AirLink Pro
T1/E1 Rack Mount

I n s t a l l e r ' s   G u i d e

CYLINK®

PRODUCT COMPATIBILITY

While every effort has been made to verify operation of this product with many different communications products and networks, Cylink Corporation makes no claim of compatibility between its products and other vendors' equipment. It is assumed that users have thoroughly evaluated this product's performance in the communications environment in which it will be used.

SAFETY

The following general safety precautions must be observed during all phases of operation and service of this product. Failure to comply with these precautions or with specific warnings elsewhere in this Manual willfully violates standards of design, manufacture, and intended use of the product. Cylink Corporation assumes no liability for the customer's failure to comply with these requirements.

This product must be grounded. In the event of a short circuit, grounding reduces the risk of electrical shock by providing an escape wire for the current.

Do not install or operate this product in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

No user maintained or adjustable components are present within this product. The covers should not be removed by anyone other than authorized Cylink service personnel. The potential for electrical shock exists within the enclosure at all times unless it is unplugged.

Do not install substitute parts or perform any unauthorized modification to the AirLink Pro T1or E1. Return the product to Cylink Corporation for service and repair to ensure that safety features are maintained. Prior to returning any product(s) for repair, contact Cylink at the telephone numbers or address located on the front of this Manual, and obtain a Return Material Authorization (RMA) number.

Changes or modifications not expressly approved by Cylink Corporation can void the user's authority to operate the equipment.

LITHIUM BATTERY

The digital module in the AirLink Pro T1/E1 Rack Mount contains a lithium battery molded into the real-time clock component. The lithium battery is NOT a customer-replaceable part. The lithium battery could explode if mistreated. Do not attempt to expose the battery by opening the real-time clock component. Do not attempt to recharge the battery. Do not dispose of the component by fire.

SYSTEM GROUNDING

Direct grounding of the antenna, mast, and tower serves as protection from lightning strikes and static buildup. A direct electrical connection should be made to a suitable grounding rod at the base of the tower or mast using at least #10 AWG ground wire, or its equivalent, and non corrosive hardware. For details and safety standards, consult the appropriate local Electrical Codes or a similar document. Use lightning arresters in appropriate places.

TOWER CONSTRUCTION

Compliance with local zoning and tower construction regulations is recommended when AirLink Pro T1/E1 Rack Mount systems require a tower. These regulations generally mandate that permits be obtained before any tower construction begins. Check with local zoning and aviation authorities for more information.

FCC NOTICE TO USERS

The Airlink Pro T1 complies with Part 15 of the FCC rules. Operation is subject to the condition that this device does not cause harmful interference.

Federal Communications Commission (FCC) Rules on spread spectrum devices, such as the AirLink Pro T1 or E1, require that you be notified of the following:

FCC regulations require that this device be professionally installed by a person knowledgeable in electronics and trained in the correct installation of this device.

All interface cables must be shielded.

Operation of this device is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference that may cause undesired operation.

Changes or modifications not expressly approved by Cylink Corporation can void the user's authority to operate the equipment.

STATEMENT OF WARRANTY

CYLINK products, except as stated otherwise in an applicable price list, are warranted against defects in workmanship and material for a period of one (1) year from date of delivery as evidenced by CYLINK's packing slip or other transportation receipt.

CYLINK's sole responsibility under this warranty shall be to either repair or replace, at its option, any component which fails during the applicable warranty period because of a defect in workmanship and material, provided PURCHASER has promptly reported same to CYLINK in writing. All replaced Products or parts shall become Cylink's property.

CYLINK shall honor the warranty at CYLINK's repair facility in Sunnyvale, California. It is PURCHASER's responsibility to return, at its expense, the allegedly defective Product to CYLINK. PURCHASER must obtain a Return Materials Authorization (RMA) number and shipping instructions from CYLINK prior to returning any Product under warranty. Transportation charges for the return of the Product to PURCHASER shall be paid by CYLINK within the United States. For all other locations, the warranty excludes all costs of shipping, customs clearance and other related charges. If CYLINK determines that the Product is not defective within the terms of the warranty, PURCHASER shall pay CYLINK all costs of handling, transportation and repairs at the then prevailing repair rates.

All the above warranties are contingent upon proper use of the Product. These warranties will not apply (i) if adjustment, repair or parts replacement is required because of accident, unusual physical, electrical or electromagnetic stress, negligence of PURCHASER, misuse, failure of electric power environmental controls, transportation, not maintained in accordance with CYLINK specifications, or abuses other than ordinary use (ii) if the Product has been modified by PURCHASER or has been repaired or altered outside CYLINK's factory, unless CYLINK specifically authorizes such repairs or alterations; (iii) where CYLINK serial numbers, warranty data or quality assurance decals have been removed or altered.

CYLINK also reserves the right to make product improvements without incurring any obligation or liability to make the same changes in Products previously manufactured or purchased. In no event shall CYLINK be liable for any breach of warranty in an amount exceeding the net selling price of any defective Product. No person, including any dealer, agent or representative of CYLINK is authorized to assume for CYLINK any other liability on its behalf except as set forth herein. Nonpayment of any invoice rendered within the stated payment terms automatically cancels any warranty or guarantee stated or implied. If any payment is due CYLINK for services performed hereunder, it shall be subject to the same payment terms as the original purchase.

CYLINK HEREBY DISCLAIMS ALL IMPLIED WARRANTIES ON PRODUCTS INCLUDING WITHOUT LIMITATION, ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. The warranties expressly stated herein are the sole obligation or liability on the part of CYLINK arising out of or in connection with the sale or performance of the products.

Products Manufactured by Others - For products not manufactured by CYLINK the original manufacturer's warranty shall be assigned to PURCHASER to the extent permitted and is in lieu of any other warranty, express or implied. For warranty information on a specific product, a written request should be made to CYLINK.

IN NO EVENT WILL CYLINK BE LIABLE TO PURCHASER FOR (i) REPROCUREMENT COSTS; (ii) SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES; (iii) ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT, OR THE USE OF PERFORMANCE OF CYLINK PRODUCTS, REGARDLESS OF WHETHER THE CAUSE OF ACTION IS IN CONTRACT, TORT, INCLUDING NEGLIGENCE, OR ANY OTHER FORM.

No action, whether in contract or tort, including negligence, arising out of or in connection with this Agreement, may be brought by either party more than eighteen (18) months after the cause of action has accrued, except that an action for nonpayment may be brought within eighteen (18) months of the date of last payment.

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PREFACE
About This Guide

The *AirLink Pro T1/E1 Rack Mount Installer's Guide* covers the information needed to unpack, install, configure, and operate the AirLink Pro T1 or the Airlink Pro E1 system. Begin by reading this preface for more information about how this guide supports your use of the AirLink Pro T1/E1 Rack Mount system.

Inside this chapter:

Who Should Read This Manual

This is an installation guide for persons who must perform or coordinate the tasks associated with unpacking and installing the AirLink Pro T1/E1 Rack Mount.

Prerequisite Knowledge

Throughout this guide are explanations and procedures that presume working familiarity with basic telephone trunking and transmission concepts and practices, as well as basic digital data communications concepts and practices. If you are not familiar with the concepts and practices involved in these disciplines, we recommend that you familiarize yourself with them before proceeding.

Also, this guide does not attempt to provide any detailed system planning or installation information on radio frequency (RF) antenna assemblies or Path analysis . For details about these topics, please refer to the *Airlink Applications and Site Planning Guide*.

Guide Organization

Each of the chapters and appendices in this guide begins by introducing the contents of that chapter or appendix. Before beginning the installation process, you should read the introductions to all of the guide portions so that you have a sense of what each portion provides.

When you come to a procedure, you should skim through the entire procedure before you begin performing the step-by-step instructions. By doing this, you will know what is coming, and will be prepared with the appropriate information, equipment, or tools.

The information in this guide is organized according to the sequence of tasks necessary to plan for unpacking, installing, and configuring, as well as operating and maintaining the AirLink Pro T1/E1 Rack Mount system.

NOTE   The Airlink Pro T1 and the Airlink Pro E1 are similar radio units. The installation, system administration, and the operational procedures for the two units have therefore been combined into this manual. The minor differences between the two units are indicated wherever necessary.

The guide is divided into the following sections:

Guide Section	Description
Chapter 1: Product Description	Describes the features and capabilities of the AirLink Pro T1/E1 system.
Chapter 2: Installation and SystemAdministration	Outlines the procedures for unpacking and installing the AirLink Pro T1/E1 Rack Mount system hardware, connecting the antenna, and performing initial operation checks.
Chapter 3: Configuring the AirLink Pro T1/E1 Rack Mount	Provides instructions for configuring the AirLink Pro T1/E1.
Chapter 4: Operations and Maintenance	Contains information on the operation and maintenance of the AirLink Pro T1/E1 system.
Appendix A: Messages	Lists the system alarm, status, and error messages.
Appendix B: Specifications	Contains a quick reference to the AirLink Pro T1/E1 Rack Mount system specifications.
Appendix C: Commands	Provides a list of frequently used commands.
Appendix D: Glossary	Provides definitions for the terms commonly used throughout this guide.
Index	Provides a quick reference to assist you in locating important topics in the guide.

Guide Conventions

The procedures and instructions in this guide use the following conventions:

▌ Typography that highlights information within text, including screen displays, figures, and tables.

▌ Keyboard usage conventions.

▌ Notes that add information, point to other important considerations, or alert you to possible risks to yourself, your equipment, or your data.

Typographic Conventions

❚ Terminal displays are shown as text in the Courier font:

```
AIRLINK PRO T1> get configuration
Site Name:        Sunnyvale 2

Application:      6. Slave unit in a point-to-point Link
Burst Mode:       Normal
Coding:           B8ZS
Equalization:     0 - 133 ft
PN Code:          1
RF Power:         10 dBm

Alarm Reporting:  Immediate
Alarm Level:      Status
Date/Time:        May 1 1996 10:35:00
```

❚ **Bold Courier font** indicates a command keyword or operand that you are expected to type exactly as shown.

❚ *Italic Courier font* indicates a command operand that you must replace with a selected value when you type the command.

❚ Named keys in text are shown enclosed in angle brackets. The notation <Return> is used to indicate either the Return key or the Enter key.

Keyboard Usage

❚ All command examples shown in text are executed by typing the command and then pressing <Return>.

❚ Two or more keys that must be pressed simultaneously are shown in text linked with a plus (+) sign: <Ctrl>+C.

Notes, Cautions, and Warnings

NOTE	The standard text note highlights important or additional information for you to consider.

CAUTION	These notes warn you of situations that could result in damage to your equipment or loss of data if you do not heed the instructions.

WARNING	These notes warn you of situations that could endanger your personal health if you do not heed the instructions.

Customer Support

If after reading this guide you encounter any trouble installing or using the AirLink Pro T1/E1 Rack Mount, please contact your local distributor. If problems are not resolved, you can call Cylink's Customer Service for assistance. The telephone numbers are:

Domestic (USA)

1-800-545-6608	Sunnyvale, CA
1-800-814-5587	Jersey City, NJ

International

1-408-735-5822	Sunnyvale, CA
1-201-333-3400	Jersey City, NJ
+65-297-6196	Singapore
+44-1256-841919	United Kingdom
+91-11-301-0090	India
+92-21-215-7264	Pakistan

Domestic and International Customer Service Fax

1-408-735-6641	Sunnyvale, CA
1-201-333-8560	Jersey City, NJ
+65-297-6195	Singapore
+44-1256-24156	United Kingdom
+91-11-379-3584	India
+92-21-587-0065	Pakistan

You can also contact Cylink's Tech Support through the Internet at the following address:

support@cylink.com

If you need to return equipment, call Customer Service to obtain a Return Material Authorization (RMA) number prior to returning the equipment. The RMA number must be placed on the outside of the shipping carton. Please be prepared to provide the unit serial number, software version, and a detailed description of the problem.

Return all equipment to:

Cylink Corporation
1350 Bordeaux Drive
Sunnyvale, CA 94089

Attn: Repair and Return Department
RMA No: xxxxxxxxxx

Reader Response

Cylink's Technical Publications Department wants its documents to meet your requirements. To this end, your ideas about the documentation are valuable. After you have had a chance to read and use the guide, we encourage you to submit your comments to

Manager, Technical Publications
Cylink Corporation
910 Hermosa Court
Sunnyvale, CA 94086

You may also submit your comments through the Internet at the following address:

techpubs@cylink.com

Cylink may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligations whatsoever.

CHAPTER 1
Product Description

This chapter introduces the AirLink Pro T1/E1 Rack Mount and provides an overview of the features and capabilities.

Inside this chapter:

Introduction to the AirLink Pro T1/E1 Rack Mount

The AirLink Pro T1 and the AirLink Pro E1 systems are spread-spectrum transceivers that operate in the license-free 5.725 to 5.850 GHz (C-band) Industrial Scientific Medical (ISM) band. The AirLink Pro T1/E1 Rack Mount uses a Spread Spectrum modulation technique to create a high-quality, point-to-point radio link between itself and another AirLink Pro T1/E1 Rack Mount located many miles away.

The AirLink Pro T1/E1 Rack Mount (Figure 1-1) unit is a rack mount unit that mounts in a 19 or 23 inch equipment rack or cabinet. The design of the unit can be aisle or flush mounted. Status and Alarm LEDs are duplicated on the unit's rear panel so that it can be flush mounted against a wall.
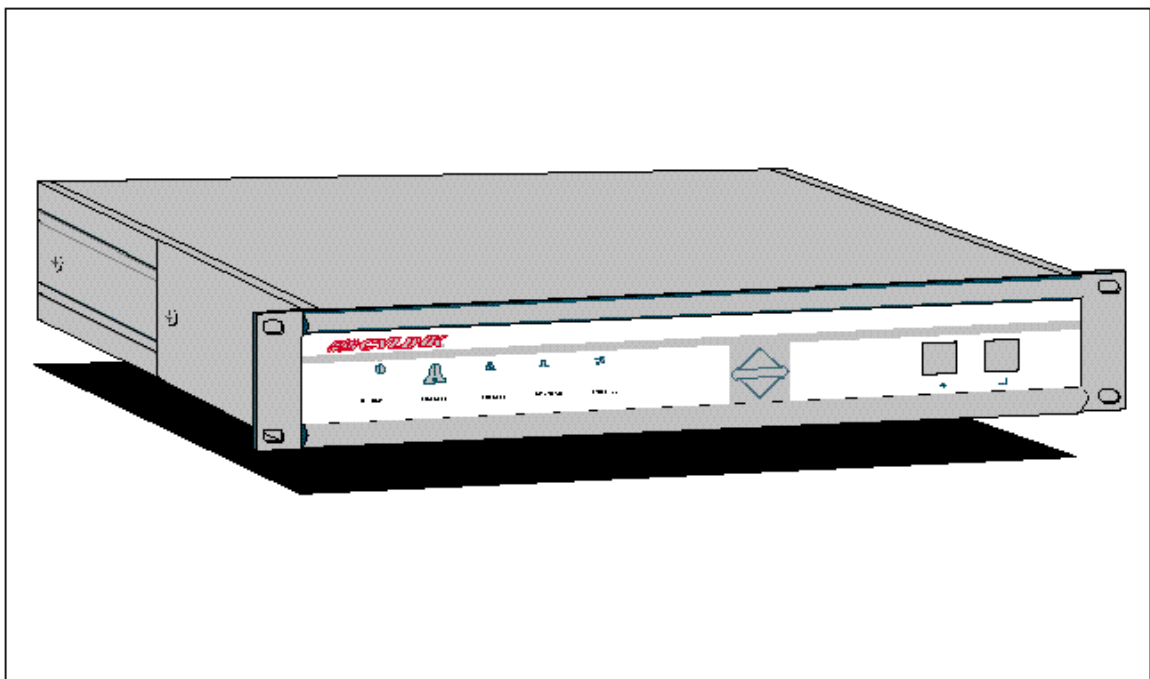
P2406-0496

Figure 1-1
AirLink Pro T1/E1 Rack Mount - Full View

Features and Capabilities

The AirLink Pro T1/E1 Rack Mount supports a range of sophisticated control capabilities and options, including:

❚ Remote control of far-end

❚ Built-In Testing Equipment (BITE)

❚ Flexible, interactive user interface through an ASCII terminal

❚ Easily modified configuration parameters

❚ Local and remote monitoring, diagnostic, and maintenance capabilities

❚ Separate end-to-end communication channel for control and order wire signals. Control signals and order wire voice signals do not disturb the T1 channel

❚ Every radio-frequency (RF) burst verified by an error-checking algorithm

The AirLink Pro T1 and E1 are similar radio units with minor differences in their internal structures. These are:

❚ The AirLink Pro T1 and E1 have different internal clock oscillators

❚ The AirLink Pro T1 supports the Bipolar with 8-Zero Substitution (B8ZS) coding format

❚ The AirLink Pro E1 supports the High Density Bipolar 3 (HDB3) coding format

❚ The AirLink Pro E1 allows an electrical-interface option between Balanced and Unbalanced

❚ The AirLink Pro T1 operates at 1.544 Mbps and the E1 at 2.048 Mbps

❚ The operating range between two AirLink Pro T1 units is up to 40 km and that of two E1 units is 35 km

In a typical installation, an AirLink Pro T1 or E1 pair is installed between a user's communication facility—Data Circuit Equipment (DCE) or network—and the Data Terminating Equipment (DTE). Figure 1-2 shows the AirLink Pro T1/E1 Rack Mount in a typical operating environment.
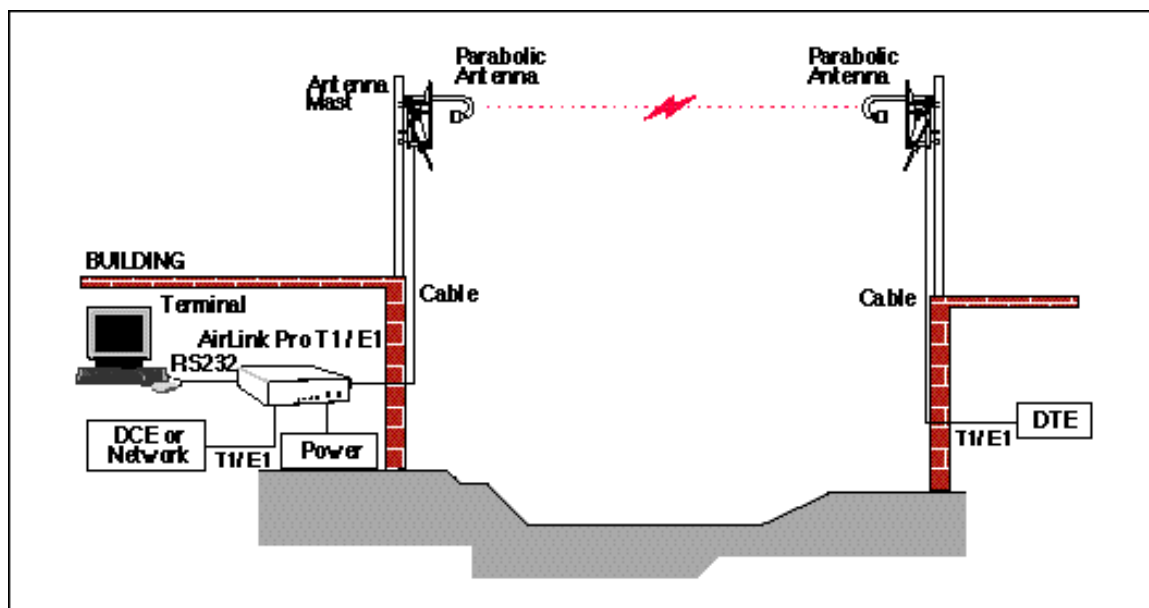
P2403-0496

Figure 1-2
Typical AirLink Pro T1/E1 Rack Mount Operating Environment

The AirLink Pro T1/E1 Rack Mount link is effectively transparent to the T1/E1 equipment on either end:

■   Accepts T1/E1 as input

■   Presents T1/E1 as output

AirLink Pro T1 operation is independent of the protocol used, so the AirLink Pro T1 supports both the Bipolar with Eight-Zero Substitution (B8ZS) and the Alternate Mark Inversion (AMI) coding formats. The AirLink Pro E1 supports both the High Density Bipolar 3 (HDB3, and AMI) coding formats. These formats do not interfere with the framing and maintenance channel used between T1/E1 links so the AirLink Pro T1/E1 Rack Mount works with Extended Frame format, ISDN Primary Rate Services, and so on.

The AirLink Pro T1/E1 Rack Mount provides full-duplex, radio-to-radio communication that follows a Ping-Pong analogy: while one unit transmits a radio burst, the other unit receives that burst. After the other unit receives a complete burst, it waits through a guard interval before turning on its transmitter and transmitting its burst.

The ping-pong radio-to-radio communication is invisible to the T1/E1 equipment on either end of the link because the digital buffering of the AirLink Pro T1/E1 Rack Mount produces a smooth T1/E1 bit stream at the user interface.

Buffering is only a few milliseconds, so no perceptable degradation occurs to voice or data communications.

AirLink Pro T1/E1 Rack Mount Antenna

The antenna is usually a two-foot or four-foot solid-parabolic dish for the 5.7 GHz C-band, with a narrow beam and high gain. For other kinds of antennas, contact your distributor.

The AirLink Pro T1/E1 Rack Mount ASCII Terminal User Interface

The AirLink Pro T1/E1 Rack Mount ASCII terminal user interface is an EIA/TIA-232 interface that allows a terminal device or personal computer to control and monitor AirLink Pro T1/E1 Rack Mount operation at either end of the link. The connection to the EIA/TIA-232 interface can be either a direct connection (device to port), or an indirect connection (device to modem to port) for dial-up operation.

Programmed Configuration Parameters

AirLink Pro T1/E1 Rack Mount operation is governed by user-selectable configuration and control parameters that reside in the non-volatile memory of the unit. These parameters are displayed and controlled through a terminal device that can access both the local and remote unit. When power is lost and then restored, the system reconfigures itself from its protected configuration database.

A long-life lithium battery protects all system configuration settings during power losses. The battery is part of the non-volatile memory/real-time clock circuitry on the digital module in the AirLink Pro T1 and has a 10-year storage life (in the absence of power to the AirLink Pro T1/E1 Rack Mount).

Refer to Chapter 3, *Configuration*, for more information on changing configuration parameter settings.

Monitoring and Diagnostic Capabilities

The AirLink Pro T1/E1 Rack Mount system constantly monitors the quality of the wireless link, checking the receive RF signal level, bit errors, and many other critical factors. This information is stored in an internal database of status and performance information that the AirLink Pro T1/E1 Rack Mount uses, in part, to derive the events that are stored in the event queue. As alarm events occur, they are signaled through indicators on the front panel of the

AirLink Pro T1/E1 Rack Mount and are entered in the event queue. To report alarms, attach a modem and dial-out to the maintenance center.

Using the terminal user interface, query either the local AirLink Pro T1/E1 Rack Mount or the remote AirLink Pro T1/E1 Rack Mount for status, performance and alarm information, and make configuration changes for either the local or remote end of the link.

The AirLink Pro T1/E1 Rack Mount also provides bit-error and loopback tests to isolate problems. Initiate tests in the local AirLink Pro T1/E1 Rack Mount or in the remote AirLink Pro T1/E1 Rack Mount through the terminal user interface.

Refer to Chapter 4, *Operations and Maintenance*, for information on monitoring operation and using diagnostic tools and procedures.

T1/E1 Link Backup Capability

The T1/E1 link backup capability built into the AirLink Pro T1/E1 Rack Mount enables an AirLink Pro T1/E1 Rack Mount pair to provide a parallel T1/E1 path (the RF link) to a standard T1/E1 line (see Figure 1-3).
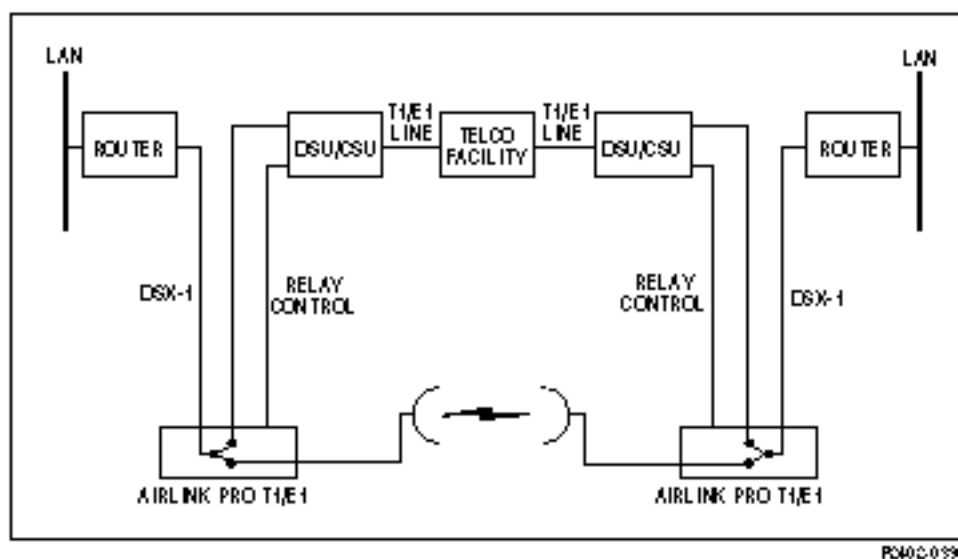
Figure 1-3
A Point-to-Point Backup Link

Under normal operating conditions, the primary (protected) T1/E1 line is routed to an external device such as a CSU through the AirLink Pro T1/E1 Rack Mount and carries its normal T1/E1 traffic.

In the event of a fault in the primary T1/E1 link, each DSU/CSU generates a relay control signal that is transmitted to the attached AirLink Pro T1/E1 Rack

Mount units. The AirLink Pro T1/E1 Rack Mount pair switch the protected T1/E1 line to provide a protected bypass T1/E1 path.

The backup switch can be opened or closed by an external switch or relay wired to the CSU SEL connector on the rear panel of the AirLink Pro T1/E1 Rack Mount.

Alarm Relay Contacts

Major and minor alarm contacts are built into the AirLink Pro T1/E1 Rack Mount. If an alarm occurs such that an entry is put into the event queue, the alarm contacts switch to the alarm state for as long as the alarm event persists. For more information on the AirLink Pro T1/E1 Rack Mount alarm relay contacts, refer to Chapter 2, *Installation and System Administration.*

Order Wire Interface

The Order Wire interface is an end-to-end voice communication channel that is carried on the radio link between the local and remote AirLink Pro T1/E1 Rack Mount units. Maintenance and service personnel can connect telephones to order wire ports on the local and remote AirLink Pro T1 units and have direct voice communication between the local and the remote site.

Order Wire communication can only occur when there is an active radio link between the local and remote AirLink Pro T1/E1 Rack Mount units (refer to Chapter 2, *Installation and System Administration*). The Order Wire channel is outside of the T1/E1 channel and does not affect the user's data. The Order Wire can also be used with 4-wire modems in a large network management system.

Fail-Safe Link

A reliable link can be created by eliminating all "single points of failure." This is illustrated in Figure 3-1 and discussed in detail in Chapter 3, *Point-to-Point Link*.

Block Diagram

The following illustration is a functional block diagram of the Cylink AirLink Pro T1/E1 Rack Mount.

Figure 1-4
Block Diagram of the AirLink Pro T1 / E1 Rack Mount

CHAPTER 2

Installation and System Administration

This chapter outlines general planning and the procedures for unpacking, and installing the AirLink Pro T1/E1 Rack Mount hardware, connecting cables, and performing power-up checks. This chapter also contains important instructions regarding safety in setting up the AirLink Pro T1/E1 Rack Mount system.

Inside this chapter:

Overview

This chapter discusses the general technical requirements of antenna and RF transmission line installation,and focuses on the task of installing the AirLink Pro T1/E1 Rack Mount system at each end of the communication link, integrating all of the equipment, and performing a system check and alignment before turning the system over to normal customer traffic.

