TOTAL CONTROL™

Quad V.34 Modem/ Quad NIC

HARDWARE INSTALL GUIDE

Table Of Contents

Regulatory Certification

Radio Communications Interference

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the installation and operations guide, may cause interference to radio communications. This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when 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 required to correct the interference.

In accordance with Part 15 of the FCC rules, any modification to or tampering with this device that causes harmful interference to others may be reason for prohibiting future operation.

FCC Registration

FCC68: CJEUSA-22213-MM-E

RINGER EQUIVALENCE: 0.4B

IC (Industry Canada)

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the radio interference regulations of Industry Canada (formerly the Canadian Department of Communications).

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la classe A prescrites dans le Reglement sur le brouillage radioelectrique edicte par l'Industrie Canada (anterieurement le ministre des Communications).

Canadian Installations

The Industry Canada (formerly the Canadian Department of Communications) label identifies certified 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 purchaser's satisfaction.

Before installing this equipment, make sure connection to the local telecommunications company is permissible. Install the equipment using an acceptable method. Be aware, however, 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 a user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

For protection, make sure 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: Do not attempt to make such connections; contact the appropriate electrical inspection authority or electrician.

U.S. Robotics Quad / Analog RS-232 NIC
Load Number: 9

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load connected to the telephone loop used by the device, without 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 not exceed 100.

Connecting to the Telephone Company

The telephone company may request the telephone number (numbers) to which the equipment is to be connected.

If a modem is malfunctioning, it may affect the telephone lines. In this case, the modem should be disconnected until the source of the difficulty is traced.

If the telephone company has any questions or raises problems, ask them to call the U.S. Robotics Technical Support Department.

Overview

The Total Control Enterprise Network Hub

The Total Control Enterprise Network Hub is a front-end platform for integrating local and wide area data networks. It may contain a variety of data communications modules to meet the needs of a particular enterprise, including the following:

- T1 Card for multiplexed digital trunk phone service
- Gateway cards for connections to Ethernet / Token Ring LANs or X.25 packet switched networks
- SNMP-based Network Management Card
- The Quad Modem Card

The Quad Modem Card

The Total Control Quad Modem Card contains four U.S. Robotics V.34 modems. It is available in digital, analog, or digital / analog versions.

Analog Applications

The analog version of the modem card uses a Quad / Analog RS-232 NIC to provide each modem with an interface to the public switched telephone network (PSTN).

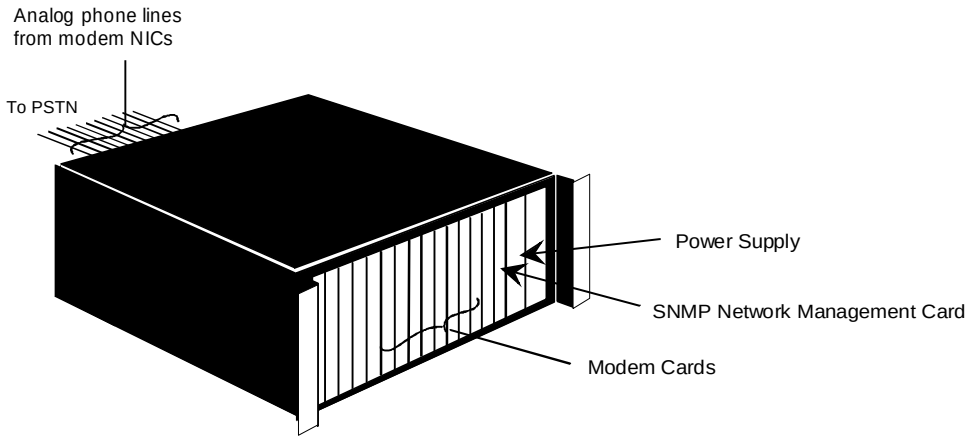


Figure 2. Analog Application of the Enterprise Network Hub

Data from analog lines can be directed to either a Gateway Card on the chassis or out the EIA RS-232 interface on the back of the NIC.

Digital Applications

Digital modem cards work with the T1 Card to provide a connection between your local network and a multiplexed digital trunk.

