ABR200

Audio Broadcast Receiver

Installation and Operation Guide

COMSTREAM
A Spar Company

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For the proper installation and operation of this equipment and/or all parts thereof, the instructions in this manual must be strictly and explicitly followed by experienced personnel. All of the contents of this manual must be fully read and understood prior to installing or operating any of the equipment, or parts thereof. **FAILURE TO COMPLETELY READ AND FULLY UNDERSTAND AND FOLLOW ALL OF THE CONTENTS OF THIS MANUAL PRIOR TO INSTALLING AND/OR OPERATING THIS EQUIPMENT, OR PARTS THEREOF, MAY RESULT IN DAMAGE TO THE EQUIPMENT, OR PARTS THEREOF, AND TO ANY PERSONS INSTALLING AND/OR OPERATING THE SAME.**

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This digital audio receiver is manufactured by ComStream Corporation. It incorporates Musicam compression technology under license from Corporate Computer Systems, Inc. as outlined in the copyright notice below.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and radiates radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

WARNING

Shock Hazard!

Do Not Open The ABR200 Equipment!
Service Only By ComStream!

Gefährliche Spannung!

Öffnen des Gerätes und Service nur durch ComStream!

The ABR200 Audio Broadcast Receiver contains no user-serviceable parts. Do not attempt to service this product yourself. Any attempt to do so will negate any and all warranties.

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Introduction

Using this Guide

Welcome to the ComStream world of satellite-based communication systems and networks. This guide is your source book for using ComStream's ABR200 Audio Broadcast Receiver. It describes the installation, operation, and performance specifications of this product.

The chapters in this guide provide step-by-step instructions for a variety of tasks and activities, including unpacking, setting up, mounting, and operating the ABR200 Audio Broadcast Receiver. The chapters also provide an overview of system operations, as well as technical specifications and troubleshooting procedures.

Conventions Used in this Guide

This guide is designed to help you find and use information quickly and easily. To take full advantage of this design, please take a moment to review the specific formats.

Locating Information

There are several tools located in this guide to help you quickly locate information. The table of contents, located at the beginning, provides you with an outline of the chapters and major topics contained within them. A detailed description of each chapter is contained in the next section, titled Organization.

Special Paragraphs

Throughout this guide you will find two types of paragraphs designed to help you identify important information. These paragraphs are:

NOTE: This identifies information for the proper operation of your equipment, including helpful hints, shortcuts, or important reminders.

CAUTION: This identifies information that requires careful attention in order to prevent equipment damage and/or injury to the operator.

Keyboard Entries

Each activity or task is presented in a series of numbered, step-by-step instructions. Commands or information that you type into the system appear in a courier, bold type:

Type **LT ?** and press Enter.

Keys that are pressed in combination appear with a plus sign (+). For example:

Control+Shift+3

Hold down the Control and Shift keys and press the number 3 key simultaneously.

Organization

This guide groups information and procedures together by the types of activities and tasks you will perform when working with the ABR200 Audio Broadcast Receiver. This guide contains seven chapters and eight appendices. These chapters and appendices are described in detail below.

Getting Started

If you are new to satellite communications or are unfamiliar with either ComStream products or the ABR200, you should read the following chapters before unpacking or installing this product:

- Chapters 1 and 2 for an overview of the ABR200
- Chapter 4 for a full set of ABR200 installation procedures
- Chapters 5 and 6 for remote monitor and control operation, maintenance, and troubleshooting

If you are an experienced user familiar with the ABR200 and other ComStream products, you may wish to begin with:

- Chapter 1 for an overview of the ABR200
- Chapter 3 for the quick installation procedure
- Other chapters as needed

Chapter Descriptions

The following detailed descriptions of each chapter and appendix are provided to help you quickly and easily locate the information you need.

Chapter 1: Overview

This chapter provides an overview of a typical satellite digital audio distribution network as well as an overview of the ABR200 audio broadcast receiver.

Chapter 2: Functional Description and Theory of Operation

Chapter 2 provides functional descriptions and the operational theory for the basic components of the ABR200 receiver system.

Chapter 3: Quick Installation

This chapter provides quick installation and startup instructions for experienced users who are familiar with satellite communications equipment.

Chapter 4: Full Installation and Startup

Chapter 4 describes the steps necessary to install and start up a complete ABR200 Audio Broadcast Receiver station. It presents instructions on how to install and align the antenna, install the ABR200, and start up the receiver system.

Chapter 5: Remote Monitor and Control Operation

This chapter details the remote control operation of the receiver. Commands are input by the user and the receiver indicates current status, errors, or faults. This chapter:

- Describes the ABR200 command syntax
- Groups commands by function
- Presents errors codes
- Provides an alphabetical listing of all ABR200 commands and codes

Chapter 6: Maintenance and Troubleshooting

Chapter 6 provides an alphabetical listing of key performance monitoring commands and the fault conditions that can occur with the ABR200. These listings also provide a detailed description of each command and fault condition.

This chapter also presents information that can help troubleshoot any problems that can occur with the ABR200.

Chapter 7: Technical Specifications and Port Information

Chapter 7 lists all of the technical specifications for the following items:

- LNB downconverter
- L-band demodulator
- Audio performance
- All ABR200 ports
- Control channel
- Monitor and control
- Mechanical
- Environment

Appendix A: Interface Pinouts

This appendix describes the pinouts and their function for each connector used with the ABR200.

Appendix B: Telephone Modem Operation

The ABR200 can be controlled and operated from a remote location by connecting the receiver to the public telephone network using the ComStream approved Hayes-compatible modem (CPN 30-0120-194). This appendix provides the necessary details for configuring the telco modem and connecting it to the ABR200.

Appendix C: Interfacility Link (IFL) Cable Characteristics and Preparation

Appendix C describes the characteristics of the IFL cable and presents the cable specifications and the vendors that supply the cables used for the ABR200. In addition, this appendix provides step-by-step instructions on how to prepare the IFL cable.

Appendix D: Antenna Installation (Prodelin)

This appendix discusses the assembly and setup of the optional Prodelin antenna system for use with the ABR200. If another antenna system is being used, the assembly and setup instructions for that system should be followed.

Appendix E: Antenna Aiming and Peaking

This appendix describes the activities necessary to:

- Point the ABR200 receive-only antenna at the appropriate satellite
- Acquire an out-route carrier
- Perform antenna peaking adjustments

Appendix F: Software Revision History

Appendix F provides a summary of the ABR software revisions. There are two different types of software within the ABR200 unit: control processor software and audio decoder software. The control software can be updated over the satellite from the uplink using a network control computer. The audio decoder software can be updated only at ComStream by physically replacing its EPROM.

Any time a receiver is serviced at ComStream, the software is updated to the latest revision level.

Appendix G: Version 1.37 and 1.38 Changes

Appendix G is for customers who have version 1.37 or 1.38. Version 1.37 mainly provides the terrestrial backlink (TB) feature. This appendix explains the TB functionality as well as the commands that were added or modified with versions 1.37 and 1.38.

Appendix H: Troubleshooting Flowchart

Appendix H provides a quick reference, troubleshooting flowchart to help you diagnose and correct minor problems in the unlikely event that you experience difficulties with your ABR200. This chart should be used in conjunction with the information provided in the Troubleshooting section of *Chapter 6: Maintenance and Troubleshooting*.

Warranty Statement

ComStream warrants that its products are free from defects in material and workmanship at the time of shipment and that they conform to applicable specifications. In no event will ComStream be liable for consequential misuse or damages.

The ComStream ABR200 Audio Broadcast Receiver is warranted against any above-mentioned defects that appear within one year of shipping date.

Should it be necessary to make a claim against this warranty, the buyer shall first notify ComStream's Customer Service Department to define the nature of the problem. When returning products, please be aware of the following:

1. Products returned to ComStream, whether for upgrade, warranted or out-of-warranty repair work, or maintenance, must comply with the ComStream Return Procedure (located on the next page).
2. Products shall be forwarded to ComStream, transportation prepaid.
3. Products returned to ComStream freight collect or without a return material authorization (RMA) number will NOT be accepted.
4. ComStream shall not accept any responsibility for returned products that are improperly packaged and/or damaged in shipment. If possible, please use original shipping and packaging materials.
5. Original product identification markings and labels must not be removed, defaced, or altered. Further, to preserve the warranty, the product should not be subjected to abuse, improper installation or application, alteration, accident, or negligence in use, storage, transportation, or handling.
6. Any returned product shall be completely evaluated in an attempt to duplicate the problem so that appropriate corrective action and repair may be completed. Following repair, the product shall be thoroughly tested for compliance with appropriate specifications. This process will be handled in an expedient and prompt manner but may be subject to available labor and material resources.

The ComStream warranty, as stated herein, is in lieu of all other warranties, expressed, implied, or statutory.

For further information, please contact

ComStream Customer Service at

619-657-6545

Return Procedure

If it is necessary to return a product for out-of-warranty repair, upgrade, or any modification, the following procedures must be followed:

1. Contact ComStream Customer Service, located in the United States, via phone or fax:
   - Phone 619-657-5454
   - Fax 619-657-5455
2. Speak to a ComStream customer service representative about any questions, issues, or problems. Quite often equipment problems can be corrected over the phone, which keeps your equipment in service and avoids unnecessary and costly downtime.
3. Should it be necessary to return a product to ComStream for any reason, the ComStream customer service representative will issue you a return material authorization (RMA) number. To issue an RMA number, the ComStream representative will need the product's serial number, model number, and a description of the problem.
4. You may be returning a product for either repair, upgrade, or modification. If you are returning the product for:
   - Repair, please include a complete description of the problem, the operating conditions which caused the problem, and any circumstances which may have led to the problem. This information is essential for ComStream repair technicians to reproduce, diagnose, and correct the problem.
   - Upgrade or modification, please include a complete description of the current configuration and the desired change(s). This information will allow a ComStream customer service representative to provide a formal quote for the upgrade.
5. Include a purchase order for any upgrade or out-of-warranty repair work being performed. ComStream will begin repair work after a PO is received.
6. Reference the RMA number on all paperwork that accompanies the equipment, and write the RMA number clearly on the outside of the shipping container.
7. Ship your module in the original shipping carton and packaging (or its equivalent), prepaid, to the following address.

   ComStream, A Spar Company
   10180 Barnes Canyon Road
   San Diego, CA 92121 USA

   RMA Unit number

   Do not include product accessories such as Installation and Operation guides or rack-mount brackets.

CAUTION: When handling or shipping static-sensitive equipment, observe antistatic procedures and always use antistatic bags for shipment. Upon request, ComStream will provide you with ESD bags for your use.

All equipment upgrade and repair requests will be completely evaluated and the required work performed in an expedient and prompt manner. The equipment will then be thoroughly tested for compliance with appropriate specifications.

Revision History

This guide is periodically updated and revised. The following table lists the revision number and date and provides a description of the type of revision made to the guide.

To determine if you have the most current documentation, you can compare the revision information at the bottom of each page to those listed in the Revision History table below. For documentation updates, call ComStream Customer Service (located in the United States) at 619-657-5454 or fax your request to 619-657-5455.

NOTE: Revision A is always the first official release to ComStream customers.

Table 1. Revision History

Revision	Date	Pages Affected
Rev. A	02/92	Initial release
Rev. B	01/93	All chapters; adds Appendices B through F
Rev. C	08/93	All chapters; convert to Word for Windows
Rev. D	08/94	All chapters; new format; adds desktop model; adds Appendices G and H
Rev. E	05/95	All chapters; updated references to ISO/MPEG Layer II/IIA
Rev. F	08/95	Updated notice page to include CCS copyright notice

Customer Support

We hope this guide provides all of the information and instructions you need to operate the ABR200 Audio Broadcast Receiver.

However, in the event that you need further assistance, or if problems are encountered, ComStream has set up a Customer Support Line for your use. Please feel free to contact ComStream Customer Support, located in the United States, by phone or fax at the following numbers:

- Phone 619-657-5454
- Fax 619-657-6455

Customer service hours are Monday through Friday 8:00 a.m. to 5:00 p.m. Pacific time.

Chapter 1: Overview

Introduction

Satellites have proven to be a reliable method of communication for distribution of CD-quality digital audio. The Integrated Digital Audio Distribution Network, of which the ABR200 is a key component, sets a new worldwide standard for digital audio distribution.

The unique capabilities of the ComStream digital audio system allow a network to start out small (offering a single monaural or stereo channel) and grow to a larger multichannel system without replacement of receiver hardware. Fast, easy selection of audio channels can be made either at the receiver or at the studio uplink.

The combination of ComStream modem technology and the latest digital audio compression technology (ISO/MPEG Layer II/IIA) achieves significant satellite savings (35-65%) when compared to alternative distribution networks. The ComStream digital audio distribution system also provides asynchronous data distribution and relay contact closures for control of external station equipment.

This chapter provides an overview of a typical satellite digital audio distribution network, as well as an overview of the ABR200 audio broadcast receiver.

Satellite Digital Audio Distribution Network Overview

A satellite broadcast network consists of three major subsystems, as shown in Figure 1-1:

- A satellite transmission uplink station
- The satellite link
- One or more remote satellite receivers

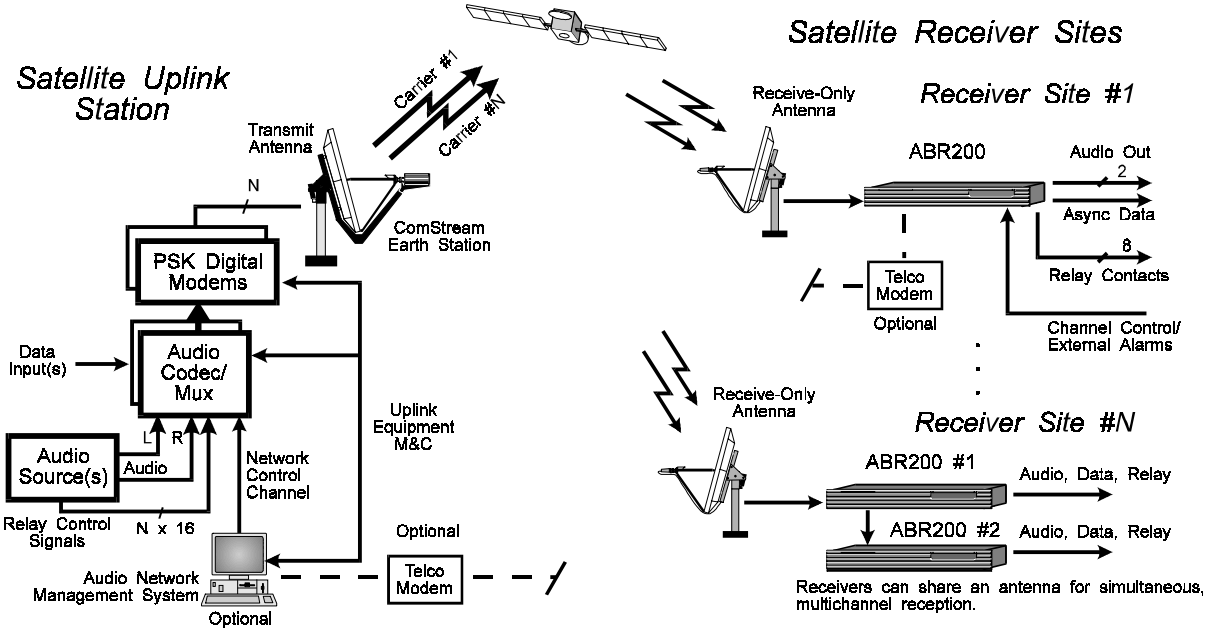

Figure 1-1. Satellite Digital Audio Distribution Network

The hub or satellite transmission uplink station is the facility where the audio to be transmitted is collected and uplinked to the satellite. This facility consists of an audio encoder/multiplexer, a digital modem, an earth station, an antenna, and a network control computer. As an option, a terrestrial link can provide dial-up diagnostics and performance monitoring of receiver sites.

The satellite link consists of a commercial telecommunications satellite in geosynchronous orbit above the earth. Two radio frequency bands that are primarily used are C-band and Ku-band.

The third major subsystem, the remote satellite receiver, includes three major components:

- A satellite antenna subsystem
- An interfacility link cable
- A satellite audio receiver such as the ABR200

The satellite antenna and its associated electronics collect and convert the signal from the satellite's native C- or Ku-band signal to L-band. This signal is then sent through the interfacility link (IFL) cable to the satellite receiver. The ABR200 audio receiver processes this signal and outputs the audio, data, and control to the user-supplied station equipment for distribution.

A phase lock loop (PLL) type low noise block (LNB) downconverter must be used for all satellite links using the QPSK modulation. Satellite links using BPSK modulation may use the dielectric resonance oscillator (DRO) type LNB.

ABR200 Overview

The ABR200 is a multiple transmission rate digital audio receiver. As previously mentioned, a satellite antenna is required with an LNB downconverter mounted on the antenna. Figure 1-2 details an ABR200 installed in a typical application, such as a radio station environment.

The analog output audio from the ABR200 is used to feed both the on-air studio console as well as taping equipment for off-hours distribution of programmed material. The relay contact closures are used to control station equipment such as cart machines and tape recorders. The data port can be connected to a low speed dot matrix printer or a personal computer for station traffic, air logs, etc. The alarm relay closure is used to activate an alternate program source should the satellite channel become inoperative.

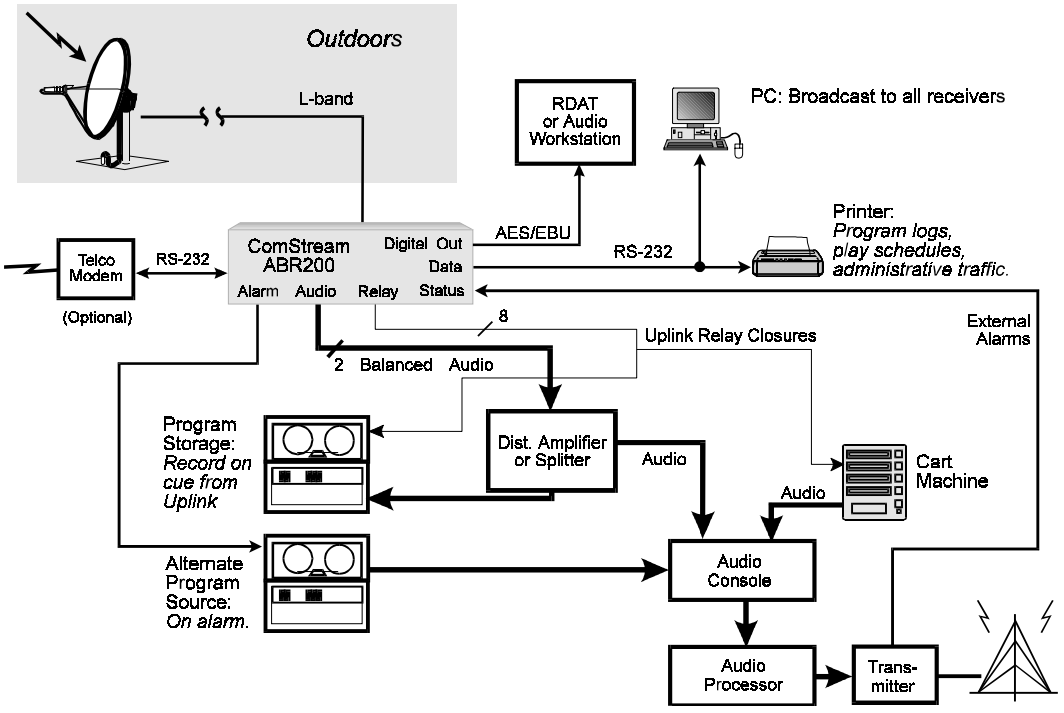

Figure 1-2. Typical ABR200 Installation

ABR200 Features

The ABR200:

- Provides full 20 kHz, CD-quality audio at 128, 192, or 256 kbps
- Accommodates both Ku- or C-band in BPSK or QPSK mode
- Uses ISO/MPEG Layer II/IIA audio compression, which is the most tested and documented audio compression algorithm in the world
- Uses Quick Channel Access, which provides fast, nearly transparent, audio channel changes for receiving multiple channels
- Provides a relay (cue) control port with eight contact closures, each independently controllable from the uplink facility
- Provides six transistor transistor logic (TTL) inputs for local channel changes and auxiliary equipment monitoring
- Is addressable to provide complete control of receiver configuration and operation from the uplink facility
- Allows audio channel changes either locally or from the uplink facility
- Is equipped with a low speed (300 to 9600 baud), asynchronous data port
- Provides remote control capability with access via an external wireline modem (optional equipment)
- Provides built-in audio, relay control, and data port diagnostics
- Has a built-in performance monitoring capability that measures the lowest received Eb/No and counts RF and audio sync losses
- Is equipped with software that can be upgraded over the satellite link via down-line loading
- Has a nonvolatile memory so that configuration and operating parameters are not lost in the event of a power outage

The remaining portion of this manual describes in detail the steps necessary to install, configure, and operate the ABR200 digital audio receiver within a network environment.

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Chapter 2: Functional Description and Theory of Operation

Overview

This chapter provides functional descriptions and operational theory for the basic components of the ABR200 receiver system.

The ABR200 system consists of the following:

- An outdoor receive-only antenna and feed—optional antenna sizes range from .75 to 2.4 meters
- A low noise block (LNB) downconverter assembly that performs the initial signal downconversion (optional frequencies)
- A user-supplied interfacility link (IFL) cable connecting the LNB downconverter on the antenna to the ABR200
- An ABR200 receiver providing an L-band demodulator and digital audio decoder on a single circuit card

Functional Description

Outdoor Components

The outdoor components consist of an antenna assembly, a feed assembly, and an LNB downconverter.

Antenna Assembly

The antenna assembly consists of the satellite reflector, mast, feed horn, and LNB downconverter. The antenna assembly collects and concentrates RF transmissions that are produced by a communication satellite and converts them to an electronic signal. A typical antenna assembly is shown in Figure 2-1.

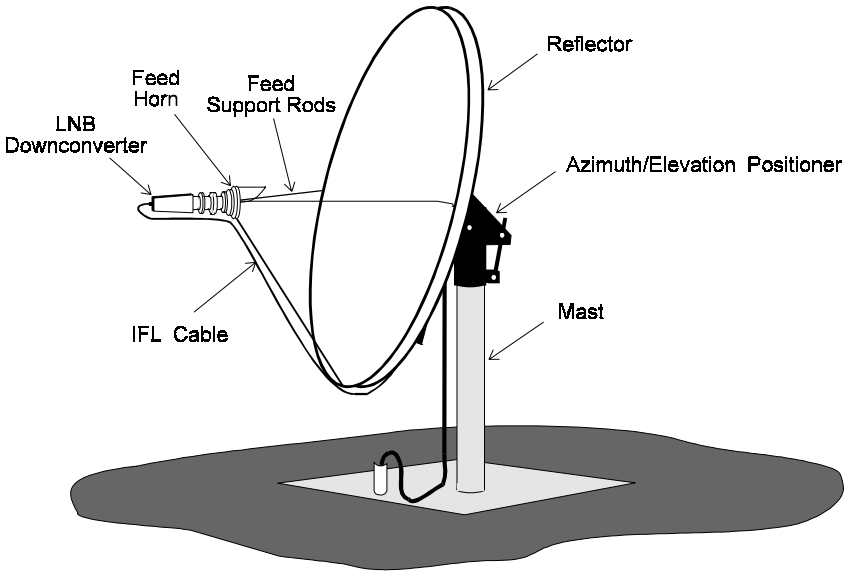

Figure 2-1. Receive-Only Antenna Assembly

The optional antenna supplied with the ABR200 system is an elliptical offset feed-type suited for receive-only applications. The appropriate antenna size is determined by the location and transmitted satellite power (EIRP) for each installation.

Available antenna sizes are shown in Table 2-1.

Table 2-1. Available Prodelin Antenna Sizes

C-band	Ku-band
1.2 m linear or circular	.60 m AZ/EL mount .60 m wall mount
1.8 m linear or circular	.76 m AZ/EL mount .76 m wall mount
2.4 m linear or circular	.90 m AZ/EL mount
3.0 m linear or circular	1.0 m AZ/EL mount
3.4 m linear or circular	1.2 m AZ/EL mount
3.7 m linear or circular (also Polar mount)	1.8 m AZ/EL mount* 2.4 m AZ/EL mount* 3.0 m AZ/EL mount* 3.4 m AZ/EL mount* 3.7 m AZ/EL mount*

* Available in both single and dual feed

The antenna subsystem receives DC power from the ABR200 receiver via the IFL cable, so an additional power source is not required at the antenna site.

The reflector is mounted on a continuously adjustable azimuth/elevation positioner that supports precision aiming to the satellite of choice. For proper signal reception, the antenna must have an unobstructed view of the satellite location in the sky. Prior to operation, the antenna must be aligned to maximize the receive signal reception from the satellite used.

Feed Assembly and LNB Downconverter

The radio frequency signals gathered by the satellite antenna are focused on the feed horn, which collects the signal. The output of the feed horn is then directed to the LNB downconverter, which, in turn, converts the Ku or C-band signals to L-band. The output of the LNB downconverter is routed to the IFL cable through an F connector.

Interfacility Link (IFL) Cable

The IFL cable connects the antenna assembly to the ABR200 receiver. This cable carries L-band signals to the ABR200 and supplies DC power to the LNB downconverter.

The outdoor end of the cable is attached to the LNB downconverter mounted on the antenna. The indoor end connects to the ABR200 RF Input connector. The IFL cable uses F connectors on both ends.

The IFL cable is an important component of the receiver system. Proper cable selection and installation is imperative to obtain optimal system performance. *Appendix C: IFL Cable Characteristic*s provides detailed information on the IFL cable, vendor sources, and connector installation.

ABR200 Satellite Receiver

The ABR200 is a multiple transmission rate digital audio receiver. Analog audio, data, and control commands are input to the ABR200. The receiver feeds the audio, data, and commands to the on-air studio console, as well as the taping equipment for off-hours distribution of programmed material.

The ABR200 receiver comes in two chassis styles, rack-mount and desktop, as shown in Figures 2-2 and 2-3. The ABR200 chassis is designed to meet worldwide emissions, safety, and power requirements. Its two-piece construction is optimized so that every joint in the box overlaps, meeting FCC requirements for emission control. The ABR200 contains a world-compatible, autosensing power supply, allowing the unit to accommodate virtually any AC power source.

Figure 2-2. The ABR200, Rack-Mount Model

Figure 2-3. The ABR200, Desktop Model

Front Panel Indicators

The front panel of the ABR200, as shown in Figure 2-4, has six indicators located on the right side of the panel. The indicators are backlit to show active operations or faults in the ABR200.

Figure 2-4. ABR200 Front Panel Indicators

The green Power LED indicates the unit is powered on and the power supply is functioning correctly.

The RF Sync indicator illuminates green to indicate that acquisition of the incoming RF signal is complete and meets all of the conditions defined by the user within the ABR200 parameter base.

The green Audio Sync LED indicates the digital audio decoder has synchronized to the uplink audio encoder. CD-quality audio is then available for output from the receiver if the unit is properly authorized for audio reception.

The Signal indicator is a green LED that reflects the current signal strength relative to user-specified criteria. The indicator has three operational states: on, blinking, and off. The signal level thresholds that determine these three states are user-specified via the Q0 and Q1 commands, as described in *Chapter 5: Remote Monitor and Control Operation*. Table 2-2 displays the factory default values.

Table 2-2. Signal Level Defaults

Signal Level (Eb/No)	Indicator
>7.0 dB	On
>4.0 dB, <7.0 dB	Blinking
<4.0 dB	Off

IDU Fault Indicator

When active, the IDU Fault indicator illuminates the words IDU Fault in red on the front panel. When lit, the LED indicates that one or more fault conditions exist that may impede signal reception or affect reliable reception. The conditions under which the indicator illuminates is programmable by the operator using the status relay mask (SR) command, as described in *Chapter 5: Remote Monitor and Control Operation*. This indicator maps to the state of the status relay closure contact that is available at the rear panel. If desired, this closure contact can be used to mirror the fault indicator. Once the fault condition has cleared, the indicator automatically turns off and the status relay returns to its normal state as defined by the user.

During the power-up sequence, the IDU Fault indicator will momentarily illuminate (indicating the LED is working) and then turn off. Once the power-up sequence is complete, it only illuminates when a fault occurs.

The ABR200 receiver software can be updated over the satellite link. Interrupted or unsuccessful software downloads will make the IDU Fault indicator blink at one-second intervals. The fault indicator will stop blinking only when the software download is successful.

ODU Fault

The ODU Fault indicator illuminates the words ODU Fault in red on the front panel. When lit, the LED indicates the LNB downconverter is not receiving power from the IDU. This indicator may be programmed to remain off using the ODU fault mask (OM) command, as described in *Chapter 5: Remote Monitor and Control Operation.*

Theory of Operation

The ABR200 is a multiple transmission rate, QPSK/BPSK, digital audio receiver. The ABR200 is comprised of two elements, an outdoor unit and an indoor unit. The outdoor unit consists of an LNB downconverter that is mounted directly onto the antenna. The L-band output signal is transmitted via coax cable to the indoor electronics. Up to 400 feet of separation is possible before line amplifiers or switching to RG-35 cable is required. Standardizing on an LNB configuration permits both Ku- and C-band satellite operation with a single indoor receiver by selecting the appropriate LNB downconverter frequency range. The LNB downconverter can receive DC power from the receiver via the single coax cable. Should the coax connection become interrupted for any reason, an ODU alarm condition occurs.

The indoor unit consists of a compact, fully integrated, digital receiver. Internally the unit is comprised of:

- An L-band demodulator
- A single microcontroller providing overall receiver control and configuration
- A single DSP-based audio decoder providing two audio outputs, analog and AES/EBU
- A relay control port
- An RS-232 asynchronous data port
- An RS-232 or RS-485 remote control/diagnostic port

The rack-mount version of the receiver requires only one rack unit (1.75 inches) of vertical space. When utilizing more than one ABR in a rack, set up the rack such that one rack unit of free air space between rack-mount ABRs is provided. (For more information, refer to *Chapter 4: Full Installation and Startup*.)

All input and output connections are made on the rear panel. Each of the DB connectors are unique in size or gender from the other so that no interconnection mistakes can be made during installation.

For installations that require stereo pair outputs from the same satellite but on different carriers, two or more receivers can be daisy-chained together. In this arrangement, the L-band RF input is passed through to each additional receiver in turn, and is demodulated, decoded, and output as an independent audio channel. Up to six receivers can operate from one LNB downconverter and antenna.

Transmission Channel Signal Format

The ComStream digital audio satellite broadcast system uses a single RF carrier to distribute audio, data, and control information from the uplink to all downlinks. This multiservice data stream uses time division multiplexing (TDM) to transport the following information:

- CD-quality digital audio (mono, dual-mono, or joint stereo pair)
- User data
- Relay contact closure messages and receiver commands
- Network management commands

The TDM frame structure is provided by the ISO/MPEG Layer II/IIA audio standard, as shown in Figure 2-5.

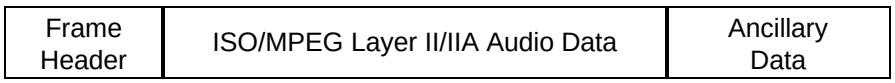

Figure 2-5. ABR200 Channel Format

The frame header provides all information regarding the audio rate, compression mode (mono, dual-mono, joint stereo), sampling rate (48 kHz), ancillary data size, and checksum. The audio data is the processed data as generated by the ISO/MPEG Layer II/IIA encoder. The ancillary data stream is used to transport the following information: network control, user data, and relay (equipment) control messages. This data is stripped out by the ISO/MPEG Layer II/IIA decoder within the receiver and is sent to a second microprocessor for additional processing and checksum. The checksum provides error detection of key audio data-related parameters.

Multiple (stereo) audio channels can be transmitted by uplinking an RF carrier for each stereo, dual-mono, or mono channel service. This technique is known as frequency division multiplexing (FDM). The ABR200 is specially designed for multicarrier FDM operation. By using digitally programmed local oscillators and optimized acquisition routines, changes from one RF carrier to another occur in less than 600 msec. Furthermore, the signal parameters between the two carriers can be completely different.

One carrier may be operating monaural audio at 64 kbps using QPSK modulation, while a second dual mono at 256 kbps using BPSK modulation. The RF frequencies may be a full 500 MHz apart. The key parameters for each RF carrier are programmed into the ABR200 unit in one of three ways:

- Locally via a computer terminal
- Remotely via a telephone modem
- Over the satellite link using the Audio Network Management System (ANMS), which is located at the uplink facility

Figure 2-6 provides an illustration of various digital audio carriers on a single transponder.

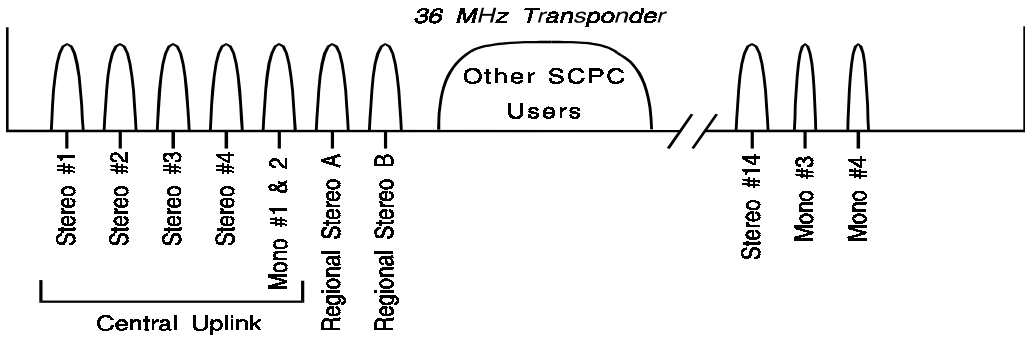

Figure 2-6. Multichannel Single Transponder System

RF channel changes can be initiated from several sources:

- Over the satellite control channel from the uplink
- Via the remote control port
- Locally (if permitted) via three TTL control inputs

The output audio is muted just prior to initiating a channel change to prevent audio blasting. If the new RF carrier cannot be acquired within one bintime, a channel change fault (FL 29) is declared and the original channel is reacquired. For information on channel acquisition and bintime, refer to the “Installation Mode Acquisition” section of this chapter.

Proper Signal Discrimination of Narrow Band RF Signals

A single satellite transponder can provide access to hundreds of individual RF carriers because of their very wide bandwidths, typically 36, 54, or 72 MHz. The ComStream Single Channel Per Carrier (SCPC) digital audio system uses very narrow bandwidth RF carriers where the bandwidth can range from 64 kHz (64 kbps, QPSK) to 512 kHz (256 kbps, BPSK). The ABR200 receiver has the capability to acquire RF signals over the full satellite frequency range of 500 MHz.

Because local oscillators are used in translating the signal to various radio frequencies throughout the transport cycle (uplink, satellite, and downlink), frequency uncertainties may become significant in comparison to the bandwidth of the signal itself. This uncertainty can be as much as 2 MHz when operating with a DRO-type LNB downconverter or as little as ±15 kHz with a PLL-type LNB. To ensure that only the RF carrier of interest is detected and processed, a further means of signal discrimination is required.

Additional discrimination is provided by embedding a unique identifier into the composite data stream of each carrier. This unique identifier is comprised of two components: a network identification (ID) number, and a channel ID number. The network and channel IDs are generated at the uplink by the codec/mux at regular intervals (typically every 100 msec). For a given uplink, each codec/mux is programmed with a unique channel number, with each carrier typically having the same network ID.

During the receiver signal acquisition process, the proper RF signal is acquired and then the channel and network identifiers are matched against the user's predetermined configuration within the receiver. When these match, the RF Sync and Audio Sync indicators are illuminated. However, if either of the IDs do not match, an acquisition network ID fault (FL 31) is declared and the acquisition process continues until the correct signal is received.

If the network and channel ID information stops for a period of ten seconds, a network ID timeout fault (FL 30) is generated.

NOTE: It is important that the channel and network ID numbers generated at the codec/mux match the receiver configuration. For example, if a channel ID of 16 is used at the uplink, then all downlink ABR200 receivers must have channel configuration #16 defined for the proper RF receiver frequency, symbol rate, and demodulation type (i.e., CC 16,11700000,128000,1).

If another channel configuration number is used, say CC 1, in any receiver, those receivers configured with CC 1 instead of CC 16 will not acquire the signal properly and will not operate. For multiple carriers from a single uplink the network ID should be the same for all codec/muxes, but the channel IDs must be unique (i.e., 1, 2, 3, etc.).

An example of several different possible combinations of channel identifiers and frequency allocations are provided in Table 2-3 (assuming QPSK operation and 128 kbps transmission rate).

Table 2-3. Channel Identifier and Frequency Allocation Combinations

Carrier No.	Uplink Site	RF Freq. MHz	NI	CI	CC/FD Format (at ABRs)	
A	X	11,700.0	2	1	CC 1,...	FD 1,2,1,7
B	Y	11,700.2	1	1	CC 1,...	FD 1,1,1,7
C	Z	11,701.0	1	2	CC 2,...	FD 2,1,2,7 FD 3,1,2,5
D	Z	11,701.2	1	3	CC 3,...	FD 4,1,3,7

If you add a fifth carrier, Carrier E (shown in Table 2-4), to the configuration of carrier frequencies and ID numbers in Table 2-3, it is possible that carriers B and E would be incorrectly received, since they are within 600 kHz of each other and do not have unique ID numbers. All other carriers would operate properly.