The components of AirLink Pro T1/E1 Rack Mount system are:

∎ AirLink Pro T1/E1

∎ AirLink Pro T1/E1 Rack Mount antenna and antenna cable

Depending upon your system plan, you will be installing all or some of these AirLink Pro T1/E1 Rack Mount system components at each end of a link. The following sections describe both required and optional system components.

Unpacking

The first step in the installation process is to take all of the materials out of the shipping carton(s) and check that you have everything shown on the packing list(s). If something is missing, contact your local distributor. Inspect the unit for any possible damage.

If you discover shipping damage, repack the unit and notify the shipping representative.

NOTE Save the shipping cartons and packing materials. You will need the carton and materials if you need to ship your equipment.

After unpacking and confirming the contents of the shipment, place the AirLink Pro T1/E1 Rack Mount system components on a flat surface to allow enough space to work around them.

Identifying Physical Features
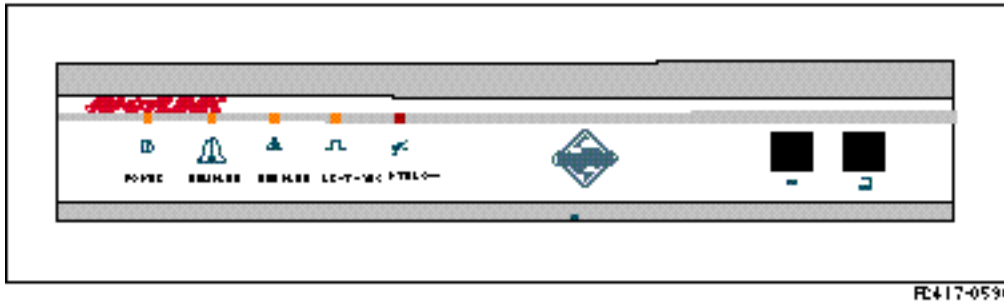
Figure 2-1
AirLink Pro T1/E1 Rack Mount Front Panel

Front Panel

The AirLink Pro T1/E1 Rack Mount front panel (Figure 2-1) consists of a metal panel that contains five status and alarm LEDs identified with graphical icons and two RJ-11 jacks.

Rear Panel

The AirLink Pro T1/E1 Rack Mount rear panel (Figure 2-2) consists of a metal panel containing four external equipment connectors, seven terminal blocks, and an n-type antenna connector. Table 2-1 lists the rear-panel connectors and describes their functions.
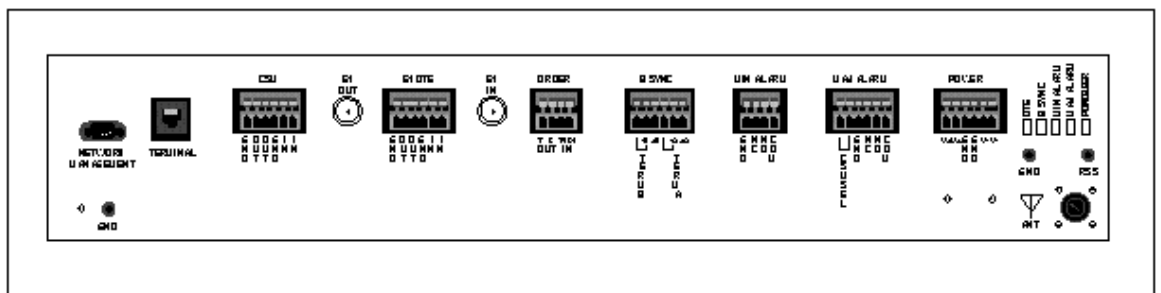
Figure 2-2
AirLink Pro T1/E1 Rack Mount Rear Panel

Table 2-1
AirLink Pro T1/E1 Rack Mount Rear-Panel Connectors

Connector	Type	Function
Network Management	9-Pin Male Subminiature D	Connects a modem to the AirLink Pro T1/E1.
Terminal	RJ - 11	Terminal connection
CSU	6-Pin Captive Wire Terminal Block	Connects the T1/E1 Line from an external device such as a CSU. Used for wire line backup only.
E1 Out	BNC	Not used for T1 unit; In E1 unit, used for configuring Unbalanced Interface option
DTE	4-Pin Captive Wire Terminal Block	T1/E1 connection to the DTE
E1 In	BNC	Not used for T1 unit; In E1 unit, used for Unbalanced Interface option
Order Wire	4-Pin Captive Wire Terminal Block	Connection for Four wire Order Wire unit
BSYNC	6 Pin Captive Wire Terminal Block	Burst sync connection
Minor Alarm	4-Pin Captive Wire Terminal Block	Minor alarm relay connection
Major Alarm	6-Pin CaptiveWire Terminal Block	Major alarm relay connection
Power	6-Pin Captive Wire Terminal Block	Power connection
Antenna	N type female	Antenna connection

Preparing a Place

Because of the special planning requirements associated with installing a microwave system, review some of the general guidelines regarding installation preparation to ensure that the site is suitable to the purpose.

General Physical and Environmental Characteristics

The AirLink Pro T1/E1 Rack Mount radio unit measures approximately 17 inches wide, 3 inches high, and 10 inches deep, and weighs approximately 10 pounds.

Lightning Protection

The AirLink Pro T1/E1 Rack Mount is provided with secondary protection on all signal leads to the printed circuit assemblies in the unit. If the AirLink Pro T1/E1 Rack Mount system is being installed in an area where lightning can be a problem, primary protection, such as gas tubes or spark gaps, is required (Cylink distributors can provide these).

Rack-Mounting

The AirLink Pro T1/E1 Rack Mount mounts indoors in a 19-inch or 23-inch equipment rack or cabinet. The rack-mount hardware kit, which consists of a pair of mounting brackets and all required fasteners, is included in the shipping carton with the AirLink Pro T1/E1 Rack Mount.

Power and Grounding Requirements

The AirLink Pro T1/E1 Rack Mount operates at 24VDC or 48VDC. Either the positive or negative input is connected to the ground, or left floating. External circuit protection not exceeding 2 amps is required.

Table 2-2
Power Requirements

Input Voltage	21 to 56 VDC
Input Power	25 Watts
Input Current	1.0 Amps @ 24 Volts 500 Ma @ 48 Volts
Input Polarity	Input is floating. Either input may be grounded
Input Protection	Nominal fuse = 2.0 A Slow Blow
Input Reverse Voltage Protection	Provided. Series diode. No current will flow if the input voltage is reversed.

NOTE	No internal fusing is provided, because to do so would violate the specifications of UL1459 section 70. (No fusing is allowed in the grounded side of a DC input circuit unless the hot side is also fused.) When the fuse in the hot side blows, the fuse in the grounded input must <u>also</u> blow. Since this equipment accepts either polarity, external circuit protection <u>must be</u> provided in the hot side of the feeder circuit.

Setting Up the System

The following sections outline the procedures for installing, cabling, and bringing up an AirLink Pro T1/E1 Rack Mount system. Some of the steps require special knowledge, experience, tools, and assistance from another person.

Installing the Antenna

Antennas are generally installed by persons who have the knowledge, experience, and tools to handle the somewhat specialized task. The following sections are intended as a general summary of the process, and not as a complete description. A successful antenna installation effort is the culmination of all the site and route preparation, and path analysis.

Typical Antenna Mounts

An antenna for a microwave system such as the AirLink Pro T1/E1 Rack Mount is typically equipped with mounting hardware that allows the antenna to attach to a length of pipe that can then be mounted in several ways, depending upon the user requirements, site conditions, and local building codes (see Figure 2-3).
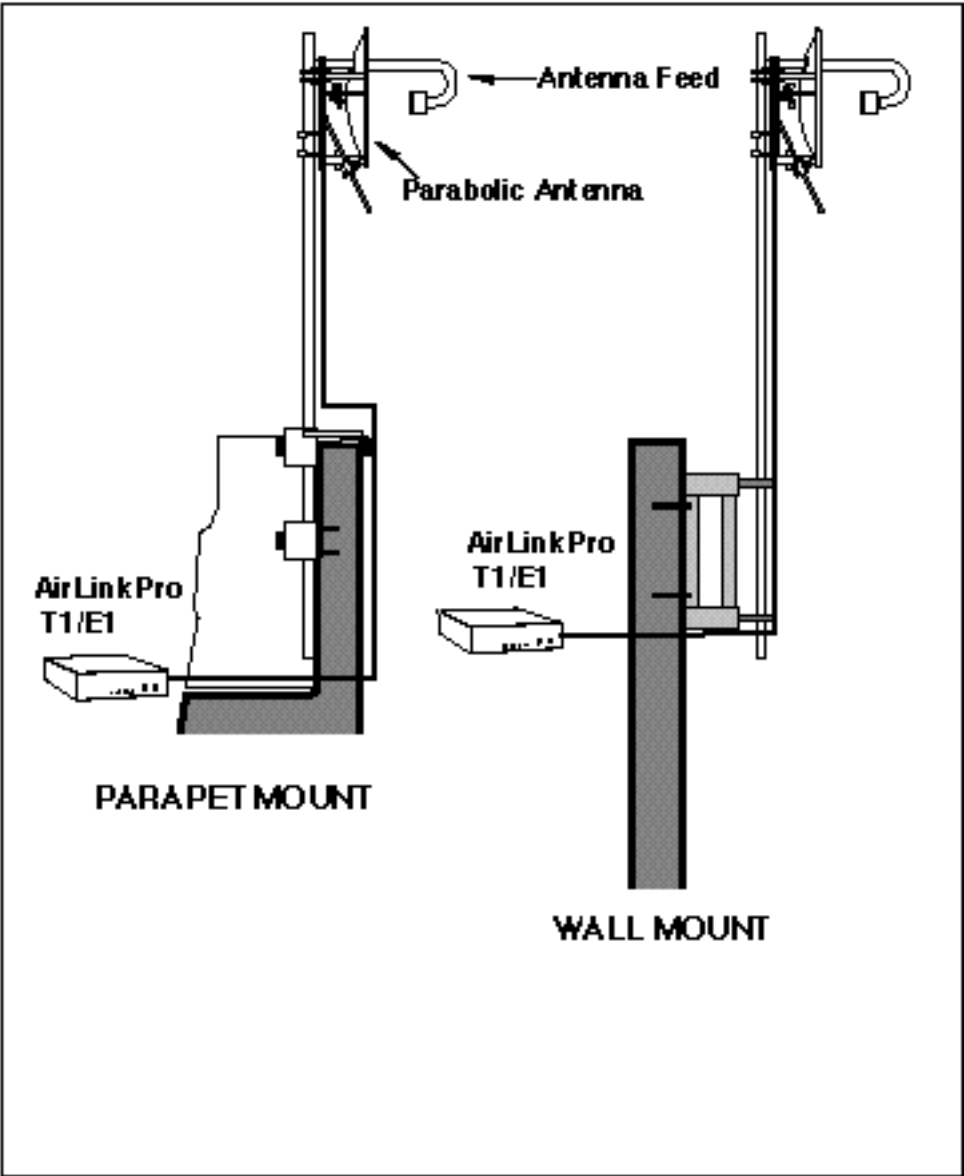
Figure 2-3
Typical Antenna Mounts

System Grounding

Direct grounding of the antenna, mast, and tower provides some protection against lightning strikes and static buildup. A direct electrical connection should be made to a suitable grounding rod at the base of the tower or mast using at least #10 AWG ground wire, or its equivalent, and non-corrosive hardware. For details and safety standards, consult the appropriate electrical code or a similar document. Use lightning arrestors in appropriate places.

Aligning the Antenna

In order for an AirLink Pro T1/E1 Rack Mount pair to operate correctly, the local antenna and the remote antenna must be aligned so that the signals from one antenna are aimed directly at the center of the other antenna. Correct antenna alignment maximizes the signal received at both ends of the radio link. An outline of the antenna alignment procedure is at the end of this chapter.

Installing the AirLink Pro T1/E1 Rack Mount

The following illustration shows how to connect the mounting ears on the unit (center-mounted or flush-mounted).

The AirLink Pro T1/E1 Rack Mount can be installed into a standard 19-inch or 23-inch equipment rack using the rack-mount hardware included with the unit. It requires 4U (7.0") of rack mounting space, of which 1U space above and below the unit is necessary for proper ventilation. Two standard blank panels can be used over the openings.

To mount the AirLink Pro T1/E1 Rack Mount in an equipment rack:

1. **Place the AirLink Pro T1/E1 Rack Mount on a table or bench.**

2. **Lay out the pieces of the rack mount hardware kit.**

   The rackmount hardware kit should contain the following parts:

   ▌ Two 1-inch increment mounting brackets for 23-inch rack mount

   ▌ Two EIA mounting brackets for 19-inch rack mount

   ▌ Eight 10-32 x 3/8" Phillips pan-head screws, lock washers, and flat washers

3. **Orient the mounting brackets for front- or mid-mounting.**

4. **Attach the brackets to the AirLink Pro T1/E1 Rack Mount with the screws provided in the hardware kit.**

5. **Position the AirLink Pro T1/E1 Rack Mount in the equipment rack and fasten with screws.**
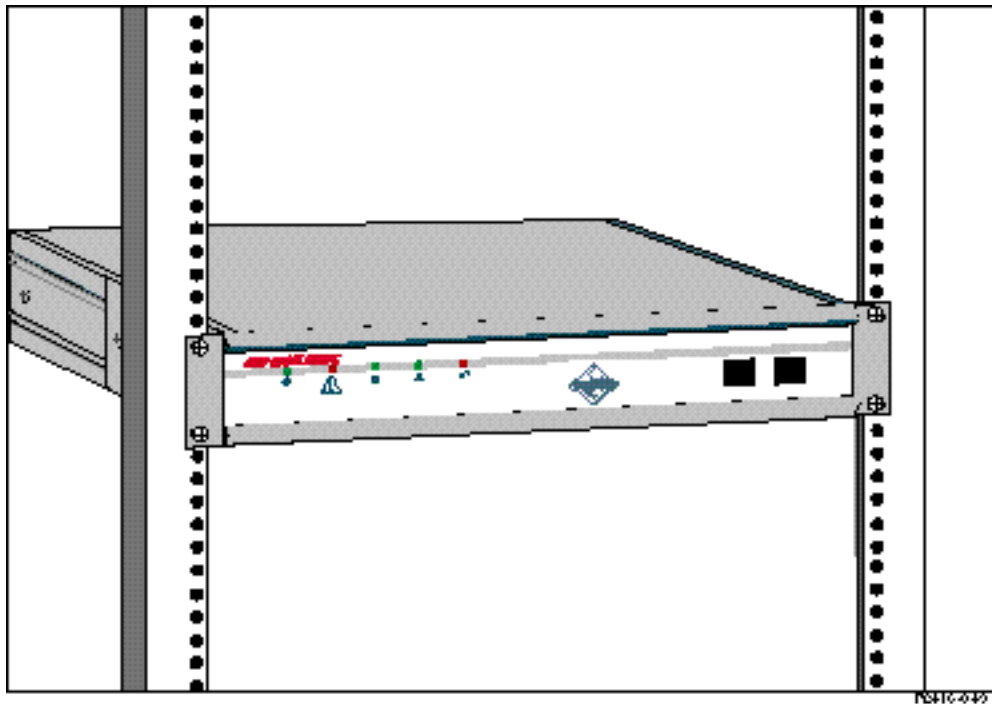
Figure 2-4
23" Rack Mount

Connecting the Antenna Cable

To connect the antenna cable to the AirLink Pro T1/E1:

1. **Locate the N-type connector on the rear panel of the AirLink Pro T1/E1 Rack Mount (see Figure 2-2).**

2. **Plug the RF cable connector firmly into the N-type jack connector and hand-tighten the cable connector shell onto the jack connector collar.**

3. **Verify that the cable connector is seated securely and that the cable is not kinked.**

4. **Recommend 1/2 or 7/8-inch case. Check the rating for 6 Ghz operation.**

5. **Recommend using short piece of more flexible coaxial to connect to the AirLink, such as the RG-6/U or the RG-59/U from Cylink.**

T1 DTE Line Connection

To connect the T1 line cable to the DTE:

1. **Locate the DTE terminal block on the Airlink Pro T1/E1 Rack Mount rear panel (see Figure 2-2).**

2. **Prepare the cable wire so that individual leads are separate. Strip a small portion of insulation off each wire lead.**

3. **With the help of a screw driver, push back one of the plastic levers located on the terminal block.**

    The following is a list of some suitable coaxial cables:

Type	Manufacturer	Part Number	AWG	ATTN[1]	UL Rating[2]
RG-6/U	Belden	9248	22 (7/30)	.3 dB	CM
RG-6/U	Belden	88248	22 (7/30)	.3 dB	CMP
RG-59/U	Belden	9259	18 (solid)	.3 dB	CM
RG-59/U	Belden	88259	18 (solid)	.3 dB	CMP

```
¹ Attenuation per 100 at 1 Mhz.
² U1 Rating System:
CM= General purpose, vertical tray. Tested per UL-1581.
CMP=Plenum Rated. Tested per UL-910.
```

The following is a list of some suitable cables for the T1 or E1 Balanced.

The cable type usually specified for indoor T1 use is Western Electric ABAM or equivalent. An equivalent cable is General Cable Specification 4162D. The characteristics of these two cables are listed in the table. These cables are rated in-building use and in-vertical risers and are not rated for use in plenumbs. Both of these cables use solid wire.

Cable	Gauge	Impedance	Loss at 1 Mhz
ATAM	22	100 Ohms	4.0 dB
GT4162	22	100 Ohms	6.0 dB

A second class of indoor cable is 100 Ohms stranded, shielded 24 ga. These cables have a characteristic impedance of 100 Ohms and a loss at 1 Mhz of about 7 dB per 1000'. Representative cables of this type are listed in the following table. These cables are also suitable for E1 applications.

Belden Part No. 8729 (UL Rating CMP (Plenum))

Individually shielded twisted pairs.

Berk-Tek Part No. 230249 (Plenum)

Berk-Tek Part No. 230131 (Non Plenum)

These cables have an overall foil shield.

The recommended E1 cable: The E1 signal can be either unbalanced, in which case the coaxial cables listed can be used or it can be unbalanced, in which case the balanced twisted pair cables can be used.

4. While holding it in this position, insert one of the leads of the cable into the spring pin connector, below the lever.

5. Release the lever.

6. Repeat Steps 3, 4 and 5 to connect each lead.

7. Ensure that each cable lead is securely held by the spring pin connectors.

T1 Backup Connections

1. Locate the CSU terminal block on the AirLink Pro T1/E1 Rack Mount rear panel (see Figure 3-2).

2. Follow the same procedure used for connecting T1/E1 DTE line.

3.   Locate the fault signal cable connector from the external device.

4. Connect the fault signal cable to the CSU -SEL connector on the major Alarm terminal block.

In the event of a fault in the primary T1/E1 link, each CSU generates a relay control signal that is transmitted to the attached AirLink Pro T1/E1 Rack Mount.   The T1/E1 pair switch the protected primary line in, to provide a protected bypass T1/E1 path.

Alarm Relay Contact Connections

If you have an application that uses the alarm relay contacts in the MAJOR & MINOR ALARM captive-wire terminal block on the rear panel of the AirLink Pro T1/E1 Rack Mount, connect the device cable to the ALARM-C and ALARM-NC or ALARM-NO contacts in the MAJOR & MINOR ALARM captive-wire terminal block (see Figure 2-5).
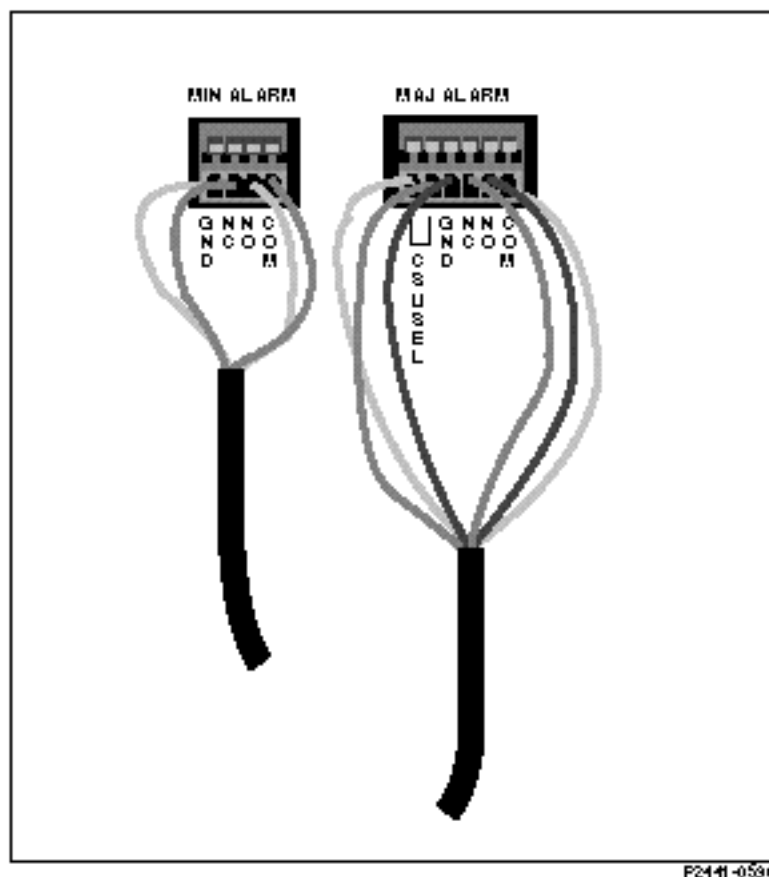
Figure 2-5
Alarm Relay Contacts

The major and minor alarm contacts built into the AirLink Pro T1 are SPDT relay contacts rated at 8 VA (0.25 A maximum at 100 VDC maximum) isolated from the ground. The alarm relays are de-energized when the AirLink Pro T1/E1 Rack Mount is in an alarm state: the NO contact is closed; the NC contact is open.

If an alarm occurs such that an entry is put into the event queue, the alarm contacts switch to the alarm state for as long as the alarm event persists or until the alarm is reset.

Terminal Connection

A simple ASCII terminal or personal computer can be connected to the RJ-11 Terminal Jack on the front or rear panels of the AirLink Pro T1/E1 Rack Mount to monitor and configure its operation. A DB9 to RJ-11 adapter is included. In a hub installation involving a number of AirLink Pro T1/E1 Rack Mount pairs, the

terminal device can be "shared" across all the AirLink Pro T1 systems by a terminal switching device.

A terminal device or a personal computer can have specific data cabling requirements (refer to Appendix B, *Specifications,* for connector pin assignments), and usually requires a grounded alternating current power outlet. An adapter kit that connects between the AirLink Pro T1/E1 Rack Mount terminal port and a male DB-9 connector is shipped with the equipment.

P2420-0596
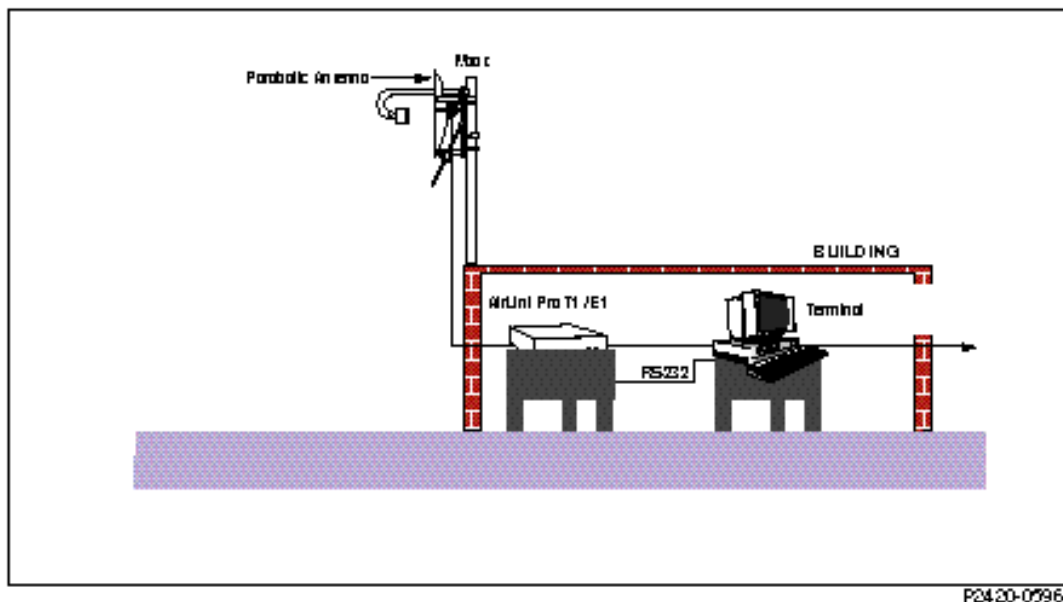
Figure 2-6
Terminal Connection to the AirLink Pro T1/E1 Rack Mount

Remote Connection

A remote terminal or personal computer can be connected to the Terminal port on the front or rear panels of the AirLink Pro T1/E1 Rack Mount unit through a modem (Figure 2-6). A modem requires a dedicated telephone line with a modular RJ-11 jack as well as a source of power, usually a standard 115 V$_{AC}$ grounded outlet.
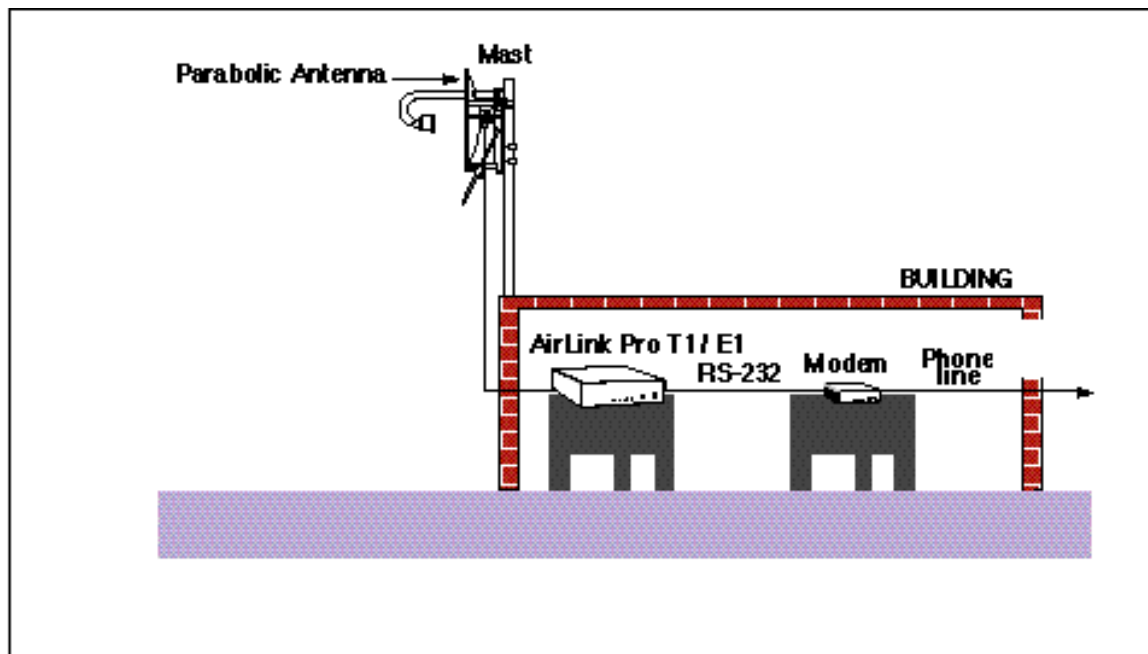
Figure 2-7
Modem Connection to the AirLink Pro T1/E1 Rack Mount

Order Wire Connection

The Order Wire interface is a 64 kbps pulse modulation (PCM) voice communication channel. This part of the AirLink Pro T1/E1 Rack Mount RF protocol does not use any part of the 1.544 Mbps T1 channel or the 2.048 Mbps E1 channel. The Order Wire interface meets V.21 and V.32 modem specifications.

