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**RASFinder**<sup>™</sup> 200-Series  
Remote Access Device

**Remote Access Server with  
Integrated WAN Devices**

**Model MTASR3-200**

**User Guide**

**MultiTech**<sup>®</sup>  
Systems 

## User Guide

88301100 Revision A

RASFinder 200-Series (Model No. MTASR3-200)

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### Patents

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## Glossary of Terms

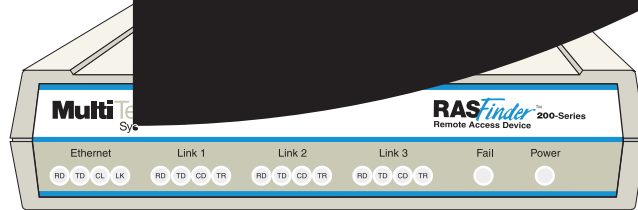


## Chapter 1 - Introduction and Description



# Introduction

Welcome to Multi-Tech's new RASFinder Server (RAS) for remote dial-in access. This is a remote access device that supports up to 32 simultaneous users. The RASFinder 200-Series features a 10Base-T Ethernet interface for easy configuration, and three internal K56flex modems for support for ISDN. The command port uses a serial port using bundled Windows® based software.



## Chapter 5 - Remote Configuration

This chapter provides procedures for changing the configuration of a remote RASFinder, located elsewhere on a LAN or at the other end of a modem connection.

## Chapter 6 - Router Management

Chapter 6 describes typical Telnet Client and WEB-browser management of the RASFinder.

## Chapter 7 - Service, Warranty and Tech Support

Chapter 7 provides statements concerning the product warranty, has space for recording information about your RASFinder prior to calling Multi-Tech's Technical Support, and includes instructions for contacting Technical Support and returning your RASFinder to the factory if it requires service. Also included is information on how to use our bulletin board service (BBS), and how to obtain product support through CompuServe and the Internet. There is also an explanation of how to order technical literature using our 24-hour Fax-Back Service.

## Appendices

Included in the Appendices are Cabling Diagrams for the external cables you connect to the RASFinder, Script Language that can be used to automate certain operations, Regulatory Information, a summary of AT Commands, and a Glossary of Terms.

## Related Documentation

The complete documentation package for the RASFinder 200-Series includes this User Guide, a Quick Start Guide, a Client Setup User Guide, and a Remote Access Server Dial-Out Redirector User Guide. The printed version of the Quick Start Guide, shipped with the unit, provides the necessary information for a qualified person to unpack, cable, load software, and configure the unit for proper operation. The Client Setup User Guide is for multiple users to configure their Windows 95 PCs to dial in to a Remote Access Server. The Dial-Out Redirector User Guide is for those who need communications connectivity for their Windows or DOS dial-out or fax-out programs. Copies of the following guides are provided on the Manuals diskette that ships with each RASFinder 200-Series unit, and you can always find the latest version of these guides at Multi-Tech's Web site.

At the Multi-Tech Home Page (<http://www.multitech.com>), click on Support, then Manuals, then RASFinder and you will find each of the guides listed by title:

- RASFinder 200-Series User Guide
- Remote Access Server (RAS) Client Setup User Guide
- Remote Access Server Dial-Out Redirector User Guide

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# TCP/IP (Transmission Control Protocol/Internet Protocol)

TCP/IP is a protocol suite and related applications developed for the U.S. Department of Defense in the 1970s and 1980s specifically to permit different types of computers to communicate and exchange information with one another. TCP/IP is currently mandated as an official U.S. Department of Defense protocol and is also widely used in the UNIX community.

Before you install TCP/IP on your network, you need to establish your Internet addressing strategy. First, choose a domain name for your company. A domain name is the unique Internet name, usually the name of your business, that identifies your company. For example, Multi-Tech's domain name is `multitech.com` (where `.com` indicates this is a commercial organization; `.edu` denotes educational organizations, `.gov` denotes government organizations). Next, determine how many IP addresses you'll need. This depends on how many individual network segments you have, and how many systems on each segment need to be connected to the Internet. You'll need an IP address for each network interface on each computer and hardware device.

IP addresses are 32 bits long and come in two types: network and host. Network addresses come in five classes: A, B, C, D, and E. Each class of network address is allocated a certain number of host addresses. For example, a class B network can have a maximum of 65,534 hosts, while a class C network can have only 254. The class A and B addresses have been exhausted, and the class D and E addresses are reserved for special use. Consequently, companies now seeking an Internet connection are limited to class C addresses.

Early IP implementations ran on hosts commonly interconnected by Ethernet local area networks (LAN). Every transmission on the LAN contains the local network, or medium access control (MAC), address of the source and destination nodes. The MAC address is 48-bits in length and is non-hierarchical; MAC addresses are never the same as IP addresses.

When a host needs to send a datagram to another host on the same network, the sending application must know both the IP and MAC addresses of the intended receiver. Unfortunately, the IP process may not know the MAC address of the receiver. The Address Resolution Protocol (ARP), described in RFC 826 (located at <ftp://ds.internic.net/rfc/rfc826.txt>) provides a mechanism for a host to determine a receiver's MAC address from the IP address. In the process, the host sends an ARP packet in a frame containing the MAC broadcast address; and then the ARP request advertises the destination IP address and asks for the associated MAC address. The station on the LAN that recognizes its own IP address will send an ARP response with its own MAC address. An ARP message is carried directly in an IP datagram.

Other address resolution procedures have also been defined, including those which allow a diskless processor to determine its IP address from its MAC address (Reverse ARP, or RARP), provides a mapping between an IP address and a frame relay virtual circuit identifier (Inverse ARP, or InARP), and provides a mapping between an IP address and ATM virtual path/channel identifiers (ATMARP).

The TCP/IP protocol suite comprises two protocols that correspond roughly to the OSI Transport and Session Layers; these protocols are called the Transmission Control Protocol and the User Datagram Protocol (UDP). Individual applications are referred to by a port identifier in TCP/UDP messages. The port identifier and IP address together form a "socket". Well-known port numbers on the server side of a connection include 20 (FTP data transfer), 21 (FTP control), 23 (Telnet), 25 (SMTP), 43 (whois), 70 (Gopher), 79 (finger), and 80 (HTTP).

TCP, described in RFC 793 (<ftp://ds.internic.net/rfc/rfc793.txt>) provides a virtual circuit (connection-oriented) communication service across the network. TCP includes rules for formatting messages, establishing and terminating virtual circuits, sequencing, flow control, and error correction. Most of the applications in the TCP/IP suite operate over the "reliable" transport service provided by TCP.

UDP, described in RFC 768 (<ftp://ds.internic.net/rfc/rfc768.txt>) provides an end-to-end datagram (connectionless) service. Some applications, such as those that involve a simple query and response, are better suited to the datagram service of UDP because there is no time lost to virtual circuit establishment and termination. UDP's primary function is to add a port number to the IP address to provide a socket for the application.



The Application Layer protocols are examples of common TCP/IP applications and utilities, which include:

- Telnet (Telecommunication Network): a virtual terminal protocol allowing a user logged on to one TCP/IP host to access other hosts on the network, described in RFC 854 (<ftp://ds.internic.net/rfc/rfc854.txt>).
- FTP: the File Transfer Protocol allows a user to transfer files between local and remote host computers per IETF RFC 959 (<ftp://ds.internic.net/rfc/rfc959.txt>).
- Archie: a utility that allows a user to search all registered anonymous FTP sites for files on a specified topic.
- Gopher: a tool that allows users to search through data repositories using a menu-driven, hierarchical interface, with links to other sites, per RFC 1436 (<ftp://ds.internic.net/rfc/rfc1436.txt>).
- SMTP: the Simple Mail Transfer Protocol is the standard protocol for the exchange of electronic mail over the Internet, per IETF RFC 821 (<ftp://ds.internic.net/rfc/rfc821.txt>).
- HTTP: the Hypertext Transfer Protocol is the basis for exchange of information over the World Wide Web (WWW). Various versions of HTTP are in use over the Internet, with HTTP version 1.0 (per RFC 1945) (<ftp://ds.internic.net/rfc/rfc1945.txt>) being the most current.
- HTML: WWW pages are written in the Hypertext Markup Language (HTML), an ASCII-based, platform-independent formatting language, per IETF RFC 1866 (<ftp://ds.internic.net/rfc/rfc1866.txt>).
- Finger: used to determine the status of other hosts and/or users, per IETF RFC 1288 (<ftp://ds.internic.net/rfc/rfc1288.txt>).
- POP: the Post Office Protocol defines a simple interface between a user's mail reader software and an electronic mail server; the current version is POP3, described in IETF RFC 1460 (<ftp://ds.internic.net/rfc/rfc1460.txt>).
- DNS: the Domain Name System defines the structure of Internet names and their association with IP addresses, as well as the association of mail, name, and other servers with domains.
- SNMP: the Simple Network Management Protocol defines procedures and management information databases for managing TCP/IP-based network devices. SNMP, defined by RFC 1157 (<ftp://ds.internic.net/rfc/rfc1157.txt>) is widely deployed in local and wide area network. SNMP Version 2 (SNMPv2), per RFC 1441 (<ftp://ds.internic.net/rfc/rfc1441.txt>) adds security mechanisms that are missing in SNMP, but is also more complex.
- Ping: a utility that allows a user at one system to determine the status of other hosts and the latency in getting a message to that host. Ping uses ICMP Echo messages.
- Whois/NICNAME: Utilities that search databases for information about Internet domain and domain contact information, per RFC 954 (<ftp://ds.internic.net/rfc/rfc954.txt>).
- Traceroute: a tool that displays the route that packets will take when traveling to a remote host.

## Internet Protocol (IP)

IP is the Internet standard protocol that tracks Internetwork node addresses, routes outgoing messages and recognizes incoming messages, allowing a message to cross multiple networks on the way to its final destination. The IPv6 Control Protocol (IPV6CP) is responsible for configuring, enabling, and disabling the IPv6 protocol modules on both ends of the point-to-point link. IPV6CP uses the same packet exchange mechanism as the Link Control Protocol (LCP). IPV6CP packets are not exchanged until PPP has reached the Network-Layer Protocol phase. IPV6CP packets received before this phase is reached are silently discarded. (See also TCP/IP.)

Before you install TCP/IP on your network, you need to establish your Internet addressing strategy. You first choose a domain name for your company. A domain name is the unique Internet name, usually the name of your business, that identifies your company. For example, Multi-Tech's domain name is multitech.com (where .com indicates this is a commercial organization; .edu denotes educational organizations, .gov denotes government organizations, etc.). Next, you determine how many IP addresses you'll need. This depends on how many individual network segments you have, and how many systems on each segment need to be connected to the Internet. You need an IP address for each network interface on each computer and hardware device.

IP addresses are 32 bits long and come in two types: network and host. Network addresses come in five classes: A, B, C, D, and E. Each class of network address is allocated a certain number of host addresses. For example, a class B network can have a maximum of 65,534 hosts, while a class C network can have only 254. The class A and B addresses have been exhausted, and the class D and E addresses are reserved for special use. Consequently, companies now seeking an Internet connection are limited to class C addresses. The current demand for Internet connections will exhaust the current stock of 32-bit IP addresses. In response, Internet architects have proposed the next generation of IP addresses, IPng (IP Next Generation). It will feature 16-byte (128-bit) addressing, surpassing the capacities of 32-bit IP. Still in its design phase, IPng (also known as IPv6) is not expected to be widely deployed before the end of this century.

An IP address can serve only a single physical network. Therefore, if your organization has multiple physical networks, you must make them appear as one to external users. This is done via "subnetting", a complex procedure best left to ISPs and others experienced in IP addressing. Since IP addresses and domain names have no inherent connection, they are mapped together in databases stored on Domain Name Servers (DNS). If you decide to let an Internet Service Provider (ISP) administer your DNS server, the ISP can assist you with the domain name and IP address assignment necessary to configure your company's site-specific system information. Domain names and IP addresses are granted by the InterNIC. To check the availability of a specific name or to obtain more information, call the InterNIC at (703)742-4777.

## A Typical Network Application

A typical application of a RASFinder 200-Series is shown in Figure 1-2. In this application, the LAN port is connected to a TCP/IP LAN. A remote node client is able to dial into WAN 1 on the RASFinder. A PPP client is connected to WAN 2 and a Win95 Netware client is using WAN 3. All three remote users are able to access shared services on the LAN and access the internet via a shared internet port.

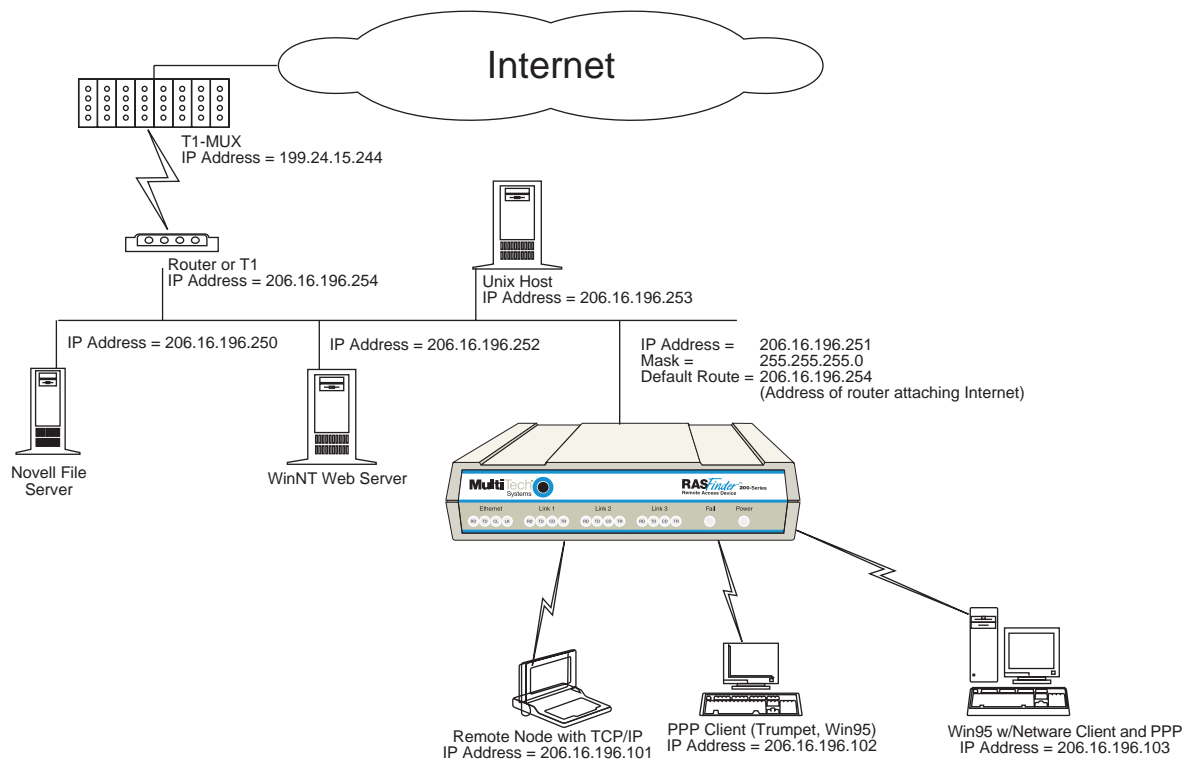


Figure 1-2. Typical network configuration.

## Front Panel

The front panel contains three groups of LEDs that provide the status of the LAN connection, link activity, and general status of the RASFinder. The EtherNet LAN LEDs display the activity of the LAN in whether the RASFinder is connected to the LAN, transmitting or receiving packets, and if a collision is in progress. The Link LEDs display the status of the three links that can be connected to the RASFinder with whether a link is ready to transmit or receive serial data. The last group of LEDs indicates whether the self test passed or failed and if the power ON/OFF switch on the back of the RASFinder is set to ON.

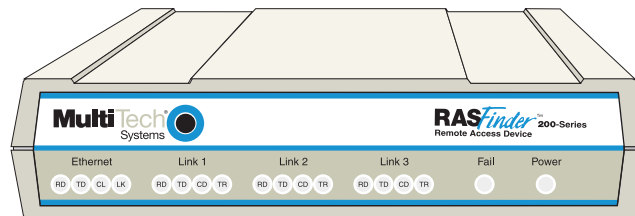


Figure 1-2. Front Panel

### ETHERNET

- RD** Receive Data indicator blinks when packets are being received from the local area network.
- TD** Transmit Data indicator blinks when packets are being transmitted to the local area network.
- CL** Collision indicator lights when a collision is in progress; that is, when two nodes are transmitting packets at the same time.
- LK** Link indicator lights indicating that the RASFinder is connected to the local area network.

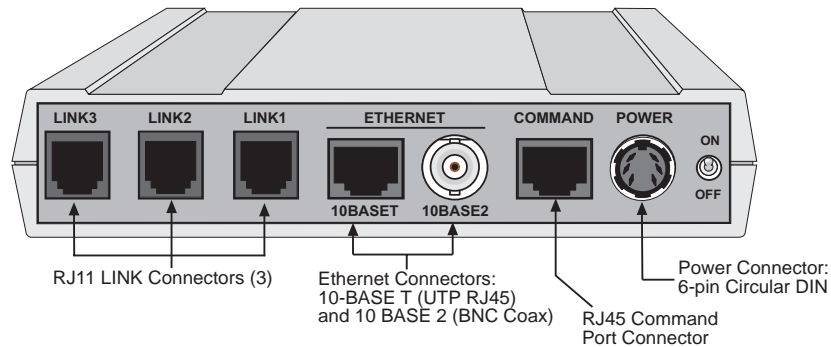
### LINK x

- RD** Receive Data indicator blinks when the link is receiving data.
- TD** Transmit Data indicator blinks when the link is transmitting data.
- CD** Carrier Detect indicator lights when the link detects a carrier signal.
- TR** Terminal Ready indicator blinks when the link is ready to transfer data.

- Fail** Fail indicator lights when a self test fails to complete as expected.
- Power** The power indicator lights when the On/Off Switch is in the ON position.

## Back Panel

The cable connections for the RASFinder are made at the back panel. Three groups of cables are used on the RASFinder: the Command Port, Link 1 (2 and 3) RJ11, and the EtherNet. The cable connections are shown in Figure 1-3 and defined in the following groups.



**Figure 1-3. Back Panel**

### Link 1 (2 and 3) Connector

These Link 1 (2 and 3) connectors are used to connect the RASFinder to a WAN. These connectors are RJ11 connectors.

### EtherNet 10Base-T Connector

The EtherNet 10Base-T connector is used to connect the RASFinder to a LAN using unshielded twisted cable. This connector is an RJ45 jack.

### EtherNet 10Base-2 Connector

The EtherNet 10Base-2 connector is used to connect the RASFinder to a LAN using thin Coax cable.

### Command Connector

The Command connector is used to configure the RASFinder using a PC with a serial port and running Windows® software. The Command connector is an RJ45 jack and a short adapter cable is provided to convert to a standard serial port DB25 female connector.

### Power Connector

The Power connector is used to connect the external power supply to the RASFinder. The Power connector is a 6-pin circular DIN connector. A separate power cord is connected to the power supply and the live AC grounded outlet.

## Specifications

The RASFinder conforms to the following specifications:

- Routing Protocols - IP and IPX, and bridging for all others
- EtherNet LAN Interface - 10Base-T (twisted pair) or 10Base2 (ThinNet) AUI
- WAN Interface - 3 async or sync Links (RS232C/V.35)
- Frame relay networks for SLIP, PPP, Async and HDLC Sync devices
- Frame relay trunk speeds up to T1/E1 synchronous
- Command Port - 19.2K bps Asynchronous
- One 70-nanosecond 4MB SIMM and a connector for a 2nd 4MB SIMM  
(RAM is expandable to a maximum of 32 MB)  
**Caution:** SIMM speed and size cannot be mixed.
- 1 MB of Flash memory (on two PROMs)

### EtherNet Port

- One Ethernet Interface - 10Base-T (twisted pair) RJ45 connector or 10Base-2 (ThinNet) BNC connector

### Command Port

- Single 19.2K bps asynchronous Command Port using a short RJ45-to-DB25 cable with a DB25 female connector

### WAN Links

- Three internal K56flex™ modems\*

### Electrical/Physical

- Voltage - 115 VAC (Standard), 240 VAC (Optional)
- Frequency - 47 to 63 Hz
- Power Consumption - 10 Watts
- Dimensions - 1.625" high x 6" wide x 9" deep  
5.63 cm high x 22.34 cm wide x 33.51 cm deep
- Weight - 2 pounds (0.92 kg)

### Requirement

- PC with Windows 3.1x or Windows 95, and one serial comm port to connect to the Command Port of the RASFinder

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\* Though this modem is capable of 56K bps download performance, line impairments, public telephone infrastructure and other external technological factors currently prevent maximum 56K bps connections.

