MT2834MR, MT2834MRI, and MT2834MRK

Owner's Manual

MT2834MR, MT2834MRI, MT2834MRK
Owner's Manual
MOD PN 88300150 Version 1.00 - 4/3/01
(Replaces Manual PN 82035706 Rev. G)

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PATENTS

This device covered by one or more of the following patents: 6,031,867; 6,012,113; 6,009,082; 5,905,794; 5,864,560; 5,815,567; 5,815,503; 5,812,534; 5,809,068; 5,790,532; 5,764,628; 5,764,627; 5,754,589; D394,250; 5,724,356; 5,673,268; 5,673,257; 5,644,594; 5,628,030; 5,619,508; 5,617,423; 5,600,649; 5,592,586; 5,577,041; 5,574,725; D374,222; 5,559,793; 5,546,448; 5,546,395; 5,535,204; 5,500,859; 5,471,470; 5,463,616; 5,453,986; 5,452,289; 5,450,425; D361,764; D355,658; D355,653; D353,598; D353,144; 5,355,365; 5,309,562; 5,301,274
Other Patents Pending

Multi-Tech Systems, Inc.
2205 Woodale Drive
Mounds View, Minnesota 55112 U.S.A.
(763) 785-3500 or (800) 328-9717
U.S. Fax (763) 785-9874
Technical Support (800) 972-2439
Internet Address: http://www.multitech.com

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1.1 Introduction

Welcome to the world of data communications. You have acquired one of the finest rack-mount intelligent modems available, the MT2834MR, from Multi-Tech Systems. This owner's manual will help you install, configure, test, and use your modem.

Your MT2834MR is designed to operate in two modes. First, it functions as a 33,600 bps leased line modem with dialback security. Communications over leased lines have been popular for many years primarily over 4-wire lines using V.29 modulation techniques. There have been dial back-up features in some leased line modems, but the dial back-up was at a slower speed. Your MT2834MR uses V.34 modulation that is designed for full 33,600 bps full duplex operation over 2-wires. That means when the MT2834MR uses its dial back-up capability, performance does not suffer.

The second MT2834MR mode of operation is as a standard ITU-T V.34 2-wire dial-up modem. As such, it has incorporated all the advanced features of other Multi-Tech intelligent modems.

This manual documents all of the MT2834MR's features and capabilities, such as autodial, auto-answer, auto-fallback, number linking, option switches, phone number memory, call progress detection, and more. The next section will show you how to use this manual. The contents of each chapter are listed, so you will know where to turn for specific information.

1.2 How To Use This Manual

This manual is divided into eight chapters. There are also several appendices at the end of the manual, most of which repeat information contained in the chapters, but in a more condensed form. The information contained in each chapter and appendix is as follows:

Chapter 1 - Introduction & Description

This chapter begins with a short introduction, followed by a guide (which you are now reading) to the use of the manual. We then provide a more detailed description of the modem, as well as a chart containing the modem's technical specifications. This is then followed by sections covering power, LED indicators and a brief summary of modem switch options. (Chapter 7 covers switch settings more thoroughly.)

Chapter 2 - Dialing and Answering

This chapter covers Answer mode operation in detail, as well as the handshaking procedures between two modems and an auto-answer application. Various methods of call termination are also discussed.

Chapter 3 - Command Mode Operation

This may be the most important chapter of this manual. It begins with an introduction and discussion of the MT2834MR's Command mode fundamentals. A flow chart is provided to illustrate Command mode and On-Line mode operation and the methods used to enter each mode. Next, there is a summary of the modem's commands and responses. We then go into a detailed explanation of each command, providing examples where applicable.

Chapter 4 - S-Registers

This chapter covers the MT2834MR's S-Registers, which are used to store and/or configure various modem options. All of the S-Registers are defined and explained, followed by instructions on accessing the S-Registers and reading or changing their values.

Chapter 5 - Error Correction, Data Compression and Speed Conversion

This chapter provides information concerning some of the advanced features of the MT2834MR. Features such as V.42 Error Correction, MNP 5 Data Compression, Speed Conversion and others enable your MT2834MR to operate at a higher level of efficiency than possible with standard AT command set features.

Chapter 6 - Testing Your Modem

This chapter provides information on loopback testing for your MT2834MR.

Chapter 7 - DIP Switches and Jumpers

The MT2834MR's printed circuit board options are covered in this chapter. The DIP switch settings and on-board jumper plugs are explained in detail, including all default settings.

Chapter 8 - Service, Warranty and Tech Support

This chapter provides instructions for getting modems serviced at the factory, a statement of limited two-year warranty and information about Multi-Tech's Technical Support. Information on the modem upgrade feature is also provided.

Appendix A - ASCII/HEX/Decimal Conversion Chart
Appendix B - Dial Pulses and Tone Dial Frequencies
Appendix C - DIP-Switch Summary
Appendix D - Result Code Summary
Appendix E - S-Register Summary
Appendix F - AT Command Summary
Appendix G - V.25bis Operation
Appendix H - RS232C Interface Specifications
Appendix I - Cable and Connector Diagrams
Appendix J - Escape Sequences Used by Multi-Tech Systems
Appendix K - Remote Configuration
Appendix L – MT2834MRI PC Board

1.3 Description

Each MT2834MR card has three integrated 33,600 bps MultiModems. Each of the three modems on the MT2834MR card can be configured independently from each other via the **MultiCommManager** (Model #MR4800). The rack can support and control up to 16 MultiModem cards, to a total of 48 modems per rack. Up to 254 racks can be networked, for a total of 12,192 modems on the network under control of a single PC. Refer to your **MultiCommManager** Owner's Manual for more information on the rack and its components.

Perhaps the most significant extras incorporated in the MT2834MR are its V.42 error correction and V.42bis data compression features. With error correction and data compression, transmission errors are eliminated while increasing the modem's throughput by a ratio of up to 4:1, for an effective overall transmission rate approaching 115,200 bps.

The MT2834MR offers interactive automatic dialing capability, as well as Command Mode option configuration. Up to ten command line/telephone numbers, of up to 60 digits each, can be stored in the modem's non-volatile memory. The modem uses pulse and/or tone dialing methods, and has the ability to recognize dial tones and busy signals for reliable call-progress detection.

The MT2834MR is FCC-Registered for direct connection to the public telephone networks. No Data Access Arrangements (DAA's) are required.

The MT2834MR is fully compatible with the Standard AT command set, and is therefore compatible with all of the popular communications software packages.

1.4 FCC Regulations for Telephone Line Interconnection

1. No repairs are to be made by you. Repairs are to be made only by Multi-Tech Systems or its licensees. Unauthorized repairs void registration and warranty. Contact Multi-Tech Systems, Inc. for details of how to have repairs made.

2. When trouble is experienced, you must disconnect your modem from the telephone company's jack to determine the cause of the trouble, and reconnect your modem only when the trouble is corrected.

3. The modem cannot be connected to pay telephones or party lines.

4. If requested by the telephone company, you must notify them of the following before the MT2834MR is installed:

a. The particular phone line (phone number) to which the connection is to be made.

b. The FCC Registration Number: **AU7USA-20673-MM-E**

c. The Ringer Equivalence: **0.3B**

d. Modems can only be connected to the phone lines through standard modular jacks. The Uniform Service Order Code (U.S.O.C.) for the standard modular jack which connect the modem to the phone lines are:

RJ11C or RJ11W (single line)

e. The manufacturer's name and model number:

Multi-Tech Systems - Model MT2834MR

5. If the telephone company notifies you that your device is causing harm, unplug it. The telephone company may disconnect your service if necessary and also may change its facilities, equipment, operations or procedures which may affect operation of your equipment. Where practical, the telephone company must promptly inform you in writing of the temporary disconnect or change in service, give you the opportunity to make changes allowing uninterrupted service, and inform you of your rights to bring a complaint to the FCC.

1.4.1 FCC Fax Update

The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device to send any message via a telephone fax machine unless such message clearly contains in a margin at the top or bottom of each page or the first page of the transmission, the date and time it is sent and an identification of the business or other entity, or other individual sending the message and the telephone number of the sending machine or such business, other entity, or individual.

See the cover page of your fax software manual for setup details.

1.5 Canadian Limitations Notice

NOTICE: The Canadian Department of Communications label identifies certificated equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment; or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100. The Load Number for this product is 5.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate."

This digital apparatus does not exceed the Class A limits for radio noise for digital apparatus set out in Department of Communications.

1.6 Compliance with BABT Requirements (MT2834MRK only)

European Low Voltage Directive

When correctly installed and maintained, the modem will present no hazard to the user. When correctly installed the modem will be connected to the PSTN or a PW and to a Data Terminal Equipment (DTE), whose modem connections comply with ITU-T recommendation V28. The DTE connections are therefore taken to be safe voltages (less than +30 volts).

Approved for connection to telecommunications system specified in the instructions for use subject to the conditions set out in them Approval no. **NS/3422/23/N/603030** (Model #MT2834MRK).

Compliance with BS6305 Clause 6.2 BS6320 Clause 7.2 and BABT/SITS/82/005S/D

a. The modem is suitable for connection to the Public Switched Telephone Network (PSTN) provided by British Telecommunications pic or Kingston Communications (Hull) plc. Circuit supply by British Communications, Mercury Communication or Hull City Council. Only direct exchange lines may be used, not shared service. The modem may be connected to private speech band.

b. The modem is suitable for household, office and similar general indoor use. It is not suitable for use as an extension to a payphone.

c. BT lines supplied must support either loop disconnect or multifrequency tone signalling.

d. REN (Ringer Equivalence Number).

The REN value of a unit is calculated from 3/n where n is the total number of units which can be connected in parallel which will still cause the standard bell (as defined in BS6305 Appendix D) to ring. REN values of less than 0.3 cannot be assigned. For apparatus which is not capable of forming part of a multiple installation, a REN value of 3 is assigned.

REN = 1

If a telephone or other device is connected in parallel with the modem, the combined REN must not exceed 4. A BT supplied telephone may be assumed to have REN of 1.0 unless otherwise noted.

The approval of this modem for connection to the British Telecom public switched telephone network is INVALIDATED if the apparatus is subject to modification in any material way not authorized by BABT or if it is used with or connected to:

i. internal software that has not been formally accepted BABT.

ii. external control software or external control apparatus which cause the operation of the modem associated call set-up equipment to contravene the requirements of the standard set out in BABT/SITS/82/005S/D.

All apparatus connected to this modem and thereby connected directly or indirectly to the British Telecom public switched telephone network must be approved apparatus as defined in Section 22 of the British Telecommunications Act 1984.

Compliance with BS6789: Section 3.1 and Part 2

a. The modem is not capable of allowing Auto Call using '999' or other PABX emergency numbers.

b. Modes, other than modes 1,2 or 3 should not be used on the BT PSTN. This modem is a mode 1 device.

c. Users are advised to check the numbers entered during the Auto Call set up phase prior to dialing.

d. The user should not issue any sequence of commands to the modem which would cause the modem to exceed the maximum allowable pause of 8 seconds from the time the modem goes off hook until dialing begins.

Compliance with BS6328 Part 1 and BABT/SITS/82/01/C (Use on Private Circuits)

a. The modem is not suitable for use on circuits with British Telecommunications signaling at a nominal frequency of 2280Hz.

b. The modem does not require signaling or otherwise employ the frequency range dc to 200Hz.

c. The modem may be connected directly to a point-to-point two-wire or four-wire Private Circuit.

d. The modem does not require dc from the Private Circuit for correct operation. The modem may be damaged if connected, in private circuit mode, to a circuit supplying dc current (the maximum permissible direct current is zero amps).

e. The approval of this modem for connection to British Telecom Private Speech band circuits is INVALIDATED if the apparatus is subject to any modification in any material way not authorized by BABT or if it is used with, or connected to:

i) internal software that has not been formally accepted by BABT.

ii) external control software or external control apparatus which cause the operation of the modem or associated call set-up equipment to contravene the requirements of the standard set out in BABT/SITS/82/01/C.

All apparatus connected to this modem and thereby connected directly or indirectly to British Telecom Private Speechband circuits must be approved apparatus as defined in Section 16 of the British Telecommunications Act. 1981.

Compliance with DTI 83/009

a. The apparatus is only approved for compatible PBXs. Consult the supplier for an up to date list of compatible PBXs.

b. There is no guarantee of correct working in all circumstances. Any difficulties should be referred to Multi-Tech.

c. If sockets are required for connection to the PBX, use the BT post card only if BT owns the wiring to the PBX.

This apparatus has been approved for the use of the following facilities:

·Auto-calling
·Loop disconnect and MF dialing
·Phone number storage and retrieval by
a predetermined code
·Operation in the absence of proceed indication
·Detection of initial and secondary proceed indication
·Automatic storage of last number dialed
·Tone detection-busy
·Auto clear from the originating end
·DTR dialing
·Modem
·PBX timed break register recall

Any other usage will invalidate the approval of the apparatus if as a result, it then ceases to comply with the standards against which approval was granted.

1.7 Technical Specifications

Tradename	MultiModemV34
Model Number	MT2834MR, MT2834MRK, MT2834MRI
Data Rates (bps)	Three independent modems (Modem A, B, C) each operating at 33,600, 31,200, 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000, 9600, 4800, 2400, 1200, or 0-300 bps
Data Format	Serial, binary, asynchronous at 0-300, 1200, 2400, 4800, 9600, 14,000, 16,800, 19,200, 21,600, 24,000, 26,400, 28,800, 31,200, or 33,600 bps; synchronous at 1200, 2400, 4800, 9600, 14,400, 16,800, 19,200, 21,600, 24,000, 26,400, 28,800, 31,200, or 33,600 bps.
Configuration	Each of the card's 3 modems are independently configurable
Compatibility	ITU-T V.42, V.42bis, V.34, AT&T V.32terbo, ITU-T V.32, V.32bis, V.25bis, V.21, V.22bis, V.22, V.23, V.17, Bell 212A* and 103/113*
Error Correction	MNP® Classes 3, 4, and LAPM
Data Compression	MNP 5, and V.42bis
Speed Conversion	Serial port data rates adjustable to 300, 1200, 2400, 4800,9600, 19,200, 38,400, 57,600, 115,200 bps
Flow Control	Xon/Xoff, Hardware CTS/RTS, ENQ/ACK
Mode of Operation	Full over both dial-up lines and 2-wire or 4-wire leased lines; automatic Dialback-up on separate lines in leased line operation, in dial-up mode; automatic or manual dialing, automatic or manual answer.
Intelligent Features	"Standard AT" command compatible, autodial, redial, repeat dial*, dial linking*, pulse or tone dial, dial pauses, call status display, auto-parity and data rate selection, keyboard-controlled modem options, non-volatile memory, Caller ID (optional feature), and on-screen displays for modem option parameters and up to ten telephone numbers/command lines of up to 60 digits each, help menus, remote configuration, and V.25bis dialing.
Commands Compatibility	100% compatible with "Standard AT" Command Set
Command Buffer	60 characters

Automatic Dialing	Choice of “Standard AT” command asynchronous dialing, “AT” command-controlled asynch-to-synch DTR dialing, or ITU-T V.25bis Synchronous or Asynchronous dialing.
Automatic Leased Line Restoral	When in dial back-up mode, modem will attempt leased line restoral periodically according to software configuration.
Modulation	Trellis Coded Modulation (TCM) at 33,600, 31,200, 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000, and 9600 bps; QAM at 9600 (non-trellis), 4800 and 2400 bps, PSK at 1200 bps, FSK at 300 bps
Carrier Frequencies 2400 & 1200 bps (V.22 or Bell 212A Standard)	Transmit Originate: 1200 Hz Transmit Answer: 2400 Hz Receive Originate: 2400 Hz Receive Answer: 1200 Hz
Carrier Frequencies, 300 bps* (Bell Standard)	1270 Hz Mark, 1070 Hz Space for Transmit Originate 2225 Hz Mark, 2025 Hz Space for Receive Originate 2225 Hz Mark, 2025 Hz Space for Transmit Answer 1270 Hz Mark, 1070 Hz Space for Receive Answer
Carrier Frequencies V.21	980 Hz Mark, 1180 Hz Space for Transmit Originate 1650 Hz Mark, 1850 Hz Space for Transmit Answer 1650 Hz Mark, 1850 Hz Space for Receive Originate 980 Hz Mark, 1180 Hz Space for Receive Answer
V.23	390 Hz Mark, 450 Hz Space for Transmit Originate 1300 Hz Mark, 2100 Hz Space for Transmit Answer 1300 Hz Mark, 2100 Hz Space for Receive Originate 390 Hz Mark, 450 Hz Space for Receive Answer
Carrier Frequencies V.32 and V.32bis	1800 Hz (V.32)
Fax Modulations	V.21CH2 FSK at 300 bps V.27ter DPSK at 4800 and 2400 bps V.29 QAM at 9600 and 7200 bps V.17 TCM at 14400, 12000, 9600, and 7200 bps
Fax Carrier Frequencies	V.21 CH2 (Half Duplex) 1650 Hz Mark. 1850Hz Space for Transmit Originate 1650 Hz Mark, 1850Hz Space for Transmit Answer V.27ter 1800 Hz Originate/Answer V.29 QAM 1700 Hz Originate/Answer V.17TCM 1800 Hz Originate/Answer

Transmit Level	-10 dBm (dial-up) 0 dBm (leased line, MT2834MR) -13 dBm (private wire MT2834MRK) -11dBm (MT2834MRI)

Note: The Transmit Values apply to the domestic, U.K., and the standard International defaults only, country-specific modems may vary.

Frequency Stability	+0.01%
Receiver Sensitivity	-43 dBm under worst case conditions
AGC Dynamic Range	43 dB
Interface	EIA RS232C
Diagnostics	On-line Diagnostics ITU-T V.54 Remote Loop, V.54 Digital Loop (with or without Pattern Generator) Offline Diagnostics ITU-T V.54 Analog Loop, Self-Tests Automatic Diagnostics Dial-up Tests
Firmware Upgrades	via Flash PROM technology on Multi-Tech's web site
Indicators	LEDs for Transmit Data, Receive Data, Carrier Detect, 28,800 bps, 24,000 bps, 19,200 bps, 14,400 bps, 9600 bps, 2400 bps, Off Hook, Data Terminal Ready, Test and Out-Of-Service, Fax and Error Correction.
Controls	Toggle switches for Busy; DIP-Switches for various modem options.
Operating Temperature	0^{o} to 50^{o} (32^{o} to 120^{o} F)
Power Requirements	5 Volts DC at 0.95 Amp +/-16 Volts DC at 0.1 Amp
Power Consumption	Approximately 6 watts
Dimensions, card modem	.9"x11"x15" (2.2x28x37 cm) HxWxD
Weight	2.5 Lbs. (1.1Kg)
Limited Warranty	Two Years
Fuses	F1 (+5V), F2 (-16V), F3 (+16V)

1.8 Power

DC voltages are supplied to all of the modems in the CC4800 rack through one or two PS4800 power supplies, designed for conventional 115 or 230 VAC connection. The power supply is a universal input switching power supply.

1.9 Modem LED Indicators

The MT2834MR has fifteen LED indicators. They are:

1. Transmit Data (***XMT***). This LED blinks when data is being transmitted, on for a space, off for a mark. The state of this LED matches that of the XMT circuit on Pin 2 of the RS232C interface.

2. Receive Data (***RCV***). This LED blinks when data is received, on for a space, off for a mark. The state of this LED matches that of the RCV circuit on Pin 3 of the RS232C interface.

3. Carrier On (***CD***). This LED lights when a valid carrier tone has been detected.

4. 28,800 bps (***28.8K***). This LED lights when the modem is set for 28,800 bps operation. This LED blinks slowly (1 blink per second) when the modem is set for 31,200 bps operation. This LED blinks quickly (5 blinks per second) when the modem is set for 33,600 bps operation.

5. 24,000 bps (***24K***). This LED lights when the modem is set for 24,000 bps operation.

6. 19,200 bps (***19.2K***). This LED lights when the modem is set for 19,200 bps operation.

7. 14,400 bps (***14.4K***). This LED lights when the modem is set for 14,400 bps operation.

8. 9600 bps (***9600***). This LED lights when the modem is set for 9600 bps operation.

9. 2400 bps (***2400***). This LED lights when the modem is set for 2400 bps operation. If the 2400 or 9600 indicators are not on, this indicates that the modem is set for 300 bps operation.

10. Off Hook (***OH***). This LED lights when the phone line is "off hook." This will occur when the modem is dialing, on line, or answering a call. The indicator will also flash when the modem is pulse dialing in Command mode.

11. Data Terminal Ready (***DTR***). When the DTR LED is lit, the modem is permitted to answer an incoming call. When it goes off, a connected modem will disconnect. The state of this LED matches that of the DTR circuit on Pin 20 of the RS232C interface.

12. Error Correction (***V.42***). This LED lights when the modem is in error correction mode, and flashes on and off when data compression is enabled.

13. Fax (***FAX***). This LED lights when the modem is in Fax mode.

14. Test Mode (***TEST***). This LED lights during test mode operation. With the optional **MultiCommManager** Software installed, a full suite of modem tests can be controlled from a central PC. Refer to the **MultiCommManager** Owner's Manual for more test information. The Test LED lights during any of the software-control diagnostic tests.

15. Out-Of-Service (***OOS***). When the OOS LED is flashing, the leased line is down and the modem is in dialback mode or the self-test has failed. When OOS LED is continuously lit, the modem is in busy out/out of service (OOS) state.

Note: The PS4800 modem rack power supply has one LED that indicates the presence of all supply voltages.

1.10 BUSY Switch

The MT2834MR contains three two-position BUSY switches on the front panel. Each switch can be used to create a "busy out" (OOS) condition for one of the three on-board modems (i.e., Modem A, B, or C).

To place a modem in the Busy condition, move the appropriate BUSY switch to the right. The selected modem goes off-hook, its OOS and OH LEDs light, and incoming calls to this modem get a busy signal. If you suspect a problem with a particular modem, you can use the BUSY switch to have an optional device (such as a "hunt group") that looks for a non-busy line to perform a "roll over" to the next available modem while you check the status of the Busy modem. **Note:** The **MultiCommManager** can perform the same function using software.

1.11 Controls on PC Board

The MT2834MR modems contain three 16-position DIP-Switches and several jumper plugs. The DIP-Switches control various modem options or set default values for Command mode operation.

There are also “jumper” option settings on the circuit board, which control V.54/Test (OOS) functions.

The toggle switch positions on the MT2834MR are be labeled “Busy” for each of the three on-board modems (Modems A,B,C).

Chapter 7 of this manual provides detailed instructions on configuring all of the MT2834MR’s DIP-Switches and jumpers.

1.12 MT2834MRK Installation Notes

The installation instructions include information about the use of blanking plates to cover empty slots in the card frame. Be sure to follow the instructions on installation that are provided in your **MultiCommManager** Owner’s Manual.

Warning: Interconnection directly, or by way of other apparatus, of ports marked ‘SAFETY WARNING see instructions for use’ with ports marked or not so marked may produce hazardous conditions on the network. Advice should be obtained from a competent engineer before such a connection is made.

This product is intended to be hard wired to the network. The final connection to the network is the responsibility of the public telecommunications network operator or a person authorized by that operator.

Any other apparatus, including cable and wiring, connected between the MT2834MRK modem and the point of connection to any speechband circuit shall comply with the following:

(1) the overall characteristics of this apparatus shall be such as to introduce no material effect upon the electrical conditions presented to one another by the modem and the speechband circuit;

(2) the apparatus shall comprise only;

(a) apparatus approved (see note) for the purpose of connection between the modem and a speechband circuit; and

(b) cable and wiring complying with a code of practice for the installation of equipment covered by this part of BS 6328 or such other requirements as may be applicable.

Note: Such apparatus may have been approved subject to limitations in its use.

2.1 Introduction

This chapter describes the dialing and answering capabilities of the MT2834MR. Since the modem can be either a leased line with dialback modem or a standard ITU-T V.34 full duplex dial-up modem, both modes are described (in terms of dialing features) in this chapter.

2.2 Automatic Leased Line Restoral Operation

When the MT2834MR is in the dial back-up mode of operation, it will periodically check the leased line to see if it's operational and try to restore the leased line if possible. This is the automatic leased line restoral feature.* The frequency of the restoral feature attempts are determined by the contents of S-Register S18. The default for S18 is 30 minutes and can be set in one minute increments from 10 to 255 minutes. Setting the restoral frequency under 10 minutes causes excessive breaks in the dial-up operation.

2.3 Manual Dial Backup Call Termination

If your MT2834MR is in the leased line mode (DIP Switch #10 in the Down ("Closed") position) and with a dial back-up operation in process, there are two ways to manually terminate (other than automatic leased line restoral) the dialback call. In each of these cases, you will be attempting to establish the leased line connection because it is back in operating condition.

*Both local and remote modems should have S-Register S18 set identically.

The methods of dial-back call termination are:

1. ***DTR Control.*** If DTR (Data Terminal Ready) is turned off for 50 milliseconds or more, a disconnect will occur. This is probably the most common method used by computer systems at the automatic answer end of the line to cause the answering modem to disconnect after logging off procedures.

2. ***Command Mode Control.*** It is possible to enter Command Mode while remaining on-line by entering the Escape Sequence (***+++AT<CR>*** in most cases). After you have entered Command mode, you may either return to the On-Line by typing ***ATO***, or terminate the call with the ***H*** command. Typing ***ATH*** will hang up the line (bring it on-hook), bringing the modem out of the On-Line mode. So, the command to hang up a call is three plus signs, and then ***ATH***.

3. ***Loss of Carrier.*** After a data connection has been established, the modem will disconnect if a loss of carrier occurs for 700 milliseconds (.7 seconds) or more. The 700 mSec time can be configured for any time from 0 to 25.5 seconds, in 100 mSec increments, with S-Register S10. Note that one cause of carrier loss would be if one of the modems were to disconnect normally. S10 works for speeds of 2400 bps or below, otherwise carrier loss will take about 20 seconds in a V.34 connection.

2.4 Dial Back-up Leased Line Restoral

The dialing associated with the MT2834MR when it's operating in leased line with dialback mode, involves the placing of a call from the originating modem due to a leased line failure. The call can be placed automatically by the modem when the below described conditions are met. The dialback condition is indicated by the OOS LED blinking. After a preset period of time (determined by S-Register S18), the modem will try and restore the leased line automatically.

The parameters used to determine whether a leased line is down (so that automatic dialback can occur), is based on the MT2834MR doing a retrain on the leased line due to an error condition in the transmission. An error condition is defined as a "hit" on the line (the Carrier gets interrupted).

The retrain is a "handshake" procedure between the modems to establish the Carrier again. If the retrain fails, both modems (originate and answer modems) start their Dialback timers. The time is determined by the setting of S-Register S19. The default for the time is one minute. During that minute, the originate modem will try to establish the leased line link. If during that time, the leased line is established, the timer is cleared and everything is back to normal. If the timer expires the modems will go to dialback mode.

The purpose of the timer for the Answer modem is to determine when it will accept a dial-up call. When both timers have expired and the leased line has not been established the dialback procedure will start. The number dialed is the one stored in location N9 of the originate modem's phone number memory. In preparation for proper dialback operation, you must enter the proper number in the N9 location using the commands detailed in Chapter 3. Keep in mind that the number also can be a V.25bis command for synchronous operation.

2.5 Dial-up Automatic Answering

With your MT2834MR in the dial-up mode (12-Position DIP Switch #10 in the UP position), the MT2834MR can be used as an automatic answering modem.

The MT2834MR, when in its idle state, will be set up with originate mode frequencies. An incoming ring signal will automatically switch the modem into answer mode.

You can program the modem to answer a call after a certain number of rings by using the modem's S-Register S0. (See Chapter 4). Refer to Section 2.6 for the handshaking procedures used by the MT2834MR in an automatic answering application.

2.6 Dial-up Handshaking Details

With your MT2834MR in the dial-up mode (12-Position DIP Switch #10 in the UP position), the following briefly explains what happens between two modems in a normal call. We are assuming that there are MT2834MR's at both the originating and at the answering end of the telephone line. (If other brands of modems are used with our modems, they will still communicate, but each manufacturer tends to use slightly different delay timings and sequences, and many of the brands vary in their LED designations.)

Before V.34 negotiation takes place, remote and local modems transfer their functional capabilities using modulated calling and answering tones. First, the Calling Menu (CM), a data sequence using V.21 low-band modulation (a handshaking technique originally developed for 300 bps modems), is sent from the originating V.34 modem to the answering V.34 modem. This describes the range of functional capabilities the originating modem supports. The answering V.34 modem responds to the CM with a Joint Menu, or JM (using V.21 high-band modulation), indicating the common capabilities of the modem at each end.

Once this is done, a probing signal is passed between the modems to identify impairments in the telephone channel. After receiving the results of the probing signal, the modem receivers and transmitters will start with the lowest speed and move up until reaching the highest speed at which they can exchange data. All this occurs in about five seconds.

Note: In order for the called modem to be able to answer the call, it must have a high DTR (Data Terminal Ready) signal. This signal comes from the computer or terminal to which it is attached, on RS232C Pin 20, or it can be forced on by a switch in the modem.

Note: If you are using the Reliable or Auto-Reliable mode, some additional handshaking takes place. This is explained in Chapter 5, in the "Auto-Reliable Mode" section.

2.7 Call Termination

With your MT2834MR in the dial-up mode (12-Position DIP Switch #10 in the UP position), there are a number of methods by which you can terminate a call, or simply stated, hang up. They are:

1. ***Command Mode Control.*** It is possible to enter Command Mode while remaining on-line by entering the Escape Sequence (***+++AT<CR>*** in most cases). After you have entered Command Mode, you may return to the On-Line state by typing ***ATO***, or you may terminate the call with the ***H*** command. Typing ***ATH*** will hang up the line (bring it on-hook), bringing the modem out of the On-Line state. So the command to hang up a call is three plus signs and then ***ATH***.

2. ***DTR Control.*** If DTR (Data Terminal Ready) is turned off for 50 milliseconds or more, a disconnect will occur. This is probably the most common method used by computer systems at the automatic answer end of the line to cause the answering modem to disconnect after log off procedures.

