM701 Manual.)

Testing**Board Level Test**

To perform a board level hardware test, enter the following command from the remote or on the front panel using the remote terminal emulator feature:

X:BIT 4

where X is the chassis slot number of the Reed-Solomon module. This test takes approximately 2 minutes.

Then enter the command

X:STR ?

If all tests pass, the response will be

STR_0

Any other response indicates a hardware failure and you should contact ComStream customer service.

NOTE: Data flow will be interrupted when this test is performed. The board will be returned to its original configuration when the test is complete.

Functional Test

To run the test below, a modulator and demodulator must be present. All tests can be performed using either the internal BERT or an external BERT. To perform a full functional test without noise, enable the Reed-Solomon loopback, and use either the internal BERT or an external BERT to confirm that clock rate in equals clock rate out, that the Reed-Solomon decoder is synchronized, and that the BERT does not report any bit errors. Also verify that the CCE remote command reports no errors corrected.

After this has been done, an IF loopback test can be performed. If a noise generator is available, you can do a performance test and then compare the performance with Figure 3. The Reed-Solomon will report the error correction rate via the CCE remote command or the R-S Byte Error Rate front panel command.

Expected performance gains achieved by using the Reed-Solomon option card can be determined through the use of the graph in Figure 3.

The Reed-Solomon code (194,178,8) would be approximately halfway between B and C in Figure 3.

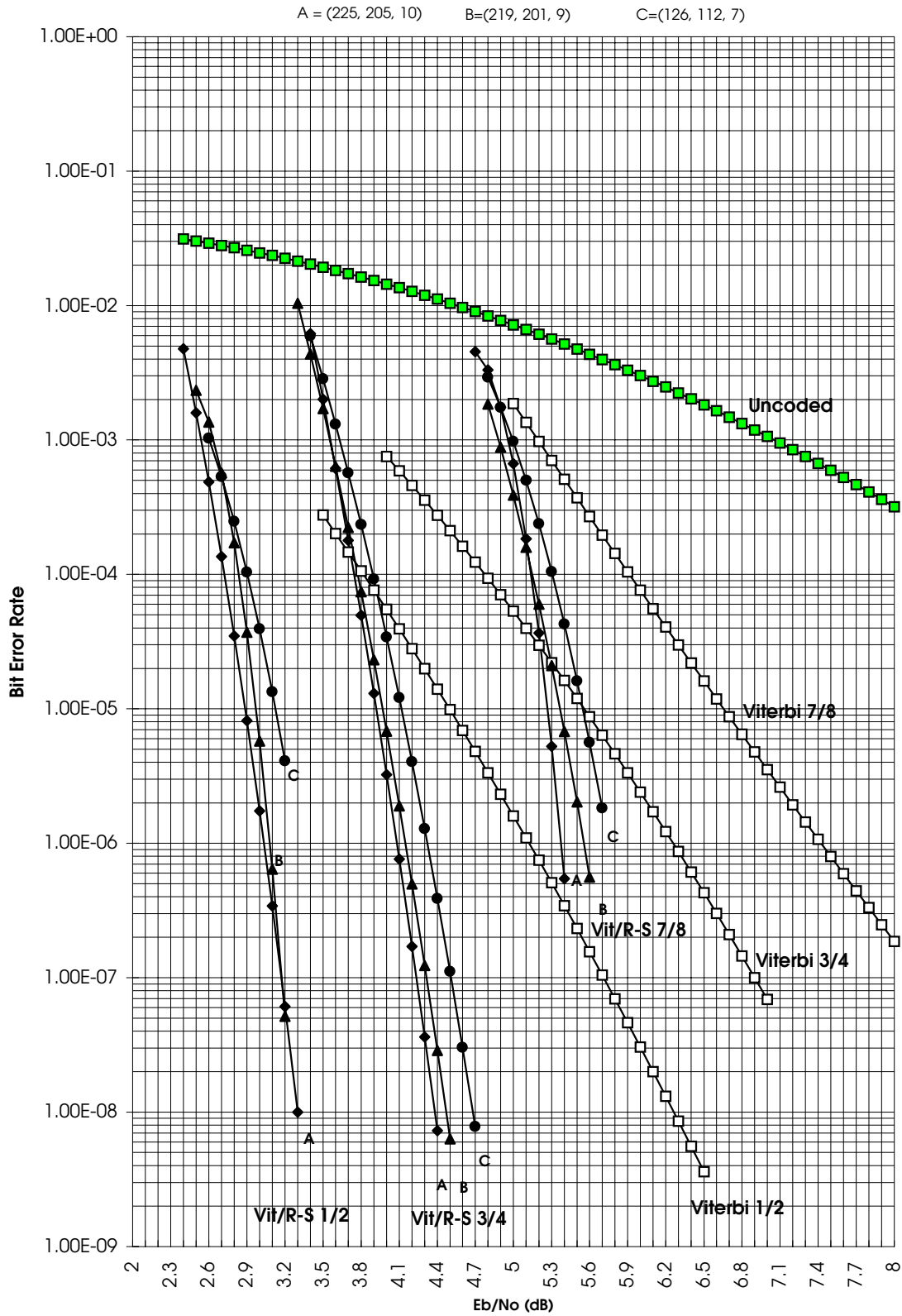


Figure 3. Reed-Solomon Performance Gain

Specifications

Data Rates 4.800 to 8544 kbps in 1-bps increments.

NOTE: CM701 data rate range depends on modules installed. The above range is only for the Intelsat Reed-Solomon option module.

Message block size (k) Refer to Table 4

Code word size (n) Refer to Table 4

Interleave depth 4

Scrambler type Synchronous (IBS Scrambler)

Table 4. Reed-Solomon Coding Specifications

Information Rate	Code Selected (n, k, t)	Scrambling (I-RSAuto)
64,000 - 1,639,998	(126, 112, 7)	Off (done by Framing Unit)
1,639,999 - 2,143,998	(225, 205, 10)	On
2,143,999 - 6,407,998	(219, 201, 9)	On
6,407,999 - 8,544,000	(194, 178, 8)	On

NOTE: n is the number of code bytes (block size); k is the number of information bytes in the block; t is $\frac{1}{2}$ the number of parity bytes and also the number of errors that can be fully corrected within the block). $n = k + 2t$.

Mechanical/Environmental

Temperature:

Operating 0° C to +50° C
 Nonoperating -20° C to +70° C

Current consumption 970 ma @ 5 V
 64 ma @ 15 V
 3 ma @ -15 V