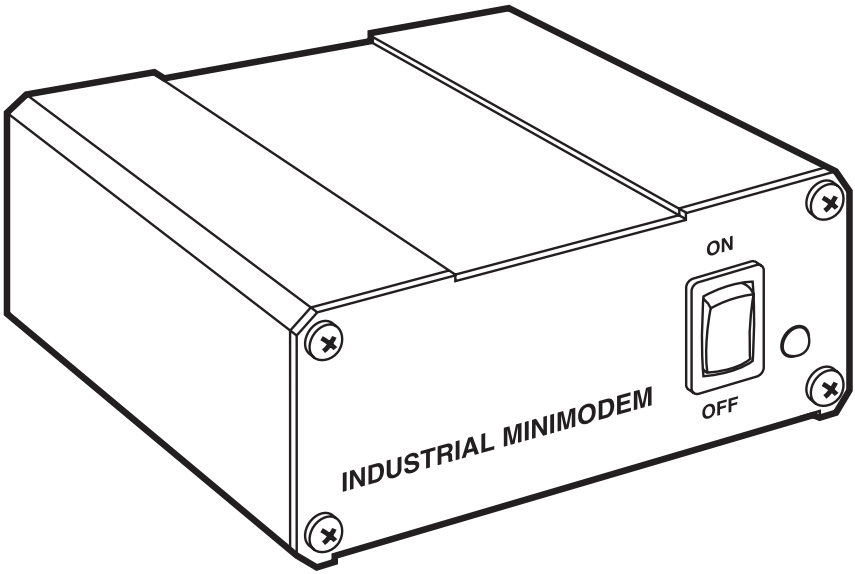
BLACK BOX®
NETWORK SERVICES

MAY 2001
MD3200A

Industrial Mini Modem



CUSTOMER SUPPORT INFORMATION

Order **toll-free** in the U.S.: Call **877-877-BBOX** (outside U.S. call **724-746-5500**)
FREE technical support 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mailing address: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: **www.blackbox.com** • E-mail: **info@blackbox.com**

FEDERAL COMMUNICATIONS COMMISSION
AND
INDUSTRY CANADA
RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

FCC Requirements for Telephone-Line Equipment

1. The Federal Communications Commission (FCC) has established rules which permit this device to be directly connected to the telephone network with standardized jacks. This equipment should not be used on party lines or coin lines.

2. If this device is malfunctioning, it may also be causing harm to the telephone network; this device should be disconnected until the source of the problem can be determined and until the repair has been made. If this is not done, the telephone company may temporarily disconnect service.

3. If you have problems with your telephone equipment after installing this device, disconnect this device from the line to see if it is causing the problem. If it is, contact your supplier or an authorized agent.

4. The telephone company may make changes in its technical operations and procedures. If any such changes affect the compatibility or use of this device, the telephone company is required to give adequate notice of the changes.

5. If the telephone company requests information on what equipment is connected to their lines, inform them of:

   a. The telephone number that this unit is connected to.

   b. The ringer equivalence number.

   c. The USOC jack required: RJ-11C.

   d. The FCC registration number.

   Items (b) and (d) can be found on the unit's FCC label. The ringer equivalence number (REN) is used to determine how many devices can be connected to your telephone line. In most areas, the sum of the RENs of all devices on any one line should not exceed five (5.0). If too many devices are attached, they may not ring properly.

6. In the event of an equipment malfunction, all repairs should be performed by your supplier or an authorized agent. It is the responsibility of users requiring service to report the need for service to the supplier or to an authorized agent.

Certification Notice for Equipment Used in Canada

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications-network protective, operation, and safety requirements. Industry Canada 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 (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 maintenance facility—in this case, Black Box. 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.

CAUTION:

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

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.

NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.

2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.

3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.

4. Todas las instrucciones de operación y uso deben ser seguidas.

5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..

6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.

7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.

8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.

9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

TRADEMARKS USED IN THIS MANUAL

Windows® is a registered trademark of Microsoft Corporation.

Hayes® is a registered trademark of Microcomputer Products, Inc.

MNP® is a registered trademark of Microcom Systems, Inc.

Any other trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.

Contents

Contents (continued)

Quick Start

1. Use a straight-through 9-pin to 9-pin RS-232 data cable to connect the Industrial Mini Modem to any PC or laptop running a terminal program such as HyperTerminal in Windows®.

2. Connect the power supply to the modem, and place the power switch in the On position. The red power LED indicator should turn on.

3. Typing "AT" and then pressing the "return" key on the PC or laptop will prompt the Industrial Mini Modem to respond with an "OK."

4. Once communication with the Industrial Mini Modem has been established, then the chosen command string can be programmed into the unit.

NOTE

We strongly recommend that you begin with the modem at factory-default settings before sending any of the configuration command strings detailed in this manual. This will prevent inadvertent settings from disrupting your communications.

5. After the chosen command string has been programmed into the Industrial Mini Modem, the only command strings that will be needed from the host device are for dialing and hanging up the modem.

6. The command instructions sent to the modem either by PC program or host device are as follows:

Dial String:	ATDT*x* (where *x* is the phone number)
Command Mode:	+++ (escape sequence to get modem attention when connected)
Hang Up:	ATH0

NOTE

We recommend that you do not allow the host device to use any initialization string when commanding the modem to dial. Many host-device manufacturers have a default initialization string programmed into the device's communication settings. This string should be edited and replaced with the ATDT command only. Any other string may affect the pre-programmed configuration and adversely affect communications

1. Specifications

Operation: Full or half-duplex asynchronous on telephone dialup line

Modulation: Trellis-coded (CCITT V.34bis, V.34, V.32, V.22bis, V.22, V.21, Bell 212A and 103 modulations supported)

User Controls: On/Off switch

Indicators: (1) Power LED

Connectors: (1) DB9 female serial port, (1) RJ-11 for phone connection

Operating Temperature: -40 to +185°F (-40 to +85°C)

Power: 9 to 15 VDC via barrel-jack power connector, 200 mA max. (120/12 VDC, 500-mA receptacle plug-in transformer supplied)

Size: 1.625"H x 3.75"W x 4.5"D (4.1 x 9.5 x 11.4 cm)

Weight: 0.75 lb. (0.3 kg)

2. Introduction

2.1 Overview

The Industrial Mini Modem meets the demanding needs of the industrial data communications industry. This full-featured modem is capable of 33.6-kbps data transfer rates. It supports the various data transmission requirements that industrial automation and signaling equipment demands, and it's designed to withstand the harsh, unforgiving environments typically found in industrial applications.

