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AirLink Pro 64S

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

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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 64S. 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 64 contains a lithium battery molded into the real-time clock component (see Appendix B for the life span of the battery). 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 one-inch wide copper grounding strap, or its equivalent, and non corrosive hardware. For details and safety standards, consult the appropriate local Electrical Codes or a similar document. Use lightning arrestors in appropriate places.

TOWER CONSTRUCTION

Compliance with local zoning and tower construction regulations is recommended when AirLink Pro 64 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 64S 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 64S, 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.

CANADIAN NOTICE TO USERS

This class B digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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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.

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Table of Contents

Preface	xiii
Who Should Read This Guide.....	xiv
Prerequisite Knowledge	xiv
Guide Organization	xiv
Guide Conventions	xv
Typographic Conventions	xvi
Keyboard Usage.....	xvi
Notes, Cautions, and Warnings	xvii
Customer Support	xvii
Reader Response	xviii
Chapter 1: Product Description.....	1-1
Introduction to the AirLink Pro 64S.....	1-2
Features and Capabilities	1-3
AirLink Pro 64S Antenna.....	1-4
Network Management Ports.....	1-4
Programmed Configuration Parameters	1-5
Monitoring and Diagnostic Capabilities	1-5
AirLink Pro/AirLink One Compatibility.....	1-6
Chapter 2: Installation.....	2-1
Overview.....	2-2
Unpacking	2-2
Identifying Physical Features.....	2-3
Front Panel.....	2-3
Rear Panel.....	2-5
Site Preparation.....	2-5
General Physical and Environmental Characteristics.....	2-5
Lightning Protection.....	2-6
Power Requirements.....	2-6
Setting Up the System.....	2-6
Installing the Antenna	2-6

Installing the AirLink Pro 64S.....	2-8
Batch File Handling.....	2-16
Burst Synchronization	2-17
Checking Operation	2-28
Power-Up LED Sequence.....	2-28
Initial Unit Configuration	2-29
Aligning the Antenna	2-31
Chapter 3: Configuration	3-1
Overview	3-2
Using the ASCII Terminal Interface	3-2
Command Line Interface.....	3-2
Command Keyword List	3-4
Administrative Parameters	3-7
Site Name	3-7
Date and Time	3-8
Password	3-9
Setting Link Parameters	3-10
Application	3-12
Configuring the DTE Interface.....	3-15
DTE Mode.....	3-15
DTE Protection.....	3-16
Data Rate.....	3-17
Comm Mode.....	3-17
RTS Source.....	3-18
RTS Delay.....	3-18
Configuring for Different Synchronous Data Clock Modes.....	3-18
AirLink One Clock Mode Emulation.....	3-21
DCE/ST.....	3-21
DCE/TT.....	3-21
DTE/TT.....	3-22
HUB/ST.....	3-22
Independent Network Clocks.....	3-22
Independent Clocks in a Point-to-Point Link.....	3-23
Independent Clocks In a Hub.....	3-24

Configuring the RF Link.....	3-24
PN.....	3-25
Range.....	3-25
RF Plan.....	3-26
RF Power.....	3-26
RF Sleep.....	3-26
Setting Alarm Control Parameters.....	3-26
Alarm Reporting	3-26
Alarm Level	3-27
Alarm Holdoff.....	3-27
HUB_SYNC.....	3-27
Threshold RSSI	3-27
Threshold RSQ	3-27
Threshold 1HR ES.....	3-27
Threshold 1HR UAS	3-28
Threshold 24 HR ES.....	3-28
Threshold 24 HR UAS.....	3-28
Other Command Keywords and Operands	3-28
Setting Modem Parameters.....	3-29
Connection and Configuration.....	3-30
Functions.....	3-33
RS-232 Modem Port Interface.....	3-36
User Interface Additions.....	3-38
Chapter 4: Operations and Maintenance	4-1
Overview	4-2
Acquiring Status Information	4-2
Viewing Status Information	4-2
Acquiring Alarm Information	4-7
The Event Queue	4-8
Acquiring Performance Information	4-10
Viewing Performance Information	4-10
Resetting Performance Counters	4-12
Diagnostic Tools.....	4-13

Appendix A: Messages	A-1
General Information	A-2
Major Alarm Messages	A-3
Minor Alarm Messages	A-3
Status Messages	A-4
Appendix B: Specifications	B-1
General Specifications	B-2
Operating and Environmental Specifications.....	B-2
Mechanical Specifications.....	B-3
Power.....	B-3
Interface Specifications	B-3
DTE Specifications.....	B-3
Radio Interface	B-5
Signal-to-Pin Assignments	B-8
Network Management.....	B-8
AC Power.....	B-6
Antenna Connector.....	B-9
Burst Sync Connector.....	B-10
DTE Connectors.....	B-10
Crossover Data Cable Specifications.....	B-13
Code of Federal Regulations.....	B-14
Appendix C: Worksheets	C-1
Appendix D: Commands	D-1
Appendix E: Glossary	E-1
Index	Index-1

Figures

1-1	AirLink Pro 64S - Full View.....	1-2
1-2	Point-to-Point Application Showing Master/Slave Configuration....	1-4
1-3	Point-to-Multipoint Application.....	1-4
2-1	AirLink Pro 64S Front Panel.....	2-3
2-2	AirLink Pro 64S Rear Panel.....	2-5
2-3	Typical Antenna Mounts.....	2-7
2-4	Terminal Connection.....	2-9
2-5	Terminal Emulation.....	2-11
2-6	Terminal Preferences.....	2-12
2-7	Communications.....	2-13
2-8	Ports.....	2-14
2-9	Settings for Com 1.....	2-14
2-10	Advanced Settings for Com 1.....	2-15
2-11	Modem Connection to the AirLink Pro 64S.....	2-16
2-12	Burst Synchronization Structure.....	2-18
2-13	TDD Burst Structure.....	2-19
2-14	Burst Sync Wiring.....	2-20
2-15	Burst Sync Backup.....	2-21
2-16	Burst Sync Compatibility	2-25
2-17	Burst Sync Compatibility.....	2-27
3-1	Point-to-Point Application.....	3-11
3-2	Point-to-Multipoint Application.....	3-12
3-3	Hub Application.....	3-13
3-4	AirLink Pro 64S Two Part Repeater Link.....	3-14
3-5	Independent Network Clocks.....	3-23
4-1	AirLink Pro 64S Loopback Tests.....	4-14
4-2	AirLink Pro 64S in Test Loopback Local.....	4-15
4-3	AirLink Pro 64S in Remote Test Loopback Local.....	4-16
4-4	AirLink Pro 64S in Test Loopback Remote.....	4-17
4-5	AirLink Pro 64S in Remote Test Loopback Remote.....	4-18
4-6	Asserted RTS in Multipoint Configuration.....	4-20
B-1	DB9 Female Network Management Connector.....	B-9
B-2	DB25 Female DTE Connector.....	B-10

Tables

2-1	AirLink Pro 64S Front Panel Indicators.....	2-4
2-2	AirLink Pro 64S Rear Panel Connectors.....	2-5
2-3	Voltage Requirements.....	2-6
2-4	Normal Burst Sync Activity.....	2-23
2-5	Bus A Activity Lost.....	2-23
2-6	Bus B Activity Lost.....	2-24
2-7	Bus A and Bus B Activity Lost.....	2-24
2-8	LED Indicators.....	2-28
2-9	Error Codes.....	2-29
2-10	Signal Quality.....	2-32
3-1	Voltage Requirements DTE Protect Configuration.....	3-17
3-2	Applications with Clock Modes.....	3-19
3-3	Terminal Commands of the Modem (Port) Interface.....	3-32
3-4	Modem Response Definitions.....	3-37
3-5	Modem Commands.....	3-38
3-6	Dial Out Parameters.....	3-39
4-1	Receive Signal Quality.....	4-6
A-1	Major Alarm Messages.....	A-3
A-2	Minor Alarm Messages.....	A-3
A-3	Status Messages.....	A-4
B-1	Operating and Environmental Specifications.....	B-2
B-2	Mechanical Specifications.....	B-3
B-3	Power Specifications.....	B-3
B-4	DTE Specifications.....	B-4
B-5	General Specifications.....	B-5
B-6	Transmitter.....	B-6
B-7a	Channel Plan 1.....	B-6
B-7b	Channel Plan 2.....	B-7
B-8	Receiver.....	B-7
B-9	Data Interface Standards.....	B-8
B-10	Terminal Connection.....	B-9
B-11	RS-232 Pin Assignments.....	B-11
B-12	EIA-530 and V.35 Pin Assignments.....	B-12

B-13	EIA 530 25-Pin Male Connectors.....	B-13
B-14	RS-232 25-Pin Male Connectors.....	B-13
B-15	Point-to-Point Maximum Delay.....	B-14

PREFACE

About This Guide

The *AirLink Pro 64S Installer's Guide* covers the information needed to unpack, install, configure, and operate the AirLink Pro 64S system. Begin by reading this preface for more information about how this guide supports your use of the AirLink Pro 64S system.

Inside this chapter:

Who Should Read This Manual.....	xiv
Prerequisite Knowledge	xiv
Guide Organization.....	xiv
Conventions Guide.....	xv
Customer Support	xvii
Reader Response	xviii

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 64S.

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 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, 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, skim through the entire procedure before you begin performing the step-by-step instructions. By doing this, you 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 64S system.

The guide is divided into the following sections:

Guide Section	Description
Chapter 1: Product Description	Describes the features and capabilities of the AirLink Pro 64S system.
Chapter 2: Installation	Outlines the procedures for unpacking and installing the AirLink Pro 64S system hardware, connecting the antenna, and performing initial operation checks.
Chapter 3: Configuration	Provides instructions for configuring the AirLink Pro 64S.
Chapter 4: Operations and Maintenance	Contains information on the operation and maintenance of the AirLink Pro 64S system.
Appendix A: Messages	Lists the system alarm, status, and error messages.
Appendix B: Specifications	Contains a quick reference to the AirLink Pro 64S system specifications.
Appendix C: Worksheets	Worksheets are provided to help the user write down configuration parameters for reference.
Appendix D Commands	Contains list of the Commands needed to configure and operate the AirLink Pro 64S.
Appendix E: 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 (this is just an example, your configuration will probably be different):

```
AIRLINK PRO > Get Configuration
Site Name:
Application:          2. Master Unit in a Point-to-Point Link
PN Code:             1
RF Channel Plan:     20 channels
RF Channel:         1
RF Frequency:       2404.468
RF Power:           0 dBm
RF sleep:           NO
Comm Mode:          Synchronous
Data Rate:          4.8 Kbps
Burst Timing:       Receive sync
Tx Clock Source:    Internal
Tx VCXO Ref         Free Run
Hub Sync:           Single
RTS Source:         Internal
RTS delay:          0 msec
DTE mode:           RS-232
DTE Protect:        Disabled
Alarm Reporting:    Request
Alarm Level:        Status
Date/Time:          01 Sept 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 64S, please contact your local distributor. **Cylink** distributors are authorized local service providers and are responsible for immediate support. If problems are not resolved, you can call Cylink's Customer Service for assistance. A 24 hour answering service is maintained for after hours emergency telephone technical support. Emergency requests for phone support are dispatched by the answering service. Cylink Technical support responses to emergency calls consist of over the phone troubleshooting and assistance in obtaining distribution support. The telephone numbers are:

Domestic (USA)

1-800-545-6608 Sunnyvale, CA

International

1-408-735-5822 Sunnyvale, CA
+65-297-6196 Singapore
+44-1256-58122 United Kingdom
+91-11-301-0090 India
+92-21-215-7264 Pakistan

Domestic and International Customer Service Fax

1-408-735-6641	Sunnyvale, CA
+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
910 Hermosa Court
Sunnyvale, CA 94086

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 64S and provides an overview of the features and capabilities.

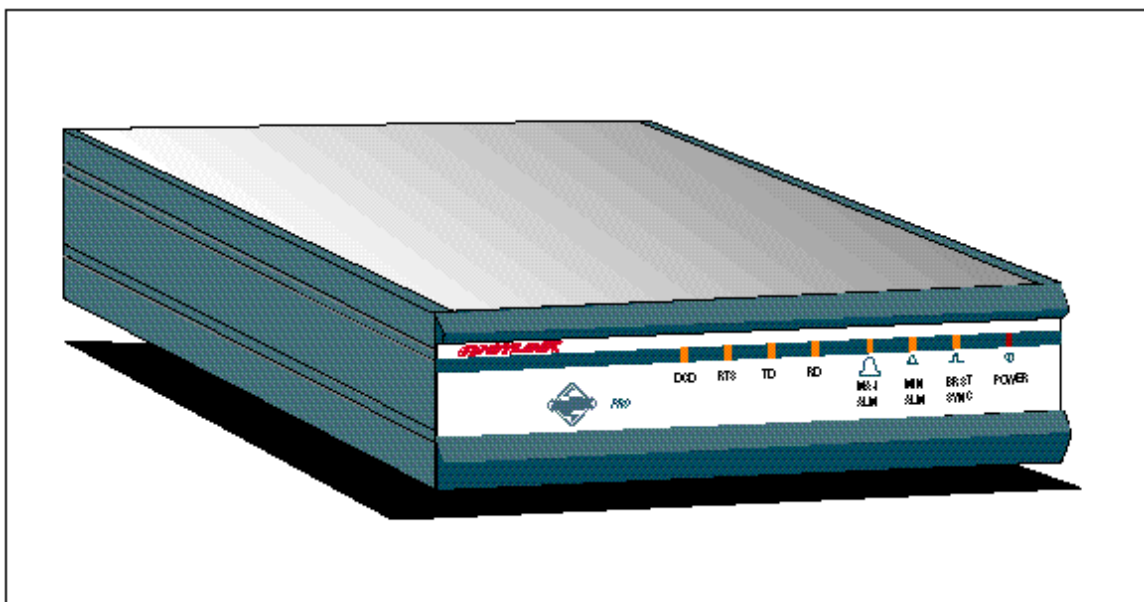
Inside this chapter:

Introduction to the AirLink Pro 64S.....	1-2
Features and Capabilities	1-3

Introduction to the AirLink Pro 64S

The AirLink Pro S-Band family of digital microwave radios are spread-spectrum transceivers that operate in the 2400 - 2483.5 MHz Industrial Scientific Medical (ISM) band. The AirLink Pro 64S uses a Spread Spectrum modulation technique to create high-quality, point-to-point and point-to-multipoint radio links between itself and other AirLink Pro 64S modems located at distant sites.

The AirLink Pro 64S is a compact table top unit (see Figure 1-1), which can also be rack mounted.



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Figure 1-1
AirLink Pro 64S- Full View

Features and Capabilities

The AirLink Pro 64S supports a range of sophisticated control capabilities and options, including:

- Flexible, interactive user interface through an ASCII terminal
- Easily modified configuration parameters
- Software configuration
- Built in testing
- Operating range up to 30 miles (50 km) between units (subject to local radio regulations)
- Local and remote monitoring, diagnostic, and maintenance capabilities
- Every radio-frequency (RFD) burst verified by an error-checking algorithm
- Modem dial-in/dial-out control at the network management ports
- RS-232, V.35, and EIA-530 interfaces supported with one unit
- Burst sync compatibility with AirLink One S-Band modems
- Redundant burst sync
- Optional Rugged Enclosure

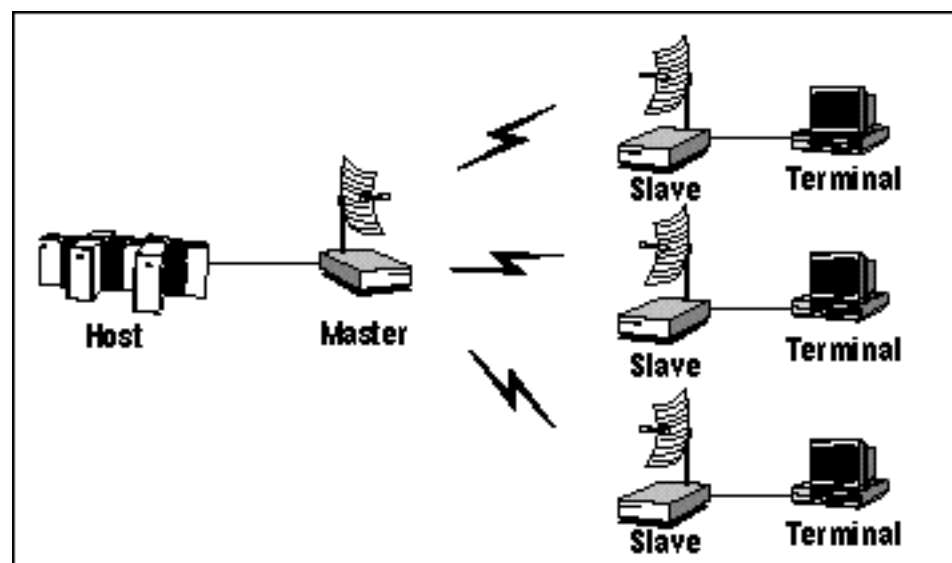
In a typical redundant installation, an AirLink Pro 64S operates in a point-to-point or point-to-multipoint environment. In a point-to-point setup, there is one master and one slave modem linked by radio. The master modem is the burst-timing synchronizer of the radio link. The master sends a timing code to the slave with transmission bursts. Once the slave receives a complete burst, it turns on its transmitter and transmits its burst. This scheme provides a full-duplex, radio-to-radio communication that follows a Ping-Pong analogy.



P2499-0896

Figure 1-2
Point-to-Point Application Showing Master/Slave Configuration

In a point-to-multipoint setup, the Pro 64S modems provide a radio link between a host computer and two or more remote terminals. The terminals are controlled by the host with a poll-select communication protocol that is transparent to the AirLink modems. In this case, polling is the process of addressing the remote terminals by the host computer's software. The master modem is the burst-timing synchronizer of the radio link. The master sends a timing code to the slave with transmission bursts. The slave synchronizes to this timing reference and sends transmission bursts back. This scheme provides a full-duplex, point-to-point session within a point-to-multipoint application. As shown in Figure 1-3, the host computer can poll one terminal via the AirLinks while transferring data to another.



P2500-0896

Figure 1-3
Point-to-Multipoint Application

AirLink Pro 64S Antenna

The antenna choices can include an 8 dBi Omnidirectional antenna or a 24 dBi semi-parabolic Directional antenna. Refer to the *AirLink Site Planning Guide* for different antenna options.

Network Management Ports

The AirLink Pro 64S ASCII terminal user interface is an RS-232 interface that allows a terminal device or personal computer to control and monitor AirLink Pro 64S operation at either end of the link. The connection to the RS-232 interface can be either a direct connection (device to port), or an indirect connection (device to modem to port).

Programmed Configuration Parameters

The AirLink Pro 64S 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.

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

A long-life lithium battery protects all system configuration settings during power losses. The battery is integrated into the non-volatile memory /real-time clock circuitry on the digital module in the AirLink Pro 64S. It has a 10-year storage life (in the absence of Power to the AirLink Pro 64S). However, a battery about to expire will result in loss of all configured parameters and revert back to the default configurations.

WARNING

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.

Monitoring and Diagnostic Capabilities

The AirLink Pro 64S system constantly monitors the quality of the wireless link, checking the receive RFD signal level, bit errors, and many other critical factors. This information goes into an internal database of status and performance information that the AirLink Pro 64S 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 modem and are entered in the event queue.

Using the terminal user interface, you can query either the local unit or the remote unit for status, performance and alarm information, and make configuration changes for either the local or remote end of the link.

The AirLink Pro 64S also provides built-in bit error testing and loopback tests that may be used to isolate problems. You can initiate tests in the local unit or in the remote unit through the terminal user interface.

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

AirLink Pro/AirLink One Compatibility

AirLink Pro 64S modems are designed to operate in the same environments as AirLink One modems. They are compatible in the sense that adjacent links emanating from a Hub Site can be implemented using different generations of AirLink modems. However, due to different burst structures in the TDD over-the-air protocol, an AirLink Pro 64S modem cannot communicate in the same link with an AirLink One 64S modem.

There are compatibility issues to consider when AirLink Pro 64S and AirLink One modems are configured together to avoid mutual interference.

- **Burst Synchronization**
- **Radio Frequency Environment**

The considerations necessary for Burst Synchronization are discussed in Chapter 2, *Installation and System Administration* in the Burst Synchronization Section.

The AirLink Pro 64S has two commands, RF Plan and Range, that must be configured for AirLink One compatibility. These commands are discussed in Chapter 3, *Configuration* in the Configuring the RF Link section.

CHAPTER 2

Installation

This chapter outlines general planning and the procedures for unpacking, and installing the AirLink Pro 64S hardware, connecting cables, and performing power-up checks. This chapter also contains important instructions regarding safety in setting up the AirLink Pro 64S system.

Inside this chapter:

Overview	2-2
Unpacking	2-2
Identifying Physical Features	2-3
Site Preparation.....	2-5
Setting Up the System	2-6
Checking Operation	2-28

Overview

This chapter touches briefly on the general technical requirements of antenna and RF transmission line installation, but mainly focuses on the task of installing the AirLink Pro 64S 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.

A typical AirLink Pro 64S system is made up of the following components:

- AirLink Pro 64S
- antenna
- optional system components

Depending upon your system plan, you will be installing all or some of these AirLink Pro 64S 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 make sure 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 ever need to ship your equipment elsewhere.

After unpacking and confirming the contents of the shipment, place the AirLink Pro 64S system components on a flat surface that allows enough space to work around them.

Identifying Physical Features

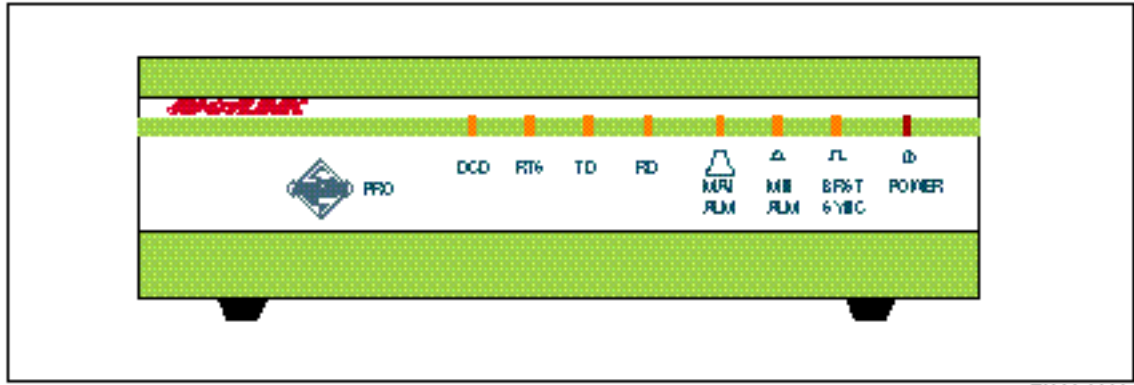


Figure 2-1
AirLink Pro 64S Front Panel

PL194-0896

Front Panel

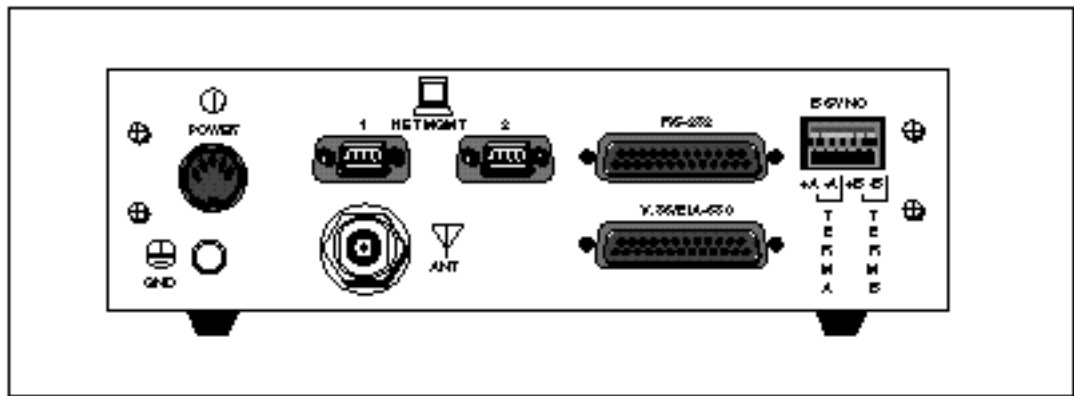
The AirLink Pro 64S front panel (Figure 2-1) consists of a metal panel that contains two clusters of indicators identified with graphical icons and labels. The two clusters have four indicators each. Table 2-1 lists the front panel LEDs and describes their functions.

Table 2-1
AirLink Pro 64S Front Panel Indicators

Name	Color	Function
DCD	Green	When ON, indicates that a good data communications channel has been established
RTS	Green	Indicates that RTS is asserted internally or externally.
TD	Green	Indicates that the unit is transmitting data (in the form of ones) to the far-end unit.
RD	Green	Indicates that the unit is receiving data (in the form of ones) from the far-end unit.
Major Alarm	Red	When ON, indicates that one or more of the following events has occurred: <ul style="list-style-type: none">- Transmit Power Below Threshold- DTE Interface Voltage Error- Radio Sync Loss- System Reset- No Burst Sync Source
Minor Alarm	Yellow	When ON, indicates that one or more of the following events has occurred: <ul style="list-style-type: none">- RSSI Below Threshold- VSWR Above Threshold- RSQ Below Threshold- Primary Burst Sync Source Loss- Backup Burst Sync Source Loss- 1-HR Errored Seconds Threshold Exceeded- 1-HR Unavailable Seconds Threshold Exceeded- 24-HR Errored Seconds Threshold Exceeded- 24-HR Unavailable Seconds Threshold Exceeded
Burst Sync	Green	When ON, indicates that the unit is the burst sync source.
Power	Green	Indicates that primary power is supplied to the equipment.

Rear Panel

The AirLink Pro 64S rear panel (Figure 2-2) consists of a metal panel containing two external equipment connectors, one terminal block, an AC power connector and an N-type antenna connector. Table 2-1 lists the rear-panel connectors and describes their functions.



F2-64S-0096

Figure 2-2
AirLink Pro 64S Rear Panel

Table 2-2
AirLink Pro 64S Rear Panel Connectors

Connector	Type	Function
Power	5-pin DIN female	Power connection.
Antenna	N-type female	Antenna connection
Network Management Ports	DB 9 male connectors	For connecting a modem or terminal to the AirLink Pro 64S.
DTE	DB 25 female for RS-232 interface DB 25 female for V.35 and EIA-530	DTE connection (Note: These are DCE emulating ports.)
Burst Sync	6-Pin Captive Wire Terminal	Burst Sync Connection

Site Preparation

Because of the special planning requirements associated with installing a microwave system, you should review some of the general guidelines regarding installation preparation to ensure that the site you are considering is suitable to the purpose. For details on Site Planning, refer to the *AirLink Site Planning Guide*.

General Physical and Environmental Characteristics

The AirLink Pro 64S radio unit measures 8.3 inches wide (21.083cm), 2.6 inches high (6.60cm), and 10 inches deep (25.4cm), and weighs approximately 5 pounds (2.3 kilograms).

Lightning Protection

If the AirLink Pro 64S system is being installed in an area where lightning is a problem, primary protection, such as gas tubes or spark gaps, is required (Cylink distributors can provide these). For more details on lightning protection refer to the *AirLink Site Planning Guide*.

Power Requirements

The AirLink Pro 64S Power Specifications are listed in the table below.

Table 2-3
Voltage Requirements

Parameter	Specifications
External AC power Supply	
Input	100-250 VAC @ 50/60 Hz
Output	+5, +/- 12 VDC, cable terminated with 5-pin male DIN Connector
Maximum Power consumption (Power Supply plus AirLink)	AC Power Supply - 23W DC Power Supply - 21W

NOTE Power supplies are available as options from Cylink and distributors.

Setting Up the System

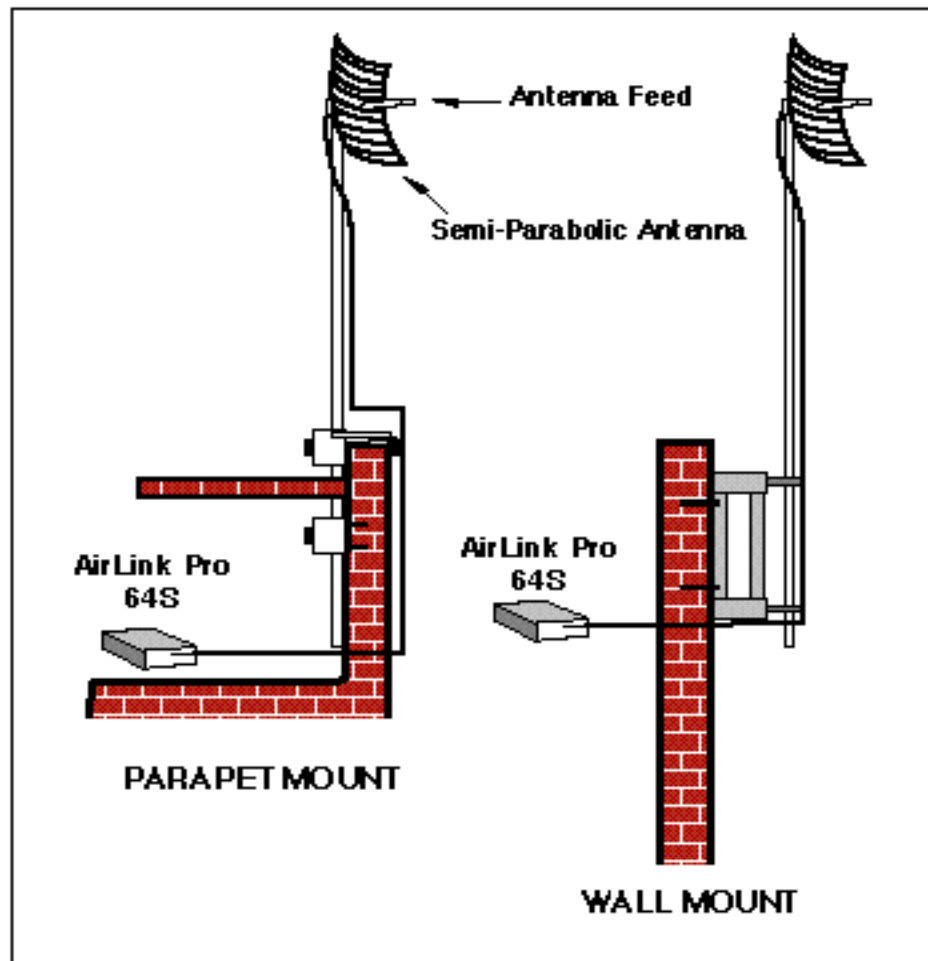
The following sections outline the procedures for installing, cabling, and bringing up an AirLink Pro 64S system. Some of the steps require special knowledge, experience, and tools; some of the installation steps may require help from another person.

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 site and route preparation and path analysis. For a detailed description of Path Analysis and antenna options refer to the *AirLink Site Planning Guide*.

Typical Antenna Mounts

An antenna for a microwave system such as the AirLink Pro 64S is typically equipped with mounting hardware that allows the antenna to be attached to a length of pipe (or stub mast) that can then be mounted in several ways, depending upon user requirements, site conditions, and local building codes (see Figure 2-3).



P2498-0896

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 one-inch wide copper grounding strap, 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 64 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. The antenna alignment procedure is outlined at the end of this chapter.

WARNING

The AirLink Pro 64S should be grounded before any other connections are made to it. This includes power, DTE, and Network Management port connections.

Installing the AirLink Pro 64S

Connecting the Antenna Cable

To connect the antenna cable to the AirLink Pro 64S:

1. **Locate the N-type connector on the rear panel of the AirLink Pro 64S (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.**

DTE Line Connection

1. **The AirLink Pro 64S supports RS-232, EIA-530, and V.35/V.11 interfaces. Two separate DB 25 female connectors are provided on the rear panel for the three interfaces.**

NOTE

Cable/connectors are available from Cylink and Cylink distributors.

2. **Locate the DTE connectors on the AirLink Pro 64S rear panel (see Figure 2-2) and use a shielded cable to secure the hold-down hardware.**
3. **Ensure that the cable is securely held by the connector.**

Connecting the Power

The AirLink uses an external power supply that is provided with the modem.

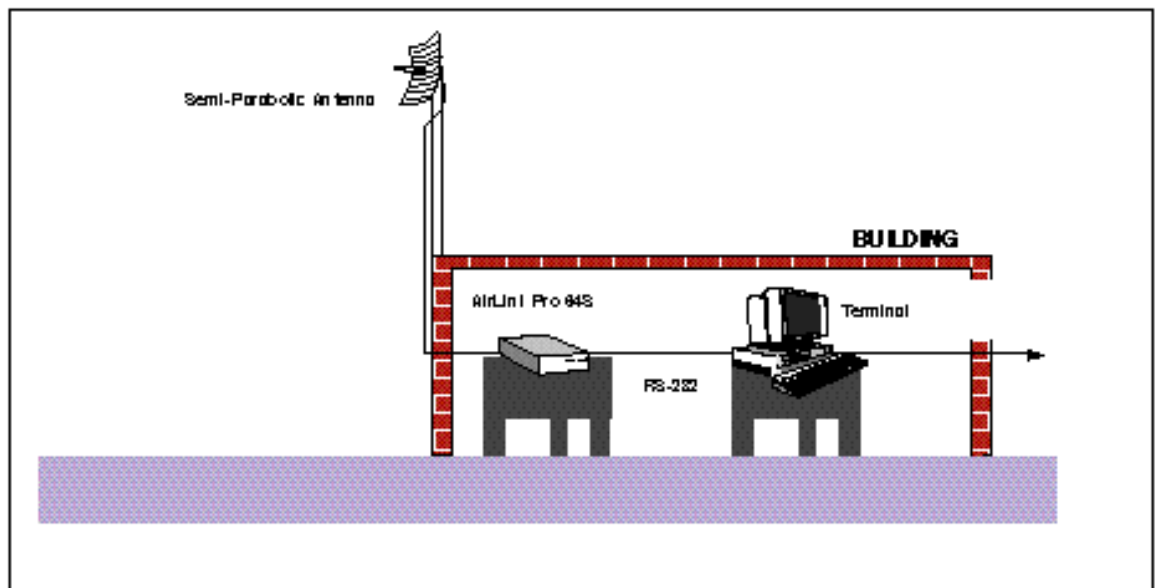
1. **Locate the power connector on the rear panel of the modem.**
2. **Plug the 5-pin DIN connector of the power supply cable into the modem.**
3. **Plug the AC power cord into the power supply and then into the grounded electrical outlet.**

WARNING

To avoid the danger of electrical shock or power loss, ensure that the power cord is securely seated in the receptacle on the modem. This equipment is designed to work with electrically grounded systems. The product's AC power cord ends in a three-pole grounding plug. **Do not** use a three-pole to two-pole adapter with the plug. Verify that the outlet you intend to use is properly installed and grounded; the outlet used must comply with the local electrical code for the country it is installed in. To ensure your safety, only connect the power cable to a properly grounded outlet.

Network Management (Terminal Connection)

On the rear panel of the AirLink Pro 64S are two Network Management ports (DB 9 male). Modems can be connected via Network Management port #1 and a simple ASCII terminal or personal computer can be connected via port #2 to monitor and configure the AirLinks operation.



P2497-0896

Figure 2-4
Terminal Connection to the AirLink Pro 64S

NOTE

The Network Management ports are "wired" as DTE (Data Terminal Equipment). This allows for a standard "straight through" cable connection for any modem (modems are wired as DCE Data Communications Equipment). Since the terminal or PC and the Network Management ports are "wired" as DTE, the user must supply a "null modem" cable when connecting a PC or a terminal to the AirLink Pro 64S.

Terminal Setup Requirements (ASCII Terminal)

The following information describes the simple steps necessary to configure a terminal in order to perform antenna alignments. Further information on terminal usage for setting each link parameter will be discussed in later in this Chapter.

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
Local Echo = OFF

To connect the terminal, follow these steps:

- 1. Connect the terminal (or a computer in terminal emulation mode) to the Network management port as described in Chapter 2.**
- 2. Turn on the terminal; adjust contrast and brightness as required.**

The AirLink Pro 64S 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 64S terminal interface software in “hunt” mode, where it looks for carriage return (<Return>) characters from 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 for each press of the <RETURN> key until it recognizes a <Return> character. When the software detects a <Return> character, it displays the AirLink Pro command-line prompt:

```
AIRLINK PRO 64S>
```

NOTE

Lap top computers do not support the break function.

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 64S prompt appears. If the prompt doesn't appear after pressing <Return> six times, press <Break> and try again.

Terminal Setup Requirements (for personal computers with Windows™)

A personal or laptop computer can be used as a dummy terminal to configure, status, and acquire information from the AirLink Pro 64S radio. The serial communication port (com1 or com2) of the computer must be connected to either of the two Network Management Ports on the rear panel of the unit. There are other communication software packages like Procomm™ that can be used to emulate a dummy terminal. The instructions given below are a guide to using the Microsoft Windows terminal emulation software.

Using the mouse buttons double click on the **ACCESSORIES** icon under the Program Manager of Windows. Double click on the **TERMINAL** icon. Pull down the menu under **Settings** near the top of the screen, and single click on **Terminal Emulation**. Select **DEC VT-100 [ANSI]** (see Figure 2-4) then single click on **OK**.

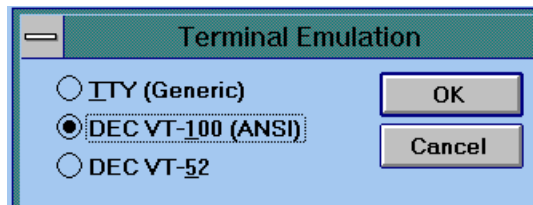


Figure 2-5
Terminal Emulation

Now go back to settings and single click on **Terminal Preferences**, and set up the terminal parameter as follows:

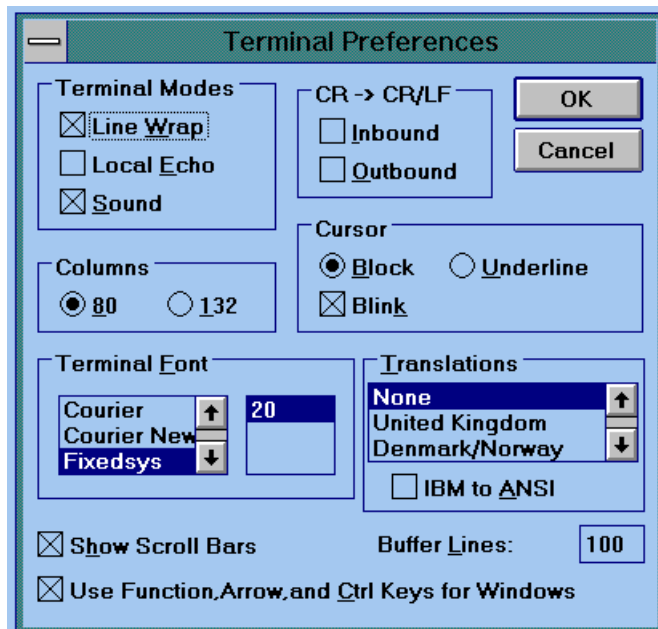


Figure 2-6
Terminal Preferences

Single click on OK to enter any changes made to these settings or click on Cancel to exit without change. While remaining under **Settings**, select **Communications** and set up the serial port as follows:

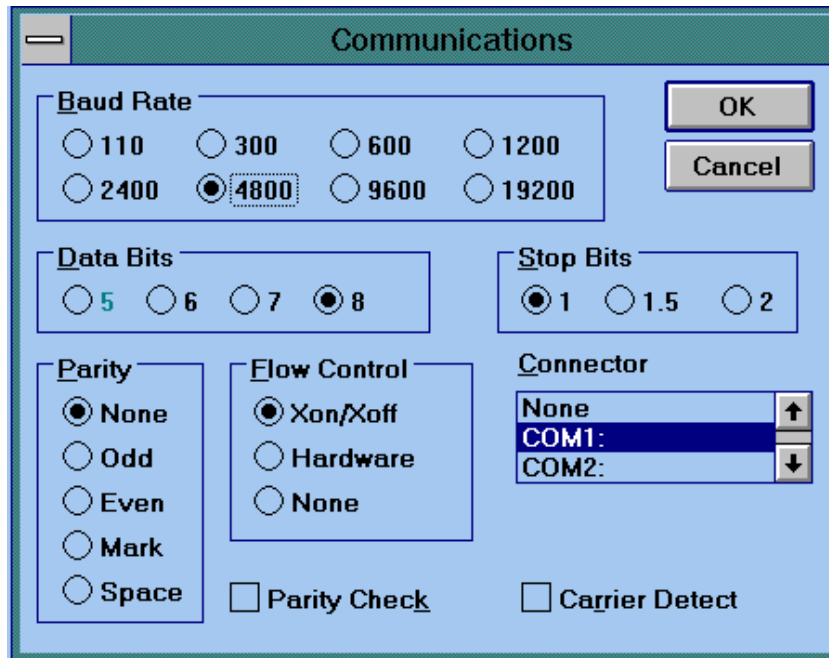


Figure 2-7
Communications

This software works best at data rates of 4800 baud or lower. To change the baud rate hold down the Control and Break key simultaneously for 10 seconds. This will send a command to the AirLink Pro 64S radio to search through and match the baud rate of interface with the baud rate of the terminal.

Configuration of the Serial Communication Port

Go to the Program Manager in Windows by typing "WIN" at the C: >\ prompt. Single click on the **MAIN** icon, then single click on the **CONTROL PANEL** icon which shows the normal or default settings for the mouse, keyboard, and serial communication ports. Double click on the **PORT** icon, then select the communication port number that will be displayed (See Figure 2-7).

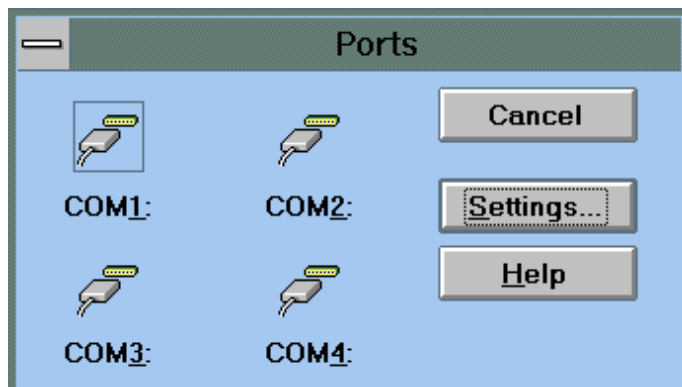


Figure 2-8
Ports

For example: Single click on **COM1** (communications port 1), then click on **Settings**. The current settings of baud rate, data bits, parity, stop bits, and flow control are displayed for com1.

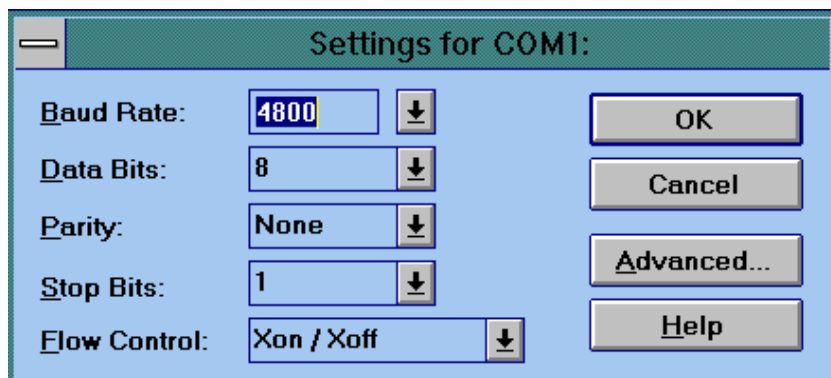


Figure 2-9
Settings for Com1

A single click on **ADVANCED** will display the advanced settings of the communication port which are **Base I/O Port Address** and **IRQ Line** (Interrupt setting).

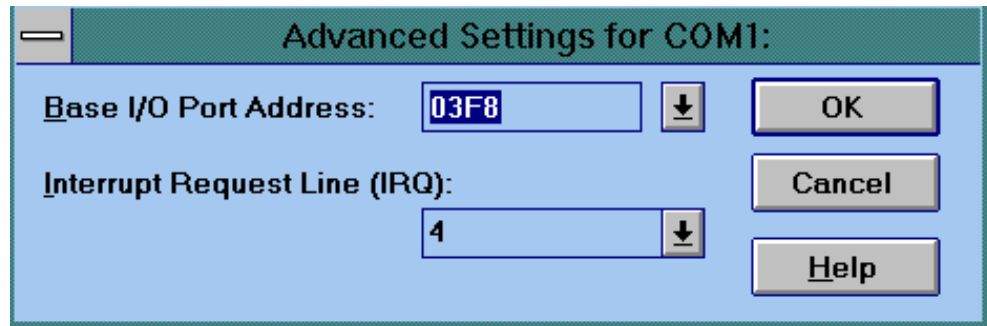


Figure 2-10
Advanced Settings for Com1

For most applications the default settings for both the **COM1** and **COM2** are as follows.

Serial Port	Base address	Interrupt Request Line (IRQ)
COM1	0X3F8	4
COM2	0X2F8	3

Single click on **OK** to enter any changes made to these settings or click on **Cancel** to exit without change.

Usually these settings are not changed unless changes are made to the system, such as the addition of a high speed I/O card or internal modem. When the computer is running an application software it is very important that all the interfaces and communication ports be set up correctly. If a laptop or a personal computer does not have a mouse you can choose or select specific settings within each menu by pressing the tab key repetitively to move through each option. Pressing <TAB> + <CURSOR> keys will allow you to step through each option and make changes as required.

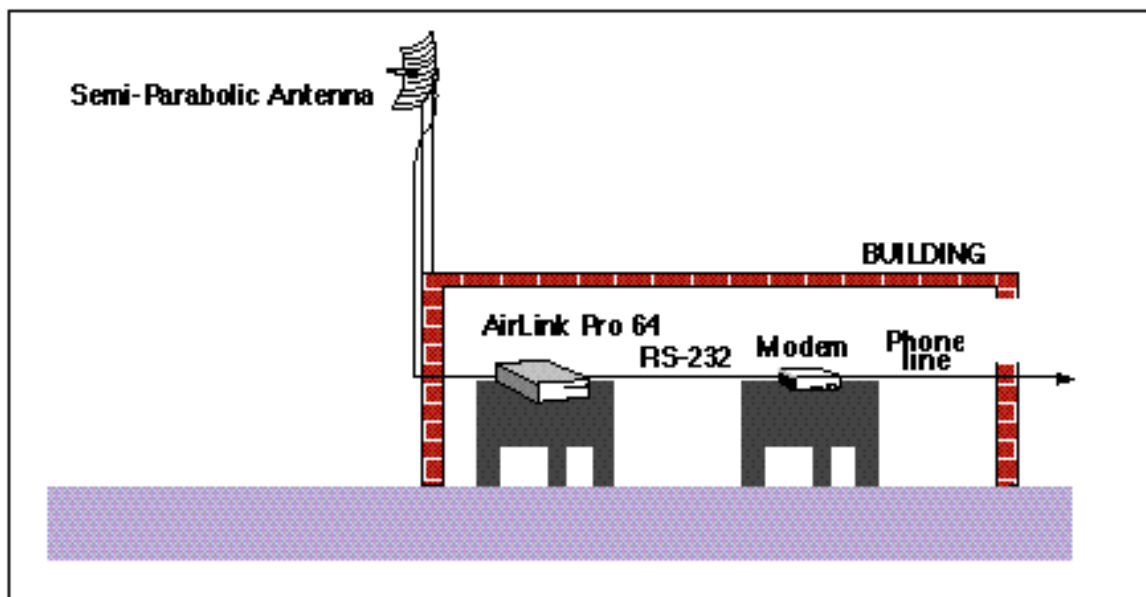
A terminal device or a personal computer may have specific data cabling requirements (refer to Appendix B, *Specifications*, for connector pin assignments), and usually requires a grounded alternating current power outlet. In a hub installation involving a number of AirLink Pro 64S pairs, the terminal device can be “shared” across all the AirLink Pro 64S systems by using a terminal switching device.

Remote Modem Connection

A remote terminal or personal computer can be connected to Network Management Port #1 on the rear panel of the AirLink Pro 64S unit through a modem (see Figure 2-11). A modem typically requires a dedicated telephone line with a modular RJ-11 jack as well as a source of power, usually a standard 115 VAC or 230 VAC grounded outlet.

NOTE AirLink power cords are available to match the power outlets in most countries.

NOTE To avoid ground loops, use the same power outlet for the AirLink Pro 64S and any auxiliary equipment, like a terminal or computer.



P2496-0896

Figure 2-11
Modem Connection to the AirLink Pro 64S

Batch File Handling

The user can configure the unit by executing commands through a batch file. The user needs a Windows terminal emulator or a serial communications package such as Procomm. The batch file can be used to execute local SET commands only (user cannot issue remote commands via a batch file). It is important that the user verify the proper execution of GET and SET commands manually before executing the batch file. This indicates that the unit is functional.

Procomm:

1. Power up the unit. Log in and verify that the GET and SET commands work.
2. Choose Alt-S option in order to select the upload parameters.
3. Select option # 4...delay between characters...suggested value: 25.

4. **Select option # 5...delay between lines...suggested value: 100 (Esc gets you out of the setup menu).**
5. **Press the PageUp key to bring up a menu that gives you several options.**
6. **Choose Option 6 (ASCII Upload). Procomm prompts you for the filename.**
7. **Enter the name of the batch file holding the configuration commands.**

NOTE

Procomm Plus software does not work with the AirLink Pro 64S at this time.

Windows Terminal Emulator:

1. **Power up the unit and wait for the POST messages.**
2. **Login and verify that the GET and SET commands work.**
3. **From the Setting menu, select the Text Transfer option.**
4. **Set the following parameters:**
 - Delay between characters : 1/10 sec**
 - Delay between lines : 25/10 sec**
5. **From the Transfer menu select Send Text File. Enter the name of the text file that contains the configuration commands.**

NOTE

The delay between character values are dependant upon the speed of your PC.

You should see each command being executed on the local unit. The command will be followed by the unit's response based on whether the command was executed. If the terminal program sends a command to the local unit before the local unit is ready for the next command, the command may be dropped.

Burst Synchronization

When you have either a hub configuration or a repeater site (more than one AirLink 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 settings.

Burst Sync Signal Description

The Burst Synchronization signal is used by AirLink Modems in Hub and Repeater applications to synchronize two or more modems to a common reference. Two types of synchronization are required: transmit burst and bit timing synchronization. These two components are necessary to align the transmit bursts, and to ensure that an exact number of user data bits are generated every 8.5 millisecond Time-Division-Duplex (TDD) frame. If this were not the case, data would be lost when the internal buffers overflowed.

The TDD over-the-air protocol used in AirLink modems is characterized by a transmit burst followed by a receive burst, in an 8.5 millisecond frame. In order to minimize interference between adjacent links, it is necessary to ensure that all of the transmit bursts emanating from the hub site occur simultaneously. This is accomplished by providing a bussed burst synchronization signal (see Figure 2-12) to all modems at the hub site. The signal has a complex structure that has two components. The first component is characterized by wide pulses, which occur at 8.5 millisecond intervals. They are used by the AirLink modems to trigger the transmit bursts and ensure the necessary time alignment. The second component is characterized by short pulses, which occur at an 8 kHz frequency. The pulses serve as phase reference for the AirLink modem internal oscillator, which ensures bit timing synchronization between the modems.

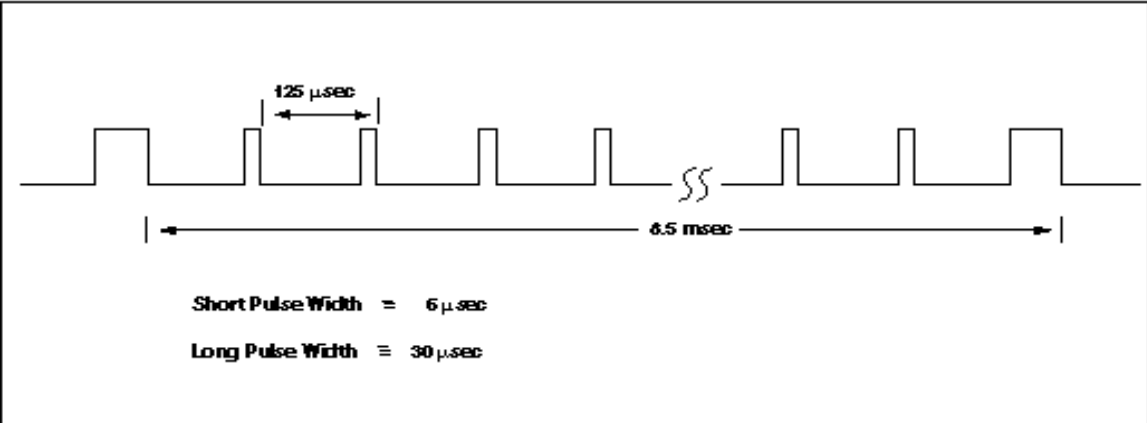


Figure 2-12
Burst Synchronization Structure

Time-Division-Duplex (TDD) Burst Structure Description

The TDD over-the-air protocol used by the AirLink Pro 64S modem is designed to provide the transport mechanism for the full-duplex user data, as well as a separate communication channel for the remote command and status capability (see Figure 2-13). The burst structure is shown in the figure below. This figure

depicts the format of a single burst, however two such bursts, a transmit and a receive burst, are required to form a complete TDD frame. Each burst is approximately 4 milliseconds long, which is about 40% of the TDD frame time. The two bursts together take up 80% of the frame time, and the unused 20% is called the guard time, which is necessary to allow for the two-way propagation delay between the two modems that form a link.

The burst is shown to be composed of five components. The Preamble (PA) is the first part of the burst. It is necessary to allow the receiving modem circuitry to re-acquire synchronization to the transmitting modem. The receiver must re-acquire sync for each burst since it will drift in frequency slightly during the time that no signal is present. The second component is the Unique Word (UW). This is a unique bit pattern that is used by the transmitter to mark the start of the payload data to the receiver. Once the receiver detects this pattern, it can immediately begin recovering the remaining three components. The third component is the inter-processor communication channel (COMM). This channel provides a 1 kbps full duplex communication link between the embedded microprocessors in the AirLink Pro modems. The channel is used to communicate commands and to request and receive status information over the RF link. The fourth component is the data payload (DATA), which provides a maximum 64 kbps full duplex communication channel for the user's data. The user's data is carried unmodified in this burst structure, making the AirLink modem's DTE interface protocol-independent. Finally, the fifth component is the Cyclic-Redundancy Check error detection code. This 16-bit code is computed on the transmit side, and checked on the receive side, once for every burst. When block errors are detected they are counted, and are reported by the microprocessor.

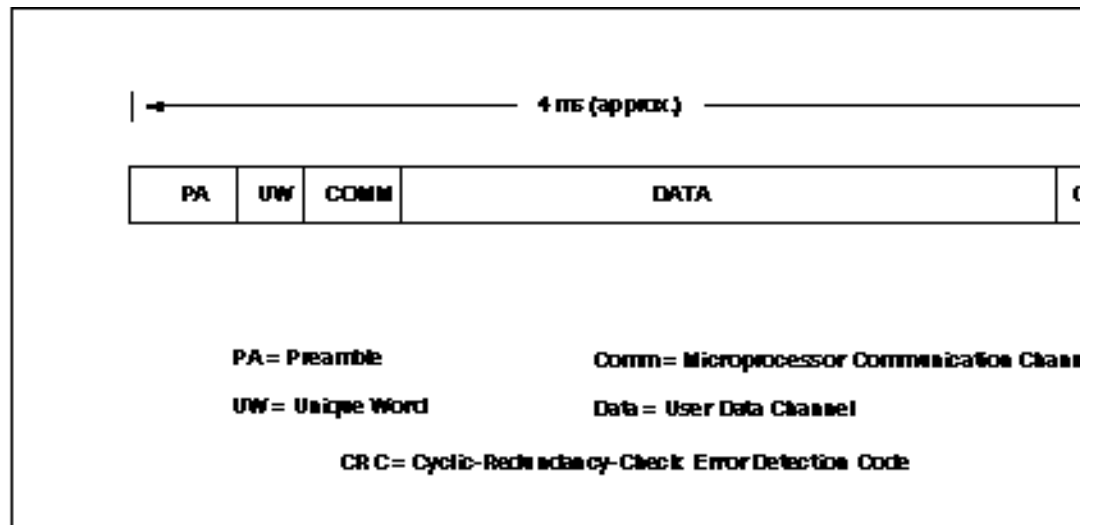


Figure 2-13
TDD Burst Structure

Installing Burst Sync Wiring

Burst synchronization minimizes near-end inter-channel interference among the units in a hub configuration; all the hub units are synchronized in order to transmit and receive at the same time. The burst synchronization system is implemented with a dual external bus. Each bus consists of a differential pair of wires, driven by a tri-stateable RS-485-type device. When multiple modems are to be synchronized, they should be interconnected via a color coded four-wire cable. Each modem has six jacks that are electrically identical to facilitate this interconnection.

The equipment should be physically located as shown in Figure 2-14. The Reference and backup masters should be the first units in the chain. Figure 2-14 illustrates the connections needed for Burst synchronization at a hub site where the A bus is used. The Reference master is the burst sync signal source, providing it for the three Subordinate master units. If the distance between the Reference master and the last Subordinate master is greater than 100 ft, the burst sync bus(es) should be terminated at the last subordinate master. The termination is done with a 100 ohm resistor (internal to AirLink) as shown in Figure 2-15. You should ensure that that the Termination is at one end of the daisy chain and the Burst sync source is at the opposite end. Care should also be taken not to use multiple terminations.

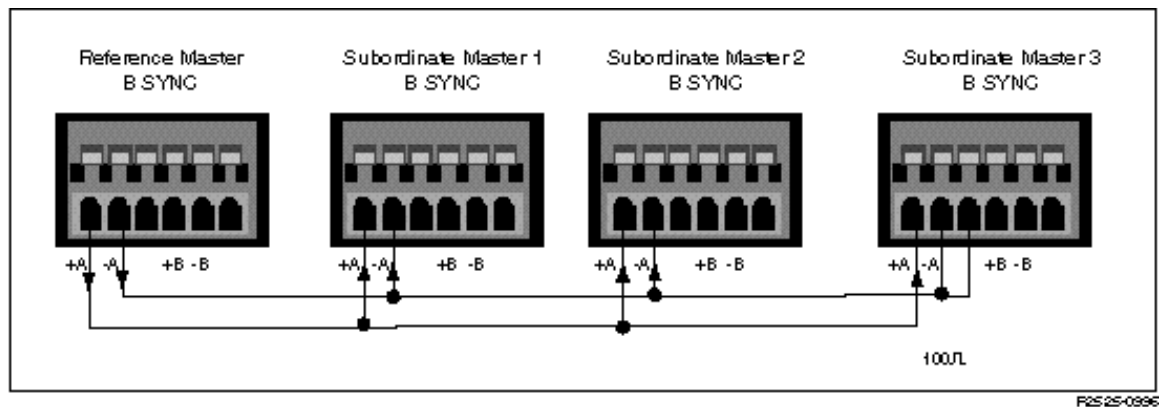


Figure 2-14
Burst Sync Wiring

Burst Sync Fail-Safe Feature

The AirLink Pro provides for a burst synchronization backup scheme which uses two buses. These are referred to as the "A" bus and the "B" bus. Use of the backup burst synchronization bus is optional. To use the backup feature, one of the two buses is designated as the primary burst synchronization bus and the other is designated as the backup burst synchronization bus. One of the units at a hub site is selected as the "Reference Master", and a second unit is selected as

the "Backup Master." All other units at the hub are designated as "Subordinate Master." The burst synchronization signal on the primary bus is provided by the Reference Master unit. When activity is lost on the primary bus, implying that the Reference Master has failed to provide the burst synchronization signal, the modems will use the backup burst synchronization signal provided by the Backup Master unit. When activity is again detected on the primary bus, the burst synchronization signal on this bus is used.

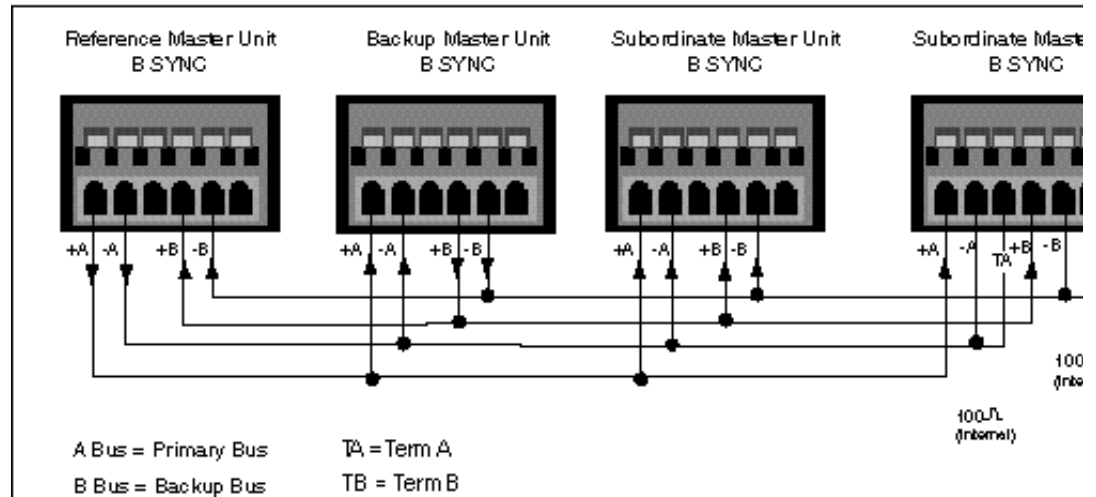


Figure 2-15
Burst Sync Backup

The Burst Sync LED is ON for the unit providing the burst synchronization signal; this will always be either the Reference Master or the Backup Master. Subordinate Master units never provide the burst synchronization signal.

The AirLink Pro modem unit monitors for loss of the burst synchronization signal. When only a single burst synchronization bus is used, the loss of the burst synchronization signal triggers a Major Alarm. The Major Alarm LED is turned ON, and an alarm message is generated in the event log. When both burst synchronization buses are being used, and both primary and backup burst synchronization signals are lost, a Major Alarm is generated. The Major Alarm LED is turned ON, and an alarm message is generated in the event log. If either the primary or backup burst synchronization signal is lost, a Minor Alarm is generated. The Minor Alarm LED is turned ON, and an alarm message is generated in the event log.

To configure all the units at a primary hub site to use the primary burst synchronization bus only, follow these steps:

1. Designate one unit to be the Reference Master unit. Type