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**RASFinder**<sup>™</sup> 200-Series  
Remote Access Device

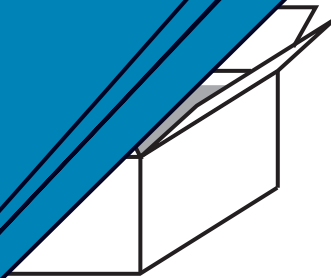
## Chapter 2 - Installation

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## Installation

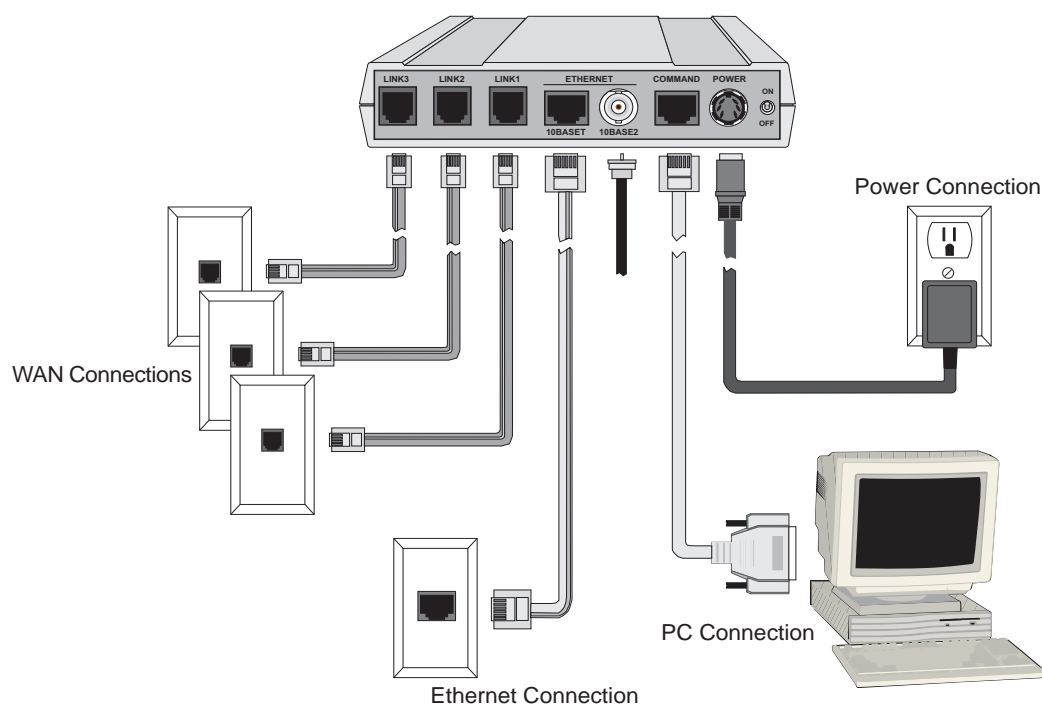
The installation procedure in Table 2-1 is organized so that if you need to open the RASFinder enclosure to install additional RAM, you do this before you connect your cables. Table 2-2 provides procedures on how to add additional RAM.

The installation procedure provides the cable connections for up to three WANs, two types of connections for your Ethernet, a short adapter cable to connect to your PC for software loading, and finally your power connection.

**Table 2-1. Installation Procedure**

### Step Procedure

- 1 If one of the links needs to be changed to a V.35 interface, perform the procedures in Table 2-2.
- 2 If additional RAM is needed, perform the procedures in Table 2-3.



**Figure 2-2. Back Panel Connections**

- 3 Connect the RASFinder to a PC using the short RJ45 to DB25 (female) cable provided with your unit. Plug the RJ45 end of the cable into the Command Port of the RASFinder and the other end into the PC's serial port or RS232 cable from the PC serial port. See Figure 2-2.
- 4 To make the network connection, connect either an RJ45 (UTP) cable to the 10 BASE-T connector (shown in Figure 2-2), or a Coax (BNC) cable to the 10 BASE-2 connector on the back of the RASFinder. Connect the other end of the cable to your LAN.
- 5 Connect one end of an RJ11 cable to each of the LINK Connectors on the RASFinder (labeled LINK 1, LINK 2, and LINK 3) and connect the other end to the phone jacks (as shown in Figure 2-2).
- 6 Connect one end of the power supply to a live AC outlet, then connect the other end to the RASFinder as shown in Figure 2-2. The power connector is a 6-pin circular DIN connector.
- 7 Turn on power to the RASFinder by setting the ON/OFF switch on the back panel to the ON position. At this time your RASFinder is completely cabled. Proceed to the next section to load the MultiRouter software.

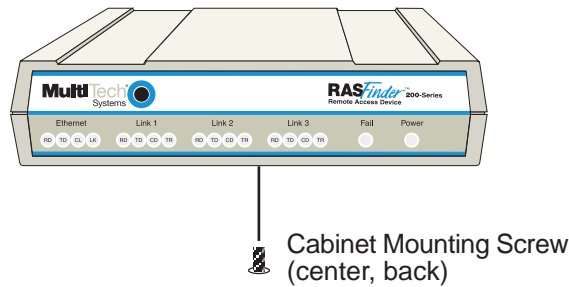
## Adding Additional RAM

A second SIMM connector is provided for adding additional RAM to the RASFinder. The procedure for adding additional RAM is provided in Table 2-2.

**Table 2-2. Adding Additional RAM Procedure**

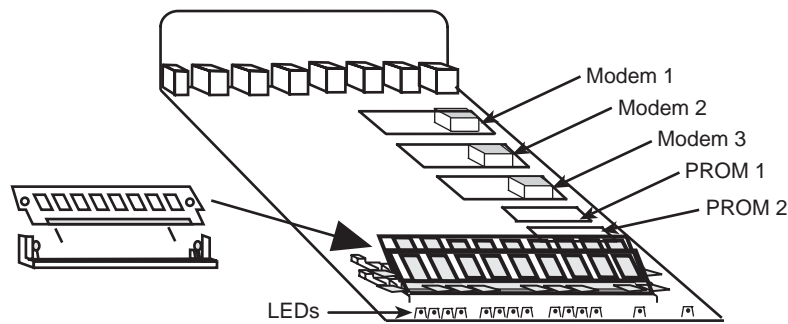
**Step Procedure**

- 1 Ensure that the external power supply is disconnected from the RASFinder.
- 2 Turn the RASFinder upside down and remove the cabinet mounting screw at the center back of the cabinet.



**Figure 2-3. Cabinet Mounting Screw**

- 3 Turn the RASFinder right side up, then slide the base out the rear of the cabinet.
- 4 Position the base so the front panel LEDs are toward you (as in Figure 2-4).
- 5 Slant the SIMM at a 45° angle to the back of the base and align the centering notch of the SIMM with the center tab on the SIMM connector.
- 6 Gently press down on the ends of the SIMM until the two short vertical white pins enter the holes at the ends of the SIMM and the two metal side clips snap in place over the SIMM, locking it down.



**Figure 2-4. Installing a SIMM**

- 7 Align the base with the mating guides on the inside of the cabinet, then slide the base all the way into the cabinet until it stops.
- 8 Turn the RASFinder upside down and replace the cabinet mounting screw that was removed in step 2.
- 9 Turn the RASFinder right side up and return to Table 2-1 to connect the cables.



## Chapter 3 - Software Loading and Configuration



## Introduction

The following loading procedure does not provide every screen or option in the process of installing the MultiRouter software. The assumption is that a technical person with a thorough knowledge of Windows and the software loading process is doing the installation.

## Loading your Software

1. Run Windows on the PC that is connected to the Command Port of the RASFinder.
2. Insert the MultiRouter 200-Series diskette into the disk drive on the PC connected to the Command Port.
3. **Win3.1 users** - From the File menu in Program Manager, click on Run. In the Run dialog box, type **a:\install** or **b:\install** (depending on the location of your floppy disk drive) in the Command Line field and then click on **OK**.

**Win95 users** - Click on the Start button and then click on Run. In the Run dialog box click on the down arrow and choose **a:\install** and then click on **OK**.

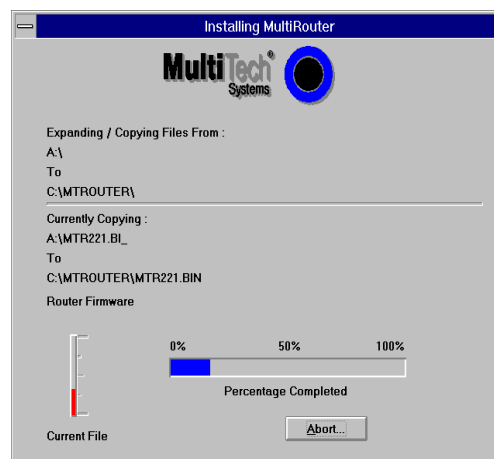


4. Click on **Install** to continue installation, at any time you may click on **Abort** if you wish to cancel the install.

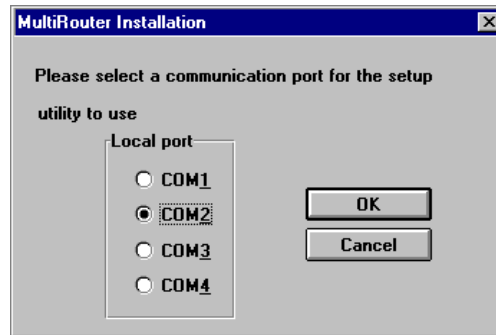
Follow the on-screen instructions to install your MultiRouter software.

The On-Line Helps for the MultiRouter software provide a detailed explanation of each dialog box and each option. To access the On-Line Help, click on the **Help** button in dialog box in which you would like additional information.

5. The Expanding/Copying Files From: dialog box is displayed. You can view the progress of the installation from this dialog box. You can click on **Abort** at any time to cancel the install.

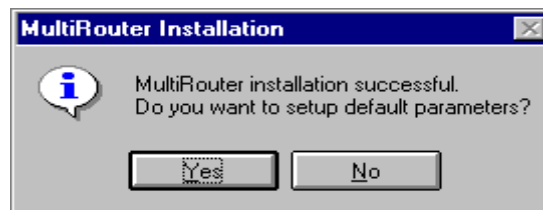


6. The MultiRouter Setup Installation dialog box appears which states, "Please select a communication port for the setup utility to use." In other words, select which COM port on your PC is connected to the Command Port of the RASFinder.

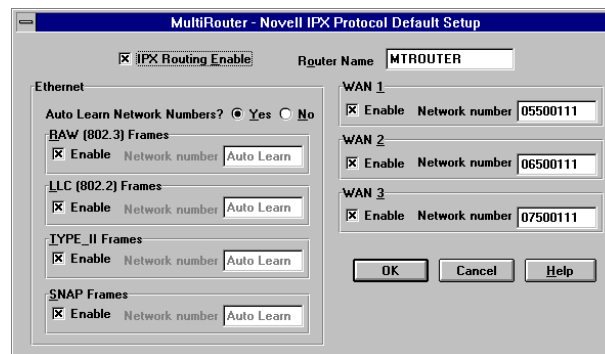


Select the **COM** port (**COM1, COM2, COM3, or COM4**) for the setup utility. The default port is COM1. Click on **OK** when you are satisfied with your selection.

7. When the software is successful loaded on your PC, a system message is displayed stating "MultiRouter Installation Successful. Do you want to setup default parameters?"



8. Ensure that the **Fail** LED is off before you click on the **Yes** button. Click on **Yes** to set up the default parameters. If you click on **No**, the installation is complete.
9. To configure your RASFinder, a series of default dialog boxes, MultiRouter - Novell IPX Protocol Default Setup, MultiRouter - IP Protocol Default Setup, MultiRouter - WAN Port Default Setup will be displayed.



If your network protocol is **IPX**, continue with the following steps. If your network protocol is **IP**, click on the **IPX Routing Enable** check box to disable IPX, then click on the **OK** button and proceed to step 14.

10. **Router Name:** You can either use the default Router Name or assign a new Router Name in this field. If you assign a new Router Name, it must be a printable ASCII string of a maximum of 47 characters. The router name is used by the RASFinder to advertise its service in the IPX inter-network.

11. **Ethernet:** You can enable Auto Learn Network Numbers by leaving the default **Yes** or you can manually assign the network numbers by clicking on **No** in the Auto Learn Network Numbers field. If no file server is connected to the Ethernet segment, then this field should be **No** (recommended). If you enable Auto Learn (**Yes**), the RASFinder will learn the IPX network numbers from the file server.

If you select **No** for Auto Learn, record the network numbers assigned by the network file server for each of the four frame types [Raw (802.3), LLC (802.2), EthernetII (Type II), and SNAP] in the space provided below.

**RAW** (802.3) Frames Network Number \_\_\_\_\_

**LCC** (802.2) Frames Network Number \_\_\_\_\_

**TYPE\_II** Frames Network Number \_\_\_\_\_

**SNAP** Frames Network Number \_\_\_\_\_

**WAN** Network Number \_\_\_\_\_

When you manually assign network numbers, make sure they match the network numbers assigned to your local file server (if any).

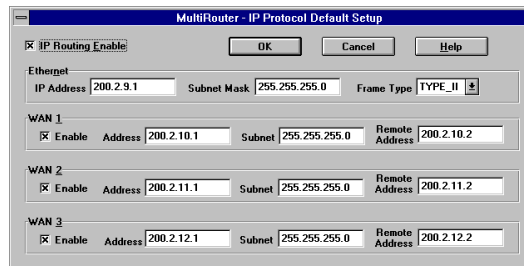
12. **WAN:** Enter the **WAN** network number for the active WAN Port(s) by clicking on the Network Number box and back spacing through the default number and entering your new WAN number. Also, the WAN network numbers must be the same as the RASFinder on the other end of the link.

The WAN network numbers have to be assigned by the network administrator and must be unique throughout the entire internetwork.

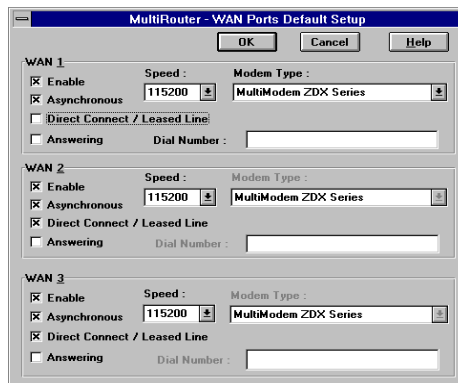
Highlight the **WAN 2** and/or **WAN 3** network number and change its Network Number.

**Note:** The WAN ports do not have the capability of learning the network number, unlike the LAN port (i.e., the WAN ports do not have a file server).

13. Click on **OK** when you are satisfied with all your selections.
14. If you clicked **OK** from the IPX Protocol Default Setup dialog box (step 9), the IP Protocol Default Setup dialog box is displayed.



15. To change the IP parameters, proceed to the next step. Clicking on the **OK** button advances to the WAN Ports Default Setup dialog box. The WAN Ports Default Setup starts at step 20.
16. The default Ethernet IP Address has to be changed to your unique LAN address. Assign an acceptable unique **IP address** to the EtherNet port.
17. Change the default **Subnet Mask** and **Frame Type** to the values you have assigned to your LAN port.
18. The default WAN Addresses have to be changed to your unique WAN addresses. Assign an acceptable unique **WAN Address** to each active WAN port.
19. Change the default **Subnet Mask** and **Remote Address** for each WAN port to the values you have assigned to your WANs.
20. Click on **OK** when you are satisfied with your selections.



21. The **WAN** Ports Default Setup dialog box is displayed with all the WAN Ports enabled, Asynchronous mode enabled, the speed set at 115200, and the Modem Type defaulted to Socket Modem K56flex. Each WAN port can be configured independently; e.g., one can dial a specific number, another could answer a call, and the third could dial a different number.

If **WAN 1** is being set up to answer a call, click on the **Answering** option and then click on the Direct Connect/Leased Line option to disable the Direct Connect/Leased Line option.

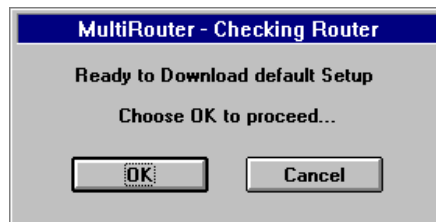
If **WAN 1** is being set up to make a call, click on the Direct Connect/Leased Line option to disable that option and enter the telephone number to be dialed in the **Dial Number** field.

The Speed and Modem type should remain at **115200** and **Socket Modem K56flex**. If either selection needs to be changed, click on the down arrow and click on your new selection.

22. Repeat the above step for **WAN 2** and **WAN 3**.  
 23. Click on **OK** when you are satisfied with your selections.

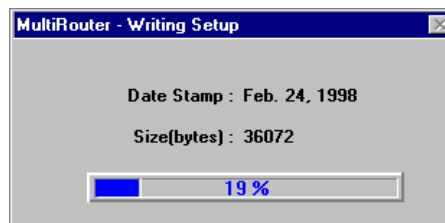
The WAN port can be further configured, once the installation of the software is completed, by clicking on the MultiRouter Configuration icon and clicking on the WAN button.

24. The **Checking Router** dialog box displays. The Setup utility is "Ready to Download default setup Choose OK to proceed".



Click on the **OK** button to continue installing the software.

The **Writing Setup** dialog box displays as the setup configuration is written to the RASFinder.

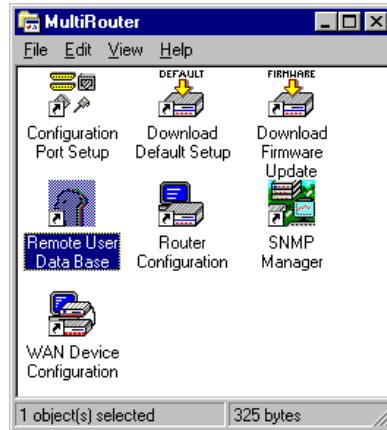


25. Check to ensure that the **Fail** LED on the RASFinder is Off after the download is complete and the RASFinder is rebooted.
26. **Win3.1 users** - you are returned to your Program Manager where the MultiRouter Program Group and Program Items (Windows icons) have been created.  
**Win95 users** - you are returned to your desktop.  
 Your RASFinder is operational at this time.

# Setting Up Your Remote User Database

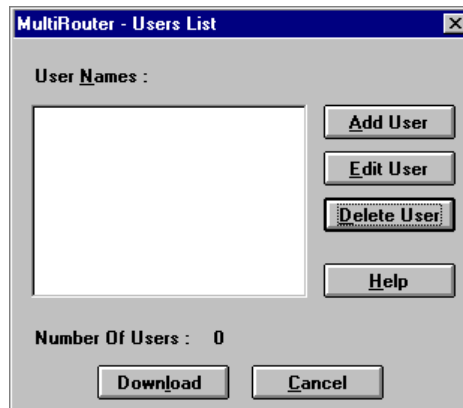
The remote user database lets you gather information about your remote users. You can add remote users, remove users from the database, or you can edit information in the database.

1. **Win3.1 users** - From the Program Manager, click on the **Remote User Data Base** icon.