The modem is housed in a rugged extruded aluminum case that provides excellent protection against shock and particle contaminants. The circuitry is designed to provide reliable operation at temperatures ranging from -40 to +185°F (-40 to +85°C) and has been treated with a special weather- and moisture-resistant coating to protect it from the elements.

Providing both firmware and hardware for critical applications, the modem is compatible with communication requirements of industrial application devices.

Some of the industries that benefit from the hardened communications of the Industrial Mini Modem include power, water, railroad, gas, petroleum, traffic, transportation, manufacturing, mining, metals, medical, agriculture, pulp and paper, material handling, banking, vending, and security.

2.1.1 Front Panel

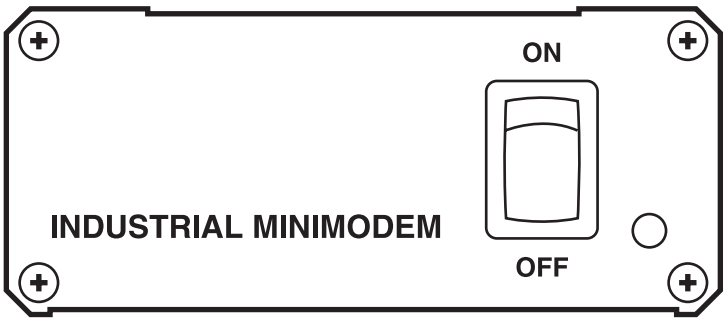


Figure 2-1. The Modem's front panel.

2.1.2 Rear Panel

Figure 2-2. The Modem's rear panel.

2.2 Features

- Rugged environmentally protected circuitry.
- Rugged extruded aluminum enclosure.
- Extended operating temperature.
- On/Off switch with LED indicator.
- Single DB9 female DCE serial port (straight-through cable to computer terminal supplied).
- RJ-11 for phone connection (phone cord cable supplied).
- 12-VDC operation (120-VAC wall plug transformer supplied).
- Hayes® AT command set compatible.
- 1200 to 33.6 kbps asynchronous data communication.
- Auto fault reset.
- Free technical support.

3. Operation

3.1 Basic Operation

The modem has been pre-configured for 19,200-baud industrial type communication settings. The default setting enables most of the features of the Industrial Mini Modem except for its cellular and fax capabilities. The default setting would be used primarily for PC or Internet communication. The modem would not answer on its own in this configuration. Many industrial data communication systems require that some of the factory-default settings be disabled in order to maintain reliable data communications. For most industrial applications, a simple ATDT dial string is all that the Industrial Mini Modem will require to connect and provide reliable communications. To do this, pre-program the modem with one of the factory-recommended AT command strings provided in this manual.

3.2 Modes of Operation

The modem operates in three modes: Data Mode, Command Mode, and Fax Mode.

3.2.1 Data Mode

The modem enters data mode after it establishes a link and issues a “Connect” result code. In data mode, the modem IC module modulates all signals on Transmit Data (pin 13) and sends them to the remote modem. The modem IC module demodulates the signal from the remote modem and places it onto Received Data (pin 3) for the host equipment. When the modem exits data mode, it issues a “No Carrier” result code.

3.2.2 Command Mode

The modem enters command mode upon application of power, reset, loss of the connection, or receipt of the escape sequence. In command mode, the modem accepts commands from the host on Transmit Data. Appropriate result codes are returned on Received Data at the same speed and parity as the commands.

3.2.3 Fax Mode

The modem enters fax mode upon receipt of the AT+FCLASS=1 command. Fax commands and responses are issued at 19,200 bits per second; the character format is 8 bits, no parity. The modem accepts Class 1 Fax commands only in fax mode. The A/, ATO, AT&T and escape commands are not valid in fax mode.

4. Command Basics

The modem is configured and controlled with AT commands. AT commands follow a strict format. The command line is stored in the command buffer and executed upon receipt of a carriage return. Until executed, the command line can be edited with the backspace key.

4.1 Command Format

Each command, except A/, begins with the AT prefix. The “A” and “T” may both be upper case or both lower case but cannot be of different cases. The modem uses the prefix to identify the host’s speed and parity. The modem determines speed by measuring the width of the incoming bits and parity by comparing the parity bits of the “A” and “T.” The modem then returns result codes at the host’s speed and parity.

4.2 Command Line

A command line may include multiple commands. The modem executes the commands in the sequence they appear in the command line. Spaces, inserted to improve legibility, do not fill space in the command buffer. A carriage return terminates the command line and causes the commands to be executed. Register S3 lets you select a character other than a carriage return to terminate the command line.

4.3 Command Buffer

The command buffer holds 40 characters, including the AT prefix. If it overflows, the modem issues an “Error” result code and commands are not executed.

4.4 Command Line Editing

A backspace can be used to edit the command any time before it is executed. On some systems, pressing the backspace character, Control, and H simultaneously erases the previous character in the command line. Any character except for the “A” and “T” can be erased. Register S5 lets you select a character other than a backspace to edit the command line.

4.5 Re-Execute Last Command

The A/ command causes the modem to re-execute the command line stored in the command buffer. This is the only command that does not require the "AT" prefix.

4.6 Omitted Parameters

Most commands include a parameter that determines the command function. When the parameter is omitted from the command string, it is assumed to be a 0.

4.7 Escape Characters

A three-character escape sequence, entered while in data mode, will switch the modem into command mode while remaining on line. The escape character, set by Register S2, is entered 3 times in succession to execute the escape. The default escape sequence is "+++."

4.8 Result Codes

The modem issues a result code after each action. Result codes may be provided as full words, numeric codes, or may be disabled. Each result code ends with a carriage return when numeric result codes are chosen. When full word result codes are chosen, a line feed and carriage return precede and follow each result code.

5. Pre-Programming Command Strings

This chapter describes programming the Industrial Mini Modem for communication with typical industrial devices at baud rates from 1200 to 19,200 bps.

NOTE

In each command string, there are operating parameters that program the modem to disable functions that will typically cause unreliable communication in an industrial environment.

