

Preface

Purpose of this Manual

This manual is the complete reference to the configuration, management and operation of the AR300/AR700 series multiprotocol routers, and includes detailed descriptions of all management commands.

The AR300/AR700 provides efficient and cost-effective multiprotocol routing, terminal serving and integrated network management over wide area networks and LANs. All models can run the same software and can provide all of the following functions simultaneously (depending on the hardware configuration):

- Wide area networking via Frame Relay and Point-to-Point Protocol.
- Basic Rate and Primary Rate access to Integrated Services Digital Network (ISDN) services, with dial-on-demand and channel aggregation.
- Multiprotocol routing, including TCP/IP, Novell® IPX, AppleTalk and GRE protocols.
- OSPF, RIP (IP and Novell®) and SAP (Novell®) routing protocols.
- ARP, Proxy ARP and Inverse ARP address resolution protocols.
- Sophisticated packet filtering.
- Bridging.
- Van Jacobson's header compression, STAC LZS and Predictor compression, and hardware-based DES encryption.
- Create secure Virtual Private Networks (VPNs) across the Internet or any other public or shared IP network, using optional encryption board.
- Terminal serving using Telnet, with local host nicknames.
- Sophisticated, configurable event logging facility for network monitoring and alarm notification to single or multiple management centres.
- Triggers for automatic and timed execution of commands in response to events.
- Scripting for automated configuration of routers and centralised management of configurations.
- Comprehensive PBX services for models fitted with both analogue voice and ISDN interfaces.

- Dynamic Host Configuration Protocol (DHCP) for automatically assigning IP addresses and other configuration information to PCs and other hosts on TCP/IP networks.
- Support for the Simple Network Management Protocol (SNMP), standard MIBs and the Allied Telesyn Enterprise MIB, enabling the router to be managed by a separate SNMP management station.
- Secure remote management using the Secure Shell protocol.
- Resource Reservation Protocol (RSVP) for delivering quality of service to application data streams.
- A fully featured, packet filtering firewall using stateful inspection.

Intended Audience

This manual is intended for the system administrator, network manager or communications technician who will configure and maintain the router, or who manages a network of routers.

It is assumed that the reader is familiar with:

- The topology of the network in which the router is to be used.
- Basic principles of computer networking, protocols and routing, and interfaces.
- Administration and operation of a computer network.

This manual is not intended for users who will use the computer network to access network services from their terminal, personal computer or workstation. Most of the commands described in this manual require MANAGER privilege and can only be entered from a terminal or port which has been assigned MANAGER privilege.

Structure of this Manual

This manual is organised into the following chapters:

- *Chapter 1, Operation* describes general operation, management and support features, including user authentication, down-line loading and installing software releases.
- *Chapter 2, Interfaces* describes the Ethernet, synchronous and asynchronous network interfaces on the router.
- *Chapter 3, Point-to-Point Protocol (PPP)* describes the router's implementation of the Point-to-Point Protocol (PPP).
- *Chapter 4, Frame Relay* describes the router's implementation of Frame Relay, and how to configure the router's Frame Relay interfaces.
- *Chapter 5, Integrated Services Digital Network (ISDN)* describes the ISDN service provided by the router, and how to configure ISDN interfaces.
- *Chapter 6, X.25* describes how to configure the router's implementation of the ITU-T Recommendation X.25 protocol, and how to build an X.25 Packet Switched Network. **(This feature is NOT SUPPORTED.)**
- *Chapter 7, Synchronous Tunnelling* describes the router's mechanism for tunnelling synchronous data through a TCP/IP network. **(This feature is NOT SUPPORTED.)**
- *Chapter 8, Internet Protocol (IP)* describes the router's implementation of the Internet Protocol (IP).
- *Chapter 9, Novell IPX* describes the router's implementation of Novell's IPX protocol.
- *Chapter 10, DECnet* describes the router's implementation of Digital Equipment Corporation's DECnet Phase IV+ protocol. **(This feature is NOT SUPPORTED.)**
- *Chapter 11, Terminal Server* describes the terminal services provided by the router, and the router's implementation of the Internet Telnet protocol.
- *Chapter 12, Printer Server* describes the network printing services provided by the router, including LPD, stream printing and permanent assignments. **(This feature is NOT SUPPORTED.)**
- *Chapter 13, Open Shortest Path First (OSPF)* describes the router implementation of the Open Shortest Path First (OSPF) routing protocol. **(This feature is SUPPORTED on AR720 ONLY.)**
- *Chapter 14, Bridging* describes the router's implementation of the IEEE 802.1D-1990 standard for MAC bridges and remote bridging.
- *Chapter 15, Compression and Encryption* describes the data compression and encryption facilities provided by the router.
- *Chapter 16, Test Facility* describes the facilities built into the router for testing the router's interfaces, and how to execute and interpret the tests.
- *Chapter 17, Network Time Protocol (NTP)* describes the router implementation of the Network Time Protocol (NTP).
- *Chapter 18, Asynchronous Call Control* describes the router's facilities for managing dial-in connections or interconnecting routers using the asynchronous ports. **(This feature is SUPPORTED on AR720 ONLY.)**
- *Chapter 19, Generic Routing Encapsulation (GRE)* describes the router implementation of the Generic Routing Encapsulation (GRE) protocol to connect private IP networks via public internets.