```
AIRLINK PRO 64S> set application 4
```

2. **Designate all the other units to be Subordinate Master units. For each unit, type**

```
AIRLINK PRO 64S> set application 6
```

3. **To designate a single burst sync system, at each unit in the hub, type**

```
AIRLINK PRO 64S> SET HUB_SYNC SINGLE
```

4. **Wire the units as shown in Figure 2-14.**

To configure all the units at a primary hub site to use the backup burst synchronization feature, follow these steps:

1. **Designate one unit to be the Reference Master unit. For this unit, type**

```
AIRLINK PRO 64S> Set Application 4
```

2. **Designate a second unit to be the Backup Reference Master unit. For this unit, type**

```
AIRLINK PRO 64S > Set Application 5
```

3. **Designate all the other units to be Subordinate Master units. For each unit, type**

```
AIRLINK PRO 64S> Set Application 6
```

4. **To designate a dual burst sync system, at each unit in the hub, type**

```
AIRLINK PRO 64S> SET HUB_SYNC DUAL
```

5. **Wire the units as shown in Figure 2-15.**

To configure units in a secondary hub site, all the above steps apply except that either a Slave modem in a point-to-point link or a Slave modem in a point-to-multipoint link is used in place of the Reference Master unit.

Normal Operation of Backup Burst Synchronization

The Backup Burst synchronization scheme is used in hub and repeater configurations. The burst synchronization signal is provided on two buses, Bus A and Bus B. The primary burst sync signal is provided by the Reference Master unit on Bus A. The Backup Burst Synchronization signal is provided by the Backup Master unit on Bus B.

Table 2-4
Normal Burst Sync Activity

Source	Reaction
Reference Master	Provides burst sync signal on Bus A Uses own burst sync signal Burst Sync Source LED is ON
Backup Master	Provides burst sync signal on Bus B Uses burst sync signal from Bus A Burst Sync Source LED is OFF
Subordinate Master(s)	Uses burst sync signal on Bus A Burst Sync Source LED is OFF

Activity Lost on Bus A Only

This condition occurs if the Reference Master unit malfunctions or the burst sync connection on Bus A is broken. It is detected by all units at the hub except for the Reference Master unit. The Reference Master unit cannot monitor its own burst sync status. The technician should power down the Reference Master Unit or remotely enable its "RF Sleep" command, until the problem is located. It may still be transmitting and can cause near-end inter-channel interference since all other units are using a different burst sync signal.

Table 2-5
Bus A Activity Lost

Source	Reaction
Reference Master	Uses own burst sync signal Burst Sync Source LED is ON
Backup Master	Provides burst sync signal on Bus B Uses own burst sync signal Burst Sync Source LED is ON Minor Alarm LED is ON Event Queue contains "Primary Burst Sync Source Loss" message
Subordinate Master(s)	Uses burst sync signal on Bus B Burst Sync Source LED is OFF Minor Alarm LED is ON Event Queue contains "Primary Burst Sync source loss" message

Activity Lost on Bus B Only

This condition occurs if the Backup Master unit malfunctions or the burst sync connection on Bus B is broken. It is detected by all units at the hub except for the Backup Master unit. The Backup Master unit cannot monitor its own burst sync status.

Table 2-6
Bus B Activity Lost

Source	Reaction
Reference Master	Provides burst sync signal on Bus A Uses own burst sync signal Burst Sync Source LED is ON Minor Alarm LED is ON
Backup Master	Uses burst sync signal on Bus A Burst Sync Source LED is OFF
Subordinate Master(s)	Uses burst sync signal on Bus A Burst Sync Source LED is OFF Minor Alarm LED is ON Event Queue contains "Backup Burst Sync Source Loss" message

Activity Lost on Bus A and Bus B

Table 2-7
Bus A and Bus B Activity Lost

Source	Reaction
Reference Master	Uses own burst sync signal Burst Sync Source LED in ON Minor Alarm LED is ON Event Queue contains "Backup Burst Sync Source Loss" message
Backup Master	Uses own burst sync signal Burst Sync Source LED is ON Minor Alarm LED is ON Event Queue contains "Primary Burst Sync Source Loss" message
Subordinate Master(s)	Burst Sync Source LED is OFF Major Alarm LED is ON Event Queue contains "No Burst Sync Source" message

Burst Synchronization Compatibility with AirLink One Modems

The AirLink Pro 64S uses a burst synchronization signal that is compatible with the signal used in the AirLink One S-band 64kbps, 128kbps, and 256kbps models and AirLink One L-band models. A hub configuration may contain both AirLink Pro and AirLink One units. AirLink One units, however, *cannot* take advantage of the backup burst synchronization feature. For the burst synchronization signal, the AirLink One models use a different connector and cable than those used on the AirLink Pro 64S. The following section describes the procedure to successfully connect AirLink Pro and AirLink One units for burst synchronization in a hub configuration. You will need an RS232 DB25 (Female) to BNC (Male) converter, RS232 DB25 (Male) to RS422 terminal block converter (see Figure 2-14) and a pair of single wires (converters can be ordered from Cylink distributors).

The RS232 and RS422 terminal block converter, Telebyte Model number 285M, must be properly configured before use. A two position switch accessible from the top of the unit should be set to the "DCE" position. Also, the five position dip switch next to the terminal block should have the following settings: SW1 through SW4 open, and SW5 closed.

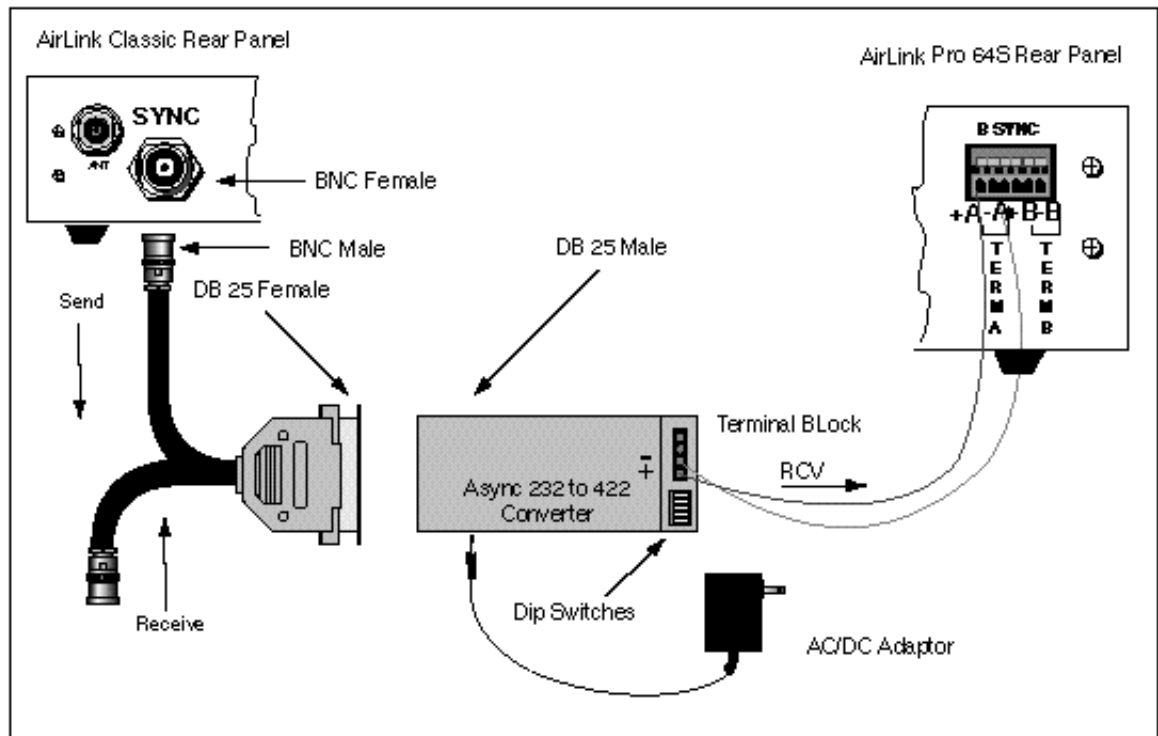


Figure 2-16
Burst Sync Compatibility (AirLink One unit providing Burst Sync)

AirLink One Unit Providing Burst Synchronization Signal

1. **Connect the BNC cable marked "SEND" of the RS232-to-BNC converter to the "SYNC" connector of the AirLink One.**
2. **Connect the DB25 female end of the RS232-to-BNC converter to the DB25 male end of the RS232-to-RS422 converter.**

NOTE

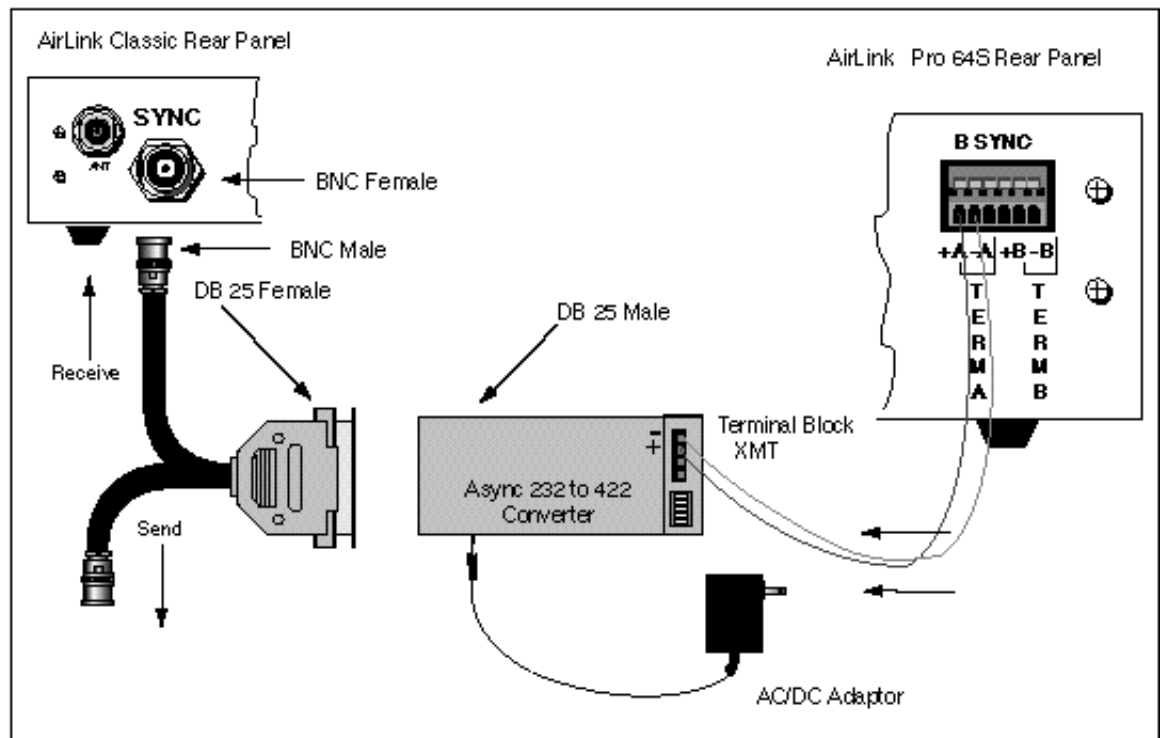
The cable and connectors are available for purchase from Cylink or Cylink distributors.

On the terminal block end of the RS232 to RS422 converter, there are provisions for two pairs of wires. One pair is used when the AirLink One unit is generating the burst synchronization signal to the other units in the hub. The other pair is used when an AirLink Pro unit is providing the burst synchronization signal (See the next section).

3. **Connect one end of a single wire to the designated "T+" terminal of the terminal block and the other end to the AirLink Pro unit's "+A" terminal. Connect one end of a second single wire to the designated "T-" terminal of the terminal block and the other end to the AirLink Pro unit's "-A" terminal.**

AirLink Pro Unit Providing Burst Synchronization Signal

1. **Connect the BNC cable marked "RECEIVE" of the RS232-to-BNC converter to the "SYNC" connector of the AirLink One.**
2. **Connect the DB25 female end of the RS232-to-BNC converter to the DB25 male end of the RS232-to-RS422 converter.**
3. **Connect one end of a single wire to the designated "R+" terminal of the terminal block and the other end to the AirLink Pro unit's "+A" terminal. Connect one end of a second single wire to the designated "R-" terminal of the terminal block and the other end to the AirLink Pro unit's "-A" terminal (see Figure 2-15).**



P2540-0926

Figure 2-17
Burst Sync Compatibility (AirLink Pro unit providing Burst Sync)

Checking Operation

At start-up an AirLink Pro 64S pair will attempt to:

- establish the radio link between the two radio units, and
- begin transferring data

When each radio unit is powered up, it performs a power-on self-test 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, in an attempt at establishing an RF link with the slave unit.

Power-up LED Sequence

The boot-up process consists of the unit performing several self-tests (described below). All LEDs will light at one time or another, so this is a visual check that they are all working. The boot-up time, defined as the time for the unit to complete the boot-up process, is 15 seconds.

All the LEDs light up when Xilinx is loaded successfully.

Table 2-8
LED Indicators

Indicator	Signifies
RD	EPROM Checksum
TD	Xilinx EPROM Checksum
RTS LED	NVRAM
DCD	Configuration databases are checked Hardware initialization
Power LED	Power is on
Burst Sync Source	Boot up is successful
Minor Alarm LED	RAM test in progress
Major Alarm LED	Xilinx loading in progress

If a unit is powered up with the factory default configuration, the following LEDs are ON when the unit successfully completes the boot-up process: Power,

Burst Sync Source, RD and TD. A few seconds later, the Major Alarm LED comes ON, followed by the Minor Alarm LED.

Error Codes

When an error code is detected, a message is entered into the AirLink Pro 64S Error Code Queue. If the RAM Test fails then the Minor Alarm LED stops flashing and the Burst Sync LED lights up. If Xilinx loading fails, the Major Alarm LED remains lit while the other LEDs are off. If the EPROM Checksum test, the Xilinx EPROM test or the NVRAM test fails, then the corresponding LED remains lit. Refer to Table 2-7 for Error Code Definitions. In such situations you are advised to call your local distributor or Cylink Customer Support.

Table 2-9
Error Codes

Message	Description
Minor Alarm LED is OFF Burst Sync LED is ON	RAM test failed.
Major Alarm LED is ON	Xilinx loading failed.
RD LED is ON	EPROM checksum test failed.
TD LED is ON	Xilinx EPROM test failed.
RTS LED is ON	NVRAM test failed.

CAUTION

The AirLink Pro 64S is not field repairable! Attempting to replace components will automatically void the warranty. For out of warranty situations this usually increases the cost of repair significantly.

Initial Unit Configuration

Because all AirLink Pro 64S units leave the factory configured as slave units in a point-to-point configuration, be sure to configure one of the units as a master.

In a new point-to-point link installation, the configuration on one end must be Master Unit in a Point-to-Point Link.

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 64S 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 then change configuration for repeater operation.

Each type of application has been assigned a specific number for configuration purposes. For more information about Applications and Burst Synchronization, refer to "Application" in the 'Setting Link Parameters' section of Chapter 3, *Configuration*.

Because there is no radio link until the AirLink Pro 64S pairs have been configured and the antennas aligned, all system configuration must be done individually at each unit. Once there is a radio link between the units of an AirLink Pro 64S pair, the remote unit can be configured from the local site across the radio link.

To configure one end of the link as a master:

1. Connect a terminal to the Terminal port on one of the two AirLink modems .

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

2. Type the following command at the prompt:

```
AIRLINK PRO 64S> set application 2
```

The text you type is shown in boldfaced type; be sure to include spaces as shown.

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

```
AIRLINK PRO 64S> get configuration
```

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

```
AIRLINK PRO 64S> Get Configuration
Site Name:
Application:      2. Master Unit in a Point-to-Point Link
PN Code:         1
RF Channel Plan: 20 channels
RF Channel:      1
RF Frequency:    2404.468
```

```
RF Power:          0 dBm
RF sleep:          NO
Comm Mode:         Synchronous
Data Rate:         64 Kbps
Burst Timing:      Free Run
Tx Clock Source:   Internal
Tx VCXO Reference  Free Run
Hub Sync:          Single
RTS Source:        Internal
RTS delay:         0 msec
DTE mode:          RS-232
DTE Protect:       Disabled
Alarm Reporting:   immediate
Alarm Level:       Status
Date/Time:         10 Sept 1996 10:35:00
```

NOTE

Depending upon your AirLink Pro 64S installation, you may need to alter more configuration values in order to ensure correct operation. Refer to Chapter 3 for more information on configuring the AirLink Pro 64S.

Aligning the Antenna

After the link pair has been turned on and configured, the antennas must be aligned. Because most AirLink Pro 64S paths will be line-of-sight paths, the initial antenna alignment can be done visually. In most cases, this rough alignment will be sufficient to allow the radio units to acquire radio synchronization lock.

To “fine tune” the antenna alignment, perform the following procedure:

- 1. Insert the probes of a DC voltmeter into test points (the test points are on Pins 1 and 25 of the RS232 DTE interface connector) on the rear panel of AirLink Pro 64S .**
- 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 be sure that the antenna is aligned on the main lobe, not one of the side lobes.

After you align the antenna, use the terminal *get status* and *get performance* commands to check the receive signal quality (RSQ). You should be able to obtain an RSQ value of 7 or 8 or more. Compare the receive signal (RSSI) level as measured from the DC voltmeter to the expected signal level based on the path calculations. (For more information about the RSSI value, see page 3 of Chapter 4). See the table below for correspondence between

measured voltages and receive signal quality (see Table 4-1 in Chapter 4 to view the Receive Signal Quality table).

Table 2-10
Signal Quality

Signal Quality	RSSI Voltage Range
Good	8.5 - 10.0 V
Bad	< 6.0

3. Type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> get status
```

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

```
AIRLINK PRO 64S> get status
Site Name:
Test in Progress:    None
DTE Status:         RS-232
Radio Sync Loss:    No
Burst Sync Loss:    No
RSSI:               -60.0 dBm
RSQ:                9.0
VSWR                N/A
Date/Time:         10 Sept 1996 10:37:09
```

4. Type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> get performance
```

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

```
AIRLINK PRO 64S> get performance
Site Name: Sunnyvale 2
QRSS BER:    Unavailable
1HR ES:      1
1HR UAS:     1
24 HR ES:    2
24 HR UAS:   3
RSQ:         9.0
Date/Time:   10 Sept 1996 10:38:00
```

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 level indication (RSSI) and a low RSQ number.

Assuming that the path to and from the AirLink Pro 64S unit is okay, the AirLink One is prepared to pass data. If you need to alter other configuration values, refer to Chapter 3, *Configuration*,

CHAPTER 3

Configuration

This chapter describes how to use the AirLink Pro 64S command line terminal user interface to set and change configuration parameters. The information in this chapter includes descriptions of all the AirLink Pro 64S configuration commands and options, and lists the default configuration settings.

Inside this chapter:

Overview	3-2
Using the ASCII Terminal Interface	3-2
Setting Administrative Parameters	3-10
Setting Link Parameters	3-12
Setting Alarm Control Parameters	3-22
Setting Modem Parameters.....	3-2?
Other Command Keywords and Operands.....	3-2?

Overview

You configure the AirLink Pro 64S by connecting an ASCII terminal or a personal computer to the Terminal port of the AirLink Pro 64S.

The AirLink Pro 64S ASCII terminal interface provides a command line interface that consists of a body of commands for manipulating the operation of the AirLink modem. This includes configuring operational parameters, monitoring operation, and responding to alarm conditions. The command line interface (CLI) also provides an on-line 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. Keywords do not have to be fully typed out if enough letters are provided to eliminate ambiguity.

You can also type in a help request for a particular command combination, to see what comes next.

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

Using the ASCII Terminal Interface

Command Line Interface (CLI)

The command line interface consists of a body of commands for manipulating the operation of the AirLink Pro 64S, including configuring operational parameters, monitoring operation, and responding to alarm conditions.

Command Line Interface Syntax

1. A command line consists of a basic command keyword. This basic command keyword must be the first word of the command. More specific keywords and operands follow this basic command keyword. For example:

```
AIRLINK PRO 64S> get RSSI
```

2. Each token (basic keyword, specific keyword, operand) must be separated from another with either an ASCII comma, ASCII space, or ASCII tab. More than one space may be used as extra spaces are ignored. Comma, space, and tab characters may never be used inside keywords or operands.
3. All operands relating to a command keyword must follow that key word in the prescribed order (always allow for a space between commands). Keywords relating to a different command keyword must follow that command keyword. However, if several keywords relate to the same command keyword, the ordering of those keywords does not matter.
4. Keywords do not have to be fully typed out if enough letters are provided to eliminate ambiguity. For example:

```
AIRLINK PRO 64S> set alar repo imme
```

instead of

```
AIRLINK PRO 64S> set alarm reporting immediately
```

5. Maximum command length is 250 characters, including comments, spaces, and carriage return. Any command that exceeds this is rejected with an appropriate error message.
6. Keywords may be entered in either lower case, upper case, or a combination of both.

Editing Capability

1. Network Management Ports 1 and 2 are Network Management and ASCII terminal ports. When they are in the command mode, the system will echo characters back to these ports.
2. Network Management 1 and 2 handle both Backspace and Delete key strokes from a VT100 terminal. When either key is entered, the function invoked is to blank out current cursor location and to move the cursor one character to the left. If the buffer is empty, no action is taken when either key is typed.

3. When the escape key <Esc> is struck during the typing of a command line, all characters typed are deleted, and the system is then ready to accept another command.
4. When <Control> R is pressed, at the prompt, the previously issued command is displayed. This command can be edited by backspacing to delete characters from the end, and/or by augmenting the command with additional characters. This is particularly helpful when the user types an incomplete command; all the user needs to type is the remaining word(s).
5. A limited help facility is available for the command mode. In command line, the user may type a question mark (?) at a position where a keyword should be entered. The Controller displays the available keywords along with their explanation. When the user types a question mark at a position where an operand should be entered, the Controller displays the available operands and their input range (for instance, 1 to 30, or Yes, No) along with the explanation of the operands. After printing the help text, the Controller reprints the command that the user typed without the question mark and gets ready for the user to type the next operand.
6. The same help facility described above is provided when the user enters a carriage return instead of a question mark before the end of a command. There is a difference in response between the termination with a carriage return and termination with a question mark. When a question mark is entered, the system always prints the help text for the next token. When a carriage return is entered, the help text is displayed only if the command is not properly terminated. Otherwise, the system treats it as a complete command and continues with execution.

Command and Operand Description Syntax

1. A description syntax is used to show operand ranges and keyword choices. This syntax is used for description purposes only and not for the command itself.
2. [x1 | x2 | ... | xn] indicates that one of the elements in the set may be selected.
3. “ - “ (a hyphen) indicates a range of numbers explicitly put into the command.

Command Keyword List

Command keywords and operands can be used to set or request configuration parameter values, or status information. For keywords longer than four letters, only the first four letters of each keyword are necessary and case is not checked (all strings are converted to upper case). White space characters are required between keywords but the

type (i.e. space or tab) and the number are not checked. Keywords in parentheses are optional; such words need not be typed for the command to execute. Refer to Appendix D for a complete list of keywords.

Power-Up Messages

Following power up, the system displays a series of successfully passed tests similar to the following:

```
Waiting for Xilinx Init
Loading Xilinx
Xilinx loaded OK!
RAM test passed
EPROM passed checksum test
Xilinx EPROM passed checksum test
NVRAM Test Passed
Passed Database checksum test
RTC Test: Passed
Passed CFG DB Checksum test
Event Queue test: Passed
Initializing Xilinx registers
CYLINK Corporation, Sunnyvale, CA 94086
AirLink Pro Software, Copyright (C) 1996
```

Logging into the System

After the tests results are displayed, the user should type LOGIN:

```
AIRLINK PRO 64S> LOGIN
```

The user is now in the Login Mode. Press <RETURN> and enter the Password when prompted. If you issue any command without logging in first, the system reminds you to log in:

```
AIRLINK PRO 64S> TYPE LOGIN FIRST
```

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 log in prompt for the Password. This password will remain in effect until changed.

If you wish to change the Password, issue the command SET PASSWORD at the prompt (see the section on PASSWORD later in this chapter for setting a new password). If the Password is accepted, the system displays an OK response and you gain access to the commands.

The LOGIN command exists only at the local unit. There is no remote LOGIN. When logged in to the local unit, you have access to the other unit in a point-to-point system.

Logout

This command is used to exit the system. It should be done when all configuration and setup is completed to prevent unauthorized use of the system.

```
AIRLINK PRO 64S> logout
```

Help

This command is a request for the on-line help facility. If the HELP keyword is not followed by any additional parameter, a command summary is displayed. If a specific command follows the HELP keyword, a list of all the possible parameters for the specified command is displayed. You can also type in a help request for a particular command combination, to see what comes next:

```
AIRLINK PRO 64S> help set
```

The system displays a list of command keywords similar to the following:

```
Next available Keywords or Operand:
```

```
ALARM  
APPLICATION  
COMM  
CONNECTION  
DATA  
DATE  
APPLICATION  
SITE  
PN CODE  
TX CLOCK  
TX VCXO
```

Local, Remote and Both Operations

The Command Line Interface allows the user to configure and monitor both ends of a point-to-point link. To configure the local end only, the "LOCAL" keyword may be used, but it is optional. To configure the far end only, the "REMOTE" keyword must be used. To configure both ends of the link, the "BOTH" keyword must be used. These keywords, when used, must precede the command keyword to be invoked.

The syntax is as follows:

```
(LOCAL) <command>
```

```
REMOTE <command>
```

BOTH <command>

For example, if you type **SET SITE NAME Sunnyvale** at the prompt, the site name is changed to Sunnyvale for the local unit. At the Prompt type

```
AIRLINK PRO 64S> remote Get status
```

to query the status of the remote unit. To configure both ends of the link use the **BOTH** command.

```
AIRLINK PRO 64S> both Set pn code 4
```

NOTE

REMOTE and BOTH commands apply only to point-to-point configuration.

Administrative Parameters

Site Name

The site name identifies the role or location of the specified AirLink Pro 64S. This parameter is optional and can be any convenient description of up to 60 alphanumeric characters.

To set the site name for the local AirLink Pro 64S, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> set site name
```

where *name* is a description of up to any 60 alphanumeric characters. For example, to set the site name of the local AirLink Pro 64S to Sunnyvale 2, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> set site Sunnyvale 2
```

To set the site name of the remote AirLink Pro 64S, use the command:

```
AIRLINK PRO 64S> remote set site name
```

It is important to select a site name that will distinguish the unit from others in the network. This allows conformation that changes are being made to the desired link. The site name is also saved when the Alarm Log is saved as a file on a PC.

Date and Time

The date and time are used in system operations as well as to provide a reference in time-stamping status, performance and alarm information.

To set the date for the local AirLink Pro 64S, type the following command at the AirLink Pro prompt:

```
AIRLINK PRO 64S> 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 64S, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> set date 9/30/96
```

To set the time for the local unit, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> 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 don't enter a value for seconds, the system assumes a setting of 00 seconds. For example, to set the time of the local AirLink Pro 64S, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> set time 10:35:00
```

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

```
AIRLINK PRO 64S> remote set time time
```

or save a step by using the BOTH command

```
AIRLINK PRO 64S> both set time 14:26:00
```

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 needed 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, 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 log in prompt for the password.

To protect the system, you should change the password at the earliest opportunity. The new password should also be written down 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 lose 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 64S prompt:

```
AIRLINK PRO 64S> 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 64S is new and currently has no password. To set the password to *1Awombat*, you would type the following commands at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> set password
Old Password: <Return>
New Password: 1Awombat
Retype New Password: 1Awombat
```

Setting Link 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 not initiate Simplex (test) BURST MODE for the remote unit, or you will be forced to travel to the remote site to reconfigure the unit.

Application

The APPLICATION parameter specifies the role of the unit in a specific system configuration. Figures 3-1 to 3-4 show the various valid configurations. The APPLICATION parameter has the following valid options:

1. Slave Unit in Point-to-Point Link
2. Master Unit in Point-to-Point Link
3. Master Unit at Repeater Site
4. Reference Master Unit at Hub
5. Backup Master Unit at Hub
6. Subordinate Master Unit at Hub
7. Master Unit in Multipoint Link
8. Slave Unit in Multipoint Link

To set the application for the local AirLink Pro 64S, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> set application operand
```

where *operand* is a number in the range 1 to 11, corresponding to the options listed above. If you do not specify a value, the system assumes the default value: 1 (slave unit in a point-to-point link). For example, to set the application for the local AirLink Pro 64S to 4 (reference master at a hub), type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> set application 4
```

To set the application of the remote AirLink Pro 64S, use the command:

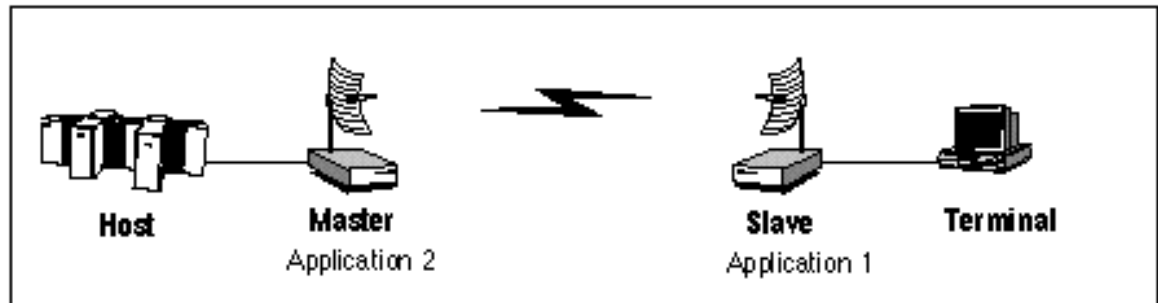
```
AIRLINK PRO 64S> remote set application operand
```

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

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

Point-to-Point Link (Applications 1 and 2)

In a point-to-point link (See Figure 3-1), where one AirLink Pro 64S modem pair consists of a *master unit* (Application 2) and a *slave unit* (Application 1), the master unit provides the burst synchronization signal source for the link when transmitting data. The slave unit synchronizes to this timing reference when it transmits data back to the master unit.



P2521-0896

Figure 3-1
Point-to-Point Application

Point-to-Multipoint Link (Application 8 and 7)

In a Point-to-Multipoint link (Figure 3-2), one *master unit* (Application 7) communicates with two or more *slave units* (Application 8). In this configuration, the host DTE may receive a response from a remote DTE while broadcasting a poll or transmitting data to a second remote DTE. All the slave units receive when the master unit transmits. The master unit receives when a slave transmits. Only one slave unit transmits at a time and this is determined at the DTE interface level, transparent to the AirLink modems via the assertion of the DTE interface signal "RTS". The master unit provides the burst synchronization signal source for the link to each slave unit in the system. Each slave unit synchronizes to this timing reference when it transmits data back to the master unit.

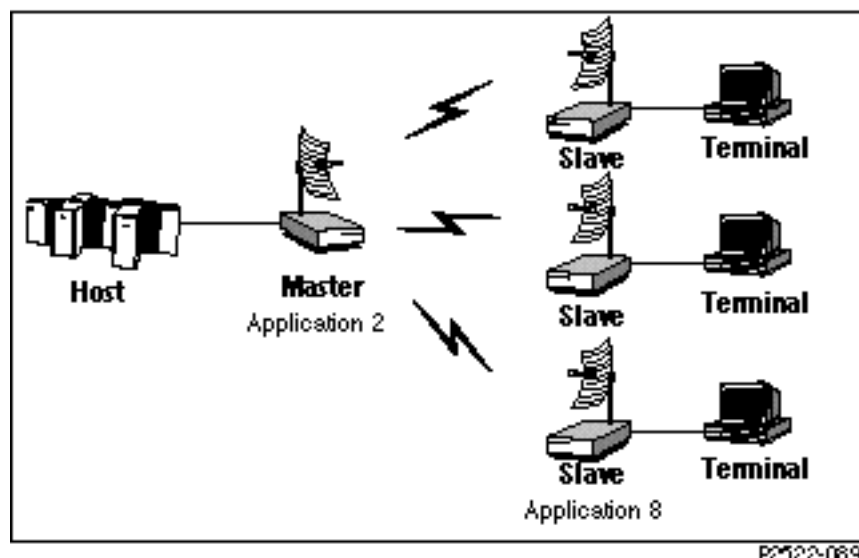
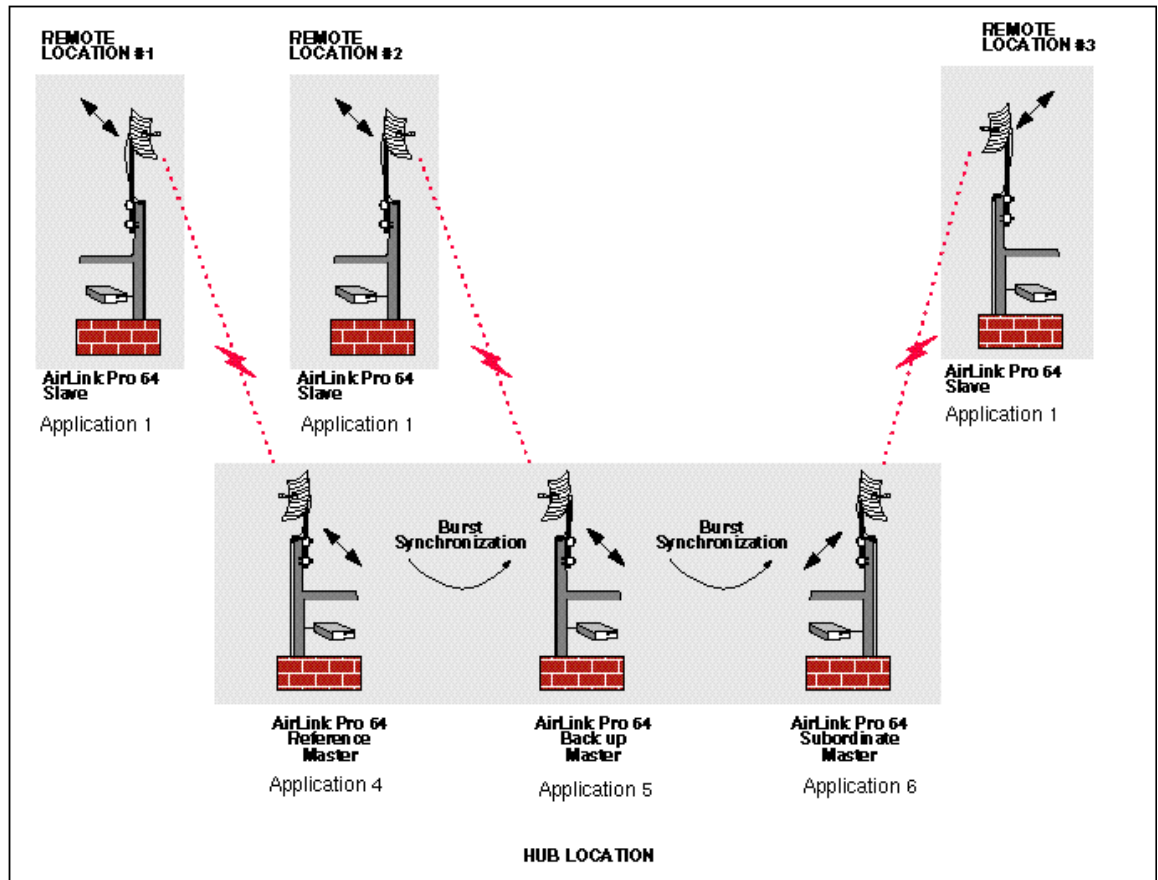


Figure 3-2
Point-to-Multipoint Application

Hub Application (Applications 4, 5, and 6)

A hub application is used when two or more full-duplex links emanate from a single centralized location. In a hub configuration, two or more units are co-located at the hub site. One of the units is the synchronizing unit, the *Reference Master* (Application 4), which generates the burst timing reference for the other units. This burst synchronization minimizes near-end inter-channel interference among the units and all the units transmit and receive at the same time. Should the Reference Master unit fail, a second unit, *Back up master at a Hub* (Application 5), is designated to provide the burst synchronization signal to the rest of the units at the Hub. All other units are configured as *Subordinate Master units* (Application 6) [See the section “Burst Synchronization” in Chapter 2].