3. ***Loss of Carrier.*** After a data connection has been established, the modem will disconnect if a loss of carrier occurs for 700 milliseconds (.7 seconds) or more. This time can be configured with S-Register S10 for any time from 0 to 25.5 seconds (in 100 mSec increments). Note that one cause of carrier loss would be if one of the modems were to disconnect normally. S10 works for speeds of 2400 bps or below. S10 has no effect at connections above 2400 bps.

4. ***Abort Timer.*** Answer Mode: When OH (Off Hook) comes on, the called modem will start a 45 second timer and wait for a carrier signal from the originating modem. If carrier is not detected within this period, the modem will disconnect (hang up) and be ready for another call. Originate Mode: The abort timer will function the same as in the answer mode, except that the timer will begin after the modem has completed dialing, instead of when it first goes off hook. It is possible to change this 45 second wait-period to any other value from 1 second up to 254 seconds by reconfiguring S-Register S7 (see Chapter 4).

5. ***Inactivity Timer.*** Causes the modem to disconnect if no data is being transmitted or received for a certain period of time. The timer is restored anytime a character is passed through the serial port in either a send or receive case. This function is controlled by S-Register S30. The inactivity timer can be disabled by setting S30 to 0, which is the factory default setting, or set to time out after the time (in minutes) selected by S-Register S30.

3.1 Introduction

The MT2834MR incorporates a microprocessor-based Command Mode, which allows you to use your computer keyboard or communications software to interact with your modem. When your modem is in Command mode, you have access to a complete communications system which allows you to use a number of features including the basic AT command set described in this chapter. The basic AT command set allows you to type phone numbers for automatic dialing without a telephone set, configure various modem options and monitor phone activity. Beyond the basic AT commands and capabilities, your modem can also perform advanced features such as error correction, data compression, speed conversion and more. Some of those features are covered in Chapter 5 of this manual.

This chapter explains Command mode, and shows you how to use each of the basic AT commands.

The MT2834MR AT commands and responses are compatible with all systems and software that have been programmed for automatic, software-controlled autodialing using the standard AT command set.

The MT2834MR also provides V.42 error correction (using the MNP or LAP-M protocols), data compression (using the MNP) Class 5 and V.42bis protocol), speed conversion, and remote configuration. These advanced features are described in either Chapter 5 of this manual.

3.2 Typographic Conventions Used in This Manual

It is important to point out the difference between the letter O and the number 0. Both of these characters will be used in the MT2834MR's commands. As you can see, the letter O is "fatter" than the number 0. We do not use the overstriken 0 to symbolize zero in this manual.

The Carriage Return and Control keys are used in many of the MT2834MR commands. Some keyboards label the Carriage Return key as ENTER, others use the word ENTER, and still others use an arrow pointing down and then left. The symbol <CR> is also commonly used. In this manual, we symbolize Carriage Return with the word ENTER, and will usually use the phrase "hit ENTER" to instruct you to press the Carriage Return key.

We symbolize the Control key with CTRL. For example, Control X, which is accomplished by pressing the X key while holding down the Control key, is written as CTRL-X.

3.3 Functional Modes

The MT2834MR can be in one of two functional modes. These are "Command mode," and "On-Line mode." (There is also an in-between mode, "Wait-For-Carrier," where the modem is out of Command mode but not yet really On-Line.) When the modem is initially powered up, it is in Command Mode, and is ready to accept commands from your keyboard or software, and respond to any Command Mode commands (described later).

The MT2834MR enters On-Line mode after dialing and making a connection with another modem, and then detecting a valid carrier signal tone. If no carrier signal is detected within a certain time, the modem abandons the call and re-enters Command mode.

Once On-Line, the modem exits On-Line mode if the carrier signal is lost or intentionally dropped. When this happens, the modem hangs up and re-enters Command mode.

The MT2834MR can exit the On-Line mode without losing the carrier signal. This is accomplished by typing certain "escape" characters while on-line, which brings the modem back into Command mode without terminating the connection.

The MT2834MR can also enter On-Line mode without going through the dialing process, by typing either the ***O*** command or the ***A*** command. This is explained later in this chapter, as are all of the MT2834MR's commands.

3.4 AT Commands

A variety of autodial operations and modem options are controlled when the MT2834MR is in Command Mode. This chapter covers each command in detail. There are also several option configurations stored in "S-Registers", which can also be accessed in Command Mode (refer to Chapter 6). Error Correction commands are covered in Chapter 5 of this manual.

The MT2834MR commands are listed below in alphabetical order.

Modem Configuration - Command Letters

AT	***AT***tention code that precedes most commands
A	***A***nswer mode
A/	Repeat Last Command
A:	Continuous redial until call answered*
&A	***A***nswerback (proprietary feature)
$An	***A***uto-Reliable Buffering
#An	***A***uto Speed Select
$AS	IBM ***AS***/400 Support
Bn	***B***ell or ITU-T answer tone select
&Bn	Transmit ***B***uffer size
&BSn	Maximum TX ***B***lock ***S***ize
$BAn	***B***aud ***A***djust
&Cn	***C***arrier Detect control
****C***	***C***aller ID Detection (optional)
Ds	***D***ial
DsDn	Store Telephone Number
&Dn	***D***TR Control
$Dn	***D***TR Dialing
En	***E***cho Commands
$En	***E***nable/Disable Error Correction
%En	***E***scape Method
$EBn	Asynchronous Word Length
&En	Mode [normal, auto-reliable, or reliable]
&En	Flow control [None, CTS, or Xon/Xoff]
&En	Pass through XON/XOFF
&En	Enq/Ack pacing
&En	Normal mode flow control
&En	Pacing
&En	Data compression disable/enable
$F	Enable/Disable Auto-Reliable ***F***allback Character
#F	***F***allback modes when on-line
&F	***F***etch Factory default values
$Fn	Enable/Disable ***F***allback character
#Gn	***G***uard tones*
H	***H***ook on/off control, or Hang up
$H	***H***elp screens
****H***	Busy out after disconnect
I	***I***dentify modem model/revision
#L	V.42 mode select (LAP-M/MNP)
L	***L***ist stored telephone numbers
L5	***L***ist current configuration parameters
L6	***L***ist current S-Register Values
L7	***L***ist additional configuration parameters
L8	***L***ist On-Line Diagnostics
&Ln	***L***ease line commands
$MI	***MI***/MIC Control*
Mn	Sync/Async control

$MBn	***M***odem ***B***aud Rate
Nd	Dial Stored Telephone ***N***umber
NdNe	***N***umber Linking
O	***O***n-line from Command Mode
P	***P***ulse Dial
&Pn	Set ***P***ulse dial ratio*
#Pn	**P**arity Select
Qn	Result Codes
&Qn	Command set select
Rn	***R***everse this mode
&Rn	CTS control
****Rn***	***R***ing message on callback modem
&RFn	CTS follow RTS control
$Rn	***R***etransmit count
S=	***S***-Register, set value
S?	***S***-Register, read value
$SBn	***S***erial port ***B***aud rate
&Sn	DSR control
&SFn	DSR follow CD control
$SP	UNIX UUCP ***Sp***oofing
T	***T***one dial
#T	Enable/Disable ***T***rellis Coded Modulation
&Tn	Recognise RDL signal
U	***U***-loop test
Vn	***V***erbose or Terse result codes
#V	User control of **V**.32terbo in Answer Mode
W	***W***ait for new dial tone
&Wn	Store configuration in RAM
X	E***x***tended or basic Result Codes and Call Progress
&Xn	Clock select
Yn	Long space disconnect
Z	***Z***ap (reset modem)
+++	Escape to Command Mode when on-line
,	Pause in dialing
;	Revert to Command Mode after dialing
!	Flash On-Hook
@	Quiet Answer
+++AT<CR>	Escape Sequence: Entering Command Mode While On-Line
BREAK AT<CR>	Alternate Escape Sequence: Entering Command Mode While On-Line

Refer to Appendix F of this manual for a summary of commands.

3.5 Result Codes

You can choose result codes that closely match those of the “Standard AT” command set (“Standard AT” Responses) or enhanced function result codes that have been used in Multi-Tech modems in the past (“Multi-Tech responses”). The ***&Q*** command selects which result codes will be used.

The Command mode provides you with several responses, or “Result Codes,” that can aid you in Command mode operation. These Result Codes are displayed on your monitor or printout.

You can choose to have these Result Codes displayed in a “verbose” format (complete words), or in a “terse” format (single digit numbers). The factory default setting is for the verbose format. To change this setting to the terse format, use the ***V*** command.

You can also choose basic result codes (connect with no speed indication), extended result codes (with speed indication), and whether you want call progress indications (busy and no dial tone) added to the extended result code set. This is controlled with the ***X*** command.

MT2834MR RESULT CODES

CODE	***DESCRIPTION***
OK	Your command was executed, and the MT2834MR is ready for your next command.
CONNECT	A carrier signal was detected at 300 bps.*
RING	A ring signal was detected from an incoming call.
NO CARRIER	No carrier signal was detected, or the carrier signal was lost.
ERROR	An error is present in your command sequence, (e.g., invalid character or too many characters).
CONNECT 1200	A carrier signal was detected at 1200 bps.*
*NO DIALTONE***	No dial tone was detected, and your modem will not dial.**
*BUSY***	A busy signal at the number you dialed was detected.**
NO ANSWER	The Remote system did not answer.
*CONNECT 2400***	A carrier signal was detected at 2400 bps.*
CONNECT 4800	A carrier signal was detected at 4800 bps.*
CONNECT 9600	A carrier signal was detected at 9600 bps.*
CONNECT 14400	A carrier signal was detected at 14,400 bps.*
CONNECT 19200	A carrier signal was detected at 19,200 bps.*
CONNECT 21600	A carrier signal was detected at 21,600 bps.*
CONNECT 24000	A carrier signal was detected at 24,000 bps.*
CONNECT 26400	A carrier signal was detected at 26,400 bps.*
CONNECT 28800	A carrier signal was detected at 28,800 bps.*
CONNECT 31200	A carrier signal was detected at 31,200 bps.*
CONNECT 33600	A carrier signal was detected at 33,600 bps.*
CONNECT 1275	The modem is connected in V.23 mode.

* These responses are used only in the Extended Result Code set, and the CONNECT response will indicate a bps connection. When the Basic Result Code set is used, the CONNECT response can be any speed from 2400 through 33,600 bps. A connection using error correction will be indicated by the addition of the word LAP-M or RELIABLE (verbose) or the letter L or R (terse) to the CONNECT responses. A connection using MNP5 data compression will be indicated by the addition of the word COMPRESSED (verbose) or the letter C (terse) to the CONNECT responses.

** In the modem’s default setting of blind dialing, these responses will not be used.

3.6 Command Mode Fundamentals

This section discusses Command Mode fundamentals, Dialing commands, Immediate Action commands (except dialing), and Configuration commands. The rest of the commands are covered in Chapter 5.

3.6.1 Entering and Executing Commands

When you type commands for the MT2834MR, each command must start with the Attention Characters ***AT***. Attention characters can be typed in either upper case (capital) or lower case (small) letters.

The ***AT*** characters alert the modem that a command follows. The Attention command can also be used to clear the command buffer, by typing ***AT*** and then hitting ENTER.

Typing the ***AT*** characters automatically sets the modem's speed to match the speed of your computer or terminal, and also sets the modem's parity.

The MT2834MR will not execute a command until you hit ENTER. Therefore, ENTER should be pressed when the entire command has been typed. There are some exceptions to this rule. The ***A***/ (Repeat Last Command) command is executed without hitting ENTER. The ***A:*** command is also executed without hitting ENTER.

Typing ***A/*** will cause the MT2834MR to repeat the last command that was executed. This last command remains stored in the modem's command buffer until the Attention Command ***AT*** is typed. Therefore, ***AT*** must not be typed before ***A/*** is typed. The ***A/*** command will have no effect if there is no command stored in the command buffer. It is not necessary to hit ENTER to execute this command.

Many MT2834MR commands consist of a letter, followed by a number (0, 1, etc.). If a command like this is typed without the number, the modem will assume that its value is zero (0). For example, if you type ***ATH*** as a command without a 0 or 1 following the ***H***, the command will be ***ATH0***. (In this example, the effect is that the modem hangs up.) As you become more familiar with the MT2834MR's commands, you will find yourself taking advantage of this shortcut.

3.6.2 Command Editing

You can use the BACKSPACE key on your keyboard to edit characters in the command line. The command will not be executed until you hit ENTER. The BACKSPACE key erases the previous character for retyping.

The BACKSPACE key will ***not*** erase the ***AT*** characters once they are typed. If your keyboard has no BACKSPACE key, CTRL-H will accomplish the same thing. The character recognized by the modem as BACKSPACE may be changed to any other ASCII character with S-Register ***S5***.

To cancel an entire command that has been typed but not yet executed, type CTRL-X. This also clears the command buffer. The effect is the same as backspacing to cancel the entire command, only quicker.

Characters typed in a command are stored in the MT2834MR's Command Buffer (memory) until executed by hitting ENTER. The Command Buffer's capacity is sixty characters. The Attention Characters ***AT*** do not count in the sixty allowed Command characters. Spaces, which may be used for increased display readability, may be used when typing a Command, but are not stored in the Command Buffer and are not counted in the sixty allowed characters. Hyphens, parentheses etc., are not allowed.

If the sixty character limit is exceeded or if invalid characters are typed, the Command Buffer is automatically erased, and an *ERROR* message appears. You then retype the command within the sixty-character maximum, using only the allowed characters.

Note: In some applications, such as auto-answer only, you may disable the Command mode altogether. When you do this, the MT2834MR ignores all commands, and functions as an auto-answer non-intelligent modem. This is done with DIP-Switch #8 on the modem card (explained in Chapter 7). The factory default setting is Command mode enabled.

3.7 Dialing Commands

3.7.1 Dialing Action Commands

D ***Dial Command***

The letter D in a command causes the MT2834MR to dial the telephone number immediately following it. For example, if you type ***ATD5551212*** and hit ENTER, the MT2834MR dials the number 555-1212.

The ***D*** command is also used in conjunction with a telephone set for manual dialing. You dial the number on your telephone set, and after hearing the answer tone on your handset, type ***ATD*** on your keyboard and hit ENTER. Then hang up the handset. Unless you have a specific need to dial in this manner, we recommend you use the first method, where you type the telephone number on your keyboard.

The MT2834MR gives you several choices regarding dialing methods. You can use tone or pulse dialing, by inserting a letter ***T*** or a letter ***P*** in the command string. (See Section 3.7.2 on Dial Modifiers).

You can also configure the modem to either wait for and detect dial tones and busy signals (which we call “Wait-for-Dial-Tone” dialing or “Smart” dialing), or work with timed pauses without dial tone and busy signal detection (which we call “Blind” dialing). (See Section 3.9 ***X*** Command.)

Note: There is another method of dialing, called “DTR Dialing”, where by manipulating the DTR signal on pin 20 of the RS232C interface, a number stored in the modem’s memory is automatically dialed. See Section 3.9 on DTR Dialing (***$D*** command) for details.

A: ***Continuous Redial (not used in MT2834MRK or MT2834MRI)***

If you select the Wait-For-Dial-tone method of dialing (see ***X3*** or ***X4*** command), it is possible for you to command the MT2834MR to continuously redial (maximum 10 redials for DOC units) a busy number until your call is answered. This is done with the ***A:*** command.

This command is used only if you have already reached a busy number after executing a normal dial command. Type ***A:*** (you need not type ***AT***, nor do you need to hit ENTER), and the modem redials the number. If you again reach a busy signal, it redials again and again until it no longer detects a busy signal. To stop the redialing, press any key.

: ***Continuous Redial***

Another way to redial a phone number continuously is to type a colon(***:***) at the end of the phone number. The result is the same as if you had typed ***A:*** after observing that the number was busy on the first dialing attempt. Using the colon in the dial command is a step saver.

H ***Hanging Up, and Bringing the Phone Line Off Hook***

You can make the MT2834MR hang up (go On Hook), or go Off Hook, with the ***H*** command. Type ***ATH1*** to bring the line Off Hook, just as if you had picked up the telephone handset.

To hang up, type ***ATH0*** or ***ATH*** (remember that the default value is 0 when no number is typed).

It is not necessary to type ***H1*** to bring the line Off Hook when using the ***D*** command to dial, since the modem will go off hook automatically when you hit ENTER at the end of the dial command.

3.7.2 Dial Modifiers

There are several commands that can be included within a dialing command (following the letter ***D***), called “dial Modifiers”. They have various functions, including the selection of Pulse or Tone dialing, pauses in the dial sequence, automatic redials if a number is busy, and reverting to Command mode or switching to Answer mode after dialing.

P, T ***Pulse or Tone Dialing***

The MT2834MR can dial numbers using either pulse or tone dialing, or a combination of both methods. Pulse dialing is the method used by rotary-dial telephones, which involves the timed opening and closing of a line relay. Tone dialing is that used by pushbutton Touch-Tone™ telephones, and is sometimes referred to as DTMF, or Dual-Tone Multi-Frequency dialing.

The dialing method is controlled by typing a ***P*** for Pulse or a ***T*** for Tone in the dialing command, right before the digits you wish to have dialed in that manner.

For example, to pulse-dial the number 555-1212, type ***ATDP5551212*** and hit ENTER. To tone-dial the same number, type ***ATDT5551212*** and hit ENTER.

If neither Pulse nor Tone dialing is specified in the dial command, the MT2834MR uses whatever method was last used. If the modem has been reset or was just powered up, it uses Pulse dialing, even if you do not include the letter ***P*** in your dial command.

Nearly all telephone systems in the U.S. are compatible with tone dialing. Since that is the faster method, you will probably use tone dialing.

An example of combining pulse and tone dialing could involve a PBX system where 9 has to be pulse-dialed first, then the rest of the number tone-dialed after pausing for a second dial tone. To dial the number, type ***ATDP9, T5551212*** and hit ENTER. (The comma causes a pause, which is explained soon.)

&P ***Set Pulse Dial Ratios***

The ***&P*** command sets the time ratios between the open and closed positions of the dialing pulse frequencies. To set a dialing pulse ratio of 60mSec to 40 mSec, type ***AT&P0***. To set a ratio of 67 mSec to 33 mSec, type ***AT&P1***. The factory default setting is ***&P0***.

The ***&P*** command is not available on the MT2834MRK.

, ***Automatic Pauses in Dialing***

You can cause the MT2834MR to pause during the dialing sequence by typing a comma (,) character where the pause is desired. This pause lasts two seconds (4.8 seconds on the MT2834MRK). If a longer pause is desired, more than one comma may be typed consecutively, with each one causing a two second pause. You can also change the length of the pause caused by the comma from 0 up to 255 seconds with S-Register ***S8*** (refer to Chapter 4).

Each comma used in a dialing command does count as one of the sixty allowed characters.

Y ***Long Space Disconnect***

The ***Y*** command enables or disables the modem’s ability to respond to a long space disconnect condition. The command ***Y0*** disables it (factory default setting) and ***Y1*** enables it.

W ***Wait for New Dial-Tone***

A ***W*** inserted in the dialing command causes the MT2834MR to wait for another dial tone, and the modem will not resume dialing until another dial tone is detected.

It is not necessary to type a ***W*** at the beginning of the dialing command to wait for a modem dial tone, since the modem will pause automatically.

In order for this command to work, you must first select Wait-for-Dial-Tone dialing with the ***X2*** or ***X4*** command, so that your modem can detect the dial tone.

; ***Returning to Command Mode After Dial Command Execution***

A semicolon (***;***), when typed as the last character of a dialing command, causes the MT2834MR to return to Command mode immediately after executing the command instead of waiting for a carrier signal and going on-line.

For example, type ***ATDT5551212***; to simply tone-dial the number, and do nothing afterwards except go back into Command mode. This is useful in dialing applications where modem data transfer is not desired, such as voice communications, or in applications involving the use of Touch Tones as a data entry method, such as bank-by-phone.

R ***Reversing the Mode of Operation***

In certain applications you may need to reverse the modem's mode of operation from originate to answer, or answer to originate, so that it answers the phone and goes into originate mode, or dials a number and goes into answer mode. This command turns off the reversing function with the ***R0*** command and turn it on with the ***R1*** command.

! ***Flashing On Hook***

Some switchboard systems react to a momentary On Hook. An exclamation mark inserted in the dialing command causes the modem to "flash" on hook for a half second, just as if you had held the switch hook on a telephone set down for a half second. (The flash is 90 mSec. on the MT2834MRK.)

For example, to flash On Hook after dialing the number 555-1234 in order to transfer to Extension -5678, type ***ATDT5551234,,!5678***. The commas cause a 4 second pause (just to be safe).

@ ***Quiet Answer***

The @ command causes the MT2834MR to wait before processing the next symbol in the dialing string. The wait is for one or more ringbacks, followed by 5 seconds of silence. If the time (specified by S-Register ***S7***) passes before the rings and silence, a *NO ANSWER* (R) result code is processed. The @ command is used for accessing a system that does not provide a dial tone.

For example, ***ATDT5551212@7853500*** causes the MT2834MR to dial the first number (555-1212) and wait for the time specified in S-Register ***S7*** for at least one ringback and 5 seconds of silence. If a busy signal is detected, the MT2834MR hangs up and generates a *BUSY* result code. If it does not detect 5 seconds of silence, a *NO ANSWER* result code is generated after hanging up. If 5 seconds of silence is then detected, 785-3500 is dialed.

3.7.3 Phone Number Memory Commands

D...N ***Storing Phone Numbers***

A telephone number and command line of up to sixty characters may be stored in the MT2834MR number memory. As many as ten of these numbers may be stored. Each number is given a name, using the codes N0 to N9.

To store a phone number, type ***ATD***, then the number as it would be dialed along with any ***P***, ***T***, ***R***, ***;*** or ***,*** characters, and then type ***N*** followed by the phone number's "name," (any number from 0 through 9) and then hit ENTER.

For example to store the number 1-612-631-3550 as number ***N3***, type ***ATDT16126313550N3*** and hit ENTER. The number is not dialed with this store command.

After storing a phone number, check if it has been stored correctly by typing ***ATL*** and hitting ENTER.

When phone numbers are stored, the entire command line is also stored so that you can effectively create a macro for each number. For example, if you know a particular number needs extended result codes, detect busy/dial tone, error correction, Xon/Xoff flow control, pacing, and data compression, type: ***ATX4&E1&E5&E13&E15DT16126313550N3***.

N *Dialing a Stored Number*

To automatically dial a telephone number that you a have stored in the MT2834MR number memory, type ***ATNn*** (where n = 0 through 9). For example, to dial a number stored at N3, type ***ATN3*** and hit ENTER. Do ***not*** include the letter ***D*** in this command, or the stored number is erased.

NN *Number Linking*

You may cause the MT2834MR to dial a second number automatically if the first number you dialed is busy. This is useful in a situation where a computer can be accessed through more than one phone number. This is called “linking”.

To link the number at ***N1*** to the number at ***N2***, type ***ATN1N2*** and hit ENTER. Several numbers can be linked in the same command. For example, to link ***N1*** to ***N2*** to ***N3*** to ***N4***, or link ***N1*** to ***N2*** and back to ***N1*** and then back to ***N2***, type ***ATN1N2N3N4*** in the first example, and ***ATN1N2N1N2*** in the second example.

The only limit to the number of numbers that can be linked is the 60 characters allowed in a command line. Number linking can not be used with blind dialing, since busy signals would not be detected. You would have to select the Wait-for-Dial-Tone dialing method using the ***X*** command to use the Number Linking feature.

Note: The ***NN*** command is not used in the MT2834MRK.

L *Listing Numbers Stored in Memory*

Telephone numbers stored in the MT2834MR’s memory may be listed and displayed with the ***L*** command. It displays all ten stored numbers in a format like that shown below. All digits and command letters are shown. The number’s “name” (0 thru 9) is shown first, followed by the complete dialing command and telephone number as originally typed.

Type ***ATL*** and hit ENTER to display these numbers on your video screen or printout. An example of an ***L*** command listing is shown below.

0 T14082345678
1 T16125551212;
2 P9, T14089876543
3 T3738315,12101,16126313550
4 T6313551R
5
6 P9,4258513
7
8 ATX4&E1E5&E13&E15DT16126313550N3
9 T12138880123

3.8 Immediate Action Commands

$H Help Screens

The ***$H*** command gives you short explanations on how to use each MT2834MR command. The ***$H*** command can be quite useful if your manual is not handy and you are in the middle of a communications session. Although the explanations are quite abbreviated compared to those in this manual, they should prove to be helpful reminders when needed.

At the time of this writing, we have three screens of Help information (Screen #1, #2 and #3), and more screens may be added in the future. The Help commands are structured so that you can call up one of three Help screens, as follows:

AT$H1 = Help Screen #1
AT$H2 = Help Screen #2
AT$H3 = Help Screen #3

+++AT<CR> Escape Sequences -- Entering Command Mode While Still On-Line

It is possible to cause the MT2834MR to enter the Command mode after the modem has gone on-line with a remote modem, without disconnecting the call. This is accomplished by typing an Escape Code. The default Escape Code used by the MT2834MR is three plus signs (**+++**) followed by the letters ***A*** and ***T***, up to sixty command characters (most typically ***H***, to hang up), and an ENTER. The number of command characters allowed after ***+++AT<CR>***, is defined by S-Register ***S34***. S-Register ***S34*** defaults to ten command characters. When this is done, the modem will escape to Command mode, execute the command (if any), and then remain in Command mode. For example, to hang up the modem at the end of a call, the command would be ***+++ATH*** followed by ENTER. There is no need to incorporate pauses before and after the plus signs, as done in earlier modems.

BREAK AT<CR>

The MT2834MR provides an alternative Escape method, using a Break signal as the Escape Code. The Break signal allows the start-stop DTE (data terminal equipment) to signal the modem without loss of character transparency. With this method, a ***BREAK*** signal is used instead of the three plus signs. The ***BREAK*** is followed by the letters ***A*** and ***T***, up to 60 command characters, and ENTER. When this is done, the modem will execute that command, but remain in the normal On-Line mode unless the command was to hang up and/or reset the modem (an ***H*** or ***Z***), in which case the modem would be in the Command mode after executing that command.

* Readers interested in further information on the use of BREAK signals as escape codes may wish to consult the ITU-T X.28 Recommendation. In the “Provisional Recommendation X.28 (Geneva 1977)”, information on the topic can be found in Section 4.9, entitled “Escape from the data transfer state”. More recent editions have been published in 1980, 1984 and 1988. ITU-T publications can be obtained from Omnicom, Inc., 112 Park Street SE, Vienna, VA 22180, Phone 703/281-1135, FAX 703/281-1505.

%E Escape Sequence Options -- Entering Command Mode While On-Line

As mentioned, the default setting is for the modem to respond to the **+++** escape method. Optional settings are for the modem to respond to the BREAK method, for the modem to respond to either the **+++** or the BREAK Methods, and for the modem to ignore both methods and not escape. The ***%E*** command is used to select these options, as follows:

%E0 = Modem Won’t Escape
%E1 = ***+++AT<CR>*** Method (factory default setting)
%E2 = ***BREAK*** Method
%E3 = Either **+++** or ***BREAK*** Methods
%E4 = Disable *OK* response to **+++**
%E5 = Enable *OK* response to **+++**

Note: The Escape Code for Remote Configuration (see Appendix K) has ***%%%AT<CR>*** for the factory default setting.

O ***Exiting Command Mode, Going Back On-Line***

To bring the MT2834MR out of Command mode back into On-Line mode, type ***ATO*** (where ***O*** is the letter O, not the number 0). In this case, the ***O*** command reverses what was done by typing the Escape Code. The ***O*** command places the modem in the same On-Line mode (Originate or Answer) that it was in prior to going into Command mode.

A ***Forcing Answer Mode***

With the ***A*** command you can force the MT2834MR into the Answer mode. Type ***ATA*** Mode when in Command mode to immediately bring your modem off-hook, out of Command mode and into the On-Line Answer mode, and cause it to transmit its carrier signal over the phone line. If no responding carrier tone is received by your modem within 45 seconds (or some other time as determined by S-Register ***S7***), your modem will cease transmitting its tone, hang up, and go back into Command mode.

I ***Inquiry for Product Code***

Some systems or software packages automatically check the “Identification” of the modem with which they are communicating, by using the ***I*** command. This “read” command lets the software determine the type of modem with which it is communicating.

When ***ATI*** or ***ATI0*** is typed, the MT2834MR responds with 247. When ***ATI1*** is typed, the modem responds with a three-digit firmware version number.

L5, L7 ***Listing Current Operating Parameters***

The ***L5*** and ***L7*** commands allow you to list the current operating parameters of your modem. This information can be very useful when reconfiguring your modem, such as when you are changing communications software or when you are changing your factory default settings.

To list the MT2834MR’s current operating parameters, type ***ATL5*** for the basic parameters. Type ***ATL7*** to list additional parameters. The parameters for all of the configuration commands (covered in section 5.9) are listed.

L6 ***Listing S-Register Values***

The ***L6*** command lists the current values stored in the modem’s S-Registers. This information can be very useful if you wish to change S-Register values. (Refer to Chapter 4 for more information on S-Registers.)

L8 ***Listing On-Line Diagnostics***

The ***L8*** command displays the current on-line status (e.g., Link Type, Line Speed, Serial Speed, Type of Error Correction/Data Compression, Number of past Retrains, etc.) of the MT2834MR, the DSP code version number, and the processor speed. This display can be printed and used as a modem status report or as diagnostic information (such as when calling Tech Support). This report is given only when on-line. To activate this command type ***+++AT<CR>*** (on-line escape command while maintaining command mode), then type ***ATL8***.

3.9 Configuration Commands

3.9.1 Configuration Storage and Default Commands

&F ***Loading Factory Defaults***

Because the modem has the capability of storing reconfigured parameters and S-Register values into its non-volatile Random Access Memory (RAM), you may wish to have a choice between these RAM stored parameters and values or the factory default parameters and values (as determined by the modem's ROM and DIP-Switches). The ***&F*** command lets you set the modem to the factory defaults in ROM. The modem will then ignore the parameters and values that remain stored in RAM.