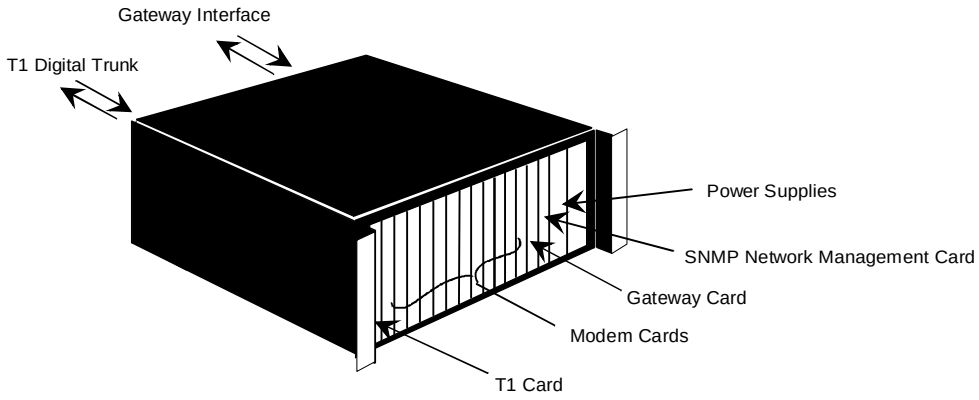


Figure 1. Digital Application of the Enterprise Network Hub

The T1 Card directs each channel of the multiplexed digital trunk to a digital modem in the chassis. Data can be directed to either a Gateway Card on the chassis or out the EIA RS-232 interface on the back of the NIC.

Modem Configuration

The modems on the Quad Modem Card are fully configurable using the Network Management Card and SNMP management software. Modems in unmanaged chassis are configured through the EIA RS-232 serial interface on the NIC using communications software .

If you are using *Total Control Manager/ SNMP* (a Windows-based SNMP management application designed especially for use with the Total Control chassis), refer to the *Total Control Manager/ SNMP Software Guide* for instructions on configuring you modems.

AT commands may be used to configure the Quad Modem Card in an unmanaged chassis. Refer to the *Quad V.34 Modem Reference Manual* for complete instructions on using the AT command set.

Features

All U.S. Robotics V.34 modems are downward compatible with most installed modems operating at 28,800 bits per second (bps) and below. The following features and capabilities assure superior reliability and performance.

- Programmable nonvolatile memory with three permanent configuration templates
- Supports standard DTE rates up to 115,200 bps
- DNIS (Dialed Number Identification String) and ANI (Automatic Identification String) number support provided by the public 950 services, Feature Groups B and D, and enhanced 800 services to customize the configuration of the modem prior to answering a call
- Software upgradable via on-board Flash ROM
- ITU-T V.42 and MNP 2-4 error control
- ITU-T V.42 *bis* and MNP 5 data compression
- Fax capabilities—V.17 Group III TIA / EIA 578 Class 1 and 592 Class 2.0 14,400 and 9600 bps fax. Automatically switches between data and fax calls.
- Remote configuration
- Asynchronous and Synchronous operation
- Chip-based security for systems not managed with *Total Control Manager/SNMP*

Network Interface Card

NOTE: If your setup does not require a Network Interface Card, then you can skip to the next section, *Installing the Quad Modem Card.*

The Quad Network Interface Card (NIC) is available in analog, digital, and analog / digital versions. Both are equipped with a 50-pin EIA RS-232 port that provides serial connections to each modem on the modem card. The analog version has four RJ11 phone jacks for connections to analog public phone lines.