A standard telephone (2 wire interface) can be plugged in to the Order Wire jack on the front panel (Figure 2-3). A telephone is required at each end of the link.
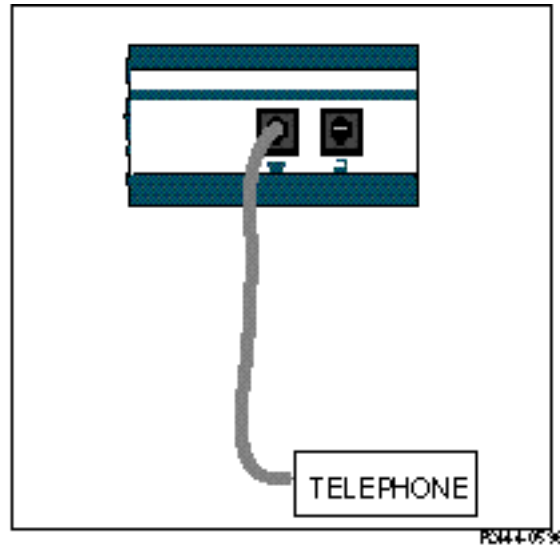
Figure 2-8
Two-Wire Order Wire Connection

Order Wire communication can only occur when there is an active radio link between the local and remote AirLink Pro T1/E1 Rack Mount units and the RSQ is 6 or higher. Communication across the order wire interface is initiated by picking up the telephone at either end of the link. When the RSQ is below 6, the AirLink Pro T1/E1 Rack Mount software mutes the order wire. Picking up the order-wire telephone causes an audible tone (beeping) at the remote Airlink Pro T1/E1 Rack Mount. This tone continues until the telephone at the remote end is picked up.

An external order wire unit can be connected to the designated terminal block on the rear panel. When an external 4 wire interface is used, the order wire unit provides its own signaling. The 4-wire interface allows multiple T1/E1 units at a hub to be connected through a 4-way or 8-way 4-wire bridge (Figure 2-11).

Connect the input pair of the order wire to the T & R located on the ORDER WIRE terminal block and connect the output pair to the T1 & R1.

Set the external order wire to transmit and receive at 0 dBm. The type of order wire interface (2 or 4-wire) is selected from the Command Line Interface Configuration screen. (See "Setting Link Parameters" in Chapter 3, *Configuration*).

ORDER
WIRE

T R T1 R1
IN OUT

R2440-0536
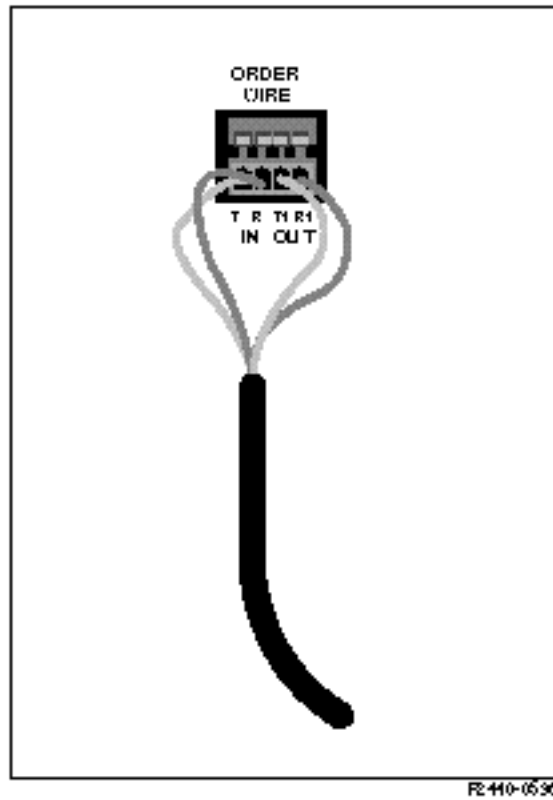
Figure 2-9
Four-Wire Order Wire Connection

CAUTION   The order wire interface must not be connected directly to the Public Switched
Telecommunications Network.

External Power Supply Connection
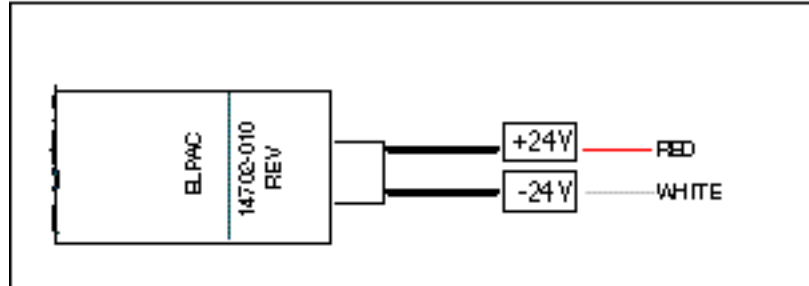
Figure 2-10
ELPAC Power Supply

For the ELPAC Power Supply

1. **Locate the Power terminal block on the unit's rear panel and insert the red wire of the power supply into the +V spring pin connector of the terminal block.**

2. **Insert the white wire into the -V spring pin connector of the terminal block.**

3. **Ensure that the two wires are securely held by the connectors.**
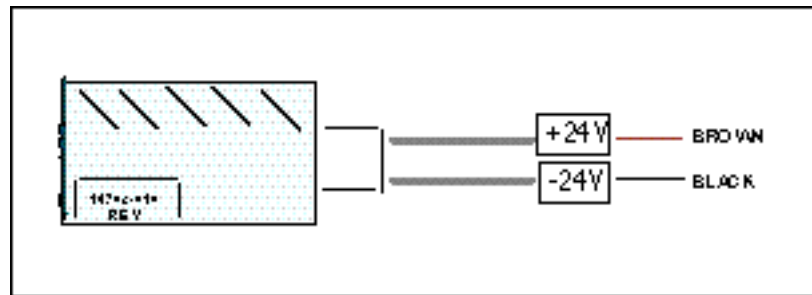
Figure 2-11
FORTRON Power Supply

For the FORTRON Power Supply

1. **Locate the Power terminal block on the rear panel of the unit and insert the brown wire of the power supply into the +V of the terminal block.**

2. **Insert the black wire into the -V spring pin connector of the terminal block.**

3. **Ensure that the two wires are securely held by the connectors.**

Wiring for Burst Synchronization

When you have either a hub configuration or a repeater site (more than one AirLink Pro T1/E1 Rack Mount unit operating from the same central site), one of the units must be set up as the source for burst synchronization. Refer to Chapter 3, *Configuration*, for Hub and Repeater configurations.

Installing the Burst Sync Wiring

The burst synchronization connections are made using unshielded twisted pair wires. The equipment should be physically located as shown in Figure 2-12. The primary and the backup masters should be the first units in the group. If the distance between the primary master and the last secondary master is greater than 100 ft, the burst sync bus(es) should be terminated at this unit (the last secondary master).

PRIMARY
MASTER

P2443-0596
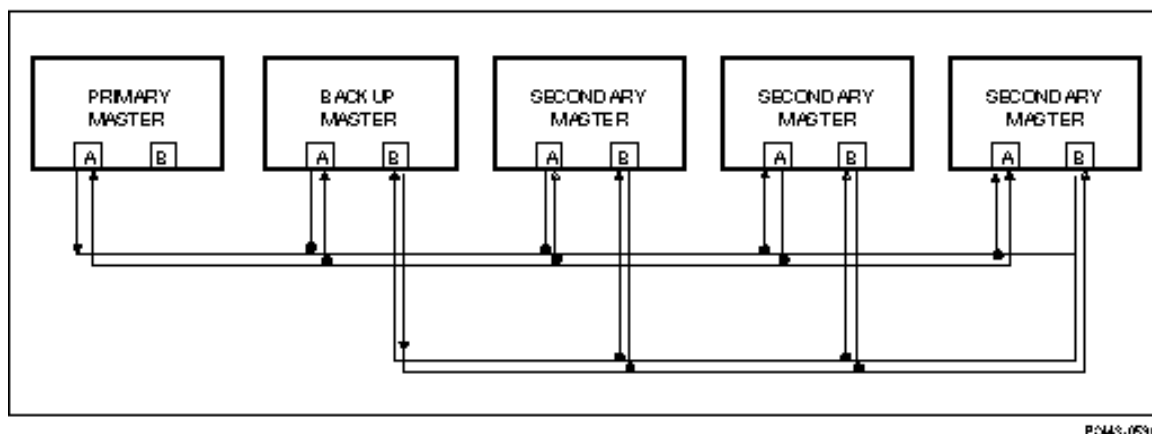
Figure 2-12
Burst Sync Wiring

Terminating the Burst Sync Bus

The burst sync bus is terminated by inserting a short jumper wire in the TERM A and TERM B locations as defined by the rear panel labels.

Checking Operation

During start-up an AirLink Pro T1/E1 Rack Mount pair:

❚ Establishes the radio link between the two radio units

❚ Starts transferring data

When each radio unit is powered up, a power-on self-test begins that determines whether the unit's hardware and software are operating within the required limits. When the test succeeds, the designated master unit begins transmitting, attempting to establish a RF link with the slave unit.

AirLink Pro T1/E1 Rack Mount units leave the factory configured as master units in a point-to-point configuration; configure one of the units as a slave.

Initial Unit Configuration

In a new point-to-point link installation, the configuration on one end must be changed to application 6 (Slave Unit in a Point-to-Point Link, refer to "Application" in Chapter 3).

In a new hub installation, the units at the hub must all be masters, and the corresponding remote units must be slaves. At a hub, set up each individual link first as a point-to-point link and then align each link separately with all the other AirLink Pro T1/E1 Rack Mount units turned off. After all the link pairs have been configured and aligned as point-to-point links, you can then change configurations for hub operation.

In a new repeater installation, treat each link segment as a point-to-point link, progressing from the near-end to the far-end sites. After all the link pairs have been configured and aligned as point-to-point links, you can change configuration for repeater operation.

For more information about applications and burst synchronization, refer to "Application Examples" in Chapter 3, *Configuration*.

No radio link exists until the AirLink Pro T1 pairs have been configured and aligned, all system configuration must be done individually at each unit. After a radio link is established between the units of an AirLink Pro T1 pair, the remote unit can be configured from the local site across the radio link.

To configure one end of the link as a slave:

1. **Connect a terminal to the Terminal port on the slave AirLink Pro T1/E1 Rack Mount or to the Terminal port on the AirLink Pro T1/E1 Rack Mount attached to the slave unit.**

    The terminal must be set up to operate according to the attributes described in " Connecting a Terminal," in this chapter.

2. **Type the following command at the prompt:**

    ```
    AIRLINK PRO T1/E1> set application 6
    ```

    The text you type is in boldfaced type; enter the spaces as shown.

3. **To verify the configuration change, type the following command at the prompt:**

    ```
    AIRLINK PRO T1/E1> get configuration
    ```

    The terminal displays the configuration of the unit, similar to the following:

    ```
    AIRLINK PRO T1/E1> Get Configuration
    Site Name:
    Application:     6. Slave Unit in a Point-to-Point Link
    Burst Mode:      Normal
    Coding:          B8ZS or (HDB3)
    ```

```
Equalization:    0 - 133 feet
PN Code:         1
RF Power:        10 dBm

Alarm Reporting: Immediate
Alarm Level:     Status
Date/Time:       May 1 1996 10:35:00
```

NOTE   You might need to alter more configuration values in order to ensure correct operation, during your AirLink Pro T1/E1 Rack Mount installation. Refer to Chapter 3 for more information on configuring the AirLink Pro T1/E1 Rack Mount.

Aligning the Antenna

After the link pair has been turned on and configured, the antennas must be aligned. Since most AirLink Pro T1/E1 Rack Mount paths will be line-of-sight paths, visually align the initial antenna. In most cases, this rough alignment is sufficient for radio units to acquire radio synchronization lock.

NOTE   When the radio link between two units is active, telephones can be plugged into the OW jacks on the AirLink Pro T1/E1 Rack Mount units permitting persons at the two sites to talk to one another. Picking up the order wire telephone causes an audible tone (pulsed beeping) at the remote AirLink Pro T1/E1 Rack Mount unit. This tone continues until the telephone at the other end is picked up.

To "fine tune" the antenna alignment, perform the following procedure:

1. **Insert the probes of a DC voltmeter into test points (RSS) and (ground) on the AirLink Pro T1/E1 Rack Mount (see Figure 2-11).**
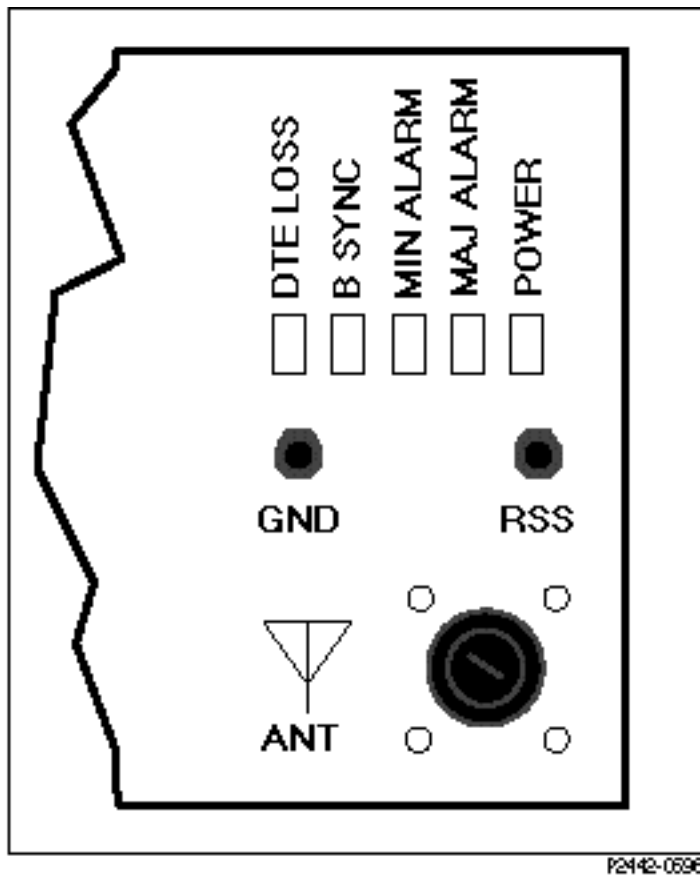
Figure 2-13
Test Point Locations

2.   **Swing the antennas on both ends of the link horizontally and vertically
     (but not at the same time!) until the observed voltage peaks.**

     Swing the antennas through the main lobe and both side lobes to check that
     the antenna is aligned on the main lobe and not one of the side lobes.

     After you align the antenna, use the terminal *query status* and *query
     performance* commands to check the receive signal strength (Rx Power) and
     the receive signal quality (RSQ). Compare the receive signal level to the
     expected signal level based on the path calculations.

3.   **Type the following command at the AirLink Pro T1/E1 Rack Mount prompt:**

     ```
     AIRLINK PRO T1/E1> query status
     ```

The system displays a list of status information similar to the following:

```
AIRLINK PRO T1/E1> query status
Site Name: Sunnyvale 2

DTE Loss:          NO
Radio Sync Loss:   NO
Burst Sync Loss:   N/A
Test in Progress:  FE Radio Remote Loop
DTE AIS:           OFF
RF AIS:            OFF
Tx Fail:           NO
Rx Power:          -60.5 dBm
Tx Power:          12.0 dBm
Temperature:       5 C
```

4. Type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> query performance
```

The system displays a list of status information similar to the following:

```
AIRLINK PRO T1/E1> query performance
Site Name: Sunnyvale 2
UWER BER:       <10E-08
QRSS BER:       Unavailable
1 HR ES:        1
1 HR UAS:       0
24 HR ES:       1
24 HR UAS:      0
RSQ:            10
```

The Receive Signal Quality (RSQ) is a figure of merit that is normalized on a scale of 1 to 10, and is a function of the receive signal-to-noise and signal-to-interference ratio. A very strong signal that is severely corrupted with interference results in a normal receive signal power indication and a low RSQ number.

Assuming that the T1/E1 lines to and from the AirLink Pro T1/E1 Rack Mount units are okay, T1/E1 data transfer begins as soon as the RF link is established. If you need to alter other configuration values, refer to Chapter 3, *Configuration*, for configuration procedures.

CHAPTER 3

Configuration

This chapter describes how to use the AirLink Pro T1/E1 Rack Mount command-line terminal user interface to set and change configuration parameters. The information in this chapter includes descriptions of all the AirLink Pro T1/E1 Rack Mount configuration commands and options, and lists the default configuration settings.

Inside this chapter:

Overview

To configure the AirLink Pro T1/E1 Rack Mount, connect an ASCII terminal or a personal computer to the Terminal port of the AirLink Pro T1/E1 Rack Mount.

The AirLink Pro T1/E1 Rack Mount ASCII terminal interface provides a command-line interface for manipulating the operation of the AirLink Pro T1/E1 Rack Mount, including configuring operational parameters, monitoring operation, and responding to alarm conditions. The command line interface also provides an online help facility to aid you in entering commands. You can also type in a help request for a particular command combination.

You can type a question mark (?) at the end of any command field, and the command interpreter will display the next valid keyword or operand that you can enter.

If you press <Return> before the command is complete, the command interpreter displays the next valid keyword or operand that you can enter. If the command is complete, the system will execute the command.

The command line interface is described in more detail in the following sections.

Using the ASCII Terminal Interface

Terminal Setup Requirements

Before connecting the ASCII terminal to the unit, configure the terminal with the following parameters:

> Terminal Mode = VT100
> Column = 80
> Autowrap = ON
> Monitor Mode = OFF
> Cursor Keys = Normal
> Newline Mode = ON
> Character Set = DEC Supplemental
> Key Code = ASCII
> Break key = ON
> Minimum Break Length = 2 character times (17 msec.)
> Data/Parity = 8/No Parity
> Stop Bits = 1

Transmit Rate = 19200, 9600, 4800, 2400, or 1200 bps
Auto Answerback = OFF
Comm = FDX (No Echo)
RS232 Data Leads Only (RxD and TxD)
Local Echo = OFF

To connect the terminal, follow these steps:

1. **Connect the terminal (or a computer in terminal emulation mode) to the Terminal port with the EIA/TIA-232 cable as described in Chapter 2.**

2. **Turn on the terminal; adjust the contrast and brightness as required.**

    The AirLink Pro T1/E1 Rack Mount terminal interface software contains an *autobaud* feature that automatically attempts to detect the operating baud rate of the attached terminal device.

3. **Press <Break> then <Return> on the terminal keyboard.**

    Pressing <Break> at the terminal puts the AirLink Pro T1/E1 Rack Mount terminal interface software in "hunt" mode, where it looks for carriage return (<Return>) characters at the attached terminal.

    If the terminal is set for 19200, 9600, 4800, 2400, or 1200 bps, the terminal interface software learns the operating baud rate by starting at 19200 bps and dropping to the next lower speed in the sequence until it recognizes a <Return> character.

    When the AirLink Pro T1/E1 Rack Mount terminal interface detects a <Return> keystroke, it displays the AirLink Pro command-line prompt:

    ```
    AIRLINK PRO T1>  or  AIRLINK PRO E1>
    ```

    Pressing <Break> puts the terminal interface software back into hunt mode. If the prompt does not appear, press <Break>once, then press <Return> repeatedly at one second intervals until the AirLink Pro T1/E1 Rack Mount prompt appears. If the prompt does not appear after pressing <Return> six times, press <Break> and try again.

Command-Line Interface

The command-line interface consists of commands for manipulating the operation of the AirLink Pro T1/E1 Rack Mount, including configuring operational parameters, monitoring operation, and responding to alarm conditions.

Command-Line Format

The general syntax of a command line consists of a basic command keyword followed by additional keywords and operands that qualify the command keyword:

BASIC_KEYWORD KEYWORD_1 … KEYWORD_n operand; comment

The command-line format and syntax is based upon the following :

■ **Separators:** Each keyword or operand must be separated by a separator character—a space or a TAB character. Extra space characters between two command elements are treated as one space character.

■ **Order:** The basic command keyword must be the first word of the command. All operands that relate to a keyword must immediately follow that keyword in the prescribed order. Keywords relating to another keyword must follow that keyword.

■ **Comments:** In a case where the command line is part of a file that is sent to the remote interface, you can add comments to a command line by appending a semicolon character (;) to the end of the command line, followed by the text of the comment. The command interpreter ignores the semicolon and any characters following it except <Return>.

■ **Length:** The maximum keyword length is 15 characters. The maximum command-line length is 250 characters, including comment text, separator characters, and <Return>. Any command that exceeds this length is rejected with an appropriate error message.

■ **Short forms of keywords:** You can save keystrokes when typing commands by abbreviating a keyword to the first four characters of the keyword.

■ **Case:** Commands are not sensitive to case. You can enter keywords as all upper-case characters, all lower-case characters, or as any combination.

■ **Choosing from a list of options:** The notation

{ x1 | x2 | ... | xn }

showing numbers or terms separated by vertical bars indicates that you can select one of the elements in the listed set of x1 to xn. For example, in the set of options:

{ 0 | 133 | 266 | 399 | 533}

you can choose any one of the listed values.

■ **Choosing from a range of numbers:** The notation

{n1 .. n2}

indicates that you can specify a number within the range of numbers shown in the active command context, for example, given the range {0 .. 24}, you would specify a single number from 0 to 24.

■ **Special keystroke sequences:**

Press <Ctrl>+R to repeat the previous command.
Press <Esc> to clear the command line and start a new command.

Command Responses

Commands that contain errors or that request information from the unit receive responses. Commands that set parameters receive a response of "OK" only when they contain no errors. The following keywords are:

OK   Indicates that a command to change system configuration settings was received correctly and executed.

SYNTAX ERROR   If an entry error is entered, the unit responds with a list of valid choices.

Setting Administrative Parameters

The AirLink Pro T1/E1 Rack Mount administrative parameters include the following:

■ Site Name

■ Date and Time

■ Password

Site Name

The site name identifies the role or location of the specified AirLink Pro T1. This parameter is optional and can be a description of up to 60 alphanumeric characters.

To set the site name for the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set site name name
```

where *name* is any convenient description of up to 60 alphanumeric characters. For example, to set the site name of the local AirLink Pro T1/E1 Rack Mount to Sunnyvale 2, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set site name Sunnyvale 2
```

To set the site name of the remote AirLink Pro T1/E1 Rack Mount, use the command:

```
AIRLINK PRO T1/E1> remote set site name name
```

Date and Time

The date and time in system operations provides a reference in time-stamping status, performance and alarm information.

To set the date for the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1 prompt:

```
AIRLINK PRO T1/E1> set date date
```

The operand *date* is the calendar date, and takes the form mm/dd/yy, where mm is a number from 1 to 12, dd is a number from 1 to 31, and yy is the last two digits of the current year.

For example, to set the date of the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set date 9/30/94
```

To set the date of the remote unit, use the command:

```
AIRLINK PRO T1/E1> remote set date date
```

To set the time for the local unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set time time
```

The operand *time* is a 24-hour clock value that takes the form hh:mm:ss, where hh is a number from 0 to 23, representing the hour, mm is a number from 0 to 59 representing the minute, and ss is a number from 0 to 59, representing the second. Seconds are optional; if you do not enter a value for seconds, the system assumes a setting of 00 seconds.

For example, to set the time of the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set time 10:35:00
```

To set the time of the remote unit, use the command:

```
AIRLINK PRO T1/E1> remote set time time
```

For outdoor use, print (AU) in the Site name when the Access Unit is installed.

NOTE   The additional time required to access the remote end of the link is a fraction of a second and need not be taken into account.

Password

The password is required when the unit is powered on, or after the operator logs off the system and wants to enter it again. The operator must provide the correct password to use the GET, SET, QUERY, RESET, TEST and REMOTE commands.

When the unit is prepared for shipment, it is configured with a null password as a default. To gain access to the system the first time, press <Return> in response to the login prompt for the password.

To protect the system, you should change the password at the earliest opportunity. The new password should be noted and stored in a safe place. After changing the password, you should test the new password by logging out and in again.

NOTE   If you are unable to use your password or forget your password, contact Cylink Customer Service for assistance.

A password can be any convenient combination of up to 16 alphanumeric characters from the set a-z, A-Z, and 0-9. *The Password is case sensitive.*

To set or change the password for the local unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set password
```

The system prompts you to enter the old password, prompts you to enter the new password, and then prompts you to enter the new password again, for confirmation. If the second instance of the new password matches the first

instance of the new password, the new password is accepted. A password can be any convenient combination of up to **16** alphanumeric characters.

For example, the local AirLink Pro T1/E1 Rack Mount is new and currently has no password. To set the password to *1Awombat*, type the following commands at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1> set password
Old Password: <Return>
New Password: 1Awombat
Retype New Password: 1Awombat
```

Setting T1/E1 Line Parameters

The AirLink Pro T1/E1 Rack Mount line interface parameters include:

❚   Coding

❚   Equalization

You might change values for either or both of these configuration parameters depending on your applications.

Coding

The AirLink Pro T1 supports both Alternate Mark Inversion (AMI) and Bipolar **8**-Zero Substitution (B8ZS)line coding The E1 supports both the HDB3 and the AMI. To set the coding for the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1 prompt:

```
AIRLINK PRO T1/E1> set coding operand
```

where *operand* is **AMI** , **B8ZS or HDB3**. If you do not specify a value, the system assumes the default value: **B8ZSor HDB3**.

For example, to set the coding for the local AirLink Pro T1/E1 Rack Mount to AMI, type the following command at the AirLink Pro T1 prompt:

```
AIRLINK PRO T1/E1> set coding ami
```

To set the coding of the remote AirLink Pro T1/E1 Rack Mount, type:

```
AIRLINK PRO T1/E1> remote set coding operand
```

T1 Equalization

The length in feet from the DSX point.

To set the equalization for the local unit, type the following command at the AirLink Pro T1 prompt:

```
AIRLINK PRO T1/E1> set equalization operand
```

where *operand* is one of the following: **0, 133, 266, 399**, or **533**.