The command ***AT&F*** causes the MT2834MR to use the factory default setting ROM configuration parameters and S-Registers values. To replace the parameters and values stored in RAM with all factory default settings, combine the ***&F*** and ***&W*** commands by typing ***AT&F&W*** and hitting ENTER.

The ***&F8*** and ***&F9*** commands determine the function of the ***&F*** command.

If you type the ***&F8*** command (the factory default setting), and later type a subsequent ***&F*** command, the modem reads the factory default settings, regardless of what is stored in non-volatile RAM (defined by the ***&W*** command).

If you type the ***&F9*** command, and then type a subsequent ***&F*** command, the modem reads the parameters and values stored in non-volatile RAM as the defaults. The result is that the setting of the ***&W*** command defines the source of the default parameters and values that your modem reads as its factory default settings.

&W ***Storing Configuration & S-Register Parameters in the Modem's Non-Volatile Memory***

The MT2834MR can store its configuration parameters and S-Register values in its non-volatile read/write (RAM) memory.

Type the ***&W*** command to store parameters and S-Register values in the modem's RAM, and to prevent any reconfiguration from being lost on a power-down or Reset (***ATZ***) condition.

Type ***AT&W0*** (or ***AT&W***) to cause the modem to store its current parameters and values in its non-volatile RAM. This command also sets the modem so that when it is powered up, or when it is reset with the ***ATZ*** command, the modem will read all of its configuration and S-Register parameters from RAM, and not from the factory default setting in ROM.

Type ***AT&W1*** to set the modem so that it does not store its parameters to RAM, and, when a subsequent power on condition or ***ATZ*** command is executed, parameters will be read from the factory default settings in ROM and from the DIP-Switch settings.

Z ***Modem Reset***

Type the ***Z*** command to reset all MT2834MR configurations to their factory default settings, and to clear the Command mode buffer. When you type ***ATZ***, the result is the same as if you had disconnected, and then reconnected power to the modem. When the ***ATZ*** command is executed, the state of the ***&W*** command determines where the default values originate. (***&W0*** defaults come from RAM and ***&W1*** defaults come from ROM.)

3.9.2 Command/Response

E ***Echoing Command Mode Characters***

If the MT2834MR is connected to a full-duplex terminal or computer, you may have to configure the modem to echo back characters typed while in Command mode in order for them to be displayed. The ***E*** command is used to configure the Command mode echo, with ***ATE0*** disabling the echo and ***ATE1*** enabling the echo.

Q ***Result Codes (Enable or Disable) and No Response Answer***

The ***Q*** command enables or disables Result Codes and the No Response Answer mode of operation.

Regarding Result Code Enable/Disable, you may want to disable the Result Codes altogether in certain applications, such as computer-controlled autodialing. The command ***ATQ1*** disables Result Code transmissions and ***ATQ0*** (or ***ATQ***) enables them. In typical operation, the originate mode and answer mode are “intelligent” operations, controlled by the position of the modem DIP-Switches and previously executed commands.

Regarding No Response Answer, you may want Answer mode handled without responses, and echo turned off but want Originate mode still intelligent. This is called the No Response Answer mode. ***ATQ2*** selects the No Response Answer mode. If you do not select any mode, the factory default setting enables the Result Codes to be sent.

&Q ***Result Codes - "Multi-Tech" or "Standard"***

The MT2834MR modems give you a choice between Multi-Tech responses (which include RELIABLE and COMPRESSED responses), and a set that more closely matches the Standard AT command set result codes.

AT&Q0 selects Multi-Tech responses with Reliable/Compression modifiers, *DIALTONE/BUSY/NO ANSWER*. With this setting, the terse response for *CONNECT 2400* is 9. This is the factory default setting.

AT&Q1 selects Standard AT responses with no Reliable/Compression modifier. With this setting, the terse response for *CONNECT 2400* is 10.

Refer to Appendix D for a summary of Result Codes.

V ***Result Codes - Word or Digit***

The ***V*** command controls whether the MT2834MR’s result codes are displayed as words (“verbose”) or single digits (“terse”).

For example, if after dialing, no carrier signal is detected, the result can be displayed either as *NO CARRIER*, or as the digit ***3***.

Type ***ATV0*** (or ***ATV***) to cause the MT2834MR to display the Result Codes as digits. Type ***ATV1*** to display the Result Codes as words. If you do not select a method, the factory default setting will cause the modem to use verbose results.

X ***Result Codes (Basic or Extended) and Call Progress Method***

The ***X*** command selects both the dialing method (“dumb” or “smart”), as well as various response combinations related to the dialing method selected.

Regarding result code selection, you can choose to have certain responses suppressed, and whether or not you want speed indications along with the *CONNECT* responses.

The MT2834MR provides “Basic” and “Extended” Result Code sets. The difference between the two is the Basic set provides one response (*CONNECT*) to indicate a connection, while

the Extended set provides several responses (*CONNECT*, *CONNECT 1200*, *CONNECT 2400* and *CONNECT 9600*).

Regarding the method of dialing, the MT2834MR can detect standard dial tones and busy signals. This capability (“smart dialing”) allows the modem to wait for a dial tone, and when one is detected, to begin dialing immediately.

The MT2834MR also can detect a distant busy signal if after dialing, it reaches a busy number. This is useful because it allows the modem to immediately abandon a call, rather than wait 45 seconds for a carrier signal that will never come.

The MT2834MR gives you a choice between the wait-for-dial-tone (“smart”) dialing method we just described, and blind (“dumb”) dialing, where instead of detecting actual dial tones, the modem relies on timed pauses. When the wait-for-dial-tone method is chosen, the busy signal detection capability is also activated. The ***X*** command is also used to select which dialing method is used.

Five different ***X*** commands are available (***X0*** through ***X4***), with five different effects on the MT2834MR’s result code set.

X0 Provides the basic (short) result codes and provides “dumb dial” capabilities.

X1 Provides the extended result codes and provides “dumb dial” capabilities.

The remaining ***X*** commands select “smart” dialing methods and turn on extended result codes.

X2 Looks for dial tone only and will not provide a busy response.

X3 Looks for busy only and not for dial tone.

X4 Looks for dial tone and for busy.

The factory default setting is ***X4***, which selects extended and "smart" result codes.

3.9.3 RS232 Interface Commands

&C ***Carrier Detect Control***

The ***&C*** command lets you control the status of the Carrier Detect signal (CD - Pin 8) on the RS232C interface. You have three choices. You can force the signal high, allow it to act normally, or set it up so that it will stay high until the modem disconnects, go low momentarily, and then go high again. The last option is useful with some CBX phone systems and mainframe front ends, which require CD to act in this manner.

To allow CD to act normally, type the command ***AT&C1*** (this is the factory default setting). To force CD on, type the command ***AT&C0***. To set up CD so that it drops for one second on disconnect and then comes up again, type ***AT&C2***. (If you want the drop time to be something other than one second, use S-Register ***S24*** to change this value. Refer to Chapter 4 for ***S24*** instructions.)

&D ***Data Terminal Ready Control***

Data Terminal Ready (DTR) on pin 20 of the RS232C interface is required for the MT2834MR to operate. A high DTR signal tells the modem that the device to which it is connected is active, or “ready” to communicate through the modem. If the signal is not being provided on the RS232C interface, 12-position DIP-Switch #1 can be used to force the DTR signal on.

DTR can also be used to trigger a dialing sequence, called DTR Dialing. The condition of DTR can also be used to cause the modem to reset to its default parameters, just as if you had given the modem an ***ATZ*** command. To do this, type the command ***AT&D3*** and hit ENTER. The modem will now reset itself whenever DTR is dropped from On to Off, and will also go on-hook (hang up) if it is on-line.

Type ***AT&D0*** or ***AT&D*** to cause the MT2834MR to ignore DTR. Type ***AT&D1*** to cause the modem to go on hook (hang up) with loss of DTR. The modem enters Command mode when DTR goes high again. Auto-answer is disabled while DTR is low. Type ***AT&D2*** to cause the modem to go on hook with loss of DTR. The modem enters Command mode when DTR goes high again.

&R ***Clear to Send Control***

The ***&R*** command lets you control the Clear to Send signal (CTS - Pin 5) on the RS232C interface. You have three choices. You can force the CTS signal high, allow it to act normally, or set it to stay high until the modem disconnects, go low momentarily, and then go high again. The last option is useful with some CBX phone systems and mainframe front ends, which require CTS to act in this manner.

To allow CTS to act normally, type ***AT&R0***. To force CTS on, type ***AT&R1*** (when the modem goes on-line, CTS still provides flow control). Type ***AT&R2*** to set up CTS so that it drops for the S24 setting on disconnect and then comes up again. (If you want the drop time to be something other than one second, change the ***S24*** value. Refer to the Chapter 4 instructions for ***S24***.)

If you type the ***&R2*** command, be sure that the CTS DIP-Switch on the modem circuit board is set to allow CTS to act independently of Request to Send (RTS). (Refer to Chapter 7 for details.)

&RF ***CTS/RTS Interaction Control***

In typical operation, Clear to Send will follow Request to Send when the modem is on-line. In other words, if RTS goes off, CTS goes off in response. The ***&RF0*** command enables CTS to follow RTS. In some applications, however, it may be necessary for CTS to operate independent of RTS. ***&RF1*** allows CTS to operate independently regardless of the state of

RTS. Refer to the ***&R*** command for control of Clear to Send functionality. The factory default setting is ***&RF1***.

&S ***Data Set Ready Control***

The ***&S*** command lets you control the status of the Data Set Ready signal (DSR - Pin 6) on the RS232C interface. You have three choices. You can force the signal high, allow it to act normally, or set it up so that it will stay high until the modem disconnects, go low momentarily, and then go high again. The last option is useful with some CBX phone systems and mainframe front ends, which require DSR to act in this manner.

To allow DSR to act normally, type ***AT&S1*** (this is the factory default setting). To force DSR on, type ***AT&S0***. To set up DSR so that it drops for one second on disconnect and then comes up again, type ***AT&S2***. (If you want the drop time to be something other than one second, use S-Register ***S24*** to change this value. Refer to Chapter 4 instructions for ***S24***.)

If you type the ***&S2*** command, be sure that the DSR DIP-Switch on the modem circuit board is set to allow DSR to act independently of Carrier Detect (CD). Refer to Chapter 7 for details.

&SF ***DSR/CD Interaction Control***

In typical applications, Data Set Ready (DSR) will follow Carrier Detect (CD). ***&SF0*** enables DSR to follow CD, and is the factory default setting. ***&SF1*** enables DSR to operate indepent of CD. If this is the case, refer to the ***&S*** command for control of Data Set Ready functionality.

3.9.4 Phone Line Conditioning Commands

#A ***Auto Speed Detect***

The ***#A*** command lets you select operation as either a 9600/4800 bps ITU-T V.32 standard modem, a 2400 bps ITU-T V.22 bis (Bell 2400) standard modem, a ITU-T V.22/Bell 212A (1200 bps) modem or a Bell 103/113 (300 bps) modem. The function of the ***#A*** command is to detect and select the operational baud rates which the MT2834MR will use for initial handshake and speed selection.

Note: The ***#A*** command does not control the originating bps rate of the modem (that is done by the Modem Baud Rate command $MBXXXX), but only answer mode fallback speeds.

Type ***AT#A0*** (or ***AT#A***) to cause the MT2834MR to operate starting at 28,800 bps with fallback to 19,200 to 14,400 to 9600 to 4800 to 2400 to 1200 to 300 bps. ***AT#A1*** uses 28,800 bps only. The ***AT#A2*** causes the modem to operate at starting speeds of 28,800 bps, with incremental fallback to 19,200, 14,400, 9600, and 4800 bps. The ***AT#A3*** command causes the modem to begin operation as a V.22*bis* modem at 2400 with fallback to 1200 to 300 bps. ***AT#A1*** is the factory default setting.

&L ***Leased Line (2/4 wire, Answer/Originate) Mode Select***

The ***&L*** command lets you select one of four modes of MT2834MR leased-line operation. You can select any combination of 2- or 4-wire operation in Answer mode or Originate mode. The factory default setting (on power up) is ***&L0*** (dial-up mode operation).

Type ***AT&L1*** to allow just one attempt at a leased line connection. Type ***AT&L2A*** for 2-wire operation in Answer mode. Type ***AT&L4A*** for 4-wire Answer mode operation. Type ***AT&L2D*** for 2-wire Originate mode operation. Type ***AT&L4D*** for 4-wire Originate mode operation.

Note: You must include the ***A*** or the ***D*** command in the dialing string with the ***&L*** command.

The ***&L*** command is intended for use by the **MultiCommManager** administrator. MT2834MR power must be cycled to clear the ***&L*** command. The ***&L*** command is not stored in modem memory. DIP-Switch #10 in the UP position (Dial-Up Operation) overides the ***&L*** command (refer to Chapter 7 of this manual).

B ***Bell or ITU-T Tone***

You can use the ***B*** command to select the frequency that the modem uses for its answer tone. (The answer tone is the tone transmitted by a modem receiving a call to the modem that called it, which initiates the handshaking between the two modems.) At higher speeds (2400 to 14.4k bps) there is no conflict, because all use ITU-T frequencies. At lower speeds (0-1200 bps), in the U.S., some modems use the Bell frequency of 2225 Hz. However, the ITU-T specification for V.22bis has an answer tone frequency of 2100 Hz.

The ***ATB0*** command enables the ITU-T answer tone. The ***ATB1*** command enables the Bell answer tone. The factory default setting is ***ATB0*** (ITU-T tones).

This ***B*** command is not available on the MT2834MRK.

$D ***DTR Dialing***

An alternate way to cause the MT2834MR to automatically dial is “DTR Dialing”. The Data Terminal Ready (DTR) signal comes into the modem from the attached terminal or computer, on pin 20 of the RS232 interface. With DTR dialing, the modem automatically dials a stored number as soon as it receives a high DTR signal. The DTR dialing method is popular when using the MT2834MR in synchronous applications.

To enable DTR Dialing, type ***AT$D1*** and hit ENTER. The modem will dial the phone number you have stored at N0 when it receives a high DTR signal (see Section 3.7.3). DTR must remain high for the duration of the call (until disconnect). To disable DTR dialing, type ***AT$D0*** (or ***AT$D***) and hit ENTER.

When you use DTR Dialing, be sure that 12-Position DIP-Switch #1 is in the UP position, so that DTR is not forced on. (Refer to Chapter 7.)

#F ***Fallback Modes When On-Line***

If the line conditions deteriorate, the MT2834MR automatically drops its transmission speed (fallback). The ***#F*** command controls the different ways that the MT2834MR falls back. During operation, if the error rate becomes too great, the modem performs a rate negotiation. If after the rate negotiation the error rate is still too high for 28,800 bps operation, the modem will fall back to 26,400 bps.

The modem continually monitors the connection and adjusts itself, automatically and incrementally, to the optimal line speed.

AT#F0 (or ***AT#F***) will cause no fallback when on-line. ***AT#F1*** will cause the MT2834MR to fall back (based on the error rate or if three retrains have occurred within a two minute period) from 28,800 to 26,400 to 24,000 to 21,600 to 19,200 to 16,800 to 14,400 to 12,000 to 9600 to 4800 to 2400 bps. ***AT#F2*** enables incremental fallback from 28,800 bps to 2400 bps, but also enables fall forward (from 2400 bps to 28,800 bps incrementally) if the phone line improves. ***AT#F2*** is the factory default setting.

&G ***Guard Tones***

You can use the ***&G*** command to control the presence or absence of guard tones from the transmitter when in Answer mode, at either 1200 or 2400 bps. Guard tones are used in Europe and other areas, in order for the modem to function in the telephone systems. Guard tones are *not* used in the United States.

AT&G0 turns off the guard tones, and is the factory default setting. ***AT&G1*** turns on a 550 Hz guard tone. ***AT&G2*** turns on an 1800 Hz guard tone.

The ***&G*** command is not used on MT2834MRK units.

$MI ***MI/MIC Control***

The ***$MI*** command enables and disables the mode indicate/mode indicate common interface function. ***AT$MI1*** enables MI/MIC operation and ***AT$MI0*** disables it.

With the MI/MIC option enabled, the modem's A and A1 telephone line interface output leads are replaced with MI and MIC input leads. (Tip and Ring remain unaffected.) When MI and MIC are connected together, the modem goes Off Hook in Originate mode, for a time period specified by the modem's Abort Timer (S-Register ***S7***). For example, a 45 second Abort Timer means that if the modem does not detect a carrier tone within 45 seconds after it goes Off Hook, it will disconnect.

The ***$MI*** command is not available on the MT2834MRK.

Note: This option is a hardware modification that must be ordered separately; it is not automatically included with the MT2834MR modems.

&T ***Enable or Disable Recognition of Remote Digital Loop Signal***

The MT2834MR has several test features, which are covered in detail in Chapter 6. The tests are activated with different ***U*** commands, such as ***ATU0***, ***ATU1*** and so forth. There is one command, however, that is really a configuration command, so we will cover it here. That is the ***&T*** command, which enables or disables the modem's ability to recognize the Remote Digital Loop (RDL) test signal.

The command ***AT&T4*** allows the MT2834MR to respond to a RDL signal, and place itself in digital loop. The command ***AT&T5*** disables this capability, meaning that the modem will ignore the RDL signal. (Refer to Chapter 6.)

#T ***Enable/Disable Trellis Coded Modulation***

The ***#T*** command enables or disables Trellis Coded Modulation for the MT2834MR. There is usually no need to disable (turn-off) Trellis Coded Modulation except under an unusual line condition called impulse noise. The command ***AT#T***0 turns off Trellis Coded Modulation and ***AT#T1*** turns it on. The factory default setting is ***AT#T1***.

3.9.5 Miscellaneous Commands

&A ***Answerback***

The ***&A*** command controls the MT2834MR's Answerback feature. Answerbacks are used in some on-line realty applications, and elsewhere, as a security measure. Due to the security aspect of this feature and the fact that there is no requirement for the user to do anything with the modem, we will not discuss Answerback here, other than to say that it exists and that we recommend you avoid ***&A*** in any commands or programming.

&B ***Transmit Buffer Size***

The size of the transmit buffer size is controlled with the ***&B*** command. It may be desirable to reduce the size of the transmit buffer for certain applications. For example, when your modem is receiving a long stream of data and the modem at the other end is using speed conversion (the serial port speed is greater than the modem baud rate). If you wanted to interrupt the current data and request data from a new source, you may have to wait for data in the buffer of the sending modem to empty. By reducing the transmit buffer size of the sending modem, this wait will be reduced. Using the reduced buffer size may cause a slight loss in data throughput.

AT&B0 = Normal transmit buffer size

AT&B1 = Reduced transmit buffer size

The factory default setting is ***&B0***

$EB ***Asynchronous Word Length Command***

The MT2834MR has an 11-bit capability when operating asynchronously. The ***$EB*** command selects between 11-bit and 10-bit operation. Type ***AT$EB1*** to enable the modem to function in an 11-bit (one start bit, eight information bits, one parity bit and one stop bit) format. Type ***$EB0*** (the default setting) to enable a 10-bit (one start bit, seven information bits, one parity bit and one stop bit) format. ***$EB*** is functional in both Command and On-line mode. ***$EB0*** automatically detects parity when an ***AT*** command is issued.

&M ***Synchronous/Asynchronous Mode Switching***

The ***&M*** command is used to set the on-line mode of the MT2834MR to either Synchronous or Asynchronous. ***AT&M0*** sets the mode to Asynchronous, and all communications will be Asynchronous, both in On-line and Command mode. ***AT&M1*** causes the MT2834MR to communicate asynchronously when in Command mode, and to switch to synchronous mode while on-line. The factory default setting is ***&M0***.

&X ***Synchronous Transmit Clock Select***

The ***&X*** command selects the Synchronous Transmit Clock Source. External clocking is when the DTE provides transmit clocking to the modem on pin 24 of the RS232C interface. Internal clocking is when the modem provides transmit clocking to the DTE on pin 15 of the RS232C interface. Internal clocking (***&X0***) is the factory default setting.

The command ***&X2*** selects Slave (External) Clocking. The ***&X2*** command causes the MT2834MR to generate the Transmit Clock timing (pin 15) from the Receive Clock (pin 17) from the DTE, (therefore 15 and 17 are the same). In Slave mode, all timing is controlled by the receive clock. The position of pin 3 is insignificant when in Slave mode.

$AS ***AS/400 Support***

The MT2834MR has the ability to function in an IBM AS/400 environment. The ***$AS1*** command enables AS/400 mode, and causes the MT2834MR function with the IBM command set. The ***$AS0*** command disables this function.

Note: The MT2834MR must have Command mode and Synchronous mode enabled to allow AS/400 mode to be selected.

The factory default setting is AS/400 mode disabled (***$AS0***).

$SP ***UNIX UUCP Spoofing***

The MT2834MR can be configured for a UNIX environment that employs ACK flow control as a means of monitoring data integrity. The modem can perform UUCP “spoofing”, where the MT2834MR can generate ACKs at the DTE interface. Data is transmitted more time effectively because the delay of waiting for data to be received, then for an ACK to be returned at the remote end, is eliminated. Type ***$SP1*** to enable UNIX UUCP spoofing. Type ***$SP0*** to disable UNIX UUCP spoofing (the factory default setting). For more information on the UUCP (UNIX-to-UNIX Copy Program) function, refer to your UNIX system documentation.

&I ***Inactivity Direction***

You may use the &I command in conjunction with S-Register ***S30*** to select how the Inactivity Timer will work in your modem. &I controls the direction of the inactivity. S-Register ***S30*** controls the duration of the inactivity. You may turn off the Inactivity Timer, or set the modem to respond to inactivity only when receiving, or only when transmitting, or to respond to both receiving and transmitting.

&I0 Turns off the Inactivity Timer.

&I1 Resets the Inactivity Timer when data is received from the other modem.

&I2 Resets the Inactivity Timer when the modem transmits.

&I3 Resets the Inactivity Timer when data is either transmitted or received.

The factory default setting is ***&I0***.

**C* *Caller ID Detection*

Note: The Caller ID detection feature is optional.

The Call Traffic window will display the phone number and the name of an individual that dials in on a phone line that supports Caller ID. The call must not be answered before the second ring to receive this information. This feature requires Caller ID phone lines, and a firmware level of 1.10a or greater. The Caller ID firmware is inactive by default, but can be activated via the modem AT command, ****C1***.

****C0*** Turns off Caller ID detection.

****C1*** Turns on Caller ID detection for the MultiCommManager.

****C2*** Is storable in MT2834MR memory and turns on Caller ID reporting on the serial port by the MultiCommManager.

****C3*** Lets you see the last Caller ID's number.

The factory default setting is ****C0***.

Note: The ****C*** command is not used in the MT2834MRI or the MT2834MRK.

&CD *Cleardown at Disconnect*

The ***&CD*** command is used for control of cleardown at disconnect in V.32, V.32bis and V.34 modes.

The ***&CD*** command enables or disables execution of a cleardown (a "Cleardown" is an ITU standard signal recognized by ITU-compatible modems). A cleardown should make a disconnect by the remote modem easier to detect and a successful subsequent reconnect more likely.

A cleardown usually adds 1-2 seconds to the time it takes for the modem to go on-hook after the disconnect; if this causes a problem, use the ***&CD1*** command to disable the cleardown function.

&CD0 Enable cleardown on disconnect.

&CD1 Disable cleardown on disconnect.

The factory default setting is ***&CD0***.

**H* *Busy Out After Disconnect*

With the ****H1*** command, the MT2834MR will stay busy until configuration from the MultiCommManager dedicated management console has finished. If no configuration option is set on the dedicated management console, the MT2834MR will stay busy for ten seconds after disconnect.

****H0*** Busy out after disconnect disabled.

****H1*** Busy out after disconnect enabled.
The factory default setting is ****H0***.

**R* *Callback Ring*

With the ***R1*** command, the modem will put out a ring message and raise pin 22 on the RS232.

R0 No ring message on outbound callback attempt.

R1 Ring message and pin 22 enabled on outbound callback attempt.

The factory default setting is ***R0***.

#V User Control of V.32terbo in Answer Mode

#V0 V.32terbo enabled.

#V1 V.32terbo disabled.

The factory default setting is ***#V1***.

Note: The bits that are used in the rate sequence words for V.32terbo can cause handshaking to fail with some V.32bis modems.

4.1 Introduction

This chapter covers MT2834MR software registers called S-Registers, where certain MT2834MR modem and Command mode configurations are stored. Each S-Register is assigned a number (***S0***, ***S1***, ***S2***, etc.). Use the ***S*** command to read and/or change the value stored in an S-Register (**ATSr?** to read and **ATSr=** to change S-Register values). Refer to Section 4.2, Reading and Assigning S-Register Values.

S0

Number of Rings until Modem Answers

Unit: 1 ring
Range: 0-255
Default: 1
Description: ***S0*** defines the number of rings the modem waits before answering an incoming call. The default value is one ring (Decimal 1), which means that the modem answers the call immediately after the first ring. The maximum number of rings that can be configured is 255. Setting the value to zero (0) disables auto-answer completely.

S1

Rings which have Occurred

Unit: 1 ring
Range: 0-255
Default: 0
Description: ***S1*** counts the number of rings that have occurred. It is a “read” type of register and is seldom, if ever, used in typical operation. Each time an incoming ring signal is detected, ***S1*** increases its value by one, up to a maximum of 255. If you set ***S1*** to a value other than its default value of zero, or if the value is increasing with rings, this new value remains stored in ***S1*** for eight seconds after the last ring is counted, after which time the value reverts back to zero.

S2

Escape Code Character

Unit: ASCII
Range: 0-127
Default: 43 (+ sign)
Description: ***S2*** defines the escape code character. The default character is the plus (+) sign (Decimal 43). It may be set for any ASCII character. Setting an ***S2*** value greater than 127 results in no escape character, and therefore no means of entering Command mode from On-line mode without breaking the on-line connection.

S3

Return Character

Unit: ASCII
Range: 0-127
Default: 13
Description: ***S3*** defines the character recognized as Carriage Return (ENTER) or Return. The default setting is CTRL-M (Decimal 13), which is the ASCII code for the ENTER key on most keyboards. ***S3*** may be set for any ASCII character.

S4

Line Feed Character

Unit: ASCII
Range: 0-127
Default: 10
Description: ***S4*** defines the character recognized as Line Feed. The default setting is CTRL-J (Decimal 10), which is the ASCII code for the Line Feed key on most keyboards. ***S4*** may be set for any ASCII character.

S5

Backspace Character

Unit: ASCII
Range: 0-127
Default: 8
Description: ***S5*** defines the character recognized as BACKSPACE. The default setting is CTRL-H (Decimal 8), which is the BACKSPACE key on most keyboards. ***S5*** may be set for any ASCII character.

S6

Wait Time for Dial Tone

Unit: 1 sec.
Range: 2-255, 4-7*
Default: 2, 4*
Description: ***S6*** sets the amount of time the modem waits after the ENTER key is pressed and a dial tone is detected before executing a dial command. The default setting is two seconds (Decimal 2) or four* seconds.

S7

Time for Carrier (Abort Timer)

Unit: 1 sec.
Range: 1-255, 1-45*
Default: 45
Description: ***S7*** defines the Abort Timer (lack of carrier) delay time. The default value is 45 seconds (Decimal 45). This means that, after dialing, the modem waits for a carrier signal for up to 45 seconds and, if none is detected, aborts the call. The maximum ***S7*** value is 255 (or 45*) seconds.

S8

Pause Time for Comma

Unit: 1 sec.
Range: 0-255, 4-7*
Default: 2, 4*
Description: ***S8*** sets the length of the pause caused by a comma inserted in a dialing command. The default setting is two seconds (Decimal 2) or four* seconds, where each unit is one second. ***S8*** may be set for up to 255 seconds.

S8 also sets the time the modem waits before retrying a call after detecting a busy signal. Some computer systems need more than two seconds to reset (in which case you should increase the value of ***S8***).

S9

Carrier Detect Response Time

Unit: 100 mSec.
Range: 1-255
Default: 6
Description: ***S9*** sets the time delay between when the modem first detects a valid incoming carrier signal and when the modem turns on its Carrier Detect circuit. The default setting is 600 milliseconds, or six units of 100 mSec each (Decimal 6). ***S9*** may be set for up to 25.5 seconds.

S10

Carrier Loss Disconnect Delay Time

Unit: 100 mSec.
Range: 0-255
Default: 7
Description: ***S10*** sets the time a carrier signal must be lost before the modem disconnects. ***S10*** can only be set at speeds of 2400 bps or less. The default setting is 700 mSec, or seven units (Decimal 7) of 100 mSec. Maximum delay is 25.4 seconds (Decimal 254). Setting the ***S10*** value to 255 causes the modem to not disconnect with loss of carrier.

S11

Tone Dialing: Tone Spacing and Duration

Unit: 1 mSec.
Range: 1-255, 80-255*
Default: 70, 80*
Description: ***S11*** sets the speed of tone dialing (spacing and tone duration times). The default value is 70 units (Decimal 70) or 80* units, where each unit is one mSec, meaning that each tone is on for 70 mSec with a 70 mSec pause between each.

The minimum ***S11*** value allowed by most telephone systems is 50 mSec (50 units). Very few telephone systems can handle anything faster than that. The maximum ***S11*** value is 255 mSec (255 units).

S13

Remote Configuration Escape Character

Unit: ASCII
Range: 0-127
Default: 37 (% sign)
Description: ***S13*** defines the remote configuration escape character (which becomes your modem's remote configuration character). The default is three percent symbols (%%%). When the ***S13*** character is entered three consecutive times from a remotely connected site, your modem responds with its Remote Configuration procedure.

S17

Changing Break Time

Unit: 10 mSec.
Range: 0-2500 mSec
Default: 250 mSec.
Description: ***S17*** defines the break time (space) to the PC. Break duration is adjustable. The break time is changed in 10 mSec increments by increasing or decreasing the value of S17.