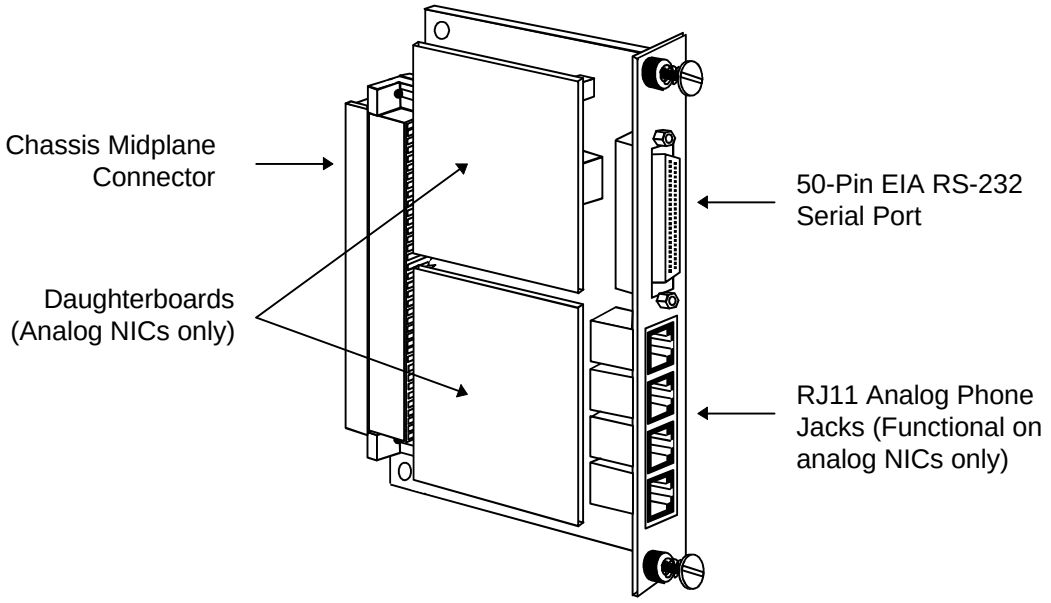


Figure 3. The Quad Analog/RS-232 NIC

Rear Panel Connections

The EIA RS-232 Fan Cable

The EIA RS-232 fan cable included with the NIC (Figure 4 below) attaches to the DB-50 connector on the NIC and fans out to four separate female DB-25 serial connectors. The DB-25 connectors labeled 1-4 correspond to channels 1-4 on the modem card.

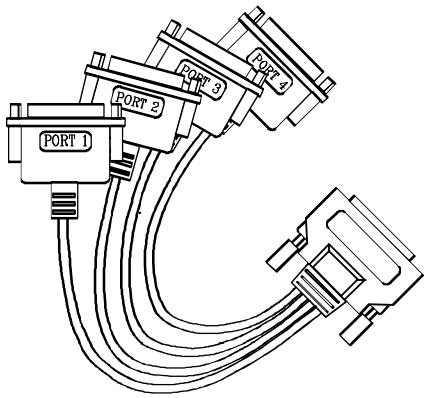


Figure 4. DB-50 EIA RS-232 fan cable (male).

Pin Assignments

Table 1 lists the supported functions for the 50-pin and DB-25 pin connector assignments. DCE indicates the modem (Data Communications Equipment). DTE indicates the computer (Data Terminal Equipment).

Table 1. EIA RS-232 Pin Assignments

DB-25	50-pin	Function	Signal Source
1	25, 50	Chassis Ground	both
2	1,13,26,38	Transmitted Data	DTE
3	2,14,27,39	Received Data	DCE
4	3,15,28,40	Request to Send	DTE
5	4,16,29,41	Clear to Send	DCE
6	11,23,36,48	Data Set Ready	DCE
7	7,19,32,44	Signal Ground	both
8	6,18,31,43	Carrier Detect	DCE
15	9,21,34,46	Sync TX Timing	DCE
17	10,22,35,47	Sync RX Timing	DCE
20	5,17,30,42	Data Terminal Ready	DTE
22	12,24,37,49	Ring Indicate	DCE
24	8,20,33,45	Sync TX Timing	DTE

Phone Jacks

The four RJ11 modular phone jacks located on the NIC's rear panel are only for use with Quad Analog modems or Quad Analog/Digital modems connecting to the Public Switched Telephone Network (PSTN). Starting from the highest jack, they are labeled CH1, CH2, CH3 and, CH4.

NOTE: The RJ11 connectors are only for use with analog phone lines.

Before Installing the Modem Card

Before inserting the modem card into the chassis, set the modem DIP switches according to your installation requirements.

Setting DIP Switches

There is one bank of 10 DIP switches located on the Quad modem board next to the front panel. Each switch controls the same function unilaterally for all four modems.

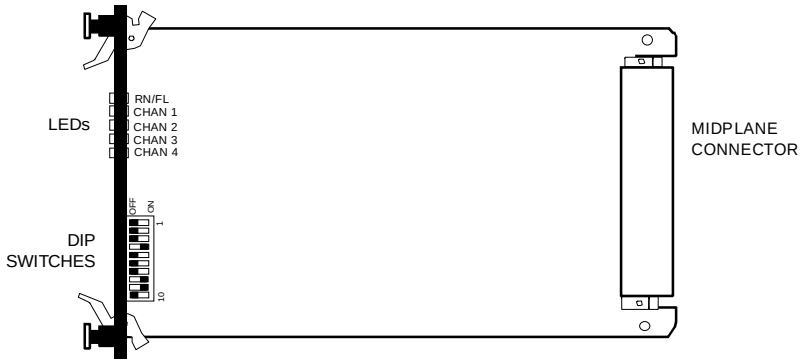


Figure 5. DIP Switches on the Modem Card

Use the tip of a pen or other small instrument to change applicable DIP switch settings. When the switch position is away from the front panel, then that switch is ON.