If you do not specify a value, the system assumes the default value: **0**. For example, to set the equalization for the local unit to 133, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set equalization 133
```

To set the equalization of the remote AirLink Pro T1/E1 Rack Mount, use the command:

```
AIRLINK PRO T1/E1> remote set equalization operand
```

The equalization distance is the total of the cable length from the AirLink Pro T1/E1 Rack Mount. If there is no physical cross-connect, use half the distance to the DTE (multiplexer, PBX, router, etc.).

Table 3-1
Line Parameters Quick Reference

Parameter	Setting	
Coding	Bipolar 8-Zero Substitution (B8ZS) T1 High Density Bipolar 3 (HDB3) E1 Alternate Mark Inversion (AMI)	(default) (default)
T1 Equalization	0 (feet) 133 266 399 533	(default)

Setting Link Parameters

The AirLink Pro T1/E1 Rack Mount Link parameters include the following:

❚ **Application**

❚ **Burst Mode**

❚ **PN Code**

❚ **RF Power**

❚ **Order Wire Type**

❚ **Interface Type (E1 only)**

Depending upon your application, you will need to set or change values for one or more of these configuration parameters.

NOTE   These are service-affecting configuration parameters. Changing any of these parameter values disrupts the radio link for the time it takes to set compatible parameter values for both ends of the link. Do the remote change always first so that the radio link can be regained by making changes to the local unit. If you make the local changes first and lose the radio link, you might be forced to go to the remote site in order to reconfigure the remote unit and reinstate operation.

Application

Application refers to the role the unit plays in either a point-to-point link (master/slave) or in a hub scheme involving primary and secondary masters. Your choice of application determines the timing (external versus internal) relationship between the AirLink Pro T1/E1 Rack Mount units:

1. Primary master at a hub

2. Secondary Master at a hub

3. Master unit at a repeater site

4. Master unit in a point-to-point link

5. Slave unit at a repeater site

6. Slave unit in a point-to-point link

7. Secondary Master in a protected link

8.   Backup Master at a hub

To set the application for the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set application operand
```

where *operand* is a number in the range 1 to 6. If you do not specify a value, the system assumes the default value: **4** (master unit in a point-to-point link). For example, to set the application for the local AirLink Pro T1/E1 Rack Mount to 1 (primary master at a hub), type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set application 1
```

To set the application of the remote AirLink Pro T1/E1 Rack Mount, use the command:

```
AIRLINK PRO T1/E1> remote set application operand
```

All units are shipped from the factory configured as master units in a point-to-point link . You must configure one of the units in the pair as a slave so that the system alignment procedures can be performed. Use your application plan to determines how each unit will be configured.

The following sections describe the use of these applications in point-to-point links, hubs, and repeaters.

Point-to-Point Link   (Applications 4 and 6)

In a point-to-point link (Fig. 3-1), where one AirLink Pro T1/E1 Rack Mount pair operates independently of any other pair, the burst synchronization timing signal is derived from the internal clock of the designated master unit, and the slave unit derives its synchronization from the received RF signal.

The master unit would be configured as a *master unit in a point-to-point link* (application 4), while the unit at the other end would be configured as a *slave unit in a point-to-point link* (application **6**).
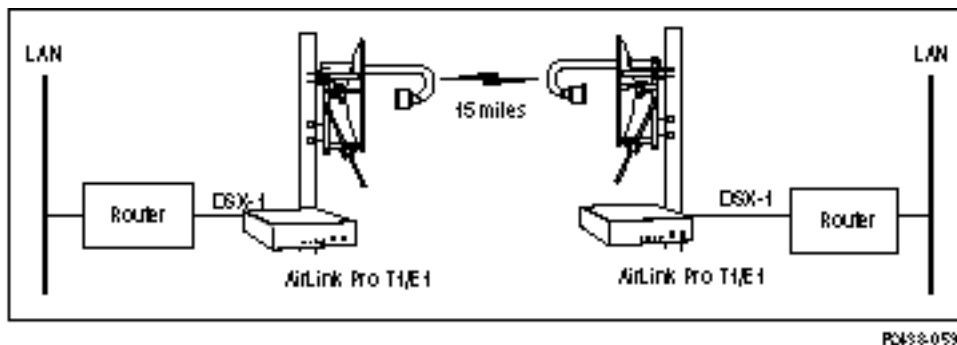
Figure 3-1
Point-to-Point Link

Hub Application (Different Paths)   (Applications 1, 2, and 8)

In a hub, where more than one AirLink Pro T1/E1 Rack Mount master unit is located at a central site (Figure 3-2), one of the master units must be configured as the *primary master at the hub* (application 1), providing burst synchronization, while a second unit is selected as the *backup hub master* (application 8). All other units at the hub are designated as *secondary masters at the hub* (application 2).

The primary master supplies burst sync as long as it is operating properly. Should the primary fail, the backup master will provide burst sync to all other secondary masters. The externally timed secondary masters are daisy-chained through their burst synchronization wire pairs to the internally timed primary master so that all of the units "talk" and "listen" in a synchronized manner (Refer to Chapter 2, Figure 2-12).
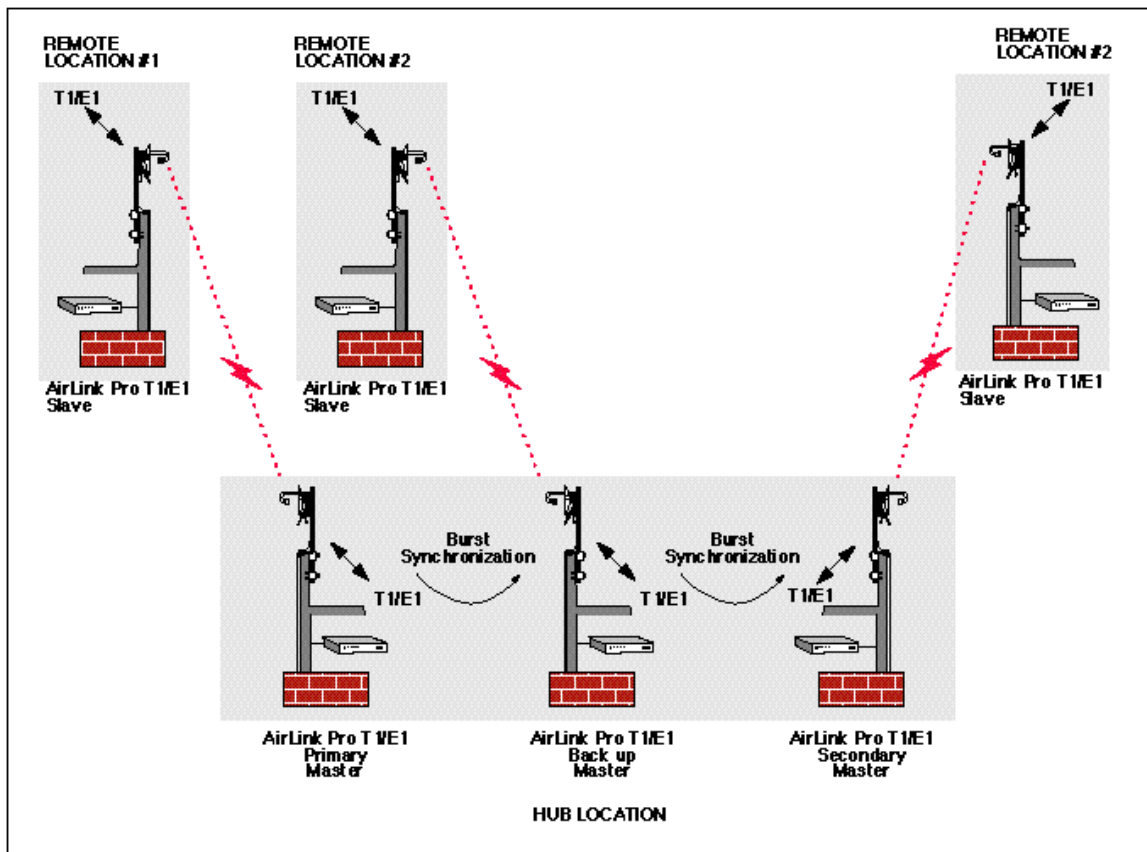
P2459-0696

Figure 3-2
Hub Application Different paths

Hub Application (Same Path)   (Application 7)

This example involves the use of antenna pairs configured to take advantage of fixed horizontal and vertical wave polarization. Wave polarization is achieved by mounting the antenna pair so that the feedhorns of both antennas are aligned either vertically or horizontally (per manufacturer's instructions).

By using antenna polarization, you can locate two AirLink Pro T1/E1 Rack Mount pairs at the same sites and use the same wave path without conflict (see Figure 3-3). In this application, the primary master provides burst sync to the secondary master and the two units are connected to a AirLink Pro T1/E1 Rack Mount protection switch (Application 7).

When the Primary master fails, the link does not break because the secondary master transfers to its own internal burst sync.
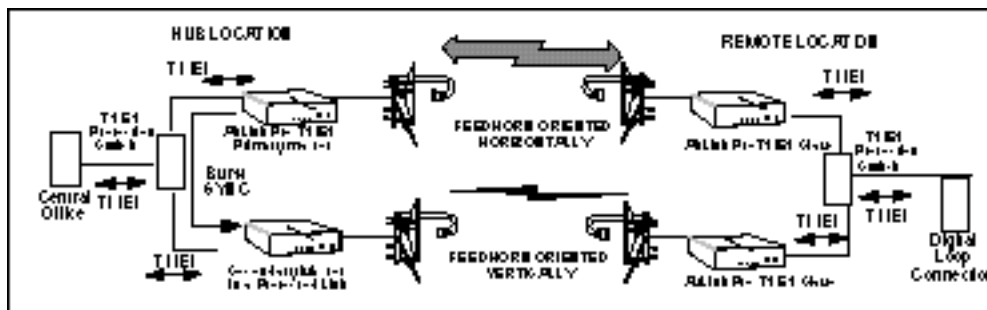
Figure 3-3
Hub Application Same Path

Repeater   (Applications 3 and 5)

In a repeater, the two AirLink Pro T1/E1 Rack Mount units that form the cross-over point between the previous segment of the entire repeater link and the next segment of the repeater link are referred to as the *repeater site* (Figure 3-4).
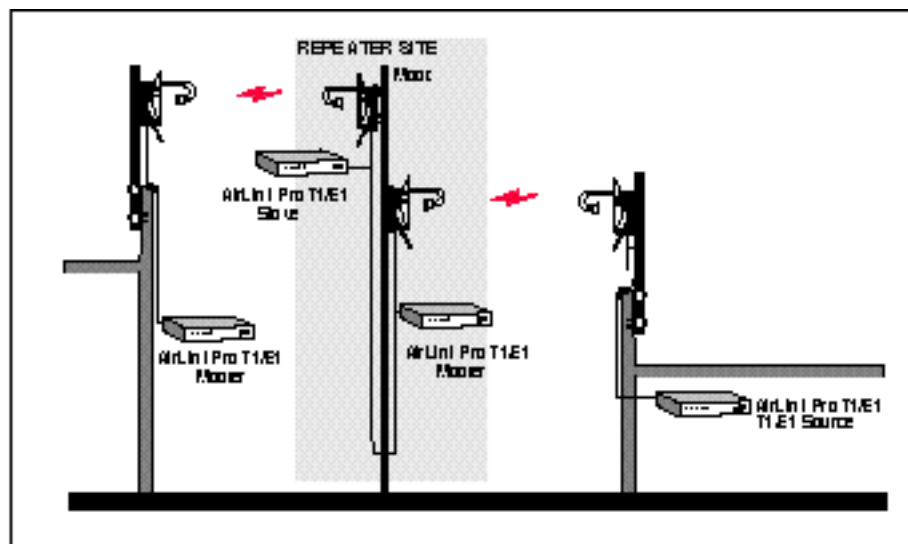
Figure 3-4
AirLink Pro T1/E1 Rack Mount Two Part Repeater Link

In this case, the slave unit of the previous segment of the repeater link is configured as the *slave unit at a repeater site* (application 5), while the master unit of the next segment of the repeater link is configured as the *master unit at a repeater site* (application 3). The burst synchronization signal pair of the slave unit at the repeater site is wired to the burst synchronization signal pair

of the master unit at the repeater site so that the slave at the repeater site provides the burst synchronization signal for the master unit of the next segment of the link.

Repeater Variations

If other AirLink Pro T1/E1 Rack Mount units are located at the repeater site, the repeater site is treated as a hybrid hub, where the added units are wired to the burst synchronization signal pairs of the slave at the repeater site and synchronize their transmit bursts to the burst synchronization signal from the slave at the repeater site. These units can be configured as either *secondary masters at a hub* (application 2) or as *master units at a repeater site* (application 5).

If the entire repeater link is set up as a point-to-point link, the AirLink Pro T1/E1 Rack Mount unit that serves as the near-end unit in the entire repeater link can be configured as a *master unit in a point-to-point link* (application 4). The AirLink Pro T1 unit that serves as the far-end unit for the entire repeater link is configured as a *slave unit in a point-to-point link* (application 6).

If the entire repeater link originates from a hub, the AirLink Pro T1/E1 Rack Mount unit that serves as the near-end unit in the entire repeater link can be configured as either a *primary master at a hub* (application 1) or a *secondary master at a hub* (application 2). The AirLink Pro T1/E1 Rack Mount unit that serves as the far-end unit for the entire repeater link is configured as a *slave unit in a point-to-point link* (application 6).

Burst Mode

Burst Mode describes the transmit timing relationship between the master unit and the slave unit. In **Normal** mode, the master unit initiates burst timing and the slave unit times its responses to the timing from the master. The master unit transmits for a time, then listens for a time; the slave waits until the master unit is listening, then transmits. In **Test** mode, the master transmits a constant RF using the QRSS data pattern; the slave only listens.

NOTE   **Test** mode should only be used for alignment and testing under the direction of Cylink personnel. In ordinary operation, the unit should be set for **Normal** operation.

To set the burst mode for the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set burst mode operand
```

where *operand* is either **Normal** or **Test**. If you do not specify a value, the system assumes the default value: **Normal**.

For example, to set the burst mode for the local AirLink Pro T1 to Normal, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set burst mode normal
```

To set the burst mode of the remote AirLink Pro T1, use the command:

```
AIRLINK PRO T1/E1> remote set burst mode operand
```

WARNING   If the burst mode of the remote unit is changed from **Normal** to **Test**, it cannot be restored to **Normal** from the local unit.

PN Code

The AirLink Pro T1/E1 Rack Mount has a set of pseudo-random noise (PN) codes. Each code number corresponds to a subset of long binary code words. These code words are substituted for each bit in the T1 data stream. This substitution is the basic principle of the direct-sequence spread spectrum modulation scheme used in the AirLink Pro T1/E1 Rack Mount.

No PN code is "better" or "worse" than another. Using a different code separates the AirLink Pro T1/E1 Rack Mount and the desired incoming signal from undesired signals from other AirLink Pro T1/E1 Rack Mount paths.

The master unit and the slave unit of a AirLink Pro T1/E1 Rack Mount pair must be set to the same PN code (pseudo-random noise code). The setting is then stored in the protected system configuration memory of both units in the pair.

To set the PN code for the local unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set pn code operand
```

where *operand* is a number from **1** to **8**. If you do not specify a value, the system assumes the default value: **1**. For example, to set the PN code for the local AirLink Pro T1 to 4, type the following command at the AirLink Pro T1 prompt:

```
AIRLINK PRO T1/E1> set pn code 4
```

To set the PN code of the remote unit, use the command:

```
AIRLINK PRO T1/E1> remote set pn code operand
```

RF Power Level

When there are a number of AirLink Pro T1/E1 Rack Mount pairs in a hub arrangement, the received signal levels are dependent on the distances to the remote sites. Adjust the transmit power level to minimize cross-channel interference and ensure that the received levels at the hub are of equal power.

To set the RF power for the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set rf power operand
```

where *operand* is a number from -**4** to **20**.

If you do not specify a value, the system assumes the default value: **0** (dBm). For example, to set the RF power level for the local AirLink Pro T1/E1 Rack Mount to -1, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set rf power -1
```

To set the RF power for the remote unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> remote set rf power operand
```

Order Wire Type

The type of order wire interface (2 or 4) is selected from the command line interface configuration screen. The interface must be the same at both ends of the link.

To set the order wire interface for the local unit, type:

```
AIRLINK PRO T1/E1> Set orderwire 2W
```

To set the order wire for the remote unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> remote set orderwire 2W
```

Interface Type (E1 Only)

Set the interface operand on the E1, where the operand is balanced or unbalanced.

Setting Alarm Control Parameters

The alarm control parameters of the AirLink Pro T1/E1 Rack Mount include:

▌ Alarm reporting

▌ Alarm level

▌ 1-hour Errored Seconds (ES) threshold

▌ 1-hour Unavailable Seconds (UAS) threshold

▌ 24-hour ES threshold

▌ 24-hour UAS threshold

▌ Receive (Rx) power

▌ Transmit (Tx) power

The following sections describe how to set values for these parameters.

Alarm Reporting

This parameter determines whether alarms are displayed as they happen or are held until you query for them. When an alarm event occurs, an alarm message is inserted in the event queue and the Major or Minor indicator is illuminated and the alarm relay contacts are de-energized: the NO contact is closed; the NC contact is opened.

The Major Alarm LED is red and indicates that there is one or more of the following events has occurred: transmit power below threshold, synthesizer loss of lock, transmitter failure, DTE input loss, radio sync loss, loss of primary burst sync (single sync bus), loss of primary and backup burst sync (dual sync bus). The minor Alarm LED is yellow and indicates that one or more of the following events has occurred: rcv input level below threshold, unit has been placed in a test mode, ES threshold exceeded, UAS threshold exceeded, loss of primary or backup burst sync (dual sync mode).

To set the alarm reporting priority for the local unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set alarm reporting operand
```

where *operand* is either **Request** or **Immediate**. If you do not specify a value, the system assumes the default value: **Immediate**. For example, to set the alarm reporting priority for the local unit to Request, type the following command at the AirLink Pro T1 prompt:

```
AIRLINK PRO T1/E1> set alarm reporting request
```

To set the alarm reporting priority of the remote unit, type:

```
AIRLINK PRO T1/E1> remote set alarm reporting operand
```

Alarm Level

The alarm level parameter sets the severity level for reporting alarms: Status, Advisory, Alarm, and Fault. The status messages are the least severe; fault messages the most severe.

If you set the alarm level at Status, the system reports all four levels. If you set the alarm level at Fault, the system only reports fault events (refer to Appendix A for alarm messages).

To set the alarm level for the local unit, type the following command at the AirLink Pro T1/ E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set alarm level operand
```

where *operand* is one of the following: **Status**, **Advisory**, **Alarm** or **Fault**. If you do not specify a value, the system assumes the default value: **Status**.

For example, to set the alarm level for the local unit to Alarm, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set alarm level Alarm
```

To set the alarm level of the remote AirLink Pro T1/E1 Rack Mount, type:

```
AIRLINK PRO T1/E1> remote set alarm level operand
```

1-Hour Errored Seconds Threshold

This parameter sets the number of errored seconds (ES) events that must occur in a one-hour interval before an entry is inserted in the Alarm queue. The 1-hour ES threshold is compared to the number of errored seconds in the past hour. If the 1-hour ES count is greater than the threshold value, the unit inserts a message in the alarm log.

To set the 1-hour ES threshold for the local radio unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold 1_hr es operand
```

where *operand* is a number from **1** to **999**. If you do not specify a value, the system assumes the default value: **1**. For example, to set the 1-hour ES threshold for the local unit to 15, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold 1_hr es 15
```

To set the 1-hour ES threshold of the remote unit, type:

```
AIRLINK PRO T1/E1> remote set threshold 1_hr es operand
```

1-Hour Unavailable Seconds Threshold

This parameter sets the number of unavailable seconds (UAS) events that must occur in a one-hour interval before an entry is inserted in the Alarm queue. The 1-hour UAS threshold is compared to the number of unavailable seconds in the past hour. If the 1-hour UAS count is greater than the threshold value, the unit inserts a message in the alarm log.

To set the 1-hour UAS threshold for the local radio unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold 1_hr uas operand
```

where *operand* is a number from **1** to **99**. If you do not specify a value, the system assumes the default value: **1**. For example, to set the local unit's 1-hour UAS threshold to 15, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold 1_hr uas 15
```

To set the 1-hour UAS threshold of the remote unit, use the command:

```
AIRLINK PRO T1/E1> remote set threshold 1_hr uas operand
```

24-Hour Errored Seconds Threshold

This parameter sets the number of errored seconds (ES) events that must occur in a 24-hour interval before an entry is inserted in the Alarm queue. The 24-hour ES threshold is compared to the number of errored seconds in the past 24 hours. If the 24-hour ES count is greater than the threshold value, the unit inserts a message in the alarm log.

To set the 24-hour ES threshold for the local unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold 24_hr es operand
```

where *operand* is a number from **1** to **999**. If you do not specify a value, the system assumes the default value: **1**. For example, to set the 24-hour ES threshold for the local radio unit to 15, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold 24_hr es 15
```

To set the 24-hour ES threshold of the remote unit, use the command:

```
AIRLINK PRO T1/E1> remote set threshold 24_hr es operand
```

24-Hour Unavailable Seconds Threshold

This parameter sets the number of unavailable seconds (UAS) events that must occur in a 24-hour interval before an entry is inserted in the Alarm queue. The 24-hour UAS threshold is compared to the number of unavailable seconds in the past 24 hours. If the 24-hour UAS count is greater than the threshold value, the unit inserts a message in the alarm log.

To set the 24-hour UAS threshold for the local unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold 24_hr uas operand
```

where *operand* is a number from **1** to **99**. If you do not specify a value, the system assumes the default value: **1**. For example, to set the local unit's 24-hour UAS threshold to 15, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold 24_hr uas 15
```

To set the 24-hour UAS threshold of the remote unit, use the command:

```
AIRLINK PRO T1/E1> remote set threshold 24_hr uas operand
```

Receive (Rx) PowerThreshold

This parameter sets the minimum receive power level before an entry is inserted in the event queue. This threshold should be set approximately 10 dB below the receive power level to allow for occasional fading.

To set the Rx power threshold for the local unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold rx power operand
```

where *operand* is a number from -**80** to -**40** (dBm). If you do not specify a value, the system assumes the default value: -**75**. For example, to set the Rx power threshold for the local unit to -45 dBm, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold rx power -45
```

To set the Rx power threshold of the remote unit, use the command:

```
AIRLINK PRO T1/E1> remote set threshold rx power operand
```

Transmit (Tx) Power Threshold

This parameter sets the minimum transmit power level before an entry is inserted in the event queue. This threshold should be set approximately 6 dB below the transmit power level.

To set the Tx power threshold for the local unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold tx power operand
```

where *operand* is a number from -**10** to **20** (dBm). If you do not specify a value, the system assumes the default value: -**6** (dBm). For example, to set the Tx power threshold for the local AirLink Pro T1 to 10 dBm, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> set threshold tx power 10
```

To set the Tx power threshold of the remote radio unit, use the command:

```
AIRLINK PRO T1/E1> remote set threshold tx power operand
```

Setting Modem Parameters

Introduction

TheAirLink Pro T1/E1 Rack Mount ASCII terminal and Network Management ports are EIA/TIA-232 interfaces that allow terminal devices or personal computers to control and monitor AirLink Pro T1/E1 Rack Mount operation at either end of a point-to-point link. Each EIA/TIA-232 connection can be either a direct connection (device to port), or an indirect connection (device to modem to port) for dial-up operation.

The Network Management (Modem) Port is available only on the Access Unit, and uses a different physical port from the Terminal port. However, when the network management port is connected (and dialed-up, in the case of a modem link), commands issued from that port, along with the responses from the terminal port, are duplicated at the Network Management port.

The modem support may be configured to work in any of these five modes:

DISABLED   The port is completely disabled and it will not respond to user commands or connection indications from the modem.

DEDICATED   The port behaves exactly as the Terminal port; all commands and responses taking place on that port are duplicated on the modem port.

ANSWER   The modem port remains idle (does not respond to user commands) until it receives a dial-in indication from the modem.

DIALOUT ONLY   The modem port is used only for dialing-out to report alarms.

DIALOUT/ANSWER   Combines the functionality of the ANSWER and DIAL-OUT modes.

After the completion of a dial-out, a connection announcement is printed at the remote end. This announcement identifies the unit type, the site name as configured by the user, the date and time, plus a copy of the alarm text message.

For example:

>>> AIRLINK-T1> Sunnyvale Engineering Unit 1
12 APR 95 14:33:59 Receive Power Below Threshold

NOTE   The particular alarm message chosen is the highest-priority alarm condition in effect when dialing commences.

Connection and Configuration

The unit is shipped with a default configuration of DISABLED and 9600 bps. Any changes to the default values can be made using the command line interface. To change the settings, use the command line interface. Each of the configuration items is stored in the configuration database. In addition, the state of the connection is maintained so that recovery from a power failure will re-initiate the connection.

Multidrop configuration (multiple units sharing a modem) is supported only by the use of an external port-sharing device.

Modem Setup Procedures

A pair of Hayes-compatible "external" modems, 1200 bps or higher is required. Configure each modem according to the following procedure. Note that not all so-called smart modems are identical. Please check your modem user's manual.

Configuring the Modem

1. **To reset modem to its factory defaults (for most modems):**

    a. **Connect the modem to a terminal using a standard EIA/TIA-232 modem cable.**

    b. **Wait one second then type +++ on the terminal.   Pause one second again and then type `AT&F<RETURN>`.**

    c. **Cycle power on the modem.**

2. **Configure the modem to ignore DTR, by typing `AT&D<RETURN>`, or selecting a DIP switch on some modems.**

3. **Configure the modem to ignore RTS, by typing `AT&K0<RETURN>` (Hayes compatible modems), or `AT&H0<RETURN>` (US Robotics modems), or by selecting a DIP switch on some modems.**

4. Configure the modem for error correction, if the modem is so equipped (newer modems). This is generally the factory default, but can be invoked by typing **AT&Q5<RETURN>** on Hayes compatible modems, or **AT&M4<RETURN>** on US Robotics modems.

5. Set the number of rings you want the modem to answer on, by typing **ATS0=X<RETURN>** where x is a digit from 1 to 9 (the number of rings), or 0 (zero) for no answer.

6. Save the new configuration in the modem's non-volatile memory by typing **AT&W<RETURN>.**

7. Cycle power on the modem.

Connecting the Modem

Connect the modem at the AirLink Pro T1/E1 Rack Mount end as follows:

1. Configure the AirLink Pro T1/E1 modem port speed by issuing the following command at the Terminal port **SET MODEM RATE XXXX <RETURN>** where XXXX is the speed in bits per second, for instance 1200, 2400, 4800, or 9600.

2. Connect the unit's modem port to the modem using a standard EIA/TIA-232 modem cable, with a 9-pin male DB-9 connector at the unit end and an appropriate connector (typically male DB-25) at the modem end.

3. Connect the modem's phone port to the phone line using an appropriate cable (usually supplied with the modem).

Connecting the Modem to the Remote Terminal

Connect the modem to the remote terminal as follows:

1. Connect the terminal's modem port to the modem using a standard EIA/TIA-232 modem cable.

2. Connect the modem's phone port to the phone line using an appropriate cable (usually supplied with the modem).

Testing the Modem Link

1. **Issue the following commands at the Terminal port:**

Table 3-2
Terminal Commands of the Modem (Port) Interface

Command	Definition
SET DIAL LEVEL FAULT <RETURN>	Prevents dialing of most alarms while the link testing
SET ALARM HOLDOFF 600 <RETURN>	Prevents any alarms from being dialed for at least 10 minutes
SET MODEM MODE BOTH <RETURN>	Enables dial-in and dial-out
SET DIAL TONE <RETURN>	TONE (touch-tone) or PULSE (rotary)
SET PHONE 1 XXX-XXXX <RETURN>	XXX-XXXX is the remote modem phone number
SET PHONE 2 XXX-XXXX <RETURN>	Optional backup phone number
GET MODEM <RETURN>	To view and verify the modem configuration
CONNECT 1	Manually dial the phone number programmed by the SET PHONE 1 command above

2. **Type characters at the terminal port; they should appear on the terminal connected to the remote modem. Type characters at the remote terminal. They should appear on the local terminal.**

3. **Type DISCONNECT <RETURN> on the unit's terminal to terminate the manual dial-out connection. The modem link is now operational.**

Functions

Port Duplication

During a manual connection (dial-in or dial-out), the modem and Command Line Interface (CLI) ports appear as one at the character level. Any character typed by either party is echoed on both terminals and entered into the ensuing command. For example, if the CLI port user types "GET" and the modem port user types "<blank>CONFIG" and presses RETURN, both users will see "GET CONFIG" and the GET CONFIG screen.

Login

When first dialing in, the remote user is not required to enter a password if the local user is already logged in.

Auto Answer Function

If Auto Answer mode is selected, the unit sends an automatic answering command to the modem to answer incoming calls after a designated number of rings. Otherwise, the modem will be configured not to answer.

Events

Events are defined in the AirLink Pro T1/E1 Rack Mount as Faults, Alarms, Advisories, or Status Messages. These are the four levels of severity, with Faults being the highest. The user may select a dial-out threshold as one of these levels by issuing the SET DIAL LEVEL command, in much the same way as selecting the event reporting level with the SET ALARM LEVEL command. The Dial-out function will dial out when there is a condition at or above that level. For proper operation, the dial-out severity level must be equal to or greater than the event queuing level.

Dialout Function

During an event, the modem is directed to dial the telephone number(s) in the configuration database and send a brief descriptive announcement. The connection is then terminated. Up to two numbers can be selected; a primary number that will always be dialed first, and a backup number in case the unit cannot reach the primary number. Also, the unit will make repeated attempts to dial if the first attempt is unsuccessful.

Operation

There are two user-configurable thresholds for alarms. An alarm threshold establishes the point when the unit begins to dial-out. In addition, to prevent excessive dialing in the presence of repetitive events, a dial holdoff time is defined.

Alarm Holdoff Time (0 - 600 seconds; default = 10)

One or more events must persist between 0 - 600 seconds before a dial-out attempt is made. When set to zero, the unit dials out immediately.

One qualifying event must be present although Alarm Holdoff does not require the same condition for the entire interval.

Repeat Alarm Count (2 - 1000 counts; default = 10)

Events are alternately declared and cleared for cyclical alarm conditions and must be declared between 2 - 1000 counts during the period defined by Alarm Holdoff Time. The event does not have to be the same one each time. Dial-out is not attempted until the end of the alarm holdoff time, even if the Repeat Count is reached before then.

Dial Holdoff Time (0 - 5000 minutes; default = 10)

Dial Holdoff Time is the length of time to wait between successive dial-outs when alarms are repetitive. This alarm timer operates independently of the alarm holdoff time and repeat alarm count. After a dial-out, any persistent or repeated alarm conditions will wait until the end of the dial holdoff time.

When the interval value is set to zero, there will be a minimum 10 seconds between the last time the local modem hung up and the next attempt (in conformance with EIA-602).

Dial Holdoff does not apply in the case of failure to connect; instead, the Dial Retry time is applied.

If any of the above parameters is changed, or if the event queue is reset with the RESET ALARMS command, the holdoff counters and timers will be reinitialized. This is to prevent spurious dial-outs.

Repeat Dialing and Prioritization

During dial-out, an alarm text message is sent according to a prioritization scheme (the highest-severity alarm condition in effect is sent first). If there are multiple alarms present at that level, the text is for the first-occurring event.

Although Radio Sync Loss and Receive Power Below Threshold are both at the level of ALARM, Radio Sync Loss takes priority over Receive Power Below Threshold, for dial-out purposes. (Both are at the ALARM level for SET ALARM THRESHOLD and SET DIAL THRESHOLD.)

Alarm conditions of a persistent nature, that do not clear themselves, will result in repeated dial-outs. Alarms of this class include all the conditions at the ALARM and FAULT levels, such as Radio Sync Loss and Receive Signal Level Below Threshold. One-time events, such as Errored-second threshold exceeded, and fault-cleared conditions, result in only a single dial-out.

Telephone Numbers and Dial Format

The primary telephone number is the first number dialed. Ringing will continue for a user-specified period (default is 30 seconds) before giving up as unanswered. When the connection to the primary telephone number is not successful, then the secondary number is attempted.

If neither the primary nor the secondary number is successful, then the AirLink-T1 waits for a Dial Retry period before retrying. In this case, an advisory event is logged stating the reason for the failed dial-out. In addition, if the unit is unable to communicate with the modem, it will continuously retry (no holdoff period is imposed), and log an advisory. Only one advisory message of each type will be logged per dialing session (from the first failed attempt until dial-out is successful) in order to prevent the event queue from becoming flooded with dial-out failures. No busy or no-answer advisory event will cause a dial-out.

The telephone numbers are entered as 40 characters, including the "ATDT" prefix. If there is no primary number, the secondary number is never attempted. The following characters may be used in the telephone number fields:

0-9	Dial numbers
, (comma)	Pause 1 second each before processing next char (to wait for second dial tone after dialing '9')
!	Flash (0.5 second ON-HOOK signal)
@	causes the modem to wait 30 seconds for one or more rings followed by 5 seconds of silence before processing the next character. This is used when the system being called does not provide a dial tone.
#	# key on touch-tone telephone keypad
*	* key on touch-tone telephone keypad
- (dash)	No meaning; provided for user convenience
( )	No meaning; provided for user convenience
' '	Blank spaces are ignored.

User-Directed Connections

To troubleshoot, enter the command to dial a specific telephone number and hold the connection. The syntax for this command is:

CONNECT 1

CONNECT 2