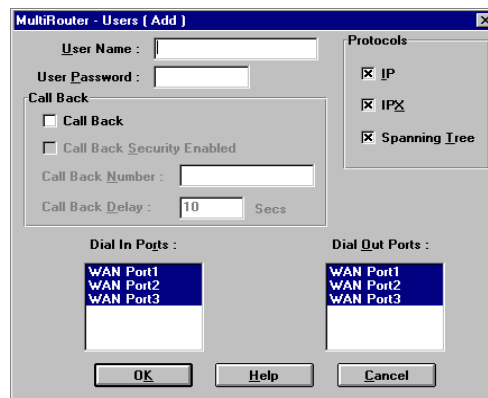


**Win95 users** - From your desktop, click on the **Start** button, point to **Programs**, then **MultiRouter**, and then click on **Remote User Data Base**.

The Users List dialog box is displayed.



2. Click on the **Add User** button and the Add Users dialog box is displayed.





3. Build your user database by filling in the following fields for each user.

**User Name**

The User Name can have as many as 39 characters. All printable characters are permitted with the restriction that no blanks are allowed in the user name. In dial-in and dial-out applications, the user name is treated as a case insensitive string.

**User Password.**

The User Password can have as many as 7 characters. In places where the password is used as a character string, it is treated as a case insensitive string. Elsewhere (PPPs CHAP), it is treated as a case sensitive pattern.

**Call Back**

You have to click this check box in order to access the following three Call Back functions.

**Call Back Security Enabled**

This parameter is of use in dial-in applications where the user is required to be called back at a specific number. Enabling this parameter results in having the administrator assigning the callback parameters. Leave this function disabled if the user is to be allowed to choose the call back number and the call back delay.

**Call Back Number**

The call back number field is editable only if call back security is enabled (checked). This is the number where the user will be called back. If call back security is enabled, the user **cannot** choose the call back number.

**Call Back Delay**

Call back delay is editable only if call back security is enabled. This specifies the duration after which this user will be called back at the administrator-assigned phone number.

**Protocols**

This lets you select the protocol(s) in which the user is allowed to dial into the RASFinder.

**Dial In Ports**

This allows you to select the port over which the user is permitted to dial into the RASFinder.

**Dial Out Ports**

This allows you to select the port over which the user is permitted to dial out from the RASFinder.

4. After each user is defined on the Add Users screen, click on the **OK** button to display the updated Users List dialog box. Click on the **Add User** button to continue adding users to your database.
5. When you have added all your users to the database, from the Users List dialog box, click on the **Download** button to load the database into the MultiRouter.





## Chapter 4 - MultiRouter Software



# Introduction

This chapter describes the RASFinder's MultiRouter software from an applications standpoint, showing how to make changes in the configuration with recommendations on the impact of any such changes. The major configuration parameters were set when the software was loaded into your PC and the setup configuration was downloaded to the RASFinder at the conclusion of the software installation. The MultiRouter software is designed for the Microsoft® Windows® environment.

Recommendations are provided to explain that changing parameters may affect your unit in a certain way. Our intent is not to cover every dialog box and every option because the Router Setup Help system provides that information. The Help menus define each button, option, field, and provide recommend values where applicable. This constitutes a dynamic help system in that the information presented always relates to the dialog box or window that is currently open.

## Before You Begin

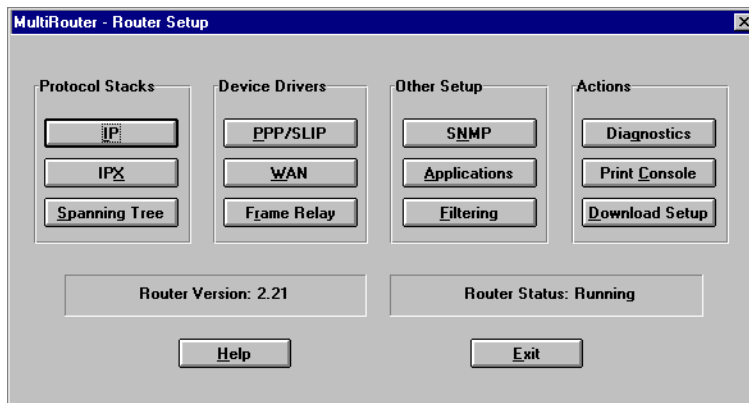
To view or change your MultiRouter configuration in Windows 95, click on the Start button, point to Programs, then MultiRouter, and click on Router Configuration. You can also start the Router Configuration from My Computer by selecting the following folders, in turn (Windows\Start Menu\Programs\MultiRouter), and finally double-clicking on the Router Configuration icon.

## Setup Menu

The Router Setup menu consists of 14 buttons in which you can point and click, and two status fields. The 12 buttons (four columns of three buttons each) in the upper part of the Router Setup window allow you to display and change the protocol stacks, define the output of the RASFinder, perform network management functions, test the communications link, print messages received from the target RASFinder, and download setup information to the RASFinder.

**Note:** The RASFinder does not support the Frame Relay function; however, the Frame Relay button is not dimmed. If at any time the PPP/SLIP button becomes dimmed, click on the Frame Relay button, then click on the check mark in front of the word, Enable, in the upper left corner of the Frame Relay Setup screen to disable the Frame Relay function and re-enable PPP/SLIP.

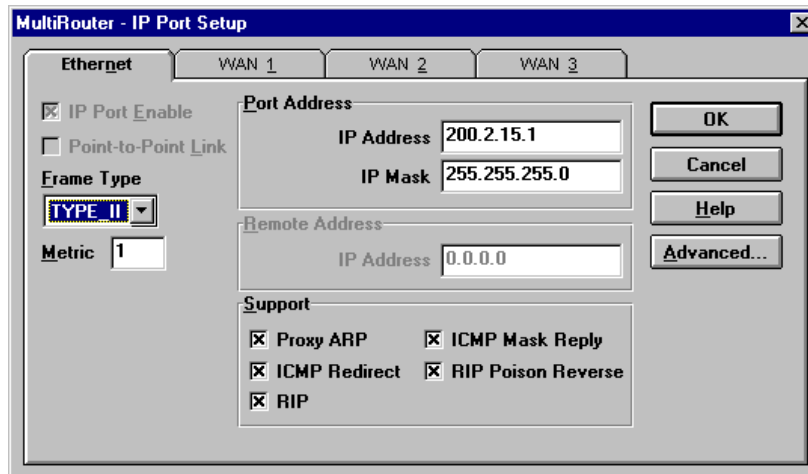
At the bottom of the screen are two buttons to open the on-line Help system (MultiRouter Setup Help) and end (Exit) a Router Setup session. Just above these buttons are two fields that display the current version number of the software (Router Version) and the Router Status, which is usually "Running."



## IP Setup

The IP Port Setup dialog box allows you change the IP routing capabilities, add or delete logical WANs, enable the DHCP server, assign DNS address, and define default routes. The initial routing capabilities were established during the software installation. You can change IP routing parameters by clicking on the Advanced tab and changing, for example, the RIP Response Time or RIP Route Aging Time. The WAN tab allows you to change the WAN port IP address, the remote address, and if logical WAN ports are being added for frame relay, you can add them by clicking on the Add button.

The Ethernet IP Setup dialog box displays the parameters for your Ethernet port with the IP Address and IP Mask established during the initial loading of the software.

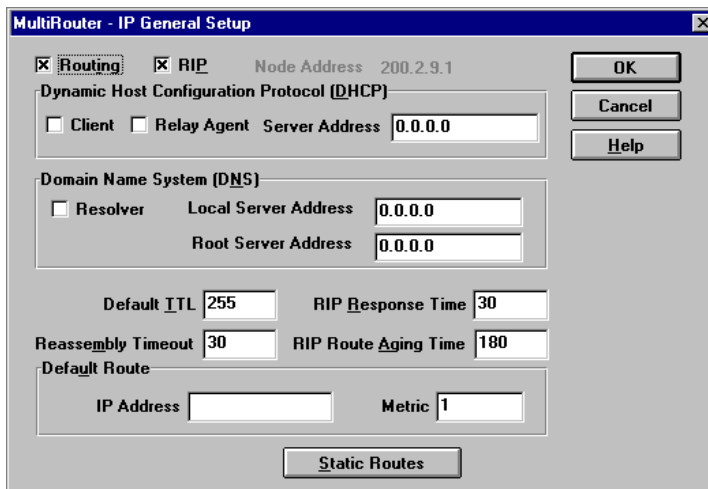


An IP address is a combination of a network number and a host number or ID. IP address masks are used to specify the network or subnet portion of the IP address. IP addresses and masks are 32-bit values. These are usually provided in what is known as the dotted decimal notation. In this notation, each 8-bit portion of the address is given a decimal quantity separated by a dot. For example, 192.2.10.1. The RASFinder expects all IP addresses to be provided in dotted decimal notation. Among IP addresses, address 0.0.0.0 and 127.?.?.? cannot be specified as they are special case addresses not used on the internetwork for addressing. For Class A, B, and C addresses, you will usually specify address masks of 255.0.0.0, 255.255.0.0 and 255.255.255.0 respectively unless other subnets have been set up.

The net mask specifies the network or subnet portion of an IP address. The net mask is a 32-bit value presented in a dotted decimal notation.

On the IP Port Setup window, you can easily switch from the Ethernet port dialog box to any of the three WAN port windows by clicking on the corresponding "tab." Also, clicking on the Advanced button will open the IP General Setup window.

The (Ethernet and WAN) IP Port Setup windows provide the capability to disable or enable IP routing on the selected port, change the port IP Address, IP mask, and remote IP address. The Port Setup windows determine how all the RASFinder ports are configured.

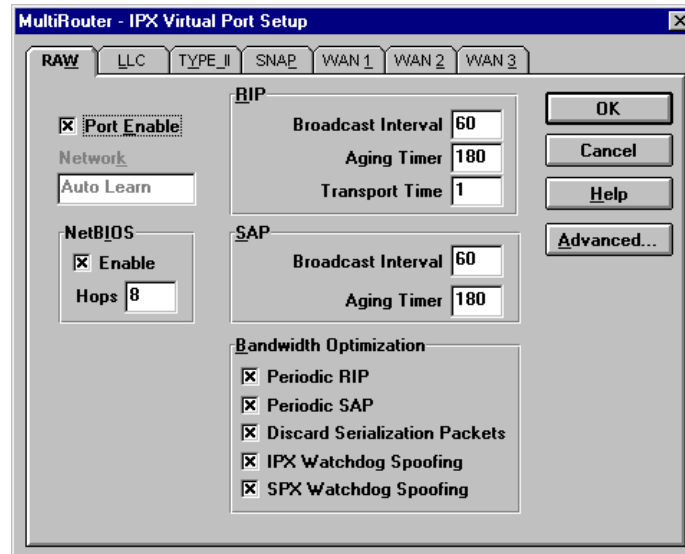


The IP General Setup dialog box controls the timers, DHCP (dynamic Host Configuration Protocol) and Domain Name System (DNS) servers, the default route, filters, and Static Routes.

In most cases, you should not have to change any of the timers (i.e., default TTL, reassembly timeout, RIP response time and RIP route aging time). The DNS Resolver is supplied for remote Telnet clients when the router is configured for remote access and the terminal server application is enabled.

## IPX Setup

The IPX Virtual Port Setup dialog box is used to control the four frame types and set up the three WAN ports of the RASFinder. The Advanced button opens an IPX General Setup window used to enable or disable IPX routing and auto learn of Ethernet network numbers; also, the distributed name of the RASFinder can be designated here.



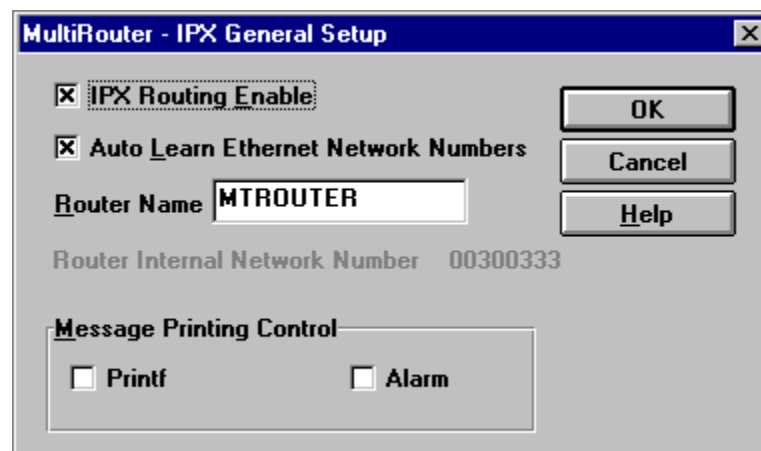
For most applications, the RIP and SAP default timers should not have to be changed. Under certain circumstances, disabling IPX and SPX Watchdog Spoofing in the Bandwidth Optimization group has proven effective.

The IPX WAN Setup windows allow you to enable or disable IPX routing on the WAN ports, change the network numbers for the WAN ports, change the default RIP and SAP timers, and optimize the bandwidth. The IPX WAN network number has to be the same on both ends of the link and must be unique throughout the internetwork. If a WAN port is configured in a point-to-point operation, both WAN network numbers have to be the same and unique.

The IPX General Setup window controls the routing of the protocol and auto learn of Ethernet network numbers, defines the broadcast name of the RASFinder, and IPX filtering.

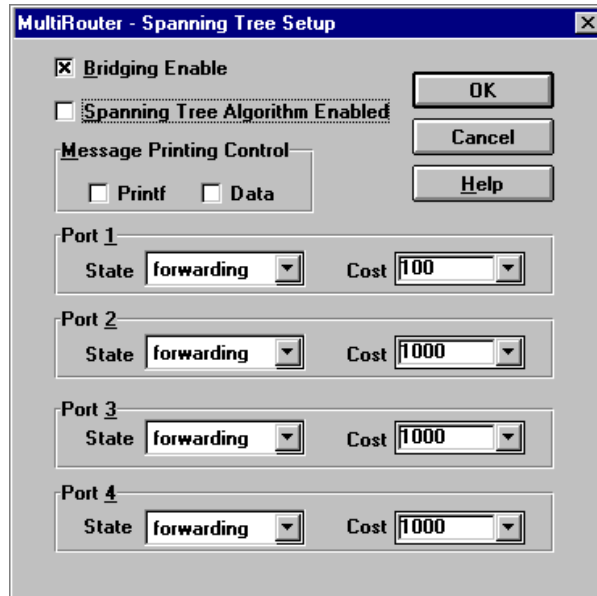
If bridging of IPX packets is desired, IPX routing must be disabled and frame type support for the frame type must be enabled.

If there is a server on the local segment, then IPX network number auto learn should be enabled. If there is no server, or if for some reason the RASFinder comes up before the server, the RASFinder will default to some random network numbers after a short period of time.



## Spanning Tree Setup

When Bridging is enabled, the Spanning Tree Setup dialog box controls simple transparent bridging between two remote Ethernet LANs. However, if your internetwork contains any loops or redundant links, then the Spanning Tree Algorithm must also be enabled. If you use only the IP and IPX protocols, leave bridging disabled to allow the RASFinder to operate more efficiently.



With Spanning Tree bridging, the RASFinder defaults with one logical WAN port mapped to a DLCI and set for “forwarding.” Any other WAN ports should be set for “blocking.” When it is required, the RASFinder will make the transition from blocking to forwarding automatically.



## WAN Port Setup

The WAN Port Setup dialog box controls how each WAN port is configured. If a port is configured for point-to-point operation, then the mode can be either synchronous or asynchronous. If the mode is asynchronous, then the connection method can be either **Answering** or **Dialing**. If the connection method is dialing, then a number to be dialed has to be entered in the **Dial Number** field and the correct modem type designated in the **Modem Types** field.

The screenshot shows a dialog box titled "MultiRouter - WAN Ports Default Setup". It contains three sections for configuring WAN ports, labeled WAN 1, WAN 2, and WAN 3. Each section has the following controls:

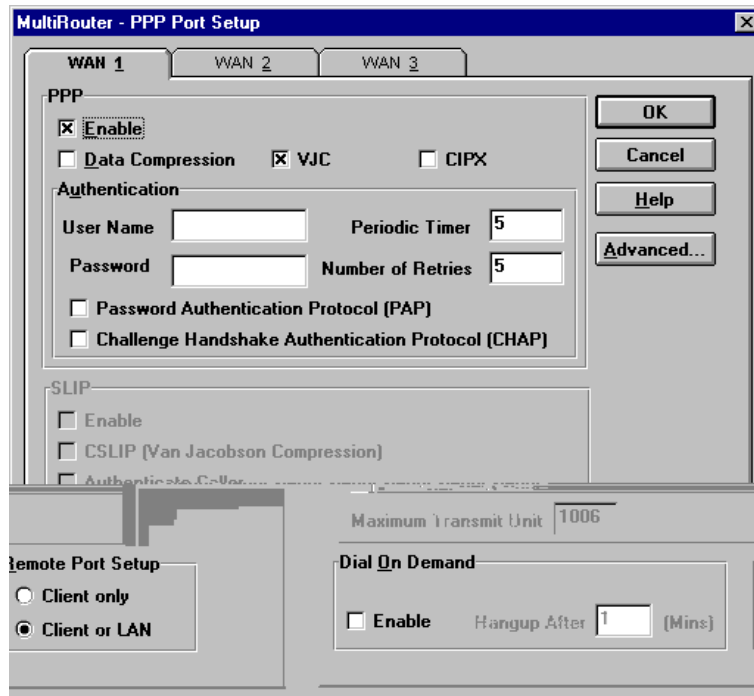
- Enable:** Checked (indicated by an 'X' in a box).
- Asynchronous:** Checked (indicated by an 'X' in a box).
- Direct Connect / Leased Line:** Unchecked (indicated by an empty box).
- Answering:** Unchecked (indicated by an empty box).
- Speed:** A dropdown menu showing "115200".
- Modem Type:** A dropdown menu showing "MultiModem ZDX Series".
- Dial Number:** An empty text input field.

Buttons for "OK", "Cancel", and "Help" are located at the top right of the dialog.

If the PPP/SLIP mode is selected, the RASFinder is configured for point-to-point operation in which data packets are transferred between two end points. Enabling this device driver allows for either an asynchronous or synchronous device to be connected between the end points. If an asynchronous device is used, the RASFinder can be used as a single port remote access server. When the PPP/SLIP mode is selected, further configuration is required using the PPP/SLIP button on the Router Setup window.

## Point-to-Point Setup

The PPP Port Setup dialog box controls the WAN port protocol, dial on demand, and remote port setup. The WAN port protocol can be either Point-to-Point Protocol (PPP) or Serial Line Internet Protocol (SLIP). Of these two protocols, PPP is the more robust as it allows the end-points to negotiate the use of the link and protocol parameters in a standardized way and also allows for standardized encapsulation of the packets. SLIP is an older protocol which requires manual authentication using a script.



PPP is the default protocol. If SLIP is to be used, click on the PPP Enable option to disable PPP, then select the SLIP Enable option. Determine if the TCP header is going to be compressed using VJC compression. If VJC compression is used, select the CSLIP (Van Jacobson Compression) optio



## Chapter 5 - Remote Configuration

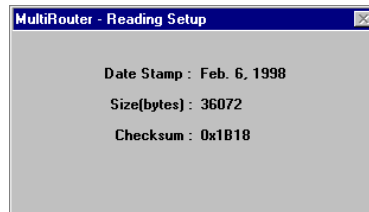




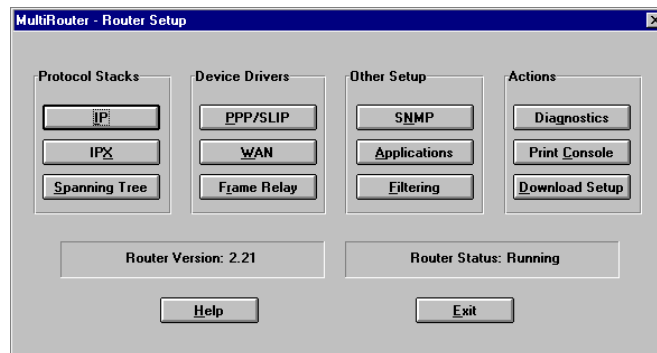
If your Modem Initialization String, Initialization Response, or Connect Response values are different from the defaults in the dialog box, refer to your modem user documentation and change the default values to match your modem.