Table 2-4. Carrier B and E Channel Identifier and Frequency Allocation

Carrier No.	Uplink Site	RF Freq. MHz	NI	CI	CC/FD Format (at ABRs)	
B	Y	11,700.2	1	1	CC 1,...	FD 1,1,1,7
E	Z	11,700.8	1	1	CC 1,...	FD 1,1,1,7

Low Noise Block (LNB) Downconverter

The LNB downconverter takes the satellite signals at C- or Ku-band and block downconverts them to L-band for processing by the satellite receiver. The performance of the LNB downconverter is critical, as it establishes the noise figure for the entire receiver system. A block diagram of the LNB subsystem is shown in Figure 2-7.

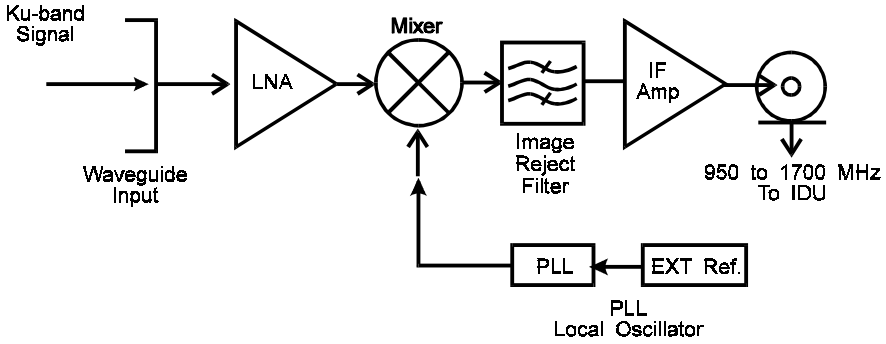

Figure 2-7. Low Noise Block (LNB) Downconverter (PLL) Block Diagram

The LNB downconverter is installed at the focus of the parabolic antenna dish. The LNB downconverter consists of:

- A low noise amplifier (LNA)
- A dielectric resonance oscillator (DRO) or phase lock loop (PLL) oscillator
- A mixer
- An image reject filter
- An IF amplifier

The input of the LNB downconverter receives signals collected by the antenna and routes them to the LNA. The LNA sets the LNB downconverter noise figure and provides the first stage of amplification. The amplified signal is mixed with the local oscillator for downconversion to L-band frequencies and then passed through the image reject filter. The IF amplifier boosts the signal to provide dynamic range, allowing for substantial cable loss. DRO technology provides good stability and phase-noise performance and is acceptable for BPSK operation. A PLL-based LNB downconverter is required for QPSK operation.

Receiver

The ABR200 broadcast receiver block diagram is shown in Figure 2-8. The major functional blocks consist of:

- An L-band digital demodulator
- The ISO/MPEG Layer II/IIA audio decoder DSP processor
- The receiver control processor

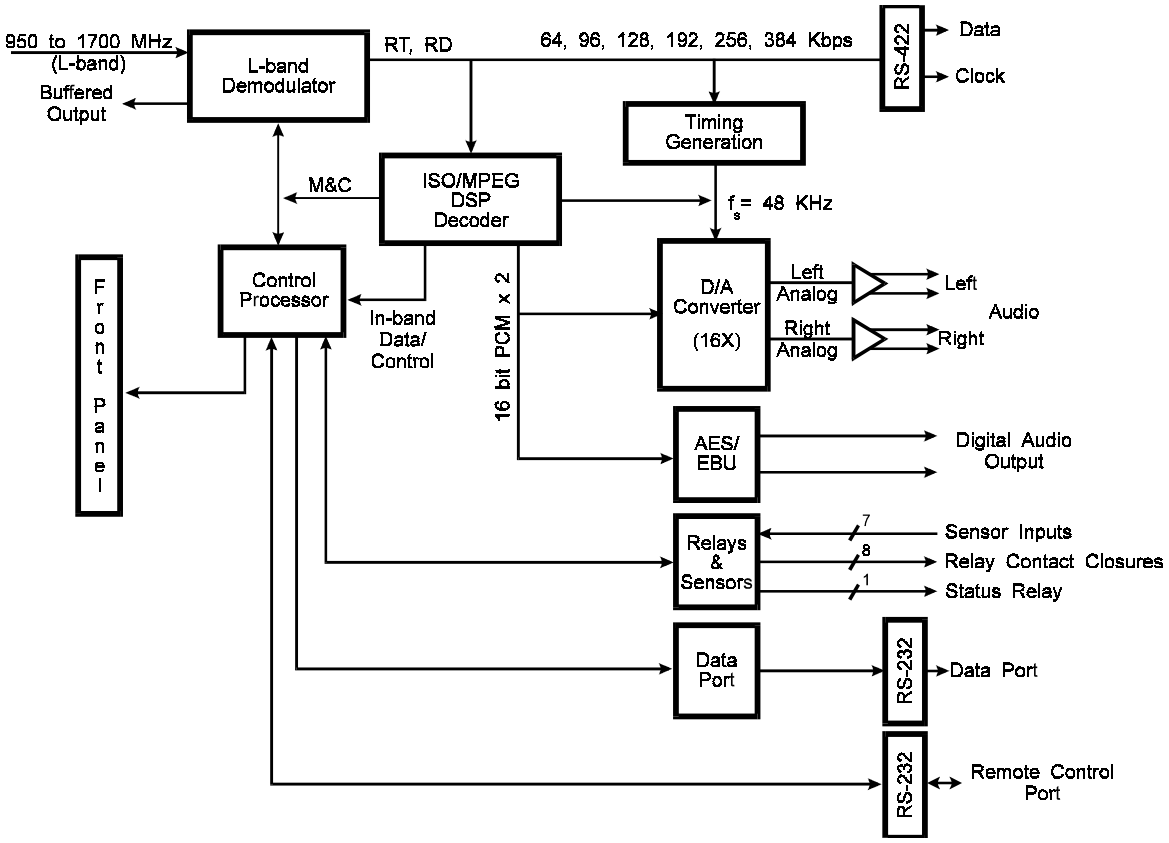

Figure 2-8. ABR200 Functional Block Diagram

The L-band demodulator receives the signal from the LNB downconverter. The signal is amplified and split to provide a buffered version for the RF output port. The signal is then downconverted by a digitally controlled local oscillator. The signal is then quadrature downconverted, sampled, and input to the demodulator IC. In the demodulator IC, soft decisions are made on the digitally compressed audio stream and it creates error signals for the carrier tracking, bit timing, and AGC loops. The soft-decision, digitally compressed audio stream is then directed to the demodulator decoder IC, which supports differential decoding, V.35 descrambling, and sequential decoding. The resulting baseband digital audio stream is presented to the audio digital signal processor. It is also available to the rear panel for direct output to storage devices via an RS-422 interface.

The Digital Signal Processor (DSP) synchronizes to the digitally compressed audio stream and performs audio decoding and audio/control demultiplexing. Next, the compressed digital audio is converted back into left and right channel 16-bit linear PCM audio. Using a dual channel, 16-times-oversampled digital-to-analog (D/A) converter, operating at a 48 kHz sampling rate, is used to produce the final CD-quality analog audio signal. The CD-quality analog audio is available on a male, 9-pin DB connector. The outputs are direct coupled, actively balanced, with the capability to drive a 600 ohm impedance load. When operating in the mono mode, there are several options for the output audio signal mapping. For information about signal mapping, refer to the left and right toggle (L/R) and mute (MU) commands in *Chapter 5: Remote Monitor and Control Operation.*

During any type of signal or processing failure, the output audio is immediately muted to prevent audio blasting. Also, to provide blast-free audio channel changes, the audio is always muted prior to changing RF channels during audio channel changes. It is then unmuted once audio decoder sync is achieved.

An AES/EBU digital output interface is also available. This interface permits direct output of the 16-bit PCM samples. The interface operates using a 48 kHz sampling rate only. Newer studio equipment using the AES/EBU interface will provide a direct digital interface from the ABR200 for maximum performance.

For diagnostic testing and installation, test tones at 1 kHz and 9.6 kHz can be generated within the receiver for output to either the left, right, or both analog audio channels. This is accomplished through the audio test (AT) command, as described in *Chapter 5: Remote Monitor and Control Operation*. Audio tone generation permits verification of external equipment connection, proper channel phasing, level settings, distortion measurements, and the like. These tests can be controlled locally through the M&C port or from the uplink via the ANMS computer.

Cue Signaling

Up to 16 cue control lines can be input into the DAC multiplexer unit located at the uplink. These 16 cue lines independently control eight relay closures located at the ABR200 receiver. The cue inputs are typically connected to studio control consoles or event sequencers.

Since only eight contact closures are available at the receiver, a mapping must be made as to which eight of the 16 possible control inputs activate the closures. This mapping is performed at the ABR200 receiver using the contact mapping (CM) command or at the uplink via the ANMS control computer. The receiver defaults to have the first eight inputs at the DAC mux control the eight closures at the ABR200.

Any change in the state of an input line is sensed, and within two sample periods this change is muxed into the continuous transmission of the control channel. The input levels are continuously transmitted over the control channel at a rate specified by the DAC RM command every 100 msec (default setting). The relay contact closures at the ABR200 receiver directly track the logic levels (active, nonactive) at the uplink mux. Given the two default sampling rates, pulsed signals are reproduced within an accuracy of less than or equal to 50 msec.

Figure 2-9 provides a pictorial representation of the 16-to-8 mapping function that occurs for the cue signals within the ABR200 receiver.

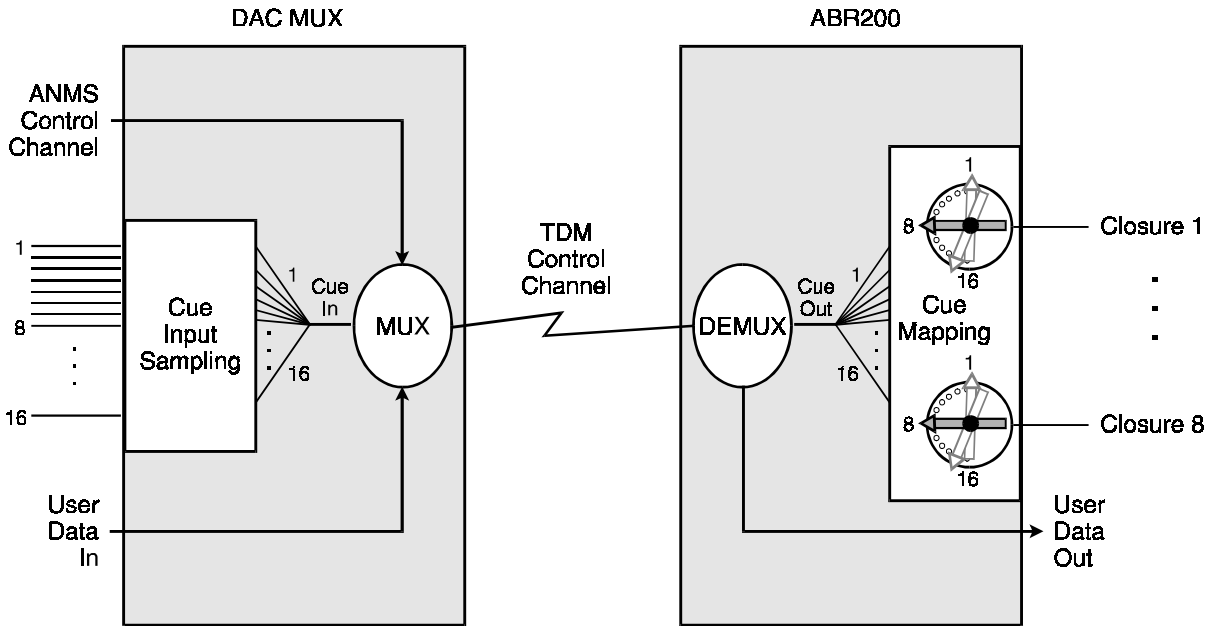

Figure 2-9. Cue Signaling System Diagram

Seven TTL sensor inputs are provided for external control of channel selection or for ancillary equipment monitoring. The first three inputs permit selection of up to eight different RF audio channels by connecting a rotary (or similar) switch to the inputs. Only a simple contact closure is required to perform audio channel changes. The actual RF channel frequencies and related operating parameters are programmed either locally or from the uplink and are stored in eight presets. For more information about the presets, refer to the preset definition (PD) command in *Chapter 5: Remote Monitor and Control Operation*.

The ComStream switch unit (CPN 03-0507-001), shown in Figure 2-10, allows the user to externally select one of eight preset channel configurations with a BCD complementary rotary switch. This unit is mounted into a one unit high chassis and has a front polycarb to allow the user to mark their presets. The unit attaches through a cable (CPN 05-0506-001) to the receiving ABR.

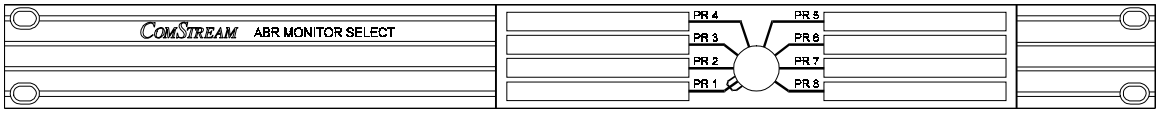

Figure 2-10. Switch Panel

The second group of three inputs can be used to trigger a fault condition within the receiver. These fault conditions are monitored and can be used to activate the status alarm relay. A brief summary of the possible trigger events are: low signal strength, loss of sync (audio or carrier), IDU and ODU Faults, and external inputs.

ABR200 Carrier Acquisition

Acquisition is the process the receiver uses to adjust its frequency, phase, gain, and synchronization to match the incoming carrier.

Acquisition of the carrier signal for the ABR200 is a sophisticated process. Frequency errors arising from temperature changes in the outdoor environment and the aging of components over time can make signal acquisition difficult. The ABR200 has been designed to overcome these errors by the use of internal synthesizers that correct for nearly all components of error, without operator intervention.

The automatic acquisition feature of the ABR200 operates in two distinct modes, installation and fade.

- Installation mode acquisition is performed when the system is locking onto a new carrier.
- Fade acquisition is performed when the receiver loses the carrier to which it was previously locked.

Added to this process is the identification of the correct carrier via unique channel identifiers transmitted within the control portion of the received audio stream. Each RF carrier is identified in two ways, a network identification (ID) number and a channel ID number. These ID numbers originate within the digital audio codec at the transmitter (uplink) site. All carriers on a single network are typically configured with the same network ID number. However, each RF channel is given a unique channel ID number. If the receiver tries to lock to an RF carrier with the incorrect network or channel identifier, the RF synchronization process is aborted and acquisition continues until the carrier with the proper network and channel number is acquired. This ensures that receivers are locked to their preassigned, authorized channel.

Installation Mode Acquisition

During installation, acquisition begins at the nominal carrier center frequency, which is user-defined by the channel configuration (CC) command.

An attempt to acquire the carrier begins by searching a range of frequencies, called a frequency bin, centered around the carrier frequency. The size of this range is determined by the computed B1 parameter value. If the ABR200 is unable to find the carrier within this range, the receiver will move to the next contiguous range below the center carrier frequency and repeat the process. If the carrier is not found there, the receiver will move to the next contiguous frequency above the center carrier frequency and continue the search.

The receiver will continue this process, each time searching the next outside range (on either side of the starting point) until the carrier is found, or until the user-defined acquisition range limit (B3) is reached. If the receiver reaches this limit, it will log an acquisition range fault (FL9) and repeat the entire process, starting again at the center carrier frequency. Figure 2-11 graphically describes the installation acquisition process.

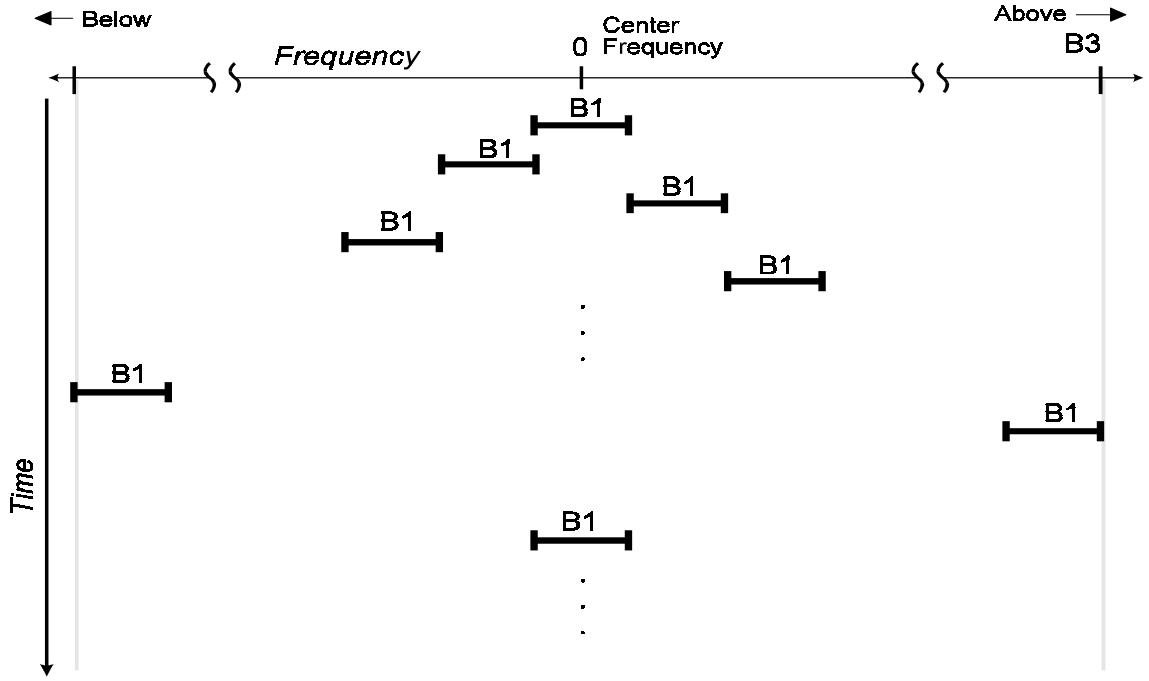

Figure 2-11. Installation Acquisition Mode

Immediately following RF carrier acquisition, the channel and network identifiers are matched against the configuration within the receiver. If these match, the RF Sync and Audio Sync indicators both illuminate and the signal is further processed by the ABR200. However, if either of the IDs do not match, an acquisition network ID fault (FL 31) is declared and the acquisition process continues until the correct signal is received and detected.

Fade Acquisition

Fade acquisition uses a different search pattern so as to concentrate the search in a narrower frequency range centered on the point the carrier was last seen, as illustrated in Figure 2-12, while still covering the entire user-defined search range (B3).

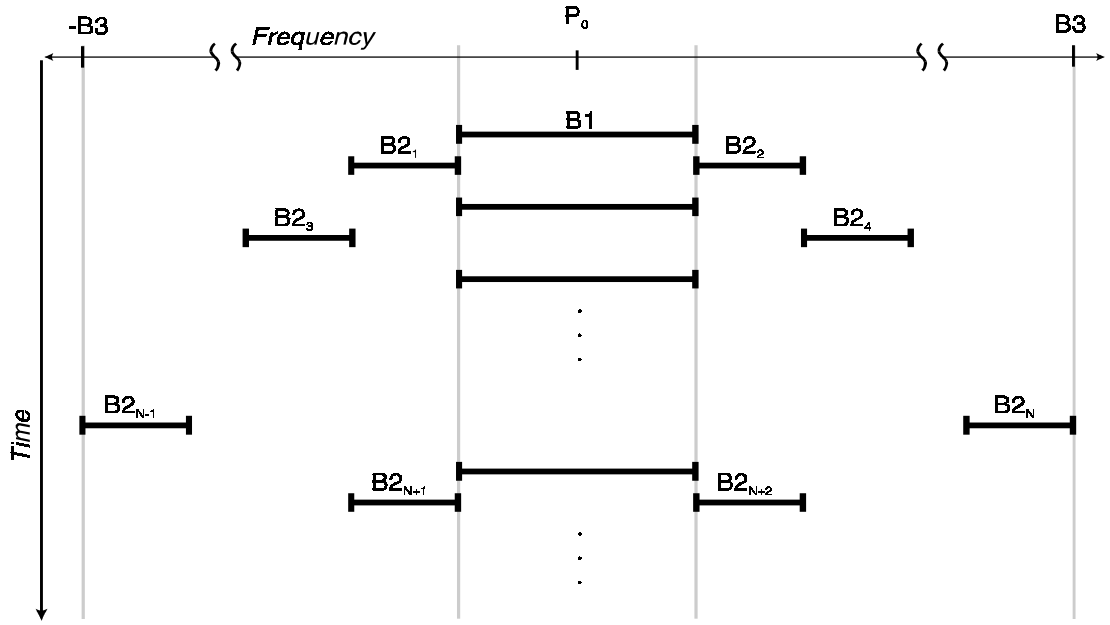

Figure 2-12. Fade Acquisition Mode

When the receiver loses the carrier, it starts a fade acquisition at the point it last saw the carrier. It searches the range centered on that point (P_0). The size of this range is defined by the B1 command. If no carrier is found, the search proceeds in the areas above and below simultaneously. The size of the range searched outside the B1 range is defined by the B2 command. These points are indicated in Figure 2-12 as $B2_1$ and $B2_2$.

Once the $B2_1$ and $B2_2$ ranges are searched, the receiver returns to P_0 and resumes the expanding search from the beginning. When the B1 limit is reached again, the system will search another B2 range beyond the last B2 attempts. If the carrier is still not found, the receiver will start again at P_0 and search the B1 range.

In this manner the system will expand the search until the carrier is found or the user-defined acquisition range limit (B3) is reached. If the range limit is reached without finding the carrier, an acquisition range fault (FL9) is declared and the entire fade acquisition process will begin again at P_0.

As previously mentioned, immediately following RF carrier acquisition the channel and network identifiers are matched against the configuration within the receiver. If these match, the RF Sync and Audio Sync indicators both illuminate and the signal is further processed by the ABR200. However, if either of the IDs do not match, an acquisition network ID fault (FL 31) is declared and the acquisition process continues until the correct signal is received and detected.

Chapter 3: Quick Installation

Overview

This chapter provides quick installation and startup instructions for experienced users who are familiar with satellite communications equipment.

It assumes that the:

- Satellite antenna is installed and aligned to the desired satellite
- IFL cable is properly installed and connected to the receiver and the LNB downconverter at the antenna
- ABR200 is configured correctly for your network

NOTE: Ensure AC power is off before connecting or disconnecting the IFL cable to the receiver.

Quick Installation Procedure

Under the above-listed conditions, the ABR200 is a plug-and-play component and the system startup is straightforward. If the above conditions do not apply, or if you experience problems following the Quick Installation procedure, refer to *Chapter 4: Full Installation and Startup*.

To perform quick installation:

1. Make sure the ABR200 is properly installed in an equipment rack with the following connected:
   - AC cord
   - IFL cable
   - Audio, data, and relay port cables

NOTE: Ensure adequate air flow is available around the unit.

2. If the receiver was not configured at the factory with customer-supplied satellite frequencies, then it must be configured by the end-user.

   To configure the receiver:

   – An RS-232 terminal (or software equivalent [i.e., PROCOMM®]) must be connected to the receiver Monitor and Control (M&C) port using the DB-9 to DB-25 adapter cable supplied.

   – The terminal must be configured to operate at 2400 baud, using 7 data bits, odd parity, and 1 stop bit.

   – The following commands and associated values must be entered at the terminal to program the minimal essential operating parameters. Items in italics are variable syntax depending on what information is being requested. (For more information about any of the following commands, refer to *Chapter 5: Remote Monitor and Control Operation*.)

     The ABR200 is factory preset for a PLL LNB, unless otherwise requested. Use of a DRO LNB requires that a master reset (MR) command be invoked first with the applicable argument shown below:

     `MR 0` {to select a DRO LNB}

     `MR 1` {to select a PLL LNB}

     - Enter the channel configuration for each channel to be used. Command format is:

       `CC channel_number,RF_frequency, symbol_rate,modulation_type`

     - Enter the definition for the service (format) that is to be received. Command format is:

       `FD format_number,network_id_number, channel_id_number,service_authorization`

     - Select the desired audio service channel using the FS (format select) command. Command format is:

       `FS format_number`

     - Initiate initial acquisition search mode by entering:

       `AQ 2`

3. Observe the following about the front panel indicators:
   - The green Power indicator is on and remains illuminated signifying that power is applied to the unit.
   - The front panel lights flash through a consistent sequence once the unit is powered on. The pattern the lights follow is dependent on the signal conditions and strength at your site.
   - When signal acquisition is complete, the RF Sync and Audio Sync indicators are illuminated (green) and the two fault indicators (red) are off.
   - The Signal indicator may or may not be illuminated based on the signal strength.
4. Check if audio is available at the audio output port. If the receiver configuration is correct and the receiver is permissioned from the uplink, then audio will be heard.

You are finished installing the ABR200 satellite audio receiver system.

For further verification of proper operation of the ABR200, or if there is a problem during quick installation, consult *Chapter 4: Full Installation and Startup*.

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Chapter 4: Full Installation and Startup

Overview

This chapter describes the steps necessary to install and start up a complete ABR200 Audio Broadcast Receiver. It presents separate instructions for outdoor equipment, the IFL cable, and indoor equipment.

The material in this chapter may be used as a guide to overall installation of a receiver site or a startup of selected components related to the ABR200 system.

Installation Overview

The overall steps for installing and starting up the ABR200 are as follows:

1. Plan the site.
2. Install and align the antenna.
3. Install the IFL cable.
4. Install the ABR200.
5. Connect the ABR200.
6. Start up the system.
7. Validate or verify the installation.

Planning the Site

The purpose of site planning is to specify where the various components of the receiver system are to be located and to identify any special installation or operational requirements. Time spent in planning prevents unnecessary complications during installation and allows potential problems to be resolved before work begins.

There are three main issues to be addressed:

- Location and mounting of the antenna assembly
- Routing of the IFL cable
- Location of the ABR200

Installing and Aligning the Antenna

The location of the receiving antenna is the first element to be considered. The antenna must be placed with an unobstructed line-of-sight path to the transmitting satellite. The antenna will not function properly if the path to the satellite is blocked or obstructed by buildings, trees, or other objects. If possible, placement should avoid situations that limit the field of view, such as buildings or large metal structures.

Aside from physical considerations, the location of the antenna requires compliance with local ordinances and building codes, particularly those pertaining to electrical conduits. This is particularly true if the outdoor portion of the cable is to be buried. The responsibility for complying with local ordinances rests solely upon the purchaser of the antenna. It is best to be aware of the local building and construction codes as early in the planning process as possible.

After the antenna assembly is complete, install the LNB and align the antenna as described in *Appendix E: Antenna Aiming and Peaking*. The LNB installation kit includes mounting hardware for most standard feed horns. Some feed horns may require different hardware (bolts, nuts).

Installing the IFL Cable

To ensure that the receiver operates properly, the IFL cable must meet the specifications described in *Appendix C: Interfacility Link (IFL) Cable Characteristics and Preparation*.

In most cases, the routing of the IFL cable from the antenna assembly to the ABR200 consists of an outdoor run, for one part of its length, and an indoor run for the remaining length. It is always advantageous to carefully plan the path for the run of the IFL cable since an improper installation can significantly degrade system performance.

In general, always try to minimize the length of the cable run. In addition, the specifications for the cable should be carefully reviewed with the proposed layout and intended system data rate in mind. For example, using the recommended RG-11 cable, a run of 400 feet is possible, assuming a 192 kbps data rate. Runs longer than 400 feet are possible using RG-35 cable or an L-band line amplifier (use L-band line amplifier LA-20 by Norsat (604) 597-6278) with a gain of 20 to 30 dB. Ensure that the line amplifier also passes on the 18 VDC line voltage to the LNB downconverter.

Table 4-1 provides information on maximum cable losses that are acceptable before signal degradation can be expected.

Table 4-1. IFL RG-11 Cable Loss vs. Data Rate (assuming 5 dB Eb/No LNB output)

Data Rate	Cable Loss Maximum (dB)
384 kbps	30.5
256 kbps	30.0
128 kbps	26.5
64 kbps	23.5

Installing the ABR200

Once the antenna has been properly located and installed, attention should be directed to the location of the receiver. The ABR200 functions over a wide range of power and environmental conditions. An autoranging power supply allows the receiver to use most common utility power feeds.

For maximum availability and reliability, connect the receiver to an uninterrupted power supply (UPS) to allow continued operation during power outages.

The low wattage requirements and small size of the unit make it adaptable to most installations. For detailed environmental specifications, refer to *Chapter 7: Technical Specifications and Port Information*.

The physical location of the ABR200 is flexible and largely depends on the location of the audio processing equipment rack. The ABR200 should be located close to the equipment it will serve.

Rack-Mount

Normally, the ABR200 rack-mount unit mounts in a standard 19-inch equipment rack, occupying one rack unit of height (1.75 inches).

To allow for adequate ventilation of the ABR200 in a rack, the ABR requires one rack unit (1U) of free air space above it. A low to moderate heat generating chassis can be placed directly above the ABR200, but it must not cover the ventilation holes on the rear cover. Alternatively, the front panel spacing can be filled in with a blank 1U rack panel, or any other shallow, nonheat-generating filler, such as a switch plate.

The maximum ambient temperature specification for the ABR200 is 50º C. This temperature is measured one inch from either side of the receiver within the rack enclosure. This temperature must not exceed 50º C to maintain the product's warranty. Proper rack ventilation and forced air flow techniques should be used to ensure the internal ambient temperature within the rack does not exceed the ABR200 specifications.

ComStream strongly recommends that surge suppression be used on the AC input to the ABR200, or any rack that contains an ABR200. There are many surge suppression vendors that can recommend and supply products to meet your voltage and power requirements.

In addition, placement of the ABR200 should allow access to its rear panel.

Desktop

To ensure proper ventilation cooling of the desktop unit, do not place obstructions within six inches of the ventilation holes on the sides or on top of the unit.

NOTE: The IDU should be rack-mounted only in enclosures that will not exceed an ambient temperature of 50° C.

External Connections

This section describes the physical and electrical connections to the ABR200 receiver.

CAUTION: Ensure that the power to the ABR200 is off when connecting or disconnecting either end of the cable that connects to RF In. Failure to do so may cause equipment damage.

All external connections to the ABR200 are made through the rear panel connectors. The ABR200 has eight possible connections on the rear panel. The location of these connectors is shown in Figures 4-1 and 4-2 for the rack-mount and desktop models, respectively. Each connector is different, either in size or type, from the other (except for RF In and Out) so that errors are minimized in making connections.

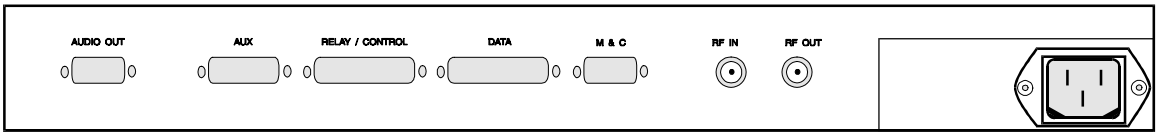

Figure 4-1. ABR200 Rear Panel Connectors, Rack-Mount Chassis

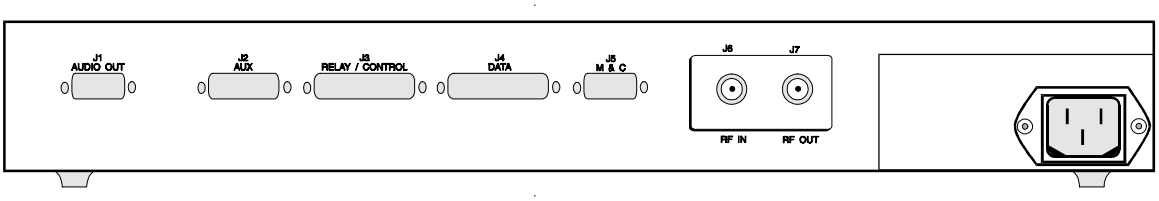

Figure 4-2. ABR200 Rear Panel Connectors, Desktop Chassis

The pinouts for these interfaces are detailed in *Appendix A: Interface Pinouts*.

NOTE: To ensure compliance with emission standards, all signal cables connected to the receiver should be shielded. The shield must be electrically attached to the mating connector.

Audio Out

Connector Type: DB-9, Male (Analog Audio)

The Audio Out port provides the analog audio output for left and right audio channels. The outputs are direct coupled, actively balanced, with the capability to drive 600 ohm impedance. To ensure against circuit damage resulting from short circuits, a series current-limiting resistor (30 ohm) is placed between the op-amp output and the connector.

When operating in the mono mode, there are several options for the output audio signal mapping. For information about signal mapping, refer to the left and right toggle (L/R) and mute (MU) commands in *Chapter 5: Remote Monitor and Control Operation*.

A mating female DB-9 connector, with a metal shell cover, is supplied with the audio receiver for connecting to studio equipment. The user is required to supply the interconnecting cable, which should be a shielded, twisted pair audio cable.

AUX (Auxiliary)

Connector Type: DB-15, Female (Various Signals)

The auxiliary port provides a connection to a variety of signals for optional use, including:

- Status relay contacts
- Digital audio output
- AGC monitor voltage
- Composite (ISO/MPEG Layer II/IIA data) synchronous RS-422 receive clock/data output

Status Relay

The Status Relay contacts are made at this connector. The Status Relay output provides the capability for an external indication of errors in the satellite receiver system operation. The Status Relay tracks the front panel IDU Fault indicator and consists of a contact closure that remains inactive during normal operation.

When an error condition is observed, the relay will activate, allowing the situation to be detected. The sense of the relay may be programmed to be either inactive open or closed using the status relay sense (SS) command described in *Chapter 5: Remote Monitor and Control Operation*. The Status Relay may be used to switch in an alternate audio source feed or to trigger an audio alarm to alert the operators that a problem exists.

A powerful feature of the Status Relay is its ability to be programmed to trigger when specific user-selected fault conditions are detected while ignoring others. This allows the status relay actions to be customized for the conditions at a specific receiver installation. The status relay mask (SR) command provides this customizing ability. (For specific details, refer to *Chapter 5: A Remote Monitor and Control Operation*.)

There is a short circuit between pins 1 and 2 on the physical layout of the relay K1; this translates to pins 2 and 9 on the ABR connector J2, as shown in Figure 4-3. If a fault occurs or the power supply fails, the connection becomes an open circuit.

NOTE: The Status Relay output should not be used to switch currents greater than 1 amp.

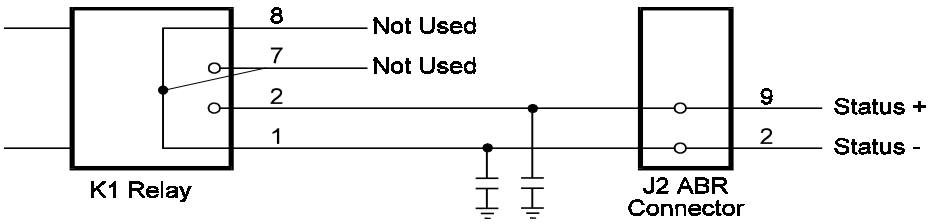

Figure 4-3. Relay K1 and J2 ABR Connector

AES/EBU Digital Audio Output

A digital pulse coded modulation (PCM) audio output is also available. This interface operates per the AES/EBU interface specification. This interface permits direct connection to studio equipment or digital audio tape recorders that support the AES/EBU interface. Higher quality audio is thereby possible since all of the digital-analog and analog-digital conversion noise is alleviated with digital PCM.

AGC Monitor Voltage

For aiding in antenna pointing, an analog version of the automatic gain control (AGC) is made available on this connector. The analog voltage range is from 0 to 10 VDC and is a representation of the incoming signal strength. This voltage is measured with respect to the signal ground, pin 1, on the Auxiliary connector. Zero volts indicates there is no receive signal present, and 10 volts indicates the receive signal is at the maximum level, as shown in Figure 4-4.

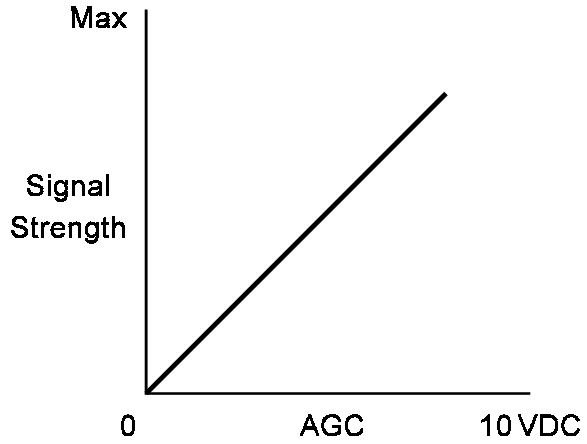

Figure 4-4. Signal Strength versus AGC Voltage

RS-422 Digital Audio Output

The undecoded audio data stream is on this connector as RS-422 data and clock signal pairs. This interface operates synchronously with the output data being valid on the falling edge of the receive timing clock that is also provided. Possible use for this data is to implement a store and forward digital audio system. The encoded audio data stream can be directly stored onto a hard disk device and then later played back into a ISO/MPEG Layer II/IIA decoder or the ABR200.