- *Chapter 20, Trigger Facility* describes the router's trigger facility for automated and timed execution of management commands in response to events.
- *Chapter 21, AppleTalk* describes the router's implementation of Apple Computer Inc.'s AppleTalk protocol.
- *Chapter 22, Time Division Multiplexing (TDM)* describes the router's implementation of time division multiplexing over G.703 links.
- *Chapter 23, Logging Facility* describes the router's advanced logging facility and how to configure the logging facility to provide flexible monitoring of the router's activities.
- *Chapter 24, Scripting* describes the router's scripting facility for creating, storing and executing sequences of commands.
- *Chapter 25, Telephony Services* describes the router's comprehensive PBX services for models fitted with both analogue voice and ISDN interfaces. **(This feature is SUPPORTED on AR300 ONLY. Is is NOT SUPPORTED on AR300L.)**
- *Chapter 26, Dynamic Host Configuration Protocol (DHCP)* describes the router's implementation of the Dynamic Host Configuration Protocol.
- *Chapter 27, Layer Two Tunnelling Protocol (L2TP)* describes the router's implementation of the Layer Two Tunnelling Protocol.
- *Chapter 28, Simple Network Management Protocol (SNMP)* describes the router's implementation of the Simple Network Management Protocol.
- *Chapter 29, Transaction Packet Assembler Disassembler (TPAD)* describes the router's method of exchanging credit card transaction information between a transaction terminal or back office server and a credit card authorisation service. **(This feature is NOT SUPPORTED.)**
- *Chapter 30, Resource Reservation Protocol (RSVP)* describes the router's implementation of the Resource Reservation Protocol, which allows receivers of traffic flow to reserve resources for the flow.
- *Chapter 31, Firewall* describes the router's packet filtering firewall using stateful inspection. **(This feature is SUPPORTED on AR720 ONLY.)**
- *Chapter 32, Secure Shell* describes the router's implementation of the Secure Shell protocol for secure remote management.
- *Appendix A, Messages* provides a complete listing of all the informational, warning and error messages generated by the router.
- *Appendix B, Reference Tables* provides reference tables of identifiers and return codes for a range of router functions and network services.
- *Appendix C, SNMP MIBs* is a complete reference to all MIBs and MIB objects supported by the router's SNMP agent, including the Enterprise MIB.
- *Glossary* contains definitions of terms and concepts used throughout this manual.

Other Documents

Supported Standards and Protocols

Table I on page xli lists the protocols and standards supported by the router and the references where these protocols and standards are defined.

Table I: Protocols and standards supported by the router.