Click on **OK** when you are satisfied with all your selections.

- 6 You are returned to the Windows program. Start the MultiRouter Configuration program.  
*Windows 3.1x:* Double click on the **Router Configuration** icon in the Program Manager.  
*Windows 95:* Click on **Start >> Programs >> MultiRouter >> Router Configuration**.
- 7 The Dialing Router dialog box is displayed while software is dialing the remote RASFinder.
- 8 The Reading Setup dialog box is displayed.



- 9 The Router Setup dialog box is displayed. This is the dialog box of the remote RASFinder. Refer to Chapter 4 for a description of each dialog box. For a detailed description of each field within a dialog box, refer to the on-line helps provided within your MultiRouter software.



- 10 After you have changed the configuration of the remote RASFinder, click on the **Download Setup** button to update the configuration. The remote RASFinder will be brought down, the new configuration written to the unit, and the unit will reboot.
- 11 Click on the **Exit** button when the downloading is complete.
- 12 The Hangup connection with Router? dialog box is displayed.  
 Click on the **Yes** button to disconnect the phone connection to the remote site.
- 13 If the same telephone number is **not** going to be used again in the immediate future, you may want to remove it from the Port Setup dialog box.
- 14 At the remote site, reconnect the RASFinder to the serial port of the PC and from the Program Manager screen click on the **Router Configuration** Icon to verify that the RASFinder is running.

# LAN-Based Remote Configuration

## Windows Sockets Compliant TCP/IP Stack

The configuration program requires a Windows Sockets compliant TCP/IP stack. Microsoft provides a TCP/IP stack free for Windows for Workgroups 3.11. TCP/IP protocol software must be installed and functional before the configuration program can be used.

- 1 You must assign an internet (IP) address for the PC and for each node that will be managed by the configuration program. Refer to the protocol software documentation for instructions on how to set the IP addresses.

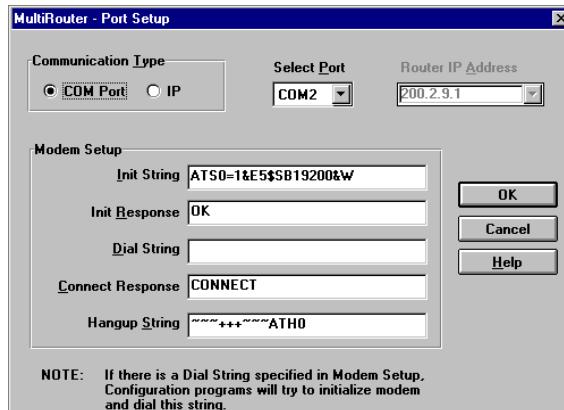
Once you have completed this step, you should be able to use the protocol Ping command for the PC host name. You should also test the network interface configuration by Pinging another TCP/IP device that is connected to the network.

- 2 Install the MultiRouter software on the local PC and at the Windows Program Manager screen, run the **Configuration Port Setup** program:

Windows 3.1x: double-click on the **Configuration Port Setup** Icon in the MultiFRAD program group.

Windows 95: Click on **Start >> Programs >> MultiRouter >> Configuration Port Setup**.

- 3 The MultiRouter Port Setup dialog box is displayed.



Verify that the **Communication Type** field is set to **IP**.

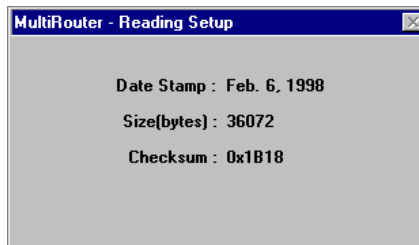
In the **Router IP Address** field, enter the IP Address of the remote RASFinder.

- 4 Click on **OK** when you are satisfied with your selections.

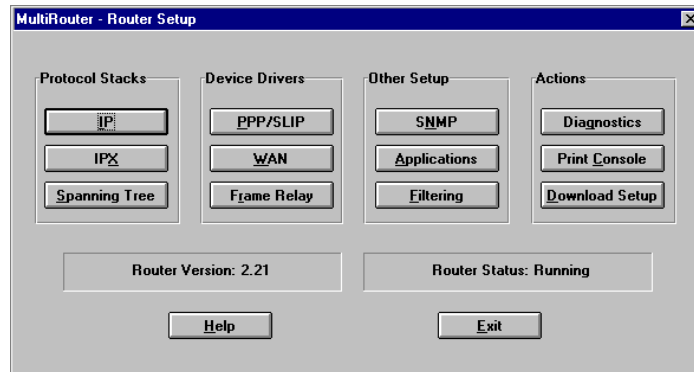
The Windows Program Manager menu is displayed.

- 5 Double click on the **Router Configuration** icon.

The Reading Setup dialog box is displayed.



- The MultiRouter Setup dialog box is then displayed. This is the dialog box of the remote RASFinder. You can select any of the Protocol Stacks, Device drivers, or other buttons and change the configuration of the remote RASFinder. Refer to Chapter 4 for a description of the MultiRouter software. For definitions of each dialog box or fields within a dialog box, refer to the on-line helps provided in the software.



- After you have changed the configuration of the remote RASFinder, click on the **Download Setup** button to update the configuration. The remote RASFinder will be brought down, the new configuration written to the unit, and the unit will reboot.
- Click on the **Exit** button when the downloading is complete.
- Click on the **Router Configuration** icon in the Program Manager screen to verify that the RASFinder is running.





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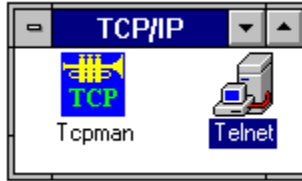
**RASFinder**<sup>™</sup> 200-Series  
Remote Access Device

## Chapter 6 - Router Management

**MultiTech**<sup>®</sup>  
Systems 

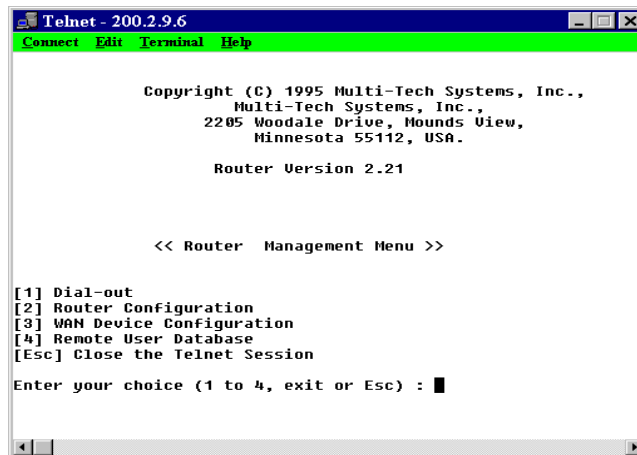
# Introduction

A typical Telnet client application, and typical WEB-browser management of the RASFinder are described in this chapter. The RASFinder has a built-in Telnet Server for access through Telnet clients. A typical Telnet client is allowed to configure the RASFinder and its data ports. In addition, the RASFinder can be remotely accessed and configured from anywhere on the Internet through its WEB interface.



For a detailed description of the MultiRouter software, refer to Chapter 4 in this manual. For a detailed description of each parameter, refer to the on-line helps provided in the software.

The TCP/IP stack has to be loaded before the Telnet client, a Windows application, can run. Double-click on the Telnet icon and a blank Telnet screen is displayed. Click on Connection (in the menu bar) to display its dropdown menu, then click on the Connect option and double-click on the Host Address assigned to the RASFinder to display the Router Management Menu.



# Router Management

The Router Management Menu provides four functional options in addition to the option of escaping and closing the Telnet session.

## Dial-Out

The Dial-out option (Option 1) on the Router Management Menu enables a Telnet user to configure one of the WAN ports for a dial-out session. The default configuration of 115200 bps, 8N1 can be used for the dial-out session, or the user can specify each parameter for the port (e.g., the baud rate, the number of data bits, parity, or the number of stop bits). When the connection is established, anything entered on the keyboard is immediately presented to the WAN port. When the dial-out session is over, the WAN port reverts to its original configuration.

## Router Configuration

The Router Configuration option (Option 2) on the Router Management Menu enables a Telnet user to view and change parameters on the protocol stacks, high or low level device drivers, enable or disable the supported servers, or view system information.

```

Telnet - 200.2.9.6
Connect Edit Terminal Help

<< Router Configuration >>

[1] Protocol Stacks
[2] High Level Device Drivers (HLDD)
[3] Low Level Device Drivers (LLDD)
[4] Applications
[5] System Information

Enter Your Choice (1 to 5, exit or ESC to Previous menu):4

<< Applications Menu >>

[1] TFTP Server
[2] Telnet Server
[3] AG Server
[4] Terminal Server
[5] Dumb TTY
[6] Router Password

Enter Your Choice (1 to 6, exit or ESC to Previous menu):1

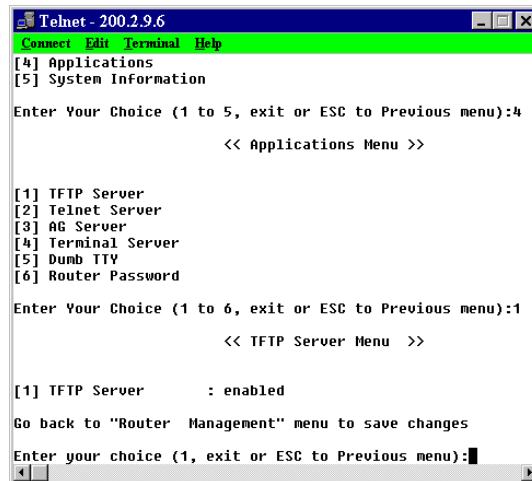
```

## Protocol Stacks

The Protocol Stacks option on the Router Configuration menu provides the options for setting up the following protocols: IPX, IP, Spanning Tree, and SNMP. Choosing the Protocol Stacks option (Option 1) in the Router Configuration menu displays the Protocol Stacks Menu. To review the IPX routing information, you can enter the number "1" to display the options to enable/disable IPX, enable or disable AutoLearn, change the Router Name, change the Network Number, etc.

## Applications

The Applications option on the Router Configuration menu allows you to enable or disable various types of servers. Choosing the Applications option (Option 4) in the Router Configuration menu displays the Applications Menu.



```
Telnet - 200.2.9.6
Connect Edit Terminal Help
[4] Applications
[5] System Information
Enter Your Choice (1 to 5, exit or ESC to Previous menu):4

      << Applications Menu >>

[1] TFTP Server
[2] Telnet Server
[3] AG Server
[4] Terminal Server
[5] Dumb TTY
[6] Router Password
Enter Your Choice (1 to 6, exit or ESC to Previous menu):1

      << TFTP Server Menu >>

[1] TFTP Server      : enabled
Go back to "Router Management" menu to save changes
Enter your choice (1, exit or ESC to Previous menu):
```

The Applications Menu displays six server options and allows the user to enable or disable the servers as necessary. Initially, all the server options are enabled. To then disable a given type of server, choose the server option number and hit the Enter key; then choose option 2 to disable it. After all selections are made, the user can return to the Router Management Menu by pressing the Escape (Esc) key several times, during which the changes are saved. To re-enable one of the server types, choose its option number and hit the Enter key, then choose option 1 to enable it.

Following are descriptions of each server type and its use.

**TFTP Server** - The TFTP server is used for transferring configuration and firmware updates across the IP internetwork. TFTP is a file transfer protocol that uses User Datagram Protocol (UDP) to provide a simple method for transferring files between two nodes (server and client).

**Telnet Server** - The Telnet server allows an authorized Telnet client to remotely access the Telnet server to dial out, view router configuration and statistics, or modify the router configuration, or remotely modify the user database.

**Async Gateway (AG) Server** - The AG server is a communications gateway for dial-up communications. The Telnet client can remotely gain access to the server and control the ports.

**Terminal Server** - The Terminal server allows an incoming call from a terminal (dumb or intelligent) to be connected to a Telnet server.

**Dumb TTY** - The Dumb TTY allows a remote user to connect to the RASFinder's command port for configuration and management of the RASFinder.

## WAN Device Configuration

The WAN Device Configuration option (Option 3 on the Router Management Menu) allows a remote user to gain access to any available WAN port on the RASFinder. The user can select either Port 1, Port 2, or Port 3, depending on what port(s) are currently available.

```
Telnet - 200.2.9.6
Connect Edit Terminal Help

<< Router Management Menu >>

[1] Dial-out
[2] Router Configuration
[3] WAN Device Configuration
[4] Remote User Database
[Esc] Close the Telnet Session

Enter your choice (1 to 4, exit or Esc) : 3

<< Select WANA Talk Port >>

[1] Port 1
[2] Port 2
[3] Port 3

Enter Your Choice (1 to 3, exit or ESC to Previous menu):
```

## Remote User Database

The Remote User Database option (Option 4 on the Router Management Menu) allows a remote user to add user information such as Name and Password, callback information, and which protocol stacks to enable or disable.

```
Telnet - 200.2.9.6
Connect Edit Terminal Help

[1] Dial-out
[2] Router Configuration
[3] WAN Device Configuration
[4] Remote User Database
[Esc] Close the Telnet Session

Enter your choice (1 to 4, exit or Esc) : 4

<<Remote User Database>>

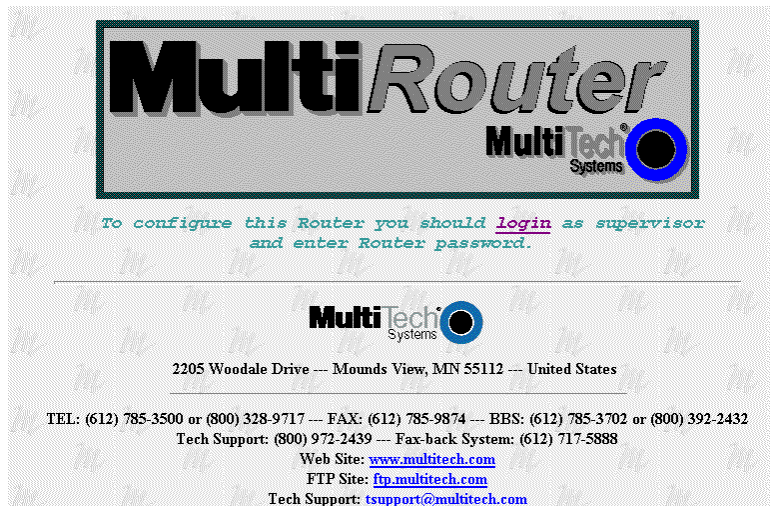
A: Add User
Enter your choice:a
[1] User Name           :
[2] User Password       :
[3] Call Back           : disabled
[4] Call Back Security  : disabled
[5] Call Back Number    :
[6] Call Back Delay     : 10
[7] IP                  : enabled
[8] IPX                  : enabled
[9] Spanning Tree       : enabled

Enter your choice (1 to 9, exit or ESC to Previous menu):
```

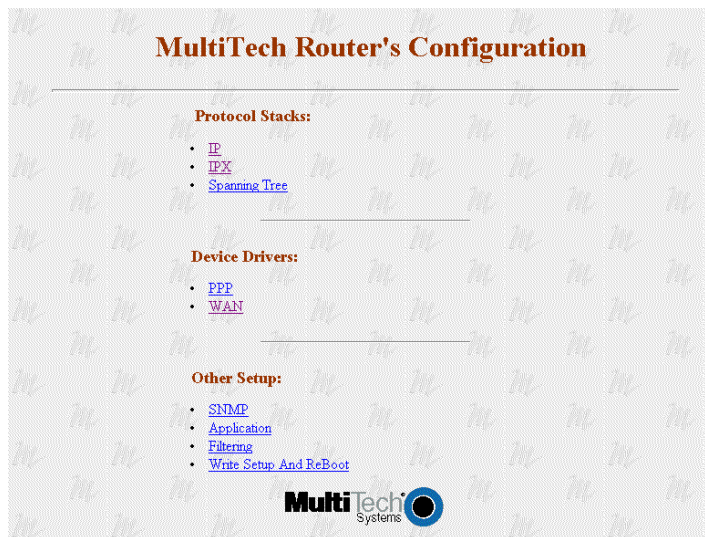
## WEB Browser Management

The RASFinder can be accessed from anywhere on the connected Internet via its built-in WEB Browser interface. To enable this function, you must check this option in Other setup. Depending on the rights of the user (read/write, or read only), it is possible to view the current parameters and statistics of the RASFinder as well as configure and download setup changes to the unit.

You can access RASFinder configuration by typing the **IP Address** of the unit into the address line of your web browser.



When the Welcome screen appears, click on the word **Login** to gain access to the RASFinder. The **Enter Network Password** screen appears. Enter your **User name** and **Password**, then click on **OK** to go to the RASFinder Configuration menu.



**Note:** The first user to access the RASFinder will have *read/write* rights over the unit. All subsequent users will have *read only* rights, and therefore, some of the options within the WEB interface will be inactive (i.e., will not be linked).



## Chapter 7 - Service, Warranty and Tech Support



## Introduction

This chapter starts out with statements about your RASFinder 2-year warranty. The next section, Tech Support, should be read carefully if you have questions or problems with your RASFinder. It includes the technical support telephone numbers, space for recording your product information, and an explanation of how to send in your RASFinder should you require service. The next three sections explain how to use our bulletin board service (BBS), and get support through CompuServe and the Internet. The final section explains how to obtain a catalog of available documents and then order technical literature using our 24-hour Fax-Back Service.

## 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.

## On-line Warranty Registration

If you would like to register your RASFinder electronically, you can do so at the following address:

<http://www.multitech.com/support/register.htm>



## 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 1-800-972-2439. Please fill out the RASFinder information (below), and have it available when you call. If your RASFinder requires service, the tech support specialist will guide you on how to send in your RASFinder (refer to the next section).

### Recording RASFinder Information

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

Model No.: \_\_\_\_\_

Serial No.: \_\_\_\_\_

Software Version: \_\_\_\_\_

The model and serial numbers are on the bottom of your RASFinder.

Please note the type of external link device that is connected to your RASFinder before calling tech support. Also, note the status of your RASFinder including LED indicators, screen messages, diagnostic test results, DIP-Switch settings, problems with a specific application, etc. Use the space below to note the RASFinder status:

---

---

---

---

---

---

---

---

---

---

## Service

If your tech support specialist decides that service is required, your RASFinder may be sent (freight prepaid) to our factory. Return shipping charges will be paid by Multi-Tech Systems.

Include the following with your RASFinder:

- a description of the problem.
- return billing and return shipping addresses.
- contact name and phone number.
- check or purchase order number for payment if the RASFinder is out of warranty. (Check with your technical support specialist for the standard repair charge for your RASFinder).
- if possible, note the name of the technical support specialist with whom you spoke.

If you need to inquire about the status of the returned product, be prepared to provide the **serial number** of the product sent.

Send your RASFinder to this address:

MULTI-TECH SYSTEMS, INC.  
2205 WOODALE DRIVE  
MOUNDS VIEW, MINNESOTA 55112  
ATTN: SERVICE OR REPAIRS

You should also check with the supplier of your RASFinder on the availability of loaner units and/or local service in your area.

## The Multi-Tech BBS

For customers who do not have Internet access, Multi-Tech maintains a bulletin board system (BBS) that mirrors its FTP site. Information available from the BBS includes new product information, product upgrade files, and problem-solving tips. The phone number for the Multi-Tech BBS is (800) 392-2432 (USA and Canada) or (612) 785-3702 (international and local).

The BBS can be accessed by any asynchronous modem operating at 1200 bps to 33,600 bps at a setting of 8 bits, no parity, and 1 stop bit (8-N-1).

### To log on to the Multi-Tech BBS

1. Set your communications program to **8-N-1**.
2. Dial our BBS at (800) 392-2432 (USA and Canada) or (612) 785-3702 (international and local).
3. At the prompts, type your first name, last name, and password; then press ENTER. If you are a first time caller, the BBS asks if your name is spelled correctly. If you answer yes, a questionnaire appears. You must complete the questionnaire to use the BBS on your first call.
4. Press ENTER until the Main Menu appears. From the Main Menu you have access to two areas: the Files Menu and News. For help on menu commands, type ?.