Relay/Control

Connector Type: DB-25, Male (Various Signals)

The Relay/Control port provides eight separate form A (SPST) relay contacts that are controlled from the uplink. Each contact can be programmed independently or in combination with other contacts. The polarity (normally open or closed) is also configurable (either locally or from the uplink). The relay contacts are intended to be used to control external equipment, either audio or other station equipment.

Seven TTL sensor inputs are provided for external control of channel selection or for ancillary equipment monitoring. Each input is internally pulled up to +5 VDC through a 4.7 K ohm resistor. These inputs can be directly monitored via the TTL sensor input query (SI) command. The first three inputs permit selection of up to eight different RF audio channels by connecting a rotary (or similar) switch to the inputs. A contact closure from the input to the ground pin provided on this connector activates the input. The actual RF channel frequencies are programmed either locally or from the uplink and are stored into eight presets.

The second group of three inputs can be used to trigger an automatic dial-out trouble reporting call into the uplink facility when activated. (For more information, refer to the FL command section in *Chapter 5: Remote Monitor and Control Operation*.) The seventh input is used as the M&C Port reset.

Also available on this port is +12 VDC. The output is currently limited to 50 mA. One possible use for this voltage is to support interfacing to coupled inputs of user equipment.

Data

Connector Type: DB-25, Female (RS-232)

The Data port provides an asynchronous RS-232 data output. The data is part of the audio data stream transmitted from the uplink. Data rates up to 9600 baud are supported. The port can be configured by the user via the user data port configuration (P1) command described in *Chapter 5: Remote Monitor and Control Operation*. Flow control is not implemented for this interface.

NOTE: To use the 9600 bps speed, the receiver must have version 1.16 or higher of the ISO/MPEG Layer II/IIA decoder software installed. Otherwise, the maximum throughput is 4800 baud.

NOTE: The sending device (i.e., DAC400) must use 2 stop bits with the ABR200 Data port configured for 1 stop bit. For data channel configuration information, refer to the *DAC400 Installation and Operation Guide*.

M&C

Connector Type: DB-9, Female (RS-232)

The M&C port is used to connect an RS-232 control terminal or telephone modem to the ABR200. During normal system operation, commands are received from the uplink via the control channel. However, control and diagnostic commands can also be issued to the receiver through this port. During normal operation, the front panel LED indicators display summary failure information. The diagnostic port is used to provide detailed information on the ABR200 status.

The M&C port is configurable via the M&C port configuration (P2) command described in *Chapter 5: Remote Monitor and Control Operation*.

With the ComStream-approved, Hayes-compatible telephone modem (CPN 30-0120-194) connected to the M&C port, a terrestrial backlink to a network uplink can be established for remote performance monitoring. (For more information about telephone modem operation, refer to *Appendix B: Telephone Modem Operation*.)

NOTE: The data terminal ready (DTR) lines must be active for proper operation. The default port configuration is 2400 baud, 7 data bits, 1 stop bit, and odd parity.

Since the M&C port can be reprogrammed, it may be necessary to reset the port to the default configuration. To reset:

1. Connect the MCRESET (Relay Control port, pin 12) pin to signal ground (Aux port, pin 1).
2. Remove and reinsert the power cord of the ABR200.
3. After power is turned on and the initialization process is complete, disconnect pin 12 from pin 1.

RF In

Connector Type: F, 75 ohm, Female (RF)

The RF In port is the primary input to the receiver. The RF signal is brought into the receiver through this connector. ABR200 units may be daisy-chained by connecting the RF Out of one unit to the RF In of another.

The power of the input carrier should be in the range of -75 dBm to -30 dBm with the RF frequency in the range of 950 MHz to 1700 MHz. The total power in the 950 MHz to 1700 MHz band should be less than -10 dBm. The input impedance is 75 ohm, with a return loss of greater than 8 dB.

The RF In connector on the back panel also supplies +18 VDC (500 mA maximum) to the LNB downconverter. This is supplied through the center conductor of the connector via the IFL cable. Caution should be exercised when:

- Fabricating an IFL cable. Using connectors or cables other than those specified in *Appendix C: Interfacility Link (IFL) Cable Characteristics and Preparation* may result in shorting the +18 V to connector ground, which may damage the equipment. Ensure the cable's center conductor slides into the receptor cup of the connector's center pin prior to crimping the connector.
- Connecting any extraneous test equipment (e.g., simulator) to the RF In port. A suitable DC blocking capacitor must be connected between the port and external equipment to prevent a possible short from overloading the internal +18 V regulator circuitry.

NOTE: Ensure that power to the ABR200 is off when making connections on either end of the cable that connects to RF In.

RF Out

Connector Type: F, 75 ohm, Female (RF)

The RF Out connector provides a buffered duplicate of the signal presented to the RF In connector. The RF Out can be used to connect an L-band video receiver for receive-only video applications or to connect additional ABR200 receivers for simultaneous reception of multiple audio channels. It can also be used for diagnosing problems in system performance or as an aid in antenna pointing.

The frequency range of the Video Output is identical to that of the receiver, 950 MHz to 1700 MHz. The gain of the Video Output is -2 dB to +5 dB, nominal +2 dB. The output impedance is 75 ohm with a return loss greater than 8 dB.

Power Connector

Connector Type: IEC 320, Male socket

The ABR200 power supply is autoranging from 90 to 264 VAC and 47 to 63 Hz. Maximum power supply output for the ABR200 is 52 watts. The typical power consumption for the ABR200 is less than 40 watts. There is no power on/off switch on the receiver. Remove the AC power cable from the unit to turn the power off.

NOTE: Always power down the ABR200 before connecting or disconnecting signal cables to the unit.

If an unterminated power cord is supplied with the unit, the appropriate certified termination plug must be installed. The power cord wires are color-coded as follows:

- Green and Yellow: earth/ground
- Blue: neutral
- Brown: live

If the color code described does not correspond to the colored markings identifying the terminals in your plug, proceed as follows:

1. The green and yellow wire must be connected to the terminal in the plug marked by the letter E or by the earth symbol, or colored green and yellow.
2. The blue wire must be connected to the terminal marked with the letter N, or colored black.
3. The brown wire must be connected to the terminal marked with the letter P, or colored red.

Table 4-2 lists the required certifying agencies for some countries.

Table 4-2. Certifying Agencies by Country

Country	Agency	Country	Agency	Country	Agency
Australia	SAA	Ireland	IIRS	New Zealand	HECT
Austria	OVE	Italy	IMQ	"	SANZ
Belgium	CEBEC	Japan	MITI	Norway	NEMKO
Canada	CSA	Netherlands	KEMA	Republic of South Africa	SABS
Denmark	DEMKO	New Zealand	SECV	Spain	AEE
Finland	FEI	"	SECQ	Sweden	SEMKO
France	UTE	"	SECWA	Switzerland	SEV
Germany	VDE	"	EANSW	United Kingdom	ASTA BSI
India	ISI	"	ETSA		

Starting Up the System

This section describes the activities necessary to bring an assembled ABR200 system online. The following steps assume that the antenna, IFL cable, and ABR200 have been properly installed and connected. Do not proceed until this setup is complete.

NOTE: Always power down the ABR200 before connecting or disconnecting either end of the cable that connects to the RF In port.

If problems are encountered in the startup sequence, refer to the "Startup Problems" section of this chapter and *Chapter 6: Maintenance and Troubleshooting*.

To start up the ABR200:

1. Make sure the ABR200 is properly installed in the equipment rack with the IFL cable and the audio/data cables connected.
2. Turn on the unit by connecting the AC power cable to the unit and observe the front panel LEDs. The front panel lights flash through a consistent sequence when the unit is first powered on. The pattern the lights follow is dependent on the signal conditions and strength at your site. When acquisition is complete, the Power, RF, and Audio Sync LEDs are illuminated, and the IDU and ODU Fault LEDs are not illuminated. The Signal LED may or may not be illuminated based on the signal strength and the Q0 (Low Signal Quality Threshold Level) and Q1 (High Signal Quality Threshold Level) command settings.
3. Check to see if audio is available at the Audio Out port. If the network is properly configured and the receiver properly authorized, audio will be present.

At this point the ABR200 is ready for verifying proper equipment setup and operation.

Validating Installation

Once the ABR200 has been powered up, verify that the unit is connected properly for the audio, data, and relay ports. This is accomplished by communicating with the receiver using an ASCII terminal and performing several diagnostic commands. The electrical interface is RS-232, and the DB-9 to DB-25 adapter cable supplied should be used to connect the receiver's M&C port to the DB-25 connector on your terminal. The terminal should be configured for 2400 baud, 7 data bits, 1 stop bit, and odd parity.

To establish communication with the receiver:

1. At the ASCII terminal connected to the ABR200, press the ENTER key on the terminal. The receiver should respond with an ASCII login request string.
2. Type the default password **HOMEYD** (must use all caps). When successful communication has been accomplished, the terminal displays a > prompt, indicating it is ready to accept commands.

Once the communications link with the ABR200 is established, the following steps can be used to verify proper receiver operation.

NOTE: For an alphabetical listing of commands and proper command syntax, refer to *Chapter 5: Remote Monitor and Control Operation.*

1. Validate the:
   a. Audio interface. Enter **AT 3** and verify that a 1000 Hz audio tone is present on both left and right audio outputs. This can be accomplished at the receiver or at an appropriate patch panel location. Use the **AT 1** and **AT 2** commands, respectively, to properly identify left and right channels. When the test is complete enter **AT 0**.
   b. Relay port interface. Each individual relay closure contact can be activated (closed/opened) or deactivated (opened/closed) via the terminal using the **CO** (contact closure) and **CS** (contact sense) commands. Each line should be verified to exercise the external equipment connection to ensure proper operation. Ensure that CO is returned to all Xs.

c. Data port interface. Connect the data port to the data terminal equipment (DTE) device. Ensure the data port configuration (P1 command) and the DTE configuration agree. At the M&C terminal enter **`X1 1`** to initiate the data port test. The string, `THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 0123456789`, should be printed out at the DTE. If not, recheck all connections and configurations. When finished, enter **`X1 0`** to stop the test.

d. Receiver operation. Enter **`ST ?`** to verify the status of the ABR200. The ST 0 response indicates status zero or no faults.

- Enter **`CF 0`** to clear the fault register.
- Enter **`EB ?`** to verify the Eb/No of the link.

2. Verify the operation of the ABR200 compared to the link budget for a particular installation. Enter **`FL 0`**. The response should be `FL 0` indicating no faults have been detected since the CF 0 command. Keep in mind that other factors, such as weather, may affect this measurement. If faults are observed, refer to *Chapter 5: Remote Monitor and Control Operation* for more information on the FL command.

At this point, the ABR200 installation is verified and ready for normal operation.

Startup Problems

This section describes common problems encountered during startup. In general, the ABR200 has been designed for unattended operation and few problems should be encountered.

The ABR200 is factory preset for a PLL LNB, unless ordered otherwise. Use of a DRO LNB requires that a master reset (MR) command be invoked with the applicable argument shown below:

`MR 0` {to select a DRO LNB}

`MR 1` {to select a PLL LNB}

For more information, refer to *Chapter 5: Remote Monitor and Control Operation*.

The receiver will not lock onto the satellite signal

The most common cause of this problem is a lack of signal at the RF input. If there is a problem with the signal, most likely it is improper pointing of the antenna or the IFL cable. An indication of a lack of signal is the AGC value. If the AGC gain factor (AG) command (AG ?) indicates a value of 255, there is no signal present.

To troubleshoot this problem:

1. Ensure the antenna is properly assembled, and recheck the antenna alignment to ensure it is pointed to the proper satellite. If not, refer to *Appendix D: Antenna Installation (Prodelin)* and *Appendix E: Antenna Aiming an dPeaking* for instructions.
2. Check the connectors on the IFL cable for proper installation. With the cable disconnected, ensure the cable passes a continuity and no-short test.
3. Measure the DC output of the ABR200 at RF Out. The DC level should be approximately 18 V. If DC is present here, the ABR200 power supply is OK.
4. Attach the IFL cable to the ABR200 and measure the DC voltage at the antenna end of the cable. If there is no DC voltage present on the center conductor of the IFL, the cable is defective.
    - If the DC value is below 15 V, there is an excessive DC voltage drop in the cable due to improper installation or use of the incorrect cable for the distance.
    - If the DC value is 15 V minimum, connect the cable to the LNB downconverter. If the AG value is still 255, then the LNB downconverter is probably defective or the antenna is not pointed correctly.
5. Ensure the correct polarization of the LNB for the network is set. If it is incorrect, you could have a strong AG value but not be able to lock on to the carrier.

If the antenna is pointed correctly and the signal is present (AG other than 255), but the unit will not acquire, then there could be many possible causes. Enter **DP** on the diagnostic terminal. Check the values of B1, B2, and B3.

Check the values of the FS, FD, and CC commands. These are dependent on the network configuration. If these commands do not match the values for the network hub, the receiver will not acquire the signal. Contact the Network Administrator for assistance.

If any of the other values vary from their expected values, change it to its proper value and enter **AQ 2** to restart signal acquisition.

No audio is received from the Audio Out port

If the front panel Audio Sync LED is on (signal is locked) but no audio is available, the most likely cause is that the receiver is not authorized to receive audio or there is a cabling problem.

To troubleshoot this problem:

1. Double check the pinouts on the cable and run the audio test described in the previous section.
2. Execute the audio sync status (AS) command, which will indicate if the audio output is muted and why. For more information, refer to *Chapter 5: Remote Monitor and Control Operation*.
3. Check with the Network Administrator to ensure audio is available on the output port you are checking.

For other problems or ideas, refer to *Chapter 6: Maintenance and Troubleshooting.*

Using the DAC400 and ABR200 in Baseband Mode

To operate the DAC400 with the ABR200 in baseband mode, a cable must be built as per the information presented in Table 4-3.

Table 4-3. Cable for Direct Connection Between DAC400 and ABR200 Decoder (no modem)

Encoder DB-15, Male, Line 1 Pin Number	Signal Name	ABR200 DB-15, Male, Aux Port Pin Number	Signal Name
2	Send Data A	7	RD+
9	Send Data B	14	RD-
7 (jumped to 3*)	Send Timing A	13	RT+
14 (jumped to 10*)	Send Timing B	6	RT-
8	Signal Ground	1	Signal Ground

* Shorted on same connector

To operate in baseband mode, follow these steps:

1. Place the receiver in DX 2 mode, this will input the ISO/MPEG Layer II/IIA data stream from the DAC400 to the baseband input of the receiver's Aux port.
2. Set dipswitch 10 of the DAC400 to the up position, so as to provide a clock to the modem.

Chapter 5: Remote Monitor and Control Operation

Overview

In audio distribution networks, the ABR200 is normally configured and controlled from the uplink via the Audio Network Management System (ANMS). In this configuration, the user typically does not need to communicate directly with the receiver. However, during receiver installation, troubleshooting, or performance monitoring, direct communication may be required.

This chapter details the remote control operation of the receiver. Complete monitoring and control of the receiver is available using an ASCII computer terminal connected to the RS-232 M&C port located on the rear of the unit. Alternatively, a telephone modem may be connected to the M&C port permitting access from a remote terminal. (For more information, refer to *Appendix B: Telephone Modem Operation*.)

Commands are input by the user to set or display ABR200 parameters. ABR200 codes are output by the receiver to indicate errors, faults, or current status. This chapter:

- Describes the ABR200 command syntax
- Explains each functional group of commands
- Presents errors, faults, and status codes
- Provides an alphabetical listing of all ABR200 commands and codes

Command Syntax

Commands are input to the ABR200 by sending a sequence of ASCII characters to the receiver M&C port. Each message consists of an (optional) escape character, a two-letter mnemonic string, a single-space character, and an optional parameter followed by a carriage return. All characters following the carriage return but preceding the next escape character are ignored. Commands may be entered in either upper or lowercase.

Most commands are used to establish internal parameter values and interrogate their current value. The parameter may be either a single-digit number referenced as *n*, a multiple-digit number referenced as *nnnnn*, or a single ASCII character or string designated *s* or *string*. Syntax that appears in italics represents variable characters; this syntax varies depending on what information is being requested.

Parameter values are interrogated by replacing the numeric parameter in the command string with a question mark (?) character, or by simply entering a carriage return immediately following the two-character command. Some commands do not have parameters associated with them and are terminated with a carriage return.

Example 1:

command SP ?

Example 2:

command

The first example requests the receiver display the current parameter value(s). The second example demonstrates the syntax for a command that does not require a parameter (i.e., RE, DC, DP, etc.).

Command actions are performed if the:

- Command is valid
- Parameter value is within the valid range
- Parameter value or command is compatible with the present receiver configuration
- Command or query can be executed immediately

Commands that do not follow these guidelines produce an error code.

Password Protection

In providing a measure of security from unauthorized access to the receiver, a login password is provided. The factory default for the password is HOMEYD. The sense of capitalization is important only for the password. The command and associated parameter syntax is such that the character case is not distinguished. The user is requested to change the password, using the password change (PC) command, if protection is desired.

Command Error Codes

Command errors occur when a command has been mistyped, is inappropriate, or cannot be immediately executed. The normal response of the receiver is to display one of the error codes/descriptions shown in Table 5-1.

Table 5-1. Error Codes/Descriptions

Error	Description
ER 1	Command format error
ER 2	Parameter out of range
ER 3	Command not supported by configuration
ER 4	Command temporarily not supported

Command Groups

Most commands establish the operating characteristics of the receiver. These commands install permanent values into memory that remain in place unless changed by the operator. Operators should avoid changing configuration values unless they are certain of the result. Most of the operating parameters are established at the uplink at the time of installation and do not change except under specific conditions.

ABR200 commands are grouped into nine functional areas:

- L-band Demodulator
- Channel Control
- Audio Port
- Data Port
- Relay Port
- M&C Port
- Alarm/Status
- Front Panel
- Miscellaneous

Tables 5-2 through 5-11 list the commands and their description.

NOTE: The characteristics and use of each command group, along with a summary of commands in the group, are discussed in following sections. The detailed usage and syntax of individual commands is presented in the alphabetical listing at the end of this chapter.

Table 5-2. L-band Demodulator Commands

Command	Description
AG	AGC Gain Factor
AO	Acquisition Offset Frequency
AQ	Acquisition Mode
B1	Primary Search (Binning) Range
B2	Secondary Search (Binning) Range
B3	Overall Search (Binning) Range
CE	Channel Error Rate
DC	Display Configuration of Receiver
DQ	Data Rate Query
EB	Eb/No Signal Level Query
EM	Eb/No Minimum Receive Level
LO	Local Oscillator Offset
LT	LNB Type
RB	Read Calculated Bit Error Rate
RF	Read RF Value

Table 5-3. Channel Control Commands

Command	Description
CC	Channel Configuration
FD	Format Definition
FS	Format Select
LA	Logical Address Definition
LC	Local Format Change Permission
NS	Network Status
PD	Preset Definition

Table 5-4. Audio Port Commands

Command	Description
AS	Audio Status
AT	Audio Test
LR	Left/Right Channel Toggle
M0	Eb/No Mute On
M1	Eb/No Mute Off
MU	Audio Mute

Table 5-5. Data Port Commands

Command	Description
P1	User Data Port Configuration
S1	Interface Select for Auxiliary Data
X1	Exercise User Data Port

Table 5-6. Relay Port Commands

Command	Description
CM	Relay Contact Mapping
CO	Relay Contact Control
CQ	Relay Contact Query
CS	Relay Contact Sense

Table 5-7. M&C Port Commands

Command	Description
BY	Bye—Logout
EE	Echo Terminal Input
P2	M&C Port Configuration
PA	Packet Address
PC	Password Change
PO	Packet-Only
S2	Monitor and Control Interface Select
X2	Exercise M&C Port

Table 5-8. Alarm/Status Commands

Command	Description
AL	Alarm Reporting
CF	Clear Fault Register
ET	Eb/No Alarm Threshold Level
EX	Maximum Eb/No
FL	Fault Query
HM	Hex Mode
NF	Number of RF Signal Fades
SI	TTL Sensor Input Query
SL	Audio Sync Loss Counter
SR	Status Relay Mask
SS	Status Relay Sense
ST	Status Query

Table 5-9. Front Panel Commands

Command	Description
OM	ODU Fault Mask
Q0	Low Signal Quality Threshold Level
Q1	High Signal Quality Threshold Level

Table 5-10. Miscellaneous Commands

Command	Description
AP	CS8204 Inputs
DE	Composite Data Port Enable
DM	Display Message
DP	Display Parameters of Receiver
DX	Decoder Data Source
EN	Enable Network Data
ID	Receiver ID Query
MR	Master Reset
P3	Printer Port Configuration
RE	System Reset

Table 5-11. Terrestrial Backlink Commands (v1.37)

Command	Description
AI	Alarm Interval
F1	Fault Mask 1
F2	Fault Mask 2
T1	Backlink Telephone Number 1
T2	Backlink Telephone Number 2
TB	Terrestrial Backlink
TI	Telco Initialization

Table 5-12. Alphabetical Command Listing

Command	Description
AG	AGC Gain Factor
AI	Alarm Interval
AL	Alarm Reporting
AO	Acquisition Offset Frequency
AP	CS8204 Inputs
AQ	Acquisition Mode
AS	Audio Status
AT	Audio Test
B1	Primary Search (Binning) Range
B2	Secondary Search (Binning) Range
B3	Overall Search (Binning) Range
BY	Bye—Logout
CC	Channel Configuration
CE	Channel Error Rate
CF	Clear Fault Register
CM	Relay Contact Mapping
CO	Relay Contact Control
CQ	Relay Contact Query
CS	Relay Contact Sense
DC	Display Configuration of Receiver
DE	Composite Data Port Enable
DM	Display Message
DP	Display Parameters of Receiver
DQ	Data Rate Query
DX	Decoder Data Source
EB	Eb/No Signal Level Query
EE	Echo Terminal Input
EM	Eb/No Minimum Receive Level
EN	Enable Network Data
ET	Eb/No Alarm Threshold Level
EX	Eb/No Maximum
F1	Fault Mask 1
F2	Fault Mask 2
FD	Format Definition
FL	Fault Query
FS	Format Select
HM	Hex Mode
ID	Receiver ID Query
LA	Logical Address Definition
LC	Local Format Change Permission

Table 5-12. Alphabetical Command Listing (continued)

Command	Description
LO	Local Oscillator Offset
LR	Left/Right Channel Toggle
LT	LNB Type
M0	Eb/No Mute On
M1	Eb/No Mute Off
MR	Master Reset
MU	Audio Mute
NF	Number of RF Signal Fades
NS	Network Status
OM	ODU Fault Mask
P1	User Data Port Configuration
P2	M&C Port Configuration
P3	Printer Port Configuration
PA	Packet Address
PC	Password Change
PD	Preset Definition
PO	Packet-Only
Q0	Low Signal Quality Threshold Level
Q1	High Signal Quality Threshold Level
RB	Read Calculated Bit Error Rate
RE	System Reset
RF	Read RF Value
S1	Interface Select for Auxiliary Data
S2	Monitor and Control Interface Select
SI	TTL Sensor Input Query
SL	Audio Sync Loss Count
SR	Status Relay Mask
SS	Status Relay Sense
ST	Status Query
T1	Backlink Telephone Number 1
T2	Backlink Telephone Number 2
TB	Terrestrial Backlink
TI	Telco Initialization
X1	Exercise User Data Port
X2	Exercise M&C Port

Command Descriptions in Alphabetical Order

Following is a list of commands with a detailed description of each command. Some commands are only available for software versions 1.37 or higher. These commands are also explained in *Appendix G: Version 1.37 and 1.38 Changes*.

Items in italics are variable syntax depending on what information is being requested.

AG AGC Gain Factor

Syntax: **AG ?**

The AG command displays the gain factor applied to the received RF signal. During normal operation, the gain factor is constantly adjusted so that it brings the baseband signal to the same level regardless of input signal power. A value of 255 indicates no signal is present. A value of 0 indicates the receive signal is too strong.

AI Alarm Interval (v1.37+)

Syntax: **AI *n***

AI ?

The alarm interval command allows the user to specify the length of time the receiver waits between backlink attempts. This command also allows the user to disable the monitoring for faults that may cause an attempt to establish a backlink.

n specifies the length of time the receiver waits between backlink attempts when a fault is detected. The range for *n* is 0 to 65535 and the units are in minutes. A value of 0 for *n* disables the monitoring of faults, which prohibits the receiver from attempting any backlinks.

AL Alarm Reporting

Syntax: **AL *n***

AL ?

This command enables/disables the automatic reporting of alarms to the M&C port. Acceptable parameter values (*n*) are 1 for enabling fault reporting and 0 for disabling fault reporting. This command has no effect on the operation of other commands, such as ST (status query) and FL (fault query). The status of the faults can still be monitored by the FL query (?) command. The default value is 1 (enabled).

AO Acquisition Offset Frequency

Syntax: AO ?

The AO command is a query-only command that displays the value of the acquisition offset. The acquisition offset is used to optimize the power-on acquisition process. The acquisition offset value is used by the ABR200 in its calculations for the frequency at which it will begin its search for the RF carrier on a power-on acquisition. The value of AO is automatically updated to the local offset (LO) value if the LO value is ever greater than 1 MHz. On subsequent power cycles, the ABR200 uses this offset value in AO to shorten the time needed to find the RF carrier.

AP CS8204 Inputs

Syntax: AP *n*

AP ?

This command allows the user to configure the AES/EBU interface. This interface provides a digital PCM audio output on the Aux port connector of the ABR200. This interface operates per the AES3-119X (ANSI S4.40-199X) interface specification. This specification allows transmission of control information along with the digital audio data stream.

The ABR200 uses the CS8204 digital transmitter manufactured by Crystal semiconductor. The CS8204 is only operated in the professional (PRO) mode. The AP command provides users with the ability to program specific values at the input pins of the CS8204, and these pins will specify the control information to be transmitted.

The AP command is AP *n*, where *n* is the decimal equivalent of the bit map of the CS8204 control interface, shown in Table 5-13. The default value for AP is 15.

Table 5-13. CS8204 Programming Inputs

Bit Position	CS8204 Pin Name	Function	*n*
0	EM 0	Encoded encoder emphasis	1
1	EM 1	Encoded encoder emphasis	2
2	C1/	Inverse of channel status bit 1	4
3	C6/	Inverse of channel status bit 6	8
4	C7/	Inverse of channel status bit 7	16
5	C9/	Inverse of channel status bit 9	32
6	CRE	Sample address counter control	64
7		Not Applicable (N/A)	N/A

The inputs to the CS8204 are encoded as shown in Table 5-14.

Table 5-14. CS8204 Programming States

Pin Name	Input State	Option Selected
EM 0, EM 1	1,1 *	Receiver defaults to no emphasis, manual override enabled
	0,0	CCITT J.17 emphasis, no override
	1,0	50/15 usec emphasis, override disable
	0,1	No emphasis, manual override disable
C1\	0	Nonaudio mode
	1 *	Normal audio mode
C6\,C7\	1,0 *	Sampling frequency = 48 kHz, no override or autosetting
	1,1	Sampling frequency defaults to 48 kHz with manual or autosetting enabled
C9\	0 *	Stereophonic mode, channel 1 is left, manual override is disabled
	1	Receiver defaults to 2 channel mode, manual override is enabled
CRE	0 *	Sample address counter reset
	1	Local sample counter and reliability flag are internally generated

* Default value

AQ Acquisition Mode

Syntax: **AQ *n***

AQ ?

This command is used to establish the acquisition type and to query the receiver for the currently active acquisition type. The value of *n* specifies what type of acquisition the receiver is to perform or, if queried, reports back the status of the receiver's acquisition state. Table 5-15 is a listing of the acquisition types and the corresponding action or status that they represent.

Table 5-15. Acquisition Type, Action, and Status

Type	Action	Status
0	Disable acquisition	Acquisition disabled/complete
1	Initiate fade acquisition	Fade acquisition in progress
2	Initiate power-on acquisition	Power-on acquisition in progress
3	None	Channel change acquisition in progress

An acquisition mode of 0 indicates acquisition has been disabled or the previous acquisition is complete. When the ABR200 achieves RF sync and audio sync, it sets the acquisition mode to 0 to indicate that the previous acquisition was successfully completed. An AQ 0 entered by the user instructs the ABR200 to disable all acquisition processes.

NOTE: Entering a value of 0 for *n* will disable any acquisition in progress. The ABR200 will NOT begin a new acquisition until an AQ 1, AQ 2, or FS *n* is entered. Normally, disabling acquisition is not desirable.

A fade acquisition is automatically initiated whenever RF sync is lost while the receiver is locked onto a carrier. During a fade acquisition the ABR200 concentrates its search for the RF carrier at the frequency where it last achieved RF sync.

A power-on acquisition occurs any time the ABR200 is power cycled. A power-on acquisition begins its search for the RF carrier at the start acquisition frequency. The start acquisition frequency is calculated by the ABR200 using the value of the RF parameter defined in the channel configuration (CC) command. It also adds the offset value specified in the acquisition offset (AO) command to the calculated start acquisition frequency.

A channel change acquisition is performed when the ABR200 is locked to one RF carrier or RF channel and is then instructed to switch to another RF carrier. The ABR200 is instructed to switch to a new channel via the format select (FS) command, not the AQ command. The FS command must be used since it programs the receiver with all of the channel parameters for the new RF carrier. The ABR200 needs these channel parameters to achieve RF and audio sync on the new RF carrier. Since the ABR200 is already locked onto an RF carrier, it has knowledge of the offsets present in the system. It uses this offset value, which is stored in the LO command, in its calculations for the frequency at which it searches for the new RF carrier. The ABR200 will only search one frequency bin for the new RF carrier. If the RF carrier is not found within this first bin, then the ABR200 performs a fade acquisition using the frequency where it last achieved RF and audio sync. A detailed description of the ABR200 binning and acquisition processes can be found in *Chapter 2: Functional Description and Theory of Operation*.

AS Audio Status

Syntax: AS ?

This command queries the receiver for the current audio status. If the audio is enabled, a value of 0 is returned. If the audio is disabled (muted), a nonzero value is returned. The value returned when audio is disabled is a weighted sum of the conditions causing the audio to be disabled. The conditions causing the audio to mute are mapped as shown in Table 5-16.

Table 5-16. Muted Conditions for Audio

Mute Condition	Weight (hex)	Weight (dec)
No RF sync	0x01	1
Low Eb/No	0x02	2
Internal mute (MU=1)	0x04	4
No audio sync	0x08	8
Not authorized to receive audio	0x10	16
System mute	0x20	32
Acquisition mute	0x40	64

AT Audio Test

Syntax: **AT *n,length***

AT ?

The *n* in the syntax above is the number of the audio test to be performed. The *length* is an optional parameter that specifies the length of time that the selected audio test is to run. The units for the length are in seconds and its range is 1 to 65535. If no parameter is given for the length, then the selected audio test runs until manually terminated with an AT 0 command.

The audio test command selects the available audio test that the digital audio signal processor can perform. Valid number values are 0 to 7, as shown in Table 5-17.

Table 5-17. Audio Built-In Self-Tests

Number	Test
0	None, normal operating state
1	1 kHz tone, left channel
2	1 kHz tone, right channel
3	1 kHz tone, both channels
4	Built-in audio processor test
5	9.6 kHz tone, left channel
6	9.6 kHz tone, right channel
7	9.6 kHz tone, both channels

When operating these commands from the M&C port, the selected test will run continuously if no parameter is specified.

NOTE: When operating this command over the satellite control channel without a length parameter, the test is only valid for five seconds.

When AT 4 is processed, the built-in tests execute continuously until halted (with AT not equal to 4) or a fault occurs. When you enter AT 4, the DSP software version number is also displayed. The default value is 0.

Table 5-18 provides detailed performance specifications for the audio tests.

Table 5-18. Audio Test Performance Specifications

Test	Frequency	Output Level	THD	Termination
AT3	1.00 kHz	+4.00 dBm	0.01%	100 K ohm
AT3	1.00 kHz	+3.25 dBm	0.01%	600 ohm
AT3	1.00 kHz	+1.11 dBm	0.01%	150 ohm
AT7	9.60 kHz	+4.00 dBm	0.01%	100 K ohm
AT7	9.60 kHz	+3.25 dBm	0.01%	600 ohm
AT7	9.60 kHz	+1.11 dBm	0.01%	150 ohm

B1 Primary Search (Binning) Range

Syntax: B1 ?

The B1 command is a query-only command that returns the value of the frequency range that will be searched for the primary (B1) bin. The value of this parameter is determined by the symbol rate and is given in units of kHz.

B1 and B2 are used together. When performing fade acquisition, the B1 range is searched first for the carrier signal. If the carrier is not found in the B1 range, the range indicated by the B2 parameter is searched above and below the B1 range. After the search of a B2 range, the B1 range is searched again. When all B2 ranges have been searched within the user-specified acquisition range limit (B2) without finding the carrier, the search pattern is repeated from the beginning. A detailed description of the ABR200 acquisition process can be found in *Chapter 2: Functional Description and Theory of Operation*.

B2 Secondary Search (Binning) Range

Syntax: B2 ?

The B2 command is a query-only command that returns the value of the frequency range that will be searched upon a fade acquisition for the secondary (B2) bin.

The value of B2 is determined by the symbol rate and is given in units of kHz. It denotes the frequency range to search for the carrier outside the B1 range. If the carrier has not been located when all the B2 ranges are exhausted, the search begins again. A detailed description of the ABR200 acquisition process can be found in *Chapter 2: Functional Description and Theory of Operation*.

B3 Overall Search (Binning) Range

Syntax: **B3 *nnnn***

B3 ?

The B3 command is used to specify the maximum frequency range that will be searched when the ABR200 is attempting to acquire the carrier in either installation or fade acquisition mode. Valid values are between 0 and 4000 in units of kHz offset from the RF frequency plus the acquisition offset defined by AO. The ? parameter causes the current B3 value to be displayed.

The default values are 2,000 when operating with a DRO LNB and 200 when operating with a PLL LNB.

The *nnnn* parameter denotes the overall frequency range to search for the carrier. When this value is reached, the acquisition search is repeated from the beginning. A detailed description of the ABR200 acquisition process can be found in *Chapter 2: Functional Description and Theory of Operation*.

BY Bye—Logout

Syntax: BY

This command performs a manual logout. The receiver automatically logs out after five minutes of inactivity at the M&C port.

CC Channel Configuration

Syntax: **CC *Channel_n,RF_nnnn,RR_nnnn,RM_n***

CC *Channel_n*,ZAP

CC *Channel_n* ?

CC ?

This command sets or displays the configuration for the specified channel. The channel number is used in defining the required parameters for a particular channel. Access to a given channel is provided via the format definition (FD) command and the format select (FS) commands. A channel configuration and format definition must be successfully defined before the ABR200 can receive an audio. Table 5-19 lists the parameters and a description of each.

Table 5-19. Parameter Descriptions

Parameter	Description
Channel_n	Channel number to be configured. Valid channel numbers are 0 through 31. This value must correspond to the channel identifier (CI) programmed into the encoder/mux at the uplink.
RF_nnnn	Specifies the RF input frequency to be received by the ODU LNB. The range of valid receive frequencies are: • C-band 3.7 to 4.2 GHz • Ku-band 10.95 to 11.699 GHz, 11.7 to 12.2 GHz, and 12.25 to 12.75 GHz All values are entered in increments of 1000 Hz (1 kHz). For: • Ku-band: 8 digits for *nnnn* • C-band: 7 digits for *nnnn*
RR_nnnn	Specifies the receive symbol rate (symbol/sec). Valid symbol rates are: 128000, 192000, 256000, 384000, 512000 sps (ABR200-1) and 64000, 128000, 192000, 256000, 512000 (ABR200-2).
RM_n	Specifies the receive modulation type. 0 = BPSK, 1 = QPSK

Example:

The following command configures channel 1 for a Ku frequency of 11,700,000 kHz, 256000 symbol rate, and QPSK operation.

CC 1,11700000,256000,1

The ZAP parameter clears the RF, RR, and RM parameters for the specified channel. If this parameter is used, the channel is no longer defined.

To display the parameters associated with a given channel number, use the syntax CC *channel_number* ?.

To display the channel configuration of all defined channels, use the syntax CC ?, or just CC. After a master reset of the ABR200, there are no values assigned to any of the CC parameters.

CE Channel Error Rate

Syntax: **CE ?**

CE

The response to this query-only command provides the current, calculated channel error rate. The value is coded such that 65 = $6x10^{-5}$. The lowest channel error rate displayed is 09 ($0x10^{-9}$).

NOTE: This command is not provided in the 1.38 or higher software version.

CF Clear Fault Register

Syntax: **CF *nn***

This command clears active faults and permits remonitoring of those faults. Once a fault is set, no further occurrences of the fault can be monitored until the fault is reset.

All faults are set on power-up and, therefore, must be cleared by the user before fault alarm messages will be sent to the diagnostic port.

Parameter values for *nn* are integers in the range of 0 to 30, inclusive. CF 0 clears all active faults. Other values for *nn* correspond to the bit number of a fault as defined in the fault register.

The FL and ST command descriptions contain a complete list of all fault code bit numbers.

CM Relay Contact Mapping

Syntax: **CM *channel_n*,*r1*,*r2*,*r3*,*r4*,*r5*,*r6*,*r7*,*r8***

CM *channel_n* ?

This command allows the receiver to be configured to provide a mapping of relay contacts at the uplink to relay contacts at the receiver. A contact map is maintained for each channel number and is recalled whenever channel changes are made via the FS command. Values for the channel number range from 0 to 31, inclusive.