NOTE: If your chassis came factory assembled and you want to change any of the Quad Modem Card's DIP switch settings, you must remove the card. See *Removing the Modem Card* at the end of the ***Installation*** section.

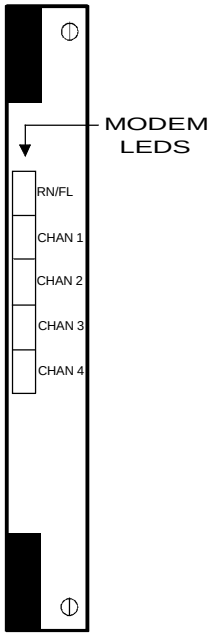
Table 2 below lists the functions and factory settings for each DIP switch.

Table 2. Hardware Factory Settings

Switch	Factory Setting	Function
1	OFF	Data Terminal Ready Operations. OFF Normal DTR operations: computer must provide DTR signal for modem to accept commands; dropping DTR terminates a call ON DTR always ON (Override)
2	OFF	Verbal/Numeric Result Codes (effective when DIP Switch 3 is ON). OFF Verbal (word) results ON Numeric results
3	OFF	Result Code Display. OFF Results suppressed ON Results enabled
4	ON	Command Mode Local Echo. OFF Keyboard commands displayed ON Echo suppressed
5	OFF	Auto Answer. OFF Modem answers on first ring ON Auto answer disabled
6	OFF	Carrier Detect Operations. OFF Modem sends CD signal when it connects with another modem, drops CD on disconnect ON CD always ON (Override)
7	OFF	Auxiliary, when DIP Switch 3 is ON. OFF Result codes in Originate and Answer mode ON Result codes in Answer mode disabled
8	ON	AT Command Set Recognition. OFF Command recognition disabled (Dumb mode) ON Recognition enabled (Smart mode)
9	ON	Escape Code (+++) Response. Requires DIP Switch 8 to be ON. OFF Modem hangs up, returns to Command mode, sends NO CARRIER result ON Modem maintains connection, returns to Command mode, sends OK result
10	OFF	Power-on and Reset Defaults. OFF Load from nonvolatile memory (NVRAM) ON Load fail-safe default configuration template from ROM (&F0)

Modem LEDs

The five LEDs on the modem card's front panel allow the modems' performance to be monitored at all times.



Front Panel LEDs

LED	Function
RN/FL	RUN/FAIL Green—normal operation Flashing green—testing/ SDL Red—critical failure
CHAN 1–4	Status for modems 1–4 OFF—modem is idle Orange—off hook/ training Green—online Red—critical failure

Figure 6. Quad Modem Card Front Panel

Inserting the NIC In the Chassis

1 Remove the safety panel from the selected slot at the back of the chassis by unscrewing the top and bottom screws.

NOTE: When installing NICs and NACs into the Total Control Chassis, always install the NICs first.

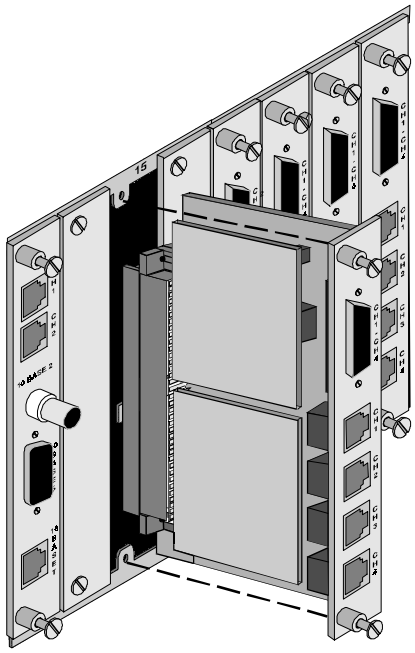


Figure 7. Quad Modem NIC Installation

2 With the DB-50 connector toward the top of the chassis, slide the NIC into the slot's upper and lower card guides. Push firmly on the NIC until the midplane connector snaps into position in the chassis midplane.

3 Tighten the thumb screws that are attached to the NIC's rear panel.

Inserting the Modem Card into the Chassis

1. Unscrew and remove the cover panel from the desired modem slot at the front of the chassis. Save the panels and screws.

   If you have installed a Quad NIC, the Quad Modem Card must occupy the slot directly in front of the NIC.