In addition, there is a command string for a factory-default setting. At the default setting, the modem will negotiate the best possible connect and data transfer rate.

The command strings, and the profiles that display after entering them correctly, are shown as they would look in a typical terminal program such as ProComm or HyperTerminal.

Take care to enter each command string correctly. Before programming any of the baud rate command strings, first send the factory-default command string to the modem. This will ensure that the modem configuration does not contain incompatible commands with the chosen command string.

5.1 Factory-Default Command String

AT&F0&W&W1&V

ACTIVE PROFILE
B1 E1 L1 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D2 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0 &Y0
S00:000 S01:000 S02:043 S03:013 S04:010 S05:008 S06: 002 S07:050 S08:002 S09:006
S10:014 S11:095 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S44:020
S46:138 S48:007 S95:000

STORED PROFILE 0:
B1 E1 L1 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D2 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0
S00:000 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:195 S46:138 S95:000

STORED PROFILE 1:
B1 E1 L1 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D2 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0
S00:000 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41: 195 S46:138 S95:000

TELEPHONE NUMBERS
0= 1=
2= 3=

OK

5.2 1200-Baud Command String

ATL3&C1&D0&Q0%E0%C0S0=1+MS=11,1,1200,1200&W&W1&V

ACTIVE PROFILE:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0 &Y0
S00:001 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:050 S08:002 S09:006
S10:014 S11:095 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S44:020
S46:136 S48:007 S95:000

STORED PROFILE 0:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0
S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:128 S46:136 S95:000

STORED PROFILE 1:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 *S0 &T5 &X0
S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:128 S46:136 S95:000

TELEPHONE NUMBERS:
0= 1=
2= 3=

OK

5.3 2400-Baud Command String

ATL3&C1&D0&Q0%E0%C0S0=1+MS=11,1,2400,2400&W&W1&V

ACTIVE PROFILE:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0 &Y0
S00:001 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:050 S08:002 S09:006
S10:014 S11:095 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S44:020
S46:136 S48:007 S95:000

STORED PROFILE 0:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0
S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:128 S46:136 S95:000

STORED PROFILE 1:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 *D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0
S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:128 S46:136 S95:000

TELEPHONE NUMBERS:
0= 1=
2= 3=

OK

5.4 4800-Baud Command String

ATL3&C1&D0&Q0%E0%C0S0=1+MS=11,1,4800,4800&W&W1&V

ACTIVE PROFILE:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0 &Y0
S00:001 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:050 S08:002 S09:006
S10:014 S11:095 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S44:020
S46:136 S48:007 S95:000

STORED PROFILE 0:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0
S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:128 S46:136 S95:000

STORED PROFILE 1:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &t5 &X0
S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:128 S46:136 S95:000

TELEPHONE NUMBERS:
0= 1=
2= 3=

OK

5.5 9600-Baud Command String

ATL3&C1&D0&Q0%E0%C0S0=1+MS=11,1,9600,9600&W&W1&V

ACTIVE PROFILE:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0 &Y0
S00:001 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:050 S08:002 S09:006
S10:014 S11:095 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S44:020
S46:136 S48:007 S95:000

STORED PROFILE 0:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0
S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:128 S46:136 S95:000

STORED PROFILE 1:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0
S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:128 S46:136 S95:000

TELEPHONE NUMBERS:
0= 1=
2= 3=

OK

5.6 19,200-Baud Command String

ATL3&C1&D0&Q0%E0%C0S0=1+MS=11,1,19200,19200&W&W1&V

ACTIVE PROFILE:
B1 E1 Le M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0 &Y0
S00:001 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:050 S08:002 S09:006
S10:014 S11:095 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S44:020
S46:136 S48:007 S95:000

STORED PROFILE 0:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0
S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:128 S46:136 S95:000

STORED PROFILE 1:
B1 E1 L3 M1 N1 Q0 T V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K3 &Q0 &R1 &S0 &T5 &X0
S00:001 S02:043 S06:002 S07:050 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:104 S41:128 S46:136 S95:000

TELEPHONE NUMBERS:
0= 1=
2= 3=

OK

6. Troubleshooting

6.1 Problems/Solutions

Problem: The modem will not respond to an AT command.

Solution #1: Check the power for 12 VDC, and confirm that the power switch is on.

Solution #2: Check that the DB9 data cable between the PC and the modem is attached correctly.

Solution #3: Confirm that the terminal program you are using is set for the correct communication port on the PC.

Solution #4: Recycle power to the modem.

Problem: The modem responds to AT commands but reports NO DIAL TONE DETECTED when dialing is attempted.

Solution #1: Check that the RJ-11 phone cord between the wall jack and the modem is attached correctly.

Solution #2: Confirm that there is a dial tone on the phone circuit in use.

Problem: The modem dials and rings but nothing answers.

Solution #1: Confirm that the answering modem is powered up and connected to the phone line correctly.

Solution #2: Check that the S0 register is not set to 0 in the answering modem. Issue an ATS0=1 command to the answering modem, and it will pick up on the first ring.

Problem: The modem reports NO CARRIER after dialing.

Solution #1: Confirm that there is another modem or fax attached to the line of the phone number being called.

Solution #2: Make sure the modem on the other end is functioning correctly and has been configured correctly for the system.

Problem: The modem connects, but the control device does not communicate.

Solution: This is generally due to a data cable wiring problem. Many industrial devices require the DSR, DTR, and CD signals to be tied together, as well as the CTS and RTS signals tied together.

6.2 Data Cable Configurations

One of the most common causes of initial communication problems involves the cable wiring between the modem and the industrial device to which it is attached. Earlier modem models relied on hardware signals to control the flow of data between devices. With advances in technology, this practice has become obsolete for industrial modems. Most newer industrial equipment requires only the transmit, receive, and signal ground lines to communicate effectively. However, much of the existing equipment was designed with the requirements of the older modem designs in mind. For this existing equipment, special data cable wiring may be required. It is common to find that the Request to Send and Clear to Send signals need to be tied together on the data device side. Other signals found commonly tied together are the Data Terminal Ready and Data Set Ready. Consult the serial port information of the data device to determine the proper connection, or call Black Box Technical Support at 724-746-5500.