S18

Automatic Leased Line Restoral

Unit: 1 min.
Range: 10-255 min.
Default: 30 min.
Description: When the MT2834MR is in the dial back-up mode of operation, it will periodically check the leased line to see if it's operational and try to restore the leased line if possible. The frequency of restoral attempts is defined by the contents of S-Register ***S18***.

The default for ***S18*** is 30 minutes and can be set in one minute increments from 10 to 255 minutes. Setting the restoral frequency to a value less than 10 minutes causes excessive breaks in the dial-up operation.

S19

Dial-Back Timer

Unit: 1 min.
Range: 0-255 min.
Default: 1 min.
Description: ***S19*** is a timer that starts when the leased line goes down and the modem has determined that the line is bad. When the set time is reached, the originate modem dials the answering modem. The answering modem uses this same timer to determine when it will accept the ring.

S24

PBX/CBX Disconnect Drop Time for DSR/CTS/CD

Unit: 50 mSec.
Range: 0-255
Default: 20
Description: Some PBX and CBX phone systems require the modem's DSR, CTS, and/or CD signals to behave in a certain manner when calls are disconnected. The MT2834MR's ***&R***, ***&S,*** and ***&C*** commands cause the modem to drop these signals for a specified time period upon disconnect, and then bring the signal(s) up again.

S24 defines the length of time that the signals drop. The default setting of 20 results in a one second drop time, which is what most PBX/CBX systems with this requirement need.

S25

DTR Dropout Time

Unit: 100 mSec.
Range: 0, 1 through 255
Default: 0
Description: ***S25*** defines the amount of time that DTR must be dropped before the modem disconnects. Normally, a disconnect occurs when DTR is dropped for 50 milliseconds or more.

The ***S25*** unit value for zero is the default value of 50 mSec. For values from 1 through 255, the unit value is 100 mSec.

S30

Inactivity Timer

Unit: 1 min.
Range: 0-255
Default: 0
Description: ***S30*** causes the modem to disconnect if no data is transmitted or received for a specified time. This timer runs during both Reliable and Normal connections. The timer restarts any time a data character is passed through the serial port (either sent or received). If noise on the phone line causes an error to be received during Normal mode, this also restarts the timer. The inactivity timer is disabled by setting ***S30*** to 0, which is the factory default setting.

S32

Time Elapse for Escape Sequence

Unit: 100 mSec.
Range: 0-255
Default: 20
Description: ***S32*** sets the time period to validate the escape sequence. If the time interval expires before the escape sequence is employed (by hitting ENTER), the escape sequence is aborted. The default is 20 units (one second).

S34

Buffer Length of Command Mode after On-line Escape Sequence

Unit: ASCII
Range: 0-60
Default: 10
Description: If the number of characters after AT exceeds the ***S34*** buffer length value, the buffer is cleared and the escape sequence is aborted.

S36

DTR Busy-out Time Length

Unit: 1 sec.
Range: 0-255 sec.
Default: 0 sec.
Description: ***S36*** sets the amount of time (in seconds) that the modem waits when DTR goes off, before going off hook (busy).

S37

DTR Busy-in Time Length

Unit: 1 sec.
Range: 0-255 sec.
Default: 5 sec.
Description: ***S37*** sets the amount of time (in seconds) that the modem waits when DTR comes back on, before going on hook.

S48

Control V.34 Connect Speed

Unit: N/A
Range: 28, 26, 24, 21, 19, 16, 14, 12, 96 and 48
Default: 0
Description: ***S48*** defines the speed at which the modem connects within V.34 mode. For example, ***S48=21*** means that the maximum connect speed is 21.6K bps. ***S48*** compensates for line conditions that have trouble supporting the higher V.34 speeds (e.g., 26.4K, 24K bps, etc). The ***S48*** default is 0, which indicates a connection attempt at 28.8K bps. Note that the ***$MB*** command is also used for V.34 rate control.

4.2 Reading and Assigning S-Register Values

The ***S*** command reads and assigns S-Register values. To read an S-Register value, type the letter **S** followed by the S-register number and a question mark (?), then hit ENTER. For example, typing **ATS7?** and hitting ENTER displays the value of S-Register ***S7*** in a 3-digit decimal form. The number 8 appears as *008*, the number 30 appears as *030*, and the number 255 appears as *255*.

Convert all ASCII characters to their decimal equivalents before entering them. S-Register decimal values range from 0-127 for ASCII characters, or 0-255 for numeric values. A complete ASCII conversion chart is located in Appendix A of this manual.

4.2.1 Examples of Assigning Values

1. Let's say you wish to have longer pauses caused by the comma in a dial command; five seconds instead of two. Typing **ATS8=5** assigns 5 as the value for S-Register ***S8*** (meaning the modem pauses five seconds for a comma in a dial command).

2. In a second example, let's say that you wish to configure the MT2834MR modem to answer incoming calls after the 30th ring instead of after the first ring. To configure S-Register ***S0*** with a value of 30, type **ATS0=30** and hit ENTER.

4.2.2 Examples of Reading Values

To verify that you entered the value correctly in the above examples, type **ATS8?** and hit ENTER in the first example and **ATS0?** in the second example. You should receive the response *005* in the first example and *030* in the second example. Type **ATL6** to list all S-Registers and their values.

When configuring the S-Registers, it is a good practice to include the verification read-entry in the same command line as the configuration assignment-entry. In the preceding examples, type **ATS8=5S8?** and **ATS0=30S3?**.

4.3 AT Commands that Affect S-Registers

Your MT2834MR's default configuration is originating a call to another 28,800 bps modem that supports error correction, data compression, and flow control ("maximum throughput"). If the receiving modem is not compatible, the MT2834MR can match any ITU-T or Bell Standard modem (but not proprietary protocols).

You may, however, have applications where you do not want this kind of maximum throughput (e.g., service not supporting error correction, or the V.42 handshake interferes with logon sequence). If so, configure the MT2834MR as strictly an auto-answering device or perhaps to function in a UNIX environment.

The ***&W*** command, used in conjunction with specific other AT commands and S-Registers, reconfigures the MT2834MR to conform to a specific application. An example of the ***&W*** command:

AT&E2$SP1#L3$R0$MB19200$SB115200$EB1S0=10&W0<CR>

The MT2834MR stores its configuration parameters and S-Register values in its nonvolatile memory. The ***&W0*** command stores current parameters and values in its nonvolatile RAM. This command also sets the modem so that on power up, or when reset with an **ATZ** command, the modem reads all its configuration and S-Register parameters from RAM, and not from the factory settings in ROM. The ***&W*** command changes the configuration parameters stored in RAM that you specifically intend to alter. All other default parameters remain unchanged.

The ***&W1*** command sets the modem so that it does not store parameters to RAM and, on power up or when an **ATZ** command is entered, parameters are read from the factory default settings in ROM.

Before using the ***&W*** command, view the modem's current operating parameters. Use the **L5**, **L6**, and **L7** commands to display the current modem configuration.

4.4 Summary

V.42 error correction is built into the MT2834MR's hardware, detecting and correcting virtually 100% of transmission errors (usually caused by noisy phone lines). When errors are detected, the V.42 protocol causes the modem to retransmit the data block in which the error was found.

V.42bis and MNP 5 data compression features are built into the MT2834MR's hardware, providing a higher data throughput than the modem's modulation speed. The throughput increase depends on the type of data transmitted.

The MT2834MR also supports ITU-T Group 3/EIA TR-29 Class 2 fax operation. This enables the modem to send and receive text, graphics, and images to and from any Group 3 fax machine.

The MT2834MR is set for one of three different modes of operation, along with activating data compression in Reliable mode. Normal mode ***(&E0)*** disables error correction, Reliable mode ***(&E2)*** turns it on, and Auto-Reliable mode ***(&E1)*** lets the modem automatically turn V.42 on when it detects its use in another modem.

Flow control methods are used by the MT2834MR to prevent data loss from buffer overflow. The modem both initiates flow control and responds to pacing, using either Xon/Xoff commands or RS232C/V.24 signaling via CTS (from the modem) or RTS (from the computer/terminal). Hewlett-Packard ENQ/ACK is also supported. If needed, Xon/Xoff commands are passed through the modem to a remote computer or terminal.

The MT2834MR's speed conversion feature lets the modem operate at one speed over the telephone line and another speed over the RS232C/V.24 serial port. This lets the computer communicate with the modem at a fixed speed of up to 115,200 bps, while the modem operates at various rates of up to 28,800 bps (V.34 enabled). This ability is vital for data compression, since your computer must send data to the modem at a higher speed than the rate at which the modem is sending data over the phone line.

5.1 Introduction

Your MT2834MR has intelligent features beyond those of the AT command set (described in Chapter 3 of this manual). This chapter covers these high performance features and commands which provide error correction, data compression and speed conversion capabilities. Error correction in your modem is via the ITU-T V.42 standard. Data compression in the MT2834MR is either MNP Class 5 or ITU-T V.42bis. The remainder of this chapter describes these features, and the commands to operate them, as well as descriptions of related commands.

Error correction is incorporated via the ITU-T V.42 standard. V.42 actually uses two error correction protocols, LAP-M and MNP Class 3 & 4. MNP Class 3 & 4 error correction emerged as the industry standard among modem manufacturers over the past decade. It's now in the public domain, and has been implemented in dozens of modem brands that offer error correction with world wide installations in the hundreds of thousands of units. LAP-M error correction is similar to MNP Class 3 & 4. They both convert asynchronous data characters to a synchronous data stream.

The MT2834MR provides two types of data compression: V.42bis and MNP Class 5. V.42bis is newer and it requires concurrent error correction using LAP-M. V.42bis is a very efficient data compression technique that can provide up to a 4-to-1 compression, depending on the type of files transmitted. MNP Class 5 data compression requires concurrent error correction using MNP Class 3 & 4. It is an older and more established standard that offers data compression in the 2-to-1 range (also dependent on the type of data).

The speed conversion feature allows the modem to operate at one speed over the telephone lines and another speed at the RS232C serial port. This allows the computer or terminal to communicate with the modem at a fixed speed of up to 115,200 bps, while the modem operates at various speeds up to 28,800 bps. This is vital if data compression is to be effective (your terminal or computer must present data to the phone line at a higher speed than which the modem is sending it over the phone line).

This chapter also covers commands that control error correction, turn data compression on and off and others that are related to high performance operation along with the changes in the result codes.

5.2 How V.42 Detects and Corrects Errors

Some of the better known software-based error-correction protocols include XMODEM and Kermit (for asynchronous file transfer software), X.PC (Tymnet's own asynchronous software protocol), and SDLC and HDLC, two popular synchronous protocols common in the IBM mainframe environment. V.42 is functionally similar to SDLC and HDLC, with some extras.

The main advantage of hardware-based V.42 error correction over these software-based protocols is in "throughput". Throughput is the effect that the use of the protocol has on the overall data rate. For example, V.42 transmissions using a 2400 bps modem have an effective throughput of about 2600 bps. The same modem using software-based X.PC would have an effective throughput of less than 2400 bps. Another way of stating it is that V.42 has an efficiency of about 108%, while X.PC has an efficiency of about 91%.

Simply stated, one modem with V.42 sends coded data to another modem with V.42, and the receiving modem is able to determine if there were any errors. If there were, the receiving modem tells the sending modem to resend the errant data until it's correct.

Technically speaking, when using V.42, the "sending" modem uses a polynomial function to calculate a 16-bit number which is a function of all the data sent in a particular "message" or "block", and then sends those sixteen bits at the end of the block. (The "block" can include up to 256 characters.) The "receiving" V.42 modem, as it is receiving the block, calculates its own version of the 16-bit number. Then it compares its number with the 16-bit number sent with the block. If the numbers are the same, the block is free from errors. If the numbers are different, an error has occurred somewhere in the block. That's how errors are ***detected***.

Once an error is detected, the receiving modem's V.42 error ***correction*** is activated.

For all practical purposes, the result of the V.42 error correction protocol is error-free transmission. Using the 16-bit redundancy check, it will detect every error which is 16 bits or smaller, with 100% probability. As a result, the chances of an error occurring are actually so small that you can, in practice, ignore them.

5.3 Data Compression

The MT2834MR has both V.42bis and MNP class 5 data compression. ITU-T V.42bis is an international data compression standard which can provide data compression of up to four to one in certain types of data. MNP class 5 is a proprietary technique for data compression that provides a data compression capability of two-to-one.

The MT2834MR must be in error correction mode before it can compress data (LAP-M error correction for V.42bis data compression or MNP error correction for MNP 5 data compression). By using the ***#L*** command, you can select which error correction to use.

The type of file transfer protocol used to send and receive data will have a big effect on the speed gain due to compression. In general, a protocol which uses large data blocks transfers files quicker. For example, YMODEM sends 1000 characters per block. It will also help to have the serial port of the receiving modem set to the highest possible speed (115,200 bps), if the sending modem is set to a lower speed.

To achieve a data rate which is higher than the modem baud rate, use the modem's speed conversion features by turning Baud Adjust off (***$BA0***) and operate the serial port at a higher speed than the modem baud rate. For example, the serial port must be set to 4800, 9600, 19200, 38400, 57600, or 115,200 bps (***$SB115200***).

To use data compression, the modem must to be driven at full capacity. In other words, the data needs to be present at enough volume (file transfers or batch operations) and speed to get maximum compression benefits. The modem speed conversion features must be used to utilize the port at a higher speed than the modem connection speed. Data compression works by locating repeated strings of characters and repeating these strings using shorter codewords.

When operating the serial port at a higher speed than the modem baud rate, some type of flow control should be used, otherwise data can be lost. (See ***&E4*** and ***&E5*** commands.)

To enable data compression, type ***AT&E15*** and hit ENTER; to disable data compression, type ***AT&E14*** and hit ENTER.

Note: For data compression to take place, both the answer and the originate modems must have data compression and error correction enabled.

5.4 MNP Classes

The MNP protocol is divided into several levels, or "Classes". The classes you would encounter today in full duplex dial-up in 1200, 2400 and 9600 bps modems are Classes 3 through 5. When modems equipped with MNP start communicating, they will negotiate operation to the highest common MNP class between them and operate at that level.

5.5 V.42 Mode Select Command (#L)

The V.42 Mode Select command (***#L***) selects which type of error correction your MT2834MR will use for transmissions. The V.42 standard implements both MNP Class 3 & 4 and LAP-M error correction protocols, and by executing one of the ***#L*** commands you are instructing your MT2834MR how to operate with each protocol. For example, the factory default setting (***#L0***) tells your MT2834MR to negotiate the protocol with the remote modem, and to prefer MNP 3 & 4.

The following details the operation of the ***#Ln*** command:

1. ***#L0*** Command (factory default setting)

   The ***#L0*** Command allows a pair of modems to negotiate which V.42 mode (MNP or LAP-M) will be used.

   Originate Mode

   a. If both modems have LAP-M capability, the modems will use LAP-M mode.

   b. If one or both modems do not have LAP-M capability and both have MNP, the modems will use the MNP.

   Answer Mode

   a. The answering modem will respond to either an MNP Link Request or LAP-M ODP signal, depending on which is issued by the originating Modem.

2. ***#L1*** Command

   The ***#L1*** Command enables MNP error correction and disables LAP-M. This command is for Originate mode only. Answer mode still accepts MNP or LAP-M.

3. ***#L2*** Command

   The ***#L2*** Command enables LAP-M error correction and disables MNP. This command is for Originate mode only. Answer mode still accepts MNP or LAP-M.

4. ***#L3*** Command

   In the above commands, the modems use a two-phase process to establish a V.42 connection ("Detection" to establish whether the remote modem is also error correcting, and "Protocol Establishment" to determine parameters and establish the error correction connection). If you know that the other modem is a V.42 error correcting modem, and you wish to use LAP-M, the ***#L3*** command to disable the Detection phase and go directly to Protocol Establishment. Both modems must have ***#L3*** in effect.

5.6 Modes of Operation

You can configure your MT2834MR in one of three different V.42 modes of operation (each mode can be with or without compression). These are the Normal, Reliable and Auto-Reliable modes. The modes and data compression features are selected with commands covered in Section 5.13.

Normal Mode (&E0)

In the Normal mode of operation, the MT2834MR's error correction capabilities are disabled, and the modem functions as a normal (non-error-correcting) modem.

Reliable Mode (&E2)

In Reliable mode, the MT2834MR uses its V.42 error correction capabilities during all transmissions. When in Reliable mode, the MT2834MR must be connected to another modem with a similar V.42 protocol activated (MNP or LAPM). If the modems cannot establish a V.42 error correction connection, the modem will time out and hang up.

Auto-Reliable Mode (&E1)

In Auto-Reliable mode, the MT2834MR will, during the handshaking procedures at the start of the on-line connection, automatically determine whether or not the modem with which it is communicating is using the error correction. If the MT2834MR determines that the other modem is using V.42, it will switch itself into the Reliable (V.42) mode of operation. If it is determined that the other modem is not using V.42, the MT2834MR will remain in Normal mode.

The method the MT2834MR uses to determine if the V.42 modem involves the use of a “Link Request”. When the MT2834MR is in Auto-Reliable mode and originates a call, it goes through normal handshaking procedures just like any dial-up modem. After establishing the on-line connection, the MT2834MR transmits a Link Request message to the answering modem. If the answering modem replies with an appropriate V.42 acknowledgment response, the MT2834MR switches into Reliable mode. Otherwise, it will stay in Normal mode. This V.42 handshaking procedure generally takes about five seconds.

When operating in V.42 Reliable mode, the MT2834MR uses its memory, or buffer, to store data as it is received. During periods of error-caused retranmissions or compression slowdowns, this buffer may fill up. To prevent buffer overflow and subsequent loss of data, the modem uses flow control to signal the computer attached to its RS232C port that the modem buffer is close to being full. This causes the computer to pause in its data transmission until the modem is able to empty its buffer sufficiently to accept more data, at which time the modem signals the computer that it may resume transmission.

5.7 Introduction to Flow Control

Flow control refers to the techniques used by computer devices to stop and restart the flow of data from each other. Flow control is necessary so that a device does not receive more data than it can handle. In the case of the MT2834MR, there is a need for flow control in both directions. Flow control for data passing from your computer to the modem is called Modem-Initiated Flow Control and flow control for data passing from the modem to your computer is called Computer/Terminal-Initiated Pacing (see Figure 5-1).

The MT2834MR supports both hardware and software Modem Initiated Flow Control, and, on the Computer/Terminal-Initiated Pacing side, supports hardware and software flow control, and a special version used by Hewlett Packard compatible systems called ENQ/ACK Pacing. The MT2834MR allows hardware and software pacing to be passed through the modem to the other end of the link so that your computer or terminal can control data start/stop activity through your modem. This is called “Xon/Xoff Pass-Through”.

<to be supplied>

Figure 5-1. Flow Control and Pacing

To state it simply, “Flow Control” is something the modem does to the computer, while “Pacing” is something the computer does to the modem.

5.8 Modem-Initiated Flow Control

When operating in the V.42 Reliable mode, the MT2834MR uses its memory, or buffer, to store data as it is received. During periods of error-caused retransmissions or compression slowdowns, this buffer may fill up. To prevent buffer overflow and subsequent loss of data, the modem uses flow control to signal the computer attached to its RS232C port that the modem buffer is close to being full. This causes the computer to pause in its data transmission until the modem is able to empty its buffer sufficiently to accept more data, at which time the modem signals the computer that it may resume transmission.

The MT2834MR gives you two choices for methods of modem-initiated flow control. (You also have a third choice, which is to not use flow control at all.) One choice is “Xon/Xoff”, which uses special characters in the data transmissions. The other is “Hardware Flow Control”, which uses the CTS output

lead on the RS232C interface (Clear to Send - Pin 5). Most terminals and computers support one or both of these methods.

Xon/Xoff Flow Control (&E5)

Xon/Xoff is the most commonly-used method of flow control. Under this method, control characters known as “Xon” and “Xoff” are inserted by the modem into the data to start and stop the flow of data from the computer or terminal to which the modem is attached. Xoff, (CTRL-S), stops the flow of data, and Xon, (CTRL-Q), restarts it. With regards to binary data, Xoff/Xon flow control is not recommended because an Xoff character may be part of the data and would trigger an Xoff of the modem or software package, which would halt data flow.

Hardware Flow Control (&E4)

With Hardware Flow Control, the modem uses its RS232C interface to control the flow of data from the computer or terminal to which it is attached. The CTS (Clear to Send) signal on Pin 5 of the RS232C interface is brought low to stop the flow of data, and is brought high to restart it.

When you select Hardware Flow Control as your Modem-Initiated Flow Control method, you are also selecting it for Pacing. The difference between the two, however, is that Modem-Initiated Flow Control uses the Pin 5 CTS output signal, while Pacing uses the Pin 4 RTS input signal. (Refer to Section 5.9.)

Modem commands are used to select the method of flow control used by the MT2834MR when its error correction capabilities are used. These commands are covered in Section 5.13. If neither method is selected, the modem will default to no flow control.

5.9 Terminal/Computer-Initiated Pacing (&E13)

As mentioned earlier, the MT2834MR can initiate flow control by issuing Xon/Xoff commands or by toggling the CTS signal on the RS232C interface. The modem can also be configured to react to similar commands and signals from the computer or terminal to which it is attached via the RS232C interface.

We refer to computer or terminal initiated flow control as “Pacing”. When the modem is set for Pacing On, the modem responds to the terminal or computer pacing. When the modem is set for Pacing Off, it will ignore pacing.

In order for the MT2834MR to be set for Pacing On, a modem-initiated method of flow control must be previously selected. Once this is done, the MT2834MR will respond to either Xon/Xoff commands, or to the toggling of the RTS (Request to Send) signal on Pin 4 of the RS232C interface, depending on what you selected earlier as your Modem-Initiated Flow Control method.

If you use RTS pacing, be sure that the RTS DIP-Switch is set so that RTS is not forced on (see Section 7.3).

5.10 Xon/Xoff Pass-Through (&E7)

So far, you have had three choices to make regarding pacing. You can set the modem to respond to Xon/Xoff pacing, or to respond to RTS pacing, or you can set the modem to ignore pacing completely.

Another choice you can make (which actually can apply to both pacing and modem-initiated flow control, although it applies mainly to pacing) is called “Xon/Xoff Pass-Through”. This means that if your modem is set to respond to Xon/Xoff commands, you can have the modem do one of the following.

1. The modem responds to the Xon and Xoff pacing commands while at the same time allowing these commands to pass through the modem and on to the remote location. We call this “Respond, Pass-Through”.

2. The modem responds to Xon/Xoff pacing, but does not allow the pacing signals to pass through the modem and on to the remote location. We call this “Respond, No Pass-Through”.

When Xon and Xoff commands are allowed to pass through the modem, the computer (or terminal) at the remote site receives these commands, and depending on how it is configured, the computer (or terminal) may respond to them also.

5.11 Normal Mode Modem Flow Control (&E10 and &E11)

When two MT2834MR's are connected in Normal mode (not using error correction), Xon/Xoff can be used to control the flow of data between the modems. Flow control can be turned on or off with the Normal Mode Modem Flow Control commands. When the modems are connected in Reliable mode, a different method of modem flow control is used, and the commands for Normal Mode Modem Flow Control are ignored.

When using Speed Conversion in Normal mode, you must activate the modem's Normal Mode Modem Flow Control. (Speed Conversion is explained in Section 5.15.)

5.12 Hewlett Packard ENQ/ACK Pacing (&E9)

If the MT2834MR is used with Hewlett Packard (or similar) equipment that employs ENQ/ACK pacing, the modem can be configured to respond to ENQ/ACK commands, making it compatible with HP systems. Doing so does not effect any other flow control or pacing already configured in the modem.

When configured for ENQ/ACK, the ENQ (CTRL-E) and ACK (CTRL-F) signals from the HP equipment will be accepted and responded to according to Hewlett Packard protocol.

5.13 Compression, Error Correction, Flow Control, Pass Through and Pacing Commands

The MT2834MR has a variety of commands to control its error correction and data compression options. These commands are listed below. (Remember to precede each command with the AT characters.)

Normal/Auto-Reliable/Reliable Mode Commands:

&E0 = Normal Mode (prevents any error correction mode)

&E1 = Auto-Reliable Mode* (enables MNP or LAP-M mode)

&E2 = Reliable Mode (MNP or LAP-M mode only)

Modem-Initiated Flow Control Commands:

&E3 = Disables flow control (no flow control)

&E4 = Hardware flow control (CTS on/off and RTS on/off)*

&E5 = Xon/Xoff flow control

Xon/Xoff Pass-Through Commands:

&E6 = Modem responds to Xon/Xoff characters, but does not allow Xon/Xoff characters to pass through to remote site.*

&E7 = Modem responds to Xon/Xoff characters, and allows them to pass through to remote site.

Enq/Ack Pacing Commands:

&E8 = Enq/Ack method of pacing off*

&E9 = Enq/Ack method of pacing on

Normal Mode Modem Flow Control Commands:

&E10 = Normal Mode Modem Flow Control off*

&E11 = Normal Mode Modem Flow Control (Xon/Xoff) on

Computer (or Terminal)-Initiated Flow Control(Pacing) Commands:

&E12 = Pacing off

&E13 = Pacing on (either RTS on/off or Xon/Xoff depending on the setting of ***&E4*** or ***&E5***).*

*Factory default setting

The factory default setting for data compression is enabled, but the modem will not compress data (*&E15***) unless ***&E1*** (auto-reliable mode) or ***&E2*** (reliable mode) is also selected.

Data Compression Commands:

&E14 = Data Compression disabled

&E15 = Data Compression enabled**

*Factory default setting

The factory default setting for data compression is enabled, but the modem will not compress data (*&E15***) unless ***&E1*** (auto-reliable mode) or ***&E2*** (reliable mode) is also selected.

5.14 Error Correction Result Codes

When the MT2834MR is operating with error-correction enabled, five of its responses are altered, to let you know that you have made a connection in Reliable mode. These Result Codes for a V.42 MNP connection are listed below:

Verbose	Terse
CONNECT RELIABLE	1R
CONNECT 1200 RELIABLE	5R
CONNECT 2400 RELIABLE	9R
CONNECT 4800 RELIABLE	11R
CONNECT 9600 RELIABLE	12R
CONNECT 14400 RELIABLE	13R
CONNECT 19200 RELIABLE	19R
CONNECT 21600 RELIABLE	21R
CONNECT 24000 RELIABLE	24R
CONNECT 26400 RELIABLE	26R
CONNECT 28800 RELIABLE	28R
CONNECT 31200 RELIABLE	31R
CONNECT 33600 RELIABLE	33R

The result codes for a V.42 LAP-M connection are listed below:

Verbose	Terse
CONNECT LAPM	1L
CONNECT 1200 LAPM	5L
CONNECT 2400 LAPM	9L
CONNECT 4800 LAPM	11L
CONNECT 9600 LAPM	12L
CONNECT 14400 LAPM	13L
CONNECT 19200 LAPM	19L
CONNECT 21600 LAPM	21L
CONNECT 24000 LAPM	24L

CONNECT 26400 LAPM	26L
CONNECT 28800 LAPM	28L
CONNECT 31200 LAPM	31L
CONNECT 33600 LAPM	33L

These responses replace the *CONNECT* (1), *CONNECT 1200* (5), *CONNECT 2400* (9), *CONNECT 4800* (11), *CONNECT 9600* (12) and *CONNECT 14400* (13) responses that the modem uses when in Normal mode.

When data compression is enabled, the word COMPRESSED (verbose) or letter C (terse) are also added to these responses.

In addition to these responses, the V.42 (Error Correction) LED lights when the modem is in error correction (reliable) mode. The V42 LED flashes on and off when the modem has data compression enabled.

* MNP 5 data compression can only be activated when using V.42 error correction.

5.15 Speed Conversion

This section addresses the speed conversion feature available in the MT2834MR. Speed conversion is a necessary part of data compression since data must be presented to the phone line faster than it can handle data, if compression is to be effective.

Speed conversion allows the MT2834MR to communicate at one speed over the phone line, and at another speed at the RS232C interface. The speed (also referred to here as “bps,” or “baud rate”) can be fixed at the RS232C interface independently of the baud rate of the on-line transmissions.

In addition to data compression, another popular application for speed conversion involves an auto-answer MT2834MR connected to a computer that does not have autobauding capability. This means that the computer must be set at a fixed baud rate, regardless of whether the modem is communicating over the phone line at 300, 1200, 2400, 4800, 9600, 14,400, 19,200, 21,600, 24,000, 26,400, 28,800, 31,200, or 33,600 bps. In this application, speed conversion allows the modem to match its speed to that of an in-calling modem, while at the same time communicating with the attached computer through its RS232C port at a fixed baud rate, which can be preselected at 300, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, or 115,200 bps.

The flow control and pacing methods used between the computer and the modem during speed conversion are the same as those used with the V.42 error correction. The two choices (Xon/Xoff or RTS/CTS) are selected with the ***&E*** commands detailed earlier in this chapter. If you are not using the modem’s V.42 error correction, you must activate modem flow control with a separate command (***&E11***), as explained earlier in Section 5.11.

There are three commands which relate specifically to speed conversion. They are Baud Adjust (***$BA***), Modem Baud Rate (***$MB***) and Serial Port Baud Rate (***$SB***).

$BA ***Baud Adjust***

In typical operations, the MT2834MR will do one of two things regarding speed. It will automatically match the speed (bps rate or “baud rate”) of its RS232C interface and phone line transmissions to that of the terminal or computer to which it is attached as soon as it receives its first ***AT*** command. Or, when in auto-answer mode, it will match its RS232C and transmission speeds to that of the originating modem that called it. This is typical for virtually all of today’s dial-up modems, and is referred to by various names, such as Auto-Speed or Baud Adjust. Here we call it Baud Adjust.

When using speed conversion, set the modem so that it does not adjust its speed at the RS232C serial port, even if the modem does adjust its line transmission speed. To turn Baud Adjust off, type ***AT$BA0*** (where 0 is “zero”).