```
CONNECT telephone-number
```

When the parameter is given as 1 or 2, the unit will dial the stored primary or backup phone number respectively. Otherwise, the modem will dial the number supplied on the command line. The telephone number must follow the syntax of the configured telephone numbers.

CONNECT does not automatically retry upon dial-out failure; this is strictly a manual operation. To redial, use the control-R key to repeat the last command. When this command is used, the connection remains in effect until the user issues a DISCONNECT command, the remote modem hangs up, or (if configured), a Connection Timeout timer expires.

Manual or automatic connections can be terminated immediately by using the following command:

```
DISCONNECT
```

This immediately hangs up the telephone connection and returns the dial-out function to IDLE. RTS is returned to its configured state and DTR is released. DISCONNECT also abandons any dial-out attempt in progress but does NOT prevent future dial-outs. For this reason, the mode should be set to DISABLED before performing any maintenance functions.

RS-232 Modem Port Interface

Data Rate and Port Parameters

The Data Rate is part of the port configuration. The available rates are 1200, 2400, 4800, and 9600 bits per second.

So-called "smart modems" of the type commonly in use, "auto-baud" or adjust their RS-232 bit rate to that of the DTE.

Before using an unknown modem, it is a good idea to reset its configuration to the factory defaults, then configure the three-wire operation if desired. For most modems, this can be accomplished by issuing the following commands:

AT&F<RETURN>	Reset to factory defaults
AT&K0<RETURN>	Ignore RTS
AT&D0<RETURN>	Ignore DTR

The remaining unchanging port parameters are:

    1 start bit
    1 stop bit

8 data bits

no parity

Protocol Modems

Protocol modems support MNP or other data compression. Since protocol modems introduce unneeded complications for flow control, and the AirLink Pro T1/E1 Rack Mount modem data rate needs are modest, such protocols should be turned off. However, error correction should be enabled if available; it will prevent garbage characters from appearing on the remote terminal when the unit hangs up the modem. This option is normally enabled by factory default on modems equipped with it.

RTS Control

RTS Control allows the Request-To-Send (RTS) line to be set to Continuous or Switched. When set to Continuous, the RTS is asserted at all times. When set to Switched, the RTS line is asserted.

The unit will wait a reasonable time (so the unit does not hang) for the modem to release the CTS line before reasserting the RTS line to begin any future transmit cycles. The Switched mode is used with modem sharing devices.

When the DTR line is needed for modem sharing devices, it can be configured to perform the modem enable function. If the DTR line is configured for a modem sharing device, it will perform the same as the RTS line and the response will come from the CTS line.

Responses

All numeric responses are followed by <CR> (ASCII 13 decimal). All "word" responses are followed by <CR> and <LF> (ASCII 10 decimal).

Table 3-3
Modem Response Definitions

Modem Response	Definition
0 (zero)	Numeric version of "OK"
OK	Successful execution of non-dial command
CONNECT	[XXXX] carrier detected; XXXX = numeric bit rate
RING	Ringing detected
NO CARRIER	No connection established, or connection lost
ERROR	Error in command line
NO DIALTONE	No dial tone present
BUSY	Busy signal
NO ANSWER	5 seconds of silence not detected if '@' dial modifier was used.

User Interface Additions

Table 3-4
Modem Commands

Parameter	Specification
SET ALARM HOLDOFF	0-600 (seconds)
SET ANSWER TIMEOUT	0-99 (seconds)
SET CONNECTION TIMEOUT	0 - 43200 (seconds; 0 means no time-out)
SET DIAL	{TONE | PULSE}
SET DIAL HOLDOFF	0-5000 (minutes, repeat dial holdoff)
SET DIAL LEVEL	{FAULT | ALARM | ADVISORY | STATUS}
SET DIAL RETRY	15-3600 (seconds)
SET MODEM MODE	{DISABLED | DEDICATED DIAL_OUT | ANSWER | BOTH}
SET MODEM RATE	{1200 | 2400 | 4800 | 9600}
SET MODEM RTS	{SWITCHED | CONTINUOUS}
SET MODEM CTS	{OBEY | IGNORE}
SET MODEM DTR	{SWITCHED | CONTINUOUS}
SET MODEM VOLUME	{OFF | LOW | MEDIUM | HIGH}
SET MODEM XOFF	{OBEY | IGNORE}
SET PHONE 1	(XXX) XXX-XXXX
SET PHONE 2	(XXX) XXX-XXXX
SET REPEAT COUNT	0-99
SET RINGCOUNT	0-9

The GET MODEM command retrieves all of the Modem Command parameters. This command produces a screen displaying all of the settings, the dial-out status, and the date and time. In addition, all the SET and GET commands are available via the REMOTE prefix.

The following commands are also supported:

```
CONNECT 1       manual connect
CONNECT 2       manual connect
CONNECT         telephone-number  manual connect
DISCONNECT      manual disconnect
```

```
GET MODEM        view modem and dial-out parameters
QUERY RS232      status of RS-232 handshaking lines
```

Responses and Alerts

Each of the following messages is an advisory. These advisories will not
trigger a dial-out, but they are entered into the Event Queue.

```
"Modem Busy"
```

```
"No Modem"
```

```
"No Answer"
```

```
"No Dialtone"
```

Default Parameters

Table 3-5
AirLink Pro T1/E1 Rack Mount Dialout Parameters

Parameter	Default
ALARM HOLDOFF	10 seconds
ANSWER TIMEOUT	30 seconds
CONNECTION TIMEOUT	3600 seconds (1 hour)
DIAL FORMAT	TONE
DIAL HOLDOFF	10 minutes
DIAL LEVEL	ALARM
MODEM MODE	DISABLED
MODEM RATE	9600
MODEM RTS	CONTINUOUS
MODEM CTS	IGNORE
MODEM DTR	CONTINUOUS
MODEM VOLUME	LOW
MODEM XOFF	IGNORE
PHONE 1	(blank)
PHONE 2	(blank)
REPEAT COUNT	10 events
RINGCOUNT	1

Alarm Holdoff

This is the period of time between the onset of the first alarm condition, and the unit dialing out to report the alarm. During this period, an alarm condition must have existed continuously, or a minimum number of events must have occurred. The minimum number of events is defined by Repeat Count. The alarm events must be all be at or above the severity level, as defined by Dial Level.

To set this value, type the command:

```
SET ALARM HOLDOFF XXX   <RETURN>
```

where XXX is the time period in (0 - 600) seconds. The default is 10.

Repeat Count

The number of alarm events occurring at or above the Dial Level, during the Alarm Holdoff period, before an Alarm Dialout is initiated.

To set this value, type the command:

```
SET REPEAT COUNT XX   <RETURN>
```

where XX is the number of (2 - 1000) events. The default is 10.

Dial Level

The severity level that alarm events must be to contribute to an Alarm Dialout. To set this level, type the command:

```
SET DIAL LEVEL {FAULT | ALARM | ADVISORY | STATUS} <RETURN>
```

The default level is ALARM.

Dial Holdoff

The period of time between alarm dial-outs. This time period is independent of the alarm holdoff and dial retry time periods. To set this value, type the command:

```
SET DIAL HOLDOFF XXX   <RETURN>
```

where XXX is the period in (1 - 5000) minutes. The default is 1.

Dial Format

To set the Dial format to TONE or PULSE, type:

```
SET DIAL TONE   <RETURN>
```

or

```
SET DIAL PULSE   <RETURN>
```

The default setting is TONE.

Dial Retry

If the unit dials an alarm and reaches a busy or no answer signal, the unit will dial a second number if one is specified. Both numbers are dialed before a holdoff period is imposed. There is no automatic retry when the unit is configured for manual dialing.

To set the holdoff period before the unit dials the first number again, type the command:

```
SET DIAL RETRY XXX   <RETURN>
```

where XXX is the period in (15 - 3600) seconds. The default is 60.

Modem (Enabling) Mode

This is the modem operation mode that is described in the section *Using the Network Management (Modem) Port*. To set this mode, type the command:

```
SET MODEM MODE {DISABLED | DEDICATED | DIAL_OUT | ANSWER | BOTH}
```

The default is DISABLED.

Modem Rate

This is the bit rate of the modem port. To set this parameter, type the command:

```
SET MODEM RATE {1200 | 2400 | 4800 | 9600}
```

The default is 9600.

Modem RTS Mode

This mode governs whether the modem port RTS line is permanently asserted, or switched on only when the port is sending characters. The RTS line is not needed for use with smart modems. To change the mode, type the following command:

```
SET MODEM RTS {SWITCHED | CONTINUOUS}
```

The default mode is CONTINUOUS.

Modem DTR Mode

This governs whether the modem port DTR line is permanently asserted or switched on only when the port is sending characters. The DTR line is not needed for use with smart modems. To change the mode, type the following command:

```
SET MODEM DTR {SWITCHED | CONTINUOUS}
```

The default mode is CONTINUOUS.

Phone Numbers 1 and 2

Phone number 1 is the phone number that the unit will dial first when trying to send out an alarm message. The phone number must be specified if a dial-out mode is chosen. Phone number 2 is an optional second phone number that the unit will dial if Phone number 1 is busy or does not answer.

To set phone numbers, type the command:

```
SET PHONE 1 XXX-XXXX <RETURN>
```

or

```
SET PHONE 2 XXX-XXXX <RETURN>
```

where XXX-XXXX is the phone number. Any string of up to 20 characters is acceptable, provided the modem can interpret it. This string is preceded by the letters ATDT or ATDP depending on whether tone or pulse dialing is selected. Any special dialing prefixes should precede the number entered here, such as "9," for dialing out from a PBX, or any special sequences for disabling Call Waiting. For example:

```
SET PHONE 1 9, 555-5555 <RETURN>
```

Ring Count

This mode determines the number of rings the modem at the unit end will answer. In order to use this command, the modem must be connected to the unit and preferably be on hook. To set this value, type the command:

```
SET RINGCOUNT X <RETURN>
```

where X is the number of (0 - 9) rings. Zero (0) means Do Not Answer. The default is 1.

Answer Timeout

For dialing out, this is the time period after that the unit will declare a no-answer condition, and if a second phone number is defined, attempt that number. To set this value, type the command:

```
SET ANSWER TIMEOUT XX <RETURN>
```

where XX is the period in (0 to 99) seconds. The default is 30 seconds. This can be adjusted depending on the number of rings that the remote modem is programmed to answer.

Connection Timeout

This mode determines the time period the unit will terminate a manual connection, either dial-in or dial-out. To set this value, type the command:

```
SET CONNECTION TIMEOUT XXXX <RETURN>
```

where XXXX is the time period in (0 - 43200) seconds. The default value is 3600 (one hour). A value of zero means that no time-out will be applied and the modem link will remain connected indefinitely.

Getting AirLink Pro T1/E1 Rack Mount Configuration Information

The GET command keyword requests configuration-related information from the AirLink Pro T1/E1 Rack Mount. Use the REMOTE command keyword to request configuration-related information from the far-end AirLink Pro T1/E1 Rack Mount on the following:

❚ Configuration parameter settings

❚ Threshold settings

❚ Hardware and software revision levels

Configuration Parameter Settings

To list the current configuration parameter settings, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> get configuration
```

The system displays a list of information similar to the following:

```
AIRLINK PRO T1/E1> get configuration
Site Name:          Cylink Sunnyvale 2

Application:        1. Primary Master at a Hub
Burst Mode:         Duplex
Coding:             B8ZS/HDB3
Equalization:       0 - 133
PN Code:            1
RF Power:           0.0 dBm

Alarm Reporting:    Immediate
Alarm Level:        Status
Date/Time:          jun 9 1996 10:35:00
```

Threshold Settings

To list the current threshold settings, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> get threshold
```

The system displays a similar list:

```
AIRLINK PRO T1/E1> get threshold

1 HR ES:        20
1 HR UAS:       5
24 HR ES:       25
24 HR UAS:      8
Rx Power:       -75 dBm
Tx Power:       0 dBm
```

Hardware and Software Revision Levels

To list the hardware and software revision information, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> get revision
```

The system displays a similar list:

```
AIRLINK PRO T1/E1> get revision

Site Name:          sunnyvale 2
Digital Assembly:   14501-010
```

```
Digital List:        1
Digital Issue:       A
Digital S/N:         001
FPGA Rev:            14496-0100
Software Rev:        1.00

IF Assembly:         13559-020-03
IF List:             1
IF Issue:            A
IF S/N:              001
Top Assembly:         14413-010-00
Top Assembly:S/N:    00000000
```

OK

Command Keywords and Operands

In addition to the SET and GET command keywords, the terminal user interface provides command keywords that monitor status, performance, and alarms, to initiate QRSS and loop tests, and reset alarm and test counters.

The command keywords are described in Appendix C, *Commands.*

CHAPTER 4

Operations and Maintenance

This chapter contains information on the operation and maintenance of the AirLink Pro T1/E1 Rack Mount procedures for monitoring the alarm queue, and describes how the AirLink Pro T1/E1 Rack Mount responds to particular alarm conditions.

Inside this chapter:

Overview

This chapter focuses on monitoring system operation by querying for status, performance, and alarm information through the terminal user interface. This chapter also includes descriptions of the LEDs on the AirLink Pro T1/E1 Rack Mount digital module. Finally, this chapter describes the diagnostic tests and procedures used to isolate and resolve errors occurring during radio unit operation.

Programmed Configuration Parameters

AirLink Pro T1/E1 Rack Mount operation is governed by user-selectable configuration and control parameters that reside in the non-volatile memory of the unit. These parameters are displayed and controlled through a terminal device that can access both the local and remote unit. When power is lost and then restored, the system reconfigures itself from its protected configuration database.

A long-life lithium battery protects all system configuration settings during power losses. The battery is part of the non-volatile memory/real-time clock circuitry on the digital module in the AirLink Pro T1 and has a 10-year storage life (in the absence of power to the AirLink Pro T1/E1 Rack Mount).

CAUTION   The component containing the lithium battery is **NOT** a customer-replaceable part. Do not expose the lithium battery cell by opening the component. Do not attempt to recharge the battery. Do not dispose of the component by fire. The lithium battery could explode if mistreated.

Refer to Chapter 3, *Configuration*, for more information on changing configuration parameter settings.

Acquiring Status Information

Each AirLink Pro T1/E1 Rack Mount system maintains an internal database of status and performance information that it uses, in part, to derive the events that are stored in the event queue. The status information categories include:

❚   T1 DTE Input Loss

❚   Radio Synchronization Loss

❚ Burst Synchronization Loss

❚ Test in Progress

❚ DTE Alarm Indicator Signal (AIS)

❚ RF Alarm Indicator Signal (AIS)

❚ Transmit module failure

❚ Receive power level

❚ Transmit power level

❚ Temperature

All this information is available from both the local and the remote AirLink Pro T1/E1 Rack Mount units.

Viewing Status Information

To view the status information for the local unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> query status
```

The system displays a list of status information similar to the following:

```
AIRLINK PRO T1/E1> query status
Site Name: Sunnyvale 2

DTE Loss:          NO
Radio Sync Loss:   NO
Burst Sync Loss:   N/A
Test in Progress:  FE Radio Remote Loop
DTE AIS:           OFF
RF AIS:            OFF
Tx Fail:           NO
Rx Power:          -60.5 dBm
Tx Power:          12.0 dBm
Temperature:       5 C
```

The significance of these information categories is explained in the following sections.

Site Name

The site name identifies the role or location of the specified AirLink Pro T1/E1 Rack Mount. In the previous example, "Sunnyvale 2" is the site name. This parameter is optional and can be any convenient description up to 60 alphanumeric characters.

When using the Dial Out Alarm feature, it is important to have a descriptive name because the Site Name is part of the specific alarm report.

It might also be useful to put AU in a site name when an Access Unit is at the site.

T1/E1 DTE Input Loss

Indicates whether the T1/E1 signal on the cable from the DTE has been lost. The T1/E1 input loss detector monitors the T1 or E1 input signal from the DTE and declares DTE input loss when it detects 175 ±75 continuous zeros in the T1 or E1 bit stream.

When the controller detects T1/E1 input signal loss, it instructs the transmitter to send all ones toward the radio, updates the status reporting database, and turns on the Signal Loss indicators in the AirLink Pro T1/E1 Rack Mount. In the absence of a T1/E1 input signal, the unit switches to internal clocking.

Radio Synchronization Loss

Indicates whether radio synchronization has been lost. An action similar to the DTE input loss occurs for radio synchronziation loss. See the previous paragraph referring to the controller detecting signal loss.

Burst Synchronization Loss

Indicates whether burst synchronization has been lost. An action similar to the DTE input loss occurs for burst synchronziation loss. See the paragraph referring to the controller detecting signal loss under the heading DTE Input Loss.

Test in Progress

When a test is active, query status identifies the test by name. Only one test can be run at a time. If you attempt to start up a second test while a test is running, the system terminates the first test and inserts an event message in the event queue.

DTE Alarm Indication Signal (AIS)

DTE AIS is declared when Radio Sync Loss (RSL) is detected, or when there is an active loop test that does not involve this DTE connection. The AirLink Pro T1/E1 Rack Mount sends an unframed, all-ones signal toward the DTE. This condition is cleared after RSL ceases or the loop test is terminated. For more information on AIS conditions, refer to "Carrier Failure Alarms" in "Acquiring Alarm Information", later in this chapter.

RF Alarm Indication Signal (AIS)

RF AIS is declared when LOS is detected, or when there is an active loop test that does not involve this connection. The AirLink Pro T1/E1 Rack Mount sends an unframed, all-ones signal toward the remote AirLink Pro T1/E1 Rack Mount, which passes it on to the remote DTE. This condition is cleared after LOS ceases or the loop test is terminated. For more information on AIS conditions, refer to "Carrier Failure Alarms" in "Acquiring Alarm Information" in this chapter.

Transmit Module Failure

Indicates whether service affecting a hardware failure has occurred.

Receive Power Level

A measurement, in dBm, representing the current receive power level for the unit.

Transmit Power Level

A measurement, in dBm, representing the current transmit power level for the unit.

Temperature

The temperature (in degrees Celsius) detected at the RF module in the AirLink Pro T1/E1 Rack Mount.

Acquiring Alarm Information

As alarm events occur, they are signaled through indicators on the AirLink Pro T1/E1 Rack Mount and are entered in the event queue. For a complete list of events causing an alarm state, refer to the section "The Event Queue" in this chapter.

While indicators provide an observable indication of alarm conditions and other behavior, the information available through the terminal connected to the system is easier to access and interpret.

The Event Queue

When an alarm is detected, a message is entered into the AirLink Pro T1/E1 Rack Mount event queue. The event queue is a chronological list of up to 256 events. An alarm event is defined as the declaration of an alarm condition *or* the clearing of an alarm condition. The event queue logs the cause and time of individual alarm events as they occur.

Events Causing an Alarm State

The following events cause an alarm state in the AirLink Pro T1/E1 Rack Mount and insert an alarm entry in the event queue:

- Receive level below the threshold
- Transmit level below the threshold
- T1 input signal loss
- Error count exceeds the threshold
- Synthesizer loss of lock
- Radio sync loss
- Transmit burst sync loss

Carrier Failure Alarms

The AirLink Pro T1/E1 Rack Mount responds to a carrier failure differently than devices in a conventional network scheme.

In a conventional network scheme (Figure 4-1), if a cable breaks and disrupts the network signal, the device immediately downstream from the break detects the loss of signal and enters a red alarm state.

In the red alarm state, the device sends an unframed, all-ones Alarm Indication Signal (AIS)—also known as a "blue" signal—toward its downstream neighbor and a Remote Alarm Indication (RAI), or "yellow "signal back towards its upstream neighbor.
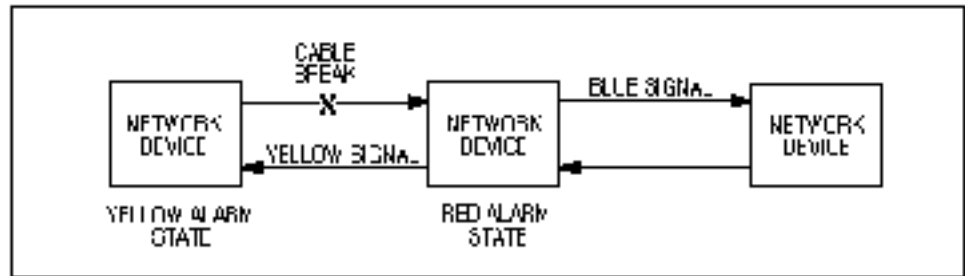
Figure 4-1
Conventional Carrier Failure Response

If the microwave signal is lost between two AirLink Pro T1/E1 units
(Figure 4-2), both AirLink Pro T1/E1 units enter the local alarm state and send
an unframed, all-ones AIS (blue alarm) back toward its neighboring network
device. When the RF signal is regained, the AirLink Pro T1/E1 will come out of
the alarm state in about 10 ms.
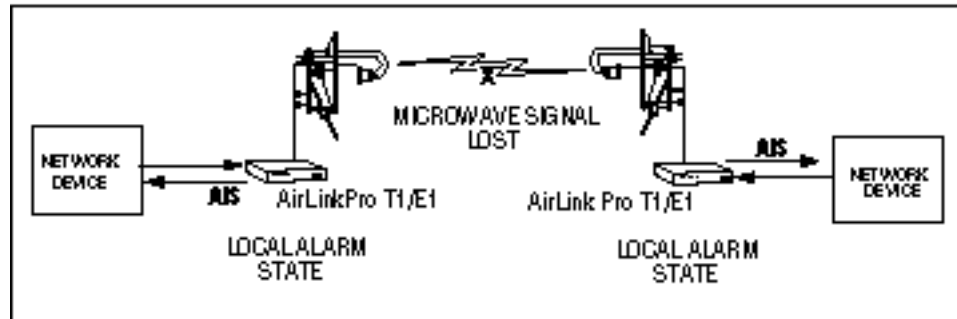
Figure 4-2
AirLink Pro T1 Carrier Failure Response

If one of the three AirLink Pro T1/E1 Rack Mount loopback tests is active, AIS
is sent toward that portion of the link that has been excluded by the loop, so
the location and direction of the AIS depends upon which loopback test is
active. For more information about AIS and loopback tests, refer to "Loopback
Tests" in "Diagnostic Tools," in this chapter.

Note that the other equipment in the network can take action upon receiving
alarm signals and might or might not restore service when the alarm clears.

Viewing the Event Queue

To view the event queue for the local unit, type the following command at the
AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> query alarms
```

The system displays a list of alarm information similar to the following:

```
AIRLINK PRO T1/E1> query alarms

8: 8001: 20 SEP 1995 15:11:32 QRSS Test Started
7: C006: 20 SEP 1995 15:11:31 All Tests Cleared
6: 8007: 20 SEP 1995 15:09:50 FE Remote Loop Test Started
5: C006: 20 SEP 1995 15:09:50 All Tests Cleared
4: C006: 20 SEP 1995 15:07:51 All Tests Cleared
3: 8001: 20 SEP 1995 15:06:22 QRSS Test Started
2: C006: 20 SEP 1995 15:06:22 All Tests Cleared
1: C000: 20 SEP 1995 14:59:22 Event queue Cleared
```

NOTE	Central office equipment, such as PBXs, and routers usually take some action when receiving AIS, and might or might not automatically restore service after AIS is cleared. When the signal is regained, it will halt AIS within 10 milliseconds.

When the event queue contains alarm messages, the most recent message with the most recent time and date displays at the top of the list.

When there are more messages than will fit on one screen, you can page through the messages by pressing <Return> to go forward one screen, or <B><Return> to go back one screen. Press <Q> to exit (quit) the event queue display.

To view the event queue of the remote unit, use the command:

```
AIRLINK PRO T1/E1> remote query alarms
```

Resetting the Event Queue

To reset the event queue for the local unit, type the following command:

```
AIRLINK PRO T1/E1> reset alarms
```

The system prompts you to confirm the event queue reset request:

```
AIRLINK PRO T1/E1> reset alarms
Reset alarms: Are you sure? (Y/N)
```

When you enter y (yes) to confirm the request, the system clears the event queue. If you enter n (no) or just press <Return>, the system ignores the event queue reset request. If you query the event queue at this point, you should see only one event, Alarm Queue Reset.
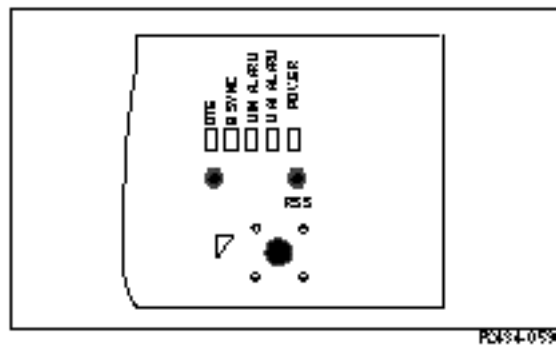
The size of the Alarm Queue is 256 lines. No more alarms are logged when the action is full.