The eight parameters r1 through r8 correspond to the eight receiver relays. The r1 parameter corresponds to the mapping for receiver relay 1, the r8 corresponds to mapping for receiver relay 8. The value of r1 through r8 represents the relay input at the uplink that is physically assigned to operate the designated receiver relay. Acceptable values for r1 through r8 are 1 to 16, inclusive, where 1 is the first uplink relay input, 2 the second, and 16 the most significant relay input. The default mapping for CM is 1,2,3,4,5,6,7,8 for all formats.

Example:

CM 3,3,2,1,4,5,6,10,7 will perform the relay mapping shown in Table 5-20 when channel 3 is selected via the FS command.

Table 5-20. Example Relay Mapping

Uplink Relay Input	Receiver Relay
3	1
2	2
1	3
4	4
5	5
6	6
10	7
7	8

CO Relay Contact Control

Syntax: **CO *string***

CO ?

This command allows the receiver relays to be temporarily activated/ deactivated for test purposes. The string in the command line is an 8-byte character string that controls the state of each relay. The first character controls relay number 1, the second controls relay number 2, and so on. Valid characters in the string are shown in Table 5-21.

Table 5-21. Valid String Characters and Descriptions

Character	Description
0	Deactivates a relay
1	Activates a relay
X	Relay action based on uplink relay input

The default setting is CO XXXXXXXX.

Example:

The following command activates relay contacts 1, 4, and 5 while not changing the other contacts.

CO 1XX11XXX

NOTE: Ensure that settings are returned to X so relay closures are controlled from the uplink. If this does not occur, the relay closures will remain in the state specified by the CO command.

CQ Relay Contact Query

Syntax: **CQ ?**

This command queries the receiver for the physical state of the relay contact closures. The value returned is an eight-character value, each character representing the status of an individual relay. A 0 for a relay indicates the relay is open, a 1 indicates the relay is closed. The first character corresponds to receiver relay contact 1, the last character corresponds to relay 8.

CS Relay Contact Sense

Syntax: **CS *string***

CS ?

This command controls the normal (deactivated) position for the control relays. The string is a character string, with each character position controlling the normal state of a single relay. The first character position controls relay 1, the last character controls relay 8. A 1 for an individual character indicates the relay is normally closed and that the relay is activated by opening it. A 0 for an individual character indicates the relay is normally open and that the relay is activated by closing it.

The default value for CS is 00000000 (all normally open).

DC Display Configuration of Receiver

Syntax: **DC ?**

DC

This command displays a summary output of the present control software and symbol rate configuration of the receiver. Two possible displays that may appear, depending on ABR200 type, are -1 or -2, as shown in Table 5-22.

Table 5-22. ABR200 Type and the Possible Display

ABR200 Type	Possible Display
ABR200-1	ComStream Digital Audio Broadcast Receiver Software Version [xxxxx, 1.38] QPSK rates: 96, 112, 128, 192, 256, 384 kbps BPSK rates: 64, 96, 128, 192, 256 kbps
ABR200-2	ComStream Digital Audio Broadcast Receiver Software Version [xxxxx, 1.38] QPSK rates: 64, 96, 112, 128, 192, 256, 384 kbps BPSK rates: 64, 96, 128, 192, 256 kbps

NOTE: The left-most version number represents the satellite-downloaded software version number. For units not downloaded, the place holder xxxxx is displayed.

DE Composite Data Port Enable

Syntax: **DE *n***

DE ?

This command enables/disables the composite baseband data to be output on the auxiliary port connector. The composite data is the encoded ISO/MPEG Layer II/IIA data stream.

The interface operates synchronously with the data valid on the falling edge of the clock. RS-422 electrical levels are used for this interface. The pinouts for this interface appear in *Appendix A: Interface Pinouts*.

A value of 0 disables the output of the composite baseband data, whereas a 1 enables this data. The default value for DE is 1. Figure 5-1 is a pictorial representation of this command.

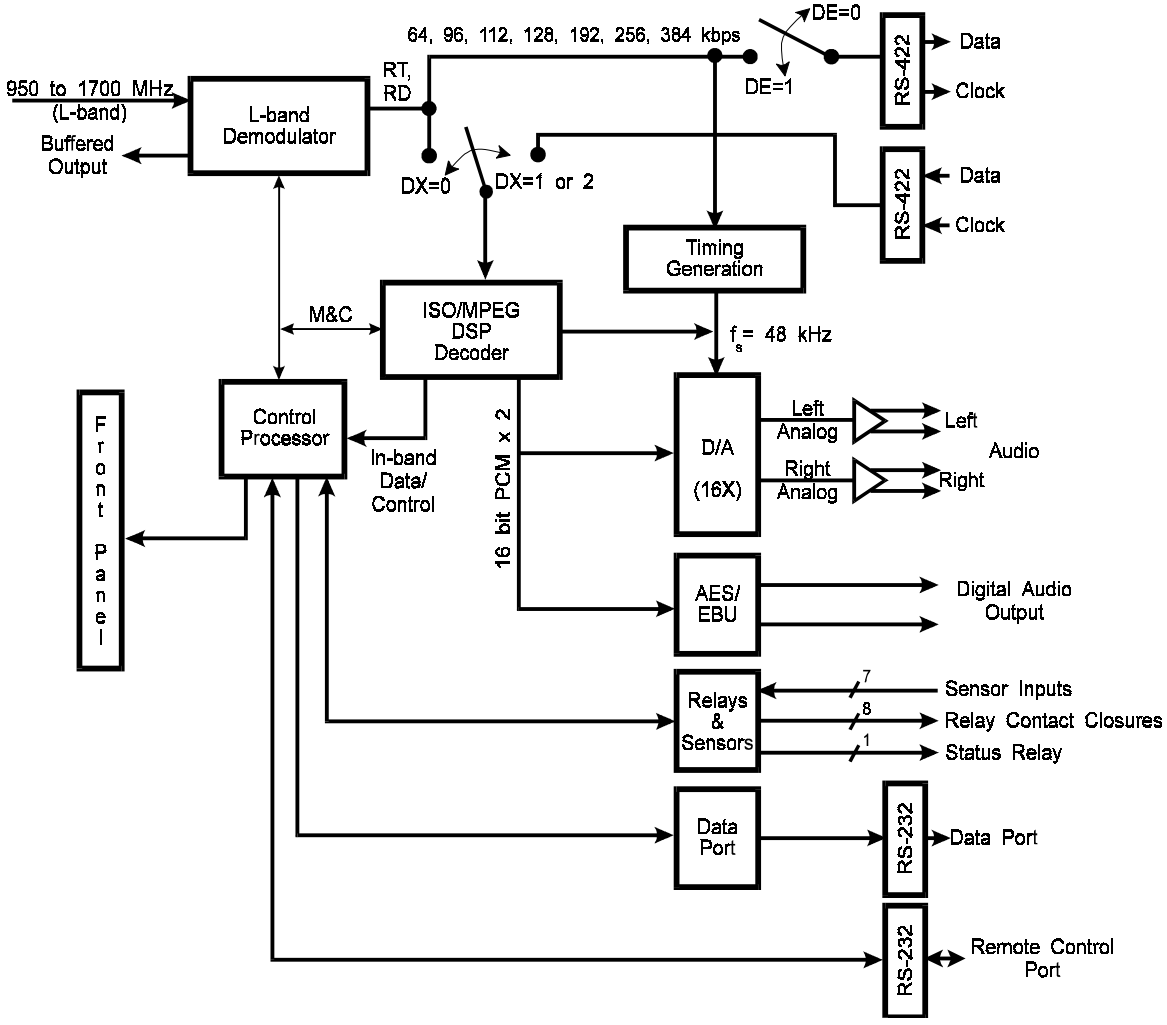

Figure 5-1. ABR Block Diagram Showing DE Commands

DM Display Message

Syntax: DM P*n*,*string*

This command provides a means of sending an ASCII character string to the designated output port. Valid range for the port number (*n*) is P1 (data port) or P2 (M&C port). The string terminates with a carriage return, which executes the command and is not part of the string.

A vertical bar character (|) can be used to force the output of a carriage return to the port.

DP Display Parameters of Receiver

Syntax: DP ?

DP

This command requests a summary output of all command parameters that are single valued. Commands that have multiple parameter sets, such as FD (format definition) and CM (relay contact mapping), are not displayed. This command does not require a parameter and is equivalent to issuing a query for every available command.

DQ Data Rate Query

Syntax: DQ ?

This command queries the receiver for the current channel data rate. The value returned is the data rate in bits per second.

DX Decoder Data Source

Syntax: DX *n*

DX ?

This command selects the input source for the audio decoder on the ABR200. A value of 0 for *n* instructs the receiver to use the output of the L-band demodulator as the input to the audio decoder, whereas a 1 or 2 instructs the receiver to use the external data input on the auxiliary port (pins 6,7,13,14) as the input to the audio decoder.

The interface operates at the RS-422 electrical levels and requires the data to be valid on the falling edge of the clock. When the DX command is set to 1, it will be overridden during carrier acquisition to ensure that the input to the audio decoder is from the L-band demodulator. This allows the receiver to monitor the incoming composite data stream for the proper network/channel ID that it needs to achieve RF and audio sync. Once RF and audio sync have been achieved, the DX command returns to the state it was in prior to the start of carrier acquisition. If DX is set to 2, the receiver disables all carrier acquisition processes and will not switch the input to the audio decoder from the auxiliary port under any circumstance. Refer to Figure 5-1 for a pictorial representation of this command.

EB Eb/No Signal Level Query

Syntax: **EB ?**

EB

This command queries the receiver for the present energy per bit with respect to noise (Eb/No) in a 1 Hz bandwidth on the channel.

An estimate of the Eb/No is returned in the range of 3 dB to 20 dB for rate 1/2 coding. The Eb/No value is in 0.1 dB steps with an accuracy of ±0.5 dB in the range between 4.0 and 10 dB. This value is valid approximately 20 seconds after ABR200 acquisition and is updated every five seconds.

The Eb/No value can be used to initiate several receiver functions, such as muting audio (see M0 and M1 commands), activating the Eb/No threshold (ET) alarm, and setting the condition of the front panel signal indicator (Q0 and Q1).

EE Echo Terminal Input

Syntax: **EE *n***

EE ?

This command specifies whether characters input to the M&C port on the ABR200 are echoed at the M&C port output. Echoing sends back each character received so that it appears on the display of the M&C port CRT terminal. A value of 0 disables the echo. A value of 1, which is the default, enables the echo.

EM Eb/No Minimum Receive Level

Syntax: **EM 0**

EM ?

This command queries the receiver for the minimum Eb/No value that was measured since the last time the minimum value was reset.

EM 0 resets the minimum value of Eb/No to the highest possible Eb/No value. The minimum value is not affected if the receiver loses lock. The default value is 20.

EN Enable Network Data

Syntax: **EN *n***

EN ?

The EN command is used to select the type of data to be output on the auxiliary data pins of the RS-232 user data port (pins 14 and 16).

A value of 0 disables the output of network ID data. The default value for EN is 0.

A value of 1 for *n* enables the output of the network ID information. The network ID information is generated at the uplink multiplexer and contains network ID, channel ID, and relay control information. This network ID information is used to support an external relay control unit (RCU). The RCU-16 provides up to 16 relay contact closures. The output of the network data is also conditioned on the unit authorization (UA command) of the receiver as specified in the FD command. If the receiver is not authorized to receive relay information, the network ID data output is disabled regardless of the state of the EN command.

A value of 2 for *n* instructs the receiver to output the user data on the auxiliary port pins instead of the user data pins. This provides the user with the option of utilizing the auxiliary data's RS-422 electrical interface option for the user data output. For information on switching between the RS-232 and RS-422 drivers for the auxiliary data output, refer to the S1 command of this appendix.

A value of 3 for *n* enables the output of the user-defined data block. This user-defined data block is a generic block type that is made available to the user for user-specific needs. This data block is generated by the user and is input at the uplink multiplexer by a user-supplied DTE. This data block must follow the ComStream Block Transfer Protocol. The receiver outputs the entire data block to a user-supplied DTE at the remote site.

ET Eb/No Alarm Threshold Level

Syntax: **ET *n.m***

ET ?

This command configures the receiver for a minimum Eb/No threshold. An Eb/No threshold error is generated whenever the value of Eb/No is strictly less than the ET value. The format for the number is *n.m*, where $0 < n <= 20$ and $0 </= m </= 9$. The default value is 3.5.

EX Maximum Eb/No

Syntax: **EX 0**

EX ?

This command queries the receiver for the maximum Eb/No value recorded since the last maximum value was reset. The format of the command is EX 0, which resets the maximum value of Eb/No to the lowest possible Eb/No value.

F1 Fault Mask 1 (v1.37+)

Syntax: **F1 *nnn***

F1 ?

The F1 command specifies the faults that will trigger a backlink attempt to the user-defined number specified in T1.

The value of *nnn* is a decimal number that represents the bit map of the faults to be monitored by the terrestrial backlink (TB).

For example:

To select faults 6, 7, and 8, the user enters 224 (32 + 64 + 128 = 224) as the value for *n*.

(For a listing of the fault monitors and their decimal weightings, refer to the fault query [FL] command in this chapter.)

The TB compares the faults specified in this command with the value of the receiver's current fault history (FL command). If any of the faults that are specified in F1 are also a member of the receiver's fault history, a backlink is attempted using the number specified in T1. The default value for this command is 0.

F2 Fault Mask 2 (v1.37+)

Syntax: **F2 *nnn***

F2 ?

The fault mask 2 command specifies the faults that will trigger a backlink attempt to the user-defined number specified in T2.

The value of *nnn* is a decimal number that represents the bit map of the faults to be monitored by the terrestrial backlink.

For example:

To select faults 6, 7, and 8, the user enters 224 (32 + 64 + 128 = 224) as the value for *n*.

(For a listing of the fault monitors and their decimal weightings, refer to the fault query [FL] command in this chapter.)

The TB compares the faults specified in this command with the value of the receiver's current fault history (FL command). If any of the faults that are specified in F2 are also a member of the receiver's fault history, a backlink is attempted using the number specified in T2. The default value for this command is 0.

FD Format Definition

Syntax: **FD *format_nn,network_ID_nnn,channel_nn,unit_authorization_n,LR_value,MU_value***

FD *format_nn*,ZAP

FD *format_nn* ?

FD *format_nn*

FD ?

FD

This command configures the specified format number for a particular network, RF channel, and unit authorization value. Valid values for format numbers are 0 to 63. Valid network values are 0 to 255. Note that the network ID and channel ID within the format definition must match the configuration of the uplink DAC. *Channel_nn* corresponds to the channel number as defined by the CC command. The valid range is 0 to 31.

The unit authorization (UA) selects what services are output from the receiver: audio, data, and relay contact closures. The authorization bit map is shown in Table 5-23, and the UA value and active ports are shown in Table 5-24.

Table 5-23. Authorization Bit Map

Bit Position	Authorization
Bit 0	0—audio disable, 1—audio enable
Bit 1	0—user data disable, 1—user data enable
Bit 2	0—relay port disable, 1—relay port enable

Table 5-24. UA Value and Active Ports

UA Value	Active Ports
0	None
1	Audio only
2	User data only
3	Audio and user data
4	Relay port only
5	Audio and relay port
6	Data and relay port
7	Audio, data, and relay port

Example:

To define format 6 to be assigned to network 1, RF channel 3, with authorization to receive audio and relay closures (UA Value 5 of Table 5-24), the following parameters are used:

FD 6,1,3,5

The left/right channel toggle (LR) and audio mute (MU) values are optional values. If no values are entered for these parameters when entering the FD command, then the LR (left/right toggle command) and MU (mute command) values are not modified when this format is selected via the FS command. If these values are entered, then the LR and MU values are modified when this format is selected using the FS command. Refer to the LR and MU command sections in this chapter for acceptable values or more information.

NOTE: The LR and MU commands are only present for the FD command in the version 1.38 software.

If the ABR indicates that an error is made in parameter entry, retype the command with the correct parameters.

To display all active format definitions, use the FD command followed by a carriage return. To delete a format definition, the parameter value ZAP is used. Once a format is defined, the configuration is made operational via the format select (FS) command. The RF channel that is used, along with the associated receiver parameters, are specified by the channel number within the format definition. The default value is not defined.

FL Fault Query

Syntax: **FL ?**

FL

FL 0

This command queries the receiver for the fault history of the receiver. Fault codes (numbers) and response values are retained in a fault register until the faults are cleared using the CF command. Each bit and associated fault weight are assigned to a particular fault indication. The fault/status map is shown in Table 5-25. The bits in the fault register are identical to those in the status register. (For more information, refer to the ST command section in this chapter.) If the hex mode (HM) is enabled (1), then the output is displayed in the hexadecimal format given in Table 5-25, with all bits displayed that are set.

If the hex mode is disabled (default), then the output valued is the summation of all set fault bits.

For example, if faults 17 and 18 are active, the returned value for the FL ? command is 196608 (decimal) or 0x00030000 (hex).

If the command format FL 0 is used, then each fault number is displayed, one per display line. Thus, for the above example, an FL 0 results in:

FL 17
FL 18

A detailed description of what each fault means is provided in *Chapter 6: Maintenance and Troubleshooting.*

Table 5-25. Fault Summary

Fault Number	Fault Description	Hex Weight	Decimal Weight
1	Not used	0x00000001	1
2	Not used	0x00000002	2
3	Not used	0x00000004	4
4	Not used	0x00000008	8
5	AGC Range Fault	0x00000010	16
6	Bit Time Lock Fault	0x00000020	32
7	Carrier Tracking Lock Fault	0x00000040	64
8	FEC Decoder Sync Fault	0x00000080	128
9	Acquisition Range Fault	0x00000100	256
10	Carrier Tracking Range Fault	0x00000200	512
11	Not used	0x00000400	1024
12	Bit Time Range Fault	0x00000800	2048
13	Nonvolatile Memory Fault	0x00001000	4096
14	Carrier Tracking DDS Fault	0x00002000	8192
15	Bit Time DDS Fault	0x00004000	16384
16	Watchdog Timer Fault	0x00008000	32768
17	Audio PLL Lock Fault	0x00010000	65536
18	Audio Decoder Sync Fault	0x00020000	131072
19	DSP Watchdog Fault	0x00040000	262144
20	DSP Bit Failure	0x00080000	524288
21	Sensor Input 4—External Alarm Monitoring	0x00100000	1048576
22	Sensor Input 5—External Alarm Monitoring	0x00200000	2097152
23	Sensor Input 6—External Alarm Monitoring	0x00400000	4194304
24	Outdoor Unit Fault	0x00800000	8388608
25	Eb/No Threshold Fault	0x01000000	16777216
26	Not used	0x02000000	33554432
27	EPROM Checksum Fault	0x04000000	67108864
28	S/W Download Failure	0x08000000	134217728
29	Channel Change Fault	0x10000000	268435456
30	Network ID Timeout Fault	0x20000000	536870912
31	Acquisition Network ID Fault	0x40000000	1073741824

FS Format Select

Syntax: **FS *format_nn***

FS ?

This command configures the receiver to the parameters specified in the format definition that corresponds to the format number. Valid values for format numbers are 0 to 63. An FS ? returns the format in operation. For example, assume the current format is 1. An FS command would return FS 1. To change to format 2, enter FS 2. The default value is not defined. Different authorizations can be created using the same channel number and switch between the authorizations without the momentary interruption of audio.

HM Hex Mode

Syntax: **HM *n***

HM ?

HM

This command assigns the display format for the ST and FL commands to be decimal or hexadecimal. Valid values for *n* are 0, hex mode disabled (display decimal format), or 1, hex mode enabled. A query displays the current format. This value is not stored in nonvolatile memory and defaults to 0 on power-up or upon login.

ID Receiver ID Query

Syntax: **ID ?**

This command displays the ABR200 ID serial number, which is used for individual unit addressing. The number should be identical to the unit serial number as displayed on the label at the rear of the chassis.

LA Logical Address Definition

Syntax: **LA *nn,address_nnnnn***

LA ?

LA

This command allows the receiver to respond to logical addresses that are received over the network control channel. Up to 32 logical addresses can be assigned to each receiver. The valid range for address_*nnnnn* is 1 to 16383. Specifying a parameter of 0 for the address has the effect of clearing the logical address assignment. The receiver responds to all logical addresses assigned and its unique physical address (unit ID). The default value is No Logical Addresses Assigned.

Example:

The following command configures logical address 3 to 9312. The remote receiver will then act upon network control messages addressed to unit 9312.

LA 3,9312

LC Local Format Change Permission

Syntax: **LC *n***

LC ?

This command allows the receiver channel to be configured via the three external TTL inputs. This command works in conjunction with the preset definition (PD) command.

A value of 1 enables the receiver to enact format changes via the external TTL inputs. A 0 disables this feature. The default value is 0.

LO Local Oscillator Offset

Syntax: **LO ?**

LO

The LO value represents the difference between the start acquisition frequency and the frequency where the carrier was actually located. The LO value represents the sum of the offsets that are present at the receive site. These offsets include the offset present in the LO of the LNB and the LO of the receiver. With a knowledge of the actual offsets present at the receive site, the ABR200 can optimize its acquisition process. When performing a channel change acquisition, the receiver uses the offset specified in the LO value to calculate the frequency at which it will start its search for the new RF carrier.

LR Left/Right Channel Toggle

Syntax: **LR *n***

LR ?

The LR command configures the receiver so that the receiver directs the:

- Incoming left audio channel to both the left and right audio output channels

or

- Incoming right audio channel to both the left and right audio output channels

The value for *n* determines the output of the left and right audio channels. The default value for LR is 0. Table 5-26 provides the valid values for *n*.

Table 5-26. Valid Values for the LR Command

n	Audio Output Status
0	Normal output. Left input goes out on the left channel, and the right input goes out on the right channel.
1	Reversed output. Left input goes out on the right channel, and the right input goes out on the left channel.
2	Left input goes out on both the right and left channels.
3	Right input goes out on both the left and right channels.

NOTE: To utilize 2 and 3 of Table 5-26, the receiver must have v1.16 or higher of ISO/MPEG Layer II/IIA decoder software installed (CPN 08-1095-116).

LT LNB Type (v1.37+)

Syntax: **LT *n***

LT ?

The LNB-type command allows the user to select a mode in which the receiver automatically selects the LNB type.

The selection of the proper LNB type modifies receiver parameters that are needed to perform carrier tracking properly. The two types of LNBs that are used at the remote site system are DRO and PLL. A value of 0 for *n* configures the receiver for a DRO-type LNB, whereas a value of 1 for *n* configures the receiver for a PLL-type LNB.

A value of 2 for *n* instructs the receiver to automatically select the type of LNB. The receiver uses the current modulation type, as specified in the CC command, to determine for which LNB type to configure. If the current modulation type is BPSK, the receiver configures for a DRO-type LNB, whereas if the modulation type is QPSK, the receiver configures for a PLL-type LNB. The receiver automatically selects the LNB type prior to every RF acquisition attempted.

M0 Eb/No Mute On

Syntax: **M0 *n.n***

M0 ?

This command allows for muting the output audio based on the received signal strength, Eb/No. It is used in conjunction with the M1, which enables the output audio. The audio is muted when the Eb/No value is at or below the specified Eb/No value. The default value for M0 is 4.0. Valid range is 0.1 to < M1 value.

M1 Eb/No Mute Off

Syntax: **M1 *n.n***

M1 ?

This command allows for unmuting the output audio based on the received signal strength, Eb/No. It is used in conjunction with the M0, which mutes the output audio. The audio is unmuted when the Eb/No value is at or above the specified Eb/No value. The default value for M1 is 4.5. Valid range is > M0 to 20.0.

MR Master Reset

Syntax: **MR *n***

MR ?

The value of *n* determines the type of reinitialization that will occur. A value of 0 reinitializes the receiver for a DRO LNB, whereas a value of 1 instructs the receiver to reinitialize for a PLL LNB. As a safety feature, two identical MR commands must be issued within 10 seconds of each other before the receiver begins to reinitialize its parameters.

NOTE: This command initializes all ABR200 parameters to their factory default settings. All user-specific configuration information (i.e., FD, CC) are lost. For the receiver to achieve RF and audio sync, this user-specific information must be re-entered.

MU Audio Mute

Syntax: **MU *n***

MU ?

The audio mute command now includes independent muting (disabling) of left and right audio channels.

The value for *n* determines the mute condition of the receiver. The default value for MU is 0. Valid values for *n* are listed in Table 5-27.

Table 5-27. Valid Values for the MU Command

n	Mute Condition
0	Both the left and right channels are enabled
1	Both the left and right channels are muted
2	The left channel is muted
3	The right channel is muted

NOTE: To utilize 2 and 3 in Table 5-27, the receiver must have v1.16 or higher of ISO/MPEG Layer II/IIA decoder software installed (CPN 08-1095-116).

NF Number of RF Signal Fades

Syntax: **NF ?**

NF

NF 0

This command displays the number of RF signal fades since the counter was last cleared. Channel changes do not increment this counter. NF 0 resets the counter.

NS Network Status

Syntax: **NS ?**

NS

This command displays the current network parameters received over the control channel. The network ID number, the channel ID number, and the relay contact closure status are displayed.

OM ODU Fault Mask

Syntax: **OM *n***

OM ?

OM

This command controls the operation of the front panel ODU Fault indicator. A 1 enables the ODU Fault indicator; 0 disables the ODU Fault indicator; the default value is 1. This command is typically used (i.e., OM 0) when the RF input is connected to another ABR so that the second ABR's +18 V output is not used. This configuration normally causes an ODU fault since no current is drawn by the RF output of the first ABR.

P1 User Data Port Configuration

Syntax: **P1 *baud,parity,data bits,stop bits***

P1 ?

P1

This command configures the user data port for the specified operating parameters. Valid values for these parameters are shown in Table 5-28.

Table 5-28. Valid Parameter Values for the P1 Command

Parameter	Valid Values
Baud	0,300,1200,2400,4800,9600
Parity	O (odd), N (none), or E (even)
Data bits	7 or 8
Stop bits	1 or 2

A 0 for the baud rate parameter disables the user data port independent of the unit authorization. The default value is 2400,O,7,1.

NOTE: The sending device (i.e., DAC400) must use 2 stop bits with the ABR200 data port configured for 1 stop bit. Refer to the *DAC400 Installation and Operation Guide* for data channel configuration information.

P2 M&C Port Configuration

Syntax: **P2 *baud,parity,data bits,stop bits***

P2 ?

This command configures the diagnostic port for the specified parameters. Valid values for these parameters are shown in Table 5-29.

Table 5-29. Valid Parameter Values for the P2 Command

Parameter	Valid Values
Baud	0,300,1200,2400,4800,9600
Parity	O (odd), N (none), or E (even)
Data bits	7 or 8
Stop bits	1 or 2

The default value is 2400,O,7,1.

P3 Printer Port Configuration

Syntax: **P3 *baud,parity,data bits,stop bits***

P3 ?

This command configures the printer data port for the specified parameters. This function is implemented on the user data port. For information on the pinouts used, refer to *Appendix A: Interface Pinouts*. Valid values for the P3 parameters are shown in Table 5-30.

Table 5-30. Valid Parameter Values for the P3 Command

Parameter	Valid Values
Baud	0,300,1200,2400,4800,9600
Parity	O (odd), N (none), or E (even)
Data bits	7 or 8
Stop bits	1 or 2

The default value is 2400,O,7,1.

PA Packet Address

Syntax: **PA *n***

PA ?

This command is used to set the packet address of the receiver. The packet address is the external device address to which the receiver responds when attached to an RS-485 multidrop bus. Using a terminal program that supports ComStream packet protocol, each receiver on the bus can receive commands that are specifically addressed to that receiver, addressed to a group of receivers (of which the receiver is a member), or addressed to all receivers.

Valid values for *n* are 1 to 31 and the default value is 31.

PC Password Change

Syntax: **PC *current password,new password,new password***

This command allows the user to change the password of the receiver. A password must be between five and 10 alphanumeric characters.

Example:

To change the default password, HOMEYD, to the new password, ABC123, the user enters the following:

PC HOMEYD, ABC123, ABC123

PD Preset Definition

Syntax: **PD *preset_n,format_n***

PD *preset_n* ?

PD

This command allows the receiver to be configured for seven format presets. The presets are used in conjunction with the receiver's external status inputs in selecting formats. The LC command enables or disables the ability of the receiver to change formats via presets.

The valid range for *preset_n* is 0 to 7, and the valid range for *format_n* is 0 to 63. A value of 0 for the format indicates there is no assigned format for a given preset. By using the external TTL inputs, the user can select the desired preset. SI3 through SI1 have internal 4.7 K pull-up resistors. A dry closure to ground (pin 1) creates a logical address of 0, and a 1 represents an open circuit (no connection).

The mapping for the TTL inputs to a particular preset setting is shown in Table 5-31.

Table 5-31. TTL Input Mapping

TTL Inputs			Preset
SI3	SI2	SI1	**Number**
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

PO Packet-Only (v1.37+)

Syntax: **PO *n***

PO ?

The packet-only command is used to place the receiver in a mode so that the receiver will only accept commands from the M&C port that are formatted in the ComStream packet protocol format. ComStream packet protocol contains addressing information that allows the ABR200 to be placed on a 485 multidrop bus. When on a multidrop bus, it is recommended that the receiver be placed in packet-only mode to eliminate the possibility of the receiver responding to a command that was not addressed to it.

A value of 1 for *n* directs the receiver to accept packet commands. A value of 0 for *n* instructs the receiver to accept packet, as well as nonpacket, formatted commands. The default is 0.

Q0 Low Signal Quality Threshold Level

Syntax: **Q0 *n.n***

Q0 ?

Q0

This command sets or reads the lower limit signal strength threshold. The receiver uses the values set in Q0 and Q1 to report the current status of the signal strength via the front panel Signal indicator. The receiver compares the present value of the measured Eb/No with the user values of Q0 and Q1. The receiver displays the signal strength via the front panel Signal indicator, as shown in Table 5-32.

Table 5-32. Signal Strength and Signal LED indication

Signal Strength	Signal LED Indication
Eb > Q1	On
Q0 < Eb < Q1	Blinking
Eb < Q0	Off

The default value for Q0 is 4.0 dB.

Q1 High Signal Quality Threshold Level

Syntax: **Q1 *n.n***

Q1 ?

Q1

This command sets or reads the upper limit signal strength threshold. The receiver uses the values set in Q0 and Q1 to report the current status of the signal strength via the front panel Signal indicator.

The default value for Q1 is 7.0 dB.

RB Read Calculated Bit Error Rate

Syntax: **RB ?**

RB

The response to this query displays the decoder estimated output bit error rate. The format for the bit error rate is *n.n*. The first number is the mantissa of the bit error rate threshold, and the second number represents the negative of the exponent (i.e., 26 represents 2×10^{-6}, or .000002).

NOTE: This command is not provided in the 1.38 or higher software version.

RE System Reset

Syntax: RE

The RE command resets the unit to a known state as defined by the stored parameters in nonvolatile memory. This command does not reset the unit to the factory default settings.

RF Read RF Value

Syntax: RF ?

RF

The RF command is used to query the C- or Ku-band frequency to be received at the input of the ODU LNB. The range of downlink frequencies received by the ABR200 are 3.7 to 4.2 GHz, 10.95 to 11.699 GHz, 11.7 to 12.2 GHz, and 12.25 to 12.75 GHz. The RF frequency is set via the CC command and selected via the FS command.

S1 Interface Select for Auxiliary Data (v1.37+)

Syntax: **S1 *n***

S1 ?

The S1 command selects the electrical interface for the auxiliary data.

A value of 0 for *n* selects the RS-232 electrical interface, whereas a value of 1 for *n* selects the RS-422 electrical interface.

S2 Monitor and Control Interface Select (v1.37+)

Syntax: **S2 *n***

S2 ?

The S2 command is used to select the electrical interface for the M&C port.

A value of 0 for *n* selects RS-232 electrical interface for the M&C port, whereas a value of 1 selects the RS-422 electrical interface. The M&C interface can be reset back to RS-232 by using the MCRESET pin (Relay Control port, pin 12). If the MCRESET pin is held at a ground state during power-up initialization, the M&C port resets to the default parameters of 2400,O,7,1, RS-232 electrical interface.

The factory initialized value for S2 is 0.

SI TTL Sensor Input Query

Syntax: SI ?

This command queries the receiver for the status of the seven TTL inputs. The reported value is a seven-character string, each character representing the status of an input line. The first character corresponds to the TTL input #1, the last character corresponds to TTL input #7.

SL Audio Sync Loss Count

Syntax: **SL 0**

SL ?

This command allows the receiver to maintain a record of the number of audio sync losses since the last time the value was reset. The sync loss count will not exceed 65535. SL 0 resets the sync loss value.

SR Status Relay Mask

Syntax: **SR *nnnn***

SR ?

SR

This command sets or reads the status relay mask. The value *nnnn* is a decimal number that represents the bit map of the faults to be monitored by the status relay. For example, to set faults 6, 7, and 8, you would input 224 (32+64+128) as the value of *nnnn*. (For a listing of fault monitors and their decimal weighting, refer to the FL command.)

The default value is 4286578687, which enables all faults but FL 24 (ODU fault) to activate the relay and front panel IDU Fault indicator.

SS Status Relay Sense

Syntax: **SS *n***

SS ?

This command configures the remote status relay sense. A value of 0 for *n* configures the relay as true sense (i.e., when there is no alarm, the relay is active). A value of 1 configures the relay to be inverted when there is no alarm condition.

Example:

Table 5-33 shows the status relay contact states for the individual conditions.

Table 5-33. Condition and Status Relay Contacts

Condition	Status Relay Contacts	
	(SS=0)	(SS=1)
Power Off	open	open
Alarm	open	closed
Normal	closed	open

The default value is 0 (true sense).

ST Status Query

Syntax: **ST ?**

ST

This command causes the receiver to display the current content of the status register. The FL ? command gives the faults that have occurred since the last time the fault register was cleared. The ST ? command gives the current condition of those fault monitors. Bits in the status register are defined exactly as the fault register. The ST command will display a decimal or hexadecimal encoded value of the bits in the status register depending on the HM command value.

T1 Backlink Telephone Number 1 (v1.37+)

Syntax: **T1 *string***

T1 ?

The T1 command specifies the telephone number the receiver uses in a backlink attempt initiated by a fault that is a member of fault mask 1 (F1 command).

String is a character string that contains the telephone number and any subcommands for the ComStream-approved, Hayes-compatible telephone modem (CPN 30-0120-194). When initiating a backlink, the receiver sends ATD followed immediately by the string entered by the user. The following is a list of valid characters that can be entered:

- 0 to 9
- A to Z
- * (asterisk)
- # (number/pound symbol)
- @ (at symbol)
- ! (exclamation mark)
- ; (semicolon)
- , (comma)

The following is an example of the T1 command:

T1 9,5553333

T2 Backlink Telephone Number 2 (v1.37+)

Syntax: **T2 *string***

T2 ?

The T2 command is used to specify the telephone number the receiver uses in a backlink attempt initiated by a fault that is a member of fault mask 2 (F2 command).

String is a character string that contains the telephone number and any subcommands for the ComStream-approved, Hayes-compatible telephone modem (CPN 30-0120-194). When initiating a backlink, the receiver sends ATD followed immediately by the string entered by the user. The following is a list of valid characters that can be entered:

- 0 to 9
- A to Z
- * (asterisk)
- # (number/pound symbol)
- @ (at symbol)
- ! (exclamation mark)
- ; (semicolon)
- , (comma)

TB Terrestrial Backlink (v1.37+)

Syntax: **TB *n***

TB ?

The TB command allows the user to manually initiate a terrestrial backlink or terminate a backlink that is in progress.

A value of 1 for *n* instructs the receiver to establish a link using the telephone number defined by the T1 command. Likewise, a value of 2 for *n* instructs the receiver to establish a backlink using the phone number defined by the T2 command. A value of 0 for *n* instructs the receiver to terminate any active backlinks.

TI Telco Initialization

Syntax: **TI *string***

TB ?

This command allows the user to enter a specific initialization string for the telco modem. This string is sent to the telco modem prior to every backlink attempt. When a backlink is attempted, the ABR200 sends a basic initialization string followed immediately by the user-defined initialization string. The following sequence of strings is sent prior to every backlink attempt:

```
AT&D3&C1S0=1E0Q0V1&Y0
AT user-defined string
```

The user-defined string can be a maximum of 40 characters. The valid characters that can be sent are:

- 0 to 9
- A to Z
- &
- =

The default string for TI is &Q5W0&Y0.

X1 Exercise User Data Port

Syntax: X1 *value*

This command allows the user data port to be exercised by providing a repeating test pattern. A value of 1 enables the user data port test. A value of 0 disables the test. The test pattern that will be issued to the port is:

```
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG
0123456789
```

The default value is 0.

X2 Exercise M&C Port

Syntax: X2 *value*

This command allows the M&C port to be exercised by providing a repeating test pattern. A value of 1 enables the M&C port test. A value of 0 disables the test. The test pattern that will be issued to the port is:

```
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG
0123456789
```

The default value is 0.

Chapter 6: Maintenance and Troubleshooting

Overview

This chapter provides information about the maintenance of the ABR200. It also provides an alphabetical listing of key performance monitoring commands and the fault conditions that can occur with the ABR200. These listings also provide a detailed description of each command and fault condition.

The last section of this chapter presents information that can help troubleshoot any problems that can occur with the ABR200.

Maintenance

The ABR200 does not require periodic or preventive maintenance. There are no adjustments or configuration switches or jumpers external or internal to the unit.