6.3 Telephone Line Circuits

A common cause of intermittent data communication problems is the quality of the telephone line circuit. This is usually the result of excessive background noise or an insufficient signal level. Both can be caused by poor circuit connections or bad premises wiring.

A quick way to check your circuit quality is to make a voice call on the data line several different times listening for background noise or very low volumes on either end of the line. Both conditions will have an adverse effect on error rates and throughput. If either of these is found, the premises wiring and modem

connections should be double-checked before contacting the local telephone company to request service.

There are times that a hard-to-find or intermittent circuit problem will prove more difficult to identify. In this case, perform regular tests on the line circuits using a quality control line test set. A pair is needed to perform all functional tests. At a minimum, the line test should be capable of continuity, line levels, and noise levels. A quality tester will also provide complete documentation and explanation on the use of all the test functions.

6.4 Frequently Asked Questions

Q: Can the Industrial Mini Modem communicate with the modem in my PC or laptop?

A: Yes. The factory configuration will negotiate the highest speed possible up to 33.6 kbps, and normal computer or Internet data can be transferred. If the PC or laptop will be used for communicating with industrial hardware, you might need to adjust the settings of the PC's or laptop's modem for compatibility with the industrial device's communication requirements. This is not always possible with a non-industrial rated modem.

Q: How long will the Industrial Mini Modem perform in an industrial environment?

A: The modem can provide 10+ years of service under most conditions.

Q: Will the modem operate in environments with a high level of EMF from sources like high-voltage power lines or transmission towers?

A: Yes, the modem is EMF hardened and will not be adversely affected when operated in close proximity to noise sources.

7. Glossary

Asynchronous: Data that is transferred without the use of a synchronizing clock signal.

Baud Rate: A measure of data transfer speed at the port. 1200 baud=1200 bits of data per second.

Carrier: A signal negotiated between the two modems that establishes the communication link.

Command String: A string of characters usually started with "AT" that contains instructions for the modem configuration.

Data Control Lines: RTS, CTS, DSR, DTR, and CD signal lines that sometimes control data flow in a serial port.

Data (Serial) Port: The 9-pin or 25-pin connector on a modem that receives data for modulation and sends data that has been demodulated.

Error Correction: The use of checksums and algorithms to ensure accurate data transmission.

Firmware: The software-developed operating instructions that are programmed into the modem hardware.

Hardware: The modem's physical components.

Line Monitor: The process where a modem continually checks and updates the quality of a connection.

Modem: A device that modulates a signal for transmission (usually over phone lines) and demodulates a signal that is received.

Process Logic Controller: A device used for monitoring and controls in an industrial environment.

Receive (RX): Data that is going into the modem phone connector for demodulation and transfer out the data port.

Speed Negotiation: The process where a modem constantly attempts to derive the best data throughput speed over a connection.

Terminal: A data device that is used to command a modem. A computer with a software terminal emulation program is the most common in use today.

Throughput: The actual amount of data that is transferred in a given time period (usually one-second intervals).

Transmit (TX): Data that is modulation going out the modem phone connector for transfer to another modem.

Appendix A. Modem AT Commands

Command	Function
A: Answer Command	ATA forces the modem to go off-hook immediately and transmit answer tone.
B*n*: Select Communications Standard	ATB*n* selects the modulation for low-speed connections. *n*=0 selects CCITT standards *n*=1 selects Bell standards
D: Dial Command	Below are the characters accepted in a dialing command. 0–9, #, *= Dialing Digits L=Redial last number P=Pulse dial T=Tone dial S=n=Dial stored number W=Wait for dial tone ,=Pause for the duration of S8 @=Wait for silence !=Switch hook flash ;=Return to the command state &=Wait for credit-card dialing tone ^=Switch calling tone status
E*n*: Command Echo	ATE*n* determines whether commands will be echoed back to the host. *n*=0 Do not echo commands *n*=1 Enable command echo
H*n*: Switch Hook Control	ATH*n* opens and closes the modem's hook switch. *n*=0 Switch hook relay opens *n*=1 Switch hook relay closes

Command	Function
I*n*: Modem Identification L*n*: Speaker Volume	ATI*n* identifies the version of the modem. ATL*n* sets the amplitude of the modem's audio input. *n*=0 Lowest speaker volume *n*=1 Low speaker volume *n*=2 Moderate speaker volume *n*=3 High speaker volume
M*n*: Speaker Activity	ATM*n* determines when the modem's audio output is active. *n*=0 Speaker off *n*=1 Speaker on until carrier received *n*=2 Speaker remains on *n*=3 Speaker off during dialing, on until carrier
N*n*: Data Rate	ATN*n* selects whether or not the modem will negotiate a lower data link speed. *n*=0 Handshake only at DTE rate *n*=1 Negotiate highest common speed
O*n*: On Line	ATO*n* switches the modem from the command mode to the data mode. *n*=0 Return On Line with no retrain *n*=1 Initiate retrain returning On Line
Q*n*: Responses	ATQ*n* determines if the modem will issue responses. *n*=0 Send responses *n*=1 No responses
Sr?: Interrogate Register	ATSr? requests the current value in register Sr Sr=n Set Register Value ATsr=n sets the value of register Sr to n

Command	Function
V*n*: Result Codes	ATV*n* sets the modem to issue numeric or full word result codes. *n*=0 Numeric result codes *n*=1 English result codes
W*n*: Connect Message Rate	ATW*n* determines whether the host or link data rate is reported in the Connect response or whether both are provided with the error control and data compression protocols. *n*=0 Send "CONNECT" at DTE rate *n*=1 Report line speed, DTE speed, link protocol *n*=2 "CONNECT" reports link speed
X*n*: Result Code Set	ATX*n* selects which set of result codes the modem may send. *n*=0 Result codes 0 to 4 *n*=1 Result codes 0 to 5 and 10 *n*=2 Result codes 0 to 6 and 10 *n*=3 Result codes 0 to 5, 7, and 10 *n*=4 Full result codes
Y*n*: Long Space Disconnect	ATY*n* determines if the modem will automatically disconnect if a continuous space is received for 1.6 seconds. *n*=0 Long space disconnect disabled *n*=1 Disconnect on long space
Z*n*: Reset	ATZ*n* executes a soft reset to the modem and resets the modem configuration. *n*=0 Reset to user profile 0 *n*=1 Reset to user profile 1