2. Lift the top ejector tab while sliding the modem card into the slot's upper and lower card guides until its rear connector is firmly positioned in the chassis midplane.

3. With your fingers, tighten the modem card's front panel thumb screws.

NOTE: Cards may be inserted and removed while the chassis is powered-on (referred to as "hot-swapping"). After the modem has been successfully inserted into a chassis that is powered on, the LEDs flash as the modem performs a startup test, after which the RN / FL LED should turn solid green.

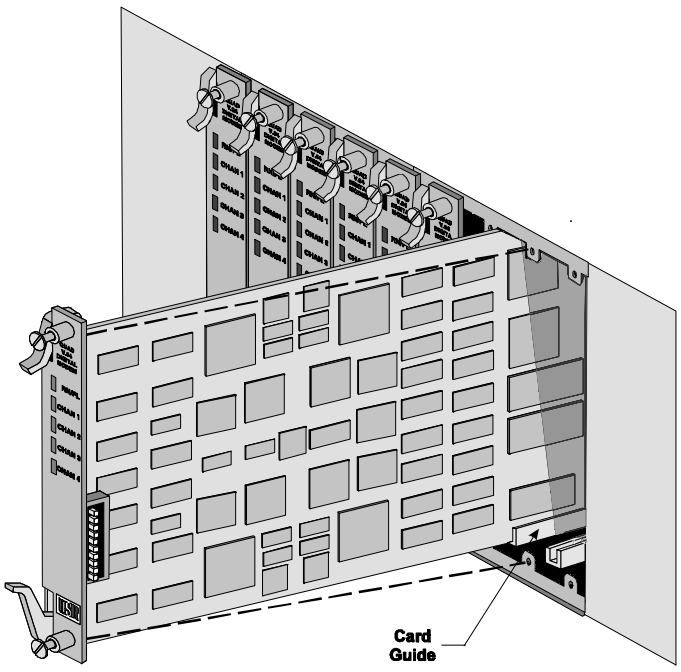


Figure 8. Quad Modem NAC Installation

Removing the Modem Card

NOTE: When removing NICs and NACs from the Total Control Chassis, always remove the NACs first.

You do NOT have to power off the chassis to remove the modem card. To remove the modem card:

1. Loosen the captive thumb screws on the front panel of the NAC. Push the gray plastic ejector tabs *away* from each other. The card pops out slightly.
2. Use the tabs or grasp the front panel to slide the card toward you and remove it from the chassis.

WARNING: Please follow precautions for handling static sensitive devices when inserting or removing modem.

Modem Configuration

NOTE: If you have a Network Management Card installed on the chassis, the modems on the Quad Modem Card may be fully configured through *Total Control Manager/SNMP* or your SNMP management software. See your software reference manual.

Sending Commands to the Modems

If you are not using management, or if you wish to configure the modems manually, you must send AT commands directly to the modem through the EIA RS-232 interface on the NIC. Follow the steps below.

1. Remove the modem card (see *Removing the Modem Card*). Verify that DIP switch 8 is ON (Smart mode: modem recognizes AT commands), and set DIP switch 4 OFF (for command echo to the terminal screen) and DIP switch 3 ON (to display results after sending a command).
2. Attach the fan cable to the DB-50 connector on the back of the NIC (see *Installing a Network Interface Card).* It provides EIA RS-232 ports 1-4 for the corresponding modems at channels 1-4.
3. Attach a PC to the corresponding port on the fan cable.
4. Use a communications software program in terminal mode to establish a session with the modem.

Commands and their functions are found in the *Quad V.34 Modem Reference Manual*, part of the Total Control Reference Library, available through your distributor or sales representative.

Setting Power-on Defaults

Each modem is equipped with nonvolatile random access memory (NVRAM). You can define settings for a modem and store them in NVRAM. The modems are factory set to load NVRAM settings at

power-on or reset (DIP switch 10 OFF), so whatever settings are stored there become the power-on (or reset) default.

NOTE: DIP switch 10 must be set OFF for the modem to load the settings stored in NVRAM at power-on or reset. If DIP switch 10 is set ON, the low performance (&F0) template is loaded (see *Using Configuration Templates*).

Using Configuration Templates

Configuration templates offer an easy way to set the modem's power-on default. A single AT command stored in NVRAM loads one of three pre-defined templates.

NOTE: The modems are shipped with the hardware flow control template (&F1) already loaded into NVRAM. This setting offers the most efficient and enhanced performance.