### To Download a file

#### If you know the file name

1. From the Main Menu, type **F** to access the Files Menu, then type **D**.
2. Enter the name of the file you wish to download from the BBS.
3. If a password is required, enter the password.

4. Answer **Y** or **N** to the automatic logoff question.
5. Select a file transfer protocol by typing the indicated letter, such as **Z** for Zmodem (the recommended protocol).
6. If you select Zmodem, the transfer will begin automatically. If you select another protocol, you may have to initiate the transfer yourself. (In most datacomm programs, the PAGE DOWN key initiates the download.)
7. When the download is complete, press ENTER to return to the File Menu.
8. To exit the BBS, type **G** and press ENTER.

### **If you don't know the file name**

1. From the Main Menu, type **F** to access the Files Menu. For a list of file areas, type **L**, press ENTER, then type **L** and press ENTER again. (If you do not type the second **L**, you will list all of the files on the BBS.)
2. Mark each file area you would like to examine by typing its list number and pressing ENTER.
3. Enter **L** to list all the files in the selected file areas. Enter **C** to go forward in the file list and **P** to go back.
4. To mark one or more files for download, type **M**, press ENTER, type the list numbers of the files, and press ENTER again.
5. Enter **D**. You will see a list of the files you have marked. Enter **E** if you would like to edit the list; otherwise enter **D** again to start the download process.
6. Select a file transfer protocol by typing the indicated letter, such as **Z** for Zmodem (the recommended protocol).
7. If you select Zmodem, the file will transfer automatically. If you select another protocol, you may have to initiate the transfer yourself. (In most data communications programs, the PAGE DOWN key initiates the download.)
8. When the download is complete, press ENTER to return to the File Menu.
9. To exit the BBS, type **G** and press ENTER.

## About CompuServe

In addition to the BBS, Multi-Tech provides support through CompuServe's Modem Vendor Forum (GO MODEMVEN). Refer to your CompuServe documentation for special operating procedures.

## About the Internet

If you prefer to receive technical support via the Internet, you can contact Tech Support via e-mail at the following address:

[http://www.multitech.com/\\_forms/email\\_tech\\_support.htm](http://www.multitech.com/_forms/email_tech_support.htm)

Multi-Tech's presence includes a Web site at:

<http://www.multitech.com>

and an ftp site at:

<ftp://ftp.multitech.com>

The ftp server mirrors the Multi-Tech BBS.

## About the Multi-Tech Fax-Back Service

Multi-Tech's fax-back system provides 24-hour access to sales, marketing, and technical literature. Dial 612-717-5888, follow the voice prompts, and request document number 10 for a catalog of available documents. For convenience, have your fax number handy: \_\_\_\_\_.

From the catalog of available documents, you can order newsletters, white papers, press releases, etc. from the sales and marketing index (pages 1-4), or order basic modem operation and troubleshooting guides from the technical support and engineering index. Just enter the applicable FB Doc. # from the left column of the catalog.

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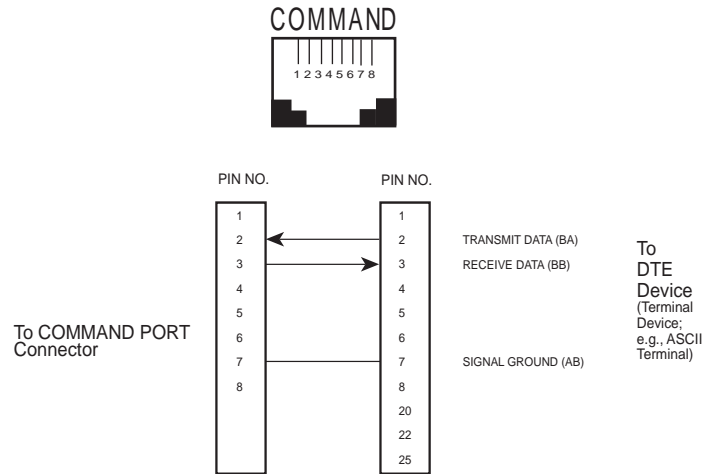
**RASFinder**<sup>™</sup> 200-Series  
Remote Access Device

## Appendices

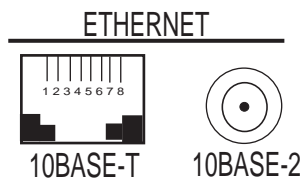
**MultiTech**<sup>®</sup>  
Systems 

# Appendix A - Cabling Diagrams

## Command Port Cable

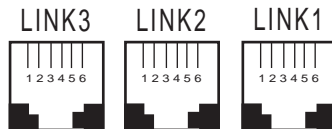


## LAN Cables



| Pin | Circuit Signal Name        | Pin | Description |
|-----|----------------------------|-----|-------------|
| 1   | TD+ Data Transmit Positive | 1   | Center      |
| 2   | TD- Data Transmit Negative | 2   | Shield      |
| 3   | RD+ Data Receive Positive  |     |             |
| 4   | RD- Data Receive Negative  |     |             |

## WAN Cables



| Pin | Circuit |
|-----|---------|
| 3   | Tip     |
| 4   | Ring    |

## Appendix B - Script Language

The script file can be used to automate certain operations. The script file is a text file containing a sequence of commands. The structure of a script file is succinctly expressed by the following grammar.

### Script Language Grammar

```

<program>           =<declarations> <proc_declarations>
<declarations>      ={<var_type> <identifier> {, <identifier> } ; }
<var_type>          =INTEGER I STRING
<statement_list>    ={<statement>}
<statement>         =<elementary_statement> I <if_statement> I <for_statement> I
                    <while_statement> I <switch_statement>
<if_statement>      =IF <expression> THEN <statement_list> {ELSE<statement_list> } ENDIF
<for_statement>     =FOR <identifier>=<expression> TO IDOWNTO <expression> STEP
                    <expression> / DO <statement_list> ENDFOR
<while_statement>   =WHILE <expression> DO <statement_list> ENDWHILE
<switch_statement>  =SWITCH <expression> {CASE <integer_const> <statement_list> I
                    CASE <string_const> <statement_list> I
                    DEFAULT <statement_list> }
                    ENDSWITCH
<elementary_statement> =<identifier> = <expression> ; I <identifier> / (<expression>
                    {,<expression> } ) /; I GOTO <identifier> ; I <identifier> : I ;
<expression>        =<expression> OPERATOR <expression> I {<expression> } I /<expression> I
                    - <expression> I <identifier> / (<expression> {, <expression> } ) /
OPERATOR             = < | <= | > | >= | == | != | && | || | + | - | * | / | !
<proc_declaration>  =PROC <identifier>/(<parameter_list>)} { :<vartype> };FORWARD ;
<proc_declaration> =PROC <identifier>/(<parameter_list>)} / : <vartype> / ;
                    <declarations> <statement_list>ENDPROC
<parameter_list>   =<argument_list> { ; <argument_list>}
<argument_list>    ={VAR} <var_type> <identifier> {<identifier>}

```

Execution starts at the PROC main. PROC main cannot have any arguments. All the variables have to be declared before use. All procedures must be declared before calling. Recursion is allowed in procedures.

To define mutually recursive procedures, use the FORWARD directive to indicate that the procedure body is defined later in the source file. Procedures defined with the FORWARD directive should have all the parameters and return value (if any) specified, the actual definition of the procedure body should not contain the formal parameter list or the return value. An example of forward defined procedures is given below:

```

proc a(integer x,y) : integer,forward:
proc b(integer u,v) : integer,forward:
proc a;
    integer t;
    /*Some more code here. */

    t=b(x,y);
    /*Some more code here. */
    return(t);
endproc

proc b;
    return(a(u,v);
endproc

```

Argument to procedures can be passed by value or address. To pass an argument by address, prefix the argument name in the formal parameter list by the keyword VAR; otherwise the argument is passed by value. Only variables can be passed by address. Expressions like A+B, where A and B are integer variables can be passed by value but cannot be passed by address.

### **Two basic types of variables are supported:**

INTEGER and STRING

In the STRING, since the ASCII null character is internally used to indicate the end of the sequence, it cannot be part of the string. All other characters, including extended ASCII characters can be part of the string.

### **There are two types of conditional constructs:**

IF and SWITCH

The IF statement is a two-way branching construct. The condition can be an arbitrary expression. The condition in the IF statement should evaluate to an integer or real. If the expression in the IF statement evaluates to non-zero, the control enters the THEN statement, otherwise control enters the ELSE statement.

The SWITCH statement is a multi-way branching construct. The type of conditional expression should be either INTEGER or STRING. The value of the conditional expression is matched against the constraints given in the CASE options, if the value matches a CASE option value, control enters that CASE option. If the values do not match any of the CASE options, and if a DEFAULT option is provided, control continues at the DEFAULT option; otherwise control continues at the statement after the ENDSWITCH. If control enters one of the CASE or DEFAULT statements, all the statements up to the next ENDCASE statement are executed. Each CASE or DEFAULT statement should be terminated by a matching ENDCASE keyword. The SWITCH statement should be terminated by a ENDSWITCH keyword. The DEFAULT statement can be placed anywhere within the scope of the SWITCH statement. There can be only one DEFAULT statement.

### **There are two types of iterative constructs:**

FOR and WHILE

The FOR construct sets the loop control variable to an initial value. The control variable is checked for bounds, and if within bounds, the <statement\_list> given is executed; otherwise the loop execution terminates. After each execution of <statement\_list>, the control variable is incremented or decremented by a certain value. This is computed as follows: if the STEP expression is given it is the value of the expression, else it is 1. The control variable is incremented if TO is specified, and is decremented if DOWNTO is specified. After updating the control variable the bounds check is done again. The keyword ENDFOR is mandatory at the end of the loop.

The WHILE loop has an expression and a <statement\_list>. The expression is evaluated and if the expression is non-zero the <statement\_list> is executed; otherwise the loop execution terminates. The keyword ENDWHILE is mandatory at the end of the loop.

### **Operator Precedence:**

Operators are listed in the order of precedence

Unary Operators :-(unary minus, logical negation)

Binary Operators :\*/ + \_ < > <= >= == != && ||

All the operators are left associative. Expressions are evaluated completely; so care must be taken while writing expressions. For example, expressions like (a !=0 && b / a) would create run time error.



---

## Appendix C - Regulatory Information

### FCC Declaration

**NOTE:** This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference.
- (2) this device must accept any interference received, including interference that may cause undesired operation.

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

### FCC Regulations for Telephone Line Interconnection

1. This equipment complies with Part 68 of the Federal Communications Commission (FCC) rules. On the outside surface of this equipment is a label that contains, among other information, the FCC registration number and ringer equivalence number (REN). If requested, this information must be provided to the telephone company.

2. As indicated below, the suitable jack (Universal Service Order Code connecting arrangement) for this equipment is shown. If applicable, the facility interface codes (FIC) and service order codes (SOC) are shown.

An FCC-compliant telephone cord with modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68 compliant. See installation instructions for details.

3. The ringer equivalence number (REN) is used to determine the number of devices which may be connected to the telephone line. Excessive REN's on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the REN's should not exceed five (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total REN's, contact the telephone company to determine the maximum REN for the calling area.

4. If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

5. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications in order to maintain uninterrupted service.
6. If trouble is experienced with this equipment (the model of which is indicated below) please contact Multi-Tech Systems, Inc., at the address shown below for details of how to have repairs made. If the equipment is causing harm to the telephone network, the telephone company may request that you remove the equipment from the network until the problem is resolved.
7. 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.
8. This equipment cannot be used on public coin service provided by the telephone company. Connection to Party Line Service is subject to state tariffs. (Contact the state public utility commission, public service commission or corporation commission for information.)
9. If so required, this equipment is hearing-aid compatible.

|                           |   |
|---------------------------|---|
| Manufacturer:             | Multi-Tech Systems, Inc.  |
| Trade name:               | RASFinder 200-Series  |
| Model Numbers:            | MTASR3-200  |
| FCC Registration Number:  | AU7USA-24992-M5-E   |
| Ringer Equivalence:       | 0.6B  |
| Modular Jack:             | RJ11  |
| Service Center in U.S.A.: | Multi-Tech Systems Inc.<br>2205 Woodale Drive<br>Mounds View, MN 55112<br>(800) 328-9717 (612) 785-3500<br>(612) 785-9874 Fax |

---

## Canadian Limitations Notice

**Notice:** The ringer equivalence number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination of an interface may consist of any combination of devices subject only to the requirement that the sum of the ringer equivalence numbers of all the devices does not exceed 5.

**Notice:** The Industry Canada label identifies certificated equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The 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. 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.

**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 B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe B prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

## Ringer Equivalence Number

**Notice:** The ringer equivalence number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the ringer equivalence numbers of all the devices does not exceed 5.

## European Community Directives

The CE mark is affixed to the enclosed MultiTech product to confirm compliance with the following European Community Directives:

Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of Member States relating to electromagnetic compatibility;

and

Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits;

both amended by

Council Directive 93/68/EEC of 22 July 1993 on the harmonization of CE marking requirements.

## Appendix D - AT Command Summary

This section summarizes your modem's AT commands. For detailed information on the commands, download ZPXHELP.EXE from the Multi-Tech BBS (see "Call the Multi-Tech BBS" in Chapter 3).

### AT Commands

Command: **+++AT<CR>** **Escape Sequence**

Values: n/a

Description: Puts the modem in command mode (and optionally issues a command) while remaining online. Type **+++AT** and up to ten command characters, then press ENTER. Used mostly to issue the hang-up command: **+++ATH<CR>**.

Command: **AT** **Attention Code**

Values: n/a

Description: The attention code precedes all command lines except **A/** and the escape sequence.

Command: **ENTER Key**

Values: n/a

Description: Press the ENTER key to execute most commands.

Command: **\$** **Detect AT&T's "call card" tone**

Values: n/a

Description: This symbol placed in dialing string enables the modem to detect AT&T's "call card" tones to access user's calling card when originating an on-line connection--

**ATDT**1028806127853500**\$**123456789  
(access/phone number) (Credit Card number)

Command: **A** **Answer**

Values: n/a

Description: Answer an incoming call before the final ring.

Command: **A/** **Repeat Last Command**

Values: n/a

Description: Repeat the last command string. Do not precede this command with **AT**. Do not press ENTER to execute.

Command: **Bn** **Communication Standard Setting**

Values:  $n = 0-3, 15, 16$

Default: 1 and 16

Description: B0 Select ITU-T V.22 mode when modem is at 1200 bps.  
 B1 Select Bell 212A when modem is at 1200 bps.  
 B2 Deselect V.23 reverse channel (same as B3).  
 B3 Deselect V.23 reverse channel (same as B2).  
 B15 Select V.21 when the modem is at 300 bps.  
 B16 Select Bell 103J when the modem is at 300 bps.

Command: **Cn** **Carrier Control**

Values:  $n = 1$

Default: 1

Description: C0 Transmit carrier always off. (Not supported.)  
 C1 Normal transmit carrier switching (included for backward compatibility with some software).

- Command: **Ds Dial**  
 Values: *s* = dial string (phone number and dial modifiers)  
 Default: none  
 Description: Dial telephone number *s*, where *s* may up to 40 characters long and include the 0–9, \*, #, A, B, C, and D characters, and the **L**, **P**, **T**, **V**, **W**, **S**, comma (,), semicolon (;), **!**, **@**, **^** and **\$** dial string modifiers.  
*Dial string modifiers:*  
**L** Redial last number. (Must be placed immediately after **ATD**.)  
**P** Pulse-dial following numbers in command .  
**T** Tone-dial following numbers in command (default).  
**V** Switch to speakerphone mode and dial the following number. Use **ATH** command to hang up.  
**W** Wait for a new dial tone before continuing to dial. (**X2**, **X4**, **X5**, **X6**, or **X7** must be selected.)  
  
**S** Dial a telephone number previously stored using the **&Zn=x** command (see **&Zn=x** command for further information). The range of *n* is 0-3.  
 , Pause during dialing for time set in register **S8**.  
 ; Return to command mode after dialing. (Place at end of dial string.)  
 ! Hook flash. Causes the modem to go on-hook for one-half second, then off-hook again.  
 @ Wait for quiet answer. Causes modem to wait for a ringback, then 5 seconds of silence, before processing next part of command. If silence is not detected, the modem returns a NO ANSWER code.  
 \$ AT&T's "call card" tones detection.  
 ^ Disable data calling tone transmission.
- Command: **DS=n Dial Stored Telephone Number**  
 Values: *n* = 0–3  
 Default: none  
 Description: Dial a number previously stored in directory number *n* by the **&Zn=x** command .  
 Example: **ATDS=3**
- Command: **En Echo Command Mode Characters**  
 Values: *n* = 0 or 1  
 Default: 1  
 Description: E0 Do not echo keyboard input to the terminal.  
 E1 Do echo keyboard input to the terminal.
- Command: **Fn Echo Online Data Characters**  
 Values: *n* = 1  
 Default: 1  
 Description: F0 Enable online data character echo. (Not supported.)  
 F1 Disable online data character echo (included for backward compatibility with some software).
- Command: **Hn Hook Control**  
 Values: *n* = 0 or 1  
 Default: 0  
 Description: H0 Go on-hook to hang up.  
 H1 Go off-hook to make the phone line busy.
- Command: **In Information Request**  
 Values: *n* = 0–4, 9, 11  
 Default: None  
 Description: I0 Display default speed and controller firmware version.  
 I1 Calculate and display ROM checksum (e.g., "12AB").  
 I2 Check ROM and verify the checksum, displaying **OK** or **ERROR**.  
 I3 Display default speed and controller firmware version.  
 I4 Display firmware version for data pump (e.g., "94").  
 I9 Display country code (e.g., "NA Ver. 1").  
 I11 Display Diagnostic Information for the last Modem Connection (i.e., DSP and Firmware version, Link Type, Line Speed, Serial Speed, Type of Error Correction/Data Compression, Number of past Retrans,etc.)

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|              |             |  |
|--------------|-------------|--|
| Command:     | <b>Ln</b>   | <b>Monitor Speaker Volume</b>  |
| Values:      |             | $n = 0, 1, 2, \text{ or } 3$   |
| Default:     |             | 2  |
| Description: | L0          | Select low volume.   |
|              | L1          | Select low volume.   |
|              | L2          | Select medium volume.  |
|              | L3          | Select high volume.  |
| Command:     | <b>Mn</b>   | <b>Monitor Speaker Mode</b>  |
| Values:      |             | $n = 0, 1, 2, \text{ or } 3$   |
| Default:     |             | 1  |
| Description: | M0          | Speaker always off.  |
|              | M1          | Speaker on until carrier signal detected.  |
|              | M2          | Speaker always on when modem is off-hook.  |
|              | M3          | Speaker on until carrier is detected, except while dialing.  |
| Command:     | <b>Nn</b>   | <b>Modulation Handshake</b>  |
| Values:      |             | $n = 0 \text{ or } 1$  |
| Default:     |             | 1  |
| Description: | N0          | Modem performs handshake only at communication standard specified by S37 and the <b>B</b> command.   |
|              | N1          | Modem begins handshake at communication standard specified by S37 and the <b>B</b> command. During handshake, fallback to a lower speed can occur. |
| Command:     | <b>O</b>    | <b>Return Online to Data Mode</b>  |
| Values:      |             | 0, 1, 3  |
| Default:     |             | None   |
| Description: | O0          | Exit online command mode and return to data mode.  |
|              | O1          | Issue a retrain and return to online data mode.  |
|              | O3          | Issue a rate renegotiation and return to data mode.  |
| Command:     | <b>Qn</b>   | <b>Result Codes Enable/Disable</b>   |
| Values:      |             | $n = 0 \text{ or } 1$  |
| Default:     |             | 0  |
| Description: | Q0          | Enable result codes.   |
|              | Q1          | Disable result codes.  |
| Command:     | <b>Sr=n</b> | <b>Set Register Value</b>  |
| Values:      |             | $r = \text{S-register number}; n \text{ varies}$   |
| Default:     |             | None   |
| Description: |             | Set value of register $Sr$ to value of $n$ , where $n$ is entered in decimal format.   |
| Command:     | <b>Sr?</b>  | <b>Read Register Value</b>   |
| Values:      |             | $r = \text{S-register number}$   |
| Default:     |             | None   |
| Description: |             | Read value of register $Sr$ and display value in 3-digit decimal form.   |
| Command:     | <b>Vn</b>   | <b>Result Code Format</b>  |
| Values:      |             | $n = 0 \text{ or } 1$  |
| Default:     |             | 1  |
| Description: | V0          | Displays result codes as digits (terse response).  |
|              | V1          | Displays result codes as words (verbose response).   |

**Command: Xn Result Code Selection**

Values:  $n = 0-7$

Default: 4

Description: X0 Basic result codes (*e.g.*, *CONNECT*); does not look for dial tone or busy signal.  
X1 Extended result codes (*CONNECT 56000 V42bis*, *CONNECT 33600 V42bis*, etc.); does not look for dial tone or busy signal.  
X2 Extended result codes with *NO DIALTONE*; does not look for busy signal.  
X3 Extended result codes with *BUSY*; does not look for dial tone.  
X4 Extended result codes with *NO DIALTONE* and *BUSY*.  
X5 Extended result codes with *NO DIALTONE* and *BUSY*.  
X6 Extended result codes with *NO DIALTONE* and *BUSY*.  
X7 Basic result codes with *NO DIALTONE* and *BUSY*.