The power input is protected with an inline fuse located within the power supply inside the receiver. The fuse is designed to protect the unit from internal damage in the event of a severe power line condition or internal failure. This fuse is not serviceable by the user.

A lithium battery is used to power the nonvolatile memory while power is off. The lifetime of the battery is 10 years.

Performance Monitoring

The ABR200 receiver has a number of commands that provide performance monitoring of key system parameters. By interrogating these parameters for key receiver sites on a periodic basis, the overall system performance level can be determined and changed if necessary.

In implementing performance monitoring, key downlink sites would be selected. At these sites, telephone modems would be connected to the ABR200 receiver so that the required two-way communication link is established. For connecting a telephone modem to the receiver, refer to *Appendix B: Telephone Modem Operation.*

The key performance monitoring commands and how they can be used in measuring symptom performance are detailed in the following paragraphs.

EM Eb/No Minimum Receive Level

The minimum receive signal level Eb/No is measured and recorded using the EM command. This parameter indicates how weak the receive signal has become due to local weather conditions and fades, antenna misalignment, etc., since the last time the parameter was reset. By monitoring key receive sites across the network, a determination of actual system availability can be made based on measured fades. If actual numbers differ from the desired availability, corrective action can be taken. Either the satellite downlink power can be increased or the receive antenna size can be increased for the affected locations.

NF Number of RF Signal Fades

This command records the number of RF signal fades that have occurred since the last time the counter was reset. While the EM command records the lowest signal level, this command records the number of signal fade events. A fade event occurs when the receiver loses RF signal lock for any reason other than channel changes. A fade causes a disruption in audio, data, and relay cue signals. Typically, a fade occurs due to weather conditions, although any event causing the signal to be temporarily interrupted could be the cause. Examples of this would be antenna obstruction by a large truck, IFL cable damage causing intermittent connections, and so on.

Receiver sites that record fade events should be investigated to determine the cause so that uninterrupted service can be provided.

SL Audio Sync Loss Count

This command records the number of audio decoder sync losses since it was last reset. An audio sync loss would normally occur when a fade condition exists. However, there could be instances where the decoder loses synchronization with the uplink audio encoder. Very low signal levels (between 3.0 to 3.5 dB Eb/No) could cause sufficiently high bit error rates causing the decoder to lose sync, but not an RF sync loss. Additionally, if the uplink encoder began to operate marginally, then typically all receive sites would record decoder sync loss events, although not all may record the same number of events.

By monitoring audio sync losses, troubleshooting system-wide or individual receive site problems is made easier.

Fault Condition Descriptions

This section provides a detailed description of each fault condition to aid in troubleshooting.

FL 5 - AGC Range Fault

This fault indicates the input signal to the demodulator is less than -75 dBm or greater than -30 dBm (approximately).

FL 6 - Bit Time Lock Fault

An FL 6 fault means the demodulator bit time loop has lost lock. The receiver output data is disabled when this fault occurs.

FL 7 - Carrier Tracking Lock Fault

This fault means the demodulator carrier tracking loop has lost lock. The receiver output data is disabled when this fault occurs.

FL 8 - FEC Decoder Sync Fault

An FL 8 fault indicates the FEC decoder output BER is greater than 10^{-2} (approximately).

FL 9 - Acquisition Range Fault

This fault means the demodulator has completed a search of all frequencies out to the limits defined by the B3 parameter and was unable to acquire a carrier.

FL 10 - Carrier Tracking Range Fault

An FL 10 fault means the demodulator carrier tracking register has reached its maximum (or minimum) setting.

FL12 - Bit Time Range Fault

This fault indicates the demodulator bit time accumulator has reached its maximum (or minimum) setting.

FL 13 - Nonvolatile Memory Fault

An FL 13 fault means one of the parameters in the demodulator nonvolatile memory may have become corrupted. If this indication occurs repeatedly, the nonvolatile memory is defective.

FL 14 - Carrier Tracking DDS Fault

This fault is generated when any errors are detected in the carrier tracking DDS during power-up initialization. The FL 14 fault indicates a hardware failure with the carrier tracking ASIC (Application Specific IC).

FL 15 - Bit Time DDS Fault

This fault is generated when any errors are detected in the bit time DDS during power-up initialization. The FL 15 fault indicates a hardware failure with the bit time ASIC.

FL 16 - Watchdog Timer Fault

This fault indication means the demodulator microprocessor fault timer has failed to reset. FL 16 normally indicates a memory fault, meaning the unit may be operating in an unintended manner. When this fault occurs, the system automatically resets.

FL 17 - Audio PLL Lock Fault

This fault occurs when the narrow band phase lock loop that operates the audio D/A converter is not locked. It is usually caused when RF sync is not achieved. If this alarm occurs by itself and will not clear by cycling power, the receiver should be returned for servicing.

FL 18 - Audio Decoder Sync Fault

An FL 18 fault indicates the receiver audio decoder is not in synchronization with the audio encoder at the uplink. This condition will normally occur if RF sync is not achieved.

FL 19 - DSP Watchdog Fault

This fault means the DSP audio decoder is not functioning normally. If this fault persists, the unit should be returned for servicing.

FL 20 - DSP BIT Failure

This fault indicates the DSP audio decoder built-in tests did not successfully pass during startup. If this fault persists, the unit should be returned for servicing.

FL 21, FL 22, FL 23 - External Alarm Monitoring

All three of these faults are caused from monitoring an external device that asserts a TTL logic low on Sensor Inputs 4, 5, and 6. (These signals are on the relay control port pins 22, 23, and 24.)

FL 24 - Outdoor Unit Fault

This fault occurs when the LNB is not drawing power from the receiver. If the receiver is connected to another ABR unit, this will be a normal condition. The front panel ODU Fault light or indicator tracks this fault condition.

FL 25 - Eb/No Threshold Fault

An FL 25 fault indicates the measured RF signal level (Eb/No) has dropped below the level set by the ET command.

FL 27 - EPROM Checksum Fault

This fault means the main control processor memory has been corrupted and is not functioning normally. If this fault persists, the unit should be returned for servicing.

FL 28 - Software Download Failure

This fault indicates a software download was not successful. The control processor operates from the EPROM while this fault is active. Once the download is successful, this fault automatically clears. While this fault is set, the IDU Fault light on the front panel blinks at a one-second rate.

FL 29 - Channel Change Fault

An FL 29 fault occurs when a channel change has been attempted but RF and audio synchronization on the new RF carrier have not occurred within five seconds. Acquisition reverts to the previous signal and, once locked, normal operation is restored. The channel change may be initiated from any one of three sources:

- Local FS command
- FS command from the uplink
- Remote (external) channel change

For more information, refer to the LC command section in *Chapter 5: Remote Monitor and Control Information*.)

This is an abnormal condition and indicates there may be a configuration error within the receiver, a mismatch with the actual RF carrier parameters, or the RF carrier is not present.

FL 30 - Network ID Timeout Fault

This fault condition exists if the channel and network ID information is not received over the control channel every 10 seconds. Typically, this indicates a problem exists at the uplink concerning the audio multiplexer. However, if other receivers in the network are not showing this alarm condition, then the unit may need servicing.

FL 31 - Acquisition Network ID Fault

An FL 31 fault is declared when the receiver achieves RF sync but there is an invalid or missing network/channel ID. This fault indicates that one or more of the following conditions is true:

- The receiver FD and/or CC commands are not configured properly.
- The uplink is not transmitting or is transmitting an invalid network/channel ID.
- There is a hardware problem with the audio decoder portion of the ABR200.
- The receiver is locked onto an adjacent audio carrier that is within its frequency search range, but is not the carrier specified in the selected format definition.

Troubleshooting

This troubleshooting section is provided to aid in isolating equipment problems and suggesting appropriate actions toward solving problems. If a particular problem cannot be resolved after reviewing the following material, or if a ComStream equipment failure is suspected, then seek further assistance by contacting your ComStream distributor or uplink provider. If equipment is purchased directly from ComStream, contact ComStream customer service for assistance.

Before Troubleshooting

Before troubleshooting the unit, go through the following questions:

- Have there been any power or bad weather problems in the area? Snow-filled dishes need to be manually swept out, even if they have a Velox coating.
- Is the ABR200 mounted on a rack or is it free-standing? Is it located in a closet? If so, is there sufficient air circulation in the closet? Is the ABR200 near a heat-generating source? Does it exceed the ComStream ambient temperature specifications? The receiver requires sufficient space for proper ventilation.
- Is the receiver connected to an uninterruptible power source (UPS)?
- Was anyone recently working on the equipment or has anyone been near the satellite dish? If so, visually check the equipment to ensure the power has not been turned off, there are no loose cables, or any damaged connectors.
- Is the receiver located at the uplink or is it a downlink in a network? If it is a downlink, are other downlinks experiencing any problems?

Symptoms and Actions

Table 6-1 has been developed to help you diagnose and correct minor problems in the unlikely event that you experience difficulties with your ABR200. A quick reference troubleshooting flow chart is also provided in *Appendix H: Troubleshooting Flow Chart*. If you decide to use the flow chart and find that you need additional information, refer to the information provided in this section.

Table 6-1. Troubleshooting Symptoms and Actions

Symptom	Action
Power light is not illuminated	1. Ensure the unit is plugged into an active AC outlet and the power cord is firmly plugged into the rear panel receptacle. 2. Verify the AC power source is supplying 90 to 264 VAC, 47 to 63 Hz. 3. Ensure the power cord is not at fault by replacing it with a known working cord. 4. If the problem persists, it indicates a possible internal fuse failure—do not attempt to repair it. Contact ComStream for technical support.
Unable to communicate with the receiver	1. If a modem is being used, verify that the correct cable is being used and that the connections are correct. Refer to *Appendix B: Telephone Modem Operation*. **NOTE**: The modem connection to the M&C port requires a crossover connection. 2. Ensure the correct terminal, cable, and configuration is being used: a. Ensure an ASCII terminal or a PC with a terminal emulator program, such as PROCOMM®, is being used. b. Ensure the RS-232 cable is connected to the M&C port via the DB-9-to-DB-25 adapter cable (CPN 30-0120-093) supplied with the receiver. If the adapter cable is too short, extend it with a straight-through cable. **NOTE**: If a DB-9-to-DB-9 cable is being used, the pin assignment is straight through. c. Verify the connection between pins 2 and 3 at both ends of the cable. Ensure pin 4, Data Terminal Ready (DTR), is an active input (high) of the M&C port. d. Check to see if the terminal is configured properly: full-duplex ASCII communications at 2400 baud, 7 data bits, odd parity, and 1 stop bit (default).

Table 6-1. Troubleshooting Symptoms and Actions (continued)

Symptom	Action
Unable to communicate with the receiver *(continued)*	3. Once the terminal has been connected and configured, press the Enter key to see if the login message displays. If the login message: • Does not display, contact ComStream. • Displays, enter commands to see if the responses are displayed. If the commands are not echoed to the display, ensure the command echo is enabled by entering **EE 1**. If they do not display after enabling the echo feature, contact ComStream for technical support.
ODU Fault light is illuminated	This indicates the LNB downconverter (located at the antenna) is not drawing power from the receiver. If the receivers are daisy-chained receivers, the illuminated ODU Fault light is normal for the receivers that are not directly connected to the LNB downconverter. The ODU Fault light can be turned off using the OM command. 1. Verify the IFL cable is connected to the LNB downconverter and the RF In port at the receiver. 2. Verify cable connectivity between the two cable ends. Use a multimeter to ohm-out after disconnecting the cable. Examine the connectors for improper assembly. 3. Ensure the voltage output of the ABR is 18 VDC. • If it is not, contact ComStream for technical support. • If it is, check to see if the maximum IFL cable length has been exceeded (refer to *Appendix C: Interfacility Link (IFL) Cable Characteristics and Preparation*). - If the cable length has been exceeded, contact ComStream for L-band amplifier recommendations. - If the cable length has not been exceeded, replace the LNB downconverter. If the problem persists, contact ComStream for technical support.

Table 6-1. Troubleshooting Symptoms and Actions (continued)

Symptom	Action
RF Sync light is not illuminated	1. If the Audio Sync light is illuminated, then the unit requires servicing. 2. If the ODU Fault light is illuminated, follow the procedure for when the ODU Fault light is illuminated. If it is not illuminated, connect the terminal to the M&C port. 3. If the Signal light is illuminated, follow the procedure for when the Signal light is illuminated. 4. Ensure the configuration parameters are correct for the installed application using the CC, FD, FS, and DI commands. 5. If the configuration parameters have been confirmed: a. Connect the spectrum analyzer to the ABR RF Out port (a DC block is not required at the RF Out). b. Ensure a proper L-band signal is present. c. If required, repeak the antenna.
Audio Sync light is not illuminated	If the RF Sync and Signal lights are not illuminated, check with the uplink station to ensure the audio encoder unit is functioning properly. If it is, the unit may need servicing. If not, the problem is at the uplink station.
Signal light is not illuminated or is blinking	This indicates the receive signal strength is below the value set by the Q0 or Q1 commands. If the RF Sync light is not illuminated, the signal is too weak. Check the signal strength by entering each of the following commands: **`Q0 ?`**, **`Q1 ?`**, and **`EB ?`**. If the value for EB is less than the default value for Q1, repeak the antenna for maximum signal strength. **NOTE**: If EB > Q1, the Signal light is illuminated If Q0 < EB < Q1, the Signal light blinks If EB < Q0, the Signal light is not illuminated The default values are 4.0 dB for Q0 and 7.0 dB for Q1.

Table 6-1. Troubleshooting Symptoms and Actions (continued)

Symptom	Action
IDU Fault light is blinking or illuminated	• If the light is blinking, it indicates a software download attempt has not been successful. The receiver continues to operate out of EPROM memory. Once the software download has been successfully completed, this fault automatically clears. • If the light is illuminated, a. Connect a terminal to the M&C port on the receiver. b. Enter **FL ?** to determine what type of fault is occurring. c. Follow the action descriptions associated with each fault type. • Faults 6, 7, 8, 9, and 10 are common faults and may indicate the following: - CC or FD are not configured correctly for carrier acquisition - The carrier is not present • If the above faults are present, verify carrier status and configuration before contacting ComStream for technical support.
No audio, but the RF and Audio Sync lights are illuminated	1. Ensure the audio is not being muted by the M0, M1, and MU commands. 2. Check the audio status (AS) to ensure audio operation is permitted. If it is not, check with the uplink operator for audio authorization. 3. Verify connector integrity and ensure the proper connections are made to the audio output (DB-9 male) connector. 4. Use the built-in audio tests (AT command) to generate audio tones. Monitor the audio output at the connector. If no tones are present, the unit may need servicing. If audio is present, contact ComStream for technical support.
Audio is highly distorted or garbled	• If the Signal light is not illuminated or is blinking, then a low signal strength may be the problem. Follow the procedure for when the Signal light is illuminated. • If the Signal light is illuminated, check the external connections to the audio port to ensure no shorts or intermittent connections are present. **NOTE**: If the output feeds several pieces of equipment, disconnect the external equipment and monitor the audio at the connector. If the problem no longer exists, then a wiring problem to the external equipment exists and you should operate the external equipment via a distribution amplifier.

Table 6-1. Troubleshooting Symptoms and Actions (continued)

Symptom	Action
Audio has unusually high background noise	When operating in joint stereo mode, a high background (common mode) noise indicates there is a phase reversal at the encoder's audio inputs. 1. Recheck the encoder wiring to ensure the input leads, (+) and (-), for both channels are properly connected. 2. Recheck the wiring connections at the output of the receiver to ensure the correct phase for the audio outputs has been connected.
Audio is at a low volume	Ensure the connections at the uplink and downlink are correct for both signal polarities (+ and -). When operating with a single connection (e.g., + only), the output level is down 6 dB when compared to balanced operation.
No data, but the RF and Audio Sync lights are illuminated	1. Check the unit authorization setting using the FD and FS commands for the current format and ensure data operation is permitted. If the current FD value, as selected by the FS parameter, does not have a 2, 3, 6, or 7 as the last digit, then data is not enabled. If it is not enabled, check with the uplink operator for proper authorization. 2. Verify the interface cable and connector integrity by ensuring the proper connections are made to the data port output connector (DB-25 female) and that the interconnecting cable is properly wired (straight-thru). The Data port pinouts are described in *Appendix A: Interface Pinouts*. 3. Ensure the external data terminal equipment (DTE) and data port configuration P1 parameter (i.e., baud rate, stop characters, parity) match by using the P1 command. 4. Test the user data port by entering the command **`X1 1`**. A test pattern should be output to the DTE. – If data output is observed, turn off the test pattern by entering **`X1 0`** and then contact the uplink operator to verify data transmission. – If data output is not observed, try connecting another type of DTE (i.e., video terminal); if data is still not available, contact ComStream for technical support.

Table 6-1. Troubleshooting Symptoms and Actions (continued)

Symptom	Action
No relay closure operation, but the RF and Audio Sync lights are illuminated	1. Check the unit authorization setting using the FD command for the current format and ensure relay closure operation is permitted. If the FD value does not have a 4, 5, 6, or 7 as the last digit, then the relays are not enabled. If they are not enabled, check with the uplink operator. 2. Enter **CO ?**: – If a 1 or 0 appears, then the cue signal from the uplink cannot be processed properly. Enter **CO XXXXXXXX** to allow the uplink to control the relays. – If CO is XXXXXXXX, ensure the proper connections are made to the Relay/Control port connector (DB-25 male) and that the interconnecting cable is properly wired. 3. Use the built-in relay test (CO command) to individually activate and deactivate the relay closures. Monitoring contact closure with a multimeter at the connector is preferred; this eliminates any misconnections. If proper operation is still not observed, contact ComStream.

Chapter 7: Technical Specifications and Port Information

LNB Downconverter (Outdoor Unit [ODU])

Input frequency range:	11.7 to 12.2 GHz
	12.25 to 12.75 GHz
	10.95 to 11.7 GHz
	3.7 to 4.2 GHz
Output frequency range:	950 to 1450 MHz
	950 to 1750 MHz
Conversion gain:	55 to 70 dB
Local oscillator:	DRO (BPSK) or PLL (QPSK)

L-band Demodulator (Indoor Unit [IDU])

Input frequency:	950 to 1700 MHz, F connector, 75 ohm
Output power (to LNB):	+18 VDC, 500 mA maximum current
Input signal level:	-75 to -30 dBm
Frequency synthesis:	25 kHz steps
Demodulation type:	BPSK or QPSK
FEC decoding:	Rate 1/2 sequential
BER performance:	128 kbps (BPSK) $1x10^{-5}$ at 4.0 dB Eb/No
	128 kbps (QPSK) $1x10^{-5}$ at 4.5 dB Eb/No
Audio threshold:	3.5 dB Eb/No (BPSK)*
	4.0 dB Eb/No (QPSK)*
L-band output:	Buffered for additional receivers,
	F connector
	75 ohm gain of -2 dB to +5 dB nominal,
	+2 dB typical
Symbol rates:	
ABR200-1	128, 192, 256, 384, 512 ksps
ABR200-2	64, 128, 192, 256, 512 ksps
AGC monitor:	Analog voltage available on rear panel
AGC monitor range:	0 to 10 V

* Add 0.3 dB to threshold values for ISO/MPEG Layer II/IIA rates.

Audio Performance

Frequency response:	15 Hz to 20.0 kHz
Audio output channels:	One or two
Operating modes:	Mono, dual mono (stereo), joint stereo
Compression technique:	ISO/MPEG Layer II/IIA
Compression factor:	12:1, 8:1, 6:1
ISO/MPEG Layer II/IIA data rates:	
ABR200-1	64, 96, 128, 192, 256 kbps (BPSK) 96, 112*, 128, 192, 256, 384 kbps (QPSK)
ABR200-2	64, 96, 128, 192*, 256 kbps (BPSK) 64, 96, 112*, 128, 192, 256, 384* kbps (QPSK)
ISO/MPEG Layer II/IIA modes:	Mono, dual mono, joint stereo
Channel change time:	< 450 msec(1)
Total harmonic distortion(2):	< 0.2% at 1 kHz[3] (@ +8 dBu signal level)
Dynamic range:	> 90 dB
Signal to noise(3):	> 85 dB (measured from +18 dBu(2))
Idle channel noise:	< -64 dBu (unweighted)
Channel mute:	< -100 dBu (unweighted)
Crosstalk (two channel):	> 80 dB (all frequencies, measured from +18 dBu(2))
Analog sampling rate:	48 kHz
Stereo phase deviation:	< 1.0° for 0 to 10 kHz; < 3.0° for 10 to 20 kHz
Output levels:	The output level will track the input level with a ±0.5 dB end-to-end gain variation. The maximum input level is +18 dBu. Direct-coupled, active-balanced or unbalanced outputs will drive down to a 60 ohm load. Outputs have short circuit protection. With a 600 ohm termination, a 0.7 dB output level reduction occurs. With a 150 ohm termination a 2.9 dB output level reduction occurs.

* Add 0.3 dB to threshold values for ISO/MPEG Layer II/IIA rates.

1 For signal strength > 9 dB Eb/No (QPSK), > 7 dB Eb/No (BPSK).

2 0 dBu is defined to be 1 mW across a 600 ohm load (0.776 VRms).

3 Operating 256 kbps, dual mono, Eb/No > 10 dB (output terminated into 100 kohm).

Available Audio Rates and Bandwidths

The available audio rates and bandwidths for the ABR200 are shown in Table 7-1.

Table 7-1. Available Audio Rates and Bandwidths

Audio Rate (kbps)	Mode	Bandwidth (kHz)	Audio Quality	Recommended User Data Rate
64	mono	8.3	AM	2400
64	dual mono	8.3	---	2400
96	dual mono	10	AM	4800
96	mono	20	CD	4800
96	dual mono	10	AM	4800
96	joint stereo	10	AM	4800
112	mono	20	CD	4800
112	dual mono	10	AM	4800
112	joint stereo	20	CD	4800
128	mono	20	CD	4800
128	dual mono	10	AM	4800
128	joint stereo	20	CD	4800
192	mono	20	CD	9600
192	joint stereo	20	CD	9600
192	dual mono	20	CD	9600
256	mono	20	CD	9600
256	dual mono	20	CD	9600
256	joint stereo	20	CD	9600
384	mono	20	CD	9600
384	dual mono	20	CD	9600
384	joint stereo	20	CD	9600

NOTE: The maximum user data rate is 9600 baud for all audio rates, however, you should select lower user data rates when using audio rates below 128 K to prevent any degradation of the audio quality.

Mechanical (IDU)

Size:	1.75" H x 16.75" W x 15" D (19" Rack-mount)
	2.9" H x 16.25" W x 17.125" D (Desktop)
Weight:	< 13 lbs
Shipping weight:	24 lbs

Power

Input voltage (AC):	100 to 240 VAC ±10%
Frequency:	47 to 63 Hz
Consumption:	< 40 W typical

Environmental

Temperature:	0 to 50°C (IDU, operating)
	-20 to 75°C (IDU, nonoperating)
	-40 to +50°C (ODU, operating)
	-50 to +60°C (ODU, nonoperating)
Humidity:	0 to 95% noncondensing (IDU, operating)
	0% to 100% condensing (ODU, operating)
Safety/Emissions:	UL 1950; CSA 950; TUV EN 60950; FCC Part 15B Class A; BZT Certified

Control Channel Interface Capabilities

Software network control:	PC AT, Windows-based (optional)
Addressing:	Unit or logical group
Receiver control:	Configuration, audio/data port operation, channel selection, etc.
Operating speed:	4800 default, 9600 capable

Monitor and Control Capabilities

Monitor:	Receive signal level (Eb/No) channel error rate, AGC level, bit error rate, equipment alarms and faults, performance monitoring
Control:	Receive channel configuration, relay mapping, alarm reporting, etc.
Status (Front Panel):	Power, RF Sync, Audio Sync, Signal level, IDU and ODU Fault summary

Rear Panel Ports

Audio Out Port

Connector:	DB-9, male
Function:	Left and right channel analog audio output

For more information about audio performance, refer to the “Audio Performance” section in this chapter.

Aux Port

Connector:	DB-15, female
Functions:	AES/EBU digital output (48 kHz sampling rate)
	AGC monitor voltage (1 pin)
	Receiver fault alarm relay (Form A)
	Synchronous composite data stream input/output with clock, RS-449 levels

Relay Status Port

Relay contact closures:	Eight, individually controlled from DAC codec/mux at uplink
Relay type:	Form A; 2 wires per contact; maximum rating is 110 VAC at 1 amp.
Connector:	DB-25, male
Operation:	< 150 msec latency w.r.t. audio, with error protection
Status inputs:	7 TTL with reference grounds, active low, internally pulled up 4.7 kohm resistors.
Status functions:	3 for local RF channel selection, 3 auxiliary alarm inputs, 1 unused (reserved)
Interface biasing:	+12V @ 50 mA max available for powering opto-couplers in external equipment

User Data Port

Interface type:	Asynchronous RS-232 and addressable RS-485 multidrop using ComStream's packet protocol
Data rates:	300, 1200, 2400, 4800[4], and 9600[5] baud
Connector:	DB-25, female

NOTE: The sending device (i.e., DAC400) must use 2 stop bits with the ABR200 data port configured for 1 stop bit. For data channel configuration information, refer to the *DAC400 Installation and Operation Guide*.

M&C Port

Interface type:	Asynchronous RS-232 and addressable RS-485 multidrop using ComStream's packet protocol
Connector:	DB-9, female, with DTR control
Default parameters:	2400, 7 data bits, odd parity, 1 stop bit, RS-232 (programmable)
Functions:	Unit configuration, diagnostics, and status; connects to ASCII terminal or telco modem.

[4] 4800 data only available when operating control channel $\geq$ 9600 baud.
[5] 9600 data only available when operating control channel $\geq$ 19200 baud.

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Appendix A: Interface Pinouts

User Data Port

Table A-1. DB-25 Female, RS-232 Connector

Pin #	I/O	Name	Description
1	O	SG	Signal Ground
2	I	TD	Transmit Data (Reserved)
3	O	RD	Receive Data
4	O	SG	Signal Ground
5	---	---	Not Used (Reserved)
6	O	DSR	Data Set Ready
7	O	SG	Signal Ground
8	---	---	Not Used (Reserved)
9	---	---	Not Used (Reserved)
10	---	---	Not Used (Reserved)
11*	O	AUXRD-	Aux Rcv Data RS-422 (-) (Rsrvd)
12*	I	AUXTD-	Aux Tsmt Data RS-422 (-) (Rsrvd)
13*	O	AUXDSR	Aux Data Set Ready (Rsrvd)
14*	I	AUXTD	Aux Tsmt Data RS-232 (Rsrvd)
15	---	---	Not Used (Reserved)
16*	O	AUXRD	Aux Rcv Data RS-232 (Rsrvd)
17	---	---	Not Used (Reserved)
18	---	---	Not Used (Reserved)
19*	I	AUXDTR	Aux Data Terminal Ready (Rsrvd)
20	I	DTR	Data Terminal Ready
21	---	---	Not Used (Reserved)
22	---	---	Not Used (Reserved)
23	---	---	Not Used (Reserved)
24*	O	AUXRD+	Aux Rcv Data RS-422 (+) (Rsrvd)
25*	I	AUXTD+	Aux Tsmt Data RS-422 (+)(Rsrvd)

* Special configuration required.

Relay Control Port

Table A-2. DB-25 Male Connector

Pin #	I/O	Name	Description
1	O	RC1A	Relay Closure Contact 1A
14	O	RC1B	Relay Closure Contact 1B
2	O	RC2A	Relay Closure Contact 2A
15	O	RC2B	Relay Closure Contact 2B
3	O	RC3A	Relay Closure Contact 3A
16	O	RC3B	Relay Closure Contact 3B
4	O	RC4A	Relay Closure Contact 4A
17	O	RC4B	Relay Closure Contact 4B
5	O	RC5A	Relay Closure Contact 5A
18	O	RC5B	Relay Closure Contact 5B
6	O	RC6A	Relay Closure Contact 6A
19	O	RC6B	Relay Closure Contact 6B
7	O	RC7A	Relay Closure Contact 7A
20	O	RC7B	Relay Closure Contact 7B
8	O	RC8A	Relay Closure Contact 8A
21	O	RC8B	Relay Closure Contact 8B
9	I	SI1	Sensor Input 1, TTL
10	I	SI2	Sensor Input 2, TTL
11	I	SI3	Sensor Input 3, TTL
22	I	SI4	Sensor Input 4, TTL
23	I	SI5	Sensor Input 5, TTL
24	I	SI6	Sensor Input 6, TTL
12	I	MCRESET-	M&C Port Reset
25	O	SG	Signal Ground
13	O	+12V	+12 V thru 220 ohm (50 mA max) resistor

M&C Port

Table A-3. DB-9 Female, RS-232/RS-485 Connector

Pin #	I/O	Name	Description
1*	I	TD+	Transmit Data, RS-485 (+)
2	O	RD	Receive Data, RS-232
3	I	TD	Transmit Data, RS-232
4	I	DTR	Data Terminal Ready
5	O	SG	Signal Ground
6	O	DSR	Data Set Ready
7*	I	TD-	Transmit Data, RS-485 (-)
8*	O	RD+	Receive Data, RS-485 (+)
9*	O	RD-	Receive Data, RS-485 (-)

* Special configuration required.

M&C Port Adapter Cable (DB-9-to-DB-25)

The M&C Port Adapter Cable connects the ABR200 with an RS-232 port. This cable is VT-100 compatible and available through ComStream (CPN 30-0120-093).

Table A-4. M&C Port Adapter Cable

Male DB-9	Female DB-25
1	8
2	3
3	2
4	20
5	7
6	6
7	4
8	5
9	22

Analog Output Port

Table A-5. DB-9 Male Connector

Pin #	I/O	Name	Description
1	O	LO+	Left Audio Output (+)
2	O	LO-	Left Audio Output (-)
3	---	---	Not Used
4	O	RO+	Right Audio Output (+)
5	O	RO-	Right Audio Output (-)
6	O	AGND	Analog Ground
7	---	---	Not Used
8	---	---	Not Used
9	O	AGND	Analog Ground

Auxiliary Port

Table A-6. DB-15 Female Connector

Pin #	I/O	Name	Description
1	O	SG	Signal Ground
2	O	Status+	Status Closure Contact 1
3*	O	RD+	Receive Data RS-422 (+) [B]
4*	O	RT-	Receive Timing RS-422 (-) [A]
5	O	AGC	AGC Output Voltage 0-10 VDC
6*	I	BBRT-	Baseband Rec. Timing RS-422 (-) [A]
7*	I	BBRD-	Baseband Rec. Data RS-422 (-) [A]
8	O	DIGOUT-	AES/EBU Digital Audio Out (-)
9	O	Status-	Status Closure Contact 2
10*	O	RD-	Receive Data RS-422 (-) [A]
11*	O	RT+	Receive Timing RS-422 (+) [B]
12	---	---	Not Used
13*	I	BBRT+	Baseband Rec. Timing RS-422 (+) [B]
14*	I	BBRD+	Baseband Rec. Data RS-422 (+) [B]
15	O	DIGOUT+	AES/EBU Digital Audio Out (+)

*Special configuration required.
[A] Denotes primary signal for differential input/output
[B] Denotes return signal

NOTE: The RD+, RD-, RT+, and RT- abbreviations/acronyms have been changed to match the pinout definitions of other ComStream products.

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Appendix B: Telephone Modem Operation

Overview

The ABR200 can be controlled and operated from a remote location by connecting the receiver to the public telephone network using the ComStream-approved, Hayes-compatible modem (CPN 30-0120-194). This appendix provides the necessary details for configuring the telco modem and connecting it to the ABR200.

Modem Configuration

To ensure proper operation of the ComStream-approved, Hayes-compatible modem (CPN 30-0120-194), the modem must be initialized, as shown in Table B-1, when it is connected to the ABR200.

Table B-1. Hayes-Compatible Modem Configuration

Modem Command	Description of Modem Actions
AT&D0	Modem ignores DTR
ATS0=1	Modem answers on one ring
AT&C1	Carrier detect (CD) active when remote carrier detected
ATQ1	Modem does not send result codes
AT&Y0	Select profile 0 as power-up configuration
ATE0	Echo off
AT&W0	Write configuration to profile 0

Modem Connection

A Hayes-compatible modem (CPN 30-0120-194) connects to the ABR200 M&C port via a special adapter cable. Table B-2 details the interconnecting cable that should be used. This cable is available through ComStream (CPN 05-0505-001).

Table B-2. Modem Adapter Cable

DB-9 (Male)	ABR Function	To	DB-25 (Male)	Modem Function
2	Out-Receive Data	→	2	In-Transmit Data
3	In-Transmit Data	→	3	Out-Receive Data
5	Signal Ground	→	7	Signal Ground
4	In-Data Terminal Ready	→	8	Out-Carrier Detect
6	Out-Data Set Ready	→	20	In-Data Terminal Ready

Appendix C: Interfacility Link (IFL) Cable Characteristics and Preparation

Cable Characteristics

General Characteristics

All cables should be uniform in quality and free from any burrs, die marks, chatter marks, foreign material, or other defects that may affect life, serviceability, or appearance.

The cable must be capable of being pulled in one-inch diameter conduit with pull boxes at 90° bends and every 200 feet, without distortion or change in electrical performance or structural integrity.

The cable should have a design life of 10 years after installation in an outdoor environment and be subject to the complete range of industrial pollutants, temperature extremes, precipitation, humidity, solar radiation, and salt water corrosion typically encountered at the installation site.

The minimum bend radius should be five times the cable's outside diameter. The electrical specifications must be met at the minimum bend radius.

Outer Cable Jacket

The jacket should cover the cable tightly and evenly in a manner consistent with the physical, mechanical, environmental, and dimensional requirements. The outer jacket material should be weatherproof and suitable for direct burial. A flooding compound must be applied to the outer braid under the jacket of the coaxial cable to block moisture and resist corrosion.

Polyisobutylene is the recommended flooding compound. Polyvinyl-chloride, Thermoplastic rubber, or Teflon are suitable jacket materials. The jacket must resist abrasion, scuffing, and peeling during the pulling process. The cable must also have sufficient flexibility at 15° to permit installation.

Maximum shrinkage tolerance of the cable jacket should be sufficient to still allow full termination capability following any shrinkage.

Cable Specifications/Vendors

The following specifications define the required performance parameters of the IFL cable intended for use with the ABR200. The IFL cable must conform to these specifications to guarantee that the ComStream equipment will operate properly. Table C-1 provides the recommended vendors for the RG-11 cable. Table C-2 lists the recommended crimp tool and F-connector vendors.

NOTE: Especially important is the use of a quad-shielded coax for the RF cable. Without quad-shielding, your system may be subject to outside radio frequency interference. This interference can degrade the performance of the ABR200 receiver.

Table C-1. Recommended Vendors, Quad-Shielded RG-11 Coax

Manufacturer Telephone #	Manufacturer Part Number	Preference Rank
Times Fiber (800) 688-6904	2282 2262	1 2
Comscope (800) 982-1708	5950 2287*	1 2

*Suitable for direct burial.

Table C-2. Recommended Vendors, F Connectors and Crimp Tool

Part	Manufacturer Telephone #	Manufacturer Part Number	Preference Rank
F connector	LRC Electronics (607) 739-3603	F11-QS	-
Crimp tool	Gilbert Engineering (800) 245-2050	GCRT-211	1
	LRC Electronics (607) 739-3603	CT611QS	2

Cable type is determined by the amount of maximum signal loss specified in Table C-3.

Table C-3. Signal Loss per 100 Foot Length for Common Cable Types

Cable Type	Loss Per 100 Feet
RG-11(preferred)	5.9 dB
RG-35	3.7 dB

Generally, an IFL cable run of 0 to 420 feet (0 to 129 m) requires the following cable specifications:

Cable type:	RG-11
Impedance:	75 ohm
DC resistance:	Less than 16.1 ohm per 1000 feet
Shield:	Quad-shielding system
Shield coverage:	100%
Capacitance:	16.5 picofarads per foot
Jacket:	PVC
Maximum loss:	5.9 dB per 100 feet at 1450 MHz
IDU connector:	F male
ODU connector:	F male

IFL cable runs of 400 to 670 feet (123 to 206 m) require the following cable specifications:

Cable type:	RG-35
Impedance:	75 ohm
DC resistance:	1.15 ohm per 1000 feet
Shield:	Single shield, solid
Shield coverage:	100%
Capacitance:	15.4 picofarads per foot
Jacket:	Standard PVC
Maximum loss:	2.69 dB per 100 feet at 1500 MHz
Outside diameter:	0.63 in over jacket
Minimum bend radius:	5.0 MHz
Weight:	0.14 lbs/ft
IDU connector:	N (male), F (male) available with adapter
ODU connector:	N (male), F (male) available with adapter

NOTE: Only N and UHF-type connectors are available. An N-to-F adapter must be used.

An N-to-F adapter is ComStream part numbers 31-0120-031 and 31-0121-031.

RG-35 cable is provided by Andrew Corporation (Andrew part number: LDF4-75A). The N plug (male) 50 ohm pin is Andrew part number: L44W-75.

NOTE: Overall cable voltage drop should be less than 3 V, regardless of length, cable type, LNB type, or data rate.