A template may be loaded into NVRAM by typing the following command:

AT &F*n* &W

where &F*n* indicates one of the following templates. Loading a template into NVRAM replaces the current template (and any other settings) in NVRAM. Only one template may be loaded at a time.

&F0 *Low performance template.* This template does not include features such as a fixed serial port rate or flow control. It does offer compatibility with non-typical computers, older equipment, or software that cannot handle flow control and other features.

&F1 *Hardware flow control template.* Default. This template sets the modem to hardware flow control, a fixed serial- port rate, and the highest level result codes.

This template is recommended for all systems and software that support Request to Send and Clear to Send, and a fixed serial port rate.

&F2 *Software flow control template.* This template sets the modem to all of the &F1 defaults except hardware flow control. Instead, it substitutes software flow control (XON / XOFF). Use if your software doesn't support hardware flow control. Software flow control is not as reliable as hardware flow control.

A complete listing of the settings in the &F*n* templates is provided in the *Quad V.34 Modem Referrence Guide*.

Initialization Strings

Most communications applications send an initialization string to the modem when you load the program. You may want to modify your software's initialization string to reflect the modem's factory settings. The initialization string that corresponds to each template is as follows:

&F0 AT &B0 &H0 &R1 X1 &A1

&F1 AT &B1 &H1 &R2 X7 &A3

&F2 AT &B1 &H2 &R1 &I2 X7 &A3

For details on the individual function of these settings, see the *Quad V.34 Modem Reference Manual*.

Customizing NVRAM

To modify the active configuration in NVRAM, type your changes and then save them to NVRAM with the &W command, as in the following example.

AT &K3 &Y2 S10=40 &A2 &W

You may want to load a new configuration template and modify it at the same time, as shown below. Your configuration commands must appear after the &F*n* command and before the &W command. Any commands placed before the &F*n* command will be overwritten with the &F*n* template settings, and any commands after the &W will not be saved in NVRAM.

AT &F2 T &K3 X1 S10=40 &A2 &W

Changing Settings Temporarily

Any setting can be changed just for the current session. You may want to use this feature for experimentation if you are experiencing performance difficulties. If the change doesn't achieve the desired effect, reset the modem using the ATZ command. This returns it to the NVRAM configuration (provided DIP switch 10 is OFF). The example below changes the result code setting, but the power-on / reset default remains intact.

ATX6

Technical Specifications

Channel Capacity

Sixteen Quad Modem Cards installed in a Total Control chassis support sixty-four phone line channels.

Compatibility

ITU-T V.34

28.8K, 25.4K, 24K, 21.6K, 19.2K, 16.8K, 14.4K, 12K, 9600, 7200, 4800, and 2400 bps asynchronous Trellis Coded Modulation (TCM)

V.Fast Class (V.FC)—Rockwell International

28.8K, 26.4K, 24K, 21.6K, 19.2K, 16.8K, 14.4K bps asynchronous Trellis Coded Modulation (TCM)

U.S. Robotics V.32 *terbo*

21.6K, 19.2K, 16.8K, 14.4K. 12K, 9600, 7200 bps asynchronous, 19.2K, 16.8K, 14.4K. 12K, 9600, 7200 bps synchronous, Trellis Coded Modulation (TCM)

4800 bps, synchronous / asynchronous, Quadrature Amplitude Modulation (QAM)

U.S. Robotics High Speed Technology (HST—Dual Standards Only)

16.8K, 14.4K, 12K, 9600, 7200 bps, synchronous / asynchronous, asymmetrical, 450 bps back channel with automatic handshake adjustment to 300 bps, Trellis-Coded Modulation (TCM), Quadrature Amplitude Modulation (QAM)

4800 bps, synchronous / asynchronous, asymmetrical, 450 bps back channel with automatic handshake adjustment to 300 bps, Quadrature Amplitude Modulation (QAM)

ITU-T V.32 *bis*

14.4K, 12K, 9600, 7200 bps, synchronous / asynchronous, Trellis-Coded Modulation (TCM)

4800 bps, synchronous / asynchronous, Quadrature Amplitude Modulation (QAM)

ITU-T V.32

9600 bps, synchronous / asynchronous, Trellis-Coded Modulation

4800 bps, synchronous / asynchronous, Quadrature Amplitude Modulation (QAM)

Additional Compatibility Features

ITU-T V.25, 2100 Hz answer tone

Bell 208B, 4800 bps, synchronous, Quadrature Amplitude Modulation (QAM)

ITU-T V.23, 1200 bps, synchronous / asynchronous, asymmetrical (1200 / 75 bps), Frequency Shift Keying (FSK)