Command	Function
&C*n*: DCD Operation	AT&C*n* determines the operation of the DCD output. *n*=0 DCD is forced active *n*=1 DCD indicates a valid carrier
&D*n*: DTR	AT&D*n* determines how the modem will respond to changes to DTR. *n*=0 DTR is ignored by the modem *n*=1 Enter command mode if DTR revoked *n*=2 Disconnect if DTR revoked *n*=3 Soft reset when DTR revoked
&F*n*: Return to Factory Defaults	AT&F*n* returns the modem configuration to one of two factory settings. *n*=0 Restore configuration 0 *n*=1 Restore configuration 1
&G*n*: Guard Tone	AT&G*n* controls the guard tone produced by the modem. *n*=0 Guard Tone Disabled *n*=1 Guard Tone Enabled *n*=2 1800-Hz Guard Tone
&K*n*: Flow Control	AT&K*n* selects the flow control method used by the modem. *n*=0 Disabled *n*=3 RTS/CTS *n*=4 X-ON/X-OFF *n*=5 Transparent X-ON/X-OFF *n*=6 RTS/CTS and X-ON/X-OFF

Command	Function
&P*n*: Dial Pulse Make/Break Ratio	AT&P*n* sets the pulse dialing parameters used by the modem. *n*=0 39/61% @ 10 pps *n*=1 33/67% @10 pps *n*=2 39/61% @ 20 pps *n*=3 33/67% @ 20 pps
&Q*n*: Line Connection	AT&Q*n* determines if error control or data buffering are active on the link. *n*=0 Direct mode (no data buffering) *n*=5 Use error correction *n*=6 Normal mode (speed buffering)
&S*n*: DSR Operation	AT&S*n* sets the operation of the DSR signal. *n*=0 DSR always active *n*=1 DSR in accordance with V.25
&T*n*: Test Modes	AT&T selects modem test modes. *n*=0 Exit test mode *n*=1 Local analog loopback *n*=3 Initiate local digital loopback *n*=4 Respond to remote loop request *n*=5 Deny remote loop request *n*=6 Initiate a remote digital loopback *n*=7 Remote digital loopback w/self-test *n*=8 Local analog loopback w/self-test
&V*n*: View Configuration Profiles	AT&V*n* lets you check on the modem's current configuration. n=0 View active profile and user profile 0 n=1 View active profile and user profile 1
&W*n*: Store Active Profile	AT&Wn stores the current modem configuration in NVRAM. *n*=0 Store active profile as profile 0 *n*=1 Store active profile as profile 1

Command	Function
&Y*n*: Recall Stored Profile	AT&Y*n* sets the stored modem configuration to be used after a hard reset. *n*=0 Recall profile 0 on power-up *n*=1 Recall profile 1 on power-up
&Z*n*	*n*=*x* Store telephone number "*x*" in memory location "*n*"
%E*n*: Line Quality Monitor/ Auto Retrain	AT%E*n* determines if the modem will monitor line quality during a connection and initiate a retrain if quality drops below acceptable levels *n*=0 Disabled *n*=1 Enabled *n*=2 Line quality, fallback, fall forward
%L: Read Received Signal Level	AT%L lets you read the magnitude of the receive signal in dBm.
%Q: Read Line Signal Quality	AT%Q lets you read the EQM value of the the received signal,
\A*n*: MNP Block Size	AT\A*n* sets the block size for MNP® data packets. *n*=0 Maximum 64 characters *n*=1 Maximum 128 characters *n*=2 Maximum 192 characters *n*=3 Maximum 256 characters
\B*n*: Transmit Break	AT\B*n* selects the duration of the break signal sent. Break=n x 100 msec

Command	Function
\K*n*: Break control	AT\K*n* determines how the modem will handle a break signal. Break received from host with reliable link. *n*=0 Enter online command mode; do not transmit break *n*=1 Purge buffers, immediately transmit break *n*=2 Same as *n*=0 *n*=3 Immediately send break *n*=4 Same as *n*=0 *n*=5 Send break in sequence with data Break received from host with direct link. *n*=0 Immediately transmit break, then enter online command mode *n*=1 Immediately send break *n*=2 Enter command mode but do not transmit break signal *n*=3 same as *n*=1 *n*=4 same as *n*=0 *n*=5 same as *n*=1 Break received from modem w/normal link. *n*=0 Purge buffers, immediately send break to the host *n*=1 Same as *n*=0 *n*=2 Immediately send break to the host *n*=3 Same as *n*=2 *n*=4 Send break in sequence with data *n*=5 Same as *n*=2 Host initiates break with \B command on reliable link. *n*=0 Purge buffers and immediately transmit break *n*=1 Same as *n*=0 *n*=2 Immediately transmit break *n*=3 Same as *n*=1 *n*=4 Transmit break in sequence with data *n*=5 Same as *n*=4

Command	Function
\N*n*: Error Control Selection	AT\N*n* determines how the modem will handle error control negotiations. *n*=0 Normal mode, no error correction *n*=1 Direct mode, no buffering, no error correction *n*=2 Reliable mode, error correction required *n*=3 V.42 auto-reliable mode, accept either an error controlled or non-error controlled link *n*=4 V.42 reliable mode, LAPM required *n*=5 MNP required
\V*n*: Single Line Result Codes	AT/V*n* determines if the Connect response is issued in a single line format. CONNECT<DTE Speed><Modulation> <Protocol><Compression><Link Speed> *n*=0 Responses per ATX, ATW, and S95 *n*=1 Single line responses
K*n*: MNP Extended Services	AT-K*n* determines how the modem handles MNP10. *n*=0 No LAPM to MNP 10 conversion *n*=1 LAPM to MNP 10 conversion *n*=2 LAPM to MNP 10 conversion but no MNP Extended Service during V.42 LAPM answer mode detect
SEC=*n*, t–MNP 10-EC	AT-SEC controls MNP 10-EC operation. *n*=0 No MNP 10-EC Protocol *n*=1 Enable MNP 10-EC with Transmit level at -t dBm where t can be any value from 0 to 30