Note: Do not be misled by the meaning of turning Baud Adjust "off", even though the term "Baud Adjust" sounds like it should mean the same thing as "Speed Conversion". It actually means the opposite:

Turn Baud Adjust off to turn Speed Conversion on.

Turn Baud Adjust on to turn Speed Conversion off.

To turn Baud Adjust on (and Speed Conversion off), enter ***AT$BA1*** and hit ENTER. The modem will now match its RS232C speed to that of the computer, and will adjust its speed to any changes in the computer's speed in the originate mode, or to the speed of the originating modem when it's in the answer mode. With baud adjust on, the speed at which the modem communicates over the phone line is always be the same as the speed at which it communicates via its RS232C serial port.

$MB Modem Baud Rate

The $MB command presets the MT2834MR's transmission baud rate for originate operations, (i.e., the speed of the modem's transmissions over the telephone lines when originating a call). With speed conversion, this transmission speed can be a different baud rate than the serial port speed.

When the MT2834MR receives (answers) a call from another modem, it automatically switches its phone line transmission baud rate to match the calling modem. However, if the MT2834MR originates a call to another modem that is unable to connect at the baud rate of the MT2834MR, the MT2834MR will automatically drop to a lower baud rate in an attempt to match the speed of that modem. For example, if the MT2834MR is set for 33,600 bps and calls another modem that has a top speed of 9600 bps, it will drop to 9600 bps.

To set the Modem Baud Rate, type ***AT$MBn***, where *n* can be 75 (in ITU-T V.23 mode) 300, 1200, 2400, 4800, 9600, 14,400, 19,200, 24,000, 28,800, or 33,600 bps as listed below:

AT$MB75 = ITU-T V.23
AT$MB300 = 300 bps
AT$MB1200 = 1200 bps
AT$MB2400 = 2400 bps
AT$MB4800 = 4800 bps
AT$MB9600 = 9600 bps
AT$MB14400 = 14400 bps
AT$MB19200 = 19200 bps
AT$MB24000 = 24000 bps
AT$MB28800 = 28800 bps
AT$MB33600 = 33600 bps

The factory default setting is 33,600 bps.

If Baud Adjust is on (***$BA1***), speed conversion is off, as we discussed earlier. This means that the ***$MB*** command is also ignored, since it is part of speed conversion.

$SB Serial Port Baud Rate

The ***$SB*** command presets the speed of the MT2834MR's serial (RS232C) port, in both the originate and answer modes. Speed conversion allows you to set this serial port baud rate at a fixed speed of up to 115,200 bps, regardless of the modem's transmission speed setting.

For this command to work, the modem's Baud Adjust feature must first be turned off with the ***$BA*** command.

In addition to the MT2834MR's serial port speed being set by this command, the default speed at which the modem issues Command mode responses (result codes) is also set.

The MT2834MR will accept ***AT*** commands at any speed, regardless of the speed preset by the ***$SB*** command. If the modem receives such a command at a speed that is different than the preset speed, the modem will switch its serial port baud rate to match the new ***AT***

command speed, although the baud rate value stored by the ***$SB*** command will remain the same. This provides you with a convenient way to switch the serial port speed, while still making it easy to go back to the original speed automatically the next time the modem is powered up or reset with an ***ATZ*** command.

To set the Serial Port Baud Rate, type ***AT$SBn***, where n can be 300, 1200, 2400, 4800, 9600,19,200, 38,400, 57,600, or 115,200 bps as listed below:

AT$SB300 = 300 bps
AT$SB1200 = 1200 bps
AT$SB2400 = 2400 bps
AT$SB4800 = 4800 bps
AT$SB9600 = 9600 bps
AT$SB19200 = 19200 bps
AT$SB38400 = 38400 bps
AT$SB57600 = 57,600 bps
AT$SB115200 = 115,200 bps

The factory default setting is 57,600 bps.

5.16 Related Commands

$A Auto-Reliable Buffering

In Auto-Reliable mode, the modem is given four seconds to establish a Reliable connection. After the four seconds, the modem will drop to Normal mode. Any data received during this period is normally discarded. The ***$A*** command is used to cause the modem to buffer (save) data that is received during the Auto-Reliable time-out period. This data is then output by the modem after the *CONNECT* message.

Type ***AT$A0*** to discard data received during the Auto Reliable time period.

Type ***AT$A1*** to buffer data received during the Auto Reliable time period.

The factory default setting is ***$A0***.

&BS Maximum Block Size

The maximum size of Reliable mode data blocks is controlled with the ***&BS*** command. MNP Class 3 sends blocks of 1 to 64 characters. MNP Classes 4 and 5 normally send blocks of 1 to 256 characters. Reducing the block size for Classes 4 and 5 to 64 characters may give a smoother flow of data, and better throughput performance on noisy phone lines. Using smaller block sizes over good phone lines may cause a slight loss in data throughout speed.

Type ***AT&BS0*** for a maximum transmit block size of 64 characters.

Type ***AT&BS1*** for a maximum transmit block size of 256 characters.

The factory default setting is ***&BS1***.

$F Enable/Disable Auto-Reliable Fallback Character

In Auto-Reliable mode, the modem is given four seconds to establish a Reliable connection. If a single CARRIAGE RETURN is received from the remote modem during this four second period, the Auto-Reliable modem will assume that the remote modem is not in Reliable mode and will drop to a Normal connection. The CARRIAGE RETURN character will then be output following the *CONNECT* message. The CARRIAGE RETURN is the only character which will cause the modem to drop to Normal mode. Any other data will either be buffered or discarded.

The ***$F*** command is used to disable this fallback-to-Normal-due-to-CARRIAGE-RETURN feature. The Auto-Reliable fallback character (***$F***) and the auto reliable buffering (***$A***)

commands can be used together to cause the modem to buffer all data received up until the CARRIAGE RETURN and then drop to Normal mode. All data received will then be output following the *CONNECT* message.

Type ***AT$F0*** to cause the modem to not fall back to normal connect if a CARRIAGE RETURN is received.

Type ***AT$F1*** to cause the modem to fall back to normal connect if a CARRIAGE RETURN is received.

The factory default setting is ***$F1***.

#P ***Parity Selection***

The ***#P*** command enables the setting of Callback modem parity for the prompt message sent by the Callback modem. ***AT#P0*** selects no parity. ***AT#P1*** selects odd parity. ***AT#P2*** selects even parity.

The factory default setting is ***#P0***.

$R ***Retransmit Count***

If errors are received during a Reliable connection, the modem will resend the block of data which contained errors. If another error occurs, the block will be re-sent again. The modem counts the number of times that a data block is resent. If the same block of data is resent 12 times and still has not been received properly, the modem will abort the connection, as dictated by the ***AT$R0*** command.

This retransmit counter can be disabled with the ***$R1*** command. When the retransmit counter is disabled, the modem will keep trying to send data and will not abort, not matter how many times the same block is resent.

Type ***AT$R0*** to disconnect if the retransmit count is exceeded.

Type ***AT$R1*** to not disconnect due to excessive retransmits.

The factory default setting is ***$R0***.

$E ***V.42 Error Correction at 300 bps***

At 300 bps, error correction is not normally used. ***$E1*** lets the MT2834MR to function in either Normal (***&E0***), Auto-Reliable (***&E1***) or Reliable (***&E2***) mode. ***$E0***, which is the factory default setting, disables V.42 error correction altogether.

5.17 Summary

This chapter has covered the commands necessary for the MT2834MR to operate as a V.42 device. Briefly, we'll summarize these sections here. If something here doesn't seem clear, now may be a good time to refer to the appropriate section.

V.42 error correction is built into the MT2834MR's hardware, and detects virtually 100% of transmission errors, which are usually caused by noisy phone lines. When errors are detected, the V.42 protocol causes the modem to retransmit the errant data block.

V.42bis and MNP data compression, also built into the MT2834MR's hardware, provides an effective throughput higher than the modem's bps transmission speed. The amount of increase depends on the type of data being transmitted.

The MNP protocol is divided into several "classes", which for our purposes are numbered 3 through 5. The MT2834MR uses all of these MNP classes, which yields a higher throughput and error free transmissions. LAP-M provides another type of error correction.

The MT2834MR can be set for three different modes of operation, along with activating data compression in Reliable mode. Normal mode disables error correction, Reliable mode enables it, and Auto-Reliable mode allows the modem to automatically turn V.42 on when it detects its use in another modem.

Flow control methods are used by the MT2834MR to prevent data loss from buffer overflow. The modem can both initiate it (“flow control”) and respond to it (“pacing”), using either Xon/Xoff commands or RS232C signaling via CTS (from the modem) or RTS (from the computer or terminal). Hewlett Packard ENQ/ACK pacing is also supported. If needed, Xon/Xoff commands can be “passed through” the modem to a remote computer or terminal.

The MT2834MR’s speed conversion feature allows it to operate at one speed over the telephone lines and another speed at the RS232C serial port. This allows the computer or terminal to communicate with the modem at a fixed speed of up to 115,200 bps, while the modem operates at various speeds up to 28,800 bps. This ability is vital if data compression is to be effective (your terminal or computer must present data to the phone line at a higher speed than which the modem is sending it over the phone line).

This concludes what is probably the most difficult chapter in this manual, covering techniques that bewilder many modem users. If you feel that you have mastered these concepts of Error Correction, Data Compression, and Speed Conversion, congratulations!

6.1 Introduction

Each time you power up the MT2834MR, it performs an automatic self- test to ensure proper operation. The MT2834MR also has four diagnostic test features: Local Analog Loopback, Digital Loopback (remote/automatic), Digital Loopback (local/manual) and a modem Back-to-Back test.

The CCITT V.54 Loopback Testing capability supports telephone circuit and transmission problem isolation. If Pin 8 on the RS232 interface goes high, the MT2834MR goes into analog loopback mode.

Other tests are initiated with the **MultiCommManager** Software as explained in the **MultiCommManager** Owner's Manual.

A loopback test involves entering data from your PC and looping that data through the circuits of your modem and/or a remote modem. When the loop has been completed, the original data entered should match the data received back on your PC's monitor after the test.

The Local Analog Loopback Test allows you to verify that the modem's transmitter and receiver circuits are functioning properly.

The Digital Loopback Test (local/manual) allows you to verify that the remote computer or terminal, the remote modem, serial ports, the telephone line and the local modem are functioning properly.

The Digital Loopback Test (remote/automatic) allows you to verify that the local computer or terminal, the two modems and the transmission line between them are functioning properly.

The Back-to-Back test lets you connct two MT2834MRs with a back-to-back cable to verify proper modem operation.

In asynchronous mode, upon completion of testing, enter either Escape Sequence, ***+++AT<CR>*** or ***<BREAK>AT<CR>***.

Note: All loopback tests will operate at all speeds except 300 bps.

6.2 Local Analog Loopback Test/V.54 Loop 3

In this test, data from your computer or terminal is sent to your modem's transmitter, converted into analog form, looped back to the receiver, converted into digital form and then received back at your monitor for verification. No connection to the phone line is required. See Figure 6-1.

<to be supplied>

Figure 6-1. Local Analog Loopback Test

The test procedure is as follows:

1. Disable Error Correction by typing the ***&E0*** command.
2. Connect the modem to your computer. With your communication software, set the desired baud rate.
3. Type ***ATU0*** **(or *ATU*)** and hit ENTER. This places your modem in Analog Loopback mode, in the Originate mode. The modem is now out of the Command mode and in a pseudo On-Line mode.
4. Once you receive a connect message (if responses are enabled), enter data from your keyboard. For this test, typing multiple upper case "U" characters is a good way to send an alternating test pattern of ones and zeros.
5. For a more complete test, you should also test the modem in Answer mode. To do this, you must "escape" from Originate mode by entering an Escape Sequence (***+++AT<CR>*** or ***<BREAK>AT<CR>***) . Then type ***ATU1*** and hit ENTER to place the modem in Analog Loopback mode, in the Answer mode. Then repeat step 3.
6. When testing is completed, you may exit Answer mode by entering an Escape Sequence (***+++AT<CR>*** or ***<BREAK>AT<CR>***), which returns the modem to Command mode.
7. Your modem passes this test if the data entered from your keyboard is the same as the data received on your monitor. If different data is appearing on your monitor, your modem is probably causing the problem, although it could also be your computer. If your modem passes this test, but you are receiving errors while On-line, the remote modem or the phone line could be at fault.

6.3 Digital Loopback Test/V.54 Loop 2 (Local/Manual)

In this test, your modem must be On-Line with another modem that can respond to a request for Digital Loopback, such as another MT2834MR. The Digital Loopback Test is an on-line test that loops data sent from one modem across the phone line to another modem, then back to the first modem. See Figure 6-2.

There are two ways to put a modem into Digital Loopback mode.

1. Locally or Manually, described here in section 6.3.
2. Remotely or Automatically, see section 6.4.

Note: The Digital Loopback Tests can only be used with the modem in Normal mode (error correction off).

<to be supplied>

Figure 6-2. Digital Loopback Test (local/manual)

In this test the local modem is placed in Digital Loopback mode. Data is entered and transmitted from the remote modem (which is not in digital loopback mode), sent across the phone line to the local modem and looped back to the remote modem.

The test procedure is as follows:

1. Disable Error Correction by typing the ***&E0*** command.
2. Go into Terminal mode. Type ***AT*** and hit ENTER; you should get an *OK* message.
3. Dial the remote modem by entering the Dial command and the phone number, to establish On-line mode.
4. Type the Escape Sequence (***+++AT<CR>*** or ***<BREAK>AT<CR>***) which brings your modem into Command mode, while still maintaining the pseudo On-line mode with the remote modem.
5. Type ***ATU3*** from the local PC and hit ENTER. Once you receive an *OK* message from your modem (if responses are enabled), the local modem is placed in Digital Loopback mode.
6. Data is typed from the remote keyboard. For this test, typing multiple upper case "U" characters is a good way to send an alternating test pattern of ones and zeros. The data received by the local modem will enter its analog receiver, be converted to digital data, be reconverted into analog, and then looped through its transmitter back to the remote modem. Your modem passes this test if the data entered from the remote keyboard is the same as the data received on the remote monitor.
7. When testing is complete, you may end the test by typing an Escape Sequence (***+++AT<CR>*** or ***<BREAK>AT<CR>***) to bring your modem into Command mode. The modem should respond with an *OK* message. If you wish to stay On-line with the remote modem for normal data transmission, type ***AT0*** and hit ENTER. If you wish to terminate the call, type ***ATH*** and hit ENTER to hang up.

6.4 Digital Loopback Test/V.54 Loop 2 (Remote/Automatic)

In this test, your modem must be On-line with another modem set up to respond to a request for Digital Loopback, such as another MT2834MR. With the MT2834MR, this ability to respond is controlled by the ***&T*** command. ***AT&T4*** enables the response to Digital Loopback Test (remote/automatic). ***AT&T5*** disables the response. The modem defaults to disable on power up, so this must be changed on the remote modem before the modem will respond to a request for the Digital Loopback Test (remote/automatic).

Initiate the Digital Loopback Test (remote/automatic) with the ***ATU2*** command which automatically places the remote modem in digital loopback mode. Data from your computer or terminal are transmitted through your modem, and over the phone line to the remote modem, where they are then looped back to your modem. See Figure 6-3.

The test procedure is as follows:

1. Disable Error Correction by typing the ***&E0*** command.
2. Go into Terminal mode. Type ***AT*** and hit ENTER; you should get an *OK* message.
3. Dial the remote modem by entering the Dial command and the phone number, to establish On-line mode.

Note: The ***&T4*** command must be set on the remote modem to run this test.

<to be supplied>

Figure 6-3. Digital Loopback Test (remote/automatic)

4. Type the Escape Sequence (***+++AT<CR>*** or ***<BREAK>AT<CR>***) which brings your modem into Command mode, while still maintaining the connection with the remote modem.
5. Type ***ATU2*** and hit ENTER. The local modem responds to this command by transmitting an unscrambled marking signal, which causes the remote modem to place itself in Digital Loopback mode. Then the local modem exits Command mode and enters pseudo On-line mode.
6. Type data from your keyboard. For this test, typing multiple upper case "U" characters is a good way to send an alternating test pattern of ones and zeros. The data received by the remote modem will enter its analog receiver, be converted to digital data, be reconverted into analog, and then looped through its transmitter back to the local modem. Your modem passes this test if the data entered from the local keyboard is the same as the data received on your monitor.

6.5 Back-to-Back Test

This test lets you connect two MT2834MRs with an RJ11 cable to verify proper operation. Using a MT2834MR that is known to be operational, you can test a second MT2834MR that is suspect.

1. Plug the modular ends of an RJ11 cable into both MT2834MR's LINE jack connectors.
2. Force DTR ON in both local and remote modems (Switch #1 DOWN).
3. Enter the command ***AT$SB9600$BA0&W0<CR>*** on both local and remote modems. This sets the serial speed to 9600bps. Make sure that the terminal/computer is set for 9600 bps.
4. Set both modems in Leased-Line mode (DIP-Switch # 10 DOWN).
5. Set one MT2834MR to Answer enabled (DIP-Switch #5 UP) and the other MT2834MR to Originate enabled (DIP-Switch #5 DOWN). Note it does not matter which modem (local/remote) is set to Answer/Originate --just so they are set opposite.
6. Set DIP-Switch # 3 UP on both local and remote modems. This changes the transmit level to -10dB and this change is necessary to operate in back-to-back mode
7. Turn on both units and wait for carrier detect (CD).
8. Short out pins 2 and 3 on the RS2332C interface on the remote modem (i.e., with a paper clip or some other metal device), see figure 6-4.

<to be supplied>

Figure 6-4. Shorting Pins 2 and 3 on the RS232 Interface

9. Entered characters should echo back to the sending modem.

6.6 Synchronous Mode Testing

The following tests must be run with your modem in Synchronous mode (DIP Switch #12 in the Up (OPEN) position), DIP Switch #9 controls the modem's Synchronous mode testing function. (Refer to Chapter 9 for DIP Switch information.) The test procedures for Synchronous mode are different from those for Asynchronous mode. In Synchronous mode, you cannot access the modem's AT commands.

With DIP Switch #9, you can perform either the Digital Loopback Test (remote/automatic) or the Digital Loopback Test (local/manual) in Synchronous mode, as described in the following sections. There is also a Local Analog Loopback Test, documented in section 6.7.

6.7 Local Analog Loopback Test (Sync. Mode)

This test diagnoses the connection between your MT2834MR and your computer or terminal. In Local Analog Loopback Test mode, data entered at the local computer or terminal are sent through the local modem's transmit and receive circuits (much like entering an ***ATU*** or ***ATU1*** command in Asynchronous mode). You then compare the test characters (multiple upper case "U" characters in Figure 6-5) on your monitor with the characters you typed. If the characters don't match, check your computer's COM port setting, then verify your communication software's configuration.

To initiate the Local Analog Loopback Test, with the modem in Synchronous mode:

1. Enter ***AT&M1U***. This first switches your modem form asynchronous to synchronous mode, and places it into the Analog Loopback/Originate mode. The modem is now out of the Command mode and in the pseudo On-Line mode.
2. Once you receive a connect message (if responses are enabled), enter data from your keyboard. For this test, typing multiple upper case "U" characters is a good way to send an alternating test pattern of ones and zeros.
3. For a more complete test, you should also test the modem in Answer mode. To do t his, Type the Escape Sequence (***+++AT<CR>*** or ***<BREAK>AT<CR>***) which brings your modem into Command mode, while still maintaining the connection. Then type ***AT&M1U1*** and hit ENTER to place the modem in Analog Loopback mode, in the Answer mode. Then repeat step 2.

<to be supplied>

Figure 6-5. Local Analog Loopback Test (Synchronous Mode)

6.8 Digital Loopback Test (Local/Manual) (Synchronous Mode)

This test must be run when you have a data connection with another modem. If a Local Analog Loopback Test resulted in errors, and this test passes without errors, then the problem exists in your computer-to-modem connection. In Digital Loopback Test (local/manual) mode, data passed from the remote modem's transmit circuit are looped back from the local modem and are received at the remote modem's receive circuit (multiple upper case "U" characters in Figure 6-6).

First make certain that you are set up for Synchronous operation by placing DIP-Switch #12 in the UP position. To initiate the Digital Loopback Test (local/manual), DIP-Switch #9 must be in the UP position, and the Answer/Orignate switch (front of the modem) must be toggled to the UP position. Once you receive an *OK* message from your modem (if responses are enabled), the local modem is placed in Digital Loopback mode.

To exit the Digital Loopback Test (local/manual), toggle the Answ/Orig switch to the Answer position.

<to be supplied>

Figure 6-6. Digital Loopback Test (local/manual) (Synchronous Mode)

6.9 Digital Loopback Test (Remote/Automatic) (Synchronous Mode)

This test must be run when you have a data connection with another modem. In this test, data is passed to the remote modem and is looped back to the local modem (as if an ***ATU2*** command was issued in Asynchronous test mode), as shown in Figure 6-7. This lets you test the local and remote modem's transmit and receive circuits, as well as your computer's serial COM port and the phone lines. If the test results in a mismatch of entered/received data (multiple upper case "U" characters in Figure 6-6), the Local Analog Loopback Test should be performed on both the remote and local modems. If that test is successful, the problem may be the phone lines.

First make certain that you are set up for Synchronous operation by placing DIP-Switch #12 in the UP position. To initiate the Digital Loopback Test (remote/automatic), DIP-Switch #9 must be in the DOWN position, and the Answer/Orignate switch (front of the modem) must be toggled to the UP position. Once you receive an *OK* message from your modem (if responses are enabled), the local modem is placed in Digital Loopback mode. To exit the Digital Loopback Test (remote/automatic), toggle the front panel Answ/Orig switch to the Answer position.

<to be supplied>

Figure 6-7. Digital Loopback Test (remote/automatic) (Synchronous Mode)

7.1 Introduction

There are 3 sets of DIP-Switches and 3 two-position jumpers on the MT2834MR card. To remove the MT2834MR modem card from the CC4800 rack, pull the ejector levers away from the rack (if necessary loosen the retaining screw first), then carefully slide the modem card out of the rack.

The DIP-Switches are used to enable or disable various user-selectable options. Each DIP-Switch is set to a factory default setting that is useful in most applications. Each set of DIP-Switches is labeled with a number and can be set to either the UP (marked “OPEN”) or Down position. The individual switches can easily be set with your fingernail or a pencil tip.

Note: Before changing any DIP-Switches on the MT2834MR, please consult your **MultiCommManager** software manual. Many of these options can be controlled by the software.

Each of the 3-pin (two-position) jumpers is used to select options. They are also pre-set to factory default settings that should be effective for your application. The default setting can be easily changed to an option setting by removing the shorting plug and replacing in the option position.

The following sections detail the function of each DIP-Switch and jumper located on the MT2834MR PC board.

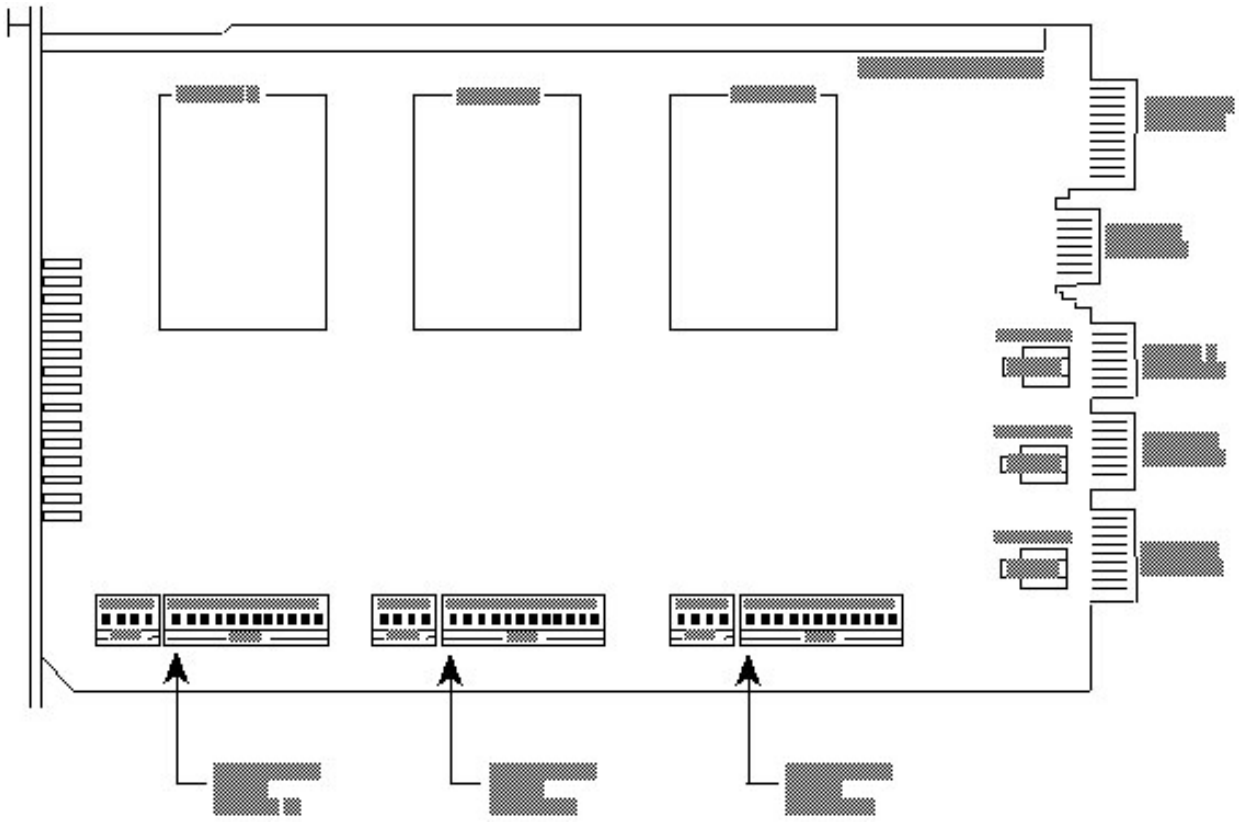


Figure 7-1. Location of PC Board Controls

7.2 16-Position DIP-Switches

The MT2834MR PC board contains three pairs of DIP-Switch blocks. Each pair of DIP-Switch blocks is numbered 1-12 and 13-16, and each pair of DIP-Switch blocks is related to each of the three on-board modems, as shown below.

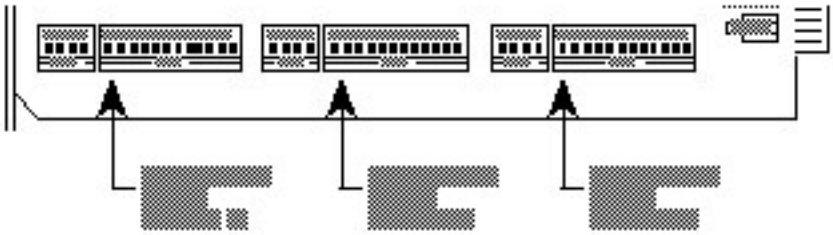


Figure 7-2. DIP-Switches

7.3 16-Position DIP-Switch Settings

Each individual switch, numbered 1-12 and 13-16, and can be set to either the Up (marked “OPEN”) or Down position. Each of these DIP-Switches controls the following functions for its corresponding on-board modem.

7.3.1 DIP-Switches #1 - #12

Switch #1
Forced DTR - “DTR”
(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

The MT2834MR must have a high DTR signal in order to operate. This signal is provided to each modem by the terminal or computer to which it is attached, through the RS232/V.24 interface on pin 20. If your terminal is not providing DTR to the modem, you can force the DTR signal DIP-Switch #1.

DTR function normally = Switch #1 UP
DTR forced ON = Switch #1 DOWN

(Factory Default Setting = UP)

Switch #2
Flow Control - &E4/&E5
(Asynchronous Mode/Leased Line/Dial-Up)

With Hardware Flow control, the modem uses its RS232C/V.24 interface to control the flow of data from the computer or terminal to which it is attached. CTS signal on Pin 5 of the RS232C/V.24 is brought low to stop the flow of data, and is brought high to restart it. Place DIP-Switch #2 in the UP position to enable Hardware Flow control (&E4). Xon/Xoff Flow control (&E5) is another method of flow control in which Xon/Xoff characters in the data dictates the start and stop of data flow from the computer or terminal. Place DIP-Switch #2 in the DOWN position to enable Xon/Xoff Flow control.

Hardware Flow Control (&E4) = Switch #2 UP
Xon/Xoff Flow control (&E5) = Switch #2 DOWN

(Factory Default Setting = UP)

Switch #2
SDLC/BSC Selection
(Synchronous Mode/Leased Line/Dial-Up)

Synchronous Data Link Control (SDLC) and Binary Synchronous Control (BSC) are two error correction protocols used in the IBM Mainframe environment. Place DIP-Switch #2 in the UP position to select SDLC mode. Place DIP-Switch #2 in the DOWN position for BSC mode.

SDLC Mode = Switch #2 UP
BSC Mode = Switch #2 DOWN

(Factory Default Setting = UP)

Switch #3
Enable/Suppress Responses - "Q"
(Asynchronous Mode/Dial-Up)

In some applications in Asynchronous mode, you may want to suppress all responses from the modem. Place DIP-Switch #3 in the DOWN position to enable result code responses (Q0). Place DIP-Switch #3 in the UP position for answer mode without responses and echo off, (but with originate still intelligent)(Q2).

Enable Responses: Originate/Answer (Q0)
= Switch#3 DOWN
Suppress Responses: Answer (Q2)
= Switch #3 UP

(Factory Default Setting = DOWN)

Switch #3
dB Transmission Levels
(Asynchronous/Synchronous Mode/Leased Line)

The MT2834MR can adjust to dB transmission levels required by some phone carriers. With DIP-Switch #3 in the DOWN position, the MT2834MR transmits at 0 db. With DIP-Switch #3 in the UP position, transmission is at -15dB.

0dB Transmission = Switch #3 DOWN
-15dB Transmission = Switch #3 UP

(Factory Default Setting = UP)

Note: dB transmission levels on International models may be different from those values shown above.