IFL Cable Preparation

This section assumes an RG-11 coaxial cable is being used in the installation. For any other cable type, the procedures remain the same with only the dimensions changing. Before connecting the coaxial cable, prepare it by attaching the F connectors as described here and as illustrated in Figure C-1:

1. Remove 3/4 inch (9.55 mm) of the cable jacket, being careful not to cut through the braid. Fold the first layer of exposed braid back over the jacket.
2. Cut through the remaining foil, braid, and dielectric to expose 1/4 inch of center conductor. Do not score the center conductor.
3. Remove the first foil, making sure the braid is not cut, and fold the second braid over the jacket.
4. Cut through the foil and dielectric to the center conductor an additional 3/8 inch. Do not score the center conductor.
5. Insert the connector over the foil and dielectric until it bottoms.
6. Crimp the collar using a .470 to .475 hex crimp tool, as shown in Figure C-1.

Use the following steps to complete the connection of the coaxial cable:

1. Cut off approximately two inches of weatherproof, heat-shrink tubing (Alpha Part Number FIT-650-3/4, or equivalent) and place it over the end of the coax cable. When installation is complete, this is used to provide a weatherproof shroud for the outdoor IFL connector, up to the body of the LNB downconverter.
2. Connect the IFL coax cable to the coaxial cable connector.
3. Slide the heat-shrink tubing over the coaxial connector and male F connector on the LNB downconverter so it completely envelops the threaded portion. Apply heat to the heat-shrink tubing in accordance with the manufacturer's instructions.
4. Loop the IFL cable and tie-wrap the cable to the lower feed rod. Loop the cable in such a way that the length of the cable between the LNB downconverter and the tie-wrap nearest it is approximately 10 inches.
5. Add additional tie-wraps along the lower feed rod at the middle and bottom, as required, to secure the IFL cable.

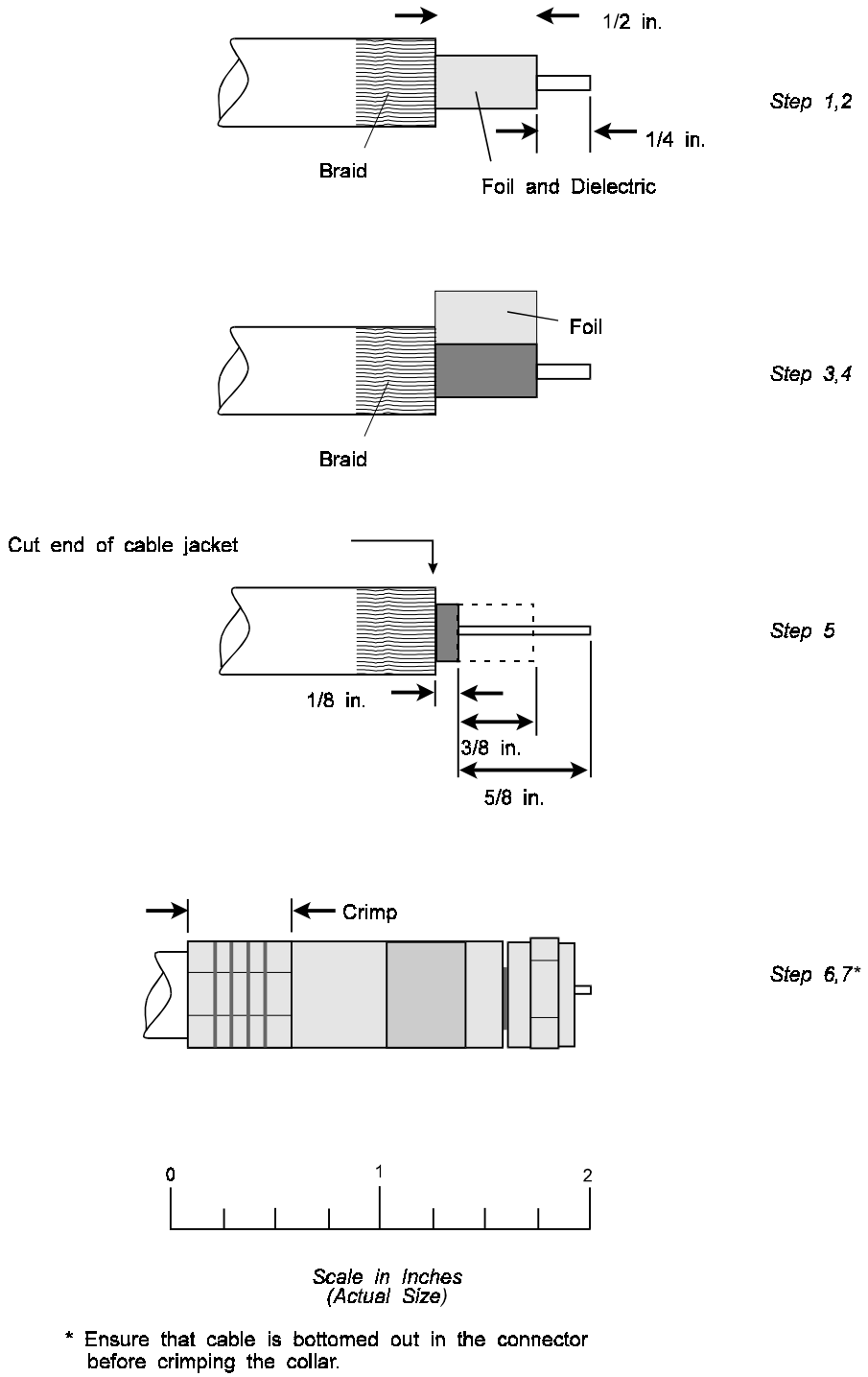

Figure C-1. Coax Cable and F Connector Assembly (to scale)

Appendix D: Antenna Installation (Prodelin)

Overview

This appendix explains the assembly and setup of the optional Prodelin antenna system for use with the ABR200. These instructions simply serve as a sample and are an example of how to assemble and set up an antenna. If another antenna system is being used, the assembly and setup instructions for that system should be followed.

Satellite Positioning

The following discussion of the internationally used earth coordinates locating system is to assist the site planner in approximating the location of the satellite of interest (i.e., the satellite that will be broadcasting to the receiver site).

Communication satellites are located in geosynchronous earth orbit, meaning their speed matches the rotation of the earth, and they remain in a relatively fixed position in the sky. This simplifies the placement of a satellite receive antenna since it can point to a single location in the sky and successfully pick up the incoming signal.

The orbit of choice for geosynchronous satellites is directly over the equator at a distance of 22,245 miles (35,800 km). The exact direction an antenna must point to pick up the signal broadcast by a particular satellite is determined by the antenna's position north or south of the equator and the point on the equator over which the satellite is located. Since the satellite occupies a stationary position somewhere on the earth's equator, its position is given in degrees of longitude.

Longitude is one component in a global coordinate system. The numerical value of the longitude component locates a position on the earth in degrees, minutes, and seconds east or west of the prime meridian (perpendicular to the equator). Latitude, the other value, indicates points on the earth that are north or south of the equator. The prime meridian, at zero degrees (0°) longitude, is an imaginary vertical line on the face of the earth that passes directly through the Royal Naval Observatory in Greenwich, England. From the prime meridian, traveling in either an easterly or westerly direction causes longitude values to increase from zero. When the 180° longitude line is reached, the traveler has moved halfway around the globe from the prime meridian (at a point located on the international date line).

In this manner, any point on the equator can be exactly referenced by giving its position in degrees of east or west longitude. For example, traveling westward from Greenwich, England (across the Atlantic toward the U.S.), about one-quarter of the way around the globe, or 90° west longitude, would be the vertical line that intersects the city of New Orleans, Louisiana. If there were a communications satellite located over the equator on the same line as New Orleans, its position would also be 90° west longitude or, as more commonly abbreviated, 90°W.

One degree of longitude is about 70 miles in length at the equator. To further pinpoint a location, degrees are subdivided into minutes and seconds. There are 60 minutes per degree, and each minute is further divided into 60 seconds. To simplify their use, degrees, seconds, and minutes are abbreviated using symbols as shown in the following example: 117°, 47', 23".

For a receiver to successfully pick up a satellite transmission, there must be an obstacle-free line of sight between the two. The site planner must ensure that the location of the antenna will comply with this requirement.

Site Location

Since communication satellites are placed over the equator, any receiver in the northern hemisphere must have a clear line of sight toward a generally southern direction, while a receiver in the southern hemisphere must have a clear line generally northward.

The following example is for a receiver in the northern hemisphere:

> If the proposed site of the receiving antenna is generally free of obstructions to the south, with adequate freedom of movement east and west, the site is suitable for free line-of-sight access to the satellite. If, however, the southerly view from the proposed site is cluttered with tall buildings, mountains, trees, or other obstructions, the planner should determine the actual position of the satellite(s) and verify that the chosen location is suitable.

The most common locations for antenna mounting are on the ground, a rooftop, or attached to the side of a building. Mounting an antenna at ground level normally requires the pouring of concrete with a mounting post embedded in the center. Rooftop or side mounting is more complicated and requires a carefully planned method for anchoring the dish.

It is important to remember that the typical satellite dish is a large and heavy object, up to 1.8 meters (6 feet) in diameter. If atmospheric conditions at the site include high winds or severe storms, appropriate safeguards should be taken during the construction of the antenna base and mounting structures.

Antenna Assembly

The following section describes the assembly and mounting of a standard 1.8 meter antenna. It is provided for reference only and is typical for a broadcast network. This information is not intended to replace instructions supplied by the antenna manufacturer.

Maximum Bolt Torques

Unless otherwise specified, the bolt torques listed in Table D-1 apply to the assembly of the antenna. These specifications should not be exceeded, as excessive torque can seriously weaken fasteners and undermine structural integrity.

Table D-1. Thread Size and Bolt Torque

Thread Size	Torque (ft/lbs)
1/4-20	5
5/16-18	11
3/8-16	16
1/2-13	40
5/6-11	85

Tools Required

The following tools are required for antenna assembly and installation:

- 1 Ratchet wrench, 1/2 inch drive
- 1 7/16 inch deep well socket, 1/2 inch drive
- 1 9/16 inch deep well socket, 1/2 inch drive
- 1 3/4 inch deep well socket, 1/2 inch drive
- 1 15/16 inch deep well socket, 1/2 inch drive
- 1 7/16 inch regular socket, 1/2 inch drive
- 1 15/16 inch regular socket, 1/2 inch drive
- 1 10 inch open-end adjustable wrench
- 1 150 ft/lb torque wrench, 1/2 inch drive
- 1 5/16 inch combination wrench
- 1 9/16 inch combination wrench
- 1 1/2 inch combination wrench
- 1 3/4 x 11/16 inch open-end wrench
- 1 5/8 x 3/4 inch open-end wrench
- 1 1/4 x 5/16 inch open-end wrench
- 1 Phillips screwdriver
- 1 Straightslot screwdriver
- 1 1/4 inch nut driver
- 1 7/16 inch nut driver
- 1 Inclinometer
- 1 Flexible ruler

Unpacking

The antenna containers should be unpacked and inspected at the earliest date possible to ensure that all material has been received and is in good condition. Check all material against the packing list.

Antenna Setup

Foundation

The most important part of the installation process is the preparation of a foundation that will support the weight and weather-induced stresses upon the antenna while maintaining the ability for its proper orientation to the satellite.

This section explains the straight, in-ground mast installation, as shown in Figure D-1. This is but one of several possible mounting configurations. Each installation should use the most appropriate antenna mounting method consistent with the needs of the site.

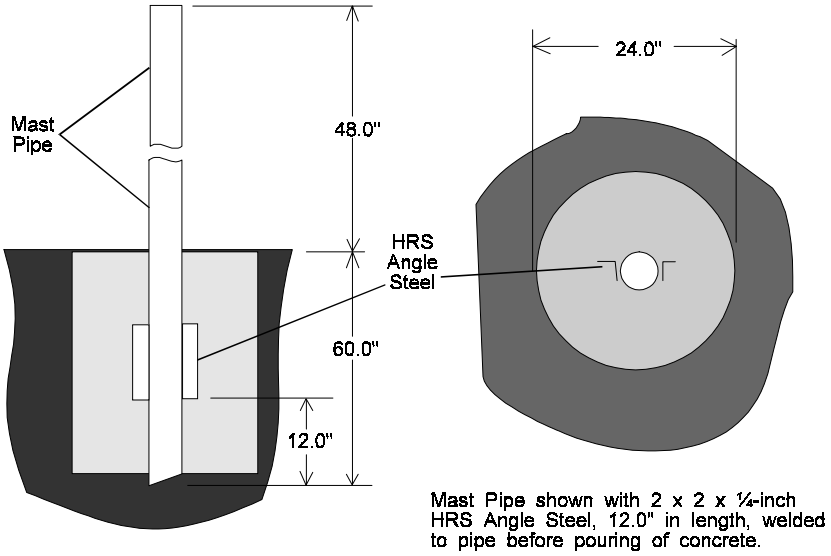

Figure D-1. Typical Antenna Mast Installation

ComStream does not warrant the method used nor the feasibility of a given mounting method for a particular site. It is the purchaser's responsibility to determine the applicability of any antenna mount. The mast upright must be constructed of, at minimum, 3 ½ inch ID (4.0 inch OD), schedule 40 steel pipe, with angle iron welded 12 inches from the bottom to prevent rotation. The angle iron and pipe should conform to ASTM A36 standards.

No attempts to install the antenna should be made until at least 24 hours after pouring the concrete for the mast base. The concrete used should conform to building standards and have a minimum compressive strength of 3000 PSI at 28 days (per ACI-318-77).

To meet local building codes, the antenna and mast should be properly grounded. The antenna can be grounded by attaching a .059 inch stainless steel strap, 26 inches by 1 inch, between two points on the antenna.

One end of the strap should be attached to the outside back rim of the reflector where the LNB support rod bolts to the reflector. The other end should be attached to the nearest bolt holding one of the reflector support arms to the back of the reflector. An example of where the grounding strap might be located on an antenna is shown in Figure D-2.

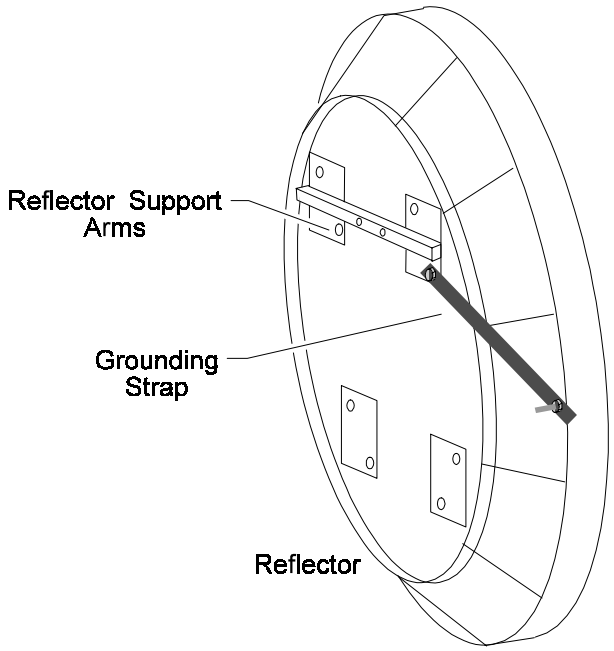

Figure D-2. Possible Location of Antenna Ground Strap

During the assembly procedure, the instructions must be performed carefully in the order listed. No hardware should be tightened until the instructions actually say to do so.

A typical 1.8 meter antenna consists of four major components, as shown in Figure D-3:

- Azimuth/Elevation (AZ/EL) Positioner
- Reflector Support Tube and Support Arms
- Reflector
- Feed Support Rods and LNB Assembly

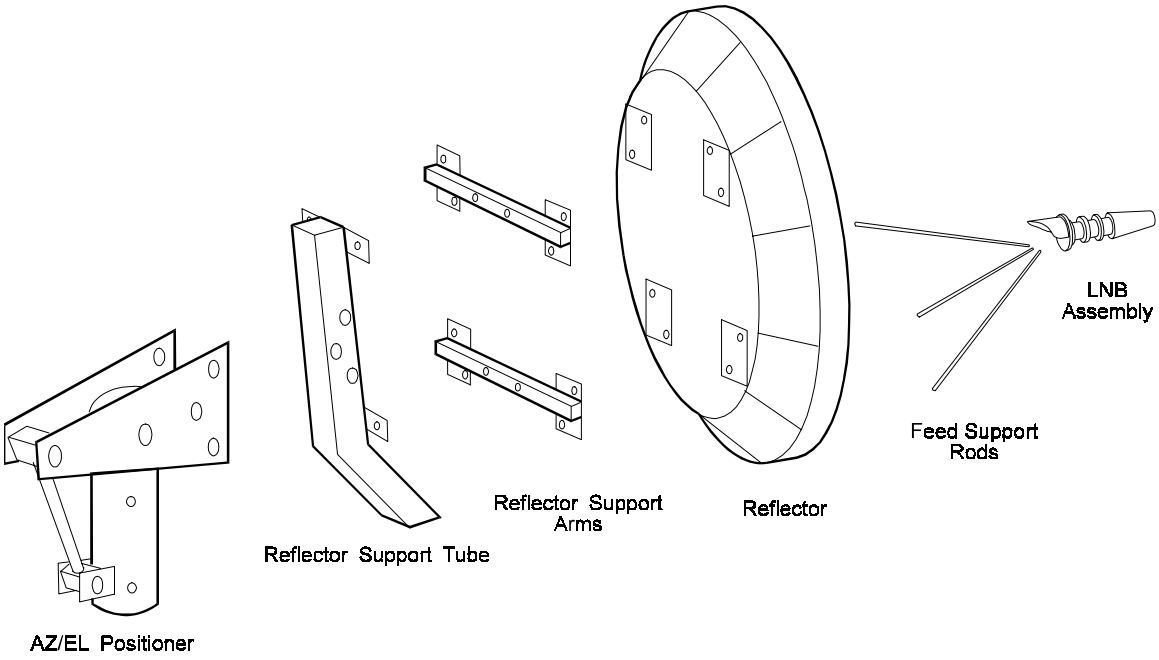

Figure D-3. Antenna Assembly

The antenna assembly mounts on a 4.0 inch OD vertical pipe, extending 48 inches above ground level. The following instructions assume that the foundation and mast pipe have been properly installed.

Reflector and Mount Assembly

To assemble the reflector and mount assembly:

1. Fasten the azimuth/elevation (AZ/EL) positioner assembly to the mast pipe, as shown in Figure D-4. Tighten the three canister bolts equally, avoiding a skewed or crooked appearance.
2. Install the reflector support tube to the AZ/EL positioner assembly using the three 5/8-11 by 6 inch bolts. Each bolt requires two flat washers and a lock washer below the nut. Hand-tighten and torque each of the bolts. For a detail of the attaching hardware, refer to Figure D-5.

NOTE: Use flat washers and a lock washer.

3. Attach the two reflector support arms to the reflector support tube using the ½-13 by 2.75 inch bolts. Each bolt requires two flat washers and a lock washer below the nut. Hand-tighten the four bolts.

   Be sure the bolt holes in the reflector mounting pads at the end of the arms are correctly oriented toward the reflector. The four bolts are torqued after the feed support structure is assembled.
4. Lift, position, and attach the reflector to the reflector support arms.

   The top reflector support arm is attached using four 3/8-16 by 5 inch bolts. The lower reflector support arm uses four 3/8-16 by 4 1/2 inch bolts. Each bolt assembly should use two flat washers and a lock washer below the nut.
5. Tighten and torque each of the eight bolts that attach the reflector to the reflector support arms.

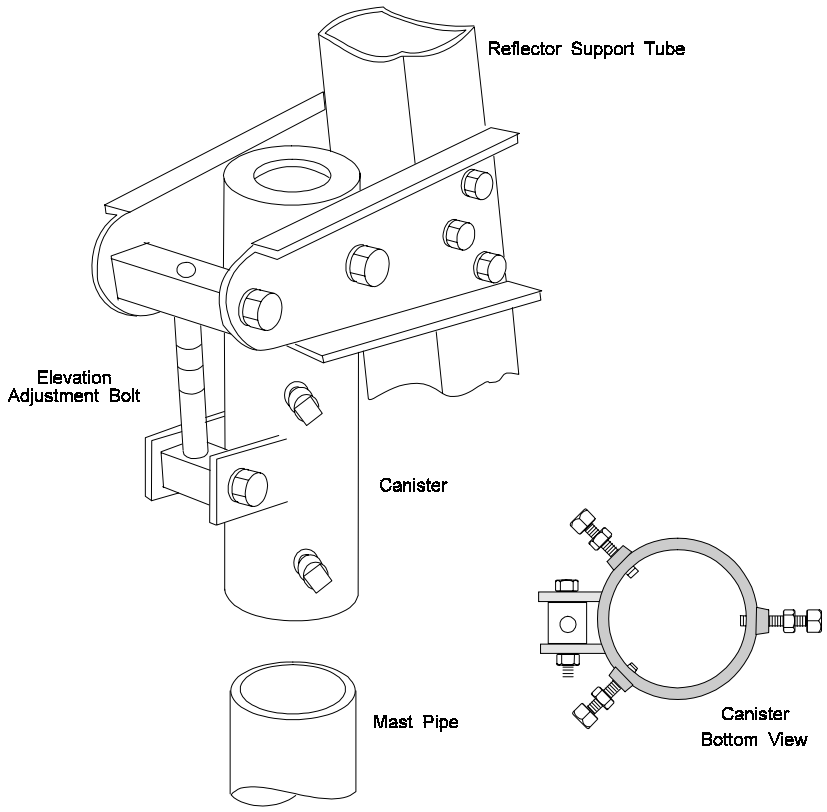

Figure D-4. Azimuth/Elevation Positioner

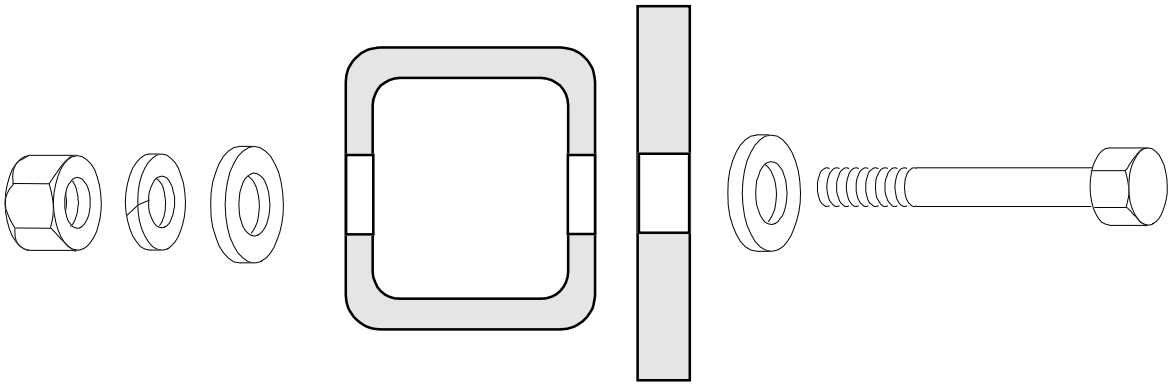

Figure D-5. Antenna Hardware Detail

LNB Downconverter/Feed Assembly

Because of the light weight of the LNB downconverter assembly, the feed rods alone are adequate to support it. Avoid over-tightening the Allen-head screws used in the assembly.

To attach the LNB downconverter to the reflector:

1. Attach the feed support rods to the reflector.
2. Position and attach the feed horn support rods to the feed horn. The reflector can be laterally adjusted to center the feed horn.
3. Tighten and torque the bolts attaching the reflector to the reflector support arms.
4. Assemble the feed horn and LNB downconverter as shown in Figure D-6.
5. Position the LNB downconverter assembly and attach the feed support rods as shown in Figure D-7.

This completes the mechanical assembly of the antenna.

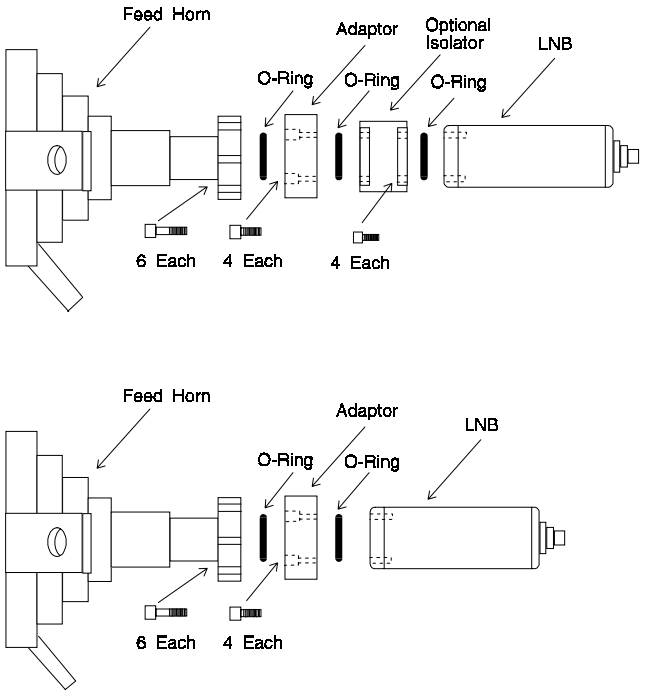

Figure D-6. LNB Downconverter Assembly

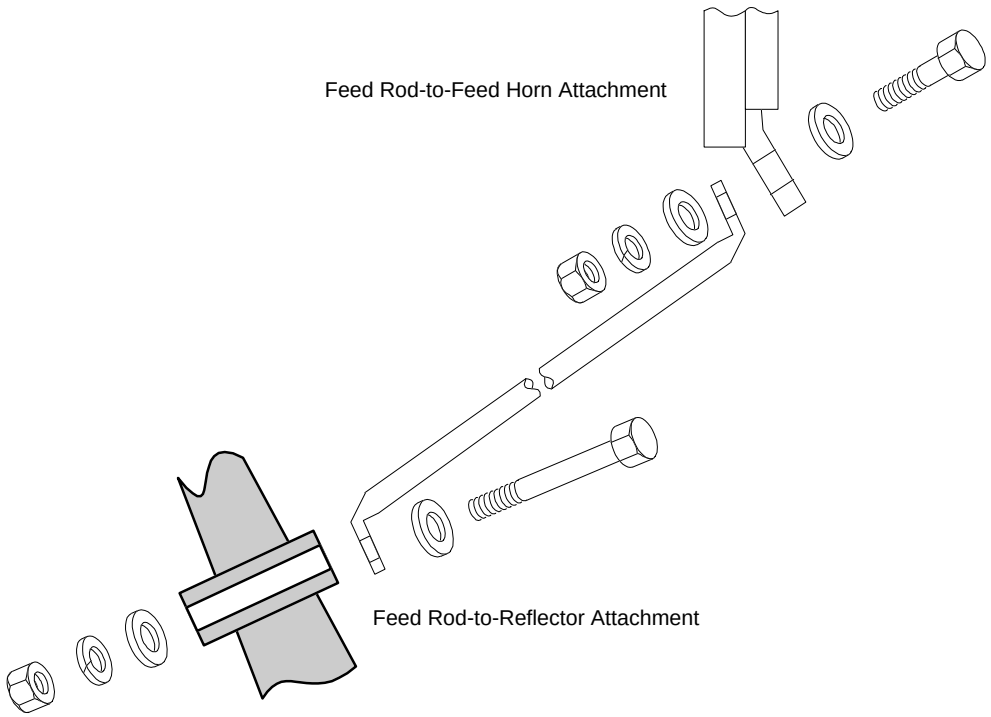

Figure D-7. Feed Support Rod Attachment

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Appendix E: Antenna Aiming and Peaking

Overview

This appendix describes the activities necessary to:

- Point the ABR200 receive-only antenna at the appropriate satellite
- Acquire an out-route carrier
- Perform antenna peaking adjustments

Proper antenna alignment is imperative to ensure proper overall system performance.

The procedure for antenna alignment can be summarized in the following steps:

1. Obtain antenna-aiming values for the azimuth, elevation, and polarization.
2. Adjust the antenna to these values as a coarse approximation in acquiring the satellite.
3. Acquire the appropriate satellite by receiving expected carrier(s).
4. Peak the antenna by maximizing the receive signal.
5. Record final antenna-aiming values.

Tool/Equipment Requirements

The following tools and test equipment are required to properly align the antenna:

- Spectrum analyzer (L-band) (portable preferred)
- Coax cable, 4 to 6 feet long with an F connector on one end and a spectrum analyzer-compatible connector on the other end
- Large, adjustable, open-end wrench
- Inclinometer
- Magnetic compass
- Calculator (for computing azimuth, elevation, and polarization)
- Permanent ink (felt tip) marking pen

Calculating Antenna-Aiming Values

To aim the antenna, first determine the exact position of the satellite relative to the earth station position on the surface of the earth. As a minimum the elevation look angle and azimuth are required to perform an initial aim of the antenna. These values can be derived from the earth station site latitude and longitude and the satellite longitude. Before using the following equations, verify the satellite has a clear line of sight to the earth station.

Z = Satellite Longitude (West = +, East = -)

Y = Earth Station Longitude (West = +, East = -)

X = Earth Station Latitude (North = +, South = -)

W = | Z - Y |

K = 1 if Z >= Y, -1 if Z < Y

R = Satellite Distance from Earth = 42230 km

$\mathbf{R_o}$ = Earth Radius = 6370 km

D = Distance from Earth Station to Satellite

$$= \sqrt{R_o^2 + (R_o + R)^2 - 2R_o \cdot (R_o + R) \cdot cosX \cdot cosW}$$

E = Elevation Look Angle

$$= arccos\left(\frac{(R_o + R) \cdot sin[arccos(cosX \cdot cosW)]}{D}\right)$$

NOTE: For offset antennas, subtract 22.3° from **E** to obtain the correct elevation look angle.

True Azimuth

$$= 180° + (K \cdot arccos[tanX \cdot cot(arccos[cosX \cdot cosW])])$$

Pol Angle

$$= arctan\left[sinW \cdot \frac{\pi}{180} \times K \times \frac{1}{tan\left(A \cdot \frac{\pi}{180}\right)}\right]$$

To determine the latitude and longitude of the earth station, use a map, atlas, or navigation system (such as LORAN). An alternative method is to contact a broadcast station in the area. The latitude and longitude are recorded on the station license.

Compute the values using a scientific calculator and the above formulas. Recheck your work and write down your results for later reference.

Coarse Antenna Pointing

The following steps describe the procedure for pointing the antenna at the appropriate satellite. The overall time required to point and peak the antenna can be significantly reduced if the initial point is correct, so it is important to complete the following steps accurately and completely.

Coarse Elevation Alignment

The elevation is adjusted by turning the elevation adjustment bolt on the rear of the AZ/EL positioner assembly, as shown in Figure E-1.

To adjust the elevation:

1. Place the inclinometer on the reflector support tube where shown in Figure E-2.
2. The antenna elevation should be adjusted so that the inclinometer reads the look angle minus 22.3° (antenna offset). For example, if the computed elevation angle is 60.5°, the elevation should be adjusted until the inclinometer reads 38.2°.
3. Using the adjustable, open-end wrench, loosen the elevation locking nuts, as shown in Figure E-1.
4. Adjust the antenna to the desired inclinometer reading by using the open end to turn the elevation adjustment bolt.

NOTE: If a large elevation adjustment is necessary, one person can lift up on the feed support tube to relieve tension on the adjustment nut. Then the second person can adjust the nut by hand to the new location on the adjustment bolt.

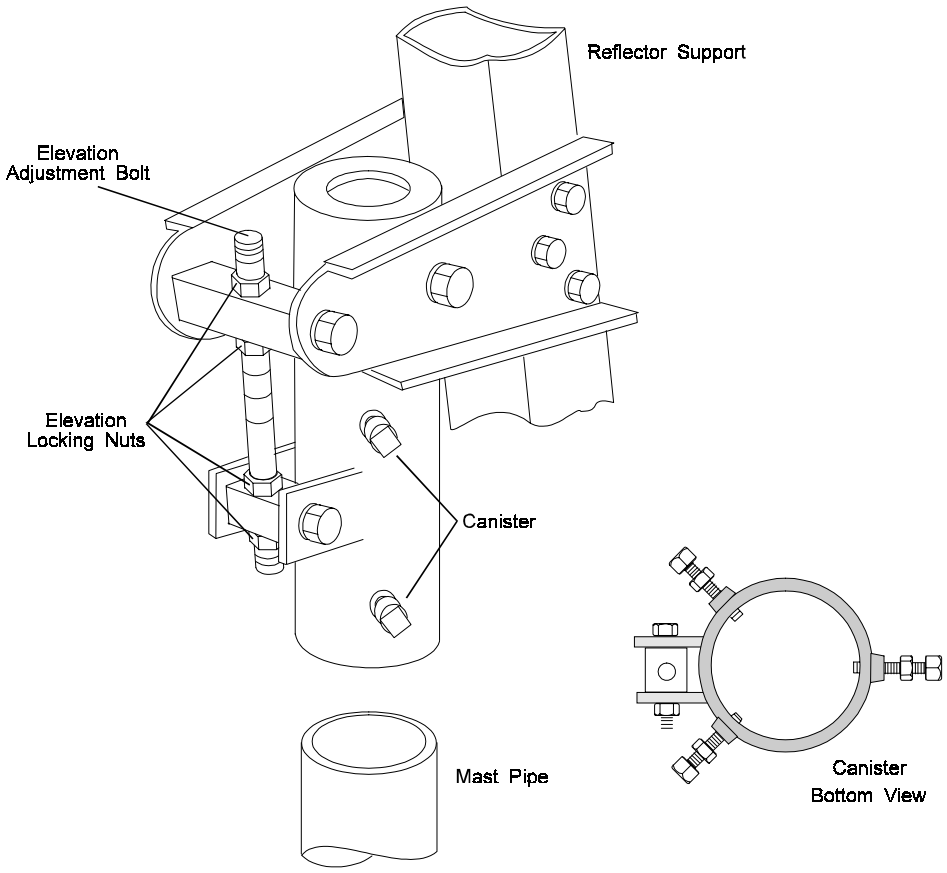


Figure E-1. Azimuth/Elevation Positioner

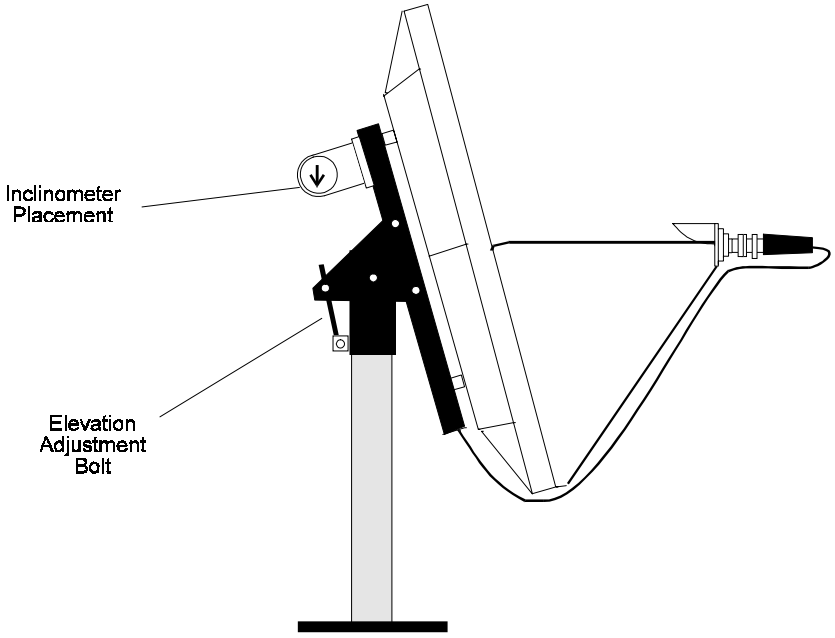


Figure E-2. Inclinometer Placement

Coarse Azimuth Alignment

The azimuth of the antenna is adjusted by rotating the AZ/EL position and antenna around the mast.

To adjust the azimuth:

1. Using a compass, determine the proper azimuth to which the antenna should be pointed. The compass must first be corrected for the magnetic declination based on the location of the antenna.

NOTE: The proper declination must be factored into compass readings, or errors of as much as 20° may result.

2. Ensure the canister bolts (shown in Figure E-1) used to lock the antenna azimuth are finger loose so the AZ/EL positioner is free to turn on the mast.
3. With the compass in hand, walk in front of the antenna and position yourself so that the compass reading corresponds to the desired azimuth reading with respect to the antenna axis.

NOTE: Be sure to take compass position readings as far away as possible from any metal that may affect a true reading. Be especially cautious on roof tops. If heavy metal reinforcement is used, the compass reading can be off by as much as 40°. To circumvent this, determine the azimuth of one side of the building by taking a reading on the street level away from the building. The building side can now be used as a point of reference.

4. Swing the antenna to point at the compass heading determined in the previous step.

Coarse Polarization Alignment

The polarization of the feed is adjusted by rotating the LNB/Feed Assembly on its mount axis. Most satellites operate both horizontal and vertical polarization planes using the same frequency assignments, doubling the amount of operational bandwidth. Ensure the carrier using vertical polarization does not interfere with the same frequency using the horizontal polarization. Figure E-3 provides an example satellite spectrum with the polarization adjusted to view both vertical and horizontal planes. Figures E-4 and E-5 show the spectrum of the same satellite when the receive feed is properly polarized vertically and horizontally, respectively. Note the separation of carriers that occurs.