Command	Function
+MS: Modulation Selection	This command sets the data rates and modulation supported by the modem. It is presented in the extended format shown below. +MS=<modulation><automode><minimum data rate><CR> Modulation type 0=V.21, 1=V.22, 2=V.22bis, 3=V.23, 9=V.32, 10=V.32bis, 11=V.34 Automode 0=use only the selected modulation 1=negotiate highest common speed Minimum data rate 300=300 bps 1200=1200 bps, 2400=2400 bps, 4800=4800 bps, 7200=7200 bps, 9600=9600 bps, 12000=12,000 bps, 14400=14,400 bps, 16800=16,800 bps 21600=21,600 bps, 24000=24,000 bps 26400=26,400 bps, 28800=28,800 bps, 31200=31,200 bps, 33600=33,600 bps

Appendix B. Modem Fax Commands

B.1 Class 1

Command	Description
AT+FCLASS*n*	Service Class Indication. *n*=0 Configured as data modem *n*=1 Configured for service class 1
AT+FCLASS=*n*	Shows service class capability. *n*=0 Configured as a data modem *n*=1 Configured for service class 1
AT+FCLASS=*n*	Sets service class. *n*=0 Configured as a data modem *n*=1 Configured for service class 1
AT+FAE=*n*	Selects Data/Fax Auto Answer. *n*=0 Answer as a fax modem only *n*=1 Either a fax or data modem
AT+FF	Enhanced Flow Control.

Command	Description
AT+FRH=*n*	Receive HDLC data frames. *n*=3 V.21 Channel 2, 300 bps *n*=24 V.27ter, 2400 bps *n*=48 V.27ter, 4800 bps *n*=72 V.29, 7200 bps *n*=73 V.17, long training, 7200 bps *n*=74 V.17, short training, 7200 bps *n*=96 V.29, 9600 bps *n*=97 V.17, long training, 7200 bps *n*=98 V.17, short training, 9600 bps *n*=121 V.17, long training, 12,000 bps *n*=122 V.17, short training, 12,000 bps *n*=145 V.17, long training, 14,400 bps *n*=146 V.17 short training, 14,400 bps
AT+FRM<mod>	Receive Fax (see AAT+FRH for “mod” values).
AT+FRS=*n*: Receive Silence	This command causes the modem to issue an OK response after detecting silence for *n**10 milliseconds.
AT+FRT*n*	Receive Test Data.
AT+FTH=*n*	Transmit HDLC data (see AAT+FRH for “mod” values)
AT+FTM<mod>	Transmit Fax (see AAT+FRH for “mod” values).
AT+FTS=*n*	Stop Transmission and Wait. This command causes the modem to stop transmission for *n**10 milliseconds before issuing the OK response.

Command	Description
AT+FRT*n*	Transmit Test Data.
+FCLASS=*n*	Set service class *n*=0 Configured as a data modem *n*=1 Configured for service class 1 *n*=2 Configured for service class 2 *n*=3 Reserved for service class 3
+FCLASS=?	Available service class.
+FCLASS?	Current service class.
+FAA=*n*	Adaptive answer. *n*=0 Answer as selected service class *n*=1 Answers as a data or fax modem
+FBOR=*n*	T.4 Data Bit Order. *n*=0 Selects direct order for T.4 data *n*=1 Selects reverse order for T.4 data
+FBUF?	Buffer size.
+FCR=n	Capability to receive. *n*=0 Do not pass message data to host *n*=1 Pass message data to host

Command	Description
+FDCC=VR, BR, WD, LN, DF, ED, BF, ST	Set DCE capabilities parameters.
VR: Vertical resolution	0 98 lines per inch (normal) 1 196 lines per inch (fine)
BR: Bit rate	0 2400 bits per second 1 4800 bits per second 2 7200 bits per second 3 9600 bits per second 4 12,000 bits per second 5 14,400 bits per second

B.2 Class 2

Command	Function
AT+FCLASS*n*	Service class indication. *n*=0 Configured as a data modem *n*=1 Configured for service class 1
AT+FCLASS=*n*	Shows service class capability. *n*=0 Configured as a data modem *n*=1 Configured for service class 1
AT+FCLASS=*n*	Sets service class. *n*=0 Configured as a data modem *n*=1 Either a fax or data modem
AT+FF	Enhanced Flow Control.

Command	Description
AT+FRH=*n*	Receive HDLC Data Frames. *n*=3 V.21 Channel 2, 300 bps *n*=24 V.27ter, 2400 bps *n*=48 V.27ter, 4800 bps *n*=72 V.29, 7200 bps *n*=73 V.17, long training, 7200 bps *n*=74 V.17, short training, 7200 bps *n*=96 V.29, 9600 bps *n*=97 V.17, long training, 9600 bps *n*=98 V.17, short training, 9600 bps *n*=121 V.17, long training, 12,000 bps *n*=122 V.17, short training, 12,000 bps *n*=145 V.17, long training, 14,400 bps *n*=146 V.17, short training, 14,400 bps
AT+FRM<mod>	Receive fax (see AAT+FRH for “mod” values).
AT+FRS=*n*	Receive Silence. This command causes the modem to issue an OK response after detecting silence for *n**10 milliseconds.
AT+FRT*n*	Receive Test Data.
AT+FTH=*n*	Transmit HDLC data (see AAT+FRH for “mod” values).
AT+FTM<mod>	Transmit Fax (see AAT+FRH for “mod” values).
AT+FTS=*n*	Stop Transmission and Wait. This command causes the modem to stop transmission for *n**10 milliseconds before issuing the OK response.
AT+FRT*n*	Receive Test Data.

Command	Description
AT+FTH=*n*	Transmit HDLC data (see AAT+FRH for "mod" values).
AT+FTM<mod>	Transmit Fax (see AAT+FRH for "mod" values).
AT+FTS=*n*	Stop Transmission and Wait. This command causes the modem to stop transmission for *n**10 milliseconds before issuing the OK response.
AT+FRT*n*	Transmit Test Data.
+FCLASS=*n*	Set Service Class. *n*=0 Configured as a data modem *n*=1 Configured for service class 1 *n*=2 Configured for service class 2 *n*=3 Reserved for service class 3
+FCLASS=?	Available service class.
+FCLASS?	Current service class.
+FAA=*n*	Adaptive Answer. *n*=0 Answer as selected service class *n*=1 Answers as a data or fax modem
+FBOR=*n*	T.4 Data Bit Order. *n*=0 Selects direct order for T.4 data *n*=1 Selects reverse order for T.4 data
+FBUF?	Buffer Size.
+FCR=*n*	Capability to Receive. *n*=0 Do not pass message data to host *n*=1 Pass message data to host