Note: Switch #3 has no effect in leased line mode in the MT2834MRK.

Switch #4
AS/400 Mode
(Synchronous Mode/Leased Line/Dial-Up)

The MT2834MR can function in an IBM AS/400 environment. Place DIP-Switch #4 in the DOWN position to cause the MT2834MR to operate via IBM command set.

Place DIP-Switch #4 in the UP position to disable AS/400 mode

Note: The MT2834MR must be in Command mode to allow AS/400 mode operation).

AS/400 Mode Enabled = Switch #4 DOWN
AS/400 Mode Disabled = Switch #4 UP

(Factory Default Setting = UP)

Switch #4
UNIX UUCP Spoofing
(Asynchronous Mode/Leased Line/Dial-Up)

The MT2834MR can be used with UNIX equipment which employs ACK flow control to monitor data integrity. The MT2834MR can do UUCP “spoofing”, where the modem is able to generate ACKs at the DTE interface. Data is then transmitted more time-efficiently, because the delay of waiting for data to be received then for the ACK to be returned at the remote end is eliminated. Place DIP-Switch #4 in the DOWN position to enable UUCP spoofing.

UUCP Spoofing Enabled = Switch #4 DOWN
UUCP Spoofing Disabled = Switch #4 UP

(Factory Default Setting = UP)

Switch #5
Disable Auto-Answer - “Ans”
(Asynchronous Mode/Synchronous Mode/Dial-Up)

In some originate-only applications, you may wish to disable the MT2834MR’s automatic answering capabilities. This may be true if you have a telephone set attached to a modem and wish to receive voice calls that you yourself would answer instead of the modem.

Auto-Answer Enabled = Switch #5 UP
Auto-Answer Disabled = Switch #5 DOWN

(Factory Default Setting = UP)

Switch #5
Originate/Answer Mode
(Asynchronous/Synchronous Mode/Leased Line)

The MT2834MR can function in either Originate mode or Answer mode. To enable Answer mode, place DIP-Switch #5 in the UP position. To enable Originate mode, place DIP-Switch #5 in the DOWN position.

Origination Enabled = Switch #5 DOWN
Answer Enabled = Switch #5 UP

(Factory Default Setting = UP)

Switch #6
Maximum Throughput Setting
(Asynchronous Mode/Leased Line/Dial-Up)

In some applications, you may want to dial into services with maximum throughput on. Other applications require maximum throughput off (e.g., service not supporting error correction, or the V.42 handshake interferes with logon sequence). Switch #6 controls three important parameters, which in effect enable or disable maximum throughput (error correction, speed conversion and serial port speed).

Maximum Throughput Enabled = Switch #6 UP

Maximum Throughput Disabled = Switch #6 DOWN

(Factory Default Setting = UP)

Switch #6
Slave Clocking
(Synchronous Mode/Leased Line/Dial-Up)

In Synchronous mode, DIP-Switch #6 controls the timing at the receive clock. The originating side, in effect, adjusts to the timing at the remote (“slave”) side.

Slave Clocking Enabled = Switch #6 DOWN
Slave Clocking Disabled = Switch #6 UP

(Factory Default Setting = UP)

Switch #7
Request To Send Forced - “RTS”
(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

If your computer or terminal uses RTS-CTS protocol (normally used in synchronous applications, but also if you are using hardware pacing for V.42 error correction or speed conversion), you may want to switch RTS to function independent of CTS (DIP-Switch #7 UP). For most applications, especially asynchronous, Switch #7 should be set so that RTS is forced on (DIP-Switch #7 DOWN).

RTS functions Normally = Switch #7 UP

RTS forced ON = Switch #7 DOWN

(Factory Default Setting = DOWN)

Switch #8
Enable/Disable Command Mode - “Com”
(Asynchronous/Synchronous Mode/Leased/Dial-Up)

In some applications you may want to disable Command mode so that the modem will not recognize or react to AT or any other commands. This may be true in strictly auto-answer applications where no call origination will be required. DIP-Switch #8 enables or disables the modem’s ability to recognize Command mode characters. The factory default setting is Command mode enabled.

Disable Command Mode = Switch #8 UP
Enable Command Mode = Switch #8 DOWN

(Factory Default Setting = DOWN)

Switch #9
No function.

Switch #10
Leased Line/Dial-Up Operation - "DDD"
(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

The MT2834MR can operate in both leased-line or dial-up modes. This switch controls leased-line/dial-up operation. For dial-up operation, place DIP-Switch #10 in the UP position. For leased-line operation, place DIP-Switch #10 in the DOWN position.

Dial-Up Operation = Switch #10 UP
Leased Line Operation = Switch #10 DOWN

(Factory Default Setting = UP)

Switch #11
"AT" Responses/Multi-Tech Responses
(Asynchronous Mode/Leased Line/Dial-Up)

In Asynchronous mode (DIP-Switch #12 DOWN), the MT2834MR responds with result codes according to the Multi-Tech command response set or with the "AT" command response set (DIP-Switch #11 in the UP position). The &Q command performs the same function of choosing AT or Multi-Tech responses and is explained further in Chapter 5.

"AT" Responses (&Q1) = Switch #11 UP
Multi-Tech Responses (&Q0) = Switch #11 DOWN

(Factory Default Setting = DOWN)

For more information on Result Codes, refer to Chapter 3.

Switch #11
Internal/External Clocking
(Synchronous Mode/Leased Line/Dial-Up)

With the MT2834MR in Synchronous Mode, the transmit clock can be supplied by the DTE on pin 24 of the RS232C/V.24 interface by DIP-Switch #11 positioned UP. DIP-Switch #11 in the DOWN position enables the DCE to control clocking.

External Clock (pin 24) = Switch #11 UP
Internal Clock (pins 15/17) = Switch #11 DOWN

(Factory Default Setting = DOWN)

Switch #12
Asynchronous/Synchronous Operation - "Sync"
(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

The MT2834MR can operate in both asynchronous mode and synchronous mode. When in synchronous mode, start and stop bits are eliminated. The modem's internal clock circuits on the RS232C/V.24 pins 15 and 17, are activated. The MT2834MR's Command Mode will not be accessible in the synchronous mode. For synchronous operation, you may want to set the RTS forcing and CTS forcing DIP-Switches so that both of signals act normally (not forced on).

Synchronous Operation = Switch #12 UP
Asynchronous Operation = Switch #12 DOWN

(Factory Default Setting = DOWN)

7.3.2 DIP-Switches #13 - #16

Switches #13 and #14 - Speed Selection

DIP-Switches #13 and #14 are used for speed selection (mainly in call origination leased line applications).

	DIP-Switch	
28800 bps Operation	**#13**	**#14**
	UP	UP
19200 bps Operation	**#13**	**#14**
	DOWN	UP
14400 bps Operation	**#13**	**#14**
	UP	DOWN
9600 bps Operation	**#13**	**#14**
	DOWN	DOWN

NOTE: The modem baud rate command, $MB, overrides the setting of DIP-Switches #13 - #14.

Switch #15
Carrier Detect/DSR Source - "DSR"
(Asynchronous/Synchronous Mode/Dial-Up/Leased Line)

Some terminals react in unusual ways to the toggling of the Carrier Detect (CD - RS232C/V.24 pin 6) signals. The most common symptom is that the modem will not respond to commands, or will not echo characters. In these cases, force these two signals On in order for the terminal to communicate properly with the modem when the modem is in Command mode by placing DIP-Switch #15 in the DOWN position. With Switch #15 UP, the state of the CD and DSR signals depend on the On-Line status.

CD and DSR normal = Switch #15 UP
CD and DSR forced On = Switch #15 DOWN

(Factory Default Setting = UP)

Switch #16
2-Wire/4-Wire Leased Line
(Asynchronous/Synchronous Mode/Leased Line)

2-Wire Leased Line = Switch #16 UP
4-Wire Leased Line = Switch #16 DOWN

(Factory Default Setting = DOWN)

7.4 Jumper Settings

The MT2834MR has three two-position jumpers (one for each modem) for OOS and service. Each set of OOS jumpers defines pin 25 of the RS232C/D interface as an input (OOS) or an output (Test Mode) for one of the three modems. Each is set to a default of OOS (U.S.); international models have a default setting of Test Mode.

There is also a factory-set selection for MI/MIC (modified dial-up phone line interface that allows dialing by an external device such as an 801 Dialer, computer or PBX/CBX system dialer).

7.4.1 ATEST/AV54 Jumper (S105)

Jumper S105 sets pin 25 of Modem A as input (OOS) for the default and output (Test Mode) as the option setting on domestic (US) modems. On international modems, Jumper S105 sets pin 25 of Modem A as input (OOS) for the option, and output (Test Mode) as the default setting. The location of these jumpers can be seen in Figure 7-1 on the right-hand side of the board.

For Modem A:

ATEST/AV54 Pin 25 Output (OOS) (MT2834MR Default)

ATEST/AV54 Pin 25 Input (Test Mode) (MT2834MRI Default)

7.4.2 BTEST/BV54 Jumper (S205)

Jumper S205 sets pin 25 of Modem B as input (OOS) for the default and output (Test Mode) as the option setting on domestic (US) modems. On international modems, Jumper S205 sets pin 25 of Modem B as input (OOS) for the option, and output (Test Mode) as the default setting.The location of these jumpers can be seen in Figure 7-1 on the right-hand side of the board.

For Modem B:

BTEST/BV54 Pin 25 Output (OOS) (MT2834MR Default)

BTEST/BV54 Pin 25 Input (Test Mode) (MT2834MRI Default)

7.4.3 CTEST/CV54 Jumper (S305)

Jumper S305 sets pin 25 of Modem C as input (OOS) for the default and output (Test Mode) as the option setting on domestic (US) modems. On international modems, Jumper S305 sets pin 25 of Modem C as input (OOS) for the option, and output (Test Mode) as the default setting. The location of these jumpers can be seen in Figure 7-1 on the right-hand side of the board.

For Modem C:

CTEST/CV54 Pin 25 Output (OOS) (MT2834MR Default)

CTEST/CV54 Pin 25 Input (Test Mode) (MT2834MRI Default)

8.1 Introduction

This chapter starts out with statements about your modem's 2-year warranty. The next section, Tech Support, should be read carefully if you have questions or problems with your modem. It includes the technical support telephone numbers, space for recording your modem information, and an explanation of how to send in your modem should you require service. The final sections explains ourweb presence.

8.2 Limited Warranty

Multi-Tech Systems, Inc. ("MTS") warrants that its products will be free from defects in material or workmanship for a period of two years from the date of purchase, or if proof of purchase is not provided, two years from date of shipment.

MTS MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

This warranty does not apply to any products which have been damaged by lightning storms, water, or power surges or which have been neglected, altered, abused, used for a purpose other than the one for which they were manufactured, repaired by the customer or any party without MTS's written authorization, or used in any manner inconsistent with MTS's instructions.

MTS's entire obligation under this warranty shall be limited (at MTS's option) to repair or replacement of any products which prove to be defective within the warranty period, or, at MTS's option, issuance of a refund of the purchase price. Defective products must be returned by Customer to MTS's factory transportation prepaid.

MTS WILL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES AND UNDER NO CIRCUMSTANCES WILL ITS LIABILITY EXCEED THE PURCHASE PRICE FOR DEFECTIVE PRODUCTS.

8.3 Tech Support

Multi-Tech has an excellent staff of technical support personnel available to help you get the most out of your Multi-Tech product. If you have any questions about the operation of this unit, call (800) 972-2439 (U.S.A. or Canada) or (763) 785-3500 (Local or International). Please fill out the modem information (below), and have it available when you call. If your modem requires service, the tech support specialist will tell you how to send in your modem (see Section 8.4).

8.3.1 Recording Modem Information

Please fill in the following information on your Multi-Tech modem. This will help tech support in answering your questions. (The same information is requested on the Warranty Registration Card.)

*Modem Model No.:*_____
Modem Serial No.: _____
*Modem Firmware Version:*_____
*FAX Software Version:*_____
DataComm Software Version: _____

The modem model and serial numbers are silkscreened on the bottom of your modem. The software versions are printed on the diskette labels. Type **ATI1** to display the modem firmware version.

Please note the status of your modem before calling tech support. This status can include LED indicators, screen messages, diagnostic test results, problems with a specific application, etc. Use the space below to note modem status (before calling for service or tech support):

_____

_____

8.4 Service

In the event that repair service is required, you may send your modem to our Mounds View factory in the USA. Products requiring repair and are shipped to us from outside the USA must have a Returned Materials Authorization (RMA) and shipping instructions. To return products for repair from inside the USA, no RMA is required, simply send products to us freight prepaid. Include a description of the problem, a return shipping address, and a check or purchase order for out-of-warranty repairs.

Please send products which require repairs to the following address:

Multi-Tech Systems, Inc.
2205 Woodale Drive
Mounds View, MN 55112
Attn: Repair

If you are shipping products from outside the USA, please contact our Repair Department prior to your shipment for an RMA. You may contact us by telephone or fax at the following numbers:

Telephone: +(763) 785-3500

Fax: +(763) 785-9874

8.7 How to Find Multi-Tech on the Internet

Multi-Tech is on the Internet at http://www.multitech.com .

8.9 Upgrading the MT2834MR Firmware

The MT2834MR has a Flash PROM which contains firmware code for the hardware. At various times, Multi-Tech may add enhancements and/or fixes to the firmware. The flash technology used in the MT2834MR allows these upgrades to be loaded directly into the PROM chip through the modem's serial port.

8.9.1 Using FlashPro to Upgrade Modem Firmware

1. Download FLASHPRO.ZIP and a new .HEX file from the Multi-Tech web site.
2. Unzip the FLASHPRO.ZIP file. Place this unzipped file and the .HEX file in the same directory.
3. Run FlashPro by typing FLASHPRO and pressing ENTER at the DOS prompt.
4. Highlight 'Configure' option in the MAIN MENU and press ENTER. Highlight 'Active Port' and select the COM port to which you have your MT2834MR attached. Highlight 'Baud Rate' and select the rate you want to program at. Press ESC when finished.
5. Highlight 'Select File to Program' option in the MAIN MENU. Highlight the .HEX file. Hit ESC when finished.
6. Highlight 'Program Firmware' option in the MAIN MENU. You are prompted to confirm the file to program.
6. Return to step 3, if you have not successfully programmed FlashPro. Or call Multi-Tech's Technical Support (see sections 8.3).

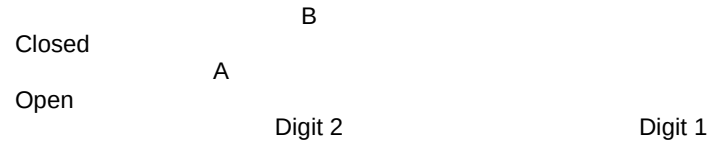
Appendix A
ASCII/Hex/Decimal Conversion Chart

CTRL	*CODE*	*HEX*	*DEC*	*CODE*	*HEX*	*DEC*	*CODE*	*HEX*	*DEC*	*CODE*	*HEX*	*DEC*
@	NUL	00	0	SP	20	32	@	40	64		60	96
A	SOH	01	1	!	21	33	A	41	65	a	61	97
B	STX	02	2	“	22	34	B	42	66	b	62	98
C	ETX	03	3	#	23	35	C	43	67	c	63	99
D	EOT	04	4	$	24	36	D	44	68	d	64	100
E	ENQ	05	5	%	25	37	E	45	69	e	65	101
F	ACK	06	6	&	26	38	F	46	70	f	66	102
G	BEL	07	7	‘	27	39	G	47	71	g	67	103
H	BS	08	8	(	28	40	H	48	72	h	68	104
I	HT	09	9	)	29	41	I	49	73	i	69	105
J	LF	0A	10	*	2A	42	J	4A	74	j	6A	106
K	VT	0B	11	+	2B	43	K	4B	75	k	6B	107
L	FF	0C	12	,	2C	44	L	4C	76	l	6C	108
M	CR	0D	13	-	2D	45	M	4D	77	m	6D	109
N	SO	0E	14	.	2E	46	N	4E	78	n	6E	110
O	SI	0F	15	/	2F	47	O	4F	79	o	6F	111
P	DLE	10	16	0	30	48	P	50	80	p	70	112
Q	DC1	11	17	1	31	49	Q	51	81	q	71	113
R	DC2	12	18	2	32	50	R	52	82	r	72	114
S	DC3	13	19	3	33	51	S	53	83	s	73	115
T	DC4	14	20	4	34	52	T	54	84	t	74	116
U	NAK	15	21	5	35	53	U	55	85	u	75	117
V	SYN	16	22	6	36	54	V	56	86	v	76	118
W	ETB	17	23	7	37	55	W	57	87	w	77	119
X	CAN	18	24	8	38	56	X	58	88	x	78	120
Y	EM	19	25	9	39	57	Y	59	89	y	79	121
Z	SUB	1A	26	:	3A	58	Z	5A	90	z	7A	122
[	ESC	1B	27	;	3B	59	[	5B	91	{	7B	123
\	FS	1C	28	<	3C	60	\	5C	92	|	7C	124
]	GS	1D	29	=	3D	61	]	5D	93	}	7D	125
	RS	1E	30	>	3E	62	^	5E	94	–	7E	126
—	US	1F	31	?	3F	63	_	5F	95	DEL	7F	127

NUL	Null, or all zeros	DC1	Device Control 1	SI	Shift In
SOH	Start of Heading	DC2	Device Control 2	SO	Shift Out
STX	Start of Text	DC3	Device Control 3	SYN	Sync.
ETX	End of Text	DC4	Device Control 4	LF	Line Feed
EOT	End of Transmission	CAN	Cancel	FF	Form Feed
ACK	Acknowledge	EM	End of Medium	ENQ	Enquiry
BEL	Bell or Alarm	SUB	Substitute	ESC	Escape
BS	Backspace	FS	File Separator	DLE	Data Link Escape
HT	Horizontal Tab	GS	Group Separator	NAK	Negative Acknowledge
VT	Vertical Tab	RS	Record Separator	CR	Carriage Return
ETB	End Transmission Block	DEL	Delete		

Appendix B
Dial Pulse and Tone-Dial Frequencies

DIAL PULSES



In the example above, the digit 2 is pulse dialed, followed by the digit 1. Each pulse consists of an A mSec. open and a B mSec. closed, where A will be either 60 or 67 mSec and B will be either 40 or 33 mSec., for a total of 100 mSec. per pulse, or a rate of 10 pulses per second. The interdigital pause time is 800 mSec. The pulse ratios are controlled by the ***&P*** command*.

TONE DIAL FREQUENCIES

Hz	**Digits**			
697				
770				
852				
941				
Hz	1209	1336	1477	

The tone-dialing method combines two frequencies for each of the twelve digits found on a Touch Tone dial pad. This method is referred to as Dual-Tone Multi-Frequency (*DTMF*) dialing.

The four horizontal rows on a Touch-Tone keypad use the four low frequencies (697, 770, 852, 941 Hz), while the three vertical columns use the three high frequencies (1209, 1336, 1477 Hz). The generally accepted tone frequency tolerance is +0.02%.

*Not applicable in BABT models

For example, the digit 4 would be dialed by combining two tone frequencies. It would use the frequency 770 Hz from the second row, and the frequency 1209 Hz from the first column. In another example, the digit 9 would be dialed with the tone frequencies of 852 Hz and 1477 Hz.

The extended DTMF characters (A, B, C, D) are the high-end frequencies (1633 Hz) defined on some telephone sets with a fourth vertical column of buttons. This fourth column provides for extended PBX control functions; the actual functions provided are dependent on the PBX manaufacturer's implementation and feature set.

Hz	**Digits**			
697	**1**	**2**	**3**	***A***
770	**4**	**5**	**6**	***B***
852	**7**	**8**	**9**	***C***
941	*****	**0**	**#**	***D***
Hz	1209	1336	1477	1633

Appendix C
DIP-Switch Summary

DIP-Switch	*Condition*	*Effect*
Asynchronous Mode		
#1	*UP	DTR dependent on interface
	Down	DTR force On at all times
#2	*UP	Hardware Flow Control
	Down	Xon/Xoff Flow Control
#3	UP	Disable Command Mode Response (dial up)
	*Down	Enable Command Mode Response (dial up)
#3	UP	-10 dB Transmission (leased line)
	*Down	0 dB Transmission (leased line)

Note: dB transmission levels on International models may be different from those values shown above.

Note: Switch #3 has no effect in leased line mode in the MT2834MRK.

#4	*UP	UUCP Spoofing Disabled
	Down	UUCP Spoofing Enabled
#5	*UP	Enable Automatic Answer (dial up)
	Down	Disable Automatic Answer (dial up)
#5	*UP	Answer Mode (leased line)
	Down	Originate Mode (leased line)
#6	*UP	Max throughput Enabled
	Down	Max throughput Disabled
#7	UP	RTS dependent on Interface
	*Down	RTS forced On at all times
#8	UP	Disable Command Mode
	*Down	Enable Command Mode
#9	UP	No function
	*Down	
#10	*UP	Dial-Up Operation
	Down	Leased Line Operation
#11	UP	"AT" Responses
	*Down	Multi-Tech Responses
#12	UP	Synchronous Mode
	*Down	Asynchronous Mode

See page C-3 for information on DIP-Switches #13 - #16

DIP-Switch	*Condition*	*Effect*
Synchronous Mode		
#1	*UP Down	DTR Dependent On interface DTR forced On at all times
#2	*UP Down	SDLC Mode On BSC Mode On
#3	UP *Down	Disable Command Mode Response (dial up) Enable Command Mode Response (dial up)
#3	UP *Down	-15 dB Transmission (leased line) 0 dB Transmission (leased line)

Note: dB transmission levels on International models may be different from those values shown above.

Note: Switch #3 has no effect in leased line mode in the MT2834MRK.

#4	*UP Down	AS/400 Mode Disabled AS/400 Enabled
#5	*UP Down	Enable Automatic Answer (dial up) Disable Automatic Answer (dial up)
#5	*UP Down	Answer Mode (leased line) Originate Mode (leased line)
#6	*UP Down	Slave Clocking Disabled Slave Clocking Enabled
#7	UP *Down	RTS Dependent on interface RTS Forced On at all times
#8	UP *Down	Disable Command Mode Enable Command Mode
#9	UP *Down	No function
#10	*UP Down	Dial-Up Operation Leased Line Operation
#11	UP *Down	External Clock Internal Clock
#12	UP *Down	Synchronous Mode Asynchronous Mode

DIP-Switches #13 - #16

Synchronous and Asynchronous Mode

#13/#14	UP/UP*	28.8 K bps Operation
#13/#14	DOWN/UP	19.2 K bps Operation
#13/#14	UP/DOWN	14.4 Kbps Operation
#13/#14	DOWN/DOWN	9600 bps Operation
#15	UP* DOWN	CD/DSR Normal CD/DSR Forced On
#16	UP DOWN*	2-wire leased-line 4-wire leased-line

Note: The modem baud rate command, $MB, overrides the setting of DIP-Switches #13 and #14.

Note: Switches #13 and #14 are used for speed selection in leased line and call origination applications.

*Factory Default Setting

Appendix D
Result Code Summary

DIGIT	*WORDS*	*EFFECT*
"Multi-Tech" Result Codes*		
0	OK	Command was executed without error; ready for next command.
1	CONNECT	Modem has detected carrier and gone on-line.
2	RING	Modem has detected ring caused by incoming call.
3	NO CARRIER	No carrier signal has been detected within allowed time.
4	ERROR	Error in Command line (too many, or invalid characters).
5	CONNECT 1200	Modem has detected carrier at 1200 bps and gone on-line.
6	NO DIAL TONE	No dial tone has been detected.
7	BUSY	A busy signal has been detected.
8	NO ANSWER	Remote system did not answer.
9	CONNECT 2400	Modem has detected carrier at 2400 bps and gone on-line.
11	CONNECT 4800	Modem has detected carrier at 4800 bps and gone on-line.
12	CONNECT 9600	Modem has detected carrier at 9600 bps and gone on-line.
13	CONNECT 14400	Modem has detected carrier at 14400 bps and gone on-line.
19	CONNECT 19200	Modem has detected carrier at 19200 bps and gone on-line.
21	CONNECT 21600	Modem has detected carrier at 21600 bps and gone on-line.
23	CONNECT 1275	Modem is connected in V.23 mode.
24	CONNECT 24000	Modem has detected carrier at 24000 bps and gone on-line.
26	CONNECT 26400	Modem has detected carrier at 26400 bps and gone on-line.
28	CONNECT 28800	Modem has detected carrier at 28800 bps and gone on-line.

Note: If the MT2834MR is used in MNP Reliable mode, the following Result Codes change:

1R	CONNECT RELIABLE
5R	CONNECT 1200 RELIABLE
9R	CONNECT 2400 RELIABLE
11R	CONNECT 4800 RELIABLE
12R	CONNECT 9600 RELIABLE
13R	CONNECT 14400 RELIABLE
19R	CONNECT 19200 RELIABLE
21R	CONNECT 21600 RELIABLE
24R	CONNECT 24000 RELIABLE
26R	CONNECT 26400 RELIABLE
28R	CONNECT 28800 RELIABLE

***See Note 2 for "AT Command Set Result Codes".**

Note: If the MT2834MR used in LAP-M Reliable mode, the following Result Codes change:

1L	CONNECT LAPM
5L	CONNECT 1200 LAPM
9L	CONNECT 2400 LAPM
10L	CONNECT 4800 LAPM
12L	CONNECT 9600 LAPM
13L	CONNECT 14400 LAPM
19L	CONNECT 19200 LAPM
21L	CONNECT 21600 LAPM
24L	CONNECT 24000 LAPM
26L	CONNECT 26400 LAPM
28L	CONNECT 28800 LAPM

Note 1: If the MT2834MR is used with data compression, the word *COMPRESSED* or the letter *C* is added to the result codes.

Note 2: If Standard AT Command Set 2400 Result Codes are selected with &Q command, the following Result Codes change:

9	(not used)	
10	CONNECT 2400	Modem has detected carrier at 2400 bps and gone on-line.

Appendix E
S-Register Summary

***** *indicates Values for MT2834MRK units only.*

REGISTER	UNIT	RANGE	DEFAULT	DESCRIPTION
S0	1 ring	0-255	1	Sets number of rings until modem answers.
S1	1 ring	0-255	0	Counts rings which have occurred.
S2	ASCII	0-127	43	Sets Escape Code character (default is plus + sign).
S3	ASCII	0-127	13	Sets character recognized as RETURN (default is CTRL-M).
S4	ASCII	0-127	10	Sets character recognized as LINE FEED (default is CTRL-J).
S5	ASCII	0-32	8	Sets character recognized as 127 BACKSPACE (default is CTRL-H).
S6	1 second	2-255	2	Defines wait-time for dial tone. 4-7* 4*
S7	1 second	1-255	45	Defines how long modem will wait for carrier before aborting call. 1-45*
S8	1 second	0-255	2	Sets pause time caused by a comma character in a dial command. 4-7* 4*
S9	100 mSec	1-255	6	Sets Carrier Detect response time.
S10	100 mSec	1-255	7	Sets delay time between when carrier is lost and when modem disconnects.
S11	1 mSec 80-255*	1-255 80*	70	Sets time duration of and spacing between tones in tone-dialing .
S13	ASCII	0-127	37	Defines Remote Configuration Escape Character
S17	10 mSec	0-2500	250 mSec	Defines length of break time seconds (space) to PC.
S18	30 min.	10-255	30	Modem monitors leased line to see if it's operational and will try to restore leased line connection.
S19	1 min	0-255	1	Dial-backup timer used for timing dial-line back-up.
S24	50 mSec	0-255	20	Sets DSR/CTS/CD dropout time. The default (20) equals one second.
S25	100 mSec	0-255	0	Sets DTR dropout time. The default (0) default equals 50 mSec.
S30	min	0-255	0	Inactivity timer used to disconnect modem.
S32	1 second	0-255	2 mSec	***S32*** sets the time that the modem waits for <CR> to be entered during Escape Sequence execution.
S34	ASCII	0-60	10	Sets the number of command characters allowed for Escape Sequence entry.
S36	1 sec	0-255	0	When DTR is low for ***S36*** seconds, the modem sets OOS.
S37	1 sec	5-255	5	When DTR is high for ***S37*** seconds, the modem clears OOS.
S48	n/a	**	0	Defines the speed at which the modem connects within V.34 mode (**range: 28,26,24,21,19,16,14,12, 96,and 48).

Appendix F
Command Summary

COMMAND	*VALUES*		*DESCRIPTION*
AT			Attention Code that precedes most command strings except A/, A: and Escape Codes.
RETURN			Pressing RETURN key executes most commands.
A			Answer call, even if no ring present.
A/			Repeat last command. Do not precede this command with AT. Do not hit ENTER to execute.
&A			Answerback (proprietary feature)
A:**			Continuous redial (10 redials in DOC units) of last number until answered.
$An	n = 0 or 1	***	$A0 discards data during auto-reliable time period. $A1 buffers data during auto-reliable time period.
#An	n = 0 thru 3	***	#A0 selects initial handshake at 28,800 to 24,000 to 21,600 to 19,200 to 16,800 to 14,400 to 12,000 to 9600 to 4800 to 2400 to 1200 to 300 bps. #A1 selects initail handshake at 28,800 bps only. #A2 selects initail handshake at 28,800 to 24,000 to 21,600 to 19,200 to 14,400 to 9600 to 4800 bps only. #A3 selects initial handshake at 2400 to 1200 to 300 bps only.
%ASn	n = 0 or 1	***	%AS0 disables IBM AS/400 Support %AS1 enables IBM AS/400 Support
Bn**	n = 0 or 1		B0 selects ITU-T answer tone at 300 baud.
		***	B1 selects Bell answer tone at 300 baud.
&Bn	n = 0 or 1	***	&B0 means normal transmit buffer size. &B1 means reduced transmit buffer size.
&BSn	n = 0 or 1		&BS0 means maximum transmit block size of 64 characters.
		***	&BS1 means maximum transmit block size of 256 characters.
$BAn	n = 0 or 1	***	$BA0 means Baud Adjust is off, speed conversion is on. $BA1 means Baud Adjust is on, speed conversion is off.
&Cn	n = 0, 1, 2, or 4		&C0 forces Carrier Detect on.
		***	&C1 lets Carrier Detect act normally. &C2 lets Carrier Detect drop S24 time on disconnect. &C4 resets modem when Carrier Detect drops.
****C***n	n=0 thru 2	***	*C0 turns off Caller ID detection. *C1 turns on Caller ID detection for the MMM. *C2 is storable in MT2834MR memory and turns on Caller ID reporting on the serial port by the MMM. *C3 lets you view the last Caller ID's number.
&CDn	n = 0 or 1	***	&CD0 enables a cleardown on disconnect. &CD1 disables a cleardown on disconnect.
Ds	s = phone #		Dial a telephone number "s," where s may include up to 60 digits or T, P, R, comma and ; characters.
Ds***D***n	s = phone #		Store telephone number. To store, phone
	d = 0 thru 9		number "s" is entered and followed by N and then Directory Number "d".
&Dn	n = 0 thru 3		&D0 DTR is ignored. &D1 means modem returns to command mode.
		***	&D2 lets modem react to DTR normally. &D3 causes modem to reset to modem default parameters.
$Dn	n = 0 or 1	***	$D0 disables DTR Dialing. $D1 enables DTR Dialing.
En	n = 0 or 1		E0 means do not echo Command Mode Character.
		***	E1 means do echo Command Mode characters.