P2902-0696

Figure 3-3
 Hub Application

Repeater (Application 3)

When either the range is too great for a single hop installation between master and slave, or line of sight can't be achieved due to physical obstacles, one solution is to use a repeater configuration. Repeater mode extends the range of remote slave units. As shown in Figure 3-4, this is accomplished by connecting a slave unit to a master unit in a repeater mode. A repeater is a special case of a secondary hub in which the burst sync signal source is a slave modem. This allows communication with remote slave units that otherwise could not be reached. In a repeater, the two AirLink Pro 64S 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*.

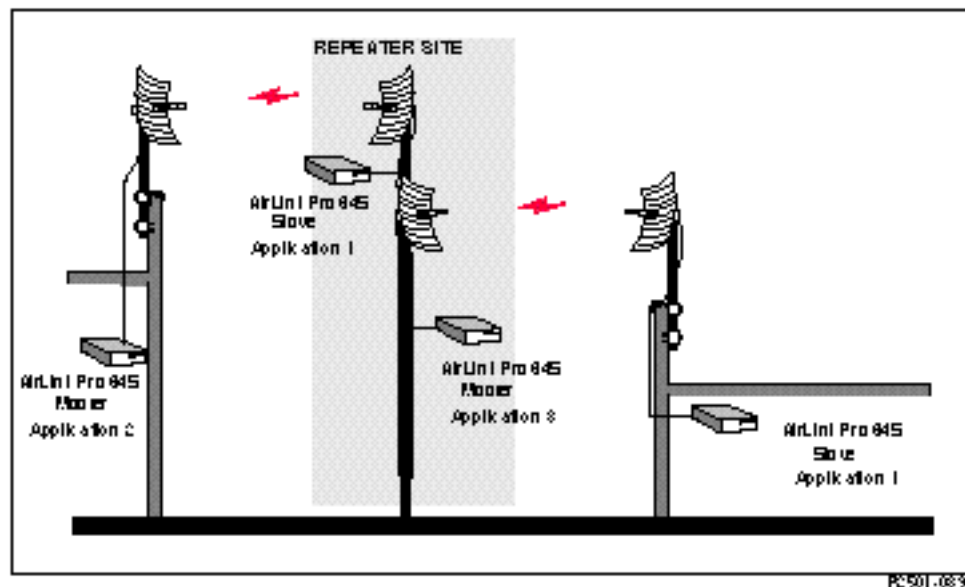


Figure 3-4
AirLink Pro 64S Two Part Repeater Link

At a repeater site, there are two modems: the slave modem (Application 1 or Application 8) for the previous hop, and the master modem (Application 3) for the next hop. To avoid interference, these modems must be burst synchronized, and since the slave's burst synchronization signal is defined by the received signal from the originating master, it must provide a burst synchronization signal to the repeater master modem for the next hop. A crossover cable must connect the DTE interfaces of the two modems at the repeater site.

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 64S 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 should be configured as *master units at a repeater site* (Application 3) for the next hop of the repeater link, or as *secondary masters at a hub* (Application 6) for all other links.

If the entire repeater link is set up as a point-to-point link, the AirLink Pro 64S 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 2). The AirLink Pro 64S 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 1).

Each Repeater hop has a master and a slave modem. The master in the first hop is set up as a point-to-point master or a Hub master depending on the application. The masters for all other hops are set up as Master unit at a repeater site (Application 3). All slaves are set up as slave units in a point-to-point link (Application 1).

Configuring the DTE Interface

The AirLink Pro 64S DTE port is the physical interface by which user data is transported into and out of the modem. The DTE port consists of two physical connectors, only one of which can be active at any particular time. One connector is used for RS-232 interfaces, and the other is used for V.11/V.35 and EIA-530 interfaces. The DTE interface emulates DCE operation and should be connected to a DTE. Configuration of the DTE interface consists of setting the interface mode, the data stream parameters, and the flow control parameters to match the user's Data Terminal Equipment, using the following appropriate commands

DTE Mode

This command is used to choose the DTE interface standard. The values are *Disabled*, *RS-232*, *EIA-530* and *V.35*. The DTE interface incorporates a protection circuit which helps to prevent damage to customer equipment and the modem interface circuitry. Since the interface standards specify different voltage levels, damage can occur if the AirLink Pro 64S is configured for an interface standard different from the one being delivered via the cable going into the DTE connector. The actual interface available on the connector used for

the V.35 and the EIA-530 standards is configurable using the "SET DTE MODE" command.

When the unit is powered up for the first time, all three interfaces are disabled. The drivers to each of the two connectors are tri-stated. Before the DTE interface can function, the SET DTE MODE must be issued to select the desired DTE interface standard.

A DTE interface protection circuit is included in the AirLink Pro 64S modem. See the command below for the use of this feature.

DTE Protection

The DTE ports support three different interface standards, which use different voltage levels for the interface signals. As a result, there is a possibility of damaging the internal interface circuitry if a DTE device using one of the three standards is connected to an AirLink 64S modem configured for a different standard. Both of the connectors provided are in DB-25 format, one used for RS-232 connections, and the other for V.35 or EIA-530 connections. Only one interface standard can be enabled at any one time. To minimize the potential for damage, a protection circuit has been included in the modem to sense voltage levels of certain signals and disable the interfaces when an incorrect voltage is detected.

In order for the protection circuit to function properly, certain interface signals must be present. The RS-232 interface uses the TXD (Transmit Data) signal exclusively for voltage detection, but the V.35 and EIA-530 interfaces use both TXD and DTR (Data Terminal Ready). Depending on the user's equipment, the lack of interface signals may be caused by the inadvertently disabled interface. To avoid this, a command has been provided to enable or disable the protection circuit. It is important to bear in mind that if this circuit is disabled, or if the proper interface signals are not active, protection of the interface cannot be guaranteed.

To set up the DTE protection circuit, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S>set DTE Protection operand
```

where *operand* is enabled or disabled.

NOTE

When the DTE Protection feature is enabled, the user's DTE equipment must provide RS-232 signal voltage levels greater than 7 volts for the interface to activate. This is necessary to discriminate between a proper RS-232 connection and an improper V.35 or EIA-530 connection.

Therefore, if the DTE equipment is supplying an RS-232 signal using voltage levels less than 7 volts, the AirLink Pro modem will not operate correctly unless the DTE Protection circuit is disabled.

Table 3-1
Voltage Requirements DTE Protect Configuration

DTE Interface	Voltage Requirements
RS-232	on TXD >7.0 or <-7V
V.35	on DTR >7.0V or <-7V and on TXD <7.0V or >-7.0V
EIA-530	on DTR <7.0V and >-7V and on TXD <7.0V and >-7V

Data Rate

This command specifies the data rate for synchronous and asynchronous data transmission. For asynchronous data rates up to 16.0 kbps that are not specifically listed, 64 kbps synchronous mode should be selected.

To set the data rate for the local unit, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> set data rate operand
```

where *operand* is 64, 56, 19.2, 9.6, or 4.8 for synchronous and 19.2, 9.6, or 4.8 for synchronous or asynchronous. If you do not specify a value, the system assumes the default value: **64 kbps**.

Comm Mode

This command specifies the communications mode of the unit. For asynchronous mode, it specifies the character lengths of the data. Total character length includes the start, stop, parity, and data bits; all are in accordance with CCITT V.14 standard and ITV standard V.14. The values are *Synchronous*, *8-bit*, *9-bit*, *10-bit*, and *11-bit*, where the last four are all asynchronous modes. To set the Comm Mode for the local or remote unit, type the command followed by the operand after the command line prompt:

```
AIRLINK PRO 64S> set comm mode operand
```

Asynchronous data of rates up to 16 kbps can also be handled via oversampling. This is accomplished by setting the Comm Mode to *Synchronous*, the data rate to 64 kbps, and the TX Clock Source to *Internal*. In this case, the asynchronous

data bits are sampled by a 64 kHz clock in the transmitter, which means that there are at least four samples per bit. The asynchronous bits are then reconstructed on the other side of the link by the receiver. For all asynchronous data applications, if the DTE is providing a clock signal on the TT pin, the command “Set TT Clock Detect Off” should be issued to avoid confusing the AirLink unit’s automatic detection circuit.

RTS Source

The RTS Source is the Request-to-send signal source for the unit. It takes the values *Internal* and *External*. *Internal* is selected when data flow control is not needed (for instance, in a point-to-point link). The unit ignores the RTS lead and activates the RTS internally. *External* is selected when data flow control is needed (for instance, in multipoint application or point-to-point repeater extensions to or from multipoint system). The unit responds to RTS lead and CTS signal follows RTS to CTS delay as specified with the RTS DELAY parameter.

RTS Delay

This command is used to specify the maximum RTS to CTS delay time in milliseconds. This delay time has an effect on the polling frequency. (Applies only when RTS SOURCE parameter is set for EXTERNAL). The values the command takes are 0, 17, 34, and 127.5.

Configuring for Different Synchronous Data Clock Modes

The AirLink Pro 64S synchronous data clock mode is determined by two parameters: the internal clock oscillator phase reference and the transmit data sample clock source. The commands that set these parameters are described below. These commands are used to configure the modem for one of the four clocking configurations (DCE/ST, DCE/TT, DTE/TT, or HUB/ST) described in the *AirLink Site Planning Guide* in the chapter entitled “System Planning”. The command sequences required to emulate these AirLink One clocking modes can be found after the command descriptions.

The use of these commands is optional and will not be needed for most installations, as these parameters are set to defaults depending on which application is selected by the “Set Application” command. The default values

for all the applications are shown in the table below. Although there is not necessarily an exact one-to-one correspondence between AirLink One and AirLink Pro 64S clocking modes, the equivalent clock mode from the AirLink Site Planning Guide that most closely matches is shown in the table. In general, the default values assume that the modem clock will be used by the DTE as a reference to clock out its data.

Table 3-2
Applications with Clock Modes

Application Number	Application	TX VCXO Source	TX Clock Source	Clock Mode
1	Slave Unit in a P-P Link	Receive_Clock	Internal	DCE/ST
2	Master Unit in a P-P Link	Free_Run	Internal	DCE/ST
3	Master Unit at a Repeater Site	Burst_Sync_Clock	External	DTE/TT
4	Reference Master at a Hub	Free_Run	Internal	DCE/ST
5	Backup Master at a Hub	Burst_Sync_Clock	Internal	HUB/ST
6	Subordinate Master at a Hub	Burst_Sync_Clock	Internal	HUB/ST
7	Master Unit in a MP Link	Receive_Clock	Internal	DCE/ST
8	Slave in a MP link	Free_Run	Internal	DCE/ST

TX Clock (Source)

This command sets the Transmit (TX) clock source. The values are either *internal* or *external*. When set to *internal*, the modem uses its internal oscillator to clock in the transmit data. If a clock signal is detected on the "TT" (Terminal Timing) pin of the DTE interface, this clock is used instead, and it should be a looped back version of the clock supplied by the modem on the "ST" (Send Timing) pin. When set to *external*, the modem uses the clock supplied by the user on the "TT" pin of the DTE interface. If no clock is provided, the modem will not function properly.

To set the TX Clock for the local unit, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> set TX Clock operand
```

where *operand* is *internal* or *external*. The default value is *internal*.

TX VCXO Source

This command sets the phase reference for the AirLink Pro 64S modem internal transmit clock oscillator. Normally it is desirable for an entire data network to

be synchronized to a single, stable frequency reference. The various network configurations that AirLink Pro supports require four choices for the phase reference: no reference (the oscillator freeruns), the externally-supplied TT clock from the DTE interface, a clock derived from the received RF signal, and a clock supplied on the burst sync bus.

To set the transmit VCXO phase reference source, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S>set tx vcxo operand
```

where operand is free_run, tt_clock, burst_sync_clock, or receive_clock.

Generally, the source of synchronization will be either an AirLink modem's own internal oscillator or an oscillator residing in the DTE equipment. If the modem's oscillator is the source, it does not need a phase reference (Free_Run). If an external oscillator is the source, the modem VCXO must be synchronized to a phase reference derived from the externally-provided clock signal from the DTE port (TT_Clock). All other modems in the network must also be synchronized to this source. Other AirLink Master units at a hub are synchronized via the Burst Sync Bus, which provides a phase reference (Burst_Sync_Clock) for the VCXO. AirLink Slaves are typically synchronized with a phase reference derived from the received RF signal (Receive_Clock).

TT Clock Detect

A sensing circuit is provided in the AirLink Pro 64S modem to detect the presence of an externally-provided clock on the "TT" (Terminal Timing) interface pin. Normally, if the modem is the source of the transmit clock (command: Set TX Clock Source Internal), the modem sends this clock to the DTE via the "ST" (Send Timing) interface signal, and also uses the local version of the clock to sample the incoming transmit data from the DTE. In some cases, long cables may introduce enough delay between the local clock and the data that errors develop in the data stream. This can be avoided if the received ST clock is "looped-back", or wired to, the TT clock pin of the DTE interface. The TT clock detector circuit will recognize this, and provides automatic selection of the TT clock when the modem clock is used for timing.

If the data clock source is external (command: Set TX Clock Source External), this circuit is disabled, and the clock is always received on the TT pin of the DTE port.

To override these default conditions, the following command can be used.

To set up the TT Clock Detect circuit, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S>set TT clock detect operand
```

where *operand* is *on* (to activate the circuit) or *off* (to de-activate the circuit).

The system displays auto-detect mode by issuing the following command:

```
AIRLINK PRO 64S>get TT clock detect operand
```

AirLink One Clock Mode Emulation

The following sections describe how to set up AirLink Pro 64S modems to emulate AirLink One clock modes. See the AirLink Site Planning Guide for more information on this topic.

DCE/ST

This mode requires that the internal oscillator provide the frequency reference, and therefore it can freerun since it doesn't need to be locked to an external reference. Furthermore, the transmit data is sampled by the local version of the data clock.

```
AIRLINK PRO 64S>set tx vcxo free_run
```

```
AIRLINK PRO 64S>set tx clock source internal
```

If the TT clock detector is enabled, the AirLink modem will sense and use a clock that is looped back from the "ST" pin to the "TT" pin on the DTE interface.

DCE/TT

This mode is again using the internal oscillator in a freerunning mode, and in this case it is expected that the ST clock will be looped back. The previous configuration (DCE/ST) will handle this condition if the TT clock detector is enabled, but if the user desires to force this mode, the following commands will accomplish this:

```
AIRLINK PRO 64S>set tx vcxo free_run
```

```
AIRLINK PRO 64S>set tx clock source external
```

In "external" transmit clock source mode, the TT clock detector is always disabled, and the modem will be forced to use the clock arriving on the "TT" pin of the DTE interface. Be aware that if no clock is present, the modem will not function properly.

DTE/TT

This mode is used when it is desired to synchronize the AirLink Modem to an external reference. Generally, only one modem in a network will be configured in this mode, and the rest will be synchronized to the master oscillator via the RF signal or the burst sync signal.

In this mode, the internal oscillator is synchronized to the incoming clock on the “TT” pin of the DTE interface, which in this case is NOT a looped back version of the “ST” clock, but is instead an independent reference frequency. The transmit data is also sampled by the TT clock. The following commands will emulate this mode.

```
AIRLINK PRO 64S>set tx vcxo tt_clock
```

```
AIRLINK PRO 64S>set tx clock source external
```

HUB/ST

This mode is required when multiple AirLink modems are present in a single location, known as a hub. One of the modems, the *primary* or *synchronizing* master, must act as the frequency reference for the entire network, and the other modems at the hub, referred to as *secondary* or *synchronized* masters, must be operated in this mode. The following commands are used for this purpose.

```
AIRLINK PRO 64S>set tx vcxo burst_sync_clock
```

```
AIRLINK PRO 64S>set tx clock source internal
```

In this case, the internal oscillator is synchronized to the clock signal arriving via the burst sync cable. A local version of the data clock is derived from this oscillator, and sent to the DTE via the “ST” pin. The modem will use the local version of the clock to sample the arriving transmit data, unless of course the clock is looped back onto the “TT” pin, and the TT clock detector is enabled.

Independent Network Clocks

It is generally desirable for all of the data clocks within a communication network to be synchronized to a common frequency reference. This results in all of the network data clocks being frequency-locked, that is, they do not drift with respect to each other. In some cases, it may be desirable for some of the data clocks to be independent. In a full-duplex point-to-point link, for example, the transmit clock (TT) and the receive clock (RT) are usually synchronized to a frequency reference at one end of the link. With AirLink Pro 64S, the Master

modem transmit oscillator acts as the frequency reference, whether it is freerunning or locked to an external reference from the DTE. However, there may be other applications where the transmit and receive data streams need to maintain synchronization with clocks that originate from independent oscillators at either end of a link.

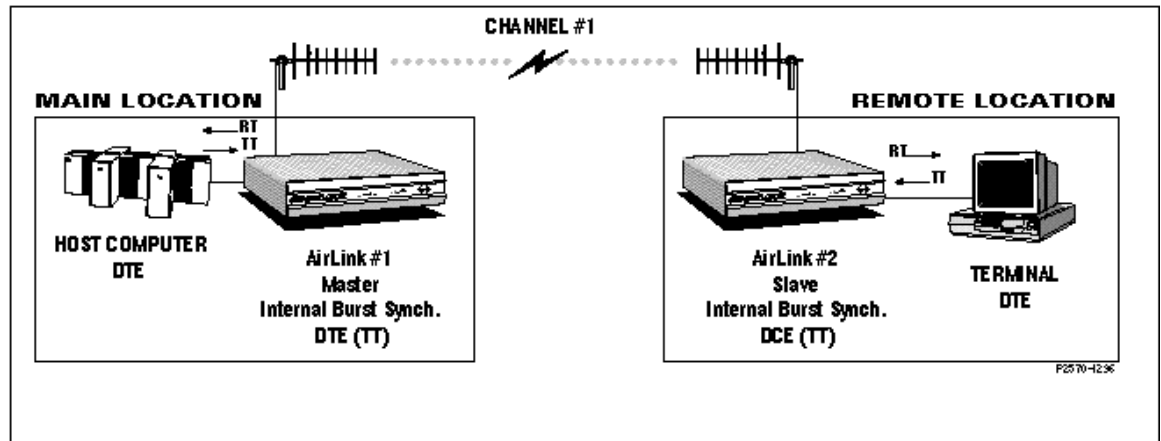


Figure 3-5
Independent Network Clocks

When two or more wireless links are networked together, such as a hub configuration, the entire network is usually synchronized to a single frequency reference. In some cases, it may be desirable for some of the individual links to operate with independent clocks, and again, within a single full-duplex link, it is sometimes desirable for the transmit (TT) and receive (RT) clocks to be independent. In the past, AirLinks have required that all clocks be synchronized to a single Master modem at the Hub Site, but AirLink Pro 64S provides the flexibility to allow some of the clocks to be independent.

If independent clocks are to be utilized in a network, it is crucial to ensure that their frequencies are within a specified tolerance for the AirLink modems to operate without loss of data. All of the data clocks must be accurate within ± 75 ppm of their nominal data rate. For example, if the data rate is 64 kbps, the clock frequencies must be in the range of 63.9952 to 64.0048 kHz.

Independent Clocks in a Point-to-Point Link

In a default point-to-point link (Master modem set to Application 2, and Slave modem set to Application 1), the Master modem's internal oscillator provides the frequency reference for all data clocks. The Master can also be set up to synchronize to an external clock (DTE/TT) as described above. Either way, the slave modem will derive its transmit (and receive) data clock from the received RF signal.

In order to operate the slave modem with an independent transmit clock that is externally provided by the DTE, issue the following commands at the AirLink prompt:

```
AIRLINK PRO 64S>set tx vcxo tt_clock
```

```
AIRLINK PRO 64S>set tx clock source external
```

This will change the frequency reference for the transmit oscillator from “Receive_Clock”, which is derived from the received signal, to “TT_Clock”, which arrives via the DTE interface port. Also, the transmit data will be clocked into the modem with the DTE clock, versus the local modem clock.

Independent Clocks in a Hub

At a Hub Site, the Master modem designated as Reference Master (application 4) will act as the synchronizing reference in the default configuration. Its own slave is synchronized via the RF signal, the same as in a Point-to-Point link. The other Master modems (applications 5 and 6) are synchronized to a component of the signal on the Burst Sync Bus.

The links that use a Backup or Subordinate Master modem (application 5 or 6) must be burst synchronized with the Reference Master, but they can be operated with an independent data clock. Since burst synchronization is necessary, the Burst Sync Bus must remain connected even if independent data clocks are used. Issue the following commands to each Master modem where independent clock operation is desired:

```
AIRLINK PRO 64S>set tx vcxo tt_clock
```

```
AIRLINK PRO 64S>set tx clock source external
```

This command sequence changes the frequency reference for the transmit oscillator from the “Burst_Sync_Clock” to the “TT_Clock”, which arrives via the DTE interface port. Also, the transmit data will be clocked into the modem with the DTE clock, versus the local modem clock.

Configuring the RF Link

The following set of commands are used to set up the parameters that describe the RF communications link. These parameters are particularly important in installations where two or more links will be operating in the same vicinity. In such installations, it is important to manage the use of the limited number of RF channels available, as well as the radiated RF power, in order to minimize the

potential for interference between adjacent links. See the AirLink Site Planning Guide for more information on this topic.

PN

The AirLink Pro 64S has a set of Pseudo-random noise (PN) codes. No PN code is “better” or “worse” than another. Using a different code helps the AirLink Pro 64S separate the desired incoming signal from undesired signals from other AirLink Pro 64S links. The PN codes have been carefully engineered to provide the best separation of desired and undesired signals. These are factory set values and cannot be changed by the user. The user can select any of the eight preset sequences.

The master unit and the slave unit of an AirLink Pro 64S pair must be set to the same PN code (pseudo-random noise code). That 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 64S prompt:

```
AIRLINK PRO 64S>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.

Range

AirLink Pro 64S is designed to be compatible with AirLink One modems so that their links can be operated side-by-side in a Hub application. The Master Units at the Hub Site must be burst synchronized (described in the Burst Synchronization section of Chapter 2) and the protocol range limit must be set to the same value. The AirLink Pro 64S has a programmable Range Limit that can be set to 46 miles (approximately 74 km) (AirLink One compatible) or 71 miles (approximately 114 km) (AirLink Pro 64S compatible).