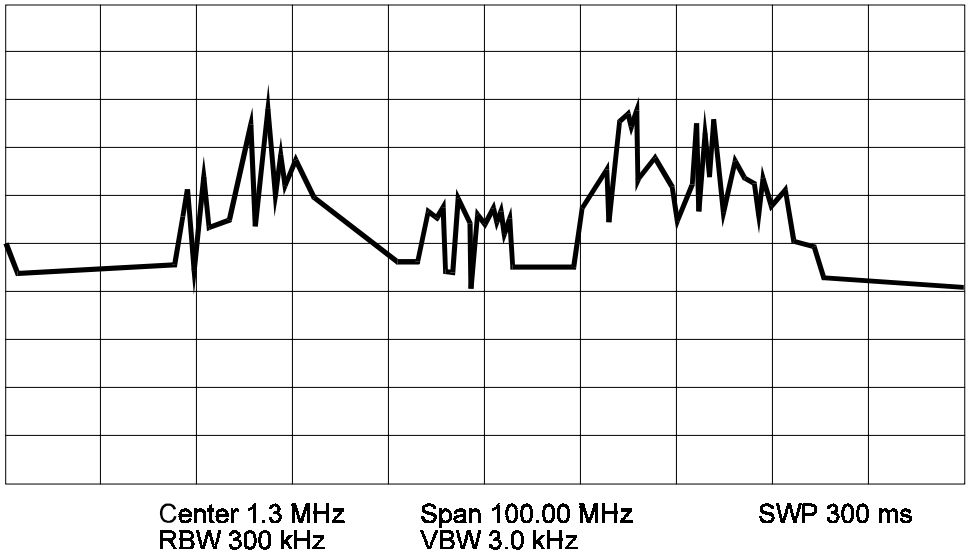


Figure E-3. Sample Spectrum, Mixed Vertical and Horizontal Polarization

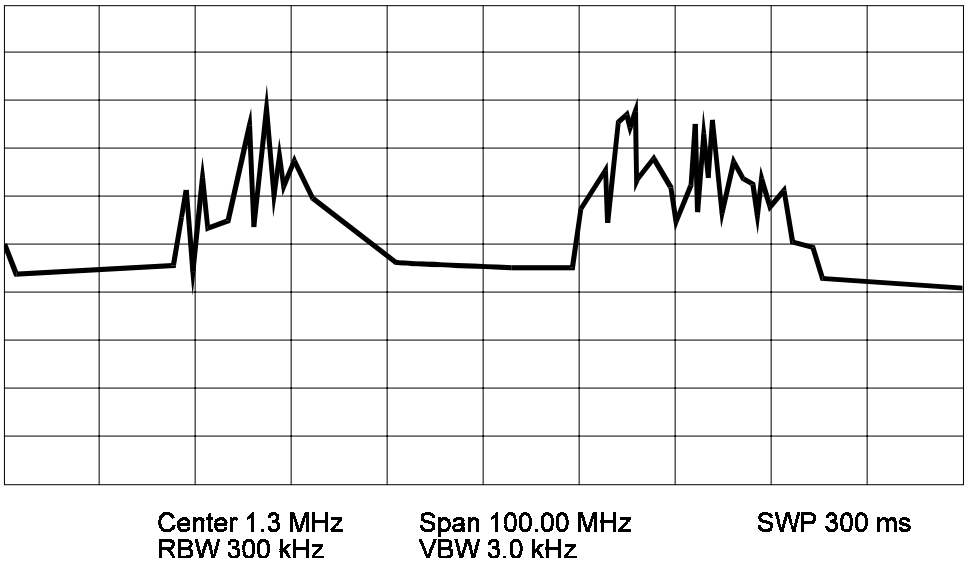


Figure E-4. Sample Spectrum, Vertical Polarization Antenna Fine Aiming

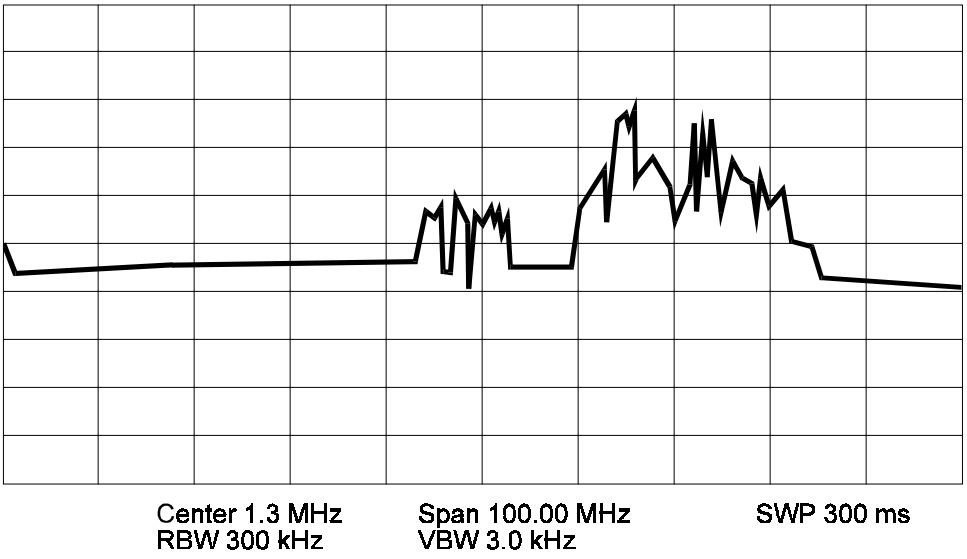


Figure E-5. Sample Spectrum, Horizontal Polarization Antenna Fine Aiming

Antenna Fine Aiming

Signal-Based Alignment

The previous coarse aiming procedure aligns the antenna so that it points in the approximate direction of the satellite. To accurately locate the satellite, the azimuth, elevation, and polarization must be adjusted to maximize the signal level of the received carrier on the spectrum analyzer.

Before beginning this procedure, ensure the canister bolts are just loose enough to permit the AZ/EL positioner to rotate on the mast pipe. Check all six bolts to ensure each is in contact with the mast pipe and that the positioner is in alignment with the mast pipe.

To align the antenna based on the signal:

1. Connect the spectrum analyzer to the LNB downconverter. Ensure that approximately +18 VDC power is supplied to the LNB downconverter, and that the spectrum analyzer is adjusted for the correct L-band frequency of the downconverted satellite broadcast.
2. With the elevation angle constant, slowly adjust the azimuth over a range 0.5 inch on either side of the notch in the mast while looking for a carrier with the appropriate data bandwidth at the center of the display on the spectrum analyzer.
3. If the carrier is present, adjust the azimuth to peak the carrier power, as indicated by the spectrum analyzer.

4. Perform Steps 2 and 3 above using the elevation adjustment with a constant azimuth. Slowly adjust the elevation angle up and down to obtain the strongest carrier power.
5. To adjust the polarization, rotate the LNB downconverter assembly to obtain the strongest carrier power. Fine-tune the polarization by nulling out the cross-polarization interference in the desired signal. The LNB may be rotated by loosening the screws that attach the feed to the LNB downconverter. Retighten the screws after the polarization adjustment is complete.
6. Repeat all adjustments as necessary to peak the received signal-to-noise ratio.

Carrier Not Found

If the carrier is not present, increase the elevation angle by making several clockwise turns of the elevation adjusting bolt and repeating the steps for signal-based alignment. If the carrier still is not found, continue increasing the elevation angle and repeating the steps for signal-based alignment until the elevation angle, as measured on the inclinometer, has been increased by 2°.

If increasing the elevation angle 2° does not locate the carrier, begin to decrease the elevation angle by making several counterclockwise turns of the elevation adjust bolt. After each decrease in elevation angle, repeat the signal-based azimuth and polarization adjustment. Continue this process until the carrier is located or the elevation angle is 2° less than the computed angle.

If the carrier has not been located at this point, repeat the coarse aiming procedure to ensure the approximate satellite location has been correctly obtained.

Final Antenna Peaking

If optimal system performance is not required, skip the following steps and proceed to the “Final Steps” section of this appendix. However, the additional time and effort needed to perform these steps will be well worth the potential gain in system performance.

Elevation Peaking

To achieve the optimum elevation peak:

1. Perform an EB query command and observe the received Eb/No value.
2. Increase the elevation by making one clockwise turn of the elevation adjusting bolt.
3. Perform another EB ?.

   If the Eb/No remains the same or increases, continue to increase the elevation angle one turn at a time with Eb/No measurements between each adjustment until the Eb/No drops off. Once the Eb/No drops off, proceed to decrease the elevation angle (counter-clockwise turns) until the Eb/No drops off again. Keep track of how many turns are made. Now divide the number of turns by two and increase the elevation by that many turns. The measured Eb/No should be at its peak value.

   If the Eb/No decreases after the first increase in the elevation angle, decrease the elevation angle (counter-clockwise direction) and perform Eb/No measurements until the ratio peaks then decreases again. Keep track of how many turns are made. Now divide the number of turns by two and increase the elevation by that many turns. The measured Eb/No should be at its peak value.
4. Tighten the lock nuts on the elevation adjustment bolt, as shown in Figure E-1. Observe the spectrum analyzer or monitor the Eb/No measurements to ensure that tightening the lock nuts does not cause a drop in signal-to-noise ratio.

Azimuth Peaking

The azimuth peaking procedure is very similar to the elevation peaking procedure. Change the azimuth in one direction very slightly and perform Eb/No measurements after each change until the measurement decreases. Then repeat the process in the other direction until the maximum Eb/No measurement is obtained.

Tighten the canister bolts, as shown in Figure E-1. Observe the spectrum analyzer or monitor the Eb/No measurements to ensure that tightening the lock nuts does not cause a drop in signal-to-noise ratio.

Polarization Peaking

Polarization is peaked under the direction of the satellite operations center. It is adjusted for minimum interference or bleed-through by monitoring the polarity opposite the uplink in use.

Final Steps

To finish the antenna peaking procedure:

1. Recheck to ensure all nuts and bolts on the antenna are securely tightened.
2. Using the marking pen, draw a 2 inch vertical line between the bottom of the AZ/EL positioner and the mast pipe. This will identify the azimuth position of the antenna for later reference.
3. Remeasure the azimuth, elevation, and polarization and record these values for future reference.

Appendix F: Software Revision History

Overview

This appendix provides a summary of the ABR software revisions. There are two different types of software within the ABR200 unit, control processor software, and audio decoder software. The control software can be updated over the satellite from the uplink using a network control computer. The audio decoder software can be updated only at ComStream by physically replacing the memory chip.

Anytime a receiver is serviced at ComStream, the software is updated to the latest revision level.

ABR Control Software

Version 1.38, Release Date: 4/94

This is the latest version of the ABR control software. For information that details the changes made with version 1.38, refer to *Appendix G: Version 1.37 and 1.38 Changes*.

Version 1.37, Release Date: 1/94

For information that details the changes made with version 1.37, refer to *Appendix G: Version 1.37 and 1.38 Changes*.

Version 1.36, Release Date: 6/93

This software corrects a problem with the receiver that occasionally occurs during a fade condition. This problem includes the following symptoms:

- The receiver does not illuminate the Audio Sync Fault indicator on the front panel, while the RF Sync and Signal level indicators operate normally.
- The receiver does not have an audio output signal but the relays and user data ports operate normally. When in this state, if the user checks the receiver, via the Monitor and Control port, an error code of FL 18 is displayed.

Version 1.35, Release Date: 3/93

This software version:

- Supports additional data rates:

  ABR200-1 QPSK: 112

  ABR200-2 BPSK: 192

  QPSK: 112, 384

- Adds the AP (CS8204 inputs) command that provides users with access to the inputs of the CS8204 digital transmitter that specify the control information to be transmitted
- Modifies the audio test (AT) command to allow an optional length of time parameter
- Modifies the display configuration (DC) command to reflect the new data rates supported by the ABR200
- Adds the composite data port enable (DE) command, which enables/disables the composite baseband data to be output on the auxiliary port connector
- Modifies the display parameters (DP) command to reflect the changes made in v1.35
- Adds the decoder data source (DX) command, which selects the input source for the audio decoder on the ABR200
- Adds the enable network (EN) command, which allows the user to enable/disable the output of the network ID information via the RS-232 data port
- Adds the maximum Eb/No (EX) command, which queries the receiver for the maximum Eb/No value recorded since the last maximum value was reset
- Adds an acquisition network ID fault (FL 31), which is declared when the receiver achieves the RF sync but receives an invalid network/channel ID, or no network/channel ID at all
- Adds a left/right channel toggle (LR) command, which instructs the receiver to reverse the sense of the left/right audio channels
- Adds the master reset (MR) command, which allows the user to reinitialize the receiver nonvolatile parameters to their factory default settings
- Adds the audio mute (MU) command, which allows the user to mute the audio output of the receiver
- Does not force an RF carrier reacquisition when the changes in the format reflect only a receiver unit authorization modification
- Modifies the default threshold values for the Eb/No mute on/off to M0=Eb/No mute on (4.0) and M1=Eb/No mute off (4.5)

Version 1.34, Release Date: 10/92

This software release:

- Enhances the power on tests to include a special RAM memory test

  Failure of this test is indicated by flashing front panel indicators in two distinctive patterns: RF Sync, Signal and ODU Fault indicators flash on, followed by Audio Sync and IDU Fault indicators flashing. If the test passes, normal power-on processing and signal acquisition occurs. The unit will indicate a failure as long as the RAM memory test fails or the unit is reset (the test reruns).

- Supports the ABR200 (Type 2) unit designation for 64 Ksps (64 kbps, QPSK) operation

Version 1.33, Release Date: 8/92

This version of the software:

- Adds a new Ku-band frequency range of 10.95 GHz to 11.699 GHz
- Enables the watchdog timer for the control processor

  This timer resets the control processor within 1.5 seconds of code execution failure.

- Adds the network ID timeout fault (FL 30)

  This error condition exists if the channel and network ID information is not received over the control channel every 12 seconds.

- Changes the default value of the status relay mask (SR command) to 3749707775, which masks off FL 30 and FL 24 and activates on all other faults

Version 1.32 (1.31), Release Date: 6/92

NOTE: Version 1.31 was released, but recalled.

This release:

- Changes the RF acquisition algorithm to improve fade acquisition time by alternating between the last known frequency bin and the new (expanding) search bin
- Automatically sets the B1 and B2 parameters according to the symbol rate; these commands are now read-only
- Initializes the network and channel ID values as returned by the network status (NS) command to 254 at the beginning of acquisition
- Changes the default values of B3 to 2000 (DRO LNB) and 200 (PLL LNB)

Version 1.29, Release Date: 4/92

This software version:

- Changes several initialization values
- Changes FL 28 to indicate a software download fault and adds a blinking IDU Fault indicator to provide a front panel indication

Audio Decoder Software

The revision number of the audio decoder software is displayed during the decoder test (AT 4) command.

Version 1.16, Release Date: 1/93

This release implements the left/right channel toggle and muting options, as well as adds the 9600 baud user data capability. This version of software is required to use the features and functions provided by the version 1.37 and 1.38 ABR200 software.

Version 1.14, Release Date: 1/93

This release permits operation with the ISO/MPEG Layer II/IIA CRC checksum or ISO/MPEG Layer II/IIA standard CRC checksum. The CRC operating mode is selected nominally at the uplink on the encoder. The audio decoder software automatically selects which CRC to use for operation.

Version 1.12, Release Date: 1/92

This software version supports only ISO/MPEG Layer II/IIA CRC operation.

Appendix G: Version 1.37 and 1.38 Changes

Overview

This appendix describes the changes made with the 1.37 and 1.38 versions of the ABR200 software. Version 1.37 software mainly provides the terrestrial backlink (TB) feature, which gives the receiver the ability to report its fault state to the network uplink. Both version 1.37 and 1.38 software added some commands, as well as modified some existing ABR200 commands.

The Terrestrial Backlink

When a critical fault occurs, the terrestrial backlink feature enables the ABR200 to automatically report its fault state to the network uplink site. The receiver reports the fault state by establishing a terrestrial backlink via a telco modem that is attached to its M&C port.

Operational Description

The basic operation of the TB is to periodically compare the faults specified by the user with the fault history (FL command) of the ABR200. If any of the specified faults occur in the receiver, a backlink is initiated to alert the network that a fault has occurred at the remote location.

There are two independent fault masks, F1 and F2, that correspond to the two user-definable phone numbers, T1 and T2. If the TB detects a fault that is a member of F1, the receiver initiates a link using the T1 phone number. Likewise, if the TB detects a fault that is a member of F2, the receiver initiates a link using the T2 phone number. If the fault is a member of both F1 and F2, the receiver first initiates a backlink using T1 and then initiates a call using T2. The length of time between the backlink attempts is specified by the user via the alarm interval (AI) command.

Once a backlink is established, the computer at the network uplink site has access to the ABR200's M&C port. The ABR200 is already in a state where it is logged in so that the computer at the uplink site does not have to have knowledge of the receiver's password. It is the responsibility of the network uplink computer to query the ABR200 for its current state; the TB does not automatically provide any information. The network uplink site can issue any valid ABR200 command or query. A recommended sequence of query/commands that can be issued are shown in Table G-1.

Table G-1. Valid Commands that Can Be Sent From the Uplink Site to the Remote Site ABR200

Command	Command Description
ID	Obtains the receiver's physical ID
ST	Obtains the current operating state of the receiver
CF	Clears the fault history
TB	Directs the receiver to terminate the link

The TB maintains the terrestrial link until either the network uplink terminates the link or there is a period of five minutes of inactivity on the link. The uplink site terminates the link by issuing a TB 0 command to the ABR200. The TB 0 command instructs the receiver to terminate the link from the remote site. Once the link is terminated, the TB waits a user-specified length of time (AI command) before it starts to monitor for faults again.

The TB continues to initiate backlinks until the fault history of the receiver is cleared. The network uplink computer must clear the fault history of the ABR200 to remove faults that have already been reported. If a fault cannot be cleared due to the condition of the receiver, then further backlink attempts can be prevented by either setting AI to 0 or by removing the backlink phone number specified in T1 and T2.

Configuration

Telco Modem

The terrestrial backlink requires that a telco modem be connected to the ABR200's M&C port. The connection between the ABR200 and the modem should be made with the cable shown in Table G-2 (CPN 05-0505-001).

Table G-2. Telco Modem Cable to be Used for the Terrestrial Backlink

Telco Side DB-25 Male	ABR200 Side DB-9 Male
2 (TD to modem)	2
3 (RD from modem)	3
7 (ground)	5
8 (DCD from modem)	4
20 (DTR to modem)	6

The TB sends all initialization information to the telco modem so a minimal amount of preconfiguration is needed. The only parameter that must be configured on the telco modem prior to connection to the ABR200 is the carrier detect status (&C) parameter. The terrestrial backlink uses this line to determine if a telco link is already in progress. If this line is asserted, then TB does not initiate a calling process. The default value for the &C command is 0, which keeps this carrier-detect line asserted. For TB to initiate a call, this parameter must be set to 1. This parameter is set by hooking up an RS-232 terminal to the modem via the telco modems 25-pin connector and typing **`AT&C1`**.

Once the parameter is set, the TB sends its own initialization string to the telco modem before every backlink attempt. The string that is sent is `AT&D3&C1S0=1E0Q0V1&Y0`.

The ABR200 also allows the user to define an initialization string that is sent to the modem after the above initialization string is sent. This string is configured using the TI command.

Terrestrial Backlink

The user must configure the TB with the:

- Fault conditions that will trigger a backlink attempt
- Telephone number to use for a backlink
- Interval of time to wait between consecutive backlink attempts

Use the commands in Table G-3 to configure the terrestrial backlink.

Table G-3. Terrestrial Backlink Commands

Command	Description
TB	Terrestrial Backlink
AI	Alarm Interval
F1	Fault Mask 1
F2	Fault Mask 2
T1	Backlink Telephone Number 1
T2	Backlink Telephone Number 2

For more information about these commands, refer to the “Commands Added” section of this appendix.

General Changes

The user data port maximum baud rate has been increased to 9600 bps. To utilize this faster speed, the receiver must have v1.16 or higher of ISO/MPEG Layer II/IIA decoder software installed.

The MCRESET pin has been moved from pin 12 of the AUX port to pin 12 of the Relay Control port. The MCRESET pin allows the user to reset the M&C port to the default parameters. These parameters reset if the MCRESET pin is at a low level during receiver initialization after power up. The default parameters for the M&C port are 2400,O,7,1, RS-232 electrical interface.

The channel error rate (CE) and read calculated bit error rate (RB) commands are not provided in the v1.38 software.

Commands Added

AI Alarm Interval

Syntax: **AI *n***

AI ?

The alarm interval command allows the user to specify the length of time the receiver waits between backlink attempts. This command also allows the user to disable the monitoring for faults that may cause an attempt to establish a backlink.

n specifies the length of time the receiver waits between backlink attempts when a fault is detected. The range for *n* is 0 to 65535, and the units are in minutes. A value of 0 for *n* disables the monitoring of faults, which prohibits the receiver from attempting any backlinks.

F1 Fault Mask 1

Syntax: **F1 *nnn***

F1 ?

The F1 command specifies the faults that will trigger a backlink attempt to the user-defined number specified in T1.

The value of *nnn* is a decimal number that represents the bit map of the faults to be monitored by the terrestrial backlink.

For example:

> To select faults 6, 7, and 8, the user enters 224 (32 + 64 + 128 = 224) as the value for *n*.
>
> (For a listing of the fault monitors and their decimal weightings, refer to the FL command in *Chapter 5: Remote Monitor and Control Operation*.)

The TB compares the faults specified in this command with the value of the receiver's current fault history (FL command). If any of the faults that are specified in F1 are also a member of the receiver's fault history, a backlink is attempted using the number specified in T1. The default value for this command is 0.

F2 Fault Mask 2

Syntax: **F2 *nnn***

F2 ?

The fault mask 2 command specifies the faults that will trigger a backlink attempt to the user-defined number specified in T2.

The value of *nnn* is a decimal number that represents the bit map of the faults to be monitored by the terrestrial backlink.

For example:

To select faults 6, 7, and 8, the user enters 224 (32 + 64 + 128 = 224) as the value for *n*.

(For a listing of the fault monitors and their decimal weightings, refer to the FL command in *Chapter 5: Remote Monitor and Control Operation*.)

The TB compares the faults specified in this command with the value of the receiver's current fault history (FL command). If any of the faults that are specified in F2 are also a member of the receiver's fault history, a backlink is attempted using the number specified in T2. The default value for this command is 0.

LT LNB Type

Syntax: **LT *n***

LT ?

The LNB type command allows the user to select a mode in which the receiver automatically selects the LNB type.

The selection of the proper LNB type modifies receiver parameters that are needed to perform carrier tracking properly. The two types of LNBs that are used at the remote site system are DRO and PLL. A value of 0 for *n* configures the receiver for a DRO-type LNB, whereas a value of 1 for *n* configures the receiver for a PLL-type LNB.

A value of 2 for *n* instructs the receiver to automatically select the type of LNB. The receiver uses the current modulation type, as specified in the CC command, to determine for which LNB type to configure. If the current modulation type is BPSK, the receiver configures for a DRO-type LNB, whereas if the modulation type is QPSK, the receiver configures for a PLL-type LNB. The receiver automatically selects the LNB type prior to every RF acquisition attempted.

PA Packet Address

Syntax: **PA *n***

PA ?

This command is used to set the packet address of the receiver. The packet address is the external device address to which the receiver responds when attached to an RS-485 multidrop bus. Using a terminal program that supports ComStream packet protocol, each receiver on the bus can receive commands that are specifically addressed to that receiver, addressed to a group of receivers (of which the receiver is a member), or addressed to all receivers.

Valid values for *n* are 1 to 31 and the default value is 31.

PO Packet-Only

Syntax: **PO *n***

PO ?

The packet-only command is used to place the receiver in a mode so that the receiver will only accept commands from the M&C port that are formatted in the ComStream packet protocol format. ComStream packet protocol contains addressing information that allows the ABR200 to be placed on a 485 multidrop bus. When on a multidrop bus, it is recommended that the receiver be placed in packet-only mode to eliminate the possibility of the receiver responding to a command that was not addressed to it.

A value of 1 for *n* directs the receiver to accept packet commands. A value of 0 for *n* instructs the receiver to accept packet as well as nonpacket formatted commands.

S1 Interface Select for Auxiliary Data

Syntax: **S1 *n***

S1 ?

The S1 command selects the electrical interface for the auxiliary data.

A value of 0 for *n* selects the RS-232 electrical interface, whereas a value of 1 for *n* selects the RS-422 electrical interface.

S2 Monitor and Control Interface Select

Syntax: **S2 *n***

S2 ?

The S2 command is used to select the electrical interface for the M&C port.

A value of 0 for *n* selects RS-232 electrical interface for the M&C port, whereas a value of 1 selects the RS-422 electrical interface. The M&C interface can be reset back to RS-232 by using the MCRESET pin (Relay Control port, pin 12). If the MCRESET pin is held at a ground state (Relay Control port, pin 25) during power-up initialization, the M&C port resets to the default parameters of 2400,O,7,1, RS-232 electrical interface.

The factory initialized value for S2 is 0.

T1 Backlink Telephone Number 1

Syntax: **T1 *string***

T1 ?

The T1 command specifies the telephone number the receiver uses in a backlink attempt initiated by a fault that is a member of fault mask 1 (F1 command).

String is a character string that contains the telephone number and any Hayes-compatible subcommands. When initiating a backlink the receiver sends ATD followed immediately by the string entered by the user. The following is a list of valid characters that can be entered:

- 0 to 9
- A to Z
- * (asterisk)
- # (number/pound symbol)
- @ (at symbol)
- ! (exclamation mark)
- ; (semicolon)
- , (comma)

The following is an example of the T1 command:

T1 9,5553333

T2 Backlink Telephone Number 2

Syntax: **T2 *string***

T2 ?

The T2 command is used to specify the telephone number the receiver uses in a backlink attempt initiated by a fault that is a member of fault mask 2 (F2 command).

String is a character string that contains the telephone number and any Hayes-compatible subcommands. When initiating a backlink, the receiver sends ATD followed immediately by the string entered by the user. The following is a list of valid characters that can be entered:

- 0 to 9
- A to Z
- * (asterisk)
- # (number/pound symbol)
- @ (at symbol)
- ! (exclamation mark)
- ; (semicolon)
- , (comma)

TB Terrestrial Backlink

Syntax: **TB *n***

TB ?

The TB command allows the user to manually initiate a terrestrial backlink or terminate a backlink that is in progress.

A value of 1 for *n* instructs the receiver to establish a link using the telephone number defined by the T1 command. Likewise, a value of 2 for *n* instructs the receiver to establish a backlink using the phone number defined by the T2 command. A value of 0 for *n* instructs the receiver to terminate any active backlinks.

TI Telco Initialization

Syntax: **TI *string***

TB ?

This command allows the user to enter a specific initialization string for the telco modem. This string is sent to the telco modem prior to every backlink attempt. When a backlink is attempted, the ABR200 sends a basic initialization string followed immediately by the user-defined initialization string. The following sequence of strings is sent prior to every backlink attempt:

```
AT&D3&C1S0=1E0Q0V1&Y0
AT user-defined string
```

The user-defined string can be a maximum of 40 characters. The valid characters that can be sent are:

- 0 to 9
- A to Z
- &
- =

The default string for TI is &Q5W0&Y0.

Commands Modified

EN Enable Network Data

Syntax: **EN *n***

EN ?

The EN command is used to select the type of data to be output on the auxiliary data pins of the user data port.

A value of 1 for *n* enables the output of the network ID information. The network ID information is generated at the uplink multiplexer and contains network ID, channel ID, and relay control information. This network ID information is used to support an external relay control unit (RCU). The RCU-16 provides up to 16 relay contact closures. The output of the network data is also conditioned on the unit authorization (UA) command of the receiver as specified in the FD command. If the receiver is not authorized to receive relay information, the network ID data output is disabled regardless of the state of the EN command.

A value of 2 for *n* instructs the receiver to output the user data on the auxiliary port pins instead of the user data pins. This provides the user with the option of utilizing the auxiliary data's RS-422 electrical interface option for the user data output. For information on switching between the RS-232 and RS-422 drivers for the auxiliary data output, refer to the S1 command of this appendix.

A value of 3 for *n* enables the output of the user-defined data block. This user-defined data block is a generic block type that is made available to the user for user-specific needs. This data block is generated by the user and is input at the uplink multiplexer by a user-supplied DTE. This data block must follow the ComStream Block Transfer Protocol. The receiver outputs the entire data block to a user-supplied DTE at the remote site.

FD Format Definition

Syntax: **FD *format_nn,network_ID_nnn,channel_nn,***
unit_authorization_n,LR_value,MU_value

The format definition command now includes the LR and MU parameters, which are optional values. If no values are entered for these parameters when entering the FD command, then the LR and MU values are not modified when this format is selected via the FS command. If these values are entered, then the LR and MU values are modified when this format is selected using the FS command. For acceptable values or more information, refer to the LR and MU command sections of this chapter.

LR Left/Right Channel Toggle

Syntax: **LR *n***

LR ?

The LR command configures the receiver so that the receiver directs the:

- Incoming left audio channel to both the left and right audio output channels

or

- Incoming right audio channel to both the left and right audio output channels

The value for *n* determines the output of the left and right audio channels. Table G-4 provides the valid values for *n*.

Table G-4. Valid Values for the LR Command

n	Audio Output Status
0	Normal output. Left input goes out on the left channel, and the right input goes out on the right channel.
1	Reversed output. Left input goes out on the right channel, and the right input goes out on the left channel.
2	Left input goes out on both the right and left channels.
3	Right input goes out on both the left and right channels.

NOTE: To utilize 2 and 3 of Table G-4, the receiver must have v1.16 or higher of ISO/MPEG Layer II/IIA decoder software installed (CPN 08-1095-116).

MU Audio Mute

Syntax: **MU *n***

MU ?

The audio mute command now includes independent muting (disabling) of left and right audio channels.

The value for *n* determines the mute condition of the receiver. Valid values for *n* are listed in Table G-5.

Table G-5. Valid Values for the MU Command

n	Mute Condition
0	Both the left and right channels are enabled
1	Both the left and right channels are muted
2	The left channel is muted
3	The right channel is muted

NOTE: To utilize 2 and 3 in Table G-5, the receiver must have v1.16 or higher of ISO/MPEG Layer II/IIA decoder software installed (CPN 08-1095-116).

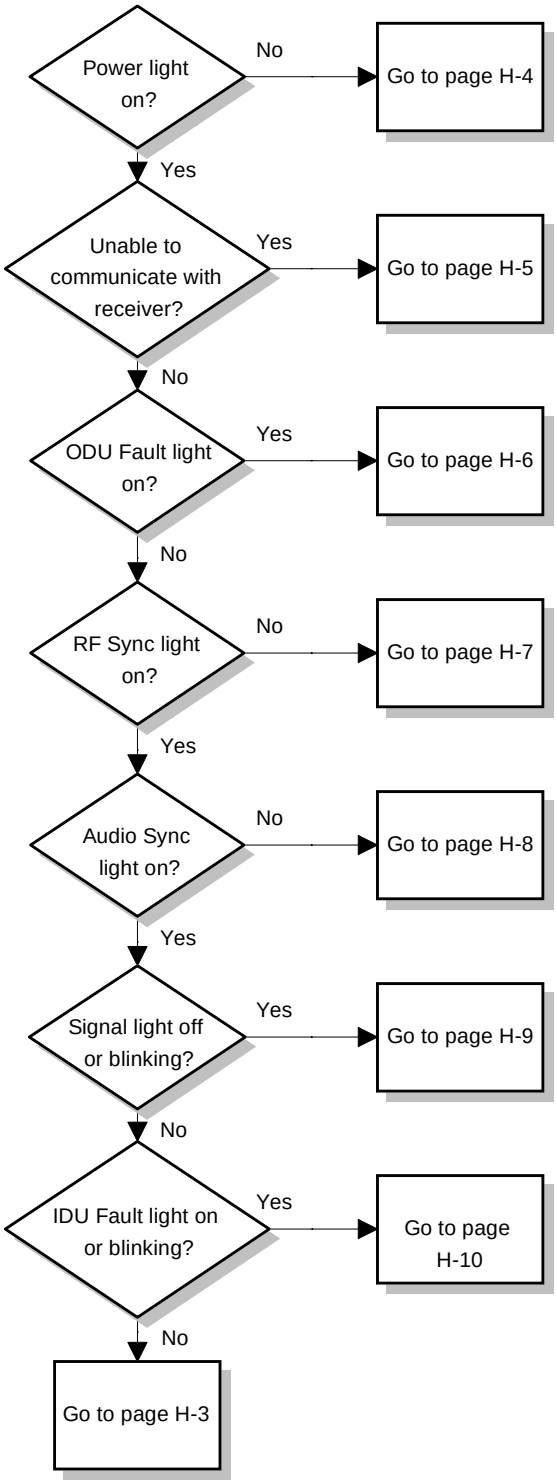
Appendix H: Troubleshooting Flowchart

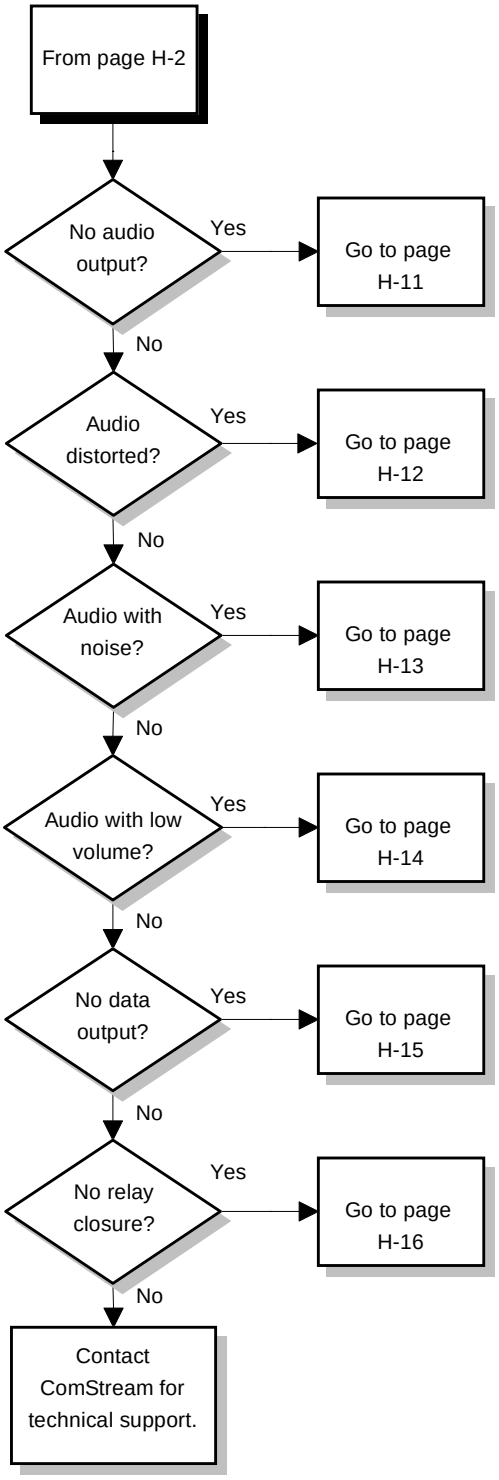
Overview

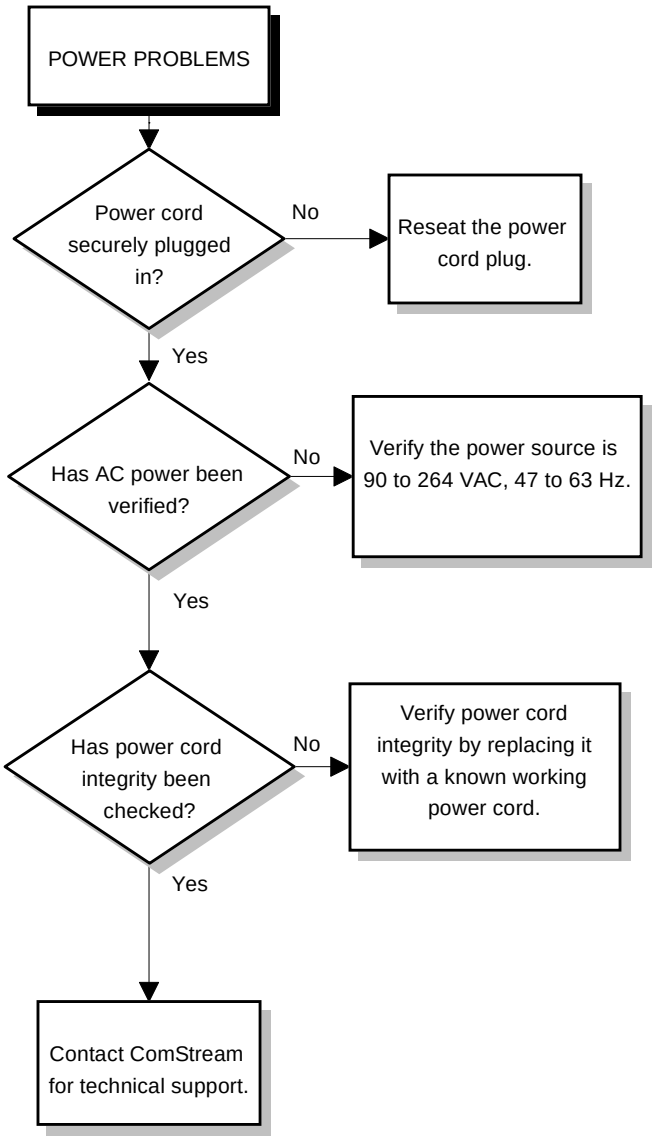
The flowchart found on the following pages was designed to help you diagnose and correct minor problems in the unlikely event that you experience difficulties with your ABR200.