$En	n = 0 or 1	***	$E0 disables 300 baud error correction. $E1 enables 300 baud error correction.
&En	n = 0 thru 15		&E0 means V.42 Normal Mode.
		***	&E1 means V.42 Auto-reliable Mode.
			&E2 means V.42 Reliable Mode.
			&E3 means no modem-initiated flow control.
		***	&E4 means CTS modem-initiated flow control.
			&E5 means Xon/Xoff modem-initiated flow control.
		***	&E6 means Xon/Xoff not passed through.
			&E7 means Xon/Xoff passed through.
		***	&E8 means Enq/Ack pacing off.
			&E9 means Enq/Ack pacing on.
		***	&E10 means Normal Mode flow control off.
			&E11 means Normal Mode flow control on.
			&E12 means Pacing off.
		***	&E13 means Pacing on.
			&E14 means data compression disabled.
		***	&E15 means data compression enabled.
$EBn	n = 0 or 1	***	$EB0 enables 10 bit mode. $EB1 enables 11 bit mode.
%En	n=0 thru 5		% E0 = Modem Won't Escape.
		***	% E1 = +++ Method (default setting).
			% E2 = Break Method.
			% E3 = Either +++ or Break Method.
		***	% E4 = Disables "OK" Response to +++ Escape Method.
			% E5 = Enables "OK" Response to +++ Escape Method.
#Fn	n = 0, 1, 8, or 9		#F0 means no fallback when on-line. #F1 means fallback from 28800 to 2400 bps when on-line.
		***	#F2 means fallback to 2400 from 28800 bps/fall forward when line improves.
&F			&F loads factory default values from ROM.
		***	&F8 loads factory defaults after &F.
			&F9 loads RAM defaults after &F.
$Fn	n = 0 or 1		$F0 means do not fall back to normal connect if CR received.
		***	$F1 means fall back to normal connect if CR received.
&Gn**	n = 0, 1 or 2	***	&G0 turns off ITU-T guard tones. &G1 turns on ITU-T 550 Hz guard tone. &G2 turns on ITU-T 1800 Hz guard tone.
Hn	n = 0 or 1		H0 means Hang Up (go on hook). H1 means Go Off Hook.
$Hn	n = 1 thru 3		$H1 brings up Help Screen #1. $H2 brings up Help Screen #2. $H3 brings up Help Screen #3.
****H***n	n = 0 or 1	***	*H0 means modems busy out after disconnect disabled. *H1 means modems busy out after disconnect enabled.
In	n = 0 or 1		I0 requests modem ID #. I1 requests firmware revision #.
L			Lists all stored telephone numbers in memory.
L5			L5 lists all current operating parameters.
L6			L6 lists all current S-Register values.
L7			L7 lists additional parameters.
L8			L8 lists on-line diagnostics
#Ln	n = 0 thru 3	***	#L0 means modems negotiate V.42 Mode. #L1 means MNP on and LAP-M off. #L2 means LAP-M on and MNP off. #L3 means no detection phase but go directly to LAP-M.
&Ln	n = 0,1,2A, 2D,4A,4D		&L0 selects Dial-up line operation &L1 allows a single attempt at laesed line connection &L2A selects 2 wire Answer mode operation &L2D selects 2 wire Originate mode operation &L4A selects 4 wire Answer mode operation

			&L4D selects 4 wire Originate mode operation
&Mn	n = 0 or 1	***	&M0 means Async when on-line. &M1 means Sync when on-line.
$MIn**	n = 0 or 1	***	$MI0 disables MI/MIC option (**) $MI1 enables MI/MIC option (**)
$MBn	n = speed		$MB75 selects ITU-T V.23 mode. $MB300 selects 300 bps on-line. $MB1200 selects 1200 bps on-line. $MB2400 selects 2400 bps on-line. $MB4800 selects 4800 bps on-line. $MB9600 selects 9600 bps on-line. $MB14400 selects 14400 bps on-line. $MB19200 selects 19200 bps on-line. $MB24000 selects 24000 bps on-line. $MB28800 selects 28800 bps on-line.
		***	$MB33600 selects 33600 bps on-line.
Nd	d = 0 thru 9		Dial stored telephone number "d". Do not include the letter D with this command.
Nd***N***e	d = 0 thru 9		Number Linking. If first number dialed is busy, another stored number may be
	e = any other number 0-9		automatically dialed. For example, stored number "d" is dialed, and if busy, stored number "e" is dialed.
O			Exit Command Mode and go into On-Line Mode.
P		***	Modem will pulse-dial numbers following the P.
&Pn**	n = 0 or 1	***	&P0 means 60-40 pulse ratio. &P1 means 67-33 pulse ratio.
#***P***n	n=0 thru 2	***	#P0 means no parity. #P1 means odd parity. #P2 means even parity.
Qn	n = 0 or 1	***	Q0 means Result Codes sent. Q1 means Result Codes will be suppressed (quiet). Q2 means Dumb Answer Mode.
&Qn	n = 0 or 1	***	&Q0 selects Multi-Tech command set. &Q1 selects AT command set.
Rn	n = 0 or 1	***	R0 means modem will not reverse modes. R1 means modem will reverse modes.
&Rn	n = 0, 1 or 2		&R0 lets Clear to Send act normally.
		***	&R1 forces Clear to Send on. &R2 drops for S24 period on disconnect.
****Rn***	n = 0 or 1	***	*R0 disables ring message on callback modem. *R1 enables ring message on callback modem.
&RFn	n = 0 or 1		&RF0 selects CTS follows RTS.
		***	&RF1 selects CTS to act independently.
$Rn	n = 0 or 1	***	$R0 means disconnect after 12 retransmits. $R1 means do not disconnect after 12 retransmits.
Sr=n	r = 0 thru 11, 13, 17-19, 24, 25, 30, 32, 34		Sets value of Register “r” to value of “n”, where “n” is entered in Decimal format.
Sr?	r = 0 thru 11, 13, 17-19, 24, 25, 30, 32, 34		Reads value of Register “r” and displays value in 3-digit Decimal format.
$SBn	n = speed		$SB1200 selects 1200 bps at serial port. $SB2400 selects 2400 bps at serial port. $SB4800 selects 4800 bps at serial port. $SB9600 selects 9600 bps at serial port. $SB19200 selects 19,200 bps at serial port. $SB38400 selects 38,400 bps at serial port $SB57600 selects 57600 bps at serial port.
		***	$SB115200 selects 115200 bps at serial port.
&Sn	n = 0, 1 or 2		&S0 forces Data Set Ready On.
		***	&S1 lets Data Set Ready act normally. &S2 Data Set Ready drop is regulated by S24 on disconnect.
&SFn	n = 0 or 1	***	&SF0 selects DSR follows CD.

			&SF1 selects DSR independent.
$SPn	n = 0 or 1	***	$SP0 disables UUCP Spoofing $SP1 enables UUCP Spoofing
T			Modem will tone-dial numbers following the T.
&Tn	n = 4 or 5		&T4 means Enable Response to Request for Remote Digital Loopback.
		***	&T5 means Disable Response to Request for Remote Digital Loopback.
#Tn	n = 0 or 1		#T0 turns off Trellis Coded Modulation
		***	#T1 turns on Trellis Coded Modulation
Un	n = 0, 1, 2, or 3		U0 places modem in Analog Loop Originate Test Mode. U1 places modem in Analog Loop Answer Test Mode. U2 places modem in Remote Digital Loopback Test Mode. U3 places modem in Local Digital Loopback Test Mode.
Vn	n = 0 or 1		V0 means Result Codes sent as (terse response).
		***	V1 means Result Codes sent as words (verbose response).
#Vn	n = 0 or 1		#V0 enables V.32terbo.
		***	#V1 disables V.32 terbo.
W			Wait for new dial-tone.
&Wn	n = 0 or 1		&W0 causes modem to store its parameters in non-volatile RAM, and modem loads these for future sessions instead of reading factory ROM defaults, unless &F command used.
		***	&W1 causes modem to not store parameters.
Xn	n=0 thru 4		Xo selects Basic Result w/o CONNECT 1200, CONNECT 2400) X1 selects Extended Result (w/ CONNECT 1200, CONNECT 2400) X2 selects Standard AT command set NO DIAL TONE X3 selects Standard AT command set with BUSY
		***	X4 selects Standard AT command set with NO DIAL TONE and BUSY
&Xn	n = o thru 2	***	&X0 Sync internal clocking. &X1 Sync external clocking. &X2 Sync slave clocking.
#Xn	n = 0 or 1		#X0 causes one XOFF to be sent until buffer reaches XON level #X1 causes one XOFF to be sent for every character received after modem reaches buffer full level
Yn	n = 0 or 1	***	Y0 disables sending or responding to long space “break”. Y1 enables sending or responding to long space “breaks”.
Z			All configuration parameters are reset to default values.
,	in Dial command		Causes pause during dialing.
;	in Dial command		Causes return to Command Mode after dialing.
!	in Dial command		Causes modem to Flash On-Hook.
@	in Dial command		Causes modem to wait for ringback, then 5 seconds of silence before processing next part of command.
+++AT<CR>			Escape Code. Puts modem in Command Mode while remaining On-Line. Type +++ followed by the letters A and T & up to ten command characters, and hit ENTER.
BREAK AT<CR>			Alternate Escape Sequence. Brings modem into Command mode while remaining On-Line. Not preceded by AT. Type BREAK signal, followed by the letters A and T, up to 60 command characters, and hit ENTER.

Appendix G
V.25bis Operation

Operation of your modem in ITU-T V.25bis mode provides you with an alternate set of commands and responses to those described in the AT Command Mode chapter of this manual. The V.25bis mode performs dialing functions in the asynchronous or synchronous mode according to the recommendations of the ITU-T (Consultative Committee of International Telephony and Telegraphy). Synchronous mode, which is the more common use of V.25bis, includes both Binary Synchronous Communications (BSC) and Synchronous Data Link Control (SDLC).* V.25bis is commonly used in IBM (and other) mainframe and mid-range (S/3x and AS/400) environments. The V.25bis mode commands are used to establish data connections over public switched telephone networks.

We've already covered the AT command set with its dialing features earlier in this manual. The V.25bis commands can be looked at as a second command set used to perform synchronous dialing functions, and, since the AT command set cannot perform synchronous dialing, it is necessary for dial-up synchronous applications.

V.25bis mode AT commands do not include any modem configuration commands. You can execute normal AT commands in V.25bis mode for modem configuration.

Delayed and Forbidden Numbers

V.25bis provides the facility to delay failed call retry attempts by putting numbers that failed to connect on a special Delayed Number list. Subsequent dialing of these numbers are delayed (time specified by a country regulation) and an appropriate message displayed. If the number is retried more than the maximum allowed number of times (number is also specified by country regulation), it is placed on the Forbidden Numbers list, and no further retries are allowed. When the Forbidden Numbers list is full, no dialing is allowed and a CFIFF indication is given. The modem in AT command mode responds with *NO CARRIER*. If country regulations require that the Forbidden Numbers list be checked in AT mode, then *NO CARRIER* is the response to a dial attempt in AT mode. Numbers are also be put on the Forbidden Numbers list if the Delayed Numbers list is full and a new number fails for the first time. In that case, the new number is added to the Delayed Number list and the oldest existing number added to the Forbidden Numbers list. Numbers are removed from the Forbidden Numbers list after a certain time has past (also by country regulation). Some country regulations have numbers remain on the Forbidden Numbers list permanently. The Delayed Number and Forbidden Numbers lists are eight numbers long (20 characters each).

Operation

Operation in V.25bis mode is similar to AT command mode except that certain DIP Switch functions are important to its operation. V.25bis does not include any speed detection for asynchronous mode, so when you are giving commands, you must stay in your initial speed (i.e., if you change your terminal speed while entering an AT command, you get no responses). In synchronous mode, the modem supplies the clock, so the synchronous terminal "knows" the speed.

You must be in V.25bis mode for the commands described here to function. Most AT commands also function, except those associated with dialing such as ATD, ATN, ATO, and ATU. To get into V.25bis mode, type ***AT$V1***. At this point your modem does no more speed or parity detection (things associated with asynchronous operation). To get out of V.25bis mode and back into AT command mode, type ***AT$VO***. The ***AT$V2*** command allows you to run one V.25bis command from AT command mode without leaving AT command mode.

There is no command to select between asynchronous and synchronous V.25bis operation. The position of 4-Position DIP-Switch #4 selects modes. For synchronous mode, thesynchronous switch must be on, the command mode enabled and a jumper plug selects between BSC and SDLC.

Another asynchronous mode issue is connecting at a different speed than the speed at which the serial port is set. If your modem port speed is different from the serial port speed, you must either:

1. Enable speed conversion and have flow control on, or

2. Enable connect responses (with the ***ATX1*** command) and change the serial baud rate after receiving a connect message.

DTR dialing is functional in V.25bis mode, except the number dialed is from the V.25bis mm memory location 01. Also, if the ***$VD1*** command is entered when in Auto-Answer mode, the modem answers immediately upon receiving the first ring.

There is no disconnect message (NO CARRIER) if a normal connection is made.

Set-Up and Initialization

Before you operate your modem in the V.25bis mode, you need to make sure it is set-up properly (various RS232 lines such as DSR and CTS act as specified in the V.25bis standard). Set-up involves proper DIP-Switch settings, and soft-switches (software controlled conditions).

V.25bis DIP-Switches

12-Position DIP-Switches

#1 - Unforced DTR
#2 - NA
#3 - NA
#4 - NA
#5 - Auto-Answer enabled
#6 - DSR/CD unforced
#7 - RTS unforced
#8 - Command Mode forced
#9 - NA
#10 - NA
#11 - NA
#12 - NA

4-Position DIP Switches

#1 - Unforced CTS
#2 - Dial-Up
#3 - Varies per modem model
#4 - Async/Sync mode set per requirements

Jumper Plugs
CTS/RTS - CTS independent of RTS
DSR - DSR independent of CD
MI/MIC - NA
SLDC/BSC - If in Synchronous mode, set per requirements.

V.25bis Mode AT Commands

The following commands either alter standard V.25bis behavior (so you must be careful in their use) or they are not allowed, as indicated. All other commands can be used in V.25bis operation.

A	Not Allowed
A/	Not Allowed
A:	Not Allowed
D	Not Allowed
D...N	Not Allowed
$D	Alters Operation ($D1 in V25bis is direct call mode)
E	Alters Operation
&F	Alters Operation (removes modem from asynchronous V.25bis mode)
N	Not Allowed
N...N	Not Allowed
O	Not Allowed
P	Not Allowed
T	Not Allowed
U	Not Allowed
W	Not Allowed
X	Alters Operation (X0 no connect message) (X1 connect message)
,	Not Allowed
;	Not Allowed
!	Not Allowed
@	Not Allowed
+++AT<CR>	Not Allowed

V.25bis Responses (Result Codes)

When in V.25bis mode (the ***AT$V1*** command executed), your modem provides you with several responses which helps you follow the progress of V.25bis operations. These are similar to the Result Codes associated with AT Command mode operation. The V.25bis responses are in the form of three-character mnemonics as listed on the next page:

INC	Incoming Call (same as RING indicator)
VAL	A valid V.25bis command has attempted
DLCt	Call delayed for *t* minutes (number on Delayed list)
CFlrr	Call failure indicator where *rr* equals:
	et - Engaged tone (same as BUSY)
	nt - Call Answered but No Answer Tone
	ab - Call Not Answered
	fc - Number on Forbidden List
	ns - Number not stored in memory
	ua - User Abort
	nd - No Dialtone
	ff - Forbidden List full
LSN*mm;dd...dd*	Phone number in V.25bis memory

LSD*mm;dd...dd*	Phone number on the Delay list
LSF*mm;dd...dd*	Phone number on the forbidden list
CON *ssss*	Connection at ssss speed (if X1 in effect)

V.25bis AT Commands

The AT commands associated with V.25bis mode are described as follows. Note that one command enables and disables V.25bis mode and the rest are only operable in the V.25bis mode.

Enable/Disable V.25bis Mode ($V) Command

The function of the $V command is to select the V.25bis mode in asynchronous mode. (Synchronous mode is set up with switches. For example, the modem could be in AT command mode, (***AT$V1***), and if synchronous mode is enabled with AT Command mode enabled, then V.25bis mode is selected). Prior to executing this command, make sure that your modem is properly set up to perform the type of operation you are performing. Refer to the initialization section of this appendix for information about modem set-up. When in V.25bis mode, most normal AT commands also function (except ***D***,***N***,***O*** and ***U***). V.25bis operates in asynchronous or synchronous modes (depending on the position of 4-Position DIP-Switch #4), and does not check for terminal speed (so do not change speeds while in this mode) or parity. In synchronous mode, speed is not important since the internal clocks provide synchronization.

To place your modem in V.25bis mode from asynchronous mode, enter the ***AT$V1*** command. To return to AT command mode, enter the ***AT$V0*** command. ***AT$V2*** allows you to run one V.25bis command from AT command mode without leaving AT command mode (the V.25bis command follows ***$V2*** on the command line).

Clear Number in Memory (CLA) Command

The ***CLA*** command clears a specific number in the *mm* phone number memory by entering **CLA*mm***.

Change Serial Baud Rate (CSP) Command

The ***CSP*** command changes the serial baud rate of your modem by entering **CSP*sssss*** where ***sssss*** can equal:

0300	=	300 bps
1200	=	1200 bps
2400	=	2400 bps
4800	=	4800 bps
9600	=	9600 bps
19200	=	19200 bps
38400	=	38400 bps
57600	=	57600 bps
115200	=	115200 bps

Dial Phone Number Provided (CRN) Command

The CRN command permits the dialing of the phone number immediately following it (from the command line). It is similar to the ***D*** command of the AT command set, except that the number is first checked against the Delayed Number and Forbidden Number list. If permitted, depending on the country regulations in effect, the number is then dialed. For example, if you type ***CRN7859875*** and hit ENTER, your modem checks the two lists. If the number is on the Delayed Numbers list, you can dial that number again after *t* minutes have passed. If the number is on the Forbidden list, a ***CFIFC*** message is displayed.

You can use various commands from the AT command set within the CRN command line to facilitate the dialing process, such as ***P***, ***T***, or ***W*** for pulse dialing, tone dialing and wait for dial tone. V.25bis supports “smart” dialing.

To dial a phone number, type ***CRNdd...dd*** where ***dd...dd*** is the phone number, which can be up to 20 characters long using any character on the telephone pad (0 through 9, *, #, P, T, and :).

Some additional dialing characters may be available, based on country regulations.

Dial Phone Number Stored in Memory (CRS) Command

A telephone number that you have stored in the modem's memory may be automatically dialed after checking it against the Delayed and Forbidden number lists by entering ***CRSmm*** where ***mm*** = 01, 02, 03, 04,....20. For example, a number stored in ***mm*** location 15 is entered ***CRS15*** and hitting ENTER, then, if the number in ***mm*** memory location 15 is not on either list, it is automatically dialed.

Store a Phone Number in Memory (PRN) Command

Your modem has a special V.25bis memory for storing phone numbers which you may dial by using the ***CRS*** command. The memory holds up to 20 numbers of 20 characters each. You can store phone numbers in this memory with the ***PRN*** command. The format for the command is ***PRNmm;dd...dd*** where ***mm*** is the memory location at which you wish to store a number (any digits 01 through 20) followed by a semicolon(***;***) and then ***dd...dd*** (the number to be stored up to 20 digits long). The number can include punctuation as required.

To clear a number from the V.25bis memory, see the ***CLA*** command.

Listing Numbers Stored in Memory (RLN) Command

Telephone numbers that you have stored in the modem's V.25bis memory may be listed and displayed with the ***RLN*** command. It displays all twenty ***mm*** storage location numbers and associated telephone numbers with any command letters and punctuation imbedded in each number. The ***RLN*** command is similar to the ***L*** command of the AT command set. To list the V.25bis stored telephone numbers, type ***RLN*** and hit ENTER.

Listing Delayed Phone Numbers (RLD) Command

When a phone number is dialed either by a CRN or CRS command and a connection is not made, the number is entered in the modem's V.25bis Delayed Number list along with the number of retry attempts. Any further dialing attempts is delayed some amount of time (determined by the regulations of each country). While the delay is in progress, the modem gives a DLC indication. The list contains eight numbers. When filled, the next number failing "bumps" off the oldest number on the list onto the Forbidden Number list. Numbers on the Delayed Number list that succeed in a connect attempt are removed. If a certain number of failed attempts occur (the number of failed attempts is specified by each country), the number is entered into the V.25bis Forbidden Phone Number List. Forbidden phone numbers cannot be dialed at all. To list the phone numbers on the V.25bis Delayed Phone Number List, type ***RLD*** and hit ENTER.

Listing Forbidden Phone Number (RLF) Command

Those phone numbers that have failed to connect the required number of times as specified by country regulations are removed from the Delayed Number list and entered onto the V.25bis Forbidden Number list. Numbers on the Forbidden Number list cannot be dialed at all for some maximum amount of time, which is also specified by country regulations. In some countries, the time might be one hour, and in others the number may never be dialed again. The forbidden list is eight numbers long, with the newest number replacing the oldest if the memory is full. To list the numbers in the Forbidden list type ***RLF*** and hit ENTER.

Disregard or Connect to Incoming Calls (DIC or CIC) Command

The Disregard or Connect to Incoming Calls commands are used for Auto-Answer operations. Depending on the country regulations, your modem waits some amount of time or number of rings before answering the call. During that time, you can stop the modem from answering the call by entering the ***DIC*** (Disregard Incoming Calls) command. The ***CIC*** (Connect to Incoming Calls) command causes your modem to answer the call (either reversing the effect of a DIC command or simply have your modem answer the call immediately without waiting the regulation time before answering).

DTR Dialing ($D) Command

DTR Dialing is an alternate method of causing the modem to automatically dial a number. Data Terminal Ready (DTR) is a signal that comes into the modem from the terminal or computer to which it is

connected via pin 20 of the RS232 interface. In DTR Dialing, the modem dials a stored number as soon as it receives a high DTR signal. The DTR Dialing method is popular when using the modem in synchronous applications.

To activate DTR Dialing, type the command **AT$D1** and hit ENTER. The modem now dials the phone number stored as N0 when it receives a high DTR signal (see the ***D...N*** command in Chapter 4). DTR must remain high for the duration of the call, until disconnect. To deactivate DTR Dialing, type the command **AT$D0** (or AT$D) and hit ENTER.

When you use DTR Dialing, be sure that DIP-Switch **#1** is in the UP position, so that DTR is not forced on.

In addition, when using DTR Dialing in a synchronous application, be sure that DIP-Switch **#8** is in the UP position to disable V.25bis Command Mode.

ITU-T V.25bis Country Specific Information

Due to the flexibility of the V.25bis standard, each country may establish specific regulations governing the way operations are handled. The purpose of this document is to detail each country's specific regulations that affect operation of V.25bis in Multi-Tech modems.

1. Italy

a) Command/Indication modifications
   1. Phone number indications include status; ZPSTTT
      a) Z - U, D, or F, for Unrestricted, Delayed or Forbidden
      b) P - Delay time if delayed
      c) S - Number of retries so far
      d) TTT - Interdiction time to further attempts
   2. Modify ***RLN*** command to allow memory parameter
      a) ***RLNmm*** is now valid to list one number in memory
   3. ***PRN*** and ***CLA*** commands do not work on active memory locations
      a) Active number are ones who are on the delay or forbidden lists
   4. Added dialing digit '<' to indicate 2 second pause

b) Delayed and Forbidden list behavior
   1. 5 retries without delay
   2. 2 minute delay between next 4 retries
   3. After 9 retries the number is put on the forbidden list
   4. 120 minute timer is started on entry to delay list
   5. When it runs out, the number is removed from whichever list it is on

c) Auto-Answer mode behavior
   1. Auto-Answer in 5 seconds if no DIC
   2. Get 10 seconds after DIC to enter CIC
   3. If 10 seconds times out then no connection is possible

2. Switzerland

a) Command/Indication modification

1. Modem must remain on-hook for 5 seconds after disconnect
2. Modem must remain on-hook for 5 minutes after consecutive failed calls
3. If modem must remain on-hook, then it is “paused”
4. If the modem is paused and a call is attempted a ***PAU*** indication is given.
    a) ***PAUt*** Modem is paused for ***t*** minutes

b) Delayed and Forbidden list behavior

1. 2 minute delay between 4 retries
2. After 4 retries the number is put on the forbidden list
3. The number remains on the forbidden list forever

c) Auto-Answer behavior

1. Auto-Answer mode after 2 rings if no ***DIC***

3. Austria

a) Command/Indication modification (none)

b) Delayed and Forbidden list behavior

1. No delay between retries
2. After 2 retries to numbers that answer, but give no answer tone (***CFINT***), the number is put on the forbidden list
3. After 10 retries with busy or no dialtone, the number is put on the forbidden list
4. The number remains on the forbidden list forever
5. Delayed and Forbidden Numbers lists are checked when dialing in AT mode. If dialing is not possible then NO CARRIER is the response.

c) Auto-Answer behavior

1. Auto-Answer in 5 seconds if no DIC

4. France

a) Command/Indication modification (none)

b) Delay and Forbidden list behavior

1. 2 min. delay after 1st call, 4 after 2nd, 6 after 3rd, etc.
2. After 5 retries, the number is put on the forbidden list
3. The number remains on the forbidden list forever
4. Delayed and Forbidden Numbers lists are checked when dialing in AT command mode. If dialing is not possible then No Carrier is the response.

c) Auto-Answer mode behavior

1. Auto-Answer in 5 seconds if no ***DIC***

5. Belgium

a) Command/Indication modification (none)

b) Delay and Forbidden list behavior

1. 1 min. delay between calls
2. After 4 retries, the number is put on the forbidden list
3. The number remains on the forbidden list for 1 hour after entry to forbidden list
4. Delayed and Forbidden Numbers lists are checked when dialing in AT command mode. If dialing is not possible then No Carrier is the response.

c) Auto-Answer behavior

1. Auto-Answer in 5 seconds if no ***DIC***.

6. Singapore

a) Command/indication modifications

1. Dialing digit '=' means wait for dialtone (acts the same as ':' in dialing string).

b) Delay and Forbidden list behavior

1. 5 retries without delay
2. 2 minute delay between next 4 retries
3. After 9 retries the number is put on the forbidden list
4. 120 minute timer is started on entry to delay list
5. When it runs out, the number is removed from whichever list it is on.

Appendix H
RS232C Interface Specifications

The MT2834MR's RS232C interface circuits have been designed to meet the electrical specifications given in EIA (Electronic Industries Association) RS232C standards. All signals generated by the modem are approximately 10 volts when measured across a load of 3000 ohms or greater. The receiving circuits of the modem accepts signals in the 3 to 25 volt range. The voltage thresholds are:

Negative = voltage more negative than 3 volts with respect to signal ground

Positive = voltage more positive than +3 volts with respect to signal ground

SIGNAL INFORMATION:			***NEGATIVE***	***POSITIVE***	
Binary State	One	Zero	Signal Condition	Mark	Space
Timing Function	Off	On			Control and

The input impedances of all modem circuits which accept signals from the data processing terminal or CPU equipment have DC resistances of 4.7K. For more specific details, consult the EIA RS232C standard itself.

The following chart lists the EIA RS232C interface pins and circuits present on the MT2834MR's RS232C Interface connector. All other pins are unused.

PIN	MULTI-TECH	EIA	SIGNAL	ASSIGNMENT	DESIGNATION	CIRCUIT SOURCE*
CIRCUIT FUNCTION						
1	PG	—	—	Protective Ground		
2	SD	BA	DTE	Transmitted Data		
3	RD	BB	DCE	Received Data		
4	RTS	CA	DTE	Request to Send		
5	CTS	CB	DCE	Clear to Send		
6	DSR	CC	DCE	Data Set Ready		
7	SG	AB	—	Signal Ground		
8	CD	CF	DCE	Data Carrier Detector		
9	+V	+V	DCE	Test Voltage		
12	HS	--	DCE	High Speed		
15	TC	DB	DCE	Transmit Clock		
17	RC	DD	DCE	Receive Clock		
20	TR	CD	DTE	Data Terminal Ready		
22	RI	CE	DCE	Ring Indicator		
24	XTC	DA	DTE	External Transmit Clock		
25	OOS	CN	DTE	Terminal Busy		

* DTE = Data Terminal Equipment (terminal or computer)
DCE = Data Communications Equipment (the modem)

The computer or terminal should be supplied with a cable terminated with a Cinch DB25P (or equivalent) connector mounted in a Cinch DB51226-1 (or equivalent) hood assembly as specified by the EIA RS232C standard.