To set the protocol range limit for AirLink Pro, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S>set range operand
```

where operand is *airlink_1* for a 46 mile limit, and *extended* for a 71 mile limit.

Please note that the protocol range limit is merely an upper bound on range, and does not take into account other factors such as line-of-sight, multipath fade margin requirements, transmit power level, and so forth.

RF Plan

This command specifies the radio channel plan. The AirLink Pro 64S may be configured for one of the two sets of channels. The values are Channel Plan 1 (Channels 1-15) and Channel Plan 2 (channels 1-20). Channel Plan 1 consists of 15 channels used in a network consisting of both AirLink Pro 64S and AirLink One 64SMP units. Channel Plan 2 consists of 20 channels that are selected when the AirLink Pro 64S unit is not used in a network containing AirLink One 64SMP units. Refer to Tables 6A and 6B in Appendix B for center frequencies to each channel plan.

RF Power

When there are a number of AirLink Pro 64S pairs in a hub arrangement, the received signal levels are dependent on the distances to the remote sites. You may need to adjust the transmit power level to minimize cross-channel interference and ensure that the received levels at the hub are of equal power. You may also need to set this to comply with applicable regulations.

RF Power sets the transmit power level. The values it takes are from 0 to +28 (dBm) in 1 dB increments.

RF Sleep

The RF section can be powered down into “sleep” mode to conserve power when not in use. You can use this command to power down the RF section. The values are *Yes* (to power down) and *No* (to restore power). If the RF Sleep mode is enabled, the entire RF section is powered OFF.

Setting Alarm Control Parameters

Alarm Reporting

This parameter determines whether alarm events are displayed as they happen or are held until you query for them. The operands are *Request* and *Immediate*. If you choose *Request*, then alarm events are displayed only when queried. When *Immediate* is chosen, alarm events are displayed as soon as they occur.

Alarm Level

This parameter sets the severity level for reporting alarms: *Status*, *Minor*, and *Major*. *Status* messages are the least severe and all events are reported, while the *Major* messages are the most severe and only fault events are reported. Refer to Tables A-1 to A-3 in Appendix A.

Alarm Holdoff

This command specifies the amount of time for which an alarm condition must persist before a dialout attempt is made. One or more events may occur and overlap during this interval; there must always be at least one event occurring for the duration of the interval. The value ranges between 0 and 600 seconds.

HUB_SYNC

This parameter specifies the burst sync activity type for a hub application. The values it takes are *Single* and *Dual*. If you choose *Single*, then the activity on the primary burst sync bus is reported; loss of activity on the backup burst sync bus is ignored. The loss of activity on primary burst sync bus generates a *Major* alarm. If *Dual* is chosen then activity on primary and backup busses are reported. Loss of activity on either bus generates a *Minor* alarm; loss of activity on both busses generates a *Major* Alarm.

Threshold RSSI

The Threshold RSSI command indicates the minimum acceptable Receive Signal Strength indicator value before an entry is made in the event queue. The values range from -95 to -50 dBm.

Threshold RSQ

The Threshold RSQ command indicates the minimum acceptable Receive Signal quality value before an entry is made in the event queue. The values range from 1 to 10 .

Threshold 1 HR ES

This parameter specifies the number of errored seconds (ES) events that must occur in a 1-hour interval before an entry is made into the event queue. One errored second is a 1-second interval in which a CRC-16 error is detected in the data payload. The operand is between 1 and 999.

Threshold 1 HR UAS

1 HR UAS threshold sets the number of unavailable seconds (UAS) events that must occur in a 1-hour interval before an entry is made into the event queue. One unavailable second is a 1-second interval during which Radio Sync Loss has occurred. The value must be in the range from 1 to 99.

Threshold 24 HR ES

This command sets the number of errored seconds (ES) events that must occur in a 24-hour interval before an entry is made into the event queue. The value must be in the range from 1 to 999.

Threshold 24 HR UAS

This command specifies the number of unavailable seconds (UAS) events that must occur in a 24-hour interval before an entry is made into the event queue. The values must be in the range from 1 to 99.

Other Command Keywords and Operands

Besides the SET and GET command keywords, the terminal user interface also provides command keywords for resetting. The Reset command controls the following parameters.

RESET

QRSS
ALARMS
TEST
DEFAULTS

QRSS

You can use this command to reset the QRSS error register and restart a test.

Alarms

This command resets the alarm events in the event queue.

Test

If you need to terminate a test, issue the command RESET TEST and the system terminates the current test. 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.

Defaults

This command resets the unit to factory default configuration. When a unit is new, or the software revision has been upgraded, the unit's configuration memory will not contain valid, recognizable values. At power-up, the software will sense this to be the case, and set the values to a set of factory defaults.

These default values are:

General Default Configuration:

```

Site Name:          (blank)
Application:        1. Slave Unit in a Point-to-
Point
PN Code:           1
RF Channel:        1
RF Frequency:      2404.468
RF Power:          0 dBm
RF Channel Plan:   20 channels
RF Sleep:          No
Comm Mode:         Synchronous
Data Rate:         64 kbps
Burst Timing:      Receive Sync
Tx Clock Source:   Internal
Tx VCXO RF        RX clock
Hub Sync:          Single
RTS Source:        External
RTS Delay:         0 msec
DTE Mode:          RS-232
DTE Protect:       Disabled
Alarm Reporting:   Request
Alarm Level:       Status
Date/Time:         23 MAY 1997 10:02:53
  
```

Setting Modem Parameters

Introduction

The AirLink Pro 64S ASCII terminal and Network Management ports are EIA/TIA-232 interfaces that allow terminal devices or personal computers to control and monitor AirLink Pro 64S 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. When the Network Management Port #1 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 Network Management port #2.

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

<i>DISABLED</i>	The port is completely disabled and it will not respond to user commands or connection indications from the modem.
<i>DEDICATED</i>	The port behaves exactly as the Terminal port; all commands and responses taking place on that port are duplicated on the modem port.
<i>ANSWER</i>	The modem port remains idle (does not respond to user commands) until it receives a dial-in indication from the modem.
<i>DIALOUT ONLY</i>	The modem port is used only for dialing-out to report alarms.
<i>DIALOUT/ANSWER</i>	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 PRO 64S> 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 64S end as follows:

1. Configure the AirLink Pro 64S 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 3-3
Terminal Commands of the Modem (Port) Interface

Command	Definition
SET DIAL LEVEL MAJOR <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 CONFIG <RETURN>	To view and verify the modem configuration
CALL 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 has to enter a password even 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 64S as Major Alarm, Minor Alarm, or Status. These are the three levels of severity, with Major Alarm 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 (3 - 5000 minutes; default = 15)

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.

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.

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 Major Alarm levels, such as Radio Sync Loss and No Burst Sync. 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-Pro 64S 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 character. This is used when the system provide a dial tone.
the next being called does not	
#	# 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:

CALL 1

CALL 2

CALL 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.

CALL 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 64S 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.

Responses

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

Table 3-4
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 3-5
ModemCommands

Parameter	Specification
SET ALARM HOLDOFF	0-600 (seconds)
SET CONNECTION	0 - 43200 (seconds; 0 means no time-out)
SET DIAL	{TONE PULSE}
SET DIAL HOLDOFF	3-5000 (minutes, repeat dial holdoff)
SET DIAL LEVEL	MAJOR MINOR STATUS
SET DIAL RETRY	15-3600 (seconds)
SET MODEM MODE	{DISABLED DEDICATED DIAL_OUT ANSWER BOTH}
SET MODEM RATE	{1200 2400 4800 9600}
SET PHONE 1	(XXX) XXX-XXXX
SET PHONE 2	(XXX) XXX-XXXX
SET REPEAT COUNT	0-99
SET RINGCOUNT	0-9

The GET MODEM configuration 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:

- CALL 1 manual connect
- CALL 2 manual connect

CALL	telephone-number manual connect
DISCONNECT	manual disconnect
GET MODEM	view modem and dial-out parameters
GET 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 3-6
AirLink Pro 64S Dialout Parameters

Parameter	Default
ALARM HOLDOFF	10 seconds
CONNECTION	3600 seconds (1 hour)
DIAL FORMAT	TONE
DIAL HOLDOFF	5 minutes
DIAL LEVEL	ALARM
MODEM MODE	DISABLED
MODEM RATE	9600
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 {MAJOR | MINOR | STATUS} <RETURN>
```

The default level is MAJOR.

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 (3 - 5000) minutes. The default is 5.

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.

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.

Connection

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 XXXX <RETURN>
```

where XXXX is the time period in (300 - 43200) seconds. The default value is 3600 (one hour).

CHAPTER 4

Operations and Maintenance

This chapter contains information on the operation and maintenance of the AirLink Pro 64S. It includes procedures for monitoring the alarm queue and describes how the AirLink Pro 64S responds to particular alarm conditions.

Inside this chapter:

Overview.....	4-2
Acquiring Status Information.....	4-2
Acquiring Alarm Information.....	4-7
Acquiring Performance Information.....	4-10
Diagnostic Tools.....	4-13

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 Major and Minor alarm LEDs on the AirLink Pro 64S digital module. Finally, this chapter describes the diagnostic tests and procedures used to isolate and resolve errors occurring during radio unit operation.

Acquiring Status Information

Each AirLink Pro 64S 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:

- DTE Status
- Radio Synchronization Loss
- Burst Synchronization Loss
- Test in Progress

DTE Status is available from both the local and the remote AirLink Pro 64S units.

Viewing Status Information

To view the status information for the local unit, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> Get status
```

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

```
AIRLINK PRO 64S> Get status
```

```
Site Name:  
Test in progress: None  
DTE Status:      Disabled  
Radio Sync Loss: NO  
Burst Sync Loss: No  
RSSI:           -62.3dBm (typical value)
```

RSQ: 10.0
VSWR: N/A
Date/Time: 09 Jan 1996 13:20:34

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

DTE Status

Indicates whether the DTE interface is *enabled* or *disabled*. When it is enabled it will also indicate which interface is enabled:

- RS-232
- RS-232
- No RTS
- V.35
- V.35
- No RTS
- EIA-530
- EIA-530
- No RTS
- Unknown DTE type
- voltage error.

Radio Synchronization Loss

Indicates whether radio synchronization has been lost. The time to detect loss and the time for recovery are the same (17ms).

Burst Synchronization Loss

Indicates whether burst synchronization has been lost. The time to detect synchronixation loss and the time for recovery are the same (1second).

RSSI

RSSI (Receive Signal Strength Indicator) provides an indication of the amount of “raw” RF signal being received at the frequency of the AirLink. It is an

unqualified signal because it is a reading of all RF at that frequency. RSSI can be used as a single spectrum analysis by recording values for each channel. When selecting a channel for a new link, select the one that has the lowest RSSI for both ends of the link. The RSSI value can be viewed by issuing the GET STATUS command, and looking at the RSSI line on the response screen:

```
RSSI: -83.5 dBm
```

If RSSI is uncalibrated, the following line will appear:

```
RSSI: Uncalibrated
```

NOTE

If the unit is uncalibrated, it should be shipped back to Cylink.

Alternatively, the RSSI can be displayed continuously by issuing the TEST RSSI command. The user will be prompted to respond Yes or No, as follows:

```
Are you sure? Type Y for yes, N for no. >
```

(Press Y to proceed.)

The user will then be prompted with brief instructions, as follows:

```
Press <RETURN> to begin display. Press Q to Quit now.
```

Press any key to quit afterwards or press <RETURN> to proceed. Afterwards, press any key to stop the test.

Example display:

```
RSSI -83.5 . . . # . . . . . . . . . .  
RSSI -83.5 . . . # . . . . . . . . . .  
RSSI -83.5 . . . # . . . . . . . . . .
```

The dots represent a scale from -95 to -50 dBm, as shown below, when lined up with the examples.

```
-95 -90 -85 -80 -75 -70 -65 -60 -55 -50
```

The maximum value that can be displayed graphically is -50 dBm; if the RSSI value is greater than that, the display will plot -50, but display the actual numerical value at the left side of the screen. For instance:

```
RSSI -45.0 . . . . . . . . . . #
```

When 'U' characters appear in place of '#' characters, the unit is uncalibrated, and the values are not necessarily accurate. For instance:

```
RSSI Uncal . . . U . . . . .  
RSSI Uncal . . . U . . . . .  
RSSI Uncal . . . U . . . . .
```

The dynamic range of the RSSI measurement circuit tops out at approximately -50 dBm, so higher values will not be displayed accurately. This range should be more than sufficient for its intended purposes - antenna alignment and link monitoring/alarm generation.

Test in Progress

When a test is active, GET 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. The possible values for "Test in progress" are: *None, Local Loopback, Remote Loopback, Unknown.*

RSQ

RSQ is the Receive Signal Quality specific to data transmission of the radio link. RSQ is energy correlated with the PN code, whereas RSSI is not correlated. It is a measure of specific RF energy and is a figure of merit that is normalized on a scale of 1 to 10.

Table 4-1
Receive Signal Quality

RSQ	BER (64 kbs)	RSSI (dBm)
10.0	$<10^{-7}$	>-83.5
9.5	:	-86.5
9.0	:	-91.0
8.0	:	-94.7
7.0	:	-96.1
6.2	$<10^{-7}$	-96.7
5.7	$<10^{-6}$	-97.2
5.3	$<10^{-5}$	-97.8
4.3	$<10^{-4}$	-98.8
3.2	$<10^{-3}$	-99.8
2.0	$<10^{-2}$	100.7
1.0	N/A	-101.8
0.0	N/A	<-104.5

NOTE These calculations are relative and not absolute.

The RSQ number, when obtained from TEST RSQ, or GET STATUS, is approximately the same as the voltage at the RSSI test point ranges from 0.0 to 10.0.

VSWR

The VSWR value can be viewed by issuing the GET STATUS command, and by looking at the VSWR line on the response screen, as shown below:

```
VSWR: 1.9
```

If VSWR is uncalibrated, the following line will appear:

```
VSWR: N/A
```

NOTE If the unit is uncalibrated, it should be shipped back to Cylink.

Alternatively, the VSWR can be displayed continuously by issuing the TEST VSWR command. The user will be prompted to respond Yes or No, as follows:

Are you sure? Type Y for yes, N for no >

(Press Y to proceed.)

The user will then be prompted with brief instructions, as follows:

Press <RETURN> to begin display. Press Q to quit. Press any key to quit afterwards.

(Press <RETURN> to proceed. Afterwards, press any key to stop the test.)

Example display:

```
VSWR 1.9 . #. . . . . . . . . . . .  
VSWR 1.9 . #. . . . . . . . . . . .  
VSWR 1.9 . #. . . . . . . . . . . .
```

The dots represent a scale from 1 to 10, as shown below, when lined up with the examples.

```
1 2 3 4 5 6 7 8 9 10
```

The maximum value that can be displayed graphically is 10.0; if the

VSWR value is greater than 10, the display will plot 10, but display the actual numerical value at the left side of the screen, as follows:

```
VSWR 20.0 . . . . . . . . . . #
```

If the VSWR value is greater than 99, the display will indicate "greater than 99", as follows:

```
VSWR>99.0 . . . . . . . . . . #
```

Acquiring Alarm Information

As alarm events occur, they are signaled through LEDs on the AirLink Pro 64S and are entered in the event queue. For a complete list of events causing an alarm state, see Appendix A.

While LEDs and 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 condition is detected, a message is entered into the AirLink Pro 64S event queue. The event queue lists the most current 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 date, time and cause of each alarm event as it occurs.

Events Causing an Alarm State

Various detectable error and failure conditions are defined for AirLink Pro 64S. These are grouped into two categories:

1. *Error* events that get declared anytime a specific failure condition occurs, such as loss of radio sync.
2. *Performance* events which get declared when some parameter falls below a user-specified threshold, such as RSSI.

All events are classified into one of three levels to facilitate filtering or screening:

STATUS	error or performance condition restored, test started or stopped
MINOR	generally a performance event, or link/unit degradation
MAJOR	generally an error event, or link loss

The following events put the AirLink Pro 64S into an alarm state and insert an alarm entry in the event queue (also refer to Table 2-1, Chapter 2):

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

Event messages can be viewed on the terminal immediately as they occur, and/or upon request to see a log.

```
AIRLINK PRO> Get alarm log
```

```
Site Name: Sunnyvale 2  
10 SEP 1996 11:50:42 4006: Radio Sync Loss  
10 SEP 1996 11:40:38 4009: RSQ Below Threshold Thresh:6.0  
Actual:4.0  
10 SEP 1996 11:30:46 4006: Radio Sync Loss
```

```
10 SEP 1996 11:20:22 800B: 24 HR ES Threshold Exceeded
Thresh: 500 Actual:501
10 SEP 1996 11:10:42 8009: 1 HR ES Threshold Exceeded
Thresh: 450 Actual:451
10 SEP 1996 11:00:14 4009: RSQ Below Threshold Thresh:6.0
Actual:4.0
09 SEP 1996 18:19:42 4006: Radio Sync Loss
09 SEP 1996 18:09:00 4009: RSQ Below Threshold Thresh:6.0
Actual:4.0
```

OK

Viewing the Event Queue

To view the event queue on the terminal as it occurs, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> Set alarm reporting immediate
```

to view the event queue only when you query for it, use the operand *request*.

To filter the level at which alarms get reported, type the following command at the prompt:

```
AIRLINK PRO 64S> Set alarm level (Major, Minor, or Status)
```

Regardless of the setting of the Set Alarm level parameter, the Major and the Minor alarm LEDs are always updated.

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 <Return> to go back one screen. Press <Q> to exit (quit) the event queue display.

To view the event queue of the remote unit (in a point-to-point configuration), use the command:

```
AIRLINK PRO 64S> remote get alarms
```

Resetting the Event Queue

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

```
AIRLINK PRO > reset alarms
```

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

```
AIRLINK PRO 64S> reset alarms  
Reset alarms: Are you sure? (Y/N)
```

When you enter a y (yes) to confirm the request, the system clears the event queue. If you enter an 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.

You can reset alarms for the remote unit (only for a point-to-point link), by issuing the command:

```
AIRLINK PRO 64S> remote reset alarms
```

Acquiring Performance Information

Each AirLink Pro 64S 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:

- Errored Second (ES) counts (1-hour and 24-hour)
- Unavailable Second (UAS) counts (1-hour and 24-hour)
- Receive Signal Quality (RSQ)

Viewing Performance Information

To view the performance information for the local unit, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> Get performance
```

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

```
AIRLINK PRO 64S> Get performance  
Site Name:  
QRSS BER:      N/A  
1 HR ES:       1  
1 HR UAS:      1  
24 HR ES:      2  
24 HR UAS:     3  
RSQ:           9.9  
Date/Time:     12 Sept 1996 13:21:30
```

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

QRSS Test

Replaces the transmitted data payload with a standard QRSS test pattern. The unit's own QRSS detector/counter attempts to lock onto an incoming QRSS pattern in the incoming payload; once lock is acquired, individual errors are counted and an overall BER is computed.

A typical test scenario is a bi-directional test with two units in a point-to-point configuration (master and slave). Point-to-multipoint is not supported. Each unit sends and receives the pattern, and records errors appearing in the incoming pattern.

To invoke the test, type

```
AIRLINK PRO>BOTH TEST QRSS
```

The unit will prompt you to ask if you are sure, as follows. Invoking the test will disrupt the payload link.

```
Are you sure? Type Y for yes, N for no. >
```

(Press Y to proceed.)

To view the test results (received bit error rate, BER) at the local unit, type

```
AIRLINK PRO>GET PERFORMANCE
```

The BER will be displayed as a line in the performance screen, for instance:

```
QRSS BER: < 10E-7
```

To view the BER at the remote unit, type

```
AIRLINK PRO> REMOTE GET PERFORMANCE
```

To reset the error count and BER to zero, at the local, remote, or both units respectively, type

```
AIRLINK PRO>RESET PERFORMANCE
```

or

```
AIRLINK PRO>REMOTE RESET PERFORMANCE
```

or

AIRLINK PRO>BOTH RESET PERFORMANCE

When the QRSS mode is first entered, the receiver portion will initially enter a hunt mode; attempting to view the data during this phase will result in the display of the message "Unavailable".

Units at each end of a link can both send QRSS and measure the link statistics in each direction independently. Also, one of the units can be placed in QRSS mode, and the other can be placed in remote loopback. See next section on Remote Loop Test.

NOTE

Remember, both cannot be used in a multipoint network unless RTS is controlled (by the host). See Figure 4-6.

Errored Seconds (ES)

An errored second is defined as any one-second interval during which there is a CRC-16 error (Cyclic Redundancy Check error-checking system). Errored seconds can be asynchronous; they do not have to be correlated with real time. An Errored Seconds (ES) total is maintained in a data base for the previous one hour and the previous 24 hours.

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

Unavailable Seconds (UAS)

An unavailable second is the number of seconds in which the radio signal is lost. In all other aspects the same as Errored Seconds (above).

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. Specifically, it represents the data quality of the link. 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 1-hour and 24-hour ES and UAS counters, type the following command at the AirLink Pro 64S prompt:

```
AIRLINK PRO 64S> reset performance
```

The system prompts you to confirm the reset request:

```
AIRLINK PRO 64S> reset performance  
Reset performance: Are you sure?
```

When you enter a y (yes) to confirm the request, the system clears the ES and UAS counters. If you enter an 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 64S provides two loopback tests as diagnostic tools:

- Local Loop test
- Remote Loop test

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.

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 4-1 shows a generalized view of the loopback test types. Each of the loopback tests and the conditions that apply during the test are described in the following sections.

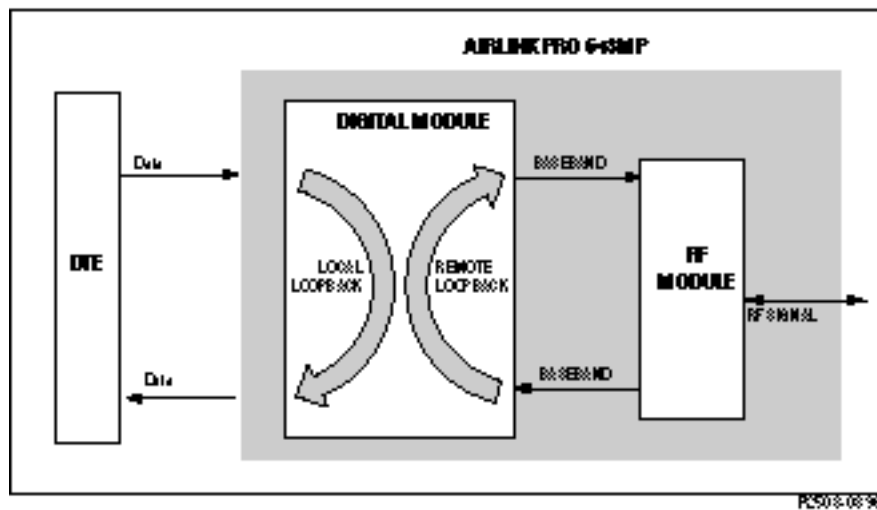


Figure 4-1
AirLink Pro 64S Loopback Tests

Local Loop Test

A local loopback loops the data signal back toward the DTE at the line transceiver. When a local loopback is in progress, a stream of ones is transmitted toward the RF module in place of the data payload. This test does not exercise any hardware on the digital module except the line drivers.