AirLink Pro T1/E1 Rack Mount Indicators

The AirLink Pro T1/E1 Rack Mount has five front-panel indicators. These indicators (LEDs) are duplicated on the rear panel. Refer to Figure 4-3 and 4-4.
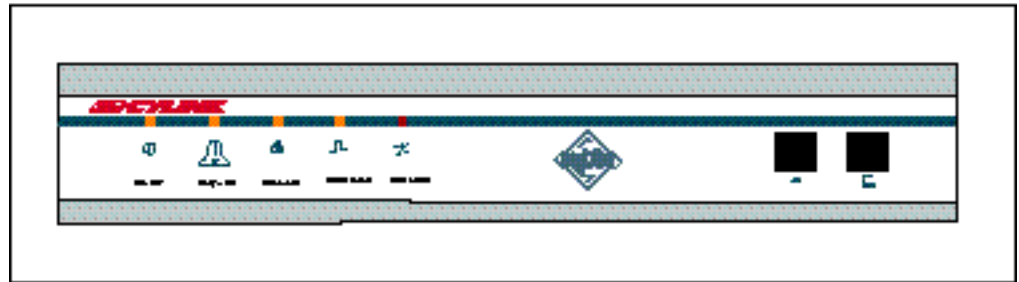
Figure 4-3
Front Panel Indicators

Figure 4-4
Rear Panel Indicators

Table 4-1
Visual Indicators

Name	Color	Function
Power	Green	Indicates that primary power is applied to the equipment and the power supply is working.
Major Alarm	Red	When ON, indicates that one or more of the following events has occurred. -Transmit Power below threshold -Synthesizer Loss of Lock (equipment failure) -Transmitter Failure - DTE Input Loss - Radio Sync Loss - Loss of primary burst sync (single sync bus) - Loss of primary and backup burst sync (dual sync bus)
Minor Alarm	Yellow	When ON, indicates that one or more of the following events has occurred. - RCV Input Level Below Threshold - Unit has been placed in a test mode - ES threshold exceeded - UAS threshold exceeded - Loss of primary or backup burst sync (dual sync mode)
Sync Source	Green	When ON, indicates that this unit is a source of burst sync for other AirLinks.
T1/E1 SIG Loss	Red	When ON, indicates the T1/E1 input signal from the DTE has been lost or all zeros.

Acquiring Performance Information

Each AirLink Pro T1/E1 Rack Mount system maintains an internal database of status and performance information that it uses, in part, to derive the events that are stored in the event queue. The performance information categories include:

❚ Quasi-Random Signal Sequence Bit Error Rate (QRSS BER)

❚ Errored Second (ES) counts (1-hour and 24-hour)

❚ Unavailable Second (UAS) counts (1-hour and 24-hour)

❚   Receive Signal Quality (RSQ)

The AirLink Pro T1/E1 Rack Mount uses a Cyclic Redundancy Check (CRC) error-checking system that constantly monitors the link error performance. The CRC calculation is only performed on the T1/E1 payload. The CRC sequence is a 16-bit sequence that is appended to the end of the burst. The receiver on the other end uses the same CRC-16 algorithm to perform the check on the received burst and then compares the result. If the two checks do not match, the system declares a CRC-16 error and increments the CRC-16 counter. Whether errored or not, the CRC-16 sequence is removed and the payload is passed through to the DSX-1 interface.

Viewing Performance Information

To view the performance information for the local unit, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> query performance
```

The system displays a list of performance information similar to the following:

```
AIRLINK PRO T1/E1> query performance
Site Name: Sunnyvale 2
QRSS BER:       Unavailable
1 HR ES:        1
1 HR UAS:       0
24 HR ES:       1
24 HR UAS:      0
RSQ:            10
```

The following sections contain significance information about these categories.

QRSS BER

When the QRSS test is active, the Quasi-Random Signal Sequence Bit Error Rate (QRSS BER) is the count of QRSS bit errors detected. The error counter normally used to count CRC-16 errors is used instead to count QRSS bit errors.

When the QRSS test is active, the count of ES and UAS errors is suspended and the existing values held, unaffected by the QRSS test. These counts are reactivated when the QRSS test is terminated.

The results of the QRSS BER calculation are displayed in one of the following forms:

unavailable   When QRSS test is not selected, the word unavailable is displayed.

`< 10E-xx`	When there are no errors, the result of the calculation is displayed as < 10E-xx, where 10E-xx is the number of bits transmitted, for example < 10E-08.
`n.nE-xx`	When there are errors, the result of the calculation is displayed as the bit error rate, for example 1.6E-07.

Errored Seconds

An errored second is any one-second interval during which there is a CRC-16 error. Errored seconds can be asynchronous, that is, they do not have to be correlated with real time. An Errored Seconds (ES) total is maintained in a database for the previous one hour and the previous 24 hours.

The one hour and 24 hour errored second databases are both updated each time an errored second occurs. The one hour database is cleared to zero one hour after the first errored second is logged. The 24 hour database is cleared to zero 24 hours after the first errored second is logged.

Unavailable Seconds

The link is declared unavailable during the time that Radio Sync Loss is active.

RSQ

Receive Signal Quality (RSQ) is a figure of merit that is normalized on a scale of 1 to 10, and is a function of the receive signal-to-noise ratio and signal-to-interference ratio. A strong signal that is severely corrupted with interference results in a normal receive signal indication and a low RSQ number.

Resetting Performance Counters

To reset the QRSS counter, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> reset qrss
```

The system prompts you to confirm the reset request:

```
AIRLINK PRO T1/E1> reset qrss
Reset QRSS: Are you sure? (Y/N)
```

When you enter y (yes) to confirm the request, the system clears the qrss counter. If you enter n (no) or just press <Return>, the system ignores the reset request. If

you query performance at this point, you should see that the counter has been reset.

To reset the 1-hour and 24-hour ES and UAS counters, type the following command at the AirLink Pro T1/E1 prompt:

```
AIRLINK PRO T1/E1> reset performance
```

The system prompts you to confirm the reset request:

```
AIRLINK PRO T1/E1> reset performance
Reset performance: Are you sure? (Y/N)
```

When you enter y (yes) to confirm the request, the system clears the ES and UAS counters. If you enter n (no) or just press <Return>, the system ignores the reset request. If you query performance at this point, you should see that the 1-hour and 24-hour ES and UAS counters have been reset.

Diagnostic Tools

The AirLink Pro T1/E1 Rack Mount provides the following diagnostic tools:

▮ A QRSS test

▮ Two loop tests

The QRSS test and the loopback tests are initiated by commands entered through the terminal user interface.

NOTE Only one test can be active at a time. If you attempt to start up a second test while a test is running, the system terminates the first test and activates the second test.

Radio QRSS Testing

The QRSS signal is the Telco industry standard QRS test signal as defined in ANSI Standard T1.403-1989. It is a 1,048,575-bit sequence generated by a 20-stage shift register with feedback taps on stage 17 and 20. The sequence is further altered to permit no more than 14 consecutive zeros. A QRSS test checks the continuity and performance of a link (Figure 4-5). In QRSS testing, the network traffic signal is interrupted and customer data on the radio signal is replaced with a QRSS signal. When a QRSS test is initiated, QRSS (unframed) is sent to the DTE. This causes a frame loss on any associated DTE equipment that expects a framed DS1 signal thereby forcing an alarm condition. This forces the equipment to go out of service.
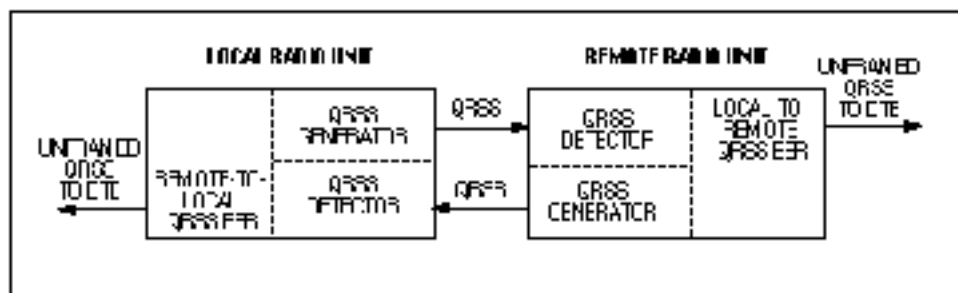
Figure 4-5
AirLink Pro T1/E1 Rack Mount QRSS Test

Initiating the Test

The QRSS test is separate for each direction. This helps isolate unsymmetric faults, such as RF interference versus antennae cable faults. The QRSS test can be initiated by a command entered through the terminal user interface. You can initiate a QRSS test from either end of the AirLink Pro T1/E1 Rack Mount link. When the test is initiated, it is activated simultaneously from both ends of the radio link. Each end of the link measures the received errors (independently) and calculates the Bit Error Rate.

CAUTION
This test interrupts the payload in the T1/E1 channel. Before initiating this test, you should consider the impact of this test on the rest of the T1/E1 system.

To start a QRSS test on the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> test qrss
```

The system prompts you to confirm the QRSS test:

```
AIRLINK PRO T1/E1> test qrss
WARNING: Start QRSS test? (Y/N)
```

When you enter Y (yes) to confirm the request, the system starts the QRSS test.

```
AIRLINK PRO T1/E1> test qrss
WARNING: Start QRSS test? (Y/N) y
Site Name: Sunnyvale 2

   OK
AIRLINK PRO T1/E1>
```

If you enter N (no) or just press <Return>, the system ignores the event queue reset request. If you query the performance statistics at this point, you can check the QRSS BER:

```
AIRLINK PRO T1/E1> query performance
Site Name: Sunnyvale 2
UWER BER:      Unavailable
QRSS BER:      1.6E-07
1 HR ES:       1
1 HR UAS:      0
24 HR ES:      1
24 HR UAS:     0
RSQ:           10
```

The QRSS Bit Error Rate (BER) is measured from a starting point of 0.00E-99. The QRSS BER is equal to:

$$\frac{\text{Number of Errors}}{\text{Test Duration (in seconds)}} \times \frac{1}{1.544 \times 10^6}$$

Terminating a QRSS Test

To terminate a QRSS test on the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> reset test
```

The system prompts you to confirm the QRSS test termination request:

```
AIRLINK PRO T1/E1> reset test
Clear all tests? (Y/N)
```

When you enter Y (yes) to confirm the request, the system stops the QRSS test.

```
AIRLINK PRO T1/E1> reset test
Clear all tests? (Y/N) y

   OK
AIRLINK PRO T1/E1>
```

Resetting The QRSS Error Register

To reset the QRSS error register and restart a test, type the following at the command prompt:

```
AIRLINK PRO T1/E1> reset QRSS
```

NOTE   The command RESET TEST does not reset the error count. The results of the last QRSS test will remain on the QUERY PERFORMANCE screen until RESET QRSS is initiated.

Loopback Tests

The AirLink Pro T1/E1 Rack Mount provides the following loopback tests:

❚ Local Loop test

❚ Remote Loop test

NOTE   You can initiate a loopback test for the local unit or the remote unit, but only one loopback test can be active at a time.

Figure 4-6 shows a generalized view of the two loopback test types. Each of the loopback tests and the conditions that apply during the test are described in the following sections.
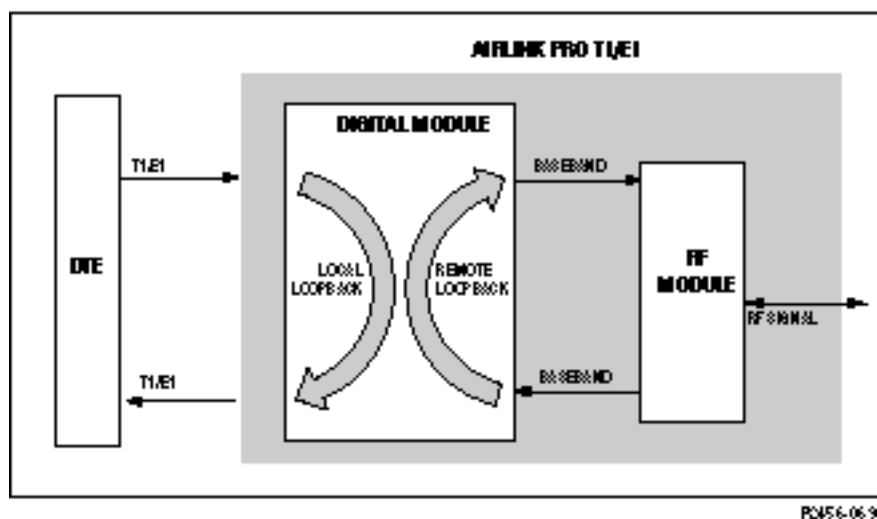
Figure 4-6
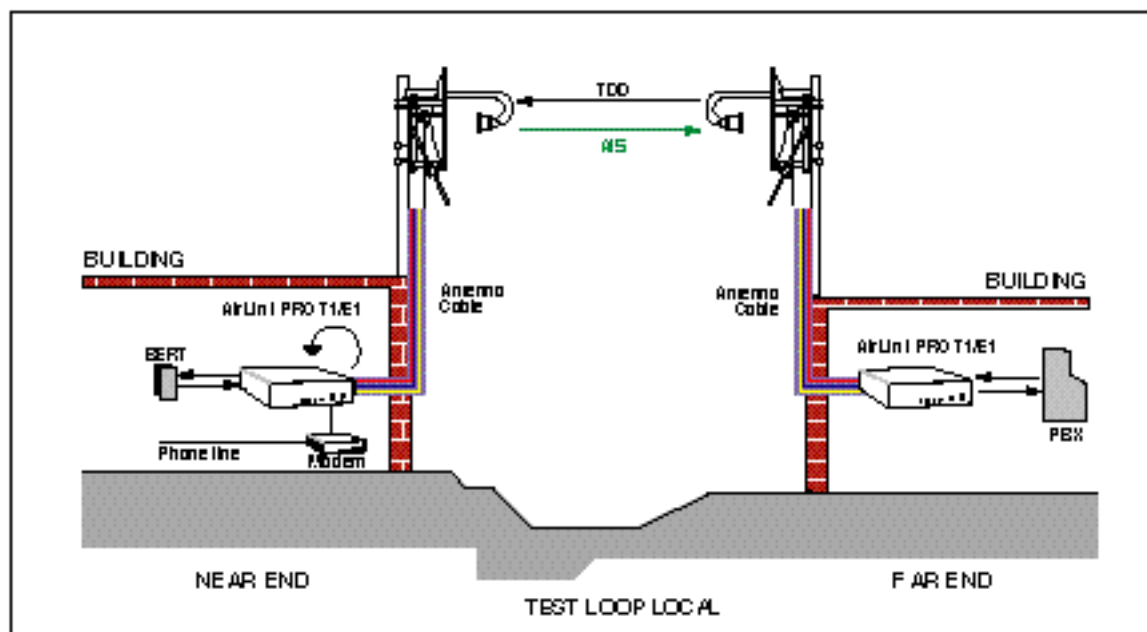AirLink Pro T1/E1 Rack Mount Loopback Tests

Figure 4-7 shows end-to-end communication on a typical AirLink Pro T1/E1 Rack Mount link. Figures 4-8 and 4-9 show the two types of loopback tests in operation.
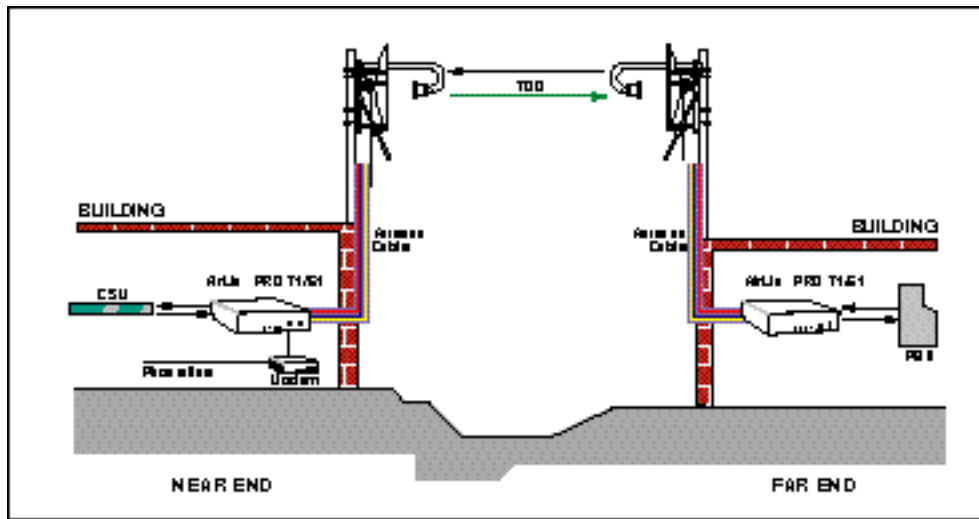
Figure 4-7
AirLink Pro T1/E1 Rack Mount in Normal Operation

Local Loop Test, Near End

The Local Loop test (Figure 4-8) sets a loopback at the T1/E1 interface of the local (near end) radio unit and causes the T1/E1 signal to be returned to the DTE. The AirLink Pro T1/E1 Rack Mount sends an unframed, all-ones Alarm Indication Signal (AIS) toward the downstream (far end) AirLink Pro T1/E1 Rack Mount.

PC495-0596

Figure 4-8
AirLink Pro T1/E1 Rack Mount in Local Loop Test, Near End

To start a local loopback, type the following command at the prompt:

```
AIRLINK PRO T1/E1> test loop local
```
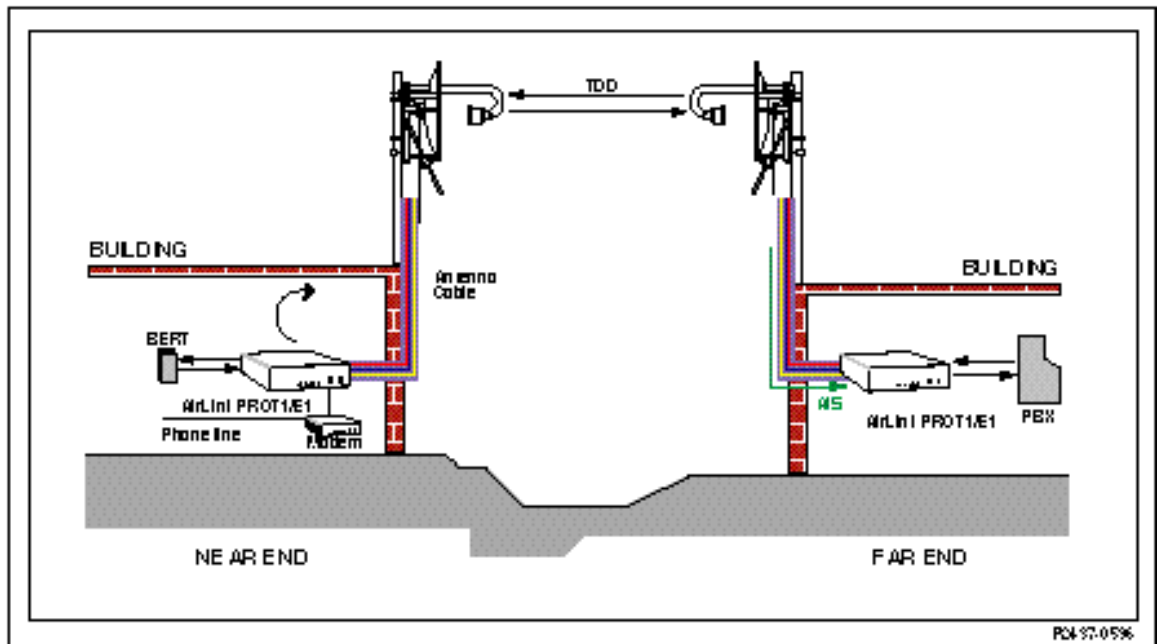
The system prompts you to confirm the loop test:

```
AIRLINK PRO T1/E1> test loop local
WARNING: Start Local Loop test? (Y/N)
```

When you enter Y (yes) to confirm the request, the system starts the loop test.

```
     OK
AIRLINK PRO T1/E1>
Site Name: Sunnyvale 2
```

Remote Loop Test, Near End

The Remote Loop test, Near End (Figure 4-9) causes the over-the-air received T1/E1 signal to be looped back at the output of the receive T1/E1 signal processing circuits. This loopback includes all of the radio circuits and approximately 90% of the digital circuits. The affected AirLink Pro T1/E1 Rack Mount sends an unframed, all-ones Alarm Indication Signal (AIS) toward the DTE.

Figure 4-9
AirLink Pro T1/E1 Rack Mount in Remote Loop Test, Near End

To start a remote loopback, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> test loop remote
```

The system prompts you to confirm the loop test:

```
AIRLINK PRO T1/E1> test loop remote

WARNING: Start Remote Loop test? (Y/N)
```

When you enter Y (yes) to confirm the request, the system starts the
loop test.

```
    OK
  AIRLINK PRO T1/E1>
Site Name: Sunnyvale 2
```

Local Loop Test, Far End

The Local Loop test (Figure 4-10) sets a loopback at the T1/E1 interface of the
remote (far end) radio unit and causes the T1/E1 signal to be returned to the
DTE. The AirLink Pro T1/E1 Rack Mount sends an unframed, all-ones Alarm
Indication Signal (AIS) toward the downstream (near end) AirLink Pro T1/E1
Rack Mount.
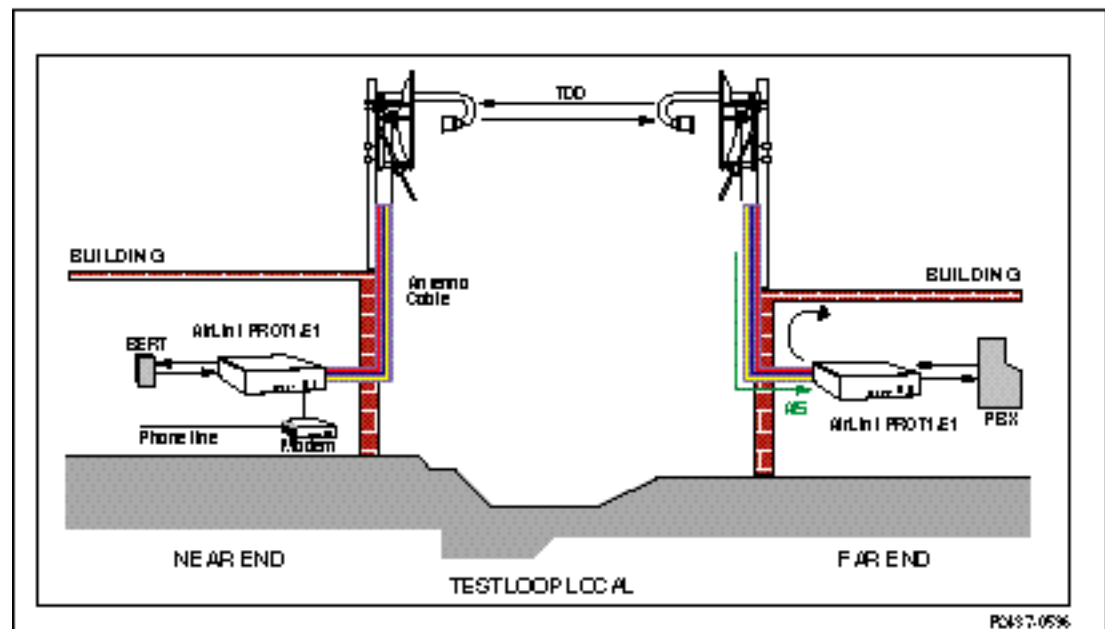
Figure 4-10
AirLink Pro T1/E1 Rack Mount in Local Loop Test, Far End

Remote Loop Test, Far End

The Remote Loop test, Far End (Figure 4-11) causes the over-the-air received
T1/E1 signal to be looped back at the output of the receive T1/E1 signal
processing circuits. This loopback includes all of the radio circuits and
approximately 90% of the digital circuits. The affected AirLink Pro T1/E1
Rack Mount sends an unframed, all-ones Alarm Indication Signal (AIS) toward
the DTE.

Figure 4-11
AirLink Pro T1/E1 Rack Mount in Remote Loop Test, Far End

To start a remote loopback, type the following command at the AirLink Pro
T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> remote test loop remote

The system prompts you to confirm the loop test:

AIRLINK PRO T1/E1> Sending command downline. Please Wait.

WARNING: Start Remote Loop test? (Y/N)

When you enter Y (yes) to confirm the request, the system starts the
loop test.
```
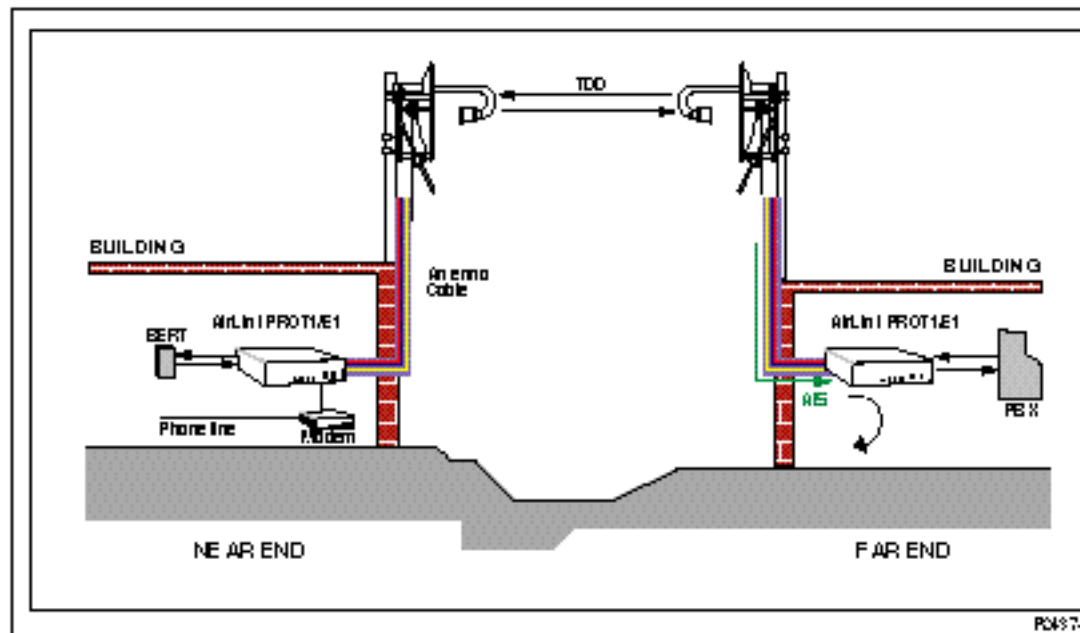
```
     OK
AIRLINK PRO T1/E1>
Site Name: Sunnyvale 1
```

If you query the status information while the test is running, you can verify that the test is running:

```
AIRLINK PRO T1/E1> query status
Site Name: Sunnyvale 2

DTE Loss:         NO
Radio Sync Loss:  NO
Burst Sync Loss:  N/A
Test in Progress: Remote Loop
DTE AIS:          OFF
RF AIS:           OFF
Tx Fail:          NO
Rx Power:         -60.5 dBm
Tx Power:         12.0 dBm
Temperature:      5 C
```

Rack Mount Unit Working with Pro T1 Ruggedized Unit

The following describes the differences between an AirLink Pro T1 Rack Mount Unit and the AirLink Pro T1 Ruggedized Unit.

• A Ruggedized unit has an option to use an Access Unit, and if the Access Unit is installed, there is an additional remote loopback command called "Access Unit Remote Loop."

• A Rack-Mount unit has software set-ability of the E1 Interface (balanced or unbalanced). A Ruggedized unit does not have this option. This option appears in the Rack-Mount unit list of "SET" commands.

• A Rack-Mount unit has a two-wire or four-wire Order wire option. The Ruggedized unit has only two-wire. This option appears in the list of "SET" commands.

NOTE   When an AirLink Pro T1/E1 Rack Mount is operating end-to-end with and AirLink Pro T1/E1 Ruggedized unit, the Order wire option in the Airlink Pro Rack Mount unit MUST be set to two-wire.