FUNCTIONAL DESCRIPTION OF MT2834MR RS232C SIGNALS:

Transmitted Data - Pin 2, *SD* (BA)

Direction: to modem

Signals on this circuit are generated by the customer's terminal and transferred to the transmitter of the MT2834MR. A positive signal is a space (binary 0) and a negative signal is a mark (binary 0). The transmitting terminal should hold this line in the marking state when no data is being transmitted, including intervals between characters or words. The TRANSMIT (SD) LED indicates the status of this circuit.

Received Data - Pin 3, *RD* (BB)

Direction: from modem

The lead is the data output of the modem. Data signals received from the remote modem are presented on this line. When no carrier signal is received (pin 8 negative), this line is forced into a marking condition. The RECEIVE (RD) LED indicates the status of this signal.

Request To Send - Pin 4, *RTS* (CA)

Direction: to modem

The RTS signal indicates to the modem that the computer or terminal has data to transmit.

Clear To Send - Pin 5, *CTS* (CB)

Direction: from modem

The CTS line indicates to the terminal that the MT2834MR will transmit any data present on the Transmit Data line (pin 2).

Data Set Ready - Pin 6, *DSR* (CC)

Direction: from modem

DSR ON, indicates that the MT2834MR is in the data mode and is connected to the communications channel. This signal is on during analog-loop-test mode.

Signal Ground - Pin 7, *SG* (AB)

The SG lead is connected to signal ground of the modem. It establishes the common ground reference for all other interface signals.

Data Carrier Detect - Pin 8, *CD* (CF)

Direction: from modem

DCD On (positive voltage) indicates that data carrier has been received from the other modem. This circuit does not typically turn on in the presence of message circuit noise or out-of-band signals. There is a one second delay between when the carrier tone is detected and when the CD circuit is turned on.

This signal goes off if received data carrier falls below the receiver threshold for more than 37 mSec. When CD is off, the Received Data circuit (pin 3) is held to the marking state.

Test Voltage - Pin 9, XV

Direction: from modem

The XV lead has 330 ohms of resistance to +12 volts DC. This lead may be used to strap other signals high. For example, if the terminal does not supply a DTR (Data Terminal Ready) signal, Pin 9 may be jumpered to Pin 20 (DTR) on the RS232 connector or in the cable to force DTR on.

High Speed - Pin 12, HS

The On condition of this circuit indicates that the modem is in the high speed (1200 bps) mode. This circuit is commonly used to signal the computer or terminal to which the modem is connected to switch to its 1200 bps setting.

Transmit Clock - Pin 15, *TC* (DB)

Direction: from modem

The TC signal is provided only when the MT2834MR is used in the synchronous mode. The clock is a square wave and is used to provide the computer or terminal with timing information for its Transmit Data circuit (pin 2). This clock is provided on the interface at all times when the modem is in synchronous mode.

The first signal element of the Transmitted Data signal should be presented by the terminal on the first positive (Off to On) transition of TC which occurs after the CTS circuit on pin 5 is turned on. The transmitted data is sampled by the modem on negative transition of TC.

Receive Clock - Pin 17, *RC* (DD)

Direction: from modem

The RC signal has the same characteristic of Transmit Clock, with the exception that it is used to provide the computer or terminal with timing information for its Receive Data (pin 3) circuit. The negative transition (On to Off) of RC indicates the center of each signal element on the Received Data circuit.

Data Terminal Ready - Pin 20, *TR* or *DTR* (CD)

Direction: to modem

This signal (TR or DTR) provides a means for the terminal or computer to control the modem's connection to the communications channel. A high DTR signal is required by the modem to be able to communicate. Turning DTR off for more than 50 mSec forces the modem to disconnect.

The most common use of DTR is in automatic answer applications. A high DTR signal is required by the modem to answer a call. A frequently used method is to have the computer turn on DTR in response to RI (Ring Indicator), which allows the modem to answer. Later, DTR is turned off at the conclusion of the log off procedure, which forces the modem to disconnect, enabling it to receive another call. In non-auto answer applications it is advisable to leave DTR on using the modem's DIP-Switch option. This is the standard factory setting. An alternative is to provide a constant high DTR from the terminal or computer. The Data Terminal Ready (DTR) LED indicates the status of this signal.

Ring Indicator - Pin 22, *RI* (CE)

Direction: from modem

This signal remains on for the duration of the ringing signal. When a ring signal is received by the modem, the modem automatically answers after the first ring. The modem can answer after a specified number of rings which can be programmed in AT Command Mode, but if none is specified, the modem answers after the first ring.

External Transmit Clock - Pin 24, *XTC*

Direction: to modem

Supplies the same function as transmit clock on Pin 15.

Terminal Busy (Out of Service) - Pin 25, *OOS*

Direction: to modem

The Terminal Busy (OOS) circuit is not defined in the RS232C standard, but is used by us and most manufacturers to make the phone lines busy to incoming phone calls. Pin 25 is not typically connected to the RS232C interface when shipped from the factory; it can be ordered connected as an option. If pin 25 is connected and is brought high, the modem is placed Off Hook, and is busy to incoming calls.

Appendix I
Cable and Connector Pin Diagrams

RS232 Cable

1	1	Frame Ground	1
2	2	Transmit Data	2
3	3	Receive Data	3
4	4	Request to Send	4
5	5	Clear to Send	5
6	6	Data Set Ready	6
7	7	Signal Ground	7
8	8	Carrier Detect	8
9	9	+ Voltage Test	9
12	12	High Speed	12
15	15	Transmit Clock	15
17	17	Receive Clock	17
20	20	Data Terminal Ready	20
22	22	Ring Indicator	22
25	25	Terminal Busy	25

25-pin Male Connector (DB25P type)

25-pin Female Connector (DB25S type) (on back of modem or CC216 rack)

Connects to Terminal or Computer RS232 Interface (serial port). Gender and pin-out depends on device.

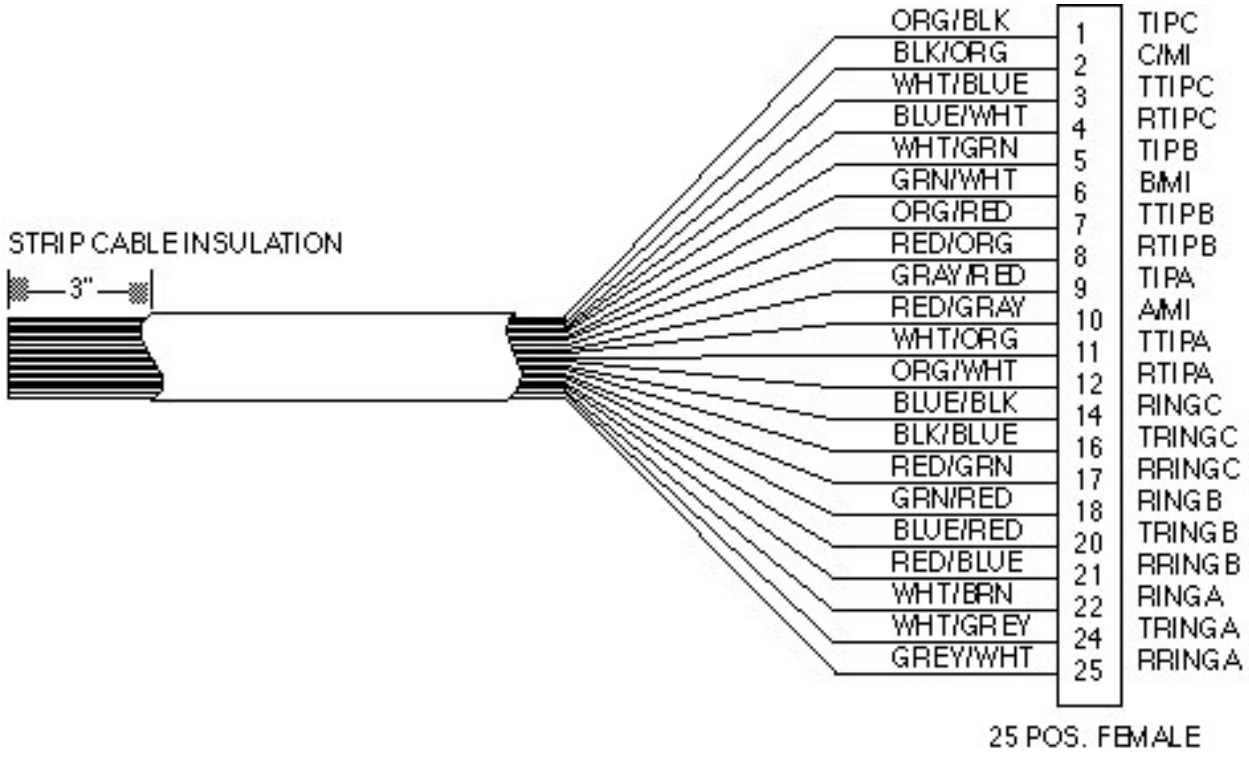


Figure I-2. Line Cable

APPENDIX J
MULTI-TECH SYSTEMS' ESCAPE METHODS

Introduction

You may find it necessary sometimes to issue AT commands to your modem while you are on-line with a remote modem, without disconnecting the call. If so, you will want to take advantage of *Escape methods* which allow you to change the modem's mode of operation from On-Line mode to Command mode, where you may issue AT commands, without disconnecting. While you may then return on-line, typically most users escape so that they may hang up a modem upon completion of a call.

Our modems offer two Escape Methods: *in-band*, and *out-of-band*. Both incorporate Time Independent Escape Sequence (TIES) methodology. An *escape sequence* is a pattern, or sequence, that the modem recognizes as its signal to shift from On-Line mode to Command mode. *Time Independent* means that the modem recognizes the escape sequence without a prefixed and/or suffixed delay.

In an *in-band* escape, the modem recognizes the escape sequence as a pattern sent to it as part of the data stream or band (hence its name).

In an *out-of-band* escape, the escape sequence is a pattern that **cannot** and **does not** occur in the data stream.

Our in-band escape method is: **+++AT<CR>.**

Our out-of-band escape method is: **<BREAK>AT<CR>.**

A **BREAK** signal cannot be sent as part of a data file; instead it is sent by a direct program command to the UART used by that computer.

BREAK is defined as either the transmission of binary 0 for a minimum of 10 bits; or as a minimum interval of 135 milliseconds as established in the ITU-T X.28 standard. There are routines in high level languages, and keys on most computers that have been established to send BREAK for fixed intervals, but you may control the BREAK's duration by refering to your UART's specifications.

How to Select an Escape Method

If you want your modem to escape and then wait for you to issue a command before it will return to On-Line mode, then use **+++AT<CR>**. You might use this method if you find you need to review a help screen in the middle of a communications session.

If you wish to combine the escape with a command (or commands) and with an immediate return to On-Line mode, then use the **<BREAK>AT<CR>** method. You may also use this method to have the modem wait before it will return On-Line.

You may select your modem's escape method by using an **AT%E** command.

The AT commands used to select the modem's Escape Method are:

%E0 = Escape Disabled	**%E3 =** Both escape methods enabled
%E1 = +++AT method (default)	**%E4 =** Disable OK response to +++
%E2 = <BREAK>AT method	**%E5 =** Enable OK response to +++

Escape Method 1: +++AT<CR>

In the following example, a user who is On-Line decides to set S0 Register to 1, to configure the modem to answer on the first ring.

1. The user enters the sequence **+++AT<CR>** . The sequence is sent to the modem.

2. The modem transmits the +++.

3. The modem buffers AT and starts the **Wait for <CR> timer**.

4. Upon receiving the <CR> the modem escapes to Command mode.

5. The modem responds OK.

6. The user enters the command **ATS0=1<CR>**. This sequence is sent to the modem.

7. The modem buffers **ATS0=1<CR>** and identifies it as a valid command.

8. The modem executes the command, setting S0=1.

9. **ATO<CR>** is sent to the modem.

10. The modem returns to On-Line mode.

Escape Method 2: <BREAK>AT<CR>

In the following example, a user who is On-Line decides to set S-Registers S0 to 1, to configure the modem to answer on the first ring.

1. The **<BREAK>** signal is sent to the modem.

2. The modem buffers **<BREAK>**.

3. The modem starts the S32 **Wait for <CR> timer**.

4. **ATS0=1<CR>** is sent to the modem.

5. The modem buffers **ATS0=1<CR>** and identifies it as a valid command.

6. The modem escapes to Command mode.

7. The modem executes the command, setting S0=1.

8. The modem returns to On-Line mode.

S-Registers and Escape Sequences

There are two S-Registers that you may set to modify the functioning of your escape sequences. The first is S-Register S32, which establishes a value for how much time may elapse between the receipt of the beginning of the escape sequence, whether **<BREAK>AT**, or **+++AT**, and the receipt of a <CR>. This interval is known as Wait for <CR> Time, or BREAK passthru.

You may assign a value to S32 in increments of 100 milliseconds. The default value is 20, or 2 seconds.

In the **+++AT<CR>** method, the Wait for <CR> Time interval begins once the A in **+++AT** is received by the modem.

In the **<BREAK>AT** method, the Wait for <CR> Time interval begins once the modem has received the **BREAK** signal.

You may use S-Register S34 in conjunction with our in-band escape sequence, **+++AT<CR>**, to establish the maximum number of characters that your modem can buffer following an “AT,” before a <CR> must be received. The default value is 10 characters. Do not confuse this buffer size with our regular Command mode buffer length of 60 characters.

S-Register S34 does not affect our out-of-band escape sequence’s buffer length, which is fixed at 60 characters.

Aborting an Escape Sequence

The **+++AT<CR>** escape will abort if you do not issue a <CR> before the Wait for <CR> Time interval expires.

The **<BREAK>AT<CR>** method will also abort if you do not issue a <CR> before the Wait for <CR> Time interval expires, and also if any of the following occurs:

1. An illegal sequence is detected, including:

a) A character other than A follows the **<BREAK>;**

b) A character other than T follows **<BREAK>A;**

c) Two BREAKS are received in succession;

2. The command buffer overflows before a **<CR>** occurs.

If you have any questions about the information contained in this document, please direct them to:

Technical Support

c/o Multi-Tech Systems, Inc.

2205 Woodale Drive

Mounds View, Minnesota 55112 USA

APPENDIX K
Remote Configuration

Introduction

This chapter describes how the MT2834MR Remote Configuration feature operates. This feature uses a multilevel security system that involves the use of LOGIN passwords, SETUP passwords, and remote escape characters.

The primary level security code is the modem's LOGIN password. Once this password is entered, other passwords can be used. For instance, entering the LOGIN password lets you enter the SETUP password.

The remote escape character is the key to using the Remote Configuration feature. The remote escape character lets you enter Command mode via a remote call, so that you can type AT commands just as if you were locally connected. You must also type your modem's SETUP password. The remote escape character is contained in S-Register S13.

Remote Configuration Description

The Remote Configuration feature is a network management tool that lets you configure modems remotely. This means you can configure modems anywhere in your network from one location, without having to visit the sites or rely on remote users to follow your instructions. With Remote Configuration, which is protected by two-level security, you can downline load new parameters, program new V.42 capabilities, and implement new features. Remote Configuration also makes troubleshooting remote locations a lot easier.

S-Register S13 contains the special remote configuration escape code. When calling a Remote Configuration equipped modem, you enter the proper remote escape code and SETUP password. After entering both correctly, you can then execute AT commands as if you were connected locally. If you set S-Register S13 to zero, Remote Configuration is disabled.

Initial SETUP Procedures for Remote Configuration

Your modem is shipped with default LOGIN and SETUP passwords (LOGIN=MULTI-TECH and SETUP=MODEMSETUP) so you can configure the modem. Because the defaults are in the owner's manual, anyone can find out what they are. You should change the codes as the first step of your initialization procedure.

To change your modem's LOGIN and SETUP passwords, follow the steps below.

NOTE: Passwords are upper/lower case sensitive. The case you enter here is the case that must be used at login.

Modem LOGIN, SETUP, and Remote Escape Codes

1. Type **AT#IMULTI-TECH** and press ENTER. Your modem responds with:

   OK (if the LOGIN password is wrong, the modem's response is *ERROR)*

2. Type **AT#SMODEMSETUP** and press ENTER. Your modem responds with the following:

   OK (or *ERROR* if the wrong SETUP password is entered)

NOTE: At this point you can change the LOGIN password and SETUP passwords.

3. Type **AT#I=xxxxxxxxxx** (with any keyboard characters used: minimum = 6, maximum = 10) and press ENTER. Your modem responds with:

   OK

4. Type **AT#S=yyyyyyyyyy** (with keyboard characters used: minimum = 6, maximum = 10) and press ENTER. Your modem responds with:

   OK

To change the status of your Remote Configuration feature:

5. To disable Remote Configuration, set S-Register S13 to 0 (zero). See Chapter 6 for details on how to set S-Register values.
6. To enable Remote Configuration and change the remote escape character, type in a new S-Register S13 value.

Remote Configuration AT Commands

The following AT commands are used with the Remote Configuration feature.

#I ***Modem LOGIN Password***

The ***#I*** command lets you select a unique LOGIN password for your modem. Once you have selected a LOGIN password for your modem, it only responds to that code. Your modem is shipped with MULTI-TECH as its default password so that you can gain access to the command initially.

#S ***Modem SETUP Password***

The ***#S*** command lets you select a unique SETUP password for your modem. Once you have selected a SETUP password for your modem, it only responds to that code. Your modem is shipped with MODEMSETUP as its default password, so that you can gain access to the command initially.

Remote Configuration S-Register

S-Register S13 is used with Remote Configuration. It defines the MT2834MR remote configuration escape character. When the S13 character is entered three consecutive times from a remotely connected site, your modem responds to it with its Remote Configuration procedure. The default remote configuration escape character is the "%" sign. See Chapter 4 for more information about this S-Register.

Remote Configuration Procedures

This section explains how to use the Remote Configuration feature; they are the same whether or not a call originates from the remote modem.

Remote Configuration Operation

1. Enter a break signal, then type the S13 remote configuation escape character three times (the default S13 value is the "%" sign).

   The modem responds with:

   1. - DATA Mode
   2. - COMMAND Mode

2. Select 1 or 2. With option 1, the modem goes back into Data mode and with option 2, the modem responds with *Password>.*
3. Type your SETUP password and, if the code is correct, the modem responds with *OK.*

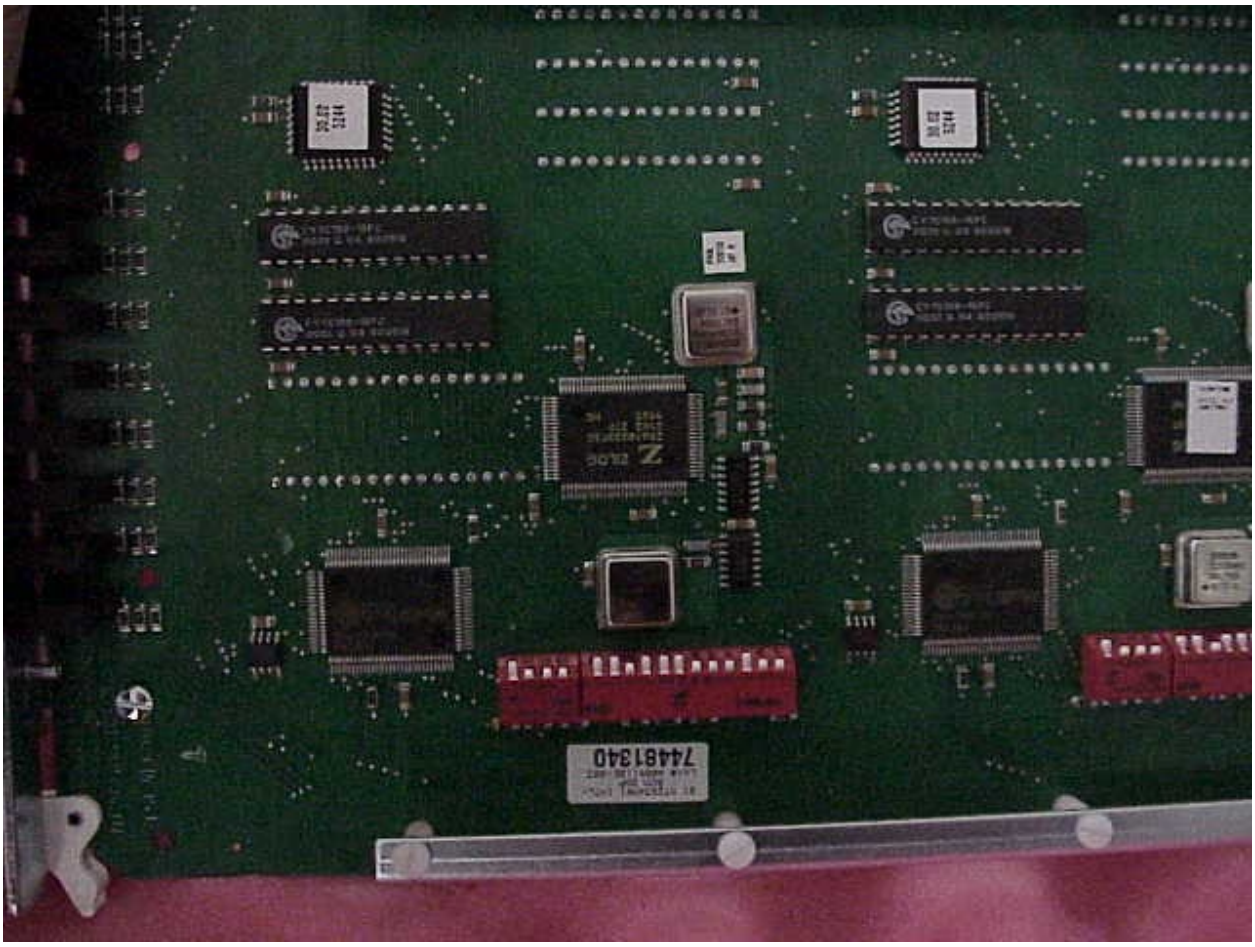
   You can now use any AT commands remotely as if they were entered locally. You cannot change the LOGIN password until you enter the proper LOGIN password.

4. When you are done typing AT commands and you wish to exit, type **AT0** and press ENTER. The modem responds with:

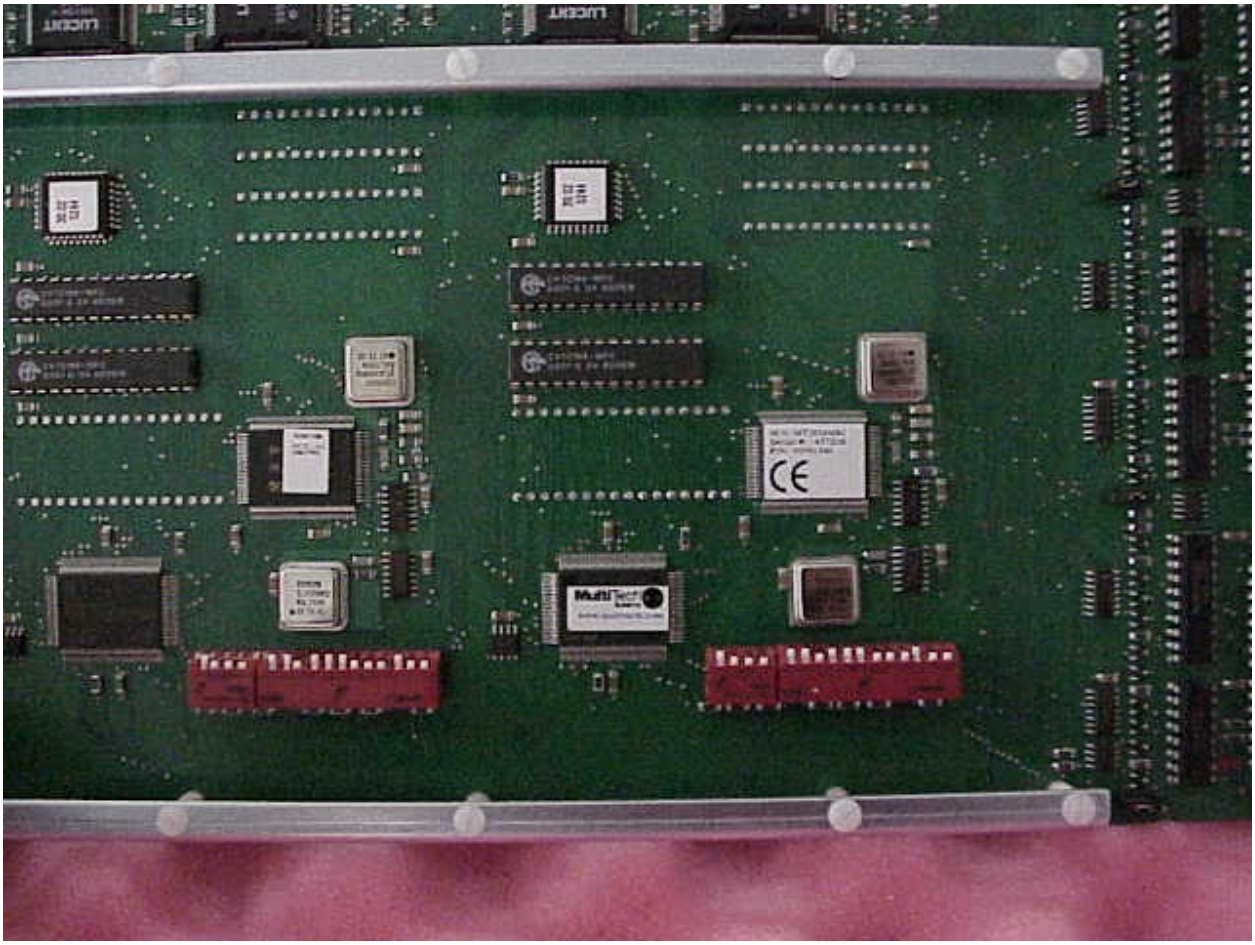
   1. DATA Mode
   2. COMMAND Mode

5. Type **1** to go back on-line with your computer, or type **2** and the correct password to talk to your modem.

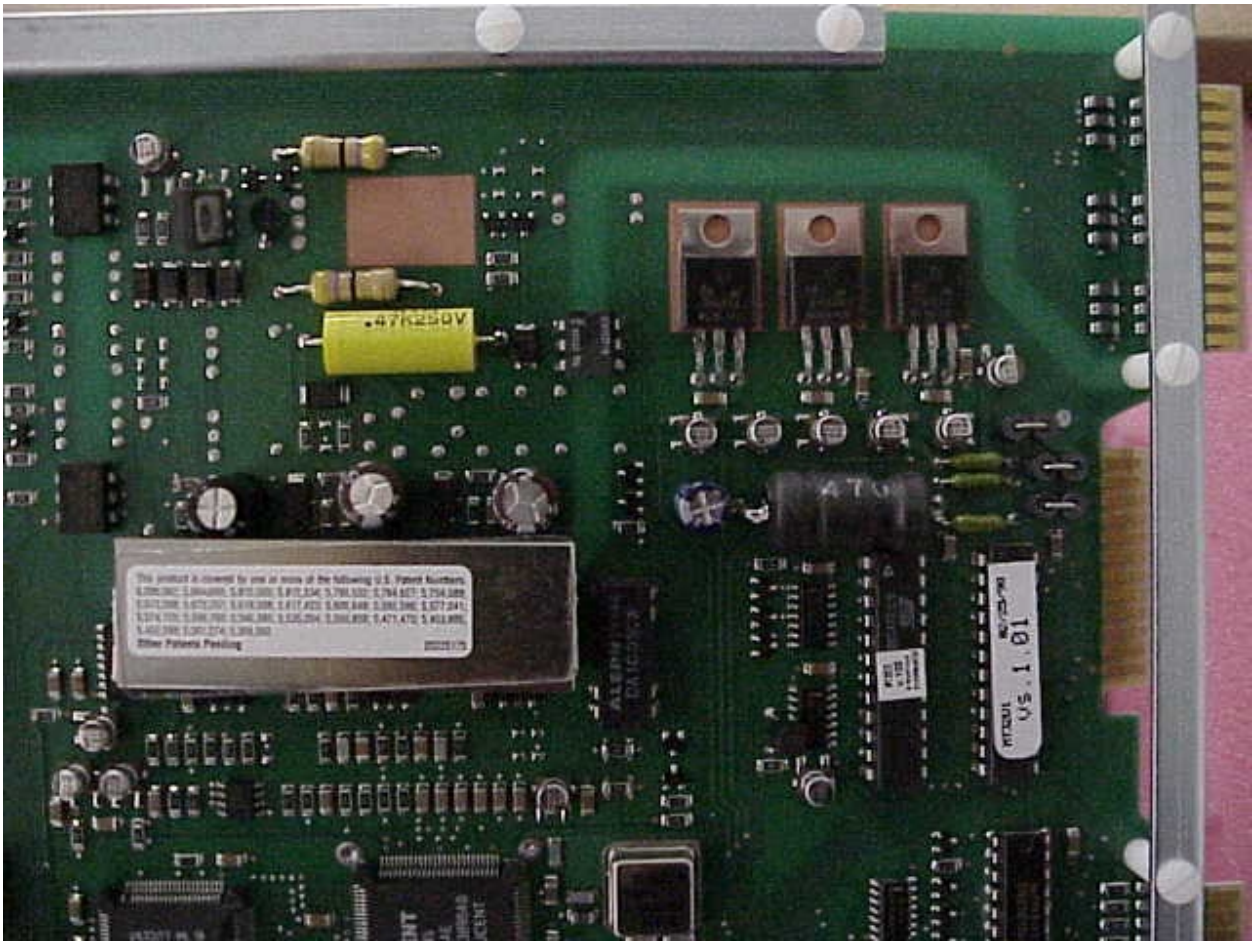
Appendix L
MT2834MRI PC Board



MT2834MRI PCB Top



MT2834MRI PCB (Chassis 2)



MT2834MRI Labels