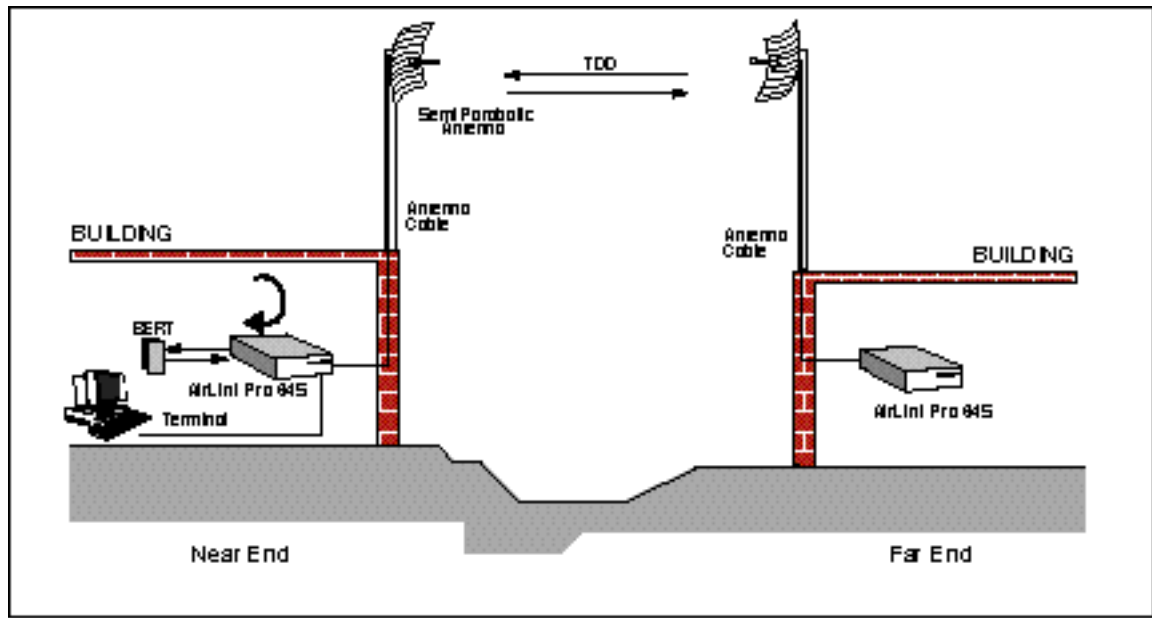


Figure 4-2
AirLink Pro 64S in Test Loopback Local

To initiate a local loopback at the local unit (see Figure 4-2), type the following command at the prompt:

```
AIRLINK PRO 64S> test loopback local
```

The system prompts you to confirm the loop test:

```
AIRLINK PRO 64S> test loopback local  
Are you sure? Type Y for Yes and N for No
```

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

```
OK  
AIRLINK PRO 64S>
```

To set the far end unit to a local loopback test (see Figure 4-3), type the following command:

```
AIRLINK PRO 64S> remote test loopback local
```

The system prompts you to confirm the loop test:

```
Sending command downline. Please wait...  
Are you sure? Type Y for Yes and N for No
```

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

```
OK  
AIRLINK PRO 64S>
```

To terminate a loopback test:

```
AIRLINK PRO> Reset Test
```

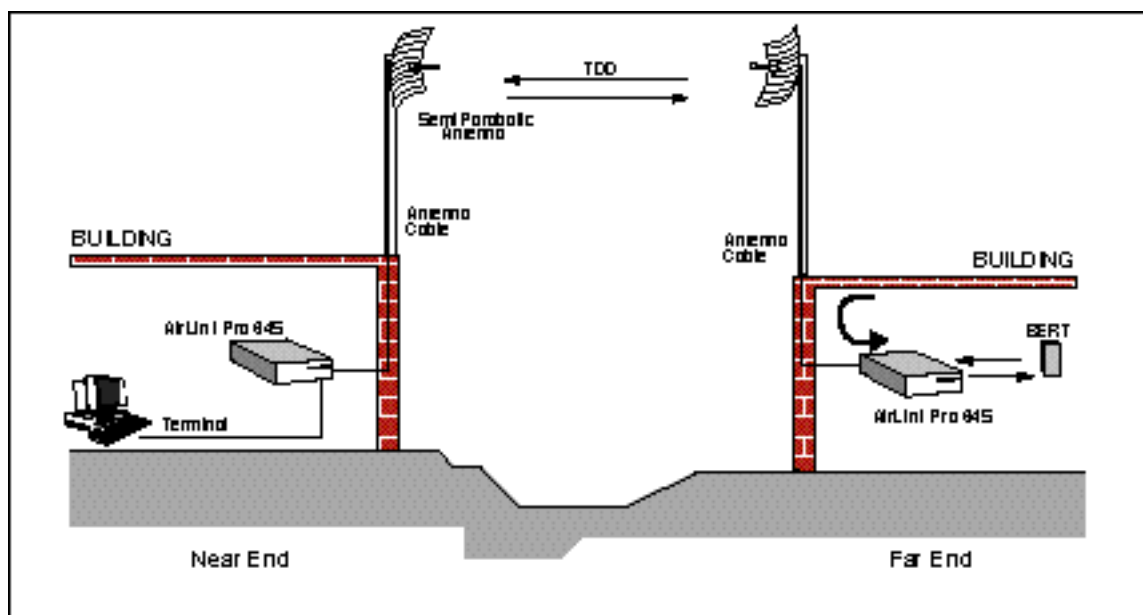


Figure 4-3
AirLink Pro 64S in Remote Test Loopback Local

Remote Loop Test

A remote loopback loops the signal at the far end back towards the near end. When a remote loop is in progress, a stream of ones is transmitted toward the DTE in place of the data payload, and the receive clock is used to clock the transmit data. This test is an end-to-end test of the link and exercises all the hardware on the digital and RF modules of both sides of the link. In a point-to-multipoint set up, the DTE interface signal "RTS" must be asserted at both ends of the link for this test to operate properly. In a point-to-point link the RTS is ignored in the far end.

To initiate a remote loopback at the far end unit from the near end unit (see Figure 4-4), type the following command at the prompt:

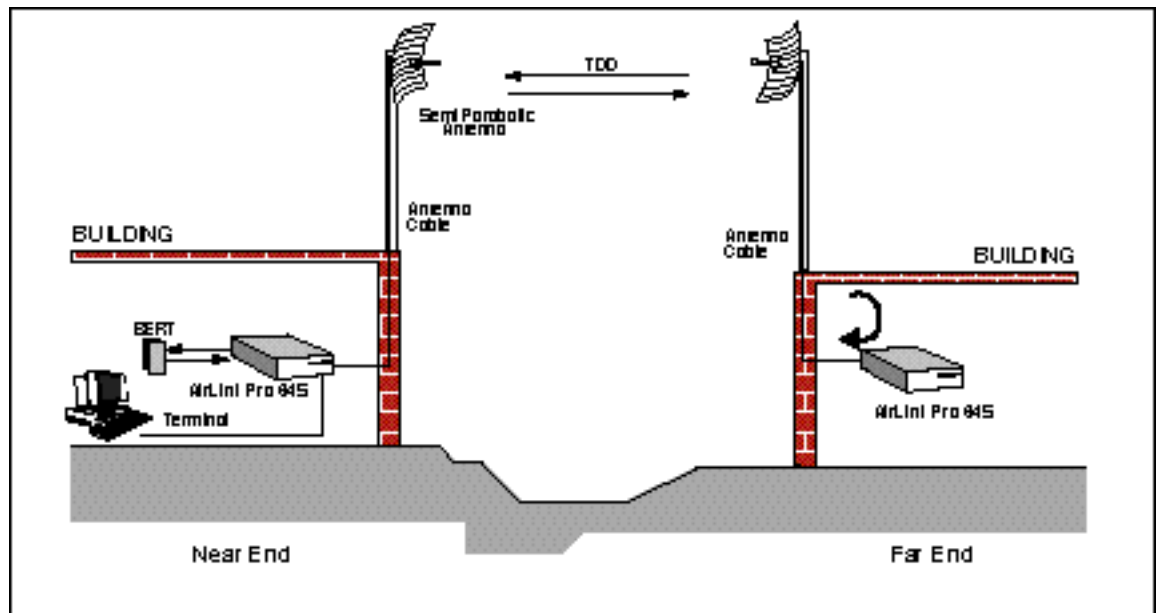
```
AIRLINK PRO 64S> test loopback remote
```

The system prompts you to confirm the loop test:

```
AIRLINK PRO 64S> test loopback remote  
Are you sure? Type Y for Yes and N for No
```

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

```
OK  
AIRLINK PRO 64S>
```



PC 504-03 96

Figure 4-4
AirLink Pro 64S in Test Loopback Remote

To start a remote loopback test at the near end unit (see Figure 4-5) type the following command at the prompt:

```
AIRLINK PRO 64S> Remote test loopback remote
```

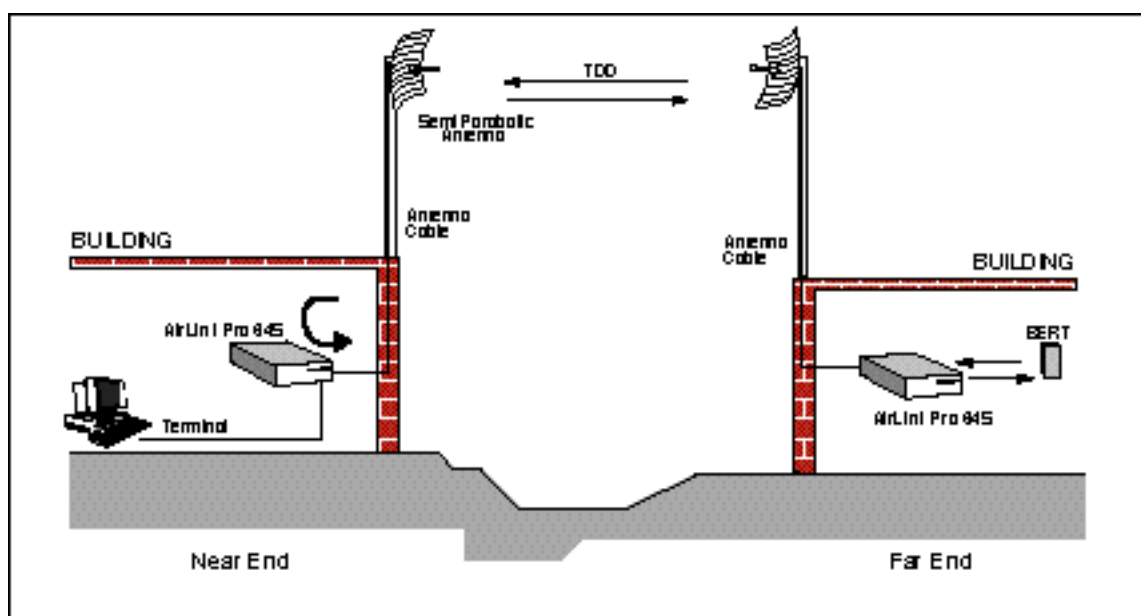
To terminate a loopback test:

```
AIRLINK PRO> Reset Test
```

If you enter an N (no) or just press <Return>, the system ignores the loop test request.

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

```
AIRLINK PRO 64S> Get status
Site Name:
Test in Progress: Remote Loop
DTE Status: RS-232
Radio Sync Loss: NO
Burst Sync Loss: NO
RSSI: N/A
RSQ: 10.0
VSWR: N/A
Date/time: 15 Sept 1996 12:02:63
```



PC506-0996

Figure 4-5
AirLink Pro 64S in Remote Test Loopback Remote

Loopback Tests for Multipoint Networks

It is possible to execute loopback tests for point-to-multipoint applications, however there are some interface requirements for the external systems. Since multiple slaves may communicate with a single master, it is necessary, as it is during normal operation, to ensure that only one slave is transmitting at a particular time. In both cases, this is achieved by the selective assertion of Request-to-Send (RTS) on the DTE interface. As shown in Figure 4-6, one of the three remote slaves is performing a loopback test due to the assertion of RTS by the terminal. The other two slaves receive a negated RTS signal, and are not transmitting.

The assertion and negation of RTS must be handled by the user's equipment through the normal data communication channel. If the Host wishes to run a loopback test at the second remote slave, it must command the first slave to negate RTS and then command the second slave to assert RTS. When changing loopback nodes, it is necessary to exit loopback mode, since the commands through the normal data channel won't get through while in this mode (a stream of one's is transmitted instead).

A typical command sequence follows:

To initiate a loopback test for Link #1 (where Host sends commands to slave #1 to assert RTS, other slaves to negate RTS):

```
AIRLINK PRO> test loopback remote
```

(The first link is now in Loopback mode)

To initiate a loopback test for link #2:

```
AIRLINK PRO> reset test
```

(Host sends commands to slave #1 to negate RTS and slave #2 to assert RTS)

```
AIRLINK PRO> test loopback remote
```

(Second link is now in loopback mode)

To terminate a loopback test:

```
AIRLINK PRO> reset test
```

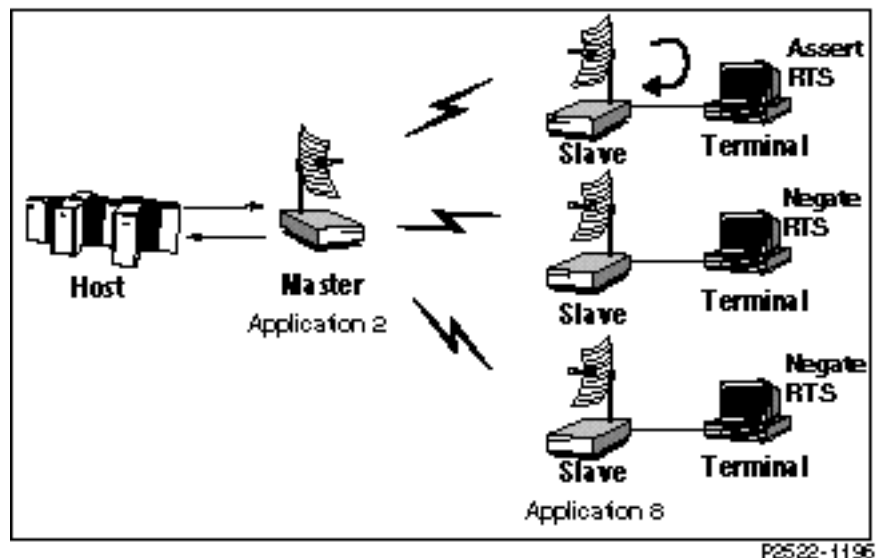


Figure 4-6
Asserted RTS in Multipoint Configuration

Maintenance of Standby Battery

All parameters are saved in a non-volatile memory which is normally powered from the main power source. During power outages, a battery keeps the memory. This battery is molded into the memory chip and cannot be replaced.

The battery will keep the memory for over 10 years of power outage, or shelf life if the AirLink is a spare unit.

To verify the battery is good, simply set a parameter, like Time or Date, and power down the AirLink. If the Date/Time is correct on power up, the battery is good. If the battery ever fails, return the AirLink Pro 64S to the factory.

APPENDIX A

Messages

This chapter describes messages generated by AirLink Pro 64S.

Inside this chapter:

General Information	A-2
Major Alarm Messages	A-3
Minor Alarm Messages	A-3
Status Messages	A-4

General Information

AirLink Pro 64S messages are accessible through a terminal device connected to one of the Network Management ports on the AirLink Pro 64S. 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:

- Major Alarm messages
- Minor Alarm messages
- Status messages

Messages are grouped according to severity level. Major alarm messages are the most severe as these are service-affecting failures. The Status messages are the least severe. When you enter GET ALARMS LOG command, the system displays a list of alarm and event information similar to the following:

```
47: 4000  10 Aug 96 18:20:37  1 HR ES Threshold
46: 4004  10 Aug 96 18:40:17  24-HR ES Threshold Exceeded
45: C001  10 Aug 96 18:40:19  RSSI Below Threshold
      :      :      :
24: 8001  11 Aug 96 03:15:52  DLC Timeout on Final Retry (01)
```

The following information describes the message format:

The first entry is the number in the list, followed by the message code, date stamp, time stamp and the message text. 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 to go back one screen. Press <Q> to exit (quit) the event queue display.

Major Alarm Messages

Table A-1
Major Alarm Messages

Code	Message
0003	DTE Interface Voltage Error
4006	Radio Sync Loss
4007	System Reset
4013	No Burst Sync Source
4014	+/- 12V Supply Out of Range

Minor Alarm Messages

These messages are generally conditions that can be resolved by an operator in the field.

Table A-2
Minor Alarm Messages

Code	Message		
4009	RSQ Below Threshold	Threshold: xxx*	Actual: xxx
400A	RSSI Below Threshold	Threshold: xxx	Actual: xxx
400B	VSWR Above Threshold	Threshold: xxx	Actual: xxx
4011	Primary Burst Sync Source Loss		
4012	Backup Burst Sync Source Loss		
8009	1-HR ES Threshold Exceeded	Threshold: xx	Actual: xx
800A	1-HR UAS Threshold Exceeded	Threshold: xx	Actual: xx
800B	24-HR ES Threshold Exceeded	Threshold: xx	Actual: xx
800C	24-HR UAS Threshold Exceeded	Threshold: xx	Actual: xx
8012	CFG dB test failed		
8013	MFG dB test failed		

* where xx is a value. This value can be set for the threshold.

Status Messages

Table A-3
Status Messages

Code	Message
4008	Powered Up
8001	QRSS Test Started
8002	Local Loop Test Started
8003	Remote Loop Test Started
800D	Modem Busy
800E	No Answer
800F	No Modem
8010	No Dialtone
C000	Event Queue Reset
C001	RSSI Recovered Threshold: xx Actual:xx
C005	Radio Sync Recovered
C006	All Tests Cleared
C007	Reset to Defaults
C00F	RSQ Recovered Threshold: xx Actual:xx
C010	VSWR Recovered Threshold: xx Actual:xx
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 64S system.

Inside this chapter:

General Specifications.....	B-2
Interface Specifications.....	B-3
Signal to Pin Assignments.....	B-8

General Specifications

Table B-1
Operating and Environmental Specifications

Parameter	Specifications
Operating Temperature:	0 to 50° C (32° to 122° F)
Storage Temperature:	-40 to 66° C (ambient)
Operating Humidity	10 to 95% RH non-condensing
Storage Humidity	10 to 95% RH non-condensing
Electrostatic Discharge (ESD)	IEC 801-2 using limits prescribed by 50082-1
Electromagnetic Compatibility (EMC)	IEC 801-3, Radiated RF Immunity IEC 801-4, Electronic Fast Transient Immunity
Shock	Transportation/Handling Shock: Drop Test per NSTA Project 2A Operation Shock: Bellcore TR-TSY-000487, Section 5.1.4.9, Subsection IIA, (Drop Tests for Unpacked Housing Weighing 50 lb. or less).
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, 5-200 Hz) according to the general requirements of ASTM D 4728.

Table B-2
Mechanical Specifications (Refer to Figure 1-1)

Parameter	Specifications		
Dimensions	Width	8.3 inches	211 mm
	Height	2.6 inches	66 mm
	Depth	10 inches	254 mm
Weight	5 pounds	2.3kg	

Table B-3
Power Specifications

Parameter	Specification
External AC Power Supply:	
AC Input	100-250 VAC @ 50/60 Hz, 0.3-0.7A
AC Power Cable	According to model ordered
DC Output	+5, ± 12 VDC, cable terminated with 5-pin male DIN Connector
Dimensions	Height 2.00 inches (50.8 mm)
	Width 3.40 inches (86.4 mm)
	Length 5.87 inches (149.1 mm)
Weight	1.3 pounds (.6 kg)
Maximum Power Consumption: (power supply plus AirLink)	AC Power Supply - 23 Watts
	DC Power Supply - 21 Watts

Interface Specifications

This section contains specifications for the two major interfaces of the AirLink Pro 64 S:

- DTE interface
- Radio interface

DTE Specifications

Table B-4
DTE Specifications

Parameter	Specification
Protocol	Transparent
Synchronous Mode	DTE Clock: (TT, Input to AirLink) Frequency: Nominal rate \pm 70 ppm Max. Jitter: 10 U _{Ipp} @ 300 Hz, and 0.2 U _{Ipp} @ 10 kHz DCE Clock: (ST or RT, Output from AirLink) Smooth, 50% duty cycle Frequency: Nominal rate \pm 50 ppm Data Rate 64, 56, 19.2, 9.6, 4.8
Asynchronous Mode	8-, 9-, 10-, and 11-bit character size. Complies with ITU - T V.14 specification except that the baud rate of the RD lead is +1.5 % over the nominal rate at all times. Data rate 19.2, 9.6, and 4.8 By means of oversampling for rates up to 16 kbps.

Error Correction

The error correction scheme used in the AirLink modem is a majority voting algorithm that applies only to the subrate data in synchronous and asynchronous modes. The redundancy ratio number is 3 and provides 2-3 dB of coding gain. Error correction takes place when the unit is set for one of the following standard data rates: 4.8, 9.6, and 19.2 kbps. Error correction for these rates is active for both synchronous and asynchronous operation modes. If the unit is set for asynchronous mode, it first converts the data to synchronous and then repeats it three times for the error correction algorithm. In synchronous mode, the error correction process is the same, but there is no async-to-sync conversion.

The error correction can also be utilized when sending asynchronous data of any non-standard rate of up to (and including) 4.8 kbps. This is achieved by setting the unit for 19.2 kbps *synchronous* mode, which then allows it to oversample the asynchronous data. This is in compliance with ITU-T V.14.

Radio Interface

Table B-5
General Specifications

Parameter	Specification
Frequency Range	2.400 - 2.4835 GHz (S-Band)
Radio Technology	Spread Spectrum using Direct Sequence
PN Sequence Length	32 bits
Modulation Technique	Minimum Shift Keying (MSK)
Channel Bandwidth	4.0 MHz
Sync Word Length	32 bits
Processing Gain	12 dB
System Gain (not including antenna gain)	120 dB
Radio Protocol	Timed Division Duplexing (TDD)
Burst Period	8.5 milliseconds
Boot-up Time	15 seconds
Lithium Battery	10 year storage life in the absence of power to the AirLink unit.
MTBF* (Mean Time Between Failure)	
AirLink alone	20 years
Power Supply (AC/DC)	12 years
Combination	7.5 years
Actual experience of AirLink Classic S-Band field returns is MTBF of 28 years.	

*Calculated using the Bellcore technical reference TR-NWT-000332, Issue 4, September 1992, assuming ambient temperature is 25 degrees Celsius.

Table B-6
 Transmitter

Parameter	Specifications
Number of Channels	15 or 20 software selectable
Frequency source	Synthesized
Bandwidth	4.0 MHz
Nominal Output Impedance	50 Ohms
Carrier Frequency Stability	+/- 10 ppm
Output Power Tolerance	28 dBm (650 mW) max with 28 dB of dynamic range +/- 1 dB over all RF channels +/- 1 dB from 0 to 50° C

Table B-7A
 Channel Plan 1

Channel	Center Frequency (MHz)
1	2407.067 MHz
2	2412.266 MHz
3	2417.465 MHz
4	2422.664 MHz
5	2427.863 MHz
6	2433.062 MHz
7	2438.261 MHz
8	2443.459 MHz
9	2448.658 MHz
10	2453.857 MHz
11	2459.056 MHz
12	2464.255 MHz
13	2469.454 MHz
14	2474.653 MHz
15	2479.851 MHz

Table B-7B
Channel Plan 2

Channel	Center Frequency (MHz)
1	2404.468 MHz
2	2408.367 MHz
3	2412.266 MHz
4	2416.165 MHz
5	2420.065 MHz
6	2423.964 MHz
7	2427.863 MHz
8	2431.762 MHz
9	2435.661 MHz
10	2439.560 MHz
11	2443.459 MHz
12	2447.359 MHz
13	2451.258 MHz
14	2455.157 MHz
15	2459.056 MHz
16	2462.955 MHz
17	2466.854 MHz
18	2470.753 MHz
19	2474.653 MHz
20	2478.552 MHz

Table B-8
Receiver

Parameter	Specifications
Acquisition Time	less than 8.5 milliseconds
Noise Figure	5 dB maximum
Nominal Input Impedance	50 Ohms
Receiver Sensitivity (@ BER 1×10^{-6})	-98 dBm minimum for all factors (-92 dBm typical) ± 1 over channels ± 1 over temperature
Receive Overload Threshold	> -10 dBm
Unfaded BER	< 10^{-10}

AirLink Data Interface Standards Bibliography

Cylink AirLink Modems conform to the electrical and mechanical interface specifications contained in the data and telecommunication standards listed in the following table.

Table B-9
Data Interface Standards

Standard Number	Title	Organization
EIA/TIA-232-E	Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange (ANSI/EIA/TIA-232-E-91) (July, 1991)	Electronic Industries Association
V.11	Recommendation V.11 (03/93) - Electrical characteristics for balanced double-current interchange circuits operating at data signaling rates up to 10 Mbit/s.	International Telecommunications Union
V.35	Recommendation V.35 (1976) - Data Transmission at 48 Kilobauds per second using 60-108 kHz Group Band Circuits.	International Telecommunications Union
EIA/TIA-530-A	High Speed 25-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment, Including Alternative 26-Position Connector (ANSI/EIA-530-A-92) (June, 1992)	Electronic Industries Association

Signal-to-Pin Assignments

This section presents the pin assignments and functions for connectors and captive-wire terminal block on the AirLink Pro 64S:

- Network Management
- AC Power Connector
- Antenna Connector
- Burst Sync Connector
- DTE Connectors

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).