Command	Description
+FDCC = VR, BR, WD, LN, DF, ED, BF, ST	Set DCE Capabilities Parameters
VR—Vertical resolution	0 98 lines per inch (normal) 1 196 lines per inch (fine)
BR—Bit Rate	0 2400 bits per second 1 4800 bits per second 2 7200 bits per second 3 9600 bits per second 4 12,000 bits per second 5 14,400 bits per second

Appendix C. Modem Registers

Register	Description
S0: Answer on nth ring	S0 sets the modem to automatically answer on the nth ring. Setting S0 to 0 disables automatic answer. Range: 0 to 255 Units Rings Default 0
S1: Ring Count	S1 is a read-only register showing the number of rings detected. If a ring is not detected within 8 seconds, S1 is reset to zero. Range: 0 to 255 Units Rings Default 0
S2: Escape Character	S2 determines the ASCII escape character. Values of 0 to 127 select valid ASCII escape characters; values from 128 to 255 disable the escape sequence. Range: 0 to 255 Units ASCII Character Default 43 (+)
S3: Carriage Return Character	S3 determines the ASCII character to serve as a carriage return to terminate commands and modem responses. Range: 0 to 127 Units ASCII Character Default 13 (Carriage Return)
S4: Line Feed Character	S4 sets the ASCII character to act as a line feed in modem responses. Range: 0 to 127 Units ASCII Character Default 10 (Line Feed)

Register	Description
S5: Backspace Character	S5 defines the ASCII character used as a backspace to edit the command line. Range: 0 to 32 Units ASCII Character Default 8 (Backspace)
S6: Dial Tone Wait Time	S6 determines how long the modem waits for the dial tone before dialing begins. The Dial Tone Wait Time cannot be set to less than two seconds. Range: 2 to 255 Units Seconds Default 2
S7: Wait for Carrier after Dialing	S7 determines how long the modem waits for a valid carrier signal after dialing is completed. Range: 1 to 255 Units Seconds Default 50
S8: Command Pause Time	S8 defines the duration of the pause initiated by a command in the dialing string. The pause is generally used when waiting for a second dial tone. Range: 1 to 255 Units Seconds Default 50 Active

Register	Description
S21: General Bit-Mapped Options	S21 reflects the state of several "AT" commands. Bit 0–2 Not used Bit 3, 4 0=DTR ignored (AT&D0) 1=Enter command mode on DTR off (&D1) 2=Disconnect on DTR off (AT&D2) 3=Reset on DTR off (AT&D3) Bit 5 0=DCD always active (AT&C0) 1=DCD on with Carrier (AT&C1) Bit 6 0=DSR always active (AT&C0) 1=DSR on when modem ready (&C1) Bit 7 0=No disconnect on Space (ATY0) 1=Disconnect on Space (ATY1)
S22: General Bit-Mapped Options	S22 reflects the state of several "AT" commands. Bit 0–1 0=Low speaker volume (L0) 1=Low speaker volume (L1) 2=Moderate speaker volume (ATL2) 3=High speaker volume (L3) Bit 2–3 0=Speaker off (ATM0) 1=Speaker off with carrier (M1) 2=Speaker always on (M2) 3=Speaker on during handshake (M3) Bit 4–6 0=Basic Result codes (X0) 4=Connect speed result codes (X1) 5=No Blind Dial (X2) 6=Busy Detection (X3) 7=Full result codes (X4) Bit 7 Not Used

Register	Description
S23: General Bit-Mapped Options	S23 reflects the state of several “AT” commands. Bit 0 0=Remote DLB Disabled (&T5) 1=Remote DLB Allowed (&T4) Bit 1–3 0=Host Interface at 300 bps 1=Host Interface at 600 bps 2=Host Interface at 1200 bps 3=Host Interface at 2400 bps 4=Host Interface at 4800 bps 5=Host Interface at 9600 bps 6=Host Interface at 19200 bps 7=Host Interface at 38400 bps or higher Bit 4–5 0=Even parity in use 1=Not used 2=Odd Parity in use 3=No Parity in use Bit 6–7 0=No Guard Tone (&G0) 1=No Guard Tone (&G1) 2=1800-Hz guard tone (&G2) 3=Not Used
S24: Sleep Inactivity Timer	S24 sets the length of time the modem will remain inactive before it enters the low power sleep mode. If S24 equals 0 sleep mode is disabled. Range: 0 to 255 Units 1 Seconds Default 0

Register	Description
S27: General Bit-Mapped Options	S27 reflects the state of several "AT" commands Bit 0 1 3 0 0 0=Normal Mode (AT&Q0) 1 0 1=Error control enabled (AT&Q5) 0 1 1=Direct Mode (AT&Q6) Bit 2 4-5, 7 Not Used Bit 6 0=CCITT protocols (ATB0) 1=Bell protocols (ATB1)
S28: Pulse Dialing Bit-Mapped Options	S28 stores the modem's pulse dialing configuration Bit 0–2 Not Used Bit 3–4 0=Make/Break ratio 39%/61%; 10 pulses per second (&P0) 1=Make/Break ratio 33%/67%; 10 pulses per second (&P1) 2=Make/Break ratio 39%/61%; 20 pulses per second (&P2) 3=Make/Break ratio 33%/67%; 20 pulses per second (&P3) Bit 5–7 Not Used
S29: Hook Flash Timer	S29 determines the time the modem closes its off-hook relay to simulate a switch hook flash with the "!" dial modifier. Range: 0 to 255 Units 10 milliseconds Default 70

Register	Description
S30: Disconnect on Inactivity Timer	S30 sets the modem to disconnect after the given time period with no data being sent or received. A 0 disables the inactivity timer. Range: 0 to 255 Units 10 Seconds Default 0
S31: General Bit-Mapped Options	S31 stores the status of various AT commands. Bit 0 0=No single-line connect messages (\V0) 1=Single-line connect messages (\V1) Bit 1 0=No Automode detection active (N1) 1=Automode detection active (N1) Bit 2–3 0=Report host speed (W0) 1=Report all parameters (W1) 2=Report modem speed only (W2) Bit 4–7 Not Used
S32: XON Character	S32 determines the ASCII character sent as XON for in-band flow control Range: 0 to 255 Units ASCII Character Default 11 (VT)
S33: XOFF Character	S32 determines the ASCII character recognized as X-OFF for in-band flow control Range: 0 to 255 Units ASCII Character Default 19 (DC3)