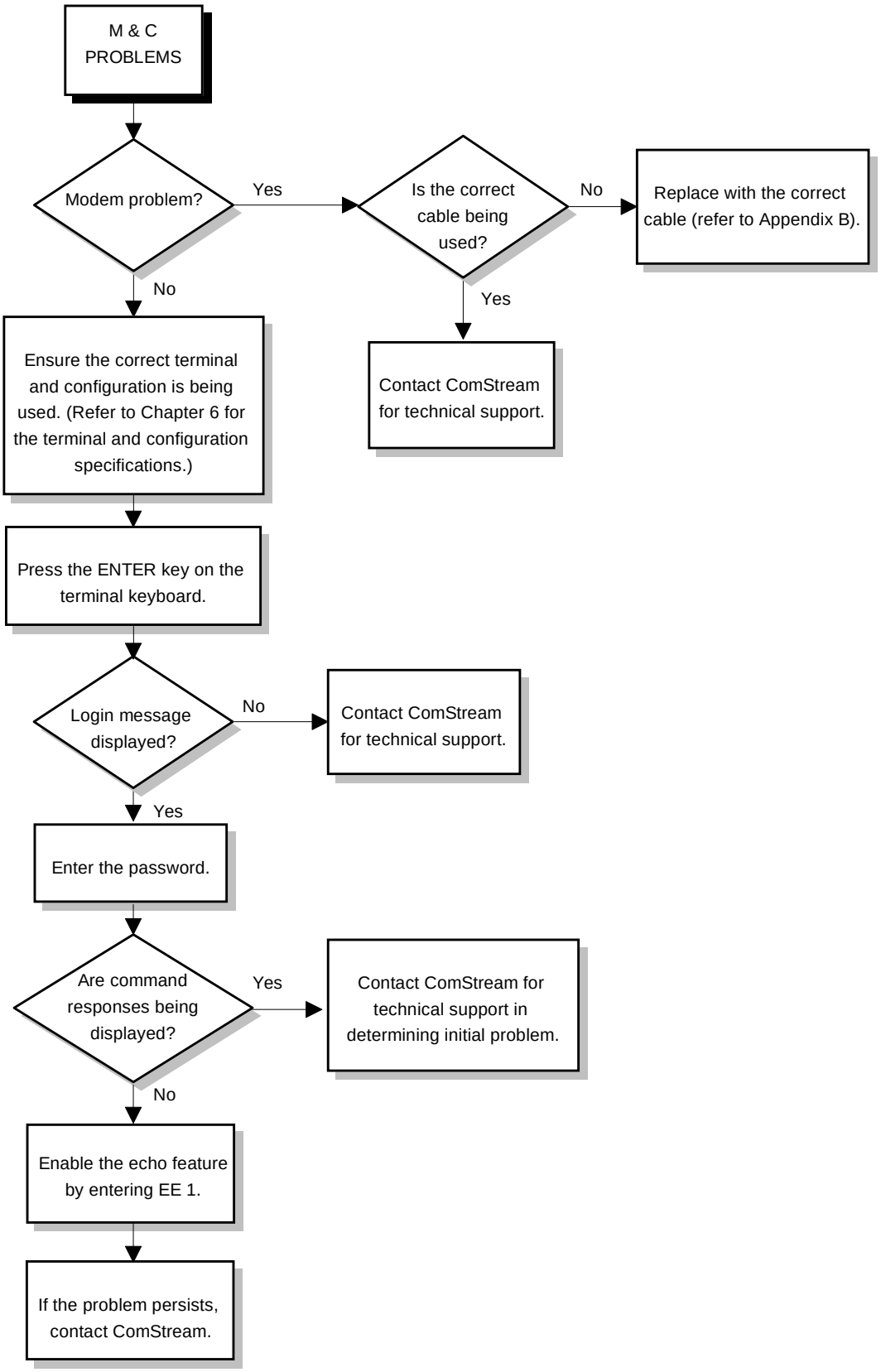
The first two pages of the flowchart list the primary symptoms you may experience. Whenever you experience any difficulties with the ABR200, begin at the top of the first page of the flowchart and work your way through each primary symptom or question. If the flowchart directs you to another page, go to the referenced page and work through that procedure to resolve the symptom. If you have resolved a symptom but are still experiencing difficulties, again start at the beginning of the flowchart and work through each symptom.

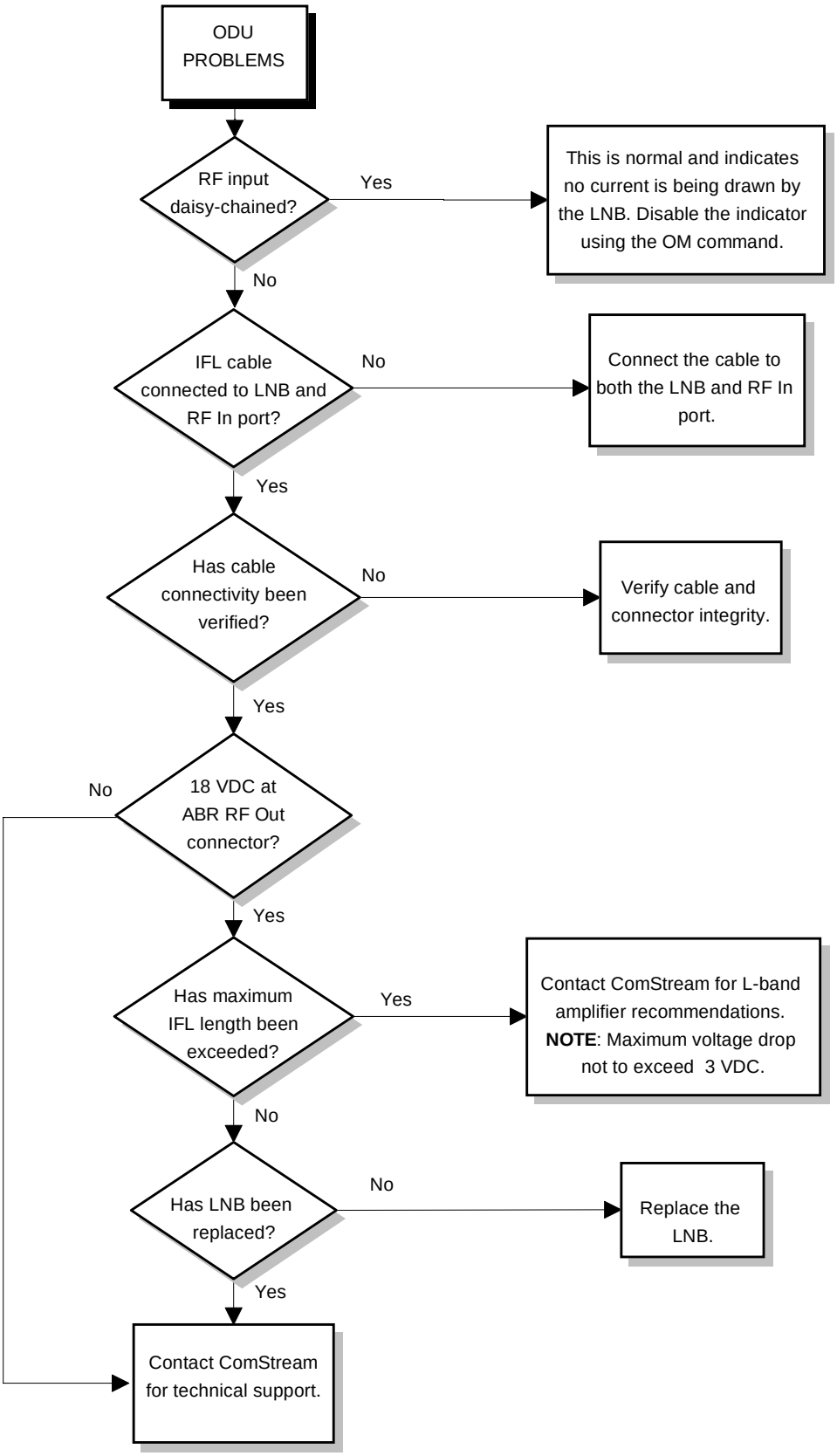
If you need additional information while working through the flowchart, refer to *Chapter 6: Maintenance and Troubleshooting*.

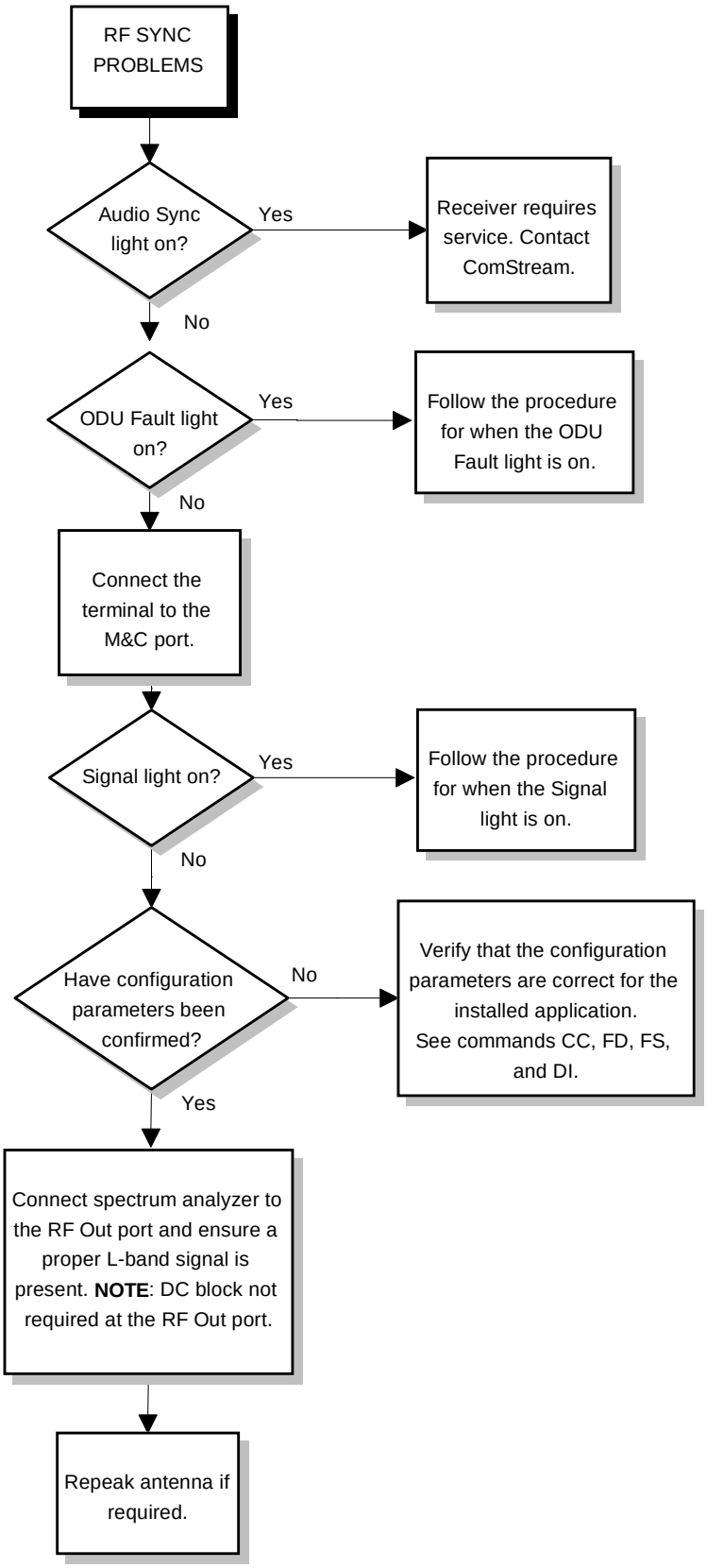

Power light on?
No
Go to page H-4
Yes
Unable to communicate with receiver?
Yes
Go to page H-5
No
ODU Fault light on?
Yes
Go to page H-6
No
RF Sync light on?
No
Go to page H-7
Yes
Audio Sync light on?
No
Go to page H-8
Yes
Signal light off or blinking?
Yes
Go to page H-9
No
IDU Fault light on or blinking?
Yes
Go to page H-10
No
Go to page H-3

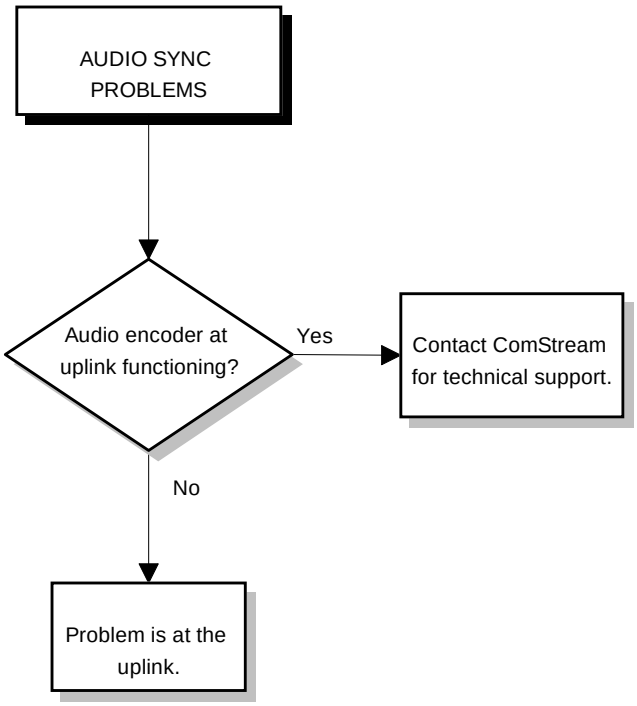

From page H-2
No audio output?
Yes
Go to page H-11
No
Audio distorted?
Yes
Go to page H-12
No
Audio with noise?
Yes
Go to page H-13
No
Audio with low volume?
Yes
Go to page H-14
No
No data output?
Yes
Go to page H-15
No
No relay closure?
Yes
Go to page H-16
No
Contact ComStream for technical support.

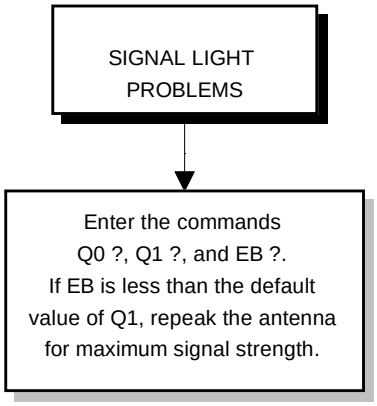

POWER PROBLEMS
Power cord securely plugged in?
No
Reseat the power cord plug.
Yes
Has AC power been verified?
No
Verify the power source is 90 to 264 VAC, 47 to 63 Hz.
Yes
Has power cord integrity been checked?
No
Verify power cord integrity by replacing it with a known working power cord.
Yes
Contact ComStream for technical support.


M & C PROBLEMS
Modem problem?
Yes
Is the correct cable being used?
No
Replace with the correct cable (refer to Appendix B).
Yes
Contact ComStream for technical support.
No
Ensure the correct terminal and configuration is being used. (Refer to Chapter 6 for the terminal and configuration specifications.)
Press the ENTER key on the terminal keyboard.
Login message displayed?
No
Contact ComStream for technical support.
Yes
Enter the password.
Are command responses being displayed?
Yes
Contact ComStream for technical support in determining initial problem.
No
Enable the echo feature by entering EE 1.
If the problem persists, contact ComStream.


ODU PROBLEMS
RF input daisy-chained?
Yes
This is normal and indicates no current is being drawn by the LNB. Disable the indicator using the OM command.
No
IFL cable connected to LNB and RF In port?
No
Connect the cable to both the LNB and RF In port.
Yes
Has cable connectivity been verified?
No
Verify cable and connector integrity.
Yes
18 VDC at ABR RF Out connector?
No
Yes
Has maximum IFL length been exceeded?
Yes
Contact ComStream for L-band amplifier recommendations. **NOTE**: Maximum voltage drop not to exceed 3 VDC.
No
Has LNB been replaced?
No
Replace the LNB.
Yes
Contact ComStream for technical support.


RF SYNC PROBLEMS
Audio Sync light on?
Yes
Receiver requires service. Contact ComStream.
No
ODU Fault light on?
Yes
Follow the procedure for when the ODU Fault light is on.
No
Connect the terminal to the M&C port.
Signal light on?
Yes
Follow the procedure for when the Signal light is on.
No
Have configuration parameters been confirmed?
No
Verify that the configuration parameters are correct for the installed application. See commands CC, FD, FS, and DI.
Yes
Connect spectrum analyzer to the RF Out port and ensure a proper L-band signal is present. **NOTE**: DC block not required at the RF Out port.
Repeak antenna if required.


AUDIO SYNC PROBLEMS
Audio encoder at uplink functioning?
Yes
Contact ComStream for technical support.
No
Problem is at the uplink.



NOTE:

If EB > Q1the Signal light will be on

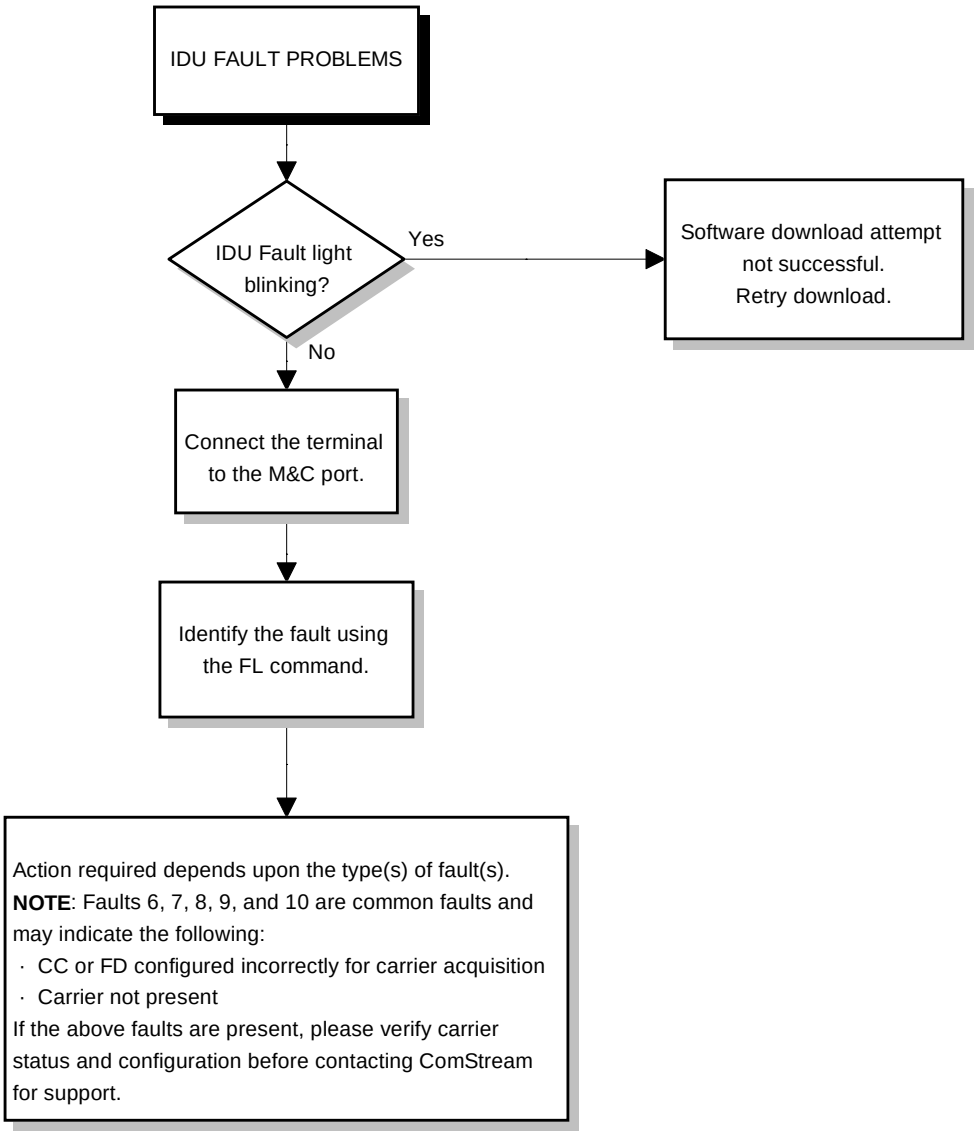
If Q0 < EB < Q1 the Signal light will blink

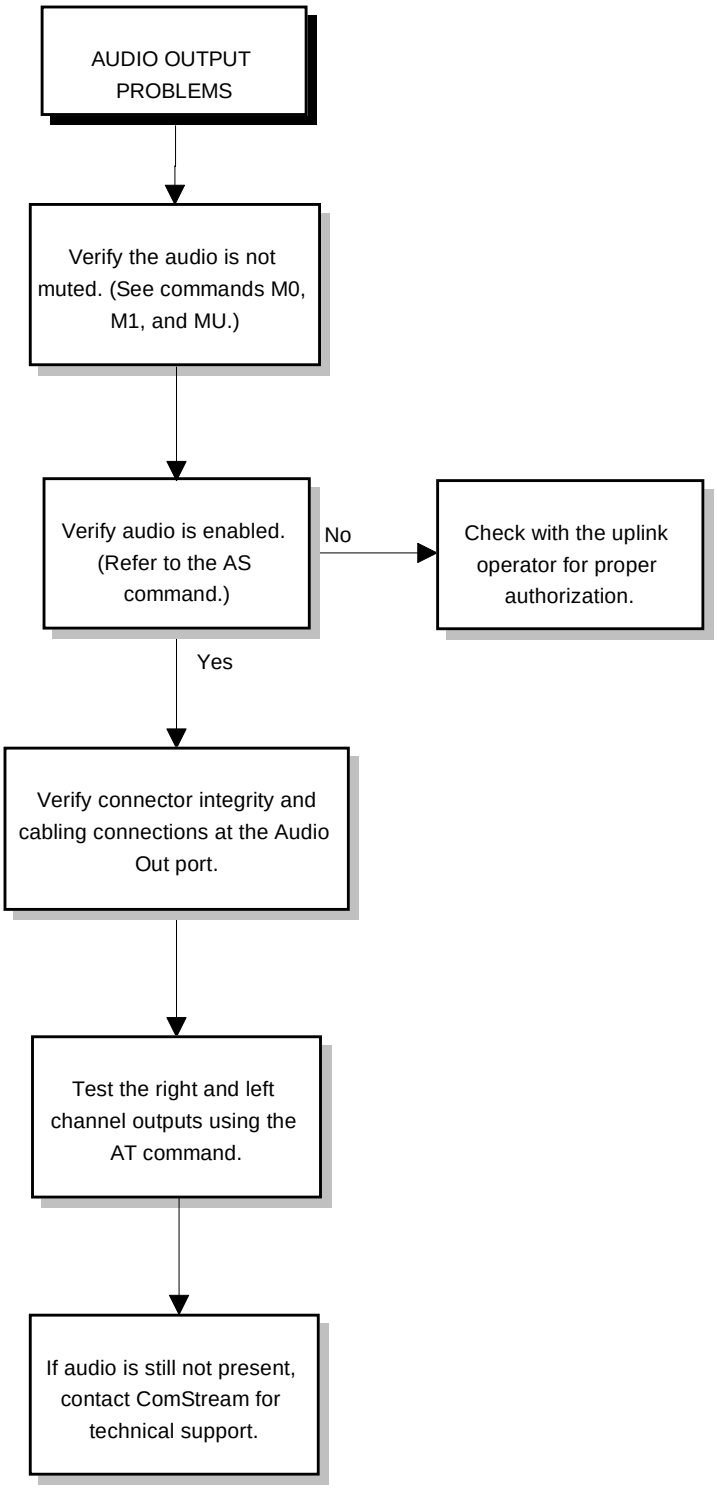
If EB < Q0 the Signal light will be off

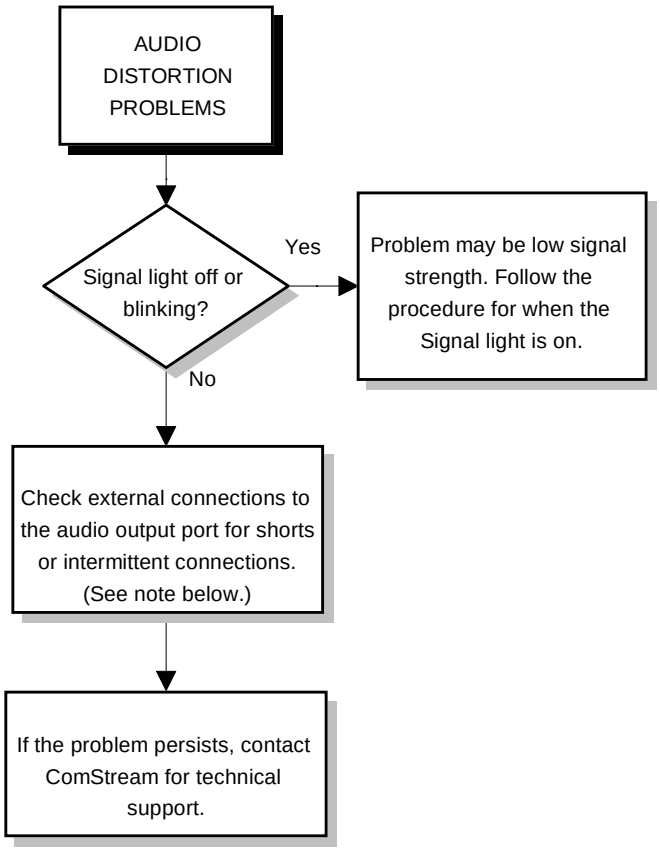
Default values:

Q0 = 4.0 db

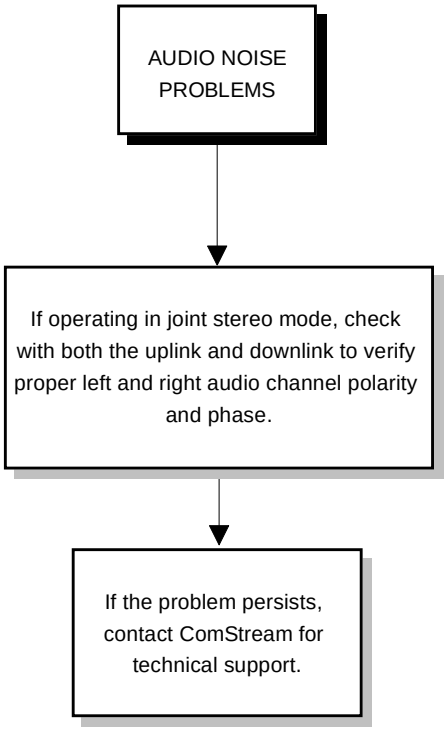
Q1 = 7.0 db

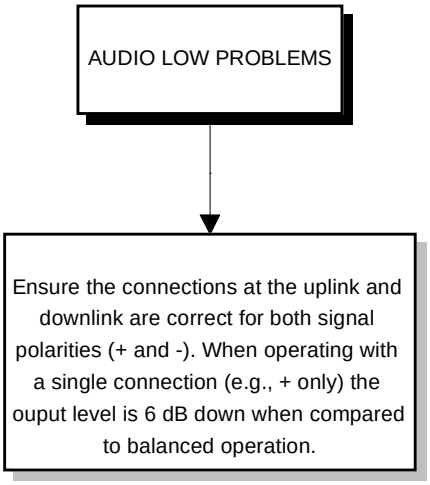

IDU FAULT PROBLEMS
IDU Fault light blinking?
Yes
Software download attempt not successful. Retry download.
No
Connect the terminal to the M&C port.
Identify the fault using the FL command.
Action required depends upon the type(s) of fault(s).
NOTE: Faults 6, 7, 8, 9, and 10 are common faults and may indicate the following:
· CC or FD configured incorrectly for carrier acquisition
· Carrier not present
If the above faults are present, please verify carrier status and configuration before contacting ComStream for support.

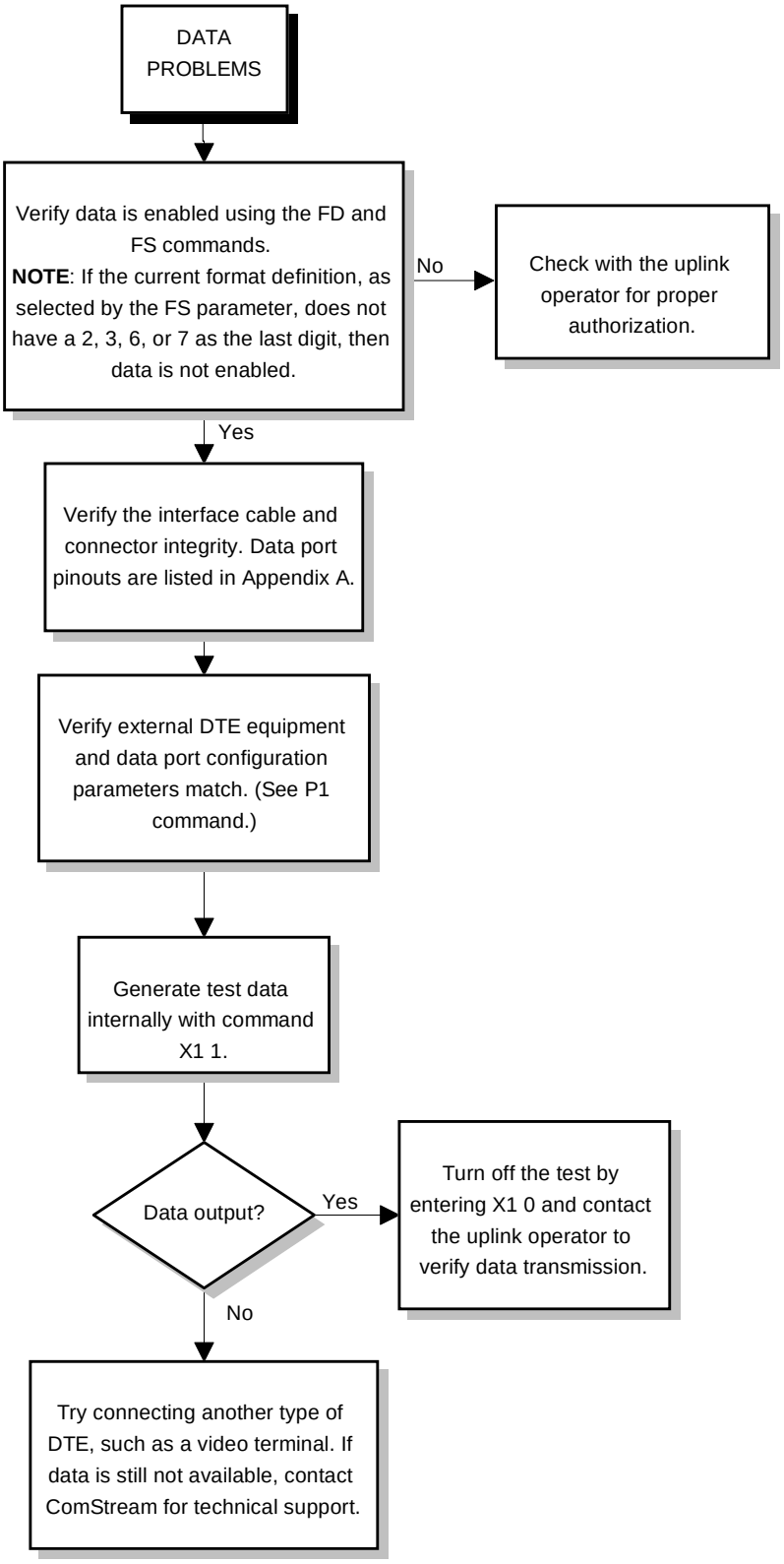

AUDIO OUTPUT PROBLEMS
Verify the audio is not muted. (See commands M0, M1, and MU.)
Verify audio is enabled. (Refer to the AS command.)
No
Check with the uplink operator for proper authorization.
Yes
Verify connector integrity and cabling connections at the Audio Out port.
Test the right and left channel outputs using the AT command.
If audio is still not present, contact ComStream for technical support.

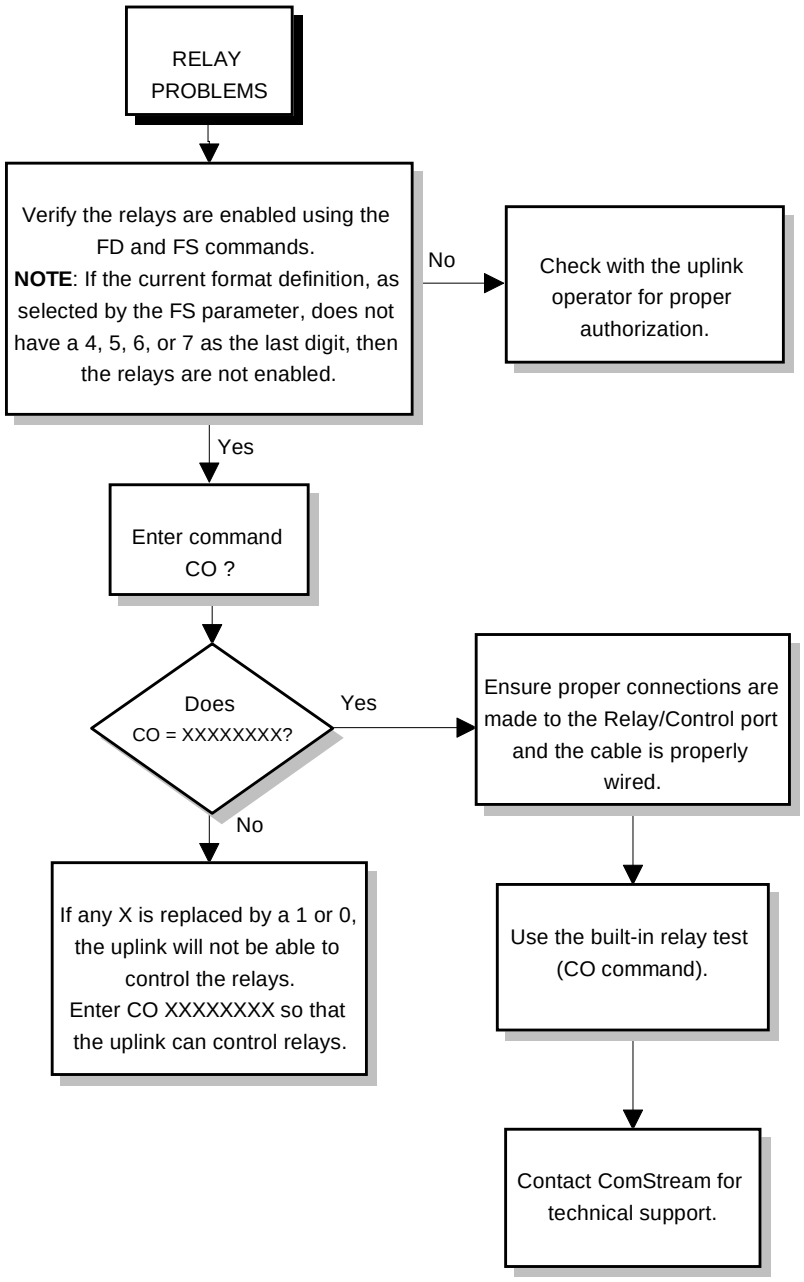


NOTE:
If audio output feeds several pieces of equipment, disconnect the equipment and monitor the audio at the connector. If the problem disappears, then a wiring problem to the external equipment exists, or operate the equipment via a distribution amplifier.


AUDIO NOISE PROBLEMS
If operating in joint stereo mode, check with both the uplink and downlink to verify proper left and right audio channel polarity and phase.
If the problem persists, contact ComStream for technical support.


AUDIO LOW PROBLEMS
Ensure the connections at the uplink and downlink are correct for both signal polarities (+ and -). When operating with a single connection (e.g., + only) the ouput level is 6 dB down when compared to balanced operation.


DATA PROBLEMS
Verify data is enabled using the FD and FS commands.
NOTE: If the current format definition, as selected by the FS parameter, does not have a 2, 3, 6, or 7 as the last digit, then data is not enabled.
No
Check with the uplink operator for proper authorization.
Yes
Verify the interface cable and connector integrity. Data port pinouts are listed in Appendix A.
Verify external DTE equipment and data port configuration parameters match. (See P1 command.)
Generate test data internally with command X1 1.
Data output?
Yes
Turn off the test by entering X1 0 and contact the uplink operator to verify data transmission.
No
Try connecting another type of DTE, such as a video terminal. If data is still not available, contact ComStream for technical support.


RELAY PROBLEMS
Verify the relays are enabled using the FD and FS commands.
NOTE: If the current format definition, as selected by the FS parameter, does not have a 4, 5, 6, or 7 as the last digit, then the relays are not enabled.
No
Check with the uplink operator for proper authorization.
Yes
Enter command CO ?
Does CO = XXXXXXXX?
Yes
Ensure proper connections are made to the Relay/Control port and the cable is properly wired.
No
If any X is replaced by a 1 or 0, the uplink will not be able to control the relays.
Enter CO XXXXXXXX so that the uplink can control relays.
Use the built-in relay test (CO command).
Contact ComStream for technical support.