**Command: Yn Long Space Disconnect**

Values:  $n = 0$

Default: 0

Description: Y0 Disable sending or responding to long space break signal on disconnect.  
Y1 Enable sending or responding to long space break signal on disconnect. (Not supported.)

**Command: Zn Modem Reset**

Values:  $n = 0$  or  $1$

Default: None

Description: Z0 Reset modem to profile saved by the last **&W** command.  
Z1 Same as Z0.

**Command: &Bn V.32 Auto Retrain**

Values:  $n = 1$

Default: 1

Description: &B0 Disable V.32 auto retrain. (Not supported.)  
&B1 Enable V.32 auto retrain.

**Command: &Cn Data Carrier Detect (DCD) Control**

Values:  $n = 0$  or  $1$

Default: 1

Description: &C0 Force Data Carrier Detect signal high.  
&C1 Let Data Carrier Detect follow carrier signal.

**Command: &Dn Data Terminal Ready (DTR) Control**

Values:  $n = 0, 1, 2,$  or  $3$

Default: 2

Description: &D0 Modem ignores DTR signal.  
&D1 When DTR drops while in online data mode, the modem enters command mode, issues an OK, and remains connected.  
&D2 When DTR drops while in online data mode, the modem hangs up.  
&D3 When DTR drops, the modem hangs up and resets as if an **ATZ** command were issued.

**Command: &Fn Load Factory Default Settings**

Values:  $n = 0$

Default: None

Description: &F0 Load factory settings as active configuration.

**Command: &Gn V.22bis Guard Tone Control**

Values:  $n = 0, 1,$  or  $2$

Default: 0

Description: &G0 Disable guard tone.  
&G1 Enable 550 Hz guard tone.  
&G2 Enable 1800 Hz guard tone.

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☒: The **&G** command is not used in North America.

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|              |                  |   |
|--------------|------------------|---|
| Command:     | <b>&amp;Jn</b>   | <b>Auxiliary Relay Control</b>  |
| Values:      |                  | $n = 0$   |
| Default:     |                  | 0   |
| Description: | &J0              | The auxiliary relay is never closed.  |
|              | &J1              | Not supported—responds ERROR.   |
|              |                  |   |
| Command:     | <b>&amp;Kn</b>   | <b>Local Flow Control Selection</b>   |
| Values:      |                  | $n = 0, 3, \text{ or } 4$   |
| Defaults:    |                  | 3   |
| Description: | &K0              | Flow control disabled.  |
|              | &K3              | Enable CTS/RTS hardware flow control.   |
|              | &K4              | Enable XON/XOFF software flow control.  |
|              |                  |   |
| Command:     | <b>&amp;Mn</b>   | <b>Communications Mode</b>  |
| Values:      |                  | $n = 0$   |
| Defaults:    |                  | 0   |
| Description: | &M0              | Asynchronous mode.  |
|              | &M1              | Reserved—responds ERROR.  |
|              |                  |   |
| Command:     | <b>&amp;Qn</b>   | <b>Asynchronous Communications Mode</b>   |
| Values:      |                  | $n = 0, 5, \text{ or } 6$   |
| Defaults:    |                  | 5   |
| Description: | &Q0              | Asynchronous with data buffering. Same as <b>IN0</b> .  |
|              | &Q5              | Error control with data buffering. Same as <b>IN3</b> .   |
|              | &Q6              | Asynchronous with data buffering. Same as <b>IN0</b> .  |
|              |                  |   |
| Command:     | <b>&amp;Sn</b>   | <b>Data Set Ready (DSR) Control</b>   |
| Values:      |                  | $n = 0 \text{ or } 1$   |
| Default:     |                  | 0   |
| Description: | &S0              | Force DSR high (on).  |
|              | &S1              | Let DSR follow CD.  |
|              |                  |   |
| Command:     | <b>&amp;Tn</b>   | <b>Self-Test Commands</b>   |
| Values:      |                  | $n = 0, 1, 3 \text{ or } 6$   |
| Default:     |                  | None  |
| Description: | &T0              | Abort. Stop any test in progress.   |
|              | &T1              | Local analog loop test.   |
|              | &T3              | Local digital loopback test.  |
|              | &T6              | Remote digital loopback test.   |
|              |                  |   |
| Command:     | <b>&amp;V</b>    | <b>View Current Configuration</b>   |
| Values:      |                  | n/a   |
| Description: |                  | Displays the active modem settings.   |
|              |                  |   |
| Command:     | <b>&amp;Wn</b>   | <b>Store Current Configuration</b>  |
| Values:      |                  | $n = 0$   |
| Default:     |                  | None  |
| Description: | &W0              | Store active modem settings in NVRAM; load them at power-on or following the <b>ATZ</b> command instead of loading the factory defaults from ROM. |
|              |                  |   |
| Command:     | <b>&amp;Yn</b>   | <b>Select Stored Configuration for Hard Reset</b>   |
| Values:      |                  | $n = 0$   |
| Default:     |                  | 0   |
| Description: | &Y0              | Select stored configuration 0 on power-up. (For backward compatibility with some software.)   |
|              | &Y1              | Not supported—responds ERROR.   |
|              |                  |   |
| Command:     | <b>&amp;Zn=x</b> | <b>Store Telephone Number</b>   |
| Values:      |                  | $n = 0, 1, 2, \text{ or } 3$<br>$x = \text{Dialing string}$   |
| Default:     |                  | None  |
| Description: |                  | Stores telephone dial string $x$ in memory location $n$ . Dial the stored number using the command <b>ATDS=n</b> .                                |

Command: **\Gn Modem Port Flow Control**

Values:  $n = 0$

Default: 0

Description: \G0 Returns an *OK* for backward compatibility with some software.  
\G1 Not supported—responds ERROR.

Command: **\Jn Data Buffer Control**

Values:  $n = 0$

Default: 0

Description: \J0 Enable data buffer—serial port speed is independent of connect speed.  
\J1 Not supported—responds ERROR.

Command: **\Kn Set Break Control**

Values:  $n = 5$

Default: 5

Description: \K5 Modem sends break signal received from the DTE to the remote modem.

Command: **\Nn Error Correction Mode Selection**

Values:  $n = 0-5$ , or 7

Default: 3

Description: \N0 Non-error correction mode with data buffering (same as **&Q6**).  
\N1 Direct mode.  
\N2 MNP reliable mode.  
\N3 V.42/MNP auto-reliable mode.  
\N4 V.42 reliable mode.  
\N5 V.42, MNP, or non-error correction (same as **IN3**).  
\N7 V.42, MNP, or non-error correction (same as **IN3**).

Command: **\Qn Local Flow Control Selection**

Values:  $n = 0, 1$ , or 3

Default: 3

Description: \Q0 Disable flow control (same as **&K0**).  
\Q1 XON/XOFF software flow control (same as **&K4**).  
\Q2 CTS-only flow control. Not supported—responds ERROR.  
\Q3 RTS/CTS hardware flow control (same as **&K3**).

Command: **\Tn Inactivity Timer**

Values:  $n = 0-255$

Default: n/a

Description: \Tn Inactivity timer setting contingent on either \T value or S-Register S30 value (e.g., AT\T45&W0<cr> configures in parallel ATS30=45&W0<cr>), and vice versa.

Command: **\Vn Protocol Result Code**

Values:  $n = 0$  or 1

Default: 1

Description: \V0 Disable protocol result code appended to DCE speed.  
\V1 Enable protocol result code appended to DCE speed.

Command: **\Xn XON/XOFF Pass-Through**

Values:  $n = 0$  or 1

Default: 0

Description: \X0 Respond to and discard XON/XOFF characters.  
\X1 Not supported—responds ERROR.

Command: **-Cn Data Calling Tone**

Values:  $n = 0$  or 1

Default: 0

Description: -C0 Disable V.25 data calling tone.  
-C1 Enable V.25 data calling tone.

- 
- Command: **%B View Numbers in Blacklist**  
 Values: n/a  
 Description: If blacklisting is in effect, this command displays the numbers for which the last call attempted in the previous two hours failed. In countries that do not require blacklisting, the ERROR result code appears.
- Command: **%Cn Data Compression Control**  
 Values: n = 0 or 1  
 Default: 1  
 Description: %C0 Disable V.42bis/MNP 5 data compression.  
 %C1 Enable V.42bis/MNP 5 data compression.
- Command: **+ES=6 Enable Synchronous Buffered Mode**  
 Values: n/a  
 Description: Allows an H.324 video application direct access to the synchronous data channel. On underflow, the modem sends HDLC flag idle (0x7E) to the remote modem. This special error correction mode is overridden by any of the following commands: **&F**, **&M**, **&Q**, and **W**. **+ES = ?** shows the only allowed value.
- Command: **&&S Speaker Codec Loopback**  
 Values: n/a  
 Description: Provides a loopback from the microphone to the speaker. *For testing and debugging only.*
- Command: **%T94 Testing External RAM**  
 Values: n/a  
 Description: This command is used for testing the external RAM. Enter AT%T94<cr> to determine the status of external RAM. The response you should receive will be either "FAIL" or "PASS"
- Command: **%T125 Testing DSP 56K Code Version/Checksum**  
 Values: n/a  
 Description: Entering AT%T125<cr> tests the DSP56K code version and checksum running in external RAM. Upon issuing this command the user may then issue ATi4<cr> to get DSP version or ATi1<cr> to get DSP checksum in RAM.  
 Entering AT%T124<cr> tests the DSP56K code version and checksum running in internal ROM. Upon issuing this command the user may then issue ATi4<cr> to get DSP version or ATi1<cr> to get DSP checksum in ROM.



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**RASFinder**<sup>™</sup> 200-Series  
Remote Access Device

## Glossary of Terms

**MultiTech**<sup>®</sup>  
Systems 

### A

**Access:** The T1 line element made up of two pairs of wire that the telephone company brings to the customer premises. The Access portion ends with a connection at the local telco (LEC or RBOC).

**Accunet Spectrum of Digital Services (ASDS):** The AT&T 56K bps leased (private) line service. Similar to services of MCI and Sprint. ASDS is available in nx56/64K bps, where n=1, 2, 4, 6, 8, 12.

**ACK (ACKnowledgement code) (pronounced “ack”):** A communications code sent from a receiving modem to a transmitting modem to indicate that it is ready to accept data. It is also used to acknowledge the error-free receipt of transmitted data. Contrast with NAK.

**Adaptive Differential Pulse Code (ADCPM):** In multimedia applications, a technique in which pulse code modulation samples are compressed before they are stored on a disk. ADCPM, an extension of the PCM format, is a standard encoding format for storing audio information in a digital format. It reduced storage requirements by storing differences between successive digital samples rather than full values.

**Address:** A numbered location inside a computer. It's how the computer accesses its resources, like a video card, serial ports, memory, etc.

**AMI line coding:** One of two common methods of T1 line coding (with B8ZS). AMI line coding places restrictions on user data (B8ZS does not).

**Analog signal:** A waveform which has amplitude, frequency and phase, and which takes on a range of values between its maximum and minimum points.

**Analog Transmission:** One of two types of telecommunications which uses an analog signal as a carrier of voice, data, video, etc. An analog signal becomes a carrier when it is modulated by altering its phase, amplitude and frequency to correspond with the source signal. Compare with digital transmission.

**Application Program Interface (API):** A software module created to allow dissimilar, or incompatible applications programs to transfer information over a communications link. APIs may be simple or complex; they are commonly required to link PC applications with mainframe programs.

**ASCII (American Standard Code for Information Interchange) (pronounced “askey”):** A binary code for data that is used in communications and in many computers and terminals. The code is used to represent numbers, letters, punctuation and control characters. The basic ASCII code is a 7-bit character set which defines 128 possible characters. The extended ASCII file provides 255 characters.

**Asynchronous Transfer Mode (ATM):** A very high-speed method of transmission that uses fixed-size cells of 53 bytes to transfer information over fiber; also known as cell relay.

**AT Commands:** A standard set of commands used to configure various modem parameters, establish connections and disconnect. The “AT” is used to get the “attention” of the modem before the actual command is issued.

**Availability:** The measure of the time during which a circuit is ready for use; the complement of circuit “outage” (100% minus % outage = % available).

### B

**B7ZS (Bipolar 7 Zero Suppression) line coding:** One method of T1 line coding (see also “B8ZS” and “AMI”). B7ZS line coding does not place restrictions on user data (AMI does).

**B8ZS (Bipolar 8 Zero Suppression) line coding:** One of two common methods of T1 line coding (with AMI). B8ZS line coding does not place restrictions on user data (AMI does). A coding method used to produce 64K bps “clear” transmission. (See also “B7ZS” and “AMI” line coding)

**Backbone:** 1. A set of nodes and their interconnecting links providing the primary data path across a network. 2. In a local area network multiple-bridge ring configuration, a high-speed link to which the rings are connected by means of bridges. A backbone may be configured as a bus or as a ring. 3. In a wide area network, a high-speed link to which nodes or data switching exchanges (DSEs) are connected. 4. A common distribution core that provides all electrical power, gases, chemicals, and other services to the sectors of an automated wafer processing system.

**Background:** An activity that takes place in the PC while you are running another application. In other words, the active user interface does not correspond to the ‘background’ task.

**Bandwidth:** The transmission capacity of a computer channel, communications line or bus. It is expressed in cycles per second (hertz), the bandwidth being the difference between the lowest and highest frequencies transmitted. The range of usable frequencies that a transmission medium will pass without unacceptable attenuation or distortion. Bandwidth is a factor in determining the amount of information and the speed at which a medium can transmit data or other information.

**Backward Explicit Congestion Notification (BECN):** A bit that tells you that a certain frame on a particular logical connection has encountered heavy traffic. The bit provides notification that congestion-avoidance procedures should be initiated in the opposite direction of the received frame. See also FECN (Forward Explicit Congestion Notification).

**Basic Rate Interface (BRI):** An ISDN access interface type comprised of two B-channels each at 64K bps and one D-channel at 64K bps (2B+D).

**Bell Operating Companies (BOC):** The family of corporations created during the divestiture of AT&T. BOCs are independent companies which service a specific region of the US. Also called Regional Bell Operating Companies (RBOCs).

**Bell Pub 41450:** The Bell publication defining requirements for data format conversion, line conditioning, and termination for direct DDS connection.

**Bell Pub 62310:** The Bell publication defining requirements for data format conversion, line conditioning, and termination for direct DDS connection.

**Binary Synchronous Communication (BSC):** A form of telecommunication line control that uses a standard set of transmission control characters and control character sequences, for binary synchronous transmission of binary-coded data between stations.

**Bit (Binary digit):** A bit is the basis of the binary number system. It can take the value of 1 or 0. Bits are generally recognized as the electrical charge generated or stored by a computer that represent some portion of usable information.

**Bit Error Rate Test (BERT):** A device or routine that measures the quality of data transmission. A known bit pattern is transmitted, and the errors received are counted and a BER (bit error rate) is calculated. The BER is the ratio of received bits in error relative to the total number of bits received, expressed in a power of 10.

**Bit robbing:** The use of the least significant bit per channel in every sixth frame for signaling. The line signal bits "robbed" from the speech part conveys sufficient pre-ISDN telephony signaling information with the remaining line signal bits providing sufficient line signaling bits for recreating the original sound. See "robbed bit signaling".

**Blue Alarm:** An error indication signal consisting of all 1s indicating disconnection or attached device failure. Contrast "Red Alarm" and "Yellow Alarm".

**Bps (bits per second):** A unit to measure the speed at which data bits can be transmitted or received. Bps differs from baud when more than one bit is represented by a single cycle of the carrier.

**Bridges:** 1. A functional unit that interconnects two local area networks that use the same logical link protocol but may use different medium access control protocols. 2. A functional unit that interconnects multiple LANs (locally or remotely) that use the same logical link control protocol but that can use different medium access control protocols. A bridge forwards a frame to another bridge based on the medium access control (MAC) address. 3. In the connection of local loops, channels, or rings, the equipment and techniques used to match circuits and to facilitate accurate data transmission.

**Buffer:** A temporary storage register or Random Access Memory (RAM) used in all aspects of data communications which prevents data from being lost due to differences in transmission speed. Keyboards, serial ports, muxes and printers are a few examples of the devices that contain buffers.

**Bus:** A common channel between hardware devices either internally between components in a computer, or externally between stations in a communications network.

**Byte:** The unit of information a computer can handle at one time. The most common understanding is that a byte consists of 8 binary digits (bits), because that's what computers can handle. A byte holds the equivalent of a single character (such as the letter A).

## C

**Call Setup Time:** The time to establish a circuit-switched call between two points. Includes dialing, wait time, and CO/long distance service movement time.

**Carrier Group Alarm (CGA):** A T1 service alarm generated by a channel bank when an OOF condition occurs for a predefined length of time (usually 300mS to 2.5 seconds). The CGA causes the calls using a trunk to be dropped and for trunk conditioning to be applied.

**Carrier signal:** An analog signal with known frequency, amplitude and phase characteristics used as a transport facility for useful information. By knowing the original characteristics, a receiver can interpret any changes as modulations, and thereby recover the information.

**CCITT (Consultative Committee for International Telephone and Telegraph):** An advisory committee created and controlled by the United Nations and headquartered in Geneva whose purpose is to develop and to publish recommendations for worldwide standardization of telecommunications devices. CCITT has developed modem standards that are adapted primarily by PTT (post, telephone and telegraph) organizations that operate telephone networks of countries outside of the U.S. See also ITU.

**Central Office (CO):** The lowest, or most basic level of switching in the PSTN (public switched telephone network). A business PABX or any residential telephone connects to the PSTN at a central office.

**Centrex:** A multi-line service offered by operating telcos which provides, from the telco CO, functions and features comparable to those of a PBX for large business users. See also "Private Branch Exchange", "Exchange".

**Channel:** A data communications path between two computer devices. Can refer to a physical medium (e.g., UTP or coax), or to a specific carrier frequency.

**Channel Bank:** A device that acts as a converter, taking the digital signal from the T1 line into a phone system and converting it to the analog signals used by the phone system. A channel bank acts as a multiplexer, placing many low-speed voice or data transactions on a single high-speed link.

**Circuit-switched Network:** A technology used by the PSTN that allocates a pair of conductors for the exclusive use of one communication path. Circuit switching allows multiple conversations on one talk path only if the end-users multiplex the signals prior to transmission.

**Circuit Switching:** The temporary connection of two or more communications channels using a fixed, non-shareable path through the network. Users have full use of the circuit until the connection is terminated.

**Clear Channel:** A transmission path where the full bandwidth is used (i.e., no bandwidth needed for signaling, carrier framing or control bits). A 64K bps digital circuit usually has 8K bps used for signaling. ISDN has two 64K bps circuits, and a 16K bps packet service of which part is used for signaling on the 64K channels.