ITU-T V.22 *bis*, 2400 bps, synchronous / asynchronous, Quadrature Amplitude Modulation (QAM)

ITU-T V.22, 1200 bps, synchronous / asynchronous, Differential Phase Shift Keying (DPSK)

Bell 212A, 1200 bps, synchronous / asynchronous, Differential Phase Shift Keying (DPSK)

Bell 103, 300 bps, asynchronous, Frequency Shift Keying (FSK)

ITU-T V.21, 300 bps, asynchronous, Frequency Shift Keying (FSK)

U.S. Robotics HST error control protocol, asymmetrical mode, at 16.8K / 14.4K / 12K / 9600 / 7200 / 4800 bps; 450 / 300 bps back channel

ITU-T V.42 error control protocol, at 14.4K / 12K / 9600 / 7200 / 4800 bps (V.32 *bis* mode) and at 2400 / 1200 bps

ITU-T V.42 *bis* data compression (all modes and speeds of 1200 bps and higher)

Microcom Networking Protocol (MNP) error control protocol, Levels 2-4 at 14.4K / 12K / 9600 / 7200 / 4800 (V.32 *bis* mode) and at 2400 / 1200 bps

Microcom Networking Protocol (MNP), Level 5 data compression (all modes and speeds of 1200 bps and higher)

Pulsed DSR / CTS following CD signal options

Superset of industry standard AT command set

Certification

FCC Part 68 registered and complies with Part 15, Class A for nationwide telephone systems; UL-listed, CSA-approved, and IC-certified

Operational Modes

Auto Dial/Auto Answer, Auto Answer only

Fax Modems: The above modes plus fax mode

Fax Service Class 2.0 Commands

For information on Class 2.0 technical specifications, contact Global Engineering Documents, at 1-800-854-7179. The document that covers this information is:

ANSI/EIA/TIA-592-1993 (EIA-592)
Asynchronous Facsimile DCE Control Standard
May, 1993

Optional Class 2.0 Fax Commands Supported

U.S. Robotics uses these optional Class 2.0 fax commands:

+FNS=0,1	Pass-through non-Standard negotiation byte string
+FCR=0,1	Capability to receive
+FAA=0,1	Adaptive Answer mode
+FCT=0-255 sec.	Phase C Timeout
+FHS=0-255	Hangup Status Code, read only
+FMS=0-3	Minimum Phase C Speed
+FBS?=500,100	Buffer size, read only

Fax Service Class 1 Commands

+FCLASS=n (0,1)	Class identification and control
+FTS=n (0,255)	Stop transmission and pause, 10 ms.
+FRS=n (0,255)	Wait for silence, 10 ms.
+FTM=n (3,24,48,72,96)	Transmit data with carrier
+FRM=n (3,24,48,72,96)	Receive data with carrier
+FTH=n (3,24,48,72,96)	Transmit HDLC data with carrier
+FRH=n (3,24,48,72,96)	Receive HDLC data with carrier

V.25 bis Synchronous Commands and Result Codes

Dial options:

0–9 & : > < = P T);

Result Codes:

Call failure indication (CFI) with optional parameters: Abort call (CFAB); local modem busy (CFCB); Engaged tone (CFET); Forbidden call (CFFC); Number not stored (CFNS); Answer tone not detected (CFNT); Ring tone (CFRT); Connect (CNX); List of numbers (LS); List of forbidden numbers (LSF); List of stored numbers (LSN); Incoming call (INC); Invalid (INV) with optional parameters: Message syntax error (INVMS); Command Unknown (INVCU); Parameter syntax error (INVPS); Parameter value error (INVPV); Valid (VAL).

Commands and Result Codes not supported:

Call request with identification number (CRI); Program identifier (PRI); Request list of identification numbers (RLI); List of delayed call numbers (RLD).

DTE Interface Rates

115.2K, 57.6K, 38.4K, 19.2K, 9600, 4800, 2400, 1200, 300 bps

Phone Channel Rates

Data Mode:	**V.34**:	28.8K, 26.4K, 24K bps
	V.FC:	28.8K, 26.4K, 24K bps
	V.32 *plus*:	21.6K, 19.2K, 16.8K bps
	HST:	16.8K bps
	Both:	14.4K, 12K, 9600, 7200, 4800, 2400, 1200, 300 bps HST back channel; 75 bps V.23 back channel
Fax Mode:		14.4K, 12K, 9600, 7200, 4800, 2400, 300 bps