Features of Various Units

The following table shows the features the AirLink Pro T1/E1 Rack Mount as compared to the AirLink Pro T1/E1 Ruggedized Unit.

	Ruggedized with Access Unit	Ruggedized without Access Unit	Rack Mount Unit
Access Unit Loop	Yes	No	No
Order Wire	2 wire	2 wire	2 wire or 4 wire
E1 Interface Select	Hardware Jumpers	Hardware Jumpers	Software Selected

APPENDIX A
Messages

This chapter describes AirLink Pro T1/E1 Rack Mount Messages.

Inside this chapter:

General Information

AirLink Pro T1/E1 Rack Mount messages are only accessible through a terminal device connected to a Terminal port on the AirLink Pro T1/E1 Rack Mount. All messages are coded with a four-digit alphanumeric code so that higher-level network management software can detect the message. These messages are grouped into the following categories:

∎ Fault messages (0xxx)

∎ Alarm messages (4xxx)

∎ Advisory messages (8xxx)

∎ Status messages (Cxxx)

When you enter a `query alarms` command, the system displays a list of alarm and event information similar to the following:

```
AIRLINK T1> query alarms

8: 8001: 20 SEP 1994 15:11:32 QRSS Test Started
7: C006: 20 SEP 1994 15:11:31 All Tests Cleared
6: 8007: 20 SEP 1994 15:09:50 FE Remote Loop Test Started
5: C006: 20 SEP 1994 15:09:50 All Tests Cleared
4: C006: 20 SEP 1994 15:07:51 All Tests Cleared
3: 8001: 20 SEP 1994 15:06:22 QRSS Test Started
2: C006: 20 SEP 1994 15:06:22 All Tests Cleared
1: C000: 20 SEP 1994 14:59:22 Event queue Cleared
```

When the event queue contains alarm messages, the most recent message is displayed at the top of the list, with the most recent time and date.

When there are more messages than will fit on one screen, you can page through the messages by pressing <Return> to go forward one screen, or <B><Return> to go back one screen. Press <Q> to exit (quit) the event queue display.

Fault Messages

Fault messages (see Table A-1) indicate service-affecting failures; contact Cylink Customer Support for help.

Table A-1
Fault Messages

Code	Message
0000	Transmit Power Below Threshold
0001	Synthesizer Loss of Lock
0002	Transmitter Failure

Alarm Messages

Alarm messages (see Table A-2) indicate conditions or events that insert an entry into the Event queue and may cause an alarm state. These are generally conditions that can be resolved by an operator in the field.

Table A-2
Alarm Messages

Code	Message
4004	Receive Power Below Threshold
4005	DTE Input Loss
4006	Radio Sync Loss
4008	Powered Up
4011	Primary Burst Sync Source Loss
4012	Backup Burst Sync Source Loss
4013	No Burst Sync Source

Advisory Messages

Advisory messages (see Table A-3) indicate conditions or events that insert an entry into the Event queue, but do not cause an alarm state. Except for "Event Queue Full," which does not indicate a service-affecting condition, these messages generally indicate that the system is working, but that something the operator has done—such as starting a test—is preventing data from passing from one end of the link to the other.

Table A-3
Advisory Messages

Code	Message
8000	Event Queue Full
8001	QRSS Test Started
8002	Local Loop Test Started
8003	Remote Loop Test Started
8005	FE QRSS Test Started
8006	FE Local Loop Test Started
8007	FE Remote Loop Test Started
8009	1 HR ES Threshold
800A	1 HR UAS Threshold
800B	24 HR ES Threshold
800C	24 HR UAS Threshold
800D	Modem Busy
800E	No Answer
800F	No Modem
8010	No Dialtone

Status Messages

Status messages (see Table A-4) indicate the negation of another alarm or advisory condition or event.

Table A-4
Status Messages

Code	Message
C000	Event Queue Reset
C001	Receive Power Above Threshold
C002	Transmit Power Above Threshold
C003	DTE Input Loss Ends
C004	Synthesizer Loss of Lock Ends
C005	Radio Sync Loss Ends
C006	All Tests Cleared
C008	Transmitter Failure Ends
C011	Primary Burst Sync Source Recovered
C012	Backup Burst Sync Source Recovered
C013	Burst Sync Recovered

APPENDIX B

Specifications

This appendix is the reference for the specifications of the AirLink Pro T1/E1 Rack Mount system.

Inside this chapter:

AirLink Pro T1/E1 Rack Mount Specifications

Typical of the design quality and extensive testing, the AirLink Pro family is designed to meet the following specifications:

Environmental Requirements

Temperature

Operating: -40C to +60C (-40 to +140 Fahrenheit)

Storage: -40C to +60C

Humidity

Operating: 10% to 95% non-condensing

Storage: 10% to 95% non-condensing

Altitude

200 feet below sea level to 13,000 feet above sea level

Electromagnetic Interference (EMI)

FCC Part 15 Class B

EN 55022 Class B

Safety

The AirLink Pro T1/E1 Rack Mount units are low-voltage devices and are excluded from Underwriters Laboratories (UL) coverage. The optional AC/DC power supply is UL listed.

Fire Resistance

All plastic parts and printed circuit boards are made from materials that comply with UL flame retardant requirements for central office quality.

Shock

Transportation/Handling Shock

Drop Test NSTA Project 2A for packaged devices

Operation Shock

Bellcore TR-TSY-000487, Section 5.1.4.9 (Vibration Test-Low Level)

Vibration

Operational Vibration

Bellcore TR-TSY-000487, Section 5.1.4.11 (Vibration Test-Low Level)

Transportation Vibration

ASTM D 4728 Random Vibration Testing

Truck/Air Spectrum (IG, 5-200HZ-according to the general requirements of ASTM D 4728)

Quality

The Cylink manufacturing organization has been certified by the British Approvals Board for Telecommunications (BABT) with Production Quality Assurance Approval (PQAA) since November 19, 1992. PQAA is similar to ISO 9002, and emphasizes safety and compliance affecting processes, as well as quality methods. BABT conducts annual audits to verify continued compliance.

Operational Reliability

During the product design process, mean time between (MTBF) is calculated using the process defined in Bellcore technical reference TR-NWT-000332. For the AirLink T1 unit, the MTBF hours are 77,503.

Table B-1
Power

Input Voltage	21 to 56 VDC
Input Power	25 Watts (Maximum)
Input Current	1.0 Amps @ 24 Volts 500 Ma @ 48 Volts
Input Polarity	Input is floating. Either input may be grounded.
Input Protection	Nominal fuse = 2.0 A Slow Blow
Input Reverse Voltage Protection	Provided. Series diode. No current will flow if the input voltage is reversed.

NOTE   No internal fusing is provided, because to do so would violate the specifications of UL1459 section 70. (No fusing is allowed in the grounded side of a DC input circuit unless the hot side is also fused.) When the fuse in the hot side blows, the fuse in the grounded input must <u>also</u> blow. Since this equipment accepts either polarity, external circuit protection <u>must be</u> provided in the hot side of the feeder circuit.

Interface Specifications

This section contains specifications for the two major interfaces of the AirLink Pro T1/E1 Rack Mount:

❚   T1/E1 DTE interface

❚   Radio interface

T1 DSX-1 Interface

The DS1 interface in the AirLink Pro T1 performs according to the specifications of DSX-1 cross connects as specified in ANSI T1.102-1987 and Bellcore # TR-NWT-000 499.

Table B-3
T1 DSX-1 Interface

Transmission Line Rate	1.544 Mbps ± 150 bps
Line Coding	Bipolar 8-Zero Substitution (B8ZS) or Alternate Mark Inversion (AMI)
Impedance	$100\,\Omega\ \pm 5\%$
Pulse Shape	An isolated pulse shall fit the template shown in T1.102, Figure 1. The pulse amplitude shall be between 2.4 and 3.6 volts, measured at the center of the pulse.
Cable Length	The pulse shape must meet the mask when the equipment is connected to a DSX-1 cross connect located at any distance from 0 to 655 feet (200 meters) with #22 AWG ABAM cable (or equivalent).
Loss of Signal Threshold	Loss of signal is reported upon detection of 175 ± 75 consecutive zeros.
Power Level	For an all-ones transmitted pattern, the power in a band no wider than 3 kHz centered at 772 kHz shall be between 12.6 and 17.9 dBm. The power in a band no wider than 3 kHz centered at 1.544 MHz shall be at least 29 dB below that at 772 kHz.
Jitter	The jitter performance of the AirLink Pro T1 meets or exceeds all input tolerance, output generation, and transfer function specifications of AT&T Publication 62411. 1983 Edition and Belicore TR-TSY-000499
DSX Line Equalization	User-selectable pre-distortion to offset cable lengths of: 0 - 133 feet 0 - 40 meters 133 - 266 feet 40 - 81 meters 266 - 399 feet 81 - 122 meters 399 - 533 feet 122 - 162 meters 533 - 655 feet 162 - 200 meters

Airlink Pro E1 Interface General Specifications

The E1 interface in the AirLink E1 performs according to the specifications in the ITU-T Fascicle III.4 Recommendation G.703, Section 6.

Transmission Line Rate	2.048 Mbps ± 200 bps
Line Coding	High Density Bipolar 3 (HDB3) or Alternate Mark Inversion (AMI)
Impedance	120 Ω ±5% (balanced) 75 Ω ±5% (unbalanced)

E1 Interface Output Specifications

Pulse Amplitude	3.0 volts ±10% (balanced) 2.3 volts ±10% (unbalanced)
Pulse Width	244 nanoseconds
Pulse Shape	An isolated pulse shall fit the template shown in Recommendation G.703, Figure 15.
Pulse Imbalance	The ratio of the amplitude and pulse width of the positive and negative pulse shall not exceed ±5%.
Output Jitter Generation	Refer to Recommendation G.823, Figure 1 and Table 1. The maximum output jitter shall not exceed the following limits: 1.5 U.I. in a bandwidth from 20 Hz to 100 kHz. 0.2 U.I. in a bandwidth from 18 kHz to 100 kHz.

E1 Interface Input Specifications

Signal Level	No more than 6 dB loss, referenced to the pulse mask. The transmission medium is assumed to have an $F^{1/2}$ characteristic and the loss is measured at 1024 kHz.

Return Loss	Frequency Range (kHz) Return Loss (dB)
	   51 to 102 12
	   102 to 2048 18
	   2048 to 3072 14

Loss of Signal Threshold	Loss of signal is reported upon detection of 175 ± 75 consecutive zeros.
Input Jitter Tolerance	The jitter performance of the AirLink E1 meets or exceeds all input tolerance, output generation, and transfer function specifications of Fascicle III.4, Recommendation G.703.

Radio Interface

Table B-4 (for both T1 and E1)
General

Frequency Band	5.725 to 5.850 GHz
Carrier Frequency	5.7875 GHz
Allocated Bandwidth	125 MHz
Occupied Bandwidth	T1=95 MHz E1=120 MHz
Number of Channels	1
Modulation Type	GFSK
Spreading Method	Direct Sequence
Spreading Code	Eight sets of 32-bit PN sequences
Processing Gain	>10 dB
Operating Protocol	Time Division Duplex
Frequency Stability	10 ppm
System Gain	T1=100 dB E1=98 dB
End-to-End Delay End-to-End Delay	T1=3 ms E1=2.2 ms

Table B-5
Transmitter

Power Output	100 mW (20 dBm) maximum
Load Impedance:	50 Ω nominal
Tx Output Detector Accuracy	± 2 dB
Output Level Control	Digitally controlled attenuator, Dynamic Range: -4 to +20 dBm Resolution: can be set in 1 dB steps Accuracy: ± 2 dB @ 25° C; ± 3 dB over operating temperature range
Output Level Detector	Generates an alarm when the output falls below the user defined threshold
RF Port Protection	Open or Short circuit protected

Table B-6
Receiver

Input Impedance	50 Ω nominal. VSWR < 2:1 over the frequency and temperature range
RF Input Protection	+10 dBm continuous without damage
Maximum RF Input Power Without Causing Dribbling Errors	-25 dBm
Receiver Dynamic Range	> 40 dB
Receive Signal Strength	± 2 dB
Receive Level Detector	Dynamic range: 40 dB Accuracy: ± 3 dB
Frequency Band	5.725 to 5.850 GHz
Noise Figure	5.5 dB maximum, measured from the antenna port
RSQ Detector	Dynamic Range: 0 - 10 Operating Range: 9 - 10

Receiver Sensitivity (dBm)	T1	E1
10^{-6} Guaranteed	-80	-78
10^{-6} Typical	-82	-80
10^{-9} Guaranteed	-77	-75
10^{-9} Typical	-79	-77

Table B-7
2-wire Order Wire

Terminating Impedance	600 Ω ± 5%
Coding Method	64 kbps PCM
Open Circuit Battery Feed Voltage	24 V_{DC}
Battery Feed Current	100 mA maximum
Maximum Input Signal	Meets V.21 and V.32 modem specifications; no ringing required
End-end loss	0 dBm

Table B-8
4-wire Order Wire

Terminating Impedance	400 Ω ± 5%
Coding Method	64 kbps PCM
Nominal input	0 dBm
Nominal output	0 dBm
End-end loss	0 dBm

Signal-to-Pin Assignments

This section presents the pin assignments and functions for connector and captive-wire terminal blocks on the AirLink Pro T1/E1 Rack Mount:

❏ Network Management
❏ AirLink Control
❏ AirLink Pro T1/E1 Rack Mount
❏ CSU/DSU
❏ T1/E1 DTE
❏ CSU SEL
❏ Power & Alarm
❏ Order Wire

NOTE	Occasionally, industry names and terms change. For example, the EIA RS-*xxx* standards are now referred to as the EIA/TIA-*xxx* standards, a change that reflects their acceptance as standards by the Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA). Similarly, the former Consultative Committee for International Telegraph and Telephone (CCITT) is now referred to as the International Telecommunication Union Telecommunication Standardization Sector (ITU-T).

Terminal

Connector Location: Two Connectors. AirLink Pro T1/E1 Rack Mount Front and Rear Panels
Connector Type: RJ-11 Modular Jack

Table B-9
Interface signals are per EIA/TIA-232.

Pin	Signal/Function	Direction
1	No Connection	-----
2	Received Data	To AirLink Pro T1/E1 Rack Mount
3	Circuit Ground	Not Applicable
4	Circuit Ground	Not Applicable
5	Transmitted Data	From AirLink Pro T1/E1 Rack Mount
6	No Connection	-----

2-wire Order Wire

Connector Location: AirLink Pro T1/E1 Rack Mount Front Panel
Connector Type: RJ-11 Modular Jack

Table B-10
2-wire Order Wire

Pin	Signal/Function	Direction
1	No Connection	-----
2	No Connection	-----
3	Order Wire Tip	Not Applicable
4	Order Wire Ring	Not Applicable
5	No Connection	-----
6	No Connection	-----

4-wire Order Wire

Connector Location: AirLink Pro T1/E1 Rack Mount Rear Panel
Connector Type: 4-Pin Captive Wire Terminal Block

Table B-11
4-wire Order Wire

Pin	Signal/Function	Direction
1	OUT-T	Orderwire Output
2	OUT-R	Orderwire Output
3	IN-T1	Orderwire Input
4	IN-R1	Orderwire Input

Network Management

Connector Location: AirLink Pro T1/E1 Rack Mount Rear panel
Connector Type: 9-Pin Male Subminiature "D"

This connector is configured per EIA/TIA-574. Interface signals levels are for EIA/TIA-232.

Table B-12
Network Management

Pin	EIA/TIA Circuit	ITU-T Circuit	Description	Direction
1	CF	109	Received Line Signal Detector	To AirLink Pro T1/E1 Rack Mount
2	BB	104	Received Data	To AirLink Pro T1/E Rack Mount
3	BA	103	Transmitted Data	From AirLink Pro T1/E1 Rack Mount
4	CD	108.2	DTE Ready	From AirLink Pro T1/E1 Rack Mount
5	AB	102	Signal Common	-----
6	CC	107	DCE Ready	To AirLink Pro T1/E1 Rack Mount
7	CA	105/133	Request to Send/Ready for Sending	From AirLink Pro T1/E1 Rack Mount
8	CB	106	Clear to Send	To AirLink Pro T1/E1 Rack Mount
9	CE	125	Ring Indicator	To AirLink Pro T1/E1 Rack Mount

Table B-13
DC Power

Connector Location: AirLink Pro T1 Rear panel
Connector Type: Four-Pin Captive Wire term Block

Pin	Signal/Function	Explanation
1	V-	DC Input Negative
2	V-	DC Input Negative
3	GND	Ground
4	GND	Ground
5	V+	DC Input Positive
6	V+	DC Input Positive

Table B-14
Major Alarm

Connector Location: AirLink Pro T1 Rear Panel
Connector Type: Four-Pin Captive Wire term Block

Pin	Signal/Function	Explanation
1	COM	Alarm Relay Common Contact
2	NO	Alarm Relay Normally Open Contact
3	NC	Alarm Relay Normally Closed Contact
4	GND	Ground
5	CSU-SEL	Strap from Pin 5 to Pin 6
6	CSU-SEL	Activates the CSU SEL relay

Table B-15
Minor Alarm

Pin	Signal/Function	Explanation
1	COM	Alarm Relay Common Contact
2	NO	Alarm Relay Normally Open Contact
3	NC	Alarm Relay Normally Closed Contact
4	GND	Ground

CSU

Connector Location: Rear Panel
Connector Type: Six-Pin Captive Wire Terminal Block

Table B-16
CSU

Pin	Signal	Description	Direction
1	IN	Input Data (Tip)	To AirLink Pro T1
2	IN	Input Data (Ring)	To AirLink Pro T1
3	GND	Cable Shield Ground	
4	OUT	Output Data (Tip)	From AirLink Pro T1
5	OUT	Output Data (Ring)	From AirLink Pro T1
6	GND	Cable Shield Ground	

DTE

Connector Location: Rear Panel
Connector Type: Six-Pin Captive Wire from Block

Table B-17
DTE

Pin	Signal	Description	Direction
1	IN	Input Data (Tip)	To AirLink Pro T1
2	IN	Input Data (Ring)	To AirLink Pro T1
3	GND	Cable Shield Ground	
4	OUT	Output Data (Tip)	From AirLink Pro T1
5	OUT	Output Data (Ring)	From AirLink Pro T1
6	GND	Cable Shield Ground	

Terminal and Modem Adapter Cables

Use the following figures to fabricate cables to connect terminals and modems to the AirLink Pro T1.
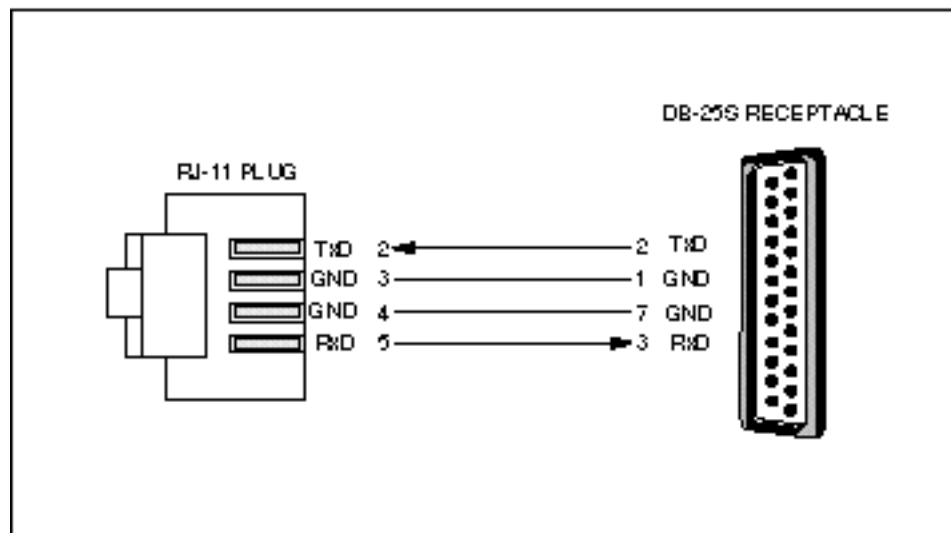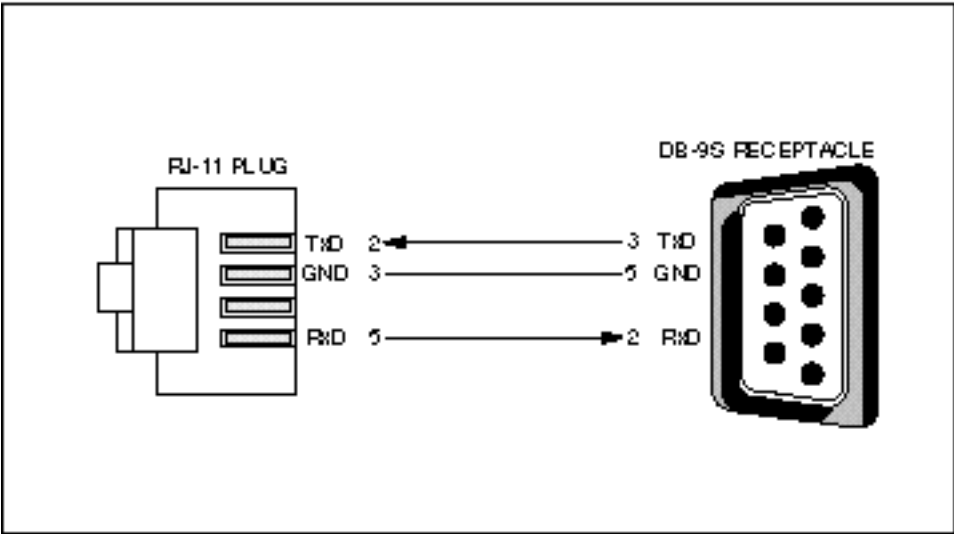

Figure B-1
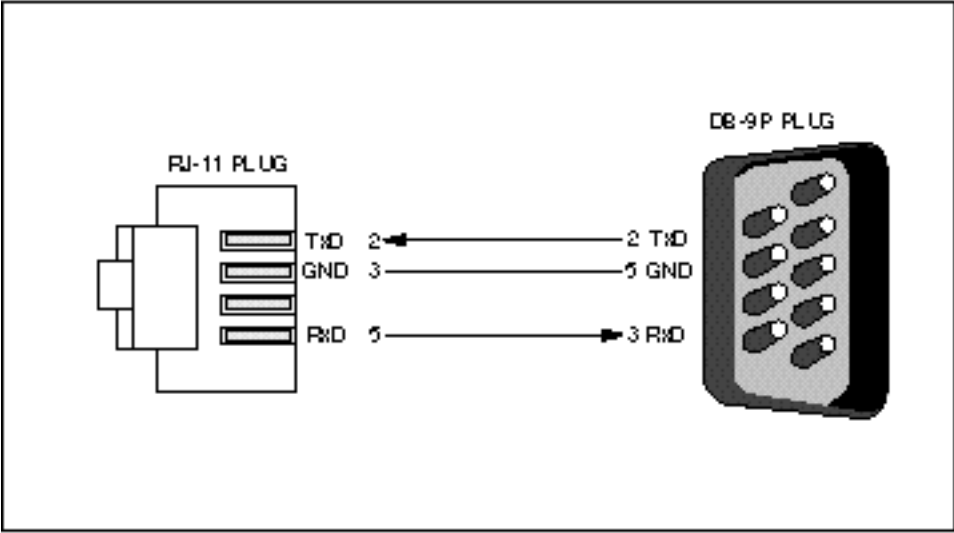Terminal Cable: AirLink Pro T1 Terminal Port to a DB-25 Terminal Port
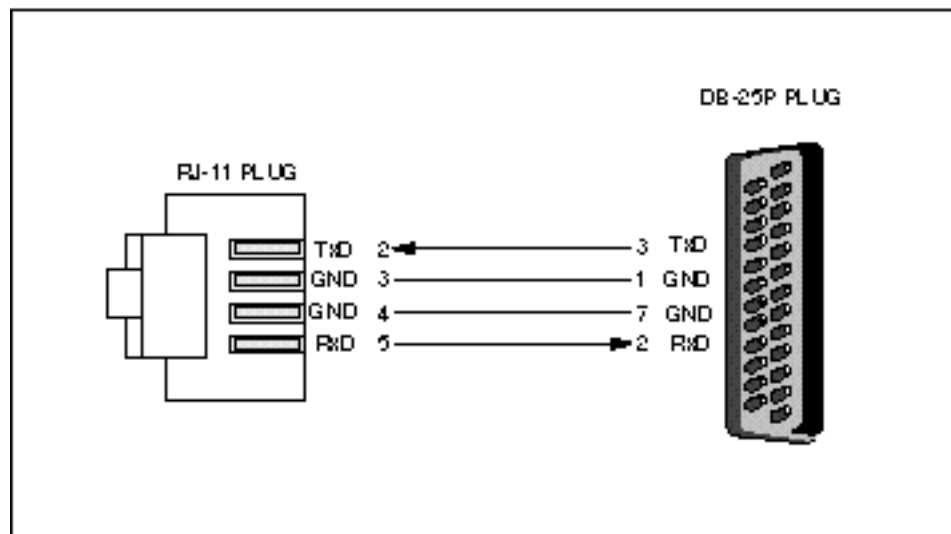
Figure B-2
Modem Cable: AirLink Pro T1 Terminal Port to a DB-25 Modem Port

Figure B-3
Terminal Cable: AirLink Pro T1 Terminal Port to a DB-9 Terminal Port

Figure B-4
Modem Cable: AirLink Pro T1 Terminal Port to a DB-9 Modem Port

Terminal Configuration

Before connecting the ASCII terminal to the unit, configure the terminal with the following parameters:

Terminal Mode = VT100
Column = 80
Autowrap = ON
Monitor Mode = OFF
Cursor Keys = Normal
Newline Mode = ON
Character Set = DEC Supplemental
Key Code = ASCII
Break key = ON
Minimum Break Length = 2 character times (17 msec.)
Data/Parity = 8/No Parity
Stop Bits = 1
Transmit Rate = 19200, 9600, 4800, 2400, or 1200 bps
Auto Answerback = OFF
Comm = FDX (No Echo)
RS232 Data Leads Only (RxD and TxD)
Local Echo = OFF

A Break code is recognized by many systems as an attention signal, and most systems vary as to the length of time Break must be generated before it is recognized. Most terminals and terminal emulation software allow you to set the length of the Break signal.

The minimum Break length for the AirLink Pro T1/E1 Rack Mount is two character times or approximately 17 milliseconds. A longer Break length (limited by the range available from the setup program of the terminal or terminal emulation software) has no effect on the AirLink Pro T1/E1 Rack Mount.

For more information about terminal configuration, see the *AirLink Site Planning Guide*.

Configuration Defaults

The following table lists default configuration/operational values.

Table B-18
Configuration Defaults

Parameter	Value	Notes
Application	4. Master Unit in a Point-to-Point Link	
Site Name	(Blank)	
Burst Mode	Normal	
Coding	B8ZS	
Equalization	0	(0 - 133 feet)
PN Code	1	
RF Power	0	(dBm)
Alarm Reporting	Immediate	
Alarm level	Status	
Date	01/01/91	
Time	00:00:00	(midnight)
Password	<Return>	
1 HR ES Threshold	1	
1 HR UAS Threshold	1	
24 HR ES Threshold	1	
24 HR UAS Threshold	1	
Rx Power Threshold	-75	(dBm)
Tx Power Threshold	-6	(dBm)

The prompt is reprinted when the <ENTER> key is pressed and the command line is empty. All command responses end with a new prompt. When printing formatted text, tabs are not used; all alignment is performed with spaces to remove any problems associated with the interpretation of tab stops on customer equipment. If an incomplete command line is issued, the text to finish the command line is returned.