**Client-Server:** In TCP/IP, the model of interaction in distributed data processing in which a program at one site sends a request to a program at another site and awaits a response. The requesting program is called a client; the answering program is called a server.

**Cluster Controller:** A device that can control the input/output operations of more than one device connected to it. A cluster controller may be controlled by a program stored and executed in the unit, or it may be entirely controlled by hardware.

**Committed Burst Size:** The maximum number of bits that the frame relay network agrees to transfer during any measurement interval.

**Committed Information Rate (CIR):** An agreement a customer makes to use a certain minimum data transmission rate (in bps). The CIR is part of the frame relay service monthly billing, along with actual usage, that users pay to their frame relay service provider.

**Compression:** 1. The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks. 2. In SNA, the replacement of a string of up to 64-repeated characters by an encoded control byte to reduce the length of the data stream to the LU-LU session partner. The encoded control byte is followed by the character that was repeated (unless that character is the prime compression character). 3. In Data Facility Hierarchical Storage Manager, the process of moving data instead of allocated space during migration and recall in order to release unused space. 4. Contrast with decompression.

**COMx Port:** A serial communications port on a PC.

**congestion:** A network condition where there is too much data traffic. The ITU I.233 standard defines congestion management in terms of speed and burstiness.

**congestion notification:** The function in frame relay that ensures that user data transmitted at a rate higher than the CIR are allowed to slow down to the rate of the available network bandwidth.

**Consecutive Severely Errored Seconds (CSES):** An error condition that occurs when from 3 to 9 SES (Severely Errored Seconds) are logged consecutively.

**Customer Premise Equipment (CPE):** The generic term for data comm and/or terminal equipment that resides at the user site and is owned by the user with the following exclusions: Over voltage protection equipment, inside wiring, coin operated or pay telephones, "company-official" equipment, mobile telephone equipment, "911" equipment, equipment necessary for the provision of communications for national defense, or multiplexing equipment used to deliver multiple channels to the customer.

## D

**D4:** the T1 4th generation channel bank.

**D4 channelization:** Refers to the compliance with AT&T TR 62411 for DS1 frame layout.

**D4 framing:** The T1 format for framing in AT&T D-Series channel banks, in which there are 12 separate 193-bit frames in a super-frame. A D4 framing bit is used to identify the channel and the signaling frame. Signalling for voice channels is carried in-band for every channel, along with the encoded voice. See "robbed-bit signaling".

**Data Communications Equipment (DCE):** Any device which serves as the portal of entry from the user equipment to a telecommunications facility. A modem is a DCE for the telephone network (PSTN) that is commonly on site at the user's premises. Packet Switched Networks have another level of DCE which is most often located at a central office.

**Data Link Connection Identifier (DLCI):** One of the six components of a frame relay frame. Its purpose is to distinguish separate virtual circuits across each access connection. Data coming into a frame relay node is thus allowed to be sent across the interface to the specified "address". The DLCI is confirmed and relayed to its destination, or if the specification is in error, the frame is discarded.



**Dataphone Digital Service (DDS):** A private line digital service that offers 2400, 4800, 9600 and 56K bps data rates on an inter-LATA basis by AT&T and on an intra-LATA basis by the BOCs.

**Data Service Unit (DSU):** A device that provides a digital data service interface directly to the data terminal equipment. The DSU provides loop equalization, remote and local testing capabilities, and a standard EIA/CCITT interface.

**Dedicated Line:** A communication line that is not switched. The term leased line is more common.

**Default:** This is a preset value or option in software packages, or in hardware configuration, that is used unless you specify otherwise.

**Device driver:** Software that controls how a computer communicates with a device, such as a printer or mouse.

**Digital Cross-connect System (DCS):** The CO device which splits and redistributes the T1 bandwidth. The DCS takes time slots from various T1 lines and alters them to provide the needed connectivity. DCS connections are made with software at an administrator's workstation.

**Digital Data:** Information represented by discrete values or conditions (contrast "Analog Data").

**Digital Loopback:** A technique used for testing the circuitry of a communications device. Can be initiated locally, or remotely (via a telecommunications device). The tested device decodes and encodes a received test message, then echoes the message back. The results are compared with the original message to determine if corruption occurred en route.

**Digital PBX:** A Private Branch Exchange that operates internally on digital signals. See also "Exchange".

**Digital Service, level 0 (DS0):** The world-wide standard speed (64K bps) for digital voice conversation using PCM (pulse coded modulation).

**Digital Service, level 1 (DS1):** The 1.544M bps voice standard (derived from an older Bell System standard) for digitized voice transmission in North America. The 1.544M bps consists of 24 digitally-encoded 64K bps voice channels (north America) and 2.048M bps (30 channels) elsewhere.

**Digital Signal:** A discrete or discontinuous signal (e.g., a sequence of voltage pulses). Digital devices, such as terminals and computers, transmit data as a series of electrical pulses which have discrete jumps rather than gradual changes.

**Digital Signaling Rates (DSn):** A hierarchical system for transmission rates, where "DS0" is 64K bps (equivalent to ISDN B channel), and DS1 is 1.5 Mbps (equivalent to ISDN PRI).

**Digital Transmission:** A method of electronic information transmission common between computers and other digital devices. Analog signals are waveforms: a combination of many possible voltages. A computer's digital signal may be only "high" or "low" at any given time. Therefore, digital signals may be "cleaned up" (noise and distortion removed) and amplified during transmission.

**Digitize:** To convert an analog signal to a digital signal.

**DIP switch (pronounced "dip switch"):** A set of tiny toggle switches, built into a DIP (dual in-line package), used for setting configurable parameters on a PCB (printed circuit board).

**Driver:** A software module that interfaces between the Operating System and a specific hardware device (e.g., color monitors, printers, hard disks, etc.). Also known as a device driver.

**Drop and Insert:** The process where a portion of information carried in a transmission system is demodulated ("Dropped") at an intermediate point and different information is included ("Inserted") for subsequent transmission.

**DTE (Data Terminal Equipment):** A term used to include any device in a network which generates, stores or displays user information. DTE is a telecommunications term which usually refers to PCs, terminals, printers, etc.

**DTMF (Dual-Tone MultiFrequency):** A generic push-button concept made popular by AT&T TouchTone.

## E

**E&M:** A telephony trunking system used for either switch-to-switch, or switch-to-network, or computer/telephone system-to-switch connection.

**EIA:** The Electronics Industries Association is a trade organization in Washington, DC that sets standards for use of its member companies. (See RS-232, RS-422, RS530.)

**Encapsulation:** A technique used by network-layer protocols in which a layer adds header information to the protocol data unit from the preceding layer. Also used in "enveloping" one protocol inside another for transmission. For example, IP inside IPX.

**Errored Seconds (ES):** Any second of operation that all 1.544M bits are not received exactly as transmitted. Contrast "Error Free Seconds".

**Error Free Seconds (EFS):** Any second of operation that all 1.544M bits are received exactly as transmitted. Contrast "Errored Seconds".

**ESF Error Event:** A T1 error condition that is logged when a CRC-6 error or an out-of-frame (OOF) error occurs.

**Ethernet:** A 10-megabit baseband local area network that allows multiple stations to access the transmission medium at will without prior coordination, avoids contention by using carrier sense and deference, and resolves contention by using collision detection and transmission. Ethernet uses carrier sense multiple access with collision detection (CSMA/CD).

**Excess Zeros:** A T1 error condition that is logged when more than 15 consecutive 0s or fewer than one 1 bit in 16 bits occurs.

**Exchange:** A unit (public or private) that can consist of one or more central offices established to serve a specified area. An exchange typically has a single rate of charges (tariffs) that has previously been approved by a regulatory group.

**Exchange Area:** A geographical area with a single uniform set of charges (tariffs), approved by a regulatory group, for telephone services. Calls between any two points within an exchange area are local calls. See also "Digital PBX", "PBX".

**Exchange Termination (ET):** The carrier's local exchange switch. Contrast with "Loop Termination - LT".

**Explicit Congestion Management:** The method used in frame relay to notify the terminal equipment that the network is overly busy. The use of FECN and BECN is called explicit congestion management. Some end-to-end protocols use FECN or BECN, but usually not both options together. With this method, a congestion condition is identified and fixed before it becomes critical. Contrast with "implicit congestion".

**Extended Super Frame (ESF):** One of two popular formats for framing bits on a T1 line. ESF framing has a 24-frame super-frame, where robbed bit signaling is inserted in the LSB (bit 8 of the DS-0 byte) of frames 6, 12, 18 and 24. ESF has more T1 error measurement capabilities than D4 framing. Both ESF and B8ZS are typically offered to provide clear channel service.

## F

**Failed Seconds:** A test parameter where the circuit is unavailable for one full second.

**Failed Signal:** A T1 test parameter logged when there are more than 9 SES (Severely Errored Seconds).

**Fax (facsimile):** Refers to the bit-mapped rendition of a graphics-oriented document (fax) or to the electronic transmission of the image over telephone lines (faxing). Fax transmission differs from data transmission in that the former is a bit-mapped approximation of a graphical document and, therefore, cannot be accurately interpreted according to any character code.

**Firmware:** A category of memory chips that hold their content without electrical power, they include ROM, PROM, EPROM and EEPROM technologies. Firmware becomes "hard software" when holding program code.

**Foreground:** The application program currently running on and in control of the PC screen and keyboard. The area of the screen that occupies the active window. Compare with "background".

**Fractional T1 (FT1):** A digital data transmission rate between 56K bps (DS0 rate) and 1.544M bps (the full T1 rate - in North America). FT1 is typically provided on 4-wire (two copper pairs) UTP. Often used for video conferencing, imaging and LAN interconnection due to its low cost and relatively high speed. FT1 rates are offered in 64K bps multiples, usually up to 768K bps.

**Frequency:** A characteristic of an electrical or electronic signal which describes the periodic recurrence of cycles. Frequency is inversely proportional to the wavelength or pulse width of the signal (i.e., long wavelength signals have low frequencies and short wavelength signals yield high frequencies).

**Foreign Exchange (FX):** A CO trunk with access to a distant CO, allowing ease of access and flat-rate calls anywhere in the foreign exchange area.

**Foreign Exchange Office (FXO):** provides local telephone service from a CO outside of ("foreign" to) the subscriber's exchange area. In simple form, a user can pick up the phone in one city and receive a tone in the foreign city. Connecting a POTS telephone to a computer telephony system via a T1 link requires a channel bank configured for the FX connection. To generate a call from the POTS set to the computer telephony system, a FXO connection must be configured.

**Foreign Exchange Station (FXS):** See FX, FXO. To generate a call from the computer telephony system to the POTS set, an FXS connection must be configured.

**Forward Explicit Congestion Notification (FECN):** A bit that tells you that a certain frame on a particular logical connection has encountered heavy traffic. The bit provides notification that congestion-avoidance procedures should be initiated in the same direction of the received frame. See also BECN (Backward Explicit Congestion Notification).

**Frame:** A group of data bits in a specific format to help network equipment recognize what the bits mean and how to process them. The bits are sent serially, with a flag at each end signifying the start and end of the frame.

**Frame Relay:** A form of packet switching that uses small packets and that requires less error checking than other forms of packet switching. Frame relay is effective for sending "bursty" data at high speeds (56/64K, 256K, and 1024K bps) over wide area networks. Frame Relay specifications are defined by ANSI documents ANSI T1.602, T1.606, T1S1/90-175, T1S1/90-213, and T1S1/90-214. In using frame relay, blocks of information (frames) are passed across a digital network interface using a "connection number" that is applied to each frame to distinguish between individual frames.

**Frame Relay Forum:** A non-profit organization of 300+ vendors and service providers, based in Foster City, CA, that are developing and deploying frame relay equipment.

**Frame Relay Implementors Forum:** A group of companies supporting a common specification for frame relay connection to link customer premises equipment to telco network equipment. Their specification supports ANSI frame relay specs and defines extensions such as local management.

**Frame Relay Access Device (FRAD):** A piece of equipment that acts as a concentrator or frame assembler/dissassembler that can support multiple protocols and provide basic "routing" functions.

## G

**Gateway:** 1. A functional unit that interconnects two computer networks with different network architectures. A gateway connects networks or systems of different architectures. A bridge interconnects networks or systems with the same or similar architectures. 2. A network that connects hosts.

**Graphical User Interface (GUI):** A type of computer interface consisting of a visual metaphor of a real-world scene, often of a desktop. Within that scene are icons, representing actual objects, that the user can access and manipulate with a pointing device.

## H

**Handshaking:** A process that two modems go through at the time of call setup to establish synchronization over the data communications link. It is a synchronization and negotiation process accomplished by the exchange of predefined, mutually recognized control codes.

**High-level Data Link Control (HDLC):** An ISO standard, bit-oriented data communications protocol that provides nearly error-free data transfers.

## I

**Hexadecimal:** A base 16 numbering system used to represent binary values. Hex uses the numbers 0-9 and the letters A-F: usually notated by an "h" (e.g., "4CF h", read "four charley fox, hex"). The result is that one hex digit represents a 4-bit value.

**Implicit congestion management:** A method of informing the terminal that the network is busy. This method relies on the end-system protocol to detect and fix the congestion problem. (TCP/IP is an example of a protocol using only implicit congestion management.) See also "explicit congestion management".

**In-band:** Refers to the type of signalling over the conversion path on an ISDN call. Contrast "out-of-band".

**Insufficient Ones:** A T1 error condition that is logged when fewer than one 1 in 16 0s or less than 12.5 % average 1s density is received.

**Inter Exchange Carrier (IEC):** The long distance company (LE) who's central office provides the point of reference for T1 access. Any common carrier authorized by the FCC to carry customer transmissions between LATAs.

**Internet:** Refers to the computer network of many millions of university, government and private users around the world. Each user has a unique Internet Address.

**Internet Address (IP Address):** A unique 32-bit address for a specific TCP/IP host on a network. Normally printed in dotted decimal format (e.g., 129.128.44.227).

**Internet Protocol (IP):** A protocol used to route data from its source to its destination in an Internet enviroment. The Internet Protocol was designed to connect local area networks. Although there are many protocols that do this, IP refers to the global system of interconnecting computers. It is a highly distributed protocol (each machine only worries about sending data to the next step in the route).

**Internetwork Packet Exchange (IPX):** A NetWare communications protocol used to route messages from one node to another. IPX packets include network addresses and can be routed from one network to another. An IPX packet can occasionally get lost when crossing networks, thus IPX does not guarantee delivery of a complete message. Either the application has to provide that control, or NetWare's SPX protocol must be used.

**Interoperable:** Devices from different vendors that can exchange information using a standard's base protocol.

**I/O Addresses:** Locations within the I/O address space of your computer used by a device, such as an expansion card, a serial port, or an internal modem. The address is used for communication between software and a device.

**IRQ Level (Interrupt Request Level):** The notification a processor receives when another portion of the computer's hardware requires its attention. IRQs are numbered so that the device issuing the IRQ can be identified, and so IRQs can be prioritized.

**ISA (Industry Standards Architecture) (pronounced "ice a"):** The classic 8 or 16-bit architecture introduced with IBM's PC-AT computer.

**ISDN (Integrated Services Digital Network):** An International telecommunications standard for transmitting voice, video and data over a digital communications line. ISDN is a world-wide telecommunications service that uses digital transmission and switching technology to support voice and digital data communications. Frame relay was partially based on ISDN's data link layer protocol (LAPD). Frame relay can be used to transmit across ISDN services offering circuit-switched connection at 64K bps and higher speeds. Contrast Public Switched Telephone Network (PSTN).

**ITU-TSS (formerly CCITT):** International Telecommunications Union-Telecommunications Sector; the United Nations organization that prepares standards ("Recommendations") for resolving communications issues and problems.

## J

No Entries.

## K

**Key Telephone System (KTS):** Phone devices with multiple buttons that let you select incoming or outgoing CO phone lines directly. Similar in operation to a PBX, except with a KTS you don't have to dial a "9" to call outside the building.

**Key Service Unit (KSU):** A small device containing the switching electronics for a business key telephone system (KTS).

**Key Set:** A telephone set with several buttons for call holding, line pickup, intercom, autodialing, etc. Also called a touchtone phone (Ericsson) and a KTS (Key Telephone Set).

## L

**LAPB:** Link Access Procedure Balanced; based on the X.25 Layer 2 specification. A full-duplex, point-to-point, bit-synchronous protocol commonly used as a data link control protocol to interface X.25 DTEs. LAPB is the link initialization procedure that establishes and maintains communications between the DTE and the DCE.

**LAPD:** Link Access Protocol for the D-Channel; based on the ISDN Q.921 specification. A full-duplex point-to-point bit-synchronous link-level protocol for ISDN connections; different from LAPB in its framing sequence. Transmission is in units called "frames", and a frame may contain one or more X.25 packets.

**Line Coding:** The representation of 1s and 0s on a T1 line. The two methods of line coding commonly used, B8ZS and AMI, differ in the restrictions placed on user data. T1 line coding ensures that sufficient timing information is sent with the digital signal to ensure recovery of all the bits at the far end. Timing information on the T1 line is included in the form of 1s in the data stream; a long string of 0s in the data stream could cause problems recovering the data.

**Line Termination (LT):** The electronics at the ISDN network side of the user/network interface that complements the NT1 at the user side. The LT and the NT1 together provide the high-speed digital line signals required for BRI access.

**Listed Directory Number (LDN):** The main number assigned by the telco; the number listed in the telephone directory and also provided by Directory Assistance. Some devices can have more than one LDN, such as ISDN devices that have one LDN for voice and another LDN for data.

**Local Area Network (LAN):** 1. A computer network located on a user's premises within a limited geographical area. Communication within a local area network is not subject to external regulations; however, communication across the LAN boundary may be subject to some form of regulation. 2. A LAN does not use store-and-forward techniques. 3. A network in which a set of devices are connected to one another for a communication and that can be connected to a larger network.

**Local Access and Transport Area (LATA):** A post-divestiture geographical area generally equivalent to a Standard Metropolitan Statistical Area. At divestiture, the territory served by the Bell system was divided into approximately 161 LATAs. The Bell Operating Companies (BOCs) provide Intra-LATA services.

**Local Exchange Carrier (LEC):** The local phone company which provides local (i.e., not long distance) transmission services. AKA "telco". LECs provide T1 or FT1 access to LDCs (unless the T1 circuit is completely intra-LATA). Inter-LATA T1 circuits are made up of a combination of Access and Long Haul facilities.

**Local Management Interface (LMI):** A specification for frame relay equipment that defines status information exchange.

**Local Loop:** A transmission path, typically twisted-pair wire, between an individual subscriber and the nearest public telecommunications network switching center. The wires provide ISDN service, but require an NT1 at the user end and an LT at the network end. (AKA, "loop" or "subscriber loop".)

**Logical Link Control (LLC2):** In a local area network, the protocol that governs the exchange of transmission frames between data stations independently of how the transmission medium is shared. The LLC2 protocol was developed by the IEEE 802 committee and is common to all LAN standards.

**Logical Unit (LU):** A type of network accessible unit that enables end users to gain access to network resources and communicate with each other.

**Long Haul:** The T1 element that connects to the Access portion of the long distance company's (LDC's) central office. The LDC is commonly called the point of presence (POP). Each LDC has a number of POPs, located throughout the country. The LDC is also called an IEC (Inter Exchange Carrier).

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**Long Haul Communications:** The type of phone call reaching outside of a local exchange (LE).

## M

**Management Information Base (MIB):** A database of network management information used by the Common Management Information Protocol (CMIP) and the Simple Network Management Protocol (SNMP).

**Megacom:** An AT&T service with a normal WATS line (typically T1) between the customer premise and the AT&T serving class 4 CO are the customer's responsibility.

**MegaLink:** BellSouth's leased T1 service.

**Message:** Associated with such terms as packet, frame, and segment. 1. In information theory, an ordered series of characters intended to convey information. 2. An assembly of characters and sometimes control codes that is transferred as an entry from an originator to one or more recipients.

**Modem:** A communications device that enables a computer to transmit information over a telephone line. It converts the computer's digital signals into analog signals to send over a telephone line and converts them back to digital signals at the receiving end. Modems can be internal and fit into an expansion slot, or external and connect to a serial port.