Network Management

Connector Location: RS-232C/RS-485. AirLink Pro 64S Rear panel
Connector Type: (Two) DB 9 Female Connectors

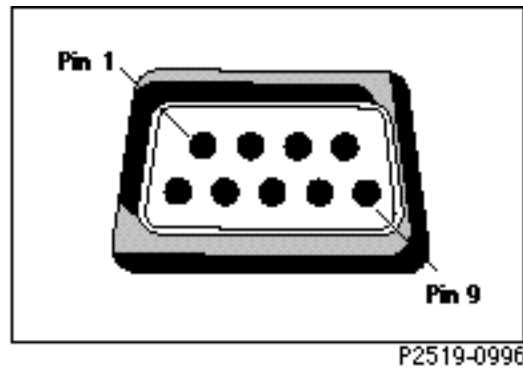


Figure B-1
DB9 Female Network Management Connector

NOTE

The Network Management ports are "wired" as DTE (Data Terminal Equipment). This allows for a standard "straight through" cable connection for any modem (modems are wired as DCE Data Communications Equipment). Since the terminal and Network Management ports are "wired" as DTE, the user must supply a "null modem" cable when connecting the two

Table B-10
Terminal Connection

Pin	Circuit	Description	Usage
1	100	Received Line Signal Detect	to AirLink Pro
2	104	Received Data	to AirLink Pro
3	103	Transmitted Data	from AirLink Pro
4	108/2	DTE ready	from AirLink Pro
5	102	Signal Common	circuit ground
6	107	DCE ready	to AirLink Pro
7	105	RTS	from AirLink Pro
8	106	CTS	to AirLink Pro
9	125	Ring Indicator	not used

AC Power Connector

Connector Location: AirLink Pro 64S Rear Panel
Connector Type: 5-pin DIN female

NOTE Power cords are available for the United Kingdom, Australia, and Europe through a Cylink Distributor or Cylink.

Antenna Connector

Connector Location: AirLink Pro 64S Rear Panel
Connector Type: N-type female

Burst Sync Connector

Connector Location: AirLink Pro 64S Rear Panel
Connector Type: 6-position captive-wire terminal

(2) identical 2-wire balanced networks, implemented with 4-wire cable of 2 twisted pairs;

RS-485 (balanced, differential, tri-stateable) drivers/receivers;

loads: 64

24 AWG twisted pair cables, Category 3 or better data cable

DTE Connectors

Connector Location: AirLink Pro 64S Rear Panel
Connector Type: DB25 (female) for RS-232 interface
DB25 (female) for V.35 and EIA-530 interface

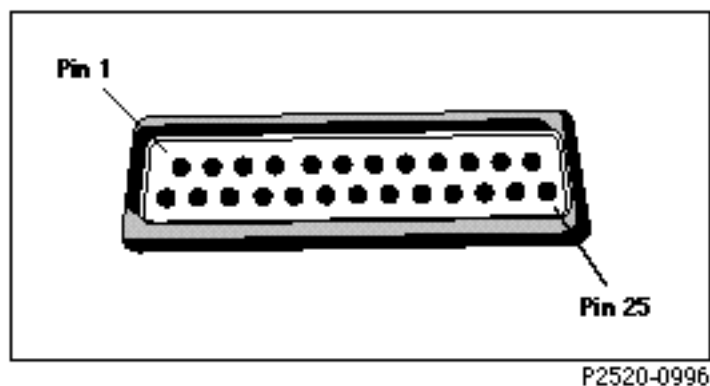


Figure B-2
DB 25 Female DTE Connector

Table B-11
RS-232 Pin Assignments

Pin	Circuit	Description	Usage
1		Shield Ground	Signal Quality Ground
2	103	Send Data	to AirLink Pro
3	104	Receive Data	from AirLink Pro
4	105	RTS	to AirLink Pro
5	106	CTS	from AirLink Pro
6	107	Data Set Ready	active with power on
7		Signal Ground	
8	109	Data Carrier Detect	from AirLink Pro
15	114	Send Timing Clock	from AirLink Pro
17	115	Receive Timing Clock	from AirLink Pro
20	108	Data Terminal Ready	Ignored
24	113	Terminal Timing Clock	to AirLink Pro
25		Test Pin	Signal Quality Voltage

Table B-12
 EIA-530 and V.35 Pin Assignments

Pin	Signal	Circuit	Description	Usage
1			Shield Ground	
2	BA	103	Send Data (TD)	to AirLink Pro
3	BB	104	Receive Data (RD)	from AirLink Pro
4	CA	105	RTS	to AirLink Pro
5	CB	106	CTS	from AirLink Pro
6		107	Data Set Ready	active with power on
7	SG	102	Signal Ground	
8	CF	109	Data Carrier Detect	from AirLink Pro
9	/DD		Receive Timing Inverse	from AirLink Pro
10	/CF	122	RLSD Inverse	from AirLink Pro
11	/DA		Terminal Timing Inverse	to AirLink Pro
12	/DS		Send Timing Inverse	from AirLink Pro
13	/CB	121	CTS Inverse	from AirLink Pro
14	/BA	118	Send Data Inverse	to AirLink Pro
15	DS	114	Send Timing (ST)	from AirLink Pro
16	/BB	119	Receive Data Inverse	from AirLink Pro
17	DD	115	Receive Timing (RT)	from AirLink Pro
19	/CA	120	RTS Inverse	to AirLink Pro
20		108	Data Terminal Ready	enable Interface
22			Data Set Ready Inverse	Active with power on
24	DA	113	Terminal Timing	to AirLink Pro

Crossover Data Cable Specifications

Table B-13
EIA 530 25-Pin Male Connectors

Connector #1			Connector #2		
Pin	Pin Description		Pin	Pin Description	
1	Shield Ground		1	Shield Ground	
2	Send Data <BA>	TD	3	Receive Data <BB>	RD
14	Send Data </BA>	TD	16	Receive Data </BB>	RD
3	Receive Data <BB>	RD	2	Send Data <BA>	TD
16	Receive Data </BB>	RD	14	Send Data </BA>	TD
7	Signal Ground		7	Signal Ground	
4	Request To Send <CA>	RTS	8	RSLD <CF>	DCD
19	Request To Send </CA>	RTS	10	RSLD </CF>	DCD
8	RSLD <CF>	DCD	4	Request To Send <CA>	RTS
10	RSLD </CF>	DCD	19	Request To Send </CA>	RTS
24	Terminal Timing <DA>	TT	17	Receive Timing <DD>	RT
11	Terminal Timing </DA>	TT	9	Receive Timing </DD>	RT
17	Receive Timing <DD>	RT	24	Terminal Timing <DA>	TT
9	Receive Timing </DD>	RT	11	Terminal Timing </DA>	TT

Table B-14
RS-232 25-Pin Male Connectors

Connector #1			Connector #2		
Pin	Pin Description		Pin	Pin Description	
1	Shield		1	Shield	
2	Send Data	TD	3	Receive Data	RD
3	Receive Data	RD	2	Send Data	TD
4	Request To Send	RTS	8	Data Carrier Detect	DCD
7	Signal Ground		7	Signal Ground	
8	Data Carrier Detect	DCD	4	Request To Send	RTS
17	Receive Timing	RT	24	Transmit Timing	TT
24	Transmit Timing	TT	17	Receive Timing	RT
25	Do not connect		25	Do not connect	

System Delay

The maximum System Delay is defined as the maximum time between the arrival of a data bit at the transmitter's DTE port and when it departs the receiver's DTE port. The system delay is consistent for all RTS/CTS delay settings.

Table B-15
Point-to-Point (Slave to Master) Maximum System Delay in Milliseconds

	Asynchronous	Synchronous
64K		6.9 ms
56K		6.9 ms
19.2K	7.6 ms	6.9 ms
9.6K	8.4 ms	6.9 ms
4.8K	9.8 ms	6.9 ms

Code of Federal Regulations

Telecommunication

47 Parts 0 to 19

Revised copy as of October 1994

- Part 15; Subpart B, Unintentional Radiators'
- Part 15; Sub part C, Intentional Radiators

For spread spectrum radios, direct sequence system consult 15.247, Section 2

APPENDIX C

Worksheets

This appendix contains two sets of worksheets to help the user to configure the AirLink Pro 64S.

AirLink Pro 64S 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 (Blank)		
Site Name, Master:			
Site Name, Slave:			
Password			
Date/Time	dd/mm/yy hh:mm:ss		
Link Parameters			
Application	1. Slave unit in a point-to-point link 2. Master unit in a point-to-point link 3. Master unit at a repeater site 4. Reference master unit at a hub 5. Backup master unit at a hub 6. Subordinate master unit at a hub 7. Master unit in a multipoint link 8. Slave unit in multipoint link		
PN Code	1 to 8 (default: 1)		
RF Channel	1 to 20 (default: 1)		
RF Plan	Channel Plan 1 (1-15) Channel Plan 2 ((1-20) (default: 20)		
RF Channel Plan	2 (MSK 64 - 20 channels) (default: 20 chan)		
Comm Mode	Synchronous (default: Synch) Asynchronous 8-bit, 9-bit, 10-bit, and 11-bit		
Data Rate	64 or 56 synchronous 19.2, 9.6, and 4.8 asynchronous or synchronous (default: 64 kbps)		
Burst Timing	External, Free Run, and Receive (default: Free Run)		
HUB Sync	Single or Dual (default: Single)		
Tx Clock Source	External or Internal (default: Internal)		

RTS Source	Internal or External (default: External)		
RTS Delay	0, 17, 34, and 127.5 (0 msec)		
DTE Mode	Disabled, RS-232, EIA-530, and V.35 (default: RS-232)		
DTE Protect	Enabled, disabled (default: Disabled)		
RF Power	0 dBm .. 28 dBm (default: 0 dBm)		

Alarm Control Parameters

Alarm Reporting	Request or Immediate (default Request)		
Alarm Level	Status, Minor, or Major (Default Status)		
Alarm Holdoff	0 - 600 (seconds)		
Burst	Mode, Output, and Timing		
Threshold RSSI	-95 to -50 (dBm)		
Threshold RSQ	1 to 10 (dBm)		
Threshold 1 Hour ES	1 to 99		
Threshold 1 Hour UAS	1 to 99		
Threshold 24 Hour ES	1 to 999		
Threshold 24 HR UAS	1 to 999		

APPENDIX D

Commands

This appendix contains a list of the available command keywords and operands that can be used to set or request configuration parameter values, or to request configuration parameter values, or to request configuration or status information.

Command Keyword List

Command keywords and operands can be used to set or request configuration parameter values, or status information. For keywords longer than four letters, only the first four letters of each keyword are necessary and case is not checked (all strings are converted to upper case). White space characters are required between keywords but the type (i.e. space or tab) and the number are not checked. Keywords in parentheses are optional; such words need not be typed for the command to execute.

BOTH
CALL
DISCONNECT
EXPERT
HELP
(LOCAL)
LOGIN
LOGOUT
REMOTE

SET

ALARM HOLDOFF
ALARM LEVEL
ALARM REPORTING
APPLICATION
BSYNC A
BSYNC B
BURST MODE
BURST OUTPUT
BURST TIMING (SOURCE)
COMM
CONNECTION
DATA
DATE
DIAL
HOLDOFF
LEVEL
PULSE
RETRY
TONE
DTE
HUB_SYNC
MODEM PHONE
MODEM
MODE

	RATE
	PASSWORD
	PN
	RANGE
	REPEAT
	RF PLAN
	RF POWER
	RF SLEEP
	RTS THRESHOLD
	RTS DELAY
	RTS SOURCE
	SITE
	TIME
	TT CLOCK (DETECT)
	TX CLOCK (SOURCE)
	TX VCXO
	PHONE
	1
	2
	REPEAT COUNT
	RINGCOUNT
GET	ALARM LOG
	APPLICATION
	COMM
	CONFIGURATION
	CONNECTION
	DATA
	DATE
	DIAL
	DIGITAL
	DTE
	HUB_SYNC
	LIMITS
	MODEM
	PERFORMANCE
	PHONE
	PN
	REPEAT
	REVISION
	RF
	RINGCOUNT
	RS232
	RSQ
	RSSI
	RTS
	STE

STATUS
TEST
THRESHOLD
TIME
TOP
TX
VSWR

RESET

ALARMS
DEFAULT
PERFORMANCE
QRSS
SYSTEM
TEST

TEST

LOOPBACK LOCAL
 REMOTE

QRSS
RSSI
RSQ
VSWR

APPENDIX E

Glossary

This glossary provides definitions of some of the more important specialized terms and acronyms associated with the operation of the AirLink Pro 64S.

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.
Asynchronous Data Transmission	The transmission of data in which each character is a self-contained unit with its own start and stop bits and intervals between characters may be uneven.
Bit Error Rate (BER)	The measure of the frequency of errors in a digital transmission.
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.
Channel	A specified frequency slot within the specified frequency band used for transmission.
CRC (Cyclic Redundancy Check)	A check performed on data to see if an error has occurred in transmitting, reading or writing of the data.
DCE	Data Circuit Equipment—a communications device that establishes, maintains, and terminates a session on a network.
DTE	Data Terminating Equipment—a communications device that is the source or destination of signals on a network.
Fade Margin	The measure of how much signal attenuation the system can endure without dropping below the minimum desired BER level.
Free Space Path Loss	The loss of power of a radiated signal as it travels through space.
Full Duplex	Transmission in two directions simultaneously.
Half Duplex	A circuit designed for data transmission in both directions, but not at the same time.

Handshake Signal	The series of signals between a computer and another peripheral device (for example, a modem) that establishes the parameters required for passing data.
Hub Configuration	A system configuration in which several master AirLinks/terminals are co-located. Usually, one acts as the synchronizing modem to the others at the site.
LED	A light-emitting diode is a device that emits a visible light on the front of the AirLink modem.
Line-of-Sight	An unobstructed view from the transmit antenna to the receive antenna.
Master Modem	The master modem is the modem which controls the slave modem. The master modem always transmits the initial burst to which the slave modem must respond. The master modem is the only modem capable of initiating any activity on its own.
Modem	An acronym for MOdulator - DEModulator. A device used to convert digital signals into a form suitable for long distance transmission, and to reconvert received signals.
Omnidirectional Antenna	An antenna with a radiation pattern that is the same in all horizontal directions.
Over Sampling	The process of sampling a signal at a higher than the minimum acceptable rate to ensure greater accuracy.
Overlapping Channels	A situation in which the operating channel frequency bandwidth of one transmitting device shares part of the frequency bandwidth of another transmitting device.
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.
Point-to-Point Configuration	A system configuration in which only one master modem communicates with its one slave modem between the two sites.
Point-to-Multipoint Configuration	A system configuration in which one master modem communicates with one or more slave modem.
Polling	A controller checks stations (or terminal nodes) at intervals, according to a predefined list, to see if each respective station has anything to send. If a station (or terminal node) has data, it sends the data, and then the controller moves to the next station.

PN 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.
Preamble	A short portion of the beginning of a burst that allows the receiver time to synchronize.
Receiver Sensitivity	The measure of the ability of a receiver to differentiate between the selected signal and background noise for a specific performance.
RF	Radio Frequency. Electromagnetic waves propagated without guide (wire or cable) in free space.
Repeater	A site where the data received by an AirLink slave is retransmitted to a second site by an AirLink master in order to achieve greater communication range.
Send Timing	A timing mode where the transmit timing is provided internally by the modem.
Slave Modem	The slave modem is the modem which is under control of the master modem. The slave modem always transmits a burst in reaction to a received burst from the master modem. The slave modem is incapable of initiating any activity of its own.
Synchronous Data Transmission	The transmission of data in which both stations are synchronized. Timing codes are sent from the transmitting station to the receiving station to establish the synchronization. The data is then transmitted in continuous streams.
System Gain	The overall signal gain from input to output of a device or several devices connected as a system.
Terminal Timing	A timing mode where the transmit timing is provided to the modem via an externally wired path. Generally, this path is a loop through the DTE.
Transmitter Output Power	The amount of transmitted signal strength measured at the antenna post of the modem.
VSWR (Voltage Standing Wave Ratio)	The ratio of the maximum effective voltage to the minimum effective voltage measured along the length of mis-matched radio frequency transmission line. This value indicates the status of the antenna.

Index

—A—

AC Power Connector, B-9
Acquiring Alarm Information, 4-7
Acquiring Performance Information, 4-10
Acquiring Status Information, 4-2
Activity Lost on Bus A Only, 2-23
Activity Lost on Bus B Only, 2-23
Alarms, 3-28
 Holdoff, 3-27, 3-39
 Holdoff Time, 3-34
 Level, 3-27
 Reporting, 3-26
 Aligning the Antenna, 2-8
antenna, 1-5, 2-2, 2-4, 2-6, 2-7, 2-8, 2-31
 alignment, 2-8
 Connector, B-10
Application, 3-10
 command, 3-10
 parameter, 3-10
 with Clock Modes, 3-19
ASCII terminal, 2-9
ASCII Terminal Interface, 1-5, 3-2
Asynchronous Mode, B-4
audience, x

—B—

battery, 1-5
Backup Burst Synchronization, 2-22
Batch File Handling, 2-16
Burst Synchronization, 2-4, 2-17
 Compatibility, 2-25
 Connector, B-10
 backup scheme, 2-20
 Fail-Safe Feature, 2-20
 Loss, 4-3
 Signal Description, 2-18

—C—

Channel Plan B-2, B-7
checking operation, 2-28

Clock Mode Emulation, 3-21
Code of Federal Regulations, B-14
Comm Mode, 3-17
Command and Operand Description Syntax, 3-4
Command Keyword List, 3-4
Command line Interface, 3-2
 Syntax, 3-3
Compatibility, 1-6
Configuring
 Modem, 3-31
 RF Link, 3-24
Connection, 3-42
Connecting the Modem, 3-31
configuration change, 2-30
Connecting Power, 2-9
Connection and Configuration, 3-30
conventions used in this guide, xi
Customer Support, xiii

—D—

Data Interface Standards, B-8
Data Rate, 3-17
Data rate parameters, 3-36
Date and Time, 3-8
date command, 3-8
DC voltmeter, 2-31
DCD, 2-4
DCE/TT, 3-21
DCE/ST, 3-21
Defaults, 3-29
Default Parameters, 3-39
Diagnostic Tools, 4-13
DTE Status, 4-3
Dial
 Format, 3-40
 Holdoff, 3-40
 Holdoff Time, 3-34
 Level, 3-40
 Retry, 3-40
Dialout Function, 3-33

DTE Connectors, B-10
DTE Line Connection, 2-8
DTE interface standard, 3-15
DTE Mode, 3-15
DTE ports, 3-16
DTE Protection, 3-16
DTE Specifications, B-4
DTE/TT, 3-22
DTR (Data Terminal Ready), 3-16

—E—

Editing Capability, 3-3
EIA 530 25-Pin Male Connectors, B-13
EIA-530 and V.35 Pin Assignments, B-12
Error Correction, B-4
 Error Codes, 2-29
 Error Code Queue, 2-29
Errored Seconds (ES), 4-12
ES
Event Queue, 4-8
Events Causing an Alarm State, 4-8
Events, 3-33
external power supply, 2-9

—F—

front panel, 2-3
 Indicators, 2-4
full-duplex point-to-point link, 3-22
Functions, 3-33

—G—

General Default Configuration, 3-29
General Specifications, B-2, B-5

—F—

Features and Capabilities, 1-3
full-duplex, 1-3

—H—

help, 3-2, 3-6
Hub Application, 3-12
hub installation, 2-29

HUB/ST, 3-22
HUB_SYNC, 3-27

—I—

independent clocks, 3-23
 in a Hub, 3-24
Identifying Physical Features, 2-3
Initial Unit Configuration, 2-29
installation, 2-8
Installing Burst Sync Wiring, 2-20
Interface Specifications, B-3

—K—

Keyboard Usage, xii

—L—

Lightning Protection, 2-6
Local Loop Test, 4-14
local loopback, 4-13
Logging into the System, 3-5
Logout, 3-6
Login, 3-33
Loopback Tests for Multipoint Networks, 4-18

—M—

Major Alarm, 2-4, 2-21
majority voting algorithm, B-4
Mechanical Specifications, B-3
Maintenance of Standby Battery, 4-20
master modem, 1-4
Minor Alarm, 2-4
Modem (Enabling) Mode, 3-41
Modem Rate, 3-41
Modem Setup Procedures, 3-31

—N—

near-end inter-channel interference, 2-20
Network Management, 2-9, B-8
 ports, 1-5, 2-9, 2-11
N-type jack connector, 2-8
non-volatile memory, 1-5

Notes, Cautions, and Warnings, xiii

-O-

operand *time*, 3-8
Operation, 3-34
Operations Local and Remote, 3-6
Operating and Environmental Specifications,
B-2

—P—

Password, 3-9
 command, 3-9
performance information, 4-10
 statistics, 4-12
Phone Numbers 1 and 2, 3-41
Physical and Environmental Characteristics,
2-5
PN, 3-25
Point-to-Multipoint Link, 3-11
Point-to-Multipoint Application, 1-4
Point-to-Point Link, 3-10
polling, 1-4
poll-select communication protocol, 1-4
Port Duplication, 3-33
Port Parameters, 3-36
Power, 2-4
 Requirements, 2-6
 Specifications, B-3
power-on self-test, 2-28
Power-Up Messages, 3-5
Protocol Modems, 3-37
Pseudo-random noise, 3-25
Power-up LED Sequence, 2-28
Prerequisite Knowledge, x
Programmed Configuration Parameters, 1-5
primary burst synchronization bus, 2-21
primary hub, 2-21
Procomm, 2-16
Protocol, B-4

-Q-

QRSS Test, 4-11
query alarms command, 4-9
query performance command, 4-10
query status command, 4-2

—R—

Radio Interface, B-5
radio interface specifications, B-6
Receiver, B-7
RS-232 25-Pin Male Connectors, B-13
Radio Synchronization Loss, 4-3
Range, 3-25
RD, 2-4
Reader Response, xiv
rear panel, 2-4
 rear-panel connectors, 2-5
Receive Signal Quality (RSQ), 4-12
Reference Master, 3-24
Remote Loop Test, 4-16
Remote Modem Connection, 2-15
Repeat Alarm Count, 3-34
Repeat Count, 3-39
Repeat Dialing and Prioritization, 3-34
Repeater, 3-13
 Variations, 3-15
reset alarms command, 4-9
reset UWER command, 4-12
Resetting Performance Counters, 4-12
Resetting the Event Queue, 4-9
reset alarms, 4-9
reset UWER, 4-12
Responses, 3-37
 and Alerts, 3-38
RF
 RF Plan, 3-26
 RF Power, 3-26
 RF setup parameters
RSQ, 4-5, 4-12
RSSI, 4-3

RTS, 2-4

—S—

Serial Communication Port, 2-13
set up instructions, 2-6
Signal-to-Pin Assignments, B-8
Site Preparation, 2-5
spread-spectrum, 1-2
 modulation, 1-2
stub mast, 2-7
substrate data, B-4
synchronizer, 1-4
Synchronous Mode, B-4
System Delay, B-14
system grounding, 2-8
system start-up, 2-28

—T—

TD, 2-4
Telecommunication, B-14
Terminal
 Connection, 2-9, B-9
 Preferences, 2-11
 user interface, 1-6
 setup parameters, 2-10
 Setup Requirements, 2-10
 Setup Requirements with Windows™,
 2-11
Test in Progress, 4-5
timing code, 1-3, 1-4
Time Division Duplex, 1-3
 Burst Structure, 2-18
transmission bursts, 1-3, 1-4
Transmitter, B-6
Typical Antenna Mounts, 2-7
Typographic Conventions, xii
Typography, xi

—U—

UAS
 performance statistics, 4-12

Unavailable Seconds, 4-12

Unpacking, 2-2
User-Directed Connections, 3-36
User Interface Additions, 3-38

-V-

Viewing
 Performance Information, 4-10
 Status Information, 4-2
 Event Queue, 4-9
VSWR, 4-6

—W—

Windows Terminal Emulator, 2-17