Protocol/standard	Reference
AppleTalk	" <i>Inside AppleTalk</i> ", Second Edition, 1990; Gursharan S. Sidhu, Richard F. Andrews, Alan B. Oppenheimer; Apple Computer Inc., Addison-Wesley Publishing Company, Reading, Massachusetts. ISBN 0-201-55021-0.
ARP	RFCs 826, 925.
Assigned Numbers	RFC 1700.
Bridging	IEEE 802.1D-1990
DHCP	RFCs 1541, 1542.
Encryption	FIPS PUB 46; ISO DEA-1; ANSI X3.92.
GRE	RFCs 1701, 1702.
Frame Relay	ANSI T1S1; RFCs 1294, 1490.
ICMP	RFCs 792, 950.
IEEE 802.2	ANSI/IEEE Std 802.2-1985.
IEEE 802.3	ANSI/IEEE Std 802.3-1985, 802.3a, b, c, e-1988.
Inverse ARP	RFC 1293.
IP	RFCs 791, 821, 950, 951, 1009, 1055, 1122, 1144, 1349, 1542, 1812, 1858.
IP addressing	RFC 1597.
IP Security	RFCs 1825–1829.
IPX	" <i>IPX Router Specification</i> ", v1.2, Novell, Inc., Part Number 107-000029-001. RFC 1582.
ISDN	ANSI T1.231-1997, ANSI T1.403-1995, ANSI T1.408-1990, AT&T TR 54016-1989, Austel TS 013.1:1990, Bellcore SR-3887 1997, TS 013.2:1990, TS 014.1:1990, TS 014.2:1990; ITU G.703, ITU G.704, ITU G.706, ITU-T Recommendations G.703 (1972), ITU-T Recommendation Q.922, G.794 (1988), G.706 (1988), I.120 (1988), I.121 (1988), I.411 (1988), I.430 (1988), I.431 (1988), Q.920 (1988), Q.921 (1988), Q.930 (1988), Q.931 (1988); ETSI Specifications ETS 300 011:1991, ETS 300 012:1992, ETS 300 102-1:1990, ETS 300 1022:1990, ETS 300 125:1991, ETS 300 153:1992, ETS 300 156:1992; New Zealand Telecom TNA 134; German Monopol (BAPT 221); Japan NTT I.430-a, Rockwell Bt8370 Fully Intergrated T1/E1 Framer and Line Interface data sheet, Technical Reference of Frame Relay Interface, Ver. 1, November 1993, Nippon Telegraph and Telephone Corporation.
NAT	RFC 1631.
NTP	RFCs 958, 1305, 1510.

Table I: Protocols and standards supported by the router. (Continued)

Protocol/standard	Reference
OSPF	RFCs 1245–1247, 1583, 1586.
Point-to-Point Protocol	RFCs 1331–1334, 1376, 1378, 1548, 1549, 1552, 1570, 1638, 1661, 1662, 1762, 1962, 1968, 1974, 1978, 1990, 2125.
Reverse ARP	RFC 903.
Proxy ARP	RFC 1027.
RADIUS	RFCs 2138, 2139.
RIP	RFCs 1058, 1388.
RSVP	RFCs 1112, 1812, 2205, 2211.
SNMP, MIBs	RFCs 1155, 1157, 1213, 1239, 1315, 1398, 1493, 1514, 1573, 2233.
SSH	The SSH (Secure Shell) Remote Login Protocol, T. Ylonen, 15 November 1995.
TACACS	RFC 1492.
TCP	RFC 793.
Telnet	RFCs 854–858, 932 1091.
TFTP	RFC 1350.
UDP	RFC 768.
Van Jacobson's compression	RFC 1144.

Obtaining Copies of Internet Protocols and Standards

The Internet Protocols are defined in *Requests For Comments* (RFCs). RFCs are developed and published under the auspices of the *Internet Engineering Steering Group* (IESG) of the *Internet Engineering Task Force* (IETF). For more information about the IESG and IETF, visit the IETF web site at <http://www.ietf.org/>. For more information about RFCs and Internet Drafts (the starting point for RFCs), visit the RFC Editor web site at <http://www.rfc-editor.org/>. This site has information about the RFC standards process, archives of RFCs and current Internet Drafts, links to RFC indexes and search engines, and a list of other RFC repositories.

RFCs can be obtained electronically from many RFC repositories, mail servers, World Wide Web (WWW), Gopher or WAIS sites. A good starting point for finding the nearest RFC repository is to point your Web browser at <http://www.isi.edu/in-notes/rfc-retrieval.txt>.

To obtain a copy of an RFC using FTP, FTP to the host and login as user `anonymous`, and a password of either `guest` or your email address. The FTP server will usually prompt you for one or the other. Use the `get` command to retrieve the desired RFC. Most sites have a file, usually `rfc-index.txt`, which lists the titles and file names of all available RFCs. Most sites have a file, usually `rfc-retrieval.txt`, which gives detailed information about RFC repositories and how to retrieve RFCs via FTP, mail servers, WWW, Gopher and WAIS.

To learn how to obtain a copy of an RFC via email from a mail server, point your browser at <http://www.isi.edu/in-notes/rfc-editor/rfc-info>.

To obtain a copy of an RFC from a Web site, or to search RFC repositories for a specific RFC or all RFCs relating to a topic, point your Web browser at <http://www.rfc-editor.org/rfc.html>.

Background Reading

For an introduction to the Internet Protocols refer to:

DDN Protocol Handbook, Elizabeth J. Feinler, 1991, DDN Network Information Center, SRI International, 333 Ravenswood Avenue, Menlo Park, CA 94025, USA. Email: nic@nic.ddn.mil.