**Multiplexer (Mux):** 1. A device that takes several input signals and combines them into a single output signal in such a manner that each of the input signals can be recovered. 2. A device capable of interleaving the events of two or more activities or capable of distributing the events of an interleaved sequence to the respective activities. 3. Putting multiple signals on a single channel.

**Multiprotocol:** A device that can interoperate with devices utilizing different network protocols.

**MultiRouter:** A secure gateway that provides multiple LAN users with high performance Internet access by functioning as a TCP/IP MultiRouter that resides on the outer edge of a firewall.

**Multithreading:** The ability of a software system to be able to handle more than one transaction concurrently. This is contrasted to the case where a single transaction is accepted and completely processed before the next transaction processing is started.

## N

**Nailed Connection:** A permanent or dedicated circuit of a previously switched circuit or circuits.

**Nailed-up Circuit:** A semi-permanent circuit established through a circuit-switching facility for point-to-point connectivity.

**NAK (Negative Acknowledgment):** Communications code used to indicate that a message was not properly received, or that a terminal does not wish to transmit. Contrast with ACK.

**Network:** A group of computers connected by cables or other means and using software that enables them to share equipment, such as printers and disk drives to exchange information.

**Node:** Any point within a network which has been assigned an address.

## O

**Object-Oriented:** A method for structuring programs as hierarchically organized classes describing the data and operations of objects that may interact with other objects.

**Office Channel Unit - Data Port (OCU-DP):** The CO channel bank used as the interface between the customer's DSU and the channel bank.

**Off-hook:** The condition of a device which has accessed a phone line (with or without using the line). In modem use, this is equivalent to a telephone handset being picked up. Dialing and transmission are allowed, but incoming calls are not answered. Contrast "on-hook".

**Off Premise Extension (OPX):** An extension or phone that terminates in a location other than that of the PBX. Commonly used to provide a corporate member with an extension of the PBX at home.

**Ones Density:** the measure of the number of logical 1s on a T1 line compared to a given total number of bits on that line; used for timing information in data recovery in AMI and B8ZS.

**On-Hook:** The condition of a device which has not accessed a phone line. In modem use, this is equivalent to a telephone handset that has not been picked up. In other words, it can receive an incoming call. Contrast "off-hook".

**Open Shortest Path First (OSPF):** A hierarchical Interior Gateway Protocol (IGP) routing algorithm for IP that is a proposed standard for the Internet. OSPF incorporates least-cost routing, equal-cost routing, and load balancing.

**Outage:** The measure of the time during which a circuit is not available for use due to service interrupt. Outage is the complement of circuit "availability" (100% minus % available = % outage).



**Out-of-band:** Signaling that is separated from the channel carrying the information (e.g., the voice/data/video signal is separate from the carrier signal). Dialing and various other “supervisory” signals are included in the signaling element. Contrast “In-band” signaling.

**Out of Frame (OOF):** A T1 alarm condition that is logged on the loss of 2, 3 or 4 of 5 consecutive FT framing bits.

## P

**Packet:** 1. In data communication, a sequence of binary digits, including data and control signals, that is transmitted and switched as a composite whole. The data, control signals and, possibly, error control information are arranged in a specific format. 2. Synonymous with data frame. 3. In TCP/IP, the unit of data passed across the interface between the Internet layer and the link layer. A packet includes an IP header and data. A packet can be a complete IP datagram or a fragment of an IP diagram. 4. In X.25, a data transmission information unit. A group of data and control characters, transferred as a unit, determined by the process of transmission. Commonly used data field lengths in packets are 128 or 256 bytes. 5. The field structure and format defined in the CCITT X.25 recommendation.

**Packet Assembler/Disassembler (PAD):** Used by devices to communicate over X.25 networks by building or stripping X.25 information on or from a packet.

**Packet Data:** The information format (“packetized”) used for packet-mode calls.

**Packet Mode:** Refers to the switching of chunks of information for different users using statistical multiplexing to send them over the same transmission facility.

**Parity bit:** An extra bit attached to each byte of synchronous data used to detect errors in transmission.

**Permanent Virtual Circuit (PVC):** A connection between two endpoints dedicated to a single user. In ISDN, PVCs are established by network administration and are held for as long as the user subscribes to the service.

**Physical Unit (PU):** The component that manages and monitors the resources (such as attached links and adjacent link stations) associated with a node, as requested by an SSCP via an SSCP-PU session. An SSCP activates a session with the physical unit in order to indirectly manage, through the PU, resources of the node such as attached links. This term applies to type 2.0, type 4, and type 5 nodes only.

**Point of Presence (POP):** The central office’s end points of the long distance carriers.

**Point-to-Point Protocol (PPP):** A protocol that lets a PC user access TCP/IP (Internet member) using an ISDN terminal adapter or a high-speed modem over a standard telephone line.

**Port:** A location for input or output data exchange. Computers, muxes, etc. have ports for various purposes.

**Primary Rate Interface (PRI):** Used on ISDN. In North America, and Japan, PRI is one 64Kbps D channel and 23 B channels. Elsewhere, it is one D channel and 30 B channels.

**Primitive:** An abstract representation of interaction across the access points indicating that information is being passed between the service user and the service provider. The OSI Reference Model defines four types of primitives: Request, Indication, Response and Confirm.

**Private Branch Exchange (PBX):** A telephone exchange located on the customer’s premises. The PBX provides a circuit switching facility for telephone extension lines within the building, and access to the public telephone network. See also “Exchange”.

**PROM (Programmable Read Only Memory - pronounced “prom”):** A permanent memory chip that can be programmed or filled by the customer after by the manufacturer has set initial values. Contrast with ROM.

**Protocol:** 1. A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication. 2. In Open Systems Interconnection architecture, a set of semantic and syntactic rules that determine the behavior of entities in the same layer in performing communication functions. 3. In SNA, the meanings of and the sequencing rules for requests and responses used for managing the network, transferring data, and synchronizing the states of network components. 4. Synonymous with line control discipline.

**PSTN (Public Switched Telephone Network):** A worldwide public voice telephone network that is used as a telecommunications medium for the transmission of voice, data and other information.

**Public Data Network (PDN):** A packet-switched network that is available to the public for individual (“subscriber”) use. Typically, controlled by a government or a national monopoly.

**Public Switched Telephone Network (PSTN):** The group of circuit-switching voice carriers, which are commonly used as analog data communications services.

**Pulse Code Modulation (PCM):** 1. In data communication, variation of a digital signal to represent information; for example, by means of pulse amplitude modulation (PAM), pulse duration modulation (PDM), or pulse position modulation (PPM). 2. Transmissions of analog information in digital form through sampling and encoding the samples with a fixed number of bits.

**Pulse dialing:** One of two methods of dialing a telephone, usually associated with rotary-dial phones. Compare with “tone dialing”.

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## Q

**Quantizing:** The process of analog-to-digital conversion by assigning a range, from the contiguous analog values, to a discrete number.

## R

**Random Access Memory (RAM):** A computer's primary workspace. All data must be stored in RAM (even for a short while), before software can use the processor to manipulate the data. Before a PC can do anything useful it must move programs from disk to RAM. When you turn it off, all information in RAM is lost.

**Rate Enforcement:** The concept in frame relay where frames sent faster than the CIR are to be carried only if the bandwidth is available, otherwise they are to be discarded. (The frame relay network assumes that anything exceeding the CIR is of low priority.) Rate enforcement makes sure that the network will not get so congested that it isn't able to meet the agreed on CIR.

**Recognized Private Operating Agency (RPOA):** A corporation, private or government-controlled, that provides telecommunications services. RPOAs, such as AT&T, participate as non-voting members in the CCITT.

**Red Alarm:** A T1 error condition generated when a local failure (e.g., loss of synchronization) exists for 2.5 seconds, causing a Carrier Group Alarm (CGA). See also "Blue Alarm" and "Yellow Alarm".

**Request for Comment (RFC):** A set of papers in which Internet standards (published and proposed), along with generally-accepted ideas, proposals, research results, etc. are published.

**Ring Down Box:** A device that emulates a CO by generating POTS calls for testing and product demos.

**Ring Down Circuit:** A tie line connecting phones where picking up one phone automatically rings another phone. A feature used for emergencies to alert the person at the other phone of the incoming call.

**RJ-11:** An industry standard interface used for connecting a telephone to a modular wall outlet; comes in 4-and 6-wire packages.

**RJ-45:** An 8-wire modular connector for voice and data circuits.

**Robbed Bit Signaling:** The popular T1 signaling mechanism where the A and B bits are sent by each side of the T1 termination and are "buried" in the voice data of each voice channel in the T1 circuit. Since the bits are "robbed" infrequently, voice quality remains relatively uncompromised. See "bit robbing". The robbed-bit signaling technique is used in D4 channel banks to convey signaling information. The eighth (least significant) bit of each of the 24 8-bit time slots is "robbed" every sixth frame to convey voice-related signaling information such as on-hook, off-hook, etc. for each channel.

**Router:** A device that connects two networks using the same networking protocol. It operates at the Network Layer (Layer 3) of the OSI model for forwarding decisions.

**Routing Information Protocol (RIP):** A distance vector-based protocol that provides a measure of distance, or hops, from a transmitting workstation to a receiving workstation.

**RS232-C:** An EIA standard for a serial interface between computers and peripheral devices (modem, mouse, etc.). It uses a 25-pin DB-25, or a 9-pin DB-9 connector. The RS-232 standard defines the purposes, electrical characteristics and timing of the signals for each of the 25 lines.

**RS-422:** The EIA standard for a balanced interface with no accompanying physical connector. RS-422 products can use screw terminals, DB9, various DB25, and DB37 connectors.

**RS-530:** The EIA standard for the mechanical/electrical interface between DCEs and DTEs transmitting synchronous or asynchronous serial binary data. RS-530 provides for high data rates with the same connector used for RS-232; however, it is incompatible with RS-232.

## S

**Serial Port:** The connector on a PC used to attach serial devices (those that need to receive data one bit after another), such as a mouse, a printer or a modem. This consists of a 9- or 25-pin connector that sends data in sequence (bit by bit). Serial ports are referred to as "COMx" ports, where x is 1 to 4 (i.e., COM1 through COM4). A serial port contains a conversion chip called a "UART" which translates between internal parallel and external serial formats.

**Service:** The requirements offered by an RPOA to its customers to satisfy specific telecommunications needs.

**Severely Errored Seconds (SES):** Refers to a typical T1 error event where an error burst occurs (a short term, high bit-error rate that is self-clearing). Per the ITU-T (CCITT) G.821: any second in which the BER is less than  $1 \times 10^{-3}$ .

**Signaling:** The process of establishing, maintaining, accounting for, and terminating a connection between two endpoints (e.g., the user premises and the telco CO). Central office signals to the user premises can include ringing, dial tone, speech signals, etc. Signals from the user's telephone can include off-hook, dialing, speech to far-end party, and on-hook signals. In-band signaling techniques include pulse and tone dialing. With common channel signaling, information is carried out-of-band.

**Simple Network Management Protocol (SNMP):** TCP/IP protocol that allows network management.

**Simultaneous Voice Data (SVD):** A technology for letting a user send data via a modem, and use a handset to talk to another user at the same time over the same connection. The alternative, making a second call, can be expensive or even impossible. The uses for SVD are telecommuting, videoconferencing, distant learning, tech support, etc.

**Stop Bit:** One of the variables used for timing in asynchronous data transmission. Depending on the devices, each character may be trailed by 1, 1.5, or 2 stop bits.

**Superframe (D4):** A T1 transmission format that consists of 12 DS1 frames, or 2316 bits. A DS1 frame consists of 193 bit positions. A frame overhead bit is in the first position, and it is used for frame and signaling phase alignment only.

**Subscriber Loop:** See "Local loop".

**Switched 56:** A circuit-switched (full duplex digital synchronous data transmission) service that lets you dial a number and transmit data to it at 56K bps. It is a relatively low cost service, widely used in North America for telecommuting, videoconferencing and high speed data transfers. Many phone companies are (or will be) phasing out Switched 56 in favor of ISDN service.

**Switched Virtual Circuit (SVC):** A type of data transmission where the connection is maintained only until the call is cleared.

**Switched Line:** In communications, a physical channel established by dynamically connecting one or more discrete segments. This connection lasts for the duration of the call, after which each segment can be used as part of a different channel. Contrast with leased line.

**Switched Network:** A network in which a temporary connection is established from one point via one or more segments.

**Synchronous Data Link Control (SDLC):** A discipline conforming to subsets of the Advanced Data Communications Control Procedures (ADCCP) of the American National Standards Institute (ANSI) and High-level Data Link Control (HDLC) of the International Organization for Standardization, for managing synchronous, code-transparent, serial-by-bit information transfer over a link connection. Transmission exchanges may be duplex, or half-duplex over switched or nonswitched links. The configuration of the link connection may be point-to-point, multipoint, or loop.

**Synchronous Transmission:** The transmission of data which involves sending a group of characters in a packet. This is a common method of transmission between computers on a network or between modems. One or more synchronous characters are transmitted to confirm clocking before each packet of data is transmitted. Compare to Asynchronous Transmission.

**Systems Network Architecture (SNA):** The description of the logical structure, formats, protocols, and operational sequences for transmitting information units through, and controlling the configuration and operation of, networks.

## T

**Tariff:** The rate/availability schedule for telephone and ISDN services from a regulated service provider.

**TCP/IP:** A set of communication protocols that support peer-to-peer connectivity functions for both local and wide area networks.

**T Carrier:** The generic name for a digitally multiplexed carrier system. In the North American digital hierarchy, a T is used to designate a DS (digital signal) level hierarchy. Examples: T1 (DS1) is a 1.544 M bps 24-channel designation. In Europe, T1 is called E1. The T Carrier system was originally designed for transmitting digitized voice signals, but has since been adapted for digital data applications.

**T1:** A digital transmission link capable of 1.544M bps. T1 uses two pairs of normal UTP, and can handle 24 voice conversations, each digitized at 64K bps. T1 is a standard for digital transmission in the U.S., Canada, Japan and Hong Kong. T1 is the access method for high-speed services such as ATM, frame relay, and SMDS. See also T Carrier, T1 line and FT1.

**T1 Channel Tests:** A set of diagnostics that vary by carrier, used to verify a T1 channel operation. Can include Tone, Noise Level, Impulse Noise Level, Echo Cancelers, Gain, and Crosstalk testing.

**T1 Framing:** To digitize and encode analog voice signals requires 8000 samples per second (twice the highest voice frequency of 4000 Hz). Encoding in an 8-bit word provides the basic T1 block of 64K bps for voice transmission. This "Level 0 Signal, as its called, is represented by "DS-0", or Digital Signal at Level 0. 24 of these voice channels are combined into a serial bit stream (using TDM), on a frame-by-frame basis. A frame is a sample of all 24 channels; so adding in a framing bit gives a block of 193 bits (24x8+1=193). Frames are transmitted at 8000 per second (the required sample rate), creating a 1.544M (8000x193=1.544M) transmission rate.

**T1 Line:** A digital communications facility that functions as a 24-channel pathway for data or voice transmission. A T1 line is composed of two separate elements: the Access element and the Long Haul element.

**T1 Mux:** A device used to carry many sources of data on a T1 line. The T1 mux assigns each data source to distinct DS0 time slots within the T1 signal. Wide bandwidth signals take more than one time slot. Normal voice traffic or 56/64K bps data channels take one time slot. The T1 mux may use an internal or external T1 DSU; a "channel bank" device typically uses an external T1 CSU.



**Transmission Control Protocol / Internet Program (TCP/IP):** A multi-layer set of protocols developed by the US Department of Defense to link dissimilar computers across dissimilar and unreliable LANs.

**Terminal:** The screen and keyboard device used in a mainframe environment for interactive data entry. Terminals have no "box", which is to say they have no file storage or processing capabilities.

**Terminal Adapter (TA):** An ISDN DTE device for connecting a non-ISDN terminal device to the ISDN network. Similar to a protocol converter or an interface converter, a TA connects a non-ISDN device between the R and S interfaces. Typically a PC card.

**Tie line:** A dedicated circuit linking two points without having to dial a phone number (i.e., the line may be accessed by lifting the telephone handset or by pushing a button).

**Time-Division Multiplexing (TDM):** Division of a transmission facility into two or more channels by allotting the common channel to several different information channels, one at a time.

**Time Slot:** One of 24 channels within a T1 line. Each channel has a 64K bps maximum bandwidth. "Time slot" implies the time division multiplexing organization of the T1 signal.

**Toll Call:** A call to a location outside of your local service area (i.e., a long distance call).

**Tone dialing:** One of two methods of dialing a telephone, usually associated with Touch-Tone® (push button) phones. Compare with pulse dialing.

**Topology:** Physical layout of network components (cables, stations, gateways, and hubs). Three basic interconnection topologies are star, ring, and bus networks.

**Transmission Control Protocol (TCP):** A communications protocol used in Internet and in any network that follows the US Department of Defense standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It assumes that the Internet protocol is the underlying protocol.

**Transport Layer:** Layer 4 of the Open Systems Interconnection (OSI) model; provides reliable, end-to-end delivery of data, and detects transmission sequential errors.

**Transport Protocol Data Unit (TPDU):** A transport header, which is added to every message, contains destination and source addressing information that allows the end-to-end routing of messages in multi-layer NAC networks of high complexity. They are automatically added to messages as they enter the network and can be stripped off before being passed to the host or another device that does not support TPDU's.

**Trunk:** Transmission links that interconnect switching offices.

**TSR (terminate and stay resident):** A software program that remains active and in memory after its user interface is closed. Similar to a daemon in UNIX environments.

**Tunneling:** Encapsulation data in an IP packet for transport across the Internet.

**Twisted pair wiring:** A type of cabling with one or more pairs of insulated wires wrapped around each other. An inexpensive wiring method used for LAN and telephone applications, also called UTP wiring.

## U

**UART (Universal Asynchronous Receiver/Transmitter) (pronounced "you art"):** A chip that transmits and receives data on the serial port. It converts bytes into serial bits for transmission, and vice versa, and generates and strips the start and stop bits appended to each character.

**UNIX:** An operating system developed by Bell Laboratories that features multiprogramming in a multi-user environment.

**Unshielded Twisted Pair (UTP):** Telephone-type wiring. Transmission media for 10Base-T.

## V

**V.25bis:** An ITU-T standard for synchronous communications between a mainframe or host and a modem using HDLC or other character-oriented protocol.

**V.54:** The ITU-T standard for local and remote loopback tests in modems, DCEs and DTEs. The four basic tests are:

- local digital loopback (tests DTE send and receive circuits),
- local analog loopback (tests local modem operation),
- remote analog loopback (tests comm link to the remote modem), and
- remote digital loopback (tests remote modem operation).

**Virtual Circuit:** A logical connection. Used in packet switching wherein a logical connection is established between two devices at the start of transmission. All information packets follow the same route and arrive in sequence (but do not necessarily carry a complete address).

### W

**Wide Area Network (WAN):** 1. A network that provides communication services to a geographic area larger than that served by a local area network or a metropolitan area network, and that may use or provide public communication facilities.  
2. A data communications network designed to serve an area of hundreds or thousands of miles; for example, public and private packet-switching networks, and national telephone networks. Contrast with local area network (LAN).

**Wide Area Telecommunications Service (WATS):** A low-cost toll service offered by most long distance and local phone companies. Incoming (800 call service, or IN-WATS) and outgoing WATS are subscribed to separately, but over the same line.

### X

**X.25:** ITU-T's definition of a three-level packet-switching protocol to be used between packet-mode DTEs and network DCEs. X.25 corresponds with layer 3 of the 7-layer OSI model.

### Y

**Yellow Alarm:** An error indication sent by the T1 device when it has not gotten a receive signal, or cannot synchronize on the receive signal received. Contrast "Red Alarm" and "Blue Alarm".

### Z

**Zero Byte Time Slot Interchange (ZBTSI):** A method for allowing 64K bps unrestricted user data (allowing all 0s in the user data). An alternative to (but not as popular as) B8ZS.

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