Dialout Parameter Defaults

Table B-19
AirLink Pro T1/E1 Rack Mount Dialout Parameters

Parameter	Default
ALARM HOLDOFF	10 seconds
ANSWER TIMEOUT	30 seconds
CONNECTION TIMEOUT	3600 seconds (1 hour)
DIAL FORMAT	TONE
DIAL HOLDOFF	10 minutes
DIAL LEVEL	ALARM
MODEM MODE	DISABLED
MODEM RATE	9600
MODEM RTS	CONTINUOUS
MODEM CTS	IGNORE
MODEM DTR	CONTINUOUS
MODEM VOLUME	LOW
MODEM XOFF	IGNORE
PHONE 1	(blank)
PHONE 2	(blank)
REPEAT COUNT	10 events
RINGCOUNT	1

APPENDIX C

Commands

This command-list associated with the AirLink Pro T1/E1 Rack Mount covers the keywords to logging in and out, testing, local and remote access, and how to use help.

Command Keyword List

This section lists the available command keywords and operands used to set, view, or change configuration parameter values. The command line syntax uses a set of keywords to get or set parameters, to query status, and to reset counter and queues. Only the first four letters of each keyword are necessary. Add space between keywords.

Setup Commands

HELP

LOCAL   (Local is implied and doesn't need to be typed in)

REMOTE

    SET

APPLICATION	1........8	
	1. Primary Master in a Hub	
	2. Secondary Master in a Hub	
	3. Master Unit at a Repeater	
	4. Master Unit in a Point to Point	
	5. Slave Unit at a Repeater Site	
	6. Slave Unit in a Point-to-Point Link	
	7. Secondary Master in a protected Link	
	8. Backup Master in a Hub	
SITE NAME:	{ Up to 60 Characters}	
BURST MODE:	{Normal | Test}	
CODING:	{HDB3 | B8ZS | AMI}	
EQUALIZATION:	{ 0 | 133 | 266 | 399 | 533}	
HUBSYNC:	{Single | Dual}	
INTERFACE:	{Balanced | Unbalanced}	
ORDERWIRE:	{2W | 4W}	
PN CODE:	{1...8}	
RF POWER:	{-3...20}	

ALARM REPORTING:	{Request | immediate}	
ALARM LEVEL:	{Status | Advisory | Alarm | Fault}	
DATE:	MM/DD/YY	
TIME:	HH:MM:SS	
PASSWORD:	16 character alphanumeric string.	
THRESHOLD	1 HR ES	{1..999}
	1 HR UAS	{1..99}
	24 HR ES	{1..999}
	24 HR UAS	{1..99}
	Rx Power	{-35...-85}
	Tx Power	{-3...20}

Modem Dialout Setup Commands

CONNECT 1	PHONE #1
CONNECT 2	PHONE #2
DISCONNECT	
SET MODEM	
MODE	{DISABLED | DEDICATED | DIAL_OUT |ANSWER | BOTH}
RATE	{1200 |2400 | 4800 |9600}
RTS	{SWITCHED | CONTINUOUS}
DTR	{SWITCHED | CONTINUOUS}
CTS	{OBEY | IGNORE}
XOFF	{OBEY | IGNORE}
SET DIAL	
TONE	
PULSE	
HOLDOFF	{0...5000}
LEVEL	{FAULT | ALARM | ADVISORY | STATUS}
RETRY	{15...3600}
SET	
ALARM HOLDOFF	{0...600]
ANSWER TIMEOUT	{0..99}
CONNECTION TIMEOUT	{0...43200}
PHONE 1	(XXX) XXX-XXXX
PHONE 2	(XXX) XXX-XXXX

REPEAT COUNT	{0...99}	
RINGCOUNT	{0...9}	

Information Retrieval Commands

GET

	CONFIGURATION	Displays configurations from Application through Date/Time
	THRESHOLD	Displays Threshold configuration
	REVISION	Displays H/W and S/W revision information
	MODEM	Displays dialout configuration information

QUERY

ALARMS

PERFORMANCE

STATUS

Test Commands

TEST

  QRSS

  LOOP

    LOCAL

    REMOTE

Reset Commands

RESET

  QRSS

  ALARMS

  TEST

Valid Responses

OK	Command interpreted and executed without error. If an invalid command is entered, the system responds with a list of valid keywords.
AIRLINK Pro T1	Prompt when configured as a T1 AirLink
AIRLINK Pro E1	Prompt when configured as a E1 AirLink

Responses and Alerts

Each of the following messages is an advisory. These advisories will not trigger a dial-out, and they are entered into the Event Queue.

"Modem Busy"

"No Modem"

"No Answer"

"No Dialtone"

All numeric responses are followed by <CR> (ASCII 13 decimal). All "word" responses are followed by <CR> and <LF> (ASCII 10 decimal).

Modem Response Definitions

Modem Response	Definition
0 (zero)	Numeric version of "OK"
OK	Successful execution of non-dial command
CONNECT	[XXXX] carrier detected; XXXX = numeric bit rate
RING	Ringing detected
NO CARRIER	No connection established, or connection lost
ERROR	Error in command line
NO DIALTONE	No dial tone present
BUSY	Busy signal
NO ANSWER	5 seconds of silence not detected if '@' dial modifier was used.

Logging In and Logging Out

The operator must enter the LOGIN command keyword and provide the correct password to use the GET, SET, QUERY, RESET, TEST, and REMOTE commands.

NOTE   When the unit is prepared for shipment, it is configured with a null password as a default. To gain access to the system the first time, press <Return> in response to the login prompt for the password. This password will remain in effect until changed.

To login to the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> login
```

Throughout this manual, the command line prompt `AIRLINK PRO T1>` represents the
       E1 command line prompt `AIRLINK PRO E1>`.

The system prompts you to enter the password. If the password is accepted, the system displays an *OK* response and gives access to the commands.

To login using the factory-set null password, type the LOGIN command at the AirLink Pro T1/E1 Rack Mount prompt and press <Return> when the system prompts you for the password:

```
AIRLINK PRO T1/E1> login
Password: <Return>

   OK
AIRLINK PRO T1/E1>
```

If the new password is *1Awidget*, type the LOGIN command and *1Awidget* for the password:

```
AIRLINK PRO T1/E1> login
Password: 1Awidget

   OK
AIRLINK PRO T1/E1>
```

For information on changing the password, refer to "Password" in the section "Setting Administrative Parameters," in this chapter.

The LOGOUT command keyword exitsthe system and prevents unauthorized system use. To logout of the local AirLink Pro T1/E1 Rack Mount, type the following command at the AirLink Pro T1/E1 Rack Mount prompt:

```
AIRLINK PRO T1/E1> logout
```

For remote command operations, it is not necessary to login to the remote unit if you are logged in to the local system.

Help

The terminal interface also provides an online help facility to aid you in entering commands. You can type a question mark (?) at the end of any command field, and the command interpreter will display the next valid keyword or operand that you can enter.

If you press <Return> before the command is complete, the command interpreter displays the next valid keyword or operand that you can enter. If the command is complete, the system will execute the command.

You can also type in a help request for a particular command combination, to see what comes next:

```
  AIRLINK PRO T1/E1> help set
```

The system displays a similar list:

```
  Site Name: Sunnyvale 2
  Keywords or Operand
        APPLICATION
        SITE
        BURST
        CODING
        PN
        RF
        ALARM
        DATE
        THRESHOLD
        TIME
        PASSWORD

  Type HELP LOCAL SET <keyword> for more help.
```

Local or Remote Operations

The terminal user interface allows a terminal device or personal computer attached to an AirLink Pro T1/E1 Rack Mount to control and monitor AirLink Pro T1/E1 Rack Mount operation at either end of the point-to-point link. Any command that starts with the REMOTE keyword causes the action to be performed at the far-end AirLink Pro T1/E1 Rack Mount.

Do not include the LOCAL keyword to execute a command on the local unit; you must include the REMOTE keyword in order to execute a command on the remote unit.

APPENDIX D

Glossary

This glossary provides definitions of some of the more important specialized terms and acronyms associated with the operation of the AirLink Pro T1/E1 Rack Mount.

A   *Ampere*: A unit of electrical current related to the actual number of electrons moving past a given point per second.

AIS   *Alarm Indication Signal.* To maintain transmission continuity, an Alarm Indication Signal (AIS) is transmitted to the network upon Loss of Signal (LOS) or Loss of Clock (LOC). It is halted when the triggering signal is terminated. An AIS is an unframed, all-ones signal.

AMI   *Alternate Mark Inversion.* A signal encoded according to the AMI method is a bipolar pseudo-ternary signal conveying binary digits (bits) in which successive "marks" are normally of alternating polarity, positive and negative. This is the traditional method of encoding DS1 signals.

antenna   A transmitting or receiving device for radiated waves. The antenna acts as a form of matching transformer for waves along a line and waves in space so that the maximum transfer of energy can be achieved.

antenna gain   Antenna gain is a measure of the efficiency of an antenna compared with the efficiency of a standard reference antenna. The efficiency is measured in terms of the power radiated or received in a given direction as compared with the standard under the same conditions.

Azimuth   The angle in the horizontal ground plane with respect to true North (i.e., horizontal direction); used in reference to antenna alignment.

B8ZS   *Bipolar with Eight-Zero Substitution.* This coding scheme is one of the methods used to avoid long strings of zeroes in a bipolar DS1 signal entering the network from the DTE. In B8ZS, every string of eight zeroes is replaced by a special code for transmission over networks that are sensitive to long strings of zeroes. The code contains a pattern of bipolar violations that is identified by the recipient and then removed in the decoding process to recreate the original string of zeroes. This particular method of coding is the evolving standard, but is not yet fully supported by all carriers.

baud   Baud is a unit for measuring signaling rate for a digital signal, used similarly to *bits per second* (bps) for low-speed data.

BER	*Bit Error Rate.* The measure of the frequency of errors in a digital transmission, typically expressed in exponential notation (e.g., 10^{-6} BER).
Blue Alarm Signal	An unframed all-ones bit pattern sent by equipment at the far end to indicate that an alarm condition exists upstream in a circuit leading to the downstream equipment. Also known as an *All Ones Keep-Alive* or *Alarm Indication Signal* (AIS).
burst	A sequence of signals counted as a unit in accordance with some specific criterion or measure.
burst timing	A form of timing in which the receiving device is synchronized to the transmitting device by receiving bursts of data.
cable loss	The amount of signal attenuation (loss) for a particular type of cable of a given length.
coaxial cable	A type of transmission line, consisting of a center conductor (wire) surrounded by a layer of insulation, which is in turn surrounded by a conductive shield (wire braid and/or metal foil) and another layer of insulation.
CRC	*Cyclic Redundancy Check.* An error-checking control technique using the remainder of a polynomial calculation performed on the transmitted data to determine whether that data was corrupted.
dB	*Decibels.* The standard unit of measure for relative signal power.
dBm	*Decibels referred to 1 milliwatt.* The standard unit of measure for absolute signal power (signal power relative to 1 mW).
DCE	*Data Circuit Equipment.* A communication device that establishes, maintains, and terminates a session on a network.
digital line rate	The digital bit rate, as determined by the standard levels of the digital hierarchy.
DS-0, 1, 2, 3	The first four levels of the North American Standard digital hierarchy corresponding to the line rates of 64 Kbps (one standard PCM voice channel), 1.544 Mbps, 6.312 Mbps, and 44.736 Mbps, respectively.
DSX-1, 2, 3	The Bell System interface specifications that define the line rate, line code (bipolar), test load, pulse shape, and power

	level of the DS1 (T1), DS2 (T2), and DS3 levels of the North American digital hierarchy.
DTE	*Data Terminating Equipment*. A communication device that is the source or destination of signals on a network.
dynamic range	The difference between the maximum receiver input signal and the minimum receiver input signal level (receiver sensitivity). The measure of the maximum achievable fade margin of a radio system.
Errored Second (ES)	An errored second is defined as any one-second interval during which there is one or more CRC-16 errors. Errored seconds can be asynchronous, that is, they do not have to be correlated with real time.
Errored Seconds Threshold	This threshold value is compared to the number of Errored Seconds in the current time interval. That is, when the number of Errored Seconds crosses the specified threshold value, an alarm message is generated.
ESF Error Event	An ESF Error Event occurs when an Extended Superframe contains a CRC-16 Error Event, or when an Out-of-Frame (OOF) state occurs.
fade margin	The measure of how much signal attenuation the system can endure without dropping below the minimum desired BER level.
Framing	Insertion of framing bits that signal the beginning of a framed block of data. For example, in D4 transmissions there are 12 frame sequences of data identified by a unique framing bit— the 193rd bit in the sequence— that carries the framing and signaling information.
free space path loss	The loss of power of a radiated signal as it travels through space.
frequency stability	The measure of frequency variation of an oscillator from its assigned operational mean frequency.
gain	The increase in signal power caused by a device or network (e.g., the signal gain provided by an antenna).
GHz	*Gigahertz*; 1 billion, or 10^9 cycles per second.

hub configuration	A system configuration in which several AirLink ProT1/E1 units are co-located. Usually, one unit acts as the burst synchronization master for all the other units at the site.
jitter	Jitter is short-term, high-frequency variations of the significant instants (clock measuring points) from their ideal position in time.
kbps	The abbreviation/notation for "one thousand bits per second."
kHz	The abbreviation/notation for kilohertz, "one thousand cycles per second."
line-of-sight	An unobstructed view from the transmit antenna to the receive antenna.
LOS	*Loss of Signal.* Declared upon detection of 175 ± 75 consecutive zeros.
Mbps	*Megabits per second*; 1 million, or 10^6 digital bits per second.
MHz	*Megahertz*; 1 million, or 10^6 cycles per second.
OOF	*Out of Frame.* An OOF condition is when errors are detected in at least two out of four, or three out of five consecutive framing bits.
Order Wire	An auxiliary communications channel provided for use by maintenance and service personnel. It allows voice communications between the local and remote AirLink Pro T1/E1 sites.
path loss	The total amount of radio signal attenuation (loss) between the transmitting antenna and the receiving antenna; the sum of attenuation caused by obstacles located in the path and the free space path loss.
power output	The power of the radio signal as it leaves the RF unit.
pseudo-random noise	Noise that satisfies one or more of the standard tests for statistical randomness. Spread-spectrum modulated carrier transmissions appear as pseudorandom noise to a receiver that is not locked to, or is incapable of correlating a locally-generated pseudorandom code with the received signal.
pseudo-random noise sequence	An operation in which a random stream of data bits is

generated within limited parameters. The stream (sequence) is typically used for encoding data for communication.

QRSS　　　　　*Quasi-Random Signal Sequence.* A test pattern used to test the continuity and integrity of a link.

receiver sensitivity　　　　The measure of the ability of a receiver to differentiate between the selected signal and background noise for a specific performance.

Red Alarm　　　　A locally-detected failure that occurs when DS1 frame synchronization is lost (i.e., when errors are detected in at least two out of four, or three out of five consecutive framing bits) and is declared when one of these OOF conditions has been detected in the network for 2.5 consecutive seconds.

RF　　　　*Radio Frequency.* Electromagnetic waves propagated without guide (wire or cable) in free space.

RSQ　　　　*Receive Signal Quality.* A figure of merit that is normalized on a scale of 1 to 10, and is a function of the receive signal-to-noise ratio and signal-to-interference ratio. A strong signal that is severely corrupted with interference results in a normal receive signal indication and a low RSQ number.

RSS　　　　*Receive Signal Strength.* The measured signal strength at the AirLink Pro T1/E1.

signal-to-noise ratio　　　The ratio of the *signal* power to the *noise* power at a given point in a given system; usually expressed in decibels (dB).

system gain　　　　The sum of the transmitter power output and the receiver sensitivity (the ability of the transmitter to produce a strong signal, combined with the ability of the receiver to detect a weak signal).

transmitter output power　　The amount of transmitted signal strength measured at the antenna connector of the AirLink Pro T1/E1.

Typical Power Output　　　The mean transmitter power output, as specified in FCC regulations.

Terminal Switching Device　　A matrix switching device that allows any of its ports to communicate with any other connected port, or any pair of ports to communicate simultaneously.

Unavailable Second. An unavailable second is defined as any

UAS	one-second interval during which Radio Sync Loss is active.
Yellow Alarm	The indicator of a remotely-detected failure, such as an Out-of-Frame (OOF) condition. When a Red alarm is declared, a Yellow alarm is transmitted in the opposite direction. In the ESF format, a Yellow alarm is signaled by a transmission of alternating eight ones and eight zeros in the ESF Data Link bits. In the D4 format, a Yellow alarm is signaled by a transmission of a logical zero in the second bit of each channel (24 channels per frame).
Zero Suppression	The function performed by several different coding techniques (e.g., B8ZS, Ones Insertion Mode, Cylink Ones Density Controller) that are designed to remove long strings of zeros from data transmission.

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AirLink ProT1/E1 Rack Mount Configuration Worksheet

Pair ID/Name— Master: _____ Slave: _____

Serial Number— Master: _____ Slave: _____

Pair Location— Master: _____ Slave: _____

Antenna Type: _____ Cable Length: _____

PARAMETER	VALUES	MASTER	SLAVE
Administrative Parameters			
Site Name	≤ 60 alphanumeric chars (null string)		
Site Name, Master:			
Site Name, Slave:			
Time	mm/dd/yy (default: **01/01/91**)		
Date	hh:mm:ss (default: **00:00:00**)		
Password	≤ 16 alphanumeric chars (null string)		
T1 Line Parameters			
Coding	**B8ZS** or AMI		
Equalization	**0**, 133, 266, 399, or 533		
Link Parameters			
Application	1. Primary master at a hub 2. Secondary master at a hub 3. Master unit at a repeater site 4. Master unit in a Point-to-Point link 5. Slave unit at a repeater site 6. Slave unit in a point-to-point link		
Burst Mode	**Duplex** or Simplex (Default: Duplex)		
PN Code	1 .. 8 (default: **1**)		
RF Power Level	-4 dBm .. 20 dBm (default: **0 dBm**)		
Alarm Control Parameters			
Alarm Reporting	Request or **Immediate**		
Alarm Level	**Status**, Advisory, Alarm, or Fault		
1-Hour ES Threshold	1 .. 999 (seconds) (default: **1**)		
1-Hour UAS Threshold	1 .. 99 (seconds) (default: **1**)		
24-Hour ES Threshold	1 .. 999 (seconds) (default: **1**)		
24-Hour UAS Threshold	1 .. 99 (seconds) (default: **1**)		
Rx Power Threshold	-80 .. -40 dBm (default: **-75 dBm**)		
Tx Power Threshold	-10 .. 20 dBm (default: **-6 dBm**)		

Configuration Notes

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Configuration Notes

AirLink™ T1/E1

S U P P L E M E N T

(U.S./Canada Installation Rules)

UPDATES TO THE AIRLINK T1 & E1 Installer's Guides

This supplement to the *AirLink T1 Installer's Guide* and *AirLink E1 Installer's Guide* contains information needed to make the system comply with Federal Communications Commission Rules and Regulations and the Canadian Industry Canada Certification. All information in this supplement supersedes that in the Installer's Guide.

This supplement is divided into two sections. The first section provides information pertaining to United States regulations, and the second provides information pertaining to Canadian regulations.

Please read the appropriate information carefully prior to installation of the AirLink T1 or AirLink E1.

Inside this supplement:

United States Installation Regulations

FCC Notice to Users

Federal Communications Commission (FCC) Rules on spread spectrum devices, such as the AirLink T1 or AirLink E1, require that you be notified of the following:

FCC regulations require that this device be professionally installed by a person knowledgeable in electronics and trained in the correct installation of this device.

All interface cables must be shielded.

Operation of this device is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference that may cause undesired operation.

Changes or modifications not expressly approved by Cylink Corporation can void the user's authority to operate the equipment.

Installation Requirements

Proper planning and installation must be done by professionals to achieve best performance and to assure compliance with FCC rules and other regulations.

These regulations restrict both the output power at the AirLink T1/E1 antenna connector and the power radiated from the antenna. They do this with a complex set of requirements over a wide frequency range, both above and below the frequency band of operation.

Section 15.247 of the Federal Communications Commission's Rules and Regulations require that the Effective Isotropic Radiated Power (EIRP) of this installation be limited to no more than 36 dBm (6 dBW).

The FCC has granted Cylink a waiver to this limit when the AirLink T1/E1 is installed with Cylink's antennas. The waiver permits the AirLink T1/E1 to be set to any power level within its range, i.e., up to 20 dBm.

NOTE   When antennas other than those sold by Cylink are to be used for the AirLink T1/E1, the 36 dBm EIRP limit applies.

It is imperative that the installer calculate the EIRP of this installation with non-Cylink antennas and adjust the transmit output power so that the maximum allowable EIRP is not exceeded.

NOTE	Exceeding specified levels may create an installation that violates United States FCC Rules and Regulations.

The EIRP depends on the transmit output power, the antenna feedline and connector losses, and the antenna gain. The transmit output power must be reduced by the amount in dB required to limit the EIRP to no more than 36 dBm.

**Calculating the Maximum Transmit Output Power
with Non-Cylink Antennas**

The transmit output power of the AirLink T1/E1 is adjustable in discrete increments according to the levels described in the *AirLink T1 Installer's Guide* or *AirLink E1 Installer's Guide.*

To determine the maximum allowable transmit output power, start with the maximum EIRP (36 dBm). Add the calculated antenna feedline loss and the specified connector loss. Next, refer to the antenna manufacturer's specifications to determine the antenna gain value. If the antenna gain is expressed in dB relative to a reference dipole (that is, in dBd), add 2 dB to the specified gain value to get the antenna gain relative to an isotropic radiator (that is, in dBi). Subtract this value from the earlier numbers to get the resultant transmit output power level. Compare the resultant transmit output power level to the 36 dBm maximum allowed by the FCC specifications. Take the lesser of the resultant transmit output power level or 36 dBm as the maximum AirLink T1/E1 transmit output power. Adjust the AirLink T1/E1 RF power to this level.

Use the following format to calculate the maximum transmit output power level:

(a)	Maximum allowable EIRP:	+	36 dBm
(b)	Plus feedline loss:	+	_____ dB
(c)	Plus connector loss:	+	_____ dB
(d)	Minus antenna gain:	-	_____ dB
(1)	**Resultant AirLink T1/E1 transmit output power (sum of a through d):**		_____dBm
(2)	**U.S. Specifications—FCC power limit:**		36 dBm
(3)	**Maximum AirLink T1/E1 transmit output power (the lesser of (1) and (2):**		_____dBm

In the following example, given antenna gain of 25 dBi, feedline loss of 3 dB, and connector loss of 1 dB, the transmit output power cannot be adjusted to more than 32 milliwatts (15 dBm).

Example

(a)	Maximum allowable EIRP:	+	36 dBm
(b)	Plus feedline loss:	+	3 dB
(c)	Plus connector loss:	+	1 dB
(d)	Minus antenna gain:	-	25 dB
(1)	**Resultant AirLink T1/E1 transmit output power (sum of a through d):**		15 dBm
(2)	**U.S. Specifications—FCC power limit:**		36 dBm
(3)	**Maximum AirLink T1/E1 transmit output power (the lesser of (1) and (2):**		15 dBm

Tower Construction Considerations

When the use of AirLink T1/E1 systems requires construction of a tower, the following requirements must be considered:

(1) *Local and state zoning and tower construction regulations*:
These requirements generally mandate that permits be obtained before any tower construction begins. Check with local zoning and state aviation authorities for more information.

(2) *U.S. Federal Aviation Administration (FAA) and Federal Communications Commission tower location, marking, and lighting requirements*:
Unless the proposed antenna structure is less than 20 feet in height—except one that would increase the height of another antenna structure, any proposal to locate a tower within 20,000 feet of an aircraft landing area (including private airfields and seaports) must be analyzed to determine whether the FAA must be notified of the proposed construction by filing FAA Form 7460-1 (Notice of Proposed Construction or Alteration) and to determine whether a determination of no hazard should be sought. For any proposed tower of 200 feet or more in height, regardless of location, the FAA must be notified and a determination of no hazard must be obtained. For any tower that requires painting and/or lighting: painting and lighting requirements must be obtained from the Antenna Survey Branch of the FCC's Field Operations Bureau. For further information and referral to the appropriate office, contact the nearest FAA regional office or flight service center, and the nearest field office of the FCC.

Canadian Installation Regulations

Industry Canada Notice to Users

The Industry Canada Rules on spread spectrum devices, such as the AirLink T1 or AirLink E1, require that you be notified of the following:

Industry Canada requires that this device be professionally installed by a person knowledgeable in electronics and trained in the correct installation of this device.

All interface cables must be shielded.

Operation of this device is subject to the following three conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference that may cause undesired operation.

(3) This device shall not pose any safety hazard.

Changes or modifications not expressly approved by Cylink Corporation can void the user's authority to operate the equipment.

Installation Requirements

Proper planning and installation must be done by professionals to achieve best performance and to assure compliance with Industry Canada rules and other regulations.

These regulations restrict both the output power at the AirLink T1/E1 antenna connector and the power radiated from the antenna. They do this with a complex set of requirements over a wide frequency range, both above and below the frequency band of operation.

Industry Canada Guidelines GL-36 Rev 1, Annex B, and RSS 210 require that the Effective Isotropic Radiated Power (EIRP) of this installation be limited to no more than 36 dBm (6 dBW).

It is imperative that the installer calculate the EIRP of this installation and adjust the transmit output power so that the maximum allowable EIRP is not exceeded.

NOTE	Exceeding specified levels may create an installation that violates Industry Canada's Rules and Regulations.

The EIRP depends on the transmit output power, the antenna feedline and connector losses, and the antenna gain. The transmit output power must be reduced by the amount in dB required to limit the EIRP to no more than 36 dBm.

Calculating the Maximum Transmit Output Power

The transmit output power of the AirLink T1/E1 is adjustable in discrete increments according to the levels described in the *AirLink T1 Installer's Guide* or *AirLink E1 Installer's Guide.*

To determine the maximum allowable transmit output power, start with the maximum EIRP (36 dBm). Add the calculated antenna feedline loss and the specified connector loss. Next, refer to the antenna manufacturer's specifications to determine the antenna gain value. If the antenna gain is expressed in dB relative to a reference dipole (that is, in dBd), add 2 dB to the specified gain value to get the antenna gain relative to an isotropic radiator (that is, in dBi). Subtract this value from the earlier numbers to get the resultant transmit output power level. Compare the resultant transmit output power level to the 36 dBm maximum allowed by applicable Industry Canada Specifications and Guidelines. Take the lesser of the resultant transmit output power level or 36 dBm as the maximum AirLink T1 transmit output power. Adjust the AirLink T1/E1 RF power to this level.

Use the following format to calculate the maximum transmit output power level:

(a)	Maximum allowable EIRP:	+	36 dBm
(b)	Plus feedline loss:	+	_____ dB
(c)	Plus connector loss:	+	_____ dB
(d)	Minus antenna gain:	-	_____ dB
(1)	**Resultant AirLink T1/E1 transmit output power (sum of a through d):**		_____ dBm
(2)	**Industry Canada Specifications and Guidelines—IC power limit:**		36 dBm
(3)	**Maximum AirLink T1/E1 transmit output power (the lesser of (1) and (2):**		_____ dBm

In the following example, given antenna gain of 25 dBi, feedline loss of 3 dB, and connector loss of 1 dB, the transmit output power cannot be adjusted to more than 32 milliwatts (15 dBm).

Example

(a)	Maximum allowable EIRP:	+	36 dBm
(b)	Plus feedline loss:	+	3 dB
(c)	Plus connector loss:	+	1 dB
(d)	Minus antenna gain:	-	25 dB

(1) Resultant AirLink T1/E1 transmit output power (sum of a through d): 15 dBm

(2) Industry Canada Specifications and Guidelines—IC power limit: 36 dBm

(3) Maximum AirLink T1/E1 transmit output power (the lesser of (1) and (2): 15 dBm

Tower Construction Considerations

When the use of AirLink T1/E1 systems requires construction of a tower, the following requirements must be considered:

Local and provincial zoning and tower construction regulations:
These requirements generally mandate that permits be obtained before any tower construction begins. Check with local zoning and state aviation authorities for more information. Local requirements as to flight path obstructions and the installation of proper markings and lighting need to be evaluated and, if necessary, the proper local or national regulatory authorities need to be informed. For details, contact Transport Canada, Microwave Division.