Internetworking with TCP/IP — Volume I: Principles, protocols and architecture (2nd Edition), Douglas E. Comer, 1991, Prentice-Hall International, Inc., New Jersey. ISBN 0-13-474321-0.

Internetworking with TCP/IP — Volume II: Design, implementation, and internals, Douglas E. Comer and David L. Stevens, 1991, Prentice-Hall International, Inc., New Jersey. ISBN 0-13-472242-6.

Internetworking with TCP/IP — Volume III: Client-server programming and applications, Douglas E. Comer and David L. Stevens, 1993, Prentice-Hall International, Inc., New Jersey. ISBN 0-13-474222-2.

For a description of layered protocols refer to:

Computer networks (2nd Edition), Andrew S. Tanenbaum, 1989, Prentice-Hall International, Inc., New Jersey. ISBN 0-13-162959-0.

For a guide to Novell®'s IPX and SPX protocols, refer to:

IPX Router Specification, Document Version 1.2, Part Number 107000029001.

Novell's Guide to NetWare LAN Analysis (Second Edition), L. A. Chappell and D. E. Hakes, 1994. Novell Press. ISBN 0-7821-1362-1.

For a description of Apple Computer Inc's AppleTalk protocols, refer to:

AppleTalk® Network System Overview, Apple Computer, Inc., 1989, Addison-Wesley Publishing Company, Reading, Massachusetts. ISBN 0201517604.

Inside AppleTalk®, Second Edition, 1990. Gursharan S. Sidhu, Richard F. Andrews, Alan B. Oppenheimer, Apple Computer, Inc. Addison-Wesley Publishing Company, Reading, Massachusetts. ISBN 0-201-55021-0.

For an introduction to network management refer to:

The simple book — An introduction to management of TCP/IP-based Internets, Marshall T. Rose, 1991, Prentice-Hall International, Inc. ISBN 013812611-9.

For an introduction to firewalls and internet security refer to:

Firewalls and Internet Security — Repelling the Wily Hacker, William R. Cheswick and Steven M. Bellovin, Addison-Wesley Publishing Company, Reading, Massachusetts. ISBN 0-201-63357-4.

These books are listed for your convenience. It does not mean that these books are recommended over others on the same subject.

Conventions

A number of symbols, typographic and stylist conventions are used throughout this manual to aid learning and make information easier to find (Table II on page xlv).

Table II: Typographic conventions used in this manual.

This typeface	Is used for
<i>Italic</i>	Referring to another section in this manual or another manual, or to introduce and emphasise new terms. For example, "See <i>Chapter 2, Configuration</i> ".
Monospace	Text as it appears on-screen, or anything you must type.
0xFF	Numbers starting with the 0x prefix are hexadecimal values.
[Key]	A key on your keyboard. For example, "at the prompt, type a command and press [Enter]. Example key names include [Shift], [Alt], [Ctrl] and [Backspace].
[Key/Key]	A pair of keys on your keyboard that should be pressed together. For example, [Ctrl/P] means "press and hold down the [Ctrl] key, and while holding down the [Ctrl] key, press and release the [P] key, then release the [Ctrl] key".
[Key,Key]	A sequence of keys that should be pressed in sequence. For example, [Break,T] means "press and release the [Break] key, then press and release the [T] key". The [Key/Key] and [Key,Key] symbols may be combined, as in [Ctrl/P,T], which means "press and hold down the [Ctrl] key, and while holding down the [Ctrl] key, press and release the [P] key, release the [Ctrl] key, then press and release the [T] key".
<i>Attention</i>	A special keystroke known as the attention character, which will be either [Break] or [Ctrl/P].



Note. A note like this presents additional information or interesting sidelights.



Warning. A warning alerts you to situations in which you could do something that might result in a loss of data, or cause damage to the equipment.