Register	Description
S36: LAPM Failure	S36 instructs the modem what to do if the error control negotiations fail Bit 0–2 0=Modem Disconnects 1=Establish Direct Connection 3=Establish Normal Connection 4=Disconnect if MNP fails 5=Establish Direct Connection if MNP handshake fails 7=Establish Normal Connection if MNP handshake fails Bit 3–7 Not Used
S38: Forced Disconnect Timer	S38 sets the delay between receipt of the command to disconnect and the actual opening of the switch hook. If S38 is set to 255, the modem disconnects only after its buffers are empty. Range: 0 to 255 Units 1 Second Default 20
S39: Flow Control Bit-Mapped Options	S39 shows the modem's flow control status Bit 0–2 0=Flow Control Disabled 3=Hardware Flow Control, RTS/CTS 4=In-Band Flow Control X-ON/X-OFF 5=Transparent In-Band Flow Control 6=Both Hardware and In-Band Flow Control Bit 3–7 Not Used

Register	Description
S40: Bit-Mapped Options	S40 shows the status of the modem's MNP commands. Bit 0–1 0=No LAPM/MNP10 conversion (-K0) 1=Enable LAPM/MNP10 conversion (-K1) Bit 2 Not Used Bit 3–5 0=AT\K0 break handling selected 1=AT\K1 break handling selected 2=AT\K2 break handling selected 3=AT\K3 break handling selected 4=AT\K4 break handling selected 5=AT\K5 break handling selected Bit 6–7 0=MNP Block size 64 characters 1=MNP Block size 128 characters 2=MNP Block size 192 characters 3=MNP Block size 256 characters
S41: General Bit-Mapped Options	S41 stores the condition of various "AT" commands. Bit 0–1 0=No Data Compression (AT%C0) 1=MNP 5 Data Compression (&C1) 2=V.42bis Data Compression (&C2) 3=Either MNP 5 or V.42bis Data Compression (&C3) Bit 2 6 0 0=No Fallback/Forward (%E0) 1 0=Retrain Enabled (%E1) 0 0=Fallback/Forward Enabled (%E2) Bit 3–5, 7 Not Used

Register	Description
S46: Data Compression Control	S46 selects if the modem supports data compression with error control S46=136 No data compression S46=138 Data Compression selected Default 138 Bit 0 Connect result code shows link speed Bit 1 Add/ARQ to connect response Bit 2 Add/VFC to Carrier response Bit 3 Enable Protocol response Bit 4 Not Used Bit 5 Enable Compression Result Code Bit 6 Not used Bit 7 Not used
S48: V.42 Negotiations	S48 determines the modem's V.42 negotiation process. S48=0 Proceed with LAPM S48=7 Negotiate per V.42 S48=128 Assume LAPM failure Default 7
S86: Call Failure Code	S86 shows why the last "NO CARRIER" response was issued. S86=0 Normal Disconnect S86=4 Loss of Carrier S86=5 V.42 Negotiation Failure S86=9 Modem Handshake Failure S86=12 Disconnect initiated by remote modem S86=13 No response after 10 retries S86=14 Protocol violation

Register	Description		
S95: Extended Result Codes	S95 lets you customize the extended result codes		
	Digits	**Verbose**	**Description**
	0	OK	Successfully executed command line
	1	CONNECT	300-bps connection
	2	RING	Ring signal detected
	3	NO CARRIER	Carrier not detected/lost
	4	ERROR	Error in command line
	5	CONNECT 1200	1200-bps connection
	6	NO DIAL TONE	No dial tone detected
	7	BUSY	Busy signal detected
	8	NO ANSWER	5-second silence not detected
	10	CONNECT 2400	2400-bps connection
	11	CONNECT 4800	4800-bps connection
	12	CONNECT 9600	9600-bps connection
	13	CONNECT 7200	7200-bps connection
	14	CONNECT 12000	12,000-bps connection
	15	CONNECT 14400	14,400-bps connection
	16	CONNECT 19200	19,200-bps connection
	17	CONNECT 38400	38,400-bps connection
	18	CONNECT 57600	57,600-bps connection
	19	CONNECT 115200	115,200-bps connection
	22	CONNECT 75TX/ 1200RX	V.23 originate connection
	23	CONNECT 1200TX/ 75RX	V.23 answer connection
	33	FAX	Fax connection
	35	DATA	Data connection in Fax mode
	40	CARRIER 300	300-bps carrier received
	44	CARRIER 1200/75	V.23 reverse channel carrier received
	45	CARRIER 75/1200	V.23 forward channel carrier received

Register	Description		
S95: Extended Result Codes (continued)	**Digits**	**Verbose**	**Description**
	46	CARRIER 1200	1200-bps carrier received
	47	CARRIER 2400	2400-bps carrier received
	48	CARRIER 4800	4800-bps carrier received
	49	CARRIER 7200	7200-bps carrier received
	51	CARRIER 12000	12,000-bps carrier received
	52	CARRIER 14400	14,400-bps carrier received
	53	CARRIER 16800	16,800-bps carrier received
	54	CARRIER 19200	19,200-bps carrier received
	55	CARRIER 21600	21,600-bps carrier received
	56	CARRIER 24000	24,000-bps carrier received
	57	CARRIER 26400	26,400-bps carrier received
	58	CARRIER 28800	28,800-bps carrier received
	59	CONNECT 16800	16,800-bps connection
	61	CONNECT 21600	21,600-bps connection
	62	CONNECT 24000	24,000-bps connection
	63	CONNECT 26400	26,400-bps connection
	64	CONNECT 28800	28,800-bps connection
	66	COMPRESSION: CLASS 5	MNP 5 data compression
	67	COMPRESSION: V.42bis	V.42bis data compression
	69	COMPRESSION: NONE	No data compression
	76	PROTOCOL: NONE	No error correction
	77	PROTOCOL: LAPM	LAPM error correction
	80	PROTOCOL: ALT	MNP error correction
	81	PROTOCOL: ALT	CELLULAR MNP10 error correction +F4 +FC ERROR Fax carrier error

1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746