Online Fallback/Fall Forward

28.8K, 26.4K, 24K 21.K (V.32 *plus* only), 19.2K (V.32 *plus* only), 16.8K, 14.4K, 12K, 9600, 7200, 4800 bps

Communications Channel

2-wire dial-up; demand-driven high speed channel turnaround in HST mode; symmetrical speeds in V.32 *bis* and V.32 *plus* modes

Dialing

DTMF tone dialing or pulse dialing
(DTMF tones = 0–9, #, *)

Data Format

Binary, serial, asynchronous; defaults to 7-bit word length, even parity, 1 stop bit

Word Length	Parity	Stop Bits
7	Even, Odd, Mark, Space	1
7	None	2
8	None	1

Modem Power Requirements

1.5 A @ 5VDC

0.1 A @ 12VDC

8.7 watts

25 BTU

Mechanical

Component	L”	H”
Modem Board	12.45	6.400
EIA RS-232 Network Interface Board (NIC)	4.85	6.400

Modem Test Functions

Analog Loopback (Quad Analog and Quad Analog / Digital modems only)

Bilateral Digital Loopback

Remote Digital Loopback

Testing is individually selectable using software. The system supports simultaneous testing, regardless of test type selected for any one modem.

Automatic Retrain

On poor quality lines when operating at 2400–14.4K bps

Flow Control Buffers

Transmit Buffer:

Error control—3.25K bytes

Non-Error control—1.5K bytes, 128-byte option

Receive buffer: 2K bytes

Command Buffer

64 characters, exclusive of AT prefix, Carriage Return and spaces

Front Panel LEDS

RN / FL	Normal / Fail
CHAN	Modem Channels 1–4 / Testing / Fail (one LED for each modem)

Transmitter Carrier Frequencies

Protocol	Originate Mode	Answer Mode
ITU-T V.34	1800 Hz	1800 Hz
	1829 Hz	1829 Hz
	1867 Hz	1867 Hz
	1920 Hz	1920 Hz
	1959 Hz	1959 Hz
	2000 Hz	2000 Hz
V.Fast Class	1800 Hz	1800 Hz
	1875 Hz	1875 Hz
	1920 Hz	1920 Hz
USR-V.32 *terbo*/V.32 *bis*/V.32	1800 Hz	1800 Hz
USR-HST, 450 bps back channel	375 Hz	1800 Hz
USR-HST, 300 bps back channel	350 Hz	1800 Hz
V.32 *bis*	1800 Hz	1800 Hz
V.23	*Mark:* 390 Hz	*Mark:* 1300 Hz
	Space: 450 Hz	*Space:* 2100 Hz
V.22 *bis*, V.22, Bell 212A	1200 Hz	2400 Hz
Bell 103	*Mark:* 1270 Hz	*Mark:* 2225 Hz
	Space: 1070 Hz	*Space:* 2025 Hz
V.21	*Mark:* 980 Hz	*Mark:* 1650 Hz
	Space: 1180 Hz	*Space:* 1850 Hz

Receiver Carrier Frequencies

Protocol	Originate Mode	Answer Mode
ITU-T V.34	1800 Hz	1800 Hz
	1829 Hz	1829 Hz
	1867 Hz	1867 Hz
	1920 Hz	1920 Hz
	1959 Hz	1959 Hz
	2000 Hz	2000 Hz
V.Fast Class	1800 Hz	1800 Hz
	1875 Hz	1875 Hz
	1920 Hz	1920 Hz
USR-V.32 *terbo*/V.32 *bis*/V.32	1800 Hz	1800 Hz
USR-HST, 450 bps back channel	1800 Hz	375 Hz
USR-HST, 300 bps back channel	1800 Hz	350 Hz
V.32 *bis*	1800 Hz	1800 Hz
V.23	*Mark:* 1300 Hz	*Mark:* 390 Hz
	Space: 2100 Hz	*Space:* 450 Hz
V.22 *bis*, V.22, Bell 212A	2400 Hz	1200 Hz
Bell 103	*Mark:* 2225 Hz	*Mark:* 1270 Hz
	Space: 2025 Hz	*Space:* 1070 Hz
V.21	*Mark:* 1650 Hz	*Mark:* 980 Hz
	Space: 1850 Hz	*Space:* 1180 Hz

Receive Sensitivity

- 44 dBm ± 2 dBm

Transmit Level

- 9 dBm maximum

Transmitter Frequency Tolerance

.01%

Operating Environment

Temperature: 0–40° C

Relative Humidity: 0–95% non-condensing