Screen views show examples of the output resulting from particular commands, or what the screen should look like at a particular time, for instance:

```
Configuration for ETH instance 0:
```

Module	Protocol	Format	Discrim	MAC address
IPG	IP	Ethernet	0800	0000cd000027
IPG	ARP	Ethernet	0806	0000cd000027
IPX	Novell	Novell	-	0000cd000027
DNT	DECnet	Ethernet	6003	aa0004003908
Bridging	LAT	Ethernet	6004	-
Bridging	EtherTalk	SNAP	00000080f3	-

Commands are described under *Command Reference* within the section to which they apply. Each command is described in the following format:

Command name

The syntax of the command

What the command does, and what each of the parameters mean

Examples show how the command is used

References to related commands

Internet Protocol (IP)		DELETE IP RIP	8-73
		DELETE IP RIP	
	Syntax	DELETE IP RIP INTERFACE= <i>interface</i> [CIRCUIT= <i>miox-circuit</i>] [DLCI= <i>dldci</i>] [IP= <i>ipadd</i>]	
		where:	
		<ul style="list-style-type: none"> ■ <i>interface</i> is an interface name formed by concatenating a layer 2 interface type, an interface instance, and optionally a hyphen followed by a logical interface number in the range 0 to 3 (e.g. eth0, ppp1-1). If a logical interface is not specified, 0 is assumed (i.e. 'eth0' is equivalent to 'eth0-0'). ■ <i>miox-circuit</i> is the name of a MIOX circuit defined for an X.25 interface, 1 to 15 characters in length. The name is not case-sensitive. ■ <i>dldci</i> is the Data Link Connection Identifier (DLCI) of a Frame Relay DLC (circuit), in the range 0 to 1023. ■ <i>ipadd</i> is an IP address in dotted decimal notation. 	
	Description	<p>This command deletes a RIP neighbour. Use this command to stop sending and/or receiving RIP to and/or from a RIP neighbour.</p> <p>The INTERFACE parameter specifies the interface via which RIP packets are received from the RIP neighbour.</p> <p>The CIRCUIT parameter specifies the X.25 circuit on which to send or receive RIP packets. It is a required parameter for X25T interfaces and is valid only when the interface is an X25T interface.</p> <p>The DLCI parameter specifies the Frame Relay DLC on which to send or receive RIP packets. It is a required parameter for Frame Relay interfaces and is valid only when the interface is a Frame Relay interface.</p> <p>The IP parameter specifies the IP address of the neighbour to delete.</p>	
	Examples	<p>To delete a neighbour that is broadcasting RIP on an Ethernet interface, use the command:</p> <pre>DELETE IP RIP INTERFACE=eth0</pre> <p>To delete a neighbour that is sending to a specific IP address on a PPP interface, use the command:</p> <pre>DELETE IP RIP INTERFACE=ppp0 IP=172.16.248.33</pre>	
	See Also	<p>ADD IP EGP ADD IP RIP DELETE IP EGP DISABLE IP EGP DISABLE IP EGP EXPORTTRIP ENABLE IP EGP ENABLE IP EGP EXPORTTRIP SET IP RIP SHOW IP SHOW I RIP</p>	
Software Release 1.7.2 J613-M0274-00 Rev.B			

Command syntax is defined using these conventions:

This	Is used for
CAPS	Keywords to be typed as shown. In general keywords may be abbreviated to the shortest string that is unambiguous within the current context. The exception is commands with a profound effect, such as RESTART IMMEDIATELY, which must be typed in full.
<i>italic</i>	A variable placeholder, to be replaced by an actual value in a command.
[]	Square brackets enclose optional items. Enter the item or items required, but do not type the brackets.
	Vertical bars separate choices in a list — choose one of the items.
...	Ellipses indicate that the preceding element may be repeated any number of times.
{ }	Braces surround a required choice of options; you must choose one of the options listed.
n..m	Defines a range of values from n to m inclusive. n and m are decimal numbers.
<i>interface</i>	An interface type — one of: <ul style="list-style-type: none"> ETHn for Ethernet interfaces SYNn for Synchronous interfaces PORTn for Asynchronous interfaces BRIn for Basic Rate ISDN interfaces PRIn for Primary Rate ISDN interfaces PPIn for Point-to-Point interfaces FRn for Frame Relay interfaces LAPBn for LAPB interfaces LAPDn for LAPD interfaces X25Tn for X.25 DTE interfaces SLIPn for SLIP interfaces n when defining one of the above interface types. n is a non-negative, zero-based decimal number.
<i>ipadd</i>	An IP address in dotted decimal form (e.g. 131.203.9.197). In some situations an address in domain name format.
<i>macadd</i>	A hardware address (such as an Ethernet address) of the form xxxxxxxxxxxx, where xx is a two-digit hexadecimal number with leading zeros if necessary.

Unsupported Features

Some of the features described in this manual are not supported on all the models of AR300/AR700 series routers. Chapters on these unsupported features have a notice in header on all pages, such as “UNSUPPORTED” or “SUPPORTED ON AR720 